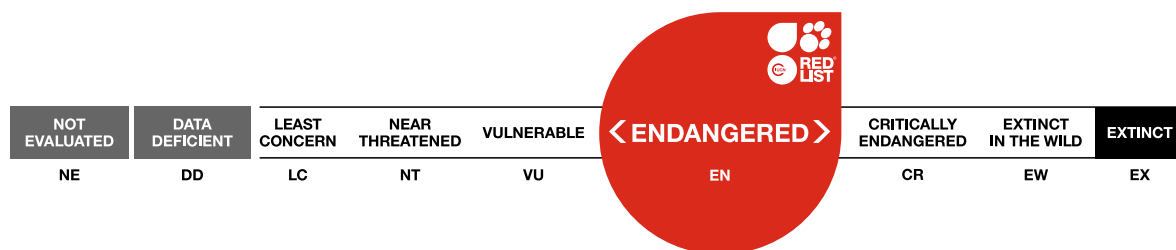


Arthonia kermesina, Hot Dots

Amendment version

Assessment by: Allen, J., Tripp, E. & Lendemer, J.



View on www.iucnredlist.org

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Fungi	Ascomycota	Arthoniomycetes	Arthoniales	Arthoniaceae

Scientific Name: *Arthonia kermesina* R.C.Harris, E.A.Tripp & Lendemer

Common Name(s):

- English: Hot Dots

Identification Information:

The small, bright red apothecia and white thallus make this species unmistakable. There are no other species that grow on *Picea rubens* in the southern Appalachians that look remotely similar.

Assessment Information

Red List Category & Criteria: Endangered A2c+4c; B1ab(i,ii,iii,iv,v); D [ver 3.1](#)

Year Published: 2020

Date Assessed: August 31, 2017

Justification:

Arthonia kermesina grows only on the bark of large, mature individuals of red spruce (*Picea rubens*) in high-elevation forests of the southern Appalachians where it is restricted to small areas of two mountain ranges: the Great Smoky Mountains and Black Mountains (Allen and Lendemer 2016, Lendemer *et al.* 2013). This species is most threatened by climate change and habitat loss. Ensuring the continued existence of high-quality, old-growth spruce forests in the high-elevations of the southern Appalachians is essential for the continued existence of this species.

This species warrants Endangered status under the A2c criterion due to an estimated historical decline of 52% in the species Area of Occupancy, and thus a loss of >50% of previously extant populations. This estimated decline is based on species distribution models. First, the suitable habitat was modelled throughout the region and used as the estimated historical distribution and AOO, resulting in an area of 1069.8 km². Then, areas that were predicted to be climatically suitable for the species, but where it does not currently occur, most likely due to logging history, were removed resulting in an estimated current AOO of 518.5 km². The resulting figures were used to estimate a 52% decline within the past three generations (~100 years). This estimated decline is further supported by the documented land use history of the spruce-fir forest on which this species relies, since it was subject to over extensive clear cut logging over the same time period after which as much as 53% of this forest type was replaced by hardwoods (Noss *et al.* 1995, White *et al.* 2012). Additionally, most of the remaining old-growth spruce-fir forest occurs in Great Smoky Mountains National Park, where this species is most abundant (Rose and Nicholas 2008).

It also qualifies as Endangered under criterion B1 due to its small extent of occurrence (1210 km²) in combination with severe fragmentation of the population and continuing decline in area of occupancy,

extent of occurrence, extent and quality of habitat, number of subpopulations, and number of mature individuals.

Additionally, it qualifies as Endangered under criterion D as its population size is estimated as 160-220 mature individuals.

Previously Published Red List Assessments

2019 – Endangered (EN)

<https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T70385721A70385726.en>

Geographic Range

Range Description:

