No. 19-70115

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

NATIONAL FAMILY FARM COALITION, *et al.*,

Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, *et al.*,

Respondents,

and

MONSANTO COMPANY,

Intervenor-Respondent.

ON PETITION FOR REVIEW FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

PETITIONERS' EXCERPTS OF RECORD VOLUME VI of IX

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[1] Unless otherwise specified, the document identifier numbers refer to their document numbers as listed in the Certified Indices, ECF Nos. 26-3 (Sections A through P), 34-3 (Section Q).

[2] Respondent United States Environmental Protection Agency (EPA) did not produce, but only provided hyperlinks to, publicly available documents. *See* ECF No. 26-3. For the Court's convenience, Petitioners have produced those hyperlinked documents in their entirety in the Excerpts of Record.

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10/1/2018	P.194	E-mail from Nancy Beck to S. Smith re: Thank You	ER 0527
10/2018	O.95	EPA/BEAD Summary of 2017 & 2018 Incidents by State	ER 0529
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[3] This e-mail contains a hyperlink to an online article that Petitioners have produced in its entirety. For the Court's convenience, Petitioners have produced relevant hyperlinked articles in their entirely in the Excerpts of Record. Throughout the index these documents containing hyperlinks are noted with a double asterisk (*e.g.* __.__**).

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CENTER for BIOLOGICAL DIVERSITY Because life is good.

May 31, 2016

Dicamba: New Use on Herbicide-Tolerant Cotton and Soybeans
Environmental Protection Agency
Mailcode 28221 T
1200 Pennsylvania Ave, NW
Washington, DC 20460

Re: Comments on Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean (Docket #: EPA-HQ-OPP-2016-0187).

Please accept the following comments on behalf of the Center for Biological Diversity ("Center") in response to the Environmental Protection Agency's ("EPA") proposed new use registration for dicamba as part of its registration process under the Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA").

The Center is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has more than one million members and online activists dedicated to the protection and restoration of endangered species and wild places. The Center has worked for many years to protect imperiled plants and wildlife, open space, air and water quality, and overall quality of life. The Center's Pesticides Reduction Campaign aims to secure programmatic changes in the pesticide registration process and to stop toxic pesticides from contaminating fish and wildlife habitats. We appreciate the opportunity to provide comment.

THE EPA HAS NOT COMPLIED WITH ITS DUTIES UNDER THE ENDANGERED SPECIES ACT

The EPA's proposed registration of this new use of dicamba does not comply with the mandates Congress established in Section 7 of the Endangered Species Act (ESA), as interpreted by the expert wildlife agencies in the ESA regulations and handbook, the courts, and as recently set forth by the National Academies of Sciences. Instead, for assessments of new herbicide tolerant crop uses, such as the proposed use of dicamba on herbicide tolerant corn and soybean, the EPA applies its FIFRA risk assessment to unlawfully avoid lawful ESA "may affect" determinations. These "may affect" determinations require either informal consultation and written concurrence from the wildlife agencies or formal consultation and a biological opinion.

The new Interim Approaches for effects determination, based on the National Academies of Sciences report entitled "*Assessing Risks to Endangered and Threatened Species from Pesticides,*"[1] (hereafter "NAS report") lays out an approach that the EPA should use as a guide to begin to comply with its obligations under the Endangered Species Act ("ESA").

Following the publication of the NAS report in 2013, the agencies have developed two policy documents to guide consultations on pesticide review and approvals moving forward: (1) *Enhancing Stakeholder Input in the Pesticide Registration Review and ESA Consultation Processes*,[2] and (2) *Interim Approaches for National-level Pesticide Endangered Species Act Assessments Based on Recommendations of the National Academy of Science April 2013* (Hereafter "*Interim Approaches*").[3]

As laid out in the NAS report and *Interim Approaches*, the risk assessment and consultation process should follow three steps.[4] These steps generally follow the three inquiries of the ESA consultation process: (1) the "no effect"/ "may affect" determination (2) the "not likely to adversely affect"/ "likely to adversely affect" determination (3) the jeopardy/no jeopardy and adverse modification/no adverse modification of critical habitat determination.

The agencies made clear at a November 15, 2013 public meeting that it would apply the NAS recommendations and *Interim Approaches* "day forward"[5] and in November of 2014 made the same statement in a report to Congress.[6] However, the EPA arbitrarily decided that it will only apply the *Interim Approaches* in the context of registration review.[7] For new herbicide tolerant crop uses, the EPA states it will do "Overview Document-compliant" endangered species assessments.[8] The Overview Document, and the assessment conducted for this new use of dicamba, reverts to the same

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[1] National Academy of Sciences. 2013. *Assessing Risks to Endangered and Threatened Species from Pesticides* (hereafter NAS REPORT), Committee on Ecological Risk Assessment under FIFRA and ESA Board on Environmental Studies and Toxicology Division on Earth and Life Studies National Research Council (April 30, 2013).

[2] U.S. Environmental Protection Agency 2013, Office of Chemical Safety and Pollution Prevention- Office of Pesticide Programs, Enhancing Stakeholder Input in the Pesticide Registration Review and ESA Consultation Processes and Development of Economically and Technologically Feasible Reasonable and Prudent Alternatives, Docket ID #: EPA-HQ-OPP-2012-0442-0038 (March 19, 2013).

[3] Available at https://www.epa.gov/sites/production/files/2015-07/documents/interagency.pdf

[4] NAS REPORT at Figure 2-1.

[5] INTERAGENCY APPROACH FOR IMPLEMENTATION OF NATIONAL ACADEMY OF SCIENCES REPORT: ASSESSING RISKS TO ENDANGERED AND THREATENED SPECIES FROM PESTICIDES, Public Meeting Silver Spring NOAA Auditorium (Nov. 15, 2013).

[6] Interim Report to Congress on Endangered Species Act Implementation in Pesticide Evaluation Programs. U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the U.S. Department of Agriculture. November 2014. Page 9. Available at: https://www.epa.gov/sites/production/files/2015-07/documents/esareporttocongress.pdf

[7] *Id.* at 21-22.

[8] *Id.* at 22. The link to the "Overview Document" in the Interim Report to Congress, *supra* n. 8, does not appear to work. However, the EPA is most likely referring to: EPA 2004. Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs, U.S. Environmental Protection Agency. Available at: https://www.epa.gov/sites/production/files/2014-11/documents/ecorisk-overview.pdf. Notably, for authorization of pesticides with new active ingredients, the EPA does not intend to do ESA effects determinations. Interim Report to Congress at 22.

"Risk Quotient" and "Level of Concern" approach that the NAS found is not adequate to determine the effects on endangered and threatened species. While EPA may not be legally bound by the NAS recommendations or the *Interim Approaches*, EPA is not free to violate the ESA.

The effects determinations associated with over-the-top dicamba usage on soybean and cotton do not fulfill EPAs obligations under the ESA. Listed below are inadequacies that have been identified with the current approach for assessing risk to endangered species that is encompassed in the following documents[9] (Hereafter "Current Approach") as well as measures that could be taken by EPA to become compliant with the ESA moving forward.

EPA Makes Improper "No Effect" Determinations

As the U.S. Fish and Wildlife Service ("FWS") and National Marine Fisheries Service ("NMFS") (collectively the "Services") joint consultation handbook explains, an action agency such as the EPA is permitted to make a "no effect" determination, and thus avoid undertaking informal or formal consultations, only when "the action agency determines its proposed action will not affect listed species or critical habitat."[10] To put this in context, the Services define "may affect" as "the appropriate conclusion when a proposed action may pose ***any*** effects on listed species or designated critical habitat."[11] The phrase "may affect" has been interpreted broadly to mean that "any possible effect, whether beneficial, benign, adverse, or of an undetermined character, triggers the formal consultation requirement."[12] For this initial stage of review, exposure to a pesticide does not require that effects reach a pre-set level of significance or intensity to trigger the need to consult (e.g. effects do not need to trigger population-level responses). Under the Services' joint regulations implementing the ESA, if an effect on a listed species is predicted to occur or is

[9] EPA documents "Addendum to Dicamba Diglycolamine Salt (DGA) and its Degradate, 3,6-dichlorosalicylic ac id (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Soybean and Cotton in 16 states (Arkansas, Illinois, Iowa, Indiana, Kansas, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin)." "Addendum to Dicamba Diglycolamine (DGA) Salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Cotton and Soybean in 7 U.S. States (Alabama, Georgia, Kentucky, Michigan, North Carolina, South Carolina, and Texas)" "Addendum to Dicamba Diglycolamine Salt (DGA) and its Degradate, 3,6-dichlorosalicylic acid (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Soybean and Cotton in 11 U.S. States: (Arizona, Colorado, Delaware, Florida, Maryland, New Mexico, New Jersey, New York, Pennsylvania, Virginia and West Virginia)." (Identified as docket ID documents EPA-HQ-OPP-2016-0187-0002, EPA-HQ-OPP-2016-0187-0003, and EPA-HQ-OPP-2016-0187-0004, respectively)

[10] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act* (hereafter CONSULTATION HANDBOOK) at 3-13.

[11] *Id*. at xvi (emphasis in original).

[12] *Western Watersheds Project v. Kraayenbrink*, 632 F.3d 472, 496 (9th Cir. 2011) (brackets omitted) (quoting 51 Fed. Reg. at 19,949). The threshold for triggering ESA consultation "is relatively low." *Lockyer v. U.S. Dep't of Agric.*, 575 F.3d 999, 1018 (9th Cir. 2009); *Karuk Trib of Cal. V. U.S. Forest Serv.*, 681 F.3d 1006, 1027 (9th Cir. 2012) (*en banc*) ("any possible effect" on species or their habitat is sufficient).

documented, then the EPA must undergo consultations with the Services.[13] The courts have made abundantly clear that the "may affect" threshold is very low.[14] A "may affect" determination is required when any "*possible* effect, whether beneficial, benign, adverse, or of an undetermined character" occurs.[15]

Therefore, the no effect/may affect threshold is a *very low* bar. In the Current Approach, EPA uses Risk Quotients ("RQ") and Levels of Concern ("LOC") to make "no effect" findings -- thereby ruling out impacts to all aquatic plants and animals and all invertebrates that don't have associated indirect effects. The RQ/LOC approach, which conflates a FIFRA determination with an ESA determination, is much too high of a threshold for an ESA "no effect" determination. Therefore, EPA has made a policy judgment that some level of impact to these species represents an acceptable level of risk. This is not permitted under the ESA, which requires consultation with the expert wildlife agencies whenever there is "any possible effect," either through informal consultation and a written concurrence or formal consultation and a biological opinion.[16]

The NAS report made several significant conclusions about the current ecological risk assessment process and its use of RQs, including:

- The EPAs "concentration-ratio approach" for its ecological risk assessments "is ad hoc (although commonly used) and has unpredictable performance outcomes."[17]

- "RQs are not scientifically defensible for assessing the risks to listed species posed by pesticides or indeed for any application in which the desire is to base a decision on the probabilities of various possible outcomes."[18]

- "The RQ approach does not estimate risk…but rather relies on there being a large margin between a point estimate that is derived to maximize a pesticide's environmental concentration and a point estimate that is derived to minimize the concentration at which a specified adverse effect is not expected."[19]

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[13] 50 C.F.R. § 402.14(a); *Karuk Tribe*, 681 F.3d at 1027 ("[A]ctions that have any chance of affecting listed species or critical habitat—even if it is later determined that the actions are 'not likely' to do so—require at least some consultation under the ESA").
[14] *Karuk Tribe*, 681 F.3d at 1027 (quoting Lockyer, 575 F.3d at 1018); *Colorado Envt'l Coalition v. Office of Legacy Management*, 819 F. Supp. 2d 1193, 1221-22 (D. Colo. 2011)
(citing cases).
[15] *Center for Biological Diversity v. BLM*, 698 F.3d 1101 (9th Cir. 2012) (emphasis added).
[16] 50 C.F.R. §§ 402.13, 402.14; *Washington Toxics Coalition v. FWS*, 457 F.Supp.2d. 1158, 1178 (W.D. Wash. 2006); *see also Defenders of Wildlife v. EPA,* 420 F.3d 946, 961 (9th Cir. 2005); *Thomas v. Peters* 753 F.2d 754, 763 (9th Cir. 1985).
[17] NAS Report at 149.
[18] *Id*. at 15.
[19] *Id*. at 14.

The Current Approach uses the RQ/LOC method to preclude taxa from undergoing co-occurrence analyses (provided there were no possible indirect effects) as well as to make "no effect" findings for species that may co-occur with pesticide use.

The use of RQs and LOCs cannot be reasonably anticipated to accurately reflect the no effect/may affect threshold and should not be used to make effects determinations. At Step 1, the EPA must gather sufficient data to complete the following two related inquiries: (1) the EPA must determine whether pesticide use areas will overlap with areas where listed species are present, including whether a use area overlaps with any listed species' critical habitat (2) the EPA must determine whether off-site transport of pesticides will overlap with locations where listed species are present and/or critical habitat is designated. Off-site transport must include considerations of downstream transport due to runoff as well as downwind transport due to spray drift and volatilization when the best available science indicates such transport is occurring.[20]

In making endangered species assessments, EPA categorically and arbitrarily assumes zero off-site exposure of listed species to dicamba via spray drift and volatilization, and either assumes zero or inconsequential exposure of aquatic and terrestrial organisms via runoff, despite clear evidence that dicamba may move off-site including into aquatic areas, even with field buffers in place. There is considerable uncertainty regarding the movement of dicamba off field, with one third of studies indicating that the labeled buffers may not be adequately protective.[21] Furthermore, the available incident data indicate that dicamba use can cause significant harm to plants adjacent to treated fields.[22] Incidents in Arkansas and Missouri indicate that plant damage can occur following dicamba treatment 1300 feet from the site of application (an order of magnitude greater than the current field buffers).[23] In addition, post-emergence treatment will occur later in the year than typical pre-emergence treatment and may increase off site transport.[24] With the uncertainty surrounding the off-site movement of dicamba, even with full field buffers, it is simply indefensible to assume that zero off-site exposure will occur in the effects determinations.

What the EPA should do to meet the legal requirements of the ESA is use the best available spatial data regarding where cotton and soybeans are grown and the distribution and range

[20] The Center acknowledges that in many areas, atmospheric transport is difficult to model and assess. However, in some areas, the impacts of atmospheric transport of pesticides are well understood. A recent study found that a variety of pesticides are accumulating in the Pacific chorus frogs (*Pseudacris regilla*) through atmospheric deposition at remote, high-elevation locations in the Sierra Nevada mountains, including in Giant Sequoia National Monument, Lassen Volcanic National Park, and Yosemite National Park Smalling, K.L., et al. 2013. *Accumulation of Pesticides in Pacific Chorus Frogs (Pseudacris regilla) from California's Sierra Nevada Mountains*, Environmental Toxicology and Chemistry, 32:2026–2034.
[21] EPA, 2016. Ecological Risk Assessment for Dicamba DGA Salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed Post-Emergence New Use on Dicamba-Tolerant Cotton (MON 8770 I) (Docket ID EPA-HQ-OPP-2016-0187-0005). Page 26
[22] *Id.* at 29-33.
[23] *Id*. at 32.
[24] *Id.* at 36.

of listed species to determine whether a pesticide's use overlaps with species, and then make a "may affect"/"no effect" determination. The FWS ECOS website provides GIS-based data layers for each listed species with designated critical habitat.[25] These maps are scalable and can achieve the precision needed to make accurate effects determinations regarding whether a pesticide will have "no effect" or "may affect" a listed species and are accurate enough to make determinations as to whether the use of a pesticide represents adverse modification of critical habitat. For species without associated critical habitat, EPA should request the most refined range data from experts at the FWS and NMFS.

Other sources provide additional data on the distribution and life history of threatened and endangered species. NatureServe provides detailed life history information, including spatial distribution, for native species across the United States.[26] In addition, many State governments collect detailed information on non-game species through their State Wildlife Action Plans.[27] In short, there are many sources of data that can provide EPA with the detailed information it needs to conduct an effects determination for each species. If there are species where it believes information is still lacking, EPA should make it clear to all stakeholders which species, specifically, it believes such data are lacking early in the process such that this information can be collected from the Services and other sources.

Fortunately, these data have already been compiled in draft form for the nationwide ESA consultation that was recently completed for chlorpyrifos.[28] The GIS data have not been made available to the public, so we have not had a chance to scrutinize these data to make sure they truly reflect not only the species' range, but also the habitat needed for recovery. But, nevertheless, this analysis has already been done and is available for the EPA to use right now.

As far as the spatial data on crop use, these data have been compiled as well.[29] Importantly, the data compiled for the nationwide ESA consultation for chlorpyrifos spatially represents potential agricultural use sites for each crop, including soybeans and cotton. Furthermore, it aggregates the use data for the previous 5 years to account for crop rotations, which are common for these two crops. Some refinement to these maps will be needed, as they were generated based on offsite travel of chlorpyrifos.

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[25] US Fish and Wildlife Service Environmental Conservation Online System. http://ecos.fws.gov

[26] NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life Version 7.0. NatureServe, Arlington, VA. USA. Available from http://explorer.natureserve.org

[27] State Wildlife Action Plans. http://teaming.com/state-wildlife-action-plans-swaps

[28] EPA. Biological Evaluation Chapters for Chlorpyrifos ESA Assessment. ATTACHMENT 1-6: Co-Occurrence Analysis. Species ranges were provided to EPA from FWS and NMFS in the form of GIS mapping data. Available at https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment

[29] EPA. Biological Evaluation Chapters for Chlorpyrifos ESA Assessment. ATTACHMENT 1-2, 1-3, 1-6. Cropland data layer (CDL) and Census of Agriculture (CoA) provided by USDA. Available at https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment

Therefore, the EPA already has mapping data on the range and habitat of every single listed species in the U.S. and mapping data on all cotton and soybean field sites in the U.S. **In short, all of the information needed to run a proper Step 1 "no effects" determination has been compiled and is available for the EPA to use right now**. Many scientists at the EPA and other agencies put in a lot of work to generate these data in a good faith effort to ensure proper compliance with the ESA moving forward in pesticide registrations. To disregard these data would violate the ESA mandate that the action agency (EPA) use the best available science to conduct its effects determination.

Effects Thresholds Are Not Protective And "Best Available Science" Is Not Used

The use of surrogate animals is an essential part of the risk assessment process. When measuring risk to humans, the EPA will often apply uncertainty factors to offset the assumptions that mice or rats are an appropriate surrogate for human toxicity. Since lab animals are generally inbred strains with little genetic heterogeneity between individuals (unlike the human population), EPA will apply a 10x uncertainty factor to account for this. An extra 10x uncertainty factor will be applied to account for probable differences in sensitivities between the test species and humans. Another 10x uncertainty factor is occasionally applied to account for heightened toxicity of the developing fetus and young children.

Uncertainty factors are problematic because they are not science based, but at least they partially offset some of the many assumptions that are made during risk assessment. In the current ecological risk assessment approach that EPA uses, no uncertainty factors are used for anything. That means that the sensitivity of the surrogate animal is assumed to be *identical* to every species in its taxa (and occasionally other taxa as well). So a bobwhite quail is assumed to have the exact same sensitivity to a pesticide as a hummingbird, a lizard and a salamander. In reality, this extensive use of surrogates will overestimate toxicity to some species and drastically underestimate it for others.

The failure to account for and incorporate this uncertainty into the ecological risk assessment is putting many species at risk of harm. This is especially true when it comes to endangered or threatened species. Every listed species has a population that is in peril, making potential harm to individuals much more likely to lead to adverse effects on the species' population. Therefore, appropriate protections need to be put in place during the effects determination process to account for this extensive use of surrogacy and other uncertainties inherent with using models and estimating exposure. Not doing so would be a direct acknowledgement that harm may occur to some listed species.

The NAS report lays out an approach of using best available science and protective toxicity thresholds. The EPA has clearly relied on registrant supplied guideline studies for most of the analysis, and it is unclear to what extent the primary and gray literature were searched for studies related to toxicity. However, considerable efforts need to be taken so that studies

with the most appropriate surrogate data are used. Studies should be of high scientific rigor but not necessarily comply with Good Laboratory Practice ("GLP") guidelines. GLP guidelines were designed to prevent fraud and do not necessarily indicate a study is of higher scientific quality.

Many times, studies with more appropriate surrogates will not be available. In the Current Approach, the LD_{50} or "no observable adverse effect level" ("NOAEL") of the most appropriate surrogate species are used to estimate toxicity to listed species. These toxicity values are not protective enough, especially with the uncertainty associated with them. When EPA uses LD_{50}, the concentration required to kill 50% of a population, as a threshold for acute toxicity, the end result is not the prevention of species extinction, but the enabling of it. The *Interim Approaches* and the current draft effects determination for chlorpyrifos lay out effects thresholds that are appropriately protective of listed species during the effects determination and consultation process.[30] Importantly, the threshold for direct effects is the concentration that would result in a one in a million chance of causing mortality to an individual or the NOAEL, whichever is lower.

Using protective toxicity thresholds is the only way EPA can make effects determinations that comply with the mandates of the ESA. As noted above, the "may affect" threshold is very low, necessitating the use of these protective toxicity values. Furthermore, as described in the consultation handbook, the "Not Likely to Adversely Affect" ("NLAA") threshold is also quite low. The Services define NLAA as "when effects on listed species are expected to be discountable, insignificant, or completely beneficial." Discountable effects are those that are extremely unlikely to occur and that the Services would not be able to meaningfully measure, detect, or evaluate" because of their insignificance.[31] In the context of pesticides, only if predicted negative effects are discountable or insignificant can the EPA avoid the need to enter formal consultations with the Services, although such a determination requires informal consultation and a written concurrence from the Services.

The one in a million threshold is widely accepted in environmental regulation and used by EPA (including the Office of Pesticides Program), Food and Drug Administration ("FDA"), European Food Safety Authority ("EFSA") and Canada's Pest Management Regulatory Agency ("PMRA") as the standard for negligible risk. Though mainly used to assess the probability of developing cancer due to chemical exposure, this negligible risk standard was adopted to reflect a risk that was so small as to not cause concern from a regulatory or public health perspective. In other words, a risk that is discountable or insignificant. The one in a million mortality threshold for "may affect" and "likely to adversely affect" reflects the

[30] EPA. Biological Evaluation Chapters for Chlorpyrifos ESA Assessment. ATTACHMENT 1-4; Process for Determining Effects Thresholds (DOCX). Available at https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment

[31] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act*. at xv.

ESA's and the Consultation Handbook's requirements – requirements that need to be met when assessing harm to listed species.

We note that this will likely have two effects: one will be the expansion of the pesticide exposure area beyond what current EPA models show, and the other will be more "may affect" and "likely to adversely affect" findings, due to the lower threshold of toxicity.

EPA Does Not Follow The Effects Determination Process Outlined In The ESA:

In the Current Approach, EPA comes to many "may affect" findings only to revert back to a "no effect" finding after further analysis. This is not an appropriate protocol to use to determine effects to listed species. For instance in the endangered species assessment for 16 states, the EPA makes "may affect" findings for 10 species based on habitat co-occurrence with dicamba use in soy and cotton fields.[32] EPA subsequently does an additional analysis and determines that all but one should be given a "no effect" designation. Once a "may affect" finding is made, EPA cannot simply revert back to a "no effect" finding. If EPA believes that the initial "may affect" finding is discountable or insignificant, then it must make a NLAA finding. An NLAA finding requires written concurrence with the Services, an essential step in the ESA consultation process.[33]

In addition, by categorically excluding off-site transport and runoff, and by assuming that some negative impacts would not exceed levels of concern, the EPA merged the "no effect"/"may affect" inquiry with the "not likely to adversely affect"/"likely to adversely affect" inquiry of Step 2 that requires concurrence with FWS or NMFS. This is the one thing that the EPA may not do because it is not the expert agency on assessing risks to endangered species. As the federal courts have made clear, Section 7 of the ESA "requires that EPA, in contemplating even actions deemed NLAA, 'consult' with the Services to ensure that its action be not likely to jeopardize listed species."[34]

EPA makes indefensible NLAA findings.

Once EPA has determined that some species may co-occur with soybean and corn fields, they then turn to a qualitative analysis of FWS recovery plan documents to try to tease out species' habitats. To do this, they take one to two sentence narratives from these documents to support their conclusions that most species' habitat does not co-occur with soy and cotton fields. This is completely inadequate. First of all, a species habitat encompasses a broad

[32] EPA. Memorandum. Addendum to Dicamba Diglycolamine Salt (DGA) and its Degradate, 3,6 dichlorosalicylic ac id (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Soybean and Cotton in 16 states (Arkansas, Illinois, Iowa, Indiana, Kansas, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, orth Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin). Docket ID EPA-HQ-OPP-2016-0187-0002.
[33] 50 C.F.R. § 402.13(a).
[34] *Washington Toxics Coalition v. FWS*, 457 F.Supp.2d. 1158, 1178 (W.D. Wash. 2006); *see also Defenders of Wildlife v. EPA,* 420 F.3d 946, 961 (9th Cir. 2005); *Thomas v. Peters* 753 F.2d 754, 763 (9th Cir. 1985).

contiguous area. Just because a listed butterfly prefers open areas with wild lupines does not mean that it spends 100% of its time in those areas. Many species have to travel throughout a large area of habitat to seek food or nesting materials or a mate. Second, just because a species habitat is not directly affected does not mean indirect effects are not occurring. For example, a cave dwelling species may never leave the cave that it lives in, but its primary food source may come from outside the cave and potentially be harmed by dicamba use.

The ESA requires that EPA use the best available science to analyze effects to listed species. Descriptions of a species' habitat in written documents are not the best science available and this is not even a scientific approach. Rather, the EPA has cherry-picked a few sentences and then made a sweeping assumption about an extremely complex issue. As mentioned above, maps of species ranges and habitats have been compiled along with maps of soy and cotton fields. Once the maps of cotton and soy fields are refined to reflect true offsite migration of dicamba, a simple overlay of these two maps is all that needs to be done. It seems as though EPA is going out of its way to make this as difficult and unscientific as possible.

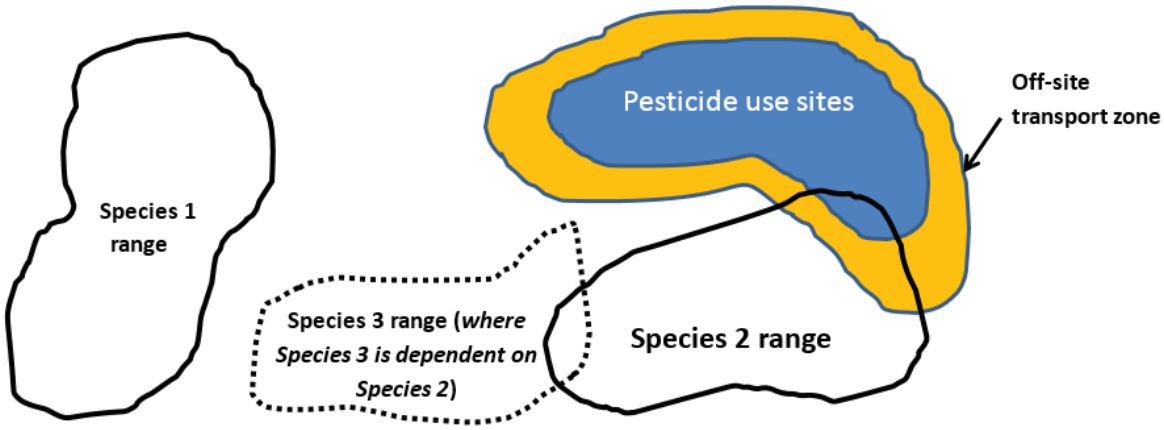
EPA Does Not Properly Measure Indirect Effects Or Critical Habitat Modification

In the Current Approach, EPA includes some species in the co-occurrence analysis based on possible indirect effects, however, proceeds to make "no effect" determinations if the species' habitat does not overlap with soy or cotton fields. This conveys a complete lack of understanding of how indirect effects work. The following is a figure from the chlorpyrifos draft ESA assessment conducted by EPA.[35]

[35] EPA. Biological Evaluation Chapters for Chlorpyrifos ESA Assessment. Figure 1-6 in Chapter 1. Available at https://www.epa.gov/endangered-species/biological-evaluation-chapters-chlorpyrifos-esa-assessment

Determination based on overlap of action area and species' ranges

- **Action area = Pesticide use sites + off-site transport**
- **Step 1 Determinations:**
  Species 1: *No Effect* Species 2: *May Affect* Species 3: *May Affect*



Note that Species 3 habitat does not overlap with the pesticide use site, yet it still gets a "may effect" determination because it is dependent on a species that does overlap with pesticide use. This analysis was done properly, with correct assumptions being made about how species interact with one another and how seemingly safe pesticide use could have major unintended consequences.

Therefore, the Current Approach EPA uses to analyze indirect effects to listed species falls short of what is mandated under the ESA and unjustly discounts those effects. The protocol outlined in the *Interim Approaches* should be used to measure indirect effects to listed species.

Section 7 of the ESA prohibits agency actions that would result in the "destruction or adverse modification of [critical] habitat."[36] This inquiry is separate and distinct from the question as to whether a pesticide approval will result in jeopardy to any listed species. A no jeopardy finding (or a NLAA finding in an informal consultation) is *not* equivalent to a finding that critical habitat will not be adversely modified. While there is much overlap between these two categories (for example, as in *Tennessee Valley Authority v. Hill*[37] where the proposed agency action to build a dam would both destroy a species' habitat and kill individual members of the species in the same time) many agency actions do result in adverse modification to critical habitat without causing direct harms to species that do rise to

[36] 16 U.S.C. § 1536(a)(2).
[37] 437 U.S. 153 (1978)

the level of jeopardy.[38] Indeed, the ESA's prohibition on "destruction or adverse modification" of critical habitat does not contain any qualifying language suggesting that a certain species-viability threshold must be reached prior to the habitat modification prohibition coming into force.

In the current effects determination, this is completely disregarded. For example, in the ESA assessment of 16 states[39] 53 out of 59 critical habitats were judged "no modification" based on the sole criterion that the species did not use cotton or soybean fields. That is an incorrect way to come to a "no modification" determination and does not comply with the ESA.

As three federal circuit courts have made abundantly clear, avoiding a species' immediate extinction is not the same as bringing about its recovery to the point where listing is no longer necessary to safeguard the species from ongoing and future threats. Therefore, Section 7 requires that critical habitat not be adversely modified in ways that would hamper the *recovery* of listed species.[40] These potent pesticides with known adverse ecological effects have the potential to adversely modify critical habitat by altering ecological community structures, impacting the prey base for listed species, and by other changes to the physical and biological features of critical habitat. Accordingly, the informal consultation must separately evaluate whether these pesticide products and formulations will adversely modify critical habitat regardless of whether these pesticide products jeopardize a particular listed species. For example, if plant communities alongside a water body that has been designated as critical habitat suffer increased mortality, and this then results in increased temperatures or increased sedimentation, then that would represent adverse modification of critical habitat. Likewise, if pesticides are toxic to species lower in the food chain, and a threatened or endangered species feeds on those affected prey species, this impact to the food web would represent a clear example of adverse modification to critical habitat.

EPA's evaluation must address impacts to critical habitat even if the direct effects on listed species fall below the NLAA or jeopardy thresholds.

EPA Must Assess Product Mixtures

Just as the EPA must consult with the Services regarding the registration of an active pesticide ingredient, EPA must also consult with the Services regarding the registration or approval of end use and technical pesticide products. Such consultations must also occur at

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[38] *See* Owen, D. 2012. *Critical Habitat and the Challenge of Regulating Small Harms*. Florida Law Review 64:141-199.
[39] EPA. Memorandum. Addendum to Dicamba Diglycolamine Salt (DGA) and its Degradate, 3,6 dichlorosalicylic ac id (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Soybean and Cotton in 16 states (Arkansas, Illinois, Iowa, Indiana, Kansas, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, orth Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin). Docket ID EPA-HQ-OPP-2016-0187-0002.
[40] *See Gifford Pinchot Task Force v. FWS*, 378 F.3d 1059, 1069-71 (9th Cir. 2004) (finding a FWS regulation conflating the requirements of survival and recovery to be unlawful); *see also N.M. Cattle Growers Ass'n v. FWS*, 248 F.3d 1277, 1283 n.2 (10th Cir. 2001); *Sierra Club v. FWS*, 245 F.3d 434, 441-42 (5th Cir. 2001)

the earliest possible time to ensure that specific product formulations do not result in jeopardy for a listed species or adversely modify critical habitat.

In addition, because end use formulations may result in mixes of the active ingredient with "other ingredients" before application, the EPA must consider during the consultation process the effects of these "inert" or "other" ingredients together with the active ingredient on listed species and set appropriate conservation restrictions accordingly. As noted in *Washington Toxics Coalition v. U.S. Dept. of Interior*, "other ingredients" within a pesticide end product may cause negative impact to listed species even if they are less toxic than the active ingredient being reviewed.[41] "Other ingredients," such as emulsifiers, surfactants, anti-foaming ingredients, and fillers may harm listed species and adversely modify critical habitat. Many of the more than 4,000 potentially hazardous additives allowed for use as pesticide additives are environmental contaminants and toxins that are known neurotoxins and carcinogens.[42] The EPA has routinely failed to consult with the Services on the registration of "other ingredients," potentially compounding harms to listed species by allowing such ingredients to be introduced widely into the environment. EPA must, as part of the consultation process, consider the range of potential impacts by using different concentrations and different formulations of the active ingredient, as well as the potential negative impacts of "other ingredients" used in end use products.

The EPA and Services must consider the environmental baseline as well as all cumulative effects when determining if the approval pesticides, formulations, or uses will jeopardize any threatened or endangered species. The Services define environmental baseline as "the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process."[43] Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation."[44] Pesticide consultations must consider the interactions between the active ingredient under review and other pollutants in the present in the environment.

The Food Quality Protection Act of 1996 ("FQPA") requires EPA to measure risk of a pesticide based on "… available information concerning the cumulative effects on infants and children of such residues and other substances that have a common mechanism of toxicity." The EPA has interpreted this to mean that only pesticides with a common

[41] 457 F. Supp. 2d 1158 (W.D. Wash 2006).
[42] Draft BiOp at 113, lines 4062-68; 120-121, lines 4262-308; 127, lines 4445-4455; Northwest Coalition for Alternatives to Pesticides, et al., Petition to Require Disclosure of Hazardous Inert Ingredients on Pesticide Product Labels. 2006. http://www.epa.gov/opprd001/inerts/petition_ncap.pdf.
[43] *Id*. at xiv.
[44] *Id*. at xiii.

mechanism of action be assessed in a cumulative risk assessment. We strongly disagree with this interpretation. First, the term "other substances" can include chemicals other than pesticides and also stressors that are not chemicals, like radiation and climate change. The EPA itself defines cumulative risk as "the combined risks from aggregate exposures to multiple agents or stressors," where agents or stressors can be chemicals or "may also be biological or physical agents or an activity that, directly or indirectly, alters or causes the loss of a necessity such as habitat."[45] Second, the term "common mechanism of toxicity" does not dictate that the EPA only consider agents or stressors with a common mechanism of action. The National Research Council has recommended that the EPA use the endpoint of common adverse outcome rather than common mechanism of action to group agents that could act cumulatively.[46] EPAs European counterpart, EFSA, has announced that it intends to measure cumulative risk based on cumulative assessment groups. EFSA notes that this new methodology "….rests on the assumption that pesticides causing the same specific phenomenological effects, well defined in terms of site and nature, can produce joint, cumulative toxicity – even if they do not have similar modes of action."[47]

As for how this relates to EPA's duty under the ESA, cumulative risk in the ESA needs to be interpreted very broadly as this piece of legislation is a precautionary document meant to ensure that no harm comes to listed species. Although the EPA interprets the scope of cumulative risk assessments under FQPA to be limited to the common mechanism effect, **there is absolutely no such written or intended limit in the ESA**. The EPA needs to begin discussions on how it will test true cumulative risk, the way it is broadly defined in the ESA, because current metrics and protocols that measure cumulative risk under FQPA are inadequate for the EPA to meet its legal obligations under the ESA.

Pesticides and their residues and degradates do not occur in single exposure situations and many different mixtures of pesticides occur in water bodies at the same time.[48] The mixtures of these chemicals can combine to have additive or synergistic effects that are substantially more dangerous and increase the toxicity to wildlife.[49] Thus, to fully understand the ecological effects and adverse impacts, the EPA and the Services must consider the pesticide's use in the context of *current* water quality conditions nationwide. In particular, the use of pesticides in watersheds that contain threatened or endangered species

[45]U.S. Environmental Protection Agency 2003. Framework for Cumulative Risk Assessment. U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC, EPA/600/P-02/001F, 2003. Pg. xvii.
[46] National Research Council (US) Committee on the Health Risks of Phthalates. Phthalates and Cumulative Risk Assessment: The Tasks Ahead. Washington (DC): National Academies Press (US); 2008. Page 4.
[47] EFSA. Press release. Pesticides: breakthrough on cumulative risk assessment. Available at: http://www.efsa.europa.eu/en/press/news/160127. Accessed 1/28/2016.
[48] NMFS 2011, *Endangered Species Act Section 7 Consultation Draft Biological Opinion for the Environmental Protection Agency's Pesticide General Permit for Discharges from the Application of Pesticides (*hereafter Draft BiOp) at 118-119, lines 4209-31; Gilliom, R.J. et al. 2006. *Pesticides in the Nation's Streams and Ground Water, 1992–2001—A Summary*, available at http://pubs.usgs.gov/fs/2006/3028/.
[49] Draft BiOp at 127-129, lines 4471-4515; Gilliom, R.J. 2007. *Pesticides in the Nation's Streams and Ground Water*; Environmental Science and Technology, 413408–3414.

and where water quality is already impaired could be particularly problematic. Therefore, the agencies must use the best available data to fully inform its ecological risk assessment by considering water quality.

The EPA must also analyze the mixtures of dicamba and other active ingredients, such as glyphosate to be compliant with the ESA. More information on this is discussed below.

In conclusion, the EPA should obtain the needed spatial data from within its own agency to make an informed "no effect" or "may affect" finding for *each* listed species that will likely overlap with the use of these pesticides or come into contact with its environmental degradates. If there is overlap, EPA must at a minimum conclude that the use of these pesticides "may affect" listed species. Where this occurs, EPA has a choice—(1) the EPA can elect to complete an informal consultation through a biological assessment (also known as a biological evaluation), or (2) the EPA can undergo formal consultation with the Services. If EPA completes a biological assessment and implements geographically-tailored conservation measures through *Bulletins Live! Two*, it may be able to reach NLAA determinations via the informal consultation process and alleviate the need for formal consultations. In the alternative, the EPA can move directly to formal consultation after making "may affect" determinations for species where the impacts of pesticides are more complex and will take additional expertise to develop sufficient conservation measures.

The NAS report recognized that without real-world considerations of where listed species are located, the relative conservation status of listed species, the environmental baseline, and the interaction of pesticides with other active ingredients, pesticide degradates, and other pollutants, the EPA risk assessment process will not be able to make meaningful predictions about which endangered species will be adversely affected. Until the EPA can conduct realistic assessments, it should take a precautionary approach and enter into formal consultations with the Services as outlined in the *Interim Approaches* document. Implementing the recommendations above will help ensure that the EPA meets its obligations under both FIFRA and the ESA.

THERE ARE SERIOUS CONCERNS WITH EPA'S RISK ASSESSMENT METHODS

The Current Process For Evaluating New Uses

We find it odd that Monsanto has decided to apply for a new use for dicamba with a single product (M1691 Herbicide EPA Reg. No. 524-582) that, quite frankly, won't have much utility for farmers. Dicamba is not an herbicide that will be particularly effective at controlling weeds in cotton and soybean fields alone. It is a broadleaf herbicide that has very little activity against weeds that farmers will commonly encounter, such as ryegrass in cotton fields.[50]

[50] EPA. Memorandum. Review of Benefits as Described by the Registrant of Dicamba Herbicide for Postemergence Applications to Soybean and Cotton *and* Addendum Review of the Resistance Management Plan as Described by the

It's no secret that the entire point of this new use application is so that Monsanto can sell a companion product for its dicamba/glyphosate resistant soybean and cotton seeds, likely to be named Roundup® Xtend, that will contain both dicamba and glyphosate in the same formulation. Yet it has decided to go through the process of getting the new use registration for a product that has only one active ingredient and a mildly restrictive label (no tank mixing with other herbicides allowed) presumably to make it through the "new use" registration process more easily. If the new use registration is finalized, the Roundup® Xtend product may go through the much less rigorous process of "product registration." This is very troubling for multiple reasons:

1) Under FIFRA, every pesticide registration is a cost-benefit analysis. By splitting up the approval of Roundup® Xtend between the new use registration and the product registration, the environmental costs associated with the use of this product will likely be split between the two and, ultimately, diluted out. The costs of 1) the "over-the-top" use and 2) the synergistic/additive action of the two active ingredients used together will, therefore, be assessed separately. While at the same time, the purported benefits (i.e. use on glyphosate resistant weeds, reduced tillage) will likely be the same with the new use registration and the product registration. So the costs get split up while the benefits remain the same. The benefits that were used in the new use registration of dicamba cannot simply be reused in a possible product registration of Roundup® Xtend. Those benefits were already taken into account and weighed against the costs of the over-the-top use. Therefore, the only benefit that should be taken into account in any possible product registration decision for Roundup® Xtend is the convenience of having these two ingredients premixed in one formulation (not much of a benefit when weighed against the costs of synergistic/additive toxicity, as discussed below).

2) If history is any indication, any possible product registration decision for Roundup® Xtend may not go through public comment. In the past, EPA has often registered single ingredients for use with stakeholder comments only to later approve labels of specific formulations that contain multiple active ingredients without a public comment period. In fact, a conditional registration was granted for the M1769 Premix Herbicide[51] that contains both dicamba and glyphosate without any public comment period that we're aware of. It is unclear if the conditions of this registration have been met, or if synergistic/additive effects of dicamba and glyphosate were analyzed for this product registration. This is in direct conflict with an open and accountable process for pesticide approvals and it would be especially glaring if this same thing were to happen with Roundup® Xtend or if the existing M1769 label were to simply be amended to include over-the-top use of dicamba.

Registrant of Dicamba Herbicide for Use on Genetically Modified Soybean and Cotton. Document ID EPA-HQ-OPP-2016-0187-0012. Page 3.

[51] M1769 PREMIX HERBICIDE. Monsanto Co. EPA Registration Number: 524-616. Conditional Registration granted 4/22/2014. Label available at https://www3.epa.gov/pesticides/chem_search/ppls/000524-00616-20140422.pdf

Last year Dow Agrosciences applied for registration of a product similar to Roundup® Xtend called Enlist Duo®, which combined glyphosate with 2,4-D. The process that Dow went through to gain approval of Enlist Duo® was consistent with its intentions. We strongly disagree with EPA's decision to register it, but, nevertheless, combining the registration of the signature product with the new use registration allowed for stakeholders to grasp the big picture of how a registration decision would impact pest management techniques and human and environmental health. Splitting up this process undermines EPA's ability to accurately assess the costs and benefits associated with registration and deprives stakeholders the ability to meaningfully comment on the big picture of how this registration will negatively impact farming, human health and the environment. At the very least, we urge EPA to open up a public comment period for any product that contains dicamba mixed with another active ingredient and, moving forward, hope EPA will put safeguards in place to ensure that the system cannot be "gamed," so to speak, for future registration decisions.

Literature Review

It is essential that the EPA have every bit of information available in order to make an informed decision on the risk of exposure to pesticides. The EPA must require that that the registrant provide all necessary data and studies, including, but not limited to any previously identified data or study gaps, additional studies to evaluate effects on pollinators in accordance with the *Guidance for Assessing Pesticide Risks to Bees,*[52] information concerning estrogen or other endocrine disruption effects,[53] and any information that this pesticide may have synergistic effects. Moreover, without a catalogue of the studies that were analyzed in the open- and gray-literature, it is impossible to determine why certain studies were not utilized for this risk assessment. An open and transparent literature review is vital to ensuring that all applicable studies were analyzed, not just industry-funded guideline studies.

Industry-funded studies are furnished to the EPA for analysis, but data from third party researchers generally have to be searched for in databases. This creates a bias in the studies that EPA analyzes because there is always the potential that third party research may be missed or wrongly discounted. Furthermore, the funding source of a study can create a bias that is more favorable towards the desired outcome of those who fund the research.[54] This makes it extremely important that all available studies are analyzed, so as to mitigate any bias associated with the risk assessment. Without further information it is impossible to tell if there were any studies that were missed or whether any were wrongly discounted.

Before a registration decision is made, EPA needs to provide to the public:

1) The databases that were searched for open- and gray-literature studies
2) The search terms used to identify those studies and the dates the searches were conducted

[52] EPA 2014. Guidance for Assessing Pesticide Risks to Bees. Available at https://www.epa.gov/sites/production/files/2014-06/documents/pollinator_risk_assessment_guidance_06_19_14.pdf
[53] *See* 21 U.S.C. §§ 346a(d)(2)(A)(x) and 346a(p).
[54] Boone, M., et al., *Pesticide Regulation amid the Influence of Industry.* Bioscience, 2014. 64(10): p. 917-922.

3) An appendix listing all of the publications that were found in the literature search
4) A brief description of why any study was eliminated from review for the risk assessment, why a study was deemed qualitative instead of quantitative, any potential source of study bias (including the funding source), and the relative weight each study was given in any weight of evidence analysis.

This added transparency will help ensure that comprehensive literature searches are carried out and that all relevant studies are analyzed before a registration decision is made. Additionally, the NAS has recommended to the EPA that stakeholders be given the opportunity to comment on data collection at the earliest stage and throughout the risk assessment process.[55] We are simply asking for the EPA to be more transparent with this vital part of the risk assessment process.

Increased Use

The EPA's risk assessment approach is not designed to analyze risk due to increased total usage of a pesticide compared to current levels. It is simply designed to estimate exposure to a single chemical based on labeled usage rates on specific crops. This exposes one of the great shortcomings in EPA's risk assessment approach – it is very short sighted. It takes a narrow approach to assess risk without taking into account the bigger picture of total usage of a particular pesticide or combined usage of multiple pesticides. Therefore, risk is typically underestimated and potential increases in total pesticide usage are not accurately assessed for potential harms.

The EPA recognizes this and states that "[a]lthough the risks, based on standard risk assessment methods used by the Environmental Fate and Effects Division (EFED), are not expected to differ from the previous assessment done for dicamba use on soybeans (because the rates are similar to those already assessed), there is potential for other ecological concerns that would not normally be captured using our standard risk assessment methods. These concerns are related to a potential increase in usage of dicamba products and the proposed changes in the timing of applications."[56] And, "[t]hough the rates are similar to those in currently registered dicamba pesticide products, there is potential for ecological concerns related to a potential increase in acres treated with dicamba products, resulting in additional acres with residues of DCSA in dicamba-tolerant soybeans."[57]

It is incredibly likely that this proposed "new use" dicamba approval will result in increased usage of dicamba on cotton and soybean. The EPA cites a government testimony and a personal

[55] National Academy of Sciences. 2013. *Assessing Risks to Endangered and Threatened Species from Pesticides*, Committee on Ecological Risk Assessment under FIFRA and ESA Board on Environmental Studies and Toxicology Division on Earth and Life Studies National Research Council (April 30, 2013). Page 45.
[56] EPA. Memorandum. Ecological Risk Assessment for Dicamba and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed New Use on Dicamba-Tolerant Soybean (MON 87708). Docket ID: EPA-HQ-OPP-2016-0187-0008.
[57] EPA. Proposed Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean. Docket ID EPA-HQ-OPP-2016-0187-0016.

communication to support this position,[58] however, more lines of evidence exist.[59] Furthermore, Monsanto did an analysis on possible future increase in use of dicamba for USDA when applying for deregulation of genetically engineered ("GE") dicamba/glyphosate resistant soybean and cotton. Monsanto predicted that annual commercial dicamba use on soybeans would increase from 233,000 pounds in 2011 to 20.5 million pounds at the time of peak (40%) GE crop adoption.[60] This is a nearly 100-fold increase in dicamba usage just on soybean and could be even higher if these GE crops are more widely adopted. Similar projections were made for dicamba use on cotton from 364,000 pounds applied annually in 2011 to 5.2 million pounds at the time of peak (50%) adoption.[61] Assuming peak adoption of dicamba resistant soybean and cotton would occur in the next 3-4 years, the U.S. is looking at a more than 25 million pound increase in dicamba usage for these two crops by 2020.

Although this is likely an underestimate, as crop adoption rates may be much higher and current labels urge users to spray higher than typical rates to slow weed resistance, it is a starting point for the EPA to begin to analyze the effects of total pesticide load on human and environmental health. This increase in dicamba usage would not likely displace other herbicide use. The EPA needs to view registration decisions as not only a way to analyze the effects of labeled pesticide usage, but also as a way to ensure that total pesticide use does not increase. The EPA could take this into account in the cost-benefit analysis by analyzing the associated costs of labeled pesticide use as well as the costs associated with total pesticide load in the environment.

The Use Of Historical Controls

Concurrent controls are always the best cohort to use. If there is reason to believe that the concurrent control data are significantly out of line with recent historical control data and may not be representative of a true control cohort, then historical control data may be used to inform the interpretation of study data. But extreme care needs to be taken, as a scientist or a regulatory agency may be tempted to use the control cohort that will give an anticipated or desirable outcome. This is why guidelines with specific protocols need to be developed and followed if concurrent control data are suspect.

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[58] EPA. Memorandum. Ecological Risk Assessment for Dicamba DGA Salt and its Oegradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed Post-Emergence New Use on Dicamba-Tolerant Cotton (MON 8770 I). Docket ID EPA-HQ-OPP-2016-0187-0005. Page 36.

[59] Mortensen, DA, Egan, JF, Maxwell, BD, Ryan, MR, Smith, RG. Navigating a Critical Juncture for Sustainable Weed Management. BioScience (2012) 62 (1): 75-84. doi:10.1525/bio.2012.62.1.12. and Bohnenblust, EW, Vaudo, AD, Egan, JF, Mortensen, DA, Tooker, JF. Effects of the herbicide dicamba on nontarget plants and pollinator visitation. Environ Toxicol Chem. (2016) 35(1): 144-51. doi: 10.1002/etc.3169.

[60] USDA. *Monsanto Petitions (10-188-01p and 12-185-01p) for Determinations of Nonregulated Status for Dicamba Resistant Soybean and Cotton Varieties. Final environmental impact statement. EIS appendix, Table 4-9 and page 4-16.* 2014; Available from: http://www.aphis.usda.gov/brs/aphisdocs/dicamba_feis_appendices.pdf.

[61] USDA. *Monsanto Petitions (10-188-01p and 12-185-01p) for Determinations of Nonregulated Status for Dicamba Resistant Soybean and Cotton Varieties. Final environmental impact statement. EIS Appendix, Table 4-12 and page 4-19*. 2014; Available from: http://www.aphis.usda.gov/brs/aphisdocs/dicamba_feis_appendices.pdf.

In the current risk assessment, EPA states that: "The screening-level risk assessment for the proposed new use on soybeans (USEPA, 2011. D378444) used the chronic endpoint from the rat 2-generation study (MRID 43137101), a NOAEL of 45 mg/kg-bw, based on decreased pup weight at 136 mg/kg-bw compared to the concurrent controls. The Health Effects Division (HED) recently reanalyzed the data from this study (USEPA, 2016a; D431873) in comparison to the historical control database range and determined that the NOAEL and LOAEL should be raised to 136 and 450 mg/kg-bw, respectively, because pup weights in each generation in the 136 mg/kg-bw treatment group were within the historical control range and above the historical control mean for the F1, F2A and F2B generations."[62]

EPA currently has some internal guidance on how to use historical control data in assessing tumor development that could also be used in assessing pup weight.[63] This guidance states that "Generally speaking, statistically significant increases in tumors should not be discounted simply because incidence rates in the treated groups are within the range of historical controls or because incidence rates in the concurrent controls are somewhat lower than average. Random assignment of animals to groups and proper statistical procedures provide assurance that statistically significant results are unlikely to be due to chance alone." But if historical control data are to be used, then "The most relevant historical data come from the same laboratory and the same supplier and are gathered within 2 or 3 years one way or the other of the study under review; other data should be used only with extreme caution."[64]

From the information given in the risk assessment, it is impossible to tell whether EPA is following its own guidelines or those of internationally recognized organizations like the Organisation for Economic Co-operation and Development (OECD).[65] More information needs to be available to the public regarding the historical control data that were used; including a detailed explanation of why concurrent control data were deemed insufficient and detailed information on the animals used in the historical control cohort.

Herbicide Resistance Management

Due to the indiscriminate use of glyphosate over vast acreage of Roundup Ready® crop monocultures, glyphosate-resistant weeds have evolved and are now present on an estimated 100

[62] EPA. Memorandum. Ecological Risk Assessment for Dicamba DGA Salt and its Oegradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed Post-Emergence New Use on Dicamba-Tolerant Cotton (MON 8770 I). Docket ID EPA-HQ-OPP-2016-0187-0005. Page 12.
[63] EPA. (2005) Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001F, Accessed at: https://www.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf
[64] *Id*. at 2-21
[65] OECD. (2012) Guidance Document 116 on the Conduct and Design of Chronic Toxicity and Carcinogenicity Studies, Supporting Test Guidelines 451, 452 and 453, 2nd Edition Series on Testing and Assessment No. 116. Avail. at: http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/JM/MONO(2011)47&doclanguage=en

million acres in 36 different states.[66] So far, these herbicide resistant weeds have cost farmers more than $1 billion in damages[67] and have increased costs to farmers by as much as 7-fold.[68]

The proposed Herbicide Resistance Management ("HRM") plan is insufficient to deal with the current and future problem of dicamba resistance in weed species. EPA acknowledges that weed resistance is a significant problem and that certain populations of weeds that occur in soybean and cotton fields have **already** developed resistance to dicamba.[69] The HRM plan provides absolutely no resistance *prevention* strategies. Resistance prevention is really where the focus needs to be; after all, preventing weed resistance is much more efficient and beneficial than managing the resistant species that are certain to develop.

There are some weak label requirements designed to prevent weed resistance from *spreading*. These requirements are, of course, dependent on individual farmers' vigilance. Some farmers are likely to be very vigilant in scouting for dicamba "lack of performance," while others will be less so. This decentralization of oversight will likely hamper management efforts and regionalize the severity of resistance that develops.

Furthermore, Monsanto has been put in control of confirming and reporting any dicamba weed resistance to the EPA -- and the proposed registration may terminate in 5 years if EPA determines that this a problematic issue. It will, therefore, be in Monsanto's best financial interest if there are no weed resistance issues that are reported. This sets up an inherent conflict of interest that should preclude Monsanto from being involved in this important data-gathering step. Monsanto, of course, should foot the bill, but a third party needs to do this analysis so as to avoid the inherent conflict of interest this situation presents.

This data-gathering step on the spread of dicamba resistance in the HRM plan is a baby step in the right direction, but without any serious *prevention* strategies, we are unsure what it will accomplish in the grand scheme of things. Having data to analyze doesn't really provide much comfort when the problem has already spread and is too late to stop. In addition, all of the data collected will be reliant on individual reporting, a very unreliable source of information that will lead to significant underestimation of the true scope of the problem.

Sure, Monsanto will have to set up a website and a hotline, but other than that most of the responsibility for identifying and reporting weed resistance is placed squarely on the farmer or user.

