United States Department of Agriculture
Office of the Chief Economist
Office of Pest Management Policy
1400 Independence Avenue, SW
Washington, D.C. 20250-3810

October 22, 2023

Jan Matuszko, Director
Environmental Fate and Effects Division (7507M)
Office of Pesticide Programs, Environmental Protection Agency
1200 Pennsylvania Ave., N.W.
Washington, DC 20460-0001

Re: USDA Comments on the Draft Herbicide Strategy Framework to Reduce Exposure of Federally Listed Endangered and Threatened Species and Designated Critical Habitats from the Use of Conventional Agricultural Herbicides. EPA-HQ-OPP-2023-0365

Dear Ms. Matuszko:

Thank you for the opportunity to comment on the U.S. Environmental Protection Agency's (EPA) Draft Herbicide Strategy Framework, posted on July 24, 2023, in the *Federal Register*. We continue to appreciate EPA's commitment to transparency around its efforts to bring pesticide actions into compliance with the Endangered Species Act (ESA).

The Draft Herbicide Strategy Framework document proposes spray drift and runoff/erosion mitigations for agricultural uses of conventional herbicides to protect Federally listed endangered and threatened species and their critical habitats. EPA's accompanying documents include *Case Studies*, which provides details on the mitigation levels required for 12 herbicides; *Scenarios* prepared by the Biological and Economic Analysis Division (BEAD) for 13 regionally specific crop production systems; and the *Technical Support Document*, which provides additional information on the efficacy of the spray drift and runoff minimization practices proposed in the Framework. EPA has committed to issuing a final Herbicide Strategy by May 30, 2024, and incorporating the mitigation measures identified in the strategy into subsequent PIDs in the Proposed Stipulated Partial Settlement Agreement that was posted publicly on July 17, 2023 (docket ID EPA-HQ-OGC-2019-0478-0008) and updated on July 18, 2023 (docket ID EPA-HQ-OGC-2019-0478-0009). The final agreement was signed on September 12, 2023.

The U.S. Department of Agriculture (USDA) recognizes EPA's need to take action quickly and efficiently to meet its obligations under the ESA. USDA appreciates EPA's inclusion of prior public and USDA input on previous proposals in this framework, such as the use of wind-directional buffers, considering field slope < 2% as a runoff-reduction practice, expanding the definition of a spray-drift buffer, and creating a runoff-mitigation exemption for growers with site-specific plans developed with experts. USDA also appreciates that the proposed framework represents an evidence- and risk-based approach that has been adapted to this purpose from more typical environmental fate and ecological risk assessments.

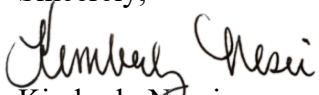
At the same time, USDA has substantial concerns about the Herbicide Strategy Framework insofar as it proposes complex, and potentially restrictive, mitigations for all outdoor uses of conventional herbicides prior to full consultation. USDA's main concerns about these mitigations include the high cost and impact of implementing the runoff/erosion mitigation; whether sufficient options are available for runoff/erosion mitigation across all cropping systems; the lack of options for farmers who farm the 39% of agricultural land that is rented or leased; the lack of clarity around "habitat" as defined by EPA; the complexity of, and the ability of growers to comply with, these mitigations; and the disproportionate impact of buffers on small fields for specialty crops. The proposed spray-drift, runoff and soil-erosion mitigations will be an obstacle to the continuing production of agricultural crops in some areas of the U.S., particularly when considering the cumulative mitigations that would be required when growers apply multiple herbicides at the same time, as is commonly done. These mitigations could also have unintended consequences for the species they are designed to protect if farmers have the option to sell land for development and opt to sell sooner than they would otherwise.

USDA believes that EPA can protect species and minimize adverse consequences to growers and will be more effective at doing so if sufficient public discussions and engagement opportunities are provided. And we believe many agricultural stakeholders will struggle to make sense of and comply with the complex mitigations described in the framework. To help USDA, state lead agencies, and other stakeholders to understand better how the proposed framework will be implemented in practice, a review of the label language and Bulletins Live Too text for a subset of herbicides, before the framework is finalized, would be welcome. To accommodate this request, another round of public comment prior to finalization and implementation may be warranted.

Lastly, given the scope of the Herbicide Strategy, likely similarities with the future Insecticide and Fungicide Strategies, and in the context of other documents recently released by EPA, we believe EPA's approach reflects a fundamental change to the pesticide evaluation process and the standard for regulatory approval of these important tools. We understand that the implementation of the Herbicide Strategy and other EPA proposals will occur incrementally through regulatory decisions on individual pesticide active ingredients; that said, we believe the collective impacts to agriculture of this fundamental change will be great.

Our detailed comments are attached for your review. We look forward to discussing our concerns and our suggestions in more detail, and we would be happy to provide any information that could be useful as the Draft Herbicide Strategy Framework advances. Please contact Elyssa Arnold at Elyssa.Arnold@usda.gov, or me at Kimberly.Nesci@usda.gov, if you would like to discuss this case further.

Sincerely,



Kimberly Nesci
Director, Office of Pest Management Policy

cc: Anne Overstreet, Director, Biological and Economic Analysis Division
Elissa Reaves, Director, Pesticide Re-evaluation Division
Billy Smith, Director, Registration Division
Ed Messina, Director, Office of Pesticide Programs, Environmental Protection Agency

USDA Office of Pest Management Policy Comments on the Draft Herbicide Strategy Framework, Docket ID EPA-HQ-OPP-2023-0365, July 24, 2023

1. Step 1: Identify Population-level Impacts

USDA appreciates the risk-based approach represented by this first step of the Herbicide Strategy, particularly in contrast with the Vulnerable Species Pilot Project (VSPP). This risk assessment approach is more consistent with EPA's prior ESA risk assessments included in Biological Evaluations. Moreover, USDA welcomes the use of the Plant Assessment Tool (PAT) in Step 1 of the Herbicide Strategy, at least with regards to estimation of Estimated Environmental Concentrations (EECs) for wetland aquatic plants. As mentioned in previous comments, in USDA's view, PAT represents a substantial improvement over TerrPlant, though USDA will echo the views of other stakeholders that full external peer review of PAT would benefit EPA's ability to expand the use of PAT in future plant risk assessments.

With this said, USDA has concerns with the use of overly conservative application assumptions for the calculation of Magnitude of Differences (MoDs). EPA states that they use the maximum single application rate in addition to habitat-specific Estimated Environmental Concentrations (EECs) to calculate MoDs. There is no accounting for typical application rates as part of this MoD derivation, and so USDA has some concerns that these MoDs, which form the basis of determining the need for mitigations, are potentially fundamentally unrealistic. In the pilot herbicide Biological Evaluations (BEs) for atrazine and glyphosate, EPA calculated EECs based on a range of application rates including typical and maximum single application rates (USEPA 2021a, 2021b). It is unclear from the strategy why EPA changed its approach and why that application rate bounding was not proposed in Step 1 of the Herbicide Strategy. We are concerned that the identification of population-level impacts is therefore based on unrealistically

high exposure scenarios. Given the availability of usage data from both proprietary and public sources, USDA would encourage EPA to explore options for better accounting for more typical application rates in the Herbicide Strategy. USDA would be happy to work with EPA moving forward to provide access to USDA data on typical application rates for crops not surveyed by the proprietary usage data sources used by both EPA and USDA.

2. Step 2: Identify Type and Level of Mitigation Measures

2.1. Spray Drift

USDA greatly appreciates that EPA has made substantial progress with regards to specifications for spray drift mitigations that maintain meaningful reductions in off-field movement of herbicide via spray drift while appropriately minimizing impacts on agricultural stakeholders. One example is the now-routine requirement for wind-directional buffers, as opposed to buffers that, even a few years ago, were required on all sides of fields regardless of wind direction. In the Herbicide Strategy EPA has also, for the first time, included roads, buildings, and conservation planting areas in what is considered to be part of a spray drift buffer. All of these structures and sites provide meaningful physical separation between a treated agricultural field and potential listed species habitat.

USDA has, however, identified several specific issues with the proposed spray drift mitigations:

a) *Impacts of buffers on specialty crop growers.* While the expanded definition of what is considered to be part of a spray drift buffer theoretically reduces the potential negative impacts of this buffer requirement (versus simply requiring in-field buffers), requiring a buffer of 200 or 300 feet would still likely result in some growers having to use cultivated land as part of these buffers. The potential for land having to be taken out of production in order to satisfy this spray drift buffer requirement is even higher for specialty crop growers, who typically have smaller fields with higher crop values, and are more likely produce perennial crops. Yan and Roy (2016) found that average field size was associated with crop type, with the crops generally having the largest fields being cotton, wheat, corn, soybean, and alfalfa; for these five crops at least 50% of fields were at least roughly 123 acres in size. In contrast, in a survey of vegetable producers (crops grown included bell pepper, cabbage, cucumbers, summer squash, sweet corn, sweet potato, watermelon, and winter squash) in North Carolina, Johnson et al. (2018) found that the average vegetable field was about only 12 acres in size. Based just on these coarse average field sizes from the available literature, we can project that the average field sizes for major commodity crops are up to ten times greater than the average field size for vegetable producers, who represent just one type of smaller scale crop producer. Therefore, the potential impact of a 200-foot buffer, for example, would be greater for the vegetable producer than the cotton producer. USDA previously described yield impacts of buffers on varying field sizes in the context of the Application Exclusion Zone with a 20-acre square field experiencing 10 percent yield loss from a 50-foot buffer on two sides compared to a 5% yield loss for a 100-acre field (USDA 2023a). The impact of buffers on different sized fields are also described further in Section 4 and illustrate the potential for disproportionate impacts to specialty crop producers.
b) *Use of ultra-coarse droplets.* The use of ultra-coarse spray droplets has become increasingly common for the application of herbicides, given abundant research

indicating that ultra-coarse spray droplets meaningfully reduce spray drift while not compromising control for most weeds (Butts et al. 2018; da Cunha et al. 2022; Ferguson et al. 2018; Franca et al. 2020). Despite the increasingly common use of ultra-coarse droplets for herbicide applications in some parts of the U.S. (Butts and Kruger 2018; Culpepper 2023; Virk and Prostko 2022), in the Herbicide Strategy EPA only accounts for use of up to coarse-very coarse droplets, which are roughly 25% smaller than ultra-coarse droplets.

