Integration and Synthesis Summary for Plants

Lichens, Ferns and Allies, Conifers and Cycads, and Monocots and Dicots with Abiotic Pollination Vectors

Assessment Groups 1, 2, 3, 4, and 8

This Integration and Synthesis Summary includes our jeopardy analysis for species that we or EPA determined would “likely be adversely affected” by the proposed action. Our jeopardy analysis of the proposed action’s impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine individual species’ rankings including environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. The species included in this appendix were placed together as they all have low toxicity due to one of two shared life history characteristics. Either they do not use pollination for reproduction (the lichens in assessment group 1 and ferns and allies in assessment group 3) or they use abiotic pollination vectors, such as wind or water, for reproduction (the conifers and cycads in assessment group 2 and monocot and dicot flowering plants in assessment groups 4 and 8).

Vulnerability

For the plant species that we or EPA determined are “likely to be adversely affected” by the proposed action, we considered several factors for each listed plant to summarize the current vulnerability of that species to additional stressors. This effort allows us to consider whether a species’ current condition is stable, moving toward recovery, or moving toward further decline. In general, we expect the species’ vulnerability to additional stressors to be higher if they are moving toward further decline than if their condition is improving. We also identify which species are most (and least) susceptible to additional stressors in general based on information that could be surmised from species listing and recovery documents, or other sources as cited and considered in the Status section of this biological opinion.

Our assessment of vulnerability focuses on seven factors: (1) the species listing status and recent 5-year status review recommendation (if available), (2) distribution, (3) number of populations, (4) species population trends, (5) if pesticides have been noted as a threat, (6) if pollinator loss has been noted as a threat, and (7) impacts from activities associated with environmental baseline and cumulative effects. We obtained the information to create the vulnerability summary from the Status of the Species accounts (Appendix B), overarching Environmental Baseline section of this Opinion, five-year species status reviews, species recovery plans, species status assessments, and other sources containing the best available scientific information for the species.

We scored each of the seven vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as medium or high. We assigned a medium vulnerability ranking if a species' scores were a mix of high and low (though exceptions were allowed for species that have a low status score or have an uplisting recommendation). We assigned a low vulnerability ranking to species with only low or medium scores. Considerations regarding specific aspects of the species vulnerability, or beyond what was included in the vulnerability ranking were applicable for some species depending on unique aspects of their life history. This information is reflected in the rationales for conclusion below.

Exposure to Agricultural Uses

We anticipate plants and their pollinators (if they use them) will primarily be exposed to carbaryl through direct contact, either as the result of exposure to pesticide applications on-field or through spray drift off-field. Carbaryl degrades quickly in the environment (i.e., within a few days) and as such is not likely to persist on surfaces or in the air for prolonged periods of time.

We characterize the expected level of exposure using overlaps between the species' ranges and agricultural land uses where carbaryl is registered for use (i.e., overlaps), past carbaryl usage data (when available; the amount and location where carbaryl has been used in the past), any species-specific considerations such as life history information (e.g., habitat preferences, pollinator preferences), and existing protections or conservation actions. Species with greater than 10% overlap between their range and carbaryl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with carbaryl use sites, we considered past carbaryl usage data within a species' range to determine how much of a species' range we expect to be treated with carbaryl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this biological opinion. Species that data indicate will have a large portion of their range (>10%) treated with carbaryl each year are assigned a high usage score. Species that will have a medium portion of their range (5-10%) treated with carbaryl each year are assigned a medium usage score, and species that data indicate will have a low portion of their range (<5%) treated with carbaryl each year are assigned a low usage score. Agricultural uses of carbaryl in the state of Hawai`i are no longer registered; however, agricultural uses are still registered for other island territories.

