Integration and Synthesis Summary for Reptiles

This Integration and Synthesis Summary includes our jeopardy analysis for reptile 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 vulnerability, exposure, and toxicity. Data and information used for each species include environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how species were assessed are in Appendix E. Status of the Species for each species can be found in Appendix B.

Most of these species have low exposure to atrazine due to the factors described in the tables or individual rationales below, in combination with reductions in atrazine residues in spray drift and runoff resulting from implementation of conservation measures that will be added to the product label (including those developed during this consultation through the Herbicide Strategy[1]; see Conservation Measures section below).

Vulnerability

For the reptile species that we or EPA determined are "likely to be adversely affected" by the proposed action, we considered several factors for each listed reptile to determine 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 near extinction, far from recovery, or moving toward further decline than if their condition is stable or improving. We also identify which species are most (and least) susceptible to additional stressors in general based on information from species listing and recovery documents, or other sources as cited and considered in the Status of the Species and Critical Habitat section of this Opinion (Appendix B).

Our assessment of vulnerability focuses on six factors (as currently understood and available): (1) the species listing status and recent 5-year status review recommendation (if available), (2) distribution, (3) number of populations[2], (4) species population trends, (5) if pesticides have been noted as a threat, , and (6) current and projected future 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

[1] https://www.regulations.gov/docket/EPA-HQ-OPP-2023-0365

[2] The number will vary in value and importance by species and in some cases is unknown. In general, species with a greater number of populations have greater representation, will be more resilient, and when distributed geographically, will have greater redundancy. Conversely, species with fewer populations, in general, have less representation, are less resilient, and have less redundancy.

recovery plans, species status assessments, range and critical habitat information from our ECOS[3] repository, and other sources containing the best available scientific information for the species.

We scored each of the six vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as high, a mixture of medium and high, or if a threatened species was recommended for uplisting to endangered status in the most recent 5-year status review or proposed rule. We assigned a medium vulnerability ranking if a species' scores were all medium, a mix of high, medium, and low, or a mix of high and low (unless the species has been recommended for uplisting or delisting). We assigned a low vulnerability ranking to species with only low scores, a mixture of low and medium scores, or if the species was recommended for delisting. Considerations regarding specific aspects of the species' vulnerability or beyond what was included in the vulnerability ranking were applicable in our jeopardy analyses for some species depending on unique aspects of their vulnerability factors, recovery needs, or life history. This information is reflected in the rationales for conclusion below.

Exposure

We anticipate that the main route of exposure for reptiles is dietary, through consumption of contaminated food items either as the result of exposure to pesticide applications on-field or through off-field transport via spray drift or runoff. Atrazine is moderately mobile in water and is relatively persistent in the environment relative to other pesticides, indicating that off-site transport, particularly through runoff, may result in exposure to listed species in areas far from use sites.

Exposure to Agricultural Uses

Atrazine has several registered agricultural uses (see Appendix 1-4 of EPA's Biological Evaluation) in the coterminous United States. We characterize the expected level of exposure using overlaps between the species' ranges and agricultural areas where atrazine is registered for use (i.e., overlap data; including a 305-m off-site transport area adjacent to use sites), past atrazine usage data (when available; the amount and location where atrazine has been used in the past), any species-specific considerations such as life history information (e.g., habitat preferences, dietary needs, dispersal behavior), and existing protections or conservation actions (e.g., existing label measures, conservation measures from the action agency). Species with greater than 10% overlap between their range and agricultural atrazine 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% overlap are assigned a low overlap score. In addition to range overlaps with atrazine use sites, we considered past atrazine usage data within a species' range to determine how much of a species' range we expect to be treated with each year of the proposed

[3] https://ecos.fws.gov/ecp/

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 Opinion. Species with usage data that indicate a large portion of their range (>10%) is treated with atrazine each year are assigned a high usage score. Species that have a medium portion of their range (5-10%) treated with atrazine each year are assigned a medium usage score, and species where data indicate a low portion of their range (<5%) is treated with atrazine each year are assigned a low usage score.

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.

Agricultural uses of atrazine include labeled uses for corn, vegetables and ground fruit (i.e., sweet corn), sod, orchards (i.e., guava and macadamia nut), other grains (including sugarcane and sorghum), and fallow fields only within the coterminous United States.

Exposure to Non-Agricultural Uses

In addition to agricultural uses, atrazine is registered for use on non-agricultural turf, including residential lawns and golf course turf. UDLs for non-agricultural uses sites that represent turf tend to be less defined than those for agricultural UDLs and are less likely to accurately represent the actual footprint of these use sites on the landscape. As such, we assess exposure of species to all non-agricultural uses of atrazine in a qualitative manner, considering the life history of species, methods of application, atrazine usage, and any existing conservation measures to reduce drift and runoff or otherwise limit exposure to species. To facilitate this analysis, for every species in this Appendix, we reviewed species' documents (e.g., Status of the Species (Appendix B), 5-year reviews, Species Status Assessments, recovery plans, listing rules) to determine if the species could occur on or near non-agricultural atrazine use sites (i.e., residential areas where lawns or golf courses are likely present) and the manner in which they may rely on these sites.

Depending on region, cool-season, warm-season, or a combination of turf grass species are managed on golf courses and lawns. Cool-season grasses grow best in cooler conditions, and warm-season grasses thrive in hot, dry weather (USDA, 2004); there is a transition zone across the U.S. where either category of turf grasses may be planted based on microclimate conditions. Exposure to triazines will kill cool-season grasses, but warm-season grasses can tolerate exposure to atrazine. As such, EPA estimated where in the U.S. only cool-season grasses are exclusively used in turf based on the U.S. Department of Agriculture's plant hardiness zone map as atrazine use is not expected in these areas (USDA, 2023). Because hardiness zones will change over time with environmental conditions, EPA created a static map based on the hardiness zones where they expect warm- and cool-season grasses are grown based on the most recent data mapped (i.e., 1991-2020). EPA determined zones 1a-6a represent cool-season grasses (i.e., white areas) and zones 6b-13b may include warm-season grasses (i.e., black areas) (Figure 1). We expect the cool- and warm-season grass assessment to apply to all turf, including residential, commercial, and golf course turf. We refer to EPA's cool-season map in species assessments where relevant, particularly if a species occurs exclusively in the cool-season zone where we expect atrazine will not be used on turf and no exposure will occur from this use.

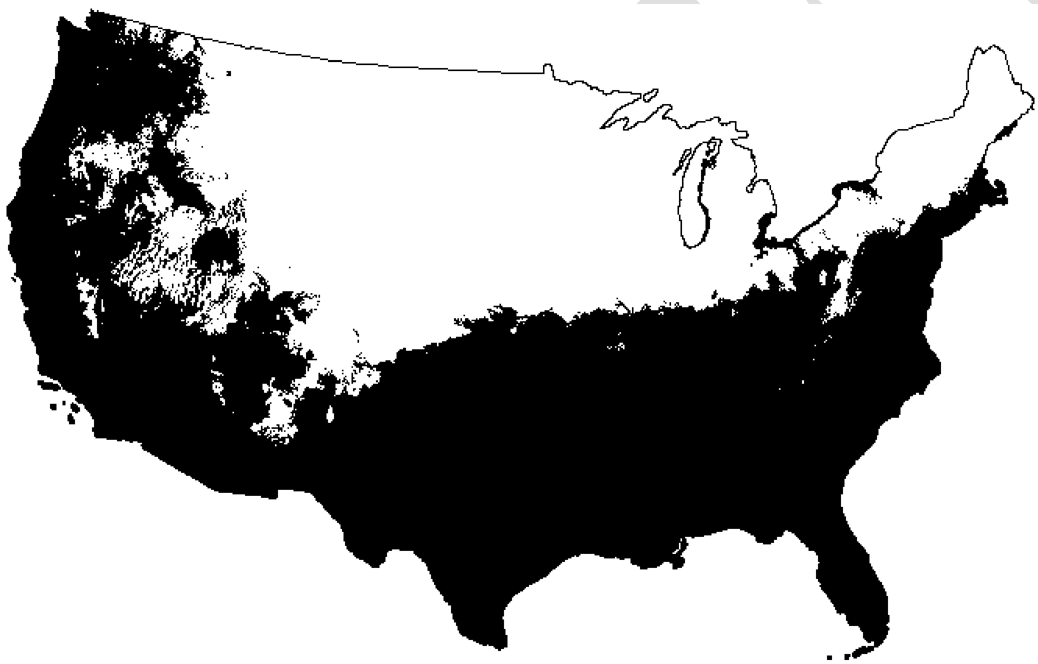

Figure 1. Map showing where cool-season grasses (white areas) and warm-season grasses (black areas) are used on turf across the continental U.S.

Particularly for residential and commercial turf uses, qualitative usage information obtained by EPA from the National Association of Landscape Professionals (NALP) indicate that atrazine is no longer commonly used on residential or commercial turf due to preferential use of newer herbicides. If atrazine were used on residential or commercial turf, it would be applied during the fall and spring as a pre-emergent. In addition, commercial and residential applicators typically apply herbicides with hand-held equipment that release course droplets, limiting the potential for spray drift.

Particularly for golf course turf uses, we obtained qualitative usage information directly from the Golf Course Superintendents Association of America (GCSAA) and an academic turf scientist that indicate that atrazine is used to control winter annual broadleaf and annual bluegrass weeds on golf courses. They are applied as a pre-emergent in early fall and early winter to fairways and roughs, which make up approximately 30% of a golf course's acreage. Triazines are not applied to tee boxes or greens, which make up an additional 6% of golf course acreage. Most applications are made at rates lower than what is on the label (i.e., 1 lbs. AI./A spray). These applications are made only once or twice a year, 45-60 days apart. In general, golf courses typically apply herbicides using dedicated ground equipment with a low boom height (as per the label), and golf course superintendents make use of several tools to monitor soil moisture before any applications are made to help ensure turf and soil conditions do not lead to off-target movement of herbicides. In addition, riparian buffer zones are often used on golf courses between all water features to reduce off target movement (Golf Course Superintendents Association of America [GCSAA], pers. comm., 2025). The no-till methodology and continuous cover of a turf grass area inherent in managing golf course turf are equivalent to additional run-off mitigations (i.e., equivalent to six points on EPA's mitigation menu), and we considered them in our assessment.

For most species in this Appendix, we anticipate that non-agricultural uses will not meaningfully add to the overall level of anticipated exposure considered in our analysis of agricultural uses. Due to runoff and spray drift considerations described above, off-site exposure is not expected to result in effects to most species in this Appendix. In addition, we expect most listed species' habitat requirements preclude them from occupying non-agricultural use sites where atrazine may be used. For species whose habitat is known or presumed to occur in non-agricultural use sites of atrazine, we consider, individually and qualitatively, the extent and manner of non-agricultural atrazine 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 atrazine.

References:

GCSAA (Golf Course Superintendents Association of America). 2025. Personal communication with USFWS HQ staff.

USDA. 2004. Comparing warm-season and cool-season grasses for erosion control, water quality, and wildlife habitat. Natural Resources Conservation Service, U.S. Department of Agriculture. 5 pp.

USDA. 2023. Plant Hardiness Zone Map. Agricultural Research Service, U.S. Department of Agriculture. Accessed from https://planthardiness.ars.usda.gov/ on August 20, 2025.

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[4] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to atrazine 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, reproduction, impaired motor activity or behavior) 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 food or habitat resources, are exposed to atrazine and experience adverse effects.

We consider estimated concentrations of atrazine on the landscape or within the environment and effects reported in available toxicity studies to determine the level of direct and indirect adverse effects to listed species or critical habitat. Concentrations of atrazine on food items can vary greatly depending on the particular item and where exposure takes place. For instance, exposures on or near use sites are at higher levels than exposures that occur in areas far away from use sites. We anticipate reptiles that primarily forage on atrazine use sites will accumulate higher levels of atrazine than individuals that forage solely in off-site areas or those that forage between on- and off-site areas. Based on available toxicity data in birds (which we use as a surrogate for reptiles), we anticipate individuals exposed directly on use sites will not die but may experience sublethal adverse effects to growth or reproduction, but only at high exposure concentrations. For instance, a study in mallard ducks observed statistically significant reductions in hatchling weight (ranging from 5.3% to 12.3% reduction), impacts to egg production, reduced food consumption, and reduced male weight gain were observed at exposure concentrations ranging from 75 to 675 mg atrazine/kg-diet. A study in northern bobwhite quail observed similar impacts (reduced egg production and embryo viability, reduced male weight gain) at similar exposure concentrations. While this and other reproductive studies are based on chronic exposures occurring over multiple days to weeks, it is often difficult to tease out which aspect of the reproductive process was compromised and the length of exposure required to elicit the effect, as explained in more detail in our Biological Opinion (General Effects to Terrestrial Species). As such, we assess the risk of reproductive effects using EECs associated with acute exposure but consider the uncertainty associated with that analysis in our weight of evidence for each species. In contrast, we do not anticipate individuals that are only exposed off-site (i.e., in areas only

[4] 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 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.

exposed to atrazine through spray drift of runoff) will accumulate levels of atrazine that would result in any direct adverse effects.

We anticipate species that only rely on plant-based resources, such as seeds or leaves for food or vegetation as habitat, are likely to experience indirect adverse effects with atrazine exposure. In contrast, species that rely on animal prey for food resources will experience lower levels of indirect adverse effects (if any) as atrazine exposure will not likely impact the abundance and availability of animal prey. While animal prey, particularly mammalian prey species, will also experience sublethal adverse effects if they only forage directly in atrazine use sites, we do not anticipate this sublethal effect to prey species will result in significant changes to the overall availability of prey for listed reptile species to forage on. Thus, we anticipate listed reptile species that can rely on animal prey instead of or in addition to plant food resources are less likely to experience indirect adverse effects from atrazine use.

Similarly, while many listed reptile species require vegetative structures or plant communities as components of their habitat, we do not anticipate atrazine exposure will result in complete mortality of the entire plant community. While we anticipate impacts to growth and survival of sensitive plant species, given that most listed reptiles can rely on a wide variety of species for food or shelter, we expect there will still be sufficient vegetative food resources or complex vegetative structures that provide habitat for individuals with atrazine exposure as these general plant resources are likely more robust to changes in plant composition and can endure impacts to sensitive plant species.

We determine the overall toxicity ranking for reptiles by qualitatively assessing both the expected levels of direct adverse effects (e.g., sublethal effects to growth and reproduction) and indirect adverse effects (e.g., prey and vegetation loss). Given that mortality is the most adverse of direct effects to an individual of a species, we assign the most weight to direct adverse effects resulting in mortality when determining the toxicity ranking. As mentioned previously, available toxicity data in birds (used as surrogate for reptiles) indicate reptiles are not likely to die directly from atrazine exposure at estimated environmental concentrations. However, sublethal effects may result in reductions to reproduction. Thus, we rank reptiles exposed at these concentrations from low to high depending on the nature and extent of exposure, considering factors such as dietary preference. Ranking for indirect effects will be variable based upon effects to food resources.

