Integration and Synthesis Summary for Plants

Plants in Non-flowing Wetland Habitats

This Integration and Synthesis Summary includes our jeopardy analysis for listed plant species that we or EPA determined would "likely be adversely affected" by the proposed action. Our jeopardy analysis of the proposed action's impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine individual species' rankings include environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. Status of the species for each species can be found in Appendix B.

The species in this I&S appendix were grouped together as they occur in similar types of habitats (i.e., non-flowing wetlands) and were predicted by EPA to be exposed to similar concentrations of atrazine from registered uses. 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 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]) and conservation measures that will be implemented through Pesticide Use Limitation Areas (PULAs) in EPA's Bulletins Live! Two (see Conservation Measures section below). For some species in this Appendix, we anticipate exposures in the habitats where these species occur are at low enough levels where the label measures (including the 15- and 170-feet spray drift buffers and three runoff points) adequately reduce atrazine concentrations to levels where effects are expected to be low. Some species in Table 2 need species-specific conservation measures (i.e., six runoff points total, implemented through PULAs) for all agricultural atrazine uses because the species are anticipated to experience higher concentrations of atrazine in their habitats.

Vulnerability

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

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

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 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 listed plant species will be exposed to atrazine primarily through direct contact, either as a result of exposure to pesticide applications on-site or in off-site areas 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.

[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.

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

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), and existing protections or conservation actions (e.g., existing label measures, conservation measures from the action agency). Species with greater than 10% overlap between their range and agricultural atrazine use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% overlap are assigned a low overlap score. In addition to range overlaps with atrazine use sites, we considered past atrazine usage data within a species' range to determine how much of a species' range we expect to be treated with each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this Opinion. Species with usage data that indicate a large portion of their range (>10%) is treated with atrazine each year are assigned a high usage score. Species that have a medium portion of their range (5-10%) treated with atrazine each year are assigned a medium usage score, and species where data indicate a low portion of their range (<5%) is treated with atrazine each year are assigned a low usage score.

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

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

Exposure to Non-Agricultural Uses

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

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

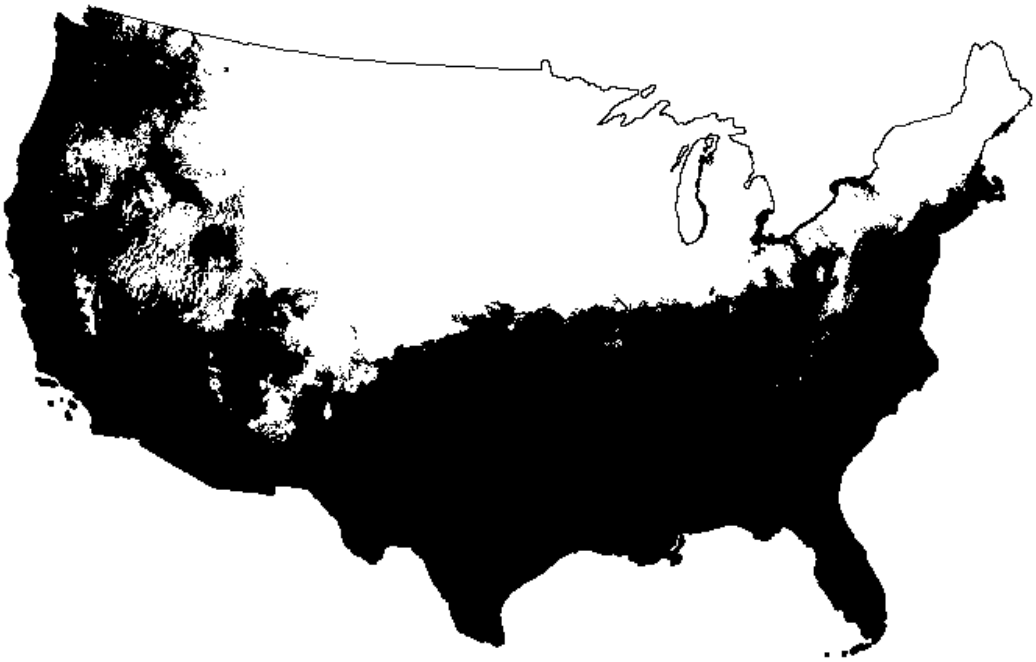

Figure 1. Map showing where cool-season grasses (white areas) and warm-season grasses (black areas) are used on turf across the continental U.S.

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

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

cover of a turf grass area inherent in managing golf course turf are equivalent to additional run-off mitigations (i.e., equivalent to six points on EPA's mitigation menu), and we considered them in our assessment.

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

References:

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

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

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

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[4] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to atrazine at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (e.g., reduced growth) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is

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

likely to experience when the organisms they rely on, such as those that act as pollinators or seed dispersers, are exposed to atrazine and experience adverse effects.