We determine the overall exposure ranking by qualitatively considering both the total overlap and total usage, as well as any additional exposure considerations that might modify the level of exposure likely to occur. When overlap and usage scores are the same, we assign the overall exposure ranking the same score (e.g., if both overlap and usage is high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. As usage is a subset of overlap, the overlap score will always be greater than the usage score. In cases where overlap is high, but usage is low, we anticipate a moderate portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. For species where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate.

Exposure to Non-Agricultural Uses

Carbaryl has several registered non-agricultural uses, including use sites within developed, open space developed, nurseries, rangeland, managed forests, and rights of way Use Data Layers (UDLs). Rights of way includes roadsides, and we refer to roadsides when applicable. In many cases, data provided by EPA indicate low to high levels of overlap between species' ranges and non-agricultural UDLs. However, UDLs for non-agricultural uses tend to be less defined than those for agricultural UDLs and may not accurately represent the actual footprint of these use sites on the landscape. As such, we assess exposure of species to non-agricultural uses of carbaryl in a qualitative manner, considering the life history of species, methods of application, carbaryl usage, and any existing conservation measures to reduce drift and runoff or otherwise limit exposure to species.

For most species, we anticipate that non-agricultural uses will not meaningfully add to the overall level of anticipated exposure considered in our analysis of agricultural uses and discuss each use in more detail in the *Overall Considerations for the Opinion* section. Briefly, we expect listed species are generally not likely to be exposed to non-agricultural uses of carbaryl as there are low levels of past usage and several existing mitigation measures are protective of listed species. Usage data summarized by the EPA indicate that all non-agricultural UDLs have very low levels of past usage (at most 2.5% treatable areas treated with carbaryl annually). Some use patterns, like rights of way, have particularly low usage, with less than 500 lbs. of carbaryl applied nationally each year.

Additionally, based on application information, we anticipate carbaryl use in these UDLs are restricted to small application areas that are treated infrequently over long periods of time. Use patterns like forestry, rangeland, or rights of way may also be geographically restricted as available past usage data indicate carbaryl usage only occurs in certain areas of the country, such as the western conterminous U.S. Available usage data from the U.S. Forest Service indicate that, over a five year period (from 2016-2020), the Forest Service treated 322 acres of forests in California and 557 acres of forests across three Forest Service Regions (covering North Dakota, Montana, South Dakota, Idaho, Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada), with the majority of applications taking place in small areas (less than 1 acre in size). Similarly, usage data from the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) show limited past carbaryl usage as well. From 2019-2023, APHIS treated 92,309 acres of rangeland in seven states (Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming) and 25 counties. While this represents a large area overall, when distributed across the areas within the seven states where usage occurs, we anticipate only a small percentage of any species' range is likely to be treated for this use pattern. Additionally, all but one of these applications were made using carbaryl bait, which we expect has a much lower risk profile as bait applications are not likely to cause off target exposures as there is no spray drift or contact exposure likely to occur.

Additionally, there are several existing conservation and mitigation measures for non-agricultural uses of carbaryl that will reduce the likelihood of exposure to listed species. For example, from the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the areal extent that can be treated on many use sites within the developed, open space developed, and nurseries UDLs. Similarly, we anticipate all rangeland applications of carbaryl will be carried out in association with USDA APHIS as part of their grasshopper and Mormon cricket suppression program (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. Examples of measures include a reduced agent area treatment strategy that minimizes the amount of pesticide applied within a treatment block, allowance of only one application per year, reduced application rates, minimized treatment area size within 500 feet and 1000 feet from listed species ranges for ground and aerial applications, respectively, and extended application buffers when applications are made near the listed species' habitat (e.g., up to 750 feet for some ground applications and up to a mile for some aerial applications).

To assess the likelihood of exposure to non-agricultural uses of carbaryl, we conducted a habitat assessment for each listed species, incorporating available information regarding habitat preferences, known occurrences, relevant life history traits or behaviors, as well as relevant available usage data (summarized in the above sections). For species whose habitat is known or presumed to occur in or adjacent to non-agricultural use sites, we consider, individually and qualitatively, the extent and manner of non-agricultural carbaryl usage within the species' range to generally determine whether a small, moderate, or large number of individuals are likely to be exposed and the expected level of adverse effects from non-agricultural exposure of carbaryl.

