Integration and Synthesis Summary for Birds

This Integration and Synthesis Summary includes our jeopardy analysis for bird 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 added to the product label (including those developed during this consultation through the Herbicide Strategy [1]; see Conservation Measures section below).

Vulnerability

For the bird species that we or EPA determined are “likely to be adversely affected” by the proposed action, we considered several factors for each listed bird 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 birds 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

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

determine how much of a species' range we expect to be treated with each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this 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 agricultural 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 agricultural exposure ranking the same score (e.g., if both overlap and usage is high, the agricultural 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 agricultural 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 agricultural exposure ranking of medium. For species where there are additional exposure considerations, we adjust the agricultural 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.

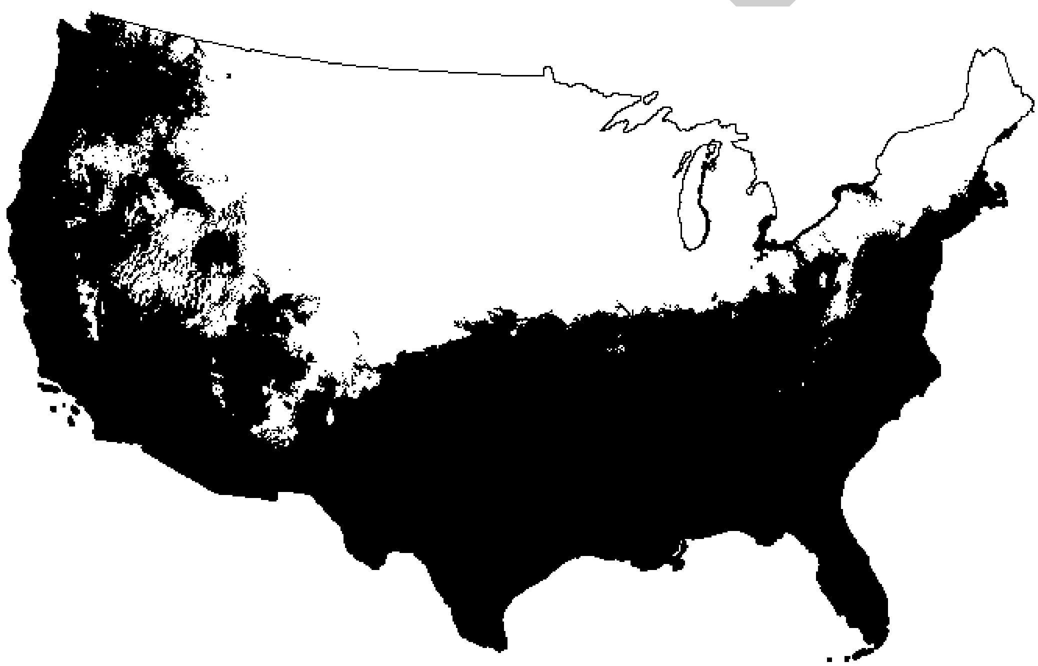

Figure 1. Map showing where cool-season grasses (white areas) and warm-season grasses (black areas) are used on turf across the continental U.S.

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.

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

[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

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 birds 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, 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 estimated exposure concentrations 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 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

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.

availability of prey for listed bird species to forage on. Thus, we anticipate listed bird 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 bird 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 birds 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 birds 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 indicate birds 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 birds 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.

Experimental Populations, Nonessential

We considered the following nonessential experimental populations for bird species in this section of the consultation: northern aplomado falcon (Entity ID 9122) and whooping crane (Entity IDs 4679, 7342, and 10124). We do not provide separate analyses and jeopardy determinations for these populations. Rather, we treat all populations of the species (including populations designated as experimental) as a single listed entity when making jeopardy determinations or for other analyses in a section 7 consultation. An "essential experimental population" is a reintroduced population whose loss would be likely to appreciably reduce the likelihood of the survival of the species in the wild. However, there are no “essential experimental populations” in this consultation. A "nonessential experimental population" is a reintroduced population whose loss would not be likely to appreciably reduce the likelihood of survival of the species in the wild. By definition, a "nonessential experimental population" is not essential to the continued existence of the species. Therefore, no proposed action impacting a population so designated could lead to a jeopardy determination for the entire species. In cases where our assessment of the listed entity (i.e., the non-experimental population(s) of the species) leads to a “not likely to jeopardize” determination, we generally assume any added effects to the nonessential experimental population will not change these determinations. However, we consider the role of the experimental population in the survival and recovery of the species and consider this information in our jeopardy analyses as appropriate.

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:

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[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

  - 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 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).

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

In cases where EPA has identified additional runoff measures are needed, additional points (up to six points total) will be required. EPA will communicate where additional runoff mitigation points are needed and for what specific atrazine uses through their Bulletins Live! Two online platform, which all applicators are required to check before making pesticide applications. In areas requiring up to six runoff mitigation points total, EPA expects estimated environmental concentrations of atrazine will decrease by up to two orders of magnitude (i.e., reduce pesticide loading to one-one hundredth of pre runoff mitigation levels; 99% reduction).

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 Birds

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 13 of the 18 bird species in this Appendix. For the remaining five birds in this appendix, we plan to continue coordination with EPA and the technical registrants to further assess these species.

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 process and analysis for each species remained the same, regardless of the format of the discussion presented below.

Species with low exposure informed by low overlap with agriculture and low likelihood of non-agricultural exposure

For the species in Table 1, we expect low exposure as informed by low overlap between the species' range and agricultural lands where atrazine is registered for use. Therefore, our concern for adverse effects is low. While we present some specific information about the species in Table 1 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species account can be found in Appendix B.

Table 1. Species with low exposure informed by low overlap with agricultural areas and low likelihood of non-agricultural exposure.

Common Name	Scientific Name	Vulnerability Ranking	Agricultural Exposure Ranking	Toxicity Ranking	Total Agricultural Action Area Overlap (% Range)	Determination
Greater sage-grouse	*Centrocercus urophasianus*	Medium	Low	High	3.4	No Jeopardy

The species in Table 1 has medium vulnerability. Specifically, pesticides are a noted threat to the greater sage-grouse. Greater sage-grouse are known to occur in agricultural fields, namely foraging in alfalfa fields; however, alfalfa is not a labeled use for atrazine.

The greater sage-grouse has high toxicity because sublethal effects and/or loss of prey items are likely when exposure occurs. We anticipate adverse effects are most likely for individuals that primarily forage on items that have been recently exposed to atrazine applications at some of the highest application rates on use sites. EPA's exposure modeling indicates that foraging off treated sites or consuming prey that have only been exposed through spray drift or runoff is not likely to result in direct adverse effects to these species or reduction in prey abundance, but individual loss of prey items may occur. However, the species in Table 1 has a low extent of overlap between its range and agricultural atrazine use sites (3.4%), including associated off-site transport areas. The total overlap metric we use is a conservative estimate of exposure as it does not fully account for redundancy between registered use sites, assumes exposure is occurring in all possible overlapping areas, assumes spray drift will occur in all directions during treatment of fields, and does not consider information on past atrazine usage. As such, we expect that exposure of this species to atrazine from agricultural uses will occur in even smaller portions of the species' range than the overlap shown in Table 1.

In addition to agricultural exposure, the greater sage-grouse will not be exposed to atrazine from non-agricultural (i.e., turf) uses. These non-agricultural use sites do not provide the species' necessary habitat (e.g., sagebrush fields). In addition, 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.

We do not anticipate the greater sage-grouse will occur on atrazine use sites where exposures to individuals would be highest. The greater sage-grouse may forage on alfalfa fields, but alfalfa is not a labeled use for atrazine. We expect the general label measures for agricultural uses (including the 15-foot spray drift buffer and three runoff mitigation points) will reduce off-field exposures by an order of magnitude (i.e., a 90% reduction), which we do not expect to cause direct 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 (or to any animal food resources required). Therefore, due to the effectiveness of the conservation measures required under the action, we expect these species to be exposed to only low levels of atrazine through off-site transport from agricultural use sites to their habitats.

In summary, we expect a small number of individuals of the greater sage-grouse will experience exposure to atrazine over the project duration. Exposure will be limited to small portions of the species' range that overlaps with agricultural or non-agricultural use sites and areas of off-site transport, and the few exposed individuals may experience adverse effects to growth and/or reproduction. Therefore, we determine the overall risk of adverse effects to this species is low. After reviewing the current status of the specie, environmental baseline for the action area, cumulative effects, and effects of the action (including general label conservation measures), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of this 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 greater sage-grouse.

Species with low exposure informed by low past usage from the California Department of Pesticide Regulation's Pesticide Use Reporting data

The species in Table 2 occurs completely within California and has low exposure determined by low levels of past atrazine usage within its range (% range treated annually), as informed by the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data. Given the commitment by the registrants to restrict usage within California solely to Imperial County, the data below represent usage only within that county. Therefore, we expect adverse effects to the least Bell's vireo be low. While we present some specific information about the species in Table 2 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species account can be found in Appendix B.

Table 2. Species with low exposure informed by low past usage from California Department of Pesticide Regulation, Pesticide Use Reporting Data.

Common Name	Scientific Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Least Bell's vireo	*Vireo bellii pusillus*	High	Low	Medium	0.1	No Jeopardy

The species in Table 2 has high vulnerability. The least Bell's vireo is an endangered, narrow endemic species that occurs entirely in California.

The least Bell's vireo has medium toxicity because sublethal effects and/or loss of prey items are likely when exposure occurs. We anticipate adverse effects are most likely to occur for individuals that primarily forage on prey items that have recently been exposed to atrazine applications at some of the highest application rates on use sites. We expect this is unlikely to occur because individual least Bell's vireos are unlikely to exclusively encounter and consume prey species that have been recently exposed to atrazine on-field because atrazine use sites do not represent preferred foraging habitat and agriculture makes up a small portion of the species' range. EPA's exposure modeling indicates that foraging off treated sites or consuming prey that have only been exposed through spray drift or runoff is not likely to result in direct mortality of these species, but sublethal effects are anticipated for some exposed individuals. Sublethal effects, and reductions in prey abundance, can lead to mortality, reduced growth, and reduced fitness. However, we expect the Least bell's vireo to have limited exposure to atrazine due to low past atrazine usage in the species' range.

While this species range may have high overlap with agricultural use sites, past usage data from the California Department of Pesticide Regulations from Imperial County shows that, from

2013-2022, very little atrazine was used within the species' range (0.1% overlap). Given that this usage reporting is mandated by the state of California, these data are provided regularly at a relatively high spatial resolution, and that this data includes all agricultural and most non-agricultural uses of atrazine, we have high confidence that only a small percentage of the species' ranges are likely to be exposed to atrazine. In addition, the California usage data we consider for this species represents usage patterns from a large number of reporters within the range of the species, such that estimates are more likely to be robust to small changes in usage that may occur over the course of the action. Therefore, we anticipate a small number of individuals of the least Bell's vireo will be exposed to atrazine from agricultural uses.

In addition to agricultural exposure, the least Bell's vireo may be exposed to atrazine from non-agricultural (i.e., turf) uses. However, these non-agricultural use sites do not provide the species' necessary habitat (e.g., riparian corridors). In addition, 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 the least Bell's vireo 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 this species.

In summary, we expect a small number of individual least Bell's vireos will experience exposure to atrazine over the project duration. Exposure will be limited to small portions of the species' range that overlaps with agricultural atrazine usage according to CalPUR data, or other non-agricultural usage on turf as applicable, and the few exposed individuals may experience adverse effects to growth and/or reproduction. Therefore, we determine the overall risk of adverse effects to the 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 conservation measures), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of this 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 least Bell's vireo.

Species with low agricultural exposure informed by low past usage of all herbicides from the USDA's Census of Agriculture and low likelihood of non-agricultural exposure

We anticipate that the Mississippi sandhill crane will experience low levels of exposure to atrazine based on available data from the USDA's Census of Agriculture (CoA) (Table 3). 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 3. Species with low agricultural exposure informed by low past usage of all herbicides from the USDA's Census of Agriculture (CoA) and low likelihood of non-agricultural exposure.

Common Name	Scientific Name	Vulnerability Ranking	Agricultural Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Mississippi sandhill crane	*Antigone canadensis pulla*	High	Low	High	4.16	No Jeopardy

The Mississippi sandhill crane has high vulnerability, and pesticides are a noted threat. The species regularly occurs on agricultural fields and pastures for foraging. It maintains a very small population size in a small geographic footprint, experiencing limited growth and high mortality.

Mississippi sandhill cranes have high toxicity because sublethal effects and/or loss of prey items are likely when exposure occurs. We anticipate adverse effects are most likely for individuals that primarily forage on items that have been recently exposed to atrazine applications at some of the highest application rates on use sites. EPA's exposure modeling indicates that foraging off treated sites or consuming prey that have only been exposed through spray drift or runoff is not likely to result in direct adverse effects to the species or reduction in prey abundance, but individual loss of prey items may occur.

We anticipate a small number of individual Mississippi sandhill cranes is likely to experience exposure to agricultural uses of atrazine because the CoA indicates very little herbicide usage (potentially including atrazine) occurred on the agricultural crops in the counties where this species' range occurs. Given that this reporting broadly includes all herbicide usage, we consider the CoA data a conservative estimate of atrazine usage. In addition, these data are presented at a relatively high spatial resolution. Therefore, we have high confidence that only a small percentage of the species' range is likely to be exposed to atrazine.

In addition to agricultural exposure, Mississippi sandhill cranes may be exposed to atrazine from non-agricultural (i.e., turf) uses. However, these non-agricultural use sites do not provide the species' necessary habitat (e.g., fields, pastures, savannas and forests). In addition, 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 this species.

In summary, we expect a small number of individual Mississippi sandhill cranes will experience exposure to atrazine over the project duration. Exposure will be limited to small portions of the species' range that overlap with agricultural herbicide usage according to CoA or non-agricultural usage on turf, where applicable, and the few exposed individuals may experience adverse effects to growth and/or reproduction. Therefore, we determine the overall risk of adverse effects to this 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 conservation measures), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of this 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 Mississippi sandhill crane.

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

For the species in Table 4, we expect they 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) and, if necessary, species-specific measures accessed through EPA's Bulletins Live! Two. 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 4. Bird species with low agricultural exposure achieved through spray drift and runoff conservation measures and low likelihood of non-agricultural exposure.