Conservation Measures

The technical registrants have previously agreed to substantial conservation measures that were incorporated into EPA's 2021 BE. These conservation measures include the following:

- Prohibit use in Hawaii, Alaska, and the Territories,
- Prohibit use on roadsides, shelterbelts, Conservation Reserve Program (CRP) land, conifers (including Christmas tree plantings), timber and forestry, and miscanthus and other perennial bioenergy crops,

- Prohibit application via mechanically pressurized handguns to macadamia nuts, sweet corn, and guava,
- Restrict “fallow” uses on all labels to the following scenarios and geographies only:
    - Wheat-corn-fallow and wheat-fallow-wheat in CO, KS, ND, NE, SD, and WY,
    - Wheat-sorghum-fallow in AR, CO, GA, IL, KS, LA, MS, MO, NE, NM, NC, OK, SD, and TX
- Reduce the single maximum application rate of turf, granular formulations to 2.0 lbs. AI/A, and reduce the single maximum application rate of turf, sprays to 1.0 lb. AI/A,
- Restrict applications made by backpack-spray to landscape turf to spot treatments only,
- Restrict applicators from applying atrazine products to the same sorghum acre,
- Require all applications to use coarse or coarser droplet sizes,
- Require an in-field downwind buffer of 15-ft for all ground applications (from the edge of all streams and rivers as well as the high-tide line for all estuarine/marine environments, and from threatened and endangered species critical habitat and/or species locations)
- Prohibit all ground applications when wind speeds exceed 10 miles per hour at the application site,
- For ground boom applications, only apply with the release height recommended by the manufacturer, but no more than 4-ft above the ground or crop canopy,
- Require an in-field downwind buffer of 150-ft for all aerial applications (from the edge of all streams and rivers as well as the high-tide line for all estuarine/marine environments, and from threatened and endangered species critical habitat and/or species locations),
- If the windspeed is 10 miles per hour or less, applicators must use ½ swath displacement upwind at the downwind edge of the field. When the windspeed is between 11-15 miles per hour, applicators must use ¾ swath displacement upwind at the downwind edge of the field,
- If the windspeed is greater than 10 mph, the boom length must be 65% or less of the wingspan for fixed wing aircraft and 75% or less of the rotor diameter for helicopters. Otherwise, the boom length must be 75% or less of the wingspan for fixed-wing aircraft and 90% or less of the rotor diameter for helicopters,
- Prohibit all aerial applications when wind speeds exceed 15 miles per hour at the application site,
- Restrict aerial applications from releasing spray at a height greater than 10-ft above the ground or vegetative canopy unless a greater application height is necessary for pilot safety,
- Prohibit aerial applications of non-liquid formulations,
- Prohibit all applications during temperature inversions.

While these conservation measures are impactful and contribute to reducing the level of exposure and adverse effects to listed species, EPA and the Service anticipate substantial risk of adverse effects to many listed species remain after incorporating these measures into the proposed action.

Herbicide Strategy Conservation Measures

As part of the atrazine ESA consultation with the Service, EPA is implementing the final Herbicide Strategy to inform and identify any necessary conservation measures where EPA's analysis indicated there was a risk of population level effects to listed species. The measures identified by EPA, and committed to by the technical registrants, include:

- a standard 170-foot wind-directional spray drift buffer for aerial applications[5] (not in addition to the buffers the technical registrants committed to previously), and
- a minimum of three runoff mitigation points[6] necessary in all areas where atrazine is used, as well as additional runoff mitigation points (i.e., six points total) for certain atrazine uses limited to certain geographic areas when required to protect specific listed species.

In addition to the conservation measures identified through EPA's Herbicide Strategy, in the course of this consultation the technical registrants have also committed to additional measures for specific registered uses of atrazine to reduce exposure to listed species, including:

- Reduce the maximum annual application rate for field corn from 2.5 lbs. AI/A to 2.0 lbs. AI/A,
- For sweet corn uses, adopt one of the following:
    - Do not apply atrazine to sweet corn from August 15th to November 1st; when applied during other times of the year, use as a pre-emergent up to 2.0 lbs ai/acre.
    - With no timing restrictions for use, use as pre-emergent up to 1.25 lbs ai/acre followed by post-emergent 0.75 lbs ai/acre.
- Restrict "corn" in wheat-corn-fallow rotations to "field corn" meaning "wheat-field corn-fallow rotations",
- Off-label all uses in California except for Imperial County, and
- Add the restriction "Do not apply atrazine products during rain or when soils are saturated or above field capacity" to all formulations.

The spray drift buffers will be placed on the general label and will apply to all uses of atrazine. EPA's Herbicide Strategy provides applicators with options to reduce the distance of this buffer by using other spray drift reduction strategies that we anticipate will result in an equivalent reduction in spray drift entering non-target habitats as stated buffers. These measures and the

[5] Note: The 170-foot aerial buffer replaces the 150-foot aerial buffer agreed to before implementation of the Herbicide Strategy.

[6] Ecological Mitigation Support Document to Support Endangered Species Strategies

degree to which applicators can reduce buffers by employing them are described in EPA's Herbicide Strategy and EPA's Ecological Mitigation Support Document to Support Endangered Species Strategies. These documents are provided in Appendix A-1.

Based on EPA's analyses, the required spray drift conservation measures described above (from the current label, those from implementation of the Herbicide Strategy, and additional measures committed to through consultation for specific registered atrazine uses) will reduce spray drift from entering species' habitats by >95%. The Service anticipates that this reduction will minimize off-site transport of atrazine from spray drift to a level where no more than low levels of effects are likely to occur to most species.

As stated above, all agricultural labels will include a requirement for applicators to achieve three points of runoff mitigation, as described in the Herbicide Strategy, for all agricultural uses. EPA's Herbicide Strategy provides applicators with various options to reduce runoff and erosion and assigns points to each option based on its effectiveness. Applicators must implement sufficient mitigation points to meet the label requirement. Applicators can achieve the required points using the conservation measures identified on EPA's Mitigation Menu website[7]. The menu provides a suite of options, including relief points for certain field characteristics and likelihood for pesticide transport.

We expect implementation of the required runoff and erosion reduction measures to minimize off-site transport of atrazine to habitats of listed species. EPA's analyses indicated that the general label requirement of three runoff mitigation points will reduce estimated environmental concentrations of atrazine in runoff by up to an order of magnitude (i.e., up to 90% reduction, in other words reduce pesticide loading to one-tenth of pre-runoff mitigation levels).

For all the species in this document, we expect that the runoff and conservation measures will reduce exposure concentrations to within one order of magnitude of the exposure level where individuals exposed to atrazine in areas off-site will not accumulate more than low levels of atrazine and are not likely to experience more than low levels of sublethal adverse effects to growth or reproduction (if any). Additionally, we anticipate these agricultural measures will reduce exposure to plant species, resulting in no more than low levels of adverse effects to plants that provide food or habitat features for listed species.

Summary of Conclusions for Reptile Species

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the registration of atrazine, as proposed, is not likely to jeopardize the continued existence of the eight reptile species in this Appendix.

[7] Mitigation Menu website: https://www.epa.gov/pesticides/mitigation-menu

Appendix C-A8. Reptiles: Integration and Synthesis Summaries

In our analysis below, some species that had the same or very similar rationales for their conclusions 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 indicating 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 detailed process for each species-specific analysis remained the same, including for species for which we summarized our findings in tables below.

Species with low agricultural exposure achieved through conservation measures and low likelihood of non-agricultural exposure

For the species in Table 1, we expect they will have low exposure after incorporating general label measures (i.e., measures already on the label, three runoff points and ground and aerial buffers determined through implementation of the Herbicide Strategy, and rate reductions and other restrictions to particular registered uses). Therefore, we expect adverse effects to be low. While we present some specific information about the species below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Species with low agricultural exposure achieved through conservation measures and low likelihood of non-agricultural exposure.

Common Name	Scientific Name	Vulnerability Ranking	Agricultural Exposure Ranking	Toxicity Ranking	Conservation Measures	Determination
Cedar Key mole skink	*Plestiodon egregius insularis*	High	Low	Low	General label measures	No Jeopardy
Plymouth redbelly turtle (=Plymouth redbelly cooter)	*Pseudemys rubriventris bangsi*	High	Low	Low	General label measures	No Jeopardy

The species in Table 1 are grouped together because the conservation measures included in the proposed action—including both the measures from the registrant and those derived using EPA's Herbicide Strategy—are expected to sufficiently reduce atrazine transport to their terrestrial or aquatic habitats such that no more than low levels of adverse effects are anticipated. All species in this group have high vulnerability rankings, reflecting their limited distributions, small or declining populations, and known sensitivity to environmental stressors. Specifically, pesticides are a noted threat to the Plymouth redbelly turtle. While individuals of the species spend most of their time in aquatic habitats, including coastal plains ponds, river systems and wetlands, herbicide use in cranberry bogs is noted as a threat to the species, potentially affecting water quality and food resources for the species (USFWS, 2021). The species also consumes aquatic vegetation and aquatic invertebrates, including both milfoil and crayfish, respectively. However, atrazine is not registered for use for cranberry production, and we do not anticipate it represents a threat to this species with the exception of low levels of direct adverse sublethal effects to growth from consumption of exposed invertebrate prey and reductions in aquatic plant dietary items, both from residual agricultural runoff affecting a small number of individuals. The Cedar Key mole skink inhabits low-lying coastal wetland, beach and hammock habitats in largely protected sites (i.e., USFWS National Wildlife Refuges (NWRs)). The species has a low toxicity ranking because, while in general for reptiles, we anticipate individuals exposed directly on use sites will not die but may experience sublethal adverse effects to growth or reproduction, but only at high exposure concentrations. For this species, sea-level rise is a significant threat, but pesticides are not noted as a threat and we do not anticipate direct adverse effects to growth or reproduction from exposure on agricultural sites as the species is not likely to inhabit such sites, preferring its low-lying coastal wetland and hammock habitats. The Plymouth redbelly turtle also has a low toxicity ranking. For both species, the toxic effects from atrazine are not anticipated to result in greater than low level adverse effects as the anticipated exposure to both species is expected to be low.

We anticipate the species in this group are not likely to occur in agricultural atrazine use sites. We expect the general label measures for agricultural uses described above (e.g., reduced application rates, 15-foot spray drift buffer for ground application, 170-foot spray drift buffer for aerial applications, and three runoff mitigation points) will reduce off-field exposures by an order of magnitude (i.e., a 90% reduction), which we expect will not cause more than low levels of adverse effects to exposed individuals and will not result in more than low levels of adverse effects to the plant communities that provide habitat and food resources to individuals.

In addition to low levels of agricultural exposure, neither of the species in Table 1 are anticipated to be exposed to atrazine from non-agricultural (i.e., turf) uses. These non-agricultural use sites do generally not provide the species' necessary habitat (e.g., aquatic sites) and in the case of the Cedar Keys mole skink, most of the species habitat exists in low-lying coastal wetlands within the Cedar Keys NWR and the Lower Suwannee NWR, which are absent golf courses and turf sites and where we do not anticipate atrazine use based on Service reporting of atrazine use through our Pesticide Use Proposal database (i.e., no reported atrazine use nationwide for the period of 2015-2025). While there are approximately 20 golf courses within the range of the Plymouth redbelly turtle, including several in proximity to the Massasoit NWR, given our understanding of atrazine usage on use sites such as golf courses and residential lawns (see *Exposure to Non-Agricultural Uses*, above), we expect atrazine usage within the ranges of these species to be limited. In addition, if applied, we anticipate off-site transport of atrazine will be minimal as characteristics of the use sites (i.e., continuous cover, no till) are expected to result in little runoff. Furthermore, commercial and residential applicators typically apply herbicides with hand-held equipment that release course droplets, limiting the potential for spray drift from these specific uses. Therefore, we expect atrazine exposure from non-agricultural uses to be low for these species.

In summary, with implementation of conservation measures on product labels, we expect that few individuals will be exposed to atrazine via off-site transport from agricultural or non-agricultural areas. Those few exposed individuals will experience no more than low level of direct adverse effects to growth and indirect effects through dietary loss. Therefore, we determine the overall risk of adverse effects to these species is low. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including general label and specific conservation measures), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of these species in the wild. Thus, it is our biological opinion that the registration of atrazine, as proposed, is not likely to jeopardize the continued existence of the species in Table 1.

References

U.S. Fish and Wildlife Service. 2021. Species Status Assessment Report for the Massachusetts Population of the Northern Red-bellied Cooter (*Pseudemys rubriventris*), Version 1.0. November 2021. Hadley, Massachusetts.

U.S. Fish and Wildlife Service. 2023. Species status assessment report for the Cedar Key mole skink (*Plestiodon egregius insularis*). Version 2.0. October 2023.

U.S. Fish and Wildlife Service. 2025. Pesticide Use Proposal (PUP) database. Accessed September 2025.

Species with Individual Integration and Synthesis Summaries

The species in Table 2 have individual Integration and Synthesis summaries. We expect Herbicide Strategy conservation measures to reduce pesticide loading into aquatic habitats by 90% (i.e., one order of magnitude) compared to unmitigated runoff and reduce spray drift from entering species' terrestrial habitats by >95%. We anticipate that this reduction will minimize off-site transport and reduce the likelihood, magnitude, and frequency of exposure of atrazine to a level where no more than low levels of adverse effects are likely to occur to plants through this exposure route. While the conservation measures are expected to reduce the extent of off-field exposure and reduce exposure concentrations, we anticipate atrazine residues on use sites could remain at levels high enough to cause greater than low levels of adverse direct and/or indirect effects to these species. They may occur on atrazine use sites, either agricultural or non-agricultural. For each species, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Species with individual integration and synthesis summaries.

