Vulnerable Listed (Endangered and Threatened) Species Pilot Project: Proposed Mitigations, Implementation Plan, and Possible Expansion

Draft Plan

USEPA, Office of Pesticide Programs
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1. Introduction

Under section 7(a)(2) of the Endangered Species Act (ESA), EPA must ensure that any action authorized, funded, or carried out by the Agency (referred to as an "agency action") is not likely to jeopardize the continued existence of federally threated and endangered (listed) species or destroy or adversely modify designated critical habitat. In fulfilling the requirements of ESA section 7(a)(2), EPA must use the best scientific and commercial data available. When appropriate for the agency action, EPA consults with the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) (hereinafter the Services). As EPA works towards meeting its ESA obligations for FIFRA actions, EPA's ESA Workplan[1] identified several pilot projects to ensure that EPA adopts meaningful protections for listed species without waiting until the Agency has completed effects determinations (the precursor to consulting with the Services) or completed consultation with the Services. These pilots included the "EPA Vulnerable Species Pilot Project," to identify early mitigations for listed species that EPA has determined are particularly vulnerable to potential pesticide effects, and the "Federal Mitigation Pilot Project" (federal pilot), a collaboration between EPA, the Services, and the U.S. Department of Agriculture (USDA). This paper is focused on the Vulnerable Species Pilot. The federal pilot is briefly discussed in this introduction because it informed the proposed mitigations for the Vulnerable Species Pilot. During the public comment period, EPA welcomes stakeholders and the general public to review the proposal, provide input and propose suggested improvements.

Through EPA's Vulnerable Species Pilot, the Agency has identified an initial set of "pilot" listed species (**Section 2**) and is proposing pesticide mitigation measures designed to reduce the pilot species' exposures to conventional pesticides from non-residential outdoor uses of those pesticides (*e.g.,* agricultural, rights of way, mosquito adulticide; **Section 3**). Among listed species, the pilot species are particularly vulnerable to the potential effects of pesticides due to a combination of factors including a limited geographic range, small population size, and general susceptibility to environmental stressors where effects to even a small number of individuals may be highly impactful to populations or the entire species. As a result, these species face a higher likelihood of a future jeopardy or adverse modification determination for certain pesticide uses. To proactively address this situation, the Vulnerable Species Pilot focuses on implementing early protections (before EPA has made effects determinations or completed any necessary consultation) for multiple types of registered pesticides (*e.g.,* insecticides, herbicides) to protect the pilot species. By incorporating early measures to avoid and minimize exposure, EPA expects to reduce the likelihood of future jeopardy or adverse modification determinations and to minimize potential take[2] for the pilot species from the ongoing use of registered conventional pesticides.

For the Vulnerable Species Pilot, EPA is proposing mitigations to avoid pesticide exposures in areas where the pilot species are expected to occur and to minimize pesticide transport (via spray drift and runoff/erosion) from the application site to those areas, as applicable. Because the pilot species are some of the most vulnerable to potential effects, EPA designed the mitigation measures to be broad enough that the mitigations protect the pilot species while being implemented efficiently and effectively, and clear enough that pesticide users can understand and apply the use-limitation

[1] https://www.epa.gov/endangered-species/epas-workplan-and-progress-toward-better-protections-endangered-species#workplan

[2] Take means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." ESA § 3(19), 16 U.S.C. § 1532(19). Incidental take is a take "that result[s] from, but [is] not the purpose of, carrying out an otherwise lawful activity." *See* 50 C.F.R. § 402.02.

instructions. EPA expects that the proposed mitigations would apply to the majority of conventional outdoor-use pesticides[3]. To efficiently and effectively implement mitigations for these pilot species, EPA is proposing one set of mitigations for all conventional outdoor-use pesticides, regardless of their differences in exposure or potential effects. EPA considered applying more complex combinations of mitigations to different pesticides but chose a simpler approach in the interest of improving EPA's confidence that implementing the mitigations could potentially reduce the likelihood of future jeopardy or adverse modification determinations for the majority of conventional pesticide applications, achieving implementation more expeditiously, and having simpler and consistent mitigation instructions for all users.

Because the pilot species have relatively small ranges, EPA intends to implement the mitigations for the pilot species through geographic-specific restrictions located in Endangered Species Protection Bulletins that are accessed through the Bulletins Live! Two (BLT) website, which are made enforceable through directions to access and follow them on pesticide labeling.[4] Where EPA identifies mitigations specific to certain geographic areas, it uses Geographic Information System (GIS) mapping information typically in combination with species location information to delineate pesticide use limitation areas (PULAs). PULAs are the spatial files in BLT that allow users to determine if their intended pesticide application falls within a location where additional use restrictions or mitigations are necessary to protect listed species or their designated critical habitat. Because EPA is proposing to use BLT, and the ranges of these species are relatively small, the area potentially affected is spatially limited.

Accompanying the release of this white paper in the public docket, EPA is also releasing a series of StoryMaps[5] that offer the unique ability to convey geospatial information about the location of the pilot species, the mitigations EPA is proposing, where specific agricultural commodities are grown, monitoring data, habitat descriptions, and other visual information. Users can zoom in on the StoryMaps to view specific locations that may be of interest to them (*e.g.,* where pesticide use restrictions may apply through PULAs for the pilot species). The StoryMaps help to convey some of the complex information described in this white paper in an easy-to-understand manner, offering a greater sense of the place-based mitigations to protect the pilot species from pesticides. Any mitigations and associated geographic locations discussed in the StoryMaps are for informational purposes only and are not changes to pesticide use requirements until they are incorporated into bulletins and the relevant labels reference the BLT website.

Following the public comment period on this draft plan, EPA will work to consider public comments and determine whether any mitigations should be revised, or additional measures are necessary. EPA expects this part of the pilot to be completed by December 2023. In 2024, EPA will consider whether the pilot can be expanded to other selected vulnerable listed species.

Through the federal pilot,[6] EPA, the Services, and USDA began to develop approaches for identifying mitigation to minimize the effects of pesticides on a dozen listed species. One of the main goals of the federal pilot was for these federal agencies to gain a common understanding of how to reduce exposures to listed species from pesticides. Collaborating agencies made substantial progress discussing

[3] Including non-residential outdoor uses of conventional pesticides, except for rodenticides and avicides.
[4] https://www.epa.gov/endangered-species/bulletins-live-two-view-bulletins
[5] https://storymaps.arcgis.com/collections/896d140363174c9d8ee78e4c471bd7fd
[6] https://www.epa.gov/endangered-species/implementing-epas-workplan-protect-endangered-and-threatened-species-pesticides

practical, flexible, feasible, and effective measures that are expected to reduce pesticide exposure to the federal pilot species. EPA applied the lessons learned in the federal pilot collaboration as a starting point to developing the mitigations proposed below for the Vulnerable Species Pilot (**Section 4**) and evaluating their effectiveness (**Section 5**).

Another primary goal of the Vulnerable Species Pilot is to help increase the efficiency of the pesticide consultation process with FWS because FWS has authority over the listed species in the Vulnerable Species Pilot. Because the vulnerable pilot species are all under the jurisdiction of the FWS, EPA has been discussing the proposed mitigations with FWS during the development of this proposal. EPA intends to continue to work with the FWS before issuing the final mitigations and may incorporate additional species-specific information. EPA and FWS may develop a pesticide programmatic consultation, or other streamlining process, that will include the evaluation of pesticide exposure to pilot species using the Vulnerable Species Pilot. By implementing these earlier mitigations, EPA expects that a programmatic or other consultation could be more efficient and potentially allow FWS to make final determinations concluding that the actions are not likely to jeopardize the pilot species or adversely modify their designated critical habitats. In the meantime, EPA is proposing to start implementing the Vulnerable Species Pilot once it finalizes the proposed mitigations.

Concurrent with the timeline for the Vulnerable Species Pilot, the Office of Pesticide Programs (OPP) is also developing several other early mitigation efforts to reduce exposure to non-target wildlife, such as the Herbicide Strategy and the FIFRA Interim Ecological Mitigation Measures. Where possible, OPP has sought to harmonize the mitigation measures across these ongoing projects to reduce exposure to listed species from run-off, erosion and spray drift. In some situations, however, there may be inconsistencies between the proposed mitigations described in this draft plan and the upcoming publications for other strategies. OPP may not be able to resolve all inconsistencies between the different efforts due to differences in timing and goals of these efforts as well as the evolving nature of EPA's ESA strategies. However, OPP will more comprehensively harmonize the mitigation menu options and approaches across the various ongoing efforts, to the extent possible, as the Vulnerable Species Pilot evolves.

This document describes EPA's proposal for the Vulnerable Species Pilot. The sections below describe the species included in the pilot, the general approach to drafting the mitigations, the draft mitigations (avoidance and minimization), and where they would apply to the pilot species. This document also describes the proposed mitigations effectiveness in reducing exposure to the pilot species using a subset of pesticides that have been observed in monitoring data relevant to some of the pilot species. Also, this document describes EPA's proposed implementation plan for the Vulnerable Species Pilot. The implementation plan discusses development of bulletins and EPA's proposal on how to incorporate BLT language on labels through different FIFRA actions. The implementation plan also describes EPA's thoughts on training and outreach to encourage voluntary adoption of protections. Finally, this document includes a discussion of how the Vulnerable Species Pilot effort may be expanded to identify and implement mitigations for other vulnerable species.

2. Pilot species

EPA identified the 27 pilot species listed below using documentation (*e.g.,* 5-year reviews, biological opinions) from FWS and NMFS and spatial data for species' ranges. All of the selected pilot species are under the authority of FWS and are located within the continental United States. Although EPA considered the NMFS species, EPA decided they did not meet the criteria for the pilot species (mainly because they have large ranges). For the species that EPA identified for this pilot, FWS concluded that they have high or medium overall vulnerability (FWS 2022[7,8]); they have limited ranges (**Figure 1**); and pesticides have already been identified as a stressor to the species (*e.g.,* in status of species assessments, biological opinions or EPA biological evaluations). Although the pilot species generally have small range sizes, many of the locations of their ranges overlap with ranges of other listed species not included in the pilot. Therefore, protections for the pilot species would protect additional listed species where they co-occur with the pilot species. **Table 1** includes a summary of the pilot vulnerable species. The 27 pilot species, and their designated critical habitat where relevant, are located throughout the continental United States, in all of the FWS regions, except Region 7 (which covers Alaska). Four of these species have designated critical habitats. The StoryMaps developed for the pilot species include additional information on the pilot species, including pictures, interactive maps, life history, and discussions of pesticides as stressors to these species.

EPA's list of pilot species includes seven plant species located in the Lake Wales Ridge area of Florida. Those species include Avon Park harebells, Garrett's mint, wireweed, scrub blazingstar, short-leaved rosemary, scrub mint and Florida ziziphus. In the FWS recovery plan amendment for the Lake Wales Ridge plants[9], FWS includes five additional species: Highland scrub hypericum (*Hypericum cumulicola*), snakeroot (*Eryngium cuneifolium*), Carter's mustard (*Warea carteri*), sandlace (*Polygonella myriophylla*) and Lewton's polygala (*Polygala lewtonii*). Therefore, EPA expects that the mitigations proposed for the Lake Wales Ridge plants will reduce exposure for all 12 listed plants in this area, not just the pilot species.

[7] FWS considered various factors when they determined the overall vulnerability of a species, including: Population size and trajectory, distribution, and other factors relevant to the environmental baseline.
[8] USFWS 2022. Biological and Conference Opinion on the Registration of Malathion Pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act. U.S. Fish and Wildlife Service Ecological Services Program. February 28, 2022. Available at https://www.epa.gov/endangered-species/biological-opinions-available-public-comment-and-links-final-opinions.
[9] https://ecos.fws.gov/docs/recovery_plan/Lake%20Wales%20Ridge%20Plants%20Recovery%20Plan%20Amendment_1.pdf

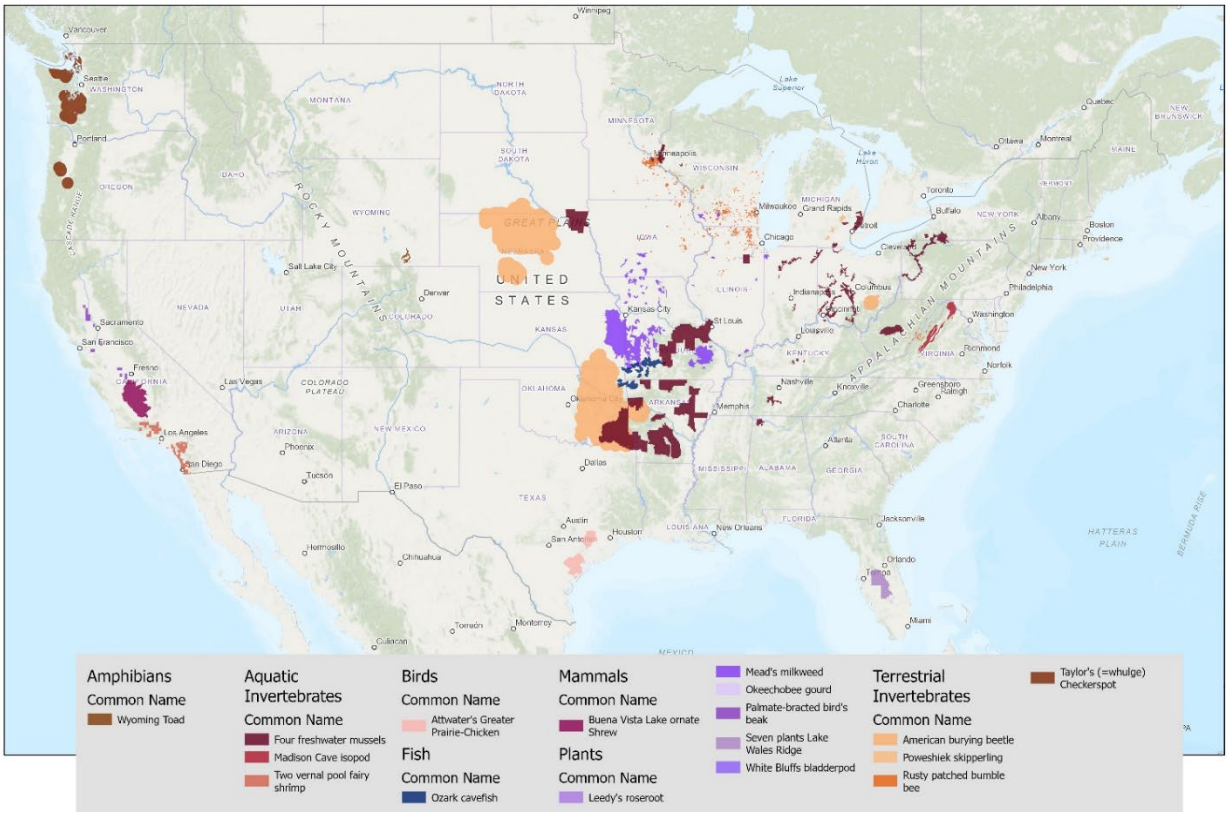

Figure 1. Locations of ranges and designated critical habitats (if available) of 27 vulnerable pilot species.

