August 6, 2023

Environmental Fate and Effects Division
Office of Pesticide Programs
Environmental Protection Agency
1201 Constitution Avenue N.W.
Washington, DC 20004-0001

RE: Comments to the U.S. EPA on the Vulnerable Listed Species Pilot Project: Proposed Mitigations, Implementation Plan, and Possible Expansion. Docket No. EPA-HQ-OPP-2023-0327

Introduction

The Weed Science Society of America (WSSA) appreciates the opportunity to provide comments to The U.S. Environmental Protection Agency's (EPA) draft white paper that identifies draft mitigation measures for 27 federally threated and endangered (listed) pilot species, part of EPA's Vulnerable Species Pilot released on June 22, 2023 (EPA, 2023).

The WSSA is a non-profit professional society consisting of approximately 1,200 members from 46 U.S. states and 37 countries. Our organization promotes research, education, and extension outreach for the management of weedy plants. This includes providing science-based information to the public and to policy makers and fosters awareness of weeds and their impacts on managed and natural ecosystems. Our scientists publish their research in many journals, but the three journals published by the WSSA include Invasive Plant Science and Management, Weed Science, and Weed Technology.

The WSSA respects the challenges the agency faces under the current registration and re-registration environment. Ample non-scientific court decisions coupled with the loss of personnel is a monumental task to overcome, but one that can be addressed through partnering with science-based organizations such as the WSSA. The WSSA is committed to working with the agency to 1) generate dependable, accurate, and usable science-based data, thereby improving the regulatory process and 2) provide a direct connection to research and extension experts working with herbicides across environments in real-world situations. Furthermore, the WSSA is requesting the agency consider the many benefits of developing WSSA-EPA working groups to cooperatively and more effectively address issues facing herbicides, including the endangered species act.

Although this document is focused on the vulnerable species project, our ultimate objective is to develop a cooperative long-term strategy between the EPA and the WSSA facilitating more accurate regulatory and on-farm decisions based on a robust scientific data set.

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Pilot Species

The EPA has identified 27 pilot species based on documentation from the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration, also known as the National Marine Fisheries Service and consider them to medium or high overall vulnerability and pesticides have been identified as a stressor to the species. The EPA did not consult with FWS to or NMFS to develop the list (page 6). Because of the short time frame the WSSA looked at the life cycle of only two species to describe the potential impact of pesticides on their survival and potential ways to mitigate the risks of pesticides. Appendix A. American Burying Beetle *Nicrophorus americanus* demonstrate that the greatest stressor to this species is reduced availability of appropriately sized animal carcasses required for reproduction (Sikes and Raithel, 2002). Much lower on the list of contributing factors are light pollution, pesticide usage, runoff, erosion, and spray drift. Appendix B the Mead's Milkweed *Asclepias meadii* document demonstrates that the FWS do consider pesticides as a primary stressor to this species. The risks

are due to commercial and residential developments, habitat fragmentation due to land development, and agricultural practices such as hay mowing that takes place in June and July which interrupts the plants life cycle. Both documents also describe additional methods to mitigate the impact of pesticides on these species.

Recommendation. The current list of vulnerable species was not developed with direct consultations with FWS and NMFS. Future additions to the Vulnerable Species Pilot list should include direct consultations with the FWS and NMFS to avoid selecting species where pesticides are not a direct stressor on the species.

Benefits Documents

It would be very helpful to the reader and decision makers to have a description of the benefits and impacts of your proposal. This type of information would allow selection of the least impactful methods to mitigate the potential impacts of using a pesticide. In addition, the Federal Fungicide Insecticide and Rodenticide Act (FIFRA) requires a discussion of the benefits of use of the pesticide. On page 49 of the Vulnerable Species Pilot Project (EPA, 2023) document it says "EPA will also continue to incorporate the FIFRA Interim Ecological Mitigation (IEM) into its registration review decisions, as appropriate." Which reaffirms the need for a benefit document. The ESA Workplan document (EPA, 2022) confirms that these are FIFRA decisions "EPA has thus determined that proposed interim decisions (PIDs) and Interim Decisions issued under FIFRA should move the Agency forward in addressing its obligations under ESA (EPA, 2022)." Finally, a benefits assessment would be helpful because as the Services consider impacts on critical habitats, they also consider the risks and benefits, "The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, …" (16 CFR, 2023).