Given that herbicides like atrazine are designed to control plants, we assume listed plant species are sensitive to atrazine exposure. In general, we anticipate individuals exposed to atrazine are likely to experience direct adverse effects in the form of reduced biomass and growth, which, in severe cases, would result in mortality of individuals. Based on the available toxicity data in plants for atrazine, we use the HC_{05} (i.e., the exposure concentration where we expect more than 95% of plant species would not experience measurable impacts) for biomass at seedling emergence and compare that to the estimated environmental concentration (EEC) of atrazine for each listed species to determine the anticipated level of adverse effects atrazine. In contrast, available toxicity data indicate that animal species, including potential pollinators and seed dispersers of listed plant species, are not likely to experience mortality from atrazine exposure, suggesting that indirect adverse effects are not likely to occur to listed plant species.

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

[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

atrazine uses limited to certain geographic areas when required to protect specific listed species.

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

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

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

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).

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 95% of plant species are not likely to experience measurable adverse effects. We anticipate this level of mitigation will protect listed plant species by reducing the number of individuals exposed (by reducing the extent of off-site transport of atrazine residues) and reducing the level of adverse effects that will occur to exposed individuals (by reducing estimated exposure concentrations).

Summary of Conclusions for Plants in Non-Flowing Wetland Habitats

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of atrazine with conservation measures, and the cumulative effects, it is the Service's biological opinion that the registration of atrazine, as proposed, is not likely to jeopardize the continued existence of the 35 plant species in this Appendix.

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

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

separate rationale because of their life history, conservation status, or other information indicated that effects could be different, would have had an individual discussion to provide additional explanation. This approach allowed us to streamline our discussion in this Opinion by avoiding repeating our findings when we expected species in the respective groupings would be affected similarly. The use of these groupings, therefore, does not mean that our evaluation failed to evaluate each individual species. On the contrary, our detailed process for each species-specific analysis remained the same, including for species for which we summarized our findings in tables below.

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

The species in Table 1 were grouped together as we anticipate they will experience low levels of exposure to atrazine based on available data from the USDA's Census of Agriculture (CoA). Therefore, our concern for adverse effects is low. While we present some specific information about the species below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Species with low agricultural exposure 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
Florida pineland crabgrass	*Digitaria pauciflora*	High	Low	High	4.8	No Jeopardy
Huachuca water-umbel	*Lilaeopsis schaffneriana var. recurva*	Medium	Low	High	3.7	No Jeopardy
Pecos (=puzzle, =paradox) sunflower	*Helianthus paradoxus*	Medium	Low	High	2.6	No Jeopardy

The species in Table 1 have medium or high vulnerabilities. Florida pineland crabgrass no longer occurs outside of protected areas (USFWS 2023).

The species in Table 1 have high toxicity because herbicides like atrazine are designed to control plants. Therefore, we assume all listed plant species are sensitive to atrazine exposure and no significant difference in the toxicity of atrazine among major plant taxa (e.g., dicots, monocots, non-flowering plants) is expected. In general, we anticipate individuals exposed to atrazine, from agricultural or non-agricultural use sites, are likely to experience direct adverse effects in the form of reduced biomass and growth, which, in severe cases, would result in death. We do not expect reductions in pollinators and seed dispersers of listed plant species from atrazine exposure, and therefore, indirect adverse effects are not likely to occur for these species.

We anticipate a small number of individuals of each species are 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 these species' ranges occur. 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' ranges are likely to be exposed to atrazine.

In addition to agricultural exposure, none of the species in Table 1 occur on non-agricultural atrazine use sites (i.e., turf) because non-agricultural use sites do not provide the species' necessary habitat (e.g., wetlands, alluvial fans). 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.

In summary, we expect a small number of individuals of the species in Table 1 will experience exposure to atrazine over the project duration. Exposure will be limited to small portions of the species' ranges that overlap with agricultural herbicide usage according to CoA. Therefore, we expect the proposed action will result in direct adverse effects (e.g., reduced biomass, growth, or survival) of, at most, a very small number of individuals of these species. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from atrazine exposure. 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 1.

References:

U.S. Fish and Wildlife Service. 2023. Florida Pineland Crabgrass (*Digitaria pauciflora*) 5-Year Status Review: Summary and Evaluation. Vero Beach, Florida. 12 pp.

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

For the species in Table 2, we expect they will have low exposure after incorporating general label measures (e.g., measures already on the label, three runoff points and a 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 six-point PULAs 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 2. Species with low agricultural exposure due to conservation measures and low likelihood of non-agricultural exposure.