Table 1. Listed species included in vulnerable species pilot

Species (common name)	Species (Scientific name)	Entity ID(s)	Taxon	Status	Overall vulnerability (USFWS 2022)	FWS region	Designated Critical habitat?
Lake Wales Ridge plants (Avon Park harebells, Garrett's mint, wireweed, scrub blazingstar, short-leaved rosemary, scrub mint, Florida ziziphus)	*Crotalaria avonensis*, *Dicerandra christmanii*, *Polygonella basiramea*, *Liatris ohlingerae*, *Conradina brevifolia*, *Dicerandra frutescens*, *Ziziphus celata*	1235, 1046, 804, 752, 675, 695, 1234	Plant	Endangered	High	4	No
Mead's milkweed	*Asclepias meadii*	636	Plant	Threatened	Medium	3	No
Leedy's roseroot	*Rhodiola integrifolia ssp. leedyi*	1150	Plant	Threatened	High	3	No
Okeechobee gourd	*Cucurbita okeechobeensis ssp. okeechobeensis*	914	Plant	Endangered	High	4	No
Palmate-bracted bird's beak	*Cordylanthus palmatus*	679	Plant	Endangered	High	8	No
White bluffs bladderpod	*Physaria douglasii ssp. tuplashensis*	4565	Plant	Threatened	High	1	Yes
Ozark cavefish	*Amblyopsis rosae*	260	Fish	Threatened	Medium	4	No
Madison cave isopod	*Antrolana lira*	476	Invert	Threatened	High	5	No
Riverside and San Diego fairy shrimp	*Streptocephalus woottoni and Branchinecta sandiegonensis*	492 and 495	Invert	Endangered	High	8	Yes
Ouachita rock pocketbook	*Arkansia wheeleri*	343	Mussel	Endangered	Medium	2	No
Rayed bean	*Villosa fabalis*	6062	Mussel	Endangered	High	3	No
Scaleshell mussel	*Leptodea leptodon*	345	Mussel	Endangered	High	3	No
Winged mapleleaf	*Quadrula fragosa*	328	Mussel	Endangered	High	3	No
American burying beetle	*Nicrophorus americanus*	440	Invert	Threatened	Medium	2	No
Poweshiek skipperling	*Oarisma poweshiek*	10147	Invert	Endangered	High	3	Yes
Rusty patched bumble bee	*Bombus affinis*	10383	Invert	Endangered	High	3	No
Taylor's checkerspot	*Euphydryas editha taylori*	7495	Invert	Endangered	High	1	Yes
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	83	Bird	Endangered	High	2	No
Buena Vista Lake ornate shrew	*Sorex ornatus relictus*	58	Mammal	Endangered	High	8	Yes
Wyoming toad	*Bufo hemiophrys baxteri*	202	Amphibian	Endangered	High	6	No

3. Approach to developing proposed mitigations for pilot species

EPA identified mitigations that are intended to apply broadly to conventional pesticide active ingredients that are applied outdoors. EPA designed the mitigations to be as general as possible so that they apply to groups of pesticides and species, rather than only certain pesticides or species. Mitigations focused on avoidance and minimization measures, specifically the predominant off-site transport routes for most pesticides (*i.e.,* spray drift and runoff/erosion). Avoidance was based on the current location and habitat information available for each of the pilot species. EPA is proposing to allow an exception to avoidance of applications to the habitat of the listed species when applicators get input and approval from local FWS experts. This would allow for applications to manage the habitats of the pilot species (*e.g.,* invasive species control) or under conditions or timing when effects to the species are not a concern to the species experts. When deciding upon spray drift and runoff/erosion mitigations, EPA first considered the life history of the species (*i.e.,* habitat) and potential overlaps with pesticide exposure areas to identify relevant transport routes. EPA also considered the life cycles of the species and their dependencies on other species (*e.g.,* insect pollinators) to identify any relevant timing restrictions. When identifying specific spray drift and runoff/erosion mitigations, EPA used existing mitigation approaches that are available to pesticide users. The avoidance and minimization measures proposed for the pilot species are intended to reduce the likelihood of future jeopardy/adverse modification determinations and to minimize potential take for the pilot species from the ongoing use of registered conventional pesticides. Although offsets (compensatory mitigation) are potentially useful for conserving the pilot species, EPA is not currently proposing offsets for the Vulnerable Species Pilot. This is because EPA is still considering when and how offsets can apply to pesticide actions and will continue discussions on this topic with the Services during consultations and with stakeholders, including to consider stakeholder proposals for offsets. EPA expects to work with FWS to identify species that may be particularly amenable to offsets, especially if offsets could substantially improve the conservation outcome for the species. Therefore, EPA's proposal for the Vulnerable Species Pilot relies upon avoidance and minimization.

EPA first developed mitigations for the Poweshiek skipperling. For this species, EPA identified avoidance mitigations to occur in the skipperling's designated critical habitat and spray drift and runoff/erosion mitigations to minimize exposure from application sites outside of the avoidance area. Then, EPA considered whether the mitigations could be applied directly to other terrestrial insects within the pilot (*i.e.,* rusty patched bumble bee and Taylor's checkerspot). Because of the similarity of the habitats (all three species inhabit grassland areas) and life histories of these three insect species, the pesticide exposure routes are similar (*i.e.,* all three may be exposed to pesticides from direct applications on their habitats or spray drift and runoff/erosion transport from adjacent use sites). EPA also chose not to apply timing restrictions for these three species because different life stages are expected to be present in their habitats throughout most of the year when pesticides may be applied. Therefore, the same runoff/erosion and drift mitigations are proposed for all three terrestrial insect species included in the pilot. What differs among these species is the locations where the proposed mitigations apply, which are based on the ranges and designated critical habitats (if applicable) of the three species.

After drafting mitigations for these three species, EPA considered the life history of the American burying beetle. When spray drift mitigations are needed for this species, EPA concluded that the same mitigations applied to the other three pilot insect species discussed in the previous paragraph would apply. Where there is a difference for the American burying beetle is due to some of its life history

considerations. Based on the life cycle of this species, there are times of the year when pesticide exposure from spray drift is not of concern. Therefore, there are timing considerations applied to the mitigations for the American burying beetle that are different than for the Poweshiek skipperling, rusty patched bumble bee and the Taylor's checkerspot. EPA also concluded that runoff/erosion is not a relevant exposure pathway for the American Burying Beetle. In addition, all four species have different geographic locations where the mitigations are proposed (*i.e.,* different PULAs).

After drafting mitigations for the terrestrial insects, EPA considered whether the same mitigations would apply to other terrestrial species in this pilot, including plants and animals. When spray drift and runoff/erosion transport apply to a species, EPA is proposing the same mitigations to address these routes of exposure. For some species (*e.g.,* White Bluffs bladderpod), EPA considered the location of the species relative to agricultural uses and concluded that runoff/erosion is not a likely relevant transport route. Therefore, EPA is proposing only drift mitigations for the White Bluffs bladderpod. For some species (*e.g.,* Leedy's roseroot), EPA is proposing to limit herbicide and insecticide mitigations to times when the vegetative part of the plant is above ground and when the plant is flowering, respectively. For many of the other terrestrial species, EPA expects that the proposed PULA will include some areas that do not necessarily include the habitat of the species. In those cases, EPA is proposing to apply the avoidance areas to the habitat of the species. When deciding whether to apply avoidance areas to the range (and designated critical habitat if applicable) or to use habitat descriptions, EPA considered the geographic extent of the species range and whether it likely includes other areas where the species is not likely to occur.

EPA also considered the pilot species that inhabit aquatic areas (*e.g.,* Riverside and San Diego fairy shrimp, rayed bean) and wetlands (*e.g.,* Buena Vista Lake ornate shrew). For all of the aquatic species, habitat descriptions are used to identify avoidance areas because the ranges include watersheds, not just aquatic habitats. EPA concluded that the same drift and runoff/erosion mitigations identified above for the Poweshiek skipperling would apply to these species, with some exceptions. For the cave species (Ozark cavefish and Madison Cave isopod), EPA is proposing different runoff/erosion mitigations in proximity of sink holes. Therefore, for many aquatic species, the baseline set of spray drift and runoff/erosion mitigations applied to the Poweshiek skipperling would apply; however, there are some changes to the mitigations for species that inhabit caves that could receive pesticides through sink holes.

EPA used an iterative process to develop the proposed the mitigations by considering the species effects and exposures from representative pesticides. EPA drafted an initial set of mitigations and then evaluated and revised them based on a representative set of pesticides that have been detected in monitoring data from locations relevant to many of the pilot species. EPA used the environmental fate and toxicity information for these pesticides to estimate exposures to general habitats relevant to the pilot species. EPA used standard methods and models to develop conservative analyses of the potential effects of these pesticides on the pilot species and their prey, pollination, habitat and/or dispersal. After EPA evaluated these pesticide-specific examples, EPA revisited and revised the mitigations as appropriate. For pesticides chosen for the evaluation, EPA used data from previous assessments and relied on previously modeled Environmental Exposure Concentrations (EECs) for both aquatic and terrestrial environments, including associated use patterns and relevant application rates. Exposures were compared to available toxicity data representing potential effects to the pilot species or taxa upon which the species depend for prey, pollination, habitat and/or dispersal. If exposures exceeded the toxicity endpoints, EPA considered the order of magnitude difference in exposures and toxicity endpoint. EPA then considered the anticipated order of magnitude reduction of the proposed

mitigations. In cases where the order of magnitude reductions anticipated by the mitigations were equal to or exceeded the difference in exposure and toxicity, EPA did not adjust the mitigations. In cases where the order of magnitude reductions anticipated by the mitigations were lower than the difference in exposure and toxicity, EPA made adjustments to the mitigations. EPA relied upon this qualitative approach (order of magnitude difference in exposure and effects) because it used a deterministic, conservative approach. Neither the EECs nor the effectiveness of mitigations are precise. Exposures and effectiveness of the proposed mitigations may vary because of weather, use site characteristics, habitats, equipment, and numerous other factors.

Section 4 includes EPA's proposed mitigations after the iterative process of drafting and evaluating was completed. **Section 5** includes the discussion of the relative difference in exposure and toxicity data and compares them to the effectiveness of the proposed mitigations. For spray drift mitigations, EPA relied upon existing models (AgDRIFT) and empirical studies to identify mitigation options for different application methods. For runoff/erosion, a weight-of-evidence approach was used to develop the menu of mitigation measures. Lines of evidence included open literature data and reviews, Pesticide in Water Calculator (PWC) modeling, and the results of a mitigation workshop titled *Mitigating the Risks of Plant Protection Products in the Environment. Proceedings of the MAgPIE Workshop.* The proposed combination of drift and runoff/erosion mitigations may reduce exposures by orders of magnitude. Available information on the effectiveness of mitigation practices is provided in the *Draft Technical Support for Runoff, Erosion, and Spray Drift Mitigation Practices to Protect Non-Target Plants and Wildlife* (referred to as "technical document"). This technical document outlines many of the drift-reduction strategies and is intended as a resource for drift mitigations as well as runoff/erosion measures. This accompanying document provides details on determining the efficacy to reduce movement off field, and full description of each mitigation measure. It should be noted that through the available public comment period, EPA is looking for feedback on the mitigation menu practices and if there are other practices that should be considered. EPA's intent is to build upon work previous completed to develop the mitigation menu and allow space for additional mitigation options that become available in the future.

4. Proposed Mitigations for Pilot Species

EPA is proposing to implement the mitigations for the pilot species through geographic-specific restrictions located in Bulletins that are accessed through the BLT website. Bulletins include two components: the pesticide use limitation area (PULA) and the pesticide use restrictions. PULAs are the spatial files in BLT that allow users to determine if their intended pesticide application falls within an area that requires mitigation. The pesticide use restrictions in BLT (as referenced on pesticide labeling) describe the avoidance and minimization measures that a user must follow. This section describes EPA's proposed PULAs for the pilot species (**Section 4.1**) and proposed pesticide use restrictions (**Section 4.2**). The PULAs are described first because they may influence the specific type of pesticide use limitation language provided in the bulletin.

For the vulnerable species included in this pilot, the proposed PULAs and pesticide use limitations would apply to all actions for non-residential outdoor uses of conventional pesticides after they are finalized, except for rodenticides and avicides. EPA expects these proposed limitations to apply to the majority of agricultural and non-agricultural use sites (*e.g.,* rights of way, nursery/ornamentals, forestry, industrial, pasture/rangeland, golf courses, athletic fields, aquatic applications, including mosquito adulticide and

larvicide applications). For spray drift mitigations, EPA expects the proposed mitigations would apply to aerial and ground broadcast sprays. EPA expects that runoff/erosion mitigations would be applicable to broadcast applications of liquid or granular formulations. EPA acknowledges that this is a broad approach with many strict mitigations, but it is important to note that this pilot project is applied to a relatively small area and is intended to protect the most vulnerable species. These mitigations are not intended to be applicable for small scale spot-treatment applications, indoor uses, or applications in residential areas. Rodenticides are not included here because EPA is developing a separate rodenticide strategy for protecting listed species and designated critical habitats from the use of rodenticides. After the release of the rodenticide strategy, EPA is planning on adapting the rodenticide strategy approach to address avicide exposure to listed species.

4.1. Pesticide use limitation areas (PULAs)

PULAs are generally defined by using geographic information that can be communicated to the pesticide user. In the context of listed species, this geographic information is typically listed species locations such as range and any designated critical habitat. For each vulnerable species in the pilot, EPA is using species-specific location information (species range and designated critical habitat, if applicable) provided by FWS to establish each pilot species PULA. The proposed PULAs for the pilot species are described in **Table 2**. This table also characterizes the maximum spatial extent of the proposed PULAs. As shown in **Figure 1**, some of the proposed PULAs overlap.

In establishing PULAs, EPA's default is to use the species' ranges to identify avoidance and minimization areas. Ranges are represented by the most current information available in the FWS Environmental Conservation Online System (ECOS). For the pilot species with designated critical habitats, EPA plans to include the designated critical habitats in the PULAs. Designated critical habitats are also represented by the most current information available in the FWS ECOS. For the consultation with FWS on malathion (USFWS 2022[10]), species experts at FWS provided alternative, more refined areas where protections are needed. For the pilot species, PULAs are available for: Lake Wales Ridge plant species and Attwater's prairie chicken. EPA is proposing to use these two PULAs from the malathion Biological Opinion (BiOp) because they incorporate species expert feedback on areas where these species need protections, which also allows for less limitations to pesticide applicators in other areas within the ranges of these species. For the other species, EPA has reached out to FWS for species expert feedback on the proposed PULAs. EPA will consider revising the proposed PULAs for the other pilot species based on FWS species expert feedback.

[10] USFWS. 2022. Biological and Conference Opinion on the Registration of **Malathion** Pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act. U.S. Fish and Wildlife Service.

Table 2. Descriptions of Pesticide Use Limitation Areas (PULAs) for Pilot Species.