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed

[1] While our Opinion considers all consequences of the proposed action (per the definition of effects of the action at 50 CFR Part 402.02), the terms "direct" and "indirect" effects were used in EPA's BE, and are used in environmental risk assessment terminology in general, and do not have the same meaning as used in ESA regulations. As used in the effects analysis section, direct effects to species are those caused by the pesticide itself through dietary, dermal, or inhalation routes of exposure. Indirect effects occur when the pesticide acts on elements

to carbaryl at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (e.g., reduced growth) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is likely to experience when the organisms they rely on, such as those that act as pollinators or seed dispersers, are exposed to carbaryl and experience adverse effects.

Available toxicity data indicate that plants will not experience any direct adverse effects to survival, growth, or reproduction with exposure to carbaryl. In contrast, available toxicity data indicate that insects, including those that act as pollinators and seed dispersers for listed plants, are sensitive to carbaryl at estimated environmental concentrations and are likely to experience mortality from exposure on both application sites and adjacent areas exposed via drift. However, we expect insect species to exhibit a range of sensitivities to carbaryl and do not anticipate the entire insect pollinator community will experience mortality. Plants that rely on a select few species of pollinators or seed dispersers (i.e., specialists) are likely to experience high levels of indirect effect as high mortality in a few insect pollinator species can significantly reduce pollination and seed dispersal. In contrast, generalist plants that can use a wide range of insect species are likely able to recover more quickly from temporary losses of some insect species, resulting in lower levels of indirect effects from the proposed action.

Bird and mammal pollinators/seed dispersers are less sensitive to carbaryl exposure than insects. While carbaryl exposure in birds and mammals can cause adverse effects under specific circumstances (e.g., by consuming exclusively contaminated food items on carbaryl use sites) we do not expect carbaryl use is likely to appreciably diminish the availability of bird or mammal pollinators or seed dispersers. For species where the relationship with pollinators and seed dispersers is unknown, we make the conservative assumption that the species has a specialist-type relationship exclusively with insect pollinators and seed dispersers.

We evaluate indirect effects by assessing (1) how critical biotic outcrossing is to the species, (2) the type of pollination vector required, (3) the type of seed dispersal vector required, and (4) how strict the pollinator and seed disperser requirement is for the species (e.g., can the species use a wide range of insect species or is the species a pollinator obligate or specialist?). Species that score the same on all toxicity factors are given the same overall toxicity ranking (e.g., species scores high on all factors has a high overall toxicity ranking). Species that only have medium or low scores are given a low overall toxicity ranking. Species that have a mix of high and low scores are given a medium overall toxicity ranking, and species with a mix of high and medium scores are given a high overall toxicity ranking.

---

of the ecosystem that are required by the species, such as alterations to prey or shelter. Thus, in the effects analysis section, we may sometimes continue to use these terms to link back to the analysis in EPA's BE.

Summary of Assessment Groups 1, 2, 3, 4, & 8 Conclusions

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

All species in these plant assessment groups (1,2,3,4, and 8) had the same or very similar rationales for their conclusion due to low toxicity, thus they were grouped together to increase efficiency and avoid repetition. Relevant information and data unique to each individual species was considered when assigning species to groups and incorporated into the rationales as appropriate. Species-specific information (e.g., environmental baseline, cumulative effects, status of the species, exposure, and toxicity) was considered for all species, including those species in the grouped analyses, and are presented in full in Appendices B and E. Species with rationales that did not fit in a group, or warranted a separate rationale because of their life history, conservation status, or other information indicated that effects could be different, have an individual discussion to provide additional explanation. This approach allowed us to streamline our discussion in this Opinion by avoiding repeating our findings when species in the respective groupings would be expected to be affected similarly. The use of these groupings, therefore, does not mean that our evaluation failed to evaluate each individual species. On the contrary, our process and analysis for each species remained the same, regardless of the format of the discussion presented below.