Common Name	Scientific Name	Determination
Desert tortoise	*Gopherus agassizii*	No Jeopardy
Eastern indigo snake	*Drymarchon couperi*	No Jeopardy
Florida Keys mole skink	*Plestiodon egregius egregious*	No Jeopardy
Gopher tortoise	*Gopherus polyphemus*	No Jeopardy
Sand skink	*Neoseps reynoldsi*	No Jeopardy
Short-tailed snake	*Stilosoma extenuatum*	No Jeopardy

Integration and Synthesis Summary: Desert tortoise

Scientific Name:	Common Name:	Entity ID:
Gopherus agassizii	Desert tortoise	185

Conclusion: No Jeopardy

Species Range

Based on range map dated: 11-05-2020; Wherever found, except AZ south and east of Colorado R., and Mexico; *States within the range:* AZ, CA, NV, UT

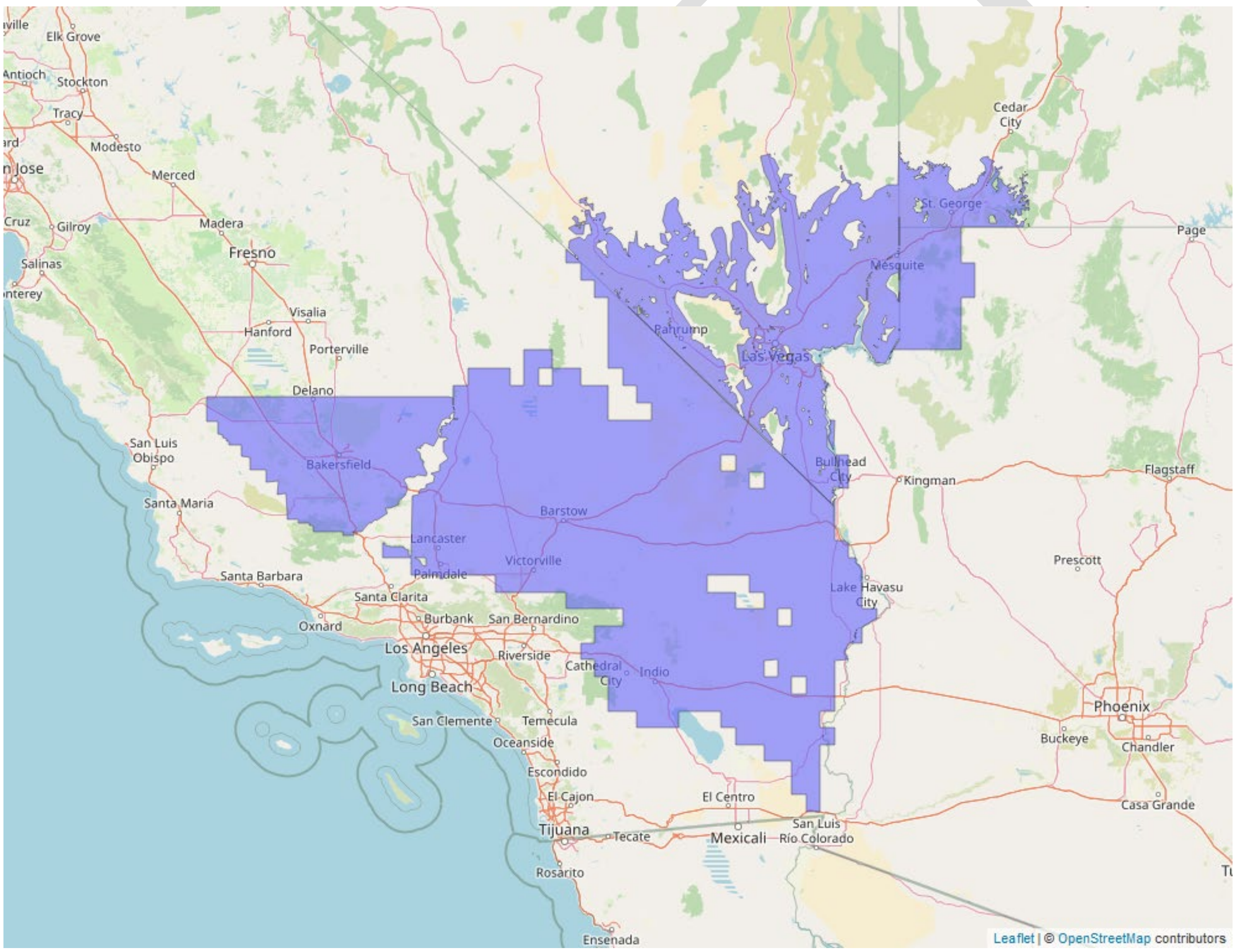

Figure 2. Range map of desert tortoise (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4481.

Vulnerability

As mentioned in the Introduction, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of Status

Listing status: Threatened

Most recent 5-year review recommendation: No change in Status

Most recently completed 5-year review: 5/20/2022

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The desert tortoise is a large, herbivorous reptile that occurs in the Mojave and Sonoran deserts. They are found in flats and slopes characterized by creosote bush scrub (*Larrea tridentata* and *Ambrosia dumosa*) at lower elevations and rocky slopes in blackbrush scrub and juniper woodland ecotones to higher elevations. They eat winter annuals, perennial grasses, woody perennials, cacti, and some non-native plants. Listed desert tortoises occur north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, and southwestern Utah and the Sonoran desert in California. Scattered subpopulations remain in undeveloped portions of Antelope, Indian Wells, and Searles Valleys. Desert tortoises also occur in the lower Colorado River Valley, Arizona uplands, plains of Sonora, and the central Gulf Coast (USFWS 2011). The range-wide population is still estimated to include hundreds of thousands of individuals, but most populations within Turtle Conservation Areas continued to decline between 2004-2014, with an estimated range-wide decline of 37%. The Northeastern Mojave recovery unit is the only area that increased in tortoise numbers during this time, from about 12,610 to 46,701 tortoises (USFWS 2022).

The primary threats to desert tortoises include habitat loss and conversion from renewable energy development, military training, invasive species, and wildfire. Desert tortoises are essentially absent from habitat within 1 km of areas with >10% development, but at least 39% of tortoise habitat in each recovery unit has nearly no development within 1 km. However, solar energy development is likely to cause more desert habitat loss in the future; to minimize impacts of development, projects in Nevada increasingly have allowed native vegetation to regrow and desert tortoises to reoccupy sites (about 13,000 acres), but the success of allowing native flora and fauna to recolonize developed areas is uncertain. Military training land expansions have occurred or approved; about 1,650 adult desert tortoises had to be translocated due to Army and Navy training operations. Invasive grasses fuel wildfires that cause mortality and habitat effects to desert tortoises. Desert tortoises are also threatened by disease (upper respiratory tract disease, *Mycoplasma agassizii*), predation (e.g., badgers, coyotes, kit foxes, ravens, dogs, red-tailed hawks), and habitat loss and fragmentation from urbanization, roads and highways, off-highway vehicle use, and grazing. Many areas of the Mojave desert are being destroyed by cannabis farms, including bulldozing, water theft, and construction of greenhouses. Effects of global climate change have also become an important consideration for desert tortoises, particularly as they relate to drought and habitat shifts (USFWS 2022).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 2.9% of the species' range overlaps with agricultural use sites and 15.1% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff). In total, there is up to 17.9% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 3).

Table 3. Agricultural use overlap and annual usage data (% Range Treated) for the desert tortoise.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Corn	0.3	2.4	2.7	<0.1	0.9	0.9
Vegetables and Ground Fruit (Sweet Corn)	0.5	3.4	3.9	<0.1	0.4	0.5
Other Grains (Sorghum & Sugarcane)	0.5	3.6	4.1	0.5	3.6	4.1

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Orchards (Guava & Macadamia Nut)	0.2	0.9	1.1	<0.1	<0.1	<0.1
Other Crops (Wheat-Corn-Fallow)	0.0	0.0	0.0	0	0	0
Other Crops (Wheat-Sorghum-Fallow)	0.0	0.0	0.0	0	0	0
Other Crops (Wheat-Fallow-Wheat)	0.0	0.0	0.0	0	0	0
Other Crops (Sod)	1.4	4.8	6.2	1.4	4.8	6.2
Total	**2.9**	**15.1**	**17.9**	**2.1**	**9.6**	**11.7**

Usage

Past usage data indicate that up to 11.7% of the species' range has been treated with atrazine annually from agricultural uses, with 2.1% occurring on agricultural fields and 9.6% resulting from off-site transport (Table 3).

Additional Exposure Considerations

While the desert tortoise typically inhabits creosote bush scrub at lower elevations and rocky slopes in blackbrush scrub and juniper woodland ecotones at higher elevations, information provided by Service species experts indicate that individuals may travel through and forage on agricultural areas if the appropriate vegetation is available, which potentially include atrazine use sites. Thus, we anticipate individuals can potentially be exposed to atrazine directly on agricultural use sites.

Exposure from Non-Agricultural Uses

Information provided by Service species experts indicate that, while not likely preferred habitat, individual desert tortoises may travel through and forage on potential non-agricultural atrazine use sites such as lawns, turf, or golf courses if the appropriate vegetation is available for forage and shelter. Thus, we anticipate individuals can potentially be exposed to atrazine directly on non-agricultural use sites. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the desert tortoise to be limited.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift and runoff to off-site areas, including a 15-foot spray drift buffer for ground applications, a 170-foot spray drift buffer for aerial applications, and three runoff mitigation points for all agricultural uses of atrazine. We expect these measures will reduce the environmental concentration of atrazine by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff), reducing both the extent of areas exposed to spray drift and runoff as well as decreasing the exposure concentration in these off-site areas.

Effects of the Action: Toxicity

Direct Effects

For listed terrestrial animal species, we anticipate dietary exposure will result in the highest levels of exposure. While individuals may be exposed through other routes (e.g., dermal exposure, inhalation, drinking water), we anticipate these routes of exposure will result in much lower levels of exposures to individuals and will not significantly contribute to the overall exposure and resulting effects to individuals. The desert tortoise is an herbivorous reptile. We expect consumption of food items in and around atrazine use sites to be the primary route of exposure to desert tortoises. We do not expect desert tortoises that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to effects on use sites within the range.

We expect that individual desert tortoises foraging on grass or other plants directly on atrazine use sites will accumulate levels of atrazine high enough to cause reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. We do not anticipate any individuals exposed on atrazine use sites will die. However, we expect a range of concentrations to be associated with contaminated food resources and we only anticipate these effects if individuals forage on plants at the maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will occur infrequently, as agricultural fields and managed turf are not typical foraging areas of the desert tortoise, and most are not likely to contain suitable foraging habitat at the time of treatment. However, an individual desert tortoise feeding exclusively on treated use sites even a short period of time, such as a single day, may still accumulate a significant body burden of pesticide.

Indirect Effects

While we anticipate off-site transport of atrazine can negatively impact the growth and survival of sensitive plant species, we do not anticipate spray drift of runoff of atrazine will destroy or limit the availability of complex vegetative structure (e.g., creosote bush scrub, blackbush scrub, or juniper woodland communities) that the species requires for its habitat. Similarly, while the desert tortoise relies on plant material for food, including species that might be sensitive to atrazine, we anticipate the conservation measures on agricultural product labels (i.e., mandatory spray drift buffers and three points of runoff mitigations) and existing pesticide practices in non-agricultural use sites will minimize impacts to the habitat and food resources of the species.

Effects of the Action Summary

There is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a portion of the species' range will be treated with atrazine on agricultural fields annually. However, we only expect individuals will experience direct adverse effects when exposed to atrazine directly on application sites. Only 2.9% of the species' range occurs on agricultural atrazine use sites and we expect only 2.1% of those areas are likely to be treated with atrazine in a given year, indicating that no more than small numbers of individuals are likely to be exposed to atrazine on use sites. Desert tortoises may similarly be exposed in non-agricultural uses sites where atrazine has been applied, such as turf or golf courses, though we expect this to occur infrequently, as this does not represent preferred habitat and atrazine usage on these sites is expected to be low.

We expect individuals that exclusively forage on use sites recently treated with atrazine will experience reproductive effects. However, given the small extent of overlap with atrazine use sites within the range of the desert tortoise, the limited extent of usage on these sites, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on plants at maximum estimated atrazine residues from recently treated use sites), we anticipate that few individuals will experience reproductive effects from atrazine use.

While we anticipate atrazine use can impact the growth and survival of sensitive plant species, with implementation of conservation measures on agricultural product labels and existing pesticide practices in non-agricultural use sites, we anticipate there will be no more than low levels of indirect adverse effects to vegetative resources the tortoise relies on.

Thus, we conclude the overall risk of adverse effects to the species is low.

Species Conclusion

The desert tortoise is a largely terrestrial herbivorous reptile that utilizes xeric and largely undeveloped habitats across the desert southwest. While still widely distributed and numbering in the hundreds of thousands range-wide, recent estimates assess range-wide decadal declines of 37%. The desert tortoise has a medium vulnerability based on its status, distribution, and trends. The primary threats to desert tortoises include habitat loss and conversion from renewable energy development, military training, invasive species, and wildfire.

The desert tortoise likely occurs at low frequency on-field and in habitats adjacent to agricultural and non-agricultural use sites where atrazine could be used. Anticipated exposure, where it occurs, is expected through direct dietary uptake. We do not anticipate exposure will result in adverse effects to tortoises in off-site areas, but individuals foraging predominantly on recently treated use sites is expected to result in sublethal effects to reproduction. However, atrazine exposure is generally anticipated at low levels due to the limited amounts of agricultural and non-agricultural use sites in the species' primarily desert habitat, and low levels of transport to off-site areas from runoff and spray drift due to the conservation measures and given our understanding of atrazine usage on use sites such as golf courses and residential lawns (see Exposure to Non-Agricultural Uses, above) and characteristics of the use sites (i.e., continuous cover, no till) that are expected to result in little runoff. Furthermore, commercial and residential applicators typically apply herbicides with hand-held equipment that release course droplets, limiting the potential for spray drift from these specific uses.

Thus, while there is a large extent of overlap between the species' range and the action area, and a large portion of the species' range is likely to be treated with atrazine each year, we only expect a small number of individuals will experience direct adverse effects to reproduction when exposed to atrazine from foraging directly on agricultural and non-agricultural use sites after applications. Approximately 2.9% of the species' range occurs on agricultural atrazine use sites, and we expect 2.1% of those areas are likely to be treated with atrazine in a given year, indicating that no more than small numbers of individuals are likely to be exposed to atrazine on agricultural use sites. Desert tortoises may similarly be exposed in non-agricultural uses sites where atrazine has been applied, though we expect this to occur infrequently, as these areas do not represent preferred habitat and atrazine usage on these sites is expected to be low. Mortality is not anticipated for those individuals that predominantly forage on recently treated use sites, but they are likely to experience reproductive effects. However, given the small extent of overlap with atrazine use sites within the range of the desert tortoise, the limited extent of usage on these sites, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on plants at maximum estimated atrazine residues from recently treated use sites), we anticipate that few individuals will experience reproductive effects from atrazine use. Additionally, while we anticipate atrazine use will impact the growth and survival of sensitive plant species, we anticipate there will be no more than low levels of indirect adverse effects to vegetative resources the tortoise relies on. We do not anticipate the small number of individuals that experience a reduction of sensitive plants or sublethal effects to reproduction will result in species-level effects. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the conservation measures that are incorporated into the proposed action), we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise.

References

U.S. Fish and Wildlife Service. 2022. Mojave Desert Tortoise (*Gopherus agassizii*) 5-Year Review: Summary and Evaluation. Las Vegas, Nevada. 55 pp.

U.S. Fish and Wildlife Service. 2011. Revised Recovery Plan for the Mojave Population of the Desert Tortoise (*Gopherus agassizii*). Sacramento, California. 246 pp.

