

Integration and Synthesis Summary for Plants, CONUS
Lichens: Assessment Group 1

The tables below contain summaries of the information and data we used to determine the ranking (high, medium, low) for vulnerability, risk and usage indicators. Information in most of the columns was used directly in the ranking determination (green fill). Where indicated, information in other columns was not used directly in the ranking calculation, but provided additional information about the species that fed into one of the ranking metrics or was used to make the draft determination when relevant. The summary for this assessment group also includes new conservation measures¹ that have been incorporated into the Action since the draft biological opinion was released. The measures and our related assumptions are incorporated into our analysis (immediately above Table 4), and also factor into the rationales for our conclusions for each species, as described below.

The two species in this assessment group are not plants, but lichens, which are composite organisms formed from algae and fungi living in a mutualistic relationship. Lichens do not produce flowers or seeds and therefore do not rely on pollinators or seed dispersers for reproduction. The primary means of reproduction of the lichens in this group is asexual, with colonies or organisms spreading clonally through vegetative reproduction. Both species have highly specific habitat requirements: Florida perforate cladonia live in open patches in rosemary scrub and rock gnome lichen are found on vertical rock faces in areas of high humidity on cliffs or gorges.

Table 1: Summarizing Data and Information for Vulnerability Ranking

Data Sources: Status of the Species (SOS) accounts updated as of November, 2019 (Appendix C); NA = Not Applicable

Scientific Name	Common Name	Status	Population Level Trends	Species Level Trends	Number of Populations	Distribution	Number of Individuals*	Pesticides Listed as a Threat	Pollinator Loss listed as a Threat	Vulnerability Ranking
<i>Cladonia perforata</i>	Florida perforate cladonia	Endangered	Declining	Declining	16	This species is found in the Florida counties of Highlands, Okaloosa, Palm Beach, Polk and Manatee (USFWS, 2007).	2,600 or greater individuals	No Mention	NA	High
<i>Gymnoderma lineare</i>	Rock gnome lichen	Endangered	Declining (USFWS, 2013)	Unknown	85 (USFWS, 2013)	Known to occur in the Smoky Mountains of North Carolina and Tennessee; also in South Carolina and Georgia (NatureServe, 2015). In 2012, the species' total range remains essentially the same, with the notable exception of a small population in Grayson County, Virginia (occupying an area of 6 square inches). In recent years, numerous populations have been discovered. The total number of known populations has increased from 35 to 85. These 85 are distributed across North Carolina (75), Tennessee (7), Georgia (1), South Carolina (1), and Virginia (1). Two of the five populations considered as extirpated in the recovery plan have been rediscovered. Of the remaining three, one was last observed in 1972 and has not been searched for since; another was last observed (despite surveys) in 1990, immediately prior to road construction that affected its habitat; and a third may be an erroneous report. This last population is reported from within the Great Smoky Mountain National Park (GSMNP), but the GSMNP botanist is not aware of the species' having occurred at this location (Janet Rock, GSMNP, personal communication, 2008). Three additional North Carolina populations counted in the listing rule (60 FR 3557) and recovery plan are not mapped in the North Carolina Natural Heritage Program	Unknown	No Mention	NA	Medium

¹ Additional information on these new conservation measures can be found in the Description of the Action section of this biological opinion.

Scientific Name	Common Name	Status	Population Level Trends	Species Level Trends	Number of Populations	Distribution	Number of Individuals*	Pesticides Listed as a Threat	Pollinator Loss listed as a Threat	Vulnerability Ranking
						database, and supporting information for these reports (other than a brief mention of the locality) is lacking. For purposes of this review, these three populations are regarded as potentially erroneous and have not been included in the tally of 85 known populations (USFWS, 2013).				

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Table 2: Summarizing Data and Information for Risk Ranking

Data Sources: SOS accounts (Appendix C); R Plot Appendices; NA = Not Applicable

Risk to Individuals and Pollinators if exposed: The individual lichens in this assessment group are estimated to experience up to a 12% decrease in dry weight if exposed to malathion on the following use sites, based on labeled application rates: orchards and vineyards, developed, nurseries, open space developed and Christmas trees. No effects are expected on other use sites. Lichens do not rely on animal species for pollination or seed dispersal, thus no effects are expected to these plants from loss in pollinator or seed disperser populations from malathion exposure across use sites within their ranges.