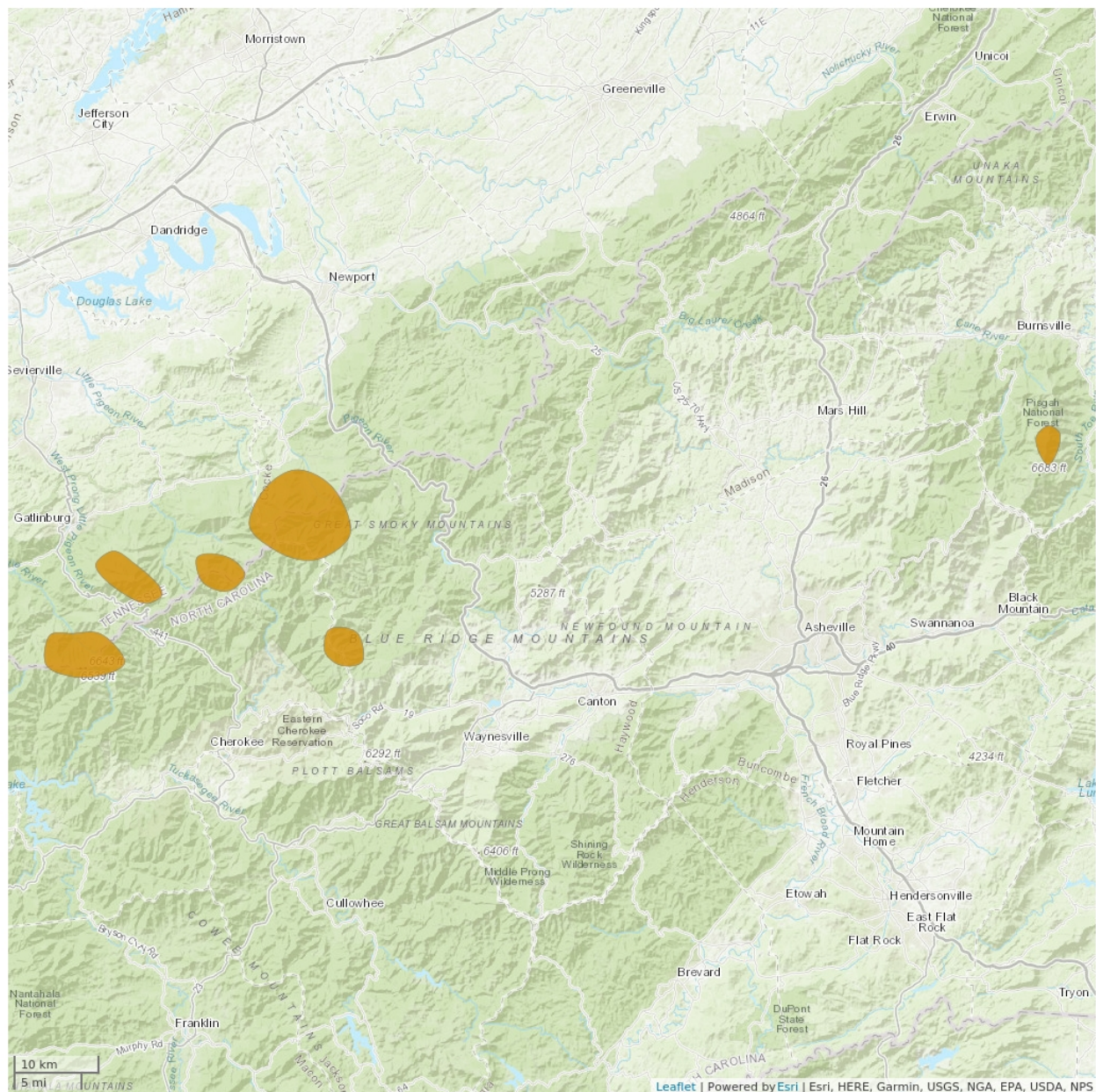
Arthonia kermesina (Hot Dots) is a highly charismatic microlichen that is endemic to high elevation spruce-fir forests of the southern Appalachians of eastern North America.

This species is narrowly restricted to small areas of two mountain ranges in the southern Appalachians: the Great Smoky Mountains and the Black Mountains. A thorough search for additional populations of this species in other high-elevation areas in the region (e.g., Balsam Mountains, Roan Mountain) did not result in the discovery of additional populations (J. Allen unpublished data). It is highly substrate specific, growing only on the bark of large, mature red spruce trees, and is almost exclusively restricted to mountain peaks greater than 5,000 feet (1,524 m) in elevation.

Country Occurrence:

Native, Extant (resident): United States (North Carolina, Tennessee)

Distribution Map

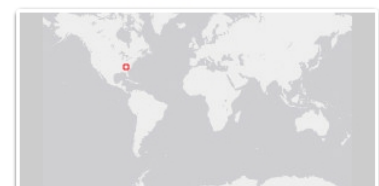


Legend

EXTANT (RESIDENT)

Compiled by:

IUCN 2019



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.



Population

Arthonia kermesina is known only from Great Smoky Mountains National Park, with a single occurrence outside the Park, in suitable habitat of the nearby Black Mountains of North Carolina. All 14 currently documented locations are extant, including one that was first discovered in 1976. Population trends are currently unknown and require study. Thirteen locations occur within Great Smoky Mountains National Park, and the remaining one occurs within Pisgah National Forest where three apothecia were found on a single tree. The population is severely fragmented, as the subpopulations are scattered widely with little intervening suitable habitat. The tiny subpopulations outside of The Great Smoky Mountains are particularly unconnected and threatened, with very little chance of reestablishment. This species has been thoroughly surveyed at every known site, with the total counted number of individuals being 160. Allowing for potentially overlooked individuals, the population size is therefore estimated as 160-220 mature individuals.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)

Hot Dots is restricted to the bark of very mature trees of *Picea rubens* (Red Spruce), at upper elevations in the southern Appalachians. Since discovering this species several years ago, extensive searches throughout eastern North America have failed to discover it in any other type of habitat.

Systems: Terrestrial

Threats (see Appendix for additional information)

Primary threats to Hot Dots include fog pollution, air pollution, forest degradation from invasive organisms, and global climate change. Because suitable habitat for this species is rare in the southern Appalachian Mountains, and because the closest extensive suitable habitat is hundreds to thousands of miles away (to the north), Hot Dots may be particularly at risk to warming temperatures.