Integration and Synthesis Summary: Eastern indigo snake

Scientific Name:	Common Name:	Entity ID:
Drymarchon couperi	Eastern indigo snake	173

Conclusion: No Jeopardy

Species Range

Based on range map dated: 02-03-2022; Wherever found; *States within the range:* AL, FL, GA, MS

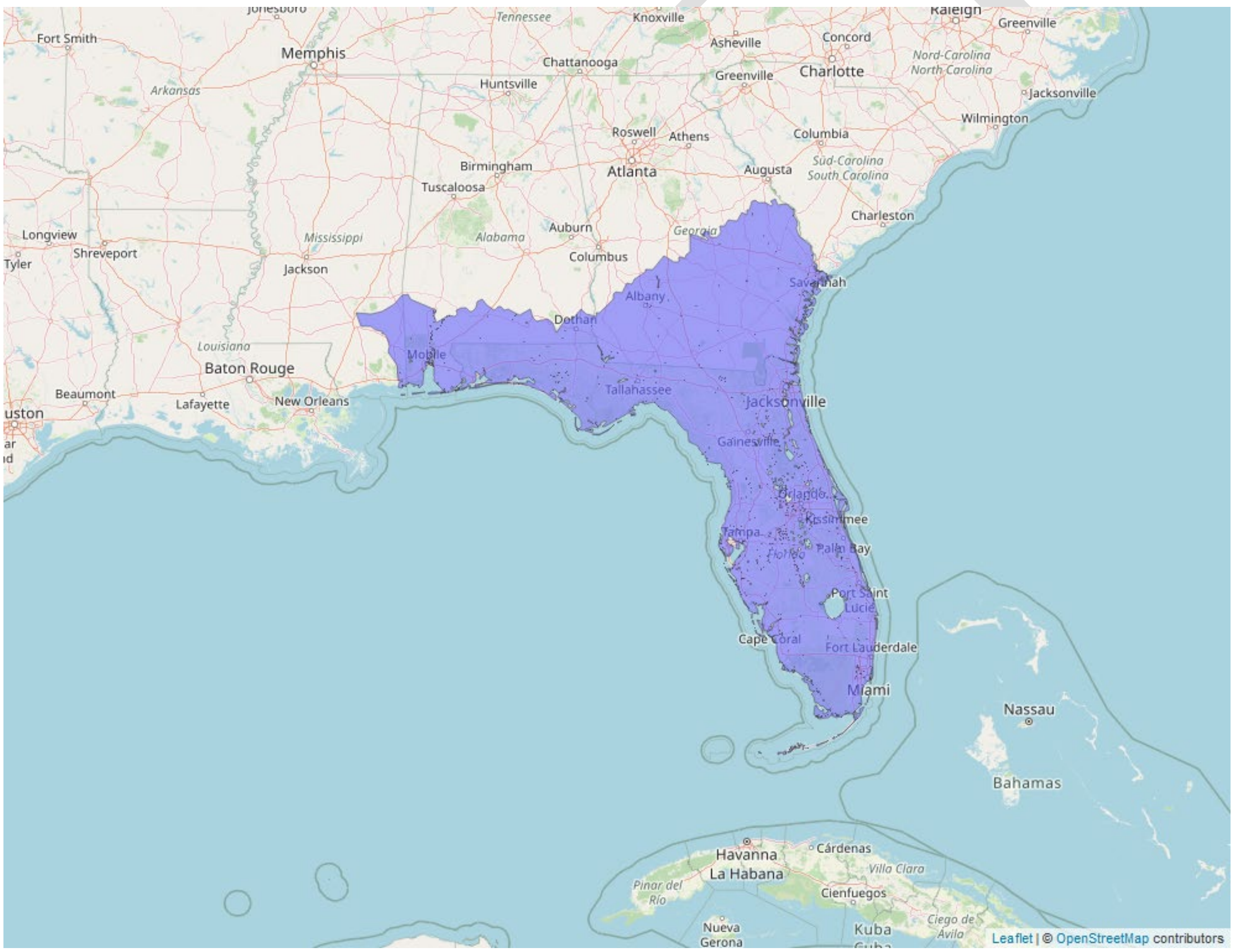

Figure 3. Range map of eastern indigo snake (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/646.

Vulnerability

As mentioned in the Introduction, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of Status

Listing status: Threatened

Most recent 5-year review recommendation: No change in Status

Most recently completed 5-year review: 8/28/2024

Distribution: Population size/Location(s) unknown

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Eastern indigo snakes are diurnal (i.e., active during the day) snakes that breed during autumn and winter. The few observed nests have been in open-canopied sandy habitats associated with gopher tortoise burrows. They are active foragers that consume a wide variety of animals, primarily rodents, anurans, snakes, and small turtles. More than half of the diet in one study was snakes. They are dependent on gopher tortoises for their burrows. Historically, the eastern indigo snake occurred throughout Florida and in the coastal plain of Georgia, Alabama, and Mississippi. The eastern indigo snake has been extirpated in Alabama and Mississippi and, and its distribution has further contracted in other areas, particularly in the Florida Panhandle, due to the decline of gopher tortoise populations. Fifty-three potential populations were estimated in 2019 (USFWS 2019). Of these populations, resilience was classified based primarily on habitat conditions as follows: eight very low, 28 low to medium-low, 13 medium to medium-high, and four high. The overall current population resiliency is medium to low. Population growth rates are unknown due to the lack of data on this cryptic species. The contemporary distribution of the eastern indigo snake represents the species' known ecological and genetic diversity, but the redundancy of populations has decreased. Most notable are the loss of populations in the Panhandle region (includes parts of Alabama, Florida, Georgia, and Mississippi) and a contraction of the distribution in the southern extent of the Peninsular Florida region, including the Florida Keys. The Panhandle and North Florida regions have zero highly resilient populations, thus limiting overall redundancy (USFWS 2019a, 2019b).

Wild collection of eastern indigo snakes for the pet trade and gassing of gopher tortoise burrows are no longer considered to be substantial threats although they still occur to some extent. Today, the primary threats to the long-term viability of the species are from habitat fragmentation and loss due to land use changes, especially urbanization. Urbanization includes a variety of negative impacts that remove or alter available habitat or impact snakes directly including: residential and commercial development, road construction and expansion, direct mortality (e.g., road mortality, human persecution, domestic pets), invasive species, predation and inadequate fire management. Habitat loss for coastal populations due to sea level rise is also an increasing risk. Snake fungal disease has emerged as an additional negative factor, but impacts to long-term viability remains uncertain, and research is on-going. Pesticides, especially those that bioaccumulate through the food chain, may present a hazard to eastern indigo snakes, but there have been no documented cases of mortality from pesticide use (USFWS 2019a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 7% of the species' range overlaps with agricultural use sites and 86.8% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff). In total, there is up to 93.8% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 4).

Table 4. Agricultural use overlap and annual usage data (% Range Treated) for the eastern indigo snake.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Corn	2.8	29.4	32.2	2.8	29.4	32.2
Vegetables and Ground Fruit (Sweet Corn)	0.6	15.5	16.1	0.1	3.0	3.1
Other Grains (Sorghum & Sugarcane)	1.5	13.2	14.7	1.4	11.8	13.3

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Orchards (Guava & Macadamia Nut)	0.1	2.6	2.7	<0.1	0.1	0.1
Other Crops (Wheat-Corn-Fallow)	0.0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Sorghum-Fallow)	0.1	6.8	6.9	<0.1	4.2	4.2
Other Crops (Wheat-Fallow-Wheat)	0.0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	1.8	19.3	21.1	1.8	19.3	21.1
Total	**7.0**	**86.8**	**93.8**	**6.2**	**67.8**	**74.0**

Usage

Past usage data indicate that up to 74% of the species' range has been treated with atrazine annually from agricultural uses, with 6.2% occurring on agricultural fields and up to 67.8% resulting from off-site transport (Table 4).

Additional Exposure Considerations

Eastern indigo snakes primarily occur in upland habitat but are also known to utilize human-altered habitats. In Florida, agricultural sites, such as sugar cane fields, improved pasture sites, citrus groves, and canal banks created in drained wetland areas are sometimes occupied by eastern indigo snakes (USFWS 2019).

Exposure from Non-Agricultural Uses

While non-agricultural atrazine use sites do not represent preferred habitat for the eastern indigo snake, available information on the species indicate that individuals may occupy areas of low-density residential housing. Thus, we anticipate individuals may be exposed to atrazine through non-agricultural uses, such as applications to residential lawns or other turf sites. However, given our knowledge of atrazine application to turf (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the eastern indigo snake to be limited.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift and runoff to off-site areas, including a 15-foot spray drift buffer for ground applications, a 170-foot spray drift buffer for aerial applications, and three runoff mitigation points for all agricultural uses of atrazine. We expect these measures will reduce the environmental concentration of atrazine by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff), reducing both the extent of areas exposed to spray drift and runoff as well as decreasing the exposure concentration in these off-site areas.

Effects of the Action: Toxicity

Direct Effects

For listed terrestrial animal species, we anticipate dietary exposure will result in the highest levels of exposure. While individuals may be exposed through other routes (e.g., dermal exposure, inhalation, drinking water), we anticipate these routes of exposure will result in much lower levels of exposures to individuals and will not significantly contribute to the overall exposure and resulting effects to individuals. The eastern indigo snake consumes a wide variety of animals, but the primary prey are rodents, anurans, snakes, and small turtles. We do not expect eastern indigo snakes that are exposed to atrazine on prey items as a result of off-site transport will experience adverse effects and thus focus our analysis to effects on use sites within the range.

We expect that individual eastern indigo snakes foraging directly on atrazine use sites will accumulate levels of atrazine high enough to cause reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. We do not anticipate any individuals exposed on atrazine use sites will die. However, we expect a range of concentrations to be associated with contaminated food resources and we only anticipate these effects if individuals forage on plants at the maximum estimated concentrations of atrazine on recently treated fields. We anticipated this will be a rare occurrence, as eastern indigo snake are expected to consume a varied diet that will also include resources off treated fields. However, an individual eastern indigo snake feeding exclusively on prey exposed on treated use sites even a short period of time, such as a single day, may still accumulate a significant body burden of pesticides, despite this species having a generally varied diet.

Indirect Effects

Available toxicity data suggests that prey items of the eastern indigo snake are not likely to die from exposure to atrazine. While individual terrestrial vertebrates may experience growth or reproductive effects if exposed to atrazine on use sites, we anticipate the conservation measures on agricultural product labels (i.e., mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices on non-agricultural use sites will reduce atrazine residues to levels where we do not expect adverse effects to prey survival and will not reduce the abundance or availability of prey for the species.

In addition, we anticipate off-site transport of atrazine can negatively impact the growth and survival of sensitive plant species, though we do not anticipate spray drift or runoff of atrazine will destroy or limit the availability of complex vegetative structure (e.g., upland vegetative community) that the species requires for its habitat. We anticipate the conservation measures on agricultural product labels and existing pesticide practices on non-agricultural use sites will further minimize impacts to the species' necessary plant resources. As such, we do not anticipate the proposed action will result in measurable levels of indirect adverse effects to the species.

Effects of the Action Summary

There is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a large percentage of the species' range will be treated with atrazine on agricultural fields annually. However, we only expect individuals that forage exclusively on atrazine use sites will experience and direct adverse effects. While prey species of the eastern indigo snake may be exposed to atrazine in non-agricultural use areas, we expect non-agricultural usage of atrazine within the range of the species to be low.

We expect individuals that exclusively eat prey contaminated on use sites recently treated with atrazine will experience reproductive effects. However, given the variable diet of the eastern indigo snake and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey at maximum estimated atrazine exposure concentrations from recently treated use sites), we anticipate that very few individuals will experience reproductive effects from atrazine use.

In addition, with implementation of conservation measures on agricultural product labels and existing pesticide practices on non-agricultural use sites, we do not anticipate atrazine use is likely to reduce the availability or abundance prey that the eastern indigo snake relies on as food resources, or result in appreciable impacts to any vegetative habitat resources for the species.

Thus, we conclude the overall risk of adverse effects to the eastern indigo snake is low.

Species Conclusion

The eastern indigo snake prefers upland habitat types (e.g. longleaf pine sandhills, scrub, pine flatwoods, tropical hardwood hammocks, and coastal dunes), but also uses a variety of lowland and human-altered habitats. As a primarily terrestrial reptile that utilizes the burrows of gopher tortoises for shelter and overwintering, the species is an active forager that consume a wide variety of animals, primarily rodents, anurans, snakes, and small turtles. The contemporary distribution of the eastern indigo snake represents the species' known ecological and genetic diversity, but the redundancy of populations has decreased, and the species is believed to be extirpated from its historic distribution in Alabama and Mississippi. The eastern indigo snake has a high vulnerability based on its status, distribution, and trends. The primary threats to eastern indigo snakes include habitat loss, primarily from residential and commercial development, road construction and expansion, and from direct mortality (e.g., road mortality, human persecution, domestic pets), invasive species, predation and inadequate fire management.

The eastern indigo snake may occur in agricultural use sites, including on-field in sugarcane fields, citrus groves and in improved pastures and farmed wetlands (not all of which are atrazine use sites, e.g., citrus groves and pastures) and in habitats adjacent to agricultural and non-agricultural use sites where atrazine could be used. As detailed above, there is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a large percentage of the species' range will be exposed to atrazine from agricultural uses annually. Agricultural use sites overlap with 7.0% of the species range, with annual usage anticipated on 6.2% of the species' range annually, with a larger portion of the range (up to 7.0%) likely to be exposed on use sites due to variations in use sites where annual usage may occur within the overlapping area over the project duration. Additional exposure is anticipated from non-agricultural uses of atrazine. However, given our understanding of atrazine usage on use sites such as golf courses and residential lawns (see Exposure to Non-Agricultural Uses, above), we expect atrazine usage within the range of the species to be limited. If applied, we anticipate off-site transport of atrazine will be minimal as characteristics of the use sites (i.e., continuous cover, no till) are expected to result in little runoff. Furthermore, commercial and residential applicators typically apply herbicides with hand-held equipment that release course droplets, limiting the potential for spray drift from these specific uses.

While we anticipate a moderate amount of atrazine usage on agricultural and non-agricultural use sites within the species' range, adverse effects to individuals are only anticipated in limited scenarios (i.e., those foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites). Because this species is likely to occur on and near use sites, we anticipate that a moderate number of individuals of this species and their prey resources will experience direct exposure over the duration of the action. We do not expect mortality of exposed individual eastern indigo snakes, but we do anticipate direct sublethal adverse effects to reproduction from agricultural and non-agricultural exposure from ingesting prey on recently treated use sites. However, given the variable diet of the eastern indigo snake and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey at maximum estimated atrazine exposure concentrations from recently treated use sites), we anticipate that a small number of individuals in localized areas overlapping with use sites will experience reproductive effects from atrazine usage. We do not anticipate snakes foraging on prey exposed in off-site areas will measurably affect eastern indigo snake reproduction. We also do not anticipate exposure will lead to losses of prey that would result in indirect effects to the snake on use sites or in off-site areas, as mortality of prey items is not anticipated and this species forages on a variety of prey, although terrestrial vertebrate prey items exposed on use sites may experience sublethal effects to growth or reproduction. We do not anticipate the reproductive effects in a small number of individuals will result in species-level effects. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the conservation measures that are incorporated into the proposed action), we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the eastern indigo snake.

References

U.S. Fish and Wildlife Service. 2024. Eastern Indigo Snake (*Drymarchon corais couperi*) 5-Year Review: Summary and Evaluation. Athens, Georgia. 23 pp.