Common Name	Scientific Name	Vulnerability Ranking	Agricultural Exposure Ranking	Toxicity Ranking	Conservation Measures	Determination
Alabama canebrake pitcher-plant	*Sarracenia rubra ssp. alabamensis*	High	Low	High	General label measures	No Jeopardy
Arizona eryngo	*Eryngium sparganophyllum*	High	Low	High	General label measures	No Jeopardy
Brooksville bellflower	*Campanula robinsiae*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Bunched arrowhead	*Sagittaria fasciculata*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Canby's dropwort	*Oxypolis canbyi*	Medium	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Cook's lomatium	*Lomatium cookii*	High	Low	High	General label measures	No Jeopardy
Cooley's meadowrue	*Thalictrum cooleyi*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Cumberland rosemary	*Conradina verticillata*	Medium	Low	High	General label measures	No Jeopardy
Decurrent false aster	*Boltonia decurrens*	Medium	Low	High	General label measures +	No Jeopardy

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Common Name	Scientific Name	Vulnerability Ranking	Agricultural Exposure Ranking	Toxicity Ranking	Conservation Measures	Determination
					PULA + sweet corn restriction	
Eastern prairie fringed orchid	*Platanthera leucophaea*	Medium	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Florida skullcap	*Scutellaria floridana*	Medium	Low	High	General label measures	No Jeopardy
Godfrey's butterwort	*Pinguicula ionantha*	Low	Low	High	General label measures	No Jeopardy
Golden sedge	*Carex lutea*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Howell's spectacular thelypody	*Thelypodium howellii ssp. spectabilis*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Kniesker''s beaked-rush	*Rhynchospora knieskernii*	Low	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Large-flowered woolly meadowfoam	*Limnanthes pumila ssp. grandiflora*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Mohr's Barbara's buttons	*Marshallia mohrii*	Medium	Low	High	General label measures	No Jeopardy
Mountain sweet pitcher-plant	*Sarracenia rubra ssp. jonesii*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Northeastern bulrush	*Scirpus ancistrochaetus*	Medium	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	Medium	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Rough popcornflower	*Plagiobothrys hirtus*	High	Low	High	General label measures +	No Jeopardy

Common Name	Scientific Name	Vulnerability Ranking	Agricultural Exposure Ranking	Toxicity Ranking	Conservation Measures	Determination
					PULA + sweet corn restriction	
Slender Orcutt grass	*Orcuttia tenuis*	Low	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Swamp pink	*Helonias bullata*	Medium	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Tennessee yellow-eyed grass	*Xyris tennesseensis*	High	Low	High	General label measures	No Jeopardy
Ute ladies'-tresses	*Spiranthes diluvialis*	Medium	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Virginia round-leaf birch	*Betula uber*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Western prairie fringed orchid	*Platanthera praeclara*	Medium	Low	High	General label measures	No Jeopardy
White birds-in-a-nest	*Macbridea alba*	Low	Low	High	General label measures	No Jeopardy
Willamette daisy	*Erigeron decumbens*	High	Low	High	General label measures + PULA + sweet corn restriction	No Jeopardy
Wright's marsh thistle	*Cirsium wrightii*	Medium	Low	High	General label measures	No Jeopardy

The species in Table 2 have low to high vulnerabilities. Specifically, pesticides are a noted threat to eight of these species (e.g., prairie fringed orchids).

The species in Table 2 have high toxicity because herbicides like atrazine are designed to control plants. Therefore, we assume all listed plant species are sensitive to atrazine exposure and no significant difference in the toxicity of atrazine among major plant taxa (e.g., dicots, monocots, non-flowering plants) is expected. In general, we anticipate individuals exposed to atrazine, from agricultural or non-agricultural use sites, are likely to experience direct adverse effects in the form of reduced biomass and growth, which, in severe cases, would result in death. We do not expect reductions in pollinators and seed dispersers of listed plant species from atrazine exposure, and therefore, indirect adverse effects are not likely to occur for these species.

We anticipate the species in this group are not likely to occur in agricultural atrazine use sites. We expect the general label measures for agricultural uses described above (e.g., reduced application rates, 15-foot spray drift buffer for ground application, 170-foot spray drift buffer for aerial applications, and three runoff mitigation points) will reduce off-field exposures by an order of magnitude (i.e., a 90% reduction).

In addition to label measures, 19 species in Table 2 are in Pesticide Use Limitation Areas (PULAs) that requires an additional three runoff mitigation points (i.e., six points total) for all agricultural uses. EPA identified additional risk of adverse effects associated with atrazine applications to sweet corn made in the fall. To minimize these additional adverse effects, sweet corn applicators must adopt one of the following additional measures to further reduce runoff into the species' habitat from sweet corn uses:

- 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.

We anticipate these additional runoff points will further reduce agricultural atrazine residues in runoff by another order of magnitude (i.e., up to 99% reduction in atrazine runoff residues in total).

In addition to agricultural exposure, none of the species in Table 2 occur on non-agricultural atrazine use sites (i.e., turf) because non-agricultural use sites do not provide the species' necessary habitat (e.g., sand bars, coastal plains, bogs, wet meadows). 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.

In summary, with implementation of conservation measures on product labels and a PULA including six runoff points for all agricultural uses and a timing restriction on sweet corn, where needed, we expect that few individuals will be exposed to atrazine via off-site transport from agricultural or non-agricultural areas. Therefore, we expect the proposed action will result in direct adverse effects (e.g., reduced biomass, growth, or survival) of, at most, a very small number of individuals of these species. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from atrazine exposure. We determine the overall risk of adverse effects to these species is low. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action

(including general label and specific conservation measures), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of these species in the wild. Thus, it is our biological opinion that the registration of atrazine, as proposed, is not likely to jeopardize the continued existence of the species in Table 2.

