Integration and Synthesis Summary for Plants

Dicots and non-flowering plants in non-flowing wetland habitats

This Integration and Synthesis Summary includes our jeopardy analysis for 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 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.

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 simazine from agricultural or non-agricultural uses. Though we expect non-flowing wetlands to accumulate higher concentrations of simazine than other habitat types, most of these species have low exposure to simazine due to the factors described in the tables or individual rationales below, in combination with reductions in simazine 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). For species in these habitats where we determined exposure was medium or high (i.e., based on overlap and/or usage), a higher level of mitigation was necessary (i.e., six runoff points implemented through Pesticide Use Limitation Areas (PULAs)) to adequately reduce simazine concentrations to levels where effects are expected to be low.

Through implementation of the conservation measures incorporated into the action, we anticipate agricultural exposures in the non-flowing wetland habitats where these species occur will be low. Dicot flowering plants and non-flowering plants are placed together simply for ease of organization. Monocot flowering plants with similar exposure profiles are found in a separate I&S Appendix (i.e., C-B3).

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

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

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 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 simazine primarily through direct contact, either as the result of exposure to pesticide applications on-field or through off-field transport via spray drift or runoff. Simazine is moderately mobile in water and is relatively persistent in the environment relative to other pesticides on the market, indicating that off-site transport, particularly through runoff, may result in exposure to listed plant species in areas far from use sites.

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[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

Simazine has several registered agricultural uses (see Appendix 1-4 of EPA's Biological Evaluation). We anticipate listed plant species will be exposed to simazine primarily through direct contact, either as the result of exposure to pesticide applications on-field or through off-field transport via spray drift or runoff. Simazine is moderately mobile in water and is relatively persistent in the environment relative to other pesticides on the market, indicating that off-site transport, particularly through runoff, may result in exposure to listed plant species in areas far from use sites.

We characterize the expected level of exposure using overlaps between the species' ranges and agricultural land uses where simazine is registered for use (i.e., overlap data; including a 305-m off-site transport area adjacent to use sites), past simazine usage data (when available; the amount and location where simazine has been used in the past), any species-specific considerations such as life history information (e.g., habitat or soil 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 simazine use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps, we considered past usage data within a species' range to determine how much of a species' range we expect to be treated with simazine 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 simazine each year are assigned a high usage score. Species that have a medium portion of their range (5-10%) treated with simazine each year are assigned a medium usage score, and species where data indicate a low portion of their range (<5%) is treated with simazine 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 simazine include labeled uses for corn, vegetables and ground fruit, other crops, citrus, Christmas trees, grapes, and other orchards only within the conterminous United States.

Exposure to Non-Agricultural Uses

Simazine has several registered non-agricultural uses, including nurseries (only ornamental conifers, deciduous trees and woody ornamental species), ornamental ponds (1,000 gallons or less), lawns, golf courses and other turf. In many cases, data provided by EPA indicate low to high levels of overlap between species' ranges and non-agricultural UDLs. Overall, nurseries (including ornamental plant uses) represent a very small footprint across the action area; across all species in this consultation, the Nurseries UDL overlaps between 0%-0.2% of species' ranges and 0%-5.6% of species' ranges plus a 305-m buffer. For species known to occur near nurseries, we assess nurseries specifically in our assessment. 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 simazine in a qualitative manner, considering the life history of species, methods of application, simazine 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 simazine use sites (i.e., residential areas where lawns are likely present, golf courses, and nurseries) 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 simazine. 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 simazine 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 simazine will not be used on turf and no exposure will occur from this use.

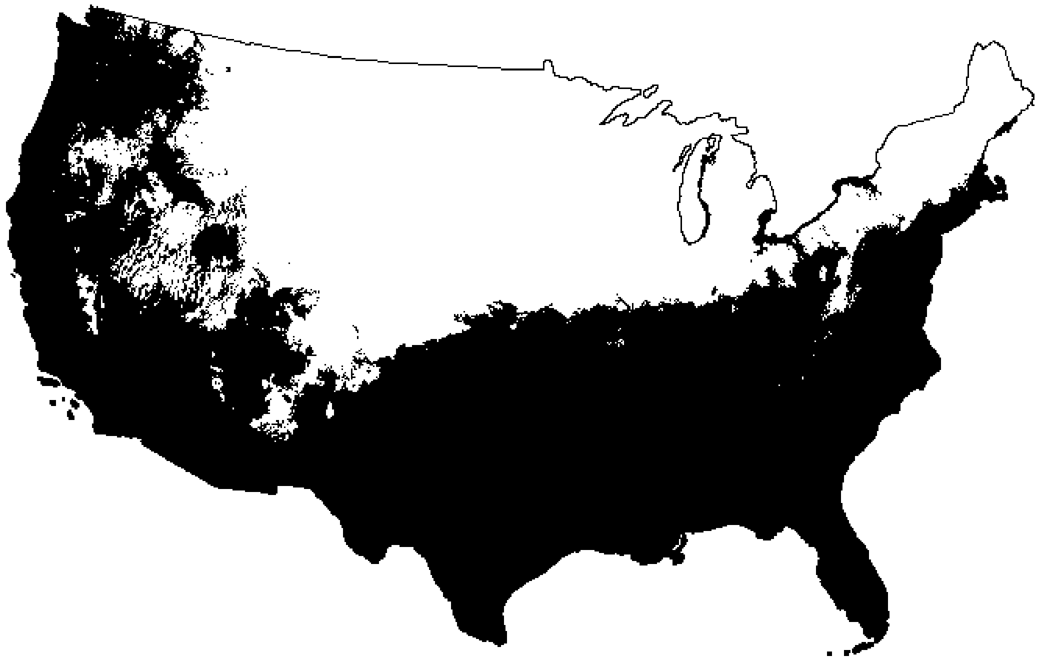

Figure 1. Map showing where cool-season grasses (white areas) and warm-season grasses (black areas) are used on turf across the continental U.S.

Particularly for residential and commercial turf uses, qualitative usage information obtained by EPA from the National Association of Landscape Professionals (NALP) indicate that simazine is no longer commonly used on residential or commercial turf as potential consequences to turf areas related to timing of application has led to preferential use of other herbicides that can be applied more broadly. If simazine 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 simazine 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., 1-1.5 lbs a.i./acre). 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 runoff mitigations (i.e., equivalent to 6 points on EPA's mitigation menu), and we considered them in our assessment.

