[Draft] Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program

Arizona Site-Specific

San Carlos Apache Tribal Rangeland portions within Gila and Graham County.

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Prepared by:
Animal and Plant Health Inspection Service
3640 East Wier Ave. Suite 1
Phoenix, Arizona 85040

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Acronyms and Abbreviations

ac	acre
a.i.	active ingredient
AChE	acetylcholinesterase
APHIS	Animal and Plant Health Inspection Service
BLM	Bureau of Land Management
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
EA	environmental assessment
e.g.	example given (Latin, exempli gratia, "for the sake of example")
EIS	environmental impact statement
E.O.	Executive Order
FONSI	finding of no significant impact
EIL	economic injury level
g	gram
ha	hectare
HHERA	human health and ecological risk assessments
i.e.	in explanation (Latin, id est "in other words.")
IPM	integrated pest management
lb	pound
MBTA	Migratory Bird Treaty Act
MOU	memorandum of understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIH	National Institute of Health
ppm	parts per million
PPE	personal protective equipment
PPQ	Plant Protection and Quarantine
RAATs	reduced agent area treatments
ULV	ultra-low volume
U.S.C.	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Services

[Draft] Site-Specific Environmental Assessment

Rangeland Grasshopper and Mormon Cricket Suppression Program
San Carlos Apache Tribal Rangeland portions within Gila and Graham County.

I. Need for Proposed Action

A. Purpose and Need Statement

An infestation of grasshoppers or Mormon crickets may occur in rangeland within the San Carlos Apache Reservation in Gila County and Graham County. The Animal and Plant Health Inspection Service (APHIS) and San Carlos Apache Tribe may, upon request by land managers or State departments of agriculture, conduct treatments to suppress grasshopper infestations as part of the Rangeland Grasshopper and Mormon Cricket Suppression Program (program). The term "grasshopper" used in this environmental assessment (EA) refers to both grasshoppers and Mormon crickets, unless differentiation is necessary.

Under the guidance of Section 417 of the Plant Protection Act of 2000, USDA plays a coordinating role between Federal agencies, State agricultural departments, and private ranchers to control both grasshoppers and Mormon crickets.

Populations of grasshoppers that trigger the need for a suppression program are normally considered on a case-by-case basis and are difficult to predict. Through late summer and autumn adult grasshopper surveys, APHIS can sometimes forecast areas where damaging grasshopper populations may occur during the following year (the next spring/summer). Potential areas where large populations may occur can be found in the 2025 Grasshopper Hazard Map in (appendix B), also the 2025 Grasshopper Hazard Map for the Tribal rangeland proposed action area (Appendix E).

Land managers and property owners request APHIS assistance to control grasshopper outbreaks because of a history of damage, the potential damage to rangeland resources forecast in the current year, and as determined by spring nymphal assessment and delimitation surveys conducted prior to the summer treatment season.

Benefits of control may include protection of rangeland ecosystem resources and adjacent cropland against impacts for the current year, as well as reducing the potential for continued elevated damage in subsequent years. When grasshopper populations become extreme due to outbreak conditions, their feeding on available vegetation can lead to denuded areas, elimination of seed production, increased soil erosion, reduced forage and habitat for other herbivores including wildlife and livestock and impacts to rare plants (plus obligate species communities such as rare native pollinators). Further they have the potential to continue for several years without diminishment from natural causes, such as unfavorable climatic conditions or sufficiently scaled-up control from coevolved predators, parasites, or diseases.

Additionally, suppressing grasshopper outbreaks on rangeland may prevent their subsequent migration and resulting potential impacts to high value crops or human safety in adjacent areas.

Rural economies depend on rangelands that managed for productive forage to provide for livestock grazing. A reduction in forage has significant impact on cattle health and gain which adversely impacts producers and their livelihoods. Economic values of rangelands also include energy production sites, both fossil and renewable, and recreation sites. Besides these direct market values, rangelands also provide important ecosystem services, such as purification of air and water, water conservation, generation and preservation of soils and renewal of their fertility, detoxification and decomposition of wastes and pollutants, pollination of crops and natural vegetation, dispersal of seeds, cycling and movement of nutrients, control of potential agricultural pests, maintenance of biodiversity, and aesthetic beauty.

The goal of the proposed suppression program analyzed in this EA is to reduce grasshopper populations below economic injury levels in order to protect the natural resources of rangeland ecosystems, the value of livestock and wildlife forage, and cropland adjacent to rangeland. The purpose of this EA is to reduce the impact of grasshopper infestations on Tribal rangeland ecosystems and agricultural productivity on the Reservation. High populations of grasshoppers can severely degrade the land, which affects both the cultural and economic well-being of the San Carlos Apache Tribe, as livestock production and land stewardship are vital components of their livelihood.

This EA analyzes potential effects of the proposed action and its alternatives. This EA applies to a proposed suppression program that could take place from April 20, 2025, to Sept. 30, 2030, in Gila County and Graham County rangeland contained within the San Carlos Apache Reservation. This timeframe was requested by the Tribe to cover local MOU agreements and tribal request timeframes. This EA is limited to Tribal rangeland within tribal cattle association boundaries on Antelope Flat and Ash Flat. All other tribal rangeland would be excluded. The exclusions are based on historical survey data, no accessibility, proximity to Gila River, San Carlos Reservoir, sensitive sites and populated areas. Other areas excluded are cited in Chapter 3 Environmental Consequences, section B, Special Management Areas and Habitat Exclusions.

This EA is prepared in accordance with the requirements under the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq*.); Council on Environmental Quality's (CEQ) regulations implementing NEPA (40 CFR 1500 *et seq*.); USDA (7 CFR Part 1b) and APHIS NEPA Implementing Procedures (7 CFR Part 372). APHIS make and issue a decision based on the analysis presented in this EA, the results of public involvement, and consultation with other agencies and individuals. A selection of one of the program alternatives will be made by APHIS for the 2025-2030 Control Program for infested rangeland in Graham and Gila County, contained within those San Carlos Apache Tribal Ranches.

APHIS is aware of the November 12, 2024, decision in Marin Audubon Society v. Federal Aviation Administration, No. 23-1067 (D.C. Cir. Nov. 12, 2024). To the extent that a court may conclude that the CEQ regulations implementing NEPA are not judicially enforceable or binding on this agency action, APHIS has nonetheless elected to follow those regulations at 40 C.F.R. Parts 1500– 1508, in addition to the APHIS's procedures and regulations implementing NEPA at 7 CFR Part 372, to meet the agency's obligations under NEPA, 42 U.S.C. §§ 4321 et seq.

B. Background Discussion

1. Grasshopper Ecology

Rangelands provide many goods and services, including food, fiber, recreational opportunities, and grazing land for cattle (Havstad et al., 2007; Follett and Reed, 2010). Grasshoppers and Mormon crickets are part of rangeland ecosystems, serving as food for wildlife and playing an important role in nutrient cycling. However, grasshoppers and Mormon crickets have the potential to occur at high population levels, referred to as outbreaks (Belovsky et al., 1996), that result in competition with livestock and other herbivores for rangeland forage and can result in damage to rangeland plant species (Wakeland and Shull, 1936; Swain, 1944; Wakeland and Parker, 1952; Hewitt, 1977; Hewitt and Onsager, 1983; Belovsky et al., 1996; Belovsky, 2000; Pfadt, 2002; Branson et al., 2006; Bradshaw et al., 2018). Out of approximately 650 western grasshopper species, only 10 to 15 are recurrent economic pests. However, even during "normal" population years, they remove over 20% of above-ground rangeland forage annually at an estimated cost of $1.2 billion per year (Hewitt & Onsager, 1983; dollar amount adjusted). During severe outbreaks, grasshoppers consume substantial forage, which may disrupt the ecological functioning of rangelands (Rashford et al., 2012).

APHIS supports the use of Integrated Pest Management (IPM) principles in the management of grasshoppers and Mormon Crickets. Integrated pest management is the selection, integration, and implementation of pest control tactics in a systems approach on the basis of anticipated economic, environmental, and sociological consequences. The economic injury level (EIL) concept is the most widely accepted decision-making framework for pest management (Pedigo et al. 1986). The basic principle is to determine the pest level (e.g., population per unit area) that results in monetary damages greater than the cost of treatment – benefit cost ratio greater than one in standard economic terminology. The mathematical formulations can vary depending on the application and data available, but the basic formulation for EIL is given by (see Higley and Pedigo 1996):

$$\text{EIL} = \frac{C}{VDK},$$

where, C is treatment cost (e.g., $/acre), V is market value per unit of production (e.g., $/lb), D is production loss per pest (e.g., lb/pest) and K is the proportional reduction in loss from applying control. The EIL identifies the pest population (e.g., pest/acre) that justifies spending C dollars on control.

The EIL can be used as an actionable criterion; however, given pest population dynamics and delays in treatment effect, applying treatment once EIL pest levels are observed may result in substantial economic losses. APHIS and our cooperators assess whether grasshopper populations are exceeding an action threshold (historically termed the "economic infestation level"), which identifies the pest level when treatment should be initiated to avoid an increasing pest population from reaching the EIL. The action threshold therefore identifies a temporal criterion to initiate management given observations of pest levels (Figure 1). Action thresholds can be developed in a variety of ways including subjective determinations based on local experience, to objective functions of the EIL.

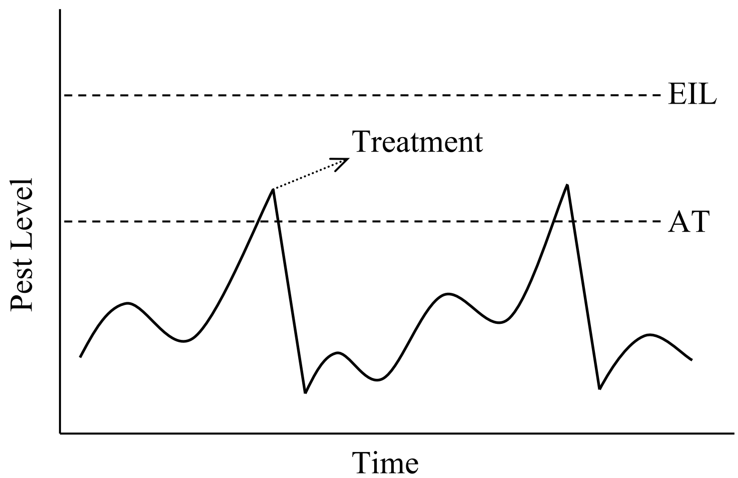


Figure 1. Diagram of the typical relationship between the economic injury level (EIL) and action threshold (AT) for applying pest treatments (Rashford et al., 2012).

The "economic injury level" is a measurement of the economic losses caused by a particular population level of grasshoppers to the infested rangeland. This value is determined on a case-by-case basis with knowledge of many factors including, but not limited to, the following: economic use of available forage or crops; grasshopper species, age, and density present; rangeland productivity and composition; accessibility and cost of alternative forage; and weather patterns. In decision making, the level of economic injury is balanced against the cost of treating to determine an "economic threshold" below which there would not be an overall benefit for the treatment. Short-term economic benefits accrue during the years of treatments, but additional long-term benefit may accrue and be considered in deciding the total value gained by treatment. Grasshopper caused losses to rangeland habitat and cultural and personal values (e.g., aesthetics and cultural resources), although a part of decision making, are not part of the economic values in determining the necessity of treatment.

While market prices are good proxies for the direct market value of commodities damaged by pests (e.g., crops or forage), market prices do not capture all of the potential economic values affected by pests. Market prices, for example, can be highly variable over time and space, depending on local supply and demand conditions (Rashford et al., 2012).

2. Grasshopper Population Control

Grasshopper populations sometimes build to economic injury levels despite even the best land management and other efforts to prevent outbreaks. The San Carlos Apache Nation has a long history of grasshopper management on Tribal rangelands. When forage and land management have failed to prevent grasshopper outbreaks insecticides may be needed to reduce the destruction of rangeland vegetation. APHIS' enabling legislation provides, in relevant part, that 'on request of the administering agency or the agriculture department of an affected State, the Secretary, to protect rangeland, shall immediately treat Federal, State, or private lands that are infested with grasshoppers or Mormon crickets'… (7 U.S.C. § 7717(c)(1)).

Under the guidance of Section 417 of the Plant Protection Act of 2000, USDA plays a coordinating role between federal agencies, state agricultural departments, and private ranchers to control both grasshoppers and Mormon crickets. APHIS accomplishes this by conducting cooperative surveys during the early spring and late summer to measure both nymphal and adult populations of grasshoppers, respectively. The annual adult surveys can be used to forecast grasshopper population levels in the following year. Where outbreaks are common, the program selectively employs nymphal surveys to delimit potential treatment boundaries.

IPM procedures are thoroughly incorporated into the management of grasshoppers by APHIS. IPM strategies consider economic, environmental, and pesticide resistance consequences of pest control tactics. The primary objective of IPM is to control agricultural pest populations below the economic injury level. APHIS published a programmatic EIS in 1987 for rangeland grasshopper control that included IPM methods as the preferred alternative. At that time APHIS expected the IPM alternative would primarily include biological or chemical methods for grasshopper control. APHIS would continue to participate in research and testing to identify other feasible cultural and mechanical control methods. The current program uses IPM principles by selecting a particular control method on an individual site after taking into consideration of economic (the cost and the cost-effectiveness of various methods in both the short and long term), ecological (the impact on nontarget organisms and the environment), and sociological (the acceptability of various IPM methods to cooperators, or the potential effects on land use) factors.

APHIS uses survey data to inform stakeholders of the potential for economic damage associated with grasshoppers. The program also provides technical assistance on insecticides, application methodology and cost benefit analysis to equip land managers with information needed to make economically and environmentally sound grasshopper treatment decisions.

APHIS responds to solicitations from land managers to assess, and if necessary, suppresses grasshopper infestations. While many stakeholders interact with the program, Federal Land Managers represent about 75% of suppression requests. Engaging in grasshopper suppression is complicated, and funding, rangeland conditions, environmental regulations, politics and public sentiment all impact the process. The need for rapid and effective response when an outbreak occurs limits the options available to APHIS. The application of an insecticide within all or part of the outbreak area is often the only response available to APHIS to rapidly suppress or reduce grasshopper populations and effectively protect rangeland (USDA APHIS, 2011). APHIS uses several factors to determine if grasshopper suppression is warranted, including, but not limited to, the pest species present, maturity of the pest species population, timing of treatment, costs and benefits of conducting the action, and ecological considerations (USDA APHIS, 2008).

The site-specific data used to make treatment decisions in real time is gathered during spring nymph surveys. Surveys help to determine general areas, among the millions of acres where harmful grasshopper infestations may occur in the spring of the following year. Survey data provides the best estimate of future grasshopper populations, while short-term climate or environmental factors change where the outbreak populations occur. The general site-specific data include: grasshopper densities, species complex, dominant species, dominant life stage, grazing allotment terrain, soil types, range conditions, local weather patterns (wind, temp., precipitation), slope and aspect for hatching beds, animal unit months (AUM's) present in grazing allotment, forage damage estimates, number of potential AUM's consumed by grasshopper population, potential AUM's managed for allotment and value of the AUM, estimated cost of replacement feed for livestock, rotational time frame for grazing allotments, number of livestock in grazing allotment.

Historical data for San Carlos Apache Reservation dates to the mid 1950's and 1960's. Nerney (1958, 1960, 1961.) reported severe damage to perennial grasses and annual grasses and forbs. Populations of *Melanoplus sanguinipes, M. cuneatus* and *Aulocara elliotti* at study plots destroyed 99% of vegetation on the rangeland at Ash Flat. Rangeland damage at other study locations reported 8 to 63% forage destruction. These grasshopper populations ranged from 9gh/yd^2 to 90gh/yd^2. Currently, the slope and aspect play an important role in the location of hatching beds, observations indicate that NE and SW facing slopes tend to have hatching occur early in the spring and then populations tend to move to the flatter areas in the Ash Flat area. During seasons of warm dry conditions which favor grasshopper development populations can occur at numbers over 75gh/yd^2. Populations this size can consume 308 tons of forage/section/month. The replacement cost for forage at 2023 prices would be approx. $88,720/section/month not including the cost/logistics of moving that much forage to remote rangeland locations for the livestock. Tribal resources are limited and cattle associations rely on tribal rangeland to provide the forage for livestock.

Although APHIS does surveys and considers the factors described above to determine whether treatment is warranted, many grasshopper and Mormon cricket species can be found statewide within suitable habitat meaning that damage or threats of damage to rangelands can occur wherever those species occur. Program activities fall within the category of actions in which the exact location of individual requests for treatments can be difficult to predict with sufficient notice to accurately describe the locations within which APHIS can reasonably expect to be acting.

On the San Carlos Apache Nation there has been historically long and extensive survey work along with research activities which has led to a relatively accurate timeline for development. Grasshopper populations of the bigheaded grasshopper, *Aulocara elliotti* usually begin to hatch the 2nd to 3rd week of March on rangeland within the San Carlos Apache Tribal Nation. The migratory grasshopper, *Melanoplus sanguinipes*, usually begins to hatch the 4th week of March to 2nd week of April depending on spring weather conditions. Due to this historical survey information, as populations begin to hatch usually in warm dry spring conditions, thus this may lead to a more conducive hatch for larger populations of grasshoppers to be on rangeland. Thus, treatment timelines may occur anywhere from 3rd to 4th week of April to 2nd to 3rd week of May. One unusual characteristic on the San Carlos Apache Nation is the fact that there are multiple generations (multivoltine) of *M. sanguinipes* in a single year (Barnes 1944, Fisher etal 1996). The fact that there are multiple generations of this species of grasshopper (Brust etal. 2009, Hilbert & Logan 1981, Kemp & Onsager 1986) makes it vital to manage early populations to reduce damage caused on rangeland. This species in more southern latitudes such as Arizona exhibit facultative diapause and responds to changes to photoperiods (Fielding 2008). Positive changes result in an increase in non-diapause egg production and a negative shift will result in an increase in diapause egg production (Dean 1982). These factors in this species biology complicates management strategies for populations of grasshoppers within the rangeland covered by this EA.

If survey data determines that a treatment is warranted, there is a small window of opportunity to treat younger grasshoppers within this timeline to get a greater mortality of the grasshopper population on rangeland. After the tribe has gone through the tribal process to submit a request from the Tribal Administrator to APHIS for service to help manage Tribal rangeland, a quick and timely response from APHIS is required to safeguard valuable forage for tribal livestock and wildlife.

In Chapter 3, Environmental Consequences, section A, Description of Affected Environment, APHIS does its utmost to predict locations where treatments may occur based on survey data, past and present requests for treatments, and historical data and trends. However, APHIS cannot predict all the specific locations at which affected resource owners would determine that a rangeland damage problem has become intolerable to the point that they request treatment, because these locations change from year to year. Therefore, APHIS must be ready for treatment requests on short notice anywhere within the proposed rangeland on the San Carlos Apache Nation within Gila County and Graham County, to protect rangeland where consistent with applicable federal and state laws, land management agency policies, and where funding and resources to conduct treatments are available.

3. APHIS Environmental Compliance and Cooperators

In June 2002, APHIS completed an EIS describing the agency's most effective methods of reducing the damage caused by grasshopper populations in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. During November 2019, APHIS published human health and ecological risk assessments (HHERA) for the use of carbaryl, chlorantraniliprole, diflubenzuron and malathion by the program. APHIS also published an updated EIS to consolidate and incorporate the available data and analyze the environmental risk of new program tools. The risk analysis in the 2019 EIS is incorporated by reference (USDA APHIS, 2019).

After consultations with the San Carlos Apache Tribe, a letter of request was received from the San Carlos Apache Tribal Administrator dated January 6, 2025, for USDA, APHIS to "*survey, suppress, and control grasshopper infestations on the San Carlos Apache Reservation, per the Memorandum of Understanding (MOU) between the U.S. Department of the Interior and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS). This Tribal request will be for the duration beginning January 2025 through December 2030. Grasshopper Survey and Treatment will be done in accordance with the Rangeland Grasshopper and Mormon Cricket Suppression Program and the USDA/ APHIS Site-Specific Environmental Assessment for Rangeland Grasshopper and Mormon Cricket Suppression*".

On September 16, 2016, APHIS and the Bureau of Indian Affairs (BIA) signed a Memorandum of Understanding (MOU) detailing cooperative efforts between the two groups on suppression of grasshoppers on BIA managed lands. This MOU clarifies that APHIS will prepare and issue to the public, site-specific environmental documents that evaluate potential impacts associated with the proposed measures to suppress economically damaging grasshopper populations. The MOU also states that these documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the BIA. The MOU further states that the responsible BIA official will request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on BIA land is necessary. The BIA must also approve a Pesticide Use Proposal for APHIS to treat infestations. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document and BIA approves the Pesticide Use Proposal.

APHIS provides technical assistance to Federal, Tribal, State and private land managers including the use of IPM. However, implementation of on-the-ground IPM activities is limited to land management agencies and Tribes, as well as private landowners. APHIS completed the Grasshopper Integrated Pest Management (GIPM) project. One of the goals of the GIPM is to develop new methods of suppressing grasshopper and Mormon cricket populations that will reduce non-target effects. Reduced agent area treatments (RAATs) is one of the methods that has been developed to reduce the amount of pesticide used in suppression activities and is a component of IPM because grasshopper populations are reduced below the level causing economic harm. APHIS typically employs the RAATs method in which the application rate of insecticide is reduced from conventional levels, and treated swaths are alternated with swaths that are not directly treated. The RAATs strategy relies on the effects of an insecticide to suppress grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not directly treated (USDA APHIS, 2002). APHIS continues to evaluate new suppression tools and methods for grasshopper and Mormon cricket populations, including biological control.

C. About This Process

Activities under the Program are subject to the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq*.). APHIS follows the Council on Environmental Quality's (CEQ) regulations implementing NEPA (40 CFR 1500 *et seq*.) along with USDA (7 CFR Part 1b) and APHIS NEPA Implementing Procedures (7 CFR Part 372) as part of the decision-making process. NEPA sets forth the requirement that all federal actions be evaluated in terms of the following:

- Their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts.
- Making informed decisions; and
- Including agencies and the public in their NEPA planning in support of informed decision-making.

As previously discussed in Section B above, the NEPA process for grasshopper management is complicated by the fact that there is a limited window of time when treatments are most effective, and it is difficult to forecast which specific sites within the area covered by this EA will both have requests for treatment and be warranted for treatment to suppress grasshopper outbreaks. As such, the geographic scope of the actions and analyses in this EA is limited to Tribal rangeland which may occur in Gila County and Graham County to account for the wide geographic areas in which grasshoppers and Mormon crickets occur on rangelands. Then, when grasshopper populations grow to nuisance levels, program managers examine the proposed treatment area to ensure that this EA applies to the specific areas where control activities will be conducted and can act quickly. At the same time, the Program strives to alert the public in a timely manner to its more concrete treatment plans and avoid or minimize harm to the environment in implementing those plans.

Section 1619 of the Farm Bill (7 USC 8791) also prohibits disclosure of certain information from agricultural producers who provide information to participate in programs of the department. Intergovernmental agreement between APHIS and San Carlos Apache Nation precludes disclosure of Tribal information to the public without the consent of the Tribal Administrator. Individuals may request information on the specific treatment areas on Tribal Lands from the individual Tribal Nation.

Public involvement under the CEQ Regulations for Implementing the Procedural Provisions of NEPA distinguishes Federal actions with effects of national concern from those with effects primarily of local concern (40 CFR 1501.9). The 2019 EIS is a programmatic analysis of the environmental impacts of the Program across 17 Western States, including Arizona.

To assist with understanding applicable issues and reasonable alternatives to manage grasshopper outbreaks in rangelands and to ensure that the analysis is complete for informed decision making, APHIS has made this Draft EA available for a 30-day public review and comment period. Public outreach notification methods for this EA include local newspaper – legal notices in Eastern Arizona Courier, Safford, Arizona and Silverbelt in Globe, Arizona. These newspapers cover local and rural areas surrounding San Carlos Apache Reservation for the proposed action area. Also notice was published through Stakeholder Registry Notice. The Draft EA was made available to the public for a 30-day comment period. The comment period began March 19th and ended April 18th, 2025. Comments can be sent to USDA, APHIS, 3640 East Wier Ave. Suite 1, Phoenix, Arizona 85040, or contacting the local USDA, APHIS Arizona State Office (602)431-3200. Comments were accepted until April 18th at 4pm MST.

Scoping as defined by NEPA is an early and open process for determining the scope of issues to be addressed by the environmental risk analysis and for identifying the significant issues related to a proposed action (40 CFR 1501.7). Tribal meetings were held with the Tribal Cattle Associations to determine the need to request APHIS' services to suppress grasshopper populations on Tribal rangeland. A decision was made to draft a letter of request from the Tribe to APHIS. A letter of request was signed by the Tribal Administrator on January 6, 2025. APHIS uses the scoping process to enlist land managers and the public to identify alternatives and issues to be considered during the development of a grasshopper suppression program. The process can occur formally and informally through meetings, conversations, or written comments from individuals and groups.

Scoping as defined by NEPA is an early and open process for determining the scope of issues to be addressed by the environmental risk analysis and for identifying the significant issues related to a proposed action (40 CFR 1501.7). APHIS uses the scoping process to enlist land managers and the public to identify alternatives and issues to be considered during the development of a grasshopper suppression program. The process can occur formally and informally through meetings, conversations, or written comments from individuals and groups. APHIS reviewed and considered all comments in preparing the draft EA.

II. Alternatives

To engage in comprehensive NEPA risk analysis APHIS must frame potential agency decisions into distinct action alternatives. These program alternatives are then evaluated to determine the significance of environmental effects. The 2019 programmatic EIS looked at the environmental impacts of three different alternatives:

1. Alternative 1: No action alternative, which would maintain the status quo of allowing applications of three pesticides (carbaryl, diflubenzuron, and malathion). Pesticides may be applied as a spray or bait using ground or aerial equipment at full coverage rates or, more typically, by using RAATs.
2. Alternative 2: No suppression alternative where APHIS would not fund or participate in any program to suppress grasshopper infestations. Any suppression program would be implemented by another entity.

3. Alternative 3: Preferred alternative updates the information allows use of four pesticides (carbaryl, diflubenzuron, and chlorantraniliprole). Upon request, APHIS would make a single application per year to a treatment area, and would apply it at conventional or, more likely, RAAT rates. The approach to use either conventional treatment or RAATs is an adaptive management feature that allows the Program to make site-specific applications with a range of rates to ensure adequate suppression. The preferred alternative further incorporates adaptive management by allowing treatments that may be approved in the future, and by including protocols for assessing the safety and efficacy of any future treatment when compared to currently approved treatments.

APHIS selected Alternative 3 in the Record of Decision (ROD). However, under each alternative APHIS would conduct survey activities, provide technical assistance, and may make insecticide treatments according to the agency's authority under the Plant Protection Act. An example of APHIS technical guidance is the agency's work on integrated pest management (IPM) for the grasshopper program. IPM is defined as a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks (7 U.S. Code 136r-1). IPM for grasshoppers includes biological control, chemical control, rangeland and population dynamics, and decision support tools. Under all the alternatives considered in the EIS APHIS would continue to conduct grasshopper surveys and provide information on ways to manage grasshopper populations in the long-term, such as livestock grazing methods and cultural control by farmers.

APHIS has funded the investigation of various IPM strategies for the grasshopper program. Congress established the Grasshopper Integrated Pest Management (GIPM) to study the feasibility of using IPM for managing grasshoppers. The major objectives of the APHIS GIPM program were to: 1) manage grasshopper populations in study areas, 2) compare the effectiveness of an IPM program for rangeland grasshoppers with the effectiveness of a standard chemical control program on a regional scale, 3) determine the effectiveness of early sampling in detecting developing grasshopper infestations, 4) quantify short- and long-term responses of grasshopper populations to treatments, and 5) develop and evaluate new grasshopper suppression techniques that have minimal effects on non-target species (Quinn, 2000). The results for the GIPM program have been provided to managers of public and private rangeland (www.sidney.ars.usda.gov/grasshopper/index.htm).

The 2019 programmatic EIS provides a solid analytical foundation, but no site-specific suppression pesticide treatments are implemented relying entirely on the risk analysis of the EIS and ROD. The EIS provides the basic background information needed for the "tiering" of future project-specific analyses on rangelands in accordance with the CEQ regulations for implementing NEPA. APHIS instead prepares state-or site-specific EAs to address local issues before implementing suppression pesticide treatments. Therefore, APHIS decided to prepare an EA for San Carlos Apache Tribal Rangeland portion within Gila and Graham County, (see Map of Affected Area, Appendix C) to analyze more site-specific impacts.

The EA tiers to the 2019 programmatic EIS and incorporates by reference the carbaryl, chlorantraniliprole, diflubenzuron, and malathion HHERAs also published in 2019. Copies of the 2019 programmatic EIS and ROD are available for review at USDA, APHIS, 3640 East Wier Ave. Suite 1, Phoenix, Arizona 85040, or contacting the local USDA, APHIS Arizona State Office (602)431-3200. These documents are also available at the Rangeland Grasshopper and Mormon Cricket Program web site, http://www.aphis.usda.gov/plant-health/grasshopper.

A. Alternatives Considered for Comparative Analysis

1. No Suppression Program Alternative

Under Alternative A, the No Action alternative, APHIS would not conduct a program to suppress grasshopper infestations within San Carlos Apache Reservation. Under this alternative, APHIS would continue to conduct grasshopper surveys and provide information on ways to manage grasshopper populations in the long-term, such as different livestock grazing methods and cultural control by farmers. Any suppression program would be implemented by a federal land management agency, a state agriculture department, a local government, or a private group or individual.

2. Insecticide Applications at Reduced Agent Area Treatments (Preferred Alternative)

Under Alternative 2, the Preferred Alternative for this EA, APHIS would manage a grasshopper treatment program using techniques and tools discussed hereafter to suppress outbreaks. The insecticides available for use by APHIS Arizona Field Ops would only include the U.S. Environmental Protection Agency (USEPA) registered chemicals of carbaryl bait, no liquid formulations of carbaryl would be considered, chlorantraniliprole and diflubenzuron would be considered under this alternative. These chemicals have varied modes of action. Carbaryl works by inhibiting acetylcholinesterase (enzymes involved in nerve impulses). Chlorantraniliprole activates insect ryanodine receptors which causes an uncontrolled release of calcium, impairing insect muscle regulation and leading to paralysis. Diflubenzuron inhibits the formation of chitin by insects which causes weak exoskeletons. APHIS would make a single application per year to a treatment area and would apply insecticide at APHIS approved reduced agent area treatments (RAATs). RAAT's rates used for grasshopper suppression treatments are the most common application method for all program insecticides.

APHIS selects which insecticides and rates are appropriate for suppression of a grasshopper outbreak based on several biological, logistical, environmental, and economical criteria. The primary biological factor is the grasshopper species and the most common life stage of the dominant species of concern. When grasshoppers' populations are mostly comprised of the first three instars diflubenzuron is typically selected because it is highly effective, economically cost effective and least harmful to non-target species. Diflubenzuron limits the formation of chitin in arthropod exoskeletons and can produce 90 to 97% grasshopper mortality in nascent populations with a greater percentage of early instars. If the window for the use of diflubenzuron closes, (mostly older grasshoppers) as a result of treatment delays, then carbaryl, chlorantraniliprole are the remaining control options. The circumstances where the use carbaryl bait would be best are reduced because of the higher cost per acre than liquid insecticide formulations. Only certain species are attracted to carbaryl insecticide when it is formulated as a bait and their migratory or banding behavior allows targeted treatments over smaller areas. Some examples of species that are highly susceptible to carbaryl bait is described in figure 2. Those species under ideal conditions can expect 80- 85% mortality. However, if conditions are less than optimal or species complex is greatly varied with species less susceptible to bait acceptance then mortality using bait could be greatly reduced. Under this condition if the window for diflubenzuron is closed and the species complex is not ideal for bait acceptance then chlorantraniliprole would be the last chemical option to suppress populations.

The RAATs strategy is effective for grasshopper suppression because the insecticide controls grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not directly treated. RAATs can decrease the rate of insecticide applied by either using lower insecticide concentrations or decreasing the deposition of insecticide applied by alternating treated and untreated swaths. Typically, program managers choose both options to lower the total amount of insecticide applied and treatment costs. Either carbaryl, chlorantraniliprole and diflubenzuron would be considered under this alternative, typically at the following application rates ((Lockwood et al., 2000, Foster et al., 2000, USDA APHIS, 2019):

- 10.0 pounds (0.20 lbs a.i./ac treated) of 2 percent carbaryl bait.
- 4.0 fluid ounces (0.013 lbs a.i./ac sprayed) of chlorantraniliprole.
- 0.75 or 1.0 fluid ounce (0.012 lbs a.i./ac sprayed) of diflubenzuron.

Classification of grasshopper species according to susceptibility to carbaryl wheat bran bait

Class and expected levels of control	Species
Sensitive (>55-% control) Control is expected to average about 70%. Worst-case and best-case scenarios will be about 55% and 85%, respectively.	*Ageneotettix deorum* *Anabrus simplex* *Aulocara elliotti* *Camnula pellucida* *Hadrotettix trifasciatus* **Melanoplus bivittatus* *Melanoplus confusus* *Melanoplus dawsoni* *Melanoplus foedus* **Melanoplus infantilis* **Melanoplus occidentalis* **Melanoplus packardii* *Melanoplus sanguinipes* *Spharagemon equale* *Stenobothrus brunneus* **Mermiria bivittata*
Vulnerable (30- to 55-% control) Control is expected to average about 42%. Worst-case and best-case scenarios will be about 12% and 72%, respectively.	**Aulocara femoratum* *Eritettix simplex* *Melanoplus femurrubrum* *Oedaloenotus enigma* *Opeia obscura* *Phoetaliotes nebrascensis* *Psoloessa delicatula*
Nonsusceptible (<30-% control) Control is expected to average about 15%. Worst-case and best-case scenarios will be about 0% and 30%, respectively.	*Aeropedellus clavatus* *Amphitornus coloradus* *Cordillacris cremulata* *Cordallacris occipitalis* *Hesperotettix viridis* *Metator pardalinus* **Phlibostroma quadrimaculatum* *Trachyrhachys kiowa*

*These species are not likely to suffer best-case scenario levels of control.

Figure 2. Bait Acceptance by Different Grasshopper Species and Instars. (Onsager etal. 1996)

The width of the area not directly treated (the untreated swath) under the RAATs method is not standardized. The proportion of land treated during RAATs is a complex function of the rate of grasshopper movement, which is a function of developmental stage, population density, and weather (Narisu et al., 1999, 2000), as well as the properties of the insecticide (insecticides with longer residuals allow wider spacing between treated swaths). Foster et al. (2000) left 20 to 50% of their study plots untreated, while Lockwood et al. (2000) left 20 to 67% of their treatment areas untreated. Following the conventions and procedures established by these studies, the grasshopper program typically leaves 50% of a spray block untreated for ground applications where the swath width is between 20 and 45 feet. The selection of insecticide and the use of an associated swath widths is site dependent. Rather than suppress grasshopper populations to the greatest extent possible, the goal of this method is to suppress grasshopper populations to less than the economic infestation level.