Species with Individual Integration and Synthesis Summaries

The species in Table 3 have individual Integration and Synthesis summaries. 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 of atrazine and reduce the likelihood, magnitude, and frequency of exposure 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 on the label 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 plant 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 3. Species with Individual Integration and Synthesis Summaries

Common Name	Scientific Name	Determination
Sensitive joint-vetch	*Aeschynomene virginica*	No Jeopardy
Virginia sneezeweed	*Helenium virginicum*	No Jeopardy

Integration and Synthesis Summary: Sensitive joint-vetch

Scientific Name:	Common Name:	Entity ID:
Aeschynomene virginica	Sensitive joint-vetch	875

Conclusion: No Jeopardy

Species Range

Based on range map dated: 10/11/2023; Wherever found; *States within the range:* DE, MD, NC, NJ, VA

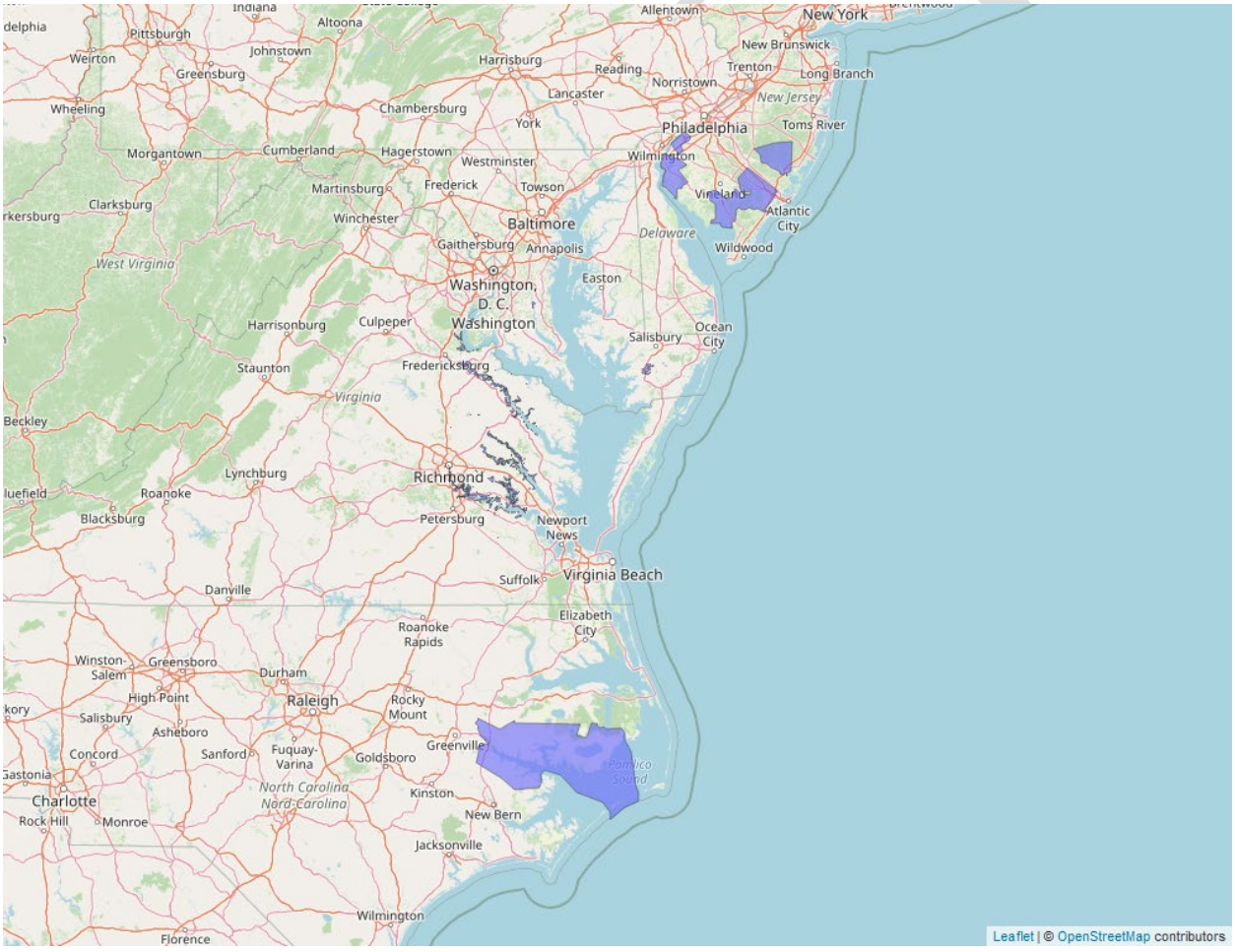

Figure 2. Range map of sensitive joint-vetch (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/855.