Recommendation. Neither the Vulnerable Species Pilot Project nor the Herbicide Strategy documents contain a description of the benefits or impacts of these proposals. Therefore, decision makers cannot select the least impactful way of protecting endangered species. Future documents should include a benefits and impact analysis.

Avoidance

The Vulnerable Species Pilot Project states that for species that have avoidance Pesticide Use Limitation Area (PULA) or species with a PULA, pesticide applications would be prohibited unless the applicator cooperates with the FWS Ecological Services to ensure the application would have no more than minor effects on the species. Since the proposed PULA for these vulnerable species covers millions of acres it is critical that the maps accurately describe where these species can be found (see discussion of StoryMaps).

Recommendation. For a productive meeting with FWS it would be critical for the EPA and FWS to provide a checklist of information that should be taken by the user to the discussion.

StoryMaps Are Overestimates of Habitat

For the Riverside fairy ghost shrimp *(Streptocephalus woottoni*) in California the StoryMaps cover areas not suitable to the species. The StoryMap provided includes areas of highly sloped rocky and paved areas of Riverside and San Diego County as habitat for the Riverside fairy ghost shrimp when in fact these are not suitable areas for this species because vernal pools do not exist in these areas. Riverside County Transportation and Land Management Agency (undated) states there are only 5 areas with the deep vernal pools necessary for this species: the Santa Rosa Plateau, Skunk Hollow, Murrieta and Lake Elsinore back basin are the only locations with suitable areas as well as the soil and environmental conditions necessary for their survival.

In 2022 in Georgia, to protect the frosted and flatwood salamanders, additional Endangered Species restrictions were added to the Enlist Duo herbicide label removing its use in corn, cotton, and soybeans from 11 Georgia counties. This restriction prohibited the use of this herbicide on 951,557 acres of cotton, corn, and soybean. Working with experts, the habitat of the salamanders was defined and a mapping process was developed to identify the habitats suitable for these species' survival. The process accounts for both historical habitats that still exist but also identify habitats that may have been missed in the past. When developing new habitat maps, the acres of potential interaction of agriculture and the salamander were 3526 acres; 99.63% less than the acres that were excluded from treatment in 2022.

In addition, the crop overlay maps did not accurately list where crops were grown (e.g., in Georgia it showed agricultural production in a 30 year old subdivision) and because the crop data layers consist of data from multiple merged crops (e.g., field crops contains corn, cotton, soybeans, and wheat) they did not accurately describe what crops were being grown and may trigger restrictions for a crop not grown in that area.

Many of the pilot species listed in this document do not have a habitat description. This makes it impossible to determine if the maps for those species accurately describe their range or for pesticide applicators to make sure they are not making applications in vulnerable areas not covered by the maps.

Recommendation. For plants the StoryMaps should be validated by a second outside group before using them to make regulatory decisions. Groups such as the Master Naturalists, found in almost all states, or a Native Plant Society could use local expertise to help provide accurate local habitat descriptions and validate that the maps are describing areas suitable to the species and that species specific management conditions exist that would allow the species to survive. StoryMaps need to include highways, and city boundaries to allow for proper interpretation by applicators. If the EPA or FWS would provide a list of endangered species where J/AM may be due to pesticides it would allow our members time to see if those maps in ECOS or StoryMaps are appropriate. Because of inaccuracies in the crop data layer maps they also need to be validated by a second outside group before making regulatory decisions.

Spray Drift Minimization

The spray drift buffers as described can result in land being taken out of production because if any type of pest cannot be controlled, insects, plant pathogens, or herbicides, then the farmer cannot economically produce a crop. This type of loss should be described in a benefit and impacts document.