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 more than low levels of adverse effects to most listed plants in this Appendix. In addition, we expect most listed species' habitat requirements precludes them from occupying non-agricultural use sites where simazine may be used. For species whose habitat is known or presumed to occur near non-agricultural use sites of simazine, we consider, individually and qualitatively, the extent and manner of non-agricultural simazine 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 simazine.

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 simazine 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 simazine and experience adverse effects.

Given that herbicides like simazine are designed to control plants, we assume listed plant species are sensitive to simazine exposure. In general, we anticipate individuals exposed to simazine 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 simazine, 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 of simazine for each listed species to determine the anticipated level of adverse effects simazine. In contrast, available toxicity data indicate that animal species, including potential pollinators and seed dispersers of listed plant species, are not likely to die from simazine exposure, suggesting that indirect adverse effects are not likely to occur to listed plant species.

Conservation Measures

Herbicide Strategy Conservation Measures

As part of the simazine ESA consultation with the Service, EPA is implementing the final Herbicide Strategy to inform and identify 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 15-foot spray drift buffer and a minimum of three runoff mitigation points[5] necessary in all areas where simazine is used, as well as additional runoff mitigation points for certain simazine uses limited to specific geographic areas.

The spray drift buffer will be placed on the general label and will apply to all uses of simazine. 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.

This buffer is in addition to spray drift mitigations that are already on the label, including:

- Restricting use to a maximum windspeed of 10 miles per hour,
- Prohibiting applications during temperature inversions,

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

- Applying with a release height of no more than 4 feet above the ground or crop canopy for ground applications,
- Selecting nozzles and pressures that deliver coarse or coarser droplets for all applications,
- and ground application only

Based on EPA's analyses, the required spray drift conservation measures described above (from the current label and implemented through the Herbicide Strategy) will reduce spray drift from entering species' habitats by >95%. The Service anticipates that this reduction will minimize off-site transport of simazine from spray drift to a level where no more than low levels of effects are likely to occur to listed plant species through this exposure route.

Additionally, 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 mitigation measures identified on EPA's Mitigation Menu website[6]. The menu provides a suite of options, including relief points for certain field characteristics and likelihood for pesticide transport.

These runoff mitigation points are in addition to runoff mitigations that are already on the label, including:

- Product must not be mixed or loaded within 50 feet of intermittent streams and rivers, natural or impounded lakes and reservoirs.
- Product must not be applied within 66 feet of points where agricultural field (nurseries, Christmas tree plantings, and turf grasses for sod farms) surface water runoff enters perennial or intermittent streams and rivers or within 200 feet of natural or impounded lakes and reservoirs. If this product is applied to highly erodible land, the 66-foot buffer or setback from runoff entry points must be planted to crop or seeded with grass or other suitable crop.
- Do not apply within 66 feet of standpipes in tile-outletted terraced fields.
    - Apply this product to the entire tile-outletted terraced field under a no-till practice only when a high crop residue management practice is practiced. High crop residue management is described as a crop management practice where little or no crop residue is removed from the field during and after crop harvest.

We expect implementation of the runoff and erosion reduction measures, as required, to minimize off-site transport of simazine to habitats of listed species. EPA's analyses indicated that the general label requirement of three runoff mitigation points will reduce estimated

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

environmental concentrations of simazine in runoff by up to an order of magnitude (i.e., up to 90% reduction, in other words reduce pesticide loading to one-tenth of pre-runoff mitigation levels).

For all the species in this document, we expect the spray drift and runoff measures, including the 3 runoff points and 15-foot spray drift buffers required under the Herbicide Strategy, 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 simazine residues) and reducing the level of adverse effects that will occur to exposed individuals (by reducing estimated exposure concentrations).

EPA identified that additional runoff measures are needed for some plants in non-flowing wetlands. As such, additional runoff mitigation points (an additional three points for six points total; i.e., up to 99% reduction) are required through the Herbicide Strategy for the species identified in Table 3 below. EPA will communicate where additional runoff mitigation points are needed and for what specific simazine 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 simazine will decrease by up to two orders of magnitude (i.e., reduce pesticide loading to one-one hundredth of pre runoff mitigation levels).

Summary of conclusions for dicots and non-flowering 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 simazine with conservation measures, and the cumulative effects, it is the Service's biological opinion that the registration of simazine, as proposed, is not likely to jeopardize the continued existence of the 40 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 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 exposure informed by low past usage from the California Department of Pesticide Regulation's Pesticide Use Reporting data and low likelihood of non-agricultural exposure

The species in Table 1 occur completely within California, and very little of their range has been treated with simazine in the past (0.0-4.0%) according to California Department of Pesticide Regulation's Pesticide Use Reporting data (CalPUR). 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 account can be found in Appendix B.

Table 1. Species with low exposure informed by low past usage from the California Department of Pesticide Regulation's Pesticide Use Reporting data and low likelihood of non-agricultural exposure.

Common Name	Scientific Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Butte County meadowfoam	*Limnanthes floccosa* ssp. *californica*	High	Low	High	1.7	No Jeopardy
Calistoga allocarya	*Plagiobothrys strictus*	High	Low	High	0.5	No Jeopardy
Contra Costa goldfields	*Lasthenia conjugens*	High	Low	High	0.0	No Jeopardy
Few-flowered navarretia	*Navarretia leucocephala* ssp. *pauciflora (=N. pauciflora)*	High	Low	High	0.3	No Jeopardy
Fleshy owl's-clover	*Castilleja campestris* ssp. *succulenta*	Low	Low	High	2.1	No Jeopardy
Gambel's watercress	*Rorippa gambellii*	High	Low	High	0.2	No Jeopardy
Hoover's spurge	*Chamaesyce hooveri*	Low	Low	High	2.5	No Jeopardy
La Graciosa thistle	*Cirsium loncholepis*	High	Low	High	0.1	No Jeopardy
Many-flowered navarretia	*Navarretia leucocephala* ssp. *plieantha*	High	Low	High	0.3	No Jeopardy
Marsh sandwort	*Arenaria paludicola*	High	Low	High	0.1	No Jeopardy
San Jacinto Valley crownscale	*Atriplex coronata* var. *notatior*	High	Low	High	0.0	No Jeopardy
Sebastopol meadowfoam	*Limnanthes vinculans*	High	Low	High	0.7	No Jeopardy