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: 7/17/2025

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (numerous)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The sensitive joint-vetch is a threatened annual legume native to the eastern U.S. It is found in tidal marshes and ditches. Populations currently exist in Maryland, New Jersey, North Carolina, and Virginia. It has been extirpated from Delaware and Pennsylvania since the 1800s. Some individuals occurred in agricultural areas, including corn fields, but those populations have been extirpated. Annual population numbers are highly variable, and minimum numbers of plants counted annually between 1991-2010 fluctuated between 1,580-24,073. Plants likely occur in fewer locations than in 1991, but population trends are unknown (USFWS 2013).

In greenhouses, 13% of sensitive joint-vetch self-pollinated, but outcrossing also occurred and morphological and biological features typical of asexual reproduction were not observed for this plant. Bumble bees have been observed on sensitive joint-vetch, suggesting they are pollinators. Other pollinators are unknown. Sensitive joint-vetch relies on abiotic means for seed dispersal. Fruits and flowers are produced between July and October, and seeds mature between August and October (USFWS 1995). Their seeds fall to the ground, many within 0.5 m of the parent plant. Most plants grow farther than 1.25 m from a stream edge, but 10% are within 0.5 m of a stream (33% are within 1 m of a stream), and many seeds that fall into water are transported away. Some seeds are transported for over 80 hours in water. About 60% of seeds are lost during the winter, either disappearing or becoming unviable by spring; therefore, the species is believed

to have a small but persistent seed bank (USFWS 2013). Seeds can survive in the seed bank for up to eight years (USFWS 2025).

Sensitive joint-vetch is threatened by invasive marsh plants (e.g., *Phragmites australis*), changes in hydrology (e.g., water withdrawals), herbicide use, right of way mowing, habitat modification (e.g., dredging), development, non-native insect predators, and effects from climate change (e.g., sea level rise, changes to precipitation patterns, storms) (USFWS 2013).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 11.7% of the species' range overlaps with agricultural use sites and 66.1% 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 77.8% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 4).

Table 4. Agricultural use overlap and annual usage data (% Range Treated) for the sensitive joint-vetch.

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	10.5	37.4	47.9	10.5	37.4	47.9
Vegetables and Ground Fruit (Sweet Corn)	0.7	8.9	9.6	0.3	4.7	5.0
Other Grains (Sorghum & Sugarcane)	0.2	4.7	4.9	0.2	4.7	4.9
Other Orchards (Guava & Macadamia Nut)	0	0	0	0	0	0
Other Crops (Wheat-Corn-Fallow)	0	0	0	0	0	0
Other Crops (Wheat-	0.2	8.9	9.1	0.2	8.9	9.1

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Sorghum-Fallow)						
Other Crops (Wheat-Fallow-Wheat)	0	0	0	0	0	0
Other Crops (Sod)	0.2	6.0	6.2	0.2	6.0	6.2
Total	**11.7**	**66.1**	**77.8**	**11.7**	**66.1**	**77.8**

Usage

Past usage data indicate that up to 77.8% of the species' range has been treated with atrazine annually from agricultural uses, with 11.7% occurring on agricultural fields and 66.1% resulting from off-site transport.

Additional Exposure Considerations

The sensitive joint-vetch occurs in fresh to slightly brackish tidal marsh tidal river systems within the intertidal tidal zone. It typically occurs at the outer fringes of marshes or shores and can occur on margins of wet agricultural fields where the ground has been disturbed. Most recently in 2024, new subpopulations in Rappahannock River had high numbers of individuals in habitat immediately adjacent to corn and soybean fields in wet areas with some tidal flooding, but this is not considered ideal habitat for the species and only a small proportion of known individuals would potentially be exposed through atrazine on the edges of corn fields (Virginia Field Office, pers. comm., 2025).

Exposure from Non-Agricultural Uses

The sensitive joint-vetch is not known to occur in non-agricultural use sites of atrazine, and we expect off-site transport from spray drift and runoff from these uses to be minimal.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift to off-site areas, including a 15-foot spray drift buffer for ground applications and a 170-foot spray drift buffer for aerial applications. Additionally, product labels require three runoff mitigation points for all agricultural uses, which will reduce atrazine concentrations in runoff. We expect these measures will reduce the concentration of

atrazine entering species' habitats by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff).

In addition to label measures, the sensitive joint-vetch is in a Pesticide Use Limitation Area (PULA) that requires an additional three runoff mitigation points (i.e., six points total) for all agricultural uses. EPA identified additional risk of adverse effects associated with atrazine applications to sweet corn made in the fall. To minimize these additional adverse effects, sweet corn applicators must adopt one of the following additional measures to further reduce runoff into the species' habitat from sweet corn uses:

- 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.

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

Based on toxicity data available for atrazine in plant species, we expect that exposure of individuals that occur on atrazine use sites will result in large impacts to growth, which, if severe enough, can result in mortality. While we anticipate atrazine use can impact the growth and survival of plant species off-field (exposure through spray drift or runoff), we expect implementation of conservation measures on product labels to reduce the likelihood, magnitude, and frequency of exposure such that we anticipate no more than low level effects to few individuals in these areas.