To address these concerns, USDA suggests the following:

- *Impacts of buffers on specialty crop growers and small producers.* USDA suggests that EPA offer a field size correction factor, for example, specifying that the spray drift buffers proposed in the Herbicide Strategy only apply for fields greater than 50 acres in size. The required buffer distance could be reduced proportionally with field size increments, with a 25% reduction for fields 25-50 acres in size, and a 50% reduction for fields less than 25 acres. Smaller crop fields receive proportionally lower spray volumes than larger fields, and with reduced spray volumes (i.e., reduced swaths) there is reduced cumulative exposure to listed species impacted by off-field movement of applied pesticides. This holds true for both aerial and ground applications. EPA's Technical Support Document acknowledges this relationship but concludes that the decreases in drift deposition do not warrant decreases in drift buffer size. As EPA considers adjustments to drift modeling inputs (as indicated in the Technical Support Document), USDA requests that they consider how these changes impact drift estimates for small fields. The outsized impacts of standardized buffer distances on smaller fields should also be considered as part of the risk-benefit balance in the risk management process for registration review decisions. Additionally, drift mitigation on small fields could present an opportunity for incorporating an offset option into the Herbicide Strategy framework. The Herbicide Strategy framework currently does not incorporate offsets, but notes that "*EPA plans to identify opportunities for offsets to complement traditional FIFRA avoidance and minimization measures for ESA species*."
- *Use of ultra-coarse droplets.* USDA suggests that EPA provide an additional buffer reduction for the use of ultra-coarse droplets, perhaps 25 to 50 feet.

USDA also proposes the following suggestions to clarify current spray drift-related mitigation requirements for the Herbicide Strategy:

- *Windbreaks.* Clarify that the windbreak exemption also applies for crops such as cranberries where the crop canopy lies below the berm from which herbicides are applied using ground-based equipment. In cranberries, herbicides are typically applied from tractor-mounted articulated booms that extend over the sunken crop canopy, so that the spray is released at a height below the berm itself. In USDA's view this application scenario would functionally satisfy the definition of a "windbreak" given on p. 36 of the Herbicide Strategy, i.e., *"The height of the trees or windbreak must be at a height higher than the release height of the application."* Moreover, a solid berm will provide an equivalent or greater capacity to intercept spray drift than the trees or windbreak described by EPA.
- *Chemigation.* USDA requests that EPA specifically exempt chemigation from spray drift buffer requirements. Chemigation is not specifically addressed in the Herbicide Strategy

but has historically been grouped with ground applications by EPA. Sprinkler and center pivot irrigation typically deliver very large droplets of highly diluted solution under low pressure and close to the crop canopy, and in many systems are chosen specifically for drift reduction benefits. Drip or trickle chemigation systems by default have no spray drift potential.

2.2. Runoff/Erosion Mitigation Menu

USDA has identified several specific issues with the proposed runoff and soil erosion mitigations:

a) *Variable efficacy.* Conceptually, USDA supports EPA's efforts to score or weight runoff and soil erosion mitigation measures based on their efficacy in reducing off-field movement as this reflects that different mitigation measures do have varying degrees of effectiveness in reducing runoff and soil erosion from agricultural fields. However, the true effectiveness of these mitigation measures is nuanced and complex, and differs according to cropping systems, soil type and conditions, climate, and perhaps most importantly, maintenance of and management of the conservation structures. Therefore, USDA presents some suggestions below for how EPA could better account for the drivers of practical runoff and soil erosion mitigation values derived from adoption, implementation, and maintenance of mitigation measures.

b) *Effective "ceiling" on mitigation adoption for some growers.* Some growers, in some portions of the U.S., can only implement a certain number of runoff and soil erosion measures and as a result may be limited by the proposed Framework in terms of which herbicides they can continue to use, potentially reducing crop yields and farmer incomes. This "ceiling" is based on the specific crops and crop rotations used by that grower, the topography of their fields, their climate, and potentially even by existing loan, credit or insurance agreements. As a coarse example, we present scenarios for several sets of producers for whom the runoff and soil erosion mitigation menu options are not feasible:

- *Specialty crop producers*. Many of the available runoff and soil erosion mitigation measures offered in the mitigation menu are less applicable to certain specialty crop growers (e.g., several of the on-field menu options don't work for growers of perennial crops, especially in orchards or vineyards). USDA has included information below on some additional practices and technologies that can reduce runoff and/or spray drift that are currently adopted by growers of specialty crops and grains. That said, many of the menu's listed practices, particularly those listed under in field, adjacent to the field, or controlled drainage, are less common in specialty crop systems. Thus, specialty crop growers are likely to have a more difficult time complying with the menu options and qualifying for the menu exemptions. This challenge of having sufficient mitigation measures available is confirmed by BEAD's scenario document. In this document, EPA presents seven specialty crop production scenarios around the U.S. and based on estimated runoff and soil erosion mitigation measure adoption by growers, BEAD suggests that growers in all but two scenarios would be unable to achieve greater than eight mitigation points. This would mean that producers would lose access to any herbicide that requires nine mitigation points in those five scenarios (Delaware non-irrigated field grown vegetables, California and

Arizona irrigated leafy vegetables, Florida irrigated field grown vegetables, New York apple orchard, and California almond), regardless of need.

- *Dryland producers.* For very similar reasons, producers growing under arid, dryland conditions simply have fewer mitigation measures that work in their production system. BEAD's scenario document estimates that dryland grain sorghum or High Plains Texas cotton producers could reach only four mitigation points, making critical herbicides such as 2,4-D or dicamba (of example herbicides analyzed by EPA) no longer available to these growers. The impact this could cause for these growers in terms of potential yield reductions is exacerbated by the increased seed prices and overall costs of production for growers planting herbicide-tolerant seed traits (Effland et al. 2022).
- *Producers on leveled lands.* While USDA does appreciate the addition of a mitigation measure for fields with less than 2% slopes, the allowance of one point for this field characteristic leaves growers needing an additional two to eight points to proceed with herbicide applications. Many of the other menu options, particularly those requiring structural land modifications, are not well suited to leveled fields, and therefore growers on leveled land may have difficulty complying with the mitigation requirements. BEAD appears to echo this concern in their scenario, estimating that Mississippi Delta cotton growers would only be able to achieve four mitigation points, again meaning that critical herbicides such as 2,4-D or dicamba (of example herbicides analyzed by EPA) would no longer be available to these growers.
- *Definition of leveled lands*. USDA stakeholders have conveyed that defining leveled land as areas with slopes up to 3% would be more appropriate than the 2% cutoff.

c) *Leased land.* The adoption of new runoff and soil erosion mitigation measures, and particularly those that take years to effectively establish, could be even more fraught for growers farming leased lands. According to the most recent U.S. Census of Agriculture from 2017, 39% of U.S. farmland acres are rented or leased (USDA 2019). Research has suggested that producers are more likely to adopt conservation agricultural practices, e.g., cover cropping, on land they own rather than land they lease (Ranjan et al. 2019; Schnitkey et al. 2021). This reduced adoption on leased land is due to compatibility issues with costs and benefits, given that a producer is more likely to incur the costs to implement conservation practices if they will receive the benefits from those practices, which can sometimes occur over a longer period of time than the land is leased (Ranjan et al. 2019; Schnitkey et al. 2021).

d) *Emphasis on single application rate reduction.* In the Herbicide Strategy, EPA provides efficacy point credits that are proportional to single application rate reductions, with up to 9 points given for an application that is 90% lower than the maximum single application rate. While EPA alludes to the potential for this incentivized rate reduction to pose issues for herbicide resistance management, USDA contends that this cautionary statement undersells the critical importance of continuing to use effective rates of herbicides. EPA's incentivization of lower than recommended rates in order to continue using a given herbicide could – in USDA's view – exacerbate herbicide resistance challenges that are already at crisis levels for some growers in the U.S. (Busi and Powles 2009; Manalil et al. 2011; Neve and Powles 2005; Norsworthy et al. 2012).

e) *Label interpretation on the use of precision application tools.* The use of precision spraying technology for pesticides, including targeted sprayers for herbicides and

intelligent sprayers for insecticides, fungicides, and plant growth regulators, is increasing. EPA offers the option for growers to receive efficacy points in return for reducing single application rates and lists "precision agriculture or sprayers" as one of the measures that can contribute to this overall single application rate reduction. USDA agrees that precision sprayers can greatly reduce the overall quantity of a pesticide applied to a particular area. For example, research has shown that intelligent sprayers (e.g., the Smart Apply® system) developed by USDA's Agricultural Research Service (ARS) or targeted spray systems (e.g., John Deere's See & Spray™)[1] can reduce pesticide spray volume by more than 80% compared to typical application methods in certain cropping systems (Fessler et al. 2020; Gullickson 2022; Nackley et al. 2021; USDA 2022a). However, despite the potential cost savings and reduced herbicide loading that would come with reduced application volumes, stakeholders have stated to USDA that applicators are reluctant to use any tool that would reduce application rates below minimum rates.