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[66] Landrigan, PJ, Benbrook, CM. GMOs, Herbicides, and Public Health. *New England Journal of Medicine*. 2015. Available at: http://www.nejm.org/doi/full/10.1056/NEJMp1505660.
[67] Koba, M. 'Superweeds' Sprout Farmland Controversy Over GMOs. NBC News. 2014. Available at: http://www.nbcnews.com/business/economy/superweeds-sprout-farmland-controversy-over-gmos-n214996.
[68] Service, RF. What Happens When Weed Killers Stop Killing? *Science*. 2013. Available at: http://science.sciencemag.org/content/341/6152/1329.
[69] EPA. Proposed Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean. Docket ID EPA-HQ-OPP-2016-0187-0016. Page 24.

Farmers have enough to worry about during the growing season, including ensuring that they are in compliance with pesticide labels that can be 80 pages or longer and incredibly complex. So now not only will farmers be on the hook for label compliance, but also for preventing the spread of herbicide resistant weeds. This HRM plan continues the troubling trend of farmers and users bearing all of the responsibility for ensuring that pesticides are used in a lawful manner while the companies that are profiting off of the sale of these pesticides get to wash their hands of any meaningful responsibility once a pesticide is registered.

The HRM plan is reactionary as opposed to proactive. It needs better resistance *prevention* strategies, including a requirement that dicamba be used only as a last resort as part of an integrative pest management strategy. The prophylactic use of herbicides is a key driving factor in weed resistance and this problem cannot be tackled if current agricultural practices are allowed to continue.

Moreover, the EPA's proposed registration is vague as to the expiration of the registration after 5 years. If the EPA decides to register this new use of dicamba, which the Center opposes without lawful compliance with the ESA and supportable risk assessment, the EPA must clarify that the expiration at the end of 5 years is a term of registration and would occur without any additional process. If it does not, the EPA will be in the same situation it has experienced with its conditional registration of flubendiamide.[70] In addition, the EPA must provide additional public participation if it intends to remove the 5 year expiration date as a term of the registration and set forth what criteria would warrant allowing an extension of the registration.

Mixtures

EPA states that "The current draft label for dicamba use on tolerant soybean and cotton plants specifies that tank mixes may only be used for products that have been tested and found not to have unreasonable adverse effects on the spray drift properties of M1691 Herbicide. EFED believes that guideline laboratory studies of effects to terrestrial plants should be required for any product or tank mixture combining dicamba and other active ingredients to assess risks associated with any tank mixture for use on dicamba-tolerant soybeans or cotton. Testing of such products should include the standard suite of tested species from the already submitted dicamba and tank mixed active ingredient vegetative vigor studies as well as those that the open literature and patent data indicate potential for synergistic effects."[71]

We are optimistic that EPA is beginning to take the issue of pesticide mixtures seriously, as this is the strongest language we've seen from EPA concerning data requirements for co-applied pesticides. These required studies, as well as studies in the primary literature and data from patents

[70] Bayer CropScience LP et al., EPA Docket Number FIFRA-HQ-2016-0001.
[71] EPA. Memorandum. Dicamba DGA: Second Addendum to the Environmental Fate and Ecological Risk Assessment for Dicamba DGA salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA) for the Section 3 New Use on Dicamba-Tolerant Soybean. Docket ID EPA-HQ-OPP-2016-0187-0007. Page 22.

that make claims of synergy, need to be analyzed before any registration decision can be made for a product that contains multiple active ingredients or label language allowing co-application of any ingredient.

In the current proposed registration decision EPA also states that "[h]owever, at this time, the topic of synergy and multiple stressors is an uncertainty in assessing risk to non-target plants including endangered species. Therefore, EPA is proposing a tank mix prohibition on the M1691 label to address this uncertainty."[72] **Unfortunately this is not correct**. The label language for M1691 states "RESTRICTIONS: DO NOT TANK MIX ANY OTHER HERBICIDE WITH M1691 HERBICIDE."[73] So any pesticide that is not categorized as an herbicide would be able to be tank mixed with this product under the current draft label language.

It is incorrect to assume that just because a pesticide has not been designed to kill plants means that it does not. In fact, it is well known that certain insecticides and fungicides can act synergistically with one another to kill insects.[74] So just because a particular pesticide is categorized as only killing insects or fungi or plants, does not mean that there is no crossover in toxicity. The same goes with dicamba: other pesticides could work synergistically with dicamba to kill plants and/or dicamba could work synergistically with other pesticides to kill insects or other animals. Until such possibilities are ruled out, more restrictive label language should be applied (see below).

The proposed label also states that the "M1691 Herbicide may only be tank-mixed with adjuvants that have been tested and found by EPA not to have an unreasonable adverse effect on the spray drift properties of M1691 Herbicide."[75] This language only restricts tank mixing with adjuvants that affect the spray drift properties of the herbicide, not the *toxicity* of the herbicide. There are many claims of synergistic toxicity with dicamba and adjuvants or inerts in patent applications (see below). Therefore, until all of those claims are assessed, more restrictive label language needs to be applied.

Furthermore, prohibiting tank mixing does not preclude someone from spraying their field with dicamba in one pass and then making another pass with another herbicide. Dicamba and glyphosate tolerant cotton and soybeans have already been deregulated and sold to farmers for the 2016 growing season. If this new dicamba use is approved, there will be an extensive amount of co-application of herbicides (possibly not in the same tank, but on the same field within a short period

[72] EPA. Proposed Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean. Docket ID EPA-HQ-OPP-2016-0187-0016. Page 21-22.
[73] Draft M1691 Herbicide label. EPA Reg. No. 524-582. Docket ID EPA-HQ-OPP-2016-0187-0015. Page 4. Emphasis added.
[74] Pilling, ED, Jepson, PC. Synergism between EBI fungicides and a pyrethroid insecticide in the honeybee (*Apis mellifera*). *Pesticide Science* (1993) 39 (4): 293–297 and Zhu, W, Schmehl, DR, Mullin, CA, Frazier, JL. Four Common Pesticides, Their Mixtures and a Formulation Solvent in the Hive Environment Have High Oral Toxicity to Honey Bee Larvae. *PLoS One*. (2014) 9(1):e77547. doi: 10.1371/journal.pone.0077547.
[75] Draft M1691 Herbicide label. EPA Reg. No. 524-582. Docket ID EPA-HQ-OPP-2016-0187-0015. Page 4. Emphasis added.

of time of one another). Whether these herbicides are applied at the exact same time or within a couple days of each other, the same toxicity concerns are possible. Once again, more restrictive label language needs to be applied.

The proposed label language is clearly not as restrictive as it needs to be to ensure product safety. The draft label language for the M1691 Herbicide should be amended to read:

- "No herbicide, insecticide, fungicide or other pesticidal active ingredient or adjuvant may be applied in the same area as this product in the same growing season."

Since mixture toxicity has not been assessed, the above label language would be a necessary change to adequately protect human and environmental health.

As mentioned above, a dicamba/glyphosate co-formulation is the impetus for this new use application and is the product that will likely account for the bulk of new dicamba use if it is approved. Therefore, it is absolutely essential that EPA analyze all available data and require additional study to assess potential synergistic and additive effects from mixtures. From the above quoted language used in the current risk assessment, it appears that EPA is committed to doing this.

The EPA has indicated its awareness of the Dow Agrosciences LLC patent[76] claiming synergy between glyphosate and dicamba for multiple species of plants in the risk assessment.[77] Although Dow is not the applicant for this new use, they did try, unsuccessfully, to patent the combination of these two chemicals for use on certain weeds. In doing so, they generated experimental data indicating that glyphosate and dicamba were able to synergistically kill certain plant species.

It is important to be aware that patent applications are very different from scientific publications. The latter are very descriptive and data intensive, while the former provide the bare minimum of information required to convince the patent office that their claim is legitimate. This does not mean that experimental data provided in patent applications are somehow less scientifically valid, only that more data may be available from the patent applicant/assignee than was provided to the patent office. In many cases the patent applicant/assignee will have additional data on synergism in their possession, as extensive experimentation is usually done before a company will invest the time and money to develop a product that they intend to market. Therefore, the EPA should make every effort to attain all of the necessary data from patent holders before an analysis of synergy is performed.

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[76] Satchivi, N and Wright, T. Synergistic herbicidal composition containing a dicamba derivative and a glyphosate derivative. Untied States patent publication no. US 20110275517 A1. Application number US 13/099,552. 10 November 2011.

[77] EPA. Memorandum. Dicamba DGA: Second Addendum to the Environmental Fate and Ecological Risk Assessment for Dicamba DGA salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA) for the Section 3 New Use on Dicamba-Tolerant Soybean. Docket ID EPA-HQ-OPP-2016-0187-0007. Page 22.

In addition to the primary literature and Dow patent that EPA cited in regards to mixture toxicity of glyphosate and dicamba, a patent by Monsanto is available that makes findings of synergy for dicamba and glyphosate (Appendix A).[78] In Example 8 of this awarded patent, the inventors state: "Further, it has unexpectedly been found that dicamba in combination with glyphosate allows control of glyphosate tolerant and susceptible weeds at lower application rates." When the Colby equation[79] is applied to the data provided in Table 8 of this patent, synergy is evident for some conditions even though it is not directly stated or measured by the applicants. This document covers the patent space on synergy between dicamba and glyphosate and was one of the reasons that Dow's patent application was ultimately rejected by the U.S. patent office (Appendix B).[80]

A couple of things should be kept in mind when analyzing this patent. 1) Although the available experimental data indicate that synergy is only occurring on glyphosate resistant marestail, the chemical concentrations used are too high to make any meaningful conclusions regarding glyphosate tolerant marestail. The applicant, Monsanto, is likely in possession of further data that was not included in the patent for the reasons outlined above and the fact that they state in the patent that this combination allows control of "glyphosate tolerant ***and*** susceptible weeds at lower application rates." (Example 8, emphasis added). 2) This patent does not diminish the data provided in the Dow patent application, it only means that Monsanto was the first to make the claim.

It appears that Monsanto did not furnish these data to the EPA even though they relate directly to this registration application. Furthermore, these data were likely not furnished to the EPA before the approval of the M1769 Premix Herbicide[81] that was conditionally registered in 2014. Pursuant to 40 CFR §159.195(a)(3) the registrant is required to submit information that indicates "Use of a pesticide may pose any greater risk than previously believed or reported to the Agency."

As long as there is no enforcement of this provision, registrants will continue to be non-compliant. It happened with Enlist Duo® and countless times before and it's happening right now. Chemical companies are using synergy to demonstrate that chemical combinations have some sort of novelty associated with them and are, therefore, patentable; yet when it comes to the toxicities associated with this synergy, somehow this information never makes it to the EPA.

Dicamba synergy does not stop with glyphosate. There are patents that make synergy claims for dicamba and other active ingredients, adjuvants and inerts. In fact, with just ten minutes of searching the U.S. Patent and Trademark Office database, we found many patents that identify synergistic interactions between dicamba and other pesticides, adjuvants and commonly used inerts.

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[78] Feng, PCC, Brinker, RJ. METHODS FOR WEED CONTROL USING PLANTS HAVING DICAMBA-DEGRADING ENZYMATIC ACTIVITY. Applicant: Monsanto Technology LLC. Patent number RE45048.
[79] Colby, S. R. 1967. Calculation of the synergistic and antagonistic response of herbicide combinations. Weeds 15:20-22.
[80] USPTO. Final rejection letter for application no. 13/099,552. Examiner Andriae Holt. 7/07/2014
[81] M1769 PREMIX HERBICIDE. Monsanto Co. EPA Registration Number: 524-616. Conditional Registration granted 4/22/2014. Label available at https://www3.epa.gov/pesticides/chem_search/ppls/000524-00616-20140422.pdf

Nonetheless, searching for patents can be a very difficult process that takes considerable time and knowledge. Many times the pesticide is not referred to by name in the patent, making a simple keyword search insufficient to identify all applicable patents. The EPA should not rely on stakeholders to provide all of the necessary information from patent applications, but rather a protocol needs to be developed to guide this process that places the burden to produce this information where it belongs – on the applicant.

1) Applicants need to be made aware that failure to submit relevant data to the EPA will be a violation of their duties under Section 6(a)(2) of FIFRA. When applicable, enforcement should be pursued.
2) To identify patent data that are not affiliated with the pesticide registrant, EPA needs to use a stepwise approach of doing a keyword and structure search for patents concerning the pesticide of interest followed by a rigorous analysis of the claims in the patent.
3) Any claims of synergy need to be assessed for relevance given the label restrictions for the pesticide (or lack thereof) and the inert ingredients that are present in any formulation up for approval.
4) Appropriate measures need to be taken to ensure that any registration decision is compliant with FIFRA. This may include label restrictions on mixing, increased in-field buffers, lower application rates or even cancellation.

We realize this gets very complicated due to the sheer number of pesticide combinations that are possible, but this is a problem of EPA's own making. This agency has been way too lenient on tank mixing and coapplication of pesticides and adjuvants, rarely putting any restrictions on what a pesticide can be mixed with in the field. In the past, the EPA has been reluctant to analyze the effects of chemical mixtures, citing lack of experimental data to come to a scientifically defensible conclusion. Fortunately, it is evident from patent applications that pesticide registrants have these data available for the EPA to analyze. This is a previously unknown and unappreciated source of much needed data.

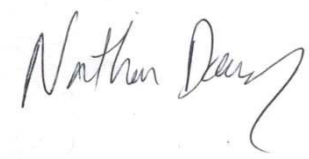
The real problem, however, is that when assessing pesticide mixtures, the EPA treats the *lack of data* the same way it would treat a conclusive negative result. The outcome for both is to allow a particular pesticide use to occur. When there are no data available, a scientifically defensible conclusion is impossible. Assuming "no enhanced toxicity" of a mixture is just as scientifically indefensible as assuming "enhanced toxicity." The only difference is that one is a cautious approach and the other is a risky approach.

Conclusions

While the Center is very encouraged that the EPA has finally recognized that it must comply with the ESA when it registers new pesticide products and uses under FIFRA, the EPA's determination that this new dicamba use would not adversely affect any endangered species is not based on the

plain language of the ESA, the best available science, is otherwise not supported by substantial evidence and is arbitrary and capricious. Dicamba will have impacts on listed species and triggers the may affect requirement for Section 7 consultations under the ESA. There are also serious issues regarding mixtures and methodologies that similarly need to be addressed in order appropriately assess risk.

Respectfully submitted,



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Docket: EPA-HQ-OPP-2016-0187
Dicamba: New Use on Herbicide-Tolerant Cotton and Soybeans

Kalsec, Inc. very much appreciates the opportunity afforded by the US EPA to comment on the proposed decision to register dicamba for use on genetically engineered crops. We are opposed to such expanded use in the absence of more serious consideration and amelioration of issues related to dicamba residue levels in off target crops.

Kalsec, Inc. is an agriculturally based and dependent company that manufactures spice, herb and vegetable extracts for the food and beverage industry. Our products are highly functional colors, flavors, antioxidants, and nutritional ingredients that are sold globally. We operate our own farming facilities in Texas, and work closely with contracted farmers in Oklahoma and elsewhere in the US and around the world. We grow highly specialized crops, namely, rosemary, chillies, carrots and paprika in close proximity to large operations where cotton and soybeans are grown. Our manufacturing process can concentrate pesticide residues in our extract products, including those resulting from overspray.

The proposed regulatory decision to register dicamba to control weeds in cotton and soybean that has been genetically engineered to tolerate dicamba is highly problematic for us. Sufficiently high levels of overspray may kill our plants or damage them in ways which reduce yield. More importantly, even if plants survive, overspray and other forms of pesticide drift will have a negative impact on our operations due to unintentional and unavoidable contamination of our crops and downstream products with dicamba and its decomposition products. This contamination renders our products unfit or less fit for sale. We already suffer from overspray and drift problems associated with other agricultural chemicals, such as tribufos (a defoliant). We spend considerable time, effort and expense in sampling and analyzing our crops to measure and control the extent of this contamination. Sometimes the contamination levels are unacceptably high and we are forced to dispose of portions of our crop. Contamination from overspray requires us

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to manage the harvest and the subsequent manufacturing processes in ways that cost us time and money and makes us less able to compete with our competitors in India and China.

In the US, there is no statutory tolerance for non-label pesticide residues in our crops and the extracts made from them. The European Commission (EC) has established default MRLs for unauthorized pesticides in food commodities at 0.01 mg/kg (EC Regulation 396/2005). In the absence of a US MRL for a non-label pesticide in our crops, we rely on the European MRLs for guidance. By a strict interpretation of the US regulations, any residue from a non-label pesticide in the US renders the contaminated crop and downstream products adulterated and illegal to sell. Therefore, it would be very helpful for companies such as ours, who are plagued by overspray of non-label pesticides, if the US adopted EC default tolerances for non-label pesticides in full. We recognize that the political sensitivities associated with such a move make it unlikely for this to happen. We suggest, however, that if a wholesale adoption of Codex MRLs can't be made, then the EPA should adopt EC MRLs on a case-by-case basis for non-target crops as part of each registration or re-registration process. We urge you to start this practice in this case.

Consumers around the globe are becoming more concerned about the potential health effects of pesticide residues in food. They want to see less pesticide use and fewer, not more pesticides being used. EPA's proposed extension of the registration of dicamba would dramatically increase the acreage of dicamba use and the impact of dicamba contamination via overspray and other mechanisms of transport.
To ensure there is reduced off-field movement of dicamba, the EPA is stipulating:

- The pesticide may not be applied from aircraft.
- The pesticide may not be applied when wind speed is over 15 mph.
- A within-field buffer that ranges from 110 to 220 feet in all directions, depending on application rate, has been set to protect endangered plants and will also further protect bystanders and non-target plants.

While these measures are helpful, they are insufficient for a variety of reasons:

- Insufficient enforcement of requirements.

It is not clear how these requirements are to be enforced or if enforcement on such a large scale is even possible. Guidance is given at the website – https://www.epa.gov/compliance/inspections-under-federal-insecticide-fungicide-and-rodenticide-act.

This website states - Agricultural inspections include the inspection of pesticide applications in conjunction with the production of agricultural commodities. Agricultural commodities are defined in 40 CFR section 171.2(a)(5) as, "[a]ny plant, or part thereof, or animal or animal product, produced by a person (including farmers, ranchers, vineyardists, plant propagators, Christmas tree growers, aquaculturists, floriculturists, orchardists, foresters, or other comparable persons) primarily for sale, consumption, propagation, or other use by man or animals."

There are simply not enough inspectors to enforce the requirements. Given the large acreage under cultivation in the United States that falls under such a broad definition - and the relatively small number of federal, state and tribal Federal Insecticide Fungicide and Rodenticide Act (FIFRA) inspectors available - it is certain that dicamba will be applied outside these restrictions. This is particularly likely in the area where our crops are grown in the high plains of west Texas and in central Oklahoma. Average wind speeds and peak gust data from the National Climactic Data Center are shown in Table 1 for locations near our Texas and Oklahoma sites. Wind gusts of up to 50-70 mph are common throughout the year, making application without transport outside the target area very difficult. Even if application is limited to times when wind speeds are below 15 mph, there is another significant mechanism of pesticide drift that can occur after the application period which operates completely outside of the proposed EPA strictures (see below).

Table 1. Wind Speed Averages (SPD) and Peak Gusts from National Climactic Data Center (1930-1996) for sites near our facilities.

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Burns Flat Clinton OK	SPD	12	12	14	14	14	12	9	9	10	10	10	12
	PGU	52	62	68	68	70	60	67	54	60	47	51	56
Lubbock TX	SPD	13	14	15	15	15	14	12	10	11	12	13	13
	PGU	59	64	77	71	74	85	72	59	58	52	63	64

https://www.ncdc.noaa.gov/sites/default/files/attachments/wind1996.pdf

- Insufficient consideration of alternate drift mechanisms.

Pesticides are distributed by another important drift mechanism besides overspray – the dispersion of pesticides adsorbed on wind-blown particles [Glotfelty et al., (1984)]. Dicamba binds tightly to soil particles and has a half-life of 30-60 days [National Pesticide Information Center - Dicamba General Fact Sheet]. Degradation products of dicamba, namely 3,6-dichlorosalicylic acid (3,6-DSCA) and perhaps 3,6-dichlorogentisic acid are more persistent than dicamba [Koskinen, et al. 1998]. For this reason, the EU has directed that dicamba residual concentrations in foods should include dicamba plus its two main degradation products [EFSA, 2013]. Because of surface area considerations, pesticides are generally found in higher concentrations on smaller soil particles. Smaller soil particles are dispersed more easily and widely than larger particles due to their smaller mass. According to a report from the European Commission – Health and Consumer Protection Directorate-General [Kubiak et al. 2008], "this [wind-blown particles] process is most important for herbicides as they are applied either at pre-emergence or post-emergence at an early growth stage of the crops when there is low soil coverage." "Wind erosion events shortly after application of a pesticide with high initial residues on the topsoil can therefore result in significant emission rates." Our neighbor's soil containing dicamba will inevitably end up in our production fields and we will see dicamba and breakdown product residues in our crops and downstream products if this proposed decision to register dicamba in genetically engineered crops is allowed.

- Insufficient regulation of application equipment and techniques.

The type of application equipment, including nozzles, etc., used in applying the herbicide, as well as the techniques used in the application have a dramatic effect on the level of overspray that is observed. Clear specifications and restrictions on the kinds of application equipment and techniques that can be used to apply dicamba should be made. Doing so, however, creates yet more conditions that need to be inspected and enforced by an overwhelmingly inadequate number of inspectors.

- Insufficient consideration of dicamba decomposition product lifetimes.

The degradation of dicamba has been seen as mitigating the risk of its high mobility. Using field lysimeters to determine ^{14}C-dicamba persistence, Koskinen et al. demonstrated that while only 5.5% of dicamba was present in the soil one month after application, the degradation product 3,6-dichlorosalicylic acid was present at 26.7% of original concentration one month after application [Koskinen et al., 1998]. The compound degraded much more slowly and was present at an average of 13% at 2 to 6 months after application and 11.2% at 12 to 16 months after application. A considerable portion of the ^{14}C was present in unknown forms that were unextractable.

As stated earlier, the European Union requires that MRLs for dicamba be calculated as the sum of dicamba and its degradation products.

Product distribution of extractable ^{14}C in the top 10 cm of soil (From Koskinen et al. [1998])

	Months after application					
	0	1	2	6	12	16
Chemical	**% of applied ^{14}C**					
dicamba	95.6	5.5	2.2?	1.7?	1.4?	1.0?
3,6-DCSA	3.4?	27.6	15.2	11.0	12.9	9.4
5-HO-dicamba	0.4?	0.2?	0.2?	0.2?	0.2?	0.1?
nonpolar	0.1	0.2	0.2	0.2	0.2	0.2
Polar	0.4	2.3	2.4	2.0	2.1	0.2
unextractable	0	58.2	36.2	38.8	30.3	31.8

? indicates that identity of the ^{14}C could not be determined.

As stated earlier, Kalsec grows chillies, paprika and rosemary in Texas and Oklahoma, in areas where significant amounts of cotton are grown. We already suffer from contamination of our crops with tribufos, a defoliant used widely on cotton. While tribufos is permitted to be applied aerially, this application method is not generally used in our location. The contamination we observe is a result of ground application. It is interesting, therefore, to compare the stipulations / restrictions that EPA is suggesting for dicamba relative to the stipulations / restrictions in place for tribufos. According to the registration documents for Def®6 Emulsifiable Defoliant (tribufos), "[T]the pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g. residential areas, bodies of water, known habitat for threatened or endangered species, **non-target crops**) is minimal (e.g. when wind is blowing **away** from the sensitive area" [emphases added] [. This label also states "Drift potential is lowest between wind speeds of 2- 10 mph. [" These stipulations are more restrictive than the stipulations for dicamba where application can occur at wind speeds up to 15 mph and where there is no mention of restricting application when wind is blowing toward non-label crops. The label does state that when applying dicamba to sensitive crops, "do not spray near sensitive crops if the wind is gusty or in excess of 5 mph and moving in the direction of sensitive crops." This has nothing to do with drift leading to contamination of non-target, non-labeled plants – it is to avoid damaging the crop being protected from weed incursion. Sensitive crops are defined as "desirable trees and plants, particularly beans, cotton, flowers, fruit trees, grapes, ornamentals, peas, potatoes, soybeans, sunflowers, tobacco, tomatoes and other broadleaf plants." We already experience drift from tribufos. Since the proposed stipulations for application of dicamba are largely less restrictive, we will undoubtedly experience contamination of our crops from dicamba and its degradation products – leading to economic harm.

The EPA recognizes that glyphosate overspray was a leading cause of the very serious and concerning development of glyphosate resistance in a number of target weeds. The EPA proposes to manage dicamba resistance by:

- Robust monitoring and reporting to EPA;
- Grower education and remediation programs
- A time limited registration of the proposed uses that would expire in 5 years, allowing for EPA to address any unexpected weed resistance issues that may result.

These measures are admirable, but are almost certain to fail in practice because the EPA does not have adequate resources to carry them out. Additionally, one of the restriction elements designed to reduce overspray will actually encourage the development of dicamba tolerance and resistance in weeds. The requirement to maintain a within-field buffer that ranges from 110 to 220 feet in all directions will provide the perfect environment to encourage the development of tolerant weeds – a zone where weeds are continually exposed to sub-lethal levels of dicamba.

We find it hard to believe that the EPA will allow the registration to expire after five years, once farmers have become dependent on dicamba.

In summary: Kalsec, Inc. is opposed to the registration of dicamba for use in genetically engineered soy and cotton because insufficient consideration has been given to the impact on contamination in non-target, non-label crops. The proposed restrictions for the application of dicamba to genetically modified cotton and soybean dealing with overspray do not take into account other important post-application transport phenomena. The proposed restrictions for application of dicamba to cotton are less restrictive than for the application of tribufos. Our crops grown in the vicinity of cotton are already beleaguered by contamination from tribufos.

References:

EFSA, 3013, Reasoned opinion on the modification of the MRL for dicamba in genetically modified soybean, EFSA Journal 2013: 11(10): 3340-3478.

Glotfelty, D.E.; Taylor, A.W.; Turner, B.C.; Zoller, W.H., Volatilization of surface-applied pesticides from fallow soils, J. Ag. Food Chem. 1984, 32, 638-643.

Koskinen, W. C.; Sorenson, B. A.; Buhler, D. D.; Wyse, D. L.; Strand, E. A.; Lueschen, W. E.; Jorgenson, M.D.; Cheng, H. H. (1998). Use of Field Lysimeters to Determine 14C-Dicamba Persistence and Movement in Soil. ACS Symposium Series, 699, 115-121.

Kubiak, R.; Bürkle, L.; Cousins, I.; Hourdakis, A.; Jarvis, T.; Jene, B.; Koch, W.; Kreuger, J.; Maier, W.- M.; Millet, M.; Reinert, W.; Sweeney, P.; Tournayre, J.-C.; Van den Berg, F., Report of the FOCUS Working Group on Pesticides in Air, EC Document Reference SANCO/10553/2006 Rev 2 (June 2008).

National Pesticide Information Center – Dicamba General Fact Sheet: http://npic.orst.edu/factsheets/dicamba_gen.pdf

Respectfully submitted,

P. Douglas Williams
Director, Regulatory Affairs

Donald R. Berdahl
Executive VP / CTO

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Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

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Comment

As a homeowner in a rural farm-economy dominated area, I own a home that is adjacent to a corn and soybean field. I am concerned about the volatility of the Dicamba products. Dicamba has the potential if used improperly to kill/destroy trees, landscaping plants, and my lawn. The burdens of increasing yield in Farm crops has come at a cost, at times, from the homeowners that surround these fields. Overspray and a lack of management of drift have killed landscape plants, reduced home property values, and caused interactions with our Farming neighbors to be less than friendly at times. Farmers that spray near property lines of Homeowners with trees and landscaping adjacent to the fields should be 100% liable to replace all lost value items to their original pre-spraying condition. A 20 foot pine tree that is lost to poor drift management must be replaced with a 20 foot pine tree, not a starter tree. Without rules and liability in place with the Farmers and Producers of these non-discriminatory killers of plant-life, the burden (as it normally does) of replacing lost home-value will fall to the Homeowners when it should rest firmly and squarely on the shoulders of those benefitting from the use of these chemicals (Farmers and Chemical Herbicide Producers).

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Comments to: EPA-HQ-OPP-2016-0187
Revised May 25, 2016

Dear EPA,

While it is undisputed that dicamba is an extremely valuable herbicide to American agriculture, broadly expanding its use pattern into genetically modified crops resistant to dicamba will greatly increase the risk of unintentional plant injury due to drift of the compound off the application target area as well as increase the potential for increased broadleaf weed resistance to other herbicide modes of action.

Drift

Use of dicamba on crops genetically modified to be tolerant to applications of dicamba will significantly change dicamba's use pattern. Applying dicamba to growing tolerant soybeans and cotton will mean much more dicamba is being applied at a time when other crops and vegetation are most vulnerable to dicamba injury. This use will also promote dicamba use in other areas of the country growing a diverse number of crops. Couple these new usage profiles with the risk that farmers will use the dicamba product during inappropriate or non-recommended weather conditions probably guarantees dicamba spray drift will become a major problem.

It appears the dicamba product Monsanto is registering for use on the dicamba tolerant crops will be the diglycolamine salt of dicamba, same as BASF Clarity among others. This low volatile salt of dicamba was first introduced by Sandoz in 1987. While volatility, as opposed to spray drift, is a drift threat that can somewhat be controlled by a registrant's product formulation, there is still no guarantee that dicamba volatilization drift injury cannot occur especially when dicamba usage is greatly expanded. Has EPA considered factors more than just comparative volatility between dicamba product formulations? The diglycolamine salt of dicamba is still volatile, just at a slower rate. What will happen when dicamba will be slowly volatilizing from thousands of acres of soybeans?

M1691 product labeling prohibits application of M1691 to Roundup Ready Xtend crops with anything other than water and certain approved adjuvants. Yet, the Roundup Ready Xtend crops and weed control system were designed for application of glyphosate and dicamba. The M1691 label recommends tank mixing other herbicides, including glyphosate, when applying for other crops. Is EPA assuming this prohibition of tank mixing will be strictly followed when tank mixing of pesticides is a standard agricultural practice? Tank mixing herbicides often provides better weed control, but always saves farmers time and money. Has EPA considered what will occur when the diglycolamine salt of dicamba is tank mixed with another pesticide salt, such as glyphosate isopropylamine? Dicamba is a very strong acid (pK_a 1.87), stronger than most pesticide active ingredient acids, including glyphosate (pK_a 2.6, 5.6, and 10.3). In

solution, the stronger acid will bond with the stronger base, so in the case of tank mixing diglycolamine salt of dicamba with glyphosate isopropylamine, it would be a dicamba isopropylamine salt applied instead of the diglycolamine salt of dicamba, thus increasing the risk of dicamba drift due to volatility.

When considering the risk pesticide drift presents to adjacent plants and crops, one must consider the nature of the pesticide itself. Dicamba is a very powerful herbicide and plant growth regulator. Very small amounts of dicamba can cause severe damage to sensitive crops, such as tomatoes and cotton. In the late 1990's a simulated drift study to compare levels of various herbicide injury was performed on Pima cotton in California. Included in this simulation were the herbicides, 2,4-D and dicamba. The results were dramatic. At the minute rates expected from application drift, the 2,4-D moderately injured the cotton, but the dicamba nearly killed the cotton. It appeared the dicamba injury was ten times more severe than from 2,4-D.

Broadleaf Weed Resistance

There already exists broadleaf weed biotypes, such as kochia, that have developed resistance to dicamba in areas where dicamba is/was routinely used for weed control in row crops. It would be naive to think widespread weed resistance to dicamba will not occur. Introduction of crops tolerant to dicamba is only a temporary band-aid to fix a weed resistance problem widespread use of genetically engineered crops caused.

While with the introduction of dicamba tolerant crops, registrants and regulators have stated there will be weed resistance management plans in place to keep weed resistance from spreading, one need not overlook the obvious. Crops genetically modified to be tolerant to certain herbicides make weed control in those crops simple and relatively cheap. Farmers are people and some people will always take the easy way out, so it should be expected that all farmers will not adhere to weed resistance management plans when dicamba is controlling their weed problems...today. Applying only dicamba as M1691 will speed the natural selection evolution process to weed resistance. Once another broadleaf weed is identified as resistant to dicamba there has likely been several more created and some of these biotypes will be resistant to multiple herbicide modes of action sending American agricultural into a worse weed control crisis.

There are many herbicides currently on the market today that control those weeds now tolerant to glyphosate. A large number of these herbicides have been effectively used for over twenty-five, even forty, years without weeds becoming resistant to their mode of action. Why haven’t weeds become resistant to many of the older herbicides? Maybe it was because they were only used when needed and herbicide treatments were changed when field conditions changed. Certainly this was not the case with the Roundup Ready crops where glyphosate was applied continuously.

Farmers have had to re-learn how to use these pre-Roundup Ready herbicides and are controlling glyphosate resistant weeds, yet they understandably yearn for the return of

the easy “one herbicide fits all” approach to weed control. As stated before this will only create more and harder to control herbicide resistant weeds.

Numerous “authorities” have stated that older herbicides are more toxic. More toxic than what? Glyphosate? Wouldn’t the World Health Organization International Agency for Research on Cancer’s finding that glyphosate is probably carcinogenic to humans render that comparison of toxicity invalid? These “authorities” have also stated that farmers are using more herbicides due to weed resistance. Compared to what? Spraying glyphosate across the same field four to five times a growing season? No wonder resistance to glyphosate is wide spread. Now EPA is wanting to let Monsanto entice farmers to do the same with dicamba?

Monsanto has done an excellent job of marketing their product to the farming community, Monsanto stock holders, and promoting its need to EPA. Good marketing is not good science and can prove to be harmful in the long run. McDonald’s Happy Meals were tremendously successful marketing concepts, but feeding them to children everyday on the way home from school has helped foster an unhealthy and overweight bunch of children who grow into unhealthy, overweight adults. There are many more examples of harmful marketing. Should the Marlboro Man be mentioned?

Hopefully, one or more of the facts stated above could convince EPA that moving forward with expanding dicamba use into crops genetically modified to be tolerant to dicamba application is a bad idea.

While I am not ashamed to voice my comments, I am a farmer, an agrochemical company employee, and a member of numerous agricultural organizations, including CropLife, I prefer to submit these comments anonymously to avoid any backlash from those wanting this technology.

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The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

Comment

I raise corn and soybeans in Central Illinois.

I am OPPOSED to Genetically Engineered Dicamba traited seed for the following reasons:

1) Dicamba is a synthetic "auxin" herbicide, acting as an artificial plant hormone that disrupts the normal growth processes of a plant. This results in deformed leaves, stems, roots, seed heads and ultimately plant death. For growers of vulnerable crops such as tomatoes, lettuce, beans, grapes, peaches, sunflowers, peanuts, timber, & non dicamba resistant soybeans & cotton, etc. dicamba drift will pose quite possibly the biggest threat to their farms' production and thus, their economic survival.

Pesticide drift occurs in two basic ways: spray drift (when pesticides are blown off their intended target at time of spraying) and volatilization drift (when the chemical evaporates in the days or even weeks after application, and can drift for miles before landing on and often destroying someone else's crops). Dicamba does both.

Currently we already have substantial 2-4D and dicamba drift injury in Central Illinois, because these relatively inexpensive herbicides are "burn down" products for winter annuals and early germinating broadleaf weeds when applied pre-plant for soybeans. The damage is limited to emerging landscape plants that have vulnerable small emerging foliage since most other crops have yet to emerge or even be planted. Most damage is explained away by winter kill, frost injury, extended cold temperature effects, etc.

However, with the new traited seed, the damage to off target flora and fauna will dramatically increase because everything will be fully leafed out and all fields will be emerged when the June and July applications will be made. The higher temperature and humidity @ this time of the year will only compound the problem exponentially.

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While applicators can "try" to manage spray drift only God can manage volatilization drift.

2) It's important that we can all continue to responsibly farm the land together, without harming someone else's crop, timber, or landscape in the process.

3) We've already seen what nearly 20 years of reliance on RoundUp has brought us.....million acres of farmland infested with RoundUp-resistant "superweeds". We need leadership towards agricultural sustainability that encourages wise use of herbicide technology by rotating herbicides, crops, along with other integrated pest management practices.

For these reasons I urge the approval be denied.

Thank you for your consideration.

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Comment submitted by Dennis M. Dixon, Field Representative, Hartung Brothers Incorporated

The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

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Comment

May 10, 2016

U.S. EPA
To whom it may concern:

Below are some salient points that I would think you have seen and previously and considered, as it pertains to the use of 2,4-D and or dicamba herbicides.

Until there are residue tolerances, NO approval should be granted
The Arkansas restrictions on buffer zones of 400' seems like a reasonable safeguard against volatility for the "safer" formulations, Engenia and M1691
The Arkansas restriction on a one-mile buffer zone for the older generic formulations should be utilized
Making the older generic formulations a Restricted Use Pesticide will add to the safety by limiting access and establishing more complete records of application
The language of "wind cannot be blowing towards a commercially grown" sensitive crop as defined in the label is a critical safeguard and is to be commended

I work for the Hartung Brothers Incorporated of Madison, WI. What I do for them is oversee the production of pickling cucumbers mostly in Indiana, but with some involvement in Michigan, Ohio and from time to time Illinois. My background is in the custom application business, both aerial and ground, as well as, for the past 35 years, the commercial production of vegetables both fresh market and processing.

I have experience with both herbicides and I understand that those chemistries are very effective in their ability to control resistant broad leaf weeds. Unfortunately, my experience, with these herbicides includes first-hand knowledge of the unintended damage that they can and often do cause to susceptible crops. I have personally seen

dicamba damage crops a few miles from the application site. Drift can be bad enough but volatility is the 800 lb. gorilla in the room. I understand that new formulations are promoted as being less volatile. I also know that some users of these materials will use lower cost formulations.

In a nutshell, I understand and appreciate both the great benefits and potential catastrophic consequences involved in the use of these technologies. My position is that the five bullet points listed would be the best approach at this juncture.

Dennis M. Dixon
Field Representative
Hartung Brothers Incorporated
Dennis.Dixon@hartungbrothers.com

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Comment

Dicamba has always been limited use herbicide in the US with application confined primarily to grass crops such as sorghum and corn. Even with limited applications, there are already two weed species in the US, kochia and prickly lettuce, which have developed resistance to the dicamba. Dicamba-tolerant cotton and soybean will not be the "silver bullet" to cure the current problem with glyphosate resistant species in these two crops. On the contrary, it seems likely that trouble species, particularly from the Amaranthus family, with develop yet another means of resistance.

As a wine grape and cotton grower in the Texas High Plains, we are concerned about the drift of dicamba onto our vineyard (a highly sensitive species), cotton fields which are not tolerant to dicamba herbicide, and other non-target plants such as trees, shrubs, and flowers. The potential wide-spread use of auxin herbicides during the growing season on dicamba tolerant broadleaf crops is unprecedented, so there is no way of predicting the level of damage which will ensue if dicamba herbicide were to become approved for use in cotton and soybean. And while Monsanto claims that the Roundup Xtend and Xtendimax formulations reduce driftable fines up to 97-99%, this still leaves 1-3% available for off-target movement onto sensitive crops.

Even without the wide spread approved use of dicamba, last year we had two mature (~20-30 year-old trees) at our rural Texas home which suffered severe damage due to auxin herbicide drift from our neighbor who sprayed his ditch. We were hopeful that the trees would recover this season, but the symptoms have persisted and threaten to cause permanent and potentially lethal damage (see attached photos).

After three years of careful tending and over $60,000 of investment in our vineyard, we hope to see our first grape production in 2016 after many years of neglect from the previous tenant. We have intentionally diversified our operation to make our family farm more sustainable for our children (now 14 and 11), especially as water becomes less

available. It would be heartbreaking to see the entire vineyard lost due to a single, careless dicamba application.

On our cotton acres, we've always enjoyed the flexibility of choosing the variety that best suits our operation and budget. We not only have to consider input costs, but also the price at the end of the season. With the tight market we currently find ourselves in, we plan to plant conventional, non-GMO cotton for the first time since 1998. Additionally, the Fibermax varieties (which do not have dicamba tolerance) have given us consistent high fiber quality and yield, allowing us to maximize the price we get paid at harvest. The wide spread use of dicamba will put all cotton farmers in a defensive position - forcing us to consider the use of high cost, dicamba tolerant seed that may not provide the best yield or fiber quality at the end of the season. We do not want to be forced to plant dicamba tolerant cotton just to protect our farm from neighbors who choose to plant it!

Finally, a recent study at Penn State University showed that a simulated drift rate equivalent to approximately 1% of the field rate, caused delayed flowering and reduced the number of flowers in species such as alfalfa. This also caused pollinators to visit these fields less often. The full ecological impact can only be speculative, but it is likely that wide spread use of dicamba during the growing season will upset a delicate balance in the bee population which is just now beginning to recover from decline due to nosema fungi, deformed wing virus, and Varroa mites.

For all of these reasons, I strongly encourage the EPA to not approve the use of dicamba in cotton and soybean genetically engineered to tolerant the herbicide.

Attachments (4)

Photograph 1

View Attachment: JPG PDF

Photograph 2

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Photograph 3

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Photograph 4

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Comment submitted by T. Kreuger

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Comment Period Closed
May 31 2016, at 11:59 PM ET

ID: EPA-HQ-OPP-2016-0187-0528
Tracking Number: 1k0-8pen-15cp

Comment

As a Commercial Applicator I have many concerns about dicamba. I went through the launch of Roundup and thus will be much worse. The amount of off target claims will be much higher thus costing the insurance companies lots of money. No matter how hard we try to do things right, there will be off target issues. This technology would be best suited for burndown applications not post applications. The chance of off target damage will be significantly less because non tolerant crops most likely won't be planted during burndown applications. The companies that have participated in the development of this trait have written the proposed lable as to put all responsibility on the applicator. We as applicators will only have a very limited amount of proper days to, by label , make applications. Dr Kevin Bradley at the University of Missouri did research to see how many days in the planting and growing season the wind in Missouri are under the 10 MPH threshold. He discovered that there really isn't that many. Most of the chemistry we currently use have many of the same regulations that dicamba will have. The big difference is volatility and drift. If we screw up spraying with dicamba it won't necessarily cause an economic to the affected party but it will look like it has and in turn cause an investigation which I will have to involve my insurance company and Missouri Department of Ag. The benefit of this product is only truly going to help those Farmers who abused the roundup trait and didn't properly use the chemistry that they had. I applaude the chemical industry for always trying to invent new chemistry and biotechnology companies to develop seed to use the chemistry but this di
camba trait and chemistry is to much for most areas to handle.
Tommy Kreuger
tommykreuger@gmail.com

Document Information

Date Posted:
May 19, 2016

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Anonymous public comment

The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

Comment Period Closed
May 31 2016, at 11:59 PM ET

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Tracking Number: 1k0-8p6j-ybha

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May 10, 2016

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Comment

While I understand the situation with Resistant weeds I do not think Dicamba resistant cotton can be deregulated safely. In season application of Dicamba will be disastrous in the Plains where there is a lack of vegetation or natural barriers to mitigate drift. The persistent wind on the plains will make farmers do things that will be off label. While Monsanto has done all the research and will make recommendations that mitigate their responsibility the reality of the location will mean that most applications will be in marginal conditions at best. Woody species such as trees and vines will suffer consistent and devastating losses. As a vineyard owner I experience 2-4 D damage every year already with relatively small acreage applications compared to what may be expected if the Dicamba is approved for in season use. Monsanto will present supporting documentation demonstrating that Dicamba can be used safely even in the Plains. When this chemical is used in large areas and not just experimental blocks we will see the damage to woody species. Current Round-up damage in woody species is bad enough. Use is so widespread in the plans cotton growing regions that glyphosate damage is a regular occurrence. Vines and trees are affected annually but since glyphosate is not auxin based the plants can be encouraged to grow out of it. That is not the case with 2-4D based herbicides. Their damage persists years after exposure. There are many herbicide options available already. It is not necessary to have this extremely dangerous herbicide approved for in season use. If it is there will be more rich lawyers and dead trees and vines on the Plains.

I

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Anonymous public comment

The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

Comment

While I understand the situation with Resistant weeds I do not think Dicamba resistant cotton can be deregulated safely. In season application of Dicamba will be disastrous in the Plains where there is a lack of vegetation or natural barriers to mitigate drift. The persistent wind on the plains will make farmers do things that will be off label. While Monsanto has done all the research and will make recommendations that mitigate their responsibility the reality of the location will mean that most applications will be in marginal conditions at best. Woody species such as trees and vines will suffer consistent and devastating losses. As a vineyard owner I experience 2-4 D damage every year already with relatively small acreage applications compared to what may be expected if the Dicamba is approved for in season use. Monsanto will present supporting documentation demonstrating that Dicamba can be used safely even in the Plains. When this chemical is used in large areas and not just experimental blocks we will see the damage to woody species. Current Round-up damage in woody species is bad enough. Use is so widespread in the plans cotton growing regions that glyphosate damage is a regular occurrence. Vines and trees are affected annually but since glyphosate is not auxin based the plants can be encouraged to grow out of it. That is not the case with 2-4D based herbicides. Their damage persists years after exposure. There are many herbicide options available already. It is not necessary to have this extremely dangerous herbicide approved for in season use. If it is there will be more rich lawyers and dead trees and vines on the Plains.

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Comment submitted by Scott E. Rice, Rice Farms Tomatoes, LLC

The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

Comment Period Closed
May 31 2016, at 11:59 PM ET

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Date Posted:
May 9, 2016

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Comment

Dear EPA,

As a producer of processing tomatoes in Indiana, my sons and I are opposed to the current plan of labeling for use on tolerant soybeans and cotton. We believe stronger safeguards are a must before this technology can hit the market. Our tomato crop is highly susceptible to any amount of drift from dicamba.

We are particularly concerned about soybean growers using older and more volatile formulations of dicamba due to the current depressed economics in the corn/soybean belt, even though this would be off-label. A devastating off-target event occurred in Arkansas due to this type of use.

Also, there is currently NO residue tolerance for dicamba on our tomato crop. If our processor finds any residue, they would mandate crop destruction as our crop would be unusable. At a field value in excess of $5,000 per acre, most applicators liability insurance would be exhausted long before they could pay our claim.

At the very least, we would ask that minimum buffers be increased to at least 400 feet instead of the proposed 110 feet. Also, Monsanto and BASF will need to do a much better job of training prospective applicators about the inherent risks of spraying anywhere near sensitive food crops such as tomatoes.

In summary, we understand the need to fight resistant weeds in the corn belt. We are also corn and soybean producers. However we must not do this at the expense of our existing specialty crop production in the Midwest. That would be devastating not only to the individual farms affected, but also to the larger economy that these high-value crops bring to our region.

We urge you to go slow with this pending approval, try to fully evaluate the risks of "unintended consequences", and consult closely with the specialty crop industry to avoid catastrophic

crop injuries.

Thank you for your consideration.

Best Regards,

Scott E. Rice
Rice Farms Tomatoes, LLC

Utterback Farms, Inc. is a family-owned business located in Alexandria, Indiana, a town in Madison County, Indiana. We started raising tomatoes in 2000 as a way to diversify our farming operation. We are concerned with the likelihood of plant damage from drift or volatilization that can happen with dicamba.

Non-target plant damage associated with herbicide spray drift and volatilization is a major concern for specialty crop growers and processors. Credible estimates project significant increases in the application levels of dicamba upon the introduction of dicamba tolerant crops. Dicamba, because of its potential to drift and volatilize, has proven to be America's most dangerous herbicide for non-target plant damage.

Utterback Farms is worried that there is still no residue tolerance for dicamba on most food crops. Even an off-target movement of dicamba could result in crop destruction, which would be a very large loss, for our farm.

We also believe that the 110' buffer is not adequate against volatility risk to specialty crops. I believe that a 400' buffer would be more reasonable, similar to what Arkansas has imposed.

Respectfully Submitted,

Curt Utterback, Secretary
Utterback Farms, Inc.
4545 W. 1000 N.
Alexandria, IN 46001

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Comment submitted by D. Dolliver

The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

Comment

I am an employee of Red Gold, Inc., a tomato processing company, and I am very concerned with the release of Dicamba and the impact that it may have when it volatiles onto tomato crops. The economic impact on the Red Gold Company would be a tremendous loss, but also the economic impact on the tomato growers would be devastating. Since there is no residue tolerance for Dicamba on tomato crops, entire fields would need to be abandoned, with the possibility of no insurance (since losses of this size most likely would go beyond the insurance coverage of nearly all applicators).
Unfortunately, Arkansas served as an example of what can happen when applicators do the wrong thing. I would like to see the new Arkansas restrictions incorporated into any approved label.
~ Danna Dolliver; Agriculture Administration Manager

Comment Period Closed
May 31 2016, at 11:59 PM ET

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Tracking Number: 1k0-8p78-vmuh

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Apr 28, 2016

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Comment submitted by Randall Woolsey, Woolsey Bros. Farm Supply

The is a Comment on the **Environmental Protection Agency** (EPA)
Other: **Public Participation for Dicamba: New Use on Herbicide-Tolerant Cotton and Soybean**

For related information, **Open Docket Folder**

Comment Period Closed
Apr 30 2016, at 11:59 PM ET

ID: EPA-HQ-OPP-2016-0187-0285
Tracking Number: 1k0-8oyh-kx45

Comment

April 8, 2016
Say NO to Dicamba!
My family has owned and operated an Ag service company for the past 60 years. We custom apply liquid fertilizer and
pesticides for farmers.
I am writing this as I am very concerned about Dicamba Beans. The problems that I see are as follows:
90% of the bean acreage we service are no-tilled. I now use paraquat for burn down because: Roundup and 2-4,d will
not kill waterhemp or marestail.
Drift will be a problem. I do not want the responsibility or liability of dealing with this.
Dicamba is very hard to rinse out of spray equipment. It will take alot of extra time to get our equipment ready for other
chemical applications.
I have informed my customers that I will not spray Dicamba beans.

Randall Woolsey
Woolsey Bros. Farm Supply

Document Information

Date Posted:
Apr 21, 2016

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Not Assigned

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Proposed Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean

Approved by: _____

Jack Housenger, Director

Office of Pesticide Programs

Date: 3/31/16

and soil. Under anaerobic soil conditions, the dicamba parent molecule has a half-life of 141 days. It is not persistent under aerobic conditions; aerobic soil metabolism is the main degradative process for dicamba, with a half-life of 6 days. Dicamba was found in two acceptable field dissipation studies in soil segments deeper than 10 cm with half-lives ranging from 4.4 to 19.8 days. In aquatic systems, dicamba degrades more rapidly when sediment is present and has an aerobic soil metabolism half-life in sediment-water system of ~24 days.

The major degradate of dicamba is 3,6-dichlorosalicylic acid (DCSA). It is persistent when formed under anaerobic conditions, comprising more than 60% of the applied dose after 365 days of anaerobic incubation in sediment-pond water system. DCSA is not persistent when formed under aerobic conditions and degrades roughly at the same rate as the parent dicamba with a half-life of 8.2 days. Like the parent molecule, DCSA is mobile and was also found in the two acceptable field studies in soil segments deeper than 10 cm. If it were to reach anaerobic groundwater, it would likely persist; however, EPA does not expect DCSA to reach groundwater at levels that would be of concern. DCSA is formed in aerobic soil under laboratory conditions at the maximum of 17.4 % of the applied parent dose. Other minor dicamba degradates of concern are DCGA and 5-OH-dicamba, and both are less toxic than the parent molecule and DCSA. The formation of DCGA in the laboratory studies did not exceed 3.64%, and the formation of 5-OH dicamba did not exceed 1.9 % in soil-water system during anaerobic aquatic degradation of dicamba under laboratory conditions. DCSA was also a major metabolite in plant metabolism and magnitude of residue studies for dicamba-tolerant soybean and cotton, comprising approximately 80% and 20%, respectively, of dicamba-related residues in plant tissues for these crops.

2. Mobility

Dicamba is very soluble and mobile. It may reach surface water via field/site runoff, spray drift during application, and by vapor drift from volatilization. It is not expected to bioaccumulate in aquatic organisms as it is an anion at environmental pHs. Since dicamba is not persistent under aerobic conditions, very little dicamba is expected to reach groundwater. The major degradage of dicamba, DCSA, is persistent under anaerobic conditions; however EPA does not expect DCSA to reach groundwater at levels that would be of concern. The major route of exposure to non-target organisms is likely spray drift and runoff. Also, multiple literature studies show that there is a high vapor drift from soybean fields resulting in non-target plant injury. The assessments related to these routes of exposure are described in the sections below.

3. Runoff

The Agency has considered the potential effects due to runoff, and has developed proposed mitigation to limit off-site runoff. A component of the model used to assess terrestrial risk assumes that the mass of pesticide running off the treated field is directly related to the pesticide's solubility in water. In the case of dicamba DGA salt, the dissociated salt yields highly soluble dicamba acid. The model assumes that the high solubility of the acid results in a runoff mass of 5 percent of the field-applied mass, which is considered to be a highly conservative estimate because the model does not account for loss of chemical from degradation, partitioning, or the temporal aspects of runoff (e.g., a rain event following application that exceeds soil's field capacity).

4. Spray Drift

The Agency considers spray drift exposure to be the principal risk issue associated with the proposed label use of dicamba DGA salt, owing to a variety of lines of evidence, including past experience with other dicamba formulations. In addition, visual observations of off-field plant damage have been reported following dicamba applications, likely the result of subsequent spray drift and/or volatilization of dicamba residues.

The Agency used a weight of evidence approach incorporating spray drift modeling, a spray drift droplet deposition study, and raw data from field trials to determine an appropriate in-field buffer to avoid dicamba exposure to non-target organisms (e.g., endangered plants). EPA has also determined that the label must specify that nozzles must be used that produce extra-course and ultra-course droplet spectra for application to reduce the potential for spray drift. Based on the weight of evidence approach, EPA determined that labels must include language to maintain an in-field buffer (to the edge of the field in all directions) of 100 feet when applying at the 0.5 lb a.e./A application rate and 220 feet when applying at the 1.0 lb a.e./A application rate in order to restrict the movement of residues to the field. Using these buffers, expected residues at the field's edge from spray drift would be below apical endpoints for the most sensitive tested species (*i.e.* NOAEC for soybean plant height).

5. Volatilization

After reviewing submitted data relating to the volatility of dicamba, the Agency had concerns regarding the volatility of dicamba, and possible post-application, vapor-phase off-site transport that might damage non-target plants. Monsanto responded to these concerns with a submission that acknowledged the long-recognized volatility of dicamba acid and described measurements of the volatilization in the different formulations.

Though the Agency found the information helpful, the submission did not include enough detail to verify the measurements in the studies. Therefore, in order to be protective of potential effects to non-target plants from volatilization, labels must include language to maintain an in-field buffer (to the edge of the field in all directions) of 100 feet when applying at the 0.5 lb a.e./A application rate and 220 feet when applying at the 1.0 lb a.e./A application rate. Although the Agency is not requiring additional data to be submitted at this time, if EPA receives volatility data under varied conditions of temperature and relative humidity, as these factors play a strong role in volatility under field conditions, it may reconsider whether this mitigation requirement is necessary.