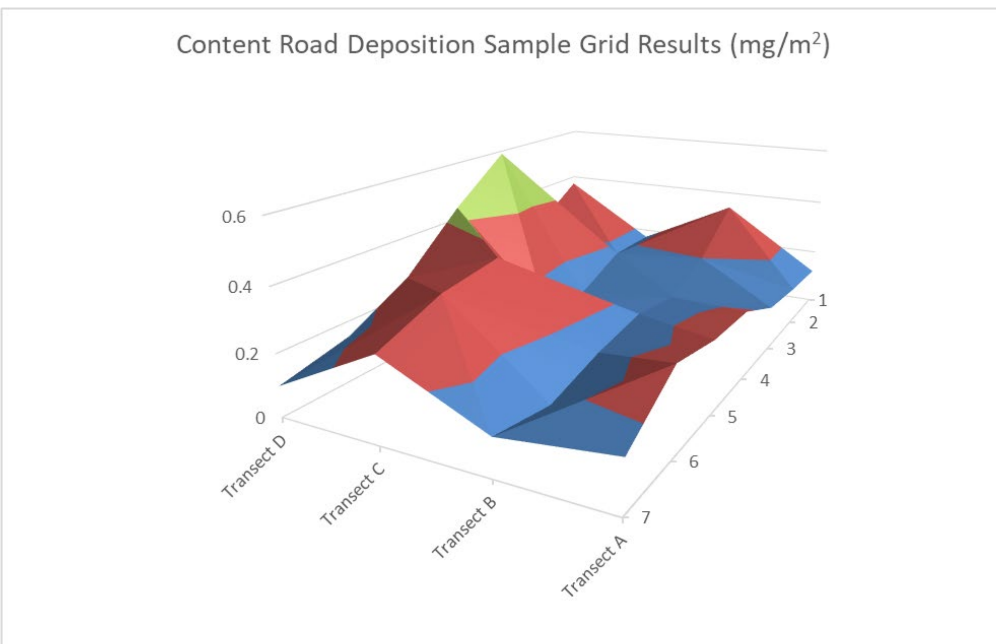
Treatments conducted using the Reduced Agent Area Treatment (RAAT's) method of skipping swaths (fig.3) decreases the amount of chemical and acreage treated still maintaining an effective kill rate. Swath widths usually range from 35-45 feet depending on ground equipment used. Aerial treatments may have a swath width of 100ft. Grasshoppers in untreated areas will tend to move to treated areas, thus becoming exposed to the insecticide. For example, if the area in figure 3 was 100 acres, with 50% RAAT's the acreage treated would be 50 acres. Protection would include the entire 100 acres, only exposing half the area with half the chemical amount compared to a conventional blanket treatment covering the entire 100 acres and the label rate of application.

Figure 3. Reduced Agent Area Treatment (RAAT's)

The recommended skipped swath width is typically no more than 100 feet for carbaryl (liquid), chlorantraniliprole, and diflubenzuron, and 25 feet for malathion. However, many Federal government-organized treatments of rangelands tend to prefer to use a 50% skipped swath width, meaning if a fixed-wing aircraft's swath width is, for example, 150 ft., then the skipped habitat area will also be 150 ft. Aerial applications on the San Carlos Apache rangeland is not an option. The selection of insecticide and the use of an associated swath widths is site dependent. Rather than suppress grasshopper populations to the greatest extent possible, the goal of this method is to suppress grasshopper populations to less than the economic injury level.

The variation in pesticide deposition resulting from following the RAATs procedures is not expected to result in chemical residues within the no spray swaths. Instead, swaths with maximum application rates alternate with swaths of low deposition rates. Program managers decided to increase the number of deposition dye card samples during 2021 to gather more data on actual application rates inside treatment blocks. Field personnel stationed 28 dye cards in a 150-foot spaced grid with four transects of seven cards. The long axis of the grid was oriented approximately parallel with the direction the aircraft were flying during the treatment. Unfortunately, strong winds caused pesticide drift from the flight swaths that were sprayed to the unsprayed swaths. Shortly after the portion of the treatment block containing the dye card grid was sprayed, the program managers ceased operations for the morning because wind gusts were measured over ten miles per hour. Figure 4 is a graph showing the pesticide concentrations on the dye cards as they were positioned in the grid. Despite the strong winds, the linear variation in deposition during an application using the RAAT method is evident. The program diflubenzuron application rate is 1.0 fluid ounce per acre which is equivalent to 1.75 mg/m2, approximately three times greater than the highest dye card concentration.

Figure 4 – Diflubenzuron concentration on dye cards placed 150 feet apart in a grid



The concept of reducing the treatment area of insecticides while also applying less insecticide per treated acre was developed in 1995, with the first field tests of RAATs in Wyoming (Lockwood and Schell, 1997). Applications can be made either aerially or with ground-based equipment (Deneke and Keyser, 2011). Studies using the RAATs strategy have shown good control (up to 85% of that achieved with a total area insecticide application) at a significantly lower cost and less insecticide, and with a markedly higher abundance of non-target organisms following application (Deneke and Keyser, 2011; Lockwood et al., 2000). Levels of control may also depend on variables such as body size of targeted grasshoppers, growth rate of forage, and the amount of coverage obtained by the spray applications (Deneke and Keyser, 2011). Control rates may also be augmented by the necrophilic and necrophagic behavior of grasshoppers, in which grasshoppers are attracted to volatile fatty acids emanating from cadavers of dead grasshoppers and move into treated swaths to cannibalize cadavers (Lockwood et al., 2002; Smith and Lockwood, 2003). Under optimal conditions, RAATs decrease control costs, as well as host plant losses and environmental effects (Lockwood et al., 2000; Lockwood et al., 2002).

The following is a brief example of previous treatment designs which have occurred on the San Carlos Apache Reservation. There were no treatments in 2024 due to low populations densities. In 2023 for example, there was 2,577 acres treated with 2% carbaryl bait at an application rate of 10lbs/acre using ground equipment. The swath width was 40 feet. The protected acres were 5,200 acres. This accounts for 2,623 acres untreated and 2,577 acres treated. The pretreatment densities were 56gh/yd^2. The treatment resulted in suppressing the population by 75% mortality rate. This treatment design was scattered throughout 5 separate pastures which had hatching beds that were spreading out into a few pastures. There were 2 stock tanks that were buffered with 500-foot buffers. This treatment occurred mid-May 2023. Historically, the smallest treatments to occur on this Tribal Rangeland have been 500 acres. Usually, by the time delimiting surveys have occurred and equipment staged, any buffered areas measured, smaller acreages will begin to expand so boundaries may be refined or adjusted to account for expansion. But there is a possibility of treating less acreage or smaller hatching beds if the weather conditions are just right and there are no delays with funding, surveys, personnel, equipment, chemical availability and shipment, species complex, livestock locations, rancher needs or last-minute requests etc.

3. Insecticide Applications at Conventional Rates with Total or 100% Coverage.

Insecticide applications at conventional rates and complete area coverage, is an approach that APHIS has used in the past but is currently uncommon because RAATs treatments use less insecticide and take less time to treat the same area resulting in substantial cost savings. Under this alternative, carbaryl, chlorantraniliprole and diflubenzuron would cover all treatable sites within the designated treatment block per maximum treatment rates following label directions:

- 10.0 pounds (0.20 lbs a.i./ac treated) of 5 percent carbaryl bait;
- 8.0 fluid ounces (0.027 lbs a.i./ac sprayed) of chlorantraniliprole;
- 1.0-2.0 fluid ounce (0.016 lbs a.i./ac sprayed) of diflubenzuron;

The generalized potential environmental effects of the application of carbaryl, chlorantraniliprole, diflubenzuron, and malathion, under this alternative are discussed in detail in the 2019 EIS. A description of anticipated site-specific impacts from this alternative may be found in Part IV of this EA.

B. Protective Measures and Program Procedures to Avoid or Reduce Adverse Impacts

The Program applies insecticides as liquid ultra-low volume (ULV) sprays or solid-based carbaryl baits through aerial or ground applications. Habitat diversity, topographical features, meteorological conditions, economic concerns, and environmental considerations all have important roles in choosing the best form of treatment (Foster and Onsager, 1996). Aerial applications are typical for treatments over large and less accessible areas. Ground applications are most likely to be made when treating localized grasshopper outbreaks or for treatments where the most precise placement of insecticide is desired.

Compared to sprays, baits are easier to direct toward the target area, are much more specific toward grasshoppers, act primarily through ingestion, and affect fewer non-target organisms than sprays (Peach et al., 1994; Foster, 1996; Latchininsky and VanDyke, 2006). The baits have a carrier, such as bran, that absorbs the carbaryl, making it less bioavailable, particularly in dermal exposures (USDA APHIS, 2015). Biodegradation of carbaryl occurs readily in soil, but there is moderate potential for bioconcentration in aquatic organisms. This is unlikely to occur due to the application buffers from aquatic sites and the lack of significant drift due to the large bait size used during application.

ULV applications use lower than the conventional label rates, specifically 0.5 gallon or less per acre of insecticide in liquid form. Liquid applications typically produce a quicker, greater, and more predictable grasshopper mortality rate than bait applications (Fuller et al., 1996). Generally, contract costs are substantially lower for applying ULV sprays compared to conventional liquid application rates and bait applications because ULV sprays use less product (Foster and Onsager, 1996). The program avoids off target drift to protect environmentally sensitive areas and maintain treatment efficacy. Various spray carriers and adjuvants minimize off-target movement of ULV sprays including synthetic or natural oils (e.g., canola oil).

The RAATs strategy reduces the treatment area, the application rate of insecticides, or both. RAATs methods suppress grasshopper populations below the economic injury level, rather than to the greatest extent possible, keeping with the IPM principles that have governed the program since the 1980s. Insecticides suppress grasshoppers within treated swaths, yet RAATs reduces cost and conserves non-target biological resources (including predators and parasites of grasshoppers, as well as beneficial grasshoppers) in untreated areas. With less area being treated, more beneficial grasshoppers and pollinators survive treatment. There is no standardized percentage of area that is left untreated. The proportion of land treated in a RAATs approach is a complex function of the rate of grasshopper movement, which is a function of developmental stage, population density, and weather (Narisu et al., 1999, 2000), as well as the properties of the insecticide (insecticides with longer residuals allow wider spacing between treated swaths).

APHIS grasshopper treatments must follow all applicable Federal, State, tribal, and local laws and regulations regarding pesticide use, including all USEPA- and State-approved label instructions. APHIS has also implemented several measures that go beyond label instructions to protect workers and the environment. All aircraft must have a positive on/off system that will prevent leaks from the nozzles and a positive emergency shutoff valve between the tank and the pump. Whenever possible, applicators must avoid aerial ferrying and turnaround routes over water bodies and sensitive habitats (USDA APHIS, 2013). This will reduce the risk of accidental release of insecticides into aquatic habitats and other sensitive habitats.

The program has procedures to limit potential movement of applied insecticides outside of the intended treatment area. Operationally, the accurate placement of the ULV spray insecticide is essential if grasshopper populations are to be suppressed efficaciously. Winds may displace the insecticide, and high air temperatures combined with low humidity may cause fine droplets to evaporate and drift without reaching the targeted vegetation. During applications, APHIS personnel constantly monitor wind conditions because when steady wind speeds exceed 10 miles per hour (mph), or wind direction changes towards sensitive habitat treatments are suspended until conditions improve. Field personnel measure ground and air temperatures to check for temperature inversions characterized by stable air with little mixing. Temperature inversions can cause ULV spray droplets to remain aloft increasing the potential for off-site transport of drift.

The program has also established treatment restriction buffers around water bodies to protect those features from insecticide drift and runoff. The labels for all program insecticides prohibit direct application to water (defined as reservoirs, lakes, ponds, pools left by seasonal streams, springs, wetlands, and perennial streams and rivers). APHIS maintains the following additional buffers for water bodies that are not designated critical habitat for listed aquatic species: 500-foot buffer for aerial sprays, 200-foot buffer for ground sprays, and a 50-foot buffer for bait applications (USDA APHIS, 2013). In addition, aquatic habitats have been excluded from the Tribal action area therefore helping to minimize harmful impacts to these environments. Ground buffers were increased from 300 feet as stated in the Programmatic Biological Assessment, to 500 feet in connection with local consultations with FWS. All stock tanks and other bodies of water are buffered with an increased 500-foot ground buffer. These protective measures help insure and minimize impacts to the San Carlos Apache Tribal Rangeland covered by this EA.

Any potential treatment in the action area will be with ground equipment and the use of Trimble EZ Guide 250 and Trimble GFX 750 Navigational guidance equipment Figure 5.

Figure 5. Trimble Guidance Systems used for Ground Treatments.

This equipment is used to navigate and capture shapefiles of the treatment areas. Thus, providing accurate mapping for Tribal reports of any possible treatments. All sensitive sites are buffered out of the treatment area using flagging which is highly visible to the applicator. All buffers can be displayed and seen by applicator. All sensitive sites are reviewed in the daily briefing with APHIS personnel including the applicator working on the treatment site.

III. Environmental Consequences

Chapter III identifies the affected environment where the Program will be implemented, identifies the types of impacts or effects that will be evaluated, and the environmental issues that will be studied. Each environmental issue section addresses a separate environmental resource, and includes background information, an evaluation of the impacts on those resources, and a conclusion. The alternatives are compared with the environmental consequences of the proposed action at the end of each issue section. Determination of significance of the impacts predicted in this chapter does not occur in this EA but is made by the APHIS decisionmaker documented in the appropriate decision document.

A. Description of Affected Environment

The proposed suppression program area included in this EA encompasses 332,120 acres of Tribal rangeland on the San Carlos Apache Reservation. This is the total estimated acres within the requested proposed action area (Appendix C map). The proposed area is tribal rangeland on Antelope Flat and Ash Flat that has an elevation from 4,000 to 5,000 feet. This area is bordered to the North by the Natanes Mountains which rises to over 7,000 feet. The Gila Mountains border to the south and rise to 6,400 feet. These areas provide essential forage for livestock, habitat for wildlife, and cultural significance to the Apache people (fig. 6).

The environment is characterized by desert grasslands, sparse shrubs, and occasional riparian areas along waterways. Forecast estimates from the 2024 adult survey resulted in approximately 15,000 acres which had 8 or more grasshoppers/yd^2 from within the total acres of the program action area (Appendix D Map). The 2002 EIS described seven ecoregions of the western U.S. A more comprehensive description of the biotic communities of the Southwest was produced by Brown (1982, 1994). This work gives a very detailed description of the types of vegetative communities within the action area.

Figure 6. Plains grassland, shortgrass community surveyed for economic species of grasshoppers on Ash Flat, Arizona.

There are three grassland habitats found in Arizona: semidesert grasslands, Plains and Great Basin grasslands and Subalpine grasslands. The grassland communities within the proposed action area contain semidesert grasslands and Plains & Great Basin Grasslands. (Appendix E Map of Arizona Biotic Communities).

The semi-desert grassland environment in the action area is characterized by a mix of arid conditions, low precipitation, and a combination of grasses, shrubs, and scattered trees. It typically occurs at elevations ranging from 3,500 to 6,500 feet, where the climate is hot and dry, with temperatures soaring in summer and cooler winters. This habitat receives an average of 12-18 inches of rain annually, primarily during the monsoon season in late summer. The soil is often sandy or gravelly, well-drained, and relatively low in nutrients. Due to its location, the semi-desert grassland supports a variety of drought-tolerant plants adapted to survive in these harsh conditions.

Vegetation in this environment is primarily made up of grasses, with shrubs and small trees dotted throughout the landscape. These plants have evolved to conserve water, with many having deep root systems, thick, waxy leaves, or other adaptations that allow them to thrive despite the scarcity of water. The grasslands are often open, with spaces between clusters of vegetation, allowing for expansive views of the desert surroundings.

Plant Species Commonly Found in a Semi-Desert Grasslands:

Blue Grama (*Bouteloua gracilis*) - A drought-tolerant grass that forms a major component of the grassland.
Sideoats Grama (*Bouteloua curtipendula*) - A perennial grass known for its oat-like seed clusters.
Black Grama (*Bouteloua eriopoda*) - Another dominant grass species, providing forage for grazing animals.
Desert Marigold *(Baileya multiradiata*) - A yellow-flowered perennial herb.
Brittlebush (*Encelia farinosa*) - A small shrub with silvery leaves and bright yellow flowers.
Tumbleweed (*Salsola tragus*) - A weedy plant that rolls across the land when mature, spreading seeds.
Prickly Pear Cactus *(Opuntia spp*.) - A widespread cactus with edible pads and fruit.
Fourwing Saltbush (*Atriplex canescens*) - A drought-resistant shrub with silver-gray leaves.
Cholla Cactus (*Cylindropuntia spp*.) - A cactus with cylindrical stems and spiny branches.
Agave *(Agave spp*.) - A succulent plant that stores water in its thick leaves.
Apache Plume (*Fallugia paradoxa*) - A shrub with feathery flowers and white, plume-like seed heads.
Bigelow's Agave (*Agave bigelovii*) - A rosette-forming succulent often found in rocky areas.
Woolly Bluecurls (*Trichostema lanatum*) - A bushy, aromatic herb with purple flowers.
Sonoran Desert Lily (*Hesperocallis undulata*) - A bulbous plant with striking white flowers.

This combination of grasses, succulents, and shrubs allows the semi-desert grassland to support a range of wildlife, including herbivores and pollinators, while still being adapted to survive in the challenging desert.

The Plains and Great Basin Grasslands of Arizona are characterized by expansive, relatively flat landscapes dominated by grass species. These grasslands are found primarily at higher elevations (typically between 4,000 and 7,000 feet) in the state’s northern and western regions, particularly within the Great Basin and Colorado Plateau.

The climate in these areas is semi-arid to arid, with hot summers and cold winters. The grasslands experience moderate to low rainfall, averaging between 8 to 12 inches annually, with precipitation primarily occurring in the form of snow in the winter and thunderstorms during the summer monsoon season. The soils are typically alkaline, sandy, and low in organic matter, which can limit the growth of certain plant species.

The vegetation in the Plains and Great Basin Grasslands in the action area is dominated by perennial grasses, with shrubs and occasional trees scattered throughout the landscape. These ecosystems are adapted to the region's harsh environmental conditions, including limited water availability, temperature fluctuations, and periodic droughts. The landscape can appear dry and open, with grasses covering much of the land and creating vast, windswept plains, though there are occasional rocky outcrops and isolated valleys.

Plant Species Commonly Found in Plains and Great Basin Grasslands of Arizona:

Indian Ricegrass (*Achnatherum hymenoides*) - A drought-tolerant, bunchgrass that is an important forage species.
Bluebunch Wheatgrass (*Pseudoroegneria spicata*) - A deep-rooted perennial grass that is crucial to the grassland ecosystem.
Sandberg Bluegrass (*Poa secunda*) - A cool-season grass that grows well in dry, alkaline soils.
Great Basin Wildrye (*Leymus cinereus*) - A large, perennial grass that thrives in alkaline soils and provides forage for wildlife.
Western Wheatgrass (*Pascopyrum smithii*) - A hardy grass species that grows in dry, well-drained soils.
Sagebrush (*Artemisia tridentata*) - A shrub common in the Great Basin, which provides habitat and forage for wildlife.
Rabbitbrush (*Chrysothamnus spp*.) - A shrub with yellow flowers that thrives in dry, disturbed areas.
Bitterbrush (*Purshia tridentata*) - A shrub with deep roots and aromatic leaves, often found in drier areas of the grassland.
Mountain Mahogany (*Cercocarpus spp*.) - A small shrub or tree found on rocky slopes and ridges, often in more elevated areas.
Chokecherry (*Prunus virginiana*) - A small deciduous shrub or tree that can grow in more moist areas of the grassland.
Four-wing Saltbush (*Atriplex canescens*) - A drought-tolerant shrub that is a common feature of many western grasslands.
Brittlebush (*Encelia farinosa*) - A small shrub that is adapted to arid conditions and has yellow daisy-like flowers.
Creeping Wildrye (*Leymus triticoides*) - A perennial grass that forms dense clumps and is found in well-drained soils.
Desert Lupine (*Lupinus sparsiflorus*) - A nitrogen-fixing plant that adds nutrients to the soil and provides beautiful blue flowers.
Prickly Pear Cactus (*Opuntia spp*.) - A cactus with broad, flat pads that are an important food source for animals in the region.

The Plains and Great Basin Grasslands on the San Carlos Tribal rangeland, are home to a variety of wildlife, including pronghorn antelope, elk, deer, rabbits, rodents, and numerous bird species that rely on the grasses and shrubs for food, shelter, and nesting sites. The resilience of the plant species in this environment enables them to endure the temperature extremes, low precipitation, and nutrient-poor soils of the region.

Great Basin Conifer woodland and Interior Chaparral also are covered in this area. Soil types include basalt and basalt flows, weakly consolidated sandstone and siltstone, unconsolidated alluvial sand, silt, and some gravel. All rangeland covered in this EA is managed by the San Carlos Apache Tribe.

Elevations range from approximately 3,500 to over 6,000 feet. Potential treatment sites are within watersheds which drain into tributaries of the Bonita Creek, Hackberry Creek, Hackberry Draw, Cottonwood Canyon Salt Creek, and San Carlos River. There are stock tanks in the potential treatment area. All potential treatment areas fall within the Arizona Interior Chaparral biome (Brown, 1994), grassland representative species of this biome include:

Plants: Emory oak (*Quercus emoryi*), alligator bark juniper (*Juniperus deppeana*), pinyon pine (*Pinus edulis*), gray oak (*Quercus grisea*), canyon live oak (*Quercus chrysolepis*), Arizona oak (*Quercus arizonica*), western chokecherry (*Prunus virginiana*), shrub live-oak (*Quercus turbinella*), ceanothus (*Ceanothus greggii*), crucifixion thorn (*Canotia holocantha*), penstemon (*Penstemon spp.*), desert verbena (*Verbena wrightii*), Wright buckwheat (*Eriogonum wrightii*), narrowleaf yerbasanta (*Eriodictyon angustifolium*), sideoats grama (*Bouteloua curtipendula*), cane bluestem (*Bothriochloa barbinodis*), plains lovegrass (*Eragrostis intermedia*), Black grama (*Bouteloua eriopoda*), Blue grama, (*Bouteloua gracilis)* Hairy grama, (*Bouteloua hirsuta)* Rothrock's grama, *(Bouteloua rothrockii),* Fendler three-awn (*Aristida spp.*), agave (*Agave parryi*), beargrass (*Nolina microcarpa*), sotol (*Dasylirion wheeleri*), banana yucca (*Yucca baccata*), squirreltail, *(Elymus elymoides),* Arizona cottontop, *(Digitaria californica),* Green sprangletop (*Leptochloa dubia*), *Junegrass, (Koeleria spp.),* Western wheatgrass (*Pascopyrum smithii),* Tobosagrass, (*Pleuraphis mutica),* Vine Mesquite, *(Panicum obtusum*), curly-mesquite (*Hilaria belangeri),* Cholla (*Opuntia spp.*), Prickly Pear (*Opuntia spp.)*,

Mammals: cliff chipmunk (*Eutamias dorsalis*), white-throated woodrat (*Neotoma albigula*), mule deer (*Odocoileus hemionus*), brush mouse (*Peromyscus boylei*), rock mouse (*P. difficilis*), white- footed mouse (*P. leucopus*), eastern cottontail (*Sylvilagus floridanus holzeri*), pronghorn antelope (*Antilocapra americana*), elk (*Cervus elaphus)* javalina (*Pecari tajacu),* jackrabbit (*Lepus spp.*), coyote (*Canis latran),* White-tailed deer *(Odocoileus virginianus).*

Birds: rufous-crowned sparrow (*Aimophila ruficeps*), scrub jay (*Aphelocoma coerulescens*), canyon wren (*Catherpes mexicanus*), rufous-sided towhee (*Pipilo erythrophthalmus*), brown towhee (*P. fuscus*), bushtit (*Psaltriparus minimus*), black-chinned sparrow (*Spizella atrogularis*), crissal thrasher (*Toxostoma dorsale*), burrowing owl (*Athene cunicularia*).

Amphibians and reptiles: glossy snake (*Arizona elegans*), Arizona alligator lizard (*Gerrhonotus kingi*), night snake (*Hypsiglena torquata*), Sonoran mountain kingsnake (*Lampropeltis pyromelana*), southwestern blind snake (*Leptotyphlops humilis*), Sonora whipsnake (*Masticophis bilineatus*), desert striped whipsnake (*M. taeniatus*), western fence lizard (*Scleroporus occidentalis*), eastern fence lizard (*S. undulates*), western blackhead snake (*Tantilla planiceps*), Sonoran lyre snake (*Trimorphodon biscutatus lambda*), Texas lyre snake (*T. b. vilkinsoni*), side-blotched lizard (*Uta stansburiana*), Arizona night lizard (*Zantusia arizonae*), Western Diamond-backed Rattlesnake *(Crotalus atrox)*, Black-tailed Rattlesnake *(Crotalus molossus)*, Arizona Black Rattlesnake *(Crotalus cerberus).*

B. Special Management Areas (HABITAT EXCLUSIONS)

APHIS is aware there are areas that have greater scenic and environmental value within or near the rangeland areas considered by this EA. These areas might have remote recreational uses, special ecological characteristics or species that are of special concern to land management agencies, the public, or other groups and individuals. **Areas Excluded from this EA are as follows**: No treatments will occur on Fishhooks Wilderness area on BLM lands to the south which borders the Tribal rangeland action area. No treatments will occur on any BLM lands which border Tribal land. No treatments will occur within 1 mile of Tribal cultural and ceremonial areas (Holy Ground). Today, San Carlos Apache's still honor spiritual traditions. The Ga'an are called upon to evoke blessings and to ward off illness and evil at ceremonies, such as the Changing Woman and Ga'an ceremonies. No description of the specific location of the ceremonial area in this EA action area, is not mentioned or described to the public to help maintain the sacred nature of the location and help maintain cultural significance to the San Carlos Apache Tribe. APHIS is aware of the cultural significance of the area and the protective measure is in accordance with Tribal consultation. All protective measures for stock tanks and bodies of water within the action area will be buffered according to and agreed upon by APHIS/FWS consultations due to potential habitat for Chiricahua leopard frog. Salt creek in Cottonwood canyon is habitat for the Arizona cliffrose and is excluded according to APHIS/FWS consultations. No treatments will occur within 5 miles of the Gila River known nesting habitat of Southwestern willow flycatcher according to APHIS/FWS consultations. Gila river is 15 miles from tribal boundary action area. The San Carlos River, San Carlos Reservoir, Gila River, Bonita creek, Ash creek, riparian areas are all excluded and or buffered according to APHIS/FWS consultations.

Tribal rangeland on Big Prairie in Natanes Mountains near Dry Lake and Point of Pines is excluded due to area being a tribal recreational location and location of dirt airstrip for staging for fire activities to north of action area. Historically, this area has maintained stable to normal densities or densities below an economic threshold of 15gh/yd^2 this may be due to higher elevations and a change in other environmental factors for this location.

C. Effects Evaluated

Chapter III examines the direct, indirect, and cumulative effects of each of the alternatives on the biological, physical, and sociocultural aspects of the human environment (issues). Direct effects are caused by the action and occur at the same time and place (40 CFR § 1508.1(i)(1)). Indirect effects are caused by the action but are later in time and farther removed in distance (40 CFR § 1508.1(i)(2)). Cumulative effects are the effects on the environment that result from the incremental effects of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency or person undertakes such other actions (40 CFR § 1508.1(i)(3)). Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.1(i)(3)).

Cumulative impact, as defined in the Council on Environmental Quality (CEQ) NEPA implementing regulations (40 CFR § 1508.1) "is the impact on the environment which results from the incremental impact of the action when added to the past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Potential cumulative impacts associated with the No Action alternative where APHIS would not take part in any grasshopper suppression program include the continued increase in grasshopper populations and potential expansion of populations into neighboring range and cropland. In addition, State and private land managers could apply insecticides to manage grasshopper populations however, land managers may opt not to use RAATs, which would increase insecticides applied to the rangeland. Increased insecticide applications from the lack of coordination or foregoing RAATs methods could increase the exposure risk to non-target species. In addition, land managers may not employ the extra program measures designed to reduce exposure to the public and the environment to insecticides.

Potential cumulative impacts associated with the Preferred Alternative are not expected to be significant because the program applies an insecticide application once during a treatment season. The program may treat an area with different insecticides but does not overlap the treatments. The program does not mix or combine insecticides. The insecticide application reduces the insect population down to levels that cause an acceptable level of economic damage. The duration of treatment activity, which is relatively short since it is a one-time application, and the lack of repeated treatments in the same area in the same year reduce the possibility of significant cumulative impacts. The insecticides proposed for use in the grasshopper program are not anticipated to persist in the environment or bioaccumulate. Therefore, a grasshopper outbreak that occurs in an area previously treated for grasshoppers is unlikely to cause an accumulation of insecticides from previous program treatments.

Based on historical outbreaks in the United States, the probability of an outbreak occurring in the same area where treatment occurred in the previous year is unlikely; however, given time, populations eventually will reach economically damaging thresholds and require treatment. No treatments occurred in the action area in 2024, this was due to a colder wetter winter 2023, and spring 2024. This resulted in an adverse effect on grasshopper hatch, development and population densities.

The 2024-2025 year ended and has begun under extreme drought conditions (figure 7). The grasshopper forecast for the San Carlos Apache Tribal rangeland may result in higher-than-normal densities due to the dry and warmer spring conditions which may result in larger hatches and faster developmental times of life stages over larger areas of rangeland. Thus, resulting in larger acres of damage to forage within the rangeland of the action area.

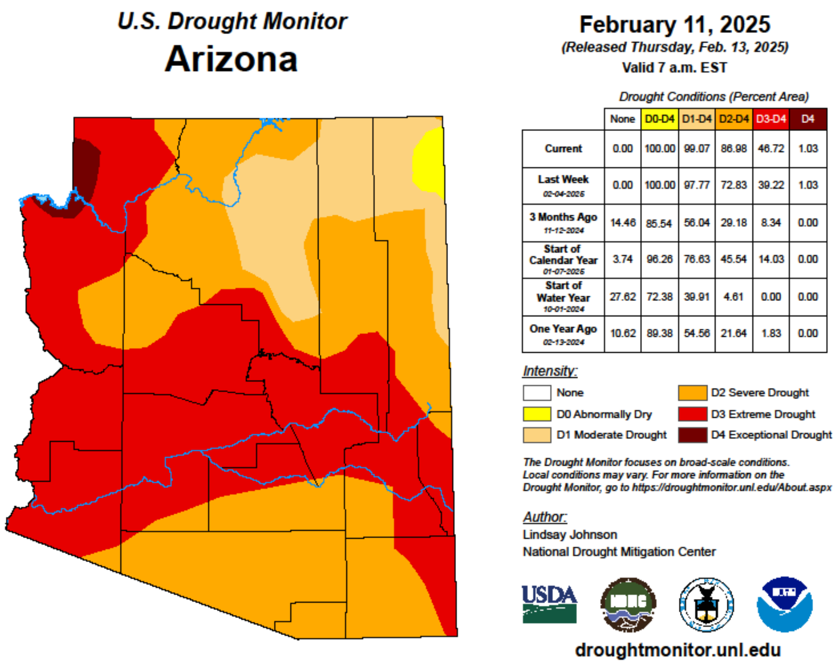


Figure 7. Drought Outlook for the state of Arizona.

The San Carlos Apache Tribe does not have active pesticide or herbicide treatment programs in the Tribal rangeland action area. APHIS does not anticipate any cumulative impacts that would result from overlap of grasshopper treatments and Tribal treatment activities.

Potential cumulative impacts resulting from the use of pesticides include insecticide resistance, synergistic chemical effects, chemical persistence and bioaccumulation in the environment. The program use of reduced insecticide application rates (i.e. ULV and RAATs) are expected to mitigate the development of insect resistance to the insecticides. Grasshopper outbreaks in the United States occur cyclically so applications do not occur to the same population over time further eliminating the selection pressure that increases the chances of insecticide resistance.

The insecticides proposed for use in the program have a variety of agricultural and non-agricultural uses. There may be an increased use of these insecticides in an area under suppression when private, State, or Federal entities make applications to control other pests. However, the vast majority of the land where program treatments occur is uncultivated rangeland and additional treatments by landowners or managers are very uncommon making possible cumulative or synergistic chemical effects extremely unlikely.

APHIS has prepared this EA for rangeland within the San Carlos Apache Reservation in Gila County and Graham County specifically limited to Tribal rangeland within cattle association boundaries on Antelope Flat and Ash Flat. Because treatments have been requested by the San Carlos Apache Tribe and signed by the Tribal Administrator on January 6th, 2025, if grasshopper populations reach outbreak levels. Experience and continued land use, climate, grasshopper population conditions lead APHIS to believe treatments will be needed in the near future. Unfortunately, the agency can't accurately predict exact treatment locations and usually discovers building grasshopper populations only a few weeks in advance. Even though the Tribe has requested APHIS to suppress grasshopper populations, treatments may not occur due to lack of Congressional funding, adverse weather conditions, low population densities, higher priority emergency programs which may pull personnel to other locations etc.

On the San Carlos Apache Nation there has been historically long and extensive survey work along with research activities which has led to a relatively accurate timeline for development. Grasshopper populations of the bigheaded grasshopper, *Aulocara elliotti* usually begin to hatch in March with the migratory grasshopper, *Melanoplus sanguinipes*, hatching soon after, 7-14 days later depending on spring weather conditions. Due to this historical survey information, as populations begin to hatch usually in warm dry spring conditions, thus this may lead to a more conducive hatch for larger populations of grasshoppers to be on rangeland. One unusual characteristic on the San Carlos Apache Nation is the fact that there are multiple generations (multivoltine) of *M. sanguinipes* in a single year (Barnes 1944, Fisher etal 1996). The fact that there are multiple generations of this species of grasshopper (Brust etal. 2009, Hilbert & Logan 1981, Kemp & Onsager 1986) makes it vital to manage early populations to reduce damage caused on rangeland. This species in more southern latitudes such as Arizona exhibit facultative diapause and responds to changes to photoperiods (Fielding 2008). Positive changes result in an increase in non-diapause egg production and a negative shift will result in an increase in diapause egg production (Dean 1982). These factors in this species biology complicates management strategies for populations of grasshoppers within the rangeland covered by this EA. The map of grasshopper distribution (fig. 8) for the last 6 years demonstrates how widespread some of the populations have been within the action area. This correlates to the
historical data produced by Nerney (1960). Within this 6-year timeframe not every season produces populations that exceed economic injury level (EIL) nor does a treatment occur. Usually, when populations exceed 15gh/yd^2 there may be multiple rangeland pastures that are affected by widespread damage. During this timeframe the grasshopper populations were 2 to 5 times the EIL (table 1).

Figure 8. Distribution of grasshoppers from 2018-2024.

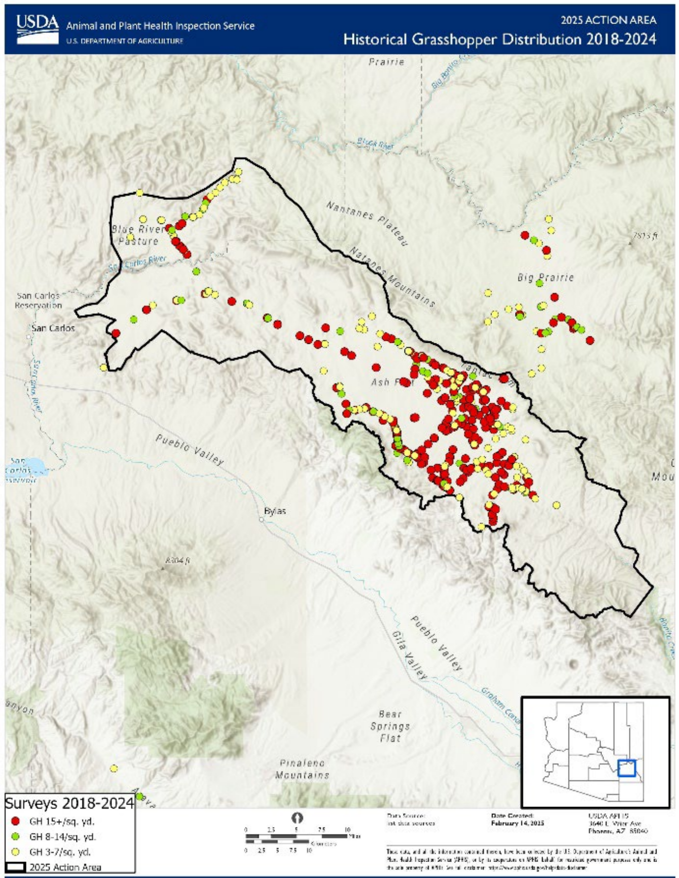


Table 1. Treatments and Densities from 2018-2024.