Common Name	Scientific Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Mitigations	Determination
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	Medium	Low	High	General label measures + PULA for sugarcane, guava, and macadamia nut	No Jeopardy
California least tern	*Sternula antillarum browni*	Medium	Low	Low	General label measures	No Jeopardy
Eskimo curlew	*Numenius borealis*	High	Low	High	General label measures	No Jeopardy
Wood stork	*Mycteria americana*	Low	Low	Medium	General label measures	No Jeopardy

The species in Table 4 have medium or high vulnerabilities. Specifically, pesticides are a noted threat to the cactus ferruginous pygmy-owl, Eskimo curlew, and wood stork. The cactus ferruginous pygmy-owl is a threatened, cavity-nesting desertscrub species. The Eskimo curlew is a small, endangered species occupying a single population. Threats to the curlew include contaminants, with the most recent sighting of in 2006. In 2023, we proposed the wood stork for delisting due to recovery (i.e., population increases and habitat loss mitigations) (USFWS 2023).

The species in Table 4 have low, medium, or high toxicities based on the likelihood of sublethal effects and/or loss of prey items when exposure occurs. We anticipate adverse effects are most likely for individuals that primarily forage on items that have been recently exposed to atrazine applications at some of the highest application rates on use sites. EPA's exposure modeling indicates that foraging off treated sites or consuming prey that have only been exposed through spray drift or runoff is not likely to result in direct adverse effects to these species or reduction in prey abundance, but individual loss of prey items may occur. Two of these species are documented to historically occur on agricultural fields: Eskimo curlews and wood storks. Eskimo curlews were known to forage on Rocky Mountain grasshoppers in agricultural fields of the central and western U.S., but the species has not been observed in the wild since the 1990s, and the grasshopper is extinct (USFWS, 2016). Therefore, we expect any exposure to atrazine and subsequent effects for this species are, at most, very low through agricultural or non-agricultural uses. Wood storks feed on fish and crustaceans in natural and artificial wetlands, including agricultural ditches and freshwater and saltwater wetlands on or near golf courses (USFWS 2021). However, we do not anticipate direct impacts to wood storks that consume aquatic prey on or near treated sites because atrazine does not bioaccumulate from prey to predator species (i.e., we expect dietary exposures to be low for species that feed on aquatic prey). We expect indirect impacts to the wood stork from losses of some sensitive prey items (i.e., crustaceans and fish) that are exposed to atrazine from runoff or drift. However, we anticipate most individuals will be able to locate alternative prey because they are known to travel 75 km or more in search of food (USFWS 2021).

We do not expect the cactus ferruginous pygmy owl or California least tern to occur on agricultural atrazine use sites where exposures to individuals would be highest. The cactus ferruginous pygmy-owl occurs in shrubscrub habitats, and the California least tern is primarily coastal. For the least tern, we expect the general label measures for agricultural uses (including the 15-foot spray drift buffer and three runoff mitigation points) will reduce off-field exposures by an order of magnitude (i.e., a 90% reduction), which we do not expect to cause direct 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 (or to any animal food resources required). Because the cactus ferruginous pygmy owl's habitat is heavily fragmented by agricultural lands, the species was included in a six-point PULA for sugarcane, guava, and macadamia nuts. We anticipate these additional runoff points will further reduce atrazine residues in runoff by another order of magnitude (i.e., up to 99% reduction). Therefore, due to the effectiveness of the conservation measures required under the action, we expect these species to be exposed to only low levels of atrazine through off-site transport from agricultural use sites to their habitats.

In addition to agricultural exposure, wood storks may be exposed to atrazine from non-agricultural (i.e., turf) uses. They are known to forage on golf course ponds. However, similar to agricultural exposure, we do not anticipate direct impacts to wood storks that consume aquatic prey on or near treated sites because atrazine does not bioaccumulate. In addition, 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. The other three species in Table 4 are not known to occur or forage on turf. 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 of these species 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 adverse effects to growth and/or reproduction. 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 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 4.

References:

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Removal of the Southeast U.S. Distinct Population Segment of the Wood Stork from the List of Endangered and Threatened Wildlife. Proposed Rule. Federal Register 88: 9830-9850.

U.S. Fish and Wildlife Service. 2021. Species status assessment report for the wood stork (*Mycteria americana*) U.S. breeding population Distinct Population Segment. Version 1.0. Atlanta, Georgia. 181 pp.

U.S. Fish and Wildlife Service. 2016. Eskimo Curlew (*Numenius borealis*) 5-Year Review: Summary and Evaluation. Fairbanks, Alaska. 16 pp.

Species with Individual Integration and Synthesis Summaries

The species in Table 5 have individual Integration and Synthesis summaries. We expect Herbicide Strategy conservation measures to reduce pesticide loading into aquatic habitats by 90-99% (i.e., one to two orders 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 5. Species with individual Integration and Synthesis summaries

Common Name	Scientific Name	Determination
Crested caracara (Audubon's) [FL DPS]	*Caracara plancus audubonii*	No Jeopardy
Florida scrub-jay	*Aphelocoma coerulescens*	No Jeopardy
Piping plover (Atlantic Coast and Northern Great Plains DPS)	*Charadrius melodus*	No Jeopardy
Piping plover (Great Lakes DPS)	*Charadrius melodus*	No Jeopardy
Red-cockaded woodpecker	*Picoides borealis*	No Jeopardy
Yellow-billed cuckoo	*Coccyzus americanus*	No Jeopardy

Integration and Synthesis Summary: Crested caracara (Audubon’s) [FL DPS]

Scientific Name:	Common Name:	Entity ID:
Caracara plancus audubonii	Crested caracara (Audubon's) [FL DPS]	125

Conclusion: No Jeopardy

Species Range

Based on range map dated: 04-26-2022; U.S.A. (FL); *States within the range:* FL

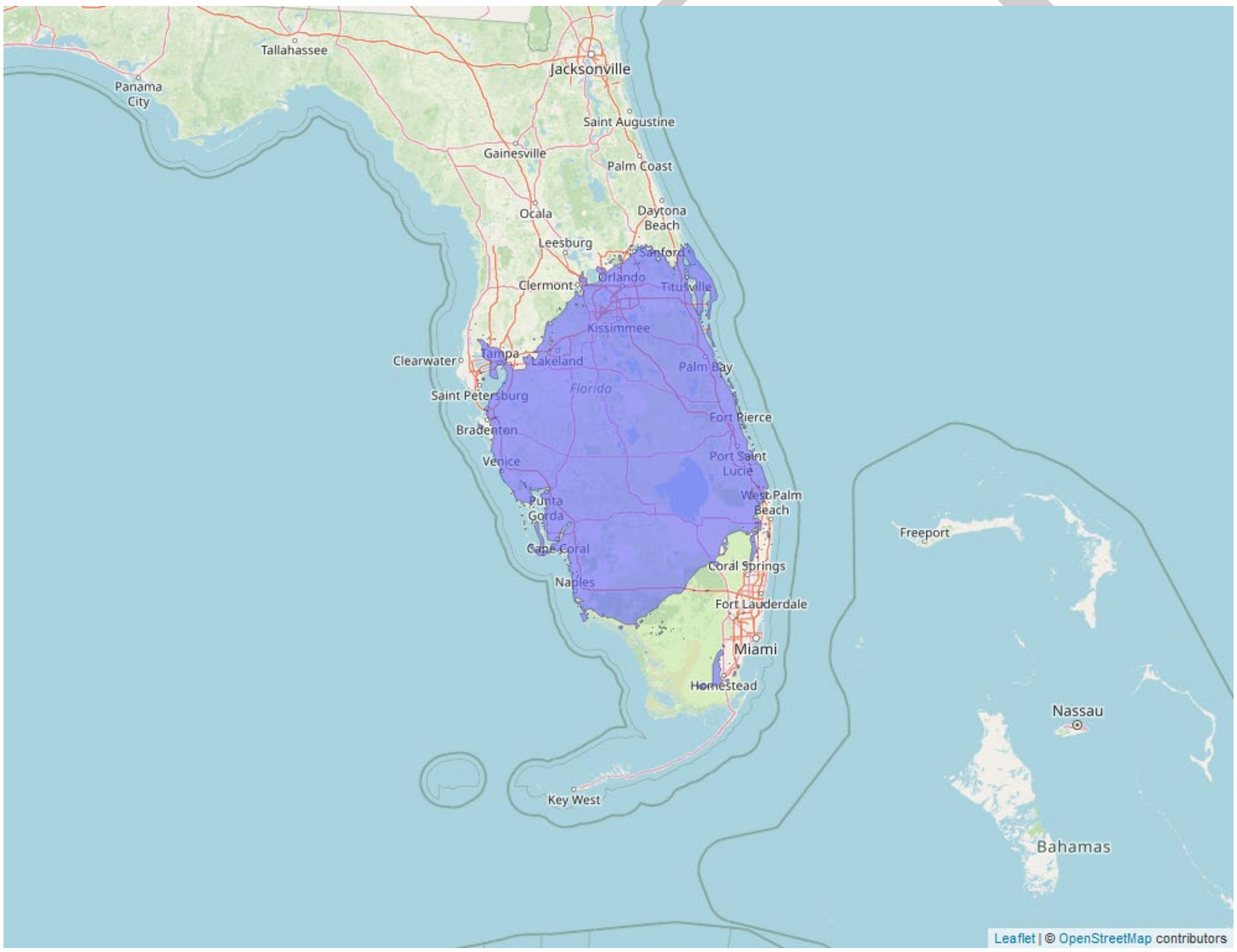

Figure 2. Range map of crested caracara (Audubon’s) [FL DPS] (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8250.

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: 4/30/2025

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Single population

Species trends: Increasing population(s)

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Florida Distinct Population Segment (DPS) of the Audubon's crested caracara (*Caracara plancus audubonii*) was listed in 1987. Since that time, the population has increased and expanded its range, effectively using human-made analogues of its natural and historical habitats. Caracara have expanded their range from a core of 5 counties of documented nesting in 1987 to 22 counties of documented nesting in 2022. Among these are observation records of caracara in the Florida panhandle indicating that caracara is expanding their range northward. The caracara population has increased from an estimated 100 adults in 1978 to an estimated 800 adults (400 breeding pairs) in 2007. Estimates of population growth is also supported by population expansion in numbers and range.

Audubon's crested caracara demonstrates resiliency to loss of natural habitats and has been shown to be adaptable to new habitats and foods. For example, they are found in human-modified habitats such as pastures, fields, orchards, and low-density urban areas, and are known to successfully forage and breed in pastures, roadside areas, low intensity or open developed spaces, row crops, and orchards. Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey (e.g., rabbits, skunks, prairie dogs, opossums, rats, mice, squirrels, frogs, lizards, young alligators, crabs, crayfish, fish, young birds, cattle egrets, beetles, grasshoppers, maggots, and worms), insects and other invertebrates, fish, snakes, turtles, birds, and mammals. Nesting territories of the species in Florida have been found to contain higher proportions of improved pasture and lower proportions of forest, woodland, oak scrub, and marsh. The Service has also confirmed numerous accounts of caracara successfully nesting or roosting in busy residential communities, on communications towers, and billboards while foraging along roadsides, in restaurant parking lots, in residential neighborhoods, on buildings, and in citrus orchards.

The species faces conservation challenges, including ongoing habitat changes and degradation as a result of commercial and residential development; individual mortality from vehicle collisions; the perception by some homeowners and landowners that they are a nuisance; exposure to contaminants; and human disturbance of nesting. Many of these stressors are already present and impacting Audubon’s crested caracara but the continued range expansion and population increases show that these threats appear to not be significant impacts to the species in Florida. For this reason, we do not believe these challenges are sufficient to cause the species to become threatened with extinction, and that these can be addressed by other conservation mechanisms in place at the state level. We believe the species has demonstrated the redundancy, adaptability (representation), stability, and resiliency to sustain ongoing population growth and range expansion despite the described threats, and based on these observations, we found that Audubon’s crested caracara no longer meets the definition of threatened or endangered species pursuant to the Act. As such, we recommended delisting in the 2025 five-year review for the population.

Overall Vulnerability: Low

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 10.7% of the species’ range overlaps with agricultural use sites and 58.9% 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 69.6% 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 Audubon’s crested caracara (FL DPS).

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	6.0	6.4	0.4	6.0	6.4

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Vegetables and Ground Fruit (Sweet Corn)	0.5	9.8	10.3	0.2	4.3	4.5
Other Grains (Sorghum & Sugarcane)	5.0	8.3	13.2	5	8.3	13.2
Other Orchards (Guava & Macadamia Nut)	0.4	6.9	7.3	<0.1	0.6	0.7
Other Crops (Wheat-Corn-Fallow)	0.0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Sorghum-Fallow)	0.0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Fallow-Wheat)	0.0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	4.4	28.0	32.4	4.4	28.0	32.4
Total	**10.7**	**58.9**	**69.6**	**10.1**	**47.2**	**57.3**

Usage

Past usage data indicate that up to 57.3% of the species' range has been treated with atrazine annually from agricultural uses, with 10.1% occurring on agricultural fields and 47.2% resulting from off-site transport.

Additional Exposure Considerations

While the species' range map encompasses a large portion of the state, the fragmentation and degradation of habitat from land use changes has resulted in patchy suitable areas where individuals occur in a clustered distribution. Core habitat lies within the Kissimmee Prairie, located northwest of Lake Okeechobee, and includes less than 1000 km^2 of suitable habitat. However, non-breeding caracaras range more widely than breeding caracaras and may occur more broadly through the range.

Primary crested caracara habitat in Florida consists of prairies interspersed with marshes and cabbage palm hammocks. Current habitat use includes (ranked highest to lowest proportion): improved pasture, dry prairie, freshwater marsh, mixed upland hardwoods, shrub swamp, shrub and brushland, grassland, pinelands, bare soil, urban, other agriculture, citrus, and scrub. The Audubon's crested caracara could enter agricultural areas, including orchards, to forage, roost, or breed (USFWS field office request, pers. comm. 2016 co-occurrence information). Though these areas represent a smaller proportion of use by caracaras than other habitats, non-breeding caracaras have been shown to use citrus groves based on availability, particularly those adjacent to pasture (Dwyer et al., 2013).

As stated above, caracaras are highly opportunistic in their feeding habits. Several authors have noted that caracaras may consume unusual items, including turtle and other eggs as well as coconut meat. Caracaras are diurnal and hunt on the wing, from perches, and on the ground. In pastures, caracaras forage on foot, which typically support small vertebrate prey as well as invertebrates associated with cattle, including those under cattle feces. They will also regularly patrol sections of highway in search of carrion.