Indirect Effects

We do not expect that atrazine use will result in any indirect adverse effects to individual plants as we do not anticipate atrazine is likely to reduce the abundance and availability of the insect pollinator species necessary to support reproduction for the sensitive joint-vetch.

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. We expect atrazine concentrations to result in high levels of adverse effects to plants on pesticide use sites, including reduced growth and potentially death. While 77.8% of the range overlaps with agricultural use sites of atrazine, we expect

atrazine applications to occur on-field in just 11.7% of the species' range. This overlap and usage is primarily attributable to corn. The sensitive joint-vetch is known to occur adjacent to agricultural fields where its required habitat conditions are met. On atrazine use sites, we expect exposure to result in large impacts to growth, which can lead to mortality. With implementation of conservation measures on product labels, we expect that few individuals will be exposed to atrazine via off-site transport and will experience no more than low level of adverse effects to growth and survival, including those at field edges.

Given the high overlap and usage of atrazine within the range of the sensitive joint-vetch and its tendency to occur near agricultural fields, we conclude the overall risk of adverse effects to the species is medium.

Species Conclusion

The sensitive joint-vetch is found in tidal marshes, ditches, and immediately adjacent to agricultural fields in the eastern U.S. Annual population numbers are highly variable, which makes assessing trends over time difficult. A few populations have been extirpated, and we believe plants occur in fewer locations than 30 years ago, but population trends are unknown. Sensitive joint-vetch is threatened by invasive marsh plants and insects, changes in hydrology, herbicide use, right of way mowing, habitat modification, development, non-native insect predators, and effects from climate change (e.g., sea level rise, changes to precipitation patterns, storms) (USFWS 2013).

We do not expect sensitive joint-vetch to occur on non-agricultural use sites. Some individuals have been observed on corn fields, but these individuals have been extirpated. Most of the overlap with atrazine use results from off-site transport (66.1%), primarily with corn, and the species is known to occur immediately adjacent to corn fields. Even though we expect plants that are exposed directly to atrazine on use sites will die or experience reduced growth, as no individuals are currently known to occur on croplands labeled for atrazine use, we expect direct effects on-field are unlikely to occur. Because this species occurs in non-flowing wetlands, it is included in a Pesticide Use Limitation Area for most uses, including corn. We expect that conservation measures on the label and the additional three runoff points from the sensitive joint-vetch PULA to result in atrazine concentrations low enough to only cause direct adverse effects (i.e., death or reduced growth) to a small number of individuals that could be exposed off-field. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from atrazine exposure.

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 sensitive joint-vetch.

References

U.S. Fish and Wildlife Service. 2025. Sensitive Joint-Vetch (*Aeschynomene virginica*) 5-Year Review: Summary and Evaluation. Gloucester, Virginia. 76 pp.

U.S. Fish and Wildlife Service. 2013. Sensitive joint-vetch (*Aeschynomene virginica*) 5-Year Review: Summary and Evaluation. Gloucester, Virginia. 46 pp.

U.S. Fish and Wildlife Service. 1995. Sensitive joint-vetch (*Aeschynomene virginica*) Recovery Plan. White Marsh, Virginia. 60 pp.

Integration and Synthesis Summary: Virginia sneezeweed

Scientific Name:	Common Name:	Entity ID:
Helenium virginicum	Virginia sneezeweed	1028

Conclusion: No Jeopardy

Species Range

Based on range map dated: 03-16-2020; Wherever found; *States within the range:* IN, MO, VA