Runoff/Erosion Minimization

To reduce runoff/erosion the document says to not apply if soil is saturated, not irrigate to the point of runoff, and not apply if NOAA/National Weather Service predicts >50% chance of 1 or more inches of rainfall to occur within 48 hours following application. In addition, four of the practices are required from Table 4 Draft options for runoff/erosion measures for selected pesticide use site. The first three requirements seem reasonably easy to follow. However, Table 4 does not have enough options to get four points for specialty crops, non-ag sites, or rice. For example, a vegetable grower in California or Florida might be able to only get 2 points by using a cover crop and planted in a field with <2% slope. A rights-of-way or highway application might not be able to get any mitigation points.

In addition, compared to the recent Enlist One and Enlist Dual Biological Opinion (FWS, 2023) similar mitigation practices were earning 1, 2, and 4 points for mitigation. The EPA has not described why the point system had to be changed for these practices.

Table 4 lists a 40% rate reduction as a possible mitigation measure. It states "Rate reductions are based on the max single application. Rate reductions can be achieved via banded application, spot treatment, precision agriculture or sprayers." The document does not describe if this reduction is from the maximum use rate for the herbicide on any crop as was used in the document calculations, from the maximum label rate for that crop, or from the maximum label rate for that crop in that state.

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	✓	✓	✓	✓	✓

Recommendation. It would help the readers if you could explain why similar mitigation practices are now receiving fewer points than in the recent biological opinion. Contact regional experts to see if there are additional mitigation measures that could be incorporated into Table 4. The EPA should clarify what they are describing as a 40% reduction.

Cover Crops

In some of the mitigation discussion it appears that cover crops are not given a very high rating for reducing runoff/erosion, one point only. In coming to the conclusion to reduce the point value of cover crops the EPA may have merged research documents on cover crops which tested the wrong species of cover crop for that site and the desired result was not feasible with the cover crop used or with the amount of organic matter produced before the cover crop was terminated. The USDA (2016) has a table to demonstrate that the correct crop is necessary for the desired result. They looked at 16 different plant species and when considering erosion control or the ability to scavenge N or P the results went from fair. to good, to excellent depending on the species being evaluated. If data from numerous species were inadvertently grouped together the results could show little advantage to using a cover crop. The same is true if the amount of vegetation produced was not a consideration in the review process. The University of California has an excellent cover crops database (https://sarep.ucdavis.edu/covercrop).

Uses of Cover Crops

	Reduce Compaction	Residue Persistence	Erosion Control	Weed Control	Nematode Control	Attract Beneficials	Scavenge Nitrogen	Scavenge P & K	Forage Quality
Legumes									
Austrian Winter Pea	F	F	VG	G	G	VG	F	F	VG
Iron Clay Cowpea	G	F	E	E	G	VG	F	G	G
Crimson Clover	F	G	VG	VG	F	VG	G	G	E
Hairy Vetch	F	F	G	G	F	E	F	G	G
Lupin	G	F	G	G	E	E	F	G	P
Red Clover	VG	F	G	VG	F	VG	G	VG	E
Sunn Hemp	E	G	VG	E	E	F	F	F	P
Velvet Bean	G	G	VG	VG	E	F	G	G	G
White Clover	F	F	VG	VG	P	G	F	F	E
Cereals									
Black Oat	F	G	VG	E	E	P	VG	F	G
Rye	G	E	E	E	G	F	E	VG	G
Oat	P	G	VG	E	P	P	VG	F	G
Ryegrass	G	VG	VG	VG	G	F	VG	G	VG
Sorghum-Sudangrass	E	VG	E	VG	VG	G	E	G	VG
Winter Wheat	G	VG	VG	VG	F	F	VG	VG	VG
Other									
Canola/Rapeseed	G	G	VG	VG	VG	G	VG	F	G
Mustards	G	F	VG	VG	VG	G	G	VG	G
Radish	VG	F	VG	E	VG	F	E	VG	G
Buckwheat	F	P	F	E	F	E	P	E	P

E=Excellent; VG=Very Good; G=Good; F=Fair; P=Poor/None

Recommendation. OPP should work with the USDA or universities to develop a comprehensive rating system for cover crop systems that considers the amount of vegetation needed to get good to excellent results and state level differences in the species that are effective in reducing runoff and erosion.