Species (Common Name)	State(s) Where PULAs are Located	Avoidance PULA Extent	Minimization PULA Extent	Minimization Mitigations	Max PULA Extent (Acres)	StoryMap Link
Mitigation Area: Delineated location, geographically explicit						
Leedy's roseroot	MN, NY	Part of range (excluding area in South Dakota)	2600 ft extension area around avoidance PULA	Drift, Run-off, Species specific[1]	Less than 50,000	Link
Okeechobee gourd	FL	Range	2600 ft extension area around avoidance PULA	Drift, Run-off, Species specific[1]	Less than 200,000	Link
Poweshiek skipperling	MI, WI, MN	Designated critical habitat	2600 ft extension area around the avoidance PULA	Drift, Run-off	Less than 50,000	Link
Rusty patched bumble bee	IL, IN, IA, ME, MA, MN, OH, VI, WV, WI	Range	2600 ft extension area around the avoidance PULA	Drift, Run-off, Species specific[1]	Greater than 1,000,000	Link
Taylor's checkerspot	OR, WI	Range, which includes designated critical habitat	2600 ft extension area around the avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
White Bluffs bladderpod	WA	Range, which includes designated critical habitat	2600 ft extension area around the avoidance PULA	Drift, Species specific[1]	Less than 10,000	Link
Mitigation Area: Known habitat, not delineated (see Table 3 for habitat description)						
American burying beetle	AR, KS, MA, NE, OH, OK, RI, SD, TX	Range	Same as avoidance PULA	Drift, Species specific[1]	Greater than 1,000,000	Link
Attwater's prairie chicken	TX	PULA from Malathion BiOp	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
Buena Vista Lake ornate shrew	CA	Range, which is inclusive of designated critical habitat	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link

Species (Common Name)	State(s) Where PULAs are Located	Avoidance PULA Extent	Minimization PULA Extent	Minimization Mitigations	Max PULA Extent (Acres)	StoryMap Link
Lake Wales Ridge plants	FL	PULA from Malathion BiOp	2400 ft extension area around the avoidance PULA	Drift, Run-off, Species specific[1]	Greater than 1,000,000	Link
Madison Cave isopod	VA, WV	Range	Same as avoidance PULA	Drift, Run-off, Species specific[1]	Greater than 1,000,000	Link
Mead's milkweed	IL, IN, IA, KS, MO, WI	Range	Same as avoidance PULA	Drift, Run-off, Species specific[1]	Greater than 1,000,000	Link
Ouachita rock pocketbook	AR, OK	Range	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
Ozark cavefish	AR, KS, MO, OK	Range	Same as avoidance PULA	Drift, Run-off, Species specific[1]	Greater than 1,000,000	Link
Palmate-bracted bird's beak	CA	Range	Same as avoidance PULA	Drift, Run-off, Species specific[1]	Less than 1,000,000	Link
Rayed bean	IN, KY, MI, NY, OH, PA, TN, WV	Range	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
Riverside and San Diego fairy shrimp	CA	Range	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
Scaleshell mussel	AR, IL, MO, NE, OK, SD	Range	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
Winged mapleleaf	AR, MN, MO, OK, TN, WI	Range	Same as avoidance PULA	Drift, Run-off	Greater than 1,000,000	Link
Wyoming toad	WY	Range	Same as avoidance PULA	Drift, Run-off	Less than 200,000	Link

[1] There is a species-specific minimization mitigation for example timing restriction.

For the pilot species, there are two types of mitigations that need PULAs. The first type of mitigation is avoidance areas where the proposed mitigations involve prohibiting pesticide applications in the areas where the species is most likely to occur based on specific and refined information from the FWS (*e.g.,* spatially defined habitat or habitat descriptions). The second type of mitigation is minimization of exposures from applications within areas that could result in off-site transport (through spray drift or runoff/erosion) to the areas where the species occurs.

EPA is proposing two approaches for defining where mitigations would be applied. The first approach is when the species area is very specific and assumed to represent the areas where the species habitat occurs (specifically*:* Poweshiek skipperling, Rusty patched bumble bee, Taylor's checkerspot, White bluffs bladderpod, Leedy's roseroot, and Okeechobee gourd). For these six species, EPA is proposing separate PULAs for avoidance and minimization areas. To show an example, **Figure 2** depicts part of the PULAs proposed for the Poweshiek skipperling, including the avoidance and minimization areas. The second approach is when range likely includes areas that are not habitat for the species (all of the other pilot species, *e.g.,* Attwater's prairie chicken). In this case, EPA is proposing one PULA for both avoidance and minimization, where the different areas are defined by the habitat description of the species (**Table 3**). **Figure 3** depicts the proposed PULA for the Attwater's prairie chicken, which would include areas subject to both avoidance and minimization. When the PULA includes both avoidance and minimization, avoidance would be relevant to the species habitat, based on a description (*e.g.,* for Attwater's prairie chicken, avoidance would apply to "grasslands"). Minimization would apply to all areas that do not match the habitat description for the species habitat. For the Attwater's prairie chicken, the range covers large sections of multiple counties that are known to include several different types of non-grassland habitat (*e.g.,* agricultural areas) where the minimization language would apply.

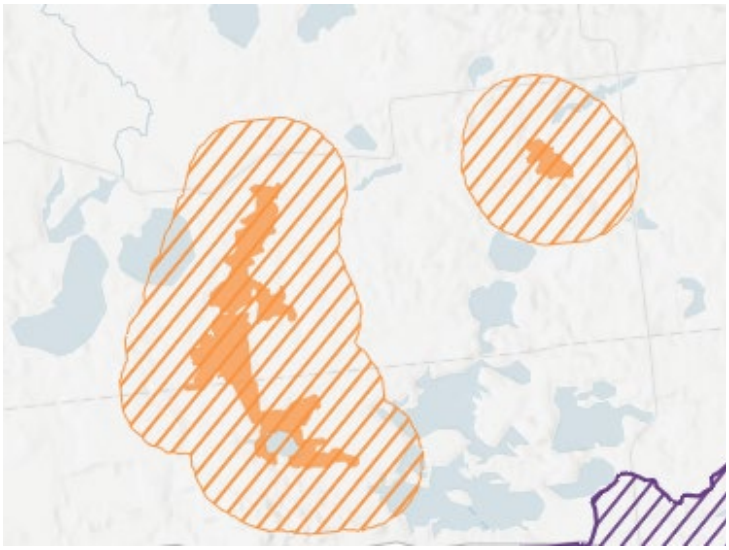

Figure 2. Subset of Poweshiek skipperling PULAs that depicts separate avoidance (solid orange) and minimization (orange hatch) areas.

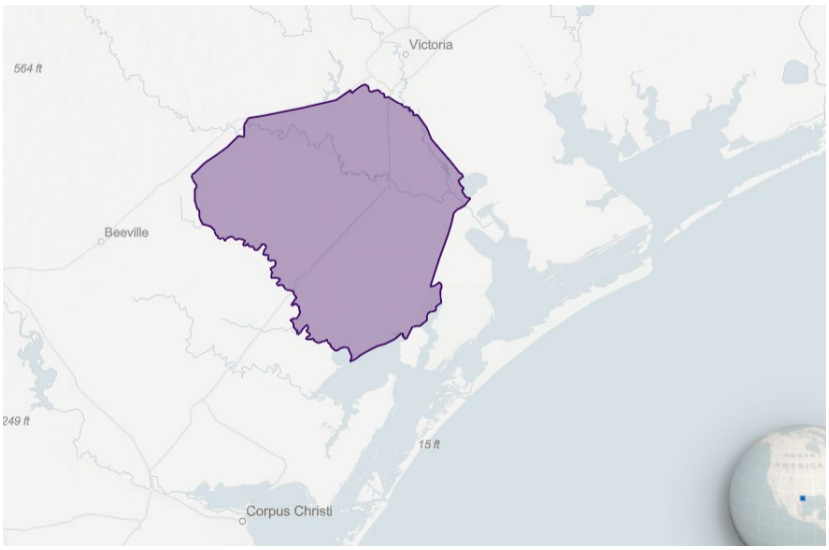

Figure 3. Subset of Attwater's prairie chicken PULA. Purple solid area represents avoidance and minimization areas.

Table 3 includes short descriptions of the habitats that are proposed for inclusion in the bulletins for the species where the PULA includes both avoidance and minimization areas. EPA used "plain language" for the short habitat descriptions so that these descriptions can be easily understood. This table also includes more detailed habitat descriptions provided by FWS (some species habitat descriptions are not yet available). To increase understanding of these habitats, these descriptions may be provided to users along with pictures (*e.g.,* pictures can be included within the vulnerable species StoryMaps).

Table 3. Habitat Descriptions (submitted by FWS experts) Used in Draft Pesticide Use Limitations for Avoidance and Minimization Measures.

Species (common name)	Short Habitat description	Detailed habitat description[1]
Lake Wales Ridge plants	Florida scrub and sandhills	Scrub and sandhill habitats are generally open habitats with sandy soil seen in patches between the trees, shrubs, and other plants that live in the habitat. Scrub may or may not have trees. If there are trees, they tend to be widely spaced in the case of pine trees, or clustered together in clumps in the case of the shrub-like oak trees found in these habitats. Between the trees (if present) you will see a variety of shrubs, flowering plants, grasses, and lichens
Mead's milkweed	Grasslands or prairies	Detailed description forthcoming.
Palmate-bracted bird's beak	Alkali sink-scrub habitats	Seasonally flooded, saline-alkali soils in low-lying areas throughout the Central Valley, CA. Occurs as patches of vernal meadows/pools in grassland habitat. Much of the suitable soils have been converted to agriculture and urban development.
Ozark cavefish	Karst groundwater systems	Features of karst groundwater systems of the Springfield Plateau aquifer that exists within a few hundred feet of the surface such as underground streams, pools, etc.
Madison Cave isopod	Sink holes, springs, disappearing streams or known cave systems	Not yet available
Riverside and San Diego fairy shrimp	Vernal pools: temporary wetlands that fill with rainwater in the winter and spring and then the water gradually evaporates away, until the pools become completely dry in the summer and fall.	**San Diego Fairy Shrimp**: Vernal pool habitat specialists, found in small, shallow vernal pools 5-30 cm (2-12 in) deep with a temperature range of 10-20°C (50-68°F). They are occasionally found in ditches and road ruts that support suitable conditions. **Riverside Fairy Shrimp**: Vernal pool habitat specialist, found in deep lowland vernal pools that retain water for 2-8 months, and are generally 12 in (30 cm) or deeper. They are also found in stock ponds, ditches and road ruts that support suitable conditions.
Ouachita rock pocketbook	Creeks, streams and large rivers	Not yet available
Rayed bean	Creeks, streams and large rivers, shallows of lakes	Not yet available
Scaleshell mussel	Creeks, streams and large rivers	Not yet available
Winged mapleleaf	Creeks, streams and large rivers	Locations with low sediment deposition and coarser and a more compacted sand and gravel mixture. Fast moving clean/clear water with low turbidity and sediment movement.
American burying beetle	Orchards, vineyards, grasslands, wetlands, meadows, forests, pastures, rangeland, and riparian zones	Not yet available

Species (common name)	Short Habitat description	Detailed habitat description[1]
Attwater's prairie chicken	Grasslands	Grasslands include savannas, prairies, and rangeland with few woody plants and a diversity of native or introduced grasses and forbs (*e.g.,* non-woody flowering plants).
Buena Vista Lake ornate shrew	Riparian or marsh areas near open water	Riparian or wetland vegetation communities with a dense understory that are in close proximity to a reliable body of water.
Wyoming toad	Floodplain ponds, rivers, and small seepage lakes	Not yet available

[1]For the detailed habitat descriptions that are not yet available, EPA plans to update this information after it is provided by FWS.

For the six species[11] where EPA is proposing separate avoidance and minimization areas (not relying on habitat descriptions), avoidance areas are proposed to apply within spatial areas where the species is known to occur or within described species habitat or designated critical habitat. Minimization areas for the purpose of this pilot project are proposed to be within species range or designated critical habitat or within extensions surrounding the species locations. EPA is proposing a 2600 ft extension area around the range or designated critical habitat to address spray drift that may come in from outside the species range or designated critical habitat (*e.g.,* fields just adjacent to the species habitat but outside the range or designated critical habitat). EPA is proposing this distance as it is the farthest extent that pesticide spray drift is estimated to transport and, therefore, accounts for drift that may occur from applications adjacent to the species habitat that would otherwise contribute exposures to the pilot species. EPA is not proposing a 2600 ft spray drift or runoff/erosion buffer. EPA is also proposing to use this distance to expand the PULA for the Lake Wales Ridge species. This is because for malathion, FWS extended the original spatial extent of the Lake Wales Ridge area by 200 ft to account for the malathion specific spray drift distance. EPA is proposing to extend this PULA by 2400 ft to be consistent with the maximum spray distance used for the other species included in this pilot.

4.2. Pesticide use limitations (mitigation measures)

This section describes EPA's proposed avoidance, spray drift minimization and runoff/erosion minimization measures for the vulnerable species pilot. This section includes proposed avoidance and minimization language for the Vulnerable Species bulletins.

4.2.1. Avoidance

For species with designated critical habitats (or range) that serve as the basis of the Avoidance PULA (specifically*:* Poweshiek skipperling, Rusty patched bumble bee, Taylor's checkerspot, White bluffs bladderpod, Leedy's roseroot, and Okeechobee gourd), the following proposed bulletin language would apply to the entire range of a listed species or designated critical habitat:

> *Pesticide applications are prohibited within this area unless the applicator coordinates with the local FWS Ecological Services field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. The applicator must coordinate with FWS at least 3 months prior to the application.[12] FWS points of contact are available through the Information, Planning, and Consultation (IPaC) website (https://ecos.fws.gov/ipac/). If a permit has been granted by FWS[13], no additional coordination with FWS is needed if a pesticide application is made in accordance with an existing FWS permit.*

[11] Poweshiek skipperling, Rusty patched bumble bee, Taylor's checkerspot, White bluffs bladderpod, Leedy's roseroot, and Okeechobee gourd

[12] In the event of unexpected pest outbreaks-the applicator must coordinate with FWS to determine appropriate measures. Applications made by FWS or by partners approved by FWS in FWS lands, like Refuges, that rely on invasives control are exempt from these measures. This proposal is still being vetted by the species experts.

[13] FWS permits include but are not limited to: depredation permit, scientific collection permit and other actions that that may act like a permit are a Biological Opinion.

For all other species, with Range or other defined PULAs, the following proposed bulletin language would apply to all habitat used by the species (see **Table 3** for habitat description relevant to avoidance area).

> *Pesticide applications are prohibited on [habitat description from Table 3] unless the applicator coordinates with the local FWS Ecological Services field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. The applicator must coordinate with FWS at least 3 months prior to the application[8]. FWS points of contact are available through the Information, Planning, and Consultation (IPaC) website (https://ecos.fws.gov/ipac/). If a permit has been granted by FWS[9], no additional coordination with FWS is needed if a pesticide application is made in accordance with an existing FWS permit.*

4.2.2. Spray drift minimization

The following mitigations apply to broadcast spray applications. EPA is not recommending that these proposed mitigations pertain to spray applications using handheld equipment, granular formulations, or seed treatment products. These spray drift mitigations are intended to include reasonable and prudent changes to application practices. EPA believes that these practices can be implemented by applicators, while still allowing use of the pesticides being applied. There is some degree of flexibility incorporated into these mitigations so that the applicator has options for achieving the desired reduction in exposure. In some cases, certain types of application methods or droplet sizes are prohibited, while for other application types, reasonable spray drift buffer distances are proposed. Those buffers are based on the location away from a treatment site where increasing distances result in a limited change in deposition. These buffers represent a practical extent of spray drift reduction that can be expected.