Year	Acres Treated	Average gh/yd2
2018	No treatment	below EIL
2019	No treatment	below EIL
2020	2,875	34
2021	2,436	34
2022	6,003	72
2023	2,577	56
2024	No treatment	below EIL

Summary of Target Grasshopper Species

There are over 600 species of grasshoppers in the United States. Of these 400 species of grasshoppers are in the 17 western states. Of these there are 238 species of grasshoppers and other orthoptera which have been recorded from localities in Arizona (Ball 1942). There are 35 species in Arizona known to reach outbreak status and threaten crops and/or valuable range resources. The most frequent complex of economic grasshopper species from 2003-2024 in Arizona have included the following species:

Melanoplus sanguinipes	migratory grasshopper
Camnula pellucida	clear-winged grasshopper
Aulocara elliotti	big-headed grasshopper
Oedaleonotus enigma	valley grasshopper
Melanoplus bivittatus	two-striped grasshopper
Melanoplus femurrubrum	red-legged grasshopper
Ageneotettix deorum	white-whiskered grasshopper
Melanoplus packardii	Packard's grasshopper
Melanoplus foedus	striped sand grasshopper
Cordillacris occipitalis	spotted-wing grasshopper
Amphitornus coloradus	striped grasshopper
Melanoplus infantilis	small spur-throat grasshopper
Philibostroma quadrimaculatum	Four-spotted grasshopper
Phoetaliotes nebrascensis	Large-headed grasshopper
Hadrotettix trifasciatus	three-banded grasshopper

D. Site Specific Considerations and Environmental Issues

Environmental issues are the resources that may be affected by the proposal, or concerns about the risks to humans from implementing the Program. The following issues are analyzed in Section E. Environmental Consequences of the Alternatives in the order outlined.

1. Human Health

The rangeland areas where treatments may occur are sparsely populated by isolated ranch units having mainly cattle operations. Rangeland grazing is the predominant livestock feeding method within the San Carlos Apache Reservation. There are three ranch houses within the action area and are used for headquarters and ranch operational staging areas. There are no family dwellings within the cattle association boundaries. Average population density living within this action area considered by this EA amounts to less than 10 people within the 625 square miles of the cattle associations considered by this EA. The nearest communities are San Carlos and Bylas, Arizona which are 37 miles and 15 miles respectively, away from where possible treatment activity would occur. Bylas is separated by a mountain range and there are no roads directly 15 miles to the action area. So, in reality Bylas is approximately 50 miles to action area.

A buffer of 1.25 miles from the treatment area to the perimeter of any town and other communities will be used. Ranch buildings and structures will have a buffer of 200 feet. Stock tanks will have a buffer of 500 feet. Tribal highways and roads will have a buffer of 25 feet. Local law enforcement, fire departments emergency medical services, hospitals and tribal agencies will be notified prior to any treatment as an advisory to access any safety risk, the treatment date and location and contact personnel.

The suppression program would be conducted on federally managed rangelands that are not inhabited by humans. Human habitation may occur on the edges of the rangeland. Most habitation is comprised of farm or ranch houses, but some rangeland areas may have suburban developments nearby. The most recent census documents 10,251 people living within the San Carlos Reservation boundaries. This area is 1.865 million acres or about 3,000 square miles (United States Census Bureau, 2018).

Permits are required from the Tribe for the public to recreate on the San Carlos. Recreationists may use the rangelands for hiking, camping, bird watching, hunting, falconry or other uses. Ranchers may work on the rangelands daily. Individuals with allergic or hypersensitive reactions to insecticides may live near or may utilize rangelands in the proposed suppression program area. No rural schools are near the rangeland action area. Children may visit areas near treatment blocks or may even enter treatment blocks before or after treatments.

The 2019 EIS contains detailed hazard, exposure, and risk analyses for the chemicals available to APHIS. Impacts to workers and the general public were analyzed for all possible routes of exposure (dermal, oral, inhalation) under a range of conditions designed to overestimate risk. The operational procedures and spraying conditions examined in those analyses conform to those expected for operations.

Direct exposure to program chemicals as a result of suppression treatments is unlikely due to the infrequency of treatments and the general lack of humans in treatment areas. In addition, program buffers and procedures further reduce the chances of human exposure. Finally, pesticide label specifications, standard spill prevention and rapid response measures mitigate the risk of accidental human exposure resulting from program activities.

Potential exposures to the general public from conventional application rates are infrequent and of low magnitude. The RAATs approach reduces this potential even further by using reduced rates and less actual directly treated area. The proposed program should benefit human and environmental health by reducing the risk of insect annoyance, blowing dust, higher light reflection and higher temperature on the semi-arid land surface.

Various compounds are released in smoke during wildland fires, including carbon monoxide (CO), carbon dioxide, nitrous oxides, sulfur dioxide, hydrogen chloride, aerosols, polynuclear aromatic hydrocarbons contained within fine particulate matter (a byproduct of the combustion of organic matter such as wood), aldehydes, and most notably formaldehyde produced from the incomplete combustion of burning biomass (Reisen and Brown, 2009; Burling et al., 2010; Broyles, 2013). Particulate matter, CO, benzene, acrolein, and formaldehyde have been identified as compounds of particular concern in wildland fire smoke (Reinhardt and Ottmar, 2004).

Many of the naturally occurring products associated with combustion from wildfires may also be present as a result of combustion of program insecticides that are applied to rangeland. These combustion byproducts will be at lower quantities due to the short half-lives of most of the program insecticides and their low use rates. Other minor combustion products specific to each insecticide may also be present as a result of combustion from a rangeland fire but these are typically less toxic based on available human health data (http://www.aphis.usda.gov/plant-health/grasshopper).

The safety data sheet for each insecticide identifies these combustion products as well as recommendations for personal protective equipment (PPE) which is equal to what typically is used in fighting wildfires. Material applied in the field will be at a much lower concentration than what would occur in a fire involving a concentrated formulation. Therefore, the PPE worn by rangeland firefighters would also be protective of any additional exposure resulting from the burning of residual insecticides. Groundwater wells are a major source of domestic water supplies. Groundwater and surface water are the major rural and livestock water sources. No impact is anticipated. Strict adherence to label requirements and the USDA treatment guidelines (appendix A) will be followed in regard to treatments bordering open surface waters.

2. Nontarget Species

While the program conducts grasshopper control treatments any other species affected by the insecticides can be viewed as non-target effects or unintentional take. The program has established and follows procedures to prevent take of species federally listed under the Endangered Species Act as endangered or threatened. The programmatic protection measures that resulted from consultation with the Services also prevent take of state listed species (sensitive species or species of concern) in the same habitats or having similar ecological (i.e., the relationship between species and their environment) niches as federal listed species. These procedures (e.g., no-spray buffers, RAATs, insecticide choices) also limit effects on pollinators (e.g., butterflies, moths, bees) and other beneficial insects.

The list of nontarget species by county from the Arizona Game and Fish is documented in Appendix F. This list is on the county level for Gila County and Graham County. Using the Arizona Game & Fish Program Environmental Evaluation Tool for habitat presence it has been determined that most species from the county list does not overlap with the Tribal rangeland action area. Therefore, only species habitat which overlap with the action area will be addressed. The species are described as follows amphibians, bird species, mammals, reptiles and invertebrates or snail's habitat overlap with the Tribal action area. There are no biological control agents or active biocontrol programs present on the San Carlos Apache Reservation which might be affected by an insecticide treatment.

Amphibian
There is a possibility of 5 amphibians to be impacted if they are in stock tanks or riparian areas within the action area. The protective measures to be implemented to protect the FWS Threatened species, Chiricahua leopard frog, *Rana chiricahuensis*, protected under the ESA, would be sufficient buffers for sensitive species of concern.

These protective measures which were determined during Section 7 consultations with FWS are as follows; The Programmatic BA (2019) established a 300-foot buffer for ground treatments for this species, local APHIS, Arizona Field Ops office agreed to a more restrictive measure of 500-foot ground buffers during local Section 7 consultations with FWS offices. These buffers would be around all stock tanks or other ponds or bodies of water within the action area. Thus, the more restrictive 500-foot buffer for Chiricahua leopard frog and other Arizona Game & Fish species of concern may affect but is not likely to affect the Chiricahua leopard frog or any species of concern such as, Northern leopard frog, Arizona toad, Lowland leopard frog or the Sonoran Desert toad that may be in the vicinity.

The following determination was made by FWS in Section 7 consultations, for the Threatened *Chiricahua leopard frog*. Since there are species of concern which are closely related, these determinations would apply to them as well.

- *Potential habitat for the frog exists primarily in earthen stock tanks. The APHIS will apply buffers and other relevant conservation measures to stock tanks and any other body of water to minimize the likelihood of directly affecting aquatic habitats; therefore, effects to frog habitat from the proposed action are discountable.*

- *Other conservation measures include avoiding applying insecticides before, during or after precipitation, which will avoid the time when frogs may be foraging away from water; therefore, there will be no effects on foraging frogs.*

- *The likelihood of indirectly exposing frogs to insecticides is extremely low; the magnitude of any exposure would not be detectable due to water dilution and insecticide degradation. Therefore, any effects to this species from insecticide exposure would be insignificant.*

Birds

There is a possibility of bird species that may be impacted if they are present in the action area. This EA will address the T&E species, Southwestern willow flycatcher, Yellow-billed cuckoo and Mexican spotted owl. FWS determined during Section 7 consultations that these three species of birds do have critical habitat, but the San Carlos Apache Tribal action area does not overlap with any critical habitat for these 3 T&E species. All critical habitat has been excluded from the Tribal action area. The following determination was made by FWS during Section 7 consultations.

<u>*Mexican Spotted Owl:*</u>

- *Potential habitat for this owl may occur in higher elevations and canyons on the San Carlos Reservation. However, treatments will be restricted to rangeland at lower elevations, so there will be no disturbance to breeding owls. Owls may migrate or disperse through the treatment area before or after the breeding season but are not likely to be present in the proposed treatment area from March 1st to August 31st; therefore, the proposed action will not result in disturbance to non-breeding owls.*

- *The likelihood of exposing owls directly or indirectly to insecticides is extremely low; therefore, any effects to the species from insecticide exposure are discountable.*

Southwestern Willow Flycatcher:

- *The flycatcher occurs along the San Carlos River below Talkalai Lake, which is about one mile from the closest proposed treatment area, on Antelope Flats. Flycatchers may fly upstream along the San Carlos River, which APHIS buffered by a 0.25-mile no-treatment zone. Flycatchers may fly through part of a treatment area. However, treatment areas do not contain flycatcher nesting habitat; therefore, there will be no effect to nesting flycatchers from the proposed action.*

- *The likelihood of indirectly exposing this species to insecticides is extremely low, and the magnitude of any exposure would not be detectable due to dispersal over large distances, water dilution and insecticide degradation. Therefore, any effects to this species from insecticide exposure would be discountable and insignificant.*

Western Yellow-billed Cuckoo:

- *The cuckoo may occur along the San Carlos River, which APHIS buffered by a 0.25-mile no-treatment zone. However, treatment areas do not contain cuckoo nesting habitat. Therefore, there will be no effect to breeding cuckoos from the proposed action.*
- *The likelihood of indirectly exposing cuckoos to insecticides is extremely low, and the magnitude of any exposure would not be detectable due to dispersal over large distances, water dilution and insecticide degradation. Therefore, any effects to this species from insecticide exposure would be discountable and insignificant.*

The U. S. Fish and Wildlife Service (FWS) made recommendations to the Animal and Plant Health Inspection Service (APHIS) to reduce the likelihood of taking bald eagles (*Haliaeetus leucocephalus*) when implementing the proposed 2025 Arizona Rangeland Grasshopper and Mormon Cricket Suppression Program.

The FWS published the final rule to remove the bald eagle from the Federal List of Threatened and Endangered Species in the *Federal Register* July 9, 2007, which took effect August 8, 2007. However, the Bald and Golden Eagle Protection Act (Eagle Act) continues to protect bald eagles. The Eagle Act prohibits anyone, without a permit issued by the Interior Secretary from taking eagles, including their parts, nests, or eggs. The Eagle Act defines “take” as “to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb” eagles. “Disturb,” based upon the best scientific information available, means to agitate or bother an eagle to a degree that causes, or is likely to cause: 1) injury; 2) productivity decreases by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (USDI 2007).

APHIS and FWS jointly developed the following conservation measures to minimize effects to bald eagle in the project area. These measures are consistent with the strategies in the “Conservation Assessment and Strategy for the Bald Eagle in Arizona” (Driscoll et al., 2006). The FWS agrees that implementing the following measures will reduce take likelihood.

Bald eagle & Golden Eagle

1. APHIS will include a one-mile radius no fly-over and treatment-free buffer around occupied eagle nests.

2. To protect foraging areas, APHIS will not apply diflubenzuron within 2.5 miles upstream and downstream of a nesting site and within 0.25 mile of waters used as foraging areas. (*The San Carlos Apache Tribe maintains information on nesting eagle sites and this information when necessary is shared with APHIS*).

APHIS has determined that there are bird species of special concern, but do not have statutory protections either federally or by Arizona Statues, the likelihood of indirectly or directly exposing these species to insecticides is extremely low, and the magnitude of any exposure would not be detectable due to dispersal over large distances, water dilution and insecticide degradation. Therefore, any effects to these species from insecticide exposure would be discountable and insignificant.

Two bird species of special concern

The American Kestrel and the Western Burrowing owl. The American Kestrel is a generalist predator. This small raptor may be present on Tribal rangeland. It has been shown that its diet is composed of a variety of arthropods, amphibians, mammals, birds and reptiles (Sherrod 2024; Orozco-Valor & Grande 2021; Cornell etal. 2023). During the 2012-2013 breeding season it was shown that the diet of kestrels varied greatly. Analysis of prey items were as follows; insects accounted for 2,047 items with a weight of 7.10 grams, reptiles 8 items for 72.9 grams, rodents 18 items for 498.6 grams and birds with 47 prey items with 875.86 grams (Orozco-Valor & Grande 2021). Insect prey items may take smaller amounts of energy in capture for little return to energy reserves. Any mortality of grasshoppers from treatments would not have any lasting affects to American Kestrels in the action area. Even though Santillan etal. (2009) found that over 4 study areas that low orthoptera in an area showed an increase in coleoptera and arachnid prey items to the diet. They collected 272 pellets that rendered 1,169 prey items that amounted to 38 different taxa. There was a variety of rodents, birds, reptiles, arachnids and insect prey items throughout these study sites. One study site had prey items which amounted to 34.3% scorpions and 31.8% Coleoptera, while another site had 22.4% Acrididae and 12.1% Curculionidae. One site mostly had 44.5% reptiles, 35.4% rodents with 14.1% of insects and 6% birds. Depending on the availability of prey items Kestrels will exploit what is available in the environment. Cornell etal. (2023) found that due to the generalist diet it was unlikely that nestlings in the same population receive the same diet. They concluded that kestrels manipulate food quantity through food supplementation leads to nestlings with greater maturity. Treatments using RAATs methodology would leave swaths of untreated grasshoppers or potential prey items for any kestrels in the area. Research has shown if there was a lack of Acrididae prey items due to treatments Kestrels will exploit other prey items to fill the diet demands. APHIS has determined that treatments in the action area would have extremely low impacts on kestrels, and the magnitude of any exposure would not be detectable due to dispersal over large distances, water dilution and insecticide degradation. Therefore, any effects to American Kestrels from insecticide exposure would be discountable and insignificant.

Western Burrowing owls may be present on Tribal rangeland. This species is protected under Arizona Statue ARS 17.235&236. The Arizona Game & Fish Dept. (AGFD), Burrowing Owl Working Group have published project guidance documentation which have guidance and recommendations for protective measures for this species (AGFD 2009). The AGFD protocols for survey, detection and mitigation measures will be adhered to by Arizona APHIS personnel, which have been trained and certified by AGFD for burrowing owl protocols. AGFD recommends all active burrows that have been surveyed for will be buffered by the recommended 100-foot buffer. APHIS has determined that with the implementation of RAATs and one pass with ground equipment along with 100-foot buffers to active burrow sites that treatments would have minimal impact on this species.

The diet of burrowing owls is well documented (Errington & Bennett 1935; York etal. 2002; Hall etal. 2009; Littles etal. 2007). In a study in South Texas, it was analyzed that of 7,476 prey items identified that 98% were arthropods. Insects composed 91% of the total prey consumed. The most abundant insect prey items were orthopterans, Gryllidae (50%), Acrididae (4%), and Tettigoniidae (4%). Gryllidae made up 50% of the composition of these insect diet items. They found that even though 2% of the prey items were vertebrates, this amounted to 71% of the biomass of the total diet composition (Littles etal. 2007). In a study in South Central Nevada, it was found that the more diverse food diets occurred in Great Basin Desert grasslands ecoregions (Hall etal.2009). APHIS has determined that Burrowing owls within the Tribal action area with active burrows will receive the 100-foot buffer recommended by AGFD. Any treatments would use RAATs methodology with one pass of ground equipment near the buffered area. This would allow grasshopper species to be left in untreated swaths. Even though research has shown that Acrididae (grasshopper) species are only a small portion of the burrowing owl's diet. This action area is in a Great Basin grassland ecoregion as discussed by Hall etal (2009). These protective measures in the action area would have extremely low impacts and the magnitude of any exposure would not be detectable due to dispersal over large distances, water dilution and insecticide degradation. Therefore, any effects to these species from insecticide exposure would be discountable and insignificant.

Mammals

It has been determined during Section 7 consultations that mammal species within the action area are described as follows.

<u>*Mexican Wolf*</u>:

• *The Mexican wolf occurs on the San Carlos Apache Reservation, but for only brief periods of time and in very limited numbers; the reservation has no established wolf* *pack. Although wolves may occur infrequently near treatment areas, insecticide bioaccumulation is minimal for this species; therefore, any effects would be insignificant.*

• *The likelihood of exposing Mexican wolves directly or indirectly to the insecticides is extremely low; therefore, any project effects to this species from insecticide exposure are discountable.*

Plants

Arizona Cliffrose:

Section 7 consultations determined that this species would have "no effect" due to the exclusions to its habitat from any Tribal action area. This is documented in the Habitat Exclusions in Chapter 3 Environmental Consequences part B Special Management Areas.

NEPA requires agencies to use "high-quality information, including reliable data and resources, models, and Indigenous Knowledge. Agencies may rely on existing information as well as information obtained to inform the analysis. Agencies may use any reliable data sources, such as remotely gathered information or statistical models. Agencies shall explain any relevant assumptions or limitations of the information, or the particular model or methodology selected for use." 40 C.F.R. § 1506.6(b).

Estimating nontarget species population sizes over large areas can be extremely difficult, labor intensive, and expensive. State and federal wildlife management agencies have limited resources to conduct flora and fauna population surveys and monitor trends. States may monitor the status of wildlife populations by assessing sex ratios and age distribution. Plant species surveys often identify historical or potential habitat locations. In accordance with CEQ regulations and to preserve the professional and scientific integrity of the analysis, this EA uses reliable existing data and resources provided by jurisdictional agencies and peer-reviewed literature to estimate nontarget species population sizes.

To estimate population size for these species, conservative estimates are derived from the best available density estimates reported in the literature, with preference given to publications and studies in Arizona or states having similar habitat. Density estimates may be for adults or all age classes. Population estimates based on potential habitat includes further extrapolation and speculation. The lowest estimate is assumed to be the minimum population. Habitat suitability indices, localized density fluctuations, and immigration or emigration are not factored into these calculations, nor is density based on quantity of habitat. All population estimates are conservative, as we have used the lowest population estimate among the ranges of those available in the literature.

The program suppresses grasshopper populations on a small portion of the area considered by this EA in any given year. In those control treatment areas substantial portions are excluded from direct insecticide applications because of buffers around sensitive sites and the alternating spray and skip swaths inherent in the RAATs method. Thus, the potential impacts from the program activities on nontarget species populations occur in a small portion of the area considered by this EA and for a limited duration.

According to USDA's Natural Resource Conservation Service (NRCS), rangelands comprise about 30% of the entire land cover of the United States, totaling about 770 million acres. These lands are described by the NRCS as lands on which the indigenous vegetation is predominately grasses, grass-like plants, forbs, and possibly shrubs or dispersed trees, containing plant communities of either native or introduced plants. Grasslands, open forest, shrublands and associated wetlands are most likely to host outbreaks of grasshoppers and be targeted for suppression programs. These lands host abundant and diverse terrestrial and aquatic organisms.

Pollinators

Based on the available scientific research, there is a decrease in quantity of pollinators across the country and in rangeland ecosystems. However, the extent of program insecticide's role in this decrease is not clear. Existing research serves to outline the impact of these pesticides on pollinators of the order Hymenoptera and Lepidoptera primarily but also delves into pollinators of other orders to a lesser extent.

The availability of native floral resources is a primary determinant of the composition and abundance of bees and other pollinators in rangeland ecosystems in the United States (Potts et al. 2003, Gilgert and Vaughan 2011, Tuell et al. 2014). Approximately 4,000 different bee species aid in pollination in the United States (Black et al. 2011, Gilgert and Vaughan 2011). Many secondary pollinators such as moths and butterflies, wasps, flies, and beetles also contribute to distributing pollen despite being less efficient than bees (Larson et al. 2018).

According to Goosey et al. (2024), rangeland ecosystems are primarily pollinated by bee species. At 27 pastures in central Montana specimens from 27, 24, and 16 different bee genera were captured during 2016, 2017, and 2018, respectively. *Lasioglossum (Dialictus)*, *Agapostemon*, and *Eucera* were the most common genera captured constituting more than half (58%) of bee specimens. *Halictus* was the fourth most common genera, adding another 7% to the total bee capture. In 2016, secondary pollinators were ~8% of total pollinator catch. Lepidopterans were 10-fold more abundant than Syrphidae as sec-ondary pollinators across all years. Secondary pollinators were 19% and 13% of the total catch in 2017 and 2018, respectively.

Furthermore, the researchers found in 2016 and 2017 bee abundance increased where periodic grazing of pastures provided suitable nesting habitat for these rangeland pollinators. They suggested forage consumption and hoof action likely created the unvegetated space required for reproduction by these mostly solitary, ground-nesting bees. However, abundances of secondary pollinators (i.e., butterflies and hover flies) were unrelated to grazing during two of the three study years. According to Gilgert and Vaughan (2011), the diverse plant landscapes that rangelands are composed meet the needs of a variety of pollinators, including Hymenopterans and Lepidopterans. Idling large swaths of rangelands could be detrimental to bee populations because most ground-nesting species exhibit breeding-site fidelity, with multiple generations returning to nest in the same pasture (Michener 2007).

The Xerces society promotes a symbiotic relationship between pollinators and rangelands, with each benefitting from the others existence (Buxton et al.). Noting rangelands provide large contiguous areas of food and shelter habitat for pollinators. Likewise, the pollination of a wide array of wildflowers produces valuable forage for cattle and wildlife, supports soil health, and makes grasslands more resilient. Information about rangeland pollinators species is generally limited, with most of it coming from "uncoordinated, short-term, small-scale sampling focusing on bees and butterflies" (Hanberry et al 2021). Though this information is limited, studies on bees of the Great Plains indicate that about two-thirds of the bee species in rangelands are generalists, which use many families of plants for nectar and nesting. With this information about generalist nature of bees in rangelands, and the increased biodiversity caused by grazing, pollinators of the rangelands are very likely widespread in both species and location, which can increase their resiliency to disturbances.
Therefore, pesticides applications will also potentially impact a much more abundant and rich collection of pollinators due to the unique qualities of rangeland habitats. Additionally, the presence of agrochemicals and other pesticides have been found in samples of bee tissue from the Great Plains, likely due to the conversion of land from pollinator friendly rangeland to crop fields (Hladik et al 2016, Otto et al 2016).

Biodiversity of invertebrate organisms is crucial for ecosystem health. Biocontrol insects and pollinators in particular help control noxious weeds and provide pollination services crucial to sustaining diverse ecosystems. Pollinators include managed exotic species such as European honeybees and a huge diversity of native species including many kinds of solitary and eusocial bees, wasps and ants, flies, hoverflies and bee-mimicking flies, many families of beetles, true bugs, moths and butterflies among others. In addition to general pollination services, some species of insects are obligate pollinators of rare plants, meaning the plants cannot reproduce without them. Other services which both terrestrial and aquatic invertebrates provide are less obvious but equally important, including nutrient cycling, decomposition and stimulating plant regrowth. Many species of herbivorous insects including grasshoppers are in this general category. Predacious invertebrates (e.g. arachnids, mantids, and dragonflies) help regulate herbivores while also providing food to larger animals. Invertebrates in general are incredibly important to ecosystem health and provide the greatest animal biodiversity within these ecosystems.

To gather more site-specific data on bee distribution within the San Carlos Tribal rangeland action area which this EA covers the North American Bee Distribution Tool was used. This tool is an interactive portal that allows for rapid assessment of apparent bee species richness throughout the United States, Canada, and Mexico. The Bee Tool incorporates species occurrence data of six families of bees using data provided by Global Biodiversity Information Facility, as well as conservation status rankings provided by NatureServe. The Bee Tool is managed by the U.S. Fish and Wildlife Service Center for Pollinator Conservation. https://www.fws.gov/beetool

The following information has been gathered from the database, for the Tribal rangeland action area. A 62-year date range for the search was from 1961 – 2023. There was no data of bee species within this date range on Tribal rangeland action area in Gila County. That portion of the action area is remote and not well traveled and access is limited to 4-wheel drive vehicles. The data for the 62-year date range from 1961- 2023 in Graham County produced 134 species with 827 occurrences. Not all data is recorded in the action area. Information for what is recorded in the action area will be discussed. The phenological curve for the sightings for bees inside the Tribal action area had the peak time of season in August. Sightings from the family Halictidae, *Dieunomia heterpoda,* Nomiine bees was observed near Lasley Tank. This area has Helianthus in bloom later in the season which would be a source plant for this species of bee. Sightings for the species, *Megachile policaris*, leafcutter bee, were also near Lasley Tank. In Ash Flat there were sightings of *Lasioglossum sisymbria*, Tansymustard sweat bee, *Andrena w-scripta*, w marked miner bee, *Andrena piperi,* Piper miner bee. All species documented within the Tribal action area have the conservation rankings of G5 secure. The Piper miner bee does not have a status rank presently according to the bee tool and NatureServe. There were sightings for *Bombus morrisoni*, *Bombus pensylanicus, Megachile newberryae,* and *Megachile sabinensis* all these species have a G3 Vulnerable status. These were documented on Mt. Graham and in the Safford Valley in Graham County. These locations are 37 miles outside the Tribal rangeland action area. The habitat of these observations is more suitable for these species. These locations have a larger variety of flowering plants with large meadows and are closer to creeks and streams where more flowering vegetation is abundant. In the 62-year date range which was covered in the search for bee species on the San Carlos Tribal rangeland action area all species recorded had a G5 secure species population ranking. During Tribal consultations there was no mention of any bee species of special concern mentioned by the tribe. APHIS has determined that any treatments, and all protective measures implemented for other T&E species, would pose low impact to recorded bee populations within the Tribal action area according to the data that has been provided and researched for this EA.

Monarch butterfly (*Danaus plexippus*).

One non-target invertebrate species of potential concern, which have been previously brought up in public scoping for the program is the monarch butterfly (*Danaus plexippus*). The monarch butterfly may potentially be found in Tribal rangeland on the San Carlos Apache action area and is a candidate species being considered for ESA protections.

The monarch butterfly (*Danaus plexippus*) is a conspicuous insect that has experienced population declines over the past few decades. There are several factors which may be contributing to this butterflies' dwindling populations, habitat loss is considered the most significant threat to monarchs. In the United States, loss of milkweed, a host plant, particularly in the Midwest, has greatly reduced the available breeding habitat for monarchs. This has led to extensive efforts to conserve and restore milkweed resources throughout the Midwest (Brym etal. 2020).

Major stressors on monarch populations in North America are widely considered to be habitat loss, climate change, and increase use of pesticides (Thogmartin etal. 2017).

Neonicotinoid use in North America increased dramatically from 1994–2011, coinciding with a 55–67% decline in the size of monarch overwintering populations recorded by Douglas & Tooker (2015). James (2024) suggests that neonicotinoid use is the primary driver to the decline of Western Monarch since 1997. The class of insecticides used by APHIS does not include neonicotinoids. The other factors of habitat loss and climate change are detailed by James (2024) to climate factors in California during which winter storms, flooding and high winds contributed to the "textbook extinction vortex" which led to an 86% decline in overwintering populations.

Stevens and Frey (2010) studied monarch host plants in Arizona and noted that there were 22 species of *Asclepias* in their model that only included the extreme west of Arizona. They reported that A. erosa, A. linaria, A. speciosa and A. tuberosa had a growing season which extended into August/September to produce a migratory generation. Dilts etal. (2019) noted that of those milkweed host plants there was a low suitability threshold for eastern Arizona which is the location of the San Carlos Tribal action area.

APHIS has determined that any treatments, and all protective measures implemented for other T&E species, would pose low impact to recorded monarch populations within the Tribal action area according to the data that has been provided and researched for this EA.

Vertebrates occurring in rangelands within San Carlos Apache action area include introduced tribal livestock, (e.g. cows and horses) and native species including carnivores (e.g. coyotes, foxes, cougars), large herbivorous mammals (e.g. deer, elk, pronghorn antelope, bighorn sheep, javelina), smaller ones (e.g. rabbits, gophers), omnivores (e.g. badgers, mice, bats). Amphibians and reptiles that may be in the area are western diamondback rattlesnake, Sonoran Mountain kingsnake, desert striped whipsnake, western fence lizard, side-blotched lizard. Birds which are often seen in the area are red-tailed hawk, American kestrel, Turkey vulture, Black vulture, western meadowlark, variety finches' sparrows. Herbivorous vertebrate species compete with some species of grasshoppers for forage, while omnivorous and predacious species utilize grasshoppers and other insects as an important food source.

A diverse community of terrestrial plants occurs within the proposed suppression area. This was described in Chapter 3 Environmental Consequences part A. Description of Affected Environment. Some considered as non-native, invasive weeds including annual grasses (e.g. cheat grass, venenata), perennial forbs (e.g., Russian thistle, white top), and woody plants (e.g. Russian olive, tamarisk). A full complement of native plants (e.g. sagebrush, bitterbrush, numerous grasses and forbs) have coevolved with and provide habitat for native and domesticated animal species, while providing broad ecological services, such as stabilizing soil against erosion.

Biological soil crusts, also known as cryptogamic, microbiotic, cryptobiotic, and microphytic crusts, occur within the proposed suppression area. Biological soil crusts are formed by living organisms and their by-products, creating a crust of soil particles bound together by organic materials. Crusts are predominantly composed of cyanobacteria (formerly blue-green algae), green and brown algae, mosses, and lichens. Liverworts, fungi, and bacteria can also be important components. Crusts contribute to various functions in the environment. Because they are concentrated in the top 1 to 4 mm of soil, they primarily affect processes that occur at the land surface or soil-air interface. These include stabilizing soil against erosion, fixing atmospheric nitrogen, providing nutrients to plants, and improving soil-plant-water relations, infiltration, seedling germination, and plant growth.

Finally, sundry other organisms (e.g. fungi and fungus-like organisms, algae and lichens, non-vascular plants, earthworms and other annelids, both terrestrial and aquatic microorganisms) are often less visible in rangelands within the San Carlos Apache Tribal area but are nonetheless present and contribute to these ecosystems in various ways.

Section 7 of the Endangered Species Act (ESA) and its implementing regulations require Federal agencies to ensure their actions are not likely to jeopardize the continued existence of listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. Within the San Carlos Apache Rangeland and surrounding area under consideration by this EA were federally listed species which are 1 mammal species, Mexican Gray wolf, 2 bird species, Southwestern willow flycatcher, Mexican spotted owl, 1 Amphibian species Chiricahua leopard frog, 4 fish species, Gila chub, razorback sucker, spickdace, loach minnow, Gila topminnow, 1 plant species, Arizona cliffrose. 1 reptile, Northern Mexican gartersnake, although not all occur within or near potential grasshopper suppression areas. APHIS consulted with local FWS to determine protective measures to ensure proper protections for T&E species covered under the ESA. As a result, all species/habitats were either excluded or given buffers to protect the impact of these species.

APHIS considers whether listed species, species proposed for listing, experimental populations, or critical habitat are present in the proposed suppression area. Before treatments are conducted, APHIS contacts the U.S Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) (where applicable) to determine if listed species are present in the suppression area, and whether mitigations or protection measures must be implemented to protect listed species or critical habitat.

APHIS submitted a programmatic biological assessment for grasshopper suppression in the 17-state program area and requested consultation with USFWS on March 9, 2015. In November 2023 APHIS revised the biological assessment to address USFWS comments and include species that had been listed since 2015. USFWS concurred (Appendix G) with APHIS' determination the grasshopper program would have no effect or was not likely to adversely affect listed species and the critical habitat on March 21, 2024. USFWS stated:

> *"As a result of the APHIS program conservation measures such as use of the buffer distances discussed above for all taxonomic groups and their designated critical habitats, as applicable, along with the reduced application rates as compared to label rates for each insecticide, and RAAT treatment procedures, any risk of exposure associated with the*

application of the three insecticides used under the APHIS grasshopper and Mormon cricket suppression program is expected to be minimal. Thus, any direct or indirect effects from the proposed action to listed species and their designated critical habitats are expected to be insignificant due to program conservation measures."

APHIS will also continue to consult with USFWS field offices at the local level to ensure listed species habitats are properly buffered during grasshopper suppression treatments. APHIS has continued to consult closely with the local FWS offices in Phoenix and Flagstaff as well as the regional office in Albuquerque, New Mexico. As a result of these consultations with local FWS, APHIS has excluded all rivers and streams areas which T&E species may be found in or nearby. These exclusions range from 5 miles to 15 miles. The local consultations between APHIS and FWS have resulted in increasing all ground buffers to 500 feet instead of the 300-foot buffers in the Programmatic biological assessment. Due to the protective measures implemented the determinations are described in table 2. The proposed application buffers are described in table 3.