Conservation Program/Conservation Specialist: Florida Best Management Programs

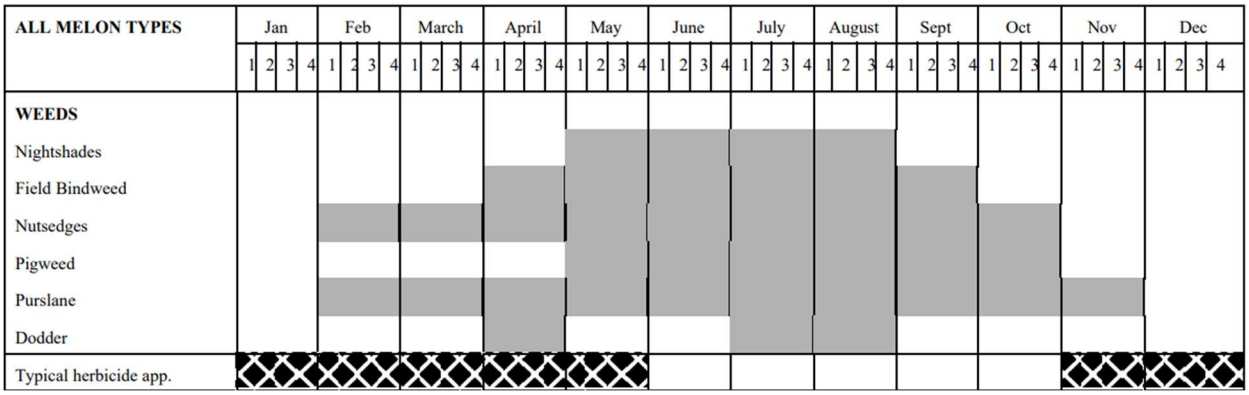
For the species with runoff concerns it says an exemption to additional runoff mitigation measures will apply if the lands are managed with a site-specific runoff and/or erosion plan implemented according to the recommendations of a recognized conservation program (page 23). The WSSA thinks that a trained conservation specialist, aware of local conditions, to help design on farm conservation practices is a good recommendation. One example of an existing program Florida's Best Management Practices (https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices) which are designed to reduce the amount of fertilizers, animal waste, and other pollutants entering the state's water resources thus improving the water quality while maintaining agricultural production. While not designed to reduce pesticide runoff they do have a similar goal of keeping contaminants out of the water. The Florida Department of Agriculture and Consumer Services (FDACS) has adopted BMPs for most commodities in the state. FDACS administers the program and the best management practices typically include: nutrient management, irrigation management, and protection of water resources. In 2022 62% of the agricultural acreage in Florida (excluding silviculture) and 83% of irrigated agricultural acres were enrolled in the BMP program (FL, 2023). Enrolling farms is labor intensive and involves site visits to determine water resource concerns, production practices, parcel information, site mapping, soil information, and a determination of the producer's ability to implement applicable BMPs. In addition, FDACS conducts a follow up on site visit every two years. Florida has cost sharing programs to help producers comply with the BMP practices.

Recommendation. OPP should work with the Services to develop a description of the risk/runoff concerns to help these conservation specialists develop site specific plans to address those issues.