To address these concerns USDA suggests the following:

- *Variable efficacy.* USDA can connect EPA with experts in USDA ARS, and local extension experts, to identify runoff and soil erosion mitigation measures (e.g., cover cropping) for which the practical efficacy of the mitigation measure varies substantially by region or practice. Based on this expert advice EPA could then offer scaling factors that are appropriate and based on expert judgments.
- *Adoption "ceilings".* USDA would like EPA to consider offering a path to compliance and meaningful non-target protection for crops with a ceiling on points that can be practically achieved. Some of these crops (e.g., cranberries or rice) represent production systems in which typical agronomic practices already arguably meaningfully reduce off-field movement of herbicides via runoff or soil erosion. For other crops with ceilings on points that can be achieved, USDA has concerns that the potential impacts (economic and otherwise) of effectively losing access to herbicides that would require 6 or 9 mitigation points would be substantial. These impacts are hard to quantify given the degree of current uncertainty on how the Herbicide Strategy framework would be implemented on product labels but could possibly lead to major changes in which crops can be grown on certain lands or even the transition of lands away from agriculture if growers can't reliably manage their weed issues. Additionally, these cropping systems could present an opportunity for incorporating an offset option into the Herbicide Strategy framework. The Herbicide Strategy framework currently does not incorporate offsets, but notes that "*EPA plans to identify opportunities for offsets to complement traditional FIFRA avoidance and minimization measures for ESA species*." Crops with ceilings on points that can be achieved from the mitigation menu offer a specific scenario where additional options are needed and may provide an opportunity to incorporate offsets into the mitigation framework.
- *Leased land.* Effectively increasing – or simply supporting – the implementation of conservation practices on leased farmland is complicated because of the existing structure of lease contracts, crop insurance, and other financial instruments. The most sustainable manner of facilitating conservation practice adoption on leased land likely requires revising existing lease contracts to better balance the costs and risks of adopting

[1] Reference to specific commercial products and technologies does not represent endorsement of these products and technologies by USDA.

conservation practices, though the degree of ease of this process would depend on a number of factors, including the rental type (Plastina 2021; Schnitkey et al. 2021). Issues of reduced conservation practice adoption by producers operating on leased lands also significantly affects the feasibility and success of this strategy, considering the number of acres and growers involved. Therefore, USDA requests that EPA acknowledge and consider that compliance with any mitigations involving substantial investment, structural changes, or lengthy maturation periods presents additional complications or challenges for U.S. producers operating on leased lands. To better consider the leased land challenge, USDA requests that EPA commit to strategies for better balancing or offsetting the costs and benefits of conservation practice implementation for producers operating on leased lands. The Herbicide Strategy framework currently does not incorporate offsets, but notes that "*EPA plans to identify opportunities for offsets to complement traditional FIFRA avoidance and minimization measures for ESA species*." Leased lands offer another specific scenario where additional options are needed and may provide an opportunity to incorporate offsets into the mitigation framework.

- *Rate reductions.* Rather than providing point reduction for lower single application rates, USDA would suggest that EPA offer point reductions for incremental reductions in the maximum annual application rate, which would effectively also account for the frequency of applications. In USDA's view, reducing the number of applications in many instances could offer equivalent exposure reduction benefits compared to simply reducing single application rates, without the concomitant increase in resistance management concerns.
- *Clarification of precision application on labels.* USDA requests that EPA clarify in writing that lower overall per-acre application rates that may occur due to application with precision spraying technology is not in violation of the label as long as the rate being applied on the target pest in a given portion of that acre is within the label application rate parameters. This could be included in the Label Review Manual.

Additionally, USDA proposes the following revisions and additions to the runoff and soil erosion mitigation menu. USDA expects additional mitigation options to emerge over time. We appreciate EPA's willingness to consider modifying the mitigation menu when warranted and request that EPA establish a process by which stakeholders can submit additional options for EPA's consideration.

- *Application area has a slope of less than 2%.* In the current Herbicide Strategy framework EPA proposes giving 1 mitigation point for fields with naturally low slopes, or those that are leveled. However, USDA points out that NRCS's Soil Survey Manual considers slopes of up to 3% as being "nearly level," and therefore would encourage EPA to give this mitigation point to fields with slopes of 3% or less (Schoeneberger et al. 2018).
- *Biochar/granulated activated carbon (GAC) filters.* Biochar and activated carbon are produced by pyrolysis of organic materials. This results in a porous product with a high surface area able to absorb many types of organic molecules (Cahn and Phillips 2019). Multiple studies have demonstrated the efficacy of biochar and activated carbon filtration systems in removing pesticides from agricultural runoff. These filters may be in self-contained mobile filtration units, placed across a drainage ditch using fabric sleeves, or otherwise incorporated as a discrete element in a runoff filtration system. Supporting research includes: (1) Mandal and Singh (2017) demonstrated the feasibility of removing

95% of imidacloprid and atrazine in water using multistage biochar reactions. (2) Phillips et al. (2017) used GAC at the outlet of a vegetated ditch to reduce the concentration of chlorpyrifos in simulated agricultural runoff 94-98%. (3) Phillips et al. (2022) evaluated the efficacy of a mobile carbon filter system with biochar in treating agricultural runoff. Concentrations of over 20 pesticides were initially reduced by greater than 99%; treatment efficacy declined linearly and was expected to remain at least 50% effective for up to 34 weeks. GAC and biochar can also be used in integrated vegetated treatment systems to reduce pesticide loading in runoff. (4) Phillips et al. (2021) used an integrated system with PAM treated irrigation water, a sediment trap, grass-lined ditch with compost swales, and GAC or biochar to remove 99% of imidacloprid and permethrin from a lettuce field. At this point, we are not including incorporation of biochar into soil instead of water as part of this additional mitigation option, but this may warrant further discussions.

- *Crop residue retention*. USDA reiterates the suggestion to add this conservation measure to the runoff and soil erosion mitigation menu, which was detailed in USDA's comments on the revised atrazine Interim Decision (USDA 2022b). For growers already practicing reduced or no-till, leaving standing crop residues on fields further increases infiltration rates and reduces soil erosion beyond practicing no-till alone, thereby functionally providing further reductions in herbicide loading (Baumhardt et al. 2011; Williams 2004). Moreover, in the proposed Herbicide Strategy EPA offers growers credit for using natural mulches (supporting this with evidence that natural mulches reduce pesticide loads in runoff). This same evidence ought to extend conceptually to standing crop residues provided that coverage of the ground is equivalent. Under the proposed Herbicide Strategy framework, growers who currently leave standing crop residues on their fields could instead mow those crop residues (provided that the residues cumulatively provide a minimum of 70% ground cover) and get the 3 mitigation points provided from the use of a natural mulch. However, this outcome would have unintended agronomic consequences (e.g., increased soil compaction) and negative climate impacts as it would necessitate an additional tractor pass over the field (Soane and Van Ouwerkerk 1994; Verbist et al. 2007). Therefore, USDA prefers that EPA allow this standing crop residue mitigation measure to count towards the runoff and soil erosion points needed.
- *IPM/IWM implementation.* Mitigation menu options related to herbicide application parameters could be expanded further to include implementation of integrated pest management (IPM) or integrated weed management (IWM) practices under the guidance of an IPM professional. IPM and IWM techniques have the potential to reduce the amount of herbicide applied, the number of applications made, or in some cases to obviate the need for an herbicide application at all (without additional tradeoffs such as impairing herbicide resistance management efforts) (Chikowo et al. 2009; Norris 1999; Zimdahl 2017). IPM incorporates prevention, avoidance, monitoring, and suppression activities to prevent unacceptable levels of pest (weed) damage while minimizing environmental risks and reducing evolution of pest resistance to pesticides. IWM compliments IPM but focuses on the use of integrated weed control strategies (e.g., crop rotations, weed seed destruction equipment that works alongside harvesters) to prevent or reduce weed populations (Grow.org 2023).