Table 2. Biological Assessment Effects Determination for T&E Species

Species	Method of Application	Protective Measure Only RAAT's Methodology Used
Mexican gray wolf	Ground	500-foot buffer
Mexican spotted owl	Ground	RAAT's Only No Aerial treatments
Southwestern willow flycatcher	Ground	No Treatments within 5 miles of known nesting habitat
Yellow-billed cuckoo	Ground	No Treatments within 5 miles of known nesting habitat
Chiricahua leopard frog	Ground	500-foot buffer
Northern leopard frog	Ground	500-foot buffer
Desert pupfish		No Treatments within 1 mile of rivers and tributaries
Gila chub		No Treatments within 1 mile of rivers and tributaries
Gila topminnow		No Treatments within 1 mile of rivers and tributaries
Loach minnow		No Treatments within 1 mile of rivers and tributaries
Spikedace		No Treatments within 1 mile of rivers and tributaries
Arizona cliffrose	Ground	.25-mile buffer from Cottonwood Canyon Gila/Graham County
Monarch Butterfly	Ground	Any known milkweed stands on rangeland will be buffered by 50 feet. Riparian areas excluded from treatment areas
Western Burrowing Owl, *Athene cunicularia*	Ground	Active burrows to be buffered by 100 feet. AGFD recommended buffer.

Table 3. Proposed application buffers to protect listed T&E species and habitat.

Species	Status	Effects Determination
Mexican gray wolf, *Canis lupus baileyi*	Endangered	May affect- Not likely to adversely affect
Mexican spotted owl, St*rix occidentalis lucida*	Threatened	May affect- Not likely to adversely affect
Southwestern willow flycatcher, *Empidonax traillii extimus*	Endangered	May affect- Not likely to adversely affect
Yellow-billed cuckoo, *Coccyzus americanus*	Threatened	May affect- Not likely to adversely affect
Chiricahua leopard frog, *Rana chiricahuensis*	Threatened	May affect- Not likely to adversely affect
Northern leopard frog, *Rana pipiens*	Arizona Game and Fish Department (AGFD), Species of Greatest Conservation Need.	May affect- Not likely to adversely affect
Desert pupfish, *Cyprinodon macularius*	Endangered	May affect- Not likely to adversely affect
Gila chub, *Gila intermedia*	Endangered	May affect- Not likely to adversely affect
Gila topminnow, *Poeciliopsis occidentalis occidentalis*	Endangered	May affect- Not likely to adversely affect
Loach minnow, *Tiaroga cobitis*	Endangered	May affect- Not likely to adversely affect
Spikedace, *Meda fulgida*	Endangered	May affect- Not likely to adversely affect
Arizona cliffrose, *Purshia subintegra*	Endangered	No Effect
Monarch Butterfly, *Danaus plexippus*	Candidate	May affect- Not likely to adversely affect
Western Burrowing Owl, *Athene cunicularia*	AGFD, Species of Concern.	May affect- Not likely to adversely affect

APHIS considers the role of pollinators in any consultations conducted with the USFWS to protect federally listed plants. Mitigation measures, such as no treatment buffers are applied with consideration of the protection of pollinators that are important to a listed plant species.

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–712) established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.

APHIS will support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or reducing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions. Impacts are minimized as a result of buffers to water, habitat, nesting areas, riparian areas, and the use of RAATs. For any given treatment, only a portion of the environment will be treated, therefore minimizing potential impacts to migratory bird populations.

The Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. During the breeding season, bald eagles are sensitive to a variety of human activities. Grasshopper management activities could cause disturbance of nesting eagles, depending on the duration, noise levels, extent of the area affected by the activity, prior experiences that eagles have with humans, and tolerance of the individual nesting pair. However, rangeland grasshopper suppression treatments occur during the late spring or early summer, after the nesting season when eagle young typically will have already fledged. The program also recognizes disruptive activities in or near eagle foraging areas can interfere with bald eagle feeding, reducing chances of survival. Program operational procedures that prevent applications near water bodies will reduce the possibility of disturbing eagle foraging activities. USFWS has provided recommendations for avoiding disturbance at foraging areas and communal roost sites that are applicable to grasshopper management programs (USFWS, 2007).

No toxic effects are anticipated on eagles as a direct consequence of insecticide treatments. Toxic effects on the principal food source, fish, are not expected because insecticide treatments will not be conducted over rivers or lakes. Buffers protective of aquatic biota are applied to their habitats to ensure that there are no indirect effects from loss of prey.

There may be species that are of special concern to land management agencies, the public, or other groups and individuals in proposed treatment areas. For example, the sage grouse populations have declined throughout most of their entire range, with habitat loss being a major factor in their decline.

There is special concern about the role of grasshoppers as a food source for American kestrel, Western Burrowing owl. Grasshopper suppression programs reduce grasshoppers and at least some other insects in the treatment area that can be a food item for these birds. As indicated in previous sections on impacts to birds, there is low potential that the program insecticides would be toxic to kestrels or burrowing owls, either by direct exposure to the insecticides or indirectly through immature eating moribund grasshoppers.

Because grasshopper numbers are so high in an outbreak year, treatments would not likely reduce the number of grasshoppers below levels present in a normal year. On the San Carlos Apache Tribal action area, the ideal grasshopper population range would be from from 1-7gh/yd^2. Should grasshoppers be unavailable in small, localized areas. By suppressing grasshoppers, rangeland vegetation is available for use by other species, and rangeland areas are less susceptible to invasive plants.

3. Physical Environment Components

a. *Geology and Soils*

The San Carlos Tribal rangeland action area contains the following soil types and % slope; Cloverdale-Terrossa complex with 1-5% slope, Ashcreek-Stanford-Lanque association, 0 to 3 percent slopes, Terrarossa-Cloverdale-Blacktail complex, 1 to 35 percent slopes, Cloverdale-Cherrycow-Kuykendall complex, 2 to 10 percent slopes.

Soil is the basic component of rangeland ecosystems and is associated with nearly all processes that occur within the ecosystem. It provides a medium to support plant growth. It is also the home for many insects and microorganisms. It is a product of parent material, climate, biological factors, topography, and time. The soil formation process is slow, especially in arid and semiarid climates. It is believed to take several hundred years to replace an inch of topsoil lost by erosion. Rangeland soils, as those found in the Great Plains and Palouse Prairie, have been extensively converted to agricultural crop production. Remaining rangeland soils may be rocky, steep, salt affected, or otherwise not very productive compared to prime agricultural lands. The chemical and physical characteristics of a soil determine: its ability to furnish plant nutrients, the rate and depth of water penetration, and the amount of water the soil can hold and its availability to plants.

b. *Hydrology and Water Resources*

The San Carlos Apache Tribal Rangeland falls within the Upper Gila Watershed. The Arizona Department of Environmental Quality (ADEQ) has reported water quality issues with the Upper Gila Watershed. Portions of the San Francisco and Blue Rivers have been listed as impaired waterways by the Arizona Department of Environmental Quality due to unsafe levels of a bacteria called *Escherichia coli,* or *E. coli*. *E. coli* is used to measure water quality of the river because high levels of it can indicate the presence of other pathogens that may pose a serious health risk to humans.

The ADEQ and the Gila Watershed Partnership work to reduce E. coli impairment on these rivers. This project engages the community through volunteer clean-up events, installation of restrooms and "do not litter" signage at high recreation sites. The hope is that through this project, the Blue and San Francisco Rivers can be a cleaner, and more beautiful place for our community to enjoy.

4. Socioeconomic Issues

Rangelands are essential to western livestock producers providing forage for a variety of domestic animals. Economic values of rangelands also include energy production sites, both fossil and renewable, and recreation sites. Two important distinctions are between market and non-market values, and between use and non-use values. Market values are associated with goods and services sold directly in a marketplace (e.g., livestock); market prices are therefore a good estimate value. Non-market values arise from goods and services that are not directly sold in a marketplace (e.g., ecosystem services). Similarly, use values arise from goods that are physically used (now or in the future), such as forage for livestock (market value) or outdoor recreation (usually a non-market value). Non-use values arise from goods that are never physically used. Non-use values, for example, include the concept of “existence value” (i.e., the value people place on simply knowing something, such as an unspoiled wilderness area, exists). Non-use values are often unrelated to any market good, but are real economic values, nonetheless. Non-market and non-use values are difficult to estimate; therefore, most economic injury level estimates only consider market values and, in most cases, only the single market value for the commodity (e.g., forage) being damaged. In the case of rangeland, there are a large suite of values, both market and non-market, and use and non-use, that can be affected by pests, such as grasshoppers (Rashford et al., 2012).

For generations, cattle ranching has been a vital part of the San Carlos Apache way of life. The first cattle issued in 1884 to the development of Apache-owned ranching associations, the industry has played a key role in our community’s history. Today, the Tribe is working to revitalize their cattle industry by empowering a new generation of Apache ranchers.

Livestock grazing is one of the primary uses of rangeland in the area and is the dominate agricultural activity. Livestock enterprises include rangeland grazing by cattle, and horses. Rangeland may be utilized for grazing throughout the year.

5. Cultural Resources and Events

Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments," calls for agency communication and collaboration with tribal officials when proposed Federal actions have potential tribal implications. The Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa-mm), secures the protection of archaeological resources and sites on public and tribal lands.

Prior to the treatment season, program personnel notify Tribal land managers of the potential for grasshopper and Mormon cricket outbreaks on their lands. Consultation with local Tribal representatives takes place prior to treatment programs to inform fully the Tribes of possible actions APHIS may take on Tribal lands. Treatments typically do not occur at cultural sites, and drift from a program treatment at such locations is not expected to adversely affect natural surfaces, such as rock formations and carvings. APHIS would also confer with the appropriate Tribal authority to ensure that the timing and location of a planned program treatment does not coincide or conflict with cultural events or observances on Tribal lands.

Federal actions must seek to avoid, minimize, and mitigate potential negative impacts to cultural and historic resources as part of compliance with the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act of 1979, and NEPA. Section 106 of the NHPA requires Federal agencies to provide the Advisory Council on Historic Preservation with an opportunity to comment on their findings.

The San Carlos Apache Cattlemen's Associations isn't just about raising livestock. It is also about preserving a legacy. Cattle ranching has been a vital part of the Apache way of life. The first cattle were issued in 1884 to the development of Apache owned ranching associations. The industry plays a key role in the community's history. Unlike commercial ranching operations, the San Carlos Apache approach is deeply rooted in the traditions, sustainability, and community-driven ranching operations. The San Carlos Apache Tribal approach is committed to the following: revitalizing Apache ranching by passing down knowledge to new generations while embracing modern techniques. Sustainable stewardship which means caring for the land and livestock with respect and ensuring long-term success. Through community-centered growth this strengthens the economy by keeping profits within the Tribe. The Tribes approach to ranching honors the Apache heritage and builds a future for Apache ranching. APHIS' commitment to working closely with the San Carlos Tribal Council, Tribal Cattle Associations, Tribal Wildlife Department, Land Operations and the Tribal Interdisciplinary Team (IDT) to safeguard, forage on the rangeland, livestock, wildlife, and all Tribal resources both natural and cultural has been a collaborative effort between APHIS and the San Carlos Apache Tribe for decades. All mitigation measures considered in this EA have been agreed upon by both Tribal government and APHIS.

The San Carlos Apache Tribal consultation process which APHIS has adhered to has been to meet with the Tribal Council personally, given training, technical assistance on APHIS rangeland program, discussed protective measures to be implemented with the Tribal Interdisciplinary Team, which consists of soil scientists, rangeland operational personnel, land operational personnel, Natural Resource Specialists, Forestry, Tribal Archeologist, Tribal Wildlife Biologist, and Tribal Council Members. After consultations the protective measures agreed upon pose minimal impacts to the Tribal rangeland environment, the IDT Team will make recommendations to the Tribal Council and then The Council votes and then the action is ratified by the Tribal Administrator. The APHIS rangeland program including the EAs are reviewed by the Tribe each season to determine if further consultations are required by the Tribe. Any areas to be excluded were addressed in Chapter 3, Environmental Consequences subpart B, Special Management Areas (Habitat Exclusions) of this EA.

6. Special Considerations for Certain Populations

a. Executive Order No. 13045, Protection of Children from Environmental Health Risks and Safety Risks

The increased scientific knowledge about the environmental health risks and safety risks associated with hazardous substance exposures to children and recognition of these issues in Congress and Federal agencies brought about legislation and other requirements to protect the health and safety of children. On April 21, 1997, President Clinton signed E.O. 13045, Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885). This E.O. requires each Federal agency, consistent with its mission, to identify and assess environmental health risks and safety risks that may disproportionately affect children and to ensure that its policies, programs, activities, and standards address those risks. APHIS has developed agency guidance for its programs to follow to ensure the protection of children (USDA, APHIS, 1999).

According to the BUREAU OF WOMEN'S AND CHILDREN'S HEALTH, Arizona Department of Health Services, there are 3,235 children between the ages of 0-14. There is approximately 1,151 youth from the ages of 15-19 according to the Arizona Department of Health Services. The risk for children to be exposed to treatment pesticides is very low due to the remote nature of the Tribal Rangeland. The nearest communities are approximately 50 miles from the Tribal rangeland areas. There will be no aerial treatments conducted in Arizona only by ground-based equipment.

E. Environmental Consequences of the Alternatives

Each alternative described in this EA potentially has adverse environmental effects. The general environmental impacts of each alternative are discussed in detail in the 2019 programmatic EIS published by APHIS. The specific impacts of the alternatives are highly dependent upon the particular action and location of the grasshopper infestation. The principal concerns associated with the alternatives are: (1) the potential effects of insecticides on human health (including subpopulations that might be at increased risk); and (2) impacts of insecticides on nontarget organisms (including threatened and endangered species).

APHIS has written human health and ecological risk assessments (HHERAs) to assess the insecticides and use patterns that are specific to the program. The risk assessments provide an in-depth technical analysis of the potential impacts of each insecticide to human health, non-target wildlife, and its environmental fate in soil, air, and water. The assessments rely on data required by USEPA for pesticide product registrations, as well as peer-reviewed and other published literature. The HHERAs are heavily referenced in the 2019 EIS and this EA is likewise tiered to that analysis (USDA APHIS, 2019a, 2019b, 2019c, 2019d). These Environmental Documents can be found at the following website: http://www.aphis.usda.gov/plant-health/grasshopper.

The program suppresses grasshopper populations on a small portion of the area considered by this EA in any given year. In those control treatment areas substantial portions are excluded from direct insecticide applications because of buffers around sensitive sites and the alternating spray and skip swaths inherent in the RAATs method. The potential harmful effects from the program activities on environmental components and nontarget species populations occur in a small portion of the area considered by this EA and for a limited duration. Site-specific environmental consequences of the alternatives are discussed below.

1. Alternative 1 - No Suppression Program Alternative

a.) Grasshopper Population Control

Under this alternative, APHIS would not conduct a program to suppress grasshoppers other than provide technical assistance and surveys to assist in the implementation of

IPM strategies by land managers. When cultural or mechanical methods have failed to prevent harmful grasshopper populations Federal land management agencies, State agriculture departments, local governments, private groups or individuals, may not effectively combat outbreaks in a coordinated effort. Without the coordination that APHIS provides during grasshopper outbreaks, the land managers and owners could use insecticides that APHIS considers too environmentally harsh. Multiple treatments and excessive amount of insecticide could be applied in efforts to suppress or even locally eradicate grasshopper populations. There are approximately 100 pesticide products registered by USEPA for use on rangelands and against grasshoppers (Purdue University, 2018).

Without APHIS' coordination and funding of grasshopper suppression programs within the San Carlos Rangeland action area the responsibility would rest with the San Carlos Apache Tribe. The Tribal Nation relies on APHIS to provide the necessary funding. The Tribe lacks the personnel and resources for any grasshopper suppression program. APHIS estimates one treatment would occur totaling possibly 15,000 acres. The most economical choice of pesticides available to the Tribe if they acquired the funding would be any insecticides labeled for grasshoppers and rangeland use and approved by State of Arizona and any private contractor. The conventions of IPM, which APHIS have incorporated into our standard program procedures could be too burdensome for other agencies or private contractors to observe. While the economic benefits of suppressing grasshoppers by using a RAATs method have been widely publicized, less frequent treatments by other agencies or private contractors might encourage widespread complete coverage treatments to "eradicate" grasshopper populations. Adverse environmental effects particularly on nontarget species, could be much greater under this scenario than under the APHIS led suppression program alternative, due to lack of operational knowledge or coordination among the groups and contractors.

(1.) Human Health

Human exposure and health risks could increase because of the inexperience of other agencies in planning, contracting and monitoring treatments. APHIS hygiene and safety protocols establish procedures for use of personal protection equipment and handling of hazardous chemicals. Other less experienced agencies might underestimate potential worker or bystander exposures, increasing health risks.

(2.) Nontarget Species

Grasshopper treatment programs could occur with more random frequency as various agencies allocate funding when it is available. These programs would almost certainly not have the same procedures and safeguards incorporated into the APHIS program. The possibility of multiple agencies with overlapping jurisdictions could result in multiple treatments per year with the same or incompatible insecticides. This overlapping of treatments could cause synergistic chemical interactions and more severe effects to nontarget species. It is also unlikely the other agencies will be equally equipped as APHIS to incorporate guidance and species location information from USFWS. Therefore, adverse effects on protected species and their critical habitat could increase.

(3.) Physical Environment Components

The potential grasshopper control conducted by third parties could result in increases and a greater variety of pesticide residues in the environment. As noted previously, APHIS can only speculate which agencies and landowners will decide to control grasshoppers and what chemicals will be used. The program has also established treatment restriction buffers around water bodies to protect those features from insecticide drift and runoff. The labels for all program insecticides prohibit direct application to water (defined as reservoirs, lakes, ponds, pools left by seasonal streams, springs, wetlands, and perennial streams and rivers). APHIS maintains the following additional buffers for water bodies that are not designated critical habitat for listed aquatic species: 500-foot buffer for aerial sprays, 200-foot buffer for ground sprays, and a 50-foot buffer for bait applications (USDA APHIS, 2013). Almost certainly land management agencies and property owners would not observe the same buffers to prevent accidental spray drift to sensitive environments.

(4.) Socioeconomic Issues

In the absence of an APHIS administered grasshopper suppression program the cost of treatments would be paid entirely by land management agencies and land owners. Ranchers that lease land for grazing livestock might also have to pay third parties to protect rangeland forage from grasshopper outbreaks. These additional expenses would increase the cost of rangeland leases and production of livestock in general. Rural economies that depend on ranching and farming would experience increased economic hardship. The economic effects of infrequent and haphazard grasshopper treatments on rangeland forage could be similar to those described below for a scenario where no treatments occur.

(5.) Cultural Resources and Events

The potential grasshopper control conducted by third parties might or might not be coordinated with Tribes and other cultural or historical observance events. It is reasonable to assume Tribal interests would ensure grasshopper treatments would not interfere with events or occur in areas of cultural significance.

(6.) Special Considerations for Certain Populations

Grasshopper suppression programs are likely to occur in the same rural rangeland areas that are largely uninhabited. No matter who conducts the treatments, disproportionately high and adverse human health or environmental impacts on Tribes, and historical and culturally sensitive sites in a program area are unlikely.

Likewise, potential grasshopper control programs would be conducted in rural rangeland areas, where agriculture is a primary industry. These areas consist of widely scattered, single, rural dwellings in ranching communities with low population density. The other agencies and landowners might notify residents within treatment areas to reduce the potential for incidental exposure to residents including children. None the less, treatments would occur on open rangelands where children would not be expected to be present during treatment or to enter should there be any restricted entry period after treatment. The APHIS grasshopper program also implements mitigation measures beyond label requirements to ensure that no treatments occur within the required buffer zones from structures, such as a 500-foot treatment buffer zone from schools and recreational areas. Also, program insecticides are not applied while school buses are operating in the treatment area (USDA APHIS, 2016). There is a reasonable expectation that treatments conducted by third parties would also avoid spraying chemicals where children are present or congregate.

b) No Grasshopper Population Control

Conversely, in the absence of an APHIS funded grasshopper suppression program the most likely environmental effects would result from other agencies and land managers not controlling outbreaks. As noted, grasshoppers consuming vast amounts of vegetation in rangelands and surrounding areas. Grasshoppers are generalist feeders, eating grasses and forbs first and often moving to cultivated crops. High grasshopper density of one or several species and the resulting defoliation may reach an economic threshold where the damage caused by grasshoppers exceeds the cost of controlling the grasshoppers. Researchers determined that during typical grasshopper infestation years, approximately 20% of forage on western rangeland is removed, valued at an estimated cost of $1.2 billion per year (Hewitt & Onsager, 1983; dollar amount adjusted). This value represents 32 to 63% of the total value of rangeland across the western states (Rashford et al., 2012). Other market and non-market values such as carbon sequestration, general ecosystem services, and recreational use may also be impacted by grasshopper outbreaks in rangeland.

(1.) Human Health

The risk of accidental exposure to insecticides would be reduced if no grasshopper control programs are implemented by APHIS or third parties. Grasshopper outbreaks could cause other health hazards including increased dust storms and road hazards.

(2.) Nontarget Species

Vegetation damage during serious grasshopper outbreaks may be so severe that all grasses and forbs are destroyed causing impaired plant growth for several years. Rare plants may be consumed during critical times of their development such as during seed production, and loss of important plant species, or seed production may lead to reduced biological diversity of the rangeland habitats, potentially creating opportunities for the expansion of invasive and exotic weeds (Lockwood and Latchininsky, 2000). Rangeland herbivorous wildlife would have to migrate or suffer food shortages caused by the loss of forage.

(3.) Physical Environment Components

When grasshoppers consume plant cover, soil is more susceptible to the drying effects of the sun, making plant roots less capable of holding soil in place. Soil damage results in erosion and disruption of nutrient cycling, water infiltration, seed germination, and other ecological processes which are important components of rangeland ecosystems (Latchininsky et al., 2011). A reduction vegetation will make steep rangeland topography more susceptible to erosion which would cause additional sediment loading in streams, rivers, and other water bodies. This would result in a decrease in water quality. Likewise the denuded rangeland caused by poor grasshopper control would have less evapotranspiration, lower humidity, and higher daily temperature ranges. During windstorms the dry soil would be more likely to allow soil particles to become airborne and result in poor air quality and possibly health and other physical hazards to humans.

(4.) Socioeconomic Issues

When the density of grasshoppers reaches economic injury levels, grasshoppers begin to compete with livestock for food by reducing available forage (Wakeland and Shull, 1936; Belovsky, 2000; Pfadt, 2002; Branson et al., 2006; Bradshaw et al., 2018). Ranchers could offset some of the costs by leasing rangeland in another area and relocating their livestock, finding other means to feed their animals by purchasing hay or grain, or selling their livestock. Local communities and families with ranching based incomes could see adverse economic impacts. Grasshoppers that infest rangeland could move to surrounding croplands. Crop agriculture farmers could incur economic losses from attempts to chemically control grasshopper populations or due to the loss of their crops. The general public could see an increase in the cost of meat, crops, and other agricultural products.

(5.) Cultural Resources and Events

The lack of grasshopper treatments would reduce the possibility of accidental spraying by third parties of cultural resources and during activities observing cultural or historically significant events. Grasshopper outbreak populations could reduce recreational and cultural uses of rangeland. Uncontrolled grasshopper populations would make these effects more severe.

(6.) Special Considerations for Certain Populations

The risk of accidental human exposure to insecticides would be reduced if no grasshopper control programs are implemented by APHIS or third parties.

As previously noted, the general public could see an increase in the cost of meat, crops, and other agricultural products. Low-income populations would suffer greater relative economic hardship from this increase in food prices, especially where grocery shopping choices are limited by longer travel between small rural villages. Likewise, the cost of food staples for families with children could increase.

2. Alternative 2 -Insecticide Applications at Conventional Rates or Reduced Agent Area Treatments with Adaptive Management Strategy

Under Alternative 2, APHIS would participate in grasshopper programs with the option of using one of the insecticides carbaryl, chlorantraniliprole and diflubenzuron depending upon the various factors related to the grasshopper outbreak and the site-specific characteristics. The use of an insecticide would typically occur at half the conventional application rates following the RAATs strategy. APHIS would apply a single treatment to affected rangeland areas to suppress grasshopper outbreak populations by a range of 35 to 98 percent, depending upon the insecticide used.

a) Carbaryl

Carbaryl is a member of the N-methyl carbamate class of insecticides, which affect the nervous system via cholinesterase inhibition. Inhibiting the enzyme acetylcholinesterase (AChE) causes nervous system signals to persist longer than normal. While these effects are desired in controlling insects, they can have undesirable impacts to non-target organisms that are exposed.

(1.) Human Health

Carbaryl can cause cholinesterase inhibition (i.e., overstimulate the nervous system) in humans resulting in nausea, headaches, dizziness, anxiety, and mental confusion, as well as convulsions, coma, and respiratory depression at high levels of exposure (NIH, 2009a; Beauvais, 2014). USEPA classifies carbaryl as "likely to be carcinogenic to humans" based on vascular tumors in mice (USEPA, 2007, 2015a, 2017).

USEPA regulates the amount of pesticide residues that can remain in or on food or feed commodities as the result of a pesticide application. The agency does this by setting a tolerance, which is the maximum residue level of a pesticide, usually measured in parts per million (ppm), that can legally be present in food or feed. USEPA-registered carbaryl products used by the grasshopper program are labeled with rates and treatment intervals that are meant to protect livestock and keep chemical residues in cattle at acceptable levels (thereby protecting human health). While livestock and horses may graze on rangeland the same day that the land is sprayed, in order to keep tolerances to acceptable levels, carbaryl spray applications on rangeland are limited to half a pound active ingredient per acre per year (USEPA, 2012a). The grasshopper program would treat at or below use rates that appear on the label, as well as follow all appropriate label mitigations, which would ensure residues are below the tolerance levels.

Adverse human health effects from the proposed program ULV applications of the carbaryl spray (Sevin® XLR Plus) and bait applications of the carbaryl 5% and 2% baits formulations to control grasshoppers are not expected based on low potential for human exposure to carbaryl and the favorable environmental fate and effects data. Technical grade (approximately 100% of the insecticide product is composed of the active ingredient) carbaryl exhibits moderate acute oral toxicity in rats, low acute dermal toxicity in rabbits, and very low acute inhalation toxicity in rats. Technical carbaryl is not a primary eye or skin irritant in rabbits and is not a dermal sensitization in guinea pig (USEPA, 2007). This data can be extrapolated and applied to humans revealing low health risks associated with carbaryl.

The Sevin® XLR Plus formulation, which contains a lower percent of the active ingredient than the technical grade formulation, is less toxic via the oral route, but is a mild irritant to eyes and skin. The proposed use of carbaryl as a ULV spray or a bait, use of RAATs, and adherence to label requirements, substantially reduces the potential for exposure to humans. Program workers are the most likely human population to be exposed. APHIS does not expect adverse health risks to workers based on low potential for exposure to liquid carbaryl when applied according to label directions and use of personal protective equipment (e.g., long-sleeved shirt and long pants, shoes plus socks, chemical-resistant gloves, and chemical-resistant apron) (USEPA, 2012a) during loading and applications. APHIS quantified the potential health risks associated with accidental worker exposure to carbaryl during mixing, loading, and applications. The quantitative risk evaluation results indicate no concerns for adverse health risk for program workers (http://www.aphis.usda.gov/plant-health/grasshopper).

Adherence to label requirements and additional program measures designed to reduce exposure to workers and the public (e.g., mitigations to protect water sources, mitigations to limit spray drift, and restricted-entry intervals) result in low health risk to all human population segments.

(2.) Nontarget Species

The APHIS HHERA assessed available laboratory studies regarding the toxicity of carbaryl on fish and wildlife. In summary, the document indicates the chemical is highly toxic to insects, including native bees, honeybees, and aquatic insects; slightly to highly toxic to fish; highly to very highly toxic to most aquatic crustaceans, moderately toxic to mammals, minimally toxic to birds; moderately to highly toxic to several terrestrial arthropod predators; and slightly to highly toxic to larval amphibians (USDA APHIS, 2019a). However, adherence to label requirements and additional program measures designed to prevent carbaryl from reaching sensitive habitats or mitigate exposure of non-target organisms will reduce environmental effects of treatments.

Acute and chronic risks to mammals are expected to be low to moderate based on the available toxicity data and conservative assumptions that were used to evaluate risk. There is the potential for impacts to small mammal populations that rely on terrestrial invertebrates for food. However, based on the toxicity data for terrestrial plants, minimal risks of indirect effects are expected to mammals that rely on plant material for food. Carbaryl has a reported half-life on vegetation of three to ten days, suggesting mammal exposure would be short-term. Direct risks to mammals from carbaryl bait applications is expected to be minimal based on oral, dermal, and inhalation studies (USDA APHIS, 2019a).

A number of studies have reported no effects on bird populations in areas treated with carbaryl (Buckner et al., 1973; Richmond et al., 1979; McEwen et al., 1996). Some applications of formulated carbaryl were found to cause depressed AChE levels (Zinkl et al., 1977); however, the doses were twice those proposed for the full coverage application in the grasshopper program.

Several field studies that assist in determining impacts of carbaryl on aquatic invertebrates and fish have been published (Relyea and Diecks, 2008; USDA FS, 2008a; NMFS, 2009) and are summarized in the 2019 EIS. The value of these studies is limited because they all had dosing levels or frequencies that are much higher than would occur in the grasshopper program.

While sublethal effects have been noted in fish with depressed AChE, as well as some impacts to amphibians (i.e. days to metamorphosis) and aquatic invertebrates in the field due to carbaryl, the application rates and measured aquatic residues observed in these studies are well above values that would be expected from current program operations. Indirect risks to amphibian and fish species can occur through the loss of habitat or reduction in prey, yet data suggests that carbaryl risk to aquatic plants that may serve as habitat, or food, for fish and aquatic invertebrates is very low.

The majority of rangeland plants require insect-mediated pollination. Native, solitary bee species are important pollinators on western rangeland (Tepedino, 1979). Potential negative effects of insecticides on pollinators are of concern because a decrease in their numbers has been associated with a decline in fruit and seed production of plants.

Research from Gao et al. found that chronic exposure to Carbaryl led to several negative effects on adult bees including impacts on nesting performance, foraging ability and gut microbial community. The researchers posited the no observed adverse effect concentration (NOAEC) of the chronic toxicity test of carbaryl (5 mg/L) to *A. mellifera* larvae were much higher than the field-realistic levels as well as the residual levels detected in bee products. They designed this study to expand the risk assessment to the chronic effects of carbaryl on the transcriptional and metabolic level of *A. mellifera* larvae at the concentration where no adverse reactions were observed.

Stock solution of carbaryl was prepared by dissolving the powder in acetone and then diluted with normal components of bee diet (50% royal jelly, 2% yeast extract, 9% d-glucose, 9% d-fructose). The final concentration of 2 mg/L carbaryl was applied to the third instar larvae for four days and correspond to the no observed adverse effect concentration (NOAEC) determined in a previous study from the researchers (Yang et.al. 2019). However, they noted the carbaryl concentration on developing larvae was 48 times the maximum residual value in nectar or honey.

Carbaryl exposure at the NOAEC disrupted the transcriptional and metabolic regulatory networks of bees, even though no adverse physiological effects were observed in exposed larvae. Metabolome analysis showed that carbaryl treatment led to reduction of amino acids, accumulation of nucleic acid components, and disturbed flavonoids and fatty acids in exposed larvae which would suggest that chronic exposure to carbaryl might change internal metabolism in bee larvae (Gao et al., 2022).

Research from Novotny et al. found that pesticides that are traditionally considered contact-based and applied when flowers are unopened can reach pollen and nectar and produce measurable risk to bees. The persistence of some agrochemicals in leaves, pollen, and nectar up to a week following application merits consideration when managing pollinator-dependent crops. Novotny et al. analyzed residues of three insecticides (carbaryl, lambda-cyhalothrin, permethrin) and three fungicides (chlorothalonil, quinoxyfen, triflumizole) in pumpkin leaves, pollen, and nectar collected from five farms in the north-central United States, one day before a spray event, and one, three, and seven days after. Bees foraging on pumpkin flowers were collected one day before and one day after spraying and screened for the same pesticides. Chemical concentrations and application rates were decided by the farmer based on what a typical schedule would look like. The pumpkin seeds had a systemic treatment containing three fungicides and the neonicotinoid insecticide thiamethoxam.

The octanol-water partition coefficient ($logK_{ow}$) is the relative concentration of a chemical in n-octanol versus water at pH 7, 20°C. Higher values of $logK_{ow}$ indicate greater lipophilicity (and a lower affinity for water). Since carbaryl has a $logK_{ow}$ value of 2.36 the chemical is less likely to adsorb and accumulate in lipid-rich plant tissues such as cuticular waxes or pollen. A chemical's ionizability is given as pK_a, the pH at which a chemical is 50% ionized, or in equilibrium between its undissociated and ionized state (calculated as the negative base-10 logarithm of the acid dissociation constant at 25°C). Chemicals with pKa < 7 are most likely to reach vascular tissue and mobilize systemically throughout the plant. A 'neutral' pKa indicates the chemical does not ionize under relevant plant conditions. Carbaryl does not offer systemic insecticidal protection because the chemical has a pK_a of 10.4. However, carbaryl has a molecular weight of 201.2 g/mol well below 800 g/mol, the molecular weight typical of chemicals that are able to penetrate plant cuticles (University of Hertfordshire Agriculture and Environment Research Unit. Pesticide properties database (PPDB). 2024. [Cited 1 March 2024]. Available from: http://sitem.herts.ac.uk).

The researchers found foliar insecticide and fungicide spray residues were detected more frequently and in greater concentrations in pumpkin leaves than in pollen, nectar, or foraging bees and insecticide concentrations in leaves often exceeded levels of concern. However, the risk indices used to examine pollinator exposure against the levels of concern assume that a foraging bee would actually come into contact with all the chemical present on or in the leaf sample.

Carbaryl applied to foliage was present in some plant pollen and nectar samples, and in two or the 69 bee samples (male *X. pruinosa*) collected one day after a spraying event. The researchers noted the bees that tested positive (male squash bees) have life history traits that bring them into prolonged contact with sprayed crop plants. Typically, either the proportion of contaminated samples or the maximum concentration of insecticides in pumpkin tissues decreased over the week following foliar application. For example, one day after application of carbaryl spray 43% of nectar samples tested positive for the insecticide, but carbaryl was not present in nectar samples collected one week later. However, the pretreatment data suggested carbaryl residues can persist longer than a week in leaves and pollen.

Carbaryl has only moderate lipophilicity ($logK_{OW}$ = 2.4), giving it more potential to mobilize vascularly and be incorporated into developing floral tissue. Consistent with this reasoning, the researchers recorded a five-fold increase in carbaryl concentrations in pollen from the first to the third day after treatment. Carbaryl has a low molecular weight and is a very weak acid. Therefore, the chemical can cross membranes and bind with compounds in plant cells with similar pH before it reaches phloem. These properties contribute to its persistence in leaves, instead of translocation to pollen and nectar that bees eat. However, this persistence prolongs pollinator risk of exposure. The high concentrations of carbaryl in leaves during the week after foliar spray led to the highest bee risk quotient values. As previously noted, the assessments may overestimate bee toxicity from leaf contact because they assume a bee receives the entire dose of chemical present in the leaf sample (Novotny et al., 2024).

Researchers analyzed persistence of pesticides in agroecosystems in the Emilia-Romagna region of northern Italy (Bogo et al. 2024). They investigated pesticide residue in beebread by analyzing 100 samples collected in 25 BeeNet national monitoring project stations in March and June of 2021 and 2022. They looked at the diversity and concentration of the chemicals, their correlation with land use, and the risk they posed to the bees. They calculated a toxicity-weighted concentration (TWC) of chemicals by computing the ratio between the measured concentration in beebread and the oral acute toxicity (LD_{50}) of that chemical for bees. For risk evaluation a risk threshold was assigned by dividing the TWC by an order of magnitude to account for chemical degradation, harmful synergistic interaction with other chemicals and chronic exposure causing sublethal effects. The risk threshold was exceeded in four beebread samples out of 100; one for carbaryl, fipronil, imidacloprid and thiamethoxam (Bogo et al. 2024).