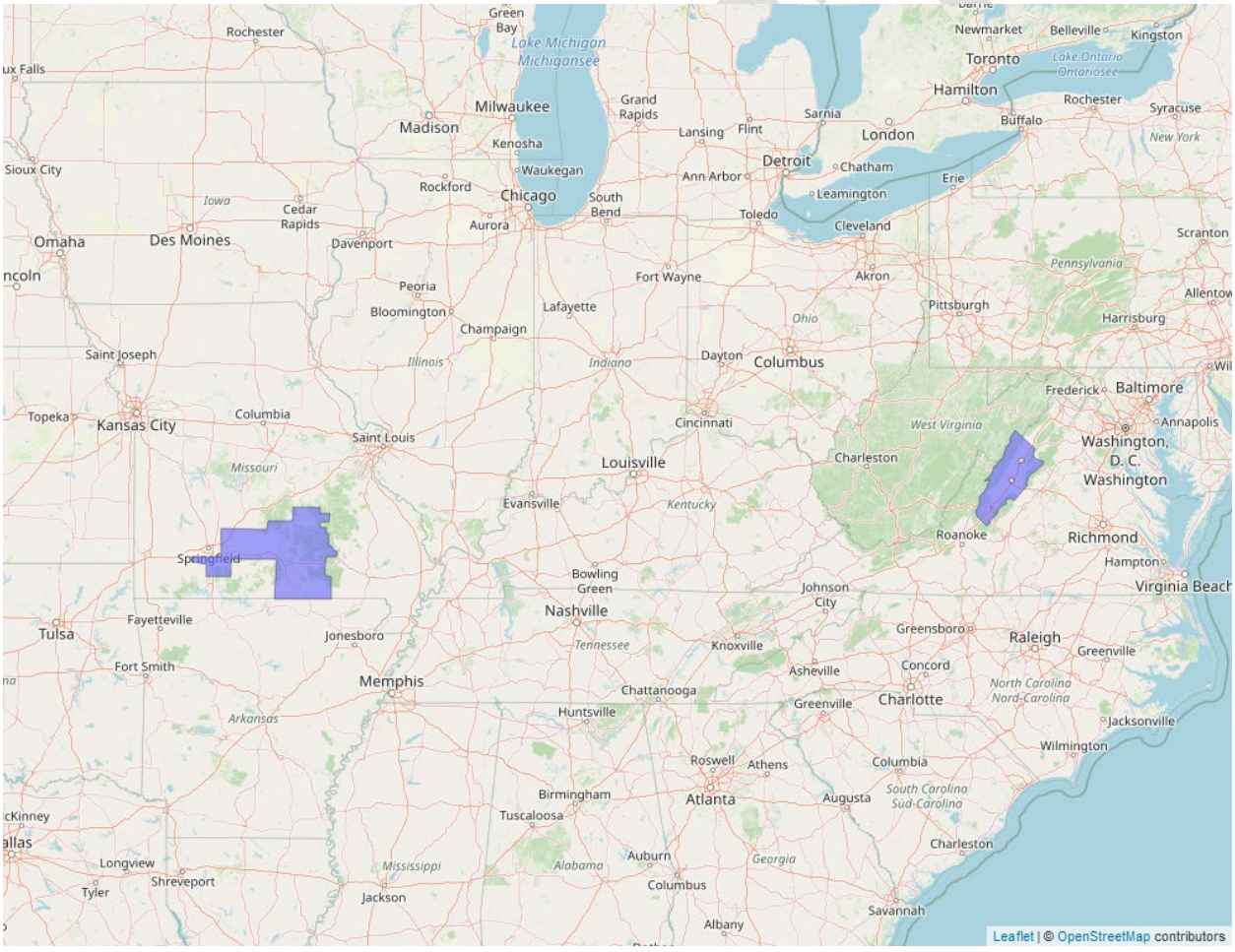

Figure 3. Range map of Virginia sneezeweed (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6297.

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

Most recently completed 5-Year Review: 4/23/2020

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (numerous)

Species trends: Increasing population trends

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Virginia sneezeweed is a perennial herb in the sunflower family (Asteraceae) that is endemic to seasonally flooded wetlands within the Shenandoah Valley of western Virginia, the Ozark Highlands of Missouri, and one occurrence in the state of Indiana. Its optimal habitat includes fluctuating water levels, little canopy cover, and acidic-to-circumneutral soils with high organic matter. It grows in sinkhole ponds, wet meadows, and shallow, seasonally inundated depressions underlain by karst topography, where hydrology is highly variable and often influenced by subsurface drainage patterns. Plants are also known to grow in human- made features such as roadside ditches, farm ponds, and other depressions or areas that act as seasonal wetlands, including lawns. It blooms from early July through October with a peak in late July to early August. Seed dispersal occurs in late fall, and dormancy is broken gradually, with most germination delayed until the next growing season after water has drawn down. The species has adapted to stress induced from fluctuations in habitat condition by maintaining an intact seed bank that allows the plants to regenerate when conditions are favorable. Because of these frequent changes in condition, Virginia sneezeweed also experiences short-term local extirpations of aboveground plants (USFWS 2025). Though population sizes vary considerably from year to year, several populations have demonstrated persistence over multiple decades (USFWS 2020). As of 2025, 76 element occurrences (EOs) have been identified across the current known species range. Fifteen EOs (20%) occur on state or Federal lands offering permanent protection. There are protections or site-specific management activities in place at 21

sites across the species range that benefit more than a quarter of known populations; these are expected to remain in place if the species is delisted. In 2025, the USFWS proposed the Virginia sneezeweed for delisting due to recovery (USFWS 2025).

Most populations occur on private lands, and these populations are unprotected. Virginia sneezeweed is threatened primarily by changes to hydrology, ATV or other vehicle use, and competition and encroachment by other plant species including invasives. Because the species is restricted to highly specific hydrological conditions and has a narrow geographic range, it is particularly vulnerable to land use changes that disrupt seasonal water availability or soil saturation (USFWS 2020).

Overall Vulnerability: Low

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 35.1% 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 37.4% overlap between the species' range and the agricultural footprint of atrazine use sites (Table 5).

Table 5. Agricultural use overlap and annual usage data (% Range Treated) for the Virginia sneezeweed.