- *Polyacrylamide (PAM).* The application of water-soluble anionic polyacrylamide (PAM) to the soil improves water infiltration and reduces soil erosion. PAM is applied to a field through irrigation water and used most commonly in western states, including in alfalfa in Arizona (Fournier and Ellsworth 2023). Research in the Central Coast of California demonstrated that the use of PAM applied initially to furrows at a concentration of 10 ppm followed by water without PAM significantly reduced the concentration of sediment in the runoff water across a range of soil types. On average, suspended sediments were reduced by 86% (Cahn 2023). Studies with sprinklers also demonstrate that the use of PAM can reduce the sediment concentration in irrigation runoff by as much as 95% (Cahn and Phillips 2019). Because PAM can limit losses of sediment, the concentration of high Koc pesticides such as pyrethroids can also be reduced in irrigation runoff. The concentration of lower Koc pesticides is unlikely to be affected, but the total load of those pesticides can be reduced due to the increased infiltration of water and overall reduction in runoff from the field (Cahn and Phillips 2019).
- *Reservoir tillage.* Reservoir tillage is used by growers of root crops including potatoes and sugar beets. The practice creates water retaining pockets between the rows that prevent runoff from the fields. USDA suggests that EPA add reservoir tillage to their no/reduced till mitigation menu item to provide this option for root crops. Additional details on the practice were provided by the National Potato Council in their public comments on the Vulnerable Species Pilot Project (Wenkel 2023).
- *Residue tillage management.* In the proposed framework EPA gives both no- and reduced tillage practices an efficacy score of "2," and in the Technical Supporting Document goes on to explain that this "medium" efficacy score is because of the wide range of percentage reductions in off-field movement of pesticides with no- or reduced tillage. EPA states that the efficacy of these practices is due in large part to the specific soil sorption coefficient (K_{OC}) of a given pesticide. USDA suggests that EPA consider allowing for an efficacy score of "3" for no-till use for specific herbicides with relatively high K_{OC} values. Although EPA lumps "no-till" and "reduced till" together into a single mitigation measure category, these two practices functionally differ with regards to their relative reductions in soil disturbance (Classen et al. 2018; Derpsch et al. 2014). For herbicides with higher K_{OC} values and other physico-chemical properties that promote tight binding with soil particles, no-till arguably offers proportionally higher reductions in off-field movement of herbicides bound to soil particles because no-till keeps more soil on the field than reduced (or mulch) till does (Williams and Wuest 2011).

USDA continues to believe that some pesticide use mitigations can be effective and practical for growers and applicators and appreciates EPA's efforts in this area. The additional proposed runoff and erosion mitigations described above reflect an attempt to offer options and flexibility for growers and will allow growers to determine the measures that work best for their specific crop and location. As EPA moves forward with implementing ecological mitigation under both FIFRA and ESA, consistency between runoff management menus on pesticide labels and in Bulletins Live! Two (BLT) will be critical to facilitating implementation by growers and applicators. This is a continuing challenge, as acknowledged by EPA on page 10 of the Herbicide Strategy framework.

2.3. Runoff/Erosion Mitigation Menu Exemptions

Given the likelihood that adoption and implementation of more than a few mitigation measures will be very challenging for most producers, USDA anticipates that most growers will need to rely on one of the exemptions listed in the Herbicide Strategy. These exemptions are: (1) subsurface tile drainage with effluent control; (2) that the field is more than 1,000 feet away from terrestrial or aquatic habitat for a listed species; and (3) if the lands are managed with a site-specific runoff and/or erosion plan implemented according to the recommendations of a recognized conservation program. Detailed comments on each of the three exemptions are below.

a) *Tile drainage exemption.* Based on conversations with stakeholders, USDA understands that there is concern with EPA's proposed exemption for producers using subsurface tile drainage with effluent control. In particular, the concern reported to USDA is twofold: 1) effluent retention is very uncommon; and, 2) producers using subsurface tile drainage without effluent control (i.e., the majority producers using subsurface tile drainage) would have few remaining runoff and soil erosion mitigation measures available to them, with the possible exception of rate reductions (which have potential resistance management and yield trade-offs) and some in-field mitigations such as cover cropping and residue tillage management. Stakeholders have stated to USDA that very few of the mitigation measures in the proposed menu would apply to land with tile drains, this could therefore dramatically constrain herbicides available to these growers to only those requiring 3 mitigation points.

   Per the most recent U.S. Census of Agriculture, 55.6 million acres of farmland had subsurface tile drainage systems, which account for about 14% of total U.S. farmland (USDA 2019). However, the majority of land with subsurface tile drainage systems was in just six states located in the Corn Belt (Zulauf and Brown 2019). There is uncertainty with the extent to which these subsurface tile drainage systems drain directly into natural water systems, flow indirectly through drainage ditches that themselves are vegetated or have bio-filters in place, or have retention structures in place to capture and/or treat effluent. Based on discussions with stakeholders, USDA understands that currently relatively few acres with subsurface tile drainage systems utilize retention structures, or even water level control structures.

   Subsurface tile drainage systems are employed primarily to quickly transport water from agricultural fields and aid in access to fields, and the interaction with subsurface tile drainage systems and nutrients and pesticides contained in the effluent transported by the drains is complicated. For pesticides in particular, subsurface tile drainage systems appear to have varying effects on concentrations moving off treated fields, which is driven both by a pesticide's environmental fate and behavior with soils and water and also by the weather and precipitation timing relative to herbicide applications (Fortin et al. 2002; Kladivko et al. 1991; Wilkommen et al. 2019). Pesticides with high sorption coefficients tend to have high binding affinities with soil particles and if they move off treated fields they do so via erosion or soil-laden runoff, while pesticides with high water solubility values tend to readily dissolve in interstitial water and if they move off treated

fields they do so via runoff or infiltration (Kjaer et al. 2011; Kladivko et al. 1991; USDA 2000; Wilkommen et al. 2019). The presence of subsurface tile drainage systems reduces surface runoff losses of sorbed pesticides, but they can increase the flow of water-soluble pesticides into subsurface tile drainage system effluent depending on the timing of pesticide applications and rainfall events (Kladivko et al. 2001). With this said, studies comparing pesticide concentrations in runoff off treated fields and in the effluent of subsurface tile drainage systems generally finds much lower concentrations of pesticides, up to an order of magnitude lower, in the latter (Kladivko et al. 2001).

There is, however, a growing body of research on modifications or additions to subsurface tile drainage systems, or to the ditches that connect subsurface drainage systems to natural aquatic systems, that can reduce nutrient and pesticide concentrations ending up in streams and rivers (USDA 2000; Williams et al. 2023). The value of some of these practices is fairly generalized across herbicides, including:

- *Biochar filters*. Recent research has suggested that the integration of Fe-coated biochar filters (30% vol/vol) onto the tail pipes of subsurface drainage systems can effectively remove up to 98% of dissolved reactive phosphorous, which is structurally similar to and behaves competitively with glyphosate (Bolster 2021; Hebert et al. 2019).
- *Blind inlets*. These alternatives to open inlets consist of a square framework of perforated drainpipe connected to a tile system that is laid into a bed of gravel and coarsely-textured soils, and can reduce sediment, nutrient and pesticides losses off field, particularly when the backfill media is amended with activated charcoal or other carbonaceous materials such as biochar (Gonzalez et al. 2016a, 2016b; Gonzalez et al. 2020; Penn et al. 2019; Williams et al. 2023).
- *Water level control structures*. When used as part of subsurface tile drainage systems these structures can increase water retention in soils, reduce nutrient loading in drainage effluent, and provide growers with the ability to essentially turn off their subsurface tile drainage systems (Haiar 2023).

The value of other innovative modifications or additions to tile drainage systems appear to be somewhat more limited depending on the specific physico-chemical characteristics of an herbicide, including:

- *Biochar filters*. Recent research has suggested that the integration of Fe-coated biochar filters (30% vol/vol) onto the tail pipes of subsurface drainage systems can effectively remove up to 98% of dissolved reactive phosphorous, which is structurally similar to and behaves competitively with glyphosate (Bolster 2021; Hebert et al. 2019).
- *Saturated buffers*. The use of constructed wetlands or vegetated riparian buffers to filter effluent from tile drainage systems is not a new idea (see USDA 2000), but saturated buffers extend these earlier concepts by re-routing tile drainage to flow as shallow groundwater and directed through a filtering riparian buffer (Johnson et al. 2023). Saturated buffers are primarily installed and used to remove nitrates and other excess nutrients from tile drainage effluent, but conceptually they could also be

valuable tools for further reducing sediment-bound or highly water-soluble herbicides as these artificial habitats act as accelerators of physical and biological processes that can aid in herbicide degradation and metabolism (Prosser et al. 2020; USDA 2000).

- *Water level control structures*. When used as part of subsurface tile drainage systems these structures can increase water retention in soils, reduce nutrient loading in drainage effluent, and provide growers with the ability to essentially turn off their subsurface tile drainage systems (Haiar 2023).