For the Ozark cavefish and the Madison Cave isopod, EPA expects the following pesticide use limitation language would apply to the bulletins:

1. *For aerial spray applications, do not apply within 300 ft of sink holes, springs, disappearing streams or known openings of cave systems.*
2. *For ground broadcast spray, do not apply within 100 ft of sink holes, springs, disappearing streams, or known cave systems.*
3. *For airblast applications, do not apply within 150 ft of sink holes, springs, disappearing streams, or known cave systems.*

For the four mussel species, fairy shrimp, Attwater's prairie chicken, Buena Vista Lake ornate shrew, and Wyoming toad, EPA expects that the following pesticide use-limitation language would apply to the bulletins:

1. *Aerial and ground spray applications with very fine to fine droplets[14] are prohibited.*
2. *For aerial spray applications with medium or coarser droplets, if winds are blowing from the treated site to [habitat description from Table 3] and there is no continuous wind break or shelter belt in between, the following buffers are required:*
    a. *300 ft for medium or coarser droplets.*
    b. *200 ft for coarse or coarser droplets.*
    c. *If a wind break or shelter belt is present, the above buffers can be reduced by half.*

[14] American Society of Agricultural & Biological Engineers Standards 641 and 572

3. *For ground boom spray applications[15] with medium or coarser droplets, if winds are blowing from the treated site to [habitat description from Table 3] and there is no continuous wind break or shelter belt, the following buffers are required:*
    a. *For applications that are made using medium or coarser droplets, a 100 ft buffer is required on the down-wind side of the application site between of the end of the last spray row and [habitat description].*
        i. *The required buffer can be reduced to 50 ft if a hooded sprayer is used, or a wind break or shelter belt is present higher than the spray release height.*
4. *For airblast applications:*
    a. *At row ends and when spraying the outer row, sprays must be directed into the canopy, and outward pointing nozzles must be turned off.*
    b. *For non-bearing orchards, on the down-wind side of the application site, a 150 ft buffer is required between the end of the last spray row and [habitat description from Table 3].*
    c. *For bearing orchards, on the down-wind side of the application site, a 10 ft buffer is required between the end of the last spray row and [habitat description from Table 3].*
    d. *If a wind break or shelter belt is present, the above buffers can be reduced by half.*
5. *When a buffer is required, all landcovers between the last spray row and [habitat description from Table 3] are counted as part of the buffer footage. The following are examples of areas that may be included as part of the buffer footage:*
    a. *Agricultural fields, including the treated field or adjacent fields.*
    b. *Roads, paved or gravel surfaces, mowed grassy areas adjacent to field, and areas of bare ground from recent plowing or grading that are contiguous with the treated area.*
    c. *Areas* occupied by a building and its perimeter, *silo, or other man-made structure with walls and/or roof.*
    d. Areas maintained for runoff/erosion or drift control, such as vegetative filter strips, field borders, hedgerows, and other areas on the mitigation menu
    e. Conservation Reserve Program and Agricultural Conservation Easement Program (ACEP) areas[16]

For the remaining pilot species, EPA is proposing different drift mitigations, some of which include longer buffer distances. This is based on comparisons of exposure information and insect and invertebrate toxicity data for the representative pesticides (described in **Section 5**). Therefore, EPA is proposing the following drift minimization language for the bulletins of Poweshiek skipperling, Rusty patch bumble bee, Taylors checkerspot, American burying beetle, the Lake Wales Ridge plants, Mead's milkweed, Leedy's roseroot, Okeechobee gourd, Palmate-bracted bird's beak, White Bluffs bladderpod:

1. *Aerial and ground spray applications with very fine to fine droplets[17] are prohibited.*

[15] This does not apply to backpack or hand wand applications.

[16] The CRP is a land conservation program administered by the Farm Service Agency (FSA). In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Agricultural Conservation Easement Program (ACEP) supports long-term viability of productive farmland from being converted into non-agricultural areas.

[17] American Society of Agricultural & Biological Engineers Standards 641 and 572

2. *For aerial spray applications with medium or coarser droplets, if winds are blowing from the treated site to [habitat description from Table 3] and there is no continuous wind break or shelter belt in between, the following buffers are required:*
    a. *600 ft for medium or coarser droplets.*
    b. *400 ft for coarse or coarser droplets.*
    c. *If a wind break or shelter belt is present, the above buffers can be reduced by half.*
3. *For ground boom spray applications[18] with medium or coarser droplets, if winds are blowing from the treated site to [habitat description from Table 3] and there is no continuous wind break or shelter belt, the following buffers are required:*
    a. *For applications that are made using medium or coarser droplets, a 200 ft buffer is required on the down-wind side of the application site between of the end of the last spray row and [habitat description from Table 3].*
        i. *The required buffer can be reduced to 100 ft if a hooded sprayer is used, or a wind break or shelter belt is present higher than the spray release height.*
4. *For airblast applications:*
    a. *At row ends and when spraying the outer row, sprays must be directed into the canopy, and outward pointing nozzles must be turned off.*
    b. *For non-bearing orchards, on the down-wind side of the application site, a 150 ft buffer is required between the end of the last spray row and [habitat description from Table 3].*
    c. *For bearing orchards, on the down-wind side of the application site, a 10 ft buffer is required between the end of the last spray row and [habitat description].*
5. *When a buffer is required, all landcovers between the last spray row and [habitat description from Table 3] are counted as part of the buffer footage. The following are examples of areas that may be included as part of the buffer footage:*
    a. *Agricultural fields, including the treated field or adjacent fields.*
    b. *Roads, paved or gravel surfaces, mowed grassy areas adjacent to field, and areas of bare ground from recent plowing or grading that are contiguous with the treated area.*
    c. *Areas* occupied by a building and its perimeter, *silo, or other man-made structure with walls and/or roof.*
    d. *Areas maintained for runoff/erosion or drift control, such as vegetative filter strips, field borders, hedgerows, and other areas on the mitigation menu*
    e. *Conservation Reserve Program and Agricultural Conservation Easement Program (ACEP) areas[19]*

[18] This does not apply to backpack or hand wand applications.

[19] The CRP is a land conservation program administered by the Farm Service Agency (FSA). In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Agricultural Conservation Easement Program (ACEP) supports long-term viability of productive farmland from being converted into non-agricultural areas.

4.2.3. Runoff/Erosion minimization

The majority of these pilot species could be exposed to pesticides that are transported via runoff/erosion from pesticide use sites to their location or designated critical habitats. The proposed mitigations are intended to prevent pesticide applications immediately prior to runoff/erosion events and to provide growers with a number of options to reduce pesticide exposures off of treated fields from runoff/erosion when a pesticide is used within or adjacent to the range of the pilot species. EPA has determined that all of the species presented in this pilot project are susceptible to runoff/erosion exposure, except for the White Bluff's bladderpod and the American Burying Beetle irrespective of the pesticide. For the White Bluff's bladderpod, this is because the species lives in very specific locations on the slopes and at the top of the White Bluffs in Eastern Washington.[20] For the American burying beetle, adults are expected to be exposed to spray while they are seeking mates above ground; however, larvae and adults are not considered likely to be impacted by pesticide exposure from runoff/erosion.

For those 25 species for which runoff/erosion is a concern, EPA is proposing the following pesticide use-limitation language in Bulletins (including **Table 4**):

1. *Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil).*
2. *Do not irrigate to the point of runoff. Follow label directions if pesticide needs to be watered into the soil for efficacy.*
3. *Do not apply if NOAA/National Weather Service predicts 50% chance or greater of 1 or more inches of rainfall to occur within 48 hours following application.*[21]
4. *Four of the measures in **Table 4** are required to reduce potential transport of pesticides off treated fields from runoff water and soil erosion into the pilot species' habitats. Formal participation in a State or Federal soil and runoff conservation plan satisfies this requirement.*
5. *The following exemptions to #1-4 apply:*
    a. *If the field has subsurface drainage installed, the mitigation measures are not applicable. The subsurface tile drains must release the effluent (water) into water-controlled drainage structures or saturation buffer zones.*
    b. *If the lands are managed with a site-specific runoff and/or erosion plan implemented according to the recommendations of a recognized conservation* program, then no additional runoff/erosion mitigations are needed. Recognized conservation programs include but are not limited to those run by federal and state agencies, a state university extension programs, National Alliance of Independent Crop Consultants, or certified agricultural conservation specialists.

[20] Runoff/erosion is not considered a significant pathway for White Bluffs bladderpod because of its location on the slopes and peak of White Bluffs, which are upslope of potential use sites (*e.g.,* surrounding agriculture).
[21] Detailed National Weather Service forecasts for local weather conditions may be obtained on-line at: http://www.nws.noaa.gov, on NOAA weather radio, or by contacting your local National Weather Service Forecasting Office."

Table 4. Draft options for runoff/erosion measures for selected pesticide use site[1].

Runoff/Erosion Mitigation Practice	Use Site				
	1: Field Crops[2]	2: Orchards	3: Specialty Crops[3]	4: Non-Ag[4]	5: Rice[5]
Applications					
Avoid Using Pesticide of a Highly Toxic Hazard Class to invertebrates	✓	✓	✓	✓	✓
40% rate reduction[6]	✓	✓	✓	✓	✓
In Field					
Contour Farming	✓	✓	✓	--	--
Cover Crop	✓	✓	✓	✓	--
In-field Vegetative Filter Strip[7]	✓	✓	✓	✓	--
Mulching	✓	✓	✓	✓	
Residue and Tillage management	✓	--	✓	--	--
Terrace Farming	✓	✓	✓	--	--
Grassed Waterways	✓	✓	✓	✓	--
Field Characteristics					
Field with <2% slope	✓	✓	✓	--	✓
Adjacent to the Field or In-between field and Protection Area					
Vegetative Filter Strips[7]	✓	✓	✓	✓	--
Riparian Area (>10m width from average high-water mark to use site)	✓	✓	✓	✓	--
Controlled Drainage					
Constructed wetlands or Water and Sediment Control Basins	✓	✓	✓	✓	✓

[1] If a use site indicates a "—" for a particular mitigation practice, the practice can be still considered for incorporation into future crops (*e.g.*, planting a new orchard on contour terraces), or relied upon if already in place (*e.g.*, terraces in vineyards). A ✓ indicates that the practice may be used by some of the crops/uses within the use site category and can be counted as mitigation practices.

[2]Including corn, cotton, sorghum, soybeans and wheat.

[3] Fruits and vegetables, horticulture, and nursery crops.

[4] Including, but not limited to golf courses, turf, forest, conservation areas, mosquito adulticides, rights of ways, roadsides, fence rows, rangeland, and pasture.

[5]At this time, EPA has only identified 4 mitigation practices for rice. EPA is considering other mitigation practices that may also help reduce exposures from pesticide use on rice.

[6]Rate reductions are based on the max single application. Rate reductions can be achieved via banded application, spot treatment, precision agriculture or sprayers.

[7]Using a vegetative filter strip is required on the downslope side of the field between the field/application site and protected terrestrial, wetland, and aquatic natural areas and habitats. The minimum width is required to be 30 feet.

As detailed in the technical document, available data on the efficacy of run-off mitigations varies considerably. Runoff/erosion mitigations tend to exhibit a large range of efficacies due to chemical characteristics, field properties, precipitation extremes and landscape level components. As the data demonstrates, the mitigations are most effective when the user selects them with a consideration of the

application sites' landscape position, soil type, underlying geology, and local hydrology. An assessment of the applications sites' land use practices can also inform which mitigations are appropriate for the given situation. For example, if implementing mitigations in an agricultural setting, the grower would decide what type of tillage and cropping strategy is on field and appropriate, as well as what season these mitigations are being implemented in when the species mitigation timing requirement does not specify a season. Understanding water pathways and how susceptible a field is to runoff/erosion can also improve the effectiveness of a mitigation. For example, selecting mitigations that will not be overwhelmed by large volumes of water and/or undercut by drainage systems increases the confidence that higher efficiencies will be yielded (or something like that). Pesticide users can work with conservation specialists to guide decisions when selecting viable and the most effective options from the mitigation menu for their specific site, and if a conservation plan is in place the user is exempt from implementing these mitigations. This is just a brief example of the considerations that are at play when selecting successful mitigations from the mitigation menu, but a basic understanding of these concepts will help the user to make informed decisions.

4.1.4. Timing restrictions

For all but one of the pilot animal species, EPA expects that the proposed mitigations would apply year-round. For American burying beetle, EPA expects there are special conditions when the avoidance and drift minimization mitigations would apply. Adults are active at night when temperatures are above 60^{o}F for multiple nights. Therefore, EPA is proposing the avoidance and minimization mitigations for the American burying beetle only apply when temperatures are forecasted to be above 60 degrees F for three consecutive nights or more.

For all of the pilot plant species, except the Lake Wales Ridge species and the Okeechobee gourd, EPA based insecticide timing restrictions on when the plants are expected to flower. With this approach, EPA assumed that restricting insecticide applications during bloom will protect the listed plant from indirect effects due to adverse effects to pollinators since mortality to pollinators in the area of the species could result in adverse reproductive effects to the plants that require pollination. Herbicide restrictions are proposed when the vegetative and reproductive parts of the plant are present above ground. **Table 5** includes the species-specific timing on when the vegetative parts are expected to be present above ground and when the species flowers. If this information is not available, EPA proposes to apply the herbicide and insecticide restrictions year-round. For the Lake Wales Ridge species, because there are so many species in the same area and they are expected to have different flowering periods and different times where they are present above ground, EPA is proposing year-round restrictions.

Table 5. Timing restrictions on spray drift mitigations for herbicides and insecticides for plant species.

Species	**Vegetative part of plant is present* (herbicide timing restriction)**	**Flowering period* (insecticide timing restrictions)**
Lake Wales Ridge plants	Variable across species, year-round restriction	Variable across species, year-round restriction
Mead's milkweed	Unknown (assume year-round)	May – June
Okeechobee gourd	Unknown (assume year-round)	Unknown (assume year-round)
White Bluffs bladderpod	Unknown (assume year-round)	May – July
Leedy's roseroot	MN: May 1- Sept 30 NY: April 15-Nov 15	MN: June 1-June 30 NY: May 15-Aug 15
Palmate bracted bird's beak	Unknown (assume year-round)	May - October

*Timing information from Appendix C of FWS 2022.