Historical impacts from logging probably greatly reduced the original range of the habitat and substrate for *Arthonia kermesina* by over 90%, and resulted in a major reduction because the majority of this ecosystem was suitable habitat for *A. kermesina* (White *et al.* 2012). Now, because all documented populations are within National Park or National Forest boundaries, development and habitat loss does not pose a large threat to the species. If logging activities did take place in any areas that this species occupies it would probably result in its extirpation since it only grows on very large spruce trees. Widespread fir death in spruce-fir forests is devastating high-elevation forests throughout the southern Appalachians (Rose and Nicholas 2008, Rollins *et al.* 2010). Though *A. kermesina* grows only on *Picea rubens*, when *Abies fraseri* is lost the structure of the spruce-fir is significantly altered, which very probably impacts *A. kermesina*. This impact is inferred from the absence of *A. kermesina* in areas of spruce-fir that have been heavily impacted by the balsam wooly adelgid. Climate change is an additional threat to this species. Species distribution models projected to 2050 and 2070 using two different climate change models (CCSM4 and HadGEM2-AO) at the lowest and highest carbon dioxide concentration (2.6 and 8.5 rcp) were recently built in Maxent for this species (Allen and Lendemer 2016). The results of the modelling predict an average suitable habitat loss of 93.8% with a minimum loss of 75.4% and a maximum loss of 100%. This represents a significant decrease in the AOO and EOO for the species.

Conservation Actions (see Appendix for additional information)

Arthonia kermesina is recognized as rare regionally and is currently included on the North Carolina Rare Plants List (NHP 2018). There are currently no focused conservation activities to protect this species.

Research is needed since Hot Dots is so conspicuous on the bark of mature trees, amateur and / or professional lichenologists could readily search for more populations of this species in areas beyond Great Smoky Mountains National Park.

Credits

Assessor(s): Allen, J., Tripp, E. & Lendemer, J.

Reviewer(s): Scheidegger, C.

Contributor(s): Weerakoon, G. & Læssøe, T.

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External Resources

For [Supplementary Material](#), and for [Images and External Links to Additional Information](#), please see the Red List website.

Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.4. Forest - Temperate	-	Suitable	Yes

Plant Growth Forms

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Plant Growth Form
LC. Lichen
E. Epiphyte

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.2. Intentional use: (large scale) [harvest]	Past, unlikely to return	Majority (50-90%)	Rapid declines	Past impact
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
7. Natural system modifications -> 7.3. Other ecosystem modifications	Ongoing	Unknown	Causing/could cause fluctuations	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.1. Unspecified species	Ongoing	Unknown	Causing/could cause fluctuations	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.5. Air-borne pollutants -> 9.5.4. Type Unknown/Unrecorded	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
11. Climate change & severe weather -> 11.3. Temperature extremes	Ongoing	Unknown	Causing/could cause fluctuations	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
11. Climate change & severe weather -> 11.5. Other impacts	Ongoing	Unknown	Causing/could cause fluctuations	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Action in Place
In-place research and monitoring
Action Recovery Plan: No
Systematic monitoring scheme: No
In-place land/water protection
Conservation sites identified: Yes, over entire range
Percentage of population protected by PAs: 91-100
Area based regional management plan: No
Occurs in at least one protected area: Yes
In-place species management
Harvest management plan: No
Successfully reintroduced or introduced benignly: No
Subject to ex-situ conservation: No
In-place education
Subject to recent education and awareness programmes: No
Included in international legislation: No
Subject to any international management / trade controls: No

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Action Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.2. Invasive/problematic species control
3. Species management -> 3.2. Species recovery
4. Education & awareness -> 4.1. Formal education
4. Education & awareness -> 4.2. Training

Conservation Action Needed
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.1. Legislation -> 5.1.2. National level
5. Law & policy -> 5.2. Policies and regulations

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.5. Threats
1. Research -> 1.6. Actions
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km ²): 518
Continuing decline in area of occupancy (AOO): Yes
Extreme fluctuations in area of occupancy (AOO): No
Estimated extent of occurrence (EOO) (km ²): 1210
Continuing decline in extent of occurrence (EOO): Yes
Extreme fluctuations in extent of occurrence (EOO): No
Number of Locations: 14
Continuing decline in number of locations: No
Extreme fluctuations in the number of locations: No
Lower elevation limit (m): 1,524
Upper elevation limit (m): 2,024
Population
Number of mature individuals: 160-220
Continuing decline of mature individuals: Yes
Extreme fluctuations: No
Population severely fragmented: Yes

Population
No. of subpopulations: 14
Continuing decline in subpopulations: Yes
Extreme fluctuations in subpopulations: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 35
Movement patterns: Not a Migrant
Congregatory: Congregatory (year-round)

Amendment

Amendment The author string has been updated.
reason:

The IUCN Red List Partnership



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