Research from Nogrado et al. investigated the effect of carbaryl pesticides on gut microbiota of honeybees, which had come in contact with rapeseed plants (*Brassica napus*) sprayed with carbaryl wettable powder. Honeybee colonies were placed in tunnels covering an area of 70 meters squared and containing *Brassica napus*. Negative controls were sprayed with tap water (400 L/ha), while the experiments were sprayed with carbaryl (250 g a.i./ha in 400 L tap water/ha) during active flight of bees. Bees were collected from the negative control and the carbaryl-treated groups, after 2 h of exposure. The unexposed bees harbored *Alphaproteobacteria*, which were absent in the exposed bees. Microorganisms found in honeybee guts such as *Snodgrassella alvi* and *L. kullabergensis*, however, were observed only in the exposed bees, but not in the unexposed bees. The difference between the two groups was distinctly recognized when copy numbers of 16S rRNA genes were compared by quantitative PCR. The researchers noted they could not conclude decisively that the differences in the composition of the gut microbial communities from the two groups can be attributed directly to the pesticide exposure. However other researchers (Raymann et al.) have suggested that one difference between a healthy colony and a colony suffering from colony collapse disorder can be a decrease in *Alphaproteobacteria* in gut bacterial communities. Lastly, there were other bacteria that are not commonly found in the gut microbiota of honeybees could have been acquired from the environment and could be considered as opportunistic pathogens. These uncategorized bacteria were observed in more abundance in the exposed group as compared to the unexposed group. *Klebsiella* was only observed in the unexposed group, while *Cronobacter*, *Edwardsiella*, *Providencia*, *Serratia*, *Erwinia*, and *Pantoea* were observed in the exposed group. The researchers suggested the uncategorized bacteria could probably be indicative of disruption of balance of gut microbiome or disease as mentioned in previous studies in relation to dysbiosis in the presence of a potential cause like chemicals.

The researchers noted the analysis could measure endpoints of sublethal effects, but there is considerable uncertainty in how to relate to adverse effects. Furthermore, there is insufficient data to establish plausible adverse outcome pathways with consistent and reproducible linkages between molecular initiating events and key events across multiple levels of biological organization to an adverse effect at the whole organism or colony or population level (Nogrado.et.al.2019).

Laboratory studies have indicated that bees can be harmed by acute exposures to carbaryl, but the studies were at rates above those proposed in the program. The chronic exposures and effects modelled in the studies described above are unlikely to result from one-time applications conducted by the program. Potential negative effects of grasshopper program insecticides on bee populations may also be mitigated by the more common use of carbaryl baits than the ULV spray formulation. Studies with carbaryl bran bait have found no sublethal effects on adults or larvae bees (Peach et al., 1994, 1995). The reduced rates of carbaryl used in the program and the implementation of application buffers should significantly reduce exposure of pollinators to carbaryl treatments for grasshopper suppression. In areas of direct application where impacts may occur, alternating swaths and reduced rates (i.e., RAATs) would reduce risk. The effects on pollinators resulting from control of rangeland grasshopper populations with carbaryl based insecticides are not expected to cause significant impacts to the human environment.

(3.) Physical Environment Components

Temperature, pH, light, oxygen, and the presence of microorganisms and organic material are factors that contribute to how quickly carbaryl will degrade in water. Hydrolysis, the breaking of a chemical bond with water, is the primary degradation pathway for carbaryl at pH 7 and above. In natural water, carbaryl is expected to degrade faster than in laboratory settings due to the presence of microorganisms. The half-lives of carbaryl in natural waters varied between 0.3 to 4.7 days (Stanley and Trial, 1980; Bonderenko et al., 2004). Degradation in the latter study was temperature dependent with shorter half-lives at higher temperatures. Aerobic aquatic metabolism of carbaryl reported half-life ranged of 4.9 to 8.3 days compared to anaerobic (without oxygen) aquatic metabolism range of 15.3 to 72 days (Thomson and Strachan, 1981; USEPA, 2003). Carbaryl's degradation in aerobic soil varies from rapid to slow with half-lives ranging from 4 to 253 days (USEPA, 2017). Half-lives decrease with increasing pH from acidic to alkaline conditions. Under anaerobic soil conditions, carbaryl has a half-life of 72 days. Little transport of carbaryl through runoff or leaching to groundwater is expected due to the low water solubility, moderate sorption, and rapid degradation in soils. There are no reports of carbaryl detection in groundwater, and less than 1% of granule carbaryl applied to a sloping plot was detected in runoff (Caro et al., 1974).

Product use restrictions appear on the USEPA-approved label and attempt to keep carbaryl out of waterways. Carbaryl must not be applied directly to water, or to areas where surface water is present (USEPA, 2012a). The USEPA-approved use rates and patterns and the additional mitigations imposed by the grasshopper program, such as using RAATs and application buffers, where applicable, further minimize aquatic exposure and risk.

It is unlikely that carbaryl will significantly vaporize from the soil, water, or treated surfaces (Dobroski et al., 1985). Carbaryl may be found in the atmosphere within air-borne particulates or as spray drift and can react with hydroxyl radicals in the ambient atmosphere (Kao, 1994). Once in the air, carbaryl has a half-life of 1 to 4 months, however these minute amounts of carbaryl are not expected to reduce air quality. Carbaryl hydrolysis occurs quickly in natural waters with pH values of 7 or above, and the presence of microorganisms and organic material also contribute to the rapid degradation of the chemical. Adverse effects resulting from carbaryl contamination of water resources would harm aquatic organisms (described above) and would be temporary or de minimis.

(4.) Socioeconomic Issues

In addition to the environmental baseline conditions, APHIS also considers other factors such as pest population, pest life stage, pest and plant species affected, cost share with State and private landowners, and the cost benefit analysis of making a treatment. Because of the cost sharing private landowners and land managers typically would only use carbaryl to suppress rangeland grasshoppers and preserve forage for livestock. Insecticides applied using the RAATs strategy is expected to provide further economic advantages due to effective treatment at reduced costs. The economics of the RAATs strategy has been studied by both Foster et al. (2000), and Lockwood and Schell (1997). In summarizing both studies (which used various rates of insecticide below the conventional rates for suppression of rangeland grasshoppers and treated less area), the results concluded that treatment costs, under this alternative, when compared to the costs for conventional treatments for rangeland grasshopper infestations, were reduced 57 to 66% with carbaryl.

Another potential economic benefit of chemical treatment of grasshoppers is to crop growers near rangelands. Carbaryl bait treatments are sometimes used to reduce the potential for rangeland grasshoppers to move to surrounding croplands. This would result in socioeconomic benefits because losses, and therefore costs, of meat, crops, and their byproducts should be reduced. Additionally, the suppressed grasshopper populations in rangeland surrounding croplands could mean less of a need for costly chemical treatments by crop farmers at these sites.

There is the potential for organic farms adjacent to carbaryl spray applications in rangeland to control grasshopper outbreak populations. However, mitigations such as buffers are meant to protect adjacent environments from runoff and insecticide drift. These protective measures are expected to protect nearby organic farms, as well as other areas of concern, from the risk of inadvertent exposure to rangeland insecticide treatments. It is also likely the organic farms would also benefit economically from reductions in crop damage caused by grasshopper populations migrating from nearby rangeland.

The suppression of grasshopper populations with carbaryl should benefit public uses rangelands for recreational activities such as camping, fishing, hiking, and biking. The public may temporarily lose the use of rangeland during and directly after carbaryl insecticide applications. However, the preservation of vegetation is expected to benefit recreational activities in the long-term by preserving their aesthetic value. This in turn will also increase the economic value of the rangeland by preserving and improving recreational opportunities.

(5.) Cultural Resources and Events

There is the potential for impacts to cultural and historical resources if the proposed carbaryl treatments occur on or near historic trails or properties. If any proposed actions are at, or adjacent to, the site of a historic trail or property, APHIS will consult with the appropriate landowner or land management agency, the State Historic Preservation Office, any affected National Trail's administrative office, or other appropriate agencies. Likewise, APHIS would coordinate the timing of treatments with Tribes or other cooperators to ensure carbaryl treatments would not occur during scheduled cultural events or ceremonies.

(6.) Special Considerations for Certain Populations

APHIS uses carbaryl insecticide treatments to suppress grasshopper populations in rural rangeland areas that are largely uninhabited. Disproportionately high and adverse human health or environmental impacts on Tribes, and historical and culturally sensitive sites in a program area are unlikely.

APHIS grasshopper insecticide treatments are conducted in rural rangeland areas, where agriculture is a primary industry. The areas consist of widely scattered, single, rural dwellings in ranching communities with low population density. The program notifies residents within treatment areas, or their designated representatives, prior to proposed operations to reduce the potential for incidental exposure to residents including children. Treatments are conducted primarily on open rangelands where children would not be expected to be present during treatment or to enter should there be any restricted entry period after treatment. The program also implements mitigation measures beyond label requirements to ensure that no treatments occur within the required buffer zones from structures, such as a 500-foot treatment buffer zone from schools and recreational areas. Also, program insecticides are not applied while school buses are operating in the treatment area (USDA APHIS, 2016).

APHIS' HHERA for carbaryl evaluated the potential exposure to each insecticide used in the program and risks associated with these insecticides to residents, including children. The HHERA suggest that no disproportionate risks to children, as part of the general public, are anticipated (USDA APHIS, 2019a).

b) Chlorantraniliprole

Chlorantraniliprole (Rynaxypyr™) is a recently introduced insecticide that belongs to the anthranilic diamide insecticide class. The mode of action is the activation of insect ryanodine receptors which causes an uncontrolled release of calcium from smooth and striated muscles that impairs muscle regulation and causes paralysis in insects (USEPA, 2008). Although these receptors occur in mammals, the insecticide is very selective to insect ryanodine receptors with more than 350-fold differential selectivity compared to mammalian receptors (Cordova et.al. 2006, USEPA, 2008). Primary activity of chlorantraniliprole is through ingestion with some contact toxicity against lepidopteran pests but also against Orthoptera, Coleoptera, Diptera, and Hemiptera pests (Hannig et al., 2009).

(1.) Human Health

Chlorantraniliprole is considered practically nontoxic via oral, dermal, and inhalation exposures (DuPont, 2012; USEPA, 2008). Median lethality values (LD50) from oral and dermal exposure to the active ingredient, chlorantraniliprole, and the proposed formulation exceeded the highest concentration tested (5,000 milligrams/kilogram (mg/kg)). Inhalation toxicity is also very low for the technical material and the formulation (Vantacor®) with median lethality values exceeding the highest test concentration (5.16 mg/L, 4.0 hours exposure, dust/mist atmosphere). Available acute toxicity data suggests that the acute toxicity between the active ingredient and the formulation are comparable. Chlorantraniliprole is not considered to be carcinogenic or mutagenic and is not known to cause reproductive or developmental toxicity. The no observable effect level (NOEL) in reproductive and developmental toxicity studies was 1,000 mg/kg/day, or the highest concentration tested (USEPA, 2008). Studies designed to assess neurotoxicity and effects on the immune system show no effects at a range of doses from the low mg/kg range to greater than 1,000 mg/kg.

Exposure and risk to all population groups is expected to be negligible. The potential for exposure is greatest for workers from handling and applying Vantacor®, however the very low toxicity and label required personal protective equipment result in minimal exposure and risk to this subgroup of the population. Exposure and risk to the general public will also be negligible based on program use of Vantacor®. Conservative estimates of potential groundwater contamination using standard USEPA models suggest residues would be orders of magnitude below any levels of concern for the general public, including children. Drift may occur during applications however program restrictions regarding treatment proximity to schools, and other measures to reduce drift, will minimize the potential for exposure and risk to the general public (USDA APHIS, 2013).

(2.) Nontarget Species

USDA APHIS (2019b) assessed the available literature regarding the toxicity of chlorantraniliprole to animals. In summary, the report indicates the chemical is of low toxicity to most terrestrial invertebrates, practically non-toxic to honeybees, low toxicity to fish, and is practically nontoxic to birds and mammals (USDA APHIS, 2019b). Aquatic invertebrates are more sensitive to chlorantraniliprole when compared to fish

(USDA APHIS, 2019b). No reptile toxicity data appears to be available. In those cases where reptile toxicity data is not available, the avian data has been used as a surrogate to characterize sensitivity to reptiles. Chlorantraniliprole would be expected to be practically nontoxic to reptiles based on the available avian toxicity data (USDA APHIS, 2019b). The lack of toxicity in other insect groups at rates that are toxic to grasshoppers is related to the activity of chlorantraniliprole, which is primarily through ingestion. Insects such as grasshoppers and larval Coleoptera and Lepidoptera would receive a larger dose from consuming treated plant material, compared to many of the non-target pests that do not eat plants.

Toxicity to most non-target organisms is low based on available toxicity data. Acute toxicity for terrestrial wildlife such as mammals and birds is very low with median lethality values exceeding the highest concentration tested for mammals and birds, such as bobwhite quail and the mallard (USEPA, 2012b).

Acute fish toxicity is low with median lethality values (LC50) for freshwater and marine test species above the highest test concentration. Amphibian toxicity data does not appear to be available however based on the reported toxicity values for fish, the toxicity to amphibians is expected to be low. Aquatic invertebrates are more sensitive to the effects of chlorantraniliprole with median lethality and effect concentrations ranging from 0.0098 milligrams per liter (mg/L) for the freshwater cladoceran, *Daphnia magna*, to 1.15 mg/L for marine mysid shrimp (Barbee et al., 2010; EPA, 2012b). Chronic no observable effect concentrations (NOEC) range from 0.0045 mg/L for *D. magna* to 0.695 mg/L for a marine mysid (USEPA, 2012b). Available aquatic plant toxicity data suggests low toxicity of chlorantraniliprole to diatoms, algae, and aquatic macrophytes with median effect concentrations exceeding the highest test concentration (USEPA, 2008). Primary and secondary metabolites that could occur in aquatic environments are less toxic than the parent material when comparing toxicity values for the freshwater cladoceran, *D. magna* (USEPA, 2012b).

The exposure and risk to aquatic organisms from chlorantraniliprole will be negligible based on the low toxicity of the insecticide, and program restrictions regarding applications near surface water. The program currently uses a 200-foot ground and 500-foot aerial application buffer from surface water. Using standardized drift modeling at the highest application rate proposed in this study results in shallow water residues of chlorantraniliprole that are approximately ten-fold below the most sensitive sublethal endpoint for aquatic invertebrates (USDA APHIS, 2019b). Residue values were also approximately ten-fold below the most sensitive acute toxicity value for aquatic vertebrates and four orders of magnitude below the acute toxicity values for fish.

Laboratory toxicity data for technical and formulated chlorantraniliprole shows that the product is practically non-toxic to honeybees in oral or contact exposures. In semi-field studies using two formulations reported NOECs ranging from 52.5 to 156.16 g a.i. chlorantraniliprole/ha (Dinter et al., 2009; USEPA, 2008). Three semi-field honeybee tunnel tests demonstrated no behavioral or flight intensity effects nor were any hive related impacts noted at a dose of 52.5 g/ha (Dinter et al., 2009). The lowest reported NOEC is approximately four times the proposed RAATs application rate for chlorantraniliprole and two times the proposed full rate. Similar NOECs have been observed for other invertebrates such as the hover fly, *Episyrphus balteatus*, ladybird beetle larvae, *Coccinella septempunctata*, green lacewing, *Chrysoperla carnea*, the plant bug, *Typhlodromus pyri*, and predatory mite, *Orius laevigatus* (USEPA, 2008; USEPA, 2012b). The low toxicity to non-target terrestrial invertebrates has also been observed in greenhouse and field applications. Gradish et al. (2011) reported low acute toxicity of formulated chlorantraniliprole to the parasitoid, *Eretmocerus eremicus*, the pirate bug, *Orius insidiosus* and the predatory mite, *Amblyseius swirskii*, in 48-hour exposures. Brugger et al. (2010) evaluated lethal and sublethal impacts of formulated chlorantraniliprole to seven parasitic hymenopterans and found no negative impacts on adult survival, percentage parasitism, or emergence when compared to controls at rates well above the full and RAATs program rates. The lack of toxicity in other insect groups at rates that are toxic to grasshoppers is related to the activity of chlorantraniliprole which is primarily through ingestion. Insects such as grasshoppers and larval Coleoptera and Lepidoptera would receive a larger dose consuming treated plant material compared to many of the non-target pests that have been evaluated in the literature.

A researcher examined the effects of four- and 72-hour chlorantraniliprole oral exposures for both technical grade active ingredient and three formulations. After 24 hours, uncoordinated movement, lethargy, and trembling was observed in bees provided the highest treatments of technical-grade and formulated chlorantraniliprole for four hours. Although these intoxication symptoms subsided by 48 hours, bees exposed for 72 hours displayed the same symptomologies for the duration of the experiment (i.e., 30 days).

Bees receiving a more field-relevant short-term exposure of Chlorantraniliprole survived and moved similarly to untreated bees, reiterating the relative safety of chlorantraniliprole exposure to adult honeybees at recommended label concentrations. A 4-hour treatment of technical-grade and formulated Chlorantraniliprole did not significantly affect the 30-day survivorship, although significantly higher mortality was observed after 30 days for bees receiving a 72-hour treatment of technical-grade Chlorantraniliprole and two formulated products. The locomotion activity, or total walking distance, of bees receiving a 4-hour treatment of one Chlorantraniliprole formulation was significantly reduced, with these individuals recovering their normal locomotion activity at 48-hour post exposure. Conversely, there was observed lethargic behavior and significantly reduced walking distances for bees provided with a 72-hour treatment of technical-grade Chlorantraniliprole and each formulated product.

The survivorship was not significantly reduced for bees exposed to chlorantraniliprole for four hours compared to the control groups. The researcher observed a significant reduction in survivorship for bees provided the 72-hour treatment of technical grade and two formulated chlorantraniliprole products when compared to the untreated bees. However, a LC_{50} was not estimated for technical-grade chlorantraniliprole or the tested formulations at the label concentration due to the low mortality observed (Williams, 2020).

Researchers investigate the effects of chlorantraniliprole using a worst-case exposure model on bumblebee (*B. terrestris*) colonies under semi-field conditions in *Phacelia tanacetifolia*. The *P. tanacetifolia* crop was grown in soil treated with modelled worst-case 20-year plateau concentration of chlorantraniliprole in the top 20 cm of soil (equivalent to 0.088 mg a.s./kg). Additionally, two chlorantraniliprole spray applications at 60 g a.s./ha were made. Dinter etal. (2021), found no effects on queen and drone production or adult and larval mortality. There were not statistically significant decreases between the control and two chlorantraniliprole groups in flight activity, weight, mortality, and number of young queen and males.

Researchers determined that chlorantraniliprole caused chronic effects on queen larvae, and these effects are positively correlated with pesticide doses (He et al., 2024). The researchers found that queen larvae began to show reduced capping and emergence rates when exposed to 2 ng/larva of chlorantraniliprole. The differences were significant at 10 ng/larva; at 20 ng/larva queen capping and emergence rates were the lowest, and larva exhibited higher mortality at five days. There were significant reductions in larval hormone level. Queen larvae were exposed to these concentrations through dietary exposure (i.e., contaminated brood food of beebread or royal jelly) for six days.

The researchers noted that accurate concentrations of chlorantraniliprole in brood food (beebread or royal jelly) offered to larvae inside the hive during field exposure has not yet been determined. This can be attributed to chemical decomposition of pesticide molecules over time, and the individual bee organisms producing brood food are also capable of detoxification (Ardalani et al., 2021). Other researchers have proposed that detoxification of xenobiotic compounds among eusocial honeybees may be complemented by a "social detoxification system", which includes colony food processing via microbial fermentation, dilution by pollen mixing, and worker discrimination (Berenbaum and Johnson, 2015).

According to Shankar and Mukhtar, chlorantraniliprole applications to control *H. armigera* on sunflower also reduced pollinator foraging visits, up to ten days after treatment. However, it also drastically reduced the floral visitation of pollinators. The study in Jammu, India showed Hymenoptera accounted for 89% of the total pollinators visiting sunflower crops followed by Lepidoptera and Diptera which covered 10% and 1% of the total for-aging pollinators, respectively (Shankar and Mukhtar, 2023).

Haas et al. found a synergistic relationship between chlorantraniliprole and propioconazole (a triazole fungicide) in acute contact toxicity in honeybees. This study was centered around California almond production, an industry that regularly use both fungicides and insecticides. Pretreatment of honeybees with propiconazole in laboratory bioassays one hour prior to insecticide application significantly increased the acute contact toxicity of chlorantraniliprole, thus confirming a previously reported synergism. While topical application of 2 µg/bee and 0.2 µg/bee chlorantraniliprole alone resulted in mortality of <15% (in accordance with the reported LD_{50} of >4 µg/bee[5]), honeybee pretreatment with 10 µg/bee propiconazole significantly increased the mortality at the same chlorantraniliprole exposure levels.

The low treatment rates and low acute toxicity of chlorantraniliprole to Hymenoptera should reduce any potential harmful effects of exposure of most pollinators during treatments for grasshopper suppression. Any potential chronic or synergistic effects are not expected to be significant because grasshopper infestations are treated once per year and overlap with other pesticide applications are unlikely. In areas of direct application where impacts may occur, alternating swaths and reduced rates (i.e., RAATs) would reduce risk to nontarget insects. The effects on pollinators resulting from control of rangeland grasshopper populations with chlorantraniliprole are not expected to cause significant impacts to the human environment.

Exposure and risk to terrestrial vertebrates that may consume treated plant material or insects in the proposed spray blocks will be negligible. USEPA acute and chronic direct risk exposure models to this group of non-target organisms from treated plant material and insects at maximum Vantacor® rates showed that residues were at least two orders of magnitude below the NOELs for various sized birds and mammals (USDA APHIS, 2015). A potential indirect effect of chlorantraniliprole applications is loss of habitat or food items. The selective nature of chlorantraniliprole to certain insect taxa and the low application rates suggests that impacts to all terrestrial invertebrates would not be anticipated. Indirect risk to terrestrial vertebrate wildlife is also not anticipated based on the selectivity of chlorantraniliprole to certain insect taxa, survival and recovery of chlorantraniliprole effected prey in untreated swaths (i.e., RAATs) and from outside treatment blocks. The potential for terrestrial indirect effects to amphibians and reptiles is also expected to be minimal. Chlorantraniliprole is not phytotoxic; therefore, risk to terrestrial wildlife habitat is minimal.

Aquatic habitat would consist of aquatic plants while aquatic food items would consist of algae, aquatic invertebrates, and small fish. To better understand the potential indirect effects of these applications, chlorantraniliprole levels were compared to the available chlorantraniliprole effects data for aquatic plants, invertebrates and fish (USDA APHIS, 2019b). Indirect risk to amphibians is expected to be minimal because expected residues do not exceed any effect endpoint for aquatic plants, invertebrates, or fish.

(3.) Physical Environment Components

The potential for impacts to soil, air and water quality are expected to be negligible based on the proposed use pattern and available environmental fate data for chlorantraniliprole. Air quality is not expected to be significantly impacted since chlorantraniliprole has chemical properties that demonstrate it is not likely to volatilize into the atmosphere (USEPA, 2008). There will be some insecticide present in the atmosphere within and adjacent to the spray block immediately after application as drift but this will be localized and of short duration. Chlorantraniliprole has low solubility in water (<1 mg/L) and is susceptible to sunlight with a half-life of 0.31 days. Microbial degradation in water and pH-related effects to chlorantraniliprole are minor with half-lives greater than 125 days (USEPA, 2008). Slow degradation in soil is also anticipated with half-lives ranging from 228 to 924 days in various soil types (USEPA, 2008). Chlorantraniliprole has a varying affinity for binding to soil, but is generally low, suggesting that it may be susceptible to run-off during storm events. However, the proposed use rates and program restrictions regarding buffers suggest that surface and ground water quality will not be impacted from the proposed program use of chlorantraniliprole.

(4.) Socioeconomic Issues

In addition to the environmental baseline conditions, APHIS also considers other factors such as pest population, pest life stage, pest and plant species affected, cost share with State and private landowners, and the cost benefit estimate of making a treatment. Because of the cost sharing private landowners and land managers typically would only use chlorantraniliprole to suppress rangeland grasshoppers and preserve forage for livestock. Insecticides applied using the RAATs strategy is expected to provide further economic advantages due to effective treatment at reduced costs.

Another potential economic benefit of chemical treatment of grasshoppers is to crop growers near rangelands. This would result in socioeconomic benefits because losses, and therefore costs, of meat, crops, and their byproducts should be reduced. Additionally, the suppressed grasshopper populations in rangeland surrounding croplands could mean less of a need for costly chemical treatments by crop farmers at these sites.

There is the potential for organic farms adjacent to chlorantraniliprole treatments in rangeland to control grasshopper outbreak populations. However, mitigations such as buffers are meant to protect adjacent environments from runoff and insecticide drift. These protective measures are expected to protect nearby organic farms, as well as other areas of concern, from the risk of inadvertent exposure to rangeland insecticide treatments. It is also likely the organic farms would also benefit economically from reductions in crop damage caused by grasshopper populations migrating from nearby rangeland.

The suppression of grasshopper populations with chlorantraniliprole should benefit public uses rangelands for recreational activities such as camping, fishing, hiking, and biking. The public may temporarily lose the use of rangeland during and directly after chlorantraniliprole insecticide applications. However, the preservation of vegetation is expected to benefit recreational activities in the long-term by preserving their aesthetic value. This in turn will also increase the economic value of the rangeland by preserving and improving recreational opportunities.

(5.) Cultural Resources and Events

There is the potential for impacts to cultural and historical resources if the proposed chlorantraniliprole treatments occur on or near historic trails or properties. If any proposed actions are at, or adjacent to, the site of a historic trail or property, APHIS will consult with the appropriate landowner or land management agency, the State Historic Preservation Office, any affected National Trail’s administrative office, or other appropriate agencies. Likewise, APHIS would coordinate the timing of treatments with Tribes or other cooperators to ensure insecticide applications would not occur during scheduled cultural events or ceremonies.

(6.) Special Considerations for Certain Populations

APHIS uses chlorantraniliprole insecticide treatments to suppress grasshopper populations in rural rangeland areas that are largely uninhabited. Disproportionately high and adverse human health or environmental impacts on Tribes, and historical and culturally sensitive sites in a program area are unlikely.

APHIS grasshopper insecticide treatments are conducted in rural rangeland areas, where agriculture is a primary industry. The areas consist of widely scattered, single, rural dwellings in ranching communities with low population density. The program notifies residents within treatment areas, or their designated representatives, prior to proposed operations to reduce the potential for incidental exposure to residents including children. Treatments are conducted primarily on open rangelands where children would not be expected to be present during treatment or to enter should there be any restricted entry period after treatment. The program also implements mitigation measures beyond label requirements to ensure that no treatments occur within the required buffer zones from structures, such as a 500-foot treatment buffer zone from schools and recreational areas. Also, program insecticides are not applied while school buses are operating in the treatment area (USDA APHIS, 2016).

APHIS' HHERA for chlorantraniliprole evaluated the potential exposure to each insecticide used in the program and risks associated with these insecticides to residents, including children. The HHERA suggest that no disproportionate risks to children, as part of the general public, are anticipated (USDA APHIS, 2019b).

c) Diflubenzuron

Diflubenzuron is a restricted use pesticide (only certified applicators or persons under their direct supervision may make applications) registered with USEPA as an insect growth regulator. It specifically interferes with chitin synthesis, the formation of the insect's exoskeleton. Larvae of affected insects are unable to molt properly. While this effect is desirable in controlling certain insects, it can have undesirable impacts to non-target organisms that are exposed.

(1.) Human Health

Adverse human health effects from ground or aerial ULV applications of diflubenzuron to control grasshoppers are not expected based on the chemical's low acute toxicity and low potential for human exposure. Diflubenzuron has low acute dermal toxicity in rabbits and very low acute oral and inhalation toxicities in rats (USEPA, 2015b). The adverse health effects of diflubenzuron to mammals and humans involves damage to hemoglobin in blood and the transport of oxygen. Diflubenzuron causes the formation of methemoglobin. Methemoglobin is a form of hemoglobin that is not able to transport oxygen (USDA FS, 2004). USEPA classifies diflubenzuron as non-carcinogenic to humans (USEPA, 2015b).

The proposed use of diflubenzuron and adherence to label requirements substantially reduces the potential for exposure to humans and the environment. Program workers are the most likely to be exposed by program applications of diflubenzuron. APHIS does not expect adverse health risks to workers based on low potential for exposure to diflubenzuron when applied according to label directions and use of personal protective equipment (PPE) during applications (e.g., long sleeve shirt and pants, chemical-resistant gloves). APHIS quantified the potential risks associated with accidental exposure of diflubenzuron for workers during mixing, loading, and application based on proposed program uses. The quantitative risk evaluation results indicate no concerns for adverse health risk for program workers (USDA APHIS, 2019b).

Dimilin® 2L is labeled with rates and treatment intervals that are meant to protect livestock and keep residues in cattle at acceptable levels (thereby, protecting human health). Tolerances are set for the amount of diflubenzuron that is allowed in cattle fat (0.05 ppm) and meat (0.05 ppm) (40 CFR Parts 180.377). The grasshopper program would treat at application rates indicated on product labels or lower, which should ensure approved residues levels.

Adverse health risk to the general public in treatment areas is not expected due to the low potential for exposure resulting from low population density in the treatment areas, adherence to label requirements, program measures designed to reduce exposure to the public, and low toxicity to mammals. APHIS treatments are conducted in rural rangeland areas consisting of widely scattered, single, rural dwellings in ranching communities, where agriculture is a primary industry. Applications are not made to farm buildings or homes. Program measures beyond those on the label require application buffers from structures as well as aquatic areas reducing the potential for exposure to the public from direct exposure due to drift and from drinking water sources. The quantitative risk evaluation results indicate no concerns for adverse health risk for humans (USDA APHIS, 2019b).

(2.) Nontarget Species

APHIS' literature review found that on an acute basis, diflubenzuron is considered toxic to some aquatic invertebrates and practically non-toxic to adult honeybees. However, diflubenzuron is toxic to larval honeybees (USEPA, 2018). It is slightly nontoxic to practically nontoxic to fish and birds and has very slight acute oral toxicity to mammals, with the most sensitive endpoint from exposure being methemoglobinemia. Minimal direct risk to amphibians and reptiles is expected, although there is some uncertainty due to lack of information (USDA APHIS, 2019c; USEPA, 2018).

In a review of mammalian field studies, Dimilin® applications at a rate of 60 to 280 g a.i./ha had no effects on the abundance and reproduction in voles, field mice, and shrews (USDA FS, 2004). These rates are approximately three to 16 times greater than the highest application rate proposed in the program. Potential indirect impacts from application of diflubenzuron on small mammals includes loss of habitat or food items. Mice on treated plots consumed fewer lepidopteran (order of insects that includes butterflies and moths) larvae compared to controls; however, the total amount of food consumed did not differ between treated and untreated plots. Body measurements, weight, and fat content in mice collected from treated and non-treated areas did not differ.

Poisoning of insectivorous birds by diflubenzuron after spraying in orchards at labeled rates is unlikely due to low toxicity (Muzzarelli, 1986). The primary concern for bird species is related to an indirect effect on insectivorous species from a decrease in insect prey. At the proposed application rates, grasshoppers have the highest risk of being impacted while other taxa have a greatly reduced risk because the lack of effects seen in multiple field studies on other taxa of invertebrates at use rates much higher than those proposed for the program. Shifting diets in insectivorous birds in response to prey densities is not uncommon in undisturbed areas (Rosenberg et al., 1982; Cooper et al., 1990; Sample et al., 1993).

Indirect risk to fish species can be defined as a loss of habitat or prey base that provides food and shelter for fish populations; however, these impacts are not expected based on the available fish and invertebrate toxicity data (USDA APHIS, 2019c). A review of several aquatic field studies demonstrated that when effects were observed it was at diflubenzuron levels not expected from program activities (Fischer and Hall, 1992; USEPA, 1997; Eisler, 2000; USDA FS, 2004).

Diflubenzuron applications have the potential to affect chitin production in various other beneficial terrestrial invertebrates. Multiple field studies in a variety of application settings, including grasshopper control, have been conducted regarding the impacts of diflubenzuron to terrestrial invertebrates. Based on the available data, sensitivity of terrestrial invertebrates to diflubenzuron is highly variable depending on which group of insects and which life stages are being exposed. Immature grasshoppers, beetle larvae, lepidopteran larvae, and chewing herbivorous insects appear to be more susceptible to diflubenzuron than other invertebrates. Within this group, however, grasshoppers appear to be more sensitive to the proposed use rates for the program. Honeybees, parasitic wasps, predatory insects, and sucking insects show greater tolerance to diflubenzuron exposure (Murphy et al., 1994; Eisler, 2000; USDA FS, 2004).

Diflubenzuron is moderately toxic to spiders and mites (USDA APHIS, 2019c). Deakle and Bradley (1982) measured the effects of four diflubenzuron applications on predators of *Heliothis* spp. at a rate of 0.06 lb a.i./ac and found no effects on several predator groups. This supported earlier studies by Keever et al. (1977) that demonstrated no effects on the arthropod predator community after multiple applications of diflubenzuron in cotton fields. Grasshopper integrated pest management (IPM) field studies have shown diflubenzuron to have a minimal impact on ants, spiders, predatory beetles, and scavenger beetles. There was no significant reduction in populations of these species from seven to 76 days after treatment. Although ant populations exhibited declines of up to 50 percent, these reductions were temporary, and population recovery was described as immediate (Catangui et al., 1996).

Due to its mode of action, diflubenzuron has greater activity on immature stages of terrestrial invertebrates. Based on standardized laboratory testing diflubenzuron is considered practically non-toxic to adult honeybees. The contact LD50 value for the honeybee, *Apis mellifera*, is reported at greater than 114.8 µg a.i./bee while the oral LD50 value was reported at greater than 30 µg a.i./bee. USEPA (2018) reports diflubenzuron toxicity values to adult honeybees are typically greater than the highest test concentration using the end-use product or technical active ingredient. The lack of toxicity to honeybees, as well as other bees, in laboratory studies has been confirmed in additional studies (Nation et al., 1986; Chandel and Gupta, 1992; Mommaerts et al., 2006). Mommaerts et al. (2006) and Thompson et al. (2005) documented sublethal effects on reproduction-related endpoints for the bumble bee, *Bombus terrestris* and *A. mellifera*, respectively, testing a formulation of diflubenzuron. However, these effects were observed at much higher use rates relative to those used in the program.

For example, in the Mommaerts et al. study researchers exposed bees via a contact application of 288 mg/L aqueous concentration which was topically applied to the dorsal thorax of each worker with a micropipette. Bumblebees also ingested orally sugar/water treated with the same concentration of diflubenzuron solution over a period of 11 weeks. Pollen was sprayed with the same concentration of diflubenzuron until saturation and then supplied to the nests. The bumble bees were not restricted in how much of these contaminated solutions they could consume. The researchers estimated mean LC50 concentrations based on the chronic exposure routes described above. These were 25 mg a.i/L dermal contact, 0.32 mg a.i/L ingested sugar-water, and 0.95 mg a.i/L pollen. The researchers noted, "In practice, bumblebees will rarely be exposed to such high concentrations," and elaborated, "it is necessary that the laboratory-based results are validated with risk assessments for these insecticides in field related conditions."