Audubon's crested caracaras are resident and non-migratory. Home ranges may encompass an area of up to 2,389 ha with an average of 1,552 ha. However, in recent years, more observations of caracara are occurring along the Atlantic Coast as far north as Nova Scotia; it is unclear if this is a new phenomenon or not. If these are Florida birds, then they will still be protected under the ESA. The assumption is that these birds are transitory and may return to Florida annually (USFWS field office request, pers. comm. 2016 co-occurrence information).

Exposure from Non-Agricultural Uses

As discussed, Audubon's crested caracaras may forage or roost in a variety of habitat types, including those that may be within or adjacent to non-agricultural use sites for atrazine. In particular, Audubon's crested caracaras may forage in and adjacent to developed areas. However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses*, above), we expect atrazine usage within the range of the Audubon's crested caracara 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.

In addition to label measures, the Audubon's crested caracara is in a Pesticide Use Limitation Area that requires an additional three runoff mitigation points (i.e., six points total) for sugarcane, guava, and macadamia nuts only. We anticipate these additional runoff points will further reduce atrazine residues in runoff by another order of magnitude (i.e., up to 99% reduction in atrazine runoff residues in total).

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.

We expect consumption of food items in and around atrazine use sites to be the primary route of exposure to crested caracara. We do not expect Audubon's crested caracara that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to individuals exposed on use sites within the range.

Maximum concentrations of atrazine in dietary items range from 4.3 - 309.5 mg/kg-bw, depending on the specific dietary item consumed and the use site where exposure occurs. These concentrations on food items represent high end exposure scenarios (i.e., maximum body burdens in individuals that only consuming contaminated food directly on atrazine use sites immediately after applications are made). We do not anticipate any of these estimated exposure concentrations will result in mortality of individuals. However, the majority of exposure concentrations are at levels associated with reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. However, we expect a range of concentrations to be associated with contaminated prey species, and we only anticipate these effects if individuals forage on prey with maximum estimated concentrations of atrazine on recently treated fields. We expect this to be a rare occurrence, as Audubon's crested caracaras are expected to consume a varied diet that will also include resources off treated areas. However, an individual Audubon's crested caracaras feeding exclusively on prey in treated use sites for 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 Audubon's crested caracaras are not likely to die from exposure to atrazine. While individual terrestrial vertebrates may experience growth or reproductive effects if exposed to atrazine use sites, we anticipate the conservation measures on agricultural product labels (including mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices in non-agricultural use sites will minimize off-site concentrations of atrazine and limit impacts to the species' prey base. As such, we do not anticipate atrazine use is likely to reduce the availability or abundance of prey that the species relies on as 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 atrazine concentrations to reach concentrations where adverse effects to the Audubon's crested caracaras and its prey will occur on atrazine use sites. We do not expect individuals will be present on-field during spray application, however, some individuals are likely to be exposed to contaminated food sources as the species is known to forage in atrazine use sites. In addition, while the Audubon's crested caracara 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 not die but will experience reproductive effects. However, given the variable diet of the Audubon's crested caracara 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 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 prey that the Audubon's crested caracara relies on as food resources.

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

Species Conclusion

The Audubon's crested caracara has a single distinct population segment that occurs throughout several counties in Florida. The population grew 8-fold from 1978 to 2007, and has likely continued to increase, though challenges in field sampling make getting an accurate estimate of the current size difficult. However, field investigations of documented nests over the past 35 years have confirmed that the species has expanded its range from an initial 5 counties in 1987 to 22 counties in 2022. While the species has confronted a loss of its natural habitat due to encroaching agricultural and urban areas, the Audubon's crested caracara is highly resilient, as evidenced by it roosting and nesting in human-modified habitats and foraging on a wide variety of food sources. Despite stressors, they do not appear to be of significant impact to the Audubon's crested caracara, which recently was recommended for delisting.

There is up to 69.6% overlap between the Audubon crested caracara's range and the footprint of atrazine agricultural use sites (on-field and adjacent use sites). Past usage data indicates that up to 57.3% of the species' range has been treated with atrazine annually from agricultural uses, with 10.1% occurring directly on agricultural fields. While only on-field exposure to atrazine is a concern for birds, this relatively high level of usage would suggest that the species is likely to have significant exposure to the chemical. The primary exposure pathway for birds is through the dietary route, and so contaminated food items the Audubon's crested caracara forages on could accumulate to levels known for sub-lethal effects such as reductions in reproductive fitness (reductions in numbers of eggs laid, hatchling survival). However, while the caracara is known to occur in agricultural sites including row crops, they are more likely to forage and roost in agricultural sites such as citrus orchards, which are not labeled use sites for atrazine. Therefore, we do not anticipate that the caracara will consume a substantial amount of contaminated prey at maximum concentrations to pose a risk of direct effects. The Audubon's crested caracara may occur within or adjacent to non-agricultural atrazine sites, particularly developed areas. However, based on our knowledge of atrazine application to turf, we expect atrazine exposure in the range of the caracara to be limited. Finally, we do not anticipate that the caracara will have indirect effects, as its prey base is not likely to die or be reduced in abundance or availability due to atrazine exposure.

While the Audubon's crested caracara has high on-field exposure, its low vulnerability and minimal occurrence in atrazine use sites suggest that the risk of adverse effects is limited for this species. While on-field exposure to atrazine poses risks of sublethal effects to reproduction for individuals that forage directly on use sites recently treated with atrazine, we expect this to impact a small number of individuals due to the likelihood that most individuals will not consume only contaminated food sources, especially given their varied diet. We do not anticipate direct mortality will occur to individuals that forage in exposed areas. We also do not anticipate prey availability will be impacted on use sites or in off-site areas. 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 Audubon's crested caracara.

References

Dwyer, J.F., J.D. Fraser, and J.L. Morrison. 2013. Range sizes and habitat use of non-breeding crested caracaras in Florida. Journal of Field Ornithology 84:223-233.

U.S. Fish and Wildlife Service. 2025. Audubon's Crested Caracara [Florida DPS] (*Caracara plancus audubonii*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 27 pp.

U.S. Fish and Wildlife Service. 1987. Endangered and Threatened Wildlife and Plants; Threatened Status for the Florida Population of Audubon's Crested Caracara. Final Rule. Federal Register 52(128):25229-25234.

Integration and Synthesis Summary: Florida scrub-jay

Scientific Name:	Common Name:	Entity ID:
Aphelocoma coerulescens	Florida scrub-jay	140

Conclusion: No Jeopardy

Species Range

Based on range map dated: 01-28-2022; Wherever found; *States within the range:* FL

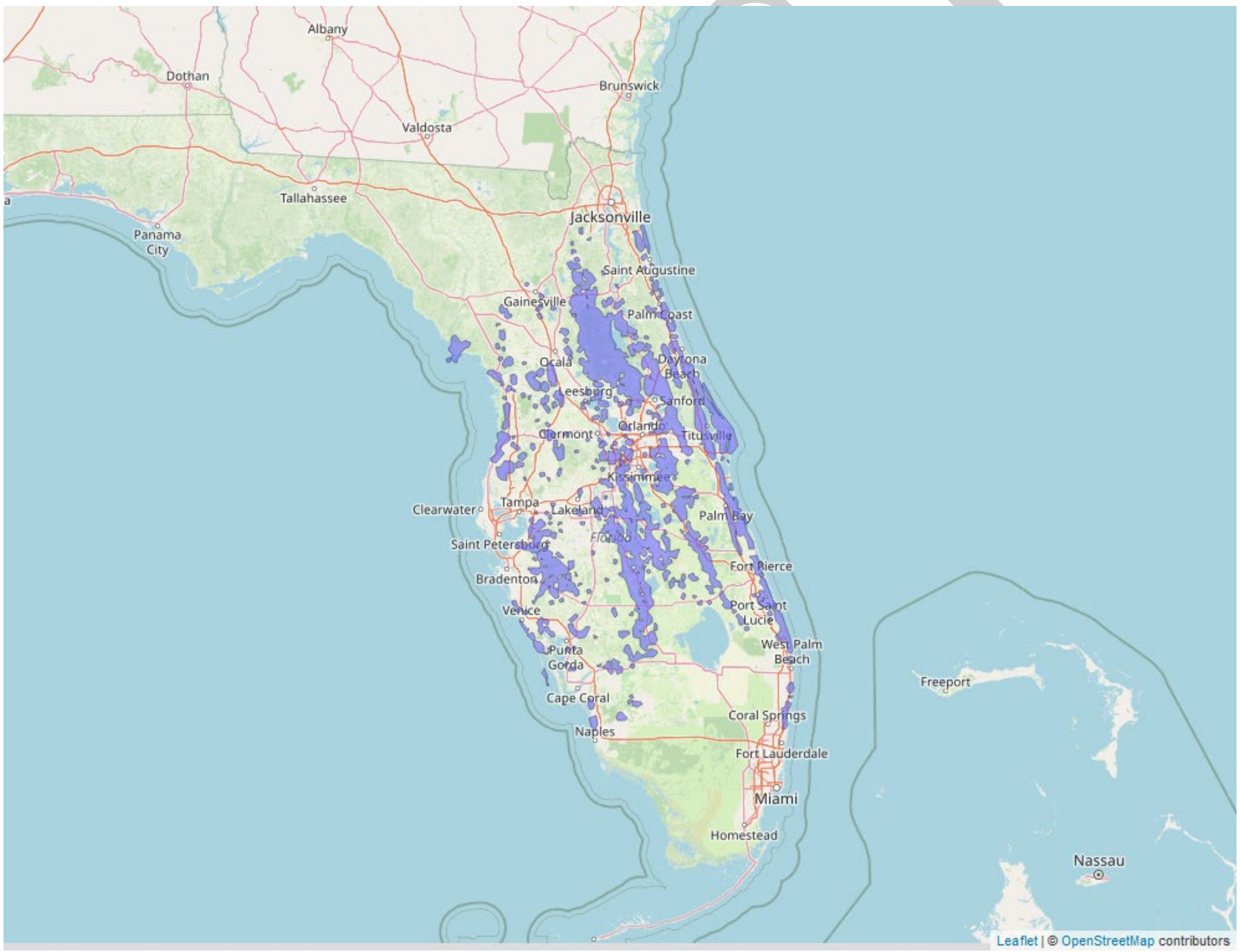

Figure 3. Range map of Florida scrub-jay (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6174.

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: 8/27/2025

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

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: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Florida scrub-jays are non-migratory, extremely sedentary, and restricted to scrub and shrubby flatwoods, primarily concentrated along both the Atlantic and Gulf coasts of Florida on central ridges. They inhabit areas with low densities of pine trees. Woodlands and forests are not suitable for the scrub-jay and they decrease habitat suitability of nearby scrub. Florida scrub-jays interact as metapopulations made up of multiple local populations that are relatively isolated, spatially distributed, and bound together by occasional dispersal between populations. Pairs occupy year-round, multi-purpose territories averaging 9 to 10 ha, with a minimum of about 5 ha in size. Given the size of Florida scrub-jay territories and the short dispersal distances exhibited by the species, it is critical to maintain large, contiguous blocks of Florida scrub-jay habitat to support local populations that are relatively resistant to local extinction and to avoid loss of connectivity with other populations. Florida scrub-jays are endemic to Florida and once occupied 39 out of 40 counties in the peninsula. Historically, many counties would have had hundreds or even thousands of breeding pairs, but extant populations have declined to less than 10% of their historic numbers. A comparative study between 1992-93 and 2009-10 analyzing populations on managed conservation lands showed a 25% decline during this timeframe, with extant populations at less than 50% of the potential carrying capacity. As of 2015, post-breeding surveys suggested 13 of the original 39 counties lacked occupancy on public conservation lands. A total of 21 metapopulations with 10 genetic units based on genetic similarity between individuals have been described. Still, the Service's 2020 5-year review found the Florida scrub-jay remains secure on many managed conservation lands throughout its historical range. A statewide mapping exercise in 2015 (unpubl.) estimated that there were approximately 139,716 ha in conservation, which includes roughly 78% of the potential remaining scrub habitat in peninsular Florida. At the time of the 2019 SSA, there were 65 Florida scrub-jay populations on conservation lands, spanning the entire width and nearly the length of the Florida peninsula. Of those, there were four very highly resilient populations that support 73% of known family groups on conservation lands (1,580 out of 2,160) (USFWS 2019, 2020). Between 2020-2025, four populations increased, one remained stable, one decreased, and one trend is unknown due to lack of reliable baseline information (USFWS 2025).

Road mortality, supplemental food, changes in habitat, stochastic events, and exotic plants and animals pose risks to some scrub-jay populations, although fire suppression and the resulting degradation in habitat represents the most significant and widespread man-made threat affecting the scrub-jay's continued existence. Demographic instability resulting from human development is another significant threat. Florida scrub-jay populations in suburban landscapes are declining and disappearing across Florida. Habitat destruction is difficult to quantify but is anticipated to continue based on past and projected human population growth and development in Florida. The recovery strategy for the Florida scrub-jay emphasizes creating and maintaining viable populations across most of the species' remaining geographic subpopulations and distinct genetic units, with priorities around the need for large landscapes that provide optimal opportunities for long-term persistence of Florida scrub-jay populations and maintaining and improving connectivity to facilitate dispersal among local populations (USFWS 2019, 2020).

Many partners have worked together towards recovery of the species since the publication of the 1990 Florida Scrub-Jay Recovery Plan. Land acquisitions by public entities (local, state and federal) and conservation non-profits have reduced habitat degradation, destruction, and fragmentation threats to some scrub-jay populations. Effective land management is essential for maintaining suitable habitat. Even on conservation lands, most populations are smaller and more isolated from one another than they were historically, and restoration and (they emphasize) effective management of potential habitat in core areas is necessary to prevent the extirpation of scrub-jay populations (USFWS 2020). Losses have continued through the present, with populations declining on both protected and unprotected lands, especially in unmanaged and suburban areas. The Service has developed Florida scrub-jay mitigation guidance to be used when assessing minimization and mitigation needs for the species for actions under section 10 and section 7 of the ESA (USFWS 2009), and some mitigation involving scrub habitat acquisition and management has occurred through Habitat Conservation Plans such as Brevard County's Scrub Conservation and Development Plan.

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 0.9% of the species' range overlaps with agricultural use sites and 49.4% 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 50.4% 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 Florida scrub-jay.