C-B1. Nonflowering and abiotic pollination plant groups

Species with low toxicity (due to lack of biotic pollinators)

The species in Table 1 were grouped together because they all have low toxicity due to one of two shared life history characteristics. Either they do not use pollination for reproduction (the lichens in assessment group 1 and ferns and allies in assessment group 3) or they use abiotic pollination vectors, such as wind or water, for reproduction (the conifers and cycads in assessment group 2 and monocot and dicot flowering plants in assessment groups 4 and 8).

Table 1. Plant species with low toxicity due to lack of biotic pollinators

Scientific Name	Common Name	Taxonomic Group	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	Flowering Plants	High	Low	Low	No Jeopardy
Ambrosia pumila	San Diego ambrosia	Flowering Plants	High	Low	Low	No Jeopardy
Carex albida	White sedge	Flowering Plants	High	Low	Low	No Jeopardy
Neostapfia colusana	Colusa grass	Flowering Plants	Low	Low	Low	No Jeopardy
Orcuttia pilosa	Hairy Orcutt grass	Flowering Plants	Medium	Low	Low	No Jeopardy
Orcuttia tenuis	Slender Orcutt grass	Flowering Plants	Low	Low	Low	No Jeopardy
Poa atropurpurea	San Bernardino bluegrass	Flowering Plants	High	Low	Low	No Jeopardy
Poa napensis	Napa bluegrass	Flowering Plants	High	Low	Low	No Jeopardy
Ambrosia cheiranthifolia	South Texas ambrosia	Flowering Plants	High	High	Low	No Jeopardy
Carex specuicola	Navajo sedge	Flowering Plants	Low	Low	Low	No Jeopardy
Orcuttia californica	California Orcutt grass	Flowering Plants	High	Low	Low	No Jeopardy
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	Flowering Plants	Medium	Low	Low	No Jeopardy
Orcuttia viscida	Sacramento Orcutt grass	Flowering Plants	High	Low	Low	No Jeopardy
Potamogeton clystocarpus	Little Aguja (=Creek) Pondweed	Flowering Plants	High	Low	Low	No Jeopardy

C-B1. Nonflowering and abiotic pollination plant groups

Scientific Name	Common Name	Taxonomic Group	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Quercus hinckleyi	Hinckley oak	Flowering Plants	High	Low	Low	No Jeopardy
Scirpus ancistrochaetus	Northeastern bulrush	Flowering Plants	Medium	Low	Low	No Jeopardy
Swallenia alexandrae	Eureka Dune grass	Flowering Plants	High	Low	Low	No Jeopardy
Tuctoria greenei	Greene's tuctoria	Flowering Plants	High	Low	Low	No Jeopardy
Tuctoria mucronata	Solano grass	Flowering Plants	High	Low	Low	No Jeopardy
Aristida portoricensis	Pelos del diablo	Flowering Plants	High	Low	Low	No Jeopardy
Amaranthus pumilus	Seabeach amaranth	Flowering Plants	Medium	Low	Low	No Jeopardy
Aristida chaseae	No common name	Flowering Plants	High	Low	Low	No Jeopardy
Atriplex coronata var. notatior	San Jacinto Valley crownscale	Flowering Plants	High	Low	Low	No Jeopardy
Juglans jamaicensis	West Indian Walnut (=Nogal)	Flowering Plants	High	Low	Low	No Jeopardy
Suaeda californica	California seablite	Flowering Plants	High	Low	Low	No Jeopardy
Carex lutea	Golden sedge	Flowering Plants	High	Low	Low	No Jeopardy
Cupressus abramsiana	Santa Cruz cypress	Conifers and Cycads	High	Low	Low	No Jeopardy
Torreya taxifolia	Florida torreya	Conifers and Cycads	High	High	Low	No Jeopardy
Cupressus goveniana ssp. goveniana	Gowen cypress	Conifers and Cycads	High	Low	Low	No Jeopardy
Asplenium scolopendrium var. americanum	American hart's-tongue fern	Ferns and Allies	Medium	Low	Low	No Jeopardy
Isoetes louisianensis	Louisiana quillwort	Ferns and Allies	Medium	Low	Low	No Jeopardy
Isoetes melanospora	Black spored quillwort	Ferns and Allies	High	Low	Low	No Jeopardy
Isoetes tegetiformans	Mat-forming quillwort	Ferns and Allies	High	Low	Low	No Jeopardy