APHIS believes conversion and comparison of program applied foliar spray rates to the concentrations of the solutions applied in this study would rely on unrealistic exposure scenarios. An exposure scenario where pollinators are exposed continuously for 11-weeks is not expected to occur in the APHIS grasshopper and Mormon cricket suppression program. In field applications diflubenzuron levels would decline over the 11-week exposure period due to degradation, flowering plants that have diflubenzuron residues would no longer be available for foraging by pollinators as flowers naturally die and do not provide pollen and nectar, and other plants would bloom after application without residues of diflubenzuron.

Diflubenzuron has been associated with several potentially harmful effects on bees, even when mortality was not recorded. Research from Camp et al. used Eastern bumble bee (*Bombus impatiens*) as surrogates to measure the effect that diflubenzuron has on bee behavior. Diflubenzuron (0.1, 1, 10, 100, 1,000 µg/liter) was formulated as an emulsion of the sugar syrup with 0.5% (v/v) Honey-B-Healthy and 1% (v/v) acetone and was delivered in syrup feeders. Drone production was reduced in a concentration-dependent manner and the 42-d IC_{50} (half-maximal inhibitory concentration) was calculated by Camp et al. to be 28.61 µg/liter diflubenzuron. They found that diflubenzuron delivered via dietary exposure of sucrose was associated with decreased pollen consumption and decreased drone production in bumble bee without there being a significant increase in adult mortalities (Camp et al., 2020).

However, the tested solutions of diflubenzuron in the supplied syrup and pollen are greater than the range of the pesticide applied during grasshopper suppression treatments. Diflubenzuron is applied once per year to foliar vegetation and only a miniscule proportion would be to flowers with nectar and pollen. In this experiment the bumble bees were fed syrup and pollen with fresh doses of diflubenzuron three times per week. The same difficulty of applying this study's findings to real field exposures, as is also the case with Mommaerts et.al., 2006, is described above.

Research from Krueger et al. showed that while diflubenzuron exposure didn't impact bumble bee worker survival, the exposure did result in a significant decrease in drone emergence that is indicative of a greater sensitivity to diflubenzuron in the immature life stage. Microcolonies exposed to 10 mg diflubenzuron/kg pollen (i.e. the pollen was contaminated with 10 parts per million of diflubenzuron) produced fewer adult drones despite no effects on worker survival (Krueger et al., 2021).

A researcher found that exposure to diflubenzuron in a 10 ppm sucrose solution resulted had significant effect on the number of larvae successfully eclosing from eggs three days after collection. The researcher posited that bee embryos with poorly formed cuticle could initiate egg eclosion and perhaps complete it, though the survivorship of the resultant larvae would likely be compromised. The results she reported for diflubenzuron suggest that the larval cuticle was not developed, resulting in mortality before or during the hatching process, and that many of the larvae observed to have hatched may not have survived to the later instar stages. Although the doses examined in this work may be high relative to what has been found inside of honeybee colonies, the exposure did not have an observable effect on egg production. However, successful hatching rates were significantly decreased in response to diflubenzuron, a chitin synthesis inhibitor (Fine 2020).

Further investigations examined two-generational effects to diflubenzuron administered at 1 ppm through the workers' diet, thus exposing queens indirectly in a manner similar to what might occur in the field (Fine et al., 2023). The researchers tracked queen performance and worker responses to queens, then the performance of the exposed queens' offspring was assessed to identify patterns that may contribute to the long-term health and stability of a social insect colony.

None of the treatments had a significant effect on the total number of eggs laid. Treated worker diets had no effect on retinue response. No differences were detected between treatment groups in the consumption of pollen supplement. Treatment had no effect on worker survival and over the two-week monitoring period, mortality rates remained below 3.2% on average across all groups. No difference was detected between treatment groups in queen weight change. Major royal jelly protein-1, MRJP-3, vitellogenin, and vitellogenin precursor proteins were among those quantified, but their abundances were not different with respect to the control queens. The researchers investigated global patterns of differential protein abundance between exposure groups and found no proteins in the diflubenzuron group were significantly altered.

Receiving care from maternally exposed workers did not have an effect on the laying rates of new queens or their total eggs produced. Receiving care from maternally exposed workers did not affect the egg hatching rate of eggs laid by new queens or rate of adult eclosions relative to controls. Treatment also had no effect on worker pollen consumption, queen weight change, or weight at adult eclosion. However, treatment had a significant effect on the timing of adult eclosion. Maternal exposure to diflubenzuron and methoxyfenozide resulted in significantly longer average time to adult eclosion relative to maternal exposure to pyriproxyfen or the control group. Maternal pesticide treatment had no effect on worker survival and over the two-week monitoring period, mortality rates remained below 1.7% on average across all groups, and no queen death was observed.

Researchers examined synergistic toxicity of common insecticides and fungicides in California almond orchards. Synergistic toxicity is the toxicity of a chemical combination that is greater than that predicted from studies of isolated chemical constituents. Young worker larvae were fed diets contaminated with 2.28 µg diflubenzuron per larva and a fungicidal dose to achieve comparable concentration ratios simulating a tank-mix at the maximum label rate. Diflubenzuron cause significantly reduced adult emergence as measured by larval mortality, but no synergistic effect was observed when combined with fungicides (Wade et al., 2019).

During June 2024 the USDA Agricultural Research Service (ARS) collected 58 plant tissue samples from flowers within a grasshopper treatment area in Prairie County, Montana. The samples were sent to the USDA Agricultural Marketing Service – National Science Laboratory for analysis to determine the concentration of diflubenzuron residue both 24 hours and 14 days after the application. Nine pretreatment flower tissue samples were accidentally collected before the insecticide application because of miscommunication between the PPQ program manager, the ARS field technician and the pilot. The program uses the RAATs method where spray and no-spray swaths are alternated. However, deposition of insecticide within the spray and no-spray swaths is variable because of changes in wind direction and speed, as well as the application height which is dictated by topography and other hazards. Of the 25 flower samples collected 24 hours after the treatment, 14 did not have detectable amounts of diflubenzuron, as was also the case with the nine pretreatment samples. The sample location coordinates, and applicator flight path software indicated only ten of these samples were collected in between spray swaths (i.e. within skip swaths). Laboratory analysis showed six samples collected within skip swaths, 24 hours after the aerial spray treatment had diflubenzuron residues. Of the 24 samples collected 14 days after the treatment, 16 did not have detectable amounts of diflubenzuron. Five of the eight samples that had diflubenzuron residues 14 days after treatment were collected in skip swaths.

Ten of the flower samples collected 24 hours after the treatment had measurable amounts of diflubenzuron that diminished in samples collected at the same location 14 days later. Laboratory analysis showed flower samples collected at five sample locations did not have detectable concentrations one day after the treatment, but did have diflubenzuron residues when samples were collected at the same or nearby locations 14 days later. Diflubenzuron residues on five flower samples collected immediately after treatment either did not attenuate significantly or had greater amounts of the chemical when more samples were collected at the same or adjacent locations 14 days later.

To assess risk to bees from contact with the rangeland flowers and leaves while collecting pollen and nectar after foliar diflubenzuron treatments we calculated the hazard quotient (HQ). The HQ was calculated as the average concentration of diflubenzuron residues detected on plant tissue for both the samples collected 24 hours and 14 days after the treatment divided by acute contact LD_{50} (Stoner and Eitzer 2013). Non-detection results were assigned a value of 0.099 parts per million (ppm), just below the limit of detection value of 0.100 ppm. Honeybee LD_{50} was used as LD_{50} was not consistently available for bumble and solitary bees.

HQ (24 hours) = 245 ppb (0.245 ppm) ÷ 114.8 µg diflubenzuron per bee = 2.134

HQ (14 days) = 159 ppb (0.159 ppm) ÷ 114.8 µg diflubenzuron per bee = 1.385

This analysis can be interpreted there is not a significant risk to bees using a common level of concern (LOC) of HQ > 50 (Thompson and Thorbahn 2009; Thompson 2021). Extrapolation to other pollinators by multiplying the HQ by an order of magnitude also did not indicate significant acute health risk from contact with the flowers with diflubenzuron residues.

In addition to HQ, we calculated contact Risk Quotient (RQcontact) using the BeeREX tool provided by the U.S. Environmental Protection Agency (EPA), which is intended for foliar sprays applied to crops in bloom. Risk quotient has the advantage over HQ of taking into account the amount of the contaminated substance consumed or encountered by a typical honeybee forager. The BeeREX RQcontact is calculated by comparing the chemical application rate, multiplied by a constant that represents the typical amount of chemical encountered by a honeybee forager if it flies through a cloud of spray, to the contact acute LD_{50}. The BeeREX RQcontact index value for 1.0 fl.oz. Dimilin/acre (0.0078125 gal. X 2.0 lb. = 0.015625 lbs./acre) = 0.000367.

To interpret risk to bees from contact with the diflubenzuron residues on flowers and plant tissues collected by USDA, the acute RQcontact value is compared to a pre-determined level of concern set to 0.4, which and is based on the historic average dose response relationship for acute toxicity studies with bees and a 10% mortality level in foragers and worker larvae. Based on calculations in the BeeREX risk model the index value of 0.000367 does not represent a significant risk to honeybees or a likely risk to other bee pollinators (USEPA 2014). Extrapolation to other pollinators by multiplying the RQ by an order of magnitude also did not indicate significant acute health risk from contact with the diflubenzuron flowers.

Insecticide applications to rangelands have the potential to impact pollinators, and in turn, vegetation and various rangeland species that depend on pollinated vegetation. Based on the review of laboratory and field toxicity data for terrestrial invertebrates, applications of diflubenzuron are expected to have minimal risk to pollinators of terrestrial plants. The use of RAATs provide additional benefits by using reduced rates and creating untreated swaths within the spray block that will further reduce the potential risk to pollinators.

APHIS reduces the risk to native bees and pollinators through monitoring grasshopper and Mormon cricket populations and making pesticide applications in a manner that reduces the risk to this group of nontarget invertebrates. Monitoring grasshopper and Mormon cricket populations allows APHIS to determine if populations require treatment and to make treatments in a timely manner reducing pesticide use and emphasizing the use of program insecticides that are not broad spectrum. The treatment history of program since the introduction of diflubenzuron demonstrates it is the preferred insecticide. Over 90% of the acreage treated by the program has been with diflubenzuron. The effects on pollinators resulting from control of rangeland grasshopper populations with diflubenzuron are not expected to cause significant impacts to the human environment.

(3.) Physical Environment Components

USEPA considers diflubenzuron relatively non-persistent and immobile under normal use conditions and stable to hydrolysis and photolysis. The chemical is considered unlikely to contaminate ground water or surface water (USEPA, 1997). The vapor pressure of diflubenzuron is relatively low, as is the Henry's Law Constant value, suggesting the chemical will not volatilize readily into the atmosphere from soil, plants or water. Therefore, exposure from volatilization is expected to be minimal. Due to its low solubility (0.2 mg/L) and preferential binding to organic matter, diflubenzuron seldom persists more than a few days in water (Schaefer and Dupras, 1977). Mobility and leachability of diflubenzuron in soils is low, and residues are usually not detectable after seven days (Eisler, 2000). Aerobic aquatic half-life data in water and sediment was reported as 26.0 days (USEPA, 1997). Diflubenzuron applied to foliage remains adsorbed to leaf surfaces for several weeks with little or no absorption or translocation from plant surfaces (Eisler, 1992, 2000). Field dissipation studies in California citrus and Oregon apple orchards reported half-live values of 68.2 to 78 days (USEPA, 2018). Diflubenzuron persistence varies depending on site conditions and rangeland persistence is unfortunately not available. Diflubenzuron degradation is microbially mediated with soil aerobic half-lives much less than dissipation half-lives. Diflubenzuron treatments are expected to have minimal effects on terrestrial plants. Both laboratory and field studies demonstrate no effects using diflubenzuron over a range of application rates, and the direct risk to terrestrial plants is expected to be minimal (USDA APHIS, 2019c).

(4.) Socioeconomic Issues

In addition to the environmental baseline conditions, APHIS also considers other factors such as pest population, pest life stage, pest and plant species affected, cost share with State and private landowners, and the cost benefit estimate of making a treatment. Because of the cost sharing private landowners and land managers typically would only use diflubenzuron to suppress rangeland grasshoppers and preserve forage for livestock. Insecticides applied using the RAATs strategy is expected to provide further economic advantages due to effective treatment at reduced costs. The RAATs strategy reduces treatment costs to half of the costs for conventional treatments for rangeland grasshopper infestations (Foster et al., 2000, Lockwood and Schell, 1997).

Another potential economic benefit of chemical treatment of grasshoppers is to crop growers near rangelands. This would result in socioeconomic benefits because losses, and therefore costs, of meat, crops, and their byproducts should be reduced. Additionally, the suppressed grasshopper populations in rangeland surrounding croplands could mean less of a need for costly chemical treatments by crop farmers at these sites.

There is the potential for organic farms adjacent to diflubenzuron treatments in rangeland to control grasshopper outbreak populations. However, mitigations such as buffers are meant to protect adjacent environments from runoff and insecticide drift. These protective measures are expected to protect nearby organic farms, as well as other areas of concern, from the risk of inadvertent exposure to rangeland insecticide treatments. It is also likely the organic farms would also benefit economically from reductions in crop damage caused by grasshopper populations migrating from nearby rangeland.

The suppression of grasshopper populations with diflubenzuron should benefit public uses rangelands for recreational activities such as camping, fishing, hiking, and biking. The public may temporarily lose the use of rangeland during and directly after diflubenzuron insecticide applications. However, the preservation of vegetation is expected to benefit recreational activities in the long-term by preserving their aesthetic value. This in turn will also increase the economic value of the rangeland by preserving and improving recreational opportunities.

(5.) Cultural Resources and Events

There is the potential for impacts to cultural and historical resources if the proposed diflubenzuron treatments occur on or near historic trails or properties. If any proposed actions are at, or adjacent to, the site of a historic trail or property, APHIS will consult with the appropriate landowner or land management agency, the State Historic Preservation Office, any affected National Trail's administrative office, or other appropriate agencies. Likewise, APHIS would coordinate the timing of treatments with Tribes or other cooperators to ensure insecticide applications would not occur during scheduled cultural events or ceremonies.

(6.) Special Considerations for Certain Populations

APHIS uses diflubenzuron insecticide treatments to suppress grasshopper populations in rural rangeland areas that are largely uninhabited. Disproportionately high and adverse human health or environmental impacts on Tribes, and historical and culturally sensitive sites in a program area are unlikely.

APHIS grasshopper insecticide treatments are conducted in rural rangeland areas, where agriculture is a primary industry. The areas consist of widely scattered, single, rural dwellings in ranching communities with low population density. The program notifies residents within treatment areas, or their designated representatives, prior to proposed operations to reduce the potential for incidental exposure to residents including children. Treatments are conducted primarily on open rangelands where children would not be expected to be present during treatment or to enter should there be any restricted entry period after treatment. The program also implements mitigation measures beyond label requirements to ensure that no treatments occur within the required buffer zones from structures, such as a 500-foot treatment buffer zone from schools and recreational areas. Also, program insecticides are not applied while school buses are operating in the treatment area (USDA APHIS, 2016).

APHIS' HHERA for diflubenzuron evaluated the potential exposure to each insecticide used in the program and risks associated with these insecticides to residents, including children. The HHERA suggest that no disproportionate risks to children, as part of the general public, are anticipated (USDA APHIS, 2019c).

d) Reduced Area Agent Treatments (RAATs)

The use of RAATS is the most common application method for all program insecticides and would continue to be so, except in rare pest conditions that warrant full coverage and higher rates. The RAATs method is an effective IPM strategy because the goal is to suppress grasshopper populations to a desired level, rather than to reduce those populations to the greatest possible extent. All APHIS grasshopper treatments are conducted in adherence with U.S. EPA approved label directions. Labeled application rates for grasshopper control tend to be lower than rates used against other pests. The RAATs rates used for grasshopper control by APHIS are lower than rates typically used by private landowners. APHIS would apply a single application of insecticide per year, typically using a RAATs strategy that decreases the rate of insecticide applied by either using lower insecticide spray concentrations, or by alternating one or more treatment swaths. Usually, RAATs applications use both lower concentrations and skip treatment swaths. The RAATs strategy suppresses grasshoppers within treated swaths, while conserving grasshopper predators and parasites in swaths that are not treated.

The efficacy of a RAATs strategy in reducing grasshoppers is, therefore, less than conventional treatments and more variable. Foster et al. (2000) reported that grasshopper mortality using RAATs was reduced 2 to 15% from conventional treatments, depending on the insecticide, while Lockwood et al. (2000) reported 0 to 26% difference in mortality between conventional and RAATs methods. APHIS will consider the effects of not suppressing grasshoppers to the greatest extent possible as part of the treatment planning process.

(1.) Human Health

The potential effects on human health during the application of pesticides using the RAATs method depends on the choice of insecticide. The possible exposure scenarios are described in detail in the above pesticide specific effects analysis. The minimal risk to program workers would not decrease because the mixing and formulation of the pesticide procedures would remain the same and are expected to prevent exposure. Any potential exposure of bystanders within treatment blocks would be reduced because of the lower application rates and skip swaths where insecticides are not applied.

(2.) Nontarget Species

The potential effects on nontarget species during the application of pesticides using the RAATs method depends on the choice of insecticide. The possible environmental impacts are described in detail in the above pesticide specific effects analysis. Any exposure of nontarget species within treatment blocks would be reduced because of the lower application rates and skip swaths where insecticides are not applied. Therefore, the risk of significant impacts to populations of nontarget species would be less than if the program used conventional application rates and complete coverage of the treatment area.

(3.) Physical Environment Components

The potential environmental effects of the application of pesticides using the RAATs method depends on the choice of insecticide. The expected fate of program applied chemicals, and possible environmental impacts are described in detail in the above pesticide specific effects analysis. The concentration of pesticide residues within treatment blocks would be reduced because of the lower application rates and skip swaths where insecticides are not applied. Therefore, the risk of significant impacts to air, soil and water resources would be less than if the program used conventional application rates and complete coverage of the treatment area.

(4.) Socioeconomic Issues

RAATs reduces treatment costs and conserves non-target biological resources in untreated areas. The potential economic advantages of RAATs were proposed by Larsen and Foster (1996) and empirically demonstrated by Lockwood and Schell (1997). Widespread efforts to communicate the advantages of RAATs across the Western States were undertaken in 1998 and have continued on an annual basis. The viability of RAATs at an operational scale was initially demonstrated by Lockwood et al. (2000) and subsequently confirmed by Foster et al. (2000). The first government agencies to adopt RAATs in their grasshopper suppression programs were the Platte and Goshen County Weed and Pest Districts in Wyoming; they also funded research at the University of Wyoming to support the initial studies in 1995. This method is now commonly used by government agencies and private landowners in States where grasshopper control is required.

(5.) Cultural Resources and Events

APHIS expects there is a negligible possibility of harm to cultural resources or disruption of events during grasshopper suppression operations because of our close cooperation with Tribes and other stakeholders. This would be the case regardless of whether the program used the RAATs method or conventional rates at complete coverage.

(6.) Special Considerations for Certain Populations

APHIS uses the RAATs method to suppress grasshopper populations in rural rangeland areas that are largely uninhabited. Disproportionately high and adverse human health or environmental impacts on Tribes in a program area are unlikely. The potential effects on human health during the application of pesticides using the RAATs method depends on the choice of insecticide. The possible exposure scenarios are described in detail in the above pesticide specific effects analysis. Any potential exposure of children near or within treatment blocks would be reduced because of the lower application rates and skip swaths where insecticides are not applied.

IV. Conclusions

This EA examines alternatives available to APHIS when requested to suppress economically damaging outbreaks of grasshoppers. The preferred alternative includes insecticide treatments which are considered based on the site conditions. APHIS decides whether a suppression of the outbreak is warranted based on the IPM principles including an assessment of the economic injury level represented by the grasshopper populations. This EA discusses and examines the tools and strategies employed by APHIS and their potential effects on the human environment. This EA does not decide which alternative will be selected, however, all reasonable options available to the agency for dealing with grasshopper infestations have been adequately considered, including consideration of direct, indirect and cumulative environmental effects. Decisions about whether, how, and when to employ the tools and strategies discussed in the EA will be made as the need to suppress grasshopper populations at specific sites arises.

In June 2002, APHIS completed an EIS describing the agency's most effective methods of reducing the damage caused by grasshopper populations to rangeland in the western United States. During November 2019, APHIS published HHERA for the use of carbaryl, chlorantraniliprole and diflubenzuron by the program. APHIS also published an updated EIS to consolidate and incorporate the available data and analyze the environmental risk of new program tools. The risk analysis in the 2019 EIS is incorporated by reference (USDA APHIS, 2019).

This EA examined a No Action alternative, where APHIS would not conduct a program to suppress grasshoppers other than provide technical assistance and surveys to assist in the implementation of IPM strategies by land managers. Without an APHIS administered program Federal land management agencies, State agriculture departments, local governments, private groups or individuals, may not effectively combat outbreaks in a coordinated effort. Without the coordination that APHIS provides during grasshopper outbreaks, the land managers and owners could use insecticides that APHIS considers too environmentally harsh. Multiple treatments and excessive amount of insecticide could be applied in efforts to suppress or even locally eradicate grasshopper populations. Conversely, in the absence of an APHIS funded grasshopper suppression program the most likely environmental effects would result from other agencies and land managers not controlling outbreaks. As noted, grasshoppers consuming vast amounts of vegetation in rangelands and surrounding areas. Grasshoppers are generalist feeders, eating grasses and forbs first and often moving to cultivated crops.

Under the Preferred Alternative APHIS would participate in grasshopper programs with the option of using one of the insecticides carbaryl, chlorantraniliprole, and diflubenzuron, depending upon the various factors related to the grasshopper outbreak and the site-specific characteristics. The use of an insecticide would typically occur at half the conventional application rates following the RAATs strategy. APHIS would apply a single treatment per year to affected rangeland areas to suppress grasshopper outbreak populations.

Each alternative described in this EA potentially has adverse environmental effects. The general environmental impacts of each alternative are discussed in detail in the 2019 programmatic EIS published by APHIS. The specific impacts of the alternatives are highly dependent upon the particular action and location of the grasshopper infestation. The principal concerns associated with the alternatives are: (1) the potential effects of insecticides on human health (including subpopulations that might be at increased risk); and (2) impacts of insecticides on nontarget organisms (including threatened and endangered species).

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VI. Listing of Agencies and Persons Consulted

John Nystedt, Fish and Wildlife Biologist,
U.S. Fish and Wildlife Service.
Flagstaff Suboffice
323 N. Leroux Street, Suite 201
Flagstaff, Arizona 86001

Shaula Hedwall, Fish and Wildlife Biologist,
U.S. Fish and Wildlife Service
Flagstaff Suboffice
323 N. Leroux Street, Suite 201
Flagstaff, Arizona 86001

Jessica Miller, Fish and Wildlife Biologist,
U. S. Fish and Wildlife Service
Flagstaff Suboffice
2500 South Pine Knoll Drive
Flagstaff, AZ 86001
(928) 556-2050

Terry Rambler, Tribal Administrator, San Carlos Apache Tribe
P.O. Box 0
#3 San Carlos Avenue
San Carlos, Arizona 85550

Clark Richins, Land Operation Coordinator, San Carlos Apache Tribe
#3 San Carlos Avenue
San Carlos, Arizona 85550

Teresa Goseyun, Rangeland Management Specialist, San Carlos Apache Tribe
#3 San Carlos Avenue
San Carlos, Arizona 85550

Daniel Juan, Biologist, San Carlos Apache Tribe
PO Box 97
San Carlos, Arizona 85550

Paul Buck, Soil Scientist, San Carlos Apache Tribe
PO Box 0
San Carlos, Arizona 85550

Kelly Hetzler, Forester, Inventory and GIS, San Carlos Apache Tribe
PO Box 0
San Carlos, Arizona 85550

Victoria Wesley, San Carlos Apache Tribe, Forestry
PO Box 0
San Carlos, Arizona 85550

Daniel Juan, Wildlife Technician,
San Carlos Apache Tribe
PO Box 0
San Carlos, Arizona 85550

Jeff McFadden, Wildlife Technician,
San Carlos Apache Tribe
PO Box 0
San Carlos, Arizona 85550

Sabrina Tuttle, Ph.D., Assistant Extension Agent,
Gila County Cooperative Extension,
U of A,
San Carlos Apache Reservation
PO Box 850
San Carlos, Arizona 85550

Jennifer Cordova, Wildlife Specialist II,
Arizona Game and Fish Dept.
PO Box 397
Seligman, AZ 86337

Kenneth Jacobson, Raptor Management Coordinator
Arizona Game & Fish Dept.
5000 W. Carefree Highway
Phoenix, AZ 85086

Bobby Lamoureux, Habitat, Evaluations and Land Program Manager
Arizona Game & Fish Dept.
7200 E. University Dr.
Mesa, AZ 85207

Appendix A: APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program

FY-2025 Treatment Guidelines
Version 01/14/2025

The objectives of the APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program are to 1) conduct surveys in the Western States; 2) provide technical assistance to land managers and private landowners; and 3) when funds permit, suppress economically damaging grasshopper and Mormon cricket outbreaks on Federal, Tribal, State, and/or private rangeland. The Plant Protection Act of 2000 provides APHIS the authority to take these actions.

General Guidelines for Grasshopper / Mormon Cricket Treatments

1. All treatments must be in accordance with:
    a. the Plant Protection Act of 2000;
    b. applicable environmental laws and policies such as: the National Environmental Policy Act, the Endangered Species Act, the Federal Insecticide, Fungicide, and Rodenticide Act, and the Clean Water Act (including National Pollutant Discharge Elimination System requirements – if applicable);
    c. applicable state laws;
    d. APHIS Directives pertaining to the proposed action;
    e. Memoranda of Understanding with other Federal agencies.

2. Subject to the availability of funds, upon request of the administering agency, the agriculture department of an affected State, or private landowners, APHIS, to protect rangeland, shall immediately treat Federal, Tribal, State, or private lands that are infested with grasshoppers or Mormon crickets at levels of economic infestation, unless APHIS determines that delaying treatment will not cause greater economic damage to adjacent owners of rangeland. In carrying out this section, APHIS shall work in conjunction with other Federal, State, Tribal, and private prevention, control, or suppression efforts to protect rangeland.

3. Prior to the treatment season, conduct meetings or provide guidance that allows for public participation in the decision-making process. In addition, notify Federal, State and Tribal land managers and private landowners of the potential for grasshopper and Mormon cricket outbreaks on their lands. Request that the land manager / landowner advise APHIS of any sensitive sites that may exist in the proposed treatment areas.

4. Consultation with local Tribal representatives will take place prior to treatment programs to fully inform the Tribes of possible actions APHIS may take on Tribal lands.

5. On APHIS run suppression programs and subject to funding availablity, the Federal government will bear the cost of treatment up to 100 percent on Federal and Tribal Trust land, 50 percent of the cost on State land, and 33 percent of cost on private land. There is

an additional 16.15% charge, however, on any funds received by APHIS for federal involvement with suppression treatments.

6. Land managers are responsible for the overall management of rangeland under their control to prevent or reduce the severity of grasshopper and Mormon cricket outbreaks. Land managers are encouraged to have implemented Integrated Pest Management Systems prior to requesting a treatment. In the absence of available funding or in the place of APHIS funding, the Federal land management agency, Tribal authority or other party/ies may opt to reimburse APHIS for suppression treatments. Interagency agreements or reimbursement agreements must be completed prior to the start of treatments which will be charged thereto.

7. There are situations where APHIS may be requested to treat rangeland that also includes small areas where crops are being grown (typically less than 10 percent of the treatment area). In those situations, the crop owner pays the entire treatment costs on the croplands.

   NOTE: The insecticide being considered must be labeled for the included crop as well as rangeland and current Worker Protection Standards must be followed by the applicator and private landowner.

8. In some cases, rangeland treatments may be conducted by other federal agencies (e.g., Forest Service, Bureau of Land Management, or Bureau of Indian Affairs) or by non-federal entities (e.g., Grazing Association or County Pest District). APHIS may choose to assist these groups in a variety of ways, such as:
   a. loaning equipment (an agreement may be required):
   b. contributing in-kind services such as surveys to determine insect species, instars, and infestation levels;
   c. monitoring for effectiveness of the treatment;
   d. providing technical guidance.

9. In areas considered for treatment, State-registered beekeepers and organic producers shall be notified in advance of proposed treatments. If necessary, non-treated buffer zones can be established.

<u>Operational Procedures</u>

GENERAL PROCEDURES FOR ALL AERIAL AND GROUND APPLICATIONS

1. Follow all applicable Federal, Tribal, State, and local laws and regulations in conducting grasshopper and Mormon cricket suppression treatments.

2. Notify residents within treatment areas, or their designated representatives, prior to proposed operations. Advise them of the control method to be used, proposed method of application, and precautions to be taken.

3. One of the following insecticides that are labeled for rangeland use can be used for a suppression treatment of grasshoppers and Mormon crickets:
    A. Carbaryl
        a. solid bait
        b. ultra-low volume (ULV) spray
    B. Diflubenzuron ULV spray
    C. Malathion ULV spray
    D. Chlorantraniliprole spray

4. Do not apply insecticides directly to water bodies (defined herein as reservoirs, lakes, ponds, pools left by seasonal streams, springs, wetlands, and perennial streams and rivers).

    Furthermore, provide the following buffers for water bodies:
    - 500-foot buffer with aerial liquid insecticide.
    - 200-foot buffer with ground liquid insecticide.
    - 200-foot buffer with aerial bait.
    - 50-foot buffer with ground bait.

5. Instruct program personnel in the safe use of equipment, materials, and procedures; supervise to ensure safety procedures are properly followed.

6. Conduct mixing, loading, and unloading in an approved area where an accidental spill would not contaminate a water body.

7. Each aerial suppression program will have a Contracting Officer's Representative (COR) OR a Treatment Manager on site. Each State will have at least one COR available to assist the Contracting Officer (CO) in GH/MC aerial suppression programs.

    NOTE: A Treatment Manager is an individual that the COR has delegated authority to oversee the actual suppression treatment; someone who is on the treatment site and overseeing / coordinating the treatment and communicating with the COR. No specific training is required, but knowledge of the Aerial Application Manual and treatment experience is critical; attendance to the Aerial Applicators Workshop is very beneficial.

8. Each suppression program will conduct environmental monitoring as outlined in the current year's Environmental Monitoring Plan.

    APHIS will assess and monitor rangeland treatments for the efficacy of the treatment, to verify that a suppression treatment program has properly been implemented, and to assure that any environmentally sensitive sites are protected.

9. APHIS reporting requirements associated with grasshopper / Mormon cricket suppression treatments include:
    A. Completion of a post-treatment report (Part C of the Project Planning and Reporting Worksheet (PPQ Form 62)

B. Providing an entry for each treatment in the PPQ Grasshopper/Mormon Cricket treatment database
C. For aerial treatments, providing copies of forms and treatment/plane data for input into the Federal Aviation Interactive Reporting System (FAIRS) by PPQ's designee

SPECIFIC PROCEDURES FOR AERIAL APPLICATIONS

1. APHIS Aerial treatment contracts will adhere to the current year's Statement of Work (SOW).

2. Minimize the potential for drift and volatilization by not using ULV sprays when the following conditions exist in the spray area:

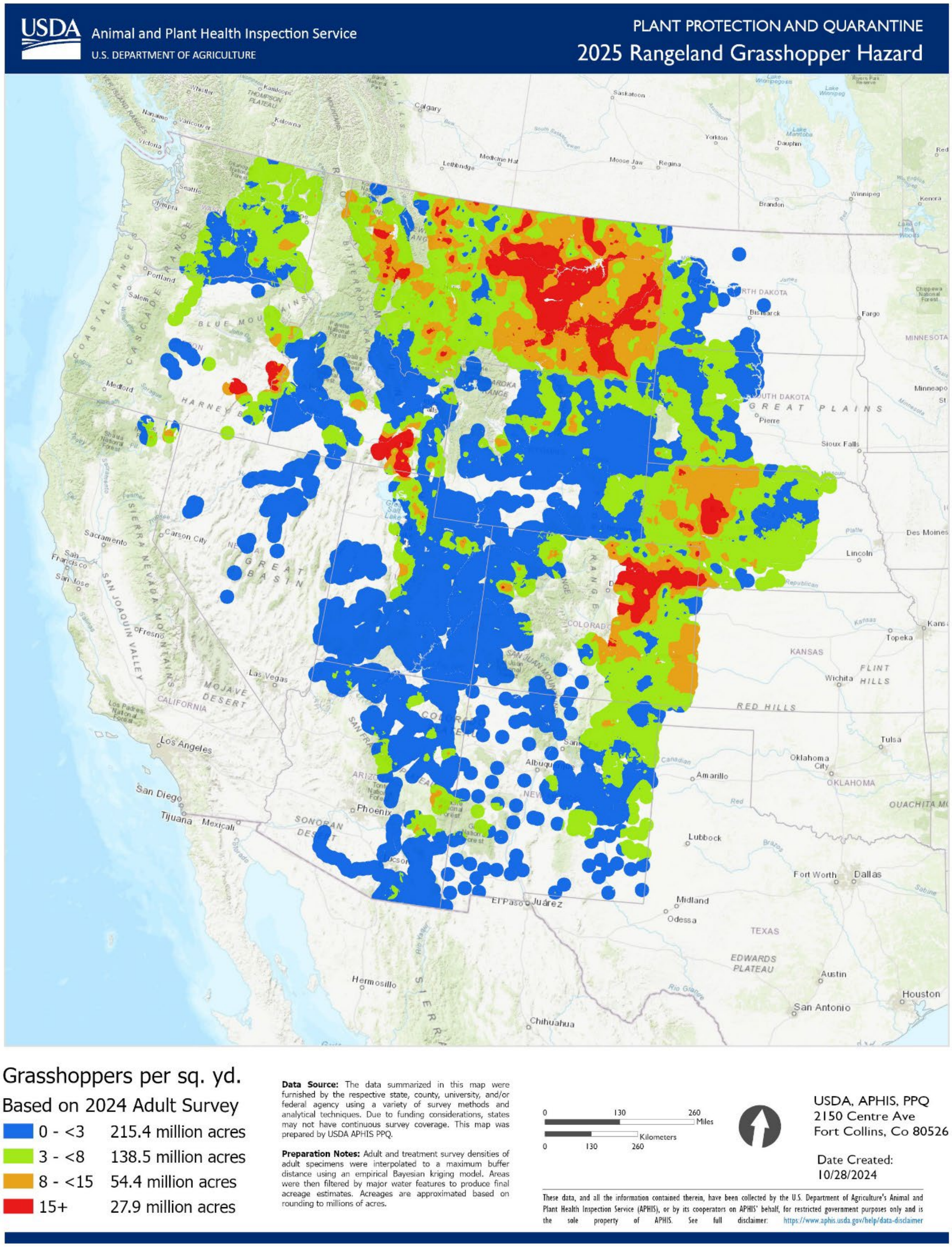
    a. Wind velocity exceeds 10 miles per hour (unless state law requires lower wind speed);
    b. Rain is falling or is imminent;
    c. Dew is present over large areas within the treatment block;
    d. There is air turbulence that could affect the spray deposition;
    e. Temperature inversions (ground temperature higher than air temperature) develop and deposition onto the ground is affected.

3. Weather conditions will be monitored and documented during application and treatment will be suspended when conditions could jeopardize the correct spray placement or pilot safety.