In summary, with respect to the proposed subsurface tile drainage system exemption USDA would suggest the following:

- Revise the specific exemption language proposed to read: *"If the field has subsurface drainage systems installed the mitigation measures are not required to allow the use of this pesticide provided that either: 1) the drainage system releases effluent into a retention pond so that untreated effluent is not directly released into a natural aquatic system; or 2) the drainage system includes end-of-system filters that effectively remove pesticides from the effluent prior to release into a natural aquatic system, these could be either end-of-pipe filters, bio-filters and amendments added to drainage ditches, or saturated buffers."* and,
- Add the use of subsurface tile drainage systems to the runoff and soil erosion mitigation measure menu, with efficacy points ranging from 1-3 depending on the sorption coefficient (Koc) of a given herbicide (i.e., higher sorption coefficients would result in a higher probably efficacy value for use of a subsurface tile drainage system). Including use of tile drainage systems as an option on the runoff and soil erosion mitigation menu would provide some credit for this beneficial practice to growers whose systems do not include the retention or filtration systems that would allow them to qualify for the full exemption.

b) *1,000 feet from habitat exemption.* In the draft Herbicide Strategy, EPA also proposes exempting fields from the runoff and soil erosion mitigation requirements if that field is *"more than 1,000 feet away from a terrestrial or aquatic habitat for listed species."* EPA separately provides generic definitions for aquatic and terrestrial habitats on page 8 of the proposed Herbicide Strategy and provides more detailed definitions of these habitats relevant to their function for listed species on page 54 of the framework document. Whereas earlier in the framework document EPA appears to broadly say that any terrestrial areas except for agricultural fields are considered to be "terrestrial habitat", but then later apparently provides exceptions for *"... roads ..., mowed grassy areas adjacent to fields, ... areas of bare ground ... contiguous with the treated area; ... areas occupied by a building and its perimeter ... or other man-made structure with walls and/or roof; ... areas maintained for runoff or drift control; and, Conservation Reserve Program (CRP) and Agricultural Conservation Easement Program (ACEP) areas."*

Moreover, the structures or vegetation that apparently provide exceptions to the definition of a terrestrial habitat can also be transient, e.g., growers could change which fields are enrolled in CRP from year to year depending on numerous factors outside of their control and could install new buildings or roads.

Whether or not EPA intended these habitat exceptions to apply to the 1,000 foot exemption is unclear, and USDA urges EPA to provide clarification on their exact definition of aquatic and terrestrial habitats with respect to this exemption. Relatedly, the proposal lacks clarity on where producers should start to measure the proposed 1,000-foot distance. For example, measurements could be taken from the edge, center, or a specific portion of the field.

At a minimum, additional clarity is required from EPA on the habitat definitions in order for producers to be able to understand whether they can utilize this exemption. If EPA intends these habitat definitions to be relatively generic (e.g., "Any non-cultivated upland areas represent terrestrial habitat.") then this proposed exemption could be useful. Alternatively, if EPA intends these habitat definitions to be more complex USDA would urge EPA to publish geospatial data that provides growers with the specific location of fields qualifying for this exemption.

c) *Conservation program exemption.* USDA is pleased to support EPA in better defining the exemption for runoff menu requirements for growers who implement site-specific runoff and/or erosion plans according to the recommendations of a recognized conservation program. For many growers, this will be the only viable option for runoff and/or erosion mitigation, but there are challenges to participation, including limited funding and over-subscription of existing programs. A substantial share of agricultural operations are not enrolled in a recognized conservation program in any given year, particularly specialty crop growers. Row crop growers are more likely to be enrolled in these programs, but enrollment is typically for a limited time (e.g., one to five years), even if maintenance of the practices and their runoff and soil erosion mitigation benefits continue.

   USDA recently conducted a survey of independent crop consultants, crop advisors, and extension agents following the release of the Herbicide Strategy to help define the universe of programs available to growers who may need to use these programs to comply, to better characterize participation in these programs by different types of growers, and to understand grower motivation and challenges to enrolling in conservation programs. A preliminary summary of these results is in Appendix A. Respondents to USDA's survey were given the option to identify specific programs with which they had participated. USDA used these responses as a starting point for identifying representative programs, understanding their requirements, and developing a list of recommended qualifications for programs that could count toward the runoff/erosion mitigation menu exemption. Below we give short descriptions of some of these programs and list some recommended qualifications based on our review. While we categorized programs in the survey as government, non-profit, commercial, extension, or other, in reality many programs are intertwined. For example, non-profits or local government programs may connect participants to state or federal funding sources. Local programs may also facilitate compliance with state or federal regulations.

   Many participants cited the robust federal programs run by USDA, such as the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), Conservation Reserve Program (CRP), Conservation Reserve Enhancement

Program (CREP), and Regional Conservation Partnership Program (RCPP). Although these programs regularly are oversubscribed, we believe these are all excellent options for growers when funding and capacity are available and that enrollment in the programs should qualify for the conservation program exemption. We do not provide further description of federal programs here but are happy to discuss them with EPA in more detail if desired.

Thirteen state run conservation programs were listed by survey respondents. More were likely represented in the survey as respondents were not required to provide the name of the program(s) in which they participated. Here we will briefly describe programs run by California, Florida, and Michigan:

- In California, the Irrigated Lands Regulatory Program is managed by nine Regional Water Quality Control Boards (e.g., Central Valley, Central Coast).[2] The program regulates water discharged from agricultural fields by irrigation runoff, flows from tile drains, and storm water runoff. The Water Boards issue growers waste discharge requirements or conditional waivers. If experts determine that agricultural lands in an area are prone to erosion, growers in that area must have a Sediment and Erosion Control Plan to identify management practices they can implement to address site specific conditions. The plans must be certified by a qualified authority. If waivers are issued, they require water quality monitoring and corrective actions if impairments are found. The Irrigated Lands Regulatory Program has approximately 40,000 growers across six million acres enrolled. The State Board issues monthly reports and the Regional Boards issue bimonthly reports on their progress.
- In Florida, the Department of Agriculture and Consumer Services (FDACS) runs a Best Management Practices (BMP) program.[3] Practices include water resource protection using buffers, setbacks, and swales to reduce transport of sediments and contaminants to waterbodies. They also include irrigation management to reduce water and nutrient losses to the environment. BMPs are developed specifically for different types of agricultural commodities. Agricultural producers in a Basin Management Action Plan (BMAP) area established by the Florida Department of Environmental Protection must enroll in the FDACS BMP program; others can enroll voluntarily. Once enrolled, the first step is a site visit by the FDACS Office of Agricultural Water Policy. The site visit is followed by identification of applicable BMPs, submission of a Notice of Intent to Implement BMPs (NOI) and BMP Checklist, and execution of the NOI and BMP checklist within 18 months. The program requires ongoing record keeping and maintenance of BMPs. The program includes cost share at the state, local, and Federal level (working with NRCS).
- The Michigan Agriculture Environmental Assurance Program (MAEAP) is a voluntary program that addressed water use, soil conservation, and nutrient management in cropping systems.[4] Program participation starts with a MAEAP technician visit to the farm to assess, develop a plan of action, and assist with paperwork. Plans are tailored to the crop(s) on the farm and lay out steps to prevent

[2] https://www.waterboards.ca.gov/water_issues/programs/agriculture/
[3] https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices
[4] https://www.michigan.gov/mdard/environment/maeap

erosion and runoff. The technician provides information on financial and technical assistance. Once the work is complete, a verifier from the Michigan Department of Agriculture and Rural Development (MDARD) visits the farm to ensure the practices are in place. Once the farm is verified, it gets a sign to display and also receives preference for cost-share, tax credits, and other financial assistance. Recognition lasts five years, after which a grower has to review their plan with a MAEAP technician and request a farm visit from MDARD to renew.

On a more local level, the Upper Susquehanna Coalition covers 22 Soil and Water Conservation Districts in NY and PA.[5] The coalition's focus areas include environmentally and economically sustainable agriculture. Participants must document their farm statistics and BMPs, develop watershed and site-specific agricultural plans, and implement and evaluate their practices. Practices include riparian buffers, conservation tillage, cover crops, and others. The coalition maintains partnerships across regional (Chesapeake Bay Program), state (New York Agricultural Environmental Management Program), local (technical staff from multiple counties), and federal (EPA, USDA FSA, and USDA NRCS) government programs.

The U.S. Cotton Trust Protocol is an example of a commercial, commodity-based program.[6] The program includes grower members and tracks the following key sustainability metrics: water use, energy efficiency, land use, soil carbon, soil conservation, and greenhouse gas emissions. Growers provide data on these metrics and also are subject to visits from third party verifiers. The recommended practices include minimizing soil disturbance (reduced tillage), maintaining living roots in soil (cover crops), covering bare soil, and practicing IPM.

A non-profit, and also non-agricultural, example of a conservation program is the Audubon Cooperative Sanctuary Program for Golf Courses.[7] Member courses start with an initial site assessment and environmental plan, followed by yearly review and goal setting to help golf course superintendents and others to responsibly care for land, water, wildlife, and natural resources. The program includes IPM techniques and BMPs for chemical use, soil health and water infiltration such as avoiding runoff and drift, maintaining buffer zones to water and other sensitive areas, and raising mowing heights along shorelines to slow and filter runoff.

Based on our review of these and other programs, we recommend that current participation in programs that meet the following qualifications allow pesticide users to be exempt from runoff and erosion mitigation menu requirements. We also recommend that past participation in programs that meet the following qualifications allow users to be exempt, provided that practices have been maintained over time. We look forward to discussing and building on these in further conversations with EPA.

- The program should deliver site-specific guidance tailored to the grower's crop and/or location.

[5] https://www.uppersusquehanna.org/
[6] https://trustuscotton.org/
[7] https://audubonintenational.org/acsp-for-golf/

- The program should focus on reducing or managing runoff or erosion from agricultural fields or other pesticide use sites. Variations in language to achieve the same goal should be acceptable (for example, soil loss, soil conservation, water quality protection). The promotion of IPM practices should also be considered as a valuable part of the bigger picture of judicious usage of pesticides.
- The program should include technical advice from qualified professionals on which runoff or erosion practices are suitable for the farm as well as guidance or assistance on practice implementation.
- The program should provide documentation of program participation. For the protection of users, we think programs that qualify would be those that provide documentation; that said, we are not suggesting that this documentation be provided to EPA for consideration.
- The program should include verification of implementation of the recommended practices or activities. This should also include following up over time to ensure implementation and maintenance of the runoff/erosion reduction practices and to determine whether additional support is needed. The latter may need to be done by the grower if program participation is limited to a certain time period (e.g., five years).