C-B1. Nonflowering and abiotic pollination plant groups

Scientific Name	Common Name	Taxonomic Group	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Cyathea dryopteroides	Elfin tree fern	Ferns and Allies	High	Low	Low	No Jeopardy
Thelypteris pilosa var. alabamensis	Alabama streak-sorus fern	Ferns and Allies	High	Low	Low	No Jeopardy
Polystichum calderonense	No common name	Ferns and Allies	High	Low	Low	No Jeopardy
Thelypteris inabonensis	No common name	Ferns and Allies	High	Low	Low	No Jeopardy
Thelypteris verecunda	No common name	Ferns and Allies	High	Low	Low	No Jeopardy
Thelypteris yaucoensis	No common name	Ferns and Allies	High	Low	Low	No Jeopardy
Cladonia perforata	Florida perforate cladonia	Lichens	High	High	Low	No Jeopardy
Gymnoderma lineare	Rock gnome lichen	Lichens	Medium	Low	Low	No Jeopardy
Rhynchospora knieskernii	Knieskern's Beaked-rush	Flowering Plants	Low	Low	Low	No Jeopardy
Pinus albicaulis	Whitebark pine	Conifers and Cycads	Medium	Low	Low	No Jeopardy
Digitaria pauciflora	Florida pineland crabgrass	Flowering Plants	High	Low	Low	No Jeopardy
Festuca ligulata	Guadalupe fescue	Flowering Plants	High	Low	Low	No Jeopardy
Trichomanes punctatum ssp. floridanum	Florida bristle fern	Ferns and Allies	High	Low	Low	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, we determined that the vulnerabilities of the species in Table 1 are mostly medium or high, with a few exceptions (slender orcutt grass, colusa grass, and Knieskern's beaked-rush) where the species have low vulnerabilities.

Toxicity is expected to be low for the plant species in this group because they do not use pollination for reproduction (the lichens and ferns and allies) or they use abiotic pollination vectors, such as wind or water (the conifers and cycads and monocot and dicot flowering plants in groups 4 and 8). As such, there are no biotic pollinators to experience impacts from carbaryl exposure and thus, no adverse reproductive impacts to the plant species. Similarly, many of the species in Table 1 use abiotic methods for seed dispersal, including wind or gravity. For the few species that use animals to disperse seeds (Solano grass, South Texas ambrosia, and West Indian walnut) they typically use birds or mammals for dispersal in addition to abiotic methods like wind or gravity. As such, we anticipate minimal effects to the dispersal capability of the species that have mixed seed dispersal mechanisms as their biotic dispersers are expected to experience minimal impacts from carbaryl exposure (as discussed in the Toxicity section, above) and there will be no impacts to their ability to disperse through abiotic means.

Our evaluation indicates varied levels of exposure from carbaryl agricultural use sites, though most species are expected to have low agricultural exposure as indicated by their low exposure ranking in Table 1. We also anticipate low exposure from non-agricultural uses of carbaryl based on the reasons outlined in the Exposure to Non-Agricultural Uses section, above. We did not further evaluate the potential for carbaryl exposure from non-agricultural uses as regardless of level of exposure, we do not anticipate impacts to the reproductive capacity or dispersal ability of these species because insects do not play a role in their reproduction or dispersal capabilities.