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	4.8	4.9	<0.1	4.8	4.9
Vegetables and Ground Fruit (Sweet Corn)	0.2	11.4	11.7	0.2	11.4	11.7
Other Grains (Sorghum & Sugarcane)	<0.1	3.9	4.0	<0.1	3.9	4.0
Other Orchards (Guava & Macadamia Nut)	0.1	6.8	6.9	<0.1	4.6	4.7
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)	0.4	22.5	22.9	0.4	22.5	22.9
Total	**0.9**	**49.4**	**50.4**	**0.9**	**47.3**	**48.2**

Usage

Past usage data indicate that up to 48.2% of the species' range has been treated with atrazine annually from agricultural uses, with 0.9% occurring on agricultural fields and 47.3% resulting from off-site transport.

Additional Exposure Considerations

Florida scrub-jays are restricted to scattered and often small, isolated patches of scrub in peninsular Florida. The Florida scrub-jay is opportunistic, consuming about 60% animal matter including invertebrates, small terrestrial and aquatic vertebrates, and carrion, as well as nuts, fruits, and seeds.

Exposure from Non-Agricultural Uses

Some populations of Florida scrub-jays are known to occur in rural and suburban residential communities where atrazine is registered for use on residential turf and golf courses. However, given our knowledge of atrazine application to turf and golf courses (see *Exposure to Non-Agricultural Uses* in the Introduction section above), we expect atrazine usage within the range of the Florida scrub-jay 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.

In addition to label measures, the Florida scrub-jay is in a Pesticide Use Limitation Area that requires an additional three runoff mitigation points (i.e., six points total) for sugarcane, guava, and macadamia nuts only. We anticipate these additional runoff points will further reduce atrazine residues in runoff by another order of magnitude (i.e., up to 99% reduction in atrazine runoff residues in total).

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.

We expect consumption of food items in and around atrazine use sites to be the primary route of exposure to the Florida scrub-jay. We do not expect individuals that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to individuals exposed on use sites within the range.

The Florida scrub-jay consumes invertebrates, small terrestrial and aquatic vertebrates, and carrion, as well as nuts, fruits, and seeds. We do not expect Florida scrub-jays 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. Maximum concentrations of atrazine in these dietary items range from 15.4 - 1113.5 mg/kg-bw. There concentrations on food items represent high end exposure scenarios (i.e., maximum body burdens in individuals that only consuming contaminated food directly on atrazine use sites immediately after applications are made). We do not anticipate any of these estimated exposure concentrations will result in mortality of individuals. In contrast, the majority of these exposure concentrations are at levels associated with reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. However, we expect a range of concentrations to be associated with contaminated prey species, and we only anticipate these effects if individuals forage on prey with maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will be a rare occurrence as Florida scrub-jays are opportunistic and expected to consume a varied diet that will also include fruit and seeds, which are expected to result in lower dosages of atrazine that are not associated with adverse effects in birds, and food resources that occur off treated use sites. However, an individual Florida scrub-jay 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 Florida scrub-jay are not likely to die from exposure to atrazine, though individual terrestrial vertebrates may experience growth or reproductive effects if exposed to atrazine on use sites. However, we anticipate the conservation measures on agricultural product labels (including mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices in non-agricultural use sites will reduce off-site concentrations of atrazine to levels where we expect no more than low levels of adverse effects to occur. As such, we do not anticipate atrazine use is likely to reduce the availability or abundance of prey that the species relies on as food resources. In addition, while we anticipate exposure to atrazine, including through off-site transport, can negatively impact the growth and survival of sensitive plant species, we do not anticipate spray drift or runoff of atrazine will destroy or limit the availability of plant resources that the species requires for food.

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 atrazine concentrations to reach concentrations where adverse effects impact the Florida scrub-jay on atrazine use sites, which occur in only 0.9% of the range. While the Florida scrub-jay prey may also be exposed to atrazine from use in non-agricultural areas, particularly on residential lawns, 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 small extent of overlap with atrazine use sites within the range of the Florida scrub-jay, the limited extent of usage on these sites, the variable diet of the Florida scrub-jay, 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.

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 prey or plant resources that the Florida scrub-jay relies on as food resources.

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

Species Conclusion

The Florida scrub-jay is a threatened, narrow endemic species, restricted to the scrub-shrub flatwoods of the Florida coast. The Florida scrub-jay has a metapopulation structure, made up of multiple local populations that are isolated, spatially distributed and bound together by occasional dispersal amongst them. In recent years, populations have declined to less than a tenth of their historic numbers, and the species now occupies only 26 of the original 39 counties once part of its range. Threats to the species include habitat degradation due primarily to fire suppression, and demographic instability resulting from human development. Conservation partners have worked in recent decades to recover the species through habitat acquisition and management.

Atrazine agricultural use sites overlap with 0.9% of the Florida scrub-jay's range. Adjacent areas that are likely to provide off-site transport exposure overlap with up to 49.4% of the species' range, though we do not expect off-field exposure to have effects to the species. Past usage data indicates that atrazine agricultural use sites overlap with 0.9% of the Florida scrub-jay's range. While the Florida scrub-jay is known to occur in rural and suburban communities where atrazine is registered for use on residential lawns and golf courses, based on our knowledge of atrazine application to these areas, we expect non-agricultural atrazine exposure within the range of the Florida scrub-jay to be limited. In addition, the Florida scrub-jay is an opportunistic species whose diet comprises a wide range of food sources, including invertebrates, small vertebrates, carrion and nuts, fruits and seeds. Therefore, we do not expect the species to exclusively consume atrazine-exposed food items. Direct effects to exposed individuals would likely include reproductive effects (reduction in eggs laid, hatching survival, etc), but we only anticipate those effects to individuals that forage exclusively on prey with maximum estimated concentrations of atrazine on recently treated use sites, which we anticipate being a rare occurrence. We also do not expect that atrazine use will reduce the availability or abundance of prey items the Florida scrub-jay relies on for food, nor do we expect that spray drift or runoff will destroy or limit the availability of plant resources that the species requires for food.

The Florida scrub-jay has a medium vulnerability ranking, and while overlap with the atrazine agricultural footprint is high, it has low direct overlap with atrazine agricultural use sites. Past usage data indicates low application levels of atrazine to atrazine use sites within the species range, suggesting the risk of adverse effects from atrazine use is limited for this species. We expect that only a very small number of individuals exposed will experience direct effects to reproduction after spending very limited time on atrazine-treated fields, and we do not anticipate indirect effects to the species' arthropod food supply. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including general label conservation measures), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of this 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 scrub-jay.

References

Boughton, R.K. and R. Bowman. 2011. State wide assessment of Florida Scrub-Jay on managed areas: a comparison of current populations to the results of the 1992-93 survey. Report to U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. 2025. Florida Scrub-Jay (*Aphelocoma coerulescens*) 5-Year Review: Summary and Evaluation. Gainesville, Florida. 25 pp.

U. S. Fish and Wildlife Service. 2020. Florida Scrub-Jay (*Aphelocoma coerulescens*) 5-Year Review: Summary and Evaluation. Jacksonville, Florida. 45 pp.

U.S. Fish and Wildlife Service. 2019. Species Status Assessment, Florida Scrub-Jay (*Aphelocoma coerulescens*), Version 1.0. Jacksonville, Florida. 140 pp.

Integration and Synthesis Summary: Piping plover (Atlantic Coast and Northern Great Plains populations)

Scientific Name:	Common Name:	Entity ID:
Charadrius melodus	Piping plover (Atlantic Coast and Northern Great Plains populations)	131

Conclusion: No Jeopardy

Species Range

Based on range map dated: 10-15-2024; [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered.; *States within the range:* AL, AR, CO, CT, DE, FL, GA, IA, IL, KS, LA, MA, MD, ME, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OK, RI, SC, SD, TN, TX, VA, WY

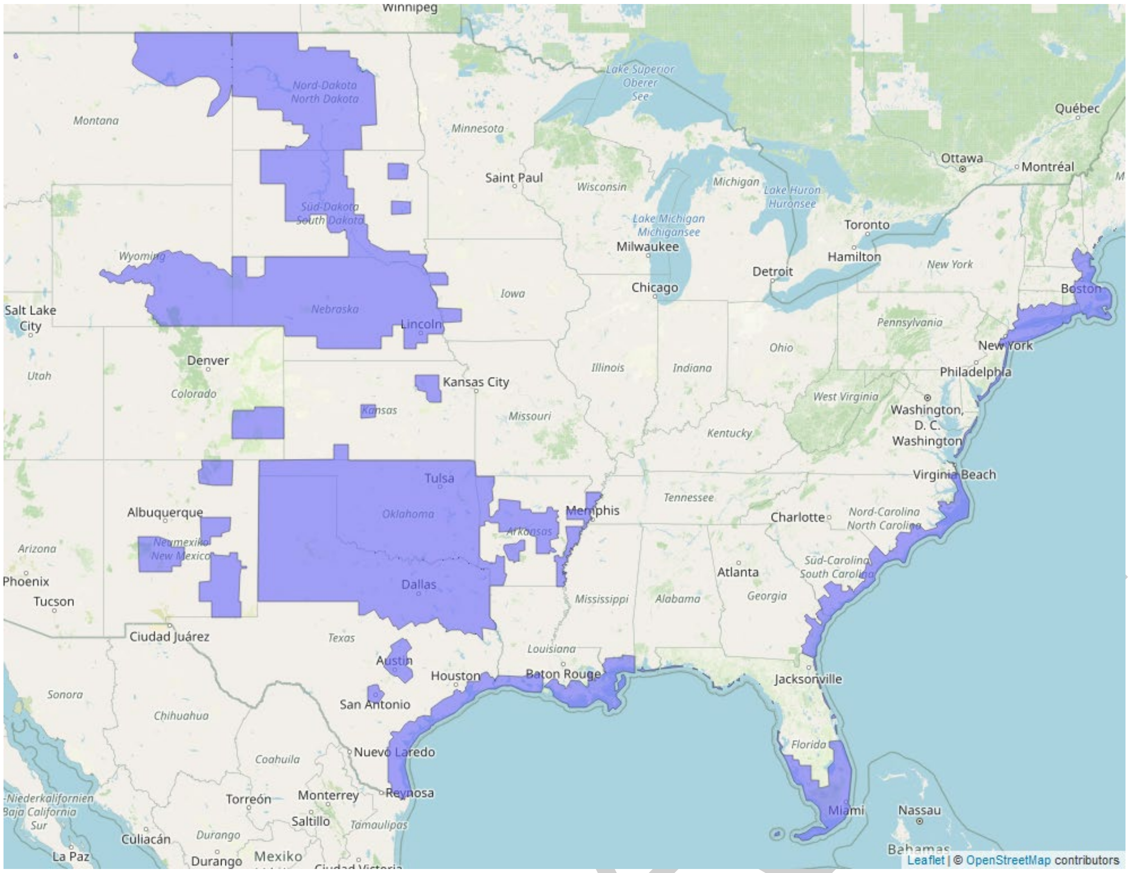

Figure 4. Range map of piping plover (Atlantic Coast and Northern Great Plains populations) (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6039.

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: 1/6/2025

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (few)

Species trends: Increasing population(s)

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Piping plovers are small shorebirds that feed on macroinvertebrates and nest above the high tide line on coastal beaches, sandflats, gently sloping foredunes, blowout areas behind foredunes, sparsely vegetated dunes, and washover areas. Endangered Species Act actions are recognized in three separate breeding populations of piping plovers: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist (USFWS 2009). The survival and recovery of all piping plover breeding populations are dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. Although there is no exclusive partitioning of the wintering range, piping plovers from the Atlantic Coast (i.e., eastern Canada) and the Great Lakes are most prevalent during migration and winter along the southern Atlantic Coast; while those breeding on the Northern Great Plains predominate in coastal Mississippi, Louisiana, and Texas; wintering ranges of all three breeding populations overlap on the Gulf Coast of Florida. Piping plovers demonstrate high fidelity to winter regions where they use a mosaic of habitats within their home ranges (USFWS 2016, 2020).

The breeding population of the Northern Great Plains piping plover extends from Nebraska north along the Missouri River through South Dakota, North Dakota, and eastern Montana, and on alkaline (salty) lakes along the Missouri River Coteau (a large plateau extending north and east of the Missouri River) in North Dakota, Montana, and extending into Canada. Most piping plovers from Prairie Canada winter along the south Texas coast, while breeding piping plovers from the U.S. Great Plains are more widely distributed along the Gulf Coast from Florida to Texas. In the Northern Great Plains, piping plovers breed and raise young on sparsely vegetated sandbars, reservoir shorelines on river systems, and on the shorelines of alkaline lakes. On the wintering grounds, piping plovers forage and roost along barrier and mainland beaches, sand, mud, and algal flats, washover passes, salt marshes, and coastal lagoons. The Northern Great Plains population is geographically widespread, with many birds in areas with small human populations. Rough estimates of adult piping plover numbers in the Great Plains population (U.S. & Canada combined) varied from about 3,500 in 1991, 4,600 in 2006, and 2,250 in 2011 (USFWS 2016). Due to difficulty in surveying the species, the population trend seen in Northern Great Plains abundance data is unreliable (USFWS 2020).

The Atlantic Coast piping plover population breeds from Newfoundland to South Carolina and winters along the Atlantic Coast from North Carolina south along the Gulf Coast and in the

Caribbean. The population was estimated to be 790 pairs at listing in 1986, nearly 1,350 pairs in 1995, and 1,849 pairs in 2008 (USFWS 1996, Service 2009). The population is unevenly distributed and there have been several documented declines in sub-populations over this time period (i.e., plovers in Maine decreased from 66 pairs in 2002 to 24 pairs in 2008). Substantially higher productivity rates were observed in New England than elsewhere in the population's range (USFWS 1996).