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Common Name	Scientific Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Sonoma sunshine	*Blennosperma bakeri*	High	Low	High	0.6	No Jeopardy
Spreading navarretia	*Navarretia fossalis*	Low	Low	High	0.1	No Jeopardy
Ventura Marsh Milk-vetch	*Astragalus pycnostachyus* var. *lanosissimus*	High	Low	High	0.2	No Jeopardy
Vine Hill clarkia	*Clarkia imbricata*	High	Low	High	4.0	No Jeopardy

Given that herbicides like simazine are designed to control plants, we assume all listed plant species are sensitive to simazine exposure and no significant difference in the toxicity of simazine among major plant taxa (e.g., dicots, monocots, non-flowering plants) is expected. In general, we anticipate individuals exposed to simazine, 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 mortality of individuals. As such, all species in Table 1 have high toxicity rankings. We do not expect reductions in pollinators and seed dispersers of listed plant species from simazine exposure, and therefore, indirect adverse effects are not likely to occur for these species.

In addition, many species in Table 1 have high vulnerability rankings. While these species may be more vulnerable to adverse effects from pesticides than species with low vulnerability rankings, all species in this group have a low exposure ranking. The low exposure ranking results from the combination of several factors. First, all species in Table 1 occur completely within the state of California and CalPUR usage data compiled between 2013-2022 for simazine indicates low usage within the sections where these species' ranges occur. Given that this usage reporting is mandated by the state of California, and that these data are provided regularly at a relatively high spatial resolution, we have high confidence that only a small percentage of the species' ranges are likely to be exposed to agricultural uses of simazine. Second, the conservation measures already on the label are expected to reduce exposure of the species to spray drift and runoff from agricultural use sites. These measures include restricting use to a maximum windspeed of 10 miles per hour, prohibiting applications during temperature inversions, applying with a release height of no more than 4 feet above the ground or crop canopy for ground applications, selecting nozzles and pressures that deliver coarse or coarser droplets for all applications, using ground applications only, and maintaining buffers from waterways. These measures, combined with conservation measures implemented through the Herbicide Strategy (i.e., 15-foot spray drift buffer and 3 runoff mitigation points) are anticipated to reduce off-site transport to the habitats of listed species by 90% or more.

In addition to agricultural use, simazine is registered for use on non-agricultural areas for nurseries and turf, including lawns and golf courses. Based on individual reviews of available life history information for each of the 16 species in Table 1, we expect that all these species are unlikely to occur on or near non-agricultural use sites of simazine and therefore are unlikely to be exposed to non-agricultural uses of this herbicide.

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As we anticipate very small numbers of individuals of the species in Table 1 are likely to be exposed, we expect the proposed action will result in reduced biomass or growth 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 simazine 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 survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species listed in Table 1.

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

For the species in Table 2, very little of their range has been treated with herbicides, potentially including simazine, for agriculture in the past (2.5% and 3.7%) according to data from USDA's Census of Agriculture. 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 account can be found in Appendix B.

Table 2. 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	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Huachuca water-umbel	*Lilaeopsis schaffneriana* var. *recurva*	Medium	Low	High	3.7	No Jeopardy
Pecos (=puzzle, =paradox) sunflower	*Helianthus paradoxus*	Medium	Low	High	2.5	No Jeopardy

Given that herbicides like simazine are designed to control plants, we assume all listed plant species are sensitive to simazine exposure and no significant difference in the toxicity of simazine among major plant taxa (e.g., dicots, monocots, non-flowering plants) is expected. In general, we anticipate individuals exposed to simazine, 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 mortality of individuals. As such, both species in Table 2 have high toxicity rankings. We do not expect reductions in pollinators and seed dispersers of listed plant species from simazine exposure, and therefore, indirect adverse effects are not likely to occur for these species.

In addition, the species in Table 2 have medium vulnerability rankings. While these species may be more vulnerable to adverse effects from pesticides than species with low vulnerability rankings, both species in this group have a low exposure ranking. The low exposure ranking results from the combination of several factors. First, both species in Table 2 have low CoA usage, indicating that very little past herbicide usage occurred on agricultural crops in the counties where these species' ranges occur. Given that this reporting broadly includes all herbicide usage on agriculture, we consider CoA data to be conservative estimates of simazine usage, indicating very small portions of the species' ranges are likely to be treated. Furthermore, the species are unlikely to occur on agricultural use sites as they are found in non-flowing aquatic habitats. The Huachuca water-umbrel prefers the margins of flood plains, streams, and cienegas (spring-fed marsh or swamp), and similarly, the Pecos sunflower is found in cienegas or spring seeps. Second, the conservation measures already on the label are expected to reduce exposure of the species to spray drift and runoff from agricultural use sites. These measures include restricting use to a maximum windspeed of 10 miles per hour, prohibiting applications during temperature inversions, applying with a release height of no more than 4 feet above the ground or crop canopy for ground applications, selecting nozzles and pressures that deliver coarse or coarser droplets for all applications, using ground applications only, and maintaining buffers from waterways. These measures, combined with conservation measures implemented through the Herbicide Strategy (i.e., 15-foot spray drift buffer and 3 runoff mitigation points) are anticipated to reduce off-site transport to the habitats of listed species by 90% or more.

In addition to agricultural use, simazine is registered for use on non-agricultural areas for nurseries and turf, such as lawns and golf courses. Based on individual reviews of available life history information for each of the two species in Table 2, we expect that these species are unlikely to occur on or near non-agricultural use sites of simazine and therefore are unlikely to be exposed to non-agricultural uses of this herbicide.