5. Evaluation of proposed pesticide use limitations

5.1. Representative pesticides used in evaluation

The vulnerable species proposed mitigations are expected to apply broadly to groups of conventional pesticides (*e.g.*, insecticides, herbicides, fungicides) for non-residential outdoor registered uses. For this evaluation, EPA selected representative conventional pesticide active ingredients from among the hundreds of registered pesticides. EPA identified the representative pesticides using available monitoring data from aquatic and terrestrial habitats relevant to the pilot species. For aquatic habitats, EPA selected pesticides with detections reported in the Water Quality Portal.[22] Monitoring data from the Water Quality Portal represent samples collected from streams and rivers. Terrestrial monitoring data was provided by FWS. These data were collected by FWS and the Minnesota Zoological Garden from 2014-2021 at sites relevant to the Poweshiek skipperling and two other listed species not included in this pilot (*i.e.,* Dakota skipper and Mitchell's satyr butterfly). Collected samples included larval host grasses, plant litter, and soil. Monitoring data was used to identify the representative pesticides for this evaluation because their detections indicate that the pilot species are potentially being exposed to these pesticides. Therefore, EPA believes it is appropriate to evaluate the effectiveness of the mitigations for those pesticides where potential exposure is supported by empirical monitoring data in habitats and locations relevant to the pilot species.

Table 6 includes representative pesticides used in this evaluation. Example pesticides include insecticides, fungicide and herbicides. Within each broad type of pesticide, there are several different classes represented, *e.g.,* organophosphates, neonicotinoids and triazines. EPA used environmental fate and toxicity information from recent assessments for the representative pesticides (*e.g.,* recent FIFRA risk assessments, biological evaluations, etc.). The following sections summarize estimated environmental exposures, toxicity endpoints and RQs for example pesticides. **Section 9** includes references for the assessments used to obtain the information.

[22] https://www.waterqualitydata.us/

Table 6. Pesticides considered in mitigation evaluations for vulnerable species by pesticide type.

Pesticide name	Pesticide type	Pesticide class	Monitoring data source where detected
Acephate/methamidophos	Insecticide/degradate	Organophosphate	Water Quality Portal
Carbaryl	Insecticide	Carbamate	Water Quality Portal
Malathion	Insecticide	Organophosphate	Water Quality Portal
Diazinon	Insecticide	Organophosphate	Water Quality Portal
Fipronil	Insecticide	Phenylpyrazole	Water Quality Portal
Imidacloprid	Insecticide	Neonicotinoid	FWS/MN zoo and Water Quality Portal
Permethrin	Insecticide	Pyrethroid	Water Quality Portal
Methomyl	Insecticide	Carbamate	Water Quality Portal
Azoxystrobin	Fungicide	Quinone Outside Inhibitors	FWS/MN zoo and Water Quality Portal
Propiconazole	Fungicide	Quinone Outside Inhibitors	FWS/MN zoo and Water Quality Portal
Chlorothalonil	Fungicide	Chloronitrile	FWS/MN zoo and Water Quality Portal
2,4-D	Herbicide	Phenoxyacetic acid	Water Quality Portal
Atrazine	Herbicide	Triazine	FWS/MN zoo and Water Quality Portal
Bromacil	Herbicide	Uracil herbicide	Water Quality Portal
Diuron	Herbicide	Phenylurea	Water Quality Portal
Glyphosate	Herbicide	Phosphono amino acid	Water Quality Portal
Linuron	Herbicide	Urea Herbicide	Water Quality Portal
Metolachlor	Herbicide	Chloroacetimide	FWS/MN zoo and Water Quality Portal
Halauxifen	Herbicide	Picolinic acid	Water Quality Portal

5.2. Toxicity endpoints used in evaluations

EPA used standard toxicity data available for the representative pesticides to assess potential direct effects to the listed pilot species as well as potential effects to the prey, pollination, habitat and/or dispersal (PPHD) of the pilot species. **Table 7** presents the taxa used to represent direct effects and PPHD. For animals, EPA used standard acute toxicity endpoints (median lethal dose or concentration, LD_{50} or LC_{50}). When assessing potential direct effects to the pilot animal species, EPA used the available slope information to extrapolate down to the 10% mortality level (*i.e.,* LD_{10} or LC_{10}). EPA used the ten percent mortality to represent the background mortality level in test organisms and thus represent a no effect level. For plants, EPA used IC_{25} (25% growth inhibition concentration) for terrestrial species and IC_{50} values for aquatic species because these are the toxicity values generated in standard studies submitted by registrants. When multiple toxicity endpoints were available for the same taxon, EPA used the most sensitive, reliable, and scientifically valid value. For terrestrial plants, EPA used the 5^{th} percentile IC_{25} value of available species sensitivity distributions for herbicides. **Tables 8 and 9** include the toxicity endpoints for the representative pesticides and taxa relevant to the pilot species. These toxicity data are from recent EPA assessments for the representative pesticides. **Section 9** includes citations for the specific assessments used in the analysis.

Table 7. Taxa used to assign toxicity endpoints to pilot species for evaluation of potential direct effects and effects to prey, pollination, habitat and/or dispersal (PPHD) of pilot species.

Pilot species	Taxon used for Direct effects	Taxa used for effects to PPHD
Lake Wales Ridge plants (Avon Park harebells, Garrett's mint, wireweed, scrub blazingstar, short-leaved rosemary, scrub mint, Florida ziziphus)	Terrestrial Plant	Terrestrial invertebrates (pollination)
Mead's milkweed	Terrestrial Plant	Terrestrial invertebrates (pollination)
Leedy's roseroot	Terrestrial Plant	Terrestrial invertebrates (pollination)
Okeechobee gourd	Terrestrial Plant	Terrestrial invertebrates (pollination)
Palmate-bracted bird's beak	Terrestrial Plant	Terrestrial invertebrates (pollination)
White bluffs bladderpod	Terrestrial Plant	Terrestrial invertebrates (pollination)
Ozark cavefish	Fish	Not assessed
Madison cave isopod	Aquatic invertebrate	Not assessed
Riverside and San Diego fairy shrimp	Aquatic invertebrate	Not assessed
Ouachita rock pocketbook	Mussel	Fish
Rayed bean	Mussel	Fish
Scaleshell mussel	Mussel	Fish
Winged mapleleaf	Mussel	Fish
American burying beetle	Terrestrial Invertebrate	Not assessed
Poweshiek skipperling	Terrestrial Invertebrate	Terrestrial Plant (diet, habitat)
Rusty patched bumble bee	Terrestrial Invertebrate	Terrestrial Plant (diet, habitat)
Taylor's checkerspot	Terrestrial Invertebrate	Terrestrial Plant (diet, habitat)
Attwater's prairie chicken	Bird	Terrestrial insects (diet), Terrestrial Plant (diet, habitat)
Buena Vista Lake ornate shrew	Mammal	Terrestrial insects (diet), Wetland Plants (habitat)
Wyoming toad	Fish and Bird (surrogates for amphibians)	Terrestrial insects (diet), Aquatic invertebrates, Wetland Plants (habitat)

Table 8. Acute animal toxicity data used to calculate RQs for representative pesticides.

	Terrestrial invertebrates		Birds		Mammals		Fish		Aquatic Invertebrates		Mussels	
Pesticide	LD50 (mg/kg-bw)	Slope[1]	LC50 (mg/kg-diet)	Slope[1]	LC50 (mg/kg-diet)	Slope[1]	LC50 (µg/L)	Slope[1]	LC or EC50 (µg/L)	Slope[1]	LC or EC50 (µg/L)	Slope[1]
Acephate	9.4	8.6	720	7.3	320	5.2	850000	4.5	1100	1.6	NA	NA
Methamidophos*	11	10.3	42	4.6	16	13	5600	4.5	26	4.9	NA	NA
Carbaryl	0.11	4.5	2300	4.5	100	7.7	1100	4.5	1.6	4.5	6600	4.5
Malathion	1.2	3.2	110	6.6	1600	4.5	21	3	1	4.5	NC	NC
Diazinon	0.15	4.9	1.2	4.5	100	2.9	85	4.5	0.21	4.5	1400	4.5
Fipronil	0.032	4.5	11	4.5	16	4.5	83	4.5	0.22	4.5	NA	NA
Imidacloprid	0.015	1.6	17	4.5	420	4.5	26000	4.5	1.4	1.7	4000	4.5
Permethrin	0.024	4.5	NC	NC	8900	4.5	0.79	4.5	0.0066	4.5	NA	NA
Methomyl	0.5	9	2.0	4.5	7.1	4.5	340	4.2	3.9	4.5	3.9	4.5
Azoxystrobin	NC	NC	NC	NC	NC	NC	470	4.5	56	4.5	1300	4.5
Propiconazole	NC	NC	750	4.5	1500	4.5	850	4.5	500	4.5	1300	4.5
Chlorothalonil	NC	NC	1700	4.5	240	4.5	18	5.6	54	4.5	3.6	4.5
2,4-D	NC	NC	3000	4.5	440	4.5	NC	NC	25000	4.5	NA	NA
Atrazine	NC	NC	5800	4.5	160	4.5	27	4.5	720	4.5	NC	NC
Bromacil	1500	4.5	NC	NC	800	4.5	36000	4.5	110000	4.5	130000	4.5
Diuron	NC	NC	960	4.5	4700	4.5	1300	4.5	180	4.5	NA	NA
Glyphosate	NC	NC	5800	3.8	1900	4.5	2000	4.5	48	4.5	NC	NC
Linuron	940	4.5	940	4.5	2600	4.5	890	4.5	120	4.5	NA	NA
Metolachlor	NC	NC	2200	4.5	2600	4.5	3200	4.5	4950	4.5	1600	4.5
Halauxifen	NC	NC	2300	4.5	5000	4.5	2000	4.5	1100	4.5	NA	NA

NC = not calculated because no effects observed at highest test concentration

NA = not available

[1]When slope was not available, default of 4.5 was used.

*Degradate of acephate

Table 9. Plant toxicity endpoints used to calculate RQs for representative pesticides.

Pesticide	Nonvascular Aquatic EC50 (µg/L)	Vascular Aquatic EC50 (µg/L)	Monocot IC25 (lb/A)	Dicot IC25 (lb/A)
Acephate	1040000	1040000	4.0	4.0
Methamidophos*	679000	3650	4	4
Carbaryl	340	24000	7.8	8.8
Malathion	500	500	NC	NC
Diazinon	3700	3700	4	3.2
Fipronil	7.6	>100	1.5	1.5
Imidacloprid	6700	5800	0.5	0.5
Permethrin	>4.4	>3.2	NC	NC
Methomyl	60000	60000	3.0	3.0
Azoxystrobin	49	3400	1	0.59
Propiconazole	21	3500	0.32	0.039
Chlorothalonil	12	640	4.4	4.4
2,4-D	3900	300	0.037	0.0038
Atrazine	4.6	4.6	0.0037	0.0037
Bromacil	6.8	45	0.027	0.0047
Diuron	3.1	13	0.0208	0.0017
Glyphosate	14	14	0.0037	0.0037
Linuron	14	27	0.034	0.014
Metolachlor	8	14	0.016	0.0041
Halauxifen	1300	0.14	0.00013	0.000010

NC = not calculated because no effects observed at highest test concentration

*Degradate of acephate

5.3. Estimated exposure information used in evaluations

For each pesticide assessed, EPA used Environmental Exposure Concentrations (EECs) for both aquatic and terrestrial environments, using the maximum application rates and scenarios. EECs are from EPA's standard models used in ecological risk assessments.[23] EPA also considered different dietary exposures to terrestrial animals using upper bound and mean Kenaga[24] values incorporated into the T-REX model. EPA used the Pesticide In water Calculator to estimate exposures that bound small and medium sized water bodies.[25] EPA used edge of field runoff/erosion concentrations as an upper bound of exposures in small water bodies (e.g., vernal pools) and the standard farm pond to represent exposures in medium sized water bodies. EPA's EECs represent the highest value predicted on a single day out of 10 years. For plant exposures, EPA used EECs for drift and runoff/erosion that were generated using the Plant Assessment Tool.[26] PAT v2.0 and v.2.8 were used to generate EECs. **Table 10** presents the maximum application rates used to assess exposures of the representative pesticides. **Tables 11 and 12** include the terrestrial and aquatic EECs (respectively) used to derive RQs for animals.

EPA used EECs from previous assessments. Since the time of the assessments, there may have been changes to pesticide labels that could affect EECs as a result of FIFRA (*e.g.*, registration review actions) or ESA (*e.g.*, ongoing consultations) activities; however, EPA screened EECs from these assessments to try and account for these changes when considering relevant exposure concentrations. The EECs used in this exercise are provided to give a range of potential exposure values that could result from use of a variety of pesticides but may not necessarily reflect recent changes to labels. In selecting relevant EECs for the pesticides from risk assessments, EPA tried to focus on uses that were still relevant to current labels for these pesticides, if they had changed, and focused on use sites that overlap with the vulnerable species locations.

[23] https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment

[24] Kenaga values refer to upper bound and mean residue concentrations for short grass, tall grass, broadleaf plants and fruits/seeds/pods as presented by Hoerger and Kenaga (1972) and modified by Fletcher *et al.* (1994). These concentrations are determined using nomograms that relate to application rate of a pesticide to residues remaining on dietary items of terrestrial organisms.

[25] https://www.epa.gov/endangered-species/revised-method-national-level-listed-species-biological-evaluations-conventional

[26] https://www.epa.gov/endangered-species/models-and-tools-national-level-listed-species-biological-evaluations-triazine

Table 10. Maximum application rates used to estimate exposures.

Pesticide	Single max rate (lb/A) used to estimate exposures[1]
Acephate	4
Methamidophos*	3.1
Carbaryl	12
Malathion	5.1
Diazinon	3
Fipronil	1.8
Imidacloprid	0.5
Permethrin	0.007
Methomyl	0.9
Azoxystrobin	0.33
Propiconazole	1.8
Chlorothalonil	2.1
2,4-D	4
Atrazine	4
Bromacil	6.4
Diuron	6.4
Glyphosate	8
Linuron	3
Metolachlor	2.8
Halauxifen	0.0091

[1] These rates were determined to be most representative considering the range of available application rates and use sites most relevant to overlap with vulnerable species ranges/CHs

*Degradate of acephate

Table 11. Estimated exposures on dietary items of terrestrial animals (grass, arthropods) and contact exposures to terrestrial invertebrates (arthropods).[1]

Pesticide	Short grass		Tall grass		Arthropods	
	Upper	Mean	Upper	Mean	Upper	Mean
Acephate	2500	340	1100	140	960	260
Methamidophos*	1600	260	740	110	630	200
Carbaryl	2900	1000	1300	440	1200	800
Malathion	1200	430	560	270	480	330
Diazinon	720	260	330	110	280	200
Fipronil	430	150	200	65	170	120
Imidacloprid	120	43	55	18	47	33
Permethrin	300	0.60	140	0.25	170	0.46
Methomyl	580	210	270	88	230	160
Azoxystrobin	240	86	110	37	96	66
Propiconazole	1200	150	530	64	450	120
Chlorothalonil	960	340	440	140	380	260
2,4-D	960	340	440	140	380	260
Atrazine	1000	370	480	160	410	280
Bromacil	1500	540	700	230	600	420
Diuron	1700	520	800	200	690	380
Glyphosate	9600	67	4400	31	3800	26
Linuron	1000	260	470	110	400	200
Metolachlor	660	230	300	99	260	180
Halauxifen	NA	NA	NA	NA	NA	NA

[1] EECs were based on most representative uses considering the range of available application rates and use sites most relevant to overlap with vulnerable species ranges/CHs

NA = Not available

*Degradate of acephate

Table 12. Highest 1-in-10 year EECs for edge of field and standard pond. Values used to calculate RQs.[1]

Pesticide	Maximum EEC from available scenarios (µg /L)	
	Edge of field	Standard pond
Acephate	NA	200
Methamidophos*	NA	200
Carbaryl	6400	640
Malathion	1400	380
Diazinon	500	300
Fipronil	NA	0.016
Imidacloprid	230	35
Permethrin	NA	0.45
Methomyl	5300	200
Azoxystrobin	NA	150
Propiconazole	NA	200
Chlorothalonil	NA	49
2,4-D	NA	140
Atrazine	1500	100
Bromacil	NA	570
Diuron	NA	190
Glyphosate	20000	2000
Linuron	NA	140
Metolachlor	NA	150
Halauxifen	NA	0.15

[1] EECs were based on most representative uses considering the range of available application rates and use sites most relevant to overlap with vulnerable species ranges/CHs
NA = Edge of field EECs not available in assessment
*Degradate of acephate

5.4. Comparison of exposure and toxicity information

EPA compared estimated exposures to standard toxicity endpoints by calculating risk quotients (RQs). RQs are one of EPA's risk assessment tools that communicates risk estimation which combines exposure profiles (*i.e.*, the findings of exposure characterization) and effects from exposure. When an RQ is >1, exposure exceeds the toxicity endpoint. In this analysis, RQs are used to determine the relative difference in order of magnitude between estimated exposure and effect. Order of magnitude precision is chosen here because this analysis is relying upon general, conservative models, and toxicity data to represent specific species and locations. The RQs do not represent refined analyses that account for variability and species-specific considerations; however, they are considered useful in determine the relative amount of difference between exposure and effects levels and the relative amount of exposure reduction that the mitigations need to achieve.