EPA is aware that for use of dicamba in Arkansas, the Arkansas Plant Board has an in-field buffer that is greater than what is being proposed by EPA (400 feet as opposed to 110 to 220 feet). EPA has reviewed the information associated with the larger buffer in Arkansas to assess why these differences exist. EPA's buffer is determined by evaluation of plant toxicity data required under FIFRA and conducted under GLP conditions where apical endpoints, plant height, and yield, are used as measures of plant growth and reproduction. Once the no observed adverse effect concentration (NOAEC) was determined for the most sensitive endpoint (*i.e.,* plant height) for the most sensitive plant species tested (*i.e.,* soybeans), EPA uses field studies and modeling to determine the distance from site of application to where the NOEC is not expected to be exceeded. It is further noted that the labels for the proposed uses will specify a spray nozzle and pressure combination that is expected to reduce drift of the herbicide, which are

drift reduction measures not on the previously registered dicamba formulations and could also influence the size of a protective buffer. In telephone conversations between EPA and the Arkansas Plant Board, it was reported that Arkansas' buffer distance of 400 feet was not computed as a result of submitted data, but as a precautionary measure that was based on information and observations from extension specialists from Arkansas and neighboring states, discussions with Monsanto, and historical information involving qualitative visual observations of damage in the field with products not containing the specific nozzle and pressure requirements contained on the proposed label. The Arkansas Plant Board felt that a 400 foot buffer should exceed what would be necessary to protect neighboring crop fields that are directly adjacent to fields receiving dicamba treatment. The Arkansas Plant Board also reports that their buffer requirement may be revisited and/or removed after a period of initial use (if registered) once additional observations are made.

B. Ecological Risk

Ecological risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The process of integrating the results of exposure with the ecotoxicity data is called the risk quotient method. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic (RQ = Exposure / Toxicity). RQs are then compared to EPA's levels of concern (LOCs). The LOCs are criteria used by the Agency to indicate potential risk to non-target organisms. The criteria indicate whether a pesticide, when used as directed, has the potential to cause adverse effects to non-target organisms.

For terrestrial animals, the Agency's acute risk LOCs are set at 0.5 for non-listed species and 0.1 for listed species. For aquatic animals, acute risk LOCs are also set at 0.5 for non-listed species but for listed species, they are set at 0.05. The chronic risk LOC is set at 1.0 for both terrestrial and aquatic animals. For plants, acute risk LOCs are set at 1 for both non-listed and listed species. The potential difference in sensitivity for listed plant species compared to non-listed plant species is addressed through the use of different toxicity endpoints in the RQ equation [the concentration causing effects to 25% of the test population (EC25) for non-listed plants vs the NOEC or concentration causing effects to 5% of the test population (EC05) for listed species]. Chronic risk is not assessed for plants.

Dicamba is currently registered for use on several food and non-food use sites, including cotton and soybean. The proposed uses on dicamba-tolerant soybeans and cotton would expand the timing of applications from pre-emergence and pre-harvest only for soybeans and pre-emergence and post-harvest only for cotton to allowing post-emergence over-the-top applications. The maximum yearly application rates would remain 2.0 lb a.e./acre for both cotton and soybeans. However, as detailed in section I of this document, the applicator could now split the 2.0 lb a.e./acre between pre-emergence and post-emergence applications.

EPA has a specific process based on sound science that it follows when assessing risks to listed species for pesticides like dicamba that will be used on seeds that have been genetically modified to be tolerant to the pesticide. The Agency begins with a screening level assessment that includes a basic ecological risk assessment based on its 2004 Overview of the Ecological Risk Assessment Process document. [USEPA, 2004, available at http://www.epa.gov/oppfead1/endanger/litstatus/riskasses.htm]. That assessment uses broad

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

MAR 30 2016

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

MEMORANDUM

SUBJECT: Review of Benefits as Described by the Registrant of Dicamba Herbicide for Postemergence Applications to Soybean and Cotton *and* Addendum Review of the Resistance Management Plan as Described by the Registrant of Dicamba Herbicide for Use on Genetically Modified Soybean and Cotton

FROM: Leonard Yourman, Plant Pathologist
Bill Chism, Senior Biologist
Biological Analysis Branch

THRU: Colwell Cook, Acting Chief
Biological Analysis Branch
Biological and Economic Analysis Division (7503P)

TO: Kathryn Montague, Product Manager
Herbicide Branch
Registration Division (7504P)

Product Review Panel: October 28, 2015

INTRODUCTION

Monsanto has requested a new use registration of the herbicide dicamba to be applied postemergence during the growing season over genetically modified dicamba-resistant cotton and soybean. Current registered uses of dicamba in cotton allow for a preplant application (except west of the Rockies) or a fall postharvest treatment for conventional or conservation tillage systems. The currently registered use of dicamba on soybeans allows for preplant application as well as a preharvest broadcast or spot treatment application after soybean pods are mature. As part of the regulatory review process BEAD here provides its review regarding the statements of benefits claimed by Monsanto (Reeves and Cubbage, 2015). As part of the regulatory review process BEAD also provides its review and recommendations regarding the resistance management and stewardship plan provided by Monsanto (Reeves and Cubbage, 2015).

BENEFITS ACCORDING TO THE REGISTRANT

The registrant submitted the following information in support of the benefits of a postemergence dicamba product:

1. Postemergence application of dicamba on dicamba-resistant crops during the growing season will help to control glyphosate-resistant weeds (14 species in the U.S.) including marestail, giant ragweed, common waterhemp, and Palmer amaranth. While glyphosate remains a valuable weed management tool the addition of dicamba will add another mechanism of action (MOA) that will reduce the chance that further glyphosate-resistant weeds will survive and reproduce.
    a) The new postemergence use of dicamba would provide a broad spectrum of weed control, especially for weeds that are resistant to glyphosate.
    b) Dicamba use can help reduce or delay resistance to other herbicide classes that might be used such as acetolactate synthase (ALS) or protoporphyrinogen oxidase (PPO) inhibitors.
2. According to the registrant, dicamba has been used for over 50 years on numerous crops, with both preemergence and postemergence applications to the crop, with little weed resistance to dicamba. Therefore, the availability of a postemergence use of dicamba during the season on cotton and soybean crops may enable growers who have relied heavily on glyphosate to use a different active ingredient with little known weed resistance. The registrant concluded that this use will achieve "simplicity, flexibility, and effectiveness" and positive economic returns in weed management. Monsanto has submitted a resistance management plan to address potential issues of resistance or apparent resistance by weeds to dicamba.
3. The product label will indicate a type of nozzle that will limit drift onto non-target crops. The proposed labels include additional restrictions to reduce drift, including wind speed and direction, spray volume, equipment ground speed and boom height, temperature and humidity, and temperature inversions.
4. Lastly, Monsanto claims that the use of dicamba "will provide environmental and economic benefits by enabling the continued use of reduced tillage agronomic practices and reducing the input required for farmers to produce a successful crop" (Reeves and Cubbage, 2015).

BEAD REVIEW OF MONSANTO'S SUBMITTED INFORMATION

1. Growers throughout the United States have experienced yield and economic losses due to weeds developing resistance to the herbicide glyphosate and other heavily used herbicides. The need for additional tools to manage these resistant weeds has become important as resistance to both glyphosate and other herbicides has become a significant financial, production, and pest managment issue for many cotton and soybean growers. Weeds such as marestail, giant ragweed, common waterhemp, and Palmer amaranth can be difficult to control during the growing season. New postemergence uses of dicamba on genetically modified cotton and soybeans would expand weed management options for growers by providing an additional MOA during the growing season. Dicamba used during the growing season would target new flushes of weeds and could have the effect of reducing populations

of these weeds and particularly would help reduce weed seed banks (i.e., viable seeds in the soil) to reduce populations of a new generation of weeds. Postemergence use of dicamba on genetically modified cotton and soybean during the growing season will expand options for broadleaf weed control, including glyphosate-resistant biotypes. Currently registered uses of dicamba in cotton allow for a preplant application (except west of the Rockies) or a fall postharvest treatment for conventional or conservation tillage systems (Tables 1 and 2). The currently registered use of dicamba on soybeans allows for preplant application as well as a preharvest broadcast or spot treatment application after soybean pods are mature (Tables 1 and 2). Information for dicamba use on corn is provided in Tables 1 and 2, as a reference.

a) There are currently several other herbicides registered that can be used for postemergence broadleaf weed control soon after plant emergence, but not throughout the growing season. On soybeans, registered herbicides include PPO inhibitors fomesafen + fluthiacet, acetochlor (chloroacetamide), acifluorfen (PPO), bentazon (PS-2-A), chlorimuron (ALS), lactofen (PPO), and some others (e.g., Curran and Lingenfelter, 2013). On cotton, for example, fluometuron (PS-2), trifloxysulfuron sodium (ALS), and pyrithiobac sodium (ALS) are registered (e.g., Morgan et al., 2013). Timing of applications is critical for all postemergence herbicides since efficacy is reduced as weed size increases beyond approximately four inches (e.g., Prostko, 2015). In general, herbicides are more effective when applied to weeds that are at early growth stages. Unlike currently registered postemergence herbicides that are restricted to early crop growth stages, dicamba used postemergence on dicamba-resistant crops could be applied throughout the growing season to control new flushes of weeds. This application timing may be a benefit for managing glyphosate-resistant weeds that may have developed where glyphosate-resistant soybeans have been extensively grown.

b) Dicamba is generally effective against certain broadleaf weeds, including weeds that may result in substantial financial inputs of additional labor and pesticides, such as marestail and Palmer amaranth. However, depending on the location and weed pressure, other herbicide MOAs will still be needed to manage weeds where dicamba is not effective, such as for ryegrass in cotton fields.

c) Dicamba used on dicamba-resistant crops would not eliminate the use of other herbicides. For example, because dicamba does not control weeds before they emerge, growers would continue to find various registered preemergence herbicide treatments of value to optimize weed management for up to six to eight weeks (e.g., Bradley et al., 2008; Stalcup, 2015). Preemergence herbicides provide early season weed control, which is critical to reduce weed competition for light, nutrients, and water while cotton and soybean crops become established.

Table 1. Current and proposed dicamba (Clarity®) use pattern restrictions.

Crop	Application Timing
Corn (current label, for comparison)	• Prior to planting to early postemergence with corn at 5 true leaf, or 8 inches, late postemergence with corn 8 to 36 inches tall or 15 days before tassel emergence
Cotton (current label)	• Prior to planting, wait 21 days before planting. Do not apply west of Rockies. • Fall postharvest
Dicamba-resistant cotton – (proposed label)	• Prior to planting and up to 7 days pre-harvest.
Soybean (current label)	• Prior to planting, wait 14 days before planting at 4 oz rate and 28 days for 16 oz rate. • Preharvest treatment is with pods a mature brown color and 75% leaf drop and at least 7 days between treatment and harvesting.
Dicamba-resistant soybean - (proposed label)	• Burndown/early preplant, preplant, at-planting, and preemergence through post-emergence up to and including bloom (R1 stage).

Table 2. Dicamba—Current average annual total area treated of field crops (2010-2014).

CROP	Average Total Area Treated per Year
Corn (for comparison)	11,740,000
Cotton	1,050,000
Soybean	1,440,000

Market Research Data

2. Although the registrant stated that there is not much pest resistance to dicamba, BEAD's review determined that in the U.S. dicamba-resistant biotypes of two weed species, Kochia and prickly lettuce, have been identified (Weed Science, 2015). Kochia has infested millions of acres of both soybean and cotton. In addition, glyphosate-resistant Kochia populations have been identified in Kansas (Godar et al., 2015) and Nebraska (Sandell et al., 2012). An increase in dicamba usage on soybean and cotton acreage could increase selection pressure for the expansion of dicamba-resistant weeds and the development of resistance by some additional weed species. Glyphosate-resistant weeds exposed to dicamba have the potential to develop resistance to both groups of herbicides. After consulting with extension specialists and crop groups the EPA is recommending that the registrant include instructions for the grower or user to scout fields and should include instructions for reporting to the registrant lack of product performance. Monsanto has submitted an Herbicide Resistance Management Plan that is designed to mitigate occurrences of herbicide resistance. Monsanto's proposed label includes recommendations to scout fields before and after applications. BEAD is recommending that Monsanto's final resistance managment plan incorporate all of the elements as outlined in the Resistance Management section in the Addendum.

3. With increased dicamba applications over crops during the growing season on large acreages of soybean and/or cotton, there is a chance for increases in the incidences of off-site crop damage (e.g., Egan et al., 2014; Johnson et al., 2012; Davis, 2012; Reynolds, 2015). The chance of off-site damage may be increased because the use of dicamba during the growing season would occur when off-site sensitive crops are actively growing. The

proposed labels indicate measures to reduce the possibility of drift, including the use of large droplet-producing nozzles, spray volume requirements, equipment ground speed restrictions, spray boom height, temperature and humidity considerations, wind speed, and tank-mix restrictions. These may reduce the potential for drift to off-target sites.

a) The proposed labels state that "applicators are required to ensure that they are aware of the proximity to sensitive areas, and to avoid potential adverse effects from off-target movement" of dicamba. The proposed label also state that "commercially grown tomatoes and other fruiting vegetables…cucurbits…and grapes are sensitive to dicamba" and applications should not be made "when the wind is blowing toward adjacent commercially grown sensitive crops", including soybeans not resistant to dicamba, which are sensitive to even small concentrations of dicamba (e.g., Egan et al., 2014; Tims, 2014).
b) The proposed label indicates that wind speeds of 3-10 mph are optimal for applications, although maximum wind speeds of 10-15 mph are allowed if not blowing toward sensitive areas. Due to state-specific concerns there may be alternative state regulations regarding the use of the pesticide in their state (e.g., Arkansas State Plant Board, 2014; Johnson et al., 2012; Reynolds, 2015).
c) According to the proposed labels ("Drift Reduction Agents"), drift reduction agents (DRA) can be added to further reduce fine droplets.
d) To reduce the chance of off-site damage from drift or volatility (e.g. Hartzler, 2001; Reynolds, 2015) the proposed labels contain buffer requirements.

4. No-till practices are used by farmers of many field crops for soil erosion control and water conservation. Monsanto has estimated that about 40% of soybean acreage is no-till (USDA-APHIS, 2013). In statements made by the registrant in support of the benefits of this product, there was an implication that no-till practices would be at risk without postemergence use of dicamba. The registrant stated that "registering dicamba will provide environmental and economic benefits by enabling the continued use of reduce tillage agronomic practices and reducing the inputs required for farmers to produce a successful crop." However, no data were submitted to support this idea.

CONCLUSION—BENEFITS

The postemergence use of dicamba would provide growers of genetically modified soybean and cotton to be resistant to dicamba with an additional mode of action to help manage difficult-to-control broadleaf weeds, especially glyphosate-resistant weeds. The use of dicamba on an actively growing crop may help to reduce seed banks of broadleaf weeds during the growing season and, thus, help to reduce populations of future generations of weeds. Until now, the use of dicamba has not resulted in substantial resistance among weed species, although dicamba-resistant Kochia populations have been identified in some areas of the U.S. (e.g., Godar et al., 2015; Sandell et al., 2012) and, overall, Kochia has been a problem weed on millions of acres of soybean and cotton. The efficacy of several herbicides has been compromised over the years for various reasons, including poor resistance management practices, leading to ineffective weed control. Glyphosate-resistant weeds (including glyphosate-resistant Kochia) have developed from the longtime extensive

use of glyphosate (e.g., Fraser, 2013). The widespread adoption of dicamba-resistant crops will increase the population of weeds exposed to dicamba during the growing season and the possibility, therefore, that selection pressure could increase the incidence of dicamba-resistant weeds. This could continue the unfortunate cycle of a new herbicide use soon followed by resistance to that herbicide. Weed species that are difficult to control in one location or cropping system may not be problematic in others. Resistance management programs designed for local conditions by state extension agencies that provide guidelines for the appropriate measures for controlling local problem weeds, are important in stemming the increasing incidences of resistance over the long-term.

Additionally, an increased number of applications of dicamba to large acreage may increase the likelihood of off-site damage to surrounding sensitive plants through drift and/or volatility. Some crops, such as soybean not resistant to dicamba, are sensitive to extremely small doses of dicamba (e.g., Kelley et al., 2005). Mitigation through label restrictions of wind speed, droplet size, buffers, etc. should reduce the chance of off-site damage.

In addition to label restrictions, communication between extension specialists and farmers will be an important resource for growers for determining optimal weed control and drift prevention measures for local growing areas. Best management practices indicate that at least two effective modes of action be used to manage weeds, which suggests that additional herbicides will likely be needed in order to manage glyphosate-resistant grasses or broadleaf weeds not controlled by dicamba or glyphosate. Furthermore, best management practices will be essential for growers where dicamba and glyphosate resistant populations have been identified.

ADDENDUM—RESISTANCE MANAGEMENT PLAN

This Addendum presents resistance management steps that may serve to alleviate the increasing development of weed resistance to dicamba (or any) herbicide. The resistance management plan submitted by Monsanto includes some of these elements (see below "Comments on Resistance Management Plan for Dicamba"), but all of these elements (Table A) should be incorporated in Monsanto's final resistance management plan.

RESISTANT WEED SPECIES

Dicamba is a synthetic auxin (Weed Science Society of America [WSSA] Group 4). This MOA has eight resistant weed species in the United States. In the U.S. dicamba has two resistant weed biotypes Kochia (*Kochia scoparia)* and prickly lettuce (*Lactuca serriola).*

ELEMENTS OF RESISTANCE MANAGEMENT PLANS

The EPA announced at the Herbicide Resistance Summit II (sponsored by the National Academy of Sciences, September 10, 2014) that it would take a more proactive role in developing regulatory approaches for managing resistant weeds. The EPA finds benefits for developing an Herbicide Resistance Management (HRM) plan that will promote herbicide resistance management efforts for all crops, including genetically engineered crops. This is part of a holistic, proactive approach being developed as a result of recommendations by crop consultants, commodity organizations, professional/scientific societies, researchers, and registrants themselves. The following table lists eleven items that should be addressed in these plans (Table A).

Table A. Recommended elements for any resistance management or stewardship plan

Element	Description
1	List Mechanism of Action (MOA) Group Number[1] ➢ Registrant lists this on the label
2	List seasonal and annual maximum number of applications and pounds ➢ Registrant lists this on the label
3	Resistance Management language from PR Notice 2001-5, and/or Best Management Practices[2] (appropriate to crop) from Weed Science Society of America (WSSA) & Herbicide Resistance Action Committee (HRAC), and/or HRAC proposed guidelines for herbicide labels ➢ Registrant lists this on the label
4	Include instructions for scouting before and after application ➢ Registrant lists this on the label ➢ User must follow the label.
5	Definition of Likely Resistance[3] ➢ Registrant lists this on the label
6	Include instructions for reporting lack of performance to registrant or their representative ➢ Registrant lists this on the label ➢ User must follow the label.
7	List confirmed resistant weeds in a separate table and list effective or recommended rates for these weeds with the table ➢ Registrant lists this on the label

	➢ User must follow the label
8	Registrant reports new cases of likely and confirmed resistance to EPA and users yearly This will be in addition to any adverse effects reporting
9	For sites of high concern registrant provides growers with: • Resistance Management Plan • Remedial Action Plan (to control resistant weeds this season or next season) • Educational materials on resistance management Plans should be locally developed and easily modified. We recommend registrants work with Extension, Consultants, Crop Groups, HRAC, & USDA. ➢ Registrant is responsible to provide educational materials
10	For any approved combination products with multiple MOA, list which herbicide is controlling what weed to avoid unnecessary applications (for example, a 3-way mixture may only have one effective MOA for some problem weeds). List minimum recommended rate if resistance is suspected. • Registrant is responsible to list on label or otherwise provide information
11	Any additional specific requirements (e.g. mandatory crop rotation, unique agronomic aspects, additional training, time limited registration, etc.) ➢ Registrant lists on the label or otherwise provide information

[1]Mechanism of Action Group number identified by WSSA.

[2]Best Management Practices (BMP) language is found in Appendices I through III.

[3]Definition of "likely resistance" is found in Norsworthy, et al. (2012).

The proposed dicamba labels ("Weed Resistance Management" section) indicate that fields should be scouted before and after application. Fields should be scouted before the application of dicamba in order to identify the weed species that are present as well as their stage of growth. Fields should be scouted after each application to identify poor performance or likely resistance. In the event that a user encounters a non-performance issue the label includes information on how the user can contact the registrant or its representative (see definition of "lack of herbicide efficacy," below). Identifying herbicide resistance is not necessarily obvious. When a lack of herbicide efficacy is identified, the registrant or its representative will investigate and conduct a site visit (if needed) to evaluate the lack of herbicide efficacy using decision criteria identified by leading weed science experts (Norsworthy, et al., 2012) in order to determine if "likely herbicide resistance" is present.

"Lack of herbicide efficacy" refers to inadequate weed control with various possible causes including, but not limited to: application rate, stage of growth, environmental conditions, herbicide resistance, equipment malfunction, mixer/loader/applicator error, post-application weed flush, unexpected weather events, weed misidentification, etc (Appendix II). EPA recognizes that it can be challenging to distinguish emerging weed resistance from other causes at an early plant growth stage. Therefore, EPA has modified criteria from Norsworthy, et al. (2012) to determine if these weeds do in fact demonstrate "likely herbicide resistance." These "likely herbicide resistance" criteria are: (1) failure to control a weed species that is normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds; (2) a spreading patch of uncontrolled plants of a particular weed species; and (3) surviving plants mixed with controlled (affected) individuals of the same species (Norsworthy, et al., 2012). The identification of one or more of these criteria in the field indicates that the weed species is "likely herbicide resistant".

The registrant should annually report to EPA findings of likely herbicide resistance or confirmed resistance in new locations. In addition, prior to implementing control measures, the registrant

should attempt to obtain samples of the likely herbicide resistant weeds and/or seeds, and as soon as practicable, submit them for laboratory or greenhouse testing in order to confirm whether resistance is the cause of lack of herbicide efficacy. When the registrant or its representative applies the Norsworthy, et al. (2012) factors (cited above) and likely herbicide resistance is identified, then the registrant should proactively engage with the grower to control and contain likely resistant weeds in the infested area. This may be accomplished by recommendations to re-treat with an effective herbicide or implement mechanical control methods. After implementing these measures the registrant should follow-up with the growers, to the extent possible and with the growers' permission, to determine if the likely resistant weeds have been controlled or take some further actions if not successful.

Beginning January 15th, 2017, and on or before January 15th of each year, the registrant should submit annual summary reports to EPA. These reports should include a summary of the number of instances of likely and confirmed resistance to dicamba listing weed species, crop, county, and state. The reports should also summarize the status of laboratory or greenhouse testing for resistance and address the disposition of incidents of likely or confirmed resistance reported in previous years. The registrant also should report annually to relevant stakeholders (i.e., crop consultants, extension, growers, university, etc.) the specifics regarding a lack of control of confirmed or likely-resistant weeds.

CATEGORIES OF CONCERN FOR HERBICIDE RESISTANCE

The recommendation in this analysis is part of a more proactive and holistic approach to slow the development and spread of herbicide-resistant-weeds. This approach has been recommended by crop consultants, commodity organizations, professional/scientific societies, researchers, and the registrants themselves. The framework considers the inherent risk of weed resistance developing for a given herbicide as well as the target weeds and the agronomic practices of the registered crops. The framework divides 28 herbicide MOAs into three categories of concern (low, moderate, high) based on the risk of developing herbicide-resistant weeds (Table B). OPP is proposing to implement herbicide resistance measures for existing chemicals during registration review, and to implement herbicide resistance measures for new chemicals and new uses at the time of registration. In registration review, proposed herbicide resistance elements will be included in every herbicide preliminary interim decision.

The category of high concern will include any 1) new or novel herbicide MOA, 2) herbicides that will be applied to a crop that is resistant to that MOA (conventionally bred or genetically engineered), or 3) herbicide MOA with the most resistant weed species. Herbicide MOA that currently have no resistant weed species will be placed in the low concern category. The remaining MOAs will be placed into the category of moderate concern. If new resistant weed species are found, then an herbicide or mechanism of action may be moved into a category of higher concern. Table B also identifies the minimum resistant management elements recommended for each of the categories.

Dicamba used on herbicide resistant cotton and soybeans is of high concern for herbicide resistance, therefore, all of the resistant management elements listed above should be implemented.

Table B. Herbicide Resistance Categories of Concern and Resistance Management Elements for Use by Risk Managers [1, 2]

Low Concern	Moderate Concern	High Concern
Mechanisms of Action (MOA) with no resistant weed species in the U.S.	MOA with only a few resistant weed species in the U.S.	• Any new herbicide with a new or novel MOA, or • Herbicide resistant crop(s) (conventionally bred or GM), or • MOA with the most resistant weeds in U.S.
1. MOA on Label 2. List seasonal and annual maximum number of applications and pounds 3. Resistance management language from PRN 2001-5, BMPs and or HRAC 4. Include instructions for scouting before and after application	***Elements 1 through 4 plus:*** 5. Definition of likely herbicide resistance 6. Include instructions for reporting lack of performance to registrant or its agent 7. List confirmed resistant species in separate table and list effective or recommended rates for these weeds with the table 8. Registrant report new cases of likely and confirmed resistance to EPA & users yearly	***Elements 1 through 8 plus:*** 9. Provide growers with: Resistance Management Plan, Remedial Action Plan, Educational materials on resistance management 10. For combination products with multiple MOA, list what herbicide is controlling what weed and minimum recommended rate 11. Any additional specific requirements (e.g. mandatory crop rotation, unique agronomic aspects, time limited registration, etc.).

[1] Resistance management elements are taken from Table B, which indicates placement on the label or as a term of registration.

[2] If new resistant weed species are found an herbicide MOA may move to a category of greater concern.

COMMENTS ON RESISTANCE MANAGEMENT PLANS FOR DICAMBA

A Resistance Management Plan and labels proposed by the registrant for the postemergence use of dicamba were reviewed to determine if the Elements from Table A had been addressed.

Element 1. Mechanism of Action (MOA) Group Number is currently on the proposed label.

Element 2. Seasonal, but not annual, maximum number of applications and pounds were listed. Annual maximum amounts should be on the label.

Element 3. Included on the label are some, but not all, information provided in the Resistance Management sections of PR Notice 2001-5, and or Best Management Practices (appropriate to crop) from WSSA & HRAC (Appendix I and III).

Element 4. Instructions to scout before and after application is on the proposed label.

Element 5. Definition of "Likely Resistance" (Appendix II) was included on the proposed label.

Element 6. The label tells the user to report a lack of performance to the registrant or their representative and includes a telephone number.

Element 7. In future discussions with the registrant, we will emphasize the value of listing confirmed resistant weeds in a separate table along with the recommended rates for these weeds.

Element 8. Registrant will report new cases of likely and confirmed resistance to EPA and users annually (as part of the terms of registration).

Element 9. The submitted materials did not indicate if the registrant will provide growers with the Resistance Management Plan, Remedial Action Plan, and Educational materials on resistance management.

Element 10. If used in a formulation with multiple mechanisms of action the registrant should provide a list of what herbicide is controlling what weed and minimum recommended rate.

Element 11. The registrant did not list any additional specific requirements for resistance management.

OTHER CONCERNS

For Drift Reduction BEAD suggests that the registrant use information from the Best Management Practices for Boom Spraying developed by the American Society of Agricultural and Biological Engineers (ASABE) 2012.

REFERENCES

Arkansas State Plant Board. 2014. State plant board approves new pesticide crop systems. University of Arkansas Extension. http://www.uaex.edu/media-resources/news/december2014/12-19-2014-Ark-Herbcide-Decision.aspx

ASABE. 2012. Best Management Practices for Boom Spraying. Approved January 2007; reaffirmed March 2012 as an American National Standard, ANSI/ASABE S592 JAN2007 (R2012) Copyright American Society of Agricultural and Biological Engineers.

Bradley, K., Smeda, R., and Massey R. 2008. Management of glyphosate-resistant waterhemp in corn and soybean. University of Missouri Extension Publ. IPM1030. http://extension.missouri.edu/p/IPM1030

Curran, W. and Lingenfelter, D. 2013. Post weed control in soybean. Pennsylvania State University Extension. http://extension.psu.edu/plants/crops/news/2013/06/post-weed-control-in-soybean

Davis, V. M. 2012. Integrating 2,4-D and dicamba resistant soybean into Wisconsin cropping systems. Proceedings of the 2012 Wisconsin Crop Management Conference 51:36-37. http://www.soils.wisc.edu/extension/wcmc/2012/pap/Davis_2.pdf

Egan, J. F., Barlow, K. M., and Mortensen, D. A. 2014. A meta-analysis on the effects of 2,4-D and dicamba drift on soybean and cotton. Weed Science 62:193-206.

Fraser, K. 2013. Glyphosate resistant weeds intensifying. Stratus Ag Research, Jan. 25, 2013 (accessed online Aug. 5, 2015). http://stratusresearch.com/blog/glyphosate-resistant-weeds-intensifying

Bodar, A. S., Stahlman, P.W., Jugulam, M., and Dille, J. A. 2015. Glyphosate-resistant Kochia (Kochia scoparia) in Kansas: EPSPS gene copy number in relation to resistance levels. Weed Science 63(3):587-595. http://www.bioone.org/doi/abs/10.1614/WS-D-14-00145.1?journalCode=wees (abstr.)

Hartzler, B. 2001. Dicamba volatility. Iowa State University, Weed Science. http://www.weeds.iastate.edu/mgmt/2001/dicambavolatility.htm

Johnson, W. G., Hallett, S. G., Legleiter, T. R., and Whitford, F. 2012. 2,4-D- and dicamba-tolerant crops—some facts to consider. Purdue University Extension Publ. ID-453-W. https://www.extension.purdue.edu/extmedia/ID/ID-453-W.pdf

Kelley, K. B., Wax, L. M., Hager, A. G., and Riechers, D. E. 2005. Soybean response to plant growth regulator herbicides is affected by other postemergence herbicides. Weed Science 53:101-112. http://naldc.nal.usda.gov/download/2148/PDF

Morgan, G. D., Baumann, P. A., and Dotray, P. A. 2013. Weed management in Texas cotton. Texas A&M University Extension Publ. SCS-2013-09. http://publications.tamu.edu/WEEDS_HERBICIDES/WeedControl_Cotton%20revision%202012%20Final.pdf

Norsworthy, J. K., Ward, S. M., Shaw, D. R., Llewellyn, R. S., Nichols, R. L., Webster, T. M., Bradley, K. W., Frisvold, G., Powles, S. B., Burgos, N. R., Witt, W. W., Barrett, M. 2012. Reducing the risks of herbicide resistance: Best Managment Practices and Recommendations. Weed Science Special Issue: 31-62. http://wssajournals.org/doi/pdf/10.1614/WS-D-11-00155.1

Prostko, E. P. 2015. General thoughts about 2,4-D and dicamba-resistant crops. Southeast Farm Press. Jan. 8, 2015. http://southeastfarmpress.com/soybeans/tailgate-talk-general-thoughts-about-24-d-and-dicamba-resistant-crops; http://southeastfarmpress.com/soybeans/tailgate-talk-general-thoughts-about-24-d-and-dicamba-resistant-crops?page=2

Reeves, B. and Cubbage, J. 2015. Public Interest Document for Dicamba Use. May 22, 2015. Monsanto Co., St. Louis, MO. [submitted in support of registration].

Reynolds, D. 2015. Evaluation of dicamba drift when applied to soybean under filed conditions. Mississippi Soybean Promotion Board, Project No. 45-2014 (Year 2) Annual Report. http://mssoy.org/wp-content/uploads/2015/08/45-2014-REYNOLDS-DICAMBA-DRIFT-ANN-REP.pdf

Sandell, L., Kruger, G., and Wilson, R. 2012. Glyphosate-resistant confirmed Kochia in Nebraska. University of Nebraska Extension, Jan. 26, 2012. http://weedscience.unl.edu/currentTopics/2012NEGlyResKochia.pdf

Stalcup, L. 2015. New herbicide technologies still require proven cultural practices. Southeast Farm Press, Jan. 15, 2015. http://southeastfarmpress.com/grains/new-herbicide-technologies-still-require-proven-cultural-practices

Tims, D. 2014. Oregon wine supply company cites 'accidental drift', halts sales of certain herbicides. The Oregonian, June 17, 2014. http://www.oregonlive.com/wine/index.ssf/2014/06/wine_country_supply_company_ci.html

USDA-APHIS. 2013. Petitioner's environmental report for dicamba-tolerant soybean MON 87708 and dicamba- and glufosinate-tolerant cotton MON 88701. Monsanto submission, Nov. 22, 2013. http://www.aphis.usda.gov/brs/aphisdocs/monsanto_submitted_env_rpt.pdf

Weed Science. 2015. Weeds resistant to the herbicide dicamba. International Survey of Herbicide Resistant Weeds. International Survey of Herbicide Resistant Weeds. http://weedscience.org/summary/resistbyactive.aspx [accessed 10-29-2015]

APPENDIX I. Guidance for Pesticide Registrants on Pesticide Resistance Management Labeling (EPA, 2001)

Herbicides

1. The following general resistance management labeling statements are recommended for herbicide products containing only a single active ingredient or only active ingredients from the same group:

   a. "For resistance management, (name of product) is a Group (mode of action group number) herbicide. Any weed population may contain or develop plants naturally resistant to (name of product) and other Group (mode of action group number) herbicides. The resistant biotypes may dominate the weed population if these herbicides are used repeatedly in the same field. Other resistance mechanisms that are not linked to this mode of action but are specific for individual chemicals, such as enhanced metabolism, may also exist. Appropriate resistance-management strategies should be followed."

   For products containing active ingredients from different groups, the statement should be modified to reflect the situation, for example:

   b. "For resistance management, please note that (name of product) contains both a Group (mode of action group number) and a Group (mode of action group number) herbicide. Any weed population may contain plants naturally resistant to Group (mode of action

group number) and/or Group (mode of action group number) herbicides. The resistant individuals may dominate the weed population if these herbicides are used repeatedly in the same fields."

2. The following additional resistance management labeling statements are recommended for herbicides, although each bulleted statement may not be appropriate or pertinent for every product label:

"To delay herbicide resistance:

a. Rotate the use of (name of product) or other Group (mode of action group number) herbicides within a growing season sequence or among growing seasons with different herbicide groups that control the same weeds in a field.

b. Use tank mixtures with herbicides from a different group if such use is permitted; Use the less resistance-prone partner at a rate that will control the target weed(s) equally as well as the more resistance-prone partner.

c. Adopt an integrated weed management program for herbicide use that includes scouting and historical information related to herbicide use and crop rotation, and that considers tillage (or other mechanical control methods), cultural (e.g., higher crop seeding rates; precision fertilizer application method and timing to favor the crop and not the weeds), biological (weed-competitive crops or varieties) and other management practices.

d. Scout after herbicide application to monitor weed populations for early signs of resistance development. Indicators of possible herbicide resistance include: (1) failure to control a weed species normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds; (2) a spreading patch of uncontrolled plants of a particular weed species; (3) surviving plants mixed with controlled individuals of the same species. If resistance is suspected, prevent weed seed production in the affected area by an alternative herbicide from a different group or by a mechanical method such as hoeing or tillage. Prevent movement of resistant weed seeds to other fields by cleaning harvesting and tillage equipment when moving between fields, and planting clean seed.

e. If a weed pest population continues to progress after treatment with this product, discontinue use of this product, and switch to another herbicide with a different target mode of action, if available.

f. Have suspected resistant weed seeds tested by a qualified laboratory to confirm resistance and identify alternative herbicide options.

g. Contact your local extension specialist or certified crop advisors for additional pesticide resistance-management and/or integrated weed-management recommendations for specific crops and weed biotypes.

h. For further information or to report suspected resistance, contact (company representatives) at (toll free number) or at (Internet site)."

APPENDIX II. Definition of Likely Resistance

Likely Resistance

Indicators of likely herbicide resistance (called "possible resistance" *in* Norsworthy et al., 2012; Pp 39) include (1) failure to control a weed species normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds; (2) a spreading patch of uncontrolled plants of a particular weed species; and (3) surviving plants mixed with controlled individuals of the same species. Likely resistant weeds are assumed to be present if any of these criteria are met.

APPENDIX III. Best Management Practices for Herbicide Resistant Weeds [1]

The following resistance management labeling statements are recommendations for herbicide products and are listed here as a reference.

Crop Selection and Cultural Practices:

1. Understand the biology of the weeds that are present.
2. Use a diversified approach toward weed management focusing on preventing weed seed production and reducing the number of weed seeds in the soil seed-bank.
3. Emphasize cultural practices that suppress weeds by using crop competitiveness.
4. Plant into weed-free fields, keep fields as weed-free as possible, and note areas where weeds were a problem in prior seasons.
5. Incorporate additional weed control practices whenever possible, such as mechanical cultivation, biological management practices, crop rotation, and weed-free crop seeds as part of an integrated weed control program.
6. Do not allow weed escapes to produce seeds, roots or tubers.
7. Manage weed seed at harvest and post-harvest to prevent a buildup of the weed seed-bank.
8. Prevent field-to-field and within-field movement of weed seed or vegetative propagules.
9. Thoroughly clean plant residues from equipment before leaving fields.
10. Prevent an influx of weeds into the field by managing field borders.
11. Fields should be scouted before application to ensure herbicides and application rates will be appropriate for the weed species and weed sizes present.
12. Fields should be scouted after application to confirm herbicide effectiveness and to detect weed escapes.
13. If resistance is suspected, treat weed escapes with an alternate mode of action or use non-chemical methods to remove escapes.
14. Avoid outcrossing to weedy relatives, in crops that outcross. Control weedy relatives in surrounding field margins. Research has demonstrated that the pollen can move hundreds of feet.

Herbicide Selection:

1. Use a broad spectrum soil applied herbicide with a mechanism of action that differs from this product as a foundation in a weed control program.
2. A broad spectrum weed control program should consider all of the weeds present in the field. Weeds should be identified through scouting and field history.
3. Difficult to control weeds may require sequential applications of herbicides with alternative mechanisms of action.
4. Fields with difficult to control weeds should be rotated to crops that allow the use of herbicides with alternative mechanisms of action.

5. Apply full rates of this herbicide for the most difficult to control weed in the field. Applications should be made when weeds are at the correct size to minimize weed escapes.
6. Do not use more than two applications of a particular herbicide or any herbicide with the same mechanism of action within a single growing season unless mixed with another mechanism of action herbicide with overlapping spectrum for the difficult to control weeds.
7. Report any incidence of non-performance of this product against a particular weed species to the registrant's representative (list contact information here).

[1] Most items are taken from the Herbicide Resistance Action Committee/Weed Science Society of America list of Best Management Practices.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, DC 20460

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

PC Code: 128931
DP Barcode :422305
Date: March 24, 2016

MEMORANDUM

Subject: Addendum to Dicamba Diglycolamine (DGA) Salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Cotton and Soybean in 7 U.S. States (Alabama, Georgia, Kentucky, Michigan, North Carolina, South Carolina, and Texas)

To: Grant Rowland, Risk Manager Reviewer
Kathryn Montague, Product Manager Team 23
Dan Kenny, Branch Chief
Herbicide Branch
Pesticide Registration Division (7505P)
Office of Pesticide Programs

From: Elizabeth Donovan, Biologist 3/24/16
Michael Wagman, Biologist 3/24/16
Monica Wait, Risk Assessment Process Leader Monica Wait 3/24/16
Environmental Risk Branch 6
Environmental Fate and Effects Division (7507P)
Office of Pesticide Programs

Through: Mark Corbin, Branch Chief 3-24-16
Environmental Risk Branch 6
Environmental Fate and Effects Division (7507P)
Office of Pesticide Programs

Prior to conducting this refined Endangered Species Assessment, the Environmental Fate and Effects Division (EFED) performed a screening level ecological risk assessment for a Federal

action involving proposed new uses of the diglycolamine salt of dicamba (dicamba DGA) on dicamba herbicide-tolerant soybean on March 8, 2011 (DP 378444); an amendment to the assessment was issued on May 20, 2014 (DP 404138, 404806, 405887, 410802, and 411382). Concurrent with this refined Endangered Species Assessment, a Section 3 New Use dicamba DGA salt on dicamba-tolerant cotton screening-level assessment (DP 404823) and a subsequent addendum (DP 426789) that addresses multiple issues (spray drift buffers, runoff, risk to terrestrial invertebrates and updated mammalian toxicological endpoints for parent dicamba and its degradate, DCSA) have been finalized. In the screening level risk assessment, potential direct risk concerns could not be excluded for:

- mammals (chronic, from the soybean use only, due to residues from dicamba's metabolite, DCSA, rather than from parent dicamba);
- birds (acute from parent dicamba for both soybean and cotton uses; chronic from DCSA residues only in soybean but not in cotton), considered surrogates for reptiles, and terrestrial-phase amphibians; and
- terrestrial plants (soybean and cotton uses)

In the screening level risk assessments, indirect effect risk concerns for all taxa were possible for any species that have dependencies (e.g., food, shelter, and habitat) on mammals, birds, reptiles, terrestrial-phase amphibians, or terrestrial plants. Additionally, the screening level assessments showed that direct risk concerns were unlikely (*i.e.* levels of concern were not exceeded) for:

- mammals (acute) and (chronic—for the cotton use only);
- birds, reptiles, and terrestrial-phase amphibians (chronic from parent dicamba or DCSA degradate from use on cotton);
- terrestrial insects (acute and chronic);
- freshwater fish (acute and chronic);
- aquatic-phase amphibians (acute and chronic);
- estuarine/marine fish (acute and chronic);
- freshwater invertebrates (acute and chronic); estuarine/marine invertebrates (acute and chronic); and
- aquatic plants[1]

EPA has a specific process based on sound science that it follows when assessing risks to listed species for pesticides like dicamba that will be used on seeds that have been genetically modified to be tolerant to the pesticide. The Agency begins with a screening level assessment that includesa basic ecological risk assessment based on its 2004 Overview of the Ecological Risk

[1] The listed species LOC was exceeded for non-vascular aquatic plants, however there are no listed species of this taxa.

Assessment Process document. [USEPA, 2004, available at http://www.epa.gov/oppfead1/endanger/litstatus/riskasses.htm]. That assessment uses broad default assumptions to establish estimated environmental concentrations of particular pesticides. If the screening level assessment results in a determination that no levels of concern are exceeded, EPA concludes its analysis. On the other hand, where the screening level assessment does not rule out potential effects (exceedances of the level of concern) based on the broad default assumptions, EPA then uses increasingly specific methods and exposure models to refine its estimated environmental concentrations. At each screening step, EPA compares the more refined exposures to the toxicity of the pesticide active ingredient to determine whether the pesticide exceeds levels of concern established for listed aquatic and terrestrial species. EPA determines that there is "no effect" on listed species if, at any step in the screening level assessment, no levels of concern are exceeded. If, after performing all of the steps in the screening level assessment, a pesticide still exceeds the Agency's levels of concern for listed species, EPA then conducts a species-specific refined assessment to make effects determinations for individual listed species. The refined assessment, unlike the screening level assessment, takes account of species' habitats and behaviors to determine whether any listed species may be affected by use of the pesticide.

The screening level ecological risk assessment generates a series of taxonomic (e.g., mammals, birds, fish, etc.) risk quotients (RQs) that are the ratio of estimated exposures to acute and chronic effects endpoints. These RQs are then compared to EPA established levels of concern (LOCs) to determine if risks to any taxonomic group are of concern. The LOCs address risks for both acute and chronic effects. Acute effects LOCs range from 0.05 for aquatic animals that are Federally-listed threatened or endangered species (listed species) to 0.5 for aquatic non-listed animal species and 0.1 to 0.5 for terrestrial animals for listed and non-listed species. The LOC for chronic effects for all animal taxa (listed and non-listed) is 1. Plant risks are handled in a similar manner, but with different toxicity thresholds (NOAEC/EC_{05} and EC_{25}, respectively) used in RQ calculation for listed and non-listed species and an LOC of 1 used to interpret the RQ. When a given taxonomic RQ exceeds either the acute or chronic LOC a concern for direct toxic effects is identified for that particular taxon. If RQs fall below the LOC, a no effect determination is identified for the corresponding taxon.

The purpose of this document is to explain the refined risk assessment conducted for Federally-listed threatened or endangered (listed) species that could potentially be impacted by this pesticide registration. The refined assessment was conducted based on the 2004 Overview document, as discussed above. The assessment of risks to listed species posed by the use of Dicamba DGA has been conducted in phases covering a specific set of states, assessing risk to all the listed species covered in those states. This assessment covers the endangered species analysis for 7 states: Alabama, Georgia, Kentucky, Michigan, North Carolina, South Carolina and Texas. Based on EFED's LOCATES v.2.4.0 database and information from the U.S. Fish and Wildlife Service (USFWS), 307 species in the 7 states proposed for registration were identified as within the action area (at a preliminary county-wide level of resolution) associated with the new herbicide-tolerant soybean and cotton uses. **Table 1** presents a summary of this assessment. Separate concurrent assessment phases cover the endangered species analysis for 16 states (D416416, 420160, 420159, 420352, 421434, 421723 covering AR, IL, IA, IN, KS, LA,

MN, MS, MO, NE, ND, OH, OK, SD, TN and WI) and 11 states (D425049 covering AZ, CO, DE, FL, MD, NM, NJ, NY, PA, VA and WV).

EPA consulted U.S. Fish and Wildlife Service Recovery Plans to determine whether listed species in these states would be expected to occur in an action area encompassing the treated soybean and corn fields. The refined assessment was then conducted on those species that could not be excluded from the action area. EPA also consulted the recovery plans in the refined assessment for additional habitat information and incorporated species biological information regarding dietary items (used to model dicamba DGA residues in prey tissue) and body weight (used to determine food consumption rates and scale ecotoxicity data from the tested surrogate species, the bobwhite quail and rat, to the body weight of the listed species).
The Environmental Fate and Effects Division (EFED) has completed an endangered species risk assessment for Alabama, Georgia, Kentucky, Michigan, North Carolina, South Carolina, and Texas in support of registering dicamba diglycolamine (DGA) salt on herbicide-tolerant cotton and soybean in these states. **Table 1** presents a summary of the assessment.

Table 1. Summary of species effects determinations and critical habitat modification determinations for Federally threatened or endangered species in Alabama, Georgia, Kentucky, Michigan, North Carolina, South Carolina, and Texas for dicamba DGA use on genetically modified cotton and soybeans.

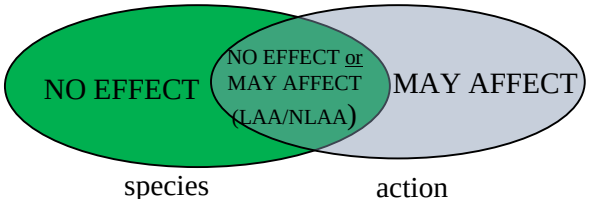
Species	**Effects Determination**	**Comments**
Eskimo Curlew	**May Affect, Not Likely to Adversely Affect**	Found in 24 counties (23 in Nebraska and 1 in Texas)
All other species (terrestrial and aquatic)	No effect	None
Critical Habitat	**Modification Determination**	**Comments**
All Critical Habitats (118 species)	No Modification	None

Making an Effects Determination

The bullets below outline EFED's process for making an effects determination for the Federal action:

- For listed individuals inside the action area but **NOT** part of an affected taxa **NOR** relying on the affected taxa for services (involving food, shelter, biological mediated resources necessary for survival/reproduction), use of a pesticide would be determined to have NO EFFECT.
- For listed individuals outside the action area, use of a pesticide would be determined to have NO EFFECT.

- Listed individuals inside the action area may either fall into the NO EFFECT or MAY AFFECT (LIKELY or NOT LIKELY TO ADVERSELY AFFECT) categories depending upon their specific biological needs, circumstances of exposure, etc.



  - LIKELY or NOT LIKELY TO ADVERSELY AFFECT determinations are made using the following criteria:
    - Insignificant - The level of the effect cannot be meaningfully related to a "take."
    - Highly Uncertain - The effect is highly unlikely to occur.
    - Wholly beneficial - The effects are only good things.

Spray Drift Mitigation

EFED's refined endangered species risk assessment took into account the spray drift mitigation language that has been added to the most recent proposed label submitted by the regitstrant. An accounting of federally-listed threatened or endangered species within the 7 states (covered in this assessment) proposed for dicamba DGA use on genetically modified cotton and soybeans is included in **Appendix 1** (307 species). Specifically, the spray drift mitigation language on the M1691 Herbicide Supplemental labels for the use dicamba DGA salt on ROUNDUP READY 2 XTEND™ soybean and BOLLGARD II® XTENDFLEX cotton includes the following limitations:

- Specifying the use of a nozzle (Tee Jet® TTI11004) with ASABE S-572 ultra-coarse and extremely coarse droplet spectra and a maximum operating pressure of 63 psi.
- A maximum equipment ground speed of 15 miles per hour and ground boom height of 24 inches above the target pest or crop canopy.
- Restricting all applications when wind speeds are < 3 mph or > 15 mph and restricting applications when wind is blowing towards sensitive areas at > 10 mph. Maintaining use of a 110 foot in-field buffer for a 0.5 lb a.i./A application (220 foot in-field buffer for a 1 lb a.i./A application) when the wind is blowing towards any areas that are not fields in crop cultivation, paved areas, or areas covered by buildings and other structures.
- Applications done in low relative humidity conditions are to use equipment set to produce larger droplet spectra to compensate for evaporation.
- Applications are not be conducted during temperature inversions.

- In order to prevent effects to non-target susceptible plants, the label also includes the following language: "do not apply under circumstances where spray drift may occur to food, forage or other plantings that might be damaged or the crops thereof rendered unfit for sale, use or consumption. Avoid contact of herbicide with foliage, green stems, exposed non-woody roots of crops, and desirable plants, including beans, cotton, flowers, fruit trees, grapes, ornamentals, peas, potato, soybean, sunflower, tobacco, tomato, and other broadleaf plants because severe injury or destruction may result, including plants in a greenhouse. Applicators are required to ensure that they are aware of the proximity to sensitive areas, and to avoid potential adverse effects from the off-target movement of M1691 Herbicide. The Applicator must survey the application site for neighboring sensitive areas prior to application. The applicator also should consult sensitive crop registries for locating sensitive areas where available."
- Finally, in order to prevent unintended damage from the drift of M1691 Herbicide, the label says not to apply this product when the wind is blowing towards adjacent commercially grown sensitive crops.

The incorporation of the spray drift mitigation measures into the product labeling as outlined above would result in exposure to dicamba DGA from spray drift at a level where effects are expected only within the confines of the treated field and so the action area is limited to the dicamba DGA treated field. Further, the incorporation of the "susceptible plants" spray drift mitigation language on the label is to avoid damage to these plants (including adjacent crops). Because the risk assessment interprets the threshold for plant damage concern to be based on the most sensitive plant species tested and the screening level ecological risk assessment has demonstrated that these plant effects endpoints constitute the most conservative terrestrial organism levels of effect, it is concluded that the "susceptible plants" requirement requires a level of drift mitigation that would also prevent less sensitive organisms from being exposed at levels of concern. Terrestrial species that are not expected to occur on treated fields under the provisions of the proposed label are not expected to be directly exposed to dicamba DGA, nor are their critical biologically mediated resources expected to be exposed to levels of the herbicide above any effects thresholds of concern. Additionally, as indicated in the screening level ecological risk assessments for cotton and soybean, no aquatic receptor taxa are of concern for drift or runoff exposure (LOCs were not exceeded for aquatic taxa). **Consequently, all but 14 of the listed species originally identified as potentially at-risk are determined to be given a "no effect" (NE) without further refinement because they are not expected to occur in an action area encompassing the treated soybean and cotton fields (Appendix 2).** The remaining 16 species are assessed using the refinements set forth in the 2004 Overview document referred to earlier in this assessment.

Exposure through Runoff

The cotton screening-level risk assessment and the concurrently issued soybean addendum characterized risk following exposure to dicamba residues in runoff and found that the predicted

concentrations from modeling were lower than the most sensitive taxa's endpoint (soybean plant height). Combining the predictions of this modeling, the toxicological endpoints and that most of the off-site plant community would not experience foliar contact with dicamba DGA in runoff sheet flow, EFED concluded that all available lines of evidence supported a "no effects" determination for runoff exposure for off-field listed plants for the proposed labeled use of dicamba DGA. Additionally, rainfast mitigation on the label would also protect against the risk of exposure to listed species off the treated field.

In addition to the spray drift and runoff mitigation measures contained in the proposed labeling, EFED analyzed species-specific biology, dicamba-specific foliar residue data and dicamba application timing information in this refined endangered species assessment. An accounting of the federally-listed threatened or endangered species within the 7 states proposed for this registration showed 307 listed species as potentially at risk (direct or indirect effects) as a result of the screening-level assessment (**Appendix 1**). The spray drift mitigation label language cannot preclude listed species being exposed to dicamba DGA salt or DCSA residues on treated fields, should a listed species utilize such areas as part of its range and corresponding habitat. Of the 307 listed species within the 7 states (AL, GA, KY, MI, NC, SC, and TX) considered part of the proposed Federal decision, the following 14 species were reasonably expected to occur on soybean and cotton fields, which could potentially be treated with dicamba and therefore could not be assumed to be "no effect" solely on the basis of occurrence outside the action area:

Of these 14 species, a "no effect" determination was reached in the concurrent assessment action for 16 states (DP 416416, 420160, 420159, 420352, 421434, 421723 covering AR, IL, IA, IN, KS, LA, MN, MS, MO, NE, ND, OH, OK, SD, TN, and WI) for the following species and is applicable to the additional seven states in this refined assessment as well:

- American burying beetle (*Nicrophorus americanus)*
- Gopher tortoise (*Gopherus polyphemus*)
- Indiana bat (*Myotis sodalis*)
- Lesser prairie-chicken (*Tympanuchus pallidicinctus*)
- Louisiana black bear (*Ursus americanus luteolus*)
- Whooping crane (*Grus americana*)

This leaves the following species for which the remainder of this document uses species specific biological information and dicamba DGA use patterns in more depth to further refine the assessment and effects determinations:

- Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*)
- Eskimo curlew (*Numenius borealis*)
- Eastern indigo snake (*Drymarchon corais couperi*)
- Houston toad (*Bufo houstonensis*)

- Virginia big-eared bat (*Corynorhinus (=Plecotus) townsendii virginianus*)
- Ocelot (*Leopardus (Felis) pardalis*)
- Gulf Coast jaguarundi (*Herpailurus (=Felis) yagouaroundi cacomitli*)
- Red wolf (*Canis rufus*)

Therefore, species specific biological information (e.g., body size, dietary requirements, and seasonality) and dicamba DGA use patterns were considered in more depth to further refine the assessment and effects determinations.

This assessment also uses the refined exposure values determined in the cotton screening level assessment and the concurrently issued addendum to the soybean screening level risk assessment documents compared to the initial exposure estimates from the soybean screening level assessment. This ESA assessment also evaluates chronic exposures from DCSA separately from the chronic exposure to parent dicamba. Dicamba exposure values were determined from the upper bound of the modeled T-REX run for exposures following spray applications based on the Kenaga nomogram modified by Fletcher *et al* (1984), which is based on a large set of actual field residue data. Modeled dicamba exposure values were identical between the soybean addendum and the cotton screening level risk assessment (since the maximum application rates and minimum application intervals are the same).