As we anticipate very small numbers of individuals of the species in Table 2 are likely to be exposed, we expect the proposed action will result in reduced biomass or growth of, at most, a very small number of individuals of these species after considering conservation measures incorporated into the action. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from simazine 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 survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

Dicots and non-flowering plants in non-flowing wetland habitats with low exposure achieved through conservation measures implemented on the general label and in Pesticide Use Limitation Areas for all agricultural uses and low likelihood of non-agricultural exposure

The species in Table 3 were grouped together because we expect low agricultural exposure with implementation of spray drift and runoff conservation measures on the simazine label and in specific PULAs and low likelihood of non-agricultural exposure. We expect off-site transport to be low, and 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 3. Plants in non-flowing wetlands with low agricultural concern 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	Habitat Description	Determination
Alabama canebrake pitcher-plant	*Sarracenia rubra* ssp. *alabamensis*	High	Low	High	Sandhill seeps, swamps, and sloping bogs (NatureServe, 2015)	No Jeopardy
Arizona eryngo	*Eryngium sparganophyllum*	High	Low	High	Riparian, herbaceous wetlands (NatureServe, 2015)	No Jeopardy
Brooksville bellflower	*Campanula robinsiae*	High	Low	High	Palustrine, terrestrial (NatureServe, 2015)	No Jeopardy
Canby's dropwort	*Oxypolis canbyi*	Medium	Low	High	Coastal plains (NatureServe, 2015)	No Jeopardy
Cook's lomatium	*Lomatium cookii*	High	Low	High	Vernal pools or alluvial floodplains (NatureServe, 2015)	No Jeopardy
Cooley's meadowrue	*Thalictrum cooleyi*	High	Low	High	Pine savanna (NatureServe, 2015)	No Jeopardy
Cumberland rosemary	*Conradina verticillata*	Medium	Low	High	Rocky river bars (USFWS, 2018)	No Jeopardy
Decurrent false aster	*Boltonia decurrens*	Medium	Low	High	Riparian, wetland (NatureServe, 2015)	No Jeopardy
Florida skullcap	*Scutellaria floridana*	Medium	Low	High	Pine-palmetto flatwoods, wet prairies (NatureServe, 2015)	No Jeopardy
Godfrey's butterwort	*Pinguicula ionantha*	Low	Low	High	Bos/long leaf pine savannas (NatureServe, 2015)	No Jeopardy

C-B4. Dicot and Non-Flowering Plants in Non-Flowing Wetlands: Integration and Synthesis Summaries

Common Name	Scientific Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Habitat Description	Determination
Howell's spectacular thelypody	*Thelypodium howellii* ssp. *spectabilis*	High	Low	High	Desert shrub communities (NatureServe, 2015)	No Jeopardy
Large-flowered woolly meadowfoam	*Limnanthes pumila* ssp. *grandiflora*	High	Low	High	Vernal pools (NatureServe, 2015)	No Jeopardy
Mohr's Barbara's buttons	*Marshallia mohrii*	Medium	Low	High	Wetland, terrestrial (NatureServe, 2015)	No Jeopardy
Mountain sweet pitcher-plant	*Sarracenia rubra* ssp. *jonesii*	High	Low	High	Bogs (NatureServe, 2015)	No Jeopardy
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	Medium	Low	High	Scrub-shrub, woodlands (NatureServe, 2015)	No Jeopardy
Virginia round-leaf birch	*Betula uber*	High	Low	High	Terrestrial, wetland (NatureServe, 2015)	No Jeopardy
White birds-in-a-nest	*Macbridea alba*	Low	Low	High	Bogs, fens, savannas (NatureServe, 2015)	No Jeopardy
Willamette daisy	*Erigeron decumbens*	High	Low	High	Herbaceous wetland, grassland (NatureServe, 2015)	No Jeopardy
Wright's marsh thistle	*Cirsium wrightii*	High	Low	High	Obligate of seeps, springs, and wetlands that have saturated soils with surface or subsurface water (NatureServe, 2015)	No Jeopardy

Given that herbicides like simazine are designed to control plants, we assume all listed plant species are sensitive to simazine exposure and no significant difference in the toxicity of simazine among major plant taxa (e.g., dicots, monocots, non-flowering plants) is expected. In general, we anticipate individuals exposed to simazine, 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 mortality of individuals. As such, all species in Table 3 have high toxicity rankings. We do not expect reductions in pollinators and seed dispersers of listed plant species from simazine exposure, and therefore, indirect adverse effects are not likely to occur for these species.

In addition, most of the species in Table 3 have medium or high vulnerability rankings. While these species may be more vulnerable to adverse effects from pesticides than species with low vulnerability rankings, all species in this group have a low exposure ranking. The low exposure ranking results from the combination of several factors. First, the conservation measures already on the label are expected to reduce exposure of the species to spray drift and runoff from agricultural use sites. These measures include restricting use to a maximum windspeed of 10 miles per hour, prohibiting applications during temperature inversions, applying with a release height of no more than 4 feet above the ground or crop canopy for ground applications, selecting nozzles and pressures that deliver coarse or coarser droplets for all applications, using ground applications only, and maintaining buffers from waterways. In addition, applicators must achieve six points of runoff and erosion control practices from EPA's Herbicide Strategy conservation measures menu, which is designed to be flexible while ensuring site-level risk is reduced. These conservation measures will both reduce the number of individuals exposed (by reducing the extent of off-site transport of simazine residues) and reduce the level of adverse effects that will occur to exposed individuals (by reducing estimated exposure concentrations). The species in Table 3 are also not anticipated to occur on agricultural use sites based on their habitat preferences and therefore will not be exposed on-site.

In addition to agricultural use, simazine is registered for use on non-agricultural areas fornurseries and turf, including lawns and golf courses. Based on individual reviews of available life history information for each of the 19 species in Table 3, we expect that all of these species are unlikely to occur on or near non-agricultural use sites of simazine and therefore are unlikely to be exposed to non-agricultural uses of this herbicide.

As we anticipate very small numbers of individuals of the species in Table 3 are likely to be exposed, we expect the proposed action will result in reduced biomass or growth of, at most, a very small number of individuals of these species after incorporating general label conservation measures and a six-point PULA for most agricultural simazine uses. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from simazine 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 survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species listed in Table 3.

References:

NatureServe. 2015. NatureServe Explorer. explorer.natureserve.org [accessed July 15, 2025]

U.S. Fish and Wildlife Service. 2018. Cumberland Rosemary (*Conradina verticillata*) 5-Year Review: Summary and Evaluation. Cookeville, Tennessee. 34 pp.