Timing Restrictions

For all but one of the pilot animal species (e.g., American burying beetle), EPA expects that the proposed mitigations would apply year-round. The Southern Integrated Pest Management Center provides crop timeline information on when pesticide applications are made to specific crops (https://ipmdata.ipmcenters.org/#cropprofiles). These crop timelines can be found in each of the 194 Pest Management Strategic Plans as well as the 17 individual crop timelines. Below is a table showing timelines showing when key weed pests are present and treated in California melons (https://ipmdata.ipmcenters.org/documents/timelines/CAmelon.pdf). The table clearly demonstrates that herbicide applications do not take place in every month of the year. For the EPA to assume that threatened and endangered species are at risk every month of the year does not consider the when applications are made, that pesticide degradation takes place, and that over time soil and plant residues bind more tightly to these substrates and poses less of a risk.

Table 2. General Time Line of Key Pests in All Melon Types Grown in California.



Recommendation. The EPA evaluate the publicly available data on crop timelines to ascertain when pesticides are or are not applied that may pose risks to threatened and endangered species.

Toxicity Endpoints

The EPA has selected multiple toxicity endpoints without providing any scientific rational for these differences: for animal species (LD_{50}, LC_{50} or EC_{50}), for aquatic plant species (IC_{50}), and for terrestrial plants a more conservative endpoint (IC_{25}). On page 27 the document states "For terrestrial plants, EPA used the 5th percentile IC_{25} value of available species sensitivity distributions for herbicides." This is not a common method of describing the IC_{25}, OPP did not describe why this calculation was more accurate than other calculations, other offices in the EPA do not list this calculation, and toxicologists in the U.S. Food and Drug Administration do not use this calculation.

Recommendation. The EPA should provide references to demonstrate that plants need a higher level of protection than other listed species. The EPA should provide references to demonstrate the necessity of calculating and using the 5th percentile IC_{25} for plant species.

Bulletins Live Two Access Is Not Available to Many Pesticide Users

The EPA stated on page 46 "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." Use of this webpage requires access to the internet to check for restrictions on how a pesticide may be used in an individual county. As stated before the USDA (2021) has shown that many farmers in the U.S. do not own or use a computer and do not have internet access. In New Mexico only 36% of farmers own or use a computer and only 50% have internet access. The WSSA discussed this with an individual from the New Mexico Department of Agriculture and one from the New Mexico State University and they suggested other ways that pesticide users could get information on endangered species restrictions in their county. Use of Bulletins Live Two to disseminate information is not appropriate because many growers do not have access to the internet.

Recommendation. If users do not have internet access, other ways to distribute the information could include:

- Registrant representative(s) along with labels
- Retailors
- Extension programs, BLM, or Soil and Water Districts
- Informational, one-page handouts for distribution at extension programs
- Pesticide license CEU presentations
- Tribal Nations generally have federal pesticide applicators license, in New Mexico this is administered through Region 9. They would only have a state license if they use restricted use pesticides. No clear information on their attendance at extension training but the Apache and Zuni have extension presence. NMSU Science Center at Farmington, NM (https://farmingtonsc.nmsu.edu/) provides educational programing directed towards the needs of the Navajo agricultural community particularly NAPI (Navajo Agricultural Products Industry; https://napi.navajopride.com/).
- The Amish and Mennonites are common in some states and would not use a computer or access the internet. No clear information on their attendance at extension training.

Expansion of Mitigations to Other Vulnerable Species

It would be helpful to growers and our members for the EPA or the Services to release a complete list of endangered and threatened plant species where pesticides are a relevant stressor (e.g., two plant species were described that might be added to the list: whorled sunflower *Helianthus verticillatus* and spring creek bladderpod *Lesquerella perforate*). This list would allow growers and our members to look for ways to mitigate the risk from pesticides to these species.

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Appendix A. American Burying Beetle

Annu Kumari, Science Policy Fellow of the Weed Science Society of America

Many hypotheses about the decline of *Nicrophorus americanus* include deforestation, agricultural intensification, pesticides, loss of prairies, artificial lighting, increased competition from vertebrate scavengers, and population declines of carrion species (Sikes and Raithel, 2002). Most assumptions were related to the reduced availability of appropriately sized carcasses required for *N. americanus* reproduction. In addition, the decline in American burying beetle populations can be attributed to various other potential factors, for example, the presence of diseases, pathogens, and parasites, the disappearance of critical mammalian predators (allowing other scavengers to flourish), and the extinction of the passenger pigeon, which served as an optimal carrion source. Moreover, other contributing factors are light pollution, pesticide usage, runoff, erosion, and spray drift.