Similar modeling of DCSA residues, which are formed inside the tolerant-soybean and tolerant-cotton plants through plant metabolism, is not feasible at this time due to a lack of sufficient data tracking DCSA residues in plant tissues over time to ascertain degradation rates. Therefore, in the soybean addendum and the cotton screening-level risk assessment, EFED used the maximum empirical measured DCSA residue concentrations in dicamba-tolerant soybean (61.1 mg/kg (ppm) DCSA in broadleaf plants and 0.440 ppm in soybean seeds) and cotton plant tissues (6.29 ppm DCSA in cotton gin byproducts and 0.27 ppm in undelinted cotton seed) to evaluate chronic exposures to DCSA for animals foraging on soybean and cotton plants. Residues in arthropods (as a dietary item for birds and mammals consuming insects that have consumed soybean/cotton tissues with DCSA residues) were assumed to follow the Kenaga nomogram relationship between broadleaf plants and arthropods for spray applications (*i.e.* arthropod concentrations estimated to be approximately 70% of the concentrations in broadleaf plant tissues or 42.5 ppm DCSA in arthropods feeding on soybean plants and 4.4 ppm in arthropods feeding on cotton plants). The empirical residue data for cotton indicated that chronic exposures of birds and mammals to dicamba or DCSA in cotton tissues ***would not*** be above any levels of concern. Although the concurrently issued soybean addendum indicates that chronic risk to mammals and birds was only a concern from DCSA residues in plant/prey tissues *and not from residues of parent dicamba*, since the original soybean screening-level assessment (USEPA, 2011) indicated chronic risk to mammals, this assessment presents the estimated exposures and comparisons to threshold toxicity values for both dicamba and DCSA for mammals, but evaluates them separately since their chronic toxicity and exposure profiles differ greatly. For birds, following

the conclusions of the screening level assessments and the soybean addendum, only acute risk from dicamba exposures and chronic risk from DCSA exposures is evaluated.

The following text discusses the lines of evidence and processes that were used to make effects determinations for listed species identified as potentially at-risk in the screening level assessment.

Refined ecological risk assessment for the remaining species potentially exposed to dicamba residues

For the effects determinations for Attwater's prairie-chicken, eskimo curlew, Eastern indigo snake, Houston toad, Virginia big-eared bat, ocelot, Gulf Coast jaguarundi and red wolf, a refined risk assessment approach was used to evaluate additional lines of evidence to determine whether the conservative generic assumptions in the screening risk assessment apply to a particular species of interest (*e.g.* the Attwater's prairie-chicken). In the case of the prairie-chicken, the refined risk assessment investigated the impacts of more chicken specific data related to:

1. Bird size (as the chicken is smaller than the 1000g large bird category used in the initial screen)
2. Bird food consumption tailored to:
   a. The true weight of the bird
   b. Energy requirements of the chicken
   c. Improvement on the generic food intake model of the screen to assess energy content of the diet and the actual free living energy requirements of a bird the size of a chicken
3. Toxicity endpoints were scaled from the weight of the tested surrogate species (bobwhite quail) to reflect the comparatively larger actual size of the Attwater's greater prairie chicken

Using the Attwater's greater prairie chicken as an example to show how EPA made its effects determinations, EPA determined that the chicken could be feeding on arthropod prey in treated cotton and soybean fields. As stated above, for acute and chronic exposures to dicamba, EPA used the upper bound predicted concentrations of dicamba DGA salt found on arthropods from T-REX modeling. For chronic exposures to DCSA residues, EPA used the maximum measured concentrations found in broadleaf plants, modified by the Kenaga relationship between broadleaf plants and arthropods. EPA used the predicted concentrations of dicamba DGA salt found on arthropods as its conservative prey analysis consistent with the preliminary risk concerns identified in the screening assessment. This prey analysis is consistent with the preliminary risk concerns identified in the screening assessments. This analysis is conservative as it assumes 1) that 100% of the chicken's food consumption comes from exposed arthropods and 2) the level of

dicamba DGA residues assumed to be on these prey arthropods is based on the upper bound Kenaga residues expected for arthropods directly exposed to spray applications of dicamba DGA and for exposure to DCSA that residues in the arthropod prey item are based on the maximum measured values in broadleaf plant tissues modified by the Kenaga relationship between residues in arthropods and broadleaf plants following spray applications. EPA determined the field metabolic rate of the prairie chicken through the use of a published peer reviewed allometric equation that relates bodyweight to energy requirements. From there the mass of prey consumed per day is determined by dividing the field metabolic rate (kcal/day) by the energy content of the arthropod prey and an assimilation factor that accounts for the ability of birds to absorb that energy from the diet. Values were obtained from a published peer reviewed EPA document produced by the Office of Research and Development for Agency-wide use in conducting ecological risk assessment (USEPA, 1993). The mass of dicamba DGA in the insect diet is determined from the T-REX run found in the addendum to the screening-level risk assessment, issued concurrently with this risk assessment (USEPA, 2016a) while the mass of DCSA in insect diet was assumed to be 42.5 ppm (70% of the maximum measured residues in soybean hay of 61.1 ppm). The mass of prey consumed per day is then multiplied by the mass of dicamba or DCSA in the insect diet to determine the mass of dicamba or DCSA in the chicken's daily diet in mg/day. Then the daily dose that the chicken (considering its bodyweight) receives is determined by multiplying the mass of dicamba or DCSA in the daily diet of arthropods (assuming that is the only food item) times the mass of prey consumed per day divided by the bodyweight of the prairie chicken. Then EPA scaled the acute toxicity endpoint (based on the tested surrogate bird species, bobwhite quail's default weight of 178 grams) to the bodyweight of the prairie chicken to determine the acute oral toxicity for the prairie chicken. For exposures to DCSA residues, the chronic toxicity endpoint for the mallard (the most sensitive tested species) was modified by the relationship between the chronic dicamba and DCSA endpoints for rats (a 17x difference). The acute RQ for dicamba exposures is then calculated by dividing the daily dose of dicamba from consuming arthropods by the acute oral toxicity endpoint while the chronic RQ is calculated by dividing the daily dose of DCSA by the chronic toxicity endpoint. In this case the acute RQ for dicamba was 0.08, which is below the endangered species level of concern of 0.1, while the chronic RQ for DCSA was 0.18, which is below the listed and non-listed species chronic LOC of 1.0. At this point, EPA was able to conclude that dicamba and its metabolite DCSA would not have an effect on the Attwater's greater prairie-chicken.

Birds

The screening-level assessments showed that birds could be at risk of mortality from acute exposures to dicamba DGA on treated fields, but chronic risk was not expected as no chronic RQs exceeded the Agency's LOC (1.0) for chronic risk (USEPA 2011. D378444, p. 15). The concurrently issued soybean addendum did indicate that chronic exposures to DCSA residues in soybean could be a concern, while the screening level cotton assessment indicated that chronic exposures to DCSA residues in cotton would not exceed the Agency's LOC for chronic risk. Therefore, for listed species that could reasonably be expected to occur on treated soybean and

cotton fields, EPA conducted a refined assessment for acute (dicamba only) and chronic (DCSA only, and only for soybean) exposures. Of the remaining bird species identified as potentially at acute risk in the seven states, two are reasonably expected to occur on treated soybean and cotton fields. Therefore, species specific biological information and dicamba DGA use patterns were considered in more depth to further refine the assessment and effects determinations for those species.

Attwater's greater prairie-chicken

Dicamba Acute Effects Assessment

Initial screening level risk assessment results for birds indicated concerns for acute effects. The assumptions in the initial screen were adjusted to account for the prairie-chicken's biology. Attwater's prairie chickens are omnivorous, feeding on a variety of dietary items including seeds and pods, insects, broadleaf plants and grasses, with adults feeding primarily on grain, while juvenile chickens primarily consume insects. (Lehman, 1941). Therefore, at the time of post-emergent dicamba applications (late spring, summer), the most attractive dietary items in soybean and cotton fields will be waste grain from weed species and terrestrial invertebrates. As a conservative approach, EPA used the modeled upper bound T-REX residues for arthodpods (which were higher than the modeled residues in grain) to evaluate the potential risk posed by dicamba applications at this time. This is considered a conservative approach as modeled residues in arthropods are higher than for the other most likely dietary items and 100% of the chicken's diet would be considered to consist of exposed arthropods receiving the upper bound Kenaga nomogram dicamba residues from the spray application. Agricultural grains are expected to have lower residues than those predicted for arthropods and other dietary items, such as broadleaf plant tissues are not expected to constitute as significant a source of the chicken's diet compared to arthropods, for juvenile chickens, or grain for adult chickens (Lehman, 1941). A biologically representative refinement to the screening assessment follows:

> Field metabolic rate kcal/day = $1.146(772)^{0.749}$ = 166.73 kcal/day
> (USEPA 1993, body weight reflects screening assumption for the Attwater's greater prairie-chicken from US FWS Recovery Plan (USFWS, 2010); http://ecos.fws.gov/docs/recovery_plan/100426.pdf)
>
> Mass of prey consumed per day = 166.73 kcal/day/(1.7 kcal/g ww X 0.72 AE) = 136.22 g/day
> (1.7 is energy content of prey item from USEPA (1993); 0.72 is assimilation efficiency from USEPA 1993, assumption of insect prey from USFWS, 2010, Lehman, 1941)
>
> Mass of dicamba DGA in insect diet 102.99 mg/kg-ww from T-REX run

Mass of dicamba DGA in daily diet = 136.22 g/day X 102.99 mg dicamba DGA/kg-ww insect prey X 0.001 = 14.03 mg/day

Daily dose in chicken = 14.03 mg dicamba DGA/day/0.772= **18.17 mg/kg-bw/day**

Chicken LD50 mg/kg-bw = 188 mg/kg-bw X $(772/178)^{(1.15-1)}$ = **234.28 mg/kg-bw**

The RQ for acute effects = 18.17/234.28 = **0.08**

An acute RQ of 0.08 does not exceed the acute LOC of 0.1. Consequently, EPA makes a "no effect" determination for the Attwater's greater prairie chicken

DCSA Assessment for Atwater's greater prairie chicken consuming arthropods that had previously consumed soybean forage

EFED considered DCSA residues in arthropods to be the maximum measured DCSA residues from broadleaf plants, modified by the Kenaga nomogram relationship between broadleaf plant and arthropods as a conservative pesticide load in the prey base. This is considered a conservative approach as the estimated residues in arthropods are higher than for the other likely dietary items and 100% of the chicken's diet would be considered to consist of exposed arthropods feeding on dicamba-tolerant soybean plants that had the highest measured DCSA residues. Agricultural grains are expected to have lower residues than those predicted for arthropods and other dietary items, such as broadleaf plant tissues are not expected to constitute as significant a source of the chicken's diet compared to arthropods, for juvenile chickens, or grain for adult chickens (Lehman, 1941). A biologically representative refinement to the screening assessment follows:

Field metabolic rate kcal/day = $1.146(772)^{0.749}$ = 166.73 kcal/day
(USEPA 1993, body weight reflects screening assumption for the Attwater's greater prairie-chicken from US FWS Recovery Plan (USFWS, 2010); http://ecos.fws.gov/docs/recovery_plan/100426.pdf)

Mass of prey consumed per day = 166.73 kcal/day/(1.7 kcal/g ww X 0.72 AE) = 136.22 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.72 is assimilation efficiency from USEPA 1993, assumption of insect prey from USFWS, 2010, Lehman, 1941)

Mass of DCSA in insect diet 42.5 mg/kg-ww (conservative assumption of Kenaga nomogram relationship between arthropod residues and broadleaf plant tissue residues based on 61.1 mg/kg maximum value from empirical data for soybean forage)

Mass of DCSA in daily diet = 136.22 g/day X 42.5 mg DCSA/kg-ww insect prey X 0.001 = 5.79 mg/day

Daily dose in chicken = 5.79 mg DCSA/day/0.772= **7.50 mg/kg-bw/day**

Avian Chronic Endpoint of 695 mg/kg-diet (from mallard duck study for parent dicamba) modified by ratio of parent dicamba to metabolite DCSA from chronic rat studies (17x) results in Avian chronic NOAEC of **40.88 mg/kg-diet.**

RQ for chronic exposure: RQ = 7.5/40.88 = **0.18**

An RQ of 0.18 does not exceed the chronic LOC of 1.0; **consequently a "no effect" determination is concluded for the Atwater's greater prairie chicken.**

Eskimo curlew

Dicamba Acute Effects Assessment

Initial screening level risk assessment results for birds indicated concerns for acute effects. The Eskimo curlew is a species determined to potentially occupy treated agricultural fields such as cotton and soybean fields and thus be subject to exposure to dicamba DGA on the treated field. Historically, the species' breeding grounds were in Alaska and the Northwest Territories, Canada and overwintered in South America (USFWS, 2011a). The curlew is thought to have crossed the Gulf of Mexico into Texas during their spring migrations and preferred burned and disturbed prairie habitats and agricultural fields where they fed primarily on grasshoppers and other insects (Gill et al., 1998, USFWS, 2011a). The assumptions in the initial screen were adjusted to account for the Eskimo curlew's biology. As a conservative approach, EPA used the modeled upper bound T-REX modeled residues for arthodpods to evaluate the potential risk posed by dicamba applications at this time. This is considered a conservative approach as 100% of the Eskimo curlew's diet would be considered to consist of exposed arthropods receiving the upper bound Kenaga nomogram dicamba residues from the spray application. A biologically representative refinement to the screening assessment follows:

Field metabolic rate kcal/day = $1.146(240)^{0.749}$ = 69.5 kcal/day
(USEPA 1993, body weight reflects screening assumption for the Eskimo curlew from USGS, 2014 http://www.npwrc.usgs.gov/resource/birds/curlew/identif.htm)

Mass of prey consumed per day = 69.5 kcal/day/(1.7 kcal/g ww X 0.72 AE) = 56.8 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.72 is assimilation efficiency from USEPA 1993, assumption of insect prey from USGS 2014)

Mass of dicamba DGA in insect diet 102.99 mg/kg-ww from T-REX run

Mass of dicamba DGA in daily diet = 56.8 g/day X 102.99 mg dicamba DGA/kg-ww insect prey X 0.001 = 5.85 mg/day

Daily dose in curlew= 5.85 mg dicamba DGA/day/0.24= **24.37 mg/kg-bw/day**

Curlew LD50 mg/kg-bw = 188 mg/kg-bw X $(240/178)^{(1.15-1)}$ = **196.6 mg/kg-bw**

The RQ for acute effects = 24.37/196.6 = **0.12**
An acute RQ of 0.12 exceeds the acute LOC of 0.1.

DCSA Assessment Eskimo curlew consuming arthropods that had previously consumed soybean forage

EFED considered DCSA residues in arthropods to be the maximum measured DCSA residues from broadleaf plants, modified by the Kenaga nomogram relationship between broadleaf plant and arthropods as a conservative pesticide load in the prey base. This is considered a conservative approach as the estimated residues in arthropods are higher than for the other likely dietary items and 100% of the curlew's diet would be considered to consist of exposed arthropods feeding on dicamba-tolerant soybean plants that had the highest measured DCSA residues. A biologically representative refinement to the screening assessment follows:

Field metabolic rate kcal/day = $1.146(240)^{0.749}$ = 69.5 kcal/day
(USEPA 1993, body weight reflects screening assumption for the Eskimo curlew from USGS, 2014 http://www.npwrc.usgs.gov/resource/birds/curlew/identif.htm)

Mass of prey consumed per day = 69.5 kcal/day/(1.7 kcal/g ww X 0.72 AE) = 56.8 g/day (1.7 is energy content of prey item from USEPA (1993); 0.72 is assimilation efficiency from USEPA 1993, assumption of insect prey from USGS 2014)

Mass of DCSA in insect diet 42.5 mg/kg-ww (conservative assumption of Kenaga nomogram relationship between arthropod residues and broadleaf plant tissue residues based on 61.1 mg/kg maximum value from empirical data for soybean forage)

Mass of DCSA in daily diet = 56.8 g/day X 42.5 mg DCSA/kg-ww insect prey X 0.001 = 2.41 mg/day

Daily dose in chicken = 2.41 mg DCSA/day/0.240 = **10.06 mg/kg-bw/day**

Avian Chronic Endpoint of 695 mg/kg-diet (from mallard duck study for parent dicamba) modified by ratio of parent dicamba to metabolite DCSA from chronic rat studies (17x) results in Avian chronic NOAEC of **40.88 mg/kg-diet.**

RQ for chronic exposure: RQ = 10.06/40.88 = **0.25**

An RQ of 0.25 does not exceed the chronic LOC of 1.0

As the analysis above concluded that exposures to the curlew from dicamba had potential to be above the acute level of concern, the assessment was further refined by using of the Terrestrial Investigation Model (TIM) to quantify the potential risks of dicamba DGA to the Eskimo curlew. The model was parameterized with two assumptions about the frequency of time they would spend on the field (frequency on field: FOF): 10 percent and 90 percent. These assumptions reflect the overall uncertainty of how much time in a given migration period the birds would encounter a feeding opportunity on crop land. The model simulated a three-day stopover in agricultural land during the early pre-emergence herbicide application season to simulate feeding during migration. The food uptake was raised to a 3X daily intake rate to simulate migratory gorging behavior. The results indicated a 5.4-94% chance of mortality to one or more Eskimo curlews (**Table 4**). The dominant route of exposure that contributes to mortality is through diet (**Table 5**). The input parameters used in this model run are included in **Appendix 3**.

Table 4. Risk of dicamba exposure to individual Eskimo curlew.

Mean FOF (%)	% Chance of mortality to one or more birds
10	5.4
90	94

Table 5. Relative contributions of exposure routes to lethal doses in simulated birds. Mean (and standard deviation) values provided.

Exposure route*	10% FOF	90% FOF
Food	93 (6.6)	84 (7.5)
Drinking water: Puddles	0	0
Drinking water: Dew	0	0
Dermal Contact	6.8 (6.6)	16 (7.5)

*Inhalation and direct spray routes of exposure were turned off.

Given the predicted chance of individual mortalities, it might be reasonable to expect effects if Eskimo curlews encountered treat fields. Known occurrences of the species span Galveston County in Texas and 23 counties in Nebraska: Nuckolls, Jefferson, Saline, Polk, Wayne, Pierce, Platte, Boone, Madison, Antelope, Merrick, Stanton, Fillmore, York, Seward, Clay, Cedar, Thayer, Hamilton, Nance, Knox, Colfax, and Butler. See Appendix 4 for range and land cover analysis.

However, the species by all accounts is extremely rare. The U.S. Fish and Wildlife Service summarized curlew numbers in a recent Biological Opinion (USFWS 2012a) for the rodenticide chlorophacinone:

> *Recent quantitative methods used to evaluate the probability of the Eskimo curlew's existence have estimated extinction dates of 1967 and 1965, respectively, with the upper bounds of 95 percent confidence intervals in 1977 and 1970 (Elphick et al. 2010, FWS 2011e). These estimates are based on the last uncontroversial record of observance, a specimen that was shot in Barbados in 1963 (FWS 2011e). From 1963 to the spring of 2009, 39 potential sightings have occurred in 22 different years (Committee on the Status of Endangered Wildlife in Canada 2009); however, the reliability of these sightings is variable, and none have been confirmed by physical evidence (FWS 2011e). If controversial records of observance are included, then the analysis estimates an extinction date of 2008 with the upper bound of 95 percent confidence interval reaching 2013 (FWS 2011e).*

In the case of chlorophacinone, EPA had initially made a "likely to adversely affect" determination for the curlew based on direct acute effects. This pesticide application involved potential large geographic areas of rangeland habitat, likely more favorable to curlews than maintained agricultural fields. The conclusion of the Biological Opinion was:

> *Eskimo curlews are likely already extinct or at best extremely rare; thus, direct and indirect effects from Rozol exposure are so highly unlikely to occur as to be considered discountable. Therefore, the Service does not anticipate adverse effects to Eskimo curlew from use of Rozol on BTPDs. No critical habitat for the Eskimo curlew has been designated; therefore none will be affected.*

It is reasonable to reach a similar conclusion with dicamba DGA, a compound of likely lower acute toxic hazard than chlorophacinone and proposed for use on land cover more marginal for curlews than the chlorophacinone case. **Therefore the Agency determines that the proposed labeled use of dicamba DGA is "not likely to adversely affect" (NLAA) the Eskimo curlew because exposures are so highly unlikely to occur as to be considered discountable.**

EPA informally consulted with the U.S. Fish and Wildlife Service on the NLAA effects determination made for the Eskimo Curlew. The concurrence memo is appended in Appendix 6.

Herpifauna

Using birds as a surrogate for reptiles and terrestrial-phase amphibians, consistent with the Overview document (USEPA, 2004), the screening level assessment suggests that reptiles and terrestrial-phase amphibians could be at risk of effects from acute exposures to dicamba DGA or chronic exposures to DCSA on treated fields. Of the reptile and amphibian species identified as

potentially at acute risk in the seven states, one reptile and one amphibian are reasonably expected to occur on treated soybean and cotton fields. Therefore, species specific biological information and dicamba DGA use patterns were considered in more depth to further refine the assessment and effects determinations for those species.

Eastern Indigo snake

Dicamba Acute Effects Assessment

Initial screening level risk assessment results for birds/reptiles indicated concerns for acute effects to reptiles (using birds as a surrogate). The Eastern Indigo Snake is known or believed to occur in Alabama, Florida and Georgia (USFWS Species Profile Page, http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=C026). In Georgia, the species has been observed moving from sandhill habitat to the vicinity of agricultural fields in summer (Speake et al., 1978). Therefore, the species was determined to potentially occupy treated cotton and soybean fields and thus be subject to exposure to dicamba DGA on the treated field. The indigo snake feeds largely on other snakes, small tortoises, small mammals, and amphibians (USFWS, 1983). Using the conservative assumptions that the prey species is represented by a 35g mammal that feeds exclusively on contaminated short grass receiving the upper bound Kenaga resiudes from the spray application of dicamba and that the snake exclusively feeds on this prey species, the assumptions in the initial screen were adjusted to account for the indigo snake's biology:

> Field metabolic rate kcal/day = $0.0530(4300)^{0.799}$ = 42.4 kcal/day
> (USEPA 1993, body weight reflects screening assumption for the indigo snake from Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013)
>
> Mass of prey consumed per day = 42.4 kcal/day/(1.7 kcal/g ww X 0.78 AE) = 32 g/day
> (1.7 is energy content of prey item from USEPA (1993); 0.78 is assimilation efficiency from USEPA 1993, assumption of small mammal prey from the recovery plan (USFWS, 1983) and Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013).
>
> Mass of dicamba DGA in a 35-g mammal diet 173.26 mg/kg-ww from T-REX run
>
> Mass of dicamba DGA in daily diet = 32 g/day X 173.26 mg dicamba DGA/kg-ww mammal prey X 0.001 = 5.54 mg/day
>
> Daily dose in snake= 5.54 mg dicamba DGA/day/4.3= **1.29 mg/kg-bw/day**

Appropriate scaling factors are not available for reptiles and amphibians so the acute toxicity value for the bobwhite quail (most sensitive avian species for which acute data are available) serves as a surrogate (USEPA, 2004) toxicity value for the tortoise:

Snake LD50 mg/kg-bw = **188 mg/kg-bw**

The RQ for acute effects = 1.29/188 = **0.007**

An acute RQ of 0.007 does not exceed the acute listed species LOC of 0.1. **Consequently, EPA makes a "no effect" determination for the indigo snake.**

DCSA Assessment for Eastern indigo snake consuming prey that had previously consumed soybean forage

The indigo snake feeds largely on other snakes, small tortoises, small mammals, and amphibians (USFWS, 1983). Using the conservative assumptions that the prey species is represented by a mammal that feeds exclusively on exposed soybean plant tissue containing the maximum measured DCSA residues of 61.1 ppm and that the snake exclusively feeds on this prey species, the assumptions in the initial screen were adjusted to account for the indigo snake's biology:

Field metabolic rate kcal/day = $0.0530(4300)^{0.799}$ = 42.4 kcal/day
(USEPA 1993, body weight reflects screening assumption for the indigo snake from Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013)

Mass of prey consumed per day = 42.4 kcal/day/(1.7 kcal/g ww X 0.78 AE) = 32 g/day (1.7 is energy content of prey item from USEPA (1993); 0.78 is assimilation efficiency from USEPA 1993, assumption of small mammal prey from the recovery plan (USFWS, 1983) and Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013).

Mass of DCSA in a mammal diet 61.1 mg/kg-ww (maximum empirical residue data on soybean forage)

Mass of DCSA in snake's daily diet = 32 g/day X 61.1 mg dicamba DGA/kg-ww mammal prey X 0.001 = 1.96 mg DCSA/day

Daily dose in snake= 1.96 mg DCSA/day/4.3= **0.46 mg/kg-bw/day**

Avian Chronic Endpoint of 695 mg/kg-diet (from mallard duck (surrogate species for reptiles) study for parent dicamba) modified by ratio of parent dicamba to metabolite DCSA from chronic rat studies (17x) results in Avian chronic NOAEC of **40.88 mg/kg-diet.**

RQ for chronic exposure: RQ = 0.46/40.88 = **0.01**

An RQ of 0.01 does not exceed the chronic LOC of 1.0; **consequently a "no effect" determination is concluded for the Eastern indigo snake.**

Houston toad

Initial screening level risk assessment results for birds/terrestrial-phase amphibians indicated concerns for acute effects to amphibians (using birds as a surrogate). Historically, Houston toads ranged across the central coastal region of Texas in grassland/prairie ecosystems or in or near forested habitat and metamorphosed adult toads likely eat small terrestrial arthropods (USFWS, 2011b). As a conservative approach, EPA used the modeled upper bound T-REX residues for arthodpods to evaluate the potential risk posed by dicamba applications at this time. This is considered a conservative approach as 100% of the toad's diet would be considered to consist of exposed arthropods receiving the upper bound Kenaga nomogram dicamba residues from the spray application. A biologically representative refinement to the screening assessment follows:

Field metabolic rate kcal/day = $0.0530(45)^{0.799}$ = 1.1 kcal/day
(USEPA 1993, body weight reflects screening assumption for the Houston toad from Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013)

Mass of prey consumed per day = 1.1 kcal/day/(1.7 kcal/g ww X 0.72 AE)= 0.9 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.72 is assimilation efficiency from USEPA 1993, insect diet assumption from USFWS, 2011b and Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013)

Mass of dicamba DGA in insect diet 102.99 mg/kg-ww from T-REX run

Mass of dicamba DGA in daily diet = 0.9 g/day X 102.99 mg dicamba DGA/kg-ww insect prey X 0.001 = 0.09 mg/day

Daily dose in toad= 0.09 mg dicamba DGA/day/0.045= **2.06 mg/kg-bw/day**

Toad LD50 mg/kg-bw = 188 mg/kg-bw X $(45/178)^{(1.15-1)}$ = **152.96** mg/kg-bw
(assumes the same scaling as for birds)

The RQ for acute effects = 2.06/152.96 = **0.01**

An acute RQ of 0.01 does not exceed the acute listed species LOC of 0.1. **Consequently, EPA makes a "no effect" determination for the Houston toad.**

DCSA Assessment for Houston toad consuming prey that had previously consumed soybean forage

EFED considered DCSA residues in arthropods to be the maximum measured DCSA residues from broadleaf plants, modified by the Kenaga nomogram relationship between broadleaf plant and arthropods as a conservative pesticide load in the prey base. This is considered a conservative approach as 100% of the toad's diet would be considered to consist of exposed arthropods feeding on dicamba-tolerant soybean plants that had the highest measured DCSA residues. A biologically representative refinement to the screening assessment follows:

Field metabolic rate kcal/day = $0.0530(45)^{0.799}$ = 1.1 kcal/day
(USEPA 1993, body weight reflects screening assumption for the Houston toad from Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013)

Mass of prey consumed per day = 1.1 kcal/day/(1.7 kcal/g ww X 0.72 AE)= 0.9 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.72 is assimilation efficiency from USEPA 1993, insect diet assumption from USFWS, 2011b and Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs July 15, 2013)

Mass of DCSA in insect diet 42.5 mg/kg-ww (conservative assumption of Kenaga nomogram relationship between arthropod residues and broadleaf plant tissue residues based on 61.1 mg/kg maximum value from empirical data for soybean forage)

Mass of DCSA in daily diet = 0.9 g/day X 42.5 mg dicamba DGA/kg-ww insect prey X 0.001 = 0.038 mg/day

Daily dose in toad= 0.038 mg DCSA/day/0.045= **0.85 mg/kg-bw/day**

Avian Chronic Endpoint of 695 mg/kg-diet (from mallard duck (surrogate species for terrestrial-phase amphibians) study for parent dicamba) modified by ratio of parent

dicamba to metabolite DCSA from chronic rat studies (17x) results in Avian chronic NOAEC of 40.88 mg/kg-diet.

RQ for chronic exposure: RQ = 0.85/40.88 = 0.02

An RQ of 0.02 does not exceed the chronic LOC of 1.0**; consequently a "no effect" determination is concluded for the Houston toad.**

Mammals

The screening-level assessments indicated that acute risk to mammals was not expected as no acute RQs exceeded the Agency's LOC (0.1) for acute risk (USEPA 2011. D378444, p. 15). However, the soybean screening-level assessment (USEPA, 2011) indicated that mammals could be at reproductive risk from chronic exposures to dicamba DGA on treated fields, though the cotton screening level and concurrently issued soybean addendum (USEPA, 2016a and USEPA, 2016b) indicated that chronic exposures to dicamba DGA would be below the chronic LOC (1.0). This difference is due to soybean screening level risk assessment's use of a chronic endpoint from the rat 2-generation study (MRID 43137101), of 45 mg/kg-bw for the NOAEL, based on decreased pup weight at 136 mg/kg-bw compared to the concurrent controls. HED recently reanalyzed the data from this study (USEPA, 2016c; D431873) in comparison to the historical control database range and determined that the NOAEL and LOAEL should be raised to 136 and 450 mg/kg-bw, respectively, as pup weights in each generation in the 136 mg/kg-bw treatment group were within the historical control range and above the historical control mean for the F1, F2A and F2B generations. Therefore, the cotton screening level risk assessment, the concurrently issued soybean addendum and this refined endangered species risk assessment use this revised NOAEL for dicamba DGA salt.

The concurrently issued soybean addendum did indicate that chronic exposures to dicamba's metabolite, DCSA, residues in soybean could be a concern, while the screening level cotton assessment indicated that chronic exposures to DCSA residues in cotton would not exceed the Agency's LOC for chronic risk. Therefore, EPA only conducted a refined assessment for chronic exposures to DCSA in soybeans for listed species that could reasonably be expected to occur on treated soybean fields.

Of the mammalian species identified as potentially at risk in the seven states, four are reasonably expected to occur on treated soybean fields. Species specific biological information and dicamba DGA use patterns were considered in more depth to further refine the assessment and effects determinations for the four species potentially expected to occur on treated soybean fields.

Virginia big-eared bat

Dicamba Effects Assessment

Initial screening level risk assessment results for mammals identified concerns for chronic effects to mammals. This bat is assumed to potentially forage over treated fields and thus be subject to exposure to dicamba DGA on the treated field. Big-eared bats feed principally on small moths and other insects (USFWS, 1984). Exposure assumptions from the screening assessment were refined to account for the Virginia big-eared bat's biology and contained the conservative assumption that bats would feed exclusively on exposed insects/arthropods having received the upper bound Kenaga residues from the spray application of dicamba.

Field metabolic rate kcal/day = $0.6167(7g)^{0.862}$ = 3.3 kcal/day
(USEPA 1993, body weight 7 g reflects screening assumption for the bat USFWS 2014a; http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A080)

Mass of prey consumed per day = (3.3 kcal/day)/(1.7 kcal/g ww X 0.87 AE) = 2.2 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.87 is assimilation efficiency from USEPA 1993)

Mass of dicamba DGA in insect diet = 102.99 mg/kg-ww from T-REX run

Mass of dicamba DGA in daily diet = 2.2 g/day X 102.99 mg dicamba DGA/kg-ww mammal prey X 0.001 = 0.23 mg/day

Daily dose in bat = 0.23 mg dicamba DGA/day/0.007 kg = **32.37 mg/kg-bw/day**

Bat NOAEL mg/kg-bw/day = 136 mg/kg-bw X $(350/7)^{0.25}$ = **361.64 mg/kg-bw**

RQ for chronic exposure = RQ =32.37/361.64= **0.09**

A chronic RQ of 0.09 does not exceed the chronic LOC of 1.0. **Consequently, EPA makes a "no effect" determination for the the Virginia big-eared bat.**

DCSA Assessment for Virginia big-eared bat consuming prey that had previously consumed soybean forage

Initial screening level risk assessment results for the Virginia big-eared bat were refined to account for the bat's biology and contained the conservative assumption that bats would feed exclusively on exposed insects/arthropods feeding on dicamba-tolerant soybean plant tissues that had the highest measured DCSA residues.

Field metabolic rate kcal/day = $0.6167(7g)^{0.862}$ = 3.3 kcal/day

(USEPA 1993, body weight 7 g reflects screening assumption for the bat USFWS 2014a; http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A080)

Mass of prey consumed per day = (3.3 kcal/day)/(1.7 kcal/g ww X 0.87 AE) = 2.2 g/day (1.7 is energy content of prey item from USEPA (1993); 0.87 is assimilation efficiency from USEPA 1993)

Mass of DCSA in insect diet = 42.5 mg/kg-ww (conservative assumption of Kenaga nomogram relationship between arthropod residues and broadleaf plant tissue residues based on 61.1 mg/kg maximum value from empirical data for soybean forage)

Mass of DCSA in daily diet = 2.2 g/day X 42.5 mg DCSA/kg-ww mammal prey X 0.001 = 0.094 mg/day

Daily dose in bat = 0.094 mg DCSA/day/0.007 kg = **13.357 mg/kg-bw/day**

Bat NOAEL mg/kg-bw/day = 8 mg/kg-bw X $(350/7)^{0.25}$ = **21.27 mg/kg-bw**

RQ for chronic exposure = RQ =13.357/21.27 = **0.63**

A chronic RQ of 0.63 does not exceed the chronic LOC of 1.0; **consequently a "no effect" determination is concluded for the Virginia big-eared bat.**

Ocelot

Dicamba Acute Effects Assessment

Initial screening level risk assessment results for mammals identified concerns for chronic effects to mammals. The recovery plan for the ocelot (USFWS, 1990, revised 2010) describes the ocelot's habitat in Texas as dense thornscrub communities on Laguna Atascosa National Wildlife Refuge and on private lands in three Texas counties. The ocelot requires dense vegetation (>75% canopy cover), with 95% cover of the shrub layer preferred in Texas and it feeds primarlily on rabbits, rodents, birds and lizards (USFWS, 1990). Although this indicates the ocelot is unlikely to inhabit agricultural row crop areas, the prey species it feeds on could be exposed in soybean or cotton fields and then subsequently consumed by the ocelot away from the field. Using the assumption that the prey species is represented by a 1000 g mammal (conservative as to rabbits) and using the conservative assumptions that the prey feeds exclusively on exposed short grass receiving the upper bound Kenaga residues from the spray application of dicamba, exposure assumptions from the screening assessment were adjusted to account for ocelot's biology:

Field metabolic rate kcal/day = $0.6167(16000)^{0.862}$ = 2594 kcal/day

(USEPA 1993, body weight reflects screening assumption for the ocelot from Recovery Plan (USFWS 1990; http://ecos.fws.gov/docs/recovery_plan/100826.pdf))

Mass of prey consumed per day = 2594 kcal/day /(1.7 kcal/g ww X 0.84 AE)= 1816 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.84 is assimilation efficiency from USEPA 1993, mammal diet assumption from Recovery Plan (USFWS 1990; http://ecos.fws.gov/docs/recovery_plan/100826.pdf))

Mass of dicamba DGA in 1kg mammal diet 40.17 mg/kg-ww from T-REX run

Mass of dicamba DGA in daily diet = 1816 g/day X 40.17 mg dicamba DGA/kg-ww mammal prey X 0.001 = 72.95 mg/day

Daily dose in ocelot = 72.95 mg dicamba DGA/day/16= **4.56 mg/kg-bw/day**

Ocelot NOAEL mg/kg-bw/day = 136 mg/kg-bw $(350/16000)^{(0.25)}$ = **52.30 mg/kg-bw**

The RQ for chronic effects = 4.56/52.30 = **0.09**

A chronic RQ of 0.09 does not exceed the chronic LOC of 1.0. Even if the ocelot were assumed to consume a smaller (35-g mammal) prey species that had consumed exposed short grass (T-REX modeled residues of 173.26 mg/kg-ww), the chronic RQ (0.38) would still be below the LOC. **Consequently, EPA makes a "no effect" determination for the ocelot.**

DCSA Assessment for Ocelot consuming prey that had previously consumed exposed soybean forage

The first step in the refinement process is to calculate DCSA residues in the prey species. Using the assumption that the prey species is represented by a 1000 g mammal and the conservative assumptions that the prey animal feeds exclusively on exposed soybean forage containing the maximum measured residues of 61.1 ppm, EFED calculated the residues based on the following allometric equations (USEPA, 1993):

1000 g mammal prey ingestion rate (dry) = $0.621(1000)^{0.564}$ =30.56 g /day

1000 g mammal prey ingestion rate (wet) = 30.56/0.2 = 152.8 g/day

DCSA residue in prey eating soybean forage/hay 61.1 mg DCSA/kg-food (ww) x 0.1528 kg food/kg-bw = **9.34 mg/kg-bw/day**

The next step is to determine the expected daily dose for a typical 16 kg ocelot, the adjusted NOAEL value and the chronic dose-based RQ for the ocelot based on the following allometric equations:

Field metabolic rate kcal/day = $0.6167(16000)^{0.862}$ = 2594 kcal/day
(USEPA 1993, body weight reflects screening assumption for the ocelot from Recovery Plan (USFWS 1990; http://ecos.fws.gov/docs/recovery_plan/100826.pdf))

Mass of prey consumed per day = 2594 kcal/day /(1.7 kcal/g ww X 0.84 AE)= 1816 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.84 is assimilation efficiency from USEPA 1993, mammal diet assumption from Recovery Plan (USFWS 1990; http://ecos.fws.gov/docs/recovery_plan/100826.pdf))

Mass of DCSA in 1kg mammal diet 9.34 mg/kg-ww (based on allometric equations above and maximum empirical residue data on soybean forage)

Mass of DCSA in daily diet = 1816 g/day X 9.34 mg DCSA/kg-ww mammal prey X 0.001 = 16.96 mg/day

Daily dose in ocelot = 16.96 mg DCSA/day/16= **1.060 mg/kg-bw/day**

Ocelot NOAEL mg/kg-bw/day = 8 mg/kg-bw $(350/16000)^{(0.25)}$ = **3.08 mg/kg-bw**

The RQ for chronic effects = 1.06/3.08 = 0.35

A chronic RQ of 0.35 does not exceed the chronic LOC of 1.0. **Consequently, EPA makes a "No Effect" determination for the ocelot.**

Gulf Coast jaguarundi

Initial screening level risk assessment results for mammals identified concerns for chronic effects. The recovery plan for the jaguarundi (USFWS, 2012b) describes the species as using desne thorny shrublands or woodlands and bunchgrass pastures adjacent to dense brush or woody cover and preying mainly on birds, small mammals, and reptiles. Although this indicates the jaguarundi is unlikely to inhabit agricultural row crop areas, the prey species it feeds on could be exposed in soybean or cotton fields and then subsequently consumed by the juaguarundi away from the field. Using the assumptions that the prey species is represented by a 1000 g mammal and using the conservative assumptions that the prey feeds exclusively on exposed short grass receiving the upper bound Kenaga residues from the spray application of dicamba,

exposure assumptions from the screening assessment were adjusted to account for the jaguarundi's biology:

> Field metabolic rate kcal/day = $0.6167(90000)^{0.862}$= 11498 kcal/day
> (USEPA 1993, body weight reflects screening assumption for the jaguarondi from Recovery Plan, USFWS 2012b)
> (http://www.fws.gov/southwest/es/Documents/R2ES/Gulf_Coast_Jaguarundi_DRAFT_Recovery_Plan_24Dec2012.pdf))
>
> Mass of prey consumed per day = 11498 kcal/day/(1.7 kcal/g ww X 0.84 AE)= 8051 g/day
> (1.7 is energy content of prey item from USEPA (1993); 0.84 is assimilation efficiency from USEPA 1993, 1 kg mammal diet from Recovery Plan, USFWS 2012b)
> (http://www.fws.gov/southwest/es/Documents/R2ES/Gulf_Coast_Jaguarundi_DRAFT_Recovery_Plan_24Dec2012.pdf))
>
> Mass of dicamba DGA in 1 kg mammal diet 40.17 mg/kg-ww from T-REX run
>
> Mass of dicamba DGA in daily diet = 8051 g/day X 40.17 mg dicamba DGA/kg-ww mammal prey X 0.001 = 323 mg/day
>
> Daily dose in jaguarundi = 323 mg dicamba DGA/day/90= **3.59 mg/kg-bw/day**
>
> Jaguarundi NOAEL mg/kg-bw/day = 136 mg/kg-bw X $(350/90000)^{(0.25)}$ = **33.96mg/kg-bw**
>
> The RQ for chronic effects = 3.59/33.96 = **0.11**.

A chronic RQ of 0.11 does not exceed the chronic LOC of 1.0. Even if the jaguarundi were assumed to consume a smaller (35-g mammal) prey species that had consumed exposed short grass (T-REX modeled residues of 173.26 mg/kg-ww), the chronic RQ (0.46) would still be below the LOC. **Consequently, EPA makes a "no effect" determination for the jaguarundi.**

DCSA Assessment for Jaguarundi consuming prey that had previously consumed soybean forage

> The first step in the refinement process is to calculate DCSA residues in the prey species. Using the conservative assumptions that the prey species is represented by a 1000 g mammal that feeds exclusively on exposed soybean forage containing the maximum measured residues of 61.1 ppm, EFED calculated the residues based on the following allometric equations (USEPA, 1993):
>
> 1000 g mammal prey ingestion rate (dry) = $0.621(1000)^{0.564}$ =30.56 g /day

1000 g mammal prey ingestion rate (wet) = 30.56/0.2 = 152.8 g/day

DCSA residue in prey eating soybean forage/hay 61.1 mg DCSA/kg-food (ww) x 0.1528 kg food/kg-bw = **9.34 mg/kg-bw/day**

The next step is to determine the expected daily dose for a typical 90 kg jaguarundi, the adjusted NOAEL value and the chronic dose-based RQ for the ocelot based on the following allometric equations:

Field metabolic rate kcal/day = $0.6167(90000)^{0.862}$= 11498 kcal/day
(USEPA 1993, body weight reflects screening assumption for the jaguarondi from Recovery Plan, USFWS 2012b)
(http://www.fws.gov/southwest/es/Documents/R2ES/Gulf_Coast_Jaguarundi_DRAFT_Recovery_Plan_24Dec2012.pdf))

Mass of prey consumed per day = 11498 kcal/day/(1.7 kcal/g ww X 0.84 AE)= 8051 g/day
(1.7 is energy content of prey item from USEPA (1993); 0.84 is assimilation efficiency from USEPA 1993, 1 kg mammal diet from Recovery Plan, USFWS 2012b)
(http://www.fws.gov/southwest/es/Documents/R2ES/Gulf_Coast_Jaguarundi_DRAFT_Recovery_Plan_24Dec2012.pdf))

Mass of DCSA in 1 kg mammal diet 9.34 mg/kg-ww (based on allometric equations above and maximum empirical DCSA residues on soybean forage)

Mass of DCSA in daily diet = 8051 g/day X 9.34 mg DCSA/kg-ww mammal prey X 0.001 = 75.20 mg/day

Daily dose in jaguarundi = 75.20 mg DCSA/day/90= **0.84 mg/kg-bw/day**

Jaguarundi NOAEL mg/kg-bw/day = 4 mg/kg-bw X $(350/90000)^{(0.25)}$ = **2.00 mg/kg-bw**

The RQ for chronic effects = 0.84/2.00 = **0.42**.

A chronic RQ of 0.42 does not exceed the chronic LOC of 1.0. **Consequently, EPA makes a "no effect" determination for the jaguarundi.**

Red wolf

Initial screening level risk assessment results for mammals identified concerns for chronic effects. Since 1987, reintroduced red wolves have been identified in a variety of habitats including wetlands, pine forests, upland shrubs, and cropland (USFWS, 2007). The diet of red

wolves is primarily white-tailed deer, but they may also eat smaller mammals such as raccoons, rabbits and mice (Whitaker and Hamilton, 1998). Using the conservative assumptions that the prey species is represented by a 1000 g mammal (conservative for deer, raccoons and rabbits) that feeds exclusively on exposed short grass receiving the upper bound Kenaga residues from the spray application of dicamba, exposure assumptions from the screening assessment were adjusted to account for the red wolf's biology, specifically their consumption of other mammals that may have been exposed to dicamba DGA residues in cotton and soybean fields.

Field metabolic rate kcal/day = $0.6167(36000)^{0.862}$= 5219 kcal/day (USEPA 1993, body weight reflects screening assumption for the red wolf from Whitaker and Hamilton (1998))

Mass of prey consumed per day = 5219 kcal/day/(1.7 kcal/g ww X 0.84 AE)= 3654 g/day (1.7 is energy content of prey item from USEPA (1993); 0.84 is assimilation efficiency from USEPA 1993, 1 kg mammal diet from Whitaker and Hamilton (1998))

Mass of dicamba DGA in 1 kg mammal diet 40.17 mg/kg-ww from T-REX run

Mass of dicamba DGA in daily diet = 3654 g/day X 40.17 mg dicamba DGA/kg-ww mammal prey X 0.001 = 147 mg/day

Daily dose in wolf = 147 mg dicamba DGA/day/36= **4.08 mg/kg-bw/day**

Wolf NOAEL mg/kg-bw/day = 136 mg/kg-bw X $(350/36000)^{(0.25)}$ = **42.71 mg/kg-bw**

The RQ for chronic effects = 4.08/42.71 = **0.10**.

A chronic RQ of 0.10 does not exceed the chronic LOC of 1.0. **Consequently, EPA makes a "no effect" determination for the red wolf.**

DCSA Assessment for red wolf consuming prey that had previously consumed soybean forage

The first step in the refinement process is to calculate DCSA residues in the prey species. Using the assumption that the prey species is represented by a 1000 g mammal and the conservative assumptions that the prey animal feeds exclusively on exposed soybean forage containing the maximum measured residues of 61.1 ppm, EFED calculated the residues based on the following allometric equations (USEPA, 1993):

1000 g mammal prey ingestion rate (dry) = $0.621(1000)^{0.564}$ =30.56 g /day

1000 g mammal prey ingestion rate (wet) = 30.56/0.2 = 152.8 g/day

DCSA residue in prey eating soybean forage/hay 61.1 mg DCSA/kg-food (ww) x 0.1528 kg food/kg-bw = **9.34 mg/kg-bw/day**

The next step is to determine the expected daily dose for a typical 36 kg wolf, the adjusted NOAEL value and the chronic dose-based RQ for the wolf based on the following allometric equations:

Field metabolic rate kcal/day = $0.6167(36000)^{0.862}$= 5219 kcal/day (USEPA 1993, body weight reflects screening assumption for the red wolf from Whitaker and Hamilton (1998))

Mass of prey consumed per day = 5219 kcal/day/(1.7 kcal/g ww X 0.84 AE)= 3654 g/day (1.7 is energy content of prey item from USEPA (1993); 0.84 is assimilation efficiency from USEPA 1993, 1 kg mammal diet from Whitaker and Hamilton (1998))

Mass of DCSA in 1 kg mammal diet 9.34 mg/kg-ww from allometric equations above and maximum empirical residue data.

Mass of DCSA in daily diet = 3654 g/day X 9.34 mg DCSA/kg-ww mammal prey X 0.001 = 34.13 mg/day

Daily dose in wolf = 34.13 mg dicamba DGA/day/36= **0.95 mg/kg-bw/day**

Wolf NOAEL mg/kg-bw/day = 8 mg/kg-bw X $(350/36000)^{(0.25)}$ = **2.51 mg/kg-bw**

The RQ for chronic effects = 0.95/2.51 = **0.38**

A chronic RQ of 0.38 does not exceed the chronic LOC of 1.0. **Consequently, EPA makes a "no effect" determination for the red wolf.**

Critical Habitat Determinations

In addition to the species-specific effects determinations, EFED also conducted a critical habitat modification analysis consistent with the Overview Document as discussed earlier in this refined assessment. The critical habitat modification analysis is based on an assessment of how dicamba DGA salt would affect the U.S. Fish and Wildlife Service or National Marine Fisheries Service (the Services) established principle constituent elements (PCE's) of the designated habitat as well as how direct species effects outcomes would impact critical habitat's present and future utility for promoting the conservation of a particular listed species. The Agency will conclude 'modification' of designated critical habitat if the range of designated critical habitat co-occurs with the states subject to the Federal action and one or more of the following conditions exist:

1. The available Services' information indicates that cotton or soybean fields are habitat for the species and there is a "may affect" determination for the species associated with exposure to dicamba DGA salt or its degradate, DCSA, as labeled.

2. The available Services' information indicates that the species uses cotton or soybean fields and one or more effects on taxonomic groups predicted for dicamba DGA salt or its degradate DCSA, on cotton and soybean fields would modify one or more of the designated PCEs.

If neither of the above conditions are met, EPA concludes "no modification."

Results of Analysis

Of the 307 listed species within the states, there are 292 species identified in the effects determinations as not using cotton or soybean fields and 14 species using these fields (**Appendix 5**). Critical habitats have been designated for 118 of the 307 species. One-hundred thirteen (113) species with critical habitat were judged to not use cotton or soybean fields and so the critical habitat determination for these was "no modification."

The remaining 5 species with critical habitat designations were assumed to use cotton or soybean fields and so the previous listed species effects determinations were consulted to ascertain if any were determined to be at risk for direct adverse effects. None of the species were determined to be at risk for direct adverse effects, so the PCE's listed in the Services' critical habitat designations were consulted to determine if, in light of the screening assessment risk findings, they would be impacted by on-field exposure to dicamba DGA salt. For all but one of these species, the PCE's are not relatable to agricultural fields and so a determination of no modification has been made for these 4 species.

The only remaining species using cotton or soybean fields and with critical habitat PCE's relatable to agricultural fields was the whooping crane, for which agricultural fields were discussed as providing waste grain as a potential food source for migratory cranes. The only way the proposed dicamba DGA salt could affect this PCE is by making grain potentially toxic to the birds. As there is unlikely to be any edible waste grain remaining following cotton harvesting, it is unlikely that the proposed dicamba DGA salt use on cotton could affect this PCE, however the proposed use on soybean could affect this PCE by making waste soybean grain potentially toxic.

The Health Effects Division summarized available soybean grain residues of dicamba in the Human Health Risk Assessment for the Registration Eligibility Decision for Dicamba and Associated Salts (DP317703). Based on the soybean trials results, maximum residues of dicamba were 0.04 ppm in hay, 0.097 ppm in forage, and 8.13 ppm in seed 6-8 days post treatment (MRIDs 43814101 and 44089307). These measured values were used to set the tolerance value of 10 ppm for soybean seeds. The measured residues are not reasonably expected to be at a level

raising a concern for direct effects to the whooping crane because the direct effects assessment for this species (presented in the Section 3 Risk Assessment Refined Endangered Species Assessment that assessed risks to endangered species in 16 states (Arkansas, Kansas, Louisiana, Illinois, Indiana, Iowa, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin {DP 416416, 420160, 420159, 420352, 421434, 421723}) did not establish a concern for residues in other dietary items at much **higher** (~ 1 order of magnitude) concentrations than would occur at the maximum measured residues in seed or if residues were present even at the tolerance level of 10.0 ppm. Because this analysis shows no direct effects of dicamba at levels that would be expected in the fields as waste grain, an indirect effect, there is no modification of critical habitat. Similarly, measured DCSA residues in waste soybean grain (0.44 ppm) would be well below the estimated DCSA concentrations in arthropods (42.5 ppm) used in the direct effects assessment for this species (D416516+, pp. 9-10). Therefore, whooping crane critical habitat within the 7 states covered in this assessment would not be modified.

Summary of Determinations for Critical Habitat

The Agency has determined that the proposed labeled use of dicamba DGA salt on cotton and soybeans will not modify designated critical habitat for all 118 species for which such habitats have been designated in AL, GA, KY, MI, NC, SC, and TX.

A summary of listed species identified as not being on agricultural fields with and without critical habitat designations for the seven states assessed for dicamba DGA salt is provided in **Appendix 5**.

References:

Dunning, JB. 1984. Bodyweights of 686 species of North American birds. Western Bird Banding Association Monograph 1.

Gill, R.E., Canevari J.P, and Iversen E.H. 1998. Eskimo Curlew (Numenius borealis). Birds of North America No. 347. In The Birds of North America. A. Poole and F. Gill, eds. The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C. 28 pp. Online version available at http://bna.birds.cornell.edu/bna/species/347/.

Lehman, V.W. 1941. Attwater's Prairie Chicken, its life history and management. United States Fish and Wildlife Service, North American Fauna Series 57. United States Government Printing Office, Washington DC, USA.

Speake, D.W., J.A. McGlincy, and T.A. Colvin. 1978. Ecology and Management of the estern indigo snake in Georgia: a progress report. Pages 64—73. in R.R. Odom and L. Landers, eds. Proc. Rare and Endangered Wildl. Symp., Georgia DNR, Game and Fish Div., Tech. Bull. WL4.

United States Environmental Protection Agency (USEPA). 1993. Wildlife Exposure Factors Handbook EPA/600/R-93/187a, Office of Research and Development, Washington, DC.

USEPA, 2011. Ecological Risk Assessment for Dicamba and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed New Use on Dicamba-Tolerant Soybean (MON 87708). DP Barcode: 378444. Environmental Fate and Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention. March 8, 2011, Washington, DC.

USEPA, 2013. Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations, United States Environmental Protection Agency, Office of Pesticide Programs. July 15, 2013.

USEPA, 2016a. Second Addendum to the Environmental Fate and Ecological Risk Assessment for Dicamba DGA salt and its Degradate, 3,6,-dichlorosalicylic acid (DCSA) for the Section 3 New Use on Dicamba-Tolerant Soybean. D426789. Environmental Fate and Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention. Washington, DC. March 24, 2016.

USEPA, 2016b. Ecological Risk Assessment for Dicamba DGA Salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed New Use on Dicamba-Tolerant Cotton (MON 87701). DP Barcodes: 404823. Environmental Fate and Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention. Washington, DC. March 24, 2016

USEPA, 2016c. 3,6-Diclorosalicyclic acid (DCSA): Benchmark Dose Analysis of a Reproduction Study. Health Effects Division. Office of Pesticide Programs, Washington D.C. March, 2, 2016. D431873.

USEPA, 2016d. Addendum to Dicamba Diglycolamine Salt (DGA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Soybean and Cotton. DP Barcodes: 416416, 420160, 420159, 420352, 421434, 421723 Environmental Fate and Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention. Washington, DC. March 24, 2016

USEPA, 2016e. Addendum to Dicamba Diglycolamine Salt (DGA) and its Degradate, 3,6-dichlorosalicylic acid (DCSA) Section 3 Risk Assessment: Refined Endangered Species Assessment for Proposed New Uses on Herbicide-Tolerant Soybean and Cotton in in 11 U.S. States: (Arizona, Colorado, Delaware, Florida, Maryland, New Mexico, New Jersey, New York, Pennsylvania, Virginia and West Virginia). D425049. Environmental Fate and Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention. Washington, DC. March 24, 2016

U.S. Fish and Wildlife Service. 1982. Eastern Indigo Snake Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 23 pp.