Species with Individual Integration and Synthesis Summaries

The species in Table 4 have individual Integration and Synthesis summaries because they have potential exposure not addressed by the Herbicide Strategy (i.e., on-field exposure or exposure from non-agricultural use). For all these species, 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 simazine 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 simazine 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 simazine 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 4. Species with Individual Integration and Synthesis Summaries

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

Integration and Synthesis Summary: Rough popcornflower

Scientific Name:	Common Name:	Entity ID:
Plagiobothrys hirtus	Rough popcornflower	592

Conclusion: No Jeopardy

Species Range

Based on range map dated: 2/2/2022; Wherever found; *States within the range:* OR

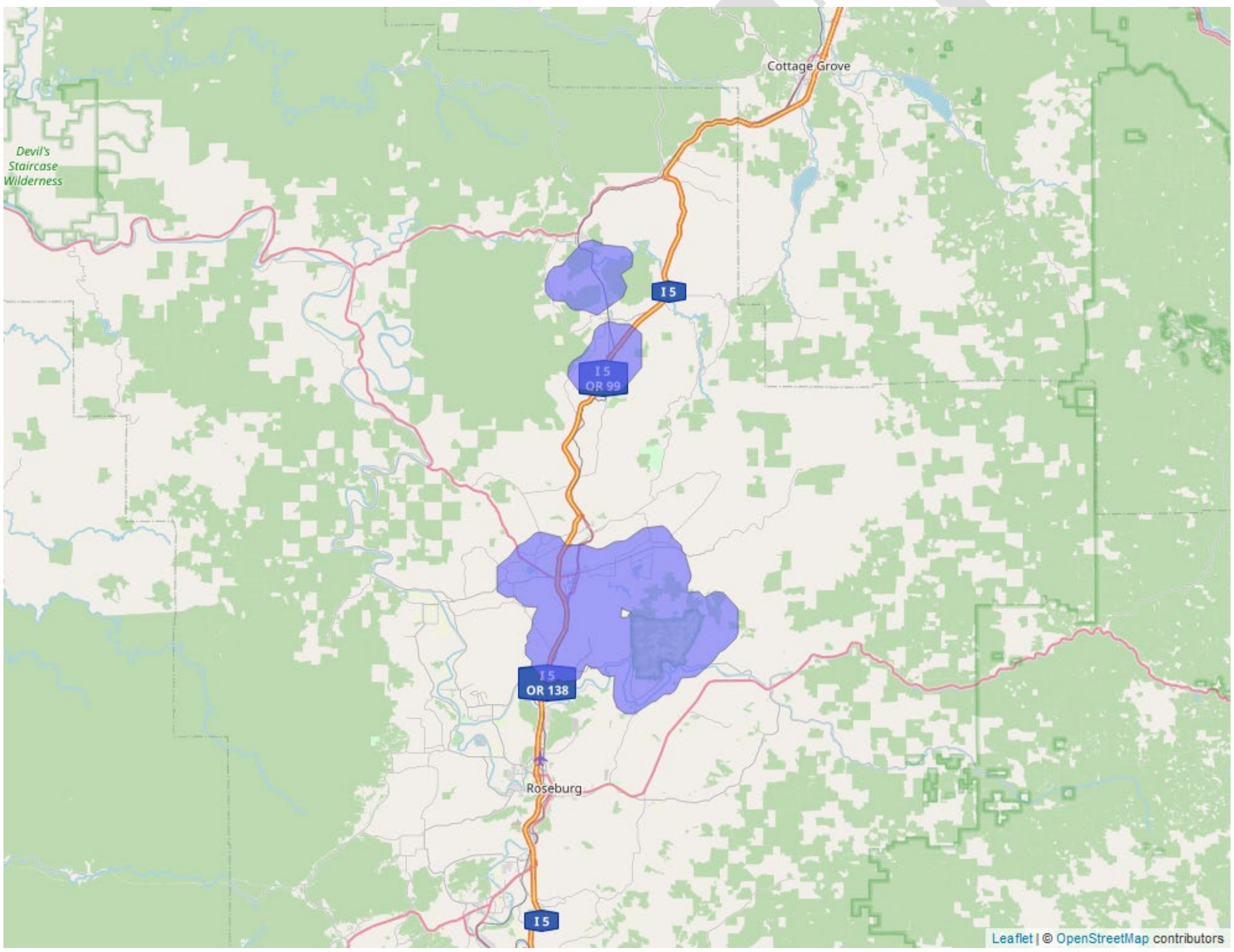

Figure 2. Range map of rough popcornflower (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2500.

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: Downlist to threatened

Most recently completed 5-Year Review: 4/14/2021

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: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Rough popcornflower is an herbaceous plant endemic to the Umpqua River basin in Douglas County, Oregon. It is closely associated with emergent wetlands within seasonally wet meadows or prairie and relatively level, open habitats formed from poor draining clayloam soils. It can be an annual or short-lived perennial that generally reaches sexual maturity and produces fruits in their first year. The plants generally germinate in the fall, bloom in late spring and early summer, produce seed beginning in late June, and then senesce between July and November. The species is capable of either self-fertilization or crossfertilization; however, generalist insect pollination appears to be the predominant vector enabling rough popcornflower reproduction. Rough popcornflower requires early seral habitat and is not associated with dense tree or shrub canopies. Periodic disturbance (e.g., flooding, fire, mowing, or grazing) is necessary to control nonnative and native plant competitors and maintain the early seral and open habitat conditions in which rough popcornflower populations thrive. Several insects are known to pollinate rough popcornflower: honey bees (*Apis* spp.); bumble bees (*Bombus* spp.); halictid and megachilid bees; Hemiptera (true bugs); bombyliid, syrphid, and tachinid flies; and red-shouldered ctenucha moths (*Ctenucha rubroscapus*). These insects require diverse native vegetation and minimal pesticide exposure. As of 2024, there are 18 known populations with over 800,000 plants. Its current distribution is analogous to its historical range.