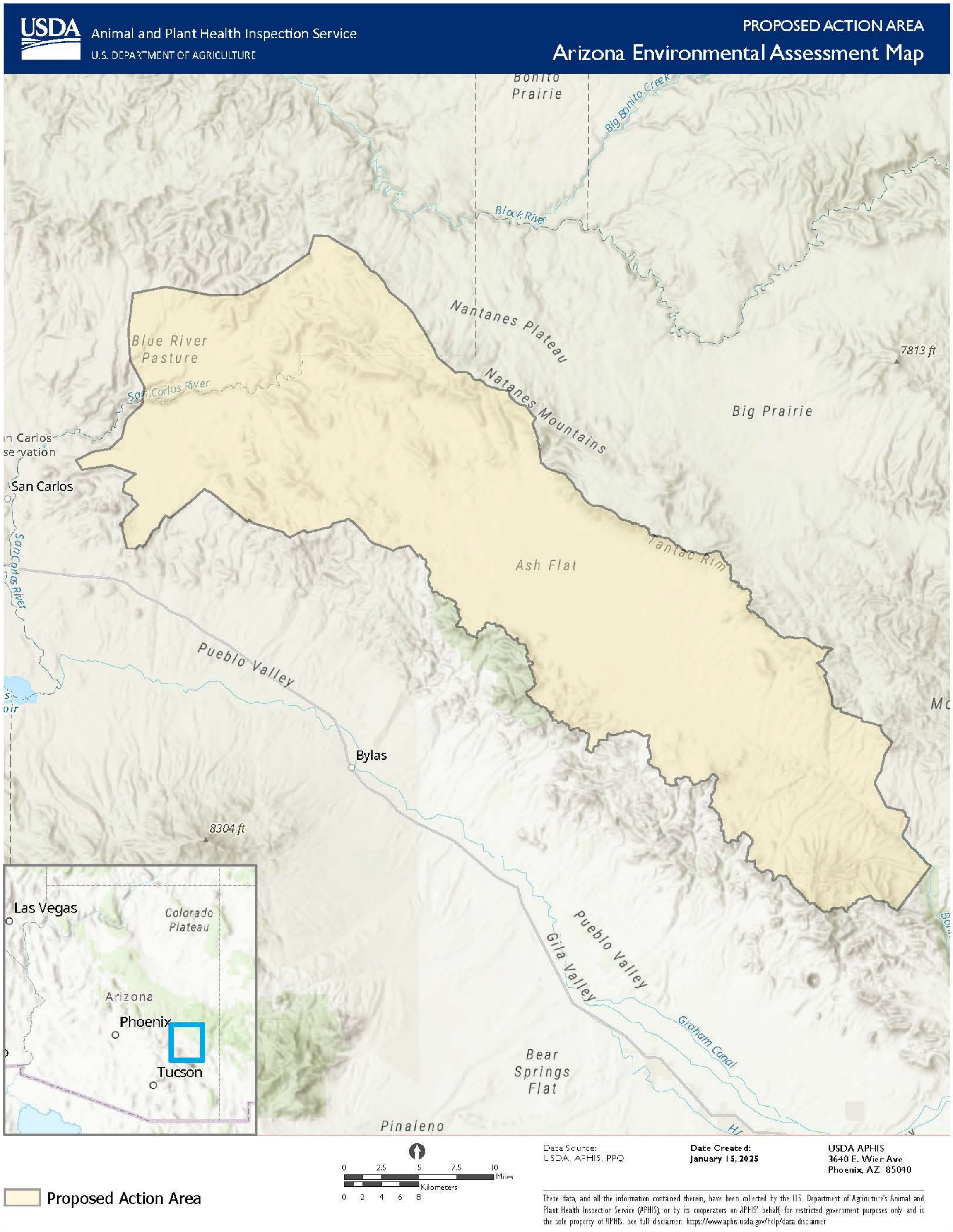
4. Application aircraft will fly at a median altitude of 1 to 1.5 times the wingspan of the aircraft whenever possible or as specified by the COR or the Treatment Manager.

5. Whenever possible, plan aerial ferrying and turnaround routes to avoid flights over congested areas, water bodies, and other sensitive areas that are not to be treated.

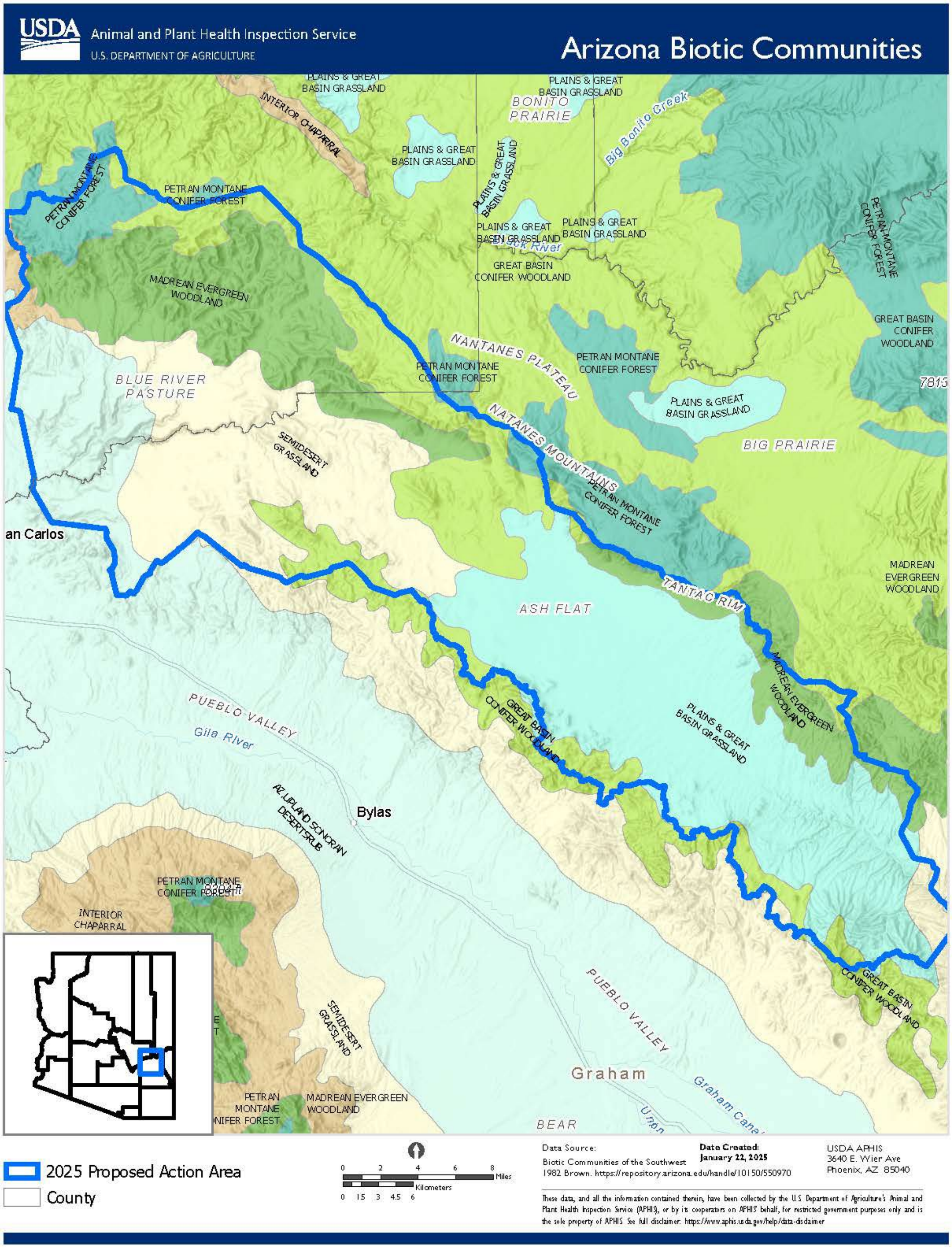
Appendix B: Grasshopper Hazard Map of the Affected Environment



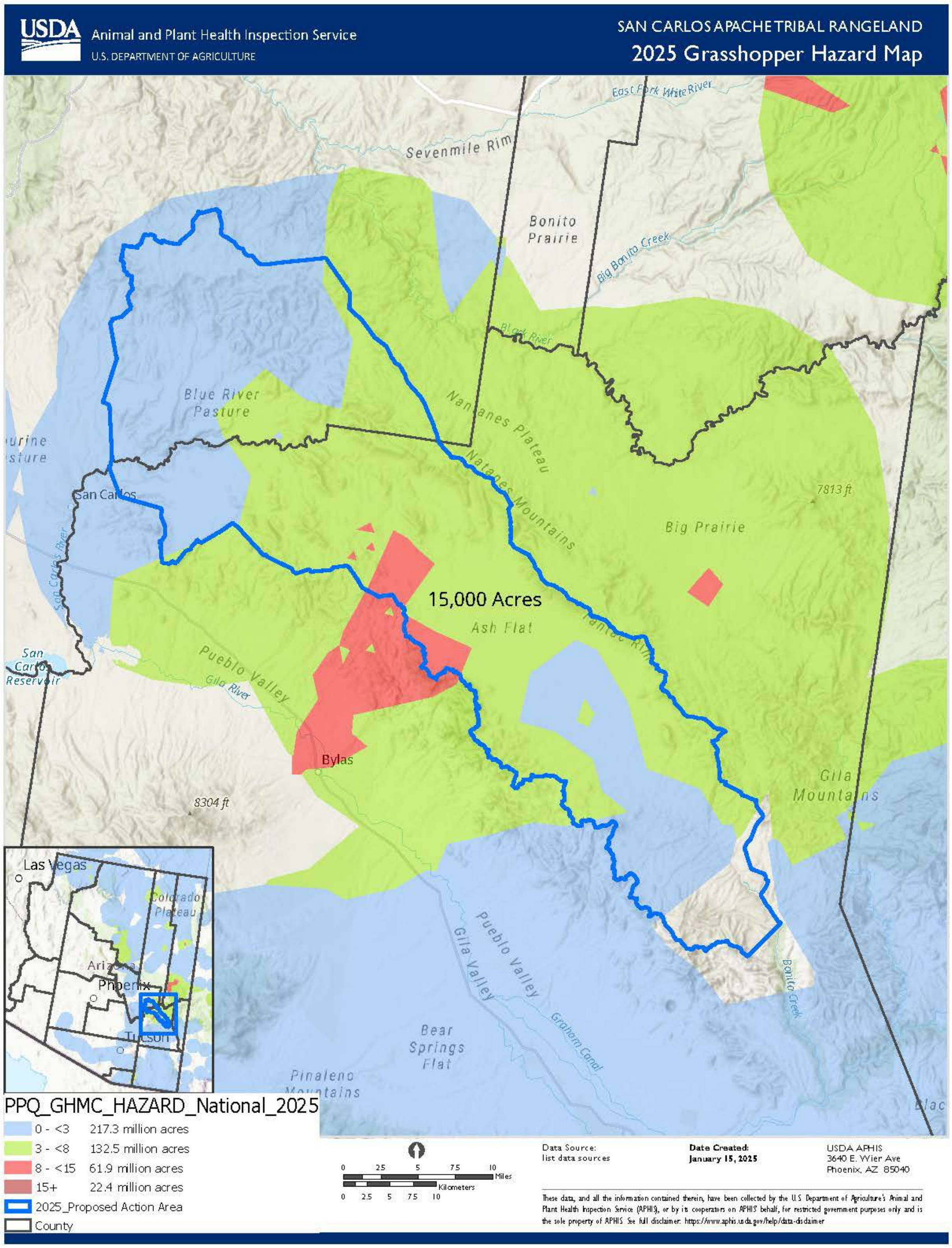
Appendix C: Map of the Affected Environment



Appendix D: Map of the Arizona Biotic Communities within Action Area.



Appendix E: Map of 2025 Grasshopper Hazard forecast for San Carlos Rangeland with potential affected acreage within Action Area. *(Not to be confused as a potential treatment boundary, red acreage calculated is only within action area for 8gh/yd^{2}or greater.)*



Appendix F: Arizona Dept. Game & Fish List of Species of Concern for Gila County and Graham County.

Special Status Species by County, Taxonomic Group, Scientific Name

Updated: 2/19/2025

COUNTY	TAXON	SCIENTIFIC NAME	COMMON NAME	ESA	CRITHAB	BLM	USFS	NESL	MEXFED	SGCN	NPL	SRANK	GRANK	TRACK	ELCODE
Coconino	Plant	Sclerocactus parviflorus ssp. parviflorus	Smallflower Fishhook Cactus								SR	S1	G4T4?	Y	PDCAC0J042
Coconino	Plant	Sclerocactus parviflorus ssp. terrae-canyonae	Longspine Fishhook Cactus								SR	S1	G2Q	Y	PDCAC0J080
Coconino	Plant	Sclerocactus sileri	Siler Fishhook Cactus			S					SR	S1	G1	Y	PDCAC0J0T0
Coconino	Plant	Sclerocactus whipplei	Whipple's Fishhook Cactus								SR	S2	G2G3	Y	PDCAC0J0V0
Coconino	Plant	Silene rectiramea	Grand Canyon Catchfly									S1	G1	Y	PDCAR0U1F0
Coconino	Plant	Stephanomeria exigua ssp. exigua	Small Wirelettuce			S						S4	G5T5	N	PDAST8U054
Coconino	Plant	Symphyotrichum welshii	Welsh's American-aster					4				S1	G3G4	Y	PDASTE8380
Coconino	Plant	Thelypteris puberula var. sonorensis	Aravaipa Woodfern			S	S					S2	G5T4	Y	PPTHE05192
Coconino	Plant	Triteleia lemmoniae	Oak Creek Triteleia								SR	S3	G3	Y	PMLIL210C0
Coconino	Plant	Yucca whipplei	Our Lords Candle								SR	S3S4	G4G5	N	PMAGA0B0X0
Coconino	Plant	Zigadenus vaginatus	Sheathed Deathcamas					3			SR	S1	G2	Y	PMLIL280C0
Coconino	Plant	Zigadenus virescens	Green Death Camas								SR	S4	G4	N	PMLIL280E0
Coconino	Reptile	Aspidoscelis pai	Pai Striped Whiptail									S1	G5T3T4	Y	ARACJ02300
Coconino	Reptile	Lampropeltis triangulum	Western Milksnake					4		1		S2	G5	Y	ARADB19050
Coconino	Reptile	Thamnophis eques megalops	Northern Mexican Gartersnake	LT	Y	S	S		A	1		S2	G4T3	Y	ARADB36061
Coconino	Reptile	Thamnophis rufipunctatus	Narrow-headed Gartersnake	LT	Y	S	S			1		S2	G3G4	Y	ARADB36110
Gila	Amphibian	Anaxyrus microscaphus	Arizona Toad			S				2		S3	G3G4	Y	AAABB01110
Gila	Amphibian	Craugastor augusti cactorum	Western Barking Frog				S			2		S2	G5T5	Y	AAABD04171
Gila	Amphibian	Rana chiricahuensis	Chiricahua Leopard Frog	LT	Y	S			A	1		S2S3	G3?	Y	AAABH01080
Gila	Amphibian	Rana yavapaiensis	Lowland Leopard Frog			S	S		PR	1		S2S3	G4	Y	AAABH01250
Gila	Bird	Accipiter atricapillus	American Goshawk			S	S	4	A	2		S3	G5	P	ABNKC12061
Gila	Bird	Aechmophorus occidentalis	Western Grebe							2		S2B,S3N	G5	P	ABNCA04010
Gila	Bird	Aquila chrysaetos	Golden Eagle			S		3	A	2		S4	G5	P	ABNKC22010
Gila	Bird	Buteogallus anthracinus	Common Black Hawk						PR	2		S3B	G4G5	P	ABNKC15010
Gila	Bird	Camptostoma imberbe	Northern Beardless-Tyrannulet				S			2		S4	G5	W	ABPAE04010
Gila	Bird	Cinclus mexicanus	American Dipper					3	PR	2		S2S3	G5	Y	ABPBH01010
Gila	Bird	Coccyzus americanus	Yellow-billed Cuckoo (Western DPS)	LT	Y	S	S	2		1		S3	G5	P	ABNRB02020
Gila	Bird	Empidonax traillii extimus	Southwestern Willow Flycatcher	LE	Y	S		2	E	1		S2S3B	G5T2	Y	ABPAE33043
Gila	Bird	Euptilotis neoxenus	Eared Quetzal				S		A			SNAB,S1N	G3	Y	ABNWA03010
Gila	Bird	Falco peregrinus anatum	American Peregrine Falcon			S	S		PR	1		S4	G4T4	P	ABNKD06071
Gila	Bird	Haliaeetus leucocephalus	Bald Eagle			S	S	2	P	1		S2S3,S4N	G5	P	ABNKC10010
Gila	Bird	Haliaeetus leucocephalus (wintering pop.)	Bald Eagle - Winter Population			S	S	2	P			S4N	G5TNRQ	P	ABNKC10015
Gila	Bird	Megaceryle alcyon	Belted Kingfisher					4				S2B,S5N	G5	P	ABNXD01020
Gila	Bird	Rallus obsoletus yumanensis	Yuma Ridgway's Rail	LE		S			P	1		S3	G3T3	P	ABNME0501A
Gila	Bird	Strix occidentalis lucida	Mexican Spotted Owl	LT	Y	S		3	A	1		S3	G3G4T3T4	P	ABNSB12012
Gila	Fish	Agosia chrysogaster chrysogaster	Gila Longfin Dace			S			A	2		S3S4	G4T3T4	P	AFCJB37151
Gila	Fish	Catostomus clarkii	Desert Sucker			S	S			2		S3S4	G3G4	Y	AFCJC02040
Gila	Fish	Catostomus insignis	Sonora Sucker			S	S		P	2		S3	G3G4	Y	AFCJC02100
Gila	Fish	Gila intermedia	Gila Chub	LE	Y	S			P	1		S2	G2	Y	AFCJB13160
Gila	Fish	Gila robusta	Roundtail Chub			S	S	2	A	1		S2S3	G3	Y	AFCJB13152
Gila	Fish	Meda fulgida	Spikedace	LE	Y	S				1		S1	G2	Y	AFCJB22010
Gila	Fish	Poeciliopsis occidentalis occidentalis	Gila Topminnow	LE,UR		S			A	1		S1S2	G3	Y	AFCNC05021
Gila	Fish	Rhinichthys osculus	Speckled Dace			S			E			S3S4	G5	Y	AFCJB37050
Gila	Fish	Tiaroga cobitis	Loach Minnow	LE	Y	S			E	1		S1	G2	Y	AFCJB37140

Arizona Game and Fish Department, Heritage Data Management System 12

COUNTY	TAXON	SCIENTIFIC NAME	COMMON NAME	ESA	CRITHAB	BLM	USFS	NESL	MEXFED	SGCN	NPL	SRANK	GRANK	TRACK	ELCODE
Gila	Fish	Xyrauchen texanus	Razorback Sucker	LE,PT	Y	S		2	P	1		S1	G1	Y	AFCJC11010
Gila	Invertebrate	Agathon arizonicus	Netwing Midge				S					S1	G1	Y	IIDIP46010
Gila	Invertebrate	Anodonta californiensis	California Floater				S			1		S1	G3	Y	IMBIV04220
Gila	Invertebrate	Cicindela oregona maricopa	Maricopa Tiger Beetle									S3	G5T3	W	IICOL02362
Gila	Invertebrate	Danaus plexippus	Monarch	C, PT	P	S			PR			S2S4N	G4	P	IILEPP2010
Gila	Invertebrate	Oreohelix anchana	Ancha Mountainsnail							2		S1	G1	Y	IMGASB5030
Gila	Invertebrate	Pyrgulopsis simplex	Fossil Springsnail				S			1		S1	G1	Y	IMGASJ0210
Gila	Invertebrate	Pyrgulopsis sola	Brown Springsnail				S			1		S1	G1	Y	IMGASJ0220
Gila	Invertebrate	Sonorella ambigua verdensis	Papago Verde Talussnail							2		S1	G5TNR	Y	IMGASC9022
Gila	Invertebrate	Sonorella anchana	Sierra Ancha Talussnail							2		S1	G1G2	Y	IMGASC9030
Gila	Invertebrate	Sonorella ashmuni	Richinbar Talussnail							2		S2	G2	Y	IMGASC9060
Gila	Invertebrate	Sonorella galiurensis	Galiuro Talussnail							2		S1	GH	Y	IMGASC9270
Gila	Invertebrate	Sonorella micromphala	Milk Ranch Talussnail							2		S1	G1?	Y	IMGASC9410
Gila	Invertebrate	Sonorella rooseveltiana	Roosevelt Talussnail							2		S1	G1	Y	IMGASC9510
Gila	Invertebrate	Wormaldia planae	A Caddisfly				S					S1S2	G4	Y	IITRI78190
Gila	Mammal	Canis lupus baileyi	Mexican Wolf	LE,XN		S		1	E	1		S1	G5T1	Y	AMAJA01032
Gila	Mammal	Corynorhinus townsendii pallescens	Pale Townsend's Big-eared Bat			S	S	4		1		S3S4	G4T3T4	P	AMACC08014
Gila	Mammal	Eumops perotis californicus	Greater Western Bonneted Bat			S				2		S2S3	G4G5T4	Y	AMACD02011
Gila	Mammal	Idionycteris phyllotis	Allen's Lappet-browed Bat			S	S			2		S2S3	G4	Y	AMACC09010
Gila	Mammal	Lasiurus cinereus	Hoary Bat							2		S4	G3G4	Y	AMACC05032
Gila	Mammal	Lasiurus frantzii	Desert Red Bat				S			2		S3	G4	Y	AMACC05080
Gila	Mammal	Macrotus californicus	California Leaf-nosed Bat			S				2		S3	G3G4	P	AMACB01010
Gila	Mammal	Myotis auriculus	Southwestern Myotis							2		S3	G5	P	AMACC01080
Gila	Mammal	Myotis occultus	Arizona Myotis			S						S3	G4G5	P	AMACC01160
Gila	Mammal	Myotis thysanodes	Fringed Myotis							2		S3S4	G4	P	AMACC01090
Gila	Mammal	Myotis velifer	Cave Myotis			S				2		S3S4	G4G5	P	AMACC01050
Gila	Mammal	Myotis volans	Long-legged Myotis									S3S4	G4G5	P	AMACC01110
Gila	Mammal	Myotis yumanensis	Yuma Myotis							2		S3S4	G5	P	AMACC01020
Gila	Mammal	Nyctinomops femorosaccus	Pocketed Free-tailed Bat							2		S3S4	G5	Y	AMACD04010
Gila	Mammal	Nyctinomops macrotis	Big Free-tailed Bat							2		S3S4	G5	Y	AMACD04020
Gila	Mammal	Perognathus flavus goodpasteri	Springerville Pocket Mouse				S			2		S2	G5T3	Y	AMAFD01031
Gila	Plant	Abutilon parishii	Pima Indian Mallow			S	S				SR	S3S4	G3	Y	PDMAL020E0
Gila	Plant	Actaea arizonica	Arizona Bugbane	CCA			S				HS	S2	G2	Y	PDRAN07020
Gila	Plant	Agave delamateri	Tonto Basin Agave				S				HS	S2	G2	Y	PMAGA010W0
Gila	Plant	Agave murpheyi	Hohokam Agave			S	S				HS	S2?	G2?	Y	PMAGA010F0
Gila	Plant	Agave phillipsiana	Phillips Agave				S				HS	S2S3	G2	Y	PMAGA01100
Gila	Plant	Agave toumeyana var. bella	Toumey Agave								SR	S3	G3T3	W	PMAGA010R1
Gila	Plant	Agave x arizonica	Arizona agave								HS	SNA	GNA	N	PMAGA01030
Gila	Plant	Carex chihuahuensis	Chihuahuan Sedge				S					S3	G3G4	W	PMCYP032T0
Gila	Plant	Carex ultra	Cochise Sedge			S	S					S2S3	G3	Y	PMCYP03E50
Gila	Plant	Desmodium metcalfei	Metcalfe's Tick-trefoil				S					S3	G3?	Y	PDFAB1D0V0
Gila	Plant	Echinocereus arizonicus ssp. arizonicus	Arizona Hedgehog Cactus	LE		S					HS	S1S2	G5T2	Y	PDCAC060K1
Gila	Plant	Echinocereus santaritensis	Santa Rita Hedgehog Cactus								SR	S3	GNR	Y	PDCAC060U0
Gila	Plant	Echinocereus yavapaiensis	Yavapai Hedgehog Cactus								SR	S3	G3	Y	PDCAC060T0

COUNTY	TAXON	SCIENTIFIC NAME	COMMON NAME	ESA	CRITHAB	BLM	USFS	NESL	MEXFED	SGCN	NPL	SRANK	GRANK	TRACK	ELCODE
Gila	Plant	Eremogone aberrans	Mt. Dellenbaugh Sandwort				S					S3	G3	Y	PDCAR04010
Gila	Plant	Erigeron anchana	Sierra Ancha Fleabane				S					S2	G2	Y	PDAST3M580
Gila	Plant	Erigeron saxatilis	Rock Fleabane				S					S3	G3	Y	PDAST3M560
Gila	Plant	Eriogonum capillare	San Carlos Wild-buckwheat								SR	S4	G4	N	PDPGN08100
Gila	Plant	Ferocactus cylindraceus	Desert Barrel Cactus						PR		SR	S4	G5	N	PDCAC08080
Gila	Plant	Fremontodendron californicum	Flannel Bush			S					SR	S2S3	G4	Y	PDSTE03010
Gila	Plant	Hedeoma diffusa	Flagstaff False Pennyroyal				S				SR	S3	G3	W	PDLAM0M0N0
Gila	Plant	Helenium arizonicum	Arizona Sneezeweed				S					S3	G3	Y	PDAST4L020
Gila	Plant	Heuchera eastwoodiae	Senator Mine Alumroot				S					S3	G3	Y	PDSAX0E0B0
Gila	Plant	Heuchera glomerulata	Chiricahua Mountain Alumroot				S					S3	G3	Y	PDSAX0E0F0
Gila	Plant	Lupinus latifolius ssp. leucanthus	Broadleaf Lupine				S					S2S3	G5T2?Q	Y	PDFAB2B29D
Gila	Plant	Mammillaria viridiflora	Varied Fishhook Cactus								SR	S4	G4	N	PDCAC0A0D0
Gila	Plant	Packera neomexicana var. toumeyi	Toumey Groundsel				S					S2	G5T2	Y	PDAST8H274
Gila	Plant	Penstemon nudiflorus	Flagstaff Beardtongue				S					S2S3	G2G3	Y	PDSCR1L4A0
Gila	Plant	Perityle gilensis var. salensis	Salt River Rock Daisy				S					S1	G2T1	Y	PDAST700D2
Gila	Plant	Perityle saxicola	Roosevelt Dam Rockdaisy				S					S1	G1	Y	PDAST700P0
Gila	Plant	Phlox amabilis	Arizona Phlox				S					S2S3	G2	Y	PDPLM0D050
Gila	Plant	Platanthera sparsiflora	Sparse Flowered Bog Orchid								SR	S3	G4G5	Y	PMORC1Y0N0
Gila	Plant	Rumex orthoneurus	Blumer's Dock				S				HS	S3	G3	Y	PDPGN0P0Z0
Gila	Plant	Salvia amissa	Aravaipa Sage			S	S					S2	G2	Y	PDLAM1S020
Gila	Plant	Triteleia lemmoniae	Oak Creek Triteleia								SR	S3	G3	Y	PMLIL210C0
Gila	Reptile	Aspidoscelis pai	Pai Striped Whiptail									S1	G5T3T4	Y	ARACJ02300
Gila	Reptile	Gopherus morafkai	Sonoran Desert Tortoise	CCA		S	S		A	1		S4	G4	Y	ARAAF01013
Gila	Reptile	Heloderma suspectum	Gila Monster						A	1		S4	G4	Y	ARACE01010
Gila	Reptile	Thamnophis eques megalops	Northern Mexican Gartersnake	LT	Y	S	S		A	1		S2	G4T3	Y	ARADB36061
Gila	Reptile	Thamnophis rufipunctatus	Narrow-headed Gartersnake	LT	Y	S	S			1		S2	G3G4	Y	ARADB36110
Gila	Reptile	Xantusia bezyi	Bezy's Night Lizard				S			2		S2	G2	Y	ARACK01060
Graham	Amphibian	Anaxyrus microscaphus	Arizona Toad			S				2		S3	G3G4	Y	AAABB01110
Graham	Amphibian	Rana chiricahuensis	Chiricahua Leopard Frog	LT	Y	S			A	1		S2S3	G3?	Y	AAABH01080
Graham	Amphibian	Rana yavapaiensis	Lowland Leopard Frog			S	S		PR	1		S2S3	G4	Y	AAABH01250
Graham	Bird	Accipiter atricapillus	American Goshawk			S	S	4	A	2		S3	G5	P	ABNKC12061
Graham	Bird	Aquila chrysaetos	Golden Eagle			S		3	A	2		S4	G5	P	ABNKC22010
Graham	Bird	Asio otus	Long-eared Owl							2		S2B,S3S4N	G5	P	ABNSB13010
Graham	Bird	Athene cunicularia hypugaea	Western Burrowing Owl			S	S	4	PR	2		S3	G4T4	Y	ABNSB10012
Graham	Bird	Buteo swainsoni	Swainson's Hawk						PR	2		S3B,S4N	G5	P	ABNKC19070
Graham	Bird	Buteogallus anthracinus	Common Black Hawk						PR	2		S3B	G4G5	P	ABNKC15010
Graham	Bird	Camptostoma imberbe	Northern Beardless-Tyrannulet				S			2		S4	G5	W	ABPAE04010
Graham	Bird	Coccyzus americanus	Yellow-billed Cuckoo (Western DPS)	LT	Y	S	S	2		1		S3	G5	P	ABNRB02020
Graham	Bird	Empidonax traillii extimus	Southwestern Willow Flycatcher	LE	Y	S		2	E	1		S2S3B	G5T2	Y	ABPAE33043
Graham	Bird	Falco peregrinus anatum	American Peregrine Falcon			S	S		PR	1		S4	G4T4	P	ABNKD06071
Graham	Bird	Haliaeetus leucocephalus	Bald Eagle			S	S	2	P	1		S2S3,S4N	G5	P	ABNKC10010
Graham	Bird	Haliaeetus leucocephalus (wintering pop.)	Bald Eagle - Winter Population			S	S	2	P			S4N	G5TNRQ	P	ABNKC10015
Graham	Bird	Megaceryle alcyon	Belted Kingfisher					4				S2B,S5N	G5	P	ABNXD01020
Graham	Bird	Ramosomyia violiceps	Violet-crowned Hummingbird				S			2		S3	G5	P	ABNUC29150

COUNTY	TAXON	SCIENTIFIC NAME	COMMON NAME	ESA	CRITHAB	BLM	USFS	NESL	MEXFED	SGCN	NPL	SRANK	GRANK	TRACK	ELCODE
Graham	Bird	Strix occidentalis lucida	Mexican Spotted Owl	LT	Y	S		3	A	1		S3	G3G4T3T4	P	ABNSB12012
Graham	Bird	Trogon elegans	Elegant Trogon				S			2		S3	G5	P	ABNWA02070
Graham	Fish	Agosia chrysogaster chrysogaster	Gila Longfin Dace			S			A	2		S3S4	G4T3T4	P	AFCJB37151
Graham	Fish	Catostomus clarkii	Desert Sucker			S	S			2		S3S4	G3G4	Y	AFCJC02040
Graham	Fish	Catostomus insignis	Sonora Sucker			S	S		P	2		S3	G3G4	Y	AFCJC02100
Graham	Fish	Cyprinodon macularius	Desert Pupfish	LE	Y	S			P	1		S1	G1	Y	AFCNB02060
Graham	Fish	Gila intermedia	Gila Chub	LE	Y	S			P	1		S2	G2	Y	AFCJB13160
Graham	Fish	Gila robusta	Roundtail Chub			S	S	2	A	1		S2S3	G3	Y	AFCJB13152
Graham	Fish	Meda fulgida	Spikedace	LE	Y	S				1		S1	G2	Y	AFCJB22010
Graham	Fish	Oncorhynchus apache	Apache Trout							1		S2	G3	Y	AFCHA02102
Graham	Fish	Oncorhynchus gilae	Gila Trout	LT						1		S1	G2	Y	AFCHA02101
Graham	Fish	Poeciliopsis occidentalis occidentalis	Gila Topminnow	LE,UR		S			A	1		S1S2	G3	Y	AFCNC05021
Graham	Fish	Rhinichthys osculus	Speckled Dace			S			E			S3S4	G5	Y	AFCJB37050
Graham	Fish	Tiaroga cobitis	Loach Minnow	LE	Y	S			E	1		S1	G2	Y	AFCJB37140
Graham	Fish	Xyrauchen texanus	Razorback Sucker	LE,PT	Y	S		2	P	1		S1	G1	Y	AFCJC11010
Graham	Invertebrate	Anodonta californiensis	California Floater				S			1		S1	G3	Y	IMBIV04220
Graham	Invertebrate	Bicellonycha wickershamorum wickershamorum	Southwest Spring Firefly	UR								S2	G2G3T2T3	Y	IICOLQS312
Graham	Invertebrate	Cicindela oregona maricopa	Maricopa Tiger Beetle									S3	G5T3	W	IICOL02362
Graham	Invertebrate	Eumorsea pinaleno	Pinaleno Monkey Grasshopper				S					S1S3	G1G3	Y	IIORT14010
Graham	Invertebrate	Oreohelix grahamensis	Pinaleno Mountainsnail	CCA			S			1		S1S2	G1G2	Y	IMGASB5120
Graham	Invertebrate	Pyrgulopsis arizonae	Bylas Springsnail			S				1		S1	G1	Y	IMGASJ0770
Graham	Invertebrate	Sonorella christenseni	Clark Peak Talussnail	CCA			S			1		S1	G1?	Y	IMGASC9150
Graham	Invertebrate	Sonorella galiurensis	Galiuro Talussnail							2		S1	GH	Y	IMGASC9270
Graham	Invertebrate	Sonorella grahamensis	Pinaleno Talussnail	CCA			S			1		S1	G1	Y	IMGASC9280
Graham	Invertebrate	Sonorella imitator	Mimic Talussnail	CCA			S			1		S1	G1	Y	IMGASC9320
Graham	Invertebrate	Sonorella macrophallus	Wet Canyon Talussnail	CCA			S			1		S1	G1	Y	IMGASC9360
Graham	Invertebrate	Tryonia gilae	Gila Tryonia			S				1		S1	G1	Y	IMGASJ7160
Graham	Mammal	Baiomys taylori	Northern Pygmy Mouse				S					S3	G4G5	Y	AMAFF05010
Graham	Mammal	Canis lupus baileyi	Mexican Wolf	LE,XN		S		1	E	1		S1	G5T1	Y	AMAJA01032
Graham	Mammal	Choeronycteris mexicana	Mexican Long-tongued Bat			S	S		A	2		S2	G3G4	Y	AMACB02010
Graham	Mammal	Corynorhinus townsendii pallescens	Pale Townsend's Big-eared Bat			S	S	4		1		S3S4	G4T3T4	P	AMACC08014
Graham	Mammal	Eumops perotis californicus	Greater Western Bonneted Bat			S				2		S2S3	G4G5T4	Y	AMACD02011
Graham	Mammal	Idionycteris phyllotis	Allen's Lappet-browed Bat			S	S			2		S2S3	G4	Y	AMACC09010
Graham	Mammal	Lasiurus cinereus	Hoary Bat							2		S4	G3G4	Y	AMACC05032
Graham	Mammal	Lasiurus frantzii	Desert Red Bat				S			2		S3	G4	Y	AMACC05080
Graham	Mammal	Lasiurus xanthinus	Western Yellow Bat				S			2		S2S3	G4G5	Y	AMACC05070
Graham	Mammal	Leptonycteris yerbabuenae	Lesser Long-nosed Bat			S			Pr	1		S2S3	G3	Y	AMACB03030
Graham	Mammal	Lepus alleni	Antelope Jackrabbit						|	2		S3	G5	Y	AMAEB03070
Graham	Mammal	Macrotus californicus	California Leaf-nosed Bat			S				2		S3	G3G4	P	AMACB01010
Graham	Mammal	Microtus longicaudus leucophaeus	White-bellied Long-tailed Vole				S			2		S1S2	G5T1	Y	AMAFF11061
Graham	Mammal	Myotis ciliolabrum	Western Small-footed Myotis									S3S4	G5	P	AMACC01230
Graham	Mammal	Myotis velifer	Cave Myotis			S				2		S3S4	G4G5	P	AMACC01050
Graham	Mammal	Myotis yumanensis	Yuma Myotis							2		S3S4	G5	P	AMACC01020
Graham	Mammal	Nyctinomops femorosaccus	Pocketed Free-tailed Bat							2		S3S4	G5	Y	AMACD04010