All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., adult and fledged juvenile survival). Cumulative habitat loss is of grave concern for all piping plovers. Major threats to the Northern Great Plains population include changes in the quality and quantity of riverine habitat due primarily to damming and water withdrawals. For the Atlantic Coast population, primary threats include development and shoreline stabilization. Artificial shoreline stabilization impedes the processes by which coastal habitats adapt to accelerating sea-level rise, thus setting the stage for compounding future losses. Human disturbance, predation, invasive plants, and pesticides further reduce breeding and wintering habitat quality and affect survival for all plover populations (USFWS 2016). Human activities affect plover activity patterns, types, and numbers of predators, exacerbating natural predation in many areas. In areas where predation appeared to drive extremely low productivity in the Great Plains, predation control (i.e., great horned owl, gulls, mammal trapping) was implemented with limited success. Predation control was effective to improve interim productivity, but because high predation rates were a symptom of insufficient available habitat, ensuring that sufficient high-quality habitat was available was more effective for plover recovery. Sandbar islands were mechanically created in South Dakota and Nebraska from 2004-2011; birds readily used them for nesting, but breeding success declined with sandbar age. Human recreational disturbance is a major threat to coastal migration and wintering range for piping plovers; interactions with dogs elicit a strong response from shorebirds. Shorebirds are more likely to flush from a dog, especially off-leash, than a person. Elevated stress levels in the nonbreeding season can carry over into the breeding season and impact future reproductive success by reducing survival and fecundity rates for plovers. In the 2020 5-Year Review, we mentioned a study that showed a negative correlation between killdeer abundance and the amount of land in an area treated with neonictinoids. Neonictinoids are insecticides that may affect the density and diversity of insects in affected wetlands; they are believed to potentially impact bird species in the areas of use and further study is needed. We are unaware of any studies that evaluated the risk of secondary poisoning (impact to plovers from eating contaminated insects), but the widespread use of neonictinoids, tendency to accumulate in wetlands, persistence in the soil, and potential adverse effects on the species' prey, neonictinoids may have a negative effect on piping plovers. The magnitude of the threats regarding climate change is yet unknown, but the impact of regional changes will have to be monitored closely to ensure the piping plover's persistence (USFWS 2020).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 20.1% of the species' range overlaps with agricultural use sites and 78.8% 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 98.9% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 8).

Table 8. Agricultural use overlap and annual usage data (% Range Treated) for the piping plover (Atlantic Coast and Northern Great Plains populations).

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	9.9	23.1	33.0	9.4	22.2	31.6
Vegetables and Ground Fruit (Sweet Corn)	0.4	3.3	3.7	0.1	1.1	1.2
Other Grains (Sorghum & Sugarcane)	4.1	21.8	25.9	3.1	15.6	18.8
Other Orchards (Guava & Macadamia Nut)	<0.1	0.2	0.2	<0.1	<0.1	<0.1
Other Crops (Wheat-Corn-Fallow)	2.5	11.9	14.4	1.1	3.9	4.9
Other Crops (Wheat-Sorghum-Fallow)	3.7	26.1	29.8	1.6	7	8.6
Other Crops (Wheat-Fallow-Wheat)	5	9.1	14.1	2.7	4.2	6.9
Other Crops (Sod)	0.6	5.6	6.2	0.6	5.6	6.2
Total	**20.1**	**78.8**	**98.9**	**16**	**50.4**	**66.4**

Usage

Past usage data indicate that up to 66.4% of the species' range has been treated with atrazine annually from agricultural uses, with 16% occurring on agricultural fields and 66.4% resulting from off-site transport.

Additional Exposure Considerations

Piping plovers forage by gleaning invertebrates from the substrate or running and pecking on the substrate with short runs between pecks. Piping plovers utilize numerous areas within breeding and wintering habitats for foraging, including wet sand in the wash zone, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons, and salt marshes. Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks. Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival.

Piping plovers return to their breeding grounds in late April to early May and initiate nesting by mid- to late May. Hatching begins in late May to early June, generally peaking in June and early July. The young leave the nest within hours of hatch and begin to forage almost immediately. Piping plovers migrate July through September in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico. Piping plovers spend three to five months on the breeding grounds annually, and the rest of the year on the wintering or in migration. Piping plovers are sparsely distributed across their Atlantic Coast breeding range.

Piping plovers are unlikely to enter atrazine use sites during breeding but may migrate through agricultural, golf courses, and other turf areas (USFWS field office request, pers. comm. 2016 co-occurrence information). Given the broad nature of the range map for this species in certain areas, it is unlikely that the entire area of overlap adjacent to these use sites represents piping plover habitat.

Exposure from Non-Agricultural Uses

Piping plovers are not expected to occur in non-agricultural atrazine use sites during breeding but may migrate through and stopover at sites containing turf, such as golf courses. These inland migratory stopover sites have not been found to contain large concentrations of piping plovers, rather most reports of birds at inland sites were single individuals. Individuals appear to stop opportunistically along the migratory route rather than show fidelity to specific sites, with duration typically lasting no longer than one day (Pompei and Cuthbert 2004). However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* section in the Introduction above), we expect atrazine usage within the range of the piping plover 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.

We expect consumption of food items in and around atrazine use sites to be the primary route of exposure to the piping plover. We generally do not expect piping plovers will forage on atrazine use sites during breeding, but may stopover on use sites during migration. We do not expect individuals that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to individuals exposed on use sites within the range.

The piping plover feeds primarily on benthic invertebrates and arthropods. Maximum concentrations of atrazine in dietary items range from 75.7 - 151.3 mg/kg-bw depending on the specific atrazine use site individuals forage on. These concentrations on food items represent high end exposure scenarios (i.e., maximum body burdens in individuals that only consuming contaminated food directly on atrazine use sites immediately after applications are made). We do not anticipate any of these estimated exposure concentrations will result in mortality of individuals. In contrast, the majority of these exposure concentrations are at levels associated with reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. However, we expect a range of concentrations to be associated with contaminated arthropods, and we only anticipate these effects if individuals forage on arthropods with maximum estimated concentrations of atrazine on recently treated fields. Furthermore, while an individual piping plover feeding exclusively on contaminated arthropods on treated turf during migration may accumulate a significant body burden of pesticides, we do not expect this exposure to occur during the breeding season of the piping plover, and thus, will be unlikely to result in reproductive effects.

Indirect Effects

The piping plover relies on benthic invertebrates and arthropods for food resources, gleaning prey from the substrate or running and pecking on the substrate. We anticipate the conservation measures on agricultural product labels (including mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices in non-agricultural use sites will reduce atrazine residues to levels where we do not expect effects to the growth or survival of the piping plover's prey. As such, we do not anticipate atrazine use is likely to reduce the availability or abundance of prey that the species relies on as 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 portion of the species' range will be treated with atrazine on agricultural fields annually. However, we do not expect that breeding piping plovers will forage on atrazine use sites, and we do not expect individuals exposed in habitat adjacent to use sites will accumulate more than low levels of atrazine, which will not result in any mortality or sublethal adverse effects. While migrating piping plovers may be exposed to atrazine on turf sites, we expect this to be rare occurrence based on low usage on these use sites and piping plover migration behavior. We anticipate that atrazine residues on arthropods exposed turf sites will reach concentrations associated with reproductive effects, however, we do not anticipate any individuals will die from on-site exposure. As piping plovers are not expected to enter these sites during breeding, we expect that reproductive effects following exposure to be unlikely.

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 prey that the piping plover relies on as food resources.

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

Species Conclusion

The piping plover (Atlantic Coast and Northern Great Plains DPS) is widely distributed across many states. All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates, i.e., survival of adults and fledged juveniles. A review of threats to piping plovers and their habitat in their migration and wintering range indicates a continuing loss and degradation of habitat due to sand placement projects, inlet stabilization, sand mining, groins, seawalls and revetments, exotic and invasive vegetation, and wrack removal, as well as other threats. Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival. The species has a medium vulnerability ranking.

The piping plover has a high exposure ranking. Based on the species range map, there is 78.8% overlap between the species' range and the agricultural footprint of atrazine use sites (use sites and areas adjacent that are likely exposed through off-site transport), with 20.1% of the species range overlapping directly with agricultural use sites, and up to 78.8% of the species range exposed through off-site transport from agricultural use sites. Past usage data indicate that 50.4% of the species range has been treated, with 16% occurring on agricultural fields, where expectation for adverse effects to the species exists. Plovers are not expected to occur in agricultural or non-agricultural atrazine use sites during the breeding season but may stopover opportunistically during migration.

We anticipate that any adverse effects to the species from exposure to atrazine will occur through the dietary route. Potential adverse effects include reproduction effects, including a reduction in the number of eggs laid and hatchling survival. However, we do not expect significant adverse effects to occur, because the piping plover feeds primarily on benthic invertebrates and arthropods and does not routinely occur in atrazine use sites to forage during the breeding or the winter seasons. Additionally, the piping plover's diet is varied, and we would anticipate it would include a range of food items with varying levels of atrazine contamination. Adverse effects to the piping plover are only expected when exclusively consuming food items with maximum estimated concentrations of atrazine on recently treated fields, which we expect to be a rare occurrence. We do not expect a reduction of the prey base where exposure to atrazine on adjacent areas occurs. We anticipate that required label mitigation language will reduce off-site transport (spray drift and runoff) by up to an order of magnitude.

In summary, the species DPS has a medium vulnerability, and the overall risk to the species is low. We do not expect reduced fitness or the loss of individuals due to atrazine exposure over the duration of the proposed action. As such, we do not expect the effects from atrazine exposure will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause 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 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 piping plover (Atlantic Coast and Northern Great Plains DPS).

References

Pompei, V.D. and F.J. Cuthbert. 2004. Spring and fall distribution of piping plovers in

North America: implications for migration stopover conservation. A report submitted to U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service. 2025. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts and East Lansing, Michigan. 170 pp.

U.S. Fish and Wildlife Service. 2020. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts. 169 pp.

U.S. Fish and Wildlife Service. 2016. Draft Revised Recovery Plan for the Northern Great Plains Piping Plover (*Charadrius melodus*). First Revision. Denver, Colorado. 173 pp.

U.S. Fish and Wildlife Service. 2009. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts. 214 pp.

U.S. Fish and Wildlife Service. 1996. Piping Plover (*Charadrius melodus*) Atlantic Coast Population Revised Recovery Plan. Hadley, Massachusetts. 236 pp.

Integration and Synthesis Summary: Piping plover (Great Lakes DPS)

Scientific Name:	Common Name:	Entity ID:
Charadrius melodus	Piping plover (Great Lakes DPS)	130

Conclusion: No Jeopardy

Species Range

Based on range map dated: 06-06-2025; [Great Lakes watershed DPS] - Great Lakes, watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.); *States within the range:* IL, IN, MI, MN, NY, OH, PA, WI

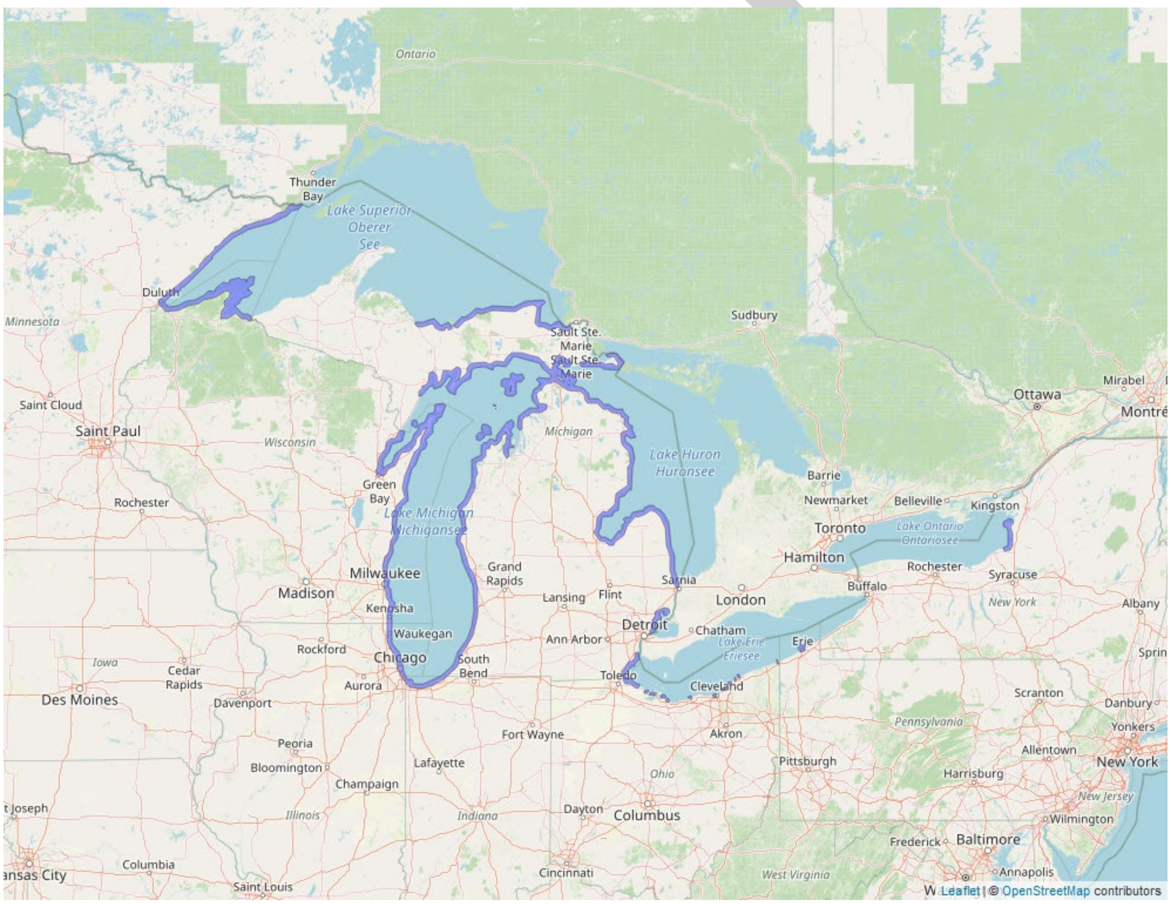

Figure 5. Range map of piping plover (Great Lakes DPS) (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6039.

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: Endangered

Most recent 5-Year Review recommendation: No change in status

Most recently completed 5-Year Review: 1/6/2025

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Unknown number of populations

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

Piping plovers are small shorebirds that feed on macroinvertebrates and nest above the high tide line on coastal beaches, sandflats, gently sloping foredunes, blowout areas behind foredunes, sparsely vegetated dunes, and washover areas. Endangered Species Act (ESA) actions are recognized in three separate breeding populations of piping plovers: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist (USFWS 2009). The survival and recovery of all piping plover breeding populations are dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. Although there is no exclusive partitioning of the wintering range, piping plovers from the Atlantic Coast (i.e., eastern Canada) and the Great Lakes are most prevalent during migration and winter along the southern Atlantic Coast; while those breeding on the Northern Great Plains predominate in coastal Mississippi, Louisiana, and Texas; wintering ranges of all three breeding populations overlap on the Gulf Coast of Florida. Piping plovers demonstrate high fidelity to winter regions where they use a mosaic of habitats within their home ranges.