U.S. Fish and Wildlife Service. 2019a. Eastern Indigo Snake (*Drymarchon corais couperi*) 5-Year Review: Summary and Evaluation. Athens, Georgia. 51 pp.

U.S. Fish and Wildlife Service. 2019b. Species Status Assessment (SSA) Report for the Eastern Indigo Snake (*Drymarchon couperi*). Version 1.1. Athens, Georgia. 160 pp.

Integration and Synthesis Summary: Florida Keys mole skink

Scientific Name:	Common Name:	Entity ID:
Plestiodon egregius egregius	Florida Keys mole skink	2238

Conclusion: No Jeopardy

Species Range

Based on range map dated: 09-23-2024; Wherever found; *States within the range:* FL

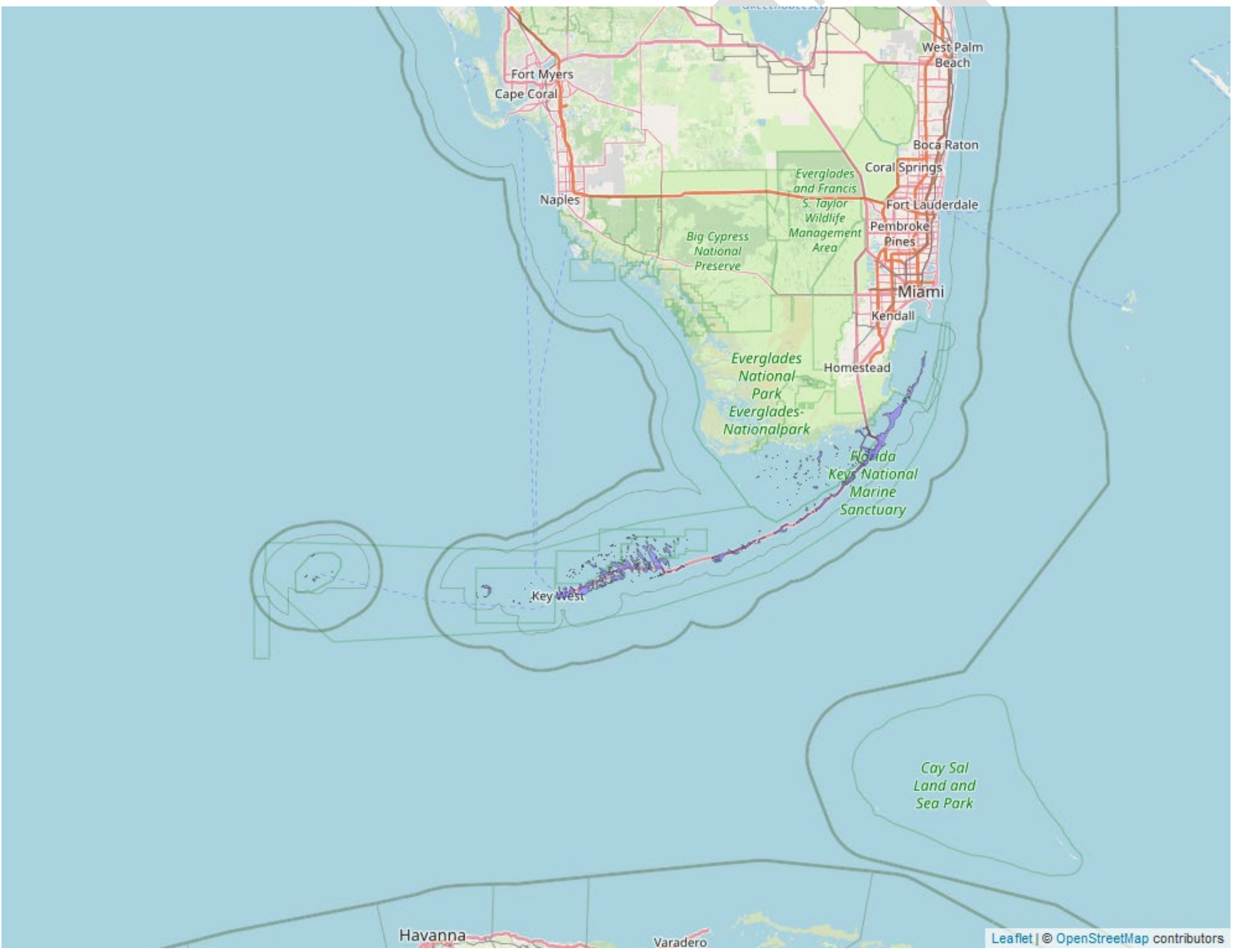

Figure 4. Range map of Florida Keys mole skink (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4480.

Vulnerability

As mentioned in the Introduction, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of Status

Listing status: Proposed Threatened

Most recent 5-year review recommendation: N/A

Most recently completed 5-year review: None available for this species

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Florida Keys mole skink (*Plestiodon egregius egregius*) is a small lizard known to occur only on islands in the Florida Keys. This species is semi-fossorial (adapted to digging and living underground) and cryptic in nature. While it can run, it more often utilizes “swimming” as a method to move through loose substrate. Soil and moisture conditions help define habitat, as skinks are seldom encountered where the soil is not well drained and friable. The Florida Keys mole skink has been found in wavewashed wrack above the intertidal zone of beaches, in debris, and in piles of rocks, as well as in other inland areas of suitable soils within other habitat types. The predominant threats currently affecting the Florida Keys mole skink and its habitat are sea level rise, more numerous high tide flooding events (the very highest tides), increased storm surges, and shifts in seasonal patterns of rainfall and temperature, all of which are predicted by climate change models. Because the Florida Keys mole skink inhabits and utilizes the transitional zone (50-80 cm above sea level) beach berm habitat and the coastal hammock habitat during all of its life stages, the species is especially vulnerable to SLR across its entire range. The Florida Keys are low-lying (average elevation is less than 1 m) the area is highly susceptible to flooding, and land further inland is at risk of inundation and saltwater intrusion from high tide flooding. Florida Keys mole skink habitat is also at risk of loss and degradation due to land uses and human activities, such as land development, human population increase and the resulting habitat disturbance, and beach erosion. The Florida Keys mole skink has been found in small numbers across the range of the Florida Keys (including the Distal Sand Keys region, consisting of the islands west of Key Wet to the Dry Tortugas). The majority of islands with any past or current detections occur within the Lower Keys, with the largest numbers of detections from Long Beach on Big Pine Key. Using individual islands as our potential populations (or analysis units, as these may not be biologically meaningful populations), we define 15 current, five recent, and four historical populations of the Florida Keys mole skink.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that <0.1% of the species' range overlaps with agricultural use sites and 0.4% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff). In total, there is up to 0.4% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 5).

Table 5. Agricultural use overlap and annual usage data (% Range Treated) for the Florida Keys mole skink.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Corn	<0.1	0.2	0.2	<0.1	0.2	0.2
Vegetables and Ground Fruit (Sweet Corn)	0	0.0	0.0	0	0.0	0.0
Other Grains (Sorghum & Sugarcane)	0	0.0	0.0	0	0.0	0.0
Other Orchards (Guava & Macadamia Nut)	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Crops (Wheat-Corn-Fallow)	0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-	0	0.0	0.0	0	0.0	0.0

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Sorghum-Fallow)						
Other Crops (Wheat-Fallow-Wheat)	0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	0	0.0	0.0	0	0.0	0.0
Total	**<0.1**	**0.4**	**0.4**	**<0.1**	**0.4**	**0.4**

Usage

Past usage data indicate that up to 0.4% of the species' range has been treated with atrazine annually from agricultural uses, with <0.1% occurring on agricultural fields and 0.4% resulting from off-site transport (Table 5).

Additional Exposure Considerations

The Florida Keys mole skink largely associated with beach berm zones and coastal hammock habitats. Given the loose soil required by the species, we do not anticipate individuals are likely to occur in agricultural atrazine use sites given that these soil characteristics are not compatible with agriculture. Thus, we anticipate individuals will only be exposed to agricultural uses of atrazine through spray drift or runoff.

Exposure from Non-Agricultural Uses

While the Florida Keys mole skink is primarily associated with beach berms habitat and adjacent dunes, individuals have been detected in developed areas of Key West, Big Pine Key, and Key Vaca and within pine rockland habitat on Big Pine Key. As such, we anticipate individuals may be exposed through non-agricultural uses of atrazine, such as in residential areas. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the Florida Keys mole skink to be limited.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift and runoff to off-site areas, including a 15-foot spray drift buffer for ground applications, a 170-foot spray drift buffer for aerial applications, and three runoff mitigation points for all agricultural uses of atrazine. We expect these measures will reduce the environmental concentration of atrazine by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff), reducing both the extent of areas exposed to spray drift and runoff as well as decreasing the exposure concentration in these off-site areas.

Effects of the Action: Toxicity

Direct Effects

For listed terrestrial animal species, we anticipate dietary exposure will result in the highest levels of exposure. While individuals may be exposed through other routes (e.g., dermal exposure, inhalation, drinking water), we anticipate these routes of exposure will result in much lower levels of exposures to individuals and will not significantly contribute to the overall exposure and resulting effects to individuals. The Florida Keys mole skink preys on a variety of small insects with a generalist and opportunistic (i.e., preying on those insects that are present and are of a size that the skink can ingest) feeding behavior within their ground cover habitat. We do not expect Florida Keys mole skinks that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to effects on use sites within the range.

We expect that individual skinks foraging directly on atrazine use sites will accumulate levels of atrazine high enough to cause reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. We do not anticipate any individuals exposed on atrazine use sites will die. However, we expect a range of concentrations to be associated with contaminated food resources and we only anticipate these effects if individuals forage on plants at the maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will occur infrequently, as managed turf is not the typical foraging areas of the Florida Keys mole skink. However, an individual Florida Keys mole skink feeding exclusively on insects exposed to atrazine on treated use sites even a short period of time, such as a single day, may still accumulate a significant body burden of pesticide.

Indirect Effects

Available toxicity data suggests that arthropod prey are not likely to experience any mortality with atrazine exposure. As such, we do not anticipate atrazine use will reduce the availability or abundance of prey species for individuals. While we anticipate off-site transport of atrazine can negatively impact the growth and survival of sensitive plant species, we do not anticipate spray drift of runoff of atrazine will destroy or limit the availability of complex vegetative structure (e.g., beach berm, sand dune, and coastal hammock ecosystems) that the species requires for its habitat. Furthermore, we anticipate the conservation measures on agricultural product labels (i.e., mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices on non-agricultural use sites will further minimize impacts to the species' necessary plant resources. As such, we do not anticipate the proposed action will result in measurable levels of indirect adverse effects to the species.

Effects of the Action Summary

There is a low extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that only a small portion of the species' range will be treated with atrazine on agricultural fields annually. However, we only expect individuals exposed to atrazine directly on application sites will experience any direct adverse effects. We do not anticipate individuals are likely to occur on agricultural use sites, but individuals may be exposed in non-agricultural uses sites where atrazine has been applied, such as turf or golf courses. We expect exposure on non-agricultural use sites will occur infrequently as this does not represent preferred habitat and atrazine usage on these sites is expected to be low.

We expect individuals that exclusively forage on non-agricultural use sites recently treated with atrazine will experience reproductive effects. However, given the small extent of atrazine usage on these sites, the limited use of these sites by individuals, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on insects with maximum estimated atrazine residues from recently treated use sites), we anticipate that very few individuals will experience reproductive effects from atrazine use.

We do not expect effects to insects, and while we anticipate atrazine use can impact the growth and survival of sensitive plant species, with implementation of conservation measures on agricultural product labels and existing pesticide practices on non-agricultural use sites, we anticipate there will be no more than low levels of indirect adverse effects to vegetative resources the skink relies on.

Thus, we conclude the overall risk of adverse effects to the species is low.

Species Conclusion

The Florida Keys mole skink is a small lizard inhabiting loose friable sands on islands in the Florida Keys. Known primarily from beach berm and sand dunes they have also been found in wave-washed wrack, debris, and piles of rocks. They prey on a variety of small insects and their diets have been shown to shift seasonally with prey abundance, which can include ants, spiders, crickets, beetles, termites, small bugs, mites, butterfly larva, pseudoscorpion, and fungus. The Florida Keys mole skink has been found in small numbers across the range of the Florida Keys (including the Distal Sand Keys region, consisting of the islands west of Key Wet to the Dry Tortugas). The majority of islands with any past or current detections occur within the Lower Keys, with the largest numbers of detections from Long Beach on Big Pine Key. The Florida Keys mole skink has a high vulnerability based on its status, distribution, and trends. The primary threats to Florida Keys mole skink include habitat loss, primarily from sea level rise, more numerous high tide flooding events, increased storm surges, and shifts in seasonal patterns of rainfall and temperature, all of which are predicted by climate change models.

The Florida Keys mole skink can occur rarely on agricultural use sites, which overlap with <0.1% of the species range and these areas may be treated with atrazine annually, exposing up to 0.4% of the range from agricultural uses. Additional exposure is anticipated from non-agricultural uses of atrazine. However, given our understanding of atrazine usage on use sites such as golf courses and residential lawns (see *Exposure to Non-Agricultural Uses* above), we expect atrazine usage within the range of the species to be limited. If applied, we anticipate off-site transport of atrazine will be minimal as characteristics of the use sites (i.e., continuous cover, no till) are expected to result in little runoff. Furthermore, commercial and residential applicators typically apply herbicides with hand-held equipment that release course droplets, limiting the potential for spray drift from these specific uses. Thus, atrazine exposure is anticipated at low levels.

We do not expect mortality of exposed individual skinks, but do anticipate direct sublethal adverse effects to reproduction from agricultural and non-agricultural exposure to prey on recently treated use sites. We do not anticipate skinks foraging on prey exposed in off-site areas will measurably affect skink reproduction. We also do not anticipate exposure will lead to losses of prey that would result in indirect effects to the skink on use sites or in off-site areas, as mortality of prey items is not anticipated and we do not anticipate any adverse effects to insects, the primary type of prey used by this species. Additionally, while we anticipate atrazine use can impact the growth and survival of sensitive plant species, we anticipate there will be no more than low levels of indirect adverse effects to vegetative resources the skink relies on. Thus, given the limited extent of atrazine usage on agricultural and non-agricultural use sites within the species' range, the variable diet of the Florida Keys mole skink, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites), we anticipate that very few individuals will experience reproductive effects from atrazine use. We do not anticipate the reproductive effects in a very small number of individuals will result in species-level effects. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the conservation measures that are incorporated into the proposed action), we have determined the proposed action is not expected to appreciably reduce the likelihood of 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 Florida Keys mole skink.

References

U.S. Fish and Wildlife Service. 2022. Species status assessment report for the Florida Keys mole skink (*Plestiodon egregius egregius*). Version 2.0. April 2022. Atlanta, Georgia.