United States Fish and Wildlife Service (USFWS). 1983. Attwater's Prairie-Chicken Recovery Plan (*Tympanuchus cupido atteri).* Second Revision. http://www.fws.gov/southwest/docs/apcrecoveryplansecondrev.pdf

USFWS. 1984. A recovery plan for the Ozark big-eared bat and the Virginia big-eared bat. U.S. Fish and Wildlife Service, Twin Cities, MN. http://ecos.fws.gov/docs/recovery_plan/840508.pdf

USFWS. 1990. Ocelot Recovery Plan (*Leopardus pardalis*) Draft First Revision.U.S. Fish and Wildlife Service, Southwest Region. Albuquerque, New Mexico. URL: http://ecos.fws.gov/docs/recovery_plan/100826.pdf

USFWS. 1993. Species profile: Virginia Big-eared Bat (*Corynorhinus (=plecotus) townsendii virginianus*). http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A080

USFWS. 1994. Mexican Long-nosed Bat (*Leptonycteris nivalis*) Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/940908.pdf.

USFWS. 1996. Recovery Plan For The Lyrate Bladderpod (*Lesquerella lyrata*) Rollins http://ecos.fws.gov/docs/recovery_plan/961017.pdf

USFWS. 2007. Red Wolf (*Canis rufus*) 5-Year Status Review: Summary and Evaluation. Red Wolf Recovery Program Ofice, Alligator River National Wildlife Refuge, Southeast Region, U.S. Fish and Wildlife Service. Manteo, North Carolina. September 28, 2007.

USFWS 2009. Lyrate bladderpod (*Lesquerella lyrata*)5-Year Review: Summary and Evaluation http://ecos.fws.gov/docs/five_year_review/doc2403.pdf

USFWS, 2010. Attwater's Prairie-Chicken Recovery Plan, Second Revision. Albuquerque, New Mexico. http://ecos.fws.gov/docs/recovery_plan/100426.pdf

USFWS, 2011a. Eskimo Curlew (*Numenius borealis*). 5-Year Review: Summary and Evaluation. Fairanks Fish and Wildlife Field Office, U.S. Fish and Wildlife Service. Fairbanks, Alaska. August 31, 2011. http://ecos.fws.gov/docs/five_year_review/doc3902.pdf

USFWS, 2011b. Houston toad (*Bufo houstonensis*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office, U.S. Fish and Wildlife Service, Austin Texas.
USFWS. 2012a. Final Biological Opinion For Rozol Use on Black-tailed Prairie Dogs Registered Under Section 3 of the Federal Insecticide, Fungicide and Rodenticide Act. U.S. Fish and Wildlife Service Ecological Services Region 6 and Region 2.

USFWS, 2012b. Draft Gulf Coast Jaguarundi (*Puma yagouaroundi cacomitli*) Recovery Plan, First Revision. U.S. Fish and Wildlife Service, Southwest Region. Albuquerque, NM, URL: http://www.fws.gov/southwest/es/Documents/R2ES/Gulf_Coast_Jaguarundi_DRAFT_Recovery_Plan_24Dec2012.pdf

USFWS. 2014a. Species Profile for Virginia Big-Eared bat (*Corynorhinus (=plecotus) townsendii virginianus*) http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A080

USFWS 2014b Species Profile for [Unnamed] gladecress (*Leavenworthia crassa*) http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q12K

USFWS 2014c. 2014. Designation of Critical Habitat for Physaria globosa (Short's bladderpod), Helianthus verticillatus (whorled sunflower), and Leavenworthia crassa (fleshy-fruit gladecress) Final Rule. Federal Register Federal Register Volume 79 Number 165 August 26, 2014.

United States Geological Survey (USGS). 2014. Eskimo Curlew, A vanishing Speicies? Northern Prairie wildlife Research center, United States Geological Survey http://www.npwrc.usgs.gov/resource/birds/curlew/identif.htm

Whitaker, J.D. and W. J. Hamilton. 1998. Mammals of the Eastern United States. Cornell University Press, Ithaca, NY.

Appendix 1

Threatened and Endangered Species in Alabama, Georgia, Kentucky, Michigan, North Carolina, South Carolina, and Texas

Common Name	Scientific Name	Taxon
Indiana bat	*Myotis sodalis*	Mammal
West Indian Manatee	*Trichechus manatus*	Mammal
Finback whale	*Balaenoptera physalus*	Mammal
Humpback whale	*Megaptera novaeangliae*	Mammal
Gray bat	*Myotis grisescens*	Mammal
Canada Lynx	*Lynx canadensis*	Mammal
Louisiana black bear	*Ursus americanus luteolus*	Mammal
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	Mammal
Whooping crane	*Grus americana*	Bird
Eskimo curlew	*Numenius borealis*	Bird
Kirtland's Warbler	*Setophaga kirtlandii*	Bird
Red-cockaded woodpecker	*Picoides borealis*	Bird
Wood stork	*Mycteria americana*	Bird
Piping Plover	*Charadrius melodus*	Bird
Least tern	*Sterna antillarum*	Bird
Black-capped Vireo	*Vireo atricapilla*	Bird
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*	Bird
Hawksbill sea turtle	*Eretmochelys imbricata*	Reptile
Leatherback sea turtle	*Dermochelys coriacea*	Reptile
Kemp's ridley sea turtle	*Lepidochelys kempii*	Reptile
Green sea turtle	*Chelonia mydas*	Reptile
Alabama red-belly turtle	*Pseudemys alabamensis*	Reptile
Copperbelly water snake	*Nerodia erythrogaster neglecta*	Reptile
Gopher tortoise	*Gopherus polyphemus*	Reptile
Snail darter	*Percina tanasi*	Fish
Spotfin Chub	*Erimonax monachus*	Fish
Slackwater darter	*Etheostoma boschungi*	Fish
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Fish
Amber darter	*Percina antesella*	Fish
Conasauga logperch	*Percina jenkinsi*	Fish
Blackside dace	*Phoxinus cumberlandensis*	Fish
Boulder darter	*Etheostoma wapiti*	Fish
Cumberland darter	*Etheostoma susanae*	Fish
Arkansas River shiner	*Notropis girardi*	Fish
Blue shiner	*Cyprinella caerulea*	Fish
Smalleye Shiner	*Notropis buccula*	Fish
Pallid sturgeon	*Scaphirhynchus albus*	Fish
Duskytail darter	*Etheostoma percnurum*	Fish
Cumberland bean (pearlymussel)	*Villosa trabalis*	Bivalve

purple cat's paw (=purple cat's paw pearlymussel)	*Epioblasma obliquata obliquata*	Bivalve
Alabama lampmussel	*Lampsilis virescens*	Bivalve
Pale lilliput (pearlymussel)	*Toxolasma cylindrellus*	Bivalve
Cumberland monkeyface (pearlymussel)	*Quadrula intermedia*	Bivalve
Pink mucket (pearlymussel)	*Lampsilis abrupta*	Bivalve
Dromedary pearlymussel	*Dromus dromas*	Bivalve
Littlewing pearlymussel	*Pegias fabula*	Bivalve
White wartyback (pearlymussel)	*Plethobasus cicatricosus*	Bivalve
Finerayed pigtoe	*Fusconaia cuneolus*	Bivalve
Rough pigtoe	*Pleurobema plenum*	Bivalve
Shiny pigtoe	*Fusconaia cor*	Bivalve
Orangefoot pimpleback (pearlymussel)	*Plethobasus cooperianus*	Bivalve
Fat pocketbook	*Potamilus capax*	Bivalve
Spectaclecase (mussel)	*Cumberlandia monodonta*	Bivalve
Southern combshell	*Epioblasma penita*	Bivalve
Rayed Bean	*Villosa fabalis*	Bivalve
Clubshell	*Pleurobema clava*	Bivalve
Cumberlandian combshell	*Epioblasma brevidens*	Bivalve
Appalachian elktoe	*Alasmidonta raveneliana*	Bivalve
Alabama (=inflated) heelsplitter	*Potamilus inflatus*	Bivalve
Orangenacre mucket	*Lampsilis perovalis*	Bivalve
Oyster mussel	*Epioblasma capsaeformis*	Bivalve
Slabside Pearlymussel	*Pleuronaia dolabelloides*	Bivalve
Stirrupshell	*Quadrula stapes*	Bivalve
Fanshell	*Cyprogenia stegaria*	Bivalve
Finelined pocketbook	*Lampsilis altilis*	Bivalve
Northern riffleshell	*Epioblasma torulosa rangiana*	Bivalve
Ovate clubshell	*Pleurobema perovatum*	Bivalve
Southern clubshell	*Pleurobema decisum*	Bivalve
Triangular Kidneyshell	*Ptychobranchus greenii*	Bivalve
Alabama moccasinshell	*Medionidus acutissimus*	Bivalve
Coosa moccasinshell	*Medionidus parvulus*	Bivalve
Southern pigtoe	*Pleurobema georgianum*	Bivalve
Snuffbox mussel	*Epioblasma triquetra*	Bivalve
Rabbitsfoot	*Quadrula cylindrica cylindrica*	Bivalve
Georgia pigtoe	*Pleurobema hanleyianum*	Bivalve
Fluted kidneyshell	*Ptychobranchus subtentum*	Bivalve
Sheepnose Mussel	*Plethobasus cyphyus*	Bivalve
Anthony's riversnail	*Athearnia anthonyi*	Gastropod
Karner blue butterfly	*Lycaeides melissa samuelis*	Insect
Mitchell's satyr Butterfly	*Neonympha mitchellii mitchellii*	Insect
American burying beetle	*Nicrophorus americanus*	Insect
Hine's emerald dragonfly	*Somatochlora hineana*	Insect
Spruce-fir moss spider	*Microhexura montivaga*	Arachnid

Short's bladderpod	*Physaria globosa*	Dicot
Price's potato-bean	*Apios priceana*	Dicot
Braun's rock-cress	*Arabis perstellata*	Dicot
Cumberland rosemary	*Conradina verticillata*	Dicot
No common name	*Geocarpon minimum*	Dicot
Spreading avens	*Geum radiatum*	Dicot
Small whorled pogonia	*Isotria medeoloides*	Monocot
Short's goldenrod	*Solidago shortii*	Dicot
Cumberland sandwort	*Arenaria cumberlandensis*	Dicot
Pitcher's thistle	*Cirsium pitcheri*	Dicot
Leafy prairie-clover	*Dalea foliosa*	Dicot
Roan Mountain bluet	*Hedyotis purpurea var. montana*	Dicot
Dwarf lake iris	*Iris lacustris*	Monocot
Pondberry	*Lindera melissifolia*	Dicot
Eastern prairie fringed orchid	*Platanthera leucophaea*	Monocot
Harperella	*Ptilimnium nodosum*	Dicot
American chaffseed	*Schwalbea americana*	Dicot
Large-flowered skullcap	*Scutellaria montana*	Dicot
Blue Ridge goldenrod	*Solidago spithamaea*	Dicot
Tennessee yellow-eyed grass	*Xyris tennesseensis*	Monocot
Virginia spiraea	*Spiraea virginiana*	Dicot
Running buffalo clover	*Trifolium stoloniferum*	Dicot
Lakeside daisy	*Hymenoxys herbacea*	Dicot
Morefield's leather flower	*Clematis morefieldii*	Dicot
Whorled Sunflower	*Helianthus verticillatus*	Dicot
American hart's-tongue fern	*Asplenium scolopendrium var. americanum*	Ferns
Louisiana quillwort	*Isoetes louisianensis*	Ferns
Rock gnome lichen	*Gymnoderma lineare*	Lichen
Red wolf	*Canis rufus*	Mammal
North Atlantic Right Whale	*Eubalaena glacialis*	Mammal
Sperm whale	*Physeter catodon (=macrocephalus)*	Mammal
Gulf Coast jaguarundi	*Herpailurus (=Felis) yagouaroundi cacomitli*	Mammal
Virginia big-eared bat	*Corynorhinus (=Plecotus) townsendii virginianus*	Mammal
Ocelot	*Leopardus (=Felis) pardalis*	Mammal
Perdido Key beach mouse	*Peromyscus polionotus trissyllepsis*	Mammal
Alabama beach mouse	*Peromyscus polionotus ammobates*	Mammal
Mexican long-nosed bat	*Leptonycteris nivalis*	Mammal
Attwater's greater prairie-chicken	*Tympanuchus cupido attwateri*	Bird
Bachman's warbler (=wood)	*Vermivora bachmanii*	Bird
Northern aplomado falcon	*Falco femoralis septentrionalis*	Bird
Mexican spotted owl	*Strix occidentalis lucida*	Bird
Roseate tern	*Sterna dougallii dougallii*	Bird

Golden-cheeked warbler (=wood)	*Dendroica chrysoparia*	Bird
Southwestern willow flycatcher	*Empidonax traillii extimus*	Bird
Loggerhead sea turtle	*Caretta caretta*	Reptile
Flattened musk turtle	*Sternotherus depressus*	Reptile
Eastern indigo snake	*Drymarchon corais couperi*	Reptile
Texas blind salamander	*Typhlomolge rathbuni*	Amphibian
Houston toad	*Bufo houstonensis*	Amphibian
Red Hills salamander	*Phaeognathus hubrichti*	Amphibian
San Marcos salamander	*Eurycea nana*	Amphibian
Barton Springs salamander	*Eurycea sosorum*	Amphibian
Frosted Flatwoods salamander	*Ambystoma cingulatum*	Amphibian
Jollyville Plateau salamander	*Eurycea tonkawae*	Amphibian
Georgetown salamander	*Eurycea naufragia*	Amphibian
Salado salamander	*Eurycea chisholmensis*	Amphibian
Austin blind salamander	*Eurycea waterlooensis*	Amphibian
Reticulated flatwoods salamander	*Ambystoma bishopi*	Amphibian
Big Bend gambusia	*Gambusia gaigei*	Fish
Clear Creek gambusia	*Gambusia heterochir*	Fish
Comanche Springs pupfish	*Cyprinodon elegans*	Fish
Shortnose sturgeon	*Acipenser brevirostrum*	Fish
Fountain darter	*Etheostoma fonticola*	Fish
Watercress darter	*Etheostoma nuchale*	Fish
Pecos gambusia	*Gambusia nobilis*	Fish
Alabama cavefish	*Speoplatyrhinus poulsoni*	Fish
Pygmy Sculpin	*Cottus paulus (=pygmaeus)*	Fish
Cape Fear shiner	*Notropis mekistocholas*	Fish
Waccamaw silverside	*Menidia extensa*	Fish
San Marcos gambusia	*Gambusia georgei*	Fish
Leon Springs pupfish	*Cyprinodon bovinus*	Fish
Alabama sturgeon	*Scaphirhynchus suttkusi*	Fish
Cherokee darter	*Etheostoma scotti*	Fish
Devils River minnow	*Dionda diaboli*	Fish
Cahaba shiner	*Notropis cahabae*	Fish
Palezone shiner	*Notropis albizonatus*	Fish
Sharpnose Shiner	*Notropis oxyrhynchus*	Fish
Sunfish, spring pygmy	*Elassoma alabamae*	Fish
Goldline darter	*Percina aurolineata*	Fish
Relict darter	*Etheostoma chienense*	Fish
Etowah darter	*Etheostoma etowahae*	Fish
Vermilion darter	*Etheostoma chermocki*	Fish
Smalltooth sawfish	*Pristis pectinata*	Fish
Rush Darter	*Etheostoma phytophilum*	Fish
Yellow blossom (pearlymussel)	*Epioblasma florentina florentina*	Bivalve
Ring pink (mussel)	*Obovaria retusa*	Bivalve
Flat pigtoe	*Pleurobema marshalli*	Bivalve

Heavy pigtoe	*Pleurobema taitianum*	Bivalve
Tar River spinymussel	*Elliptio steinstansana*	Bivalve
Choctaw bean	*Villosa choctawensis*	Bivalve
Cumberland elktoe	*Alasmidonta atropurpurea*	Bivalve
Alabama pearlshell	*Margaritifera marrianae*	Bivalve
Cracking pearlymussel	*Hemistena lata*	Bivalve
James spinymussel	*Pleurobema collina*	Bivalve
Altamaha Spinymussel	*Elliptio spinosa*	Bivalve
Dwarf wedgemussel	*Alasmidonta heterodon*	Bivalve
Southern acornshell	*Epioblasma othcaloogensis*	Bivalve
Purple bankclimber (mussel)	*Elliptoideus sloatianus*	Bivalve
Upland combshell	*Epioblasma metastriata*	Bivalve
Round Ebonyshell	*Fusconaia rotulata*	Bivalve
Carolina heelsplitter	*Lasmigona decorata*	Bivalve
Southern kidneyshell	*Ptychobranchus jonesi*	Bivalve
Oval pigtoe	*Pleurobema pyriforme*	Bivalve
Narrow pigtoe	*Fusconaia escambia*	Bivalve
Shinyrayed pocketbook	*Lampsilis subangulata*	Bivalve
Southern sandshell	*Hamiota (=Lampsilis) australis*	Bivalve
Fat three-ridge (mussel)	*Amblema neislerii*	Bivalve
Dark pigtoe	*Pleurobema furvum*	Bivalve
Gulf moccasinshell	*Medionidus penicillatus*	Bivalve
Ochlockonee moccasinshell	*Medionidus simpsonianus*	Bivalve
Chipola slabshell	*Elliptio chipolaensis*	Bivalve
Fuzzy pigtoe	*Pleurobema strodeanum*	Bivalve
Tapered pigtoe	*Fusconaia burkei*	Bivalve
Noonday globe	*Patera clarki nantahala*	Gastropod
Phantom springsnail	*Pyrgulopsis texana*	Gastropod
Phantom tryonia	*Tryonia cheatumi*	Gastropod
Armored snail	*Pyrgulopsis (=Marstonia) pachyta*	Gastropod
Pecos assiminea snail	*Assiminea pecos*	Gastropod
Diamond Y Spring snail	*Pseudotryonia adamantina*	Gastropod
Tulotoma snail	*Tulotoma magnifica*	Gastropod
Gonzales springsnail	*Tryonia circumstriata*	Gastropod
Lacy elimia (snail)	*Elimia crenatella*	Gastropod
Rough hornsnail	*Pleurocera foremani*	Gastropod
Cylindrical lioplax (snail)	*Lioplax cyclostomaformis*	Gastropod
Flat pebblesnail	*Lepyrium showalteri*	Gastropod
Painted rocksnail	*Leptoxis taeniata*	Gastropod
Plicate rocksnail	*Leptoxis plicata*	Gastropod
Round rocksnail	*Leptoxis ampla*	Gastropod
Slender campeloma	*Campeloma decampi*	Gastropod
Interrupted (=Georgia) Rocksnail	*Leptoxis foremani*	Gastropod
Hungerford's crawling water Beetle	*Brychius hungerfordi*	Insect
Coffin Cave mold beetle	*Batrisodes texanus*	Insect

Kretschmarr Cave mold beetle	*Texamaurops reddelli*	Insect
Tooth Cave ground beetle	*Rhadine persephone*	Insect
Comal Springs riffle beetle	*Heterelmis comalensis*	Insect
Comal Springs dryopid beetle	*Stygoparnus comalensis*	Insect
Saint Francis' satyr butterfly	*Neonympha mitchellii francisci*	Insect
[Unnamed] ground beetle	*Rhadine infernalis*	Insect
Helotes mold beetle	*Batrisodes venyivi*	Insect
[Unnamed] ground beetle	*Rhadine exilis*	Insect
Bee Creek Cave harvestman	*Texella reddelli*	Arachnid
Bone Cave harvestman	*Texella reyesi*	Arachnid
Tooth Cave pseudoscorpion	*Tartarocreagris texana*	Arachnid
Tooth Cave Spider	*Leptoneta myopica*	Arachnid
Cokendolpher Cave Harvestman	*Texella cokendolpheri*	Arachnid
Government Canyon Bat Cave Spider	*Neoleptoneta microps*	Arachnid
Madla's Cave Meshweaver	*Cicurina madla*	Arachnid
Robber Baron Cave Meshweaver	*Cicurina baronia*	Arachnid
Government Canyon Bat Cave Meshweaver	*Cicurina vespera*	Arachnid
Braken Bat Cave Meshweaver	*Cicurina venii*	Arachnid
Peck's cave amphipod	*Stygobromus (=Stygonectes) pecki*	Crustacean
Alabama cave shrimp	*Palaemonias alabamae*	Crustacean
Kentucky cave shrimp	*Palaemonias ganteri*	Crustacean
Diminutive Amphipod	*Gammarus hyalleloides*	Crustacean
Star cactus	*Astrophytum asterias*	Dicot
Pecos (=puzzle, =paradox) sunflower	*Helianthus paradoxus*	Dicot
Neches River rose-mallow	*Hibiscus dasycalyx*	Dicot
Kentucky glade cress	*Leavenworthia exigua laciniata*	Dicot
Fleshy-Fruit Gladecress	*Leavenworthia crassa*	Dicot
Zapata bladderpod	*Lesquerella thamnophila*	Dicot
Ashy dogweed	*Thymophylla tephroleuca*	Dicot
South Texas ambrosia	*Ambrosia cheiranthifolia*	Dicot
Little amphianthus	*Amphianthus pusillus*	Dicot
Tobusch fishhook cactus	*Sclerocactus brevihamatus ssp. tobuschii*	Dicot
Hairy rattleweed	*Baptisia arachnifera*	Dicot
Texas poppy-mallow	*Callirhoe scabriuscula*	Dicot
Small-anthered bittercress	*Cardamine micranthera*	Dicot
Nellie cory cactus	*Coryphantha minima*	Dicot
Bunched cory cactus	*Coryphantha ramillosa*	Dicot
Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	Dicot
Black lace cactus	*Echinocereus reichenbachii var. albertii*	Dicot
Davis' green pitaya	*Echinocereus viridiflorus var. davisii*	Dicot
Lloyd's Mariposa cactus	*Echinomastus mariposensis*	Dicot
Johnston's frankenia	*Frankenia johnstonii*	Dicot
Dwarf-flowered heartleaf	*Hexastylis naniflora*	Dicot
Slender rush-pea	*Hoffmannseggia tenella*	Dicot
Lyrate bladderpod	*Lesquerella lyrata*	Dicot

Walker's manioc	*Manihot walkerae*	Dicot
Mohr's Barbara button	*Marshallia mohrii*	Dicot
Texas trailing phlox	*Phlox nivalis ssp. texensis*	Dicot
Little Aguja (=Creek) Pondweed	*Potamogeton clystocarpus*	Monocot
Hinckley oak	*Quercus hinckleyi*	Dicot
Miccosukee gooseberry	*Ribes echinellum*	Dicot
Bunched arrowhead	*Sagittaria fasciculata*	Monocot
Green pitcher-plant	*Sarracenia oreophila*	Dicot
Fringed campion	*Silene polypetala*	Dicot
White-haired goldenrod	*Solidago albopilosa*	Dicot
Gentian pinkroot	*Spigelia gentianoides*	Dicot
Navasota ladies'-tresses	*Spiranthes parksii*	Monocot
Texas snowbells	*Styrax texanus*	Dicot
Cooley's meadowrue	*Thalictrum cooleyi*	Dicot
Persistent trillium	*Trillium persistens*	Monocot
Texas wild-rice	*Zizania texana*	Monocot
Large-fruited sand-verbena	*Abronia macrocarpa*	Dicot
Sensitive joint-vetch	*Aeschynomene virginica*	Dicot
Terlingua Creek cat's-eye	*Cryptantha crassipes*	Dicot
Smooth coneflower	*Echinacea laevigata*	Dicot
Chisos Mountain hedgehog Cactus	*Echinocereus chisoensis var. chisoensis*	Dicot
Schweinitz's sunflower	*Helianthus schweinitzii*	Dicot
Swamp pink	*Helonias bullata*	Monocot
Heller's blazingstar	*Liatris helleri*	Dicot
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	Dicot
Michigan monkey-flower	*Mimulus michiganensis*	Dicot
Canby's dropwort	*Oxypolis canbyi*	Dicot
Michaux's sumac	*Rhus michauxii*	Dicot
Alabama canebrake pitcher-plant	*Sarracenia rubra alabamensis*	Dicot
Mountain sweet pitcher-plant	*Sarracenia rubra ssp. jonesii*	Dicot
Houghton's goldenrod	*Solidago houghtonii*	Dicot
Seabeach amaranth	*Amaranthus pumilus*	Dicot
White bladderpod	*Lesquerella pallida*	Dicot
Relict trillium	*Trillium reliquum*	Monocot
Texas prairie dawn-flower	*Hymenoxys texana*	Dicot
Alabama leather flower	*Clematis socialis*	Dicot
Mountain golden heather	*Hudsonia montana*	Dicot
Kral's water-plantain	*Sagittaria secundifolia*	Monocot
Texas ayenia	*Ayenia limitaris*	Dicot
Texas Golden Gladecress	*Leavenworthia texana*	Dicot
White irisette	*Sisyrinchium dichotomum*	Monocot
Golden sedge	*Carex lutea*	Monocot
Florida torreya	*Torreya taxifolia*	Conf/cycds
Black spored quillwort	*Isoetes melanospora*	Ferns
Mat-forming quillwort	*Isoetes tegetiformans*	Ferns

Alabama streak-sorus fern	*Thelypteris pilosa var. alabamensis*	Ferns
False killer whale	*Pseudorca crassidens*	Mammal

Appendix 2

Listed Species Rationale for NO Effects When Action Area is Limited to Treated Agricultural Field –Accounting for Spray Drift Mitigation Labeling Restrictions.

The spray drift (in-field buffer) and rainfast mitigations discussed in the cotton section 3 ecological risk assessment (D404823), the concurrently issued soybean addendum (D426789) and at the beginning of this assessment are anticipated to restrict dicamba and DCSA residues above any threshold toxicity values to the agricultural field. Therefore, the following table describes the habitat and rationale for all listed species that were determined to not use cotton and soybean fields or resources that may overlap with dicamba DGA uses.

Species	Habitat	Rationale	Source
Animals			
Alabama beach mouse (*Peromyscus polionotus ammobates*)	Coastal sand dunes and coastal scrub (USFWS 1987, p. 2), (USFWS 2007, p. 4330); primary, secondary and interior or scrub dunes (USFWS 2009, p. 4, 11)	The proposed dicamba DGA uses are not expected to overlap with sand dunes of coastal scrub.	USFWS. 1987. Recovery plan for the Choctawhatchee, Perdido Key and Alabama Beach Mouse. U.S. Fish and Wildlife Service, Atlanta, Georgia. 45 pp. Available online at: http://ecos.fws.gov/docs/recovery_plan/870812.pdf Federal Register. 2007. Department of the Interior, Fish and Wildlife Service. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Alabama Beach Mouse. Vol. 72, No. 19. January 30, 2007. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2007-01-30/pdf/07-270.pdf#page=1 USFWS. 2009. Alabama beach mouse (*Peromyscus polionotus ammobates*, Bowen 1968), 5-Year Review: Summary and Evaluation. Daphne, Alabama. 34 pp. Available online at: http://ecos.fws.gov/docs/five_year_review/doc2996.pdf.

Species	Habitat	Rationale	Source
Alabama Red-belly turtle (*Pseudemys alabamensis*)	Streams, lakes and sloughs (USFWS, 1990, p. 1)	The proposed dicamba DGA uses are not expected to overlap with streams, likes or sloughs.	USFWS. 1990. Recovery Plan for the Alabama Red-bellied Turtle. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery_plan/900108.pdf
Austin blind salamander (*Eurycea waterlooensis*)	Strictly aquatic and spend their entire lives submersed in water from the Barton Springs Segment of the Edwards Aquifer (Hillis et al. 2001, p. 273)(Page 51340) Rocky substrate, consisting of boulder, cobble, and gravel, with interstitial spaces that have minimal sediment (Page 51341)	The proposed dicamba DGA uses are not expected to overlap with water bodies.	USFWS 2013. Designation of Critical Habitat for the Austin Blind and Jollyville Plateau Salamanders; Final Rule
Bachman's warbler (*Vermivora bachmanii*)	Breeds in palustrine forested wetlands; seen near longleaf pine forest near brackish marsh. (USFWS 2007)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS 2007. Five Year Review: http://ecos.fws.gov/docs/five_year_review/doc1037.pdf
Barton Springs salamander (*Eurycea sosorum*)	Aquatic. Stenothermal spring flows, substrates are mixtures of gravel, cobble, aquatic plants, leaf litter and are free of sediment. Pools and spring runs, subsurface portions of the aquifer (within water-bearing karst formations). Found under boulder, cobble, gravel and plant (aquatic plants, leaf litter, woody debris) substrates. (USFWS 2005)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2005. Barton Springs salamander (*Eurycea sosorum*) recovery plan. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery_plan/050921.pdf.

Species	Habitat	Rationale	Source
Bean, Cumberland (pearlymussel) (*Villosa trabalis*)	Restricted typically to tributary streams of the upper reaches of the Tennessee and Cumberland Rivers. This species is most often found associated with clean, fast flowing water in stable substrate, which contains relatively firm rubble, gravel, and sand swept-free from siltation. Typically, *V. trabalis* is found buried in shallow riffle and shoal areas, often located under large rocks that must be removed by hand to inspect the habitat underneath. Ideal habitat conditions are difficult to find; much of the historical habitat for the species has likely been degraded and may be incapable of currently harboring the species (US FWS 2010, p. 7).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2010. 5 Year Review. http://ecos.fws.gov/docs/five_year_review/doc3244.pdf
Rayed Bean (*Villosa fabalis*)	Generally known from smaller, headwater creeks, but occurrence records exist from larger rivers. Usually found in or near shoal or riffle areas and in the shallow, wave-washed areas of glacial lakes.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2012. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Rayed Bean and Snuffbox Mussels Throughout Their Ranges. http://www.gpo.gov/fdsys/pkg/FR-2012-02-14/pdf/2012-2940.pdf
Black-capped vireo (*Vireo atricapilla*)	Insect-eating, migratory songbird. Arrive in Texas from mid-March to mid-April, while those in Oklahoma arrive approximately 10 days later. Breeding habitat is quite variable across its range, but is generally shrublands with a distinctive patchy structure. The shrub vegetation is mostly deciduous and generally extends from the ground to about six feet above ground and covers	The proposed dicamba DGA uses are not expected to overlap with shrublands associated with rocky gullies, edges of ravines, or eroded slopes.	USFWS. 2007. Five Year Review. http://ecos.fws.gov/docs/five_year_review/doc1073.pdf USFWS. 1991. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/910930h.pdf

Species	Habitat	Rationale	Source
	about 30 to 60% of the total area. Open grassland separates the clumps of shrubs. (US FWS 2007, p. 7) From Oklahoma through most of Texas, this type of vegetational configuration occurs most frequently on rocky substrates with shallow soils, in rocky gullies, on edges of ravines, and on eroded slopes. (US FWS 1991, p. 20)		
Butterfly, Karner blue (*Lycaeides melissa samuelis*)	Habitat is successional areas with wild lupines, such as open areas in and near forest stands, along with old fields, highway and powerline rights-of-way, and remnant barrens and savannas, having a broken or scattered tree or tall shrub canopy (US FWS, 2003. pp.28-30)	The proposed dicamba DGA uses are not expected to overlap with successional areas with lupines or other wildflowers.	USFWS. 2003. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/030919.pdf
Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)	Mitchell's satyr habitat is best characterized as a sedge-dominated fen community; Known habitats are all peatlands but range along a continuum from prairie/bog fen to sedge meadow/swamp. However, certain attributes at each site remain fairly constant. All historical and active habitats have a herbaceous community which is dominated by sedges, usually Carex stricta, with scattered deciduous and/or coniferous trees, most often *L. laricina* or *Juniperus virginiana* (red cedar) (US FWS 1998, pp. 11-12).	The proposed dicamba DGA uses are not expected to overlap with wetlands or areas with sedge communities.	USFWS 1998. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/980402.pdf
Chub, spotfin (*Erimonax monachus*)	The species is an insectivore, feeding diurnally presumably by both sight and taste in benthic areas of slow to swift current over various substrates with little siltation.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1983. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/831121.pdf

Species	Habitat	Rationale	Source
	Streams may range from 15-60 m in width and, where occupied, 0.3-10.0 m in depth. Water temperature in their summer habitat usually reaches greater than 20°C, and submerged macrophytes are usually absent, occasionally common. The species has been observed associated with sand, gravel, rubble, boulder, and bedrock substrates (Jenkins and Burkhead, 1982) (US FWS 1983, p. 15).		
Clubshell (*Pleurobema clava*)	Clubshell is generally found in clean, coarse sand and gravel in runs, often just downstream of a riffle, and cannot tolerate mud or slackwater conditions (USFWS, 1994).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1994. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/940921.pdf
Clubshell, ovate (*Pleurobema perovatum*)	Sand/gravel shoals and runs of small rivers and large streams (US FWS 2000, p. 56)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/001117.pdf
Clubshell, southern (*Pleurobema decisum*)	Sand/gravel shoals and runs of small rivers and large streams (US FWS 2000, p. 58)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/001117.pdf
Combshell, Cumberlandian (*Epioblasma brevidens*)	This species inhabits medium-sized streams to large rivers on shoals and riffles in coarse, sand, gravel, cobble, and boulders. It is not associated with small stream habitats and tends not to extend as far upstream in tributaries (US FWS 2004, p. 18).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2004. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/040524.pdf

Species	Habitat	Rationale	Source
Combshell, southern (*Epioblasma penita*)	This species inhabits the Tombigbee River, which is a major western tributary of the Mobile Basin. It is characterized by an increasing number of sand and gravel shoals and decreasing channel size (US FWS, 1989, p. 1)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1989. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/891114e.pdf
Dace, blackside (Phoxinus cumberlandensis)	This species inhabits cool, small, upland streams with moderate flows. The fish is generally associated with undercut stream banks and large rocks, and it is usually found within well-vegetated watersheds with good riparian vegetation (US FWS 1988, p. 6).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1988. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/880817.pdf
Darter, amber (*Percina antesella*)	This species inhabits gentle riffle areas over sand, gravel, and cobble substrates. Aquatic vegetation that develops in riffles provides habitat for feeding and cover (US FWS, 1986, p. 6).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1986. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/860620.pdf
Darter, boulder (*Etheostoma wapiti*)	This species inhabits warm-water riverine environments and has been found only in moderate to fast current over boulder/slab rock substrate in water over 2 feet deep (US FWS, 1989, p. 2).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1989. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/890727.pdf
Darter, Cumberland (*Etheostoma susanae*)	This species inhabits pools or shallow runs of low to moderate gradient sections of streams with stable sand, silt, or sand-covered bedrock substrates (US FWS, 2012, p. 63605).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2012. Federal Register Notice: Designated Critical Habitat. http://www.gpo.gov/fdsys/pkg/FR-2012-10-16/pdf/2012-24468.pdf
Darter, duskytail (*Etheostoma percnurum*)	This species inhabits rocky areas in gently flowing shallow pools and runs in large creeks and moderately large rivers in the Tennessee and Cumberland River Systems (US FWS, 1994, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1994. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/duskytaildarter_RP.pdf

Species	Habitat	Rationale	Source
Darter, slackwater (*Etheostoma boschungi*)	Nonbreeding habitat is small to moderately large streams. The current is usually slow, and under normal conditions, the flow ranges from still to 0.34 m/sec. In small streams, the darters show no position preference; however, in large streams they seem to confine themselves to near the banks or to undercuts in the banks. They also occur on gravel infiltrated with silt, on silt and mud, or in a combination of these. The breeding habitat is seepage water in open fields and woods (US FWS, 1984, pp. 7-8).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840308.pdf
Darter, snail (*Percina tanasi*)	This species occupies seven of nine tributaries of the upper Tennessee River in Alabama, Georgia and Tennessee (US FWS, 2013, p. 10).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2013. Five Year Review. http://ecos.fws.gov/docs/five_year_review/doc4136.pdf
Dragonfly, Hine's emerald (*Somatochlora hineana*)	The Hine's emerald dragonfly occupies grass marshes and sedge meadows fed primarily by water from a mineral source or fens. Two important characteristics of the habitat appear to be groundwater-fed, shallow water slowly flowing through vegetation, and underlying dolomitic or limestone bedrock. Parts of the aquatic channels are typically covered by vegetation such as cattails or sedges. Soils can range from organic muck to mineral soils like marl. Two other important components are areas of open vegetation for foraging and forests, trees or shrubs that provide shaded areas for perching or roosting. Nearby adjacent	The proposed dicamba DGA uses are not expected to overlap with grass marshes, sedge meadows, forested areas, or other habitat where the Hine's emerald dragonfly is expected to be found.	USFWS. 2001. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/010927.pdf

Species	Habitat	Rationale	Source
	forests may be deciduous (Illinois) or conifer (Wisconsin and Michigan). Larvae are usually found in small flowing streamlets within cattail marshes, sedge meadows, and hummocks. Places with silt, leaf litter, and decaying grasses as a substrate are often used (US FWS, 2001, p. 15-16.). Critical Habitat of 26,531 acres have been designated in Michigan, Illinois, Wisconsin, and Missouri. Almost half of this is Mackinac County, MI.		
Elktoe, Appalachian (*Alasmidonta raveneliana*)	This species has been reported from relatively shallow medium-sized creeks and rivers with cool, well-oxygenated, and moderate- to fast-flowing water. It has been observed in gravelly substrata, often mixed with cobble and boulders; in cracks in bedrock; and occasionally in relatively silt-free, coarse, sandy substrata (US FWS, 1996, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1996. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/960826.pdf
False killer whale (*Pseudorca crassidens*)	Deep water: "They prefer tropical to temperate waters that are deeper than 3,300 feet (1000 m)."	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/falsekillerwhale.htm
Fanshell (*Cyprogenia stegaria*)	The fanshell inhabits gravel substrates in medium to large rivers of the Ohio River basin (US FWS, 1991, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1991. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/910709.pdf

Species	Habitat	Rationale	Source
Flattened musk turtle (*Sternotherus depressus*)	Streams, Lake margins (USFWS 1990, p 3); spend most of their time in benthic habitats (USFWS 1990, p 5) Optimum habitat includes creeks and small rivers with vegetated areas with depth of 3 - 600 cm (USFWS 1990, p 3)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks or other water bodies.	USFWS. 1990. Recovery Plan for the Flattened Musk Turtle. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery_plan/900226.pdf
Frosted Flatwoods salamander (*Ambystoma cingulatum*)	Fire-maintained, open-canopied, flatwoods and savannas dominated by longleaf pine (*Pinus palustris*), with naturally occurring slash pine (*P. elliotti*) in wetter areas. Adults spend most of their lives underground. Breed in small, isolated ephemeral ponds (USFWS 2009)	The proposed dicamba DGA uses are not expected to overlap with flatwoods or savannas.	USFWS 2009. Federal Register, vol. 74, No. 62. 50 CFR 17. Endangered and threatened wildlife and plants; determination of endangered status of reticulated flatwoods salamander; designation of critical habitat for frosted flatwoods salamander and reticulated flatwoods salamander. United States Fish and Wildlife Service. Available on line at: http://www.gpo.gov/fdsys/pkg/FR-2009-02-10/pdf/E9-2403.pdf#page=1
Georgetown salamander (*Eurycea naufragia*)	Aquatic. The Northern Segment of the Edwards Aquifer, which is a karst aquifer characterized by open chambers such as caves, fractures, and other cavities that were formed either directly or indirectly by dissolution of subsurface rock formations. (USFWS 2014, Pg. 10237)	The proposed dicamba DGA uses are not expected to overlap with cave aquifers.	USFWS 2014. Determination of Threatened Species Status for the Georgetown Salamander and Salado Salamander Throughout Their Ranges; Final Rule
Golden-cheeked warbler (*Dendroica chrysoparia*)	Forest (USFWS 1992, p. 7)	The proposed dicamba DGA uses are not expected to overlap with forest.	USFWS 1992. Species specific recovery plan available on FWS website. http://ecos.fws.gov/docs/recovery_plan/920930f.pdf
Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)	This species prefers a soft, stable substrate in slow to moderate currents. It has been found in sand, mud, silt and sandy-gravel, but not in large or armored gravel (US FWS, 1993, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1993. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/930413.pdf

Species	Habitat	Rationale	Source
Jollyville Plateau salamander (*Eurycea tonkawae*)	Jollyville Plateau salamanders are strictly aquatic and spend their entire lives submersed in water sourced from the Northern Segment of the Edwards Aquifer, the Trinity Aquifer, and local alluvium (loose unconsolidated soils) (COA 2001, pp. 3–4; Bowles et al. 2006, p. 112; Johns 2011, p. 5–6). (Page 51340) Rocky substrate, consisting of boulder, cobble, and gravel, with interstitial spaces that have minimal sediment (Page 51341)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks or other water bodies.	USFWS 2013. Designation of Critical Habitat for the Austin Blind and Jollyville Plateau Salamanders; Final Rule
Kidneyshell, fluted (*Ptychobranchus subtentum*)	Associated with the Cumberland and Tennessee River drainages. Generally live embedded in the bottom of stable streams and other bodies of water, and within riffle areas of sufficient current velocities to remove finer sediments and provide well oxygenated waters (US FWS, 2013, p. 59560)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2013. Federal Register Notice: Designation of Critical Habitat. http://www.gpo.gov/fdsys/pkg/FR-2013-09-26/pdf/2013-23357.pdf
Kidneyshell, triangular (*Ptychobranchus greenii*)	Sand/gravel shoals and runs of small rivers and large streams (US FWS 2000, p. 60)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/850702.pdf
Lampmussel, Alabama (*Lampsilis virescens*)	This species inhabits sand and gravel substrates in small to medium sized streams (US FWS, 1985, p. 9).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1985. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/850702.pdf

Species	Habitat	Rationale	Source
Lilliput, pale (pearlymussel) (*Toxolasma cylindrellus*)	This species is observed in clean, fast-flowing water in substrates that contain relatively firm rubble, gravel, and sand substrates swept free from siltation. These mussels are usually found buried in the substrate in shallow riffle and shoal areas (US FWS, 1984, p. 5).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840822.pdf
Loggerhead sea turtle (*Caretta Caretta*)	Ocean, Beaches, Neritic zone (NMFS 2009, p I-20)	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	NMFS and USFWS. 2009. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle, Second Revision. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service and United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery_plan/090116.pdf
Logperch, Conasauga (*Percina jenkinsi*)	This species has been collected in deep shuts and flowing pools with clear, clean gravel and mixed rubble substrates in areas with moderate to swift currents (US FWS, 1986, p. 8).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1986. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/860620.pdf
Lynx, Canada (*Lynx canadensis*)	PCE: Boreal forest landscapes with large populations of snowshoe hares. Distribution and abundance of prey and microclimate influence movement, hunting behavior, and den and resting site locations. Areas with dense cover.	The proposed dicamba DGA uses are not expected to overlap with boreal forests. The lynx's prey, snowshoe hares, also do not overlap with the proposed dicamba DGA use sites.	USFWS. 2014. Federal Register Notice: Designation of Critical Habitat http://www.gpo.gov/fdsys/pkg/FR-2014-09-12/pdf/2014-21013.pdf
Manatee, West Indian (*Trichechus manatus*)	This species lives in freshwater, brackish and marine habitats (US FWS, 2001, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2001. Recovery Plan-Third Revision. http://ecos.fws.gov/docs/recovery_plan/011030.pdf

Species	Habitat	Rationale	Source
Mexican long-nosed bat (*Leptonycteris nivalis*)	The Mexican long-nosed bat has evolved an apparent mutualistic association with *Agave sp.* The bat is principally a nectar feeder, foraging on the flowers of *Agave*, and in some minor proportions consuming the pollen, fruits, and any incidental insects associated with the flowers. The bats occupy mid- to high-elevational desert scrub, open conifer-oak woodlands, and pine forest habitats in the Upper Sonoran and Transition Life Zones.	The proposed dicamba DGA uses are not expected to overlap with the desert scrub, open conifer-oak woodlands and pine forest habitats of the bat. The bat's major resource need, *Agave* plants are not expected to be on soybean and cotton fields.	USFWS. 1994. Recovery Plan. https://ecos.fws.gov/docs/recovery_plan/940908.pdf
Mexican spotted owl (*Strix occidentalis lucida*)	Forest and canyonlands in SW U.S. (USFWS 2011, p. 7).	The proposed dicamba DGA uses are not expected to overlap with forests or Canyonlands.	USFWS 2011. Species specific recovery plan available on FWS website. http://ecos.fws.gov/docs/recovery_plan/FR00000557-%20BP031995%20Draft%20MSO%20Recovery%20Plan%20First%20Revision.pdf
Moccasinshell, Alabama (*Medionidus acutissimus*)	Inhabits sand/gravel/cobble shoals with moderate to strong currents in streams and small rivers. (US FWS 2000, p. 51)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/001117.pdf
Moccasinshell, Coosa (*Medionidus parvulus*)	Inhabits sand/gravel/cobble shoals with moderate to strong currents in streams and small rivers. (US FWS 2000, p. 52)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/001117.pdf
Monkeyface, Cumberland (pearlymussel) (*Quadrula intermedia*)	This species is most often observed in clean-fast-flowing water in substrates that contain relatively firm rubble, gravel, and sand substrates swept free from siltation. These mussels are usually found buried in the substrate in shallow riffle	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840709b.pdf

Species	Habitat	Rationale	Source
	and shoal areas (US FWS, 1984, p. 9).		
Mucket, orangenacre (*Lampsilis perovalis*)	Currently restricted to high quality stream and small river habitat, the species is found on stable sand/gravel/cobble substrate in moderate to swift currents (US FWS 2000, p. 55)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/001117.pdf
Mucket, pink (pearlymussel) (*Lampsilis abrupta*)	The pink mucket may still exist in stretches of the lower Ohio River (US FWS, 1985, p. 10). The pink mucket habitat is large rivers at least 60 feet wide, where it occurs at depths up to 25 feet deep. Currents are typically moderate to fast and substrates range from silt to boulders, rubble, gravel, and sand (US FWS, 1985, p. 11). The species seems to have adapted to living in impounded waters, at least in the upper reaches where the water is flowing (US FWS, 1985, p. 10).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1985. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/pink%20mucket%20rp.pdf
Mussel, oyster (*Epioblasma capsaeformis*)	This species is generally adapted to live in the gravel shoals of free-flowing rivers and streams (US FWS, 2004, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2004. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/040524.pdf
Mussel, sheepnose (*Plethobasus cyphyus*)	The sheepnose is a larger-stream species occurring primarily in shallow shoal habitats with moderate to swift currents over coarse sand and gravel. Habitats with sheepnose may also have mud, cobble, and	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2012. Federal Register Notice: Final Rule. http://www.gpo.gov/fdsys/pkg/FR-2012-03-13/pdf/2012-5603.pdf

Species	Habitat	Rationale	Source
	boulders. Sheepnose in larger rivers may occur at depths exceeding 6 m (US FWS, 2012, p 14916).		
Mussel, snuffbox (*Epioblasma triquetra*)	The habitat is described as swift currents and riffles, and shoals and wave-washed shores of lakes over gravel and sand with occasional cobble and boulders. They generally burrow deep into the substrate (US FWS, 2010, p 67554). This constitutes a wide diversity of habitats. However, they do not occur in impounded areas or reservoirs (except tailwaters) (US FWS, 2012, p 8652).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2010. Federal Register Notice: Listing. http://www.gpo.gov/fdsys/pkg/FR-2010-11-02/pdf/2010-27413.pdf#page=2 USFWS. 2012. Federal Register Notice: Final Rule. http://www.gpo.gov/fdsys/pkg/FR-2012-02-14/pdf/2012-2940.pdf
North Atlantic Right Whale (*Eubalaena glacialis*)	The North Atlantic right whale primarily occurs in coastal or shelf waters, but may go into deeper waters. (NMFS 2004, p. v)	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	NMFS. 2004. Recovery plan for the north Atlantic right whale (*Eubalaena glacialis*). Available online at: http://ecos.fws.gov/docs/recovery_plan/whale_right_northatlantic.pdf
Northern aplomado falcon (*Falco femoralis septentrionalis*)	Open terrain with scattered trees or shrubs. Found along yacca covered sand ridges in coastal prairies Riparian woodlands in open grasslands Desert grasslands (USFWS 1990, p. 13).	Recommend off-field status for row crop agriculture. According to the Aplomado Recovery Plan (USFWS 1990), suitable habitat contains of terrain with inter-tree distances of 15 to 45 m with a mean of 30 m and a woody plant density of 0.48 tree/ha. The suitable land covers include yucca-covered ridges of coastal prairies,	USFWS 1990. Species specific recovery plan available on FWS website. http://ecos.fws.gov/docs/recovery_plan/900608.pdf

Species	Habitat	Rationale	Source
		grasslands, prairies, desert grasslands, and riparian wooded areas near open grasslands. While the recovery plan is not specific as to row crop usage by the species, additional information on monitored individual falcons in Texas indicated that the only agricultural association with foraging falcons is for grazing lands and for fallow agricultural fields. (Perez et al. 1996)	
Pearlymussel, dromedary (*Dromus dromas*)	This species is most often observed in clean, fast-flowing water in substrates that contain relatively firm rubble, gravel and sand substrates swept free from siltation. These mussels are usually found buried in the substrate in shallow riffle and shoal areas (US FWS, 1984, p. 8).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840709c.pdf
Pearlymussel, littlewing (*Pegias fabula*)	This species inhabits small to medium, low turbidity, cool-water, high to moderate gradient streams in the Cumberland and Tennessee River basins (US FWS, 1989, p. 5).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1989. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/890922.pdf
Pearlymussel, Slabside (*Pleuronaia dolabelloides*)	Associated with the Cumberland and Tennessee River drainages. Generally live embedded in the bottom of stable streams and other bodies of water, and within riffle areas of sufficient current velocities to remove	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2013. Federal Register Notice: Designation of Critical Habitat. http://www.gpo.gov/fdsys/pkg/FR-2013-09-26/pdf/2013-23357.pdf

Species	Habitat	Rationale	Source
	finer sediments and provide well oxygenated waters (US FWS, 2013, p. 59560)		
Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*)	Coastal sand dunes & coastal scrub (USFWS 1987, p. 2); primary, secondary and interior or scrub dunes (USFWS 2007, p. 9)	The proposed dicamba DGA uses are not expected to overlap with sand dunes or coastal scrub.	USFWS. 1987. Recovery plan for the Choctawhatchee, Perdido Key and Alabama Beach Mouse. U.S. Fish and Wildlife Service, Atlanta, Georgia. 45 pp. Available online at: http://ecos.fws.gov/docs/recovery_plan/870812.pdf. USFWS. 2007. Perdido Key Beach Mouse (*Peromyscus polionotus trissyllepsis*), 5-Year Review: Summary and Evaluation. Panama City, Florida. 24 pp. Available online at: http://ecos.fws.gov/docs/five_year_review/doc1081.pdf.
Pigtoe, finerayed (*Fusconaia cuneolus*)	This species is typically a riffle species that inhabits ford and shoal areas in free-flowing streams of moderate gradient (US FWS, 1984, p. 7).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/fine%20rayed%20recov%20plan.pdf
Pigtoe, Georgia (*Pleurobema hanleyianum*)	This species requires flowing water, stable stream channels with minimal sediment and algae growth, and adequate water quality. It also requires a host fish, which is currently unknown (US FWS, 2013, Executive Summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2013. Draft Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/Hartfield%20and%20Powell%202013%20Draft%20Three%20Mollusks%20RP%20062813.pdf
Pigtoe, rough (*Pleurobema plenum*)	The rough pigtoe habitat is medium to large rivers, 60 feet or wider, in sand and gravel substrates. Very limited collection information suggests it occurs below spillways, in transition zones, and in sand and gravel substrates (US FWS, 1984, p. 8).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840806.pdf

Species	Habitat	Rationale	Source
Pigtoe, shiny Entire (*Fusconaia cor*)	This species is typically a riffle species, found along fords and shoals of clear, moderate to fast-flowing streams and rivers with stable substrate. It does not inhabit deep pools or impounded areas. This species is usually found well-buried in the substrate during most of the year and is more readily visible in early summer (US FWS, 1984, p. 8).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840709d.pdf
Pigtoe, southern (*Pleurobema georgianum*)	Sand/gravel shoals and runs of small rivers and large streams (US FWS 2000, p. 59)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2000. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/001117.pdf
Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)	The 1984 Recovery Plan indicated that the orange-foot pimpleback was known from the Tennessee, Cumberland, and lower Ohio Rivers (US FWS, 1984. p. 2). The habitat is described as medium to large rivers in sand and gravel substrates. In the Ohio River it was collected from 15-29 feet depths, but may have lived in shallower riffles (US FWS, 1984, p. 6).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1984. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/840930b.pdf
Plover, piping except Great Lakes watershed (*Charadrius melodus*)	The northern Great Plains DPS of the piping plover utilizes four types of habitats for breeding: alkali lakes and wetlands, inland lakes (Lake of the Woods), reservoirs, and rivers. Most breeding occurs along alkali lakes and wetlands, where nesting sites are generally wide, gravelly, salt encrusted beaches with minimal vegetation. At inland lakes, they use barren	The proposed dicamba DGA uses are not expected to overlap with shorelines, beaches, and sandbars of rivers and alkali wetlands.	USFWS. 2002. Federal Register Notice. http://ecos.fws.gov/docs/federal_register/fr3943.pdf

Species	Habitat	Rationale	Source
	to sparsely vegetated islands, beaches, and peninsulas. Sparsely vegetated sandbars and reservoir shorelines are preferred in riverine systems (US FWS, 2002, p. 57640).		
Pocketbook, fat (*Potamilus capax*)	The fat pocketbook is a large river species requiring flowing water and a stable substrate, which can vary widely but is most likely a mixture of sand, silt and clay. It occurs in water from a few inches deep to at least 8 feet. Habitat includes drainage ditches. (US FWS, 1989, p. 6). Populations have been found in larger rivers in the Ohio River system, and it may occur as deep as 20 feet (US FWS, 2012, p. 7-8). It can also tolerate periods of high suspended sediments (US FWS, 2012, p. 11).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1989. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/891114c.pdf USFWS. 2012. Five Year Review. http://ecos.fws.gov/docs/recovery_plan/891114c.pdf
Pocketbook, finelined (*Lampsilis altilis*)	Live embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams (US FWS 2004, p. 40097).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks or other water bodies.	USFWS. 2004. Federal Register Notice: Designation of Critical Habitat. http://www.gpo.gov/fdsys/pkg/FR-2004-07-01/pdf/04-14279.pdf#page=1
Purple Cat's paw (=Purple Cat's paw pearlymussel) (*Epioblasma obliquata obliquata*)	Inhabits boulder to sandy substrates in large rivers of the Ohio River basin (US FWS 1992, Executive summary).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1992. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/920310.pdf
Rabbitsfoot (*Quadrula cylindrica cylindrica*)	"Rabbits foot is primarily an inhabitant of small to medium sized streams and some larger rivers. It usually occurs in shallow water areas along the bank and adjacent runs and shoals with reduced water velocity." They have been reported in deep water runs up to 12 feet depth.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2012. Federal Register Notice. http://www.gpo.gov/fdsys/pkg/FR-2012-10-16/pdf/2012-24151.pdf