5.4.1. Terrestrial animals

EPA calculated RQs for terrestrial taxa that are associated with the vulnerable species, including birds, mammals, and terrestrial invertebrates. RQs presented in **Table 13** include those based on LD_{10} endpoints for direct effects to birds, mammals, and terrestrial invertebrates, and LD_{50} endpoints for indirect effects to terrestrial invertebrates. **Table 13** does not include RQs for the representative herbicides or fungicides because the RQs indicate that exposures are below the acute toxicity levels for birds, mammals, and terrestrial invertebrates. When considering the representative insecticides and their RQs presented in **Table 13**:

- for mammals, exposures are as much as an order of magnitude above toxicity endpoints,
- for birds, exposures are as much as two orders of magnitude above toxicity endpoints,
- For direct effects to terrestrial invertebrates, exposures are 1-4 orders of magnitude above toxicity endpoints and
- For indirect effects to species that depend on terrestrial invertebrates (for diet and pollination), exposures are 1-3 orders above toxicity endpoints.

Table 13. RQs for effects from insecticides to terrestrial animal taxa (prior to mitigation)

Pesticide	Direct effects to pilot species[1]			Effects to prey or pollination
	Attwater's prairie chicken and Wyoming Toad	Buena Vista Lake ornate shrew	Poweshiek skipperling, Taylor's checkerspot, rusty patched bumble bee and American burying beetle	Terrestrial Invertebrates
Acephate	0.7	1.8	39	28
Methamidophos*	12	21	25	19
Carbaryl	0.9	14	14000	7200
Malathion	6.7	0.5	690	270
Diazinon	410	6.6	2400	1300
Fipronil	26	18	6900	3700
Imidacloprid	4.8	0.2	14000	2200
Permethrin	0	0	36	19
Methomyl	190	55	440	320

[1]Direct RQs based on LC_{10}/LD_{10}, short grass mean Kenaga for birds and mammals, arthropods mean Kenaga for terrestrial invertebrates.
*****Degradate of acephate

RQs presented in **Table 13** represent exposures directly on treated fields. These values can be used to evaluate the effectiveness of the drift mitigations. Basically, spray drift deposition when mitigations are applied would need to be 1-4 orders of magnitude below the on-field exposures to not exceed the toxicity endpoints for direct effects to the terrestrial invertebrate pilot species (*i.e.,* Poweshiek skipperling, Taylor's checkerspot, Rusty patched bumble bee, and American burying beetle).

Because the bird, amphibian, and mammal pilot species consume terrestrial invertebrates, spray drift reductions needed for the Attwater's prairie chicken, Wyoming toad and the Buena Vista Lake ornate shrew need to achieve 1-3 orders of magnitude reduction to address the potential indirect effects to

their diets. EPA expects that this level of reduction would also address the potential for direct effects to these species.

5.4.2. Aquatic animals

Table 14 shows the RQs based on acute toxicity LC_{10}s, calculated from LC_{50}s previously used for risk assessment. **Table 15** presents the RQs that are calculated using the same EECs and LC_{50} values to represent effects to listed species that rely upon aquatic invertebrates for prey. EECs and toxicity data used to calculate RQs for the representative pesticides are provided in **Tables 8 and 12**. The highest EECs represent combined drift and runoff/erosion exposure and are used to provide an estimate of the level of mitigations that would be needed to reduce both drift and runoff/erosion exposures. When considering the representative pesticides and their RQs presented in **Table 14**:

- For non-mussel invertebrates (fairy shrimp and isopod), exposures are 2-3 orders of magnitude above toxicity endpoints.
- For the mussels, exposures are as much as 1-2 orders of magnitude (when considering both the edge of field and standard pond EECs) above available toxicity endpoints.
- For the Ozark cave fish and aquatic phase Wyoming toad, exposures are as much as 1 order of magnitude above the toxicity endpoint for the farm pond and 2 orders of magnitude above for edge of field EECs. This characterization also applies to possible effects to dispersal of mussels by effects to fish.
- Based on the aquatic invertebrate EECs and toxicity endpoints (non-mussels) for species that depend upon invertebrates for prey, exposures are 2-3 orders of magnitude above toxicity endpoints.
- It should be noted that both sets of EECs are limited in their representation of the exposure for the cave fish and isopod, which likely occurs from infiltration and runoff to sink holes.

Table 14. RQs for direct effects to aquatic invertebrates, fish and aquatic-phase amphibians[1,2]

Pesticide	Direct effects to fairy shrimp and isopod		Direct effects to mussels		Direct effects to Ozark cave fish and Wyoming toad	
	Standard pond	Edge of field	Standard pond	Edge of field	Standard pond	Edge of field
Acephate/ Methamidophos*	14	N/A	N/A	N/A	0.067	NA
Carbaryl	770	7800	0.2	1.8	1.1	12
Malathion	720	2600	0.0	0.026	34	120
Diazinon	2800	4600	0.4	0.70	6.7	11
Fipronil	0.1	N/A	N/A	N/A	0.00036	NA
Imidacloprid	140	910	0.0	0.11	0.0025	0.016
Permethrin	130	N/A	N/A	N/A	1.1	NA
Methomyl	96	2600	94	2500	1.1	30
Azoxystrobin	5.1	N/A	0.2	N/A	0.6	NA
Propiconazole	0.7	N/A	0.3	N/A	0.4	NA
Chlorothalonil	1.7	N/A	26	N/A	5.2	NA

[1]NA Not modeled in previous ecological risk assessments reviewed by EPA

[2]Based on LD_{10} values

*****Degradate of acephate

Table 15. RQs for effects to diet (aquatic invertebrates are food items).

Pesticide	Aquatic invertebrates	
	Standard pond	Edge of field
Acephate/Methamidophos*	7.7	NA
Carbaryl	400	4000
Malathion	380	1400
Diazinon	1400	2400
Fipronil	0.1	NA
Imidacloprid	25	160
Permethrin	69	NA
Methomyl	50	1300
Azoxystrobin	2.7	NA
Propiconazole	0.4	NA
Chlorothalonil	0.9	NA
2,4-D	0.0058	NA
Atrazine	0.14	2.1
Bromacil	0.0051	NA
Diuron	1.1	NA
Glyphosate	42	420
Linuron	0.44	NA
Metolachlor	0.03	NA
Halauxifen	0.00014	NA

[1]NA = Edge of Field EECs were not available in previous ecological risk assessments reviewed by EPA
[2]Based on LD_{50} values
*****Degradate of acephate

5.4.3. Plants

To evaluate the relative difference in the maximum exposure and plant toxicity endpoints, EPA compared maximum application rates and the most sensitive terrestrial plant IC_{25} values. **Table 16** presents the RQs for the representative herbicides. Only herbicides were included because they had the highest RQs. These values can be used to evaluate the effectiveness of the drift mitigations. Basically, spray drift deposition when mitigations are applied would need to be 2-3 orders of magnitude below the on-field application rate to not exceed the toxicity endpoints for direct effects to the terrestrial and wetland plant pilot species (*i.e.,* Lake Wales Ridge plants, Mead's milkweed, Leedy's roseroot, Okeechobee gourd, Palmate-bracted bird's beak, and white bluff's bladderpod).

Table 16. RQs for direct effects from herbicides to terrestrial plants

Pesticide	RQs[1]
2,4-D	1100
Atrazine	1100
Bromacil	1400
Diuron	3800
Glyphosate	2200
Linuron	210
Metolachlor	670
Halauxifen	890

[1]Direct RQs based on maximum relevant application rates and EC_{25} toxicity endpoints.

EPA used four of the representative herbicides to evaluate the need for mitigations for the pilot vulnerable plant species that inhabit terrestrial and wetland areas. For terrestrial and wetland plants, the Risk Quotient (RQ) is calculated as a ratio of the EEC to the 5th percentile of the species sensitivity distribution. These are a subset from all the herbicides we evaluated, as most of the previous assessments have not included PAT modeling for terrestrial or wetland exposure. Based on these RQs (**Table 17**), exposures are as much as 2 orders of magnitude higher than toxicity endpoints representing listed plants.

Table 17. Summary of Terrestrial and Wetland Exposure and RQs from Select Herbicides

Pesticide	Toxicity Endpoint	Terrestrial Exposure Zone		Wetland Exposure Zone	
	5th Percentile IC_{25} from SSD (Confidence Interval) lb a.i./A	EECs (lbs/A)	Range of RQs	EECs (lbs/A)	Range of RQs
2,4-D	0.0038 (0.0015 - 0.0101)	0.01 - 0.7	2.6 - 180	0.009 - 1.0 (10 - 4100)	2.4 - 270 (0.03 - 14)
Atrazine	0.0037 (CI not available)	0.02 - 1.3	5.4 - 350	0.03 - 3.5 (34 - 7200)	8.1 - 950 (2.3 - 500)
Metolachlor	0.0037 (0.00033 – 0.040)	0.13 - 1.1	36 – 290	0.12 - 2.2 (150)	31 – 610 (970)
Glyphosate	0.021 (CI not available)	0.002 - 13	0.01 - 600	0.12 - 33 (4.2 - 1400)	5.7 - 590 (0.001 - 0.3)

CI = 95% confidence interval

Toxicity data and EECs used to calculate aquatic plant RQs for the representative pesticides are provided in **Tables 9 and 12**. These RQs are used to assess potential habitat effects to some of the pilot animal species. The highest EECs represent combined drift and runoff/erosion exposure and are used to provide an estimate of the level of mitigations that would be needed to reduce both drift and runoff/erosion exposures. When considering the representative pesticides and their RQs presented in **Table 18**, exposures are as high as 3 orders of magnitude above toxicity endpoints for both vascular plants and algae.

Table 18. RQs for effects to aquatic plants.

Pesticide	Non-vascular (algae)		Vascular	
	Standard pond	Edge of field	Standard pond	Edge of field
Acephate/Methamidophos*	<0.1	NA	<0.1	NA
Carbaryl	1.9	19	<0.1	0.3
Malathion	0.8	2.7	0.8	2.7
Diazinon	0.1	0.1	0.1	0.1
Fipronil	<0.1	NA	NA	NA
Imidacloprid	<0.1	<0.1	<0.1	<0.1
Permethrin	<0.1	NA	<0.1	NA
Methomyl	<0.1	0.1	<0.1	0.1
Azoxystrobin	3.1	NA	<0.1	NA
Propiconazole	9.3	NA	0.1	NA
Chlorothalonil	4.1	NA	0.1	NA
2,4-D	<0.1	NA	0.5	NA
Atrazine	22	330	22	330
Bromacil	84	NA	13	NA
Diuron	63	NA	15	NA
Glyphosate	140	1400	140	1400
Linuron	3.8	NA	1.9	NA
Metolachlor	19	NA	11	NA
Halauxifen	<0.1	NA	1.1	NA

[1]NA Not modeled in previous ecological risk assessments reviewed by EPA

[2]Based on LD_{50} values for aquatic invertebrates for insecticides and fungicides; based on EC_{50} values for herbicides; represent potential indirect effects endpoints

*****Degradate of acephate

5.5. Discussion of effectiveness of mitigations in reducing exposures

Neither the EECs nor the effectiveness of mitigations are precise, and they vary due to variations in conditions, environments, equipment, and numerous other factors. Therefore, EPA is using this analysis to estimate the extent of necessary mitigations for these species given these factors and resulting variability.

The spray drift mitigations discussed **Section 4.2.2** for the terrestrial animals are anticipated to result in estimated exposures that are 2 orders of magnitude below on-field exposures. This is sufficient to address exposure concerns for direct effects to Attwater's prairie chicken, Buena Vista Lake ornate shrew and Wyoming toad (**Table 13**). Although there may be some indirect effects concerns for insect prey, EPA believes the proposed spray drift mitigations are sufficient because RQs were based on the most sensitive test species. Given that all of these species are generalists (not feeding on specific insect species), EPA expects that the 2 order of magnitude reduction in estimated exposure is sufficient to protect insect communities that represent the prey base of these species. As described above, for some of the representative pesticides, spray drift exposures for direct effect to the vulnerable pilot species of

plants (**Table 16**) and terrestrial insects (**Table 13**) may be higher. Therefore, EPA is proposing different spray drift mitigations that include larger buffer distances for vulnerable pilot species of terrestrial invertebrates (Poweshiek skipperling, Rusty patch bumble bee, Taylors checkerspot, American burying beetle) and plants (Lake Wales Ridge plants, Mead's milkweed, Leedy's roseroot, Okeechobee gourd, Palmate-bracted bird's beak, White Bluffs bladderpod). **Tables 19-22** summarize the lines of evidence considered for the evaluation of the proposed mitigations for the terrestrial animals and plants.