USDA expects the conservation program exemption to be the most practical option for fulfilling the runoff/erosion mitigation requirements for many growers. The National Marine Fisheries Service has also supported this option for fulfilling runoff reduction requirements, including the option of "participation in a recognized stewardship program" in their mitigation menu in a recent draft Biological Opinion (NMFS 2023). As a result, demand for these programs may increase. Existing programs may need to be expanded and additional programs may need to be developed to meet this demand. USDA encourages EPA to consider that these changes and implementation of programs on individual operations will take time, and to allow for a multi-year implementation period when a requirement for runoff mitigation practice implementation goes into effect. EPA should also allow for growers to continue using herbicides if they are on a waiting list for a qualifying program.

EPA's proposed exemption also allows growers to implement a site-specific runoff and/or erosion plan designed in conjunction with a qualified professional, independent of an established program. This could be an option for growers who do not want to participate in a formal conservation program or who do not have conservation programs available to them. Qualified professionals with training or expertise in mitigating runoff and erosion from agricultural fields could include: Certified Crop Advisers with a Sustainability Specialty certification, members of the National Alliance of Independent Crop Consultants with appropriate training, EnviroCert International, Inc. Certified Professionals in Erosion and Sediment Control, Technical Service Providers, and extension agents.

3. Step 3: Identify Geographic Extent of Mitigation

3.1. Bulletins Live! Two (BLT)

USDA reiterates prior concerns with BLT shared in response to EPA's ESA Workplan Update, which in large part reflect the spectrum of views on technology in U.S. agriculture (USDA 2023b; USEPA 2022). On the one end of that spectrum, BLT needs significant improvements to be made more user-friendly, particularly for use on mobile devices. At the other end of the technology adoption spectrum, EPA also needs to accommodate growers and applicators in rural areas who may not have reliable internet access. For growers in this latter group USDA requests that EPA commit to discussions with USDA and other agricultural industry partners on establishing a network of information access points. Overall, outreach and training are needed to ensure that growers and applicators are familiar with BLT. USDA acknowledges EPA's public webinar on BLT scheduled for November 9, 2023, as a good starting point.

Many growers and applicators are becoming increasingly technologically sophisticated, and from our discussions with stakeholders the current presentation of data in BLT does not interface well with how some growers and applicators are using technology. Therefore, as a short-term measure, USDA would recommend incorporating a geo-location feature into BLT so that growers who do have internet access on portable devices in the field could explicitly use BLT to determine required mitigations or restrictions in a given field. With an eye towards a longer-term measure, USDA would suggest publishing Pesticide Use Limitation Areas (PULAs) and any other spatially explicit information necessary for compliance (e.g., GIS layers delineating habitat types) as GIS shapefiles from BLT, so that these shapefiles could be pulled directly into software used by growers and applicators in on-board computers on spray equipment. For a subset of applicators, these steps will facilitate label compliance and, ultimately, protection of listed species.

3.2. Defining Pesticide Use Limitation Areas (PULAs)

While some mitigations proposed in the Herbicide Strategy will apply nationwide and appear on a product label (e.g., mitigations for listed animal generalists), others will be implemented only in specific PULAs that are based on listed species ranges. In those cases, the definition of the PULA is based on species ranges as defined by FWS, and the extent of the PULA determines the magnitude of the impact of the mitigations on pesticide users. This was particularly evident in USDA and other stakeholders' impacts analyses submitted in public comments on the Vulnerable Species Pilot Project.

Localized efforts have shown that refining PULAs beyond the species ranges to focus on areas with potential habitat can maintain protection for species without restricting agricultural pesticide use in unnecessary locations (Randell-Singleton et al. 2023). USDA encourages EPA and FWS to pursue that approach in the interest of minimizing impacts on growers while still protecting listed species. These efforts may involve more precise habitat delineation or definition through higher quality mapping (e.g., based on elevation or riparian areas) or on-the-ground surveys of areas likely to support a species. Species can be prioritized for refinement, for example, by starting with those that have the largest impact on the PULA boundaries or by habitat type.

4. Impacts Analysis

To better understand the potential economic impact of the Herbicide Strategy on agriculture, USDA estimated costs for two sample scenarios of adopting conservation practices and/or implementing spray drift buffers. The chosen scenarios were based roughly on Scenarios 1 and 9 in BEAD's representative crop production systems scenarios analysis published alongside the draft Herbicide Strategy (USEPA 2023). The first scenario examines corn grown in Iowa, Illinois, and Nebraska. The second scenario examines peppers grown in Florida. For the first scenario only, the total costs for current corn acreage in the three states to reach 3, 6, and 9 points were estimated based on past adoption rates of conservation practices and costs of adoption from NRCS Payment Schedules (USDA 2023c). This part of the analysis was intended to illustrate the magnitude of potential overall cost of growers needing to adopt additional conservation practices to meet the requirements in the proposed Framework.

The costs in this analysis are based on an assumption of no exemptions. It does not account for acreage that may be exempt for having tile drainage installed or being 1,000 ft away from listed specific habitat, and it also does not account for field exemptions based on current enrollment in a site-specific soil erosion of runoff conservation program. It does not account for the tile drainage exemption because, while data on acreage drained by tile are available by state, it is not always clear where effluent is drained. If tile drainage in the three states in Scenario 1 were suitable for the exemption, this could greatly reduce the need for conservation practice adoption. Iowa and Illinois, for example, are among the states with the highest proportion of acreage drained by tile (Zulauf and Brown, 2019) and are estimated to have roughly 53% and 39% of farmland drained by tile, respectively. However, as indicated earlier, there is uncertainty regarding the use of retention structures and saturation buffer zones are a relatively new practice which is likely to have low adoption. The analysis does not account for the runoff/erosion program enrollment exemption for two reasons. First, while many growers may have been at one point enrolled in a program, they might no longer be formally enrolled even if they still have conservation practices installed which are effectively preventing runoff. Second, even growers who are enrolled in a program are likely to incur costs as a result of that enrollment, particularly if ongoing enrollment is needed to maintain the exemption. These may not be the same costs as may be incurred in adopting conservation practices under the points system. So while the costs reported here would likely be an overestimate of total costs, we would not expect the costs of compliance to be zero even if all acres were enrolled in a runoff/erosion program.

For both scenarios, we also estimated the potential impact on per acre returns. To do this, enterprise budgets for Iowa corn and Florida peppers were used with average field sizes of 100 acres for corn and 10 acres for peppers. For both scenarios, the analysis examined how cost changes from conservation practice adoption and yield losses from spray drift buffers could affect net returns. Many of the conservation practices that would need to be adopted to achieve efficacy points under the framework are structural modifications to land (e.g., terracing, grassed waterways); these costs are spread over 10-15 years, depending on the expected practice lifespan. Other conservation practices would be recurring costs (e.g., cover crop, mulching) and would be included in annual operating costs. The costs of conservation practice adoption from NRCS Payment Schedules do not typically include maintenance costs for structural mitigations,

but it should be noted that these would also increase operating costs and are not accounted for in this analysis.

Sample field sizes of 100 acres for corn and 10 acres for peppers were selected to simplify the cost analyses. However, field sizes vary widely in both crop types, which could affect the actual costs for a grower adopting the practices. In smaller fields, per unit costs would often be higher due to the fixed costs associated with planning and implementing conservation practices on a field.

Scenario 1: Corn – Iowa, Illinois, & Nebraska

To estimate the total costs to reach 3, 6, and 9 points in the corn scenario, we first tabulated the rate of adoption of conservation practices on acres from USDA data to determine how many additional practices may need to be adopted to comply with the Framework without qualifying for an exemption. Costs for conservation practice adoption for the practices included in EPA's mitigation menu were obtained from USDA Natural Resource Conservation Service Payment Schedules for 2023 (USDA 2023c). We modified these costs to be more relevant for a 100-acre and a 10-acre field for use in this analysis (See Appendix B). The costs are based on total corn planted in 2022 for Iowa (12.9M acres), Illinois (10.8M acres), and Nebraska (9.6M acres), totaling 33.3M acres across the three states (USDA 2023d).

The analysis found that costs for all corn acres in IA, IL, and NE to adopt enough additional conservation practices to reach 3 points could range from $0 to $1.4 billion. The costs for all corn acreage in these states to reach 6 points range from $255 million to more than $3 billion, and the costs to reach 9 points range from $674 million to $5.5 billion. It is worth noting that, the potential magnitude of the overall cost of the Framework, as indicated by cost estimates in this example for corn acreage in just three states, may not be easily offset by available conservation funding. If it is not possible to obtain funding assistance through EQIP or other conservation funding assistance programs, this could leave many growers needing to fund 100% of any conservation practice adoption on their fields unless they are able to enroll in a state, local, or non-government runoff management program with funding assistance.