Pesticides Management Comments:

- Previous research concerning the role of pesticides in the decline of N. americanus primarily focused on DDT. However, it is considered an unlikely cause since its usage did not align geographically with the declines observed in N. americanus populations (Sikes and Raithel 2002 and Kozol et al. 1988). Additionally, the increased use of DDT (and other pesticides) is not a likely explanation because of inconsistent disappearances of American Burying Beetle in areas without pesticide spraying and the lack of disappearance of other Nicrophorus spp. in heavily sprayed areas (Sikes and Raithel 2002).
- It seems unlikely to attribute the fall in the population of the American burying beetle to pesticides. Moreover, DDT or other organochlorine pesticides could not have been the cause of the majority of extirpations because most of them occurred more than 25 years before these chemicals were widely used on our landscape, according to the timing and pattern of the decline, especially in the North-east region (US Fish and Wildlife Service 1991). Additional and further research is needed to examine the effects of particular pesticides on the survival and reproductive abilities of *N. americanus*.
- Instead of implementing a direct ban on pesticide use, it is necessary to conduct further research to identify the specific group of herbicides and insecticides that cause the most significant risk to *N. americanus*. This approach is important as it allows for the management of troublesome and resistant weed species, such as pigweeds, while also considering the protection of the beetle.
- In the northern region, *N. americanus* was found in wetter areas while avoiding agricultural and urban areas. On the other hand, in the southern range, *N. americanus* was associated with sandy soils, hayfields, grasslands, and native forests but actively avoiding human population centers and agricultural areas (Leasure and Hoback, 2017). However, the EPA storymap of American beetles includes numerous metropolitan cities. Hence, it is

advisable to implement geographically specific measures and recommendations of pesticides to effectively manage the American burying beetle.

- It is necessary to avoid spraying pesticides within all or part of the range and/or critical habitat of a species and avoid spraying during its peak activity period. A major factor is to consider in the avoidance area and minimization area if the application is within proximity of the species' habitat.
- Measures to reduce pesticide exposure to the species' habitats include implementing equipment and practices that minimize spray drift, such as utilizing nozzles that produce larger droplets or reducing the amount of small droplets and using swath offsets. Moreover, creating no-spray buffers and improving warning label language to prevent drift onto species ranges are part of the pilot plan. A reduction in application rate by less than 25% is suggested to help mitigate pesticide exposure.
- Runoff more easily occurs when soils are saturated or when large precipitation events occur. In case of high rainfall actions or wet soils it can lead to offsite transport of on-field pesticides. For this reason, avoiding pesticide applications when runoff is expected will reduce the likelihood of offsite pesticide transport. Furthermore, it is crucial to avoid pesticide application when there is a 50% chance of rain to prevent runoff and potential harm to the beetles and their habitat.

Other measures:

- Maintain proper habitat in mature forests, upland shrubland, and prairies. Reproduction can be enhanced by providing suitable carrion during the peak breeding period and protecting it from other scavengers.
- Some researchers also suggest that the now-extinct passenger pigeon, which once appeared in staggering numbers, might have been a significant food source for this species of burying beetle. Source: https://mdc.mo.gov/discover-nature/field-guide/american-burying-beetle
- Captive Breeding and Reintroduction: Create and maintain captive breeding populations as a safeguard against the risk of extinction. Reintroduction programs should be implemented to release beetles into suitable habitats where they have disappeared or declined.
- The carryon population, the primary food source for American burying beetles, decreased due to changes in the congenial flora and fauna brought on by urbanization-favoring activities like deforestation. Therefore, we can conclude that reintroducing species based on genetic research and restoring a favorable environment may help to solve this issue.