Great Lakes piping plovers winter from North Carolina to Texas and the Bahamas, with the majority (75%) wintering in Georgia and Florida. Population counts have been conducted annually since 1984. As of 2016, approximately 81% of breeding adults were uniquely color-banded (98% had a partial band combination). The population has shown significant growth, from approximately 17 pairs at the time of listing in 1986 to 76 pairs in 2017, representing just over 50% of the current recovery goal of 150 breeding pairs for the Great Lakes population. However, they dropped to 67 pairs in 2018. The number of non-nesting individuals also has increased annually since 2009. Annual fledgling rates vary annually, but there appeared to be an increase between 2014-2016. The average fledging rate has been 1.7, above the recovery goal of 1.5 fledglings per breeding pair, although analysis of banded plovers suggests that after-hatch year survival (adult) rates may be declining. In response to potential nest losses, a captive-rearing program started in 1997 by the University of Minnesota and subsequently managed by the Detroit Zoological Society and partners. Abandoned eggs are collected, artificially incubated, and hatched. Chicks are then hand-reared and released once they reach fledging age. The captive rearing program has increased the annual number of chicks fledged by about 12% on average. Through 2018, 289 captive-reared chicks have been released. In 2013, University of Minnesota calculated an 11.7% return rate, the percentage of captive releases that returned to breed. While the Great Lakes DPS of piping plovers is small in numbers, they are spread out over a relatively large geographic area and data suggests they are increasing in number (USFWS 2020).

All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., adult and fledged juvenile survival). Some piping plover population declines are believed to be caused by low reproductive rates and low first year survival. Some nests are lost from predation (mostly merlins), storms and flooding, consistent cold or rain, and human encroachment. Most early-season nest abandonments result from death of attendant adults; predation remains a major threat to Great Lakes piping plovers and predation by other birds has increased in recent years. Shoreline development continues as the leading cause of habitat destruction in the Great Lakes. Cumulative habitat loss is of grave concern for piping plovers. Review of threats to piping plovers and their habitat in their migration and wintering ranges indicates a continuing loss and degradation of habitat due to sand placement projects, inlet stabilization, sand mining, groins, seawalls and revetments, exotic and invasive vegetation, and wrack removal. Habitat improvement and protection through acquisition has occurred, but not at rates which offset the impacts of development. However, artificial shoreline stabilization also impedes the processes by which coastal habitats adapt to accelerating sea-level rise, thus setting the stage for compounding future losses. In the 2020 5-Year Review, we mentioned a study that showed a negative correlation between killdeer abundance and the amount of land in an area treated with neonictinoids. Neonictinoids are insecticides that may affect the density and diversity of insects in affected wetlands; they are believed to potentially impact bird species in the areas of use and further study is needed (USFWS 2020). We are unaware of any studies that evaluated the risk of secondary poisoning (impact to plovers from eating contaminated insects), but the widespread use of neonictinoids, tendency to accumulate in wetlands, persistence in the soil, and potential adverse effects on the species' prey, neonictinoids may have a negative effect on piping plovers in the Great Lakes. The magnitude of the threats regarding climate change is yet unknown, but the impact of regional changes will have to be monitored closely to ensure the piping plover's persistence. Disease has emerged as a potential new threat in the Great Lakes population, although currently the threat level remains low. This could change rapidly, however, as disease outbreaks in the vicinity of piping plover breeding areas are increasing. Human recreational disturbance is a major threat to coastal migration and wintering range for piping plovers; interactions with dogs elicit a strong response from shorebirds. Shorebirds are more likely to flush from a dog, especially off-leash, than a person. Elevated stress levels in the nonbreeding season can carry over into the breeding season and impact future reproductive success by reducing survival and fecundity rates. Piping plover populations, including the Great Lakes population, are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., survival of adults and fledged juveniles) (USFWS 2009, 2020).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 8.4% of the species' range overlaps with agricultural use sites and 55.8% 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 64.2% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 9).

Table 9. Agricultural use overlap and annual usage data (% Range Treated) for the piping plover (Great Lakes DPS).

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	5.3	27.6	32.9	5.3	27.6	32.9
Vegetables and Ground Fruit (Sweet Corn)	2.8	20.1	22.9	1.6	11.9	13.5
Other Grains (Sorghum & Sugarcane)	<0.1	3.0	3.0	<0.1	3.0	3.0
Other Orchards (Guava & Macadamia Nut)	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**
Other Crops (Wheat-Corn-Fallow)	0	0.0	0.0	0	0.0	0.0
Other Crops (Wheat-Sorghum-Fallow)	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Crops (Wheat-Fallow-Wheat)	0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	0.3	4.9	5.2	0.3	4.9	5.2
Total	**8.4**	**55.8**	**64.2**	**7.3**	**47.6**	**54.8**

Usage

Past usage data indicate that up to 54.8% of the species' range has been treated with atrazine annually from agricultural uses, with 7.3% occurring on agricultural fields and 47.6% resulting from off-site transport.

Additional Exposure Considerations

Piping plovers forage by gleaning invertebrates from the substrate or running and pecking on the substrate with short runs between pecks. Piping plovers utilize numerous areas within breeding and wintering habitats for foraging, including wet sand in the wash zone, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons, and salt marshes. Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks. Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival.

Piping plovers return to their breeding grounds in late April to early May and initiate nesting by mid- to late May. Hatching begins in late May to early June, generally peaking in June and early July. The young leave the nest within hours of hatch and begin to forage almost immediately. Piping plovers migrate July through September in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico. Piping plovers spend three to five months on the breeding grounds annually, and the rest of the year on the wintering or in migration. Piping plovers are sparsely distributed across their Atlantic Coast breeding range.

Piping plovers are unlikely to enter atrazine use sites during breeding but may migrate through agricultural, golf courses, and other turf areas (USFWS field office request, pers. comm. 2016 co-occurrence information). Given the broad nature of the range map for this species in certain areas, it is unlikely that the entire area of overlap adjacent to these use sites represents piping plover habitat.

Exposure from Non-Agricultural Uses

Piping plovers are not expected to occur in non-agricultural atrazine use sites during breeding but may migrate through and stopover at sites containing turf, such as golf courses. These inland migratory stopover sites have not been found to contain large concentrations of piping plovers, rather most reports of birds at inland sites were single individuals. Individuals appear to stop opportunistically along the migratory route rather than show fidelity to specific sites, with duration typically lasting no longer than one day (Pompei and Cuthbert 2004). However, given our knowledge of atrazine application to turf areas (see *Exposure to Non-Agricultural Uses* section in the Introduction above), we expect atrazine usage within the range of the piping plover 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.

We expect consumption of food items in and around atrazine use sites to be the primary route of exposure to the piping plover. We generally do not expect piping plovers will forage on atrazine use sites during breeding but may stopover on use sites during migration. We do not expect individuals that are exposed to atrazine as a result of off-site transport will experience adverse effects and thus focus our analysis to individuals exposed on use sites within the range.

The piping plover feeds primarily on benthic invertebrates and arthropods. Maximum concentrations of atrazine in dietary items range from 75.7 - 151.3 mg/kg-bw depending on the specific atrazine use site individuals forage on. These concentrations on food items represent high end exposure scenarios (i.e., maximum body burdens in individuals that only consuming contaminated food directly on atrazine use sites immediately after applications are made). We do not anticipate any of these estimated exposure concentrations will result in mortality of individuals. In contrast, the majority of these exposure concentrations are at levels associated with reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. However, we expect a range of concentrations to be associated with contaminated arthropods, and we only anticipate these effects if individuals forage on arthropods with maximum estimated concentrations of atrazine on recently treated fields. Furthermore, while an individual piping plover feeding exclusively on contaminated arthropods on treated turf during migration may accumulate a significant body burden of pesticides, we do not expect this exposure to occur during the breeding season of the piping plover, and thus, will be unlikely to result in reproductive effects.

Indirect Effects

The piping plover relies on benthic invertebrates and arthropods for food resources, gleaning prey from the substrate or running and pecking on the substrate. We anticipate the conservation measures on agricultural product labels (including mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices in non-agricultural use sites will reduce atrazine residues to levels where we do not expect effects to the growth or survival of the piping plover's prey. As such, we do not anticipate atrazine use is likely to reduce the availability or abundance of prey that the species relies on as 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 portion of the species' range will be treated with atrazine on agricultural fields annually. However, we do not expect that breeding piping plovers will forage on atrazine use sites, and we do not expect individuals exposed in habitat adjacent to use sites will accumulate more than low levels of atrazine, which will not result in any mortality or sublethal adverse effects. While migrating piping plovers may be exposed to atrazine on turf sites, we expect this to be rare occurrence based on low usage on these use sites and piping plover migration behavior. We anticipate that atrazine residues on arthropods exposed turf sites will reach concentrations associated with reproductive effects, however, we do not anticipate any individuals will die from on-site exposure. As piping plovers are not expected to enter these sites during breeding, we expect that reproductive effects following exposure to be unlikely.

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 prey that the piping plover relies on as food resources.

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

Species Conclusion

The piping plover (Great Lakes DPS) population has increased from approximately 17 pairs at the time of listing in 1986 to 76 pairs in 2017, to a high of 80 breeding pairs in 2023. Data indicates they remain vulnerable to major threats that remain persistent and pervasive, including habitat degradation, predation, and human disturbance. The piping plover Great Lakes DPS is inherently vulnerable to even small declines in their most sensitive vital rates, i.e., survival of adults and fledged juveniles. The survival and recovery of breeding populations of piping plovers in the Great Lakes DPS are fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual life cycle. While the population in the DPS is few in number, they are spread out over a relatively large geographic area and were never very abundant. The species has a medium vulnerability ranking.

The piping plover Great Lakes DPS has high exposure. Based on the species range map, there is up to 64.2% overlap between the species' range and the agricultural footprint of atrazine use sites (use sites and areas adjacent that are likely exposed through off-site transport), with 8.5% of the species range overlapping directly with agricultural use sites. Past usage data indicate that up to 54.8% of the species' range has been treated with atrazine, with 7.3% occurring on-field and 47.6% resulting from off-site transport. Based on a recent update to the range map, we anticipate the overlap and usage will both be less due to the removal of areas in Illinois that contained agricultural use sites, although we still expect overlaps and usage to be high based on the very high levels associated with the prior range map. We do not expect that exposure from consuming benthic invertebrate prey along shorelines will result in adverse effects under any exposure scenario, since required label conservation measures are expected to reduce off-site transport (spray drift and runoff) of atrazine. Similarly, we do not expect a reduction of the prey base where exposure to atrazine from spray drift occurs. Piping plovers are only expected to use atrazine use sites (agricultural fields and turf) during migration. While an individual feeding on contaminated arthropods in these use sites could consume a concentration of atrazine that reach levels associated with reproductive effects, we expect that contaminated prey would be associated with a range of concentrations, and we only expect adverse effects to the piping plover if it was consuming arthropods with the maximum estimated concentration of atrazine on recently treated fields. We further anticipate that since this foraging on atrazine use sites would occur outside of the breeding season, reproductive effects would not likely occur.

In summary, the species DPS has a medium vulnerability, and the overall risk to the species is low. We do not expect reduced fitness or the loss of individuals due to atrazine exposure over the duration of the proposed action. As such, we do not expect the effects from atrazine exposure will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. We anticipate no more than a very small number of individuals that at times forage on atrazine use sites will experience reductions in fitness related to growth and reproduction. 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 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 piping plover (Great Lakes DPS).

References

Pompei, V.D. and F.J. Cuthbert. 2004. Spring and fall distribution of piping plovers in North America: implications for migration stopover conservation. A report submitted to U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service. 2025. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts and East Lansing, Michigan. 170 pp.

U.S. Fish and Wildlife Service. 2020. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts. 169 pp.

U.S. Fish and Wildlife Service. 2009. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts. 214 pp.

Integration and Synthesis Summary: Red-cockaded woodpecker

Scientific Name:	Common Name:	Entity ID:
Dryobates borealis	Red-cockaded woodpecker	107

Conclusion: No Jeopardy

Species Range

Based on range map dated: 09-13-2023; Wherever found; *States within the range:* AL, AR, FL, GA, LA, MS, NC, OK, SC, TX, VA

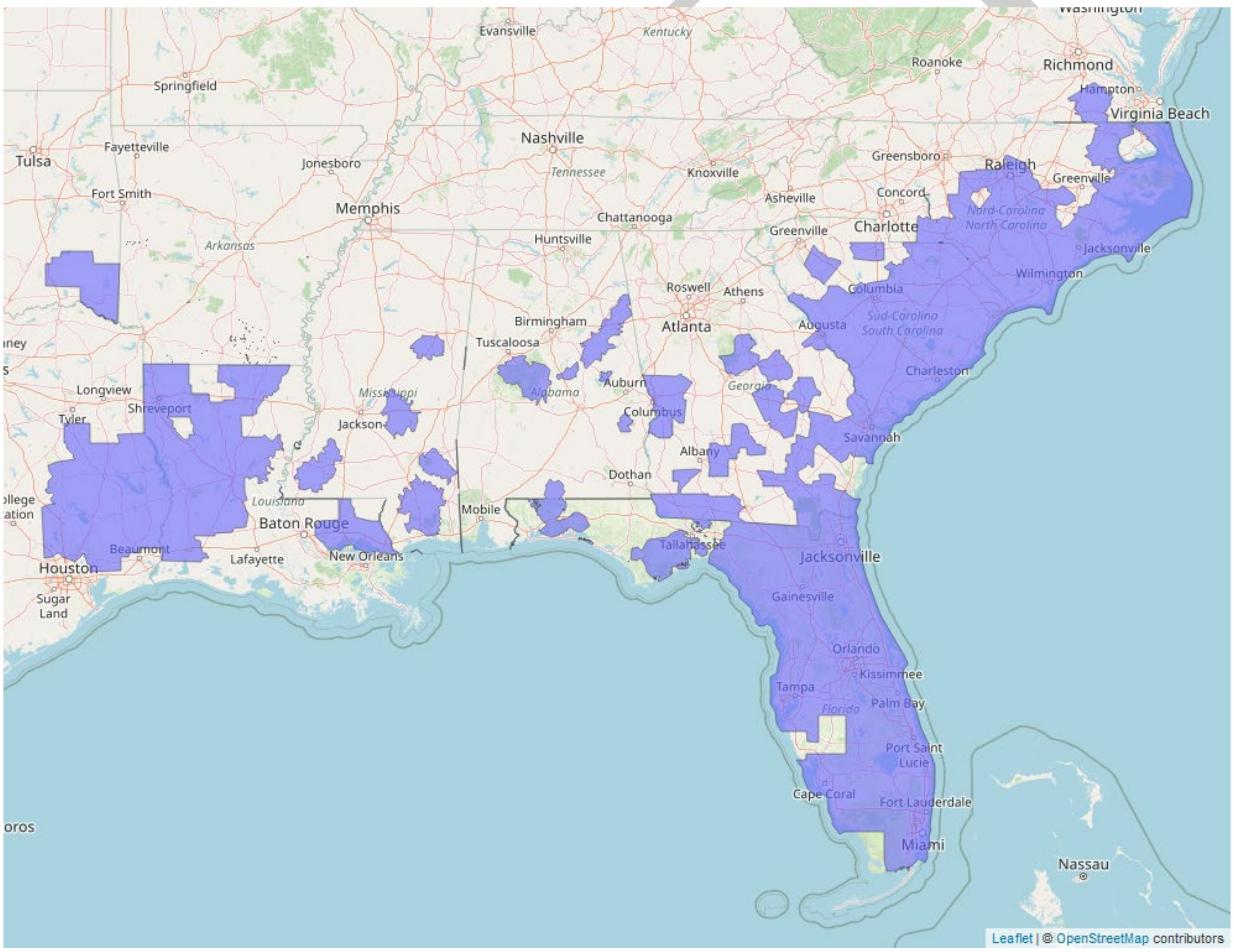

Figure 6. Range map of red-cockaded woodpecker (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7614.