As discussed in Section 2.2, this would be a particularly difficult proposition for growers who lease their farmland for several reasons. First, to be eligible for certain conservation funding, growers need to show that they have control over the land for the term of the funding, as in the case of the Environmental Quality Incentives Program (EQIP). Second, loans for conservation practice adoption through the Farm Service Agency (FSA) must be fully secured[8], a condition which could be difficult to meet without ownership of farmland. Without access to credit or financing growers may have difficulty with the upfront cost of adopting conservation practices, especially costly structural modifications. Finally, landowners might not be willing to approve certain structural modifications that

[8] https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/conservation_loan_program-factsheet.pdf

their tenants need to adopt to comply with the Herbicide Strategy requirements since they could alter the marketability or utility of land for other uses, even other agricultural uses.

Table 1 examines the potential impact to an individual grower paying for 100% of conservation practice adoption and/or from adopting spray drift buffers on a 100-acre field. The table presents a typical enterprise budget for a corn field in Iowa, adding on costs for adopting annual cover crop and installing a grassed waterway and a riparian forest buffer. The per acre costs of production after adopting conservation practices increase by $92 per acre reducing net returns by nearly 30 percent. The analysis also examines the impact of implementing a 100-foot spray drift buffer on one edge of a field. This would result in a yield loss of nearly 5% combined with a higher per unit cost of production from allocating fixed costs over a smaller total yield. The result is a decrease in net returns of approximately 11% for the particular field. Despite these potentially drastic decreases in net returns from compliance with the framework's runoff/erosion mitigation and/or spray drift buffer requirements, growers would still be likely to choose to comply because the potential yield losses associated with not using effective herbicides, which could be more than 50 percent in some cases, would be too great (WSSA 2023).

Scenario 2: Florida peppers

If vegetables growers are not able to enroll their fields in a runoff reduction program or obtain financial assistance to adopt conservation practices, they would need to fund the adoption of conservation practices to achieve the desired efficacy points. Table 2 shows an enterprise budget for a Florida pepper operation. If a grower installs cover crop, a terrace, and a filter strip, the per acre cost increases by approximately $101, reducing per acre returns by 3.7 percent. It is worth noting that the cost of most conservation practices in Appendix B does not include the cost of lost production due to installing structural changes on land. This loss could be much higher in specialty crops with higher per acre value. The implementation of a 100-foot spray drift buffer has a much larger impact on the smaller 10-acre pepper field. The field in this example (Table 2) could experience a 20 percent loss in per acre net returns from implementing a 100-foot buffer. This is due, in part to the higher value of the crop as well as the result of spreading the yield loss resulting from a 100-foot buffer over a smaller total acreage.

Table 1. Enterprise Budget for Iowa Corn, 2023, Per acre costs and returns, 100-acre field

Annual per acre production costs (baseline)			
	Fixed	***Variable***	***Total***
Preharvest Machinery	$23.90	$21.80	$45.70
Seed, Chemical, etc.		$434.31	$434.31
Harvest Machinery	$48.67	$108.61	$157.28
Labor	$45.90		$45.90
Land (cash rent equivalent)	$285.00		$285.00
Total costs	**$403.47**	**$564.72**	**$968.19**
Annual per acre costs of conservation practices			
	Fixed	***Variable***	***Total***
Cover cropping [a]		$82.00	$82.00
Grassed waterway (over 10 years) [b]	$6.49		$6.49
Riparian forest buffer (over 10 years) [b]	$3.46		$3.46
Total costs (under conservation)	**$413.42**	**$646.72**	**$1,060.14**
Annual per acre returns (baseline) [c]			
Yield per acre (bu)	202		
Price per bushel	$6.33		
Total cost per bushel	$4.79		
Returns per acre	$310.47		
Annual per acre returns (with additional conservation practices)			
Total cost per bushel	$5.25		
Returns per acre	$218.52		
Percent (%) loss (compared to baseline)	29.6%		
Annual per acre returns (with 100-foot buffer)			
Yield per acre (bu) [d]	192		
Total cost per bushel [e]	$4.90		
Returns per acre	$275.13		
Percent (%) loss (compared to baseline)	11.4%		

[a] Annual recurring cost

[b] Establishment costs are allocated over 10 years for the grassed waterway and 15 years for the riparian forest buffer, which are the expected lifespans for these practices. Annual maintenance costs are not included.

[c] Returns based on 202 bushels/ acre and Iowa corn price of $6.33/bushel, June 2023 (Johanns 2023)

[d] Yield per acre in this line is based on reduced yield resulting from a 100-foot buffer on one edge of a 100-acre square field.

[e] Revised cost per bushel based on allocating fixed cost over reduced yield and prorating variable costs

Source: Estimated Costs of Crop Production in Iowa 2023, Corn Following Soy, Conventional tillage (Plastina 2023)

Table 2. Enterprise Budget for Florida peppers, 2020, Per acre costs and returns, 10-acre field

Annual per acre production costs (baseline)			
	Fixed	***Variable***	***Total***
Transplants		$2,465	$2,465
Fertilizer, Chemical		$3,512	$3,512
Machinery (including operation and maintenance)	$311	$2,049	$2,360
Labor		$1,266	$1,266
Land (cash rent equivalent)	$694		$694
Interest on operating capital		$469	$469
Harvest cost		$4,356	$4,356
Total costs	**$1,005**	**$14,880**	**$15,885**
Annual per acre costs of conservation practices			
	Fixed	***Variable***	***Total***
Cover cropping [a]		$82	$82
Terrace (over 10 years) [b]	$13		$13
Filter strip (over 10 years)	$6		$6
Total costs (with additional conservation practices)	**$1,024**	**$14,962**	**$15,986**
Annual per acre returns (baseline) [c]			
Yield per acre (bu)	1,100		
Price per bushel	$16.91		
Total cost per bushel	$14.44		
Net returns per acre	$2,719.37		
Annual per acre returns (with additional conservation practices)			
Total cost per bushel	$14.53		
Net returns per acre	$2,618.36		
Percent (%) loss (compared to baseline)	3.71%		
Annual returns per acre (with 100-foot buffer)			
Yield per acre (bu) [d]	933		
Total cost per bushel [e]	$14.60		
Net returns per acre	$2,159.58		
Percent (%) loss (compared to baseline)	20.59%		

[a] Annual recurring cost

[b] Establishment costs are allocated over 10 years. Annual maintenance costs are not included.

[c] Returns based on 1,100 28-lb bushels per acre and 3-year average price (2019, 2021, 2022), peppers (USDA NASS Quick Stats)

[d] Yield per acre in this line is based on reduced yield resulting from a 100-foot buffer on one edge of a 10-acre square field.

[e] Revised dost per bushel based on allocating fixed cost over reduced yield and prorating variable costs.

Source: Southwest Florida Bell Peppers Enterprise Budget (Wade et al. 2020)

Summary

While the costs of compliance could be high, these costs do not take into account the potential benefits of conservation practice adoption, which in addition to potentially protecting endangered species, could result in additional agronomic benefits (e.g., improved soil health) and improved yields. These positive effects are not accounted for here, but they would be important to a more thorough analysis of the impacts of the Framework. Still, the costs of compliance could be substantial. Overall, the increase in costs per acre for certain fields to use the needed pest management tools, especially fields operated by growers without the ability to secure conservation funding or loans, could result in land being taken out of production - and for agricultural lands near urban areas, it could result in the land being converted sooner to residential or industrial use. This highlights the importance of providing ample time for growers to adopt practices, as well as having sufficient federal, state, and local site-specific runoff and soil erosion management programs available for growers. The site-specific runoff and soil erosion management program enrollment exemption is not likely to eliminate the costs of compliance with the Framework, but it could lower them considerably if a technical expert determines that fewer practices would be needed to reduce runoff than would be required under the points system or if a grower can obtain conservation funding assistance to adopt practices. For this reason, it is important that fields that have been previously enrolled in a runoff/erosion program, and for which it can be verified that practices previously adopted are still functioning and maintained, can also be exempted.

5. Implementation Concerns

Complexity, Labels and BLT. USDA has major concerns with the complexity of the framework of mitigations being proposed, and whether the proposed framework can be described on product labels and through BLT clearly enough so that growers and applicators could comply with these requirements on top of existing, already complex label language. Growers and applicators are likely to have significant difficulties parsing and complying with the proposed restrictions for individual herbicides, not to mention tank mixtures or co-formulated products that include multiple herbicides. We appreciate that in some part this complexity speaks to the challenges with developing an efficient and more generic (but still risk-based) strategy for complying with ESA moving forward for herbicide registrations. However, the tradeoff is that what EPA has proposed is so complicated that it may not be possible for growers and applicators to feel confident that they understand what they need to do to comply without both substantial training and publication of this information through more digestible media.

Given the complexity of the Herbicide Strategy Framework, including the general label mitigations on product labels under existing paradigms will be a challenge. In addition, BLT is currently formatted to present only product specific information in a static manner, and many growers are not familiar with the tool. To facilitate compliance with the restrictions in the proposed Herbicide Strategy, we recommend EPA consider existing label formatting and standardization efforts in the context of this strategy and collaborate with industry partners to explore methods to increase the capacity of BLT to present multi-layered geo-spatial information, including through a mobile application. Additionally, USDA encourages EPA to consult with major equipment manufacturers to understand whether PULAs and other spatially

explicit mitigations could be published digitally in formats that can be read by GPS-enabled computers used in spray equipment.