Species	Habitat	Rationale	Source
	"Bottom substrates generally include gravel and sand" (US FWS, 2012, p. 63446).		
Red Hills salamander (*Phaeognathus hubrichti*)	Mesic ravine slopes and bluff sides (facing North) with hardwood trees. Burrows within siltstone. Usually found on sites with loamy, friable topsoils (USFWS 1983)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1983. Recovery plan for the red hills salamander (*Phaeognathus hubrichti* Highton). United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery_plan/831123.pdf
Reticulated flatwoods salamander (*Ambystoma bishopi*)	Aquatic and terrestrial. Longleaf pine ecosystems (Coastal Plain in what were historically longleaf pine-wiregrass flatwoods and savannas). Adults spend most of their lives underground. Breed in small, isolated ephemeral ponds. (USFWS 2009)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2009. Federal Register, vol. 74, No. 26. 50 CFR 17. Endangered and threatened wildlife and plants; determination of endangered status of reticulated flatwoods salamander; designation of critical habitat for frosted flatwoods salamander and reticulated flatwoods salamander. United States Fish and Wildlife Service. Available on line at: http://www.gpo.gov/fdsys/pkg/FR-2009-02-10/pdf/E9-2403.pdf#page=1
Riffleshell, northern (*Epioblasma torulosa rangiana*)	The habitat of the riffleshell occurs in packed sand and gravel in riffles and runs, and also in the western basin of Lake Erie where there is sufficient wave action to produce continuously moving water (US FWS, 1994, p. 18). FWS further describes the habitat as medium to large rivers where they are often associated with high water velocities, although they have also been documented in Lake Erie and in deep more slow-flowing rivers down to 20 feet (US FWS, 2009. p. 9).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1994. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/940921.pdf USFWS. 2009. Five Year Review. http://ecos.fws.gov/docs/five_year_review/doc3284.pdf

Species	Habitat	Rationale	Source
Riversnail, Anthony's (*Athearnia anthonyi*)	This species is typically found in large streams on large submerged objects (e.g., rocks and logs) or gravelly substrata in relatively shallow, moderately to fast-flowing water (US FWS, 1997).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1997. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/970813.pdf
Roseate tern (*Sterna dougallii dougallii*)	Rocky offshore islands with sparse vegetation; although Northeastern Roseate tern nest under vegetation or some other shelter (USFWS 1993, p. 3).	The proposed dicamba DGA uses are not expected to overlap with offshore islands.	USFWS 1993. Species specific recovery plan available on FWS website. http://ecos.fws.gov/docs/recovery_plan/930924_v2.pdf
Salado salamander (*Eurycea chisholmensis*)	Aquatic. The Northern Segment of the Edwards Aquifer, which is a karst aquifer characterized by open chambers such as caves, fractures, and other cavities that were formed either directly or indirectly by dissolution of subsurface rock formations. (USFWS 2014, Pg. 10237)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2014. Determination of Threatened Species Status for the Georgetown Salamander and Salado Salamander Throughout Their Ranges; Final Rule
San Marcos salamander (*Eurycea nana*)	Aquatic Spring Lake. Found among aquatic plants on the bottom of the lake. Found under stones in sand and gravel areas. Must have flowing water (from springs flowing into Spring Lake). (USFWS 1996)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1996. San Marcos and Comal Springs and associated aquatic ecosystems (Revised) recovery plan. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery_plan/960214.pdf
Sea turtle, green (*Chelonia mydas*)	Green turtles are primarily restricted to tropical and subtropical waters. In U.S. Atlantic and Gulf of Mexico waters, green turtles are found from Massachusetts to Texas and in the U.S. Virgin Islands and Puerto Rico...Seagrasses are the principal dietary	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	NMFS, NOAA. 1998. Federal Register Notice: Designated critical habitat. http://ecos.fws.gov/docs/federal_register/fr3295.pdf

Species	Habitat	Rationale	Source
	component of juvenile and adult green turtles throughout the Wider Caribbean region (Bjorndal, 1995). (NMFS, NOAA 1998, p. 46694)		
Sea turtle, hawksbill (*Eretmochelys imbricata*)	The hawksbill turtle occurs in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. Coral reefs, like those found in the waters surrounding Mona and Monito Islands, are widely recognized as the primary foraging habitat of juvenile, subadult, and adult hawksbill turtles. This habitat association is directly related to the species' highly specific diet of sponges (Meylan, 1988). Hawksbills depend on coral reefs for food and shelter; therefore, the condition of reefs directly affects the hawksbill's well-being. (NMFS, NOAA 1998, p. 46695)	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	NMFS, NOAA. 1998. Federal Register Notice: Designated critical habitat. http://ecos.fws.gov/docs/federal_register/fr3295.pdf
Sea turtle, Kemp's ridley (*Lepidochelys kempii*)	This life history pattern is characterized by three basic ecosystem zones: (1) Terrestrial zone (supralittoral) - the nesting beach where both oviposition and embryonic development occur; (2) Neritic zone - the nearshore (including bays and sounds) marine environment (from the surface to the sea floor) where water depths do not exceed 200 meters, including the continental shelf; and (3) Oceanic zone - the vast open ocean environment (from the surface to the sea floor) where water depths are greater than 200 meters. (NMFS, NOAA 2011, p. I-8)	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	NMFS, NOAA. 2011. Bi-national recovery plan for the kemp's ridley sea turtle. http://ecos.fws.gov/docs/recovery_plan/090116.pdf

Species	Habitat	Rationale	Source
Sea turtle, leatherback (*Dermochelys coriacea*)	Leatherbacks are able to take advantage of a wide variety of marine ecosystems (reviewed by Saba 2013; see NOAA large marine ecosystem website: http://www.lme.noaa.gov/). Within these ecosystems, various oceanic features such as water temperature, downwelling, Ekman upwelling, sea surface height, chlorophyll-a concentration, and mesoscale eddies affect the presence of leatherbacks (Bailey et al. 2013; Benson et al. 2011). The physical characteristics observed within these marine ecosystems also affect the distribution and abundance of leatherback prey (reviewed by Saba 2013). (NFMS, NOAA 2013, p. 20-22).	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	NMFS, NOAA. 2013. Five Year Review. http://ecos.fws.gov/docs/recovery_plan/090116.pdf
Shiner, Arkansas River (*Notropis girardi*)	Wilde et al. (2000) found no obvious selection for or avoidance of any particular habitat type (i.e., main channel, side channel, backwaters, and pools) by Arkansas River shiner. Arkansas River shiners did tend to select side channels and backwaters slightly more than expected based on the availability of these habitats (Wilde et al. 2000). Likewise, they appeared to make no obvious selection for, or avoidance of, any particular substrate type. Substrates (i.e., the river bed) in the Canadian River in New Mexico and Texas were predominantly sand, however, the Arkansas River shiner was observed to occur over silt slightly more than	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	US FWS. 2005. Federal Register Notice: Designation of Critical Habitat. http://ecos.fws.gov/docs/recovery_plan/950830.pdf

Species	Habitat	Rationale	Source
	expected based on the availability of this substrate (Wilde et al. 2000) ; preferred habitat for the Arkansas River shiner is the mainstem of larger plains rivers... historically inhabited the main channels of wide, shallow, sandy-bottomed rivers and larger streams of the Arkansas River basin (Gilbert 1980). Adults are uncommon in quiet pools or backwaters lacking streamflow, and almost never occurred in habitats having deep water and bottoms of mud or stone (Cross 1967) (US FWS 2005).		
Shiner, blue (*Cyprinella caerulea*)	The blue shiner primarily occupies second to fourth order, moderate gradient streams within the Ridge and Valley and Piedmont physiographic provinces of Alabama, Georgia, and Tennessee (Smith-Vaniz 1968, Ramsey 1976, Krotzer 1984, Ramsey and Pierson 1986, Pierson and Krotzer 1987, Mayden 1989, Pierson et al. 1989, Boschung 1992, Etnier and Starnes 1993, Dobson 1994). Most watersheds where it is found are predominately forested, and agriculture and urban development are minimal. For example in Alabama, land cover in the Choccolocco watershed is 66 percent forest, 20 percent pasture, and 13 percent agriculture...It prefers a sand or sand and gravel substrate sometimes with cobble, low to moderate velocity current, and a depth of about 0.15 to 1 meters (0.5 to 3 feet)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	US FWS. 1995. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/950830.pdf

Species	Habitat	Rationale	Source
	(Gilbert et al. 1979; Krotzer 1984, Pierson and Krotzer 1987, Dobson 1994) (US FWS 1995, p. 3-4)		
Shiner, smalleye (*Notropis buccula*)	Occur in fairly shallow, flowing water, often less than 0.5 m deep with sandy substrates (US FWS 2014, p. 45252)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2014. Designation of Critical Habitat. http://www.gpo.gov/fdsys/pkg/FR-2014-08-04/pdf/2014-17694.pdf
Snake, copperbelly water (*Nerodia erythrogaster neglecta*)	Copperbellies are generally affiliated with wetlands and prefer shallow wetlands, such as shrub-scrub wetlands dominated by buttonbush (Cephalanthus occidentalis), emergent wetlands, or the margins of palustrine open water wetlands. Buttonbrush swamps are used as basking areas. Areas frequented by copperbellies generally have an open canopy, shallow water, and short dense vegetation. Uplands are also important. (US FWS, 2008, p. 17-18). Critical Habitat has not been designated for the snake because of concerns related to illegal collection (US FWS, 2008. p. 20).	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS. 2008. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/081223.pdf
Spectaclecase (mussel) (*Cumberlandia monodonta*)	The spectaclecase generally inhabits large rivers where it occurs in microhabitats sheltered from the main force of current. It occurs in a variety of substrates from mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with a slow to swift current. It is most often	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2012. Federal Register Notice: Final Rule. http://www.gpo.gov/fdsys/pkg/FR-2012-03-13/pdf/2012-5603.pdf

Species	Habitat	Rationale	Source
	found in firm mud between large rocks in quiet water very near the interface with swift currents (US FWS, 2012, p 14916).		
Spider, spruce-fir moss (*Microhexura montivaga*)	Typical habitat appears to be associated with moist, well-drained moss mats growing on rocks and boulders in well-shaded situations in mature high-elevation conifer forests dominated by Fraser fir, Abiesfraseri, often with scattered red spruce, Picea rubens. (US FWS 1998, p. iii)	The proposed dicamba DGA uses are not expected to overlap with high-elevation conifer forests.	USFWS, 1998, Recovery Plan. http://www.gpo.gov/fdsys/pkg/FR-2011-09-27/pdf/2011-24046.pdf
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Breeding: Forested wetlands or scrub-shrub wetlands-dense riparian habitat of rivers, swamps, wetlands, lakes (USFWS 2002, p. iv). Wintering: brushy savanna edges, second growth, shrubby clearings and pastures, woodlands near water (USFWS 2002, p. iv).	Recommend off-field status for row crop agriculture. According to the Critical Habitat designation document (USFWS 2013) essential characteristics for southwestern will flycatcher habit include riparian areas for flowing stream that support expansive riparian vegetation areas. Riparian trees and understory species are viewed as essential elements of flycatcher habitat. Row crop soy and corn are monocultures of non-riparian vegetation and consequently not suitable habitat for this species.	USFWS 2002. Species specific recovery plan available on FWS website. http://ecos.fws.gov/docs/recovery_plans/2002/020830c.pdf USFWS. 2013. Designation of Southwestern Willow Flycatcher Critical Habitat: Final Rule. Federal Register Vol. 78 No.2.

Species	Habitat	Rationale	Source
Sperm whale (*Physeter catodon (=macrocephalus)*)	Ocean/ Water depth of 1968 feet or more (NMFS 2012)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	NMFS. 2012. Sperm whales (*Physeter catodon*). National Marine Fisheries Service. Available online at: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm
Squirrel, Carolina northern flying (*Glaucomys sabrinus coloratus*)	Species composition of the occupied forest may vary in different locations, some combination of hardwoods and conifers (particularly spruce and fir) appears essential to support these animals...Food sources for the Carolina northern flying squirrel include fungi, lichens, staminate cones, insects, and other animal matter (US FWS 1990, p. 6-7)	The proposed dicamba DGA uses are not expected to overlap with hardwood and conifer forests.	USFWS. 1990. Recovery Plan for Appalachian Northern Flying Squirrels. United States Fish and Wildlife Service.
Stirrupshell (*Quadrula stapes*)	Habitat is the Tombigbee River, characterized by an increasing number of sand and gravel shoals and decreasing channel size in the upper portions (US FWS, 1989).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1989. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/891114e.pdf
Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)	The Gulf sturgeon is an Anadromous fish which migrates from salt water into large coastal rivers to spawn and spend the warm months. The majority of its life is spent in fresh water (US FWS, 1995).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1995. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/950922.pdf
Sturgeon, pallid (*Scaphirhynchus albus*)	Habitat is the bottom in swift waters of large, turbid, free-flowing rivers, often over sand substrates, but other substrates include at least gravel and rock. Sloughs, chutes, and side channels that transition from floodplain to the main channels are apparently important as spawning, nursery, and feeding areas.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 2014. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/Pallid%20Sturgeon%20Recovery%20Plan%20First%20Revision%20signed%20version%20012914_3.pdf USFWS. 2007. Five Year Review. http://ecos.fws.gov/docs/five_year_review/doc1059.pdf

Species	Habitat	Rationale	Source
	Within the subject states, this habitat occurs in the Mississippi and Missouri rivers (US FWS, 1993, pp 6-7). Within this habitat, they tend to select main channel habitats in the Mississippi River, and main channel habitats with islands or sand bars in the upper Missouri River (US FWS, 2007. p. 8). They do not typically occur in impounded areas due to lower flows and other hydrologic factors, nor where channel stabilization has reduced channel meandering and access to floodplain areas (US FWS, 2007, p. 38).		
Tern, least interior pop. (*Sterna antillarum*)	Species is a piscivore, feeding in shallow waters of rivers, streams (USFWS, 1990, p. 20). Beaches, sand pits, sandbars, islands and peninsulas are the principal breeding habitats of coastal areas and nesting can be close to water but is usually between the dune environment and the high tide line. Vegetation at coastal nesting areas is sparse, scattered and short. Riverine nesting areas are sparsely vegetated sand and gravel bars within a wide unobstructed river channel, or salt flats along lake shorelines. Nesting occurs along river banks (US FWS, 1990, p. 20).	The proposed dicamba DGA uses are not expected to overlap with riparian areas, including coastal areas.	USFWS. 1990. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/900919a.pdf
Texas blind salamander (*Typhlomolge rathbuni*)	Aquatic, subterranean (caves) (USFWS 1996)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1996. San Marcos and Comal Springs and associated aquatic ecosystems (Revised) recovery plan. United States Fish and Wildlife Service. Available online at:

Species	Habitat	Rationale	Source
			http://ecos.fws.gov/docs/recovery_plan/960214.pdf
Warbler, Kirtland's (*Setophaga kirtlandii*)	Forests (US FWS 1985, p. 8) During breeding, Kirtland's warblers are located in Michigan. Its wintering grounds are located in the Bahamas, where it spends 8 months of the year (September-April). (US FWS 1985) In migration, the bird travels a fairly direct route between its nesting and wintering ranges, entering and leaving the continent at the coast of North and South Carolina (USFWS 1985, p. 5). With one or few exceptions, all nests have been found on Grayling sand soil (USFWS 1985, p. 7).	The proposed dicamba DGA uses are not expected to overlap with forests.	USFWS. 1985 Kirtland's Warbler Recovery Plan, Updated. http://ecos.fws.gov/docs/recovery_plan/850930.pdf
Whale, finback (*Balaenoptera physalus*)	Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally.	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/finwhale.htm
Whale, humpback (*Megaptera novaeangliae*)	During migration, humpbacks stay near the surface of the ocean. While feeding and calving, humpbacks prefer shallow waters. During calving, humpbacks are usually found	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/humpbackwhale.htm

Species	Habitat	Rationale	Source
	in the warmest waters available at that latitude. Calving grounds are commonly near offshore reef systems, islands, or continental shores. Humpback feeding grounds are in cold, productive coastal waters.		
Wartyback, white (pearlymussel) (*Plethobasus cicatricosus*)	The white wartyback has undergone a substantial range reduction and is considered to be possibly extinct. It was historically distributed in the Wabash, Ohio, Kanawha, Cumberland, Holston, and Tennessee Rivers of the Ohio, Cumberland, and Tennessee River systems; however, no live specimens have been recovered from these drainages since the early 1900s). The white wartyback may still exist in a short reach of the Tennessee River below Pickwick Dam. No living populations have been found in numerous surveys conducted in the Tennessee River since the 1960s; however, fresh dead specimens were collected in 1979 and 1982 below Pickwick Dam near Savannah, Tennessee. If this species still exists, the viability of remaining populations is extremely threatened The white wartyback is a riffle species that is typically found in large rivers in gravel substrates.	The proposed dicamba DGA uses are not expected to overlap with coastal waters.	USFWS, 1984, Recovery Plan White Warty-backed Pearlymussel http://ecos.fws.gov/docs/recovery_plan/060313h.pdf http://ecos.fws.gov/docs/life_histories/F00M.html

Species	Habitat	Rationale	Source
Woodpecker, red-cockaded Entire (*Picoides borealis*)	Habitat: Forest, Savannah (open pine woodlands and savannahs with large old pines) (US FWS 2003, p. x) Habitat size (home range): 116 – 357 acres (US FWS 2003, p. 49)	Proposed dicamba DGA uses are not expected to overlap with forest or savannah.	USFWS. 2003. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/030320_2.pdf
Wood stork (*Mycteria americana*)	Freshwater and estuarine Wetlands. (US FWS 1986, p. iii). Wood storks breed in FL, GA and SC. They migrate south in winter (US FWS 1986, p. 2). Require a mosaic of wetlands with varying climatological and seasonal conditions around colonies and within the wintering habitat in the coastal plain of the Southeast U.S. (US FWS 2006, p. 12).	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS. 1986. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/970127.pdf USFWS. 2006. Five year Review. http://ecos.fws.gov/docs/five_year_review/doc1115.pdf
Noonday globe (*Patera clarki nantahala*)	Found mainly on the southeast side of the Nantahala River Gorge. Area is strikingly different than the surrounding area, very steep, with a mix of various hardwood trees and hemlock, and has a rich herbaceous undergrowth. The area is interrupted frequently by small streams, waterfalls, seeps, springs, and often shaded. The forest floor has a thick humus layer with much exposed rock, where the snail is most abundant on and around moist rock outcrops, but also found in thick leaf litter and humus layers around	The proposed dicamba DGA uses are not expected to overlap with forests.	Noonday Globe *Patera* (=*Mesodon*) *clarki nantahala* 5-Year Review: Summary and Evaluation, Page 4 Available at: http://ecos.fws.gov/docs/five_year_review/doc4295.pdf

	the base of ferns and underneath rhododendron and dog hobbe, and other moist habitats. Moisture is key.		
Phantom springsnail (*Pyrgulopsis texana*)	The Phantom springsnail occurs only in the four remaining desert spring outflow channels associated with the San Solomon Spring system (San Solomon, Phantom, Giffin, and East Sandia springs). Habitat of the species is found on both soft and firm substrates on the margins of spring outflows (Taylor 1987, p. 41). They are also commonly found attached to plants, particularly in dense stands of submerged vegetation (Chara sp.). Field and laboratory experiments have suggested Phantom springsnails prefer substrates harder and larger in size (Bradstreet 2011, p. 91).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2013. Determination of Endangered Species Status for Six West Texas Aquatic Invertebrates: Final Rule. Page 41236. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-07-09/pdf/2013-16222.pdf
Phantom tryonia (*Tryonia cheatumi*)	The Phantom tryonia occurs only in the four remaining desert spring outflow channels associated with the San	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2013. Determination of Endangered Species Status for Six West Texas Aquatic Invertebrates: Final Rule. Page 41236-41237. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-07-09/pdf/2013-16222.pdf

	Solomon Spring system (San Solomon, Phantom, Giffin, and East Sandia springs) (Taylor 1987, p. 40; Allan 2011, p. 1; Lang 2011, entire). The species is found on both soft and firm substrates on the margins of spring outflows (Taylor 1987, p. 41), and they are also commonly found attached to plants, particularly in dense stands of submerged vegetation (Chara sp.).		
Armored snail (*Pyrgulopsis (=Marstonia) pachyta*)	The armored snail is currently only known from Limestone and Piney Creeks, Limestone County, Alabama, and appears to be most abundant in submerged root masses and bryophytes (non-vascular land plants, e.g. mosses) along the creek edges, but also may occur on rocks and leafy/woody debris, and on other aquatic macrophytes (aquatic plants) (Garner 2004a, Haggerty and Garner 2007, 2008).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2010. Armored Snail (*Marstonia pachyta*) 5-Year Review. Page 2. Available at: http://ecos.fws.gov/docs/five_year_review/doc3288.pdf
Pecos assiminea snail (*Assiminea pecos*)	The Pecos assiminea requires saturated, moist soil at stream or spring- run margins and is found in wet mud or beneath mats of vegetation, usually within 1 inch (in) (2 to 3 centimeters (cm)) of flowing water. Spring complexes that	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2011. Designation of Critical Habitat for Roswell Springsnail, Koster's Springsnail, Noel's Amphipod, and Pecos Assiminea; Final Rule. Page 33039. Available at: http://www.gpo.gov/fdsys/pkg/FR-2011-06-07/pdf/2011-13227.pdf

	contain flowing water create saturated soils that provide the specific habitat needed for population growth, sheltering, and normal behavior of the species. Although this snail seldom occurs immersed in water, the species cannot withstand permanent drying of springs or spring complexes. Consequently, wetland plant species are required to provide leaf litter (dead leaf material), shade, and appropriate microhabitat. Plant species such as *Scirpus americanus* (American three-square), *Eleocharis spp.* (spike rush), *Distichlis spicata* (inland saltgrass), and *Juncus spp.* (rushes) provide the appropriate cover and shelter required by Pecos assiminea (NMDGF 2005, p. 13).		
Diamond Y Spring snail (*Pseudotryonia adamantina*)	Habitat of the species is primarily soft substrates on the margins of small springs, seeps, and marshes in shallow flowing water associated with emergent bulrush (*Scirpus americanus*) and saltgrass (*Distichlis spicata*) (Taylor 1987, p. 38; Echelle et al. 2001, p.5).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2013. Determination of Endangered Species Status for Six West Texas Aquatic Invertebrates: Final Rule. Page 41237. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-07-09/pdf/2013-16222.pdf

Tulotoma snail (*Tulotoma magnifica*)	Tulotoma occur in cool, well-oxygenated, clean, free-flowing streams, including rivers and the lower portions of the rivers' larger tributaries (Herschler et al. 1990, p. 822). This species is generally found in shoals (a shallow place in a body of water) and riffles (a rocky shoal lying just below the surface of the water) with moderate to strong currents. Although this species is typically associated with shoals and riffles, it inhabits rivers that rise and fall, and tulotoma have been collected at depths more than 5 meters (m) (15 feet (ft)) (Hartfield 1991, p. 7). The species is strongly associated with boulder, cobble, and bedrock stream bottoms and is generally found clinging tightly to the underside of large rocks or between cracks in bedrock (Christman et al. 1996, p. 28). Historical habitats included large coastal plain river, large high-gradient rivers, and multiple upland tributary streams.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2011. Final Reclassification of the Tulotoma Snail From Endangered to Threatened. Page 31867. Available at: http://www.gpo.gov/fdsys/pkg/FR-2011-06-02/pdf/2011-13687.pdf
Gonzales springsnail (*Tryonia circumstriata*)	Habitat of the species is primarily soft substrates on the margins of small springs, seeps, and marshes in shallow flowing water associated with emergent bulrush and	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2013. Determination of Endangered Species Status for Six West Texas Aquatic Invertebrates: Final Rule. Page 41238. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-07-09/pdf/2013-16222.pdf

	saltgrass (Taylor 1987, p. 38; Echelle et al. 2001, p. 5).		
Lacy elimia (snail) (*Elimia crenatella*)	Lacy elimia typically inhabit highly oxygenated waters on rock shoals and gravel bars. Currently, the lacy elimia is only known to survive in three Coosa River tributaries--Cheaha, Emauhee, and Weewoka Creeks, Talladega County, Alabama (Bogan and Pierson, 1993a).	The proposed dicamba DGA uses are not expected to overlap with rivers or other water bodies.	USFWS 2005. Final Recovery Plan for Six Mobile Basin Aquatic Snails. Page 8. Available at: http://ecos.fws.gov/docs/recovery_plan/051202.pdf
Rough hornsnail (*Pleurocera foremani*)	Rough hornsnails are primarily found on gravel, cobble, bedrock, and mud in moderate currents. They have been collected at depths of 1 m (3.3 ft) to 3 m (9.8 ft) (Hartfield 2004, p. 132). The species appears to tolerate low- to- moderate levels of silt deposition (Sides 2005, p. 127).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2010. Determination of Endangered Status for the Georgia Pigtoe Mussel, Interrupted Rocksnail, and Rough Hornsnail and Designation of Critical Habitat; Final Rule. Page 67514. Available at: http://www.gpo.gov/fdsys/pkg/FR-2010-11-02/pdf/2010-27417.pdf#page=2
Cylindrical lioplax (snail) (*Lioplax cyclostomaformis*)	The cylindrical lioplax is currently known only from approximately 24 kilometers (km) (15 miles (mi)) of the Cahaba River above the Fall Line in Shelby and Bibb counties, Alabama (Bogan and Pierson, 1993b). Habitat for the cylindrical lioplax is unusual for the genus,	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2005. Final Recovery Plan for Six Mobile Basin Aquatic Snails. Page 4. Available at: http://ecos.fws.gov/docs/recovery_plan/051202.pdf

	as well as for other genera of viviparid snails. It lives in isolated mud deposits found under large rocks in the rapid flowing sections of stream and river shoals.		
Flat pebblesnail (*Lepyrium showalteri*)	The flat pebblesnail is currently known from One site on the Little Cahaba River, Bibb County, and from a single shoal series on the Cahaba River above the Fall Line, Shelby County, Alabama (Bogan and Pierson, 1993b). The flat pebblesnail is found attached to clean, smooth stones in rapid currents of river shoals.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2005. Final Recovery Plan for Six Mobile Basin Aquatic Snails. Page 6. Available at: http://ecos.fws.gov/docs/recovery_plan/051202.pdf
Painted rocksnail (*Leptoxis taeniata*)	The painted rocksnail is currently known from the lower reaches of three Coosa River tributaries-- Choccolocco Creek, Talladega County; Buxahatchee Creek, Shelby County (Bogan and Pierson, 1993a); and Ohatchee Creek, Calhoun County, Alabama (Pierson in litt, 1993). Painted rocksnails are found attached to cobble, gravel, or other hard substrates in the strong currents of riffles (a shallow area in a streambed that causes ripples in the water) and shoals. Adult rocksnails move very little, and females probably glue	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2005. Final Recovery Plan for Six Mobile Basin Aquatic Snails. Page 10. Available at: http://ecos.fws.gov/docs/recovery_plan/051202.pdf

	their eggs to stones in the same habitat (Goodrich, 1922).		
Plicate rocksnail (*Leptoxis plicata*)	Plicate rocksnails inhabit shallow gravel and cobble shoals in flowing waters.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2005. Final Recovery Plan for Six Mobile Basin Aquatic Snails. Page 14. Available at: http://ecos.fws.gov/docs/recovery_plan/051202.pdf
Round rocksnail (*Leptoxis ampla*)	The round rocksnail is currently known from a shoal series in the Cahaba River, Bibb and Shelby counties, Alabama, and from the lower reach of the Little Cahaba River, and the lower reaches of Shade and Six-mile creeks in Bibb County, Alabama (Bogan and Pierson, 1993b). Painted rocksnails are found attached to cobble, gravel, or other hard substrates in the strong currents of riffles (a shallow area in a streambed that causes ripples in the water) and shoals. Adult rocksnails move very little, and females probably glue their eggs to stones in the same habitat (Goodrich, 1922).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2005. Final Recovery Plan for Six Mobile Basin Aquatic Snails. Page 12. Available at: http://ecos.fws.gov/docs/recovery_plan/051202.pdf
Slender campeloma (*Campeloma decampi*)	*Campeloma decampi* is typically found burrowing in soft sediment (sand and/or mud) or detritus. It does not appear abundant at any site, and the spotty distribution appears	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS 2000. Endangered Status for the Armored Snail and Slender Campeloma; Final Rule. Page 10034. Available at: http://ecos.fws.gov/docs/federal_register/fr3525.pdf

	consistent with other Campeloma species		
Interrupted (=Georgia) Rocksnail (*Leptoxis foremani*)	Rocksnails live in shoals, riffles, and reefs (bedrock outcrops) of small to large rivers. Their habitats are generally subject to moderate currents during low flows and strong currents during high flows. These snails live attached to bedrocks, boulders, cobbles, and gravel and tend to move little, except in response to changes in water level. They lay their adhesive eggs within the same habitat (Johnson 2004, p.116).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2010. Determination of Endangered Status for the Georgia Pigtoe Mussel, Interrupted Rocksnail, and Rough Hornsnail and Designation of Critical Habitat; Final Rule. Page 67513. Available at: http://www.gpo.gov/fdsys/pkg/FR-2010-11-02/pdf/2010-27417.pdf#page=2
Hungerford's crawling water Beetle (*Brychius hungerfordi*)	River/stream(moderate to fast flow), depth of few inches to few feet, inorganic substrate. (USFWS 2009, p 5) 1st, 2nd and 3rd order perennial streams (USFWS 2006, p 22)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	US FWS, Hungerford's crawling water Beetle (*Brychius hungerfordi*) 5 Year Review, 2009 Available at: http://ecos.fws.gov/docs/five_year_review/doc2584.pdf US FWS, Hungerford's crawling water Beetle (*Brychius hungerfordi*) Recovery Plan, 2006 Available at: http://ecos.fws.gov/docs/recovery_plan/060928a.pdf
Coffin Cave mold beetle (*Batrisodes texanus*)	Troglobitic habitat includes caves and mesocavernous voids in karst limestone (a terrain characterized by landforms and subsurface features, such as sinkholes	The proposed dicamba DGA uses are not expected to overlap with caves.	US FWS-Coffin Cave Mold Beetle (*Batrisodes texanus*) 5-Year Review: Summary and Evaluation Page 2 Available at: http://ecos.fws.gov/docs/five_year_review/doc3017.pdf

Kretschmarr Cave mold beetle (*Texamaurops reddelli*)	Their habitat includes caves and mesocavernous voids in karst limestone (a terrain characterized by landforms and subsurface features, such as sinkholes and caves, which are produced by solution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	US FWS-Tooth Cave Spider (*Neoleptoneta myopica*),Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*), and Tooth Cave Pseudoscorpion (*Tartarocreagris texana*) 5-Year Review: Summary and Evaluation Page 2 Available at: http://ecos.fws.gov/docs/five_year_review/doc3018.pdf
Tooth Cave ground beetle (*Rhadine persephone*)	They spend their entire lives underground and are endemic to karst formations (caves, sinkholes, and other subterranean voids).	The proposed dicamba DGA uses are not expected to overlap with caves.	US FWS-Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas Page III Available at: http://ecos.fws.gov/docs/recovery_plan/940825.pdf
Comal Springs riffle beetle (*Heterelmis comalensis*)	High quality unpolluted groundwater and spring outflows that have low levels of salinity and turbidity. High-quality discharge water from springs and adjacent subterranean areas also help sustain habitat components, such as riparian vegetation that are essential to the Peck's cave amphipod, Comal Springs dryopid beetle, and Comal Springs riffle beetle. The two beetle species are thought to require water with adequate levels of dissolved oxygen for respiration (Brown 1987, p. 260; Arsuffi 1993, p. 18).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2006. Designation of Critical Habitat for the Peck's Cave Amphipod, Comal Springs Dryopid Beetle, and Comal Springs Riffle Beetle; Proposed Rule. Page 40592. Available at: http://www.gpo.gov/fdsys/search/citation.result.FR.action?federalRegister.volume=2006&federalRegister.page=40588&publication=FR
Comal Springs dryopid beetle (*Stygoparnus comalensis*)	High quality unpolluted groundwater and spring outflows that have low levels of salinity and turbidity. High-quality discharge water from springs and adjacent subterranean areas also	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2006. Designation of Critical Habitat for the Peck's Cave Amphipod, Comal Springs Dryopid Beetle, and Comal Springs Riffle Beetle; Proposed Rule. Page 40592. Available at:

	help sustain habitat components, such as riparian vegetation that are essential to the Peck's cave amphipod, Comal Springs dryopid beetle, and Comal Springs riffle beetle. The two beetle species are thought to require water with adequate levels of dissolved oxygen for respiration (Brown 1987, p. 260; Arsuffi 1993, p. 18).		http://www.gpo.gov/fdsys/search/citation.result.FR.action?federalRegister.volume=2006&federalRegister.page=40588&publication=FR
Saint Francis' satyr butterfly (*Neonympha mitchellii francisci*)	The habitat occupied by this satyr consists primarily of wide wet meadows dominated by a high diversity of sedges (Carex spp.) and other wetland graminoids	The proposed dicamba DGA uses are not expected to overlap with wet meadows.	US FWS-Recovery Plan for Saint Francis' Satyr Butterfly Page 2 Available at: http://ecos.fws.gov/docs/recovery_plan/960423.pdf
[Unnamed] ground beetle (*Rhadine infernalis*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi (comments - 7). Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Helotes mold beetle (*Batrisodes venyivi*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi (comments - 7). Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
[Unnamed] ground beetle (*Rhadine exilis*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi (comments - 7). Available at:

	caves, produced by dissolution of bedrock)		http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Bee Creek Cave harvestman (*Texella reddelli*)	Bee Creek Cave Harvestman inhabit limestone caves. They are only able to survive in caves that maintain stable temperatures and humidity (close to 100%). They have been found in caves both on the north and south side of the Colorado river. They live in 'karst' type of terrain , which is formed by "dissolution of calcium carbonate from limestone bedrock by mildly acidic groundwater.	The proposed dicamba DGA uses are not expected to overlap with caves.	USFWS-Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas U.S. Fish and Wildlife Service Page III Available at: http://ecos.fws.gov/docs/recovery_plan/940825.pdf
Bone Cave harvestman (*Texella reyesi*)	Caves and mesocavernous voids in karst limestone	The proposed dicamba DGA uses are not expected to overlap with caves.	USFWS Bone Cave Harvestman 5-Year Review Page 2 Available at: http://ecos.fws.gov/docs/five_year_review/doc3016.pdf
Tooth Cave pseudoscorpion (*Tartarocreagris texana*)	Their habitat includes caves and mesocavernous voids in karst limestone (a terrain characterized by landformsand subsurface features, such as sinkholes and caves, which are produced by solution of bedrock). There are currently four caves that support the Tooth Cave pseudoscorpion (*Tartarocreagris texana*).	The proposed dicamba DGA uses are not expected to overlap with caves.	US FWS-Tooth Cave Spider (*Neoleptoneta myopica*), Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*), and Tooth Cave Pseudoscorpion (*Tartarocreagris texana*) 5-Year Review: Summary and Evaluation Page 2 Available at: http://ecos.fws.gov/docs/five_year_review/doc3018.pdf

Tooth Cave Spider (*Leptoneta myopica*)	Their habitat includes caves and mesocavernous voids in karst limestone (a terrain characterized by landforms and subsurface features, such as sinkholes and caves, which are produced by solution of bedrock). There are currently six caves known to contain the Tooth Cave spider (*Neoleptoneta myopica*).	The proposed dicamba DGA uses are not expected to overlap with caves.	US FWS Tooth Cave Spider, Kretschmarr Cave Mold Beetle, and Tooth Cave Pseudoscorpion 5-Year Review Page 2 Available at: http://ecos.fws.gov/docs/five_year_review/doc3018.pdf
Cokendolpher Cave Harvestman (*Texella cokendolpheri*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Government Canyon Bat Cave Spider (*Neoleptoneta microps*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Madla's Cave Meshweaver (*Cicurina madla*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf

Robber Baron Cave Meshweaver (*Cicurina baronia*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Government Canyon Bat Cave Meshweaver (*Cicurina vespera*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Braken Bat Cave Meshweaver (*Cicurina venii*)	Caves and mesocavernous voids in karst limestone (landforms and subsurface features, for example, sinkholes and caves, produced by dissolution of bedrock)	The proposed dicamba DGA uses are not expected to overlap with caves.	U.S. Fish and Wildlife Service. 2011. Bexar County Karst Invertebrates Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM. Page vi Available at: http://ecos.fws.gov/docs/recovery_plan/Final%202001%20Bexar%20Co%20Invertebrates%20Rec%20Plan_1.pdf
Peck's cave amphipod (*Stygobromus (=Stygonectes) pecki*)	High quality unpolluted groundwater and spring outflows that have low levels of salinity and turbidity. High-quality discharge water from springs and adjacent subterranean areas also help sustain habitat components, such as riparian vegetation that are essential to the Peck's cave amphipod, Comal Springs dryopid beetle, and Comal Springs riffle beetle. The two beetle species	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2006. Designation of Critical Habitat for the Peck's Cave Amphipod, Comal Springs Dryopid Beetle, and Comal Springs Riffle Beetle; Proposed Rule. Page 40592. Available at: http://www.gpo.gov/fdsys/search/citation.result.FR.action?federalRegister.volume=2006&federalRegister.page=40588&publication=FR

	are thought to require water with adequate levels of dissolved oxygen for respiration (Brown 1987, p. 260; Arsuffi 1993, p. 18).		
Alabama cave shrimp (*Palaemonias alabamae*)	Silt-bottomed cave pools (USFWS 1997)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	US FWS, Alabama Cave Shrimp (*Palaemonias_alabamae)* 5 year review, 2006. Available at: http://ecos.fws.gov/docs/five_year_review/doc747.pdf US FWS, Alabama Cave Shrimp (*Palaemonias_alabamae*) recovery plan, 1997. Available at: http://ecos.fws.gov/docs/recovery_plan/970904.pdf
Kentucky cave shrimp *(Palaemonias ganteri)*	Very specific habitat requirements- large, base level passages of caves characterized by slow flow, abundant organic matter, and coarse to fine grain sand and coarse silt sediments.	The proposed dicamba DGA uses are not expected to overlap with caves.	US FWS, Kentucky Cave shrimp completed 5-year review, 2010. Page 5. Available at: http://ecos.fws.gov/docs/five_year_review/doc3203.pdf
Diminutive Amphipod (*Gammarus hyalleloides*)	Amphipods in the *Gammarus pecos* species complex occur only in desert spring outflow channels on substrates, often within interstitial spaces on and underneath rocks and within gravels (Lang et al. 2003, p. 49) and are most commonly found in microhabitats with flowing water. They are also commonly found in dense stands of submerged vegetation (Cole 1976, p. 80). Because of their affinity for constant water	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2013. Determination of Endangered Species Status for Six West Texas Aquatic Invertebrates: Final Rule. Page 41238. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-07-09/pdf/2013-16222.pdf

	temperatures, they are most common in the immediate spring outflow channels, usually only a few hundred meters downstream of spring outlets.		
Alabama pearlshell (*Margaritifera marrianae*)	The Alabama pearlshell typically inhabits small headwater streams with mixed sand and gravel substrates, occasionally in sandy mud, with slow to moderate current.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61667
Altamaha Spinymussel (*Elliptio spinosa*)	This spinymussel is considered a ‘‘big river’’ species; is associated with stable, coarse-to-fine sandy sediments of sandbars, sloughs, and mid-channel islands; and appears to be restricted to swiftly flowing water (Sickel 1980, p. 12).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2011. Endangered Status for the Altamaha Spinymussel and Designation of Critical Habitat; Final Rule. Page 62928
Carolina heelsplitter (*Lasmigona decorata*)	It has been recorded from a variety of substrates (including mud, clay, sand, gravel, and cobble/boulder/ bedrock) without significant silt accumulations, along stable, well-shaded stream banks (Keferl and Shelly 1988, Keferl 1991). However, individuals have also been found near the center of the stream channel in relatively silt-free substrates comprised primarily of a mixture of sand, gravel, and cobble, with scattered areas of	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	http://ecos.fws.gov/docs/life_histories/F02L.html

	exposed boulders/ bedrock (J. Fridell personal observation, 1995).		
Chipola slabshell (*Elliptio chipolaensis*)	The Chipola slabshell inhabits silty sand substrates of large creeks and the main channel of the Chipola River in slow to moderate current (Williams and Butler 1994). Specimens are generally found in sloping bank habitats. Nearly 70 percent of the specimens found during the status survey were associated with a sandy substrate (Brim Box and Williams 2000).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 43. http://ecos.fws.gov/docs/recovery_plan/030930.pdf
Choctaw bean (*Villosa choctawensis*)	It is found in medium creeks to medium rivers in stable substrates of silty sand to sandy clay with moderate current.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61669
Cracking pearlymussel (*Hemistena lata*)	The cracking pearlymussel inhabits streams of moderate size on gravel riffles where it is often deeply buried in the substrate (Bogan and Parmalee 1983). Substrate preferences include sand, gravel, and cobble in high velocity areas and mud and sand in slower moving waters (Gordon and Layzer 1989).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	http://ecos.fws.gov/docs/life_histories/F01X.html

Cumberland elktoe (*Alasmidonta atropurpurea*)	This species inhabits medium-sized rivers and may extend into headwater streams where it is often the only mussel present (Gordon and Layzer 1989, Gordon 1991). Gordon and Layzer (1989) reported that the species appears to be most abundant in flats, which were described by Gordon (1991) as shallow pool areas lacking the bottom contour development of typical pools, with sand and scattered cobble/boulder material, relatively shallow depths, and slow (almost imperceptible) currents. They also report the species from swifter currents and in areas with mud, sand, and gravel substrates.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2004. Cumberland and Tennessee River Mussels (5 spp.) Page 18.
Dark pigtoe (*Pleurobema furvum*)	Sand/gravel/cobble shoals and rapids in small rivers and large streams.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2000. Recovery Plan for the Mobile River Basin (15 species). Page 53
Dwarf wedgemussel (*Alasmidonta heterodon*)	The dwarf wedge mussel lives on muddy sand, sand, and gravel bottoms in creeks and rivers of varying sizes, in areas of slow to moderate current and little silt deposition.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1993. Dwarf Wedge Mussel recovery plan. Page 3.
Fat three-ridge (mussel) (*Amblema neislerii*)	The fat threeridge inhabits the main channel of small to large rivers in slow to moderate current. Substrate used by this mussel varies from gravel to cobble to a	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 42. http://ecos.fws.gov/docs/recovery_plan/030930.pdf

	mixture of sand and sandy mud (Williams and Butler 1994). Brim Box and Williams (2000) found 60 percent of the specimens were located in a sandy silt substrate.		
Flat pigtoe (*Pleurobema marshalli*)	The flat pigtoe, like other Tombigbee River system mussels, inhabits moderate to large rivers with moderate to swift current. Its preferred habitat is riffle-run or shoal areas with stable substrates ranging from sandy gravel to gravel-cobble (Stanbery 1976, 1980, 1983). Unionids collected from the Tombigbee River system have been collected in water up to 0.7 meters deep (USFWS 1987).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	http://ecos.fws.gov/docs/life_histories/F013.html
Fuzzy pigtoe (*Pleurobema strodeanum*)	The fuzzy pigtoe is found in medium creeks to medium rivers in stable substrates of sand and silty sand with slow to moderate current.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61673
Gulf moccasinshell (*Medionidus penicillatus*)	The Gulf moccasinshell inhabits the channels of small to medium-sized creeks to large rivers with sand and gravel or silty sand substrates in slow to moderate currents (Williams and Butler 1994; Garner, pers. comm. 2003).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 43. http://ecos.fws.gov/docs/recovery_plan/030930.pdf

Heavy pigtoe (*Pleurobema taitianum*)	The heavy pigtoe, like other Tombigbee River system mussels, inhabits moderate to large rivers with moderate to swift current. Its preferred habitat is riffle-run or shoal areas with stable substrates ranging from sandy gravel to gravel-cobble (Stanbery 1976, 1980, 1983). Unionids collected from the Tombigbee River system have been collected in water up to 0.7 meters deep (USFWS 1987).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	http://ecos.fws.gov/docs/life_histories/F014.html
James spinymussel (*Pleurobema collina*)	This species lives in stream sites that vary in width from 10-75 feet and depth of 1/2 to 3 feet. It requires a slow to moderate water current with clean sand and cobble bottom sediments. The James spinymussel is limited to areas of unpolluted water, and may be more susceptible to competition from exotic clam species when its habitat is disturbed (Clark and Neves 1984, USFWS 1990).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	http://ecos.fws.gov/docs/life_histories/F025.html
Narrow pigtoe (Fusconaia escambia)	It is found in medium creeks to medium rivers, in stable substrates of sand, sand and gravel, or silty sand, with slow to moderate current.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61671

Ochlockonee moccasinshell (*Medionidus simpsonianus*)	The Ochlockonee moccasinshell inhabits large creeks and the Ochlockonee River main stem in areas with current. Typical substrates are sand with some gravel (Williams and Butler 1994).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 43. http://ecos.fws.gov/docs/recovery_plan/030930.pdf
Oval pigtoe (*Pleurobema pyriforme*)	The oval pigtoe occurs in small to medium-sized creeks to small rivers where it inhabits silty sand to sand and gravel substrates, usually in slow to moderate current (Williams and Butler 1994; Garner, pers. comm. 2003). Stream channels appear to offer the best habitat for this species.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 43. http://ecos.fws.gov/docs/recovery_plan/030930.pdf
Purple bankclimber (mussel) (*Elliptoideus sloatianus*)	The purple bankclimber inhabits small to large river channels in slow to moderate current over sand or sand mixed with mud or gravel substrates (Williams and Butler 1994).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 43. http://ecos.fws.gov/docs/recovery_plan/030930.pdf
Ring pink (mussel) (*Obovaria retusa*)	The ring pink inhabits gravel and sandy substrates in large rivers of the Ohio River basin	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS, 1991. Ring Pink Mussel Recovery Plan. Page 4. http://ecos.fws.gov/docs/recovery_plan/910325.pdf
Round Ebonyshell (*Fusconaia rotulata*)	It occurs in small to medium rivers, typically in stable substrates of sand, small gravel, or sandy mud in slow to moderate current.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61668

Shinyrayed pocketbook (*Lampsilis subangulata*)	The shinyrayed pocketbook inhabits small to medium-sized creeks, to rivers in clean or silty sand substrates in slow to moderate current (Williams and Butler 1994; Garner, pers. comm. 2003). Specimens are often found in the interface of stream channel and sloping bank habitats, where sediment particle size and current strength are transitional. Clench and Turner (1956) noted it preferred small creeks and spring-fed rivers.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2003. Recovery Plan for 7 mussels. Page 42. http://ecos.fws.gov/docs/recovery_plan/030930.pdf
Southern acornshell (*Epioblasma othcaloogensis*)	The southern acornshell was historically restricted to shoals in small rivers to Small streams above the Fall Line. It was found on stable sand/gravel/cobble substrate in moderate to swift currents.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2000. Recovery Plan for the Mobile River Basin (15 species). Page 57
Southern kidneyshell (*Ptychobranchus jonesi*)	It is typically found in medium creeks to small rivers in firm sand substrates with slow to moderate current (Williams et al. 2008, pp. 625).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61668
Southern sandshell (*Hamiota (=Lampsilis) australis)*	The southern sandshell is typically found in small creeks and rivers in stable substrates of sand or mixtures of sand and fine gravel, with slow to moderate current.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61672

Tapered pigtoe (*Fusconaia burkei*)	The tapered pigtoe is found in medium creeks to medium rivers in stable substrates of sand, small gravel, or sandy mud, with slow to moderate current (Williams et al. 2008, p. 296).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat: Final rule. Page 61670
Tar River spinymussel (*Elliptio steinstansana*)	The preferred habitat of the Tar spinymussel appears to be relatively fast-flowing, well-oxygenated water, in sites with a substrate comprised of relatively silt-free, uncompacted gravel and coarse sand (USFWS 1992).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	http://ecos.fws.gov/docs/life_histories/F015.html
Upland combshell (*Epioblasma metastriata*)	Restricted to shoals in rivers and large streams above the Fall Line. It was found on stable sand/gravel/cobble substrate in moderate to swift currents.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2000. Recovery Plan for the Mobile River Basin (15 species). Page 61
Yellow blossom (pearlymussel) (*Epioblasma florentina florentina*)	Riverine and typically found in streams which are shallow with sandy-gravel substrate with rapid currents (Stansbery, 1971)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1985. Recovery plan for three mussels. Page 20. http://ecos.fws.gov/docs/recovery_plan/850125.pdf
Alabama cavefish (*Speoplatyrhinus poulsoni*)	The only known locality at which the Alabama cavefish occurs is Key Cave in Lauderdale county, Alabama. Low temperature and periodic flooding are characteristic of the aquatic habitat in caves (USFWS 1990)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1990. Alabama cavefish recovery plan. Page 2. Available online at: http://ecos.fws.gov/docs/recovery_plan/901025.pdf

Alabama sturgeon (*Scaphirhynchus suttkusi*)	Very little is known of the habitat requirements of the Alabama Sturgeon. Based on capture data, it inhabits the main channel of large coastal plain rivers of the Mobile River Basin. Most specimens have been taken in moderate to swift current at depths of 6 to 14 m, over sand, gravel or mud bottom (Williams and Clemmer 1991). (USFWS 2013)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2013. Recovery Plan for the Alabama Sturgeon (*Scaphirhynchus suttkusi*). Page 13.
Big Bend gambusia (*Gambusia gaigei*)	The Big Bend gambusia is restricted to small, desert spring habitats. The spring ponds at Rio Grande Village that harbor the fish are clear warm water, stenothermal (constant temperature) springs. Hubbs (2001, pp. 315-316) documented the average outflow temperatures of Spring 4 and Spring 1 as 34.9 ºC (95ºF) and 33.1ºC (92ºF), respectively, with very low variability. The Big Bend gambusia is often found associated with dense stands of Chara spp. (submerged plant) and emergent vegetation in the refuge ponds (Hubbs et al. 2002, p. 82).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2012. Big Bend gambusia - 5 year review. Page 8.
Cahaba shiner (*Notropis cahabae*)	The habitat of the Cahaba shiner appears to be large shoal areas in the main channel of the Cahaba river (Howell et al. 1982). The species is found in the quieter waters, less	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1992. Cahaba shiner (*Notropis cahabae*) Recovery plan. Pages 1-3. Available at: http://ecos.fws.gov/docs/recovery_plan/920423.pdf

	than 1.6 feet (0.5 meters) deep, just below swift riffle areas (Howell et al. 1982). The Cahaba shiner seems to prefer sandy patches in gravel beds or downstream of larger rocks and boulders. The species is generally found in relatively clear, well oxygenated water. It probably requires a river with sufficient small crustaceans, insect larvae, and algae for food, similar to its close relatives (Gilbert and Burgess 1980). (USFWS 1992)		
Cape Fear shiner (*Notropis mekistocholas*)	The Cape Fear shiner is generally associated with gravel, cobble, and boulder substrate, and it has been observed inhabiting slow pools, riffles, and slow runs often associated with water willow (Justicia) beds (Palmer and Braswell, North Carolina State Museum of Natural History, personal communication, 1986; Pottern and Huish 1985, 1986; Snelson 1971).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1988. Cape Fear shiner Recovery Plan. Page 1. Available at: http://ecos.fws.gov/docs/recovery_plan/060313.pdf
Cherokee darter (*Etheostoma scotti*)	Cherokee darters inhabit small to medium size warm-water creeks of moderate gradient with predominantly rocky bottoms. They are usually found in shallow water sections of reduced currents typically in areas above and below riffles and at the ecotones of riffles	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1994. ETWP; Determination of Threatened Status for the Cherokee Darter and Endangered Status for the Etowah Darter. Page 65506.

	and backwaters. Moreover, this species as associated with large gravel, cobble, and small boulder substrates, and is uncommonly, or rarely found over bedrock, fine gravel, or sand. It is most abundant in stream sections with relatively clear water and clean substrates (little Silt deposition). (USFWS 1994) The Cherokee darter is endemic to the Etowah River system in north Georgia where it is primarily restricted to streams draining the Piedmont physiographic province, and to a lesser extent, the Blue Ridge physiographic province. (USFWS 1994)		
Clear Creek gambusia (*Gambusia heterochir*)	This species is restricted to the Clear Creek headspring pool that is characterized as clear, stenothermal, low pH (6.1 - 6.5) water with abundant aquatic vegetation composed mostly of an endemic, undescribed morph of *Ceratophyllum sp*.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1982. Recovery Plan for Clear Creek Gambusia. Pages 2-3. Life Histories: Clear Creek Gambusia (Gambusia heterochir). http://ecos.fws.gov/docs/life_histories/E005.html
Comanche Springs pupfish (*Cyprinodon elegans*)	The present habitat of the species consists mostly of a system of earthen and concrete irrigation canals. The water from Phantom Lake Spring is diverted into agricultural fields or sometimes flows down Phantom Lake Canal to merge with the	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1981. Recovery Plan for the Comanche Springs Pupfish. Page 2. Available at: http://ecos.fws.gov/docs/recovery_plan/051221a.pdf

	flow from San Solomon Spring.		
Devils River minnow (*Dionda diaboli*)	(1) Streams characterized by: a. Areas with slow to moderate water velocities between 10 and 40 cm/second (4 and 16 in/second) in shallow to moderate water depths between approximately 10 cm (4 in) and 1.5 m (4.9 ft), near vegetative structure, such as emergent or submerged vegetation or stream bank riparian vegetation that overhangs into the water column; b. Gravel and cobble substrates ranging in diameter between 2 and 10 cm (0.8 and 4 in) with low or moderate amounts of fine sediment (less than 65 percent stream bottom coverage) and low or moderate amounts of substrate embeddedness; and c. Pool, riffle, run, and backwater components free of artificial instream structures that would prevent movement of fish upstream or downstream. (2) High-quality water provided by permanent, natural flows from groundwater springs	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2008. Designation of Critical Habitat for the Devils River Minnow; Final rule. 73 FR 46988 47026. Page 47001. Available at: http://www.gpo.gov/fdsys/pkg/FR-2008-08-12/pdf/E8-17985.pdf#page=1

	and seeps characterized by: a. Temperature ranging between 17°C and 29°C; b. Dissolved oxygen levels greater than 5.0 mg/l; c. Neutral pH ranging between 7.0 and 8.2; d. Conductivity less than 0.7 mS/cm and salinity less than 1 ppt; e. Ammonia levels less than 0.4 mg/l; and f. No or minimal pollutant levels for copper, arsenic, mercury, and cadmium; human and animal waste products; pesticides; fertilizers; suspended sediments; and petroleum compounds and gasoline or diesel fuels. (3) Abundant aquatic food base consisting of algae; attached to stream substrates; and other microorganisms associated with stream substrates. (4) Aquatic stream habitat either devoid of nonnative aquatic species (including fish, plants, and invertebrates) or in which such nonnative aquatic species are at levels that allow for healthy populations of Devils River minnows. (5) Areas within stream courses that may be periodically dewatered for short time periods,		

	during seasonal droughts, but otherwise serve as connective corridors between occupied or seasonally occupied areas through which the species moves when the area is wetted. (USFWS 2008)		
Etowah darter (*Etheostoma etowahae*)	The Etowah darter inhabits warm and cool, medium and large creeks or small rivers that are moderate or high gradient with rocky bottoms and relatively shallow riffles and large gravel, cobble, and small boulder substrates. (USFWS 1994)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	1994. USFWS ETWP; Determination of Threatened Status for the Cherokee Darter and Endangered Status for the Etowah Darter. Page 65506. Available at: http://ecos.fws.gov/docs/federal_register/fr2753.pdf
Fountain darter (*Etheostoma fonticola*)	The fountain darter requires: 1) undisturbed stream floor habitats (including runs, riffles, and pools), 2) a mix of submergent vegetation (algae, mosses, and vascular plants) in part for cover, 3) clear and clean water, 4) constant water temperatures within the natural and normal river gradients, and 5) most importantly, adequate springflows. In general, E. fonticola prefers vegetated stream-floor habitats with constant water temperature. Higher densities of the fish are found in mats of the filamentous green algae (*Rhizoclonium sp.*) and the moss Riccia. It is occasionally found in areas lacking vegetation. Fountain	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1996. San Marcos and Comal springs and associated aquatic ecosystems (revised) recovery plan. Page 33. Available at: http://ecos.fws.gov/docs/recovery_plan/960214.pdf

	darters have also been observed among leaf litter in the Comal River. (USFWS 1996)		
Goldline darter (*Percina aurolineata*)	Prefers a moderate to swift current and water depths greater than 2 feet (Howell et al. 1982). It is found over sand or gravel substrate interspersed among cobble and small boulders. (USFWS 1992)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	1992. USFWS ETWP; Threatened Status for Two Fish, the Goldline Darter (*Percina aurolineata*) and Blue Shiner (*Cyprinella caerulea*). Page 14786. http://ecos.fws.gov/docs/federal_register/fr2036.pdf
Leon Springs pupfish (*Cyprinodon bovinus*)	The Leon Springs pupfish inhabits highly saline habitat preferring quiet waters near the edge of shallow pools with a minimal growth of vegetation. (USFWS 1980)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	1980. USFWS ETWP; Listing of Leon Springs pupfish as endangered with critical habitat. Page 14786. http://ecos.fws.gov/docs/federal_register/fr457.pdf
Palezone shiner (*Notropis albizonatus*)	The palezone shiner occurs in flowing pools and runs of upland streams that have permanent flow, clear water, and substrates composed of bedrock, cobble, pebble, and gravel mixed with clean sand (USFWS 1997). In May 1990, Warren et al. (1994) collected the species in the PRR from pools (60-75 cm depth) over fine to coarse gravel mixed with sand. In June 1990, Warren et al. (1994) observed the species in shallow (30-45 cm, 1.2-1.8 in) runs and pools of the Little South Fork that were underlain by fractured bedrock and scattered gravel patches. In	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2014. Palezone shiner (*Notropis albizonatus*) 5-year review: summary and evaluation. US Fish and Wildlife Service Southest Region Kentucky Ecological Services Field Office John C. Watts Federal Building 330 West Broadway, Room 265 Frankfort Kentucky, 40601. Page 8. http://ecos.fws.gov/docs/five_year_review/doc4374.pdf