Many conservation partners have made significant contributions to rough popcornflower through monitoring, collecting and sowing seeds, and restoring habitat. As of 2024, there were 12 reserves, 11 of which are protected and managed and one with 700,000 individuals is adequately managed but not protected. Current threats include habitat loss and fragmentation, effects of small populations (though this threat is less of a concern than when the species was listed), herbivory (e.g., deer, rodents, and livestock), non-native plant encroachment, high-intensity or frequency fires, and effects of climate change (USFWS 2024).

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 98.7% 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 99.7% overlap between the species' range and the agricultural footprint of simazine use sites (Table 5).

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

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	<0.1	6.4	6.4	<0.1	6.4	6.4
Grapes	<0.1	3.3	3.3	<0.1	3.3	3.3
Other Crops	0.4	35.3	35.7	0.4	35.3	35.7
Other Orchards	0.3	35.6	35.9	0.3	35.6	35.9
Vegetables and Ground Fruit	<0.1	11.4	11.4	<0.1	11.4	11.4
Christmas Trees	0.2	10.1	10.3	0.2	10.1	10.2
Total	**0.9**	**98.7**	**99.6**	**0.9**	**100**[7]	**100**

Usage

Past usage data indicate that up to 100% of the species' range[7] has been treated with simazine annually from agricultural uses, with 0.9% occurring on agricultural fields and the remainder resulting from off-site transport.

Additional Exposure Considerations

Though rough popcornflower does not preferentially occur in agricultural areas, individuals may occur in orchards where suitable habitat is found (e.g., emergent wetlands, seasonal depressions, or ditches with sufficient moisture, and marked by disturbance).

Exposure from Non-Agricultural Uses

Rough popcornflower occurs exclusively in the cool-season zone where we do not expect simazine will be used on turf. Therefore, we do not expect exposure to simazine from non-agricultural use for this species.

Conservation Measures

There are several conservation measures on the simazine label that apply to all uses and are intended to reduce spray drift to off-site areas, including a 15-foot spray drift buffer and ground use only restriction. Particularly relevant for aquatic species, three runoff mitigation points are also required for all simazine uses to reduce simazine concentrations in runoff. We expect these measures will reduce the concentration of simazine entering terrestrial and aquatic habitats by up to an order of magnitude (i.e., up to a 90% reduction in simazine residues in spray drift and runoff).

In addition to label measures, the rough popcornflower is in a Pesticide Use Limitation Area (PULA) that requires an additional three runoff mitigation points (i.e., six points total) for all uses except mixed greens in Washington, peaches and nectarines in California, and all strawberries. Because the species is not found in Washington or California, the strawberry exception is relevant for the rough popcornflower. We anticipate these additional runoff points will further reduce simazine residues in runoff by another order of magnitude (i.e., up to 99% reduction in simazine runoff residues in total).

[7] Total overlap is capped at 100%.

Effects of the Action: Toxicity

Direct Effects

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

Indirect Effects

We do not expect that simazine use will result in any indirect adverse effects to individual plants as we do not anticipate simazine is likely to reduce the abundance and availability of insect pollinators or seed disperser species necessary to support reproduction for the rough popcornflower.

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 simazine on agricultural fields annually. For the rough popcornflower, most of the overlap with simazine use results from off-site transport, with just 0.3% occurring in orchards, where the species may occur if suitable habitat exists. We expect simazine concentrations within these orchards to result in high levels of adverse effects to plants, where large impacts to growth can lead to mortality.

Overlap and usage data indicate that any individuals of the rough popcornflower not exposed to simazine on use sites will be exposed via off-site transport. However, with implementation of conservation measures on product labels, we expect that off-site transport of simazine will be minimized and that the extent of this exposure will be reduced. While we anticipate simazine use can impact the growth and survival of sensitive plant species in these areas, we anticipate that few individuals will be exposed to simazine off use sites and experience these adverse effects.

Though we expect high adverse effects to plants on simazine use sites, given that rough popcornflower do not use orchards preferentially and the low extent of these use sites within the range of rough popcornflower, we conclude the overall risk of adverse effects to the species is low.

Species Conclusion

Rough popcornflower is found in emergent wetlands and open habitats, including occasionally orchards where suitable habitat exists, in Oregon. There are 18 known populations across the range, many of which are protected. Many populations have over 100,000 individuals. Conservation partners have been instrumental in the species' conservation and monitoring. Primary threats include habitat loss and fragmentation, herbivory, non-native plant encroachment, high-intensity or frequency fires, and effects of climate change.

We do not expect exposure from non-agricultural uses because the species grows where cool-season grasses are used for turf, and simazine is not used on cool-season turf grasses. In addition, we do not expect rough popcornflower to occur on most agricultural use sites. Most of the overlap with simazine use results from off-site transport, with 0.3% in orchards, where the species may occur if suitable habitat exists. Even though we expect plants that are exposed directly to simazine on use sites will die or experience reduced growth, we expect these direct effects will occur to a very small number of individuals. We also expect a small number of individuals will be exposed and either die or experience reduced growth from off-site transport of simazine after accounting for conservation measures on product labels, including a six-point PULA for most uses. We do not expect any indirect adverse effects to this species through loss of pollinators.

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 rough popcornflower.

References

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Reclassification of the Rough Popcornflower From Endangered to Threatened With a Section 4(d) Rule. Proposed Rule. Federal Register 89(238):99809-99826.