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: Downlist to Threatened

Most recently completed 5-Year Review: 10/25/2024

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (numerous)

Species trends: Increasing population(s)

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Red-cockaded woodpeckers were once considered a common bird across the southeastern U.S. They are found in open pine woodlands and savannahs with large old pines for nesting and roosting. Red-cockaded woodpeckers rely on cavities to breed and compete intensely for openings in high-quality habitat rather than excavate new cavities in poor quality habitat. When artificial cavities are added to unoccupied but otherwise suitable habitat, it immediately becomes high-quality habitat and is occupied. Number of high-quality territories depends on the number and distribution of suitable cavities, which then determines breeding population size. Even after listing, the species continued to decline. However, new restoration techniques, such as artificial cavities, along with changes in silvicultural practices and wider use of prescribed fire to recreate open pine parkland structure, has led to stabilization of the species' viability and resulted in an increase in the number and distribution of populations. As of 2020, there were 124 populations across 13 ecoregions and the species had not lost any representative populations since the 2003 revised recovery plan. While most populations are still small and vulnerable to stochastic events, many populations for which we were able to determine trends were stable or increasing, and 13% were declining. We believe the species' viability, habitat conditions, and population numbers are improving (USFWS 2020).

At the time of listing in 1970, the species was severely threatened by lack of adequate habitat due to historical logging, incompatible forest management, and conversion of forests to urban and agricultural uses. Fire-maintained old growth pine savannahs, on which the species depends, were extremely rare. What little habitat remained was mostly degraded due to fire suppression and silvicultural practices that hindered the development of older, larger trees needed by the species for cavity development and foraging. Population declines were largely due to gradual abandonment of territories due to loss of cavities (i.e., tree death, cavity enlargement, encroachment by hardwood midstory) rather than poor survival or reproduction. As of 2020, the primary threats to red-cockaded woodpeckers were hurricanes and other storm events (i.e., foraging habitat loss and degradation, cavity loss, and direct mortality), southern pine beetles (i.e., loss of cavity trees), development, and wildfire. Kleptoparasitism by red-bellied woodpeckers, southern flying squirrels, and other species may threaten smaller, more isolated populations more than larger populations. Cavity enlargement by other species (i.e., pileated woodpeckers, red-bellied woodpeckers, red-headed woodpeckers, northern flickers) may deem them unusable by red-cockaded woodpeckers (USFWS 2020). Other factors unrelated to habitat loss may threaten the species, including pesticides, but their importance has not been determined (USFWS 2003). In 2024, the species was downlisted to threatened (USFWS 2024).

All Army, Air Force, and Marine Corps installations have red-cockaded woodpecker management plans and guidelines to limit adverse effects of military training. Red-cockaded woodpecker populations are highly dependent on active conservation management with prescribed fire, beneficial and compatible silvicultural methods to regulate forest composition and structure, the provision of artificial cavities where natural cavities are insufficient, translocation to sustain and increase small vulnerable populations, and effective monitoring to identify limiting biological and habitat factors for management (USFWS 2020).

Overall Vulnerability: Low

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 7.6% of the species' range overlaps with agricultural use sites and 74.6% of the species' range overlaps with areas adjacent to use sites that are likely up to through off-site transport (e.g., through spray drift or runoff). In total, there is approximately 82.1% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 10).

Table 10. Agricultural use overlap and annual usage data (% Range Treated) for the red-cockaded woodpecker.

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	3.9	25.4	29.3	3.9	25.4	29.3
Vegetables and Ground Fruit (Sweet Corn)	0.5	9.7	10.2	<0.1	1.9	2
Other Grains (Sorghum & Sugarcane)	0.9	8.9	9.8	0.9	8.9	9.8
Other Orchards (Guava & Macadamia Nut)	<0.1	1.4	1.5	<0.1	<0.1	<0.1
Other Crops (Wheat-Corn-Fallow)	0	0.0	0.0	0	0	0
Other Crops (Wheat-Sorghum-Fallow)	0.9	13.4	14.3	0.7	10.1	10.9
Other Crops (Wheat-Fallow-Wheat)	0	0.0	0.0	0	0	0
Other Crops (Sod)	1.4	15.7	17.1	1.4	15.7	17.1
Total	**7.6**	**74.6**	**82.1**	**6.9**	**62.2**	**69.1**

Usage

Past usage data indicate that up to 69.1% of the species' range has been treated with atrazine annually from agricultural uses, with 6.9% occurring on agricultural fields and up to 62.2% resulting from off-site transport.

Additional Exposure Considerations

The red-cockaded woodpecker is endemic to open, mature, and old growth pine ecosystems and is not expected to forage or roost in agricultural fields, row crops, or orchards and vineyards. (USFWS field office request, pers. comm. 2016 co-occurrence information). Though atrazine can enter these habitats via spray drift and runoff, given the broad nature of the range map for this species, it is unlikely that the entire area of overlap adjacent to agriculture represents red-cockaded woodpecker habitat. Therefore, it is expected the area of red cockaded woodpecker habitat exposed to atrazine through off-site transport is lower than the 82.1% overlap and 69.1% treated. In addition, though red-cockaded woodpeckers prefer open pine systems, spray drift is still expected to be reduced to some extent by interception with the forested habitat, further lowering the extent of habitat likely to be exposed.

Exposure from Non-Agricultural Uses

The red-cockaded woodpecker primarily occurs in open, mature, and old growth pine ecosystems, but may also use golf courses, residential areas, and other developed areas with sufficient residual large or old pines. As such, we anticipate individuals are likely to occur in proximity to sites where atrazine is registered for non-agricultural use. 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 red-cockaded woodpecker 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.

We expect consumption of food items in and around atrazine use sites to be the primary route of exposure to the red-cockaded woodpecker. However, we do not expect the red-cockaded woodpecker to be exposed to atrazine on agricultural use sites, nor do we expect that individuals exposed to atrazine on food items as a result of off-site transport will experience adverse effects. Where sufficient residual large or old pines occur, red-cockaded woodpeckers are expected to nest and forage in areas where atrazine is registered for use on turf (i.e., residential areas and golf courses). However, we do not expect red-cockaded woodpeckers to forage directly on treated turf where atrazine residues will occur at high concentrations. Rather, invertebrates consumed by red-cocked woodpeckers are captured on trees on and under tree bark. While some invertebrates could be exposed on turf and move to trees where red-cockaded woodpeckers forage, we expect that most invertebrates consumed by red-cockaded woodpeckers within these use sites would not contain atrazine residues, even after an application, due to application methods which limit spray drift or because they were under bark at the time of spray. As such, we do not anticipate that red-cockaded woodpeckers will be exposed to concentrations of atrazine high enough to result in adverse effects. As such, we do not anticipate any direct adverse effects to the red-cockaded woodpecker from the proposed action.

Indirect Effects

Available toxicity data suggests that arthropods are not likely to experience mortality with atrazine exposure. As such, we do not anticipate the proposed action will result in measurable levels of indirect adverse effects to the red-cockaded woodpecker.

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 do not expect the red-cockaded woodpecker to be exposed to atrazine on agricultural use sites, nor to experience adverse effects from consumption of food resources exposed to atrazine via off-site transport.

In addition, with implementation of conservation measures on product labels, we do not anticipate atrazine use is likely to reduce the availability or abundance arthropod prey that the species relies on as food resources.

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

Species Conclusion

The red-cockaded woodpecker was once considered a common bird across the southeastern U.S. At the time of listing in 1970, the species was severely threatened by lack of adequate habitat due to historical logging, incompatible forest management, and conversion of forests to urban and agricultural uses. However, new restoration techniques, such as artificial cavities, along with changes in silvicultural practices and wider use of prescribed fire to recreate open pine parkland structure, has led to stabilization of the species' viability and resulted in an increase in the number and distribution of populations. This species continues to have a wide distribution. There are currently at least 124 populations across 13 ecoregions. While most populations are still small and vulnerable to stochastic events, the majority are stable or increasing and the species was reclassified from endangered to threatened in 2024 due to its improvement in status. The species has low vulnerability.

The red-cockaded woodpecker has a high exposure ranking. Species range data indicates that up to 82.1% of the species' range overlaps with the overall atrazine agricultural footprint (use sites adjacent areas exposed through off-site transport), with 7.6% of the range overlapping directly with atrazine use sites. Past annual usage data demonstrates that up to 69.1% of the species' range has been treated with atrazine annually, with 6.9% occurring on agricultural fields. Because the woodpecker occurs in open pine woodlands and savannahs and is not expected to forage in agricultural use sites, and exposure from non-agricultural uses is expected to be minimal, we do not expect that individuals will experience direct effects from atrazine exposure from these use sites. Given that areas adjacent to agriculture in the species' range are unlikely to all be red-cockaded woodpecker habitat, we expect that the species' forested habitat will be less impacted by spray drift, and we do not expect exposure levels to result in direct effects to the red-cockaded woodpecker. Required label mitigation language should further reduce the instances of spray drift into off-site areas. We do not expect a reduction in the arthropod prey base where exposure to atrazine from spray drift occurs, and most red-cockaded woodpeckers, as generalist feeders that are highly mobile, will consume a diversity of dietary items with varying levels of atrazine contamination.

In summary, the species has a low vulnerability, and the overall risk to the species is low. While overlap with use sites is high and usage in the range is high, this species is not expected to occur on agricultural sites. Therefore, the most likely route of exposure to the species is from consuming arthropods or plant material, but adverse effects are not anticipated at predicted exposure levels. Exposure from non-agricultural uses is expected to be minimal, with no direct effects to individuals from these uses. We do not expect the proposed action will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. We anticipate no more than a very small number of individuals that infrequently forage on atrazine use sites (or forage on arthropods contaminated in use sites) will experience reductions in fitness related to growth and reproduction. 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 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 red-cockaded woodpecker.

References

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Reclassification of the Red-Cockaded Woodpecker from Endangered to Threatened with a Section 4(d) Rule. Federal Register 89(207):85294-85338.

U.S. Fish and Wildlife Service. 2020. Species Status Assessment Report for the Red-cockaded Woodpecker (*Picoides borealis*) Version 1.3. Atlanta, Georgia. 590 pp.

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Reclassification of the Red-Cockaded Woodpecker from Endangered to Threatened with a Section 4(d) Rule. Proposed Rule. Federal Register 85:63474-63499.

U.S. Fish and Wildlife Service. 2003. Recovery Plan for the Red-cockaded Woodpecker (*Picoides borealis*). Second Revision. Atlanta, Georgia. 316 pp.

Integration and Synthesis Summary: Yellow-billed cuckoo

Scientific Name:	Common Name:	Entity ID:
Coccyzus americanus	Yellow-billed cuckoo	6901

Conclusion: No Jeopardy

Species Range

Based on range map dated: 06-12-2023; Western DPS: U.S.A. (AZ, CA, CO (western), ID, MT (western), NM (western), NV, OR, TX (western), UT, WA, WY (western)); Canada (British Columbia (southwestern); Mexico (Baja California, Baja California Sur, Chihuahua, Durango (western), Sinaloa, Sonora); *States within the range:* AZ, CA, CO, ID, MT, NM, NV, OR, TX, UT, WA, WY

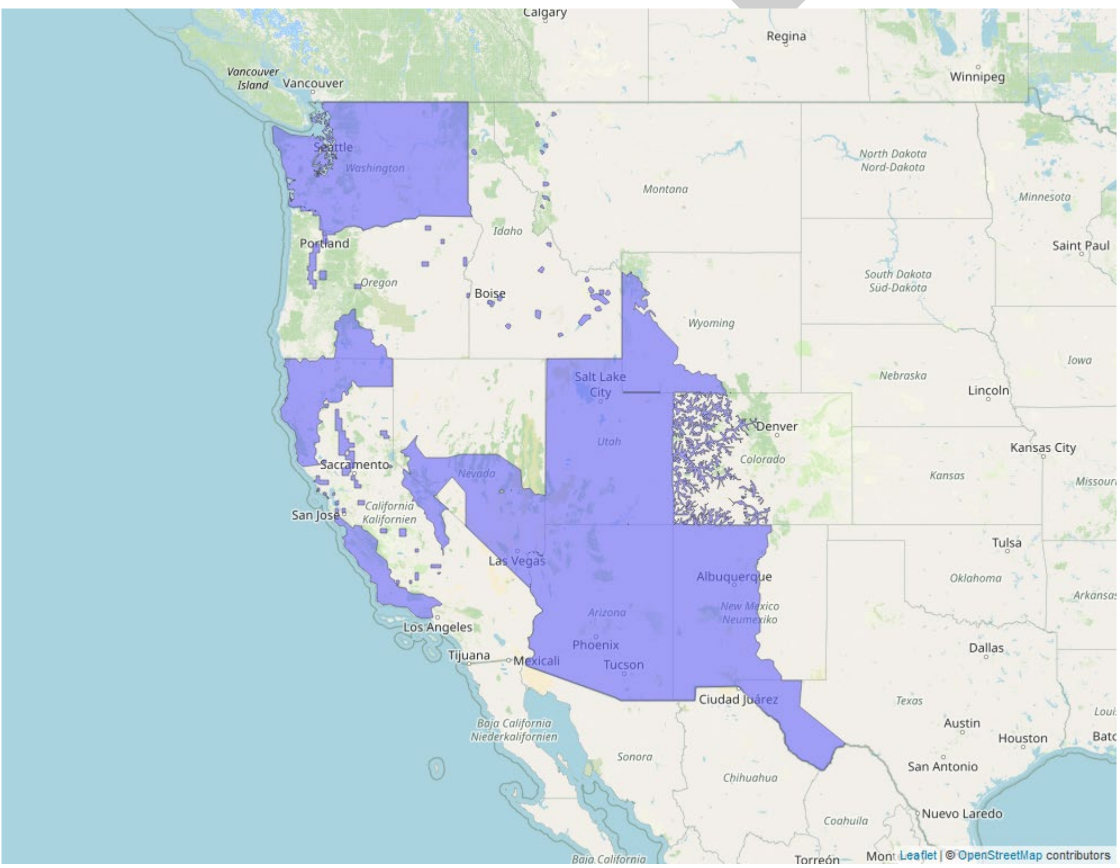

Figure 7. Range map of the yellow-billed cuckoo (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3911.