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Appendix B. Mead's Milkweed

Cynthia Sias Peppers, Science Policy Fellow, Weed Science Society of America

The decline of Mead's milkweed *Asclepias meadii* populations in grasslands and prairies in the Midwest has led to its categorization as a federally threatened species by the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act. Reasons behind the decline in its populations are often attributed to factors such as: 1) habitat loss due to residential and commercial development, 2) habitat fragmentation as a result of land development, and 3) agricultural practices such as hay mowing that takes place in June and July which prevents the completion of the plant's life cycle (FWS, 2013). Although these three main factors attributed to the decline of the Mead's milkweed population are not incorrect, the biological and reproductive cycles of the plant are also reason for its slow growth and population expansion. Slow reproductive rates as well as low percentage of seed producing plants contribute to the decline in populations of Mead's milkweed (FWS, 2013). For these reasons, multiple considerations must be applied when developing practical management plans to successfully preserve Mead's milkweed populations.

Pesticide Management Comments

Below are the main strategies submitted by USEPA, Office of Pesticide Programs on June of 2023 to propose mitigation plans for the decline of Mead's milkweed as part of the Vulnerable Listed Species Pilot Project.

Avoidance

Based on the information available from the Vulnerable Listed (Endangered and Threatened) Species Pilot Project: Proposed Mitigations, Implementation Plan, and Possible Expansion draft public document, it is stated that as for avoidance strategies for Mead's milkweed preservation, "Pesticide applications are prohibited on grasslands and prairies 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…"

Based on these actions, grasslands and prairies in states such as Kansas, Missouri, Iowa, and Illinois would have to decrease or eliminate use of pesticides for conservation purposes. These actions are not economically considerate for the farmers and ranchers of the area. Instead of

proposing cessation of pesticide use, it is important to consider the life cycle of the weed and establish relocation programs to areas of undisturbed land. It is documented that seedling growth rates can take up to 30 years to reach flowering stage (FWS, 2013). It is not feasible to expect land to remain unmanaged for 30 years from an economic perspective.

Spray drift and Erosion minimization

Agricultural research has expanded options to minimize spray drift of volatile compounds (Alheidary, 2020). Between less volatile chemistries, and application technologies, there are options for producers to minimize drift. Previous research indicates that the use of buffers, for example, is an appropriate measure to reduce risk to Mead's milkweed populations by reducing herbicide drift (Schmolke et. al., 2018). Additionally, wind breaks such as tree lines are also options for spray drift minimization (EPA, 2023). These physical buffers would allow for appropriate management of agricultural land by allowing the continuation of pesticide use while still protecting Mead's milkweed in the 34 counties it exists in (FWS, 2013).

Education and access to these tools is the next step that needs to be implemented in order to reduce instances of herbicide volatility affecting Mead's milkweed populations. Extension offices are typically one of the main resources for farmers and ranchers when it comes to education. Therefore, federal support for USDA's Cooperative Extension System is of importance for land stewardship.

Other comments:

- Removal of Mead's milkweed via herbicide contact is not always the case. Some herbicides are selective in that their mode of action will not affect broadleaf plants. Additionally, if Mead's milkweed is a grown and well-established plant, drift from an herbicide application may cause symptomology on the plant, but often will not be enough to kill the plant. These reduced levels of herbicide via drift often are an issue in row crop agriculture and can affect yield, but often are not substantial amounts enough to kill a mature established weed.
- Agricultural practices are not ranked amongst the top factors reducing Mead's milkweed populations. Residential and commercial development of land are the two top factors decreasing Mead's milkweed population.
- The main form of reproduction of Mead's milkweed is through rhizomes (FWS, 2013). The 30-year establishment period describes the time for the milkweed to set seed. Seed is often not successful at establishing, and therefore the reproduction period does not always have to be looked at in 30-year increments. Furthermore, perennial species that reproduce through rhizomes can often be perpetuated through tillage as the rhizomes are chopped up and are spread in the process.

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