While the species listed in Table 1 have variable vulnerability and exposure rankings, given that toxicity is anticipated to be low (as demonstrated by the absence of insects in the life cycle of the plant species), the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is extremely low to absent. Thus, while these species' vulnerability and exposure rankings may be high or medium, we have high confidence that there will be very minimal to no adverse effects to the reproductive capacity of the species due to the absence of insects in their life cycles. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 1.

C-B1. Nonflowering and abiotic pollination plant groups

Species with Individual Integration and Synthesis Summaries

For the fadang described below, unlike the other species in this appendix, our preliminary toxicity ranking was medium, based on the species using insects for a portion of its pollination needs. As such, we discuss the fadang in more detail.

Rationale for Species Conclusion: Fadang

Scientific Name:	Common Name:	Entity ID:
Cycas micronesica	Fadang	10729

Conclusion

The fadang is a tree in the cycad family endemic to the islands of Guam, Rota, and tentatively Pagan. The species used to be the most common understory tree in the regions' limestone forests, and it can also be found in coastal strand habitat. However, its numbers are declining rapidly; a significant percentage of the cycads observed on Guam and Rota are in poor health or dying. We estimate there is an 8.1% average annual rate of decline, most likely due to a recently introduced cycad scale insect that causes decline and death of the plants, along with other introduced pathogens and pests (USFWS 2023). Regeneration and recruitment have also been dramatically affected by these non-native introductions. Between 2005-2006 in Guam, the entire cycad seedling, and juvenile populations in 10 permanent plots were killed along with more than 50% of adults (USFWS 2020).

The fadang is a long-lived, dioecious (e.g., has separate male and female plants) gymnosperm that can reproduce vegetatively. Male trees bear an elongated, upright cone in the center of the leaves; the woolly scales of the cone produce quantities of pollen. The female trees also produce a central cone-like structure that opens outward to reveal individual tan, soft, woolly leaves that are deeply lobed and toothed and bear ovules in notches along the margins. Cones of *C. micronesica* emit chemical cues to attract specialist insects, primarily moths in the genus *Anatrachyntis* for pollination; however, there is also evidence of wind as a pollen vector in open or forested areas. Cycads can propagate by seeds, by basal suckers, or vegetative offsets (i.e., cycad pups). Cycads pups may or may not have natural root growth while on the parent tree and can be salvaged and propagated. Seeds are dispersed by floating among islands (USFWS 2020).

The fadang has a small percent overlap (1.1%) between agricultural use sites of carbaryl and the species range, and past usage data indicates a small portion, 0.7% of the species' range, has been treated with insecticides annually. Thus, the species has a low exposure ranking. The species and its pollinators are not expected to occur on non-agricultural use sites since it is found only in native (not managed) forests and coastal strand habitat. As such, we expect most exposure of pollinators to occur from agricultural uses for this species. Fadang has a medium toxicity ranking as it can use both wind and moths for pollination and relies on abiotic vectors for seed dispersal (water, gravity).

C-B1. Nonflowering and abiotic pollination plant groups

We do not anticipate the minimal adverse reproductive effects caused by loss of the moths that pollinate this species will result in species-level effects. We arrive at this conclusion because of the very low overlap and carbaryl usage in agricultural areas and lack of expected exposure on non-agricultural use sites. In addition, the species can use wind for successful pollination and water to disperse seeds among islands. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the fadang.

References:

U.S. Fish and Wildlife Service. 2020. *Cycas micronesica* (fadang, faadang) 5-Year Review Summary and Evaluation. Honolulu, Hawaii. 22 pp.

U.S. Fish and Wildlife Service. 2023. Recovery Plan for 23 Species in the Mariana Islands. Portland, Oregon. 119 pp.