Education and Training. Thorough and consistent training, education, and outreach will be crucial for success of the Herbicide Strategy. EPA should leverage existing training networks and associations to reach impacted herbicide users. Some examples include: Pesticide Safety Education Programs (PSEPs) and Pesticide Regulatory Education Program (PREP) workshops through states and land grant universities; coordination with the National Association of Independent Crop Consultants (NAICC) to provide courses that count for Continuing Education Units (CEUs); working with the National Agricultural Aviation Association (NAAA) to reach aerial applicators; and conducting outreach through national and local grower groups to reach farmers directly.

For many growers subject to drift or runoff/erosion mitigation, the implementation of the mitigation menu items as proposed will require significant technical and financial assistance. To help growers understand the requirements specific to their herbicide needs, outreach and assistance by linking growers with existing conservation programs will be needed. Outreach and education through NAICC and the Agronomy Society of America to ensure that their members understand the requirements of these initiatives will also be needed. USDA looks forward to continued collaboration with EPA to reach impacted stakeholders.

Additionally, USDA has heard concerns from commercial applicators about the uncertainties regarding specifications and standards for recordkeeping to ensure and document compliance with the proposed Herbicide Strategy framework. On top of the uncertainties with how to document and verify compliance, doing so could prove to be an added expense for commercial applicators. Therefore, USDA urges EPA to proactively collaborate with commercial applicators and with state lead agencies to develop recordkeeping guidelines in order to minimize uncertainties around enforcement expectations.

Coordination with State Lead Agencies. It is imperative that EPA work directly with State Lead Agencies to ensure that they understand the proposed mitigations, know how they can assist impacted growers and applicators in their areas, and understand their role in ensuring compliance. Collaboration with the states as co-regulators under FIFRA is key to facilitating success with any new pesticide restrictions. Given the scope of the Herbicide Strategy, and the likely similarities with the future Insecticide and Fungicide Strategies, USDA requests that EPA commit to engaging in substantive discussions with state lead agencies during the development of these strategies, collaborate on training and education, and clarify enforcement expectations.

For many growers subject to drift or runoff/erosion mitigation, the implementation of the mitigation menu items as proposed will require significant technical and financial assistance. To help growers understand the requirements specific to their herbicide needs, outreach aimed at linking growers with existing technical assistance providers and conservation programs that could potentially provide that assistance will be needed. Outreach and education through NAICC and the Agronomy Society of America to ensure that their members understand the requirements of these initiatives will also be needed. USDA looks forward to continued collaboration with EPA to reach impacted stakeholders.

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Appendix A. Survey Summary

In June 2023, under authorities granted by Congress, USDA conducted a survey to gather information from expert agricultural advisors, consultants, and extension agents across the U.S. on current participation in site-specific erosion and/or runoff reduction programs in outdoor agriculture. USDA conducted this survey of independent crop consultants, crop advisors, and extension agents to better understand the types of runoff/erosion programs that growers are currently using and the extent of participation across different types of growers, given many growers will clearly need technical and financial assistance in order to implement the proposed mitigations. The survey also asked about motivations and deterrents to program enrollment to enhance our understanding of how EPA's proposed mitigations impact growers. In this appendix we present a summary of the results of this survey.

In general, the results indicate that, for many growers, participation in a site-specific erosion and/or runoff reduction program may be an option to satisfy the Herbicide Strategy requirements if sufficient program funding exists, and that many operations are already participating in such programs. However, the results also indicate that there are barriers to entry in existing programs for some growers and that these barriers may differ by crop. The full survey results will be available at https://www.usda.gov/oce/pest/publications#factsheets.

Appendix B. Establishment Costs of NRCS Conservation Practices in Mitigation Menu

NRCS Conservation Practice	Scenario description	Cost per Unit [a]	Unit	Total cost, 100-acre field	Total cost, 10-acre field
In-field Management Mitigation Measures					
311 – Alley cropping	Trees planted down each edge of the field. Analysis assumes trees are placed 12 feet apart and 16 feet from the edge of the cash crop. Cost does not account for lost crop acreage. In some cases, alley row can have harvest value, e.g., walnuts.	$38	planted seedling	$13,218	$4,180
329 – No-till	Cost is estimated at $23 per acre in a typical scenario, but this cost is treated as $0 because while there would be costs of transition to no-till, those costs would be displacing costs of tillage and can result in higher yields from improved soil health.[b]	$23	acre	$2,300	$230
332 – Contour buffer strip [c]	Cost based on conservation tillage, 3% field slope, and average soil erodibility for 150-foot max spacing between strips. Buffer strip width = 15 feet. Costs based on 8 acres of buffer + foregone income for a 100-acre field ($499 per acre) and 1 acre of buffer + foregone income for a 10-acre field ($1,677 per acre based on high-value crop)	$499 or $1,677	acre	$3,992	$1,677
330 – Contour farming	Payment reflects the extra labor and initial supervision costs in laying out and implementing contour farming.	$11	acre	$1,100	$110
340 – Cover crop	Small grain or legume planted with a drill. Termination using herbicide.	$82	acre	$8,200	$820
345 – Reduced till	Reduced till, labor and equipment	$28	acre	$2,800	$280
412 – Grassed waterway	Typical practice is 1200' long, 12' bottom, 8:1 side slopes, 1.5' depth, half excavation. Fabric or stone checks every 100 feet along the length of the waterway, 18" deep with 12" laid over on the surface. Area ≈ 2 acres for 100-acre field and ≈ 0.25 acres for 10-acre field	$3,247	acre	$6,494	$812
484 – Mulching	Partial coverage, straw or other natural material, typically applied to new orchards, vineyards, or specialty crops.	$51	acre	$5,100	$510
585 – Stripcropping	Implementation of a stripcropping system that alternates strips of erosion susceptible crops with erosion resistant crops.	$2	acre	$200	$20
600 – Terrace	The typical installation is a broadbased terrace having 5:1 upstream and 5:1 downstream slopes measuring 2,500 feet in a field with slopes from 2% to 8% constructed in loam soils or similar. One terrace installed for a field based on horizontal interval (HI) for a field with 5:1 slope and geographical location factor 0.7. Cost based on installing two terraces across linear feet of square field.	$2	linear foot	$8,348	$1,320
Adjacent to the Field					
390 – Riparian herbaceous cover	Herbaceous area established and/or restored between terrestrial and aquatic habitat. Where the establishment of a riparian herbaceous plant community is desired, site adapted species of grasses, legumes, and/or forbs will be planted by no-till or range drill seeding methods as necessary to accomplish the	$608	0.5 acre	$1,748	$553

	intended purpose(s). Cost based on border down both sides of 6-foot stream through a field. Riparian herbaceous cover must be 2.5x width of stream.				
391 – Riparian forest buffer	Establish buffer of trees and/or shrubs to restore riparian plant communities. Buffer located adjacent to and up-gradient from a watercourse or water body extending a minimum of 35 feet wide. Planting consists of bare-root shrubs, evergreen, and deciduous trees, one-third of the area planted to each. Spacing: 6' x 6' for shrubs, 12'x15' for evergreen trees, and 15'x15' for deciduous trees. At buffer width of 35 feet, 1 acre ≈ 1,245 feet long. Costs for 100-acre and 10-acre field based on length of square field.	$3,092	acre	$5,185	$1,640
393 – Filter strip	Native species, cost to install + foregone income Filter strips must be at least 30 feet wide. Costs based on 2-acres of filter strip for 50-acre field and 1 acre for 10-acre field.	$581	acre	$1,743	$581
601 – Vegetative barrier	Permanent strips of stiff, dense vegetation established along the general contour of slopes. Barriers must be 3 feet wide. Cost based on length of a square field.	$1.26	linear foot	$2,630	$832
386 – Field border	Cost to install native species on two field edges + foregone income. Field borders must be at least 30 feet wide. Costs based on 3 acres of field border for 100-acre field and 1 acre for 10-acre field.	$497	acre	$1,491	$497
Other mitigation measures					
350 – Sediment basin	Embankment earthen basin with no pipe, 1,500 cubic yards	$3,519	1500 cubic yards	na	na
378 – Pond	Excavating 3,100 cubic yards and spreading outside pool area, does not include vegetation	$5,903	3100 cubic yards	na	na
656 – Constructed wetland	1-acre constructed wetland with 18" depth, cost only includes earthwork and wetland vegetation	$10,753	acre	na	na

[a] With the exception of mulching and cover crop, which would be recurring annual costs, these costs are expected to be establishment costs for practices with lifespans ranging at least 5 years. Maintenance costs are not included in this analysis, but these would add annual, recurring costs.

[b] A cost comparison of tillage and no-till farms from 2016 found that no-till farms had both higher machinery investments and higher fertilizer use than tillage farms. but they also had higher profits. While machinery investment in no-till planters will be a cost to growers not currently doing reduced till or no-till, the cost of these practices is treated as $0 because the cost of purchasing the new equipment would displace the cost of replacing equipment used in tillage systems. See for example https://www.agmanager.info/sites/default/files/NoTill-Tillage_Costs_2016.pdf

[c] The spacing between barriers should be in multiples of the widest field equipment width and must not exceed the computations of spacings for constructed terraces. Terrace spacing is based on soil erodibility, tillage type, geographic location, and average land slope (USDA 2021)

Source: USDA Natural Resource Conservation Service, Payment Schedules, 2023, National estimates