In the technical document, EPA evaluated the open literature associated with the runoff/erosion mitigation practices identified in **Section 4** to describe the effectiveness and reliability of these mitigations in reducing exposures. Considering variability in exposure, toxicity, effectiveness of runoff/erosion mitigations and conservativeness of the RQs, EPA anticipates that the proposed mitigations will be sufficient for those cases where EECs are 3 orders of magnitude higher than toxicity endpoints (*i.e.,* RQs are 3 orders of magnitude or less). For plants in terrestrial and wetland habitats, EECs are as high as 2 orders of magnitude above toxicity endpoints (**Table 17**). Therefore, for direct effects to the listed plants and habitat or diet effects to the listed animals in this pilot, the proposed runoff/erosion mitigations described in **Section 4.2.3** are sufficient to reduce exposures below toxicity levels. For aquatic species, EECs are as much as 3 orders of magnitude above toxicity endpoints for aquatic invertebrates but are lower for mussels and fish (and amphibians). For aquatic plants that represent the habitat of some of the pilot species, EECs are as high as 3 orders of magnitude above the toxicity endpoints. Therefore, for species in this pilot, for direct effects to the pilot species or potential PPHD effects, the proposed runoff/erosion mitigations described in **Section 4.2.3** are sufficient to reduce exposures below toxicity levels. **Tables 19-22** summarize the lines of evidence considered for the evaluation of the proposed runoff/erosion and drift mitigations for all of the pilot species.

Table 19. Summary of the Draft Mitigations Selected for Birds and Mammals

Species	Direct		Indirect	Proposed Draft Mitigations	Key Uncertainties/ Exposure Relevance	Major Use Sites
	Taxa for Evaluation	Risk Quotients	Taxa for Evaluation (RQs)			
Attwater's Greater Prairie Chicken	Bird	Bird RQ range (<0.1-410)	Terrestrial Invertebrate prey: RQs range (19-7200) Terrestrial plant (habitat, diet)	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3	For indirect prey effects- RQs are for the most sensitive invertebrate prey but prey base would likely have differing sensitivities; does not factor foraging changes or replenishment of prey	Highest overlap with hay, rice, cotton, sorghum, and corn. Birds may use non-agricultural areas, such as rights of way and rangeland.
Buena Vista Lake ornate shrew	Mammal	Mammal RQ range (<0.1-55)	Wetland plant (habitat) Terrestrial Invert (prey; RQs range 19-7200)			Mix of orchards/ vineyards (almonds, grapes, pistachios) and row crops (hay, cotton, and wheat)

Table 20. Summary of the Draft Mitigations Selected for Terrestrial Invertebrates

Species	Direct		Indirect	Proposed Draft Mitigations	Key Uncertainties/ Exposure Relevance	Major Use Sites
	Taxa for Evaluation	Risk Quotients	Taxa for Evaluation (RQs)			
Poweshiek Skipperling	Terrestrial Invertebrate	Terrestrial Invertebrate RQ (25-14,000)	Terrestrial plant (diet; habitat)	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3 Larger spray drift buffers	Captive breeding sites are located outside of its range.	Highest overlap with corn and soybean. Non-agricultural use sites include rights-of-way. The rusty patched bumble bee also overlaps with developed land.
Rusty Patched Bumblebee					--	
Taylors Checkerspot			Plants not indirect ABB because it is a scavenger and does not require plants for habitat	Drift mitigations in Section 4.2.2 Larger spray drift buffers ABB timing restriction: Do not apply above 60 degrees (see section 4)		--
American burying Beetle (ABB)					--	Most agriculture in the area is corn, soybeans, hay, and alfalfa.

Table 21. Summary of the Draft Mitigations Selected for Terrestrial plants

Species	Direct		Indirect	Proposed Draft Mitigations	Key Uncertainties/ Exposure Relevance	Major Use Sites
	Taxa for Evaluation	Risk Quotients	Taxa for Evaluation (RQs)			
Lake Wales Ridge plants	Terrestrial Plants	Terrestrial Plants (RQ range 210-3800)	Terrestrial Invertebrate (pollinator) (RQs range 19-7200)	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3 More restrictive Drift mitigations	--	Highest overlap orange/citrus groves. Other crops include cucumbers and lettuce.
Mead's milkweed				Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3 Larger spray drift buffers See Table 5 for Timing of restrictions	--	Highest overlap use sites are corn and soybean.
Okeechobee gourd					--	Agricultural use is sugarcane. Non-Agricultural use includes herbicide applications for aquatic vegetation.
Palmate bracted bird's beak					--	Highest overlap use sites are almonds and rice. Followed by grapes, tomatoes, walnuts, corn, and fallow. Non-agricultural use includes mosquito control.
Leedy's roseroot					Leedy's roseroot grows on a very specialized type of habitat called "maderate cliffs".	Agricultural uses include corn, soy, grapes. Non-Agricultural use includes developed land.
White Bluffs bladderpod				Drift mitigations in Section 4.2.2 Larger spray drift buffers See Table 5 for Timing of restrictions	Unique and restricted habitat; most of which is protected as part of Hanford Reach National Monument.	Nearby agriculture that may support pollinators.

Table 22. Summary of the Draft Mitigations Selected for Aquatic and Wetland Species

Species	Direct		Indirect	Proposed Draft Mitigations	Key Uncertainties/ Exposure Relevance	Major Use Sites
	Taxa for Evaluation	Risk Quotients [Aquatic RQs based on pond EEC unless noted]	Taxa for Evaluation (RQs)			
Riverside fairy shrimp and San Diego fairy shrimp	Aquatic Invertebrate	RQs range (910--7800) (Edge of Field)	Focus on direct effects	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3	Primary habitat: Vernal pool habitat- Represented by the edge of field EECs	Highest overlap with almonds and hay. Non- agricultural use includes rights of way
Winged Mapleleaf, Ouachita Rock Pocketbook, Scaleshell, Rayed Bean		Mussel specific RQs (<0.1- 94)	Fish (dispersal) Aquatic Plants (habitat)	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3	Consideration of primary habitat-flowing waterbodies	Rangeland and forests account for the largest footprint. Highest agricultural overlap with field crops (*e.g.*, corn, hay, soybeans).
Madison cave isopod	Cave Species Aquatic Invertebrate and Fish	Aq Invert RQs range (<1-2800)	Focus on direct effects	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3	Consideration of primary habitat is cave systems	Highest overlap with field crops (*e.g.*, corn, hay, soybeans).
Ozark cavefish		Fish RQ range (<0.1--34)				
Terrestrial (Aquatic Phase) and Wetland species						
Wyoming toad	Fish (surrogate for aquatic phase) Bird (terrestrial phase)	Fish RQ range (<1-34) Bird RQ range (<0.1-410)	Aquatic invertebrate (2.1-4000) (prey) Aquatic plant (habitat)	Drift and runoff/erosion mitigations in Sections 4.2.2 and 4.2.3	For indirect prey effects- RQs are for the most sensitive invertebrate prey but prey base would likely have differing sensitivities; does not factor foraging changes or replenishment of prey	Highest overlap with hay. Range is watershed based, thus, conservative and assume water body is directly adjacent to field.

6. Implementation Plan for Vulnerable Species Pilot

As noted above, the purpose of the Vulnerable Species Pilot is to begin adopting meaningful protections for the pilot species before EPA has completed effects determinations or, if necessary, completed consultation with the Services.

EPA's proposed implementation plan for the mitigations in this pilot is described below. Because the pilot species have ranges, EPA intends to implement the mitigations for the pilot species through geographic-specific restrictions located in Endangered Species Protection Bulletins that are accessed through the BLT website, which are made enforceable through directions to access and follow them on pesticide labeling. Throughout this pilot (in collaboration with the FWS) and the Agency's implementation of the mitigation measures, EPA expects to consider to what extent the outcomes of the pilot provide efficiencies for current or future consultations.[27]

EPA will also continue to incorporate the FIFRA Interim Ecological Mitigation (IEM) into its registration review decisions, as appropriate. The Vulnerable Species Pilot and IEM include mitigations for spray drift and runoff/erosion. When these strategies overlap, EPA will generally use the spray drift and runoff/erosion mitigations from the Vulnerable Species Pilot instead of the IEM because the mitigations for the Vulnerable Species Pilot are considered more specific and protective for the vulnerable species in the pilot, and thus advance EPA's ESA obligation the most. The IEM includes other measures not covered by the Vulnerable Species Pilot (*e.g.*, pollinator stewardship language, incident reporting language) that will be considered by EPA during registration and registration review decisions. As indicated in the November 2022 ESA Workplan Update, EPA plans to require language on labels that directs pesticide applicators to check the Bulletins Live Two! website. Including this language on the labels will be necessary to implement the geographically explicit mitigations described above.

6.1 BLT system

EPA expects to implement the Vulnerable Species Pilot consistent with the Agency's statements in its ESA Workplan and Update. As described in the Workplan Update, ESA mitigation usually takes one of two forms. The mitigations can include nationwide restrictions on the pesticide product labeling and/or geographic-specific restrictions located in Bulletins, which are made enforceable through directions to access and follow the Bulletins on pesticide labeling (BLT reference). For the Vulnerable Species Pilot, EPA plans to implement geographic-specific restrictions that are relevant to the locations of the 27 pilot species. Bulletins contain the restrictions a user located in a specific geographic location must follow in addition to the restrictions on the pesticide product labeling. EPA uses a web-based system, BLT, to provide pesticide users with access to Bulletins when a pesticide product references BLT on its labeling so that the users can determine whether there are additional use restrictions for the pesticide product for their specific location at the time of their application. In general, EPA uses the BLT system when the use restrictions apply only in a particular geographic region where listed species are present and, in some cases, only during certain times of the year.

[27] For example, EPA may consider initiating a programmatic consultation for a set of vulnerable species, thereby eliminating the need to be considered in future Biological Evaluations, as potential effects for those pesticides would be addressed.

EPA uses Bulletins to tailor the mitigations to geographically specific areas, minimizing complexity on national pesticide product labels. Where geographic-specific restrictions are appropriate, a pesticide product's physical label usually is not the preferred location for all of those mitigation instructions because adding multiple geographic-specific restrictions can make the physical label lengthy and difficult to follow. Including a requirement to access and follow bulletins through a BLT reference on the pesticide product label simplifies the label and offers a way for users to identify the applicable mitigation for a pesticide application at a specific location and point in time. When directed by the product labeling, pesticide users are required to visit the BLT online system and follow any mitigation specified in a Bulletin for the application area. EPA intends to use the BLT system to implement protections developed through this pilot.

6.2 Implementing the pilot through the BLT system

6.2.1 Bulletins

EPA plans to publish Bulletins for the 27 pilot species that would include application restrictions that would apply across multiple pesticides. To do this, EPA plans to expand the BLT system capabilities to accommodate Bulletins needed for large groups of pesticides rather than single active ingredient or product-specific Bulletins. EPA acknowledges that there are currently Bulletins in place for some specific pesticide products and for some of the species in this pilot. The Agency is considering how to address existing Bulletins for an individual pesticide product that overlaps with Vulnerable Species Pilot Bulletins.

6.2.2 Adding BLT direction to labels

As EPA undertakes particular FIFRA actions (*e.g.*, registration review actions), EPA expects to find that a reference to BLT on pesticide product labeling is necessary for most conventional pesticide products with outdoor uses. Through the ESA Workplan Update in November 2022, EPA provided an opportunity for public comment, including for any comments related to adding BLT reference language on pesticide labeling. EPA is currently considering the public comments received.

Consistent with the ESA Workplan Update, EPA will be assessing whether a BLT reference on pesticide product labeling is appropriate when the Agency reviews registration and registration review actions. EPA acknowledges that based on the workload, the existing backlog of label review actions, and the lack of an electronic labeling and label review system, it is not feasible at this time to get BLT reference language on all pesticide products undergoing registration review at the same time. Therefore, EPA is considering how to address the need for BLT reference language on pesticide product labeling. EPA is also considering how to further prioritize cases in registration review that are affected by the different ESA strategies, including the Vulnerable Species Pilot. As the Agency determines where incorporation of BLT reference on pesticide product labeling is needed for pesticides undergoing registration review, registrants should expect Proposed Interim Decisions and Proposed Final Decisions to include determinations as to the need for the BLT reference. The Agency expects that most, if not all, conventional pesticide cases involving non-residential outdoor uses currently in registration review would need a reference to BLT on pesticide product labeling because the Vulnerable Species Pilot proposed mitigation measures would likely be necessary to protect the pilot species broadly across pesticides as well as the other ESA strategies currently under development. For some cases, EPA has already approved pesticide product labeling that includes BLT reference directions through its registration and registration review programs.

Similar to implementation through the registration review program, EPA also plans to evaluate the need for BLT reference language for registration actions. EPA may prioritize the implementation for these types of actions beginning first with new conventional active ingredients. Additionally, EPA is considering if and when implementation may be appropriate for other registration actions on currently registered pesticides for conventional outdoor uses (*e.g.*, amendments to registrations and accompanying labeling, applications for new uses). Incorporating BLT reference language through registration actions allows for earlier mitigation than solely relying on the registration review process.

In addition to new pesticide active ingredient registration actions that EPA reviews in the normal course of business, consistent with 40 CFR 152.46(b), the Agency is proposing to allow registrants to include BLT reference language on their labeling through non-notification. EPA has determined that allowing this non-notification has no potential to cause unreasonable adverse effects to the environment without notifying or approval by the Agency. Following the public comment opportunity, EPA will provide further information about the process for adding BLT reference language to pesticide product labeling via non-notification. EPA expects this process can result in the language being added to more products in an efficient and timely manner. However, EPA acknowledges that allowing registrants to include BLT reference language on their labeling through non-notification, and not receiving notifications or amendments relating to the inclusion of this language on labeling, reduces EPA's ability to easily track the adoption of this labeling, outside of the actions that the registering or re-evaluation divisions regularly receive and review. However, the Pesticide Product and Label System[28] will continue to allow for EPA and the public to see label changes that occur through notification and amendments. On a case-by-case basis, EPA may determine that other avenues are necessary to ensure the BLT reference language is on all appropriate labeling.

6.2.3 Over the next 18 months

EPA plans to focus on getting BLT reference language on pesticide product labeling as part of normal registration and registration review actions and through non-notification, as described above.

To this end, EPA plans to work on the following:

- Develop Bulletins for the initial set of 27 pilot species
- Expand the BLT system capabilities to accommodate Bulletins needed for large groups of pesticides rather than single active ingredient or product-specific Bulletins
- Provide further information on the process for allowing registrants to add BLT reference language voluntarily to their labels through the non-notification process

6.4 Public outreach, education, and encouragement of voluntary adoption of mitigations

While the Agency's priority is to develop the Bulletins with mitigation for the pilot species and to link those Bulletins to product labels, EPA recognizes that it will take time for all applicable pesticide product labeling to incorporate the BLT reference. Therefore, the Agency plans to collaborate with co-regulators and stakeholders to develop materials for education and outreach so that users can voluntarily take steps to protect these listed species.

[28] https://ordspub.epa.gov/ords/pesticides/f?p=PPLS:1

The Agency is releasing StoryMaps[29] for the initial set of vulnerable species, which include the geographic area for the pilot species, proposed mitigation measures, and other information about the species. These StoryMaps, among other things, will allow growers and applicators to determine whether they routinely apply pesticides near the pilot species, even before full implementation of the Bulletins and BLT references on pesticide product labeling, and support users in proactively adopting these mitigations to protect pilot species and prepare for a future where the mitigations could be required.

In addition to the StoryMaps, EPA is also considering ways to support outreach and education on use of BLT, in general, and compliance with label directions and Bulletins.