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

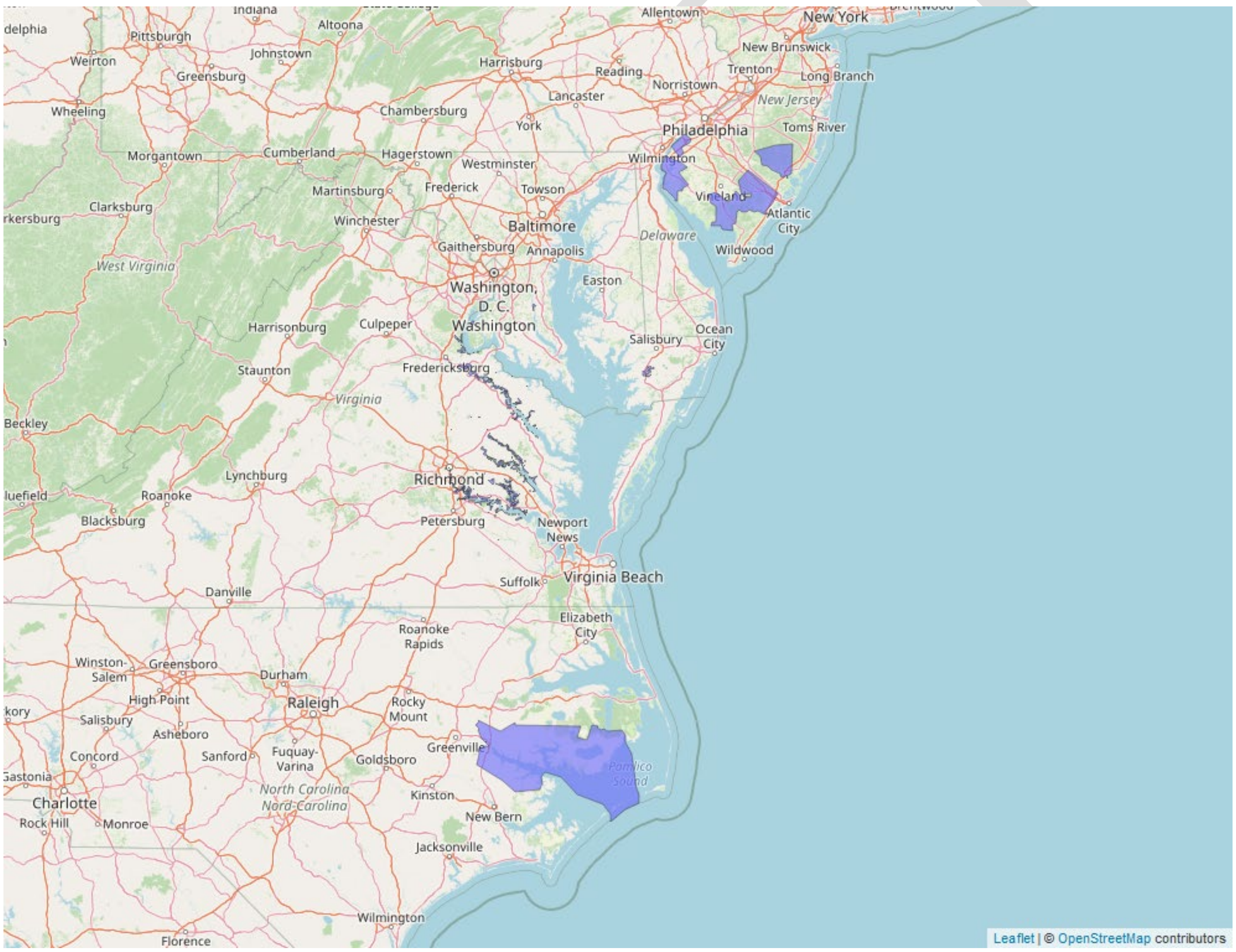

Figure 3. Range map of sensitive joint-vetch (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/855.

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 11.9% of the species' range overlaps with agricultural use sites and 69.3% 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 approximately 81.3% overlap between the species' range and the agricultural footprint of simazine use sites (Table 6).

Table 6. 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
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	10.5	37.4	47.9	8.3	33.2	41.5
Grapes	<0.1	0.7	0.7	<0.1	0.7	0.7
Other Crops	0.4	19.9	20.3	<0.1	<0.1	<0.1
Other Orchards	0.3	2.5	2.8	<0.1	0.5	0.5
Vegetables and Ground Fruit	0.7	9.2	10	0.1	2	2.1
Christmas Trees	<0.1	0.3	0.3	<0.1	0.3	0.3
Total	**11.9**	**69.3**	**81.3**	**8.5**	**36.2**	**44.6**

Usage

Past usage data indicate that up to 44.6% of the species' range has been treated with simazine annually from agricultural uses, with 8.5% occurring on agricultural fields and 36.2% 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 simazine 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 simazine, 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 simazine label that apply to all uses and are intended to reduce spray drift to off-site areas, including a 15-foot spray drift buffer and ground use only restriction. Particularly relevant for aquatic species, three runoff mitigation points are also required for all simazine uses to reduce simazine concentrations in runoff. We expect these measures will reduce the concentration of simazine entering terrestrial and aquatic habitats by up to an order of magnitude (i.e., up to a 90% reduction in simazine 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 uses except mixed greens in Washington, peaches and nectarines in California, and all strawberries. The species is not found in Washington or California, however, the strawberry exception is relevant for the sensitive joint-vetch. We anticipate these additional runoff points will further reduce simazine residues in runoff by another order of magnitude (i.e., up to 99% reduction in simazine runoff residues in total).

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data available for simazine in plant species, we expect that exposure of individuals that occur on simazine use sites will result in large impacts to growth, which, if severe enough, can result in mortality. While we anticipate simazine 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 simazine use will result in any indirect adverse effects to individual plants as we do not anticipate simazine is likely to reduce the abundance and availability of insect pollinators 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 simazine on agricultural fields annually. We expect simazine concentrations to result in high levels of adverse effects to plants on pesticide use sites, including reduced growth and potentially death. While 44.6% of the range overlaps with agricultural use sites of simazine, we expect simazine applications to occur on-field in just 8.5% 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 conditions are suitable. When exposed on simazine use sites, we expect simazine to result in large impacts to growth, which can lead to mortality. We expect that any individuals of the sensitive joint-vetch exposed to simazine via off-site transport will experience no more than low levels of effects to growth, including those at field edges.