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: 9/16/2020

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: All populations stable, with none known to be increasing or decreasing

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The western yellow-billed cuckoo is a migratory bird species, traveling between its wintering grounds in Central and South America and its breeding grounds in North America (continental U.S. and Mexico) each spring and fall, often using river corridors as travel routes. They breed in large tracts of dense riparian woodlands along low-gradient streams with riparian trees present (i.e., cotton wood (*Populus* spp.) and willow (*Salix* spp.)) and more arid riparian woodlands, desert scrub, desert grasslands drainages, and Madrean evergreen woodland drainages. The western yellow-billed cuckoo's breeding range is known from 12 States in the U.S. (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, Wyoming) and six States in Mexico. Current western yellow-billed cuckoo breeding populations are fragmented and geographically isolated. They used to be found in British Columbia; they are believed to be extirpated in Canada, and breeding was last documented in Oregon and Washington in the 1930s-1940s. The last statewide assessment in Idaho (2003-2005) estimated the breeding population was limited to 10-20 breeding pairs in the Snake River Basin. As of 2019, very few breeders (<5 breeding pairs) were believed to be in Wyoming. Yellow-billed cuckoos are uncommon in Utah and Nevada (<10 breeding pairs each) and extremely rare in Colorado. Yellow-billed cuckoos used to be widespread and locally common in California; numbers have declined 99% from historical levels and are estimated to be 18% of levels observed in the late 1970s. As of 2019, nesting numbers continue to decline, and numbers were estimated at 40-50 breeding pairs during the last statewide survey (USFWS 2019). In Arizona, the species used to be widespread and locally common but has been declining for the last several decades. There may be 350-450 territories (breeding pairs or single birds) in the state as of 2019. In New Mexico, 190-235 pairs were estimated to breed by 2019 in the state. The most recent estimates of total population size were 800 pairs in the U.S. and 500 pairs in Mexico (USFWS 2019).

In 2020, we found that delisting of the western yellow-billed cuckoo was not warranted because the threats identified in the final listing rule are still acting on the species and continue to affect the cuckoo's viability. The primary factors threatening the western DPS of the yellow-billed cuckoo are the loss and degradation of habitat for the species from altered watercourse hydrology and natural stream processes, livestock overgrazing, encroachment from agriculture, and conversion of native habitat to predominantly nonnative vegetation. Additional threats to the species include the effects of climate change, pesticides, wildfire, and small and widely separated habitat patches. Threats associated with habitat destruction, modification, and degradation are related to dam construction and operations, water diversions, riverflow management; stream channelization and stabilization; conversion to agricultural uses, such as crops and livestock grazing; urban and transportation infrastructure; and increased incidence of wildfire. Continuing ramifications of actions that caused habitat loss in the past have resulted in ongoing curtailment of the habitat of the western yellow-billed cuckoo throughout its range. These factors also contribute to fragmentation and promote conversion to nonnative plant species, particularly tamarisk. Loss of riparian habitat leads not only to a direct reduction in western yellow-billed cuckoo numbers but also leaves a highly fragmented landscape, which in combination with other threats, can reduce breeding success through increased predation rates and barriers to dispersal by juvenile and adult western yellow-billed cuckoos. Threats associated with habitat rarity and small and isolated population sizes make the remaining western yellow-billed cuckoo populations increasingly susceptible to further declines through lack of immigration, reduced populations of prey species (food items), pesticides, and collisions with tall vertical structures during migration. The serious and ongoing threat of small overall population size, which is the result of other threats in combination, leads to an increased chance of local extirpations. Patch size, when coupled with habitat loss and other threats facing the species, including proximity to incompatible land uses, which increases exposure to predators and pesticides, is a significant cumulative threat to the western yellow-billed cuckoo now and in the future. In addition, minerals mining projects negatively impact recently identified occupied habitat in central and southern Arizona (USFWS 2020, 2019, 2014).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 2.3% of the species' range overlaps with agricultural use sites and 13.1% 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 15.3% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 11).

Table 11. Agricultural use overlap and annual usage data (% Range Treated) for the yellow-billed cuckoo.

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	3.4	3.8	0.3	2.2	2.5
Vegetables and Ground Fruit (Sweet Corn)	0.8	3.2	4.0	0.1	0.5	0.6
Other Grains (Sorghum & Sugarcane)	0.1	1.1	1.3	<0.1	0.7	0.8
Other Orchards (Guava & Macadamia Nut)	<0.1	0.6	0.6	<0.1	<0.1	<0.1
Other Crops (Wheat-Corn-Fallow)	<0.1	0.4	0.4	<0.1	0.4	0.4
Other Crops (Wheat-Sorghum-Fallow)	0.2	1.6	1.8	0.1	1.5	1.7
Other Crops (Wheat-Fallow-Wheat)	<0.1	0.3	0.3	<0.1	0.3	0.3
Other Crops (Sod)	0.7	3.2	3.9	0.7	3.2	3.9
Total	**2.3**	**13.1**	**15.3**	**1.3**	**8.1**	**9.4**

Usage

Past usage data indicate that up to 9.4% of the species' range has been treated with atrazine annually from agricultural uses with 1.3% occurring on agricultural fields and 8.1% resulting from off-site transport.

Additional Exposure Considerations

The primary dietary item of the yellow-billed cuckoo is large insects such as cicadas, katydids, and caterpillars. They may also take frogs and lizards. In summer and fall, cuckoos forage on small wild fruits, including elderberries, blackberries and wild grapes. In winter, fruit and seeds become a larger part of the diet.

Yellow-billed cuckoos may forage, roost, and breed in orchards, managed forests, right of ways, and golf courses where trees are present. They also may forage in right of ways, golf courses, rangeland, and developed open spaces adjacent to riparian, mesquite, or mixed oak woodland where large insects are available. Cuckoos are likely to forage in crop edges, but not within the crop. Use of developed areas with impervious surfaces above 50% is unlikely (USFWS field office request, pers. comm. 2016 co-occurrence information).

Exposure from Non-Agricultural Uses

Yellow-billed cuckoos use developed and open-space developed areas if suitable habitat conditions exist and as such 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* section in the Introduction above), we expect atrazine usage within the range of the yellow-billed cuckoos 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.

We expect consumption of food items in and around atrazine use sites to be the primary route of atrazine exposure to yellow-billed cuckoos. The yellow-billed cuckoo feeds primarily on insects, small terrestrial vertebrates such as amphibians and lizards, and fruits and sees. We do not expect yellow-billed cuckoos that are exposed to atrazine on food resources 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 individuals exposed on-site will accumulate up to 5-20.1 mg atrazine/kg-bw. We do not anticipate any of these estimated exposure concentrations will result in mortality of individuals. In contrast, the majority of these exposure concentrations are at levels associated with reproductive effects, such as reduced hatchling weight, reduced egg production, and reduced food consumption. However, we only anticipate these effects if individuals forage on dietary items with maximum estimated concentrations of atrazine on recently treated fields. We anticipate this will occur infrequently, as yellow-billed cuckoos are expected to consume a varied diet that will also include fruits and seeds (which contain much lower levels of atrazine on-field) and all food resources off treated fields (which also contain much lower levels of atrazine than on-field dietary items). However, an individual yellow-billed cuckoo 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 of the yellow-billed cuckoo are not likely to experience any mortality with atrazine exposure. While individual terrestrial vertebrates may experience growth or reproductive effects if exposed to atrazine on use sites, we anticipate conservation measures on agricultural product labels (including mandatory spray drift buffers and three points of runoff mitigation) and existing pesticide practices in non-agricultural use sites will reduce environmental concentrations of atrazine to levels that are not likely to cause mortality or sublethal adverse effects to prey species. As such, we do not anticipate atrazine use is likely to reduce the availability or abundance of prey that the species relies on as food resources. 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, nor limit the availability of food resources, especially in light of the conservation measures. 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 portion of the species' range will be treated with atrazine on agricultural fields annually. However, we only expect individuals exposed directly on use sites will accumulate high enough levels of atrazine to experience direct adverse effects. Agricultural use sites only occur in 2.3% of the species' range, and past usage data indicate that only and even smaller portion is likely to be treated any given year. While the yellow-billed cuckoo and its prey may be exposed to atrazine from use in non-agricultural 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. While yellow-billed cuckoo are not expected to forage within crops, they may forage on the edge of fields where atrazine concentrations are likely to be similar to on-field values. However, given the small extent of overlap with atrazine use sites within the range of the species, the limited extent of usage on these sites, the variable diet of the yellow-billed cuckoo, 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.

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 prey or plant resources that the yellow-billed cuckoo relies on as food resources.

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

Species Conclusion

The yellow-billed cuckoo is a threatened species, with multiple stable populations ranging twelve western states and Central and South America. The cuckoo inhabits large, dense riparian woodlands, desert scrub and Madrean evergreen woodlands during its breeding season. Their primary food items are cicadas, katydids, caterpillars, frogs, lizards and wild fruits and seeds. The populations are fragmented and geographically isolated, and while historically common, they are now rare and have only small numbers of breeding individuals. The primary threat to the species is the loss and degradation of habitat, namely from altered watercourse hydrology, livestock overgrazing, and agricultural encroachment. Additional threats include climate change, pesticides, wildfire, and habitat fragmentation. The ongoing threat of overall population size increases the chance of local extirpations.

Species range data indicate that the species range overlaps with up to 15.3% of the agricultural footprint of atrazine use sites (use sites and adjacent areas exposed to atrazine by off-site transport), 2.3% of which overlaps directly with use sites. Annual past usage data demonstrate that 9.4% of the species' range has been treated annually with atrazine, but only 1.3% of that has occurred directly on agricultural fields, where we expect adverse effects to birds to occur. Cuckoos are likely to forage in crop edges, but not the crop itself, and they may forage, roost and breed in golf courses, right of ways and developed open spaces adjacent to riparian or mixed woodlands where insect prey are available. Yellow-billed cuckoos may be exposed to atrazine while occurring on non-agricultural use sites, however based on our knowledge of turf and nursery areas, we expect this exposure to be limited.

We anticipate that the dietary route will be the highest level of exposure. If the yellow-billed cuckoo forages on prey items such as arthropods, reptiles and amphibians that have been contaminated by atrazine on use sites, the cuckoo will be exposed to those concentrations, which could reach levels associated with reproductive effects (reduction in eggs laid, hatchling survival). However, because the cuckoo's diet is varied, and we expect prey species to be associated with a range of concentrations, we anticipate that the chances of adverse effects to the cuckoo will be low. We expect adverse effects to the cuckoo when it exclusively consumes prey items contaminated with the maximum estimated concentration of atrazine on recently treated fields, and we anticipate this scenario will be infrequent. We also do not expect atrazine use is likely to reduce the availability or abundance of food items (animal or vegetative), especially with the required label mitigation language that we anticipate will reduce spray drift and runoff to adjacent areas by an order of magnitude.

In summary, the yellow-billed cuckoo is a moderately vulnerable species with high overlap with atrazine use sites, though past usage data indicates that the percent of species range treated is low. We do not expect direct or indirect effects to the species from its exposure to the action. While there may be contamination of some prey items, the species is a generalist feeder and is not expected to consume food items at the maximum estimated concentration, and prey availability is not expected to be impacted. We anticipate no more than a very small number of individuals that frequently forage on atrazine use sites will experience reductions in fitness related to growth and reproduction. We do not expect the effects from the proposed action will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause 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 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 yellow-billed cuckoo.

References

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Findings on a Petition to Delist the Distinct Population Segment of the Western Yellow-Billed Cuckoo and a Petition To List the U.S. Population of Northwestern Moose. Final Rule. Federal Register 85:57816-57818.

U.S. Fish and Wildlife Service. 2019. Species assessment and listing priority assignment form for the Yellow-billed cuckoo. Albuquerque, New Mexico. 28 pp.

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus). Final Rule. Federal Register 79:59991-60038.

Species requiring further analysis

In our draft Biological Opinion, we focused our analyses on 1) species with low expected exposure to atrazine (due to low overlap, usage, or conservation measures adopted prior to consultation), and 2) species with more than low levels of exposure that benefited from conservation measures identified through the Herbicide Strategy that aimed to reduce off-site transport of atrazine (i.e., listed plants and listed animals that depend on plant resources). For the species in Table 12, we identified the need for further coordination. We expect Herbicide Strategy conservation measures to reduce pesticide loading into aquatic habitats by up to 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 listed birds 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. We intend to continue coordinating with EPA and atrazine registrants between the release of this draft Opinion and the transmission of the final Opinion to gain information regarding the exposure and effects of each species to atrazine. As such, we have not yet made determinations for these species.

Table 12. Species requiring further analysis

Common Name	Scientific Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking
Attwater's greater prairie-chicken	*Tympanuchus cupido attwateri*	High	High	Medium
Gunnison sage-grouse	*Centrocercus minimus*	Medium	High	High
Northern aplomado falcon	*Falco femoralis septentrionalis*	High	High	Medium
Streaked horned lark	*Eremophila alpestris strigata*	High	High	Medium
Whooping crane	*Grus americana*	High	Medium	Medium