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	1.9	21.6	23.5	1.9	21.6	23.5
Vegetables and Ground Fruit (Sweet Corn)	<0.1	0.7	0.8	<0.1	0.7	0.8
Other Grains (Sorghum & Sugarcane)	0.2	6.0	6.2	0.2	4.9	5.1
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	5.6	5.6	<0.1	5.6	5.6
Other Crops (Wheat-Fallow-Wheat)	0	0.0	0.0	0	0.0	0.0
Other Crops (Sod)	<0.1	1.2	1.2	<0.1	1.2	1.2
Total	**2.3**	**35.1**	**37.4**	**2.2**	**34.0**	**36.2**

Usage

Past usage data indicate that up to 36.2% of the species' range has been treated with or exposed to atrazine annually from agricultural uses with 2.2% occurring on agricultural fields and 34.0% resulting from off-field transport.

Additional Exposure Considerations

Virginia sneezeweed is found in open (unshaded) growing conditions and is limited to seasonally flooded sinkhole ponds and disturbed sites that appear as seasonally wet meadows, depressions in lawns, roadside ditches, and margins of farm ponds. The species is not known to occur on row crops because soils there are not suitable.

Exposure from Non-Agricultural Uses

Virginia sneezeweed occurs in depressions in lawns and could be exposed to atrazine if used on turf. However, given our knowledge of atrazine application to turf and nursery areas (see *Exposure to Non-Agricultural Uses*, above), we expect atrazine usage within the range of Virginia sneezeweed to be limited. In addition, we expect off-site transport from spray drift and runoff from these uses to be minimal.

Conservation Measures

There are several conservation measures on the atrazine label that apply to all agricultural uses and are intended to reduce spray drift to off-site areas, including a 15-foot spray drift buffer for ground applications and a 170-foot spray drift buffer for aerial applications. Additionally, product labels require three runoff mitigation points for all agricultural uses, which will reduce atrazine concentrations in runoff. We expect these measures will reduce the concentration of atrazine entering species' habitats by up to an order of magnitude (i.e., up to a 90% reduction in atrazine residues in spray drift and runoff).

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data available for atrazine in plant species, we expect that exposure of individuals that occur on atrazine use sites will result in large impacts to growth, which, if severe enough, can result in mortality. While we anticipate atrazine use can impact the growth and survival of plant species off-field (exposure through spray drift or runoff) we expect implementation of conservation measures on agricultural product labels and existing pesticide practices in non-agricultural atrazine use sites to reduce the likelihood, magnitude, and frequency of exposure to a level such that we anticipate no more than low level effects to few individuals in these areas.

Indirect Effects

We do not expect that atrazine use will result in any indirect adverse effects to individual plants as we do not anticipate atrazine is likely to reduce the abundance and availability of the pollinator species necessary to support reproduction.

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. We do not have data to indicate that the Virginia sneezeweed occurs on agricultural use sites of atrazine, though it is known to occur on the edge of farm ponds. However, given implementation of conservation measures on the product label to reduce spray drift and runoff, we expect that any individuals of the Virginia sneezeweed exposed to atrazine via off-site transport will experience no more than low levels of effects to growth, including those at field edges.

Virginia sneezeweed is known to occur in lawn depressions. We expect large impacts to growth, which, if severe enough, can result in mortality for individuals exposed on treated lawns. However, we do not expect atrazine to be a commonly used herbicide on residential turf, and as

such, we expect atrazine usage on lawns within the range of the Virginia sneezeweed, if any, will be limited. We expect off-site transport from turf use to be minimal, and as such, do not expect concentrations of atrazine to result in adverse effects to individuals exposed off-site.

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

Species Conclusion

Virginia sneezeweed is a perennial herb endemic to seasonally flooded wetlands in western Virginia, Missouri, and Indiana. It grows where hydrology is highly variable and often influenced by subsurface drainage patterns, including sink holes, wet meadows, roadside ditches, farm ponds, and other depressions or areas that act as seasonal wetlands, including lawns. The species relies on a robust seed bank to accommodate fluctuations in habitat condition. About 20% of the species occurrences are protected and the species was proposed for delisting in 2025 due to recovery. Threats include changes to hydrology, ATV or other vehicle use, and competition and encroachment by other plant species including invasives.

Though Virginia sneezeweed may occur on non-agricultural use sites (i.e., lawns) that are subject to seasonal flooding, we expect atrazine use on turf is limited. Virginia sneezeweed may occur on farm pond margins but does not occur on row crops where we expect atrazine use may be high. Even though we expect plants that are exposed directly to atrazine on use sites will die or experience reduced growth, we expect these direct effects will occur to a very small number of individuals. After incorporating conservation measures on the label, we expect a small number of individuals will be exposed to atrazine and either die or experience reduced growth. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from atrazine exposure.

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 likely to appreciably reduce the survival and recovery of the Virginia sneezeweed. Thus, it is our biological opinion that the registration of atrazine, as proposed, is not likely to jeopardize the continued existence of the Virginia sneezeweed.

References

U.S. Fish and Wildlife Service. 2025. Endangered and Threatened Wildlife and Plants; Removal of Virginia Sneezeweed From the List of Endangered and Threatened Plants. Proposed Rule. Federal Register 90(148):37445-37457.

U.S. Fish and Wildlife Service. 2020. Virginia Sneezeweed (*Helenium virginicum*) 5-Year Review: Summary and Evaluation. Abingdon, Virginia. 35 pp.