Integration and Synthesis Summary: Gopher tortoise

Scientific Name:	Common Name:	Entity ID:
Gopherus polyphemus	Gopher tortoise	181

Conclusion: No Jeopardy

Species Range

Based on range map dated: 01-16-2025; Western DPS; *States within the range:* AL, LA, MS

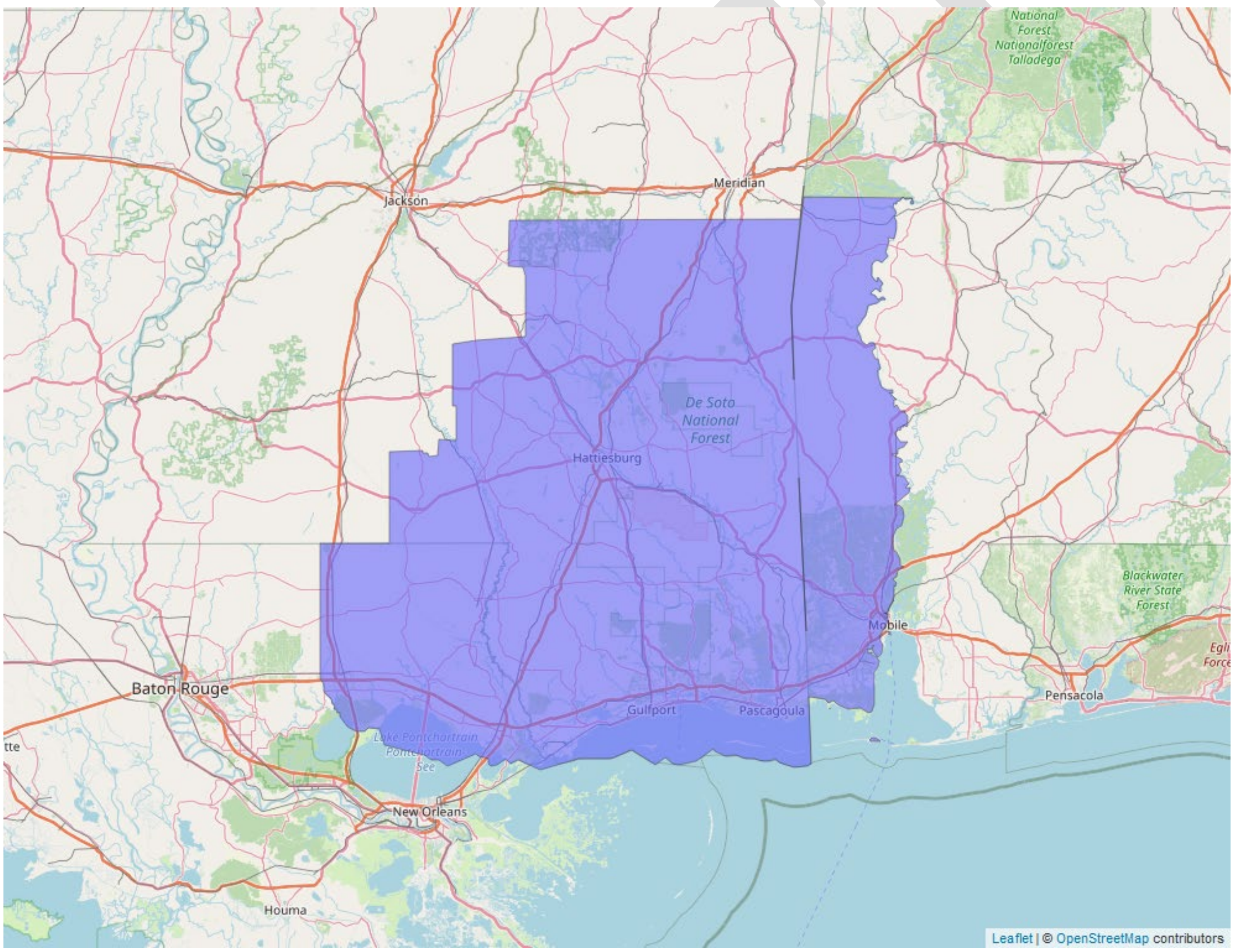

Figure 5. Range map of gopher tortoise (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6994.

Vulnerability

As mentioned in the Introduction, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of Status

Listing status: Threatened

Most recent 5-year review recommendation: No change in Status

Most recently completed 5-year review: 10/12/2022 (Notification of findings)

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (numerous)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes, herbicides only

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The gopher tortoise is a fossorial, burrowing reptile. They are found in sandhills, pine-scrub oak uplands, and pine flatwoods associated with longleaf pine ecosystems (e.g., *Pinus palustris*, *P. taeda*, and *P. elliottii*) in the southeastern Atlantic and Gulf Coast Plains. Their habitat includes open canopies with diverse herbaceous vegetation on well-drained xeric soils with widely spaces trees and shrubs that depend on frequent disturbance (e.g., fire) for maintenance and perpetuation of species composition and structure. They develop burrows underground that are used by many other wildlife species, including the threatened eastern indigo snake. They eat foliage, seeds, and fruits of grasses and forbs near their burrows. They are found from southeastern South Carolina, west through Georgia, the Florida panhandle and peninsula, Alabama, and Mississippi to extreme southeastern Louisiana. Historically, the western population was found in the longleaf pine hills west of the Tombigbee River in Alabama, Mississippi, and Louisiana. Only the western population in Louisiana, Mississippi, and far western Alabama is listed. As of the 2019 SSA, there were an estimated 149,152 gopher tortoises from 656 local populations across the species range, including both eastern and western populations. Over half of the populations (n=360) are considered to have low resiliency, 169 had moderate resiliency, and 127 had high resiliency. The western population (and listed entity) has 2% of the range-wide population total and 107 out of 123 sites have low resiliency (87%) (USFWS 2021).

The gopher tortoise is threatened by habitat loss, degradation, and fragmentation due to land use changes from urbanization, solar farms, climate change, and insufficient or incompatible habitat management. Gopher tortoises will be affected by climate change through sea level rise and habitat loss, changes in sex of young (1:1 sex ratio observed at 29.3°C), and mortality or displacement after more frequent and intense hurricanes. Effects of nonnative invasive species (e.g., kudzu, Chinese privet, Callery pear, natal grass, and Japanese climbing fern) on gopher tortoise habitat also negatively influence gopher tortoise viability. Herbicides may affect gopher tortoises if they impact herbaceous vegetation composition and are less likely to directly impact gopher tortoises if applied on target plants (as opposed to broadcast spraying) and according to the product label. Predation by red imported fire ants, raccoons, gray foxes, striped skunks, Virginia opossums, coyotes, nine-banded armadillos, multiple snake species, and red-tailed hawks impacts some populations (USFWS 2021). Upper respiratory tract disease and other viral, bacterial, fungal, and parasitic infections affect individual gopher tortoises and can have localized effects, but these threats do not appear to have species-level impacts (USFWS 2022).

We expect gopher tortoises to be significantly affected by climate warming, sea-level rise, urbanization, and habitat management in the future. About 80% of potential gopher tortoise habitat occurs on private lands, where we expect these threats to be greatest. Development and urbanization can impact gopher tortoise populations on conservation lands (lands in public or private ownership managed for conservation under a management plan) by disrupting habitat connectivity across the landscape and disrupting habitat management activities on conservation lands, particularly through the reduction of prescribed fire activities.

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 0.8% of the species' range overlaps with agricultural use sites and 32.9% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff). In total, there is up to 33.7% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 6).

Table 6. Agricultural use overlap and annual usage data (% Range Treated) for the gopher tortoise.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Corn	0.4	17.8	18.2	0.4	17.8	18.2
Vegetables and Ground Fruit (Sweet Corn)	<0.1	3.2	3.3	<0.1	1.6	1.7
Other Grains (Sorghum & Sugarcane)	<0.1	0.5	0.5	<0.1	0.5	0.5
Other Orchards (Guava & Macadamia Nut)	0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Corn-Fallow)	0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Sorghum-Fallow)	<0.1	6.3	6.3	<0.1	6.3	6.3
Other Crops (Wheat-Fallow-Wheat)	0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	0.2	5.1	5.3	0.2	5.1	5.3
Total	**0.8**	**32.9**	**33.7**	**0.7**	**31.3**	**32.1**

Usage

Past usage data indicate that up to 32.1% of the species' range has been treated with atrazine annually from agricultural uses, with 0.7% occurring on agricultural fields and 31.3% resulting from off-site transport (Table 6).

Additional Exposure Considerations

Available species information indicate that agricultural fields are not inhabited by gopher tortoises, indicating that on-field exposure to agricultural atrazine use is not likely to occur.

Exposure from Non-Agricultural Uses

While gopher tortoises typically inhabit areas of open pine or other upland areas, individuals can occur in residential areas despite the fact that these areas are of lower quality for the species. As such, we anticipate individuals may be exposed to atrazine through non-agricultural uses, such as through use on residential lawns. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the gopher tortoise to be limited.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift and runoff to off-site areas, including a 15-foot spray drift buffer for ground applications, a 170-foot spray drift buffer for aerial applications, and three runoff mitigation points for all agricultural uses of atrazine. We expect these measures will reduce the environmental concentration of atrazine by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff), reducing both the extent of areas exposed to spray drift and runoff as well as decreasing the exposure concentration in these off-site areas.

Effects of the Action: Toxicity

Direct Effects

For listed terrestrial animal species, we anticipate dietary exposure will result in the highest levels of exposure. While individuals may be exposed through other routes (e.g., dermal exposure, inhalation, drinking water), we anticipate these routes of exposure will result in much lower levels of exposures to individuals and will not significantly contribute to the overall exposure and resulting effects to individuals. Gopher tortoises mostly forage on foliage, seeds, and fruits of grasses and forbs. We do not expect gopher tortoises that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to effects on use sites within the range.

We expect that individual tortoises foraging directly on atrazine use sites will accumulate levels of atrazine high enough to cause reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. We do not anticipate any individuals exposed on atrazine use sites will die. However, we expect a range of concentrations to be associated with contaminated food resources and we only anticipate these effects if individuals forage on plants at the maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will occur infrequently, as individuals are not likely to occur in agricultural areas and managed turf is not the typical foraging areas of the gopher tortoise. However, an individual gopher tortoise feeding exclusively on treated use sites even a short period of time, such as a single day, may still accumulate a significant body burden of pesticide.

Indirect Effects

While we anticipate off-site transport of atrazine can negatively impact the growth and survival of sensitive plant species, we do not anticipate spray drift of runoff of atrazine will destroy or limit the availability of complex vegetative structure (e.g., open pine and upland vegetative communities) that the species requires for its habitat. Similarly, while the gopher tortoise relies on plant material for food, including species that might be sensitive to atrazine, we anticipate the conservation measures on agricultural product labels (i.e., mandatory spray drift buffers and three points of runoff mitigations) and existing pesticide practices on non-agricultural use sites will minimize impacts to the gopher tortoises' habitat and food resources.

Effects of the Action Summary

There is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a large percentage of the species' range will be treated with atrazine on agricultural fields annually. However, we only expect individuals exposed directly on atrazine use sites will accumulate high enough levels of atrazine to cause direct adverse effects to reproduction. We do not expect the gopher tortoise to occur on agricultural use sites. Gopher tortoises may be exposed in non-agricultural uses sites where atrazine has been applied, such as turf or golf courses, though we expect this to occur infrequently, as this does not represent preferred habitat and atrazine usage on these sites is expected to be low.

We expect individuals that exclusively forage on non-agricultural use sites recently treated with atrazine will experience reproductive effects. However, given the small extent of atrazine usage on these sites, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on plants with maximum estimated atrazine residues from recently treated use sites), we anticipate that few individuals will experience reproductive effects from atrazine use.

While we anticipate atrazine use can impact the growth and survival of sensitive plant species, with implementation of conservation measures on agricultural product labels and existing pesticide practices in non-agricultural use sites, we anticipate there will be no more than low levels of indirect adverse effects to vegetative resources the tortoise relies on.

Thus, we conclude the overall risk of adverse effects to the species is low.

Species Conclusion

The gopher tortoise is a large fossorial burrowing reptile are found in sandhills, pine-scrub oak uplands, and pine flatwoods associated with longleaf pine ecosystems (e.g., *Pinus palustris*, *P. taeda*, and *P. elliottii*) in the southeastern Atlantic and Gulf Coast Plains. Gopher tortoises develop burrows underground that are used by many other wildlife species, including the threatened eastern indigo snake. They eat foliage, seeds, and fruits of grasses and forbs near their burrows. They are found from southeastern South Carolina, west through Georgia, the Florida panhandle and peninsula, Alabama, and Mississippi to extreme southeastern Louisiana. While still widely distributed only the western population in Louisiana, Mississippi, and far western Alabama is listed. and while the range-wide population estimate is approximately a hundred and fifty thousand, the western DPS is believed to support only about 2% of this number. The gopher tortoise has a medium vulnerability based on its status, distribution, and trends. The primary threats to gopher tortoises include habitat loss, degradation, and fragmentation due to land use changes from urbanization, solar farms, climate change, and insufficient or incompatible habitat management.

There is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a large percentage of the species' range will be exposed to atrazine from agricultural uses annually. However, we only expect individuals exposed directly on atrazine use sites will accumulate high enough levels of atrazine to cause direct adverse effects to reproduction. Agricultural use sites only overlap with 0.8% of the species range, with annual usage anticipated on 0.7% of the range from agricultural use sites annually. While we do not expect the gopher tortoise to occur on agricultural use sites, gopher tortoises may be exposed in non-agricultural use sites where atrazine has been applied, such as turf or golf courses, though we expect this to occur infrequently, as this does not represent preferred habitat and atrazine usage on these sites is expected to be low. We expect individuals that exclusively forage on non-agricultural use sites recently treated with atrazine will experience reproductive effects. However, given the small extent of atrazine usage on these sites, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on plants with maximum estimated atrazine residues from recently treated use sites), we anticipate that few individuals will experience reproductive effects from atrazine use. While we anticipate atrazine use can impact the growth and survival of sensitive plant species, we anticipate there will be no more than low levels of indirect adverse effects to vegetative resources the tortoise relies on.

Thus, we anticipate a small number of individuals of this species and their food resources in localized areas will experience direct exposure over the duration of the action. We do not expect mortality of individual gopher tortoises, but we do anticipate direct adverse effects to reproduction from non-agricultural exposure to recently treated food items for a small number of individuals. We do not expect indirect adverse effects will occur to individuals from losses of exposed plant resources. We do not anticipate the reduction of reproductive success in a small number of individuals will result in species-level effects. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the conservation measures that are incorporated into the proposed action), we have determined the proposed action is not expected to appreciably reduce the likelihood of 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 gopher tortoise.

References

U.S. Fish and Wildlife Service. 2021. Species Status Assessment Report for the Gopher Tortoise (*Gopherus polyphemus*). Version 0.4. Atlanta, Georgia. 288 pp.

U.S. Fish and Wildlife Service. 2022. Endangered and Threatened Wildlife and Plants; Finding for the Gopher Tortoise Eastern and Western Distinct Population Segments. Federal Register 87(196):61834-61868.