Scientific Name	Common Name	Effects to Mortality or Growth Expected (yes or no; reduction in dry weight when exposed in use areas that may have effects)	Effects to Pollinators % insect pollinator mortality (% bird pollinator mortality)	Method of Reproduction (risk modifier)	Seed Dispersal Vector (risk modifier)	Obligate or Specific Pollinator (risk modifier)	Pollination Vector*	Risk Ranking
<i>Cladonia perforata</i>	Florida perforate cladonia	Yes (12%)	NA	Non-flowering	Abiotic	NA	NA	Low
<i>Gymnoderma lineare</i>	Rock gnome lichen	Yes (12%)	NA	Non-flowering	Abiotic	NA	NA	Low

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Volatilization: We do not expect transport from volatilization to be an appreciable source of exposure for most or all species in this assessment group. For species that occur at high elevations, we expect additional exposure to malathion that may vaporize from application sites. However, the magnitude of increased exposure is uncertain due to the unpredictability of weather events, along with variability of the geographical features across the landscapes that influence transport and deposition, though the information available does not allow us to conclude that concentrations from this route alone will rise to the level where effects are expected.

Table 3: Summarizing Data and Information for Usage Ranking

Data Sources: R Plots Appendices for individual plant species; Federal lands overlap analysis; California (CA) data analysis; NA = Not Applicable

Scientific Name	Common Name	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential Uses)*	Total Overlap % (Mosquito Adulticide)*	Anticipated Usage within Range (agricultural data based on SUUM): total % of range for all uses	Anticipated Usage within Range (agricultural data based on CalPUR): total % of range for all uses	Ranking: Confidence level	Usage ranking
<i>Cladonia perforata</i>	Florida perforate cladonia	4,581,736.20	2.63	0		32.81	78.66	6.80	NA	Standard	Medium
<i>Gymnoderma lineare</i>	Rock gnome lichen	5,073,507.23	50.24	0		8.44	10.02	0.67	NA	Standard	Low

* Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Cumulative Effects and Environmental Baseline: Please refer to the Status of the Species accounts (Appendix C) and overarching Environmental Baseline and Cumulative Effects sections of this Opinion.

Additional Conservation Measures:

Additional information on these new conservation measures can be found in the *Description of the Action* section and Appendix A-2 of this biological opinion, and further information on the anticipated impacts of each measure in the *Effects of the Action* section.

General Conservation Measures

Several additional conservation measures have recently been provided by EPA and will be implemented as part of the Action. These measures will apply to both species in this assessment group. We summarize the new measures and our related assumptions below.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit lower the maximum allowable number of applications (previously ranging from 3-13 applications per year, depending on the specific crop) to 2-4 per year, as described in the *Description of the Action* of this Opinion. This is anticipated to reduce the amount of malathion used and decrease exposure to the lichen species, thus decreasing the risk of direct sub-lethal impacts to the lichen itself.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are anticipated to substantially reduce exposure to species and their pollinators/seed dispersers that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application. We anticipate this measure will further reduce exposure to these lichen species, thus decreasing the risk of sub-lethal impacts to the lichen itself.

Table 4: Summary of Conclusions

*NJ = No Jeopardy; J = Jeopardy

Scientific Name	Common Name	Vulnerability Ranking	Risk Ranking	Usage Ranking	Species Conclusion (J, NJ)*
<i>Cladonia perforata</i>	Florida perforate cladonia	High	Low	Medium	NJ
<i>Gymnoderma lineare</i>	Rock gnome lichen	Medium	Low	Low	NJ

Rational For Species Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the two lichen species in this assessment group.

While the species in this assessment group have either high or medium vulnerabilities based on their status, distribution, and trends, as described above, the risk to all species in this group posed by labeled uses across the range is anticipated to be low. The estimated usage within the range is for all species in this group is anticipated to be low or medium, based on our analysis above. Additionally, pollinating and seed dispersing animals do not play a role in the life cycle of these lichen species. As a result, we expect there will be no effects to the reproduction and survival of these species due to loss of pollinating and seed dispersing species from malathion exposure in the lichens' range. While we expect some individual lichens will experience reduced growth due to direct exposure to malathion, we do not anticipate this reduction in growth to cause species-level effects. We anticipate the additional conservation measures described above will further decrease the likelihood of exposure and resultant sub-lethal effects of these species to malathion. For example, residential uses of malathion are now limited to two applications per year (reduced from as many as necessary) and to spot treatments only, reducing the application footprint and likelihood of spray drift within developed and open space developed areas.

We do not anticipate that the use of this pesticide is likely to have species-level effects on the lichens listed above. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of of the Florida perforate cladonia and rock gnome lichen in the wild. .