	August 1990, they collected individuals in the Little South Fork from pools and runs with current velocities ranging from 0.6-4.5 cm/sec (0.02-0.15 feet/sec) and mean depth of 59 cm (2.3 in). Substrates varied from sand mixed with fine and coarse gravel to bedrock. Shepard et al. (1997) reported the species from pools and runs of the PRR that had substrates composed of a mixture of cobble, gravel, and sand. Water depths ranged from 30.5-76.2 cm (12-30 in). (USFWS 2014)		
Pecos gambusia (*Gambusia nobilis*)	*Gambusia nobilis* occurs abundantly in springheads and spring runs. Moderately abundant populations are also known from areas with little spring influence, but with abundant overhead cover, sedge covered marshes, and gypsum sinkholes. *G. nobilis* has been observed to occur from the surface to depths of three meter.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS ECOS Life Histories for the Pecos gambusia (*Gambusia nobilis*) http://ecos.fws.gov/docs/life_histories/E00V.html
Pygmy Sculpin (*Cottus paulus (=pygmaeus)*)	Gravel and sand substrate. Habitat also contains large rocks where the spring boils occur.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	Life Histories: Pygmy sculpin (*Cottus paulus (=pygmaeus)*). http://ecos.fws.gov/docs/life_histories/E01L.html
Relict darter (*Etheostoma chienense*)	Adults are concentrated in headwaters of streams in slow flowing pools (0.2-0.6 m/sec), usually over gravel mixed with sand and under or near cover	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	2013. US Fish and Wildlife Service Southeast Region, Relict darter (*Etheostoma chienense*) Five Year Review Summary and Evaluation, Page 8.

	such as fallen tree branches, undercut banks, or overhanging riparian vegetation. (USFWS 2013)		https://ecos.fws.gov/docs/five_year_review/doc4178.pdf
Rush Darter (*Etheostoma phytophilum*)	Habitats tend to be shallow, clear, and cool, with moderate current and substrates composed of a combination of sand with silt, muck, gravel or bedrock. (USFWS 2012)	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	Fish and Wildlife Service Department of the Interior, 2012, Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Cumberland darter, Rush darter, Yellowcheek darter, Chucky madtom, and Laurel dace, Volume 77 No. 200, Page 63605 http://www.gpo.gov/fdsys/pkg/FR-2012-10-16/pdf/2012-24468.pdf
San Marcos gambusia (*Gambusia georgei)*	The San Marcos gambusia apparently prefers quiet waters adjacent to sections of moving water, but seemingly of greatest importance, thermally constant waters. *G. georgei* is found mostly over muddy substrates but generally not silted habitats, and shade from over-hanging vegetation or bridge structures is a factor common to all sites along the upper San Marcos River where apparently suitable habitats for this species occur (Hubbs and Peden 1969, Edwards et. al. 1980).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 1996. San Marcos and Comal springs and associated aquatic ecosystems (revised) recovery plan. Page 29. Available at: http://ecos.fws.gov/docs/recovery_plan/960214.pdf
Sharpnose Shiner (*Notropis oxyrhynchus)*	Sharpnose shiners occur in fairly shallow, flowing water, often less than 0.5 m (1.6 ft) deep with sandy substrates… minimum estimated reach length	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS 2014. Designation of Critical Habitat for Sharpnose Shiner and Smalleye Shiner; Final Rule. Page 45250.

	requirements for similar species and current modeling efforts for this species indicate an unobstructed reach length of greater than 275 km (171 mi) is likely required to complete the species' life history.		
Shortnose sturgeon (*Acipenser brevirostrum*)	Shortnose sturgeon are found in rivers, estuaries, and the sea, but populations are confined mostly to natal rivers and estuaries. The species appears to be estuarine anadromous in the southern part of its range, but in some northern rivers it is "freshwater amphidromous", i.e., adults spawn in freshwater but regularly enter saltwater habitats during their life (Kieffer and Kynard 1993). Adults in southern rivers forage at the interface of fresh tidal water and saline estuaries and enter the upper reaches of rivers to spawn in early spring (Savannah River: Hall et al. 1991; Altamaha River: Heidt and Gilbert 1979; Flouronoy et al. 1992, Rogers and Weber 1995a; Ogeechee River: Weber 1996).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	NMFS 1998. Final Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Page 25. Available at: http://ecos.fws.gov/docs/recovery_plan/sturgeon_shortnose_1.pdf

Smalltooth sawfish (*Pristis pectinata*)	Generally inhabit the shallow coastal waters of bays, banks, estuaries and river mouths, particularly shallow mud banks and mangrove habitats. Larger animals can be found in the same habitat, but are also found offshore at depths up to least 122 meters.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	National Marine Fisheries Service, 2009, Smalltooth sawfish Recovery Plan. Page v. http://ecos.fws.gov/docs/recovery_plan/smalltoothsawfish.pdf
Sunfish, spring pygmy (*Elassoma alabamae*)	Clear to slightly stained spring water, occurring within spring heads (where cool water emerges from the ground), spring pools (water pool at spring head), spring runs (stream or channel downstream of spring pool), and associated spring-fed wetlands… occupying depths from 13 to 102 cm (in water column)… prefers patches of dense filamentous submergent vegetation	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	Endangered and Threatened Wildlife and Plants; Threatened Species Status for Spring Pygmy Sunfish, Federal Register, 2013, 78(191): 60766-60783. Page 60768. http://www.gpo.gov/fdsys/pkg/FR-2013-10-02/pdf/2013-23726.pdf
Vermilion darter (*Etheostoma chermocki)*	Small to medium-sized clear streams, with gravel riffles and moderate currents (Kuehne and Barbour, 1983; Etnier and Starnes, 1993). Boschung et al. (1992) described the stream habitat for vermilion darters as 3 to 20 m wide, 0.01 to more than 0.5 m in depth, with pools of moderate current alternating with riffles of moderately swift current, and low water turbidity. Blanco and Mayden (1999) found this species	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	Daniel J Drennen and the Vermilion Darter Recovery Team / US Fish and Wildlife Service Department of Interior, 2007, Recovery Plan Vermilion Darter, Page 11 http://ecos.fws.gov/docs/recovery_plan/070802.pdf

	primarily in areas dominated by fine gravel with some coarse gravel or cobble. This species is absent in habitats with only a bedrock bottom, but has been found on bedrock with sand and gravel…This species is generally not found in deeper pool habitats.		
Waccamaw silverside (*Menidia extensa*)	The species is usually found in schools near the surface. It forages in areas of shallow, open water over a clean, dark sand substrate with no vegetation and spawn in open-water areas near the shoreline.	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS Life histories document. http://ecos.fws.gov/docs/life_histories/E01P.html
Watercress darter (*Etheostoma nuchale*)	Prefer deeper, slow moving backwater areas of springs that are choked with aquatic vegetation such as watercress (*Nasturtium*), and algae (*Chara* and *Spirogyra*).	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS Life Histories Watercress darter (*Etheostoma nuchale*) http://ecos.fws.gov/docs/life_histories/E00U.html

Species	Habitat	Rationale	Source
Plants			
Avens, spreading (*Geum radiatum*)	This species grows in full sun on the shallow acidic soils of high-elevation cliffs, rocky outcrops, steep slopes, and on gravelly talus (US FWS, 1993).	The proposed dicamba DGA uses are not expected to overlap with high-elevation cliffs, rocky outcrops, steep slopes or gravelly talus.	USFWS. 1993. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/930428.pdf
Bluet, Roan Mountain (*Hedyotis purpurea var. montana*)	This species grows in shallow soils and crevices of cliffs and outcrops and on thin rocky soils of grassy balds (US FWS, 1996).	The proposed dicamba DGA uses are not expected to overlap with cliffs and outcrops.	USFWS. 1996. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/960513.pdf

Species	Habitat	Rationale	Source
Chaffseed, American (*Schwalbea americana*)	Habitats described as pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems (US FWS, 1995).	The proposed dicamba DGA uses are not expected to overlap with pine flatwoods, fire-maintained savannas, wetland or sedge dominated systems.	USFWS. 1995. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/950929c.pdf
Clover, running buffalo (*Trifolium stoloniferum*)	Running buffalo clover occurs in mesic habitats of partial to filtered sunlight, where there is a prolonged pattern of moderate periodic disturbance, such as mowing, trampling, or grazing. It is most often found in regions underlain with limestone or other calcareous bedrock. Specific habitats include mesic woodlands, savannahs, floodplains, stream banks, sandbars, grazed woodlots, mowed paths (e.g. cemeteries, parks), old logging roads, jeep trails, ATV trails, skid trails, mowed wildlife openings within mature forest, and steep ravines. It has been suggested that the original habitat may have been open woods or savannah, and bison herbivory on associated species may have kept the habitats open (US FWS, 2007, p. 12.).	The proposed dicamba DGA uses are not expected to overlap with mesic habitats where the clover is expected to be found.	USFWS. 2007. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/070627.pdf

Species	Habitat	Rationale	Source
Daisy, Lakeside (*Hymenoxys herbacea*)	Although historical habitats include outcrops of dolomite or limestone bedrock, dry, gravelly prairies on terraces or hills associated with major river systems, rocky shores, sandy fields and alvars, the Lakeside daisy in the U. S. is now restricted to dry, thin-soiled, degraded prairies in which limestone or dolomite bedrock is at or near the surface. Habitats are alkaline, seasonally wet in spring and fall, and are moderately to extremely droughty in summer. Typically, habitats have little topographic relief, are relatively open at the ground surface, and vegetation density and diversity are relatively low. Within these habitats, lakeside daisy occurs in open patches of ground, occupies the dry to mesic portions of the soil moisture continuum and has a highly aggregated distribution. This species is either absent or infrequently found in shaded or densely vegetated areas (US FWS, 1990, pp. 20-21).	The proposed dicamba DGA uses are not expected to overlap with quarries and dry prairies.	USFWS. 1990. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/900919b.pdf
Fern, American hart's-tongue (*Asplenium scolopendrium var. americanum*)	Early successional habitats Northern populations occur in forests of secondary growth where canopy openings are abundant. New York populations	The proposed dicamba DGA uses are not expected to overlap early successional forests, conifer forests or bryophyte beds where the species is found.	http://ecos.fws.gov/docs/recovery_plan/930915.pdf

Species	Habitat	Rationale	Source
	occur in conifer forests. Bryophyte beds are an important substrate.		
Fleshy-fruit gladecress (*Leavenworthia crassa*) [2]	PCEs: (1) Shallow-soiled, open areas with exposed limestone bedrock or gravel that are dominated by herbaceous vegetation characteristic of glade communities. (2) Open or well-lighted areas of exposed limestone bedrock or gravel that ensure fleshy-fruit gladecress plants remain unshaded for a significant portion of the day. (3) Glade habitat that is protected from both native and invasive, nonnative plants to minimize competition and shading of fleshy-fruit gladecress.	Technical consultation with USFWS biologist indicated that this species will not persist in soy or cotton fields due to the competing vegetation.	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q12K#crithab http://www.gpo.gov/fdsys/pkg/FR-2014-08-26/pdf/2014-19558.pdf Email communication (Holbrook, S. (2015, June 17).
Geocarpon minimum (No common name)	This species grows on sandstone glades and outcrops as well as bare, sparsely vegetated areas where the soil contains relatively large amounts of magnesium and sodium salts (US FWS, 1993).	The proposed dicamba DGA uses are not expected to overlap with the sandstone glades and outcrops where this species is expected to be found.	USFWS. 1993. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/930726.pdf
Goldenrod, Blue Ridge (*Solidago spithamaea*)	This species grows on rock outcrops and vertical to near vertical cliffs in southern Appalachians of western North Carolina and extreme eastern TN. Rocky summits and cliffs usually appear as smaller-scale patchy habitats embedded in larger	The proposed dicamba DGA uses are not expected to overlap with rock outcrops and vertical cliffs.	USFWS. 1987. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/blueridge%20goldenrod%20rp.pdf

[2] Bold text indicates the four species with effects determination "may affect, likely to adversely affect".

Species	Habitat	Rationale	Source
	forest consisting of spruce-fir or northern hardwoods or occasionally high elevation red oak forest (US FWS, 1987).		
Grass, Tennessee yellow-eyed (*Xyris tennesseensis*)	*Xyris tennessensis* is a rare perennial monocot that is an obligate wetland plant that prefers relatively high pH seeps and streambanks. An Obligate wetland plant that is restricted to calcareous seeps, fens, and spring runs (US FWS, 2014).	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS. 2014. Five Year Review. http://ecos.fws.gov/docs/five_year_review/doc4360.pdf
Harperella (*Ptilimnium nodosum*)	Harperella is known from only two locations in North Carolina. One population occurs in the Tar River in Granville County. Another population was reintroduced to the Deep River recently after the original population known from that area disappeared. This population occurs in Chatham County, but the river serves as the divide between Chatham and Lee counties (US FWS, 1991).	The proposed dicamba DGA uses are not expected to overlap with river habitats.	USFWS. 1991. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/910305b.pdf
Iris, dwarf lake (*Iris lacustris*)	The dwarf lake iris grows along the northern shorelines of lakes Michigan and Huron in Wisconsin, Michigan and Ontario, Canada. It typically occurs in shallow soil over moist calcareous sands, gravel and beach rubble. Sunlight is one	The proposed dicamba DGA uses are not expected to overlap with shoreline coniferous forests.	USFWS. 2013. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/DLI%20RP%20FINAL%20AUG2013_1.pdf

Species	Habitat	Rationale	Source
	of the most critical factors to the growth and reproduction of the species and partly shaded or sheltered forest edges are optimal for sexual reproduction. Some form of disturbance is also required to maintain the forest openings that provide these partial shade conditions. The species is most often associated with shoreline coniferous forests dominated by northern white cedar and balsam fir. The principal limiting factor for dwarf lake iris is the availability of this suitable shoreline habitat (US FWS, 2013, pp. 6-7).		
Lichen, rock gnome (*Gymnoderma lineare*)	Rock gnome lichen is primarily limited to vertical rock faces where seepage water from forest soils above flows during (and only during) very wet times. It appears the species needs a moderate amount of light, but that it cannot tolerate high-intensity solar radiation. It does well on moist, generally open, sites, with northern exposures, but needs at least partial canopy coverage where the aspect is southern or western Rock gnome lichen is known from the Southern Appalachian	The proposed dicamba DGA uses are not expected to overlap with high elevation vertical rock faces where the species occurs.	http://www.fws.gov/raleigh/species/es_rock_gnome_lichen.html

Species	Habitat	Rationale	Source
	Mountains of North Carolina and South Carolina, Tennessee, and Georgia, in areas of high humidity, either at high elevations, where it is frequently bathed in fog, or in deep gorges at lower elevations.		
Lyrate bladderpod (*Lesquerella lyrata*)	Limestone glades	Technical consultation with USFWS biologist indicated that this species will not occur in corn, soy, or cotton fields within the range	http://ecos.fws.gov/docs/recovery_plan/961017.pdf Email communication (Holbrook, S. (2015, June 17).
Orchid, eastern prairie fringed (*Platanthera leucophaea*)	The eastern prairie fringed orchid occurs in a wide variety of habitats, from mesic prairie to wetland communities such as sedge meadows, marsh edges and even fens and sphagnum bogs. It requires full sunlight for optimum growth and flowering, which restricts it to grass- and sedge-dominated plant communities. The substrate of the sites where it occurs ranges from more or less neutral to mildly calcareous, typically glacial soils. It is often early successional, but can be maintained in mid- to late successional wetlands that remain open and sunny (US FWS, 1999, pp. 6-7).	The proposed dicamba DGA uses are not expected to overlap with grass or sedge-dominated plant communities.	USFWS. 1999. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/990929.pdf

Species	Habitat	Rationale	Source
Pogonia, small whorled (*Isotria medeoloides*)	The small whorled pogonia occurs on upland sites in mixed-deciduous or mixed deciduous/coniferous forests that are generally in second- or third-growth successional stages. It occurs on both fairly young and maturing forest stands. Most occurrences include sparse to moderate ground cover in the species' microhabitat, a relatively open understory canopy, and proximity to features that create long persisting breaks in the forest canopy. Soils at most sites are highly acidic and nutrient poor, with moderately high soil moisture values. Light availability could be a limiting factor for this species. The one Illinois site is unusual in being on a dry, steep, thinly forested slope atop a vertical sandstone bluff. The one Ohio site is along the Ohio River in a typical Appalachian-type forest association (US FWS, 1992, pp. 23-24).	The proposed dicamba DGA uses are not expected to overlap with mixed deciduous/coniferous forests.	USFWS. 1992. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/921113b.pdf
Pondberry (*Lindera melissifolia*)	Associated with seasonally flooded wetlands. Found on wet edges of sandy sinks, ponds, and swampy depressions. Shade tolerant (US FWS, 1993).	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS. 1993. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/930923a.pdf

Species	Habitat	Rationale	Source
Potato-bean, Price's (*Apios priceana*)	Found in open forests along the edges of forests, creeks, and rivers (US FWS, 1993, p. executive summary).	The proposed dicamba DGA uses are not expected to overlap with forests, or water bodies.	USFWS. 1993. Recovery Plan http://ecos.fws.gov/docs/recovery_plan/930210.pdf
Prairie-clover, leafy (*Dalea foliosa*)	Leafy prairie-clover is found only in open limestone cedar glades, limestone barrens, and dolomite prairies which have shallow, silt to silty clay loam soils over flat and often highly fractured, horizontally bedded limestone or dolomite with frequent expanses of exposed bedrock at surface. Elevations are typically between 550 and 700 feet. These habitats experience high surface and soil temperatures, generally have low soil moisture but are wet in the spring and fall and become droughty in summer. The distribution of glade, barren, and dry to wet dolomite prairie at any particular site varies and leads to a mosaic of soils and their associated plant communities (USFWS, 1996, p.13).	The proposed dicamba DGA uses are not expected to overlap with prairies or areas with visible bedrock.	USFWS. 1996. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/900919b.pdf
Quillwort, Louisiana (*Isoetes louisianensis*)	This species grows in sandy soils and gravel bars in or near shallow blackwater streams and overflow channels in riparian woodland. bayhead forests of fine flatwoods and upland longleaf pine (USFWS, 1996).	The proposed dicamba DGA uses are not expected to overlap with streams, overflow channels, or riparian woodlands.	USFWS. 1996. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/960930b.pdf

Species	Habitat	Rationale	Source
Rock-cress, Braun's (*Arabis perstellata*)	Braun's rockcress occurs on the slopes of calcareous mesophytic and sub-xeric forest types. The occurrence of this species does not appear to be limited to a particular slope aspect, elevation, or moisture regime within the slope forests. It is, however, sun intolerant and always occurs in at least partial shade. The largest and most vigorous populations occur on moist mid- to upper slope sites. Plants are often found around rock outcrops, protected sites on the downslope side of tree bases, and sites of natural disturbance, such as talus slopes and animal trails. It is rarely found growing among the Leaf litter and herbaceous cover of the forest floor (US FWS, 1997).	The proposed dicamba DGA uses are not expected to overlap with calcareous mesophytic and sub-xeric forested systems.	USFWS. 1997. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/970722.pdf
Rosemary, Cumberland (*Conradina verticillata*)	This species is found on rocky river bars composed of unsorted boulders, cobbles, gravel and sand, with the largest populations occurring in open, washed-out areas near the centers of these bars. The essential habitat requirements of this species are: open to barely shaded sites; moderately deep, sandy, well-drained soils with no visible organic matter; periodic forceful flooding to	The proposed dicamba DGA uses are not expected to overlap with rivers.	USFWS. 2011. Five Year Review. http://ecos.fws.gov/docs/five_year_review/doc3629.pdf

Species	Habitat	Rationale	Source
	maintain openness; topographic features to enhance sand deposition; and, perhaps, periods of inundation of at least two weeks to induce rooting at the lower nodes (pg. 8) (US FWS, 2011).		
Sandwort, Cumberland (*Arenaria cumberlandensis*)	This species is restricted to sandstone rock houses, ledges, and solution pockets on sandstone rock faces; The species is found on the sandy floors of rock houses, in solution pockets on the face of sandstone cliffs, and on ledges beneath overhanging sandstone (pg. 4) (US FWS, 1996).	The proposed dicamba DGA uses are not expected to overlap with sandstone rock houses, ledges, or rock faces.	USFWS. 1996. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/960620.pdf
Skullcap, large-flowered (*Scutellaria montana*)	This species occurs in slope, ravine, and stream-bottom forests in northwestern Georgia and adjacent southeastern Tennessee. Habitat loss and lack of information on appropriate management are the factors limiting the number of viable populations (US FWS, 1996).	The proposed dicamba DGA uses are not expected to overlap with ravine and stream-bottom forests.	USFWS. 1996. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/960515.pdf
Spiraea, Virginia (*Spiraea virginiana*)	*Spiraea virginiana* is found along the banks of high gradient sections of second and third order streams, or on meander scrolls and point bars, natural levees, and other braided features of lower reaches (often	The proposed dicamba DGA uses are not expected to overlap with rivers, streams, creeks, or other water bodies.	USFWS. 1992. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/921113a.pdf

Species	Habitat	Rationale	Source
	near the stream mouth). The habitat is in oft-disturbed early successional areas. Occasional flood scouring reduces shading and seems to be essential, although the spiraea can tolerate some overstory growth (US FWS, 1992, pp.17-18.).		
Sunflower, whorled (*Helianthus verticillatus*)	This species occurs in remnant prairie habitats found in uplands and swales of headwater streams in the Coosa River watershed in Georgia and Alabama and in the East Fork Forked Deer and Tuscumbia Rivers' watersheds in Tennessee. (US FWS 2014, p. 50993)	The proposed dicamba DGA uses are not expected to overlap with prairie habitats.	USFWS. 2014. Federal Register: Designation of Critical Habitat. http://www.gpo.gov/fdsys/pkg/FR-2014-08-26/pdf/2014-19558.pdf
Thistle, Pitcher's (*Cirsium pitcheri*)	It occurs on non-forested sand dunes of several types (grassland dunes, simple linear beach foredunes, continuous and discontinuous dune complexes), sand beaches, and sandy blowouts, primarily occurring around the Great Lakes (US FWS, 2002, p. 23-27).	The proposed dicamba DGA uses are not expected to overlap with sand dunes, sand beaches, or sandy blowouts.	USFWS. 2002. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/020920b.pdf
Alabama canebrake pitcher-plant (*Sarracenia rubra alabamensis*)	Occurs in sandhill seeps, swamps, and bogs along the fall-line of central Alabama. Colony sites are wet much of the year and are often characterized as wet bogs or wet	The proposed dicamba DGA uses are not expected to overlap with seeps, swamps or bogs.	1992 USFWS Recovery Plan: Alabama Canebrake Pitcher Plant 2012 USFWS Alabama Canebrake Pitcher-Plant (*Sarracenia rubra ssp. alabamensis*)

Species	Habitat	Rationale	Source
	flatwoods. Within this general habitat type, colony health seems to be a function of unaltered hydrology and maintenance of an early successional stage in which competing woody vegetation is limited. Naturally occurring fires and hydrological conditions control the pioneering of woody species on these sites (USFWS 1992)		5-Year Review: Summary and Evaluation
Alabama leather flower (*Clematis socialis*)	Occurs in mesic flats, specifically in right-of-ways, bush-hogged areas, forests that have been selectively logged (USFWS 1989) Open grass-seed-rush prairie areas and adjoining hardwood swamp forests (USFWS 2010)	The proposed dicamba DGA uses are not expected to overlap with mesic flats or forests.	1989 USFWS Alabama leather flower recovery plan 2010 USFWS Alabama leather flower 5-year review
Alabama streak-sorus fern (*Thelypteris pilosa var. alabamensis*)	All known Alabama occurrences of the Alabama streak-sorus fern are found on Pottsville sandstone, where plants grow in crevices and rough surfaces on the roofs and floors of sandstone rockhouses formed along these cliffs (Watkins and Farrar 2002). The plants typically occur on moist, shady sites such as ceilings of rockhouses, ledges beneath sandstone overhangs, and on exposed cliff faces	The proposed dicamba DGA uses are not expected to overlap with sandstone rockhouses.	2014 USFWS Alabama streak-sorus fern (*Thelypteris burksiorum*) 5-year Review: Summary and Evaluation. Page 7. Available at: http://ecos.fws.gov/docs/five_year_review/doc4363.pdf

Species	Habitat	Rationale	Source
	(USFWS 1996). Locations vary in slope aspect and shade coverage, from completely shaded to partially sunny on exposed bluff faces. Sites are usually directly above or a short distance from the river, are shaded to partially sunny, and have substrates that are kept moist by water vapor from the river and up-slope runoff over the sandstone (USFWS 1996). (USFWS 2014)		
Ashy dogweed (*Thymophylla tephroleuca*)	Occurs in the ceniza-blackbrush-creosotebush brush community in the South Texas Plains vegetation area; however, this site may have originally been grassland. Noted to grow in open areas on fine-sandy loam, however the only known population occurs on Maverick-Caterina soil association, which is clayey, saline, deep to shallow, fine textured, and slowly permeable. Underlying geology is the Laredo Formation, composed of Eocene sandstones and clays. The habitat probably once supported a greater diversity of plants, but dominant plants now are buffelgrass (*Cenchrus ciliaris*), mequite (*Prosopis glandulosa*), goatbush (*Castela*	The proposed dicamba DGA uses are not expected to overlap with plains.	1987 USFWS Ashy Dogweed (*Thymophylla tephroleuca*) Recovery Plan

Species	Habitat	Rationale	Source
	texana), Cenizo (*Leucophyllum frutescens*), anacahuita (*Cordia boissieri*), yucca (*yucca spp*), and javelina brush (*Microrhamnus ericoides*) (USFWS 1987)		
Black lace cactus (*Echinocereus reichenbachii var. albertii*)	This species is found in the vicinity of dense brush, but grows in mostly open, unshaded areas (USFWS 2009)	The proposed dicamba DGA uses are not expected to overlap with areas of dense brush.	2009 USFWS Black Lace Cactus (*Echinocereus reichenbachii var. albertii*) 5-year Review: Summary and Evaluation
Black spored quillwort (*Isoetes melanospora*)	Black-spored quillwort is restricted to shallow, flat bottomed depressions on granitic outcrops in the piedmont region of Georgia. Depressions are entirely rock rimmed and generally occur near the summit, with most water accumulating from direct rainfall and little flowing water to provide nutrient input. (USFWS 2008)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	2008 USFWS Granite Outcrop Plants 5-year Review. Page 8. Available at: http://ecos.fws.gov/docs/five_year_review/doc1987.pdf
Bunched arrowhead (*Sagittaria fasciculata*)	Obligate wetland species. Saturated to flooded soils. Undisturbed sites are typically located just below the origin of slow, continuous seeps on gently sloping terrain in deciduous woodlands (USFWS 1983)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	1983 USFWS Bunched Arrowhead Recovery Plan.
Bunched cory cactus (*Coryphantha ramillosa*)	The species grows on limestone in xerophyllous scrub and in the desert on bare rock, talus, or scree. *Coryphantha ramillosa* also grows in	The proposed dicamba DGA uses are not expected to overlap with desert.	1989 USFWS Bunched Cory Cactus (*Cory Dhantha ramillosa*) Recovery Plan

Species	Habitat	Rationale	Source
	Chihuahuan Desert succulent scrub on rocky slopes, ledges, and gravelly flats on Santa Elena or Boquillas limestones (USFWS 1989)		
Canby's dropwort (*Oxypolis canbyi*)	Coastal plains - specifically in pond cypress savannas, the shallows and edges of cypress pond/pine sloughs, and wet pine savannas. These are shallowly flooded, open habitats. Found in natural ponds dominated by cypress, grass-sedge dominated Carolina bays. (USFWS 1990) Wetlands (USFWS 2010)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	1990 USFWS Canby's dropwort recovery plan 2010 USFWS Canby's dropwort 5-year review
Chisos Mountain hedgehog Cactus (*Echinocereus chisoensis var. chisoensis*)	Alluvial flats with Chihuahuan desert scrub vegetation (USFWS 1993)	The proposed dicamba DGA uses are not expected to overlap with deserts.	1993 USFWS Chisos Mountain hedgehog cactus recovery plan
Cooley's meadowrue (*Thalictrum cooleyi*)	Grassland/herbaceous, woody wetland, and herbaceous wetlands (p. i). (USFWS 1994)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	1994 USFWS Recovery Plan
Davis' green pitaya (*Echinocereus viridiflorus var. davisii*)	Chichuahuan desert in a semi-arid grassland. (USFWS 1984) Outcrops of Caballos Novaculite Formation; found in cracks and crevices. (USFWS 2012)	The proposed dicamba DGA uses are not expected to overlap with desert.	1984 USFWS 5-Year Reviews of 23 Southwestern Species 2012 USFWS Davis' green pitaya and Nellie's cory cactus 5-year review

Species	Habitat	Rationale	Source
Dwarf-flowered heartleaf (*Hexastylis naniflora*)	Along bluffs and north-facing slopes, boggy areas along streams, and adjacent hillsides and ravines with acid, sandy loam soils in deciduous forests	The proposed dicamba DGA uses are not expected to overlap with wetlands or bluffs.	USFWS NC State Herbarium Fact Sheet - Dwarf-flowered heartleaf
Florida torreya (*Torreya taxifolia*)	The Florida torreya is a dioecious coniferous tree found in the slope forest (FNAI 2010) that cover hammocks, steep, deeply shaded limestone slopes and wooded ravines along the east side of the Apalachicola River in Florida (Fig. 1), and adjacent Lake Seminole in Georgia. Soils in these areas are within the orders Alfisols and Mollisols. (USFWS 2010)	The proposed dicamba DGA uses are not expected to overlap with forests.	USFWS 2010. Torreya taxifolia (*Florida torreya*) 5-Year Review. Page 13. Available at: http://ecos.fws.gov/docs/five_year_review/doc3258.pdf
Fringed campion (*Silene polypetala*)	Occurs in hardwood forests in bottomland and ravines. It is often on fairly steep slopes of deep ravines or north-facing hillsides, sometimes on nearly level ground, particularly in flatwoods developed on Iredell soils. Occurs mainly in small isolated patches of rich hardwood. The great majority of populations occur in the watershed of the Apalachicola River and its tributary, the Flint River. (USFWS 1996)	The proposed dicamba DGA uses are not expected to overlap with forests.	1996 USFWS Technical Agency Draft Recovery Plan for Fringed Campion (*Salene polypetula*) USFWS Species Profile: Fringed campion (*Silene polypetala*) (http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q21P)

Species	Habitat	Rationale	Source
Gentian pinkroot (*Spigelia gentianoides*)	Well drained upland pinelands; longleaf pine-wiregrass ecosystem (USFWS 2012)	The proposed dicamba DGA uses are not expected to overlap with forests.	2012 US FWS Gentian pinkroot 5-Year Review
Golden sedge (*Carex lutea*)	The land surface is characterized by large areas of broad, level flatlands and shallow stream basins. Golden sedge grows in sandy soils overlying coquina limestone deposits, where the soil pH is unusually high for this region, typically between 5.5 and 7.2. Soils supporting the species are very wet to periodically shallowly inundated. The species prefers the ecotone (narrow transition zone between two diverse ecological communities) between the pine savanna and adjacent wet hardwood or hardwood/conifer forest. Most plants occur in the partially shaded savanna/swamp where occasional to frequent fires favor an herbaceous ground layer and suppress shrub dominance. Other species with which this sedge grows include tulip poplar (*Liriodendron tulipifera*), pond cypress (*Taxodium ascendens*), red maple (*Acer rubrum var. trilobum*), wax myrtle (*Myrica cerifera var.*	The proposed dicamba DGA uses are not expected to overlap with wetlands.	2009 USFWS Golden Sedge (*Carex lutea*) Five-Year Review: Summary and Evaluation

Species	Habitat	Rationale	Source
	cerifera), colic root (*Aletris farinosa*), and several species of beakrush (*Rhynchospora spp*.). At most sites, golden sedge shares its habitat with Cooley's meadowrue (*Thalictrum cooleyi*), another federally endangered plant species, and with Thorne's beakrush (*Rhynchospora thornei*), a species of concern to us. (USFWS 2009)		
Bat, gray (Myotis grisescens)	Gray bats are year round cave dwellers, although they may also use mines. They hibernate from as late as November 10 to late March or early April. At other times, they forage from late afternoon through early morning within 12-20 miles of their caves, most often within 4 miles of their caves. Foraging habitat is strongly correlated with open waters (rivers, lakes, reservoirs) (US FWS, 2009, pp. 6-7). Historically, rivers near caves provided both foraging habitat and riparian tree vegetation that provided cover. Small lakes and reservoirs where cover is not too distant also provide foraging habitat. Bats will opportunistically forage in riparian and upland areas, particularly when	The proposed dicamba DGA uses are not expected to encompass caves or the forest/open water areas where bats forage.	USFWS. 1982. Recovery Plan. http://ecos.fws.gov/docs/recovery_plan/820701.pdf USFWS. 2009. 5-Year Review. http://ecos.fws.gov/docs/five_year_review/doc2625.pdf

Species	Habitat	Rationale	Source
	migrating (US FWS, 1982. pp. 6-7).		
Green pitcher-plant (*Sarracenia oreophila*)	Habitats can be generally grouped into two types: stream banks (considered ephemeral) and upland bogs. Upland bogs, fire dependent, range from open to forested, underlain by semi-impervious clay layers (USFWS 2013)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	2013 US FWS Green pitcher plant (*Sarracenia oreophila*) 5-Year Review: Summary and Evaluation
Hairy rattleweed (*Baptisia arachnifera*)	22 extant populations occur entirely in Lower Coastal Plain of Georgia, 125 square miles over northern Brantley County and southeastern corner of Wayne County. Longleaf slash-pine flatwoods with sparse canopy, fewer larger shrubs, greater light penetration and greater cover of herbs (mainly wiregrass) and low shrubs of the Lower Coastal Plain of Georgia. Early successional characteristics of open canopy and low abundance of larger shrubs. Mesic pine lowland forest or pine flatwoods. Also occurs in floristically similar but more open pine-wire grass (*Aristida stricta*) shrub woodlands with occasional oaks	The proposed dicamba DGA uses are not expected to overlap with the margins of cultivated land.	2011 USFWS Hairy Rattleweed (*Baptisia arachnifera*) 5-Year Review: Summary and Evaluation 1984 USFWS Recovery Plan for Hairy Rattleweed (*Baptisia arachnifera*)

Species	Habitat	Rationale	Source
	(*Quercus laevis, Q. virginiana, Q. nigra*). Fire adapted communities that would naturally burn every 2-4 years. Most abundant in communities with the early successional characteristics of open canopy and low abundance of larger shrubs. Presently occurs in slash-pine plantations within its range, also along highway/utility/logging road ROWs and some natural communities (longleaf pine-wiregrass-shrub communities), and margins of cultivated land (generally corn, tobacco, and pasture). Level to gently sloping land. Often adjacent to/grades into pocosin or bay swamp habitats scrub-shrub wetlands toward the wetter end of spectrum to habitats typical of longleaf pine-turkey oak communities towards the drier end. (USFWS 2011)		
Heller's blazingstar (*Liatris helleri*)	Heller's blazing star habitat consists of rock outcrops, ledges, cliffs, and balds at high elevations (USFWS 1989)	The proposed dicamba DGA uses are not expected to overlap with rock outcrops or cliffs.	1989 USFWS Recovery Plan for *Liatris helleri* (Heller's Blazing Star)
Hinckley oak (*Quercus hinckleyi*)	*Quercus hincklevi* occurs in an arid subtropical climate. Climatologists place it in the Trans-Pecos climatic area of Texas, which is extremely	The proposed dicamba DGA uses are not expected to overlap with forests.	1991 USFWS Hinckley Oak (*Quercus hinckleyi*) 5-Year Review: Summary and Evaluation

Species	Habitat	Rationale	Source
	variable because of topographic differences. The area generally has great daily temperature fluctuations and an arid profile where evaporation exceeds precipitation. The average temperature is approximately 30.40°C (86.80°F), with an average precipitation of 23.4 cm (9.2 inches) (USFWS 1991)		
Houghton's goldenrod (*Solidago houghtonii*)	This plant grows on the shores of the Great Lakes, mainly Lake Huron and Lake Michigan, at the Michigan-Ontario border. (USFWS 2011)	The proposed dicamba DGA uses are not expected to overlap with shores.	2011 US FWS Houghton's Goldenrod (*Solidago houghtonii* A. Gray, Asteraceae) 5-Year Review: Summary and Evaluation
Johnston's frankenia (*Frankenia johnstonii*)	Open or sparsely vegetated rocky gypsum hillsides or saline flats. In Texas, occur in mesquite blackbrush community (USFWS 1988)	The proposed dicamba DGA uses are not expected to overlap with saline flats.	1988 USFWS Johnston's Frankenia (*Frankenia johnstonii*) Recovery Plan 2003 USFWS Endangered and Threatened Wildlife and Plants; Delisting the plant Frankenia johnstonii (*Johnston's frankenia*) and Notice of Petition Finding.68 FR 27961
Kentucky glade cress (*Leavenworthia exigua laciniata*)	*Leavenworthia exigua var. laciniata* is typically found in cedar or limestone glades (Baskin and Baskin 1981, p. 243), which are described by Baskin and Baskin (1999, p. 206) as ‘‘open areas of rock pavement, gravel, flagstone, and/or shallow soil in which occur natural, long-persisting (edaphic climax) plant	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS 2014. Designation of Critical Habitat for *Leavenworthia exigua var. laciniata* (Kentucky Glade Cress); Final rule. Page 25691. Available at: http://www.gpo.gov/fdsys/pkg/FR-2014-05-06/pdf/2014-10050.pdf

Species	Habitat	Rationale	Source
	communities dominated by angiosperms and/or cryptogams.'' *L. exigua var. laciniata* is also known from gladelike areas such as overgrazed pastures, eroded shallow soil areas with exposed bedrock, and areas where the soil has been scraped off the underlying bedrock (Evans and Hannan 1990, p. 8). These disturbed areas are gladelike in the shallowness or near-absence of their soils, saturation, and/or inundation during the wet periods of late fall, winter, and early spring and then frequently dry below the permanent wilting point during the summer (Baskin and Baskin 2003, p. 101). (USFWS 2014, p25691)		
Kral's water-plantain (*Sagittaria secundifolia*)	This taxon typically occurs on frequently exposed shoals or rooted among loose boulders in quiet pools up to 1 meter (3.3 feet) in depth. The plant is found in the Little River drainage in Dekalb and Cherokee counties, the Town Creek drainage in Dekalb County, and in the West Sipsey Fork in Winston County in Alabama. (USFWS 1991)	The proposed dicamba DGA uses are not expected to overlap with water bodies.	1991 USFWS Kral's Water-Plantain (*Saciittaria secundifolia*) Recovery Plan

Species	Habitat	Rationale	Source
Large-fruited sand-verbena (*Abronia macrocarpa*)	Post oak savanna region of eastern Texas. Documented wild populations occur in acid, relatively infertile sandy soils of the Arenosa, Silstead-Padina, Pickton, and Wolfpen series lie 79-127 cm deep over sandy clay loam. (USFWS 2010)	The proposed dicamba DGA uses are not expected to overlap with post oak savanna.	2010 USFWS 5-year review Large-fruited Sand-verbena (*Abronia macrocarpa galloway*)
Little Aguja (=Creek) Pondweed (*Potamogeton clystocarpus*)	Grows in alluvial substrates of shallow, protected area of Little Aguja Creek. Species located in pools along the streambed. Flash floods and drought are part of the normal stream ecology (USFWS 1994)	The proposed dicamba DGA uses are not expected to overlap with alluvial areas around creeks.	1994 USFWS Little Aguja pondweed recovery plan (*Potamogeton clystocarpus*).
Little amphianthus (*Amphianthus pusillus*)	On granitic outcrops in the Piedmont physiographic region of the southeastern United States generally in eroded depressions or, rarely, quarry pools fanned on flat- to doming granite outcrops. Occur in shallow flat-bottomed pools on the crest or flattened slopes of unquarried outcrops. Pools might be several meters in diameter. (USFWS 2008)	The proposed dicamba DGA uses are not expected to overlap with granitic outcrops.	2008 USFWS Granite Outcrop Plants 5-year Review
Lloyd's Mariposa cactus (*Echinomastus mariposensis*)	Hills and lower slopes of mesas. Occur in full sun on patches of limestone chips. Chihuahauan desert scrub community. (USFWS 1990)	The proposed dicamba DGA uses are not expected to overlap with desert.	1990 USFWS Lloyd's Mariposa Cactus (*Neolioydia mariposensis*) Recovery Plan U.S. Fish and Wildlife Service Albuquerque, New Mexico

Species	Habitat	Rationale	Source
Mat-forming quillwort (*Isoetes tegetiformans*)	Mat-forming quillwort is restricted to shallow, flat bottomed depressions on granitic outcrops in the piedmont region of Georgia. Depressions are entirely rock rimmed and generally occur near the summit, with most water accumulating from direct rainfall and little flowing water to provide nutrient input. (USFWS 2008)	The proposed dicamba DGA uses are not expected to overlap with depressions on granitic outcrops.	2008 USFWS Granite Outcrop Plants 5-year Review. Page 8. Available at: http://ecos.fws.gov/docs/five_year_review/doc1987.pdf
Miccosukee gooseberry (*Ribes echinellum*)	Mixed mesophytic hardwoods (USFWS 2008)	The proposed dicamba DGA uses are not expected to overlap with forests.	2008 US FWS Miccosukee Gooseberry 5-Year Review
Michaux's sumac (*Rhus michauxii*)	It is endemic to the inner coastal plain and piedmont of the Carolinas, Georgia, and Florida, where it occupies sandy or rocky open woods. It appears to depend upon some form of disturbance to maintain the open quality of its habitat. (USFWS 1993)	The proposed dicamba DGA uses are not expected to overlap with sandy or rocky open woods.	1993 USFWS RECOVERY PLAN for Michaux's Sumac (*Rhus michauxii*) Sargent
Michigan monkey-flower (*Mimulus michiganensis*)	Aquatic to semi-aquatic habitat. It is restricted to cold, alkaline spring seepages and streams, usually in association with northern white cedar (*Thuja occidentalis*) swamps formed in drainages found at the base of relatively steep, morainic slopes and bluff. Within its habitat, it generally flourishes	The proposed dicamba DGA uses are not expected to overlap with wetlands.	2011 USFWS Michigan Monkey-flower (*Mimulus michiganensis*) 5-Year Review: Summary and Evaluation 1997 USFWS Recovery Plan for Michigan Monkey-flower (*Mimulus glabratus var. michiganensis*)

Species	Habitat	Rationale	Source
	best in tree canopy openings, along forest edges, or along streams adjacent to open, meadow-like areas and flowers abundantly when growing in full sunlight. However, it mostly persists as sterile colonies when growing under heavy tree canopy cover. (USFWS 2011) Surveys of some locations found water temperature ranging from 8.7 to 16.6° C, pH ranging from 7.66-8.4, conductivity ranging from 190 to more than 300 umhos and high concentrations of ammonium, nitrate, and phosphorus. (USFWS 1997)		
Mohr's Barbara button (*Marshallia mohrii*)	*Marshallia mohrii* typically occurs in moist, prairie-like openings in woodlands and along shale-bedded streams. (USFWS 1991)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	1991 USFWS RECOVERY PLAN for Mohr's Barbara's buttons *Marshallia mohrii* Beadle & F.E. Boynton
Mountain golden heather (*Hudsonia montana*)	Fire maintained, keeps woody trees and shrubs down. (USFWS 2012) Limited to chilhowee quartzite ledges and outcrops found along Linville Gorge. In watershed of the Linville River. Ledge habitats exposed to direct sunlight. Edaphically maintained ecotone between bare rock and	The proposed dicamba DGA uses are not expected to overlap with outcrops and ledges.	2012 USFWS Mountain Golden Heather (*Hudsonia montana*) 5-Year Review: Summary and Evaluation 1983 USFWS Mountain Golden Heather (*Hudsonia montana*) Recovery Plan

Species	Habitat	Rationale	Source
	pine/ericaceous shrub community, with mtn golden heather local dominant in the ecotone. (USFWS 1983)		
Mountain sweet pitcher-plant (*Sarracenia rubra ssp. jonesii*)	It is found in the wetter parts of boggy areas in the coastal plain from southern Georgia and northern Florida to southern Mississippi. Quite often the plants can be found near the waterline. They may occasionally be submerged. While submerged, it will capture water arthropods and tadpoles. (USFWS 2013)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	2013 USFWS Mountain sweet pitcher plant (*Sarracenia rubra ssp. jonesii*) 5-Year Review: Summary and Evaluation
Morefield's leather flower (*Clematis morefieldii*)	It occurs in patches near seeps and springs in rocky limestone woods, typically at elevations of 800 to 11 feet, on the south and wouthwest facing slopes of mountains in open to dense juniper-hardwoods communities	The proposed DGA uses are not expected to overlap with rocky limestone wood habitat on mountains.	1994 USFWS. Recovery Plan for Morefield's leather flower (*Clematis morefieldii*). Atlanta, Georgia. 15 pp. http://ecos.fws.gov/docs/recovery_plan/940503.pdf
Navasota ladies'-tresses (*Spiranthes parksii*)	Clearly associated with the Post Oak Savanna vegetation type of east-central Texas. Highest numbers of individuals found in lightly wooded, lightly grazed stream banks of minor tributaries associated with the Navosta and Brazos drainages (2, p.10-11). Oak Savanna associates – *Quercus stellata, Q. nigra, Q marilandica, Ulmus*	The proposed dicamba DGA uses are not expected to overlap with savanna.	1984 USFWS Navasota Ladies'-tresses (*Spiranthes parksii*) Recovery Plan

Species	Habitat	Rationale	Source
	alata, *Celtis laevigata*, *Ilex vomitoria*, *Forestiera ligustrina*, *Callicarpa americana*, *Ascyrum hypericoides*, *Stillingria sylvatica*, and numerous herbs (USFWS 1984)		
Neches River rose-mallow (*Hibiscus dasycalyx*)	Intermittent or perennial wetlands within the Neches, Sabine, and Angelina River floodplains or Mud and Tantabogue Creek basins that contain: (a) Hydric alluvial soils and the potential for flowing water when found in depressional sloughs, oxbows, terraces, side channels, or sand bars; (b) Native woody or associated herbaceous vegetation, largely with an open canopy providing partial to full sun exposure with low levels or no nonnative species.	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS 2013. Designation of Critical Habitat for Texas Golden Gladecress and Neches River Rose-Mallow; Final Rule. Page 56093. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-09-11/pdf/2013-22083.pdf
Nellie cory cactus (*Coryphantha minima*)	Desert grassland. Restricted to the Caballos Naviculite Formation, a quartz formation that forms low-lying ridges that are highly resistant to erosion. The Nellie Cory cactus is usually found growing among the chips of weathered and physically fractured novaculite, often associated with spikemoss (*Selaginella sp.*). The plants follow the cracks in the	The proposed dicamba DGA uses are not expected to overlap with desert grassland.	1984 USFWS Recovery Plan for the Nellie Cory Cactus 2012 USFWS Davis's Green Pitaya *Echinocereus viridiflorus var. davisii* Houghton and Nellie Cory Cactus *Escobaria minima* (Baird) D.R. Hunt (Syn. *Coryphantha minima* Baird) Five Year Review

Species	Habitat	Rationale	Source
	formation (USFWS 1984) Has a very clumped distribution, caespitose, plants not evenly distributed. (USFWS 2012)		
Pecos (=puzzle, =paradox) sunflower (*Helianthus paradoxus*)	Pecos sunflower is a wetland plant that grows on wet, alkaline soils at spring seeps, wet meadows, stream courses and pond margins. It has seven widely spaced populations in west-central and eastern New Mexico and adjacent Trans-Pecos Texas. These populations are all dependent upon wetlands from natural groundwater deposits. Incompatible land uses, habitat degradation and loss, and groundwater withdrawals are historic and current threats to the survival of Pecos sunflower. (USFWS 2005)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	USFWS 2005 Final Pecos Sunflower Recovery Plan Available at: http://www.fws.gov/southwest/es/documents/r2es/pecos_sunflower_final_recovery_plan.pdf
Persistent trillium (*Trillium persistens*)	Found in deciduous or conifer deciduous forest of steep ravines and gorges, bouldered slopes; predominantly mesic slopes, but some dry exposed slopes. Wide variety of habitat conditions – noted to occur generally under a well developed overstory but also in open or closed canopies dominated by hemlock, hemlock-white pine, hemlock-beech, white	The proposed dicamba DGA uses are not expected to overlap with forests.	1984 USFWS Persistemt Trillium (*Trillim persistens*) Recovery Plan

Species	Habitat	Rationale	Source
	pine, chestnut oak-white oak, black-oak-chestnut oak, with open or nearly closed shrub cover of Rhododendron minus, Rhododendron maximum, Leucothoe axillaris, and all combinations of the above, including with no shrubs or deciduous shrubs only. (USFWS 1984)		
Relict trillium (*Trillium reliquum*)	This species is typically found in mature and undisturbed hardwood stands. (USFWS 1991)	The proposed dicamba DGA uses are not expected to overlap with forests.	1991 USFWS Recovery Plan for Relict Trillium (*Trillium reliauum* Freeman)
Rough-leaved loosestrife (*Lysimachia asperulaefolia*)	Found in ecotone between longleaf pine or oak savannahs and wetter shrubby plant communities. Coastal plains and sandhills. Requires moist, open habitat. Associated with 6 different community types: low pocosin, high pocosin, wet pine flatwoods, pine savanna, streamhead pocosin, and sandhill seep. (USFWS 1995)	The proposed dicamba DGA uses are not expected to overlap with longleaf pine or oak savannas.	1995 USFWS Rough-leaved loosestrife recovery plan
Schweinitz's sunflower (*Helianthus schweinitzii*)	Currently known from roadsides, power line clearings, old pastures, woodland openings, and other sunny to semi-sunny situations. Formerly, it probably occurred in prairie-like habitats or post oak-blackjack oak savannas maintained by fires set by lightning and Native	The proposed dicamba DGA uses are not expected to overlap with prairie-like habitats.	1994 USFWS Recovery Plan

Species	Habitat	Rationale	Source
	Americans (p. i). (USFWS 1994)		
Seabeach amaranth (*Amaranthus pumilus*)	Barrier island beaches of the Atlantic coast, inlets, temporary habitats, may move as areas become suitable or unsuitable habitat. Overwash flats at accreting ends of islands, lower foredunes and upper strands of noneroding beaches (landward of the wrackline). Does not occur on well-vegetated sites. (USFWS 1996)	The proposed dicamba DGA uses are not expected to overlap with beaches.	1996 Weakley, Bucher, Murdock U.S. Fish and Wildlife Service. 1996. Recovery Plan for Seabeach Amaranth.(*Amaranthuspumilius) Rafinesque)*. Atlanta, Georgia. http://ecos.fws.gov/docs/recovery_plan/961112b.pdf. 2007 USFWS Seabeach Amaranth Five-Year Review; http://ecos.fws.gov/docs/five_year_review/doc1068.pdf
Sensitive joint-vetch (*Aeschynomene virginica*)	Occurs in fresh to slightly brackish tidal river systems, within the intertidal zone where populations are flooded twice daily. Typically occur in the estuarine meander zone of tidal rivers where sediments transported from upriver settle out and extensive marshes form. Need disturbed/open habitats such as: accreting point bars that have not yet been colonized by perennial species, low swales within extensive marshes, areas of nutrient deficiencies in saturated organic sediments, or areas of muskrat herbivory. (USFWS 1995)	The proposed dicamba DGA uses are not expected to overlap with wetlands.	1995 USFWS Sensitive joint-vetch recovery plan 2012 USFWS Sensitive joint-vetch 5-year review

Species	Habitat	Rationale	Source
	Majority are found in natural tidal marsh habitats, but also a few documented cases of a pocket marsh wetland, edge of a moist soybean field, and a mowed grassy strip between a manmade drainage channel and dirt road. (USFWS 2012)		
Short's bladderpod (Physaria globosa)	Soils and outcrops of calcareous geologic formations along the mainstem or tributaries of the Kentucky and Cumberland rivers. The species inhabits these outcrops and soils where they occur on steeply sloped bluffs or hillsides. The combination of calcareous outcrops and shallow soils, steep slopes, and hot and dry conditions regulates the encroachment of herbaceous and woody species that exclude Short's bladderpod from vegetation communities present on more mesic sites.	The proposed dicamba DGA uses are not expected to occur in areas where calcareous outcrops, shallow soils, steep slopes and hot and dry conditions prevent the encroachment of herbaceous and woody species such as soybean and cotton.	2014. USFWS. Designation of Critical Habitat for Physaria globosa (Short's bladderpod), Helianthus verticillatus (whorled sunflower), and Leavenworthia crassa (fleshy-fruit gladecress) Final Rule. Federal Register Federal Register Volume 79 Number 165 August 26, 2014 http://www.gpo.gov/fdsys/pkg/FR-2014-08-26/pdf/2014-19558.pdf
Short's goldenrod (Solidago shortii)	The habitat of Short's goldenrod is open areas in full sun or partial shade. Known occurrences are in limestone cedar glades, open eroded areas, edges, of open oak-hickory woods, cedar thickets, pastures, old fields, power line rights-of-way and rock ledges along rights-of-way. Cedar glades and	The proposed dicamba DGA salt uses are not expected to overlap with glades, woodland edges, pastures, or other habitat favorable for goldenrod growth.	1988 USFWS. Recovery Plan for Short's Goldenrod. U.S. Fish and Wildlife Service, Atlanta, Georgia. 27 pp. http://ecos.fws.gov/docs/recovery_plan/shortsgrodRP.pdf USFWS. 2007. 5-Year Review. http://ecos.fws.gov/docs/five_year_review/doc1609.pdf