Integration and Synthesis Summary: Sand skink

Scientific Name:	Common Name:	Entity ID:
Neoseps reynoldsi	Sand skink	179

Conclusion: No Jeopardy

Species Range

Based on range map dated: 03-02-2022; Wherever found; *States within the range:* FL

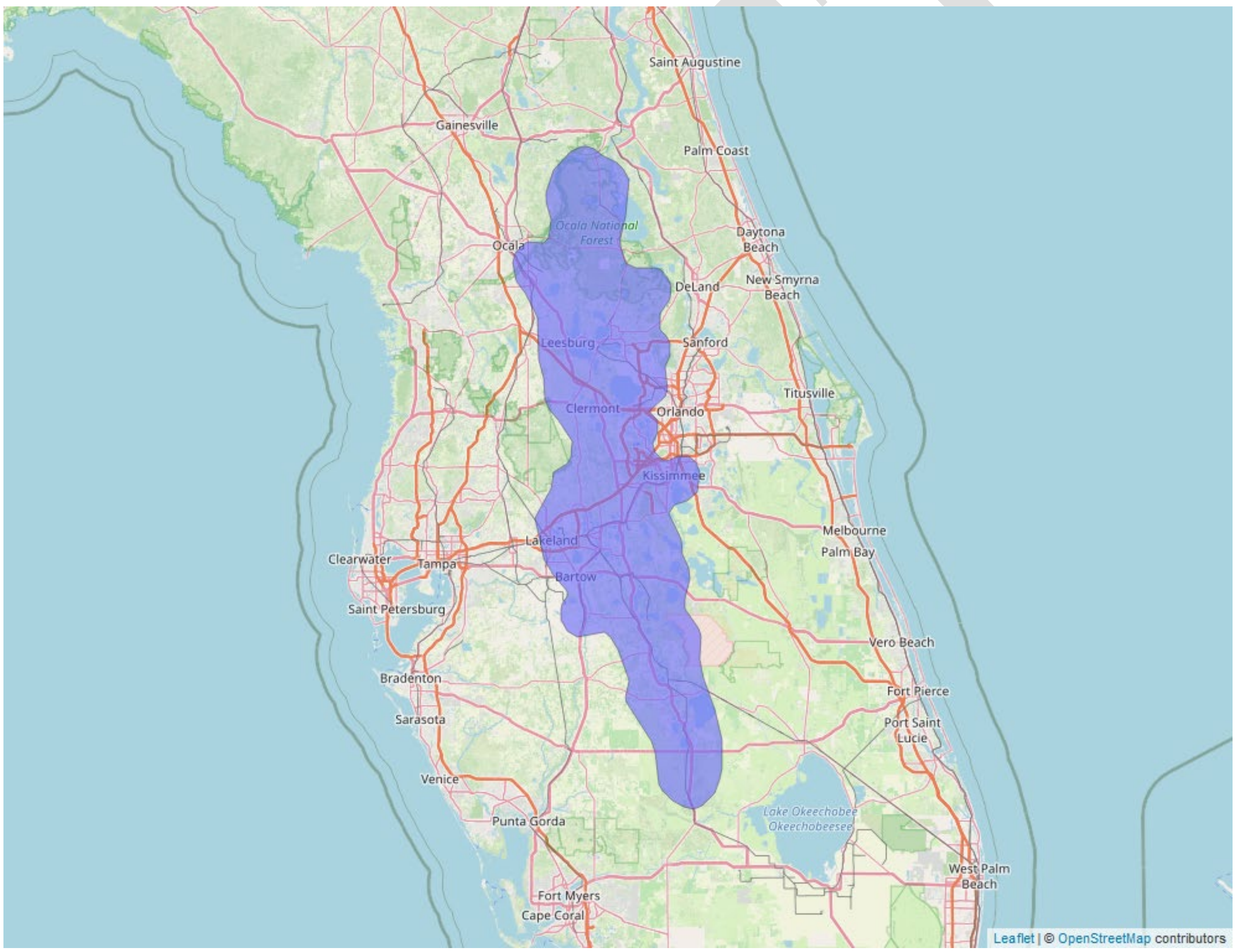

Figure 6. Range map of sand skink (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4094.

Vulnerability

As mentioned in the Introduction, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of Status

Listing status: Threatened

Most recent 5-year review recommendation: Delist, the species does not meet the definition of an endangered species or a threatened species

Most recently completed 5-year review: 11/1/2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (numerous)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The sand skink is endemic to the sandy ridges of central Florida and occurs on the Lake Wales, Winter Haven, and Mt. Dora Ridges in Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties. They are fossorial and use xeric upland habitat with sandy substrate like scrub, scrubby flatwoods, and sandhills. They prefer areas with heterogenous habitat patches that are necessary for thermoregulation. Sand skinks feed on a variety of hard- and soft-bodied arthropods that occur below the ground surface (e.g., beetle larvae, termites, spiders, larval ant lions, lepidopteran larvae, ants, roaches, and adult beetles) (USFWS 2023a). They are found on 43.9% of their historical distribution, though some historically occupied areas have not been recently surveyed. Three occupied areas (Mt. Dora Ridge, Central Lake Wales Ridge, and Southern Lake Wales Ridge) exhibit very high resiliency because they have large areas of primary habitat, greater than a third of the primary habitat is protected and managed in a manner that is beneficial to sand skinks, and habitat fragmentation is moderate to low. There are 124 populations of sand skinks range-wide, though many of them are small and isolated due to fragmentation. Abundance and trends information is not available, but the Service recommended the species for delisting due to recovery in 2023 (USFWS 2023b).

Sand skinks are threatened primarily by habitat loss, fragmentation, and changes in land use. Additional threats to sand skinks include habitat modification by invasive species and genetic diversity loss from small population sizes. Collection and disease are not known to be threats to the species. By 2006, approximately 85% of the historical scrub and sandhill habitats on Lake Wales Ridge was converted to urban and residential development and agriculture. Isolated habitat fragments surrounded by human land uses are more difficult to manage with tools like fire, which has led to habitat degradation at some of these sites as they become overgrown above and below the soil surface and therefore unsuitable for sand skinks. As of 2023, about 60% of the remaining species habitat is protected from development and managed for conservation, but additional habitat loss and fragmentation is expected on private lands because of anticipated increases in Florida's human population by 2060 (USFWS 2023a, b).

Overall Vulnerability: Low

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 1.6% of the species' range overlaps with agricultural use sites and 71.5% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff). In total, there is up to 73.1% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 7).

Table 7. Agricultural use overlap and annual usage data (% Range Treated) for the sand skink.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Corn	<0.1	2.1	2.1	<0.1	2.1	2.1
Vegetables and Ground Fruit (Sweet Corn)	0.2	18.7	18.9	0.2	18.7	18.9
Other Grains (Sorghum & Sugarcane)	0.2	3.5	3.7	0.2	3.5	3.7
Other Orchards (Guava & Macadamia Nut)	0.3	10.1	10.3	0.2	5.6	5.7

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Crops (Wheat-Corn-Fallow)	0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Sorghum-Fallow)	0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Fallow-Wheat)	0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	0.9	37.2	38.1	0.9	37.2	38.1
Total	**1.6**	**71.5**	**73.1**	**1.4**	**67.0**	**68.5**

Usage

Past usage data indicate that up to 68.5% of the species' range has been treated with atrazine annually from agricultural uses, with 1.4% occurring on agricultural fields and up to 67.0% resulting from off-site transport (Table 7).

Additional Exposure Considerations

Sand skinks use citrus fields (active and fallow), tree plantations, and likely other agricultural lands if suitable habitat conditions exist and are subject to on-field exposure to agricultural uses of atrazine.

Exposure from Non-Agricultural Uses

Sand skinks use developed and open-space developed areas if suitable habitat conditions exist and may be exposed to non-agricultural uses of atrazine. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the sand skink to be limited.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift and runoff to off-site areas, including a 15-foot spray drift buffer for ground applications, a 170-foot spray drift buffer for aerial applications, and three runoff mitigation points for all agricultural uses of atrazine. We expect these measures will reduce the environmental concentration of atrazine by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff), reducing both the extent of areas exposed to spray drift and runoff as well as decreasing the exposure concentration in these off-site areas.

Effects of the Action: Toxicity

Direct Effects

For listed terrestrial animal species, we anticipate dietary exposure will result in the highest levels of exposure. While individuals may be exposed through other routes (e.g., dermal exposure, inhalation, drinking water), we anticipate these routes of exposure will result in much lower levels of exposures to individuals and will not significantly contribute to the overall exposure and resulting effects to individuals. Sand skinks feed on a variety of hard- and soft-bodied arthropods that occur below the ground surface. We do not expect sand skinks that are exposed to atrazine on prey items as a result of off-site transport will experience adverse effects and thus focus our analysis to effects on use sites within the range.

We expect that individual skinks foraging directly on atrazine use sites will accumulate levels of atrazine high enough to cause reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. We do not anticipate any individuals exposed on atrazine use sites will die. However, we expect a range of concentrations to be associated with contaminated food resources and we only anticipate these effects if individuals forage on plants at the maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will be a rare occurrence, as sand skinks consume arthropods that occur below the ground surface where atrazine exposure is not likely to reach maximum residues and are also expected to consume resources off treated fields.

Indirect Effects

Available toxicity data suggests that arthropod prey are not likely to experience any mortality with atrazine exposure. As such, we do not anticipate atrazine use will reduce the availability or abundance of prey species for individuals. While we anticipate off-site transport of atrazine can negatively impact the growth and survival of sensitive plant species, we do not anticipate spray drift of runoff of atrazine will destroy or limit the availability of complex vegetative structure that the species requires for its habitat. Furthermore, we anticipate the conservation measures on agricultural product labels (i.e., mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices in non-agricultural use sites will further minimize impacts to the species' necessary plant resources. As such, we do not anticipate the proposed action will result in measurable levels of indirect adverse effects to the species.

Effects of the Action Summary

There is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a large percentage of the species' range will be treated with atrazine on agricultural fields annually. However, we only expect individuals exposed directly on atrazine use sites will accumulate high enough levels of atrazine to cause direct adverse effects to reproduction. While individuals are known to occur on agricultural sites, only 1.6% of the species' range occurs on agricultural atrazine use sites, indicating that very few individuals are likely to be exposed on agricultural use sites. Similarly, while sand skinks may be exposed to atrazine in non-agricultural use areas, we expect non-agricultural usage of atrazine within the range of the species to be low. As such, we anticipate that very few individuals are likely to be exposed on non-agricultural use sites.

We expect individuals that exclusively eat arthropods contaminated on use sites recently treated with atrazine will experience reproductive effects. However, while sand skinks are known to occur on use sites, they primarily feed on arthropods that occur below the ground surface and are not likely to contain high levels of atrazine. In addition, given the limited usage on agricultural and non-agricultural use sites within the species' range, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites), we anticipate that very few individuals, if any, will experience reproductive effects from atrazine use.

In addition, with implementation of conservation measures on agricultural product labels and existing pesticide practices in non-agricultural use sites, we do not anticipate atrazine use is likely to reduce the availability or abundance of insects that the sand skink relies on as food resources, or result in appreciable impacts to any vegetative habitat resources for the species.

Thus, we conclude the overall risk of adverse effects to the sand skink is low.

Species Conclusion

The sand skink is a fossorial lizard, inhabiting scrub ridges and sandy substrates in the Florida interior highlands and is widespread in these xeric uplands. Sand skinks are known primarily from Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam counties in Florida. They prey on a variety of hard and soft bodied arthropods, including primarily beetle larvae and termites though spiders, ants, roaches, adult beetles and others are also eaten. The primary threats to sand skink include habitat loss, primarily from agricultural conversion and increasingly urbanization as the human population in Florida is expected to double, from 18 million in 2005, to 36 million in 2060. However, the sand skink has low vulnerability based on its status, distribution, and trends. The Service recommended the species for delisting due to recovery in 2023.

Sand skinks use citrus fields (active and fallow) and tree plantations, which are not atrazine use sites, although they are also likely to use other agricultural lands if suitable habitat conditions exist. There is a large extent of overlap between the species' range and the action area, and pesticide usage reporting indicates that a large percentage of the species' range will be exposed to atrazine from agricultural uses annually. However, we only expect individuals exposed directly on atrazine use sites will accumulate high enough levels of atrazine to cause direct adverse effects to reproduction. Agricultural use sites overlap with 1.6% of the species range, with annual usage anticipated on 1.4% of the range from agricultural use sites annually. Sand skinks may also use developed and open-space developed areas if suitable habitat conditions exist, so they may also be exposed to non-agricultural uses of atrazine. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the sand skink to be limited. We expect individuals that exclusively forage on agricultural or non-agricultural use sites recently treated with atrazine will experience reproductive effects. However, given the small extent of atrazine usage on these sites, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites), we anticipate that few individuals will experience reproductive effects from atrazine usage. We do not anticipate mortality of individual sand skinks will occur, and we do not anticipate atrazine exposure is likely to reduce the availability or abundance of insects and other arthropods that the sand skink relies on as food resources, or result in appreciable impacts to any vegetative habitat resources for the species.

Thus, while we anticipate a large portion of the species range will be exposed to atrazine, given the variable diet of the sand skink that includes a wide variety of arthropod prey, with most prey occurring below the ground surface where atrazine exposure is not likely to reach maximum residues, the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites), and the limited overlap with use sites, we anticipate that very few individuals will experience reproductive effects from atrazine use. We do not anticipate indirect effects are likely to occur from losses of plants or prey items, and we do not anticipate reproductive effects in a small number of individuals will result in species-level effects. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the conservation measures that are incorporated into the proposed action), we have determined the proposed action is not expected to appreciably reduce the likelihood of 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 sand skink.

References

U.S. Fish and Wildlife Service. 2023a. Species Status Assessment Report for the Sand Skink (*Neoseps reynoldsi*). Version 1.0. Atlanta, Georgia. 102 pp.

U.S. Fish and Wildlife Service. 2023b. Sand Skink (*Neoseps reynoldsi*) 5-Year Review: Summary and Evaluation. Gainesville, Florida. 15 pp.