Over the next 18 months, EPA intends to collaborate with co-regulators and stakeholders on outreach and education to increase awareness of upcoming mitigations and to encourage early adoption of important measures to protect vulnerable listed species. To this end, EPA plans to work on the following:

- Work with stakeholders interested in developing training materials to educate users and support Agency outreach and education efforts.
- Continue to communicate with our co-regulators and stakeholders so they are aware of BLT and available resources, including StoryMaps for vulnerable listed species.
- Update the ESA Workplan website with information related to this pilot.

6.5 Future Consultation with FWS

As noted above, EPA—in collaboration with the Service(s)—also expects to consider whether the Vulnerable Species Pilot can lead to efficiencies in current or future consultations, including the potential for a programmatic consultation, or other streamlining process, that is larger in scope than just this pilot effort. The Services' ESA regulations define programmatic consultation as "*consultation addressing an agency's multiple actions on a program, region, or other basis*."[30] EPA's Vulnerable Species Pilot is an opportunity for EPA and FWS to consider whether the approaches detailed for pilot species could evolve to support a programmatic consultation. This would mean that EPA and the Service(s) would need to devote fewer resources to developing and evaluating mitigations to support EPA's biological evaluations and consultation for these listed species. And by incorporating mitigation measures directly into EPA's actions prior to consultation, the mitigation needs for these species would already be partly or fully addressed prior to any future consultation for conventional pesticides.

There are currently 27 listed species and 3 designated critical habitats covered by this pilot effort. If EPA—in collaboration with the Service(s)—determines that the pilot can be expanded to other vulnerable listed species, then EPA could potentially identify additional early mitigations to proactively protect additional listed species. Similar to the Vulnerable Species Pilot, EPA expects that the process of expanding the project to include additional vulnerable species would consider the effectiveness of particular mitigation measures in reducing exposures to listed species.

[29] https://storymaps.arcgis.com/collections/896d140363174c9d8ee78e4c471bd7fd

[30] 50 CFR § 402.02 (further noting that "[p]rogrammatic consultations allow the Services to consult on the effects of programmatic actions such as[] (1) [m]ultiple similar, frequently occurring, or routine actions expected to be implemented in particular geographic areas; and (2) [a] proposed program, plan, policy, or regulation providing a framework for future proposed actions").

6.6 Other ESA strategies

In addition to this pilot, EPA is also working on other ESA strategies to identify mitigation measures for classes of conventional pesticides (*e.g.*, herbicides). EPA will be providing specific implementation plans for these strategies as well. Implementation of the Vulnerable Species Pilot and other ESA strategies that EPA may provide in the future will be an evolving process. As EPA learns through implementing the strategies, the Agency may determine that it needs to update the implementation process and will, as appropriate, communicate these updates to the public. In the future, EPA may consider issuing additional policy statements, such as Pesticide Registration Notices, or undertaking rulemaking to ensure that the necessary mitigation measures are incorporated into pesticide product registrations and their accompanying labeling. EPA plans to use the implementation of this pilot and other ESA strategies to evaluate whether further actions are needed to ensure that all conventional pesticide labeling includes appropriate protections for listed species.

7. Expansion of mitigations to other vulnerable listed species

The species included in this pilot represent an initial set of listed species that have relatively limited range sizes, are considered by FWS to have high or medium overall vulnerability where pesticides are identified as potential stressors to the species. This pilot also represents diverse species that represent different taxa (*e.g.*, plants, insects), located in different types of habitats (*e.g.*, streams, grasslands) and parts of the continental US. EPA has begun discussions with FWS about the proposed mitigations for the pilot species.

Based on lessons learned from the 27 pilot species, EPA is considering expanding the Vulnerable Species Pilot to include additional species. EPA plans to continue to work with FWS as it considers expanding the pilot to include other species that may be considered vulnerable. This section describes EPA's current thinking on how additional vulnerable species may be identified and mitigations may be assigned using the lessons learned from the pilot. This section also provides some initial species EPA is considering for expansion; however, this list of species should not be considered comprehensive. In future discussions with FWS through pesticide specific, ESA strategies or programmatic consultations, EPA expects to identify additional species that could potentially be considered for expansion of the vulnerable species project.

EPA identified the initial pilot species by considering their overall vulnerability, geographic range and information suggesting that pesticides may be a stressor. Through discussions with FWS, EPA has added the following characteristics for consideration when identifying potential species for future expansion: limited population size, negative population trend, and limited distribution. EPA is also considering multiple approaches for any expansion of the pilot to include additional vulnerable species for which it would develop mitigations. One approach is to systematically review all listed species within the continental US[31] and identify other listed species that meet the above characteristics that describe the vulnerable species. Another approach is to identify species through the development of other ESA strategies (*e.g.*, herbicide strategy), programmatic consultation or pesticide specific consultations.

[31] EPA is not currently including species outside of the continental US because EPA plans to consider species in HI and the territories through other ESA strategies. See November 2022 workplan update for more information.

Given EPA's many ESA-related activities and limited resources, the second approach may be preferable because it would allow the vulnerable species project to complement its other ESA efforts. For example, if through a pesticide specific consultation, EPA and FWS identify a species that meets the characteristics of the vulnerable species, EPA may be able to add that species to the vulnerable species project so that it can gain protections from other pesticide active ingredients. Also, as EPA and FWS work together to develop a process and datasets for use in consultations, EPA expects to identify other vulnerable species that may be relevant to the vulnerable species project.

An example of how the pilot could be expanded is shown through the recent FWS consultation on the registration of the Enlist products. During the ongoing Enlist consultation[32], FWS identified 2 plant species that co-occur with agriculture and needed additional mitigations from runoff[33]. Those species are whorled sunflower (*Helianthus verticillatus*) and spring creek bladderpod (*Lesquerella perforata*). Both species have small ranges and high vulnerability. In addition, the spring creek bladderpod is known to occur on agricultural fields. Given the locations of these species (on or near agricultural fields) and the concerns identified by FWS in their draft biological opinion[34] for Enlist uses on corn, cotton and soybeans, EPA expects that pesticides are a relevant stressor for these two species. Therefore, the whorled sunflower and spring creek bladderpod are being considered for any future expansion of the vulnerable species project.

EPA reviewed the listed terrestrial insects that occur within the continental US to identify those that meet the characteristics of the vulnerable species. With some input from FWS, EPA identified the 7 species listed below as having small ranges, declining or limited populations, FWS overall vulnerability classification of "high," and pesticide use as a likely stressor. In recent biological evaluations for several insecticides,[35,36,37] EPA made LAA determinations and in some cases predicted the likelihood of jeopardy for several listed insects. Also, for malathion, FWS identified mitigations that were needed for several insect species (USFWS 2022). Therefore, EPA is considering expanding the vulnerable species project to include these terrestrial insect species:

- Bartram's hairstreak butterfly (*Strymon acis bartrami*),
- Dakota skipper (*Hesperia dacotae*),
- Island marble butterfly (*Euchloe ausonides insulanus*),
- Miami blue butterfly (*Cyclargus thomasi bethunebakeri*)
- Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii),*
- Oregon silverspot butterfly, and
- Saint Francis satyr butterfly (*Neonympha mitchellii francisci*).

For this pilot, EPA included 7 species of plants within the Lake Wales Ridge, and later identified 5 other vulnerable plant species located within that area. Protecting this habitat will benefit many different species that are known to occur only in this area. Similarly, EPA is considering the pine rockland habitat[38]

[32] https://www.regulations.gov/docket/EPA-HQ-OPP-2021-0957/document
[33] https://www.epa.gov/endangered-species/biological-opinions-available-public-comment-and-links-final-opinions
[34] https://www.epa.gov/system/files/other-files/2023-05/EnlistDraftBiOp.zip
[35] Including sulfoxaflor, imidacloprid, thiamethoxam and clothianidin.
[36] https://www.regulations.gov/document/EPA-HQ-OPP-2010-0889-0675
[37] https://www.epa.gov/system/files/documents/2023-05/ESA-JAM-Analysis.pdf
[38] Pine rockland habitat is characterized by slash pines, palmettos in the understory and limestone.

for any expansion of the pilot. Pine rockland was identified because two of the listed insects above (Bartram's hairstreak butterfly and Miami blue butterfly) occur only in this habitat. Pine rockland once covered large portions of southern Florida, but it is now fragmented and occurs within areas dominated by developed (*e.g.*, Miami) and agricultural landcovers and also occurs within the Everglades National Park. Some other listed species that fit the characteristics of vulnerable species and occur in this habitat include Florida leafwing butterfly (*Anaea troglodyta floridalis*), Miami tiger beetle (*Cicindelidia floridana*), Crenulate lead-plant (*Amorpha crenulata*), Blodgett's silverbush (*Argythamnia blodgettii*) and Florida Brickell-bush (*Brickellia mosieri*).

EPA included two vernal pool fairy shrimp in the pilot (*i.e.*, Riverside and San Diego fairy shrimp). EPA considered the other 3 listed fairy shrimp and whether they meet the characteristics of the vulnerable species. There is one additional fairy shrimp species (Longhorn fairy shrimp; *Branchinecta longiantenna*) that has a limited geographic range and high vulnerability (few populations that are small and isolated). The other two species (Conservancy fairy shrimp (*B. conservation*) and Vernal pool fairy shrimp (*B. lynchi*) do not seem relevant to the vulnerable species effort because of their relatively larger ranges and stable populations. Therefore, if EPA were to expand the project, the longhorn fairy shrimp would likely be relevant to include.

The discussion above is meant to illustrate some of the considerations EPA may apply if additional species are added to the vulnerable species project in the future. The species described above are not considered a complete list of those EPA may consider in the future for expansion of the vulnerable species effort but rather are provided as an illustration of how EPA may identify additional species in the future. If EPA expands the vulnerable species project to other species, it will consider species in other taxa (*e.g.*, birds, mussels) as appropriate.

If expanding the vulnerable species project to include additional species, EPA would assign relevant mitigations to the new species by considering the life history and location information for any potential expansion species. EPA would use lessons learned from the pilot to expand mitigations identified for specific taxa or habitat types of the pilot species to new species. EPA would consider which avoidance and minimization (spray drift and runoff/erosion) mitigations could apply based on the available information for any new species.

8. Conclusion

EPA is releasing this document for public comments on EPA's proposed mitigations and implementation plan for the vulnerable species pilot. EPA is proposing broad mitigations for the vulnerable species pilot. These species generally have declining and/or small populations, specific and refined ranges and designated critical habitat, and pesticides have been identified as a stressor. This is an evolving project that compliments other EPA ESA strategies (*e.g.*, Herbicide Strategy). EPA has proposed both avoidance and minimization mitigations to reduce exposures to the pilot species. EPA evaluated the proposed mitigations by using representative pesticides that have been detected in areas relevant to the pilot species. For these representative pesticides, EPA used estimated exposures and toxicity data to evaluate the relative difference in exposure and effects levels and to evaluate the effectiveness of the mitigations. For some pilot species, additional mitigations are proposed to further minimize exposures to the pesticides where exposures are several orders of magnitude above toxicity endpoints. EPA intends to implement the proposed mitigations outlined by this pilot project using EPA's BLT system to

apply geospatially explicit mitigations to these refined species locations, and this BLT reference language. EPA is expected to find that a reference to BLT would likely be necessary on pesticide labels as actions for these products come in for registration or registration review. EPA is also considering expanding this pilot to include other vulnerable listed species. EPA plans to use this evolving pilot as an approach to protecting the most vulnerable listed species from conventional pesticides with non-residential, outdoor uses.

9. Citations for Toxicity and Exposure Information of Representative Pesticides

USEPA, 2015. Ecological Risk Assessment for the New Herbicide **Halauxifen-methyl**. DP: 406134. December 15, 2015. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2015. Registration Review: Draft Risk Assessment of the environmental Fate and Ecological Risk of **Azoxystrobin**. DP 427660. December 10, 2015. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2016. **Bromacil and Bromacil Lithium Salt** – Transmittal of the Preliminary Environmental Fate and Ecological Risk Assessment for Registration Review. DP 432154. December 21, 2016. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2016. **Linuron**: Preliminary Ecological Risk Assessment for Registration Review. DP: 430154, June 9, 2016. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2016. Preliminary Comparative Environmental Fate and Ecological Risk Assessment for Registration Review of **Eight Synthetic Pyrethroids and the Pyrethrins**. DP: D425791, D429461, D433338, D433339, D435888. September 30, 2016. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2016. Preliminary Ecological Risk Assessment for Registration Review of **2,4-D**. DP: 424054, June 29, 2016. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2017. Biological Evaluation Chapters for **Diazinon** ESA Assessment https://www.epa.gov/endangered-species/biological-evaluation-chapters-diazinon-esa-assessment. Office of Pesticide Programs.

USEPA, 2017. Biological Evaluation Chapters for **Malathion** ESA Assessment. https://www.epa.gov/endangered-species/biological-evaluation-chapters-malathion-esa-assessment. Office of Pesticide Programs.

USEPA, 2017. Preliminary Ecological Risk Assessment for Registration Review of **Acephate**. DP: 418159, March 21, 2017. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2018. **Linuron**: Addendum to Ecological Risk Assessment in Support of Registration Review. DP: 444119, December 20, 2018. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2019. **Metolachlor/S-Metolachlor**: Draft Ecological Risk Assessment for Registration Review. DP: 448940. September 19, 2019. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2020. Chlorothalonil: Draft Ecological Risk Assessment for Registration Review. DP 457662. December 30, 2020. Environmental Fate and Effects Division, Office of Pesticide Programs.
USEPA, 2020. **Diuron**: Draft Ecological Risk Assessment for Registration Review. DP: 457224, December 16, 2020. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2020. **Propiconazole**: Draft Ecological Risk Assessment for Registration Review. DP: 456085, December 23, 2020. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2021. Final National Level Listed Species Biological Evaluation for **Atrazine**. https://www.epa.gov/endangered-species/final-national-level-listed-species-biological-evaluation-glyphosate. Chapter 2: Final Atrazine Effects Characterization. November 2021. Office of Pesticide Programs.

USEPA, 2021. Final National Level Listed Species Biological Evaluation for **Carbaryl**. https://www.epa.gov/endangered-species/final-national-level-listed-species-biological-evaluation-carbaryl. Chapter 2: Final Carbaryl Effects Characterization. March 2021. Office of Pesticide Programs.

USEPA, 2021. Final National Level Listed Species Biological Evaluation for **Methomyl**. https://www.epa.gov/endangered-species/final-national-level-listed-species-biological-evaluation-methomyl Chapter 2: Final Methomyl Effects Characterization. March 2021. Office of Pesticide Programs.

USEPA, 2021. **Fipronil**: Revised Draft Ecological Risk Assessment for Registration Review. DP 461350. April 13, 2021. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2021. **Diuron:** Response to Comments on the Draft Ecological Risk Assessment and Drinking Water Assessment for Registration Review. DP 462459, August 25, 2021. Environmental Fate and Effects Division, Office of Pesticide Programs.

USEPA, 2022. Final National Level Listed Species Biological Evaluation for **Imidacloprid**. https://www.epa.gov/endangered-species/final-national-level-listed-species-biological-evaluation-imidacloprid Chapter 2: Imidacloprid Effects Characterization. June 2022. Office of Pesticide Programs.