Species	Habitat	Rationale	Source
	woodland edges appear to be the natural habitat. Short's goldenrod was known historically and currently only from Kentucky when the Recovery Plan was written in 1988 (US FWS, pp. 3-4). An Indiana occurrence was located in 2001 along the Blue River in riparian habitat (US FWS, 2007, p. 6).		
Slender rush-pea (*Hoffmannseggia tenella*)	Occurs in patches of native short and mid-grass prairie (specifically associated with buffalograss, Texas wintergrass (*Stipa leucotrica*) and Texas grama (*Bouteloua rigidiseta*) adjacent to watercourses, such as permanent or intermittent creeks. Restricted to the Texas Coastal Bend counties of Nueces and Kleberg. Eco-region is Gulf Prairies and Marshes biotic zone. Occurs on slopes (20 degrees max), along drainages, usually located in areas of short or sparse vegetation since it can't compete with taller grasses. Has been found on slopes close to mesquite-granjeno woodland areas and where shrubs are low. (USFWS 2008)	The proposed dicamba DGA uses are not expected to overlap with prairie.	2008 USFWS Slender Rush-pea (*Hoffmannseggia tenella*) 5 Year Review: Summary and Evaluation

Species	Habitat	Rationale	Source
Small-anthered bittercress (*Cardamine micranthera*)	Native to small streambank seeps, adjacent sandbars, and stream edges in the Dan River drainage of the North Carolina and Virginia piedmont. (USFWS 1991) This plant occurs in moist and wet, shady areas near streams and in dim woodlands. Small-anthered bittercress is known only from the Dan River basin in north-central North Carolina (Stokes County) and south-central Virginia (Patrick County). (USFWS 1998)	The proposed dicamba DGA uses are not expected to overlap with stream edges.	1991 USFWS Recovery Plan for the Small-anthered bittercress *Cardamine micranthera* 1998 USFWS Recovery Plan for the *Cardamine micranthera*
Smooth coneflower (*Echinacea laevigata*)	The habitat of smooth coneflower consists of open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium- and calcium-rich soils associated with amphibolite, dolomite, or limestone (USFWS 2011)	The proposed dicamba DGA uses are not expected to overlap with open woods, barrens, or bluffs.	2011 USFWS Smooth Coneflower (*Echinacea laevigata*) 5-Year Review: Summary and Evaluation
Sneed pincushion cactus (*Coryphantha sneedii var. sneedii*)	The Sneed and Lee pincushion cacti grow in semi-desert grassland (Brown, 1982). The Sneed pincushion cactus is restricted to limestone and grows in cracks on vertical cliffs or ledges. The Sneed pincushion cactus grows at an elevation of 1,200-2,350 m in areas where the average	The proposed dicamba DGA uses are not expected to overlap with semi-desert grasslands.	1986 USFWS Recovery Plan for the Sneed and Lee Pincushion Cacti. Pages 8-9. Available at: http://ecos.fws.gov/docs/recovery_plan/860321b.pdf

Species	Habitat	Rationale	Source
	precipitation varies from 19.7 to 40 cm per year. Edaphic requirements are poorly understood. (USFWS 1986)		
South Texas ambrosia (*Ambrosia cheiranthifolia*)	Grows in the Gulf coastal grasslands of southern Texas. The plant is found in grassland and mesquite shrubland habitat on various soils. Associated with sites where native short-grass prairie species persist. Also on moderately disturbed sites such as cemeteries, right-of-ways, roadsides, parkfields, and eroded areas along creeks. (USFWS 2010)	The proposed dicamba DGA uses are not expected to overlap with grasslands.	2010 USFWS South Texas Ambrosia (*Ambrosia cheiranthifolia*) 5-Year Review: Summary and Evaluation
Star cactus (*Astrophytum asterias*)	Star cactus grows on sparsely vegetated areas in gravelly, saline clays or loams at low elevations in the Rio Grande Plains. (USFWS 2013) This species grows in grasslands and thorn shrub of the Rio Grande (US FWS 2003)	The proposed dicamba DGA uses are not expected to overlap with grasslands or thorn shrub.	USFWS 2013. Star Cactus (*Astrophytum asterias*) 5-Year Review: Summary and Evaluation Available at: http://www.fws.gov/southwest/es/Documents/R2ES/Star_Cactus_5-yr_Review_FINAL_June2013.pdf US FWS 2003. Recovery Plan. Available at: http://ecos.fws.gov/docs/recovery_plan/031106.pdf
Swamp pink (*Helonias bullata*)	Swamp pink is found in a variety of wetland habitats, including swampy forested wetlands bordering small streams; headwater wetlands; sphagnous, hummocky, dense Atlantic white cedar swamps; Blue Ridge swamps;	The proposed dicamba DGA uses are not expected to overlap with wetlands.	1991 USFWS Swamp Pink (*Helonias bullata*) Recovery Plan Available at: http://ecos.fws.gov/docs/recovery_plan/910930c.pdf

Species	Habitat	Rationale	Source
	meadows; bogs; and spring seepage areas (USFWS 1991)		
Terlingua Creek cat's-eye (*Cryptantha crassipes*)	Grows on xeric, barren, gypsiferous, low rounded hills and gentle slopes composed of small platelets of stilty limestone in the Trans-Pecos shrub savanah (p. iii). Obligate upland (p. iii). (USFWS 1994)	The proposed dicamba DGA uses are not expected to overlap with shrub savanna.	1994 USFWS Recovery Plan Available at: http://ecos.fws.gov/docs/recovery_plan/940405.pdf
Texas ayenia (*Ayenia limitaris*)	This species is associated with forest and scrubland of river flood plains and deltas in south Texas and northern Mexico. Occurs in open ground or under an open canopy, within or on the edges of thickets, on dry, alluvial clay soils. (USFWS 2010)	The proposed dicamba DGA uses are not expected to overlap with forests or scrubland.	2010 USFWS Texas Ayenia (Tamaulipan Kidneypetal), Ayenia limitaris Cristóbal, 5-Year Review Available at: http://ecos.fws.gov/docs/five_year_review/doc3241.pdf
Texas Golden Gladecress (*Leavenworthia texana*)	Open, sunny exposures of Weches outcrops within Weches glade plant communities that are characterized by the species listed in Table 1, with relatively thin, rocky soils that are classified within Nacogdoches, Trawick, or Bub soils mapping units as identified by the NRCS soil survey maps. There must be bare, exposed bedrock on top-level surfaces or rocky ledges with very shallow	The proposed dicamba DGA uses are not expected to overlap with Weches outcrops.	USFWS 2013. Designation of Critical Habitat for Texas Golden Gladecress and Neches River Rose-Mallow; Final Rule. Page 56087. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-09-11/pdf/2013-22083.pdf

Species	Habitat	Rationale	Source
	depressions where rainwater can pool or seepage can collect. (USFWS 2013)		
Texas poppy-mallow (*Callirhoe scabriuscula*)	Rolling Plains Vegetation zone of Texas. Deep, alluvial sands deposited in Runnels County, Texas (USFWS 1985)	The proposed dicamba DGA uses are not expected to overlap with the Rolling Plans.	1985 USFWS Texas poppy-mallow (*Callirhoe scabriuscula*): Recovery Plan
Texas prairie dawn-flower (*Hymenoxys texana*)	This plant grows only in the grasslands of the Gulf Coastal Plain in Texas. It can be found on open, barren stretches of saline sandy soil at the base of Mima mounds. (USFWS 1989)	The proposed dicamba DGA uses are not expected to overlap with grasslands.	1989 USFWS *Hymenoxys texana* Recovery Plan
Texas snowbells (*Styrax texanus*)	Endemic to cliffs along rivers, streams, and dry creek beds in the Edwards Plateau. Grows in limestone crevices of creek and river bluffs. Elevations are 30m to 914 m. Shallow soils, wide range of textures. Lightly wooded vertical limestone and dolomite cliffs, mapped as Segovia and Fort Terrett members of the Edwards Limestone, the Devil's River Limestone, and the Glen Rose Formation. Numerous trees, shrubs, and herbs associated. (USFWS 1987) Moist habitats like river drainages, canyons, and draws, which are	The proposed dicamba DGA uses are not expected to overlap with cliffs.	1987 USFWS Texas Snowbells (*Styrax texana*) Recovery Plan 2008 USFWS Texas Snowbells (*Styrax platanifolius ssp. Texanus*) 5-Year Review Summary and Evaluation

Species	Habitat	Rationale	Source
	abundant in the Edwards Plateau. Surface water may not be present, but sites have subsurface water or collect runoff. Most plants are found where they get at least partial shade during the day from surrounding vegetation. Many occur on level terrain, but are most often described on vertical cliffs possibly because of herbivory on more accessible terrain. (USFWS 2008)		
Texas trailing phlox (*Phlox nivalis ssp. texensis*)	Sandy soils of open pine woodlands. Pineywoods vegetational area. May also be associated with the Gulf Prairies and Marshes vegetational areas, but this is not confirmed by historical or extant records. Plant prefers open canopy and at least some ground cover, and intermediate seral stages in community succession. (USFWS 1995)	The proposed dicamba DGA uses are not expected to overlap with pine woodlands.	1995 USFWS Texas trailing phlox recovery plan
Texas wild-rice (*Zizania texana*)	This plant grows in clear flowing spring-fed waters. (USFWS 2008)	The proposed dicamba DGA uses are not expected to overlap with water bodies.	2008 USFWS 5-Year Reviews of 28 Southwestern Species
Tobusch fishhook cactus (*Sclerocactus brevihamatus ssp. tobuschii*)	The cacti occur in gravelly soils along rivers and plants are periodically disturbed by flooding. Severe floods will destroy plants but some disturbance appears to benefit the species because non-flooded	The proposed dicamba DGA uses are not expected to overlap with streams, rivers or other water bodies.	USFWS 1987. Tobusch fishhook cactus recovery plan. Available at: http://ecos.fws.gov/docs/recovery_plan/870318a.pdf USFWS 2010. Tobusch Fishhook Cactus Completed 5-Year Review. Page 27. Available at:

Species	Habitat	Rationale	Source
	areas become very grassy which tends to crowd out the cacti (USFWS 1987). However by the early 1990s many new locations had been discovered, and the species was known from eight counties. Most sites were no longer in the floodplain, but found from lower slopes to ridge tops (USFWS 2010)		http://ecos.fws.gov/docs/five_year_review/doc3073.pdf
Walker's manioc (*Manihot walkerae*)	An understory species that inhabits open brushlands in the Lower Rio Grande Valley of Texas and adjacent mexico (p. i). Most manihot species are found in relatively dry regions, and only a few are typically found in rain forest regimes. Those species found in rain forest are typically found in openings in the forest... these considerations lead us the hypothesis that most species are heliophiles capable of growth only when there is no shading, and that many of them are "weedy" types, capable of invasion into open areas (p. 6). (USFWS 2007)	The proposed dicamba DGA uses are not expected to overlap with open brushlands.	2007 USFWS Recovery Plan
White bladderpod (*Lesquerella pallida*)	The plant grows on openings in oak, hickory, and pine woods. It is limited to a part of the Piney Woods region on the Gulf	The proposed dicamba DGA uses are not expected to overlap with forests.	1992 USFWS White Bladderpod (*Lesquerella padilla*) recovery plan

Species	Habitat	Rationale	Source
	Coastal Plain. (USFWS 1992)		
White irisette (*Sisyrinchium dichotomum*)	This rare herb is typically found in open dry to mesic oak-hickory forests on mid-elevation mountain slopes and on open, disturbed sites, such as woodland edges and roadsides. (USFWS 1995)	The proposed dicamba DGA uses are not expected to overlap with forests.	1995 US FWS RECOVERY PLAN for White Irisette (*Sisyrinchitan dichoixirun*) Bicknell
White-haired goldenrod (*Solidago albopilosa*)	Grows in sandy soil behind the drip line of sandstone rock-shelters and on rock ledges. It is very rarely found in open sunlight and is never found in the darkest recesses of rock-shelters (p. i). (USFWS 1993)	The proposed dicamba DGA uses are not expected to overlap with sandstone rock shelters.	1993 USFWS Recovery Plan
Zapata bladderpod (*Lesquerella thamnophila*)	Zapata bladderpod is known to occur on graveled to sandy-loam upland terraces above the Rio Grande flood plain. The known populations of Zapata bladderpod are associated with highly calcareous sandstones and clays, and occur within a community of shrub species. Zapata bladderpod occurs as an herbaceous component of an open *Leucophyllum frutescens* (cenizo) - *Acacia berlanderi* (guajillo) shrubland alliance (Nature Serve 2002) (Figure 4). Both	The proposed dicamba DGA uses are not expected to overlap with shrubland.	2004 USFWS Zapata Bladderpod (*Lesquerella thamnophilia*) Recovery Plan

Species	Habitat	Rationale	Source
	plant communities dominate upland habitats on shallow soils near the Rio Grande (Diamond et al. 1987). These shrub lands are sparsely vegetated due to the shallow, fast-draining, highly erosional soils and semi-arid climate. (USFWS 2004)		

Appendix 3

Input parameters for TIM simulation for calculating mortality to Eskimo curlew exposed to dicamba

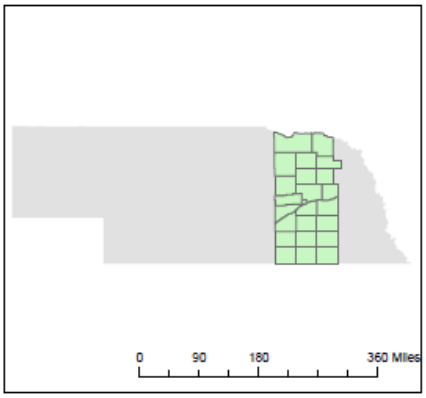
Parameter	Value	Comments
pesticide name	dicamba	none
crop name	Corn, soybean and cotton	none
species name	Eskimo curlew	
Generic bird # (values of 1-30 are generic, 0 = custom)	0	
Passerine ? (yes=1, no = 0)	0	
nest type (0 =altricial, 1 = precocial)	1	
Number of birds (trials) simulated	10,000	
Flock size	50	Most recent estimate of population size
Random number seed (Enter 0 if user does not select a seed)	0	
Turns QC reports on (1) or off (0)	0	
Turns TIM executable call for user input on (1) or off (0)	0	
Turns MCnest outputs on (1) or off (0)	0	
Food switch	1	
Drinking water puddle switch	1	
Drinking water dew switch	1	
Inhalation vapor switch	0	The maximum vapor concentration at saturation (calculated by STIR) is 2.14e-3 mg/L. Since the available rat inhalation toxicity data did not establish an LC50 at a level that is orders of magnitude higher (i.e., 5.3 mg/L, MRID 00263861), this route of exposure is not considered of toxicological concern.
Inhalation spray switch	1	This is automatically turned off by the model due to the crop height.
Dermal contact switch	1	
Dermal spray switch	1	This is automatically turned off by the model due to the crop height.
Spray drift switch	0	Spray drift mitigations in place
Number of days simulated	3	Assume that while the birds are moving through the area during migration, they will stop and forage in an area for 3 d.
Number of applications	1	Assume that birds land in field on day of application
Rate of application #1 (lb a.i./A)	1.0	Proposed label
Interval between app1 and 2 (days)	0	

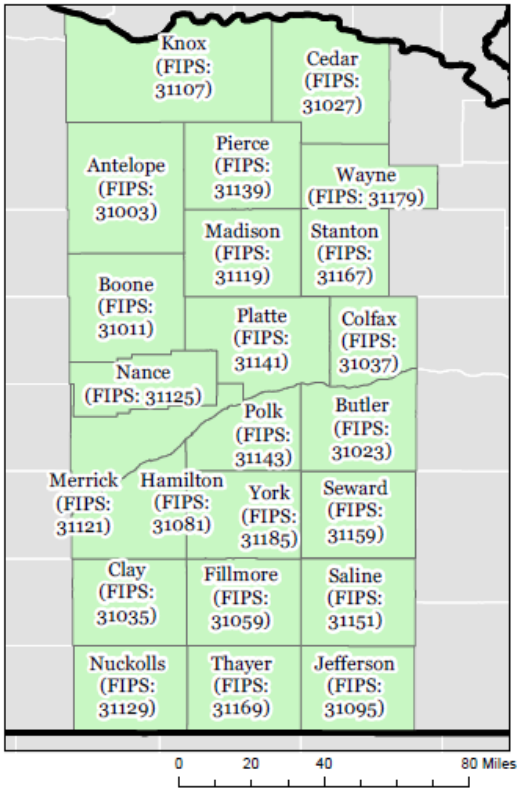
Parameter	Value	Comments
Rate of application #2 (lb a.i./A)	0	
Interval between app2 and 3 (days)	0	
Rate of application #3 (lb a.i./A)	0	
Interval between app3 and 4 (days)	0	
Rate of application #4 (lb a.i./A)	0	
Interval between app 4 and 5 (days)	0	
Rate of application #5 (lb a.i./A)	0	
Time of first application (hour)	8	Assume that application is made in the morning.
Application method (1 = Air, 2 = Ground Broadcast, 3 = Ground Banded, 4 = Ground infurrow, 5 = Airblast)	2	Proposed label
droplet spectrum for air and ground, (1= very fine to fine, 2 = fine to medium, 3 = medium to coarse (air only), 4 = coarse to very coarse (air only))	1	Since spray drift switch is turned off, this parameter value does not impact the model's results.
Spray height (m)	0.61	Assume 24" boom height.
Spray duration (min)	0.5	Default
Crop height (m)	0.127	Assumed height at time of 3rd application (4 weeks after emergence).
Plant(crop) mass (kg/ha)	1	Default value. Not used because inhalation routes are turned off.
Crop type, (1= field, 2= orchard, 3= vineyard)	1	
Fraction of edge habitat receiving drift	0	
Fraction of organic carbon in soil	0.015	Default
Bulk density of soil (kg/L)	1.5	Default
Morning feeding start times: min and max	4 5	Default (Lebanon KS)
Morning feeding end times: min and max	6 10	
afternoon feeding start times: min and max	16 19	
afternoon feeding end times: min and max	20 21	
Proportion of daily feeding taking place in morning: min and max	0.4 0.6	Varying proportions of food distributed between morning and afternoon.
Gorging factor	3	Assume that birds gorge when they land. Factor of 3x normal feeding based on ECOFRAM recommendation.
Body weight (g): mean, sd, min, max	362, 36, 273, 454	Dunning 1984
feeding category: (1 = insectivore, 2 = herbivore, 3 = granivore, 4 = omnivore)	1	
Fraction of each food item: insects, seeds, fruit, grass, broadleaf	1.0, 0, 0, 0, 0	Recovery plan

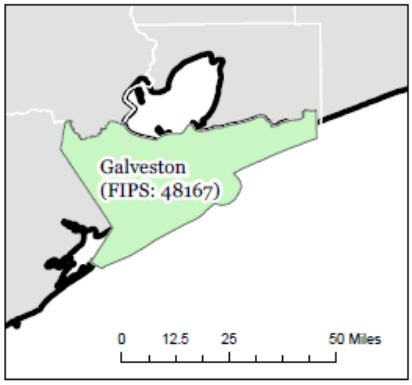
Parameter	Value	Comments
For juveniles: fraction of each food item: insects, seeds, fruit, grass, broadleaf	1.0, 0, 0, 0, 0	Note that although there are juvenile parameters included here, these values are not the focus of this report. The juvenile parameters are used by the MCnest model.
Resident status (1=field, 0 = edge)	0	
Frequency on field: mean, min, max	0.1, 0, 1	Mean frequency on field of species is unknown. Mean values of 10% and 90% used to bound risk.
Fidelity factor (Q), (edge residents = 0.6, field residents = 0.8)	0.6	Default
Contaminated fraction of food	1.0, 1.0, 1.0, 1.0, 1.0	
Food item half-lives (days)	8.5 8.5 8.5 8.5 8.5	Foliar dissipation half-life used for all food items.
Aerobic soil metabolism half-life (days)	18	Aerobic soil metabolism half-life. Stable to hydrolysis.
Koc (L/kg-oc)	13.4	MRID 42774101
Kow	0.71	Based on LogD
Henry's law constant (atm/m3-mol)	1.17e-9	
Solubility in water (mg/L)	6100	SANDZONE Safety Data Sheet (Nov 1989)
Dislodgable foliar residue adjustment factor	0. 48	default
Dermal adsorption fraction	1	default
avian acute oral LD50 (mg a.i./kg-bw)	188	From bobwhite quail study.
Slope of avian oral LD50	4.5	No value is available. Assume default.
Avian acute inhalation LD50 (mg a.i./kg-bw)	0	Not available.
Rat inhalation LD50 (mg a.i./kg-bw)	$\geq$594	Value converted from LC50 value. (MRID 00263861)
Rat acute oral LD50 (mg a.i./kg-bw)	2740	MRID 00078444
Respiratory physiology adjustment factor	3.2	Default for bird body weight.
Chemical specific avian dermal LD50 (enter 0 if no value is available)	0	None
Food matrix adjustment factor	1	No data are available. Assume default.
Fraction of pesticide retained from one hour to the next	0.99	MRID 43245202
ratio of juvenile to adult toxicity	1	No data are available. Assume default.

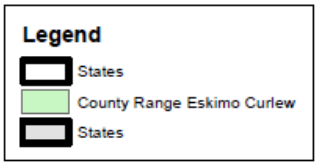
Appendix 4

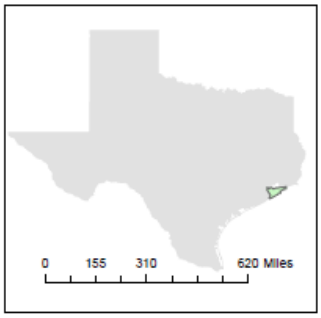
Bird Species County Land cover Information
Eskimo Curlew











	Corn	Cotton	Rice	Soybean	Wheat	Vegetable/ ground fruit	Orchards/ grapes	Other grains	Other Row crops	Other crops	Pasture/ hay/ forage
Full County Range n=24	12,971,726	0	5,016	7,312,078	560,712	21,885	582	261,925	2,495	10,263	1,270,357
Texas (n =1)	0	0	5,016	103	232	18	492	2820	0	0	16,625
Nebraska (n=23)	12,971,726	0	0	7,311,975	560,480	21,867	90	259,105	2,495	10263	1253732

Appendix 5

Critical Habitat Designations and PCE Descriptions

Summary of 14 Listed Species Identified as being on Agricultural Fields with and without Critical Habitat Designations for AL, GA, KY, MI, NC, SC and TX Assessed for dicamba DGA salt

Species Name	Primary Constituent Elements (PCE)	Source
Species with Critical Habitat Designations (5 Species)[3]		
Houston toad (*Bufo houstonensis*)	Bastrop and Burleson Counties, Texas. Primary Constituent Elements not identified.	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D004#crithab http://ecos.fws.gov/docs/federal_register/fr179.pdf
Indiana bat (Myotis sodalis)	Critical habitat designations are either mines or caves.	http://ecos.fws.gov/docs/federal_register/fr161.pdf
Louisiana black bear (Ursus americanus luteolus)	PCE: Relatively inaccessible terrain, thick understory vegetation and abundant food sources in the form of shrubs or tree borne soft or hard mast. Currently found in bottomland hardwood forest communities. Home range very dependent on forest cover.	http://www.gpo.gov/fdsys/pkg/FR-2009-03-10/pdf/E9-4536.pdf#page=1
Virginia big-eared bat (*Corynorhinus (=Plecotus) townsendii virginianus*)	Critical habitat designations are caves.	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A080#crithab http://ecos.fws.gov/docs/federal_register/fr366.pdf
Whooping crane (Grus americana)	PCE: All areas proposed in this rule would provide food, water, and other nutritional or physiological needs of the whooping crane during spring or fall migration. Consumption of some cereal crops in adjacent croplands during migration period. Direct relatable resources to agricultural field possibly treated with 2,4-D choline.	http://ecos.fws.gov/docs/federal_register/fr237.pdf
Species without critical habitat designations (10 species)		
American burying beetle (*Nicrophorus americanus)*	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=I028#crithab
Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B00O#crithab
Eastern indigo snake (*Drymarchon corais couperi*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C026#crithab
Eskimo curlew (*Numenius borealis*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B01A#crithab

[3] Critical habitat designation status determined using U.S. Fish & Wildlife Service's Environmental Conservation Online System (ECOS) species profiles.

Gopher tortoise (*Gopherus polyphemus*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C044#crithab
Gulf Coast jaguarundi (*Herpailurus (=Felis) yagouaroundi cacomitli*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A05H#crithab
Lesser prairie-chicken (*Tympanuchus pallidicinctus*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0AZ#crithab
Ocelot (*Leopardus (Felis) pardalis*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A084#crithab
Red wolf (*Canis rufus*)	None	http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A00F#crithab

Summary of 292 Listed Species Identified as being off Agricultural Fields with and without Critical Habitat Designations for AL, GA, KY, MI, NC, SC and TX Assessed for dicamba DGA salt

Critical Habitat Designation	**Species Name**
Species with Critical Habitat Designations (113 Species)[4]	[Unnamed] ground beetle *(Rhadine exilis)*
	[Unnamed] ground beetle *(Rhadine infernalis)*
	Alabama beach mouse *(Peromyscus polionotus ammobates)*
	Alabama cavefish *(Speoplatyrhinus poulsoni)*
	Alabama moccasinshell *(Medionidus acutissimus)*
	Alabama pearlshell *(Margaritifera marrianae)*
	Alabama sturgeon *(Scaphirhynchus suttkusi)*
	Altamaha Spinymussel *(Elliptio spinosa)*
	Amber darter *(Percina antesella)*
	Appalachian elktoe *(Alasmidonta raveneliana)*
	Arkansas River shiner (*Notropis girardi*)
	Austin blind salamander (*Eurycea waterlooensis*)
	Braken Bat Cave Meshweaver (*Cicurina venii*)
	Braun's rock-cress (*Arabis perstellata*)
	Cahaba shiner (*Notropis cahabae*)
	Canada lynx (*Lynx canadensis*)
	Cape Fear shiner (*Notropis mekistocholas*)
	Carolina heelsplitter (*Lasmigona decorata*)
	Chipola slabshell (*Elliptio chipolaensis)*

[4] Critical habitat designation status determined using U.S. Fish & Wildlife Service's Environmental Conservation Online System (ECOS) species profiles.

	Choctaw bean (*Villosa choctawensis*)
	Cokendolpher Cave Harvestman (*Texella cokendolpheri*)
	Comal Springs dryopid beetle (*Stygoparnus comalensis)*
	Comal Springs riffle beetle (*Heterelmis comalensis)*
	Conasauga logperch (*Percina jenkinsi*)
	Coosa moccasinshell (*Medionidus parvulus*)
	Cumberland darter (*Etheostoma susanae*)
	Cumberland elktoe (*Alasmidonta atropurpurea*)
	Cumberlandian combshell (*Epioblasma brevidens*)
	Dark pigtoe (*Pleurobema furvum*)
	Devils River minnow (*Dionda diaboli*)
	Diamond Y Spring snail (*Pseudotryonia adamantina*)
	Diminutive Amphipod (*Gammarus hyalleloides*)
	Fat three-ridge (mussel) (*Amblema neislerii*)
	Finelined pocketbook (*Lampsilis altilis*)
	Fleshy-fruit gladecress (*Leavenworthia crassa*)
	Fluted kidneyshell (*Ptychobranchus subtentum*)
	Fountain darter (*Etheostoma fonticola*)
	Frosted Flatwoods salamander (*Ambystoma cingulatum*)
	Fuzzy pigtoe (*Pleurobema strodeanum*)
	Georgetown salamander (Eurycea nau*fragia*)
	Georgia pigtoe (*Pleurobema hanleyianum*)
	Golden sedge (*Carex lutea*)
	Goldline darter (*Percina aurolineata*)
	Gonzales springsnail (*Tryonia circumstriata*)
	Government Canyon Bat Cave Meshweaver (*Cicurina vespera*)
	Government Canyon Bat Cave Spider (*Neoleptoneta microps*)
	Green sea turtle (*Chelonia mydas)*
	Gulf moccasinshell (*Medionidus penicillatus*)
	Gulf sturgeon (*Acipenser oxyrinchus desotoi*)
	Hawksbill sea turtle (*Eretmochelys imbricata*)
	Helotes mold beetle (*Batrisodes venyivi*)
	Hine's emerald dragonfly (*Somatochlora hineana*)
	Interrupted (=Georgia) Rocksnail (*Leptoxis foremani*)
	Jollyville Plateau salamander (*Eurycea tonkawae*)
	Karner blue butterfly (*Lycaeides melissa samuelisY)*
	Kentucky cave shrimp (*Palaemonias ganteri*)
	Kentucky glade cress (*Leavenworthia exigua laciniata*)
	Leatherback sea turtle (*Dermochelys coriacea*)
	Leon Springs pupfish (*Cyprinodon bovinus*)
	Loggerhead sea turtle (*Caretta caretta*)
	Madla's Cave Meshweaver (*Cicurina madla*)
	Mexican spotted owl (*Strix occidentalis lucida*)
	Mountain golden heather (*Hudsonia montana*)
	Narrow pigtoe (*Fusconaia escambia*)
	Neches River rose-mallow (*Hibiscus dasycalyx*)

	North Atlantic Right Whale (*Eubalaena glacialis*)
	Ochlockonee moccasinshell (*Medionidus simpsonianus*)
	Oval pigtoe (*Pleurobema pyriforme pyriforme*)
	Ovate clubshell (*Pleurobema perovatum*)
	Oyster mussel (*Epioblasma capsaeformis*)
	Peck's cave amphipod (*Stygobromus (=Stygonectes) pecki*)
	Pecos (=puzzle, =paradox) sunflower (*Helianthus paradoxus*)
	Pecos assiminea snail (*Assiminea pecos*)
	Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*)
	Phantom springsnail (*Pyrgulopsis texana*)
	Phantom tryonia (*Tryonia cheatumi*)
	Piping Plover (*Charadrius melodus*)
	Purple bankclimber (mussel) (*Elliptoideus sloatianus*)
	Pygmy Sculpin (*Cottus paulus (=pygmaeus))*
	Rabbitsfoot (*Quadrula cylindrica cylindrica*)
	Reticulated flatwoods salamander (*Ambystoma bishopi*)
	Robber Baron Cave Meshweaver (*Cicurina baronia*)
	Rough hornsnail (*Pleurocera foremani*)
	Round Ebonyshell (*Fusconaia rotulata*)
	Rush Darter (*Etheostoma phytophilum*)
	Salado salamander (*Eurycea chisholmensis*)
	San Marcos gambusia (*Gambusia georgei*)
	San Marcos salamander (*Eurycea nana*)
	Sharpnose Shiner (*Notropis oxyrhynchus*)
	Shinyrayed pocketbook (*Lampsilis subangulata*)
	Short's bladderpod (*Physaria globosa*)
	Slabside Pearlymussel (*Pleuronaia dolabelloides*)
	Slackwater darter (*Etheostoma boschungi*)
	Smalleye Shiner (*Notropis buccula*)
	Snail darter (*Percina tanasi*)
	Southern acornshell (*Epioblasma othcaloogensis*)
	Southern clubshell (*Pleurobema decisum*)
	Southern kidneyshell (*Ptychobranchus jonesi*)
	Southern pigtoe (*Pleurobema georgianum*)
	Southwestern willow flycatcher (*Empidonax traillii extimus*)
	Spotfin Chub (*Erimonax monachus*)
	Spruce-fir moss spider (*Microhexura montivaga*)
	Sunfish, spring pygmy (*Elassoma alabamae*)
	Tapered pigtoe (*Fusconaia burkei*)
	Texas Golden Gladecress (*Leavenworthia texana*)
	Texas wild-rice (*Zizania texana*)
	Triangular Kidneyshell (*Ptychobranchus greenii*)
	Upland combshell (*Epioblasma metastriata*)
	Vermilion darter (*Etheostoma chermocki*)
	Waccamaw silverside (*Menidia extensa*)
	West Indian Manatee (*Trichechus manatus*)

	Whorled Sunflower (*Helianthus verticillatus*)
	Zapata bladderpod (*Lesquerella thamnophila*)
Species without Critical Habitat Designations (179 species)	Alabama (=inflated) heelsplitter (*Potamilus inflatus*)
	Alabama canebrake pitcher-plant (*Sarracenia rubra alabamensis)*
	Alabama cave shrimp (*Palaemonias alabamae*)
	Alabama lampmussel (*Lampsilis virescens*)
	Alabama leather flower (*Clematis socialis*)
	Alabama red-belly turtle (*Pseudemys alabamensis*)
	Alabama streak-sorus fern (*Thelypteris pilosa var. alabamensis)*
	American chaffseed (*Schwalbea americana*)
	American hart's-tongue fern (*Asplenium scolopendrium var. americanum)*
	Anthony's riversnail (*Athearnia anthonyi*)
	Armored snail (*Pyrgulopsis (=Marstonia) pachyta*)
	Ashy dogweed (*Thymophylla tephroleuca*)
	Bachman's warbler (=wood) (*Vermivora bachmanii)*
	Barton Springs salamander (*Eurycea sosorum*)
	Bee Creek Cave harvestman (*Texella reddelli)*
	Big Bend gambusia (*Gambusia gaigei*)
	Black lace cactus (*Echinocereus reichenbachii var. albertii*)
	Black spored quillwort (*Isoetes melanospora*)
	Black-capped Vireo (*Vireo atricapilla*)
	Blackside dace (*Phoxinus cumberlandensis*)
	Blue Ridge goldenrod (*Solidago spithamaea*)
	Blue shiner *(Cyprinella caerulea)*
	Bone Cave harvestman (Texella *reyesi*)
	Boulder darter (*Etheostoma wapiti)*
	Bunched arrowhead (*Sagittaria fasciculata)*
	Bunched cory cactus *(Coryphantha ramillosa*)
	Canby's dropwort (*Oxypolis canbyi)*
	Carolina northern flying squirrel (*Glaucomys sabrinus coloratus)*
	Cherokee darter (*Etheostoma scotti*)
	Chisos Mountain hedgehog Cactus (*Echinocereus chisoensis var. chisoensis)*
	Clear Creek gambusia (*Gambusia heterochir)*
	Clubshell (*Pleurobema clava)*
	Coffin Cave mold beetle (*Batrisodes texanus)*
	Comanche Springs pupfish (*Cyprinodon elegans)*
	Cooley's meadowrue (*Thalictrum cooleyi)*
	Copperbelly water snake (*Nerodia erythrogaster neglecta*)
	Cracking pearlymussel *(Hemistena lata)*
	Cumberland bean (pearlymussel) *(Villosa trabalis)*

	Cumberland monkeyface (pearlymussel) (*Quadrula intermedia)*
	Cumberland rosemary (*Conradina verticillata)*
	Cumberland sandwort (*Arenaria cumberlandensis*)
	Cylindrical lioplax (snail) (*Lioplax cyclostomaformis)*
	Davis' green pitaya (*Echinocereus viridiflorus var. davisii*)
	Dromedary pearlymussel (*Dromus dromas)*
	Duskytail darter *(Etheostoma percnurum)*
	Dwarf lake iris (Iris *lacustris*)
	Dwarf wedgemussel (*Alasmidonta heterodon)*
	Dwarf-flowered heartleaf (*Hexastylis naniflora)*
	Eastern prairie fringed orchid (*Platanthera leucophaea)*
	Etowah darter (*Etheostoma etowahae*)
	False killer whale (*Pseudorca crassidens)*
	Fanshell (*Cyprogenia stegaria)*
	Fat pocketbook (*Potamilus capax)*
	Finback whale (*Balaenoptera physalus*)
	Finerayed pigtoe (*Fusconaia cuneolus*)
	Flat pebblesnail (*Lepyrium showalteri)*
	Flat pigtoe (*Pleurobema marshalli)*
	Flattened musk turtle (*Sternotherus depressus*)
	Florida torreya (*Torreya taxifolia*)
	Fringed campion *(Silene polypetala)*
	Gentian pinkroot (*Spigelia gentianoides)*
	Golden-cheeked warbler (=wood) (*Dendroica chrysoparia*)
	Gray bat (*Myotis grisescens*)
	Green pitcher-plant (*Sarracenia oreophila*)
	Hairy rattleweed (*Baptisia arachnifera*)
	Harperella (*Ptilimnium nodosum*)
	Heavy pigtoe (*Pleurobema taitianum*)
	Heller's blazingstar (*Liatris helleri*)
	Hinckley oak (*Quercus hinckleyi*)
	Houghton's goldenrod (*Solidago houghtonii*)
	Humpback whale (*Megaptera novaeangliae*)
	Hungerford's crawling water Beetle (*Brychius hungerfordi*)
	James spinymussel (*Pleurobema collina)*
	Johnston's frankeni (*Frankenia johnston*ii)
	Kemp's ridley sea turtle (*Lepidochelys kempii*)
	Kirtland's Warbler (*Setophaga kirtlandii*)
	Kral's water-plantain (*Sagittaria secundifolia*)
	Kretschmarr Cave mold beetle (*Texamaurops reddelli)*
	Lacy elimia (snail) (*Elimia crenatella*)
	Lakeside daisy (*Hymenoxys herbacea)*
	Large-flowered skullcap (*Scutellaria montana)*
	Large-fruited sand-verbena (*Abronia macrocarpa*)
	Leafy prairie-clover (*Dalea foliosa*)

	Least tern (*Sterna antillarum*)
	Little Aguja (=Creek) Pondweed (*Potamogeton clystocarpus*)
	Little amphianthus (*Amphianthus pusillus*)
	Littlewing pearlymussel *(Pegias fabula*)
	Lloyd's Mariposa cactus (*Echinomastus mariposensis)*
	Louisiana quillwort (*Isoetes louisianensis*)
	Lyrate bladderpod (*Lesquerella lyrata)*
	Mat-forming quillwort (*Isoetes tegetiformans*)
	Mexican long-nosed bat (*Leptonycteris nivalis*)
	Miccosukee gooseberry (*Ribes echinellum*)
	Michaux's sumac (*Rhus michauxii*)
	Michigan monkey-flower *(Mimulus michiganensis)*
	Mitchell's satyr Butterfly *(Neonympha mitchellii mitchellii)*
	Mohr's Barbara button *(Marshallia mohrii)*
	Morefield's leather flower (*Clematis morefieldii*)
	Mountain sweet pitcher-plant (*Sarracenia rubra ssp. Jonesii)*
	Navasota ladies'-tresses (*Spiranthes parksii)*
	Nellie cory cactus (*Coryphantha minima*)
	No common name *(Geocarpon minimum*)
	Noonday globe (*Patera clarki nantahala*)
	Northern aplomado falcon (*Falco femoralis septentrionalis)*
	Northern riffleshell (*Epioblasma torulosa rangiana*)
	Orangefoot pimpleback (pearlymussel) (*Plethobasus cooperianus)*
	Orangenacre mucket (*Lampsilis perovalis)*
	Painted rocksnail (*Leptoxis taeniata*)
	Pale lilliput (pearlymussel) (*Toxolasma cylindrellus*)
	Palezone shiner (*Notropis albizonatus*)
	Pallid sturgeon *(Scaphirhynchus albus*)
	Pecos gambusia *(Gambusia nobilis)*
	Persistent trillium *(Trillium persistens)*
	Pink mucket (pearlymussel*) (Lampsilis abrupta)*
	Pitcher's thistle *(Cirsium pitcheri)*
	Plicate rocksnail (*Leptoxis plicata*)
	Pondberry (*Lindera melissifolia*)
	Price's potato-bean (*Apios priceana*)
	purple cat's paw (=purple cat's paw pearlymussel) (*Epioblasma obliquata obliquata)*
	Rayed Bean (*Villosa fabalis*)
	Red Hills salamander (*Phaeognathus hubrichti)*
	Red-cockaded woodpecker (*Picoides borealis)*
	Relict darter (*Etheostoma chienense)*
	Relict trillium (*Trillium reliquum)*
	Ring pink (mussel) (*Obovaria retusa*)
	Roan Mountain bluet (*Hedyotis purpurea var. montana)*
	Rock gnome lichen (*Gymnoderma lineare*)

	Roseate tern (*Sterna dougallii dougallii*)
	Rough pigtoe (*Pleurobema plenum*)
	Rough-leaved loosestrife (*Lysimachia asperulaefolia*)
	Round rocksnail (*Leptoxis ampla)*
	Running buffalo clover (*Trifolium stoloniferum*)
	Saint Francis' satyr butterfly (*Neonympha mitchellii francisci*)
	Schweinitz's sunflower (*Helianthus schweinitzii*)
	Seabeach amaranth (*Amaranthus pumilus*)
	Sensitive joint-vetch (*Aeschynomene virginica)*
	Sheepnose Mussel (*Plethobasus cyphyus)*
	Shiny pigtoe (*Fusconaia cor)*
	Shortnose sturgeon (*Acipenser brevirostrum*)
	Short's goldenrod (*Solidago shortii)*
	Slender campeloma (*Campeloma decampi*)
	Slender rush-pea (*Hoffmannseggia tenella*)
	Small whorled pogonia (*Isotria medeoloides*)
	Small-anthered bittercress (*Cardamine micranthera*)
	Smalltooth sawfish (*Pristis pectinata)*
	Smooth coneflower (*Echinacea laevigat*a)
	Sneed pincushion cactus (*Coryphantha sneedii var. sneedii)*
	Snuffbox mussel (*Epioblasma triquetra)*
	South Texas ambrosia (*Ambrosia cheiranthifolia)*
	Southern combshell (*Epioblasma penita)*
	Southern sandshell (*Hamiota (=Lampsilis) australis*)
	Spectaclecase (mussel) (*Cumberlandia monodonta)*
	Sperm whale (*Physeter catodon (=macrocephalus))*
	Spreading avens (*Geum radiatum*)
	Star cactus (*Astrophytum asterias*)
	Stirrupshell (*Quadrula stapes*)
	Swamp pink (*Helonias bullata*)
	Tar River spinymussel (*Elliptio steinstansana)*
	Tennessee yellow-eyed grass (*Xyris tennesseensis)*
	Terlingua Creek cat's-eye (*Cryptantha crassipes*)
	Texas ayenia (*Ayenia limitaris*)
	Texas blind salamander (*Typhlomolge rathbuni*)
	Texas poppy-mallow (*Callirhoe scabriuscula*)
	Texas prairie dawn-flower (*Hymenoxys texana*)
	Texas snowbells (*Styrax texanus*)
	Texas trailing phlox (*Phlox nivalis ssp. texensis)*
	Tobusch fishhook cactus (*Sclerocactus brevihamatus ssp. tobuschii)*
	Tooth Cave ground beetle (*Rhadine persephone)*
	Tooth Cave pseudoscorpion (*Tartarocreagris texana)*
	Tooth Cave Spider (*Leptoneta myopica*)
	Tulotoma snail (*Tulotoma magnifica*)
	Virginia spiraea (*Spiraea virginiana)*

	Walker's manioc (*Manihot walkerae)*
	Watercress darter (*Etheostoma nuchale*)
	White bladderpod (*Lesquerella pallida*)
	White irisette (*Sisyrinchium dichotomum*)
	White wartyback (pearlymussel) (*Plethobasus cicatricosus*)
	White-haired goldenrod (*Solidago albopilosa*)
	Wood stork (*Mycteria americana*)
	Yellow blossom (pearlymussel) (*Epioblasma florentina florentina)*

Appendix 6

U.S. Fisk and Wildlife Service Concurrence Memo for Eskimo Curlew Effects Determination

From: Swem, Ted [mailto:ted_swem@fws.gov]
Sent: Monday, May 11, 2015 5:40 PM
To: Wagman, Michael
Subject: Re: Eskimo Curlew (Dicamba ESA assessment)

Dear Mr. Wagman

Regrettably, we do concur with your determination. Although we prefer to hold out hope and have not removed the Eskimo Curlew from the list of Threatened and Endangered Species, we consider it to be "presumed extinct." We believe therefore that there are none left to encounter pesticides applied anywhere, and thus agree that the effects of the proposed action are discountable.

Thank you for checking in, though.

Ted Swem

On Mon, May 11, 2015 at 1:33 PM, Wagman, Michael <Wagman.Michael@epa.gov> wrote:

Ted Swem, Chief,

Endangered Species Branch,

Fairbanks Fish and Wildlife Field Office,

US Fish and Wildlife Service (907) 456-0441

Dear Mr. Swem

The USEPA Office of Pesticide Programs is in the process of making an effects determination for the registration of the herbicide dicamba diglycolamine (DGA) salt on cotton and soybean fields in Texas, Nebraska and Oklahoma. Use of the pesticide will be limited to ground spray application using a formulation and specific spray equipment in combination to spray drift setbacks that result in pesticide application areas of concern limited to only the actual on-field treatment site (the targeted cotton or soybean field itself).

Our review of available species location information suggests a potential for a migrant Eskimo curlew (*Numenius borealis*) passing through Texas, Nebraska and Oklahoma to encounter a treated field with dicamba DGA residues. Our analysis indicates that if such an encounter occurred, the residue levels that would trigger a concern for adverse effects to the bird. However, in reviewing the available information on the status of the Eskimo curlew[1], we have determined that individuals of the species are extremely rare. This rarity of individuals

indicates to us that the chance of an individual curlew to encounter a dicamba DGA treated cotton or soybean field would be extremely unlikely to occur. Therefore any effects of dicamba DGA salt to an Eskimo curlew would be extremely unlikely to occur.

An effect that is extremely unlikely to occur would be considered discountable in regards to an effects determination and would be consistent with a determination of Not Likely to Adversely Affect. We therefore have determined that the proposed use of dicamba DGA salt on cotton and soybeans in Texas, Nebraska and Oklahoma will Not Likely to Adversely Affect individual Eskimo curlews.

Does the United States Fish and Wildlife Service concur with our effects determination?

Sincerely,

Michael Wagman
Biologist, Environmental Risk Branch VI
Environmental Fate and Effects Division
Office of Pesticide Programs
United States Environmental protection Agency
703-347-0198

[1] Eskimo Curlew (*Numenius borealis*) 5-Year Review: Summary and Evaluation, August 31, 2011, U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks Alaska

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

PC Code: **128931**
DP Barcode: **404823**
Date: **March 24, 2016**

MEMORANDUM

SUBJECT: Ecological Risk Assessment for Dicamba DGA Salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed Post-Emergence New Use on Dicamba-Tolerant Cotton (MON 87701)

TO: Grant Rowland, Risk Manager Reviewer
Kathryn Montague, Product Manager Team 23
Daniel Kenny, Branch Chief
Herbicide Branch
Registration Division (7505P)

FROM: Michael Wagman, Biologist 3/24/16
Elizabeth Donovan, Biologist 3/24/16
William P. Eckel, Ph.D., Senior Science Advisor (For BE) 3-24-16
Amy Blankinship, Senior Science Advisor
Environmental Risk Branch 6
Environmental Fate and Effects Division (7507P)

THRU: Mark Corbin, Branch Chief 3-24-16
Environmental Risk Branch 6
Environmental Fate and Effects Division (7507P)

The Environmental Fate and Effects Division (EFED) has completed a review of the new use request for the herbicide dicamba [M1691 Herbicide, EPA Reg. No. 524-582 (58.1% diglycolamine salt of dicamba (DGA); PC code 128931)] for post-emergent (in-crop) use on dicamba-tolerant cotton (MON 88701, BOLLGARD II® XTENDFLEX™ cotton). Dicamba is currently registered for use on cotton at application rates similar to those proposed for the new use as a pre-emergent and post-harvest application, not to exceed 2 lbs a.e./A per year. The proposed new use is included on the supplemental label of M1691 herbicide for pre-emergence *and* post-emergence (in-crop) use on MON 88701 dicamba-tolerant cotton; this risk assessment is based on the proposed label dated December, 2015. The primary difference between the proposed new use on MON 88701 cotton and the current registration on cotton is the timing of applications. The proposed new use allows

equivalents). EFED determined that fate studies conducted with dicamba acid provide "surrogate data" for the dicamba salts and that toxicity data across the acid and salts could generally be combined. (USEPA, 2005a)

MODE OF ACTION

Dicamba is a benzoic acid herbicide similar in structure and mode of action to phenoxy herbicides. Like the phenoxy herbicides, dicamba mimics auxins, a type of plant hormone and causes abnormal cell growth by affecting cell division. Dicamba acts systemically in plants after it is absorbed through leaves and roots. It is easily transported throughout the plant and accumulates in new leaves.

USE CHARACTERIZATION

Monsanto Company submitted a new use request for the herbicide dicamba [M1691 Herbicide, EPA Reg. No. 524-582 (56.8% diglycolamine salt of dicamba)] for use on dicamba-tolerant cotton (MON 87701). M1691 Herbicide is a water-soluble formulation intended for control and suppression of many broadleaf weeds, woody brush and vines. **Table 2** presents the proposed application rates to the dicamba-tolerant cotton. Rates for dicamba salts are normalized to dicamba acid equivalent per acre (a.e./A).

Table 2. Dicamba DGA Proposed Use Pattern for Dicamba-Tolerant Cotton.

Crop	Maximum Individual Application Rate[3] lbs dicamba a.e./A		Number of Applications	Application instructions and intervals (days)	Max Annual Application Rate in lbs dicamba a.e./A/year		Application Method
Dicamba-tolerant cotton MON 87701	Pre-emergence (pre-plant, at planting, or prior to crop emergence)[2]	1.0	1[4]	Pre-plant, at planting, or prior to crop emergence.	1.0	2.0 total	Restricted to ground sprays only
	Post-emergence[1] (Preharvest)	0.5	4[4]	From emergence to 7 days prior to harvest, minimum 7 days between applications	2.0		

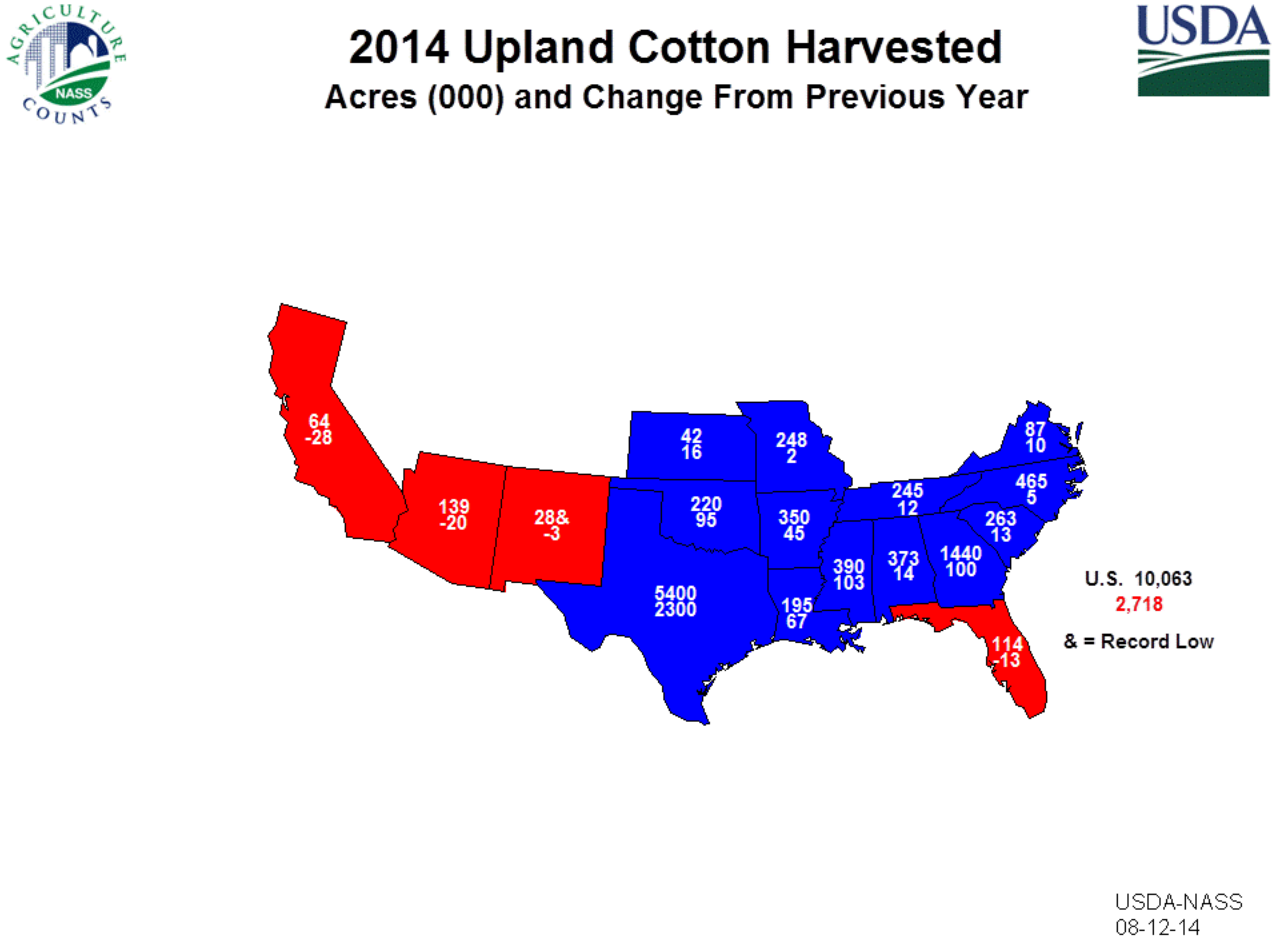
[1]- M1691 Herbicide
[2]- Registered uses
[3]- "Acid equivalent"
[4]- Calculated by dividing the max application rate by the max individual application rate.

It is common for products like this to be tank mixed with other products and pesticide active ingredients, but the label for this use prohibits tank-mixing with other herbicides and only allows tank-mixes with products that have been tested and found not to increase the likekihood of drift/volatility. EFED recommends that additional guideline laboratory plant testing be required if proposed tank mixes include additional active ingredients to account for potential synergistic phytotoxic effects. Testing of such products should include the standard suite of tested species from the already submitted dicamba and other active ingredient's vegetative vigor studies as well as those that the open literature and any other data that may indicate potential for synergistic effects.

According to the proposed label, aerial application of dicamba to dicamba-tolerant cotton is not permitted (*i.e.*, it is restricted to ground applications only).

The proposed dicamba registration is for use on dicamba-tolerant cotton (MON 87701). **Figure 1** shows acres of cotton harvested in 2014 in the U.S., per USDA. It is assumed that the new use of dicamba on dicamba-tolerant cotton would be within this 17-state area. The figure indicates that there were approximately 10 million acres of cotton harvested in 2014. The states shaded in red in the diagram below indicate a decrease in harvested cotton acres from the previous year while blue shading indicates an increase in harvested acres from the previous year.

FIGURE 1. Acres of Cotton Harvested By State in the United States in 2014 (based on information from USDA-NASS)
http://www.nass.usda.gov/Charts_and_Maps/Field_Crops/cotnacm.asp



ENVIRONMENTAL FATE CHACTERIZATION

Dicamba is very soluble (6,100 ppm) and mobile (K_{oc} = 13.4 L/mg o.c.) in the laboratory, and is