Integration and Synthesis Summary: Short-tailed snake

Scientific Name:	Common Name:	Entity ID:
Stilosoma extenuatum	Short-tailed snake	10253

Conclusion: No Jeopardy

Species Range

Based on range map dated: 07-11-2025; Wherever found; *States within the range:* FL

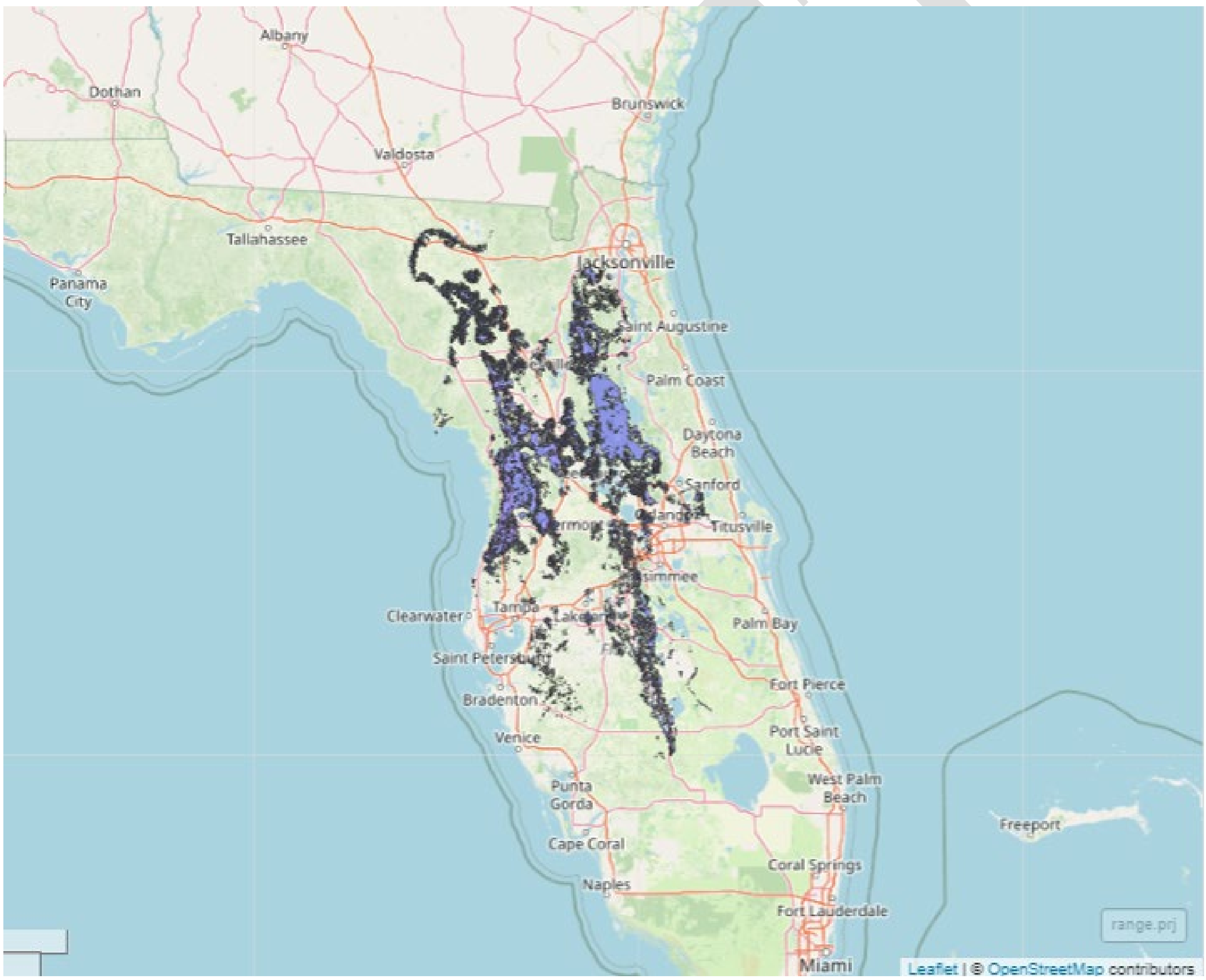

Figure 7. Range map of short-tailed snake (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9266.

Vulnerability

As mentioned in the Introduction, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of Status

Listing status: Proposed Threatened

Most recent 5-year review recommendation: N/A

Most recently completed 5-year review: None available for this species

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: Declining population(s) – one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The short-tailed snake is primarily a fossorial colubrid snake generally found in longleaf pine (*Pinus palustris*)/xeric oak sandhills and scrub and xeric hammock habitats in peninsular Florida from the central ridges west to the Gulf Coast. In general, the short-tailed snake requires well-drained sandy soils associated with xeric uplands that include an open canopy of widely spaced trees and shrubs with ample areas of exposed soils, sufficient prey that includes small snakes such as the Florida crowned snake (*Tantilla relicta*), and connectivity within and between populations. Primary threats to the viability of the short-tailed snake include habitat loss, degradation, and fragmentation due to urbanization and land conversion to agriculture and mining uses.

The species appears to be diurnally active on the surface in cooler months but may shift towards nocturnal activity in warmer months. It is uncertain if short-tailed snake exhibits a dormancy period in the winter (brumation) or summer rainy season. Short-tailed snakes apparently spend most of their lives beneath sandy soil and likely lay eggs underground. All snakes in the genus *Lampropeltis* are nonvenomous and are considered ophiophagous (to primarily consume other snakes) though other prey items such as lizards may also be consumed. Our understanding of the short-tailed snake diet is based almost entirely on observations of captive snakes.

Threats to short-tailed snakes include habitat loss, degradation and fragmentation, including urbanization, road construction, conversion to agriculture and to a more limited extent, surface mining. Additional threats to the short-tailed snake include habitat management, fire suppression, herbicide use, climate change, invasive species and disease. Compared to historical conditions, Florida's xeric upland natural communities are extensively reduced, altered, and in many areas, isolated. This is particularly evident in longleaf pine-dominated sandhills and scrub communities on the ridges of central Florida and the Gulf Coast of Florida. Sandhills covered approximately 2.4% of Florida in 1987, an 88% loss from an estimated coverage of in 1936 and scrub communities declined 59% in coverage during the same period. In a 14-year period from 1989 to 2003, 11% of sandhill and 10% of scrub natural communities were lost to urbanization or other land uses, with 4% of each of these respective habitats lost specifically to agriculture. Future losses of sandhill and scrub habitats are expected as Florida's human population continues to increase, and development expands. Research is lacking to quantify the effects of urbanization on short-tailed snake survival, recruitment, health, or long-term viability. While urbanized areas are not likely to support viable populations of short-tailed snake, this species has been observed in subdivisions within xeric uplands that retain some natural ground cover components that also likely support populations of prey species such as the Florida crowned snake. Short-tailed snakes appear to be tolerant of some degree of urbanization where sufficient and connected habitat persists, though long-term survival in these areas has not been demonstrated.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

There were no range shapefiles available for use in overlap and usage calculations when EPA released their BE. As such, we take a qualitative approach to assessing the potential exposure of the short-tailed snake to atrazine by considering available information regarding the species' habitat preferences, behaviors, and known and presumed locations.

The continued conversion of short-tailed snake habitat to intensive agricultural land uses such as row cropping or hay production would likely eliminate important habitat features (e.g., open sandy soil and native groundcover vegetation) in favor of maximizing crop yields; row crops such as cotton and corn involve considerable soil disturbance through seasonal plowing. Short-tailed snakes are unlikely to persist in areas affected by the removal of native landcover, reduction of prey, and the alteration of soil characteristics (e.g., loose, sandy soil) required for sand-swimming species. However, it is possible that short-tailed snake may persist in some agricultural areas, primarily citrus groves where pockets of natural cover and soil conditions are present or where higher quality habitat is adjacent.

Usage

Based on past usage data in Florida provided by EPA, we expect that agricultural atrazine use sites within the range of the short-tailed snake are likely to be treated with atrazine.

Additional Exposure Considerations

Short-tailed snakes predominantly consume small snakes, particularly Florida crowned snakes. Florida crowned snakes are often hidden beneath leaf litter, logs, rocks, or other surface cover; they can occur even within suburban neighborhoods where development encroaches into favorable upland habitats. Short-tailed snakes also consume worm lizards which often located just beneath a leaf-mold layer in well-drained sandy soil. Due to the tendency of prey species to occur under cover of leaves, logs, or other substrate, exposure to atrazine via spray drift, runoff, or direct contact is expected to be low.

Exposure from Non-Agricultural Uses

While urbanized areas are not likely to support viable populations of short-tailed snake, they may persist in developed areas, particularly in subdivisions containing some natural ground cover that also likely support populations of prey species such as the Florida crowned snake. There are records of short-tailed snake observations from roadways, carports, woodsheds, foundation excavations, driveways, yards (e.g., pool), and within a home in developed areas. As such, we anticipate individuals may be exposed to atrazine through non-agricultural uses, such as through use on residential lawns. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the short-tailed snake to be limited.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift and runoff to off-site areas, including a 15-foot spray drift buffer for ground applications, a 170-foot spray drift buffer for aerial applications, and three runoff mitigation points for all agricultural uses of atrazine. We expect these measures will reduce the environmental concentration of atrazine by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff), reducing both the extent of areas exposed to spray drift and runoff as well as decreasing the exposure concentration in these off-site areas.

Effects of the Action: Toxicity

Direct Effects

For listed terrestrial animal species, we anticipate dietary exposure will result in the highest levels of exposure. While individuals may be exposed through other routes (e.g., dermal exposure, inhalation, drinking water), we anticipate these routes of exposure will result in much lower levels of exposures to individuals and will not significantly contribute to the overall exposure and resulting effects to individuals. The short-tailed snake mainly consumes other small snakes, particularly the Florida crowned snakes, and may also prey upon lizards. We do not expect short-tailed snakes that are exposed to atrazine on prey items as a result of off-site transport will experience adverse effects and thus focus our analysis to effects on use sites within the range.

We expect that individual snakes foraging directly on atrazine use sites will accumulate levels of atrazine high enough to cause reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. We do not anticipate any individuals exposed on atrazine use sites will die. However, we expect a range of concentrations to be associated with contaminated food resources and we only anticipate these effects if individuals forage on plants at the maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will be a rare occurrence, as short-tailed snakes preferentially consume prey species that found under cover of leaves, logs, and other substrate where atrazine exposure is not likely to reach maximum residues and are also expected to consume resources off treated fields.

Indirect Effects

Available toxicity data suggests that prey items of the short-tailed snakes are not likely to die from exposure to atrazine. While individual terrestrial vertebrates may experience growth or reproductive effects if exposed to atrazine on use sites, we anticipate the conservation measures on agricultural product labels (i.e., mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices on non-agricultural use sites will reduce atrazine residues to levels where we do not expect adverse effects to prey species will occur. In addition, while we anticipate off-site transport of atrazine can negatively impact the growth and survival of sensitive plant species, though we do not anticipate spray drift or runoff of atrazine will destroy or limit the availability of complex vegetative structure (e.g., upland vegetative community) that the species requires for its habitat. We anticipate the conservation measures on product labels will further minimize impacts to the species' necessary plant resources. As such, we do not anticipate the proposed action will result in measurable levels of indirect adverse effects to the species.

Effects of the Action Summary

We expect agricultural and non-agricultural use sites occur broadly within the range of the short-tailed snake, and that atrazine will be applied to these areas over the course of the action.

However, we only expect individuals exposed directly on atrazine use sites will accumulate high enough levels of to cause direct adverse effects to reproduction. While some individuals are known to occur in agricultural areas (primarily citrus), we do not anticipate this will result in the exposure of more than a small number of individuals as these use sites do not represent preferred foraging habitat. Similarly, while individuals can occur in non-agricultural use sites, we do not anticipate this will result in the exposure of more than a small number of individuals given that these areas are also not likely to be preferred foraging habitat, as well as the fact that we anticipate atrazine usage in these areas will be low.

We expect individuals that exclusively eat prey contaminated on use sites recently treated with atrazine will experience reproductive effects. However, given that the habits of prey species are unlikely to lead to high levels of atrazine exposure, the limited extent of atrazine usage on non-agricultural use sites within the species', and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites), we anticipate that very few individuals, if any, will experience reproductive effects from atrazine use.

In addition, with implementation of conservation measures on agricultural product labels and existing pesticide practices on non-agricultural use sites, we do not anticipate atrazine use is likely to reduce the availability or abundance prey that the short-tailed snake relies on as food resources, or result in appreciable impacts to any vegetative habitat resources for the species.

Thus, we conclude the overall risk of adverse effects to the short-tailed snakes is low.

Species Conclusion

The short-tailed snake is a fossorial reptile, found in longleaf pine/xeric oak sandhills, but also scrub and xeric hammock habitats in peninsular Florida from the central ridges west to the Gulf Coast. All snakes in the genus *Lampropeltis* are nonvenomous and are considered ophiophagous (to primarily consume other snakes) though other prey items such as lizards may also be consumed. The short-tailed snake has a high vulnerability based on its status, distribution, and trends. The primary threats to short-tailed snake include habitat loss, primarily from agricultural conversion and increasingly urbanization as the human population in Florida is expected to double, from 18 million in 2005 to 36 million in 2060.

While some individuals are known to occur in agricultural areas where pockets of natural cover and soil conditions are present or where higher quality habitat is adjacent (primarily citrus, which is not an atrazine use site), we do not anticipate more than a small number of individuals will be exposed to atrazine in these use sites as they do not represent preferred foraging habitat. Similarly, while individuals can occur in non-agricultural use sites, we do not anticipate exposure of more than a small number of individuals will be exposed on these use sites given that these areas are also not likely to be preferred foraging habitat. In addition, we expect low levels of transport to off-site areas from runoff and spray drift from agricultural and non-agricultural use sites due to the conservation measures for agricultural uses and given our understanding of atrazine usage on use sites such as golf courses and residential lawns (see *Exposure to Non-Agricultural Uses* above) and characteristics of the use sites (i.e., continuous cover, no till) that are expected to result in little runoff. Furthermore, commercial and residential applicators typically apply herbicides with hand-held equipment that release course droplets, limiting the potential for spray drift from non-agricultural uses.

Anticipated exposure, where it occurs, is expected through direct dietary uptake. We do not anticipate exposure will result in adverse effects to short-tailed snakes in off-site areas, but individuals foraging predominantly on recently treated use sites is expected to result in sublethal effects to reproduction. Thus, given the limited anticipated atrazine exposure on agricultural and non-agricultural use sites within the species' range, the ophiophagous (primarily consuming other snakes) diet of the short-tailed snake, and the limited scenarios that we expect to result in adverse effects (i.e., foraging exclusively on prey with maximum estimated atrazine residues from recently treated use sites), we anticipate that very few individuals will experience reproductive effects from atrazine use. We do not anticipate mortality of individual short-tailed snakes will occur, and we do not anticipate atrazine exposure is likely to reduce the availability or abundance of prey items that the snake relies on as food resources, or result in appreciable impacts to any vegetative habitat resources for the species.

Thus, we anticipate a low number of individuals of this species and their prey resources will experience direct exposure over the duration of the action. We do not expect mortality of individual short-tailed snakes but do anticipate direct sublethal adverse effects to reproduction for a small number of individuals exposed through the ingestion of recently treated prey items on agricultural and non-agricultural use sites. We do not anticipate mortality of individual snakes, and we do not anticipate atrazine exposure is likely to reduce the availability or abundance of prey that the snake relies on as food resources, or result in appreciable impacts to any vegetative habitat resources for the species. We do not anticipate reproductive effects in a small number of individuals will result in species-level effects. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the conservation measures that are incorporated into the proposed action), we have determined the proposed action is not expected to appreciably reduce the likelihood of 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 short-tailed snake.

References

U.S. Fish and Wildlife Service. 2022. Species Status Assessment Report for the Short-tailed Snake. Version 1.0. Atlanta, Georgia. 56 pp.