Given the high overlap and usage of simazine 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 simazine use results from off-site transport (69.3%), 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 simazine on use sites will die or experience reduced growth, as no individuals are currently known to occur on croplands labeled for simazine 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 simazine 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 simazine 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: 3/16/2020; Wherever found; *States within the range:* IN, MO, VA

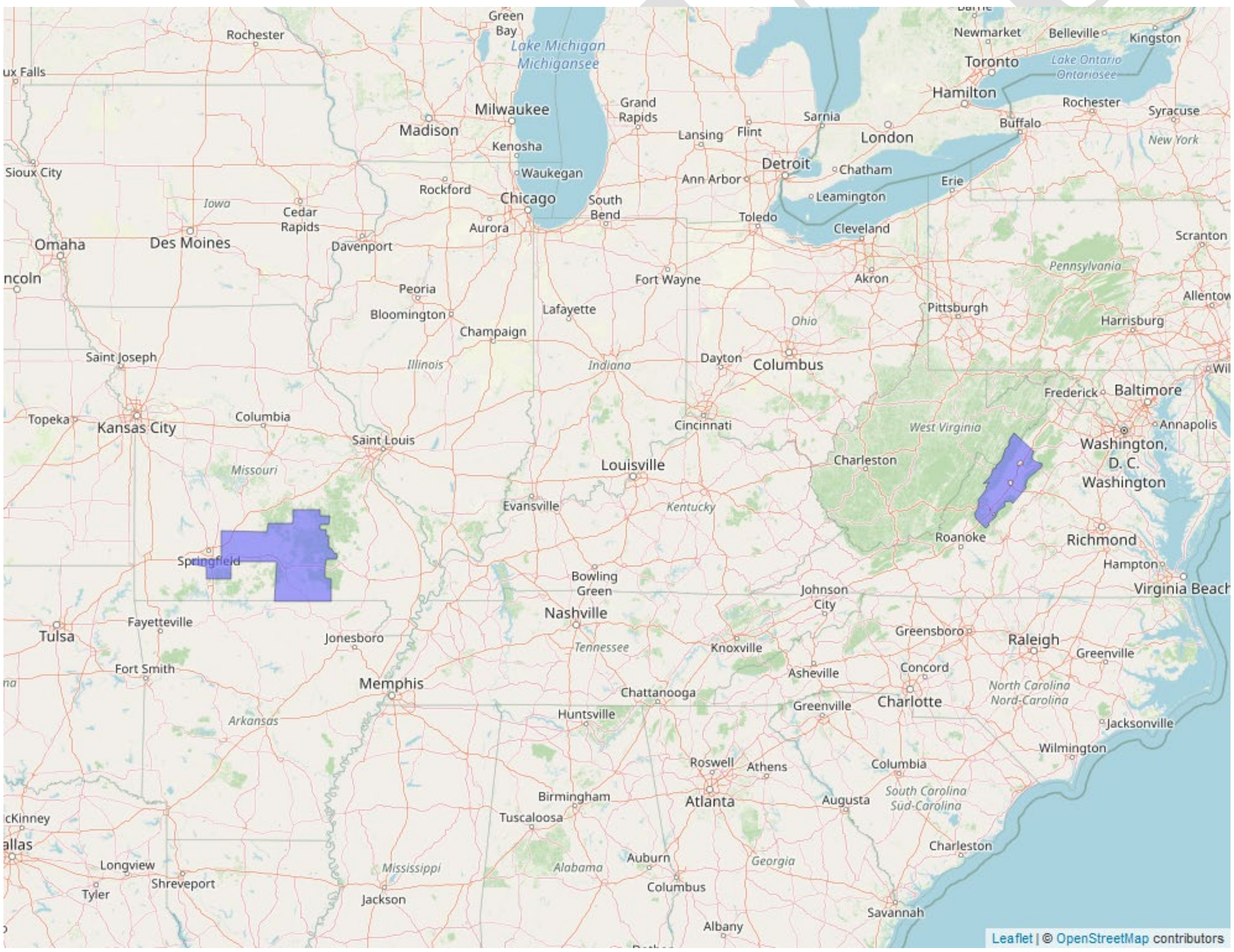

Figure 4. Range map of Virginia sneezeweed (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6297.

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 2.1% of the species' range overlaps with agricultural use sites and 37.1% 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 approximately 39.2% overlap between the species' range and the agricultural footprint of simazine use sites (Table 7).

Table 7. 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
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	1.9	21.6	23.5	1.9	21.6	23.5
Grapes	<0.1	0.2	0.3	<0.1	0.2	0.3
Other Crops	0.1	12.4	12.5	<0.1	<0.1	<0.1
Other Orchards	<0.1	2.3	2.3	<0.1	2.3	2.3
Vegetables and Ground Fruit	<0.1	0.8	0.8	<0.1	0.8	0.8

C-B4. Dicot and Non-Flowering Plants in Non-Flowing Wetlands: Integration and Synthesis Summaries

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Christmas Trees	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total	**2.1**	**37.1**	**39.2**	**2**	**24.7**	**26.6**

Usage

Past usage data indicate that up to 26.6% of the species' range has been treated with simazine annually from agricultural uses, with 2% occurring on agricultural fields and 24.7% resulting from off-site 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 simazine if used on turf. However, given our knowledge of simazine application to turf and nursery areas (see *Exposure to Non-Agricultural Uses*, above), we expect simazine 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 simazine label that apply to all uses and are intended to reduce spray drift to off-site areas, including a 15-foot spray drift buffer and ground use only restriction. Particularly relevant for aquatic species, three runoff mitigation points are also required for all simazine uses to reduce simazine concentrations in runoff. We expect these measures will reduce the concentration of simazine entering terrestrial and aquatic habitats by up to an order of magnitude (i.e., up to a 90% reduction in simazine residues in spray drift and runoff).

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data available for simazine in plant species, we expect that exposure of individuals that occur on simazine use sites will result in large impacts to growth, which, if severe enough, can result in mortality. While we anticipate simazine 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 simazine use will result in any indirect adverse effects to individual plants as we do not anticipate simazine is likely to reduce the abundance and availability of pollinators 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 simazine on agricultural fields annually. We do not have data to indicate that the Virginia sneezeweed occurs on agricultural use sites of simazine, though it is known to occur on the edge of farm ponds. However, given implementation of conservation measures to reduce spray drift and runoff, we expect that any individuals of the Virginia sneezeweed exposed to simazine 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 simazine to be a commonly used herbicide on residential turf, and as such, we expect simazine 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 simazine 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 simazine use on turf is limited. Virginia sneezeweed may occur on farm pond margins but does not occur on row crops where we expect simazine use may be high. Even though we expect plants that are exposed directly to simazine 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 simazine and either die or experience reduced growth. We do not expect indirect adverse effects through reductions in pollinators or seed dispersers from simazine 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 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.