COUNTY	TAXON	SCIENTIFIC NAME	COMMON NAME	ESA	CRITHAB	BLM	USFS	NESL	MEXFED	SGCN	NPL	SRANK	GRANK	TRACK	ELCODE
Graham	Mammal	Nyctinomops macrotis	Big Free-tailed Bat							2		S3S4	G5	Y	AMACD04020
Graham	Mammal	Sigmodon ochrognathus	Yellow-nosed Cotton Rat							3		S4	G4G5	N	AMAFF07040
Graham	Mammal	Tadarida brasiliensis	Brazilian Free-tailed Bat							2		S3S4	G5	P	AMACD01010
Graham	Mammal	Tamiasciurus fremonti grahamensis	Mt Graham Red Squirrel	LE	Y					1		S1	GNRT1	Y	AMAFB08011
Graham	Mammal	Thomomys bottae mearnsi	Mearns' Southern Pocket Gopher									S5	G5T5	N	AMAFC0102G
Graham	Plant	Abutilon parishii	Pima Indian Mallow			S	S				SR	S3S4	G3	Y	PDMAL020E0
Graham	Plant	Agave phillipsiana	Phillips Agave				S				HS	S2S3	G2	Y	PMAGA01100
Graham	Plant	Allium bigelovii	Bigelow Onion								SR	S2S3	G3	Y	PMLIL02070
Graham	Plant	Carex chihuahuensis	Chihuahuan Sedge				S					S3	G3G4	W	PMCYP032T0
Graham	Plant	Carex ultra	Cochise Sedge			S	S					S2S3	G3	Y	PMCYP03E50
Graham	Plant	Cirsium parryi	Parry Thistle				S				SR	S3	G4	W	PDAST2E260
Graham	Plant	Echinocereus arizonicus ssp. nigrihorridispinus	Black-spined Hedgehog Cactus								SR	S2	GNRTNR	Y	PDCAC060V1
Graham	Plant	Echinocereus ledingii	Pinaleno Hedgehog Cactus								SR	S2	G4G5T4	Y	PDCAC06066
Graham	Plant	Echinocereus santaritensis	Santa Rita Hedgehog Cactus								SR	S3	GNR	Y	PDCAC060U0
Graham	Plant	Erigeron heliographis	Pinalenos Fleabane				S					S1	G1	Y	PDAST3M500
Graham	Plant	Erigeron piscaticus	Fish Creek Fleabane			S	S				SR	S1	G1	Y	PDAST3M4X0
Graham	Plant	Eriogonum capillare	San Carlos Wild-buckwheat								SR	S4	G4	N	PDPGN08100
Graham	Plant	Eriogonum heermannii var. argense	Heermann's Rough Wild Buckwheat								SR	S3S4	G5T3	N	PDPGN082P8
Graham	Plant	Heuchera glomerulata	Chiricahua Mountain Alumroot				S					S3	G3	Y	PDSAX0E0F0
Graham	Plant	Hieracium abscissum	Rusby's Hawkweed				S					S1	G2?	Y	PDAST4W1A0
Graham	Plant	Malaxis porphyrea	Purple Adder's Mouth								SR	S2	G4	Y	PMORC1R0Q0
Graham	Plant	Mammillaria viridiflora	Varied Fishhook Cactus								SR	S4	G4	N	PDCAC0A0D0
Graham	Plant	Mammillaria wrightii var. wilcoxii	Wilcox Fishhook Cactus								SR	S4	G4T4	N	PDCAC0A0E1
Graham	Plant	Pediomelum pentaphyllum	Chihuahua Scurfpea			S	S					S1S2	G1G2	Y	PDFAB5L070
Graham	Plant	Penstemon discolor	Catalina Beardtongue				S				HS	S2	G2	Y	PDSCR1L210
Graham	Plant	Platanthera aquilonis	Northern Green Orchid								SR	S2S3	G5	Y	PMORC1Y150
Graham	Plant	Platanthera purpurascens	Purple-petal Bog Orchid								SR	S2	GNR	Y	PMORC1Y1G0
Graham	Plant	Potentilla albiflora	Pinaleno Cinquefoil				S					S2	G2	Y	PDROS1B010
Graham	Plant	Purshia subintegra	Arizona Cliff Rose	LE		S					HS	S2	G2	Y	PDROS1E080
Graham	Plant	Rumex orthoneurus	Blumer's Dock				S				HS	S3	G3	Y	PDPGN0P0Z0
Graham	Plant	Salvia amissa	Aravaipa Sage			S	S					S2	G2	Y	PDLAM1S020
Graham	Plant	Schiedeella arizonica	Fallen Ladies'-tresses								SR	S4	G4	N	PMORC67020
Graham	Reptile	Aspidoscelis arizonae	Arizona Striped Whiptail			S						S1S2	G5T2	Y	ARACJ02071
Graham	Reptile	Aspidoscelis stictogrammus	Giant Spotted Whiptail				S			2		S2	G4	Y	ARACJ02011
Graham	Reptile	Crotalus pricei	Twin-spotted Rattlesnake				S		PR	1		S2	G5	Y	ARADE02080
Graham	Reptile	Gopherus morafkai	Sonoran Desert Tortoise	CCA		S	S		A	1		S4	G4	Y	ARAAF01013
Graham	Reptile	Kinosternon flavescens	Yellow Mud Turtle							2		S1	G5	Y	ARAAE01020
Graham	Reptile	Phrynosoma cornutum	Texas Horned Lizard									S3S4	G4G5	Y	ARACF12010
Graham	Reptile	Sistrurus tergeminus edwardsii	Desert Massasauga			S			PR			S1	G3T3	Y	ARADE03012
Graham	Reptile	Terrapene ornata luteola	Desert Box Turtle			S			PR	1		S2S3	G4G5T4	Y	ARAAD08021
Graham	Reptile	Thamnophis eques megalops	Northern Mexican Gartersnake	LT	Y	S	S		A	1		S2	G4T3	Y	ARADB36061
Graham	Reptile	Thamnophis rufipunctatus	Narrow-headed Gartersnake	LT	Y	S	S			1		S2	G3G4	Y	ARADB36110
Greenlee	Amphibian	Anaxyrus microscaphus	Arizona Toad			S				2		S3	G3G4	Y	AAABB01110
Greenlee	Amphibian	Rana chiricahuensis	Chiricahua Leopard Frog	LT	Y	S			A	1		S2S3	G3?	Y	AAABH01080

Appendix G: FWS Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE

5275 Leesburg Pike
MS-ES
Falls Church, Virginia 22041

In Reply Refer To:
FWS/AES/DER/BNC/080572
2024-0053674-S7

Tracy Willard
U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
4700 River Road, Unit 149
Riverdale, Maryland 20737

Dear Ms. Willard:

This letter is in response to the United States Department of Agriculture-Animal and Plant Health Inspection Services (APHIS) December 13, 2023, request for concurrence on determinations of "may affect, not likely to adversely affect," (NLAA) federally listed, proposed and candidate species and designated and proposed critical habitats related to APHIS' proposal to conduct chemical treatments to suppress grasshopper infestations as part of the Rangeland Grasshopper and Mormon Cricket Suppression Program (Program) in 17 Western States. In their accompanying Biological Assessment for the APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program, December 2023, revised on January 23, 2024, APHIS uses a risk assessment approach to evaluate response data to characterize the potential hazard/risk of the use of three of four chemicals in the program to aquatic and terrestrial listed species and their habitat. APHIS is adopting the risk assessment and conservation measures from the 2022 U.S. Fish and Wildlife Service Biological Opinion for the reregistration of malathion, and thus, malathion is not considered further in their BA. The Service provides this response pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (ESA), as amended.

APHIS has made a NLAA determination for their Proposed Action for 201 threatened and endangered species, 11 proposed species, 93 designated and 8 proposed critical habitats These species include 10 amphibians, 15 birds, 57 fishes, 31 invertebrates, 15 mammals, 78 plants, and 8 reptiles. A complete list of these species and critical habitats can be found in Enclosure A.

Description of the Proposed Action

The intent of APHIS' Program is to reduce populations of various species of grasshoppers and Mormon crickets on rangeland in Arizona, California (partial), Colorado, Idaho, Kansas, Montana, Nebraska, Nevada (partial), New Mexico, North Dakota, Oklahoma (partial), Oregon (partial), South Dakota, Texas (partial), Utah, Washington (partial), and Wyoming. Chemical treatments include a seasonal one-time treatment of diflubenzuron, carbaryl, malathion, or chlorantraniliprole which can be applied from the ground or air. All four chemicals are applied at substantially reduced rates, compared to their recommended label uses, and are applied over an entire treatment area/spray block, or in alternating swaths within a treatment area/spray block. Decisions to conduct grasshopper treatments are based on many factors including the number of grasshoppers present in the area, grasshopper and plant species composition, life-cycle stage of the grasshoppers, range condition, the economic significance of the infestation, and whether it is economically and logistically feasible to conduct an effective program.

Toxicity data related to potential direct and indirect effects to listed species were compared to exposure estimates for diflubenzuron, carbaryl, and chlorantraniliprole to characterize risk to listed species and any designated critical habitat. APHIS reviewed the ecology of the listed species, including their distribution throughout the program action area, to determine whether a listed entity is found within the program treatment areas and, thus, would likely be exposed to any of the program chemicals.

Based on this review, APHIS identified listed species that could potentially occur in the program area, and then used results from the risk characterization for the three chemicals to develop program application buffers and other mitigation measures to avoid and/or minimize the potential for adverse impacts to listed species and their critical habitat (See Appendix A-9 of the BA or Enclosure B).

Best Management Practices (BMPs)

Surveys

Prior to any insecticide applications, APHIS conducts immature grasshopper surveys (i.e., nymphal surveys) in the spring and early summer (USDA, 2024). The number of grasshopper nymphs present within a given area are counted (USDA, 2024). Data gathered includes the stage of grasshopper development; location of sensitive areas such as bee yards and aquatic resources; the condition of the rangeland in relation to grasshopper numbers; and the extent of the infestation (USDA, 2024). This data is used for planning large-scale treatment programs and fiscal tracking, and for local decisions on treatments within a State (USDA, 2024).

Adult surveys occur in late summer and early fall (USDA, 2024). This survey is timed to coincide with the peak populations (USDA, 2024). Adult survey data are useful in predicting if and where potential grasshopper problems are likely to occur in the spring and early summer of the next growing season (USDA, 2024).

The survey data collected by the program is used by the agency and land managers/owners to assess whether treatments are warranted. Treatments must be requested from a Federal land management agency or a State agriculture department (on behalf of a State or local government, or private group or individual) that has jurisdiction over the land before APHIS can begin a treatment (USDA, 2024). Upon request, APHIS personnel conduct a site visit to determine whether APHIS action is warranted (USDA, 2024). Relevant factors influencing this decision may include, but are not limited to, the pest species, timing of treatment relative to the biological stage of the pest species, costs and benefits of conducting the action, and ecological impacts

(USDA, 2024). Based on survey results conducted during the growing season, APHIS is better able to predict the potential for large grasshopper populations and to respond quickly before extensive loss occurs to rangeland (USDA, 2024). Thus, State and Federal officials may initiate early coordination of local programs and request APHIS' assistance in a timely and effective cooperative effort (USDA, 2024).

Insecticide Application

When land managers request direct intervention, APHIS' role in the suppression of grasshoppers is through a single application of an insecticide—carbaryl, diflubenzuron, malathion, or chlorantraniliprole (USDA, 2024). All four insecticides are labeled by the U.S. Environmental Protection Agency, Office of Pesticide Programs (EPA–OPP) for rangeland use in the control of grasshoppers, including Mormon crickets (USDA, 2024). APHIS may conduct insecticide treatments in the above mentioned 17 states. With the exception of chlorantraniliprole, the remaining three insecticides are registered for use in all states considered in this program (USDA 2015).

Program insecticide applications can be applied in two different forms: liquid ultra-low-volume (ULV) sprays, or solid-based baits (USDA, 2024). Both ULV sprays and baits can be distributed by aerial or ground applications (USDA, 2024). Aerial applications are typical for treatments over large areas (USDA, 2024). Some grasshopper outbreak locations are economically or logistically accessible only by aircraft, while other locations may be best treated by ground applications (USDA, 2024). Ground applications are most likely to be made when treating localized grasshopper outbreaks or for treatments where the most precise placement of insecticide is desired (USDA, 2024).

Buffers and Conservation Measures

A reduced agent area treatment (RAATs) rate can be used for all four insecticides (USDA, 2024). This strategy uses insecticides at low rates combined with a reduction in the area treated for grasshopper suppression (USDA, 2024). The RAATs strategy relies on the effects of an insecticide to suppress grasshoppers within treated swaths, and the conservation of grasshopper predators and parasites in swaths not directly treated (untreated).

The Program has also established treatment restriction buffers around waterbodies to protect those features from insecticide drift and runoff (USDA, 2024). APHIS maintains the following buffers for water bodies that are not designated critical habitat for listed aquatic species: 500-foot buffer for aerial sprays, 200-foot buffer for ground sprays, and a 50-foot buffer for bait applications (USDA, 2024).

Application buffers as well as additional mitigation measures to protect listed species and their critical habitat have also been established for all four pesticides. Parameters specific to the given pesticide are used for inputs into the modeling program, AgDrift, to establish additional mitigation measure buffer distances for those areas where Program activities and listed species and their designated critical habitat are present (USDA, 2024). Specific buffer distances were established based on the integration of available effects and exposure data to characterize direct and indirect risk to listed species and their critical habitat (USDA, 2024). In addition to the standard spray buffers, conservation measures include additional measures for critical habitat PCEs, larger buffers for lekking sites (e.g., Greater sage-grouse), larger buffers for species (e.g., birds) that rely primarily on insects as food, and additional upstream buffers for fish. These additional conservation measures are described in Enclosure B

In addition to the chemical-specific application buffers, additional label and other requirements have been incorporated into the Program to reduce the potential exposure of threatened and endangered species and designated critical habitat to Program insecticide treatments:

- Avoid applications when sustained winds speeds exceed 10 miles per hour (mph).
- Use RAATs adjacent to locations of listed species and designated critical habitats.
- Avoid applications under conditions where a temperature inversion is possible or when a storm event is imminent.

The use of RAATs will be required for 500 feet from a ground application or 1,000 feet from an aerial application (USDA, 2024). This distance will be used from the location of a listed species, or its critical habitat when no application buffer is required, or from the distance beyond the no application buffer (USDA, 2024). Beyond these distances the program can choose to continue RAATs applications or use full applications depending on site-specific conditions and the need for greater efficacy (USDA, 2024).

The avoidance of applications during storm events is required to reduce the probability of off-site transport of program insecticides via runoff (USDA, 2024). Variability in weather patterns, even within small geographic areas, requires a site-specific evaluation of conditions by program personnel prior to application to determine if a rainfall or storm event would result in conditions where runoff to sensitive habitats could occur given site conditions and the proposed application buffers (USDA, 2024).

Exposure

Observed Residue Values from Program Applications

Monitoring data from drift cards collected from 2003 to 2022 was reviewed and compared to modeled data to determine if the drift assumptions were representative of the drift expected from the Program applications. Drift card data provides a standardized unit of measurement (mg/m^2) to compare with the outputs of terrestrial deposition estimates in AgDrift. The drift card comparisons are made primarily with diflubenzuron as this is the preferred active ingredient to be used for the Program activities, and thus, there are data to address the drift assumptions. Aquatic residues from the monitoring data are also summarized but are not able to be compared to AgDrift outputs due to difficulties with quantifying the waterbody types, sizes, and flow regimes.

Modeling Estimates for all three pesticides using AgDrift

The aquatic residue values calculated using AgDrift were generated based on conservative assumptions and then compared to toxicity values. The parameters used in AgDrift are discussed in detail in the Drift Simulations section of the BA (p. 30). While drift card data residue values varied, generally the closer to the treatment site, the more residue was detected, but values ranged from < LOD (limit of detection) to 1.07 mg/m^2 overall. The average drift value estimated at 500 feet was 0.246 mg/m^2 which is greater than what is observed from most drift card data at 500 feet (drift card data from 2003 to 2022 at 500 feet ranged from < 0.015 – 0.29 mg/m^2 from both carbaryl and diflubenzuron applications; BA pp 26-30).

Run-off residues in waterbodies are considered minimal due to the reduced application rates and the large buffers in place as standard for all aquatic environments and are discussed in more detail in the Runoff Simulations section of the BA (p.32).

Residue Estimates for Terrestrial Non-Target Organisms

Estimated exposure levels on vegetation and other forage items for terrestrial species were calculated using the Terrestrial Residue Exposure Model (T-REX) developed by EPA (US EPA, 2012). More details on how this model was used and the parameters for the inputs are provided in the BA (p.34). Exposure concentrations for birds and mammals are based on mg/kg diet or mg/kg body weight. The resulting concentrations from the model estimates (for each insecticide) represent what would be expected from a direct application to the listed dietary item and are then used to determine residues for different mammals and birds based on their body size and food consumption. These values are then compared to the effects data toxicity endpoints.

AgDrift was then used to estimate the amount of drift reduction needed to arrive below the toxicity endpoint. The input parameters used for estimating the aquatic residues provided in Tables 2-1 and 2-2 of the BA were the same as those used for estimating drift reduction in terrestrial environments. APHIS developed the proposed buffers using these input parameters to determine removal of 99% of the off-site drift from the program applications that will be protective of listed species and their critical habitat as applicable.

Effects of the Action

Throughout this section we summarize or describe toxicity effects of the three chemicals used in the APHIS grasshopper/cricket suppression program. Toxicity is described for both aquatic and terrestrial species using U.S. EPA criteria based on concentrations of a particular chemical (practically non-toxic, slightly toxic, moderately toxic, highly toxic, very highly toxic; **Aquatic and Terrestrial Organism Criteria for Toxicity**). Where data were unavailable for certain taxonomic groups, surrogate species data are described with assumptions for use of those data where indicated.

For aquatic species, a range of toxicity values is provided for each taxa group to describe the potential effects observed from exposure to the three chemicals, carbaryl, chlorantraniliprole, and diflubenzuron. These values are then compared, in the risk section discussion, to the estimated concentrations from field monitoring data collected, as well as AgDrift modeled estimates.

For terrestrial species, toxicity is also described based on route of exposure (i.e., oral, contact, dermal) and either acute or chronic (i.e., reproductive or developmental). These values are then scaled based on the body weight of the test organism of focus and compared in the risk section discussion. APHIS uses a methodology used by the U.S. EPA (U.S. EPA Ecological Risk Assessment Methodology) to describe risk of exposure to different taxonomic groups of organisms from each of the three program chemicals. A Risk Quotient (RQ) is calculated by dividing a point estimate of exposure (residues on dietary items or thresholds for a given effect) by a point estimate of effect and compared to a level of concern (LOC). RQs <1 are not expected to result in adverse effects, while RQs >1 are expected to result in adverse effects.

For critical habitat, APHIS reviewed the primary constituent elements (PCEs) or physical and biological features (PBFs) to determine if the Program activities would cause destruction or adverse modification of these features.

In addition, the BA goes into detail to discuss the relevant toxicity of the metabolites that may be found in environmental matrices such as soil and water, for all three chemicals as well (see pages 20, 38, 49, 59 in the BA).

Carbaryl

The mode of action of carbamates occurs primarily through acetylcholinesterase (AChE) inhibition (Klaassen, Andur, & Doull, 1986), (Smith J. G., 1987). The AChE enzyme breaks down acetylcholine, a neurotransmitter that allows for the transfer of nerve impulses across nerve synapses. Carbamates have a reversible enzyme binding reaction in that the binding will decrease as the concentration decreases over time due to metabolism and excretion.

Aquatic Species

The 96-hour acute median lethal concentration for carbaryl for fish ranges from 0.14 mg/L for channel catfish (*Ictalurus punctatus*; (Brown, Anderson, Jones, Deuel, & Price, 1979) to 1,188 mg/L for the walking catfish (*Clarias batrachus*; (Chakrawarti & Chaurasia, 1981).

For chronic effects to fish, chronic NOEC concentrations for studies ranging from 32-35 day exposures, are 210, 650, and 445 µg/L for the fathead minnow, bonytail (a listed species considered for this consultation) and the Colorado pikeminnow (also a listed species considered in the consultation; (Beyers, Keefe, & Carlson, 1994), (Carlson, 1972), respectively.

For aquatic invertebrates, carbaryl is very highly toxic to all aquatic insects, and highly to very highly toxic to most aquatic crustaceans. The toxicity from 96-hour acute static tests ranged from 1.5 µg/L in the shrimp, *Paneaus aztecus*, to 22.7 mg/L in the mussel, *Mytilus edulis* (Mayer F. L., 1987), (US EPA, 2003). EC_{50}/LC_{50} values for crustaceans range from 5 to 9 µg/L (cladoceran, mysid), 8 to 25 µg/L (scud), and 500 to 2,500 µg/L (crayfish) (Peterson, et al., 1994). Aquatic insects have a similar range of sensitivity.

Chronic toxicity of carbaryl to aquatic invertebrates varies by taxa group. Reproductive and growth endpoints have been reported for cladocerans that range from 1.0 to 15 µg/L. A NOEC of 500 µg/L was reported for the chironomid midge (Hanazato, 1991), (USDA Forest Service, 2008), (US EPA, 2003).

For aquatic plants, a study testing the effects to the freshwater green algae, *Pseudokirchneriella subcapitata*, reported a EC_{50} and NOEC of 1.27 and 0.29 mg/L, respectively (USDA Forest Service, 2008). (Peterson, et al., 1994) found statistically significant effects at 3.7 mg/L on four algal species and the aquatic macrophyte, *Lemna minor* (duckweed). (Boonyawanich, et al., 2001) reported 96-hour EC_{50} values of 0.996, 0.785, and 0.334 g/L for three aquatic plants:

Ipomoea aquatica, *Pistia stratiotes*, and *Hydrocharis dubia* (water spinach, water lettuce, and frogbit), respectively.

Terrestrial Species

Carbaryl is moderate in toxicity when ingested by male and female rats. The oral LD_{50} in male and female rats is 302.6 mg/kg and 311.5 mg/kg, respectively (US EPA, 2003). Low doses can cause skin and eye irritation. The acute inhalation LD_{50} is 721 mg/kg. The acute dermal toxicity is low with an LD_{50} more than 4,000 mg/kg for rats and more than 5,000 mg/kg for rabbits (US EPA, 2003). For chronic data, USDA-APHIS provides a discussion on the 4-week dermal study, the two-generation reproduction study, and a prenatal developmental study in rats (and one in rabbits) on p. 49 in the BA, and also includes discussion on sub-lethal endpoints such as neurotoxicity, immunotoxicity, and carcinogenicity thereafter, which are standard toxicity testing endpoints for mammalian studies.

The acute oral LD_{50} of carbaryl to avian species ranges from 16 mg/kg to > 2,000 mg/kg for starlings (*Sturnis vulgaris*) and red-winged blackbirds (*Agelaius phoeniceus*) (Hudson, Tucker, & Haegele, 1984) and (Shafer, Bowles, & Hurlbut, 1983). Several toxicity studies evaluating sublethal effects have also been conducted. For a more in-depth discussion on these in the BA, see pages 52-53. Here we discuss the results from a standardized reproduction study in the Japanese quail (*Coturnis japonica*) and mallard duck (*Anas platyrhynchos*). A NOEC of > 3,000 ppm was determined for *C. japonica* and a NOEC of 300 ppm was determined for mallard (*A Platyrhynchos*) based on a decrease in the number of eggs produced.

There are no available studies for reptiles for carbaryl; thus, where reptile data is not available, the avian data is used as a surrogate to estimate sensitivity to reptiles.

For amphibians, the acute oral LD_{50} for carbaryl exposure in the bullfrog (*Rana catesbeiana*) was > 4,000 mg/kg (Hudson, Tucker, & Haegele, 1984). Acute toxicity studies in other species have demonstrated lower LC_{50} values for the tadpole developmental stage and the BA provides more detail on these on pages 53-55. (Kirby & Sih, 2015) found carbaryl to be more lethal to the threatened Foothill yellow-legged frog (*Rana boylii*) than to the Pacific tree frog (*Pseudacris regilla*). The estimated 72-hour LC_{50} value for *R. boylii* was 585 µg/L ± 229 and for *P. regilla* was 3,006 µg/L ± 955. In addition to mortality endpoints for this study, the authors also examined the effect of carbaryl on their competitive interactions with a non-native crayfish predator (*Pacifastacus leniusculus*). *R. boylii* was found to be more susceptible to pesticide exposure than *P. regilla* and exposure reduced their ability to compete with a 50% increase in mortality observed for *R. boylii* and no change to mortality observed (at 50 µg/L) for *P. regilla.* Several sublethal effect studies have also assessed a variety of endpoints related to direct and indirect effects on carbaryl to amphibians. The BA provides a discussion on these reductions in swimming behavior in more detail on page 55.

Carbaryl is very highly toxic to many terrestrial insects. It is very highly toxic to honey bees (*A. mellifera*) with an acute contact LD_{50} of 0.0011 mg/bee (US EPA, 2003), *A. erythronii* females (0.543 µg/bee), and *M. rotundata* females (0.592 µg/bee) as well as bumble bees (*B. terrestris*) where 24- and 72-hour oral LD_{50} values ranged from 3.92 to 3.84 µg/bee, respectively and *B. terricola* workers 41.16 µg/bee (Helson, Barber, & Kingsbury, 1994). It has also been measured in colonies at 111 µg/kg (Mullin, et al., 2010), so there is a potential for population level effects.

Toxicity to terrestrial plants has been evaluated for agronomic crops based on registrant submitted studies for US EPA FIFRA regulation requirements. These studies showed no effects to cabbage, cucumber, onion, ryegrass, soybean, and tomato (US EPA, 2003) at 0.803 lb a.i./ acre based on an application rate of 0.5 lb a.i. / acre, which is higher than that projected for carbaryl used for the grasshopper and Mormon cricket program (0.37 lb a.i. / acre). Plant incident reports have also been reported but at doses well above those proposed for the APHIS program activities (USDA-APHIS BA p. 56).

Chlorantraniliprole

Chlorantraniliprole (Ryanaxypyr™) is an insecticide in the anthranilic diamide insecticide class. The mode of action of chlorantraniliprole is the activation of insect ryanodine receptors, which causes an uncontrolled release of calcium from smooth and striated muscle, causing paralysis in insects (Health Canada, 2008) (US EPA, 2008). This insecticide is very selective to insect ryanodine receptors (Lahm, et al., 2007) and thus does not impact mammals or other vertebrate groups the same way, despite these groups also having these same receptors.

Aquatic Species:

Chlorantraniliprole toxicity in fish is considered low based on available toxicity data reporting mortality above the solubility limit (1 mg/L). Two early life-stage tests in the rainbow trout (*Onchorhynchus mykiss*) and sheepshead minnow (*Cyprinodon variegatus*) showed chlorantraniliprole may have effects at 0.11 and 1.28 mg/L, respectively.

Aquatic invertebrates are more sensitive to chlorantraniliprole in acute studies as compared to fish, with values ranging from 0.0098 mg/L for *D. magna* to 1.15 mg/L for the marine mysid shrimp (Barbee, McClain, Lanka, & Stout, 2010), (US EPA, 2012) and (Rodrigues, et al., 2016). For chronic life cycle studies, toxicity threshold values ranged from 0.0031 mg/L for the midge, *C. riparius* to 0.695 mg/L for the mysid shrimp, 0.695 mg/L.

The available aquatic plant toxicity data for chlorantraniliprole to freshwater and marine algae indicates low toxicity based on EC_{50} and NOEC values greater than the highest test concentrations tested, ranging from 1.78 to 15.1 mg/L (US EPA, 2008).

Terrestrial Species

Chlorantraniliprole is considered practically non-toxic to mammalian species via oral, dermal, and inhalation exposures and is not known to cause reproductive (NOAEL = 1,594 mg/kg/day) or developmental toxicity (1,000 mg/kg/day), respectively (US EPA, 2008). Chlorantraniliprole is also not known to be neurotoxic, carcinogenic, or immunotoxic (see BA Table 3-9).

Toxicity of chlorantraniliprole to avian species is considered low for acute and chronic exposures, where there were no acute or sublethal effects observed at all doses in the oral gavage or dietary studies or in a 22-week reproduction study. The lowest acute NOEL value of 2,250 mg/kg was used to estimate the range of sensitivities to birds based on different body weights and food consumption amounts if they were to forage on treated food items (see BA Tables 3-11 and 3-12).

There are no available studies for reptiles for chlorantraniliprole; thus where reptile data is not available, the avian data is used as a surrogate to estimate sensitivity to reptiles. Chlorantraniliprole would be expected to be practically nontoxic to reptiles based on the available avian toxicity data.

Several studies reviewed by USDA-APHIS indicate that chlorantraniliprole is practically non-toxic to honeybees, bumblebees, hover fly, ladybug beetle, lacewing, other Hymenoptera species, and a predatory mite (see BA p.62-63).

The lack of toxicity observed in these other insect groups is related to the activity of chlorantraniliprole which is primarily through ingestion such that the larval stages of Coleoptera and Lepidoptera would receive larger doses due to the heightened feeding on treated plant material during this stage of development: Two acute studies in the monarch butterfly (one dietary, the other cuticular) indicated toxicity based on the 96-hour LD_{50}s. The cuticular LD_{50} was 0.012, 0.95, and 0.19 µg/g for the first, third, and fifth instars (European Food Safety Authority, 2013), while the dietary study 96-hour LC_{50} values were 0.0083, 0.046, and 0.96 µg / g leaf for second, third, and fifth instars, respectively (Krishnan, et al., 2020).

Chlorantraniliprole has low toxicity to most soil borne invertebrates such as springtail, isopods, and earthworms as is discussed in the BA (p. 63).

Terrestrial plant seedling emergence and vegetative vigor studies (using various monocot and dicot agricultural crops plants) indicate low toxicity at concentrations > 300 g/ha, which is several times greater than grasshopper/cricket suppression program rates.

Diflubenzuron

Diflubenzuron is classified as an insect growth regulator. The mode of action for this insecticide is inhibition of chitin synthesis (or interference with the formation of the insect's exoskeleton that is comprised of a protein known as chitin). The likely mechanism is through blockage of chitin synthetase, the ultimate enzyme in the biosynthesis pathway to form chitin (Cohen, 1993), (US EPA, 1997). Diflubenzuron exposure can result in both larvicidal and ovicidal effects either from dermal or dietary exposure. Ovicidal effects can occur via direct contact of eggs or through exposure to a gravid (i.e., pregnant) female by ingestion or dermal routes. Inhibition of chitin synthesis can primarily affect immature insects but can also impact other arthropods and some fungi.

Aquatic species

Diflubenzuron toxicity in fish is considered low based on available data. The LC_{50} values range from 10 mg/L for smallmouth bass to 660 mg/L in bluegill sunfish (Julin & Sanders, 1978), (USDA Forest Service, 2004), (US EPA, 1997), (Willcox & Coffey, 1978). Chronic studies from 30-days to 10 months indicate NOEC values range from 29 – 300 µg/L when tested on various species such as fathead minnow, steelhead trout, guppy (*Poecilia reticulata*), and mummichog (*Fundulus heteroclitus;* (Hansen & Garton, 1982), (Julin & Sanders, 1978).

Aquatic invertebrate sensitivity to diflubenzuron varies among different taxonomic groups. For crustaceans the median lethal concentration varies from 0.75 µg/L in *D. magna* (USDA Forest Service, 2004) to 2.95 µg/L in grass shrimp (*Palaemonetes pugio,* (Wilson & Costlow, 1986). For aquatic insects, values range from 0.5 µg/L in the mosquito (*A. nigromaculatum*; (Miura & Takahashi, 1974) to 57 mg/L in the perloid stonefly *Skwala sp.*; (Mayer & Ellersieck, 1986). For aquatic snails, the median lethal concentration in *Physa sp.* is > 125 mg/L (Willcox & Coffey, 1978).

The NOEC and EC_{50} values for aquatic plants exposed to diflubenzuron are 190 µg/L for duckweed (*L. minor*; Thompson and Swigert 1993), and 200 µg/L (US EPA, 1997) for the green algae, *S. capricornutum*, respectively.

Terrestrial species

Diflubenzuron is not very toxic to mammals via the oral route. The BA discusses the threshold values in more detail (see BA p. 41), but the lowest value was the oral LD_{50} in rats of >4,640 mg/kg (Eisler, 2000). The BA also goes into more detail to discuss diflubenzuron effects on the hematopoietic system as well as neurotoxicity, carcinogenicity, and mutagenicity effects, all indicating diflubenzuron has no impact on these physiological systems in mammals (see BA p 41-42).

Several reproductive and developmental toxicity studies in rats and rabbits provided in the BA also indicate diflubenzuron has effects on maternal blood pathologies at a LOAEL of 25 mg/kg/day (US EPA, 2015) but does not affect other endpoints in these studies (e.g., decreased body weight in offspring, fetal abnormalities).

For birds, acute toxicity data show that diflubenzuron is practically non-toxic to birds, with acute oral LD_{50} values ranging from 2,000 mg/kg to 5,000 mg/kg (Eisler, 2000), (Willcox & Coffey, 1978), (US EPA, 1997) using a variety of species such as the red-winged blackbird, mallard duck, and bobwhite quail.

Several reproductive studies are also available that evaluated chronic effects to a variety of avian species such as mallard duck, bobwhite quail, and chickens (US EPA, 1997), (Kubena, 1982), (USDA Forest Service, 2004), (Smalley, 1976), and (Cecil, Miller, & Corely, 1981). The lowest, most sensitive endpoint value used is the LOEC of 1,000 ppm value for effects on eggshell thickness and egg production in both mallard and bobwhite quail (US EPA, 1997).

Little information is available for toxicity of diflubenzuron to reptiles but likely it is low, thus where reptile data is not available, the avian data is used as a surrogate to estimate sensitivity to reptiles. Diflubenzuron would be expected to be practically nontoxic to reptiles based on the available avian toxicity data.

For amphibians one acute toxicity data indicates low sensitivity to diflubenzuron with a 48-hour LC_{50} of 100 mg/L in *Rana brevipoda porosa* tadpoles (Fryday & Thompson, 2012). Where data are scarce for amphibians, a surrogate approach is to use data for fish for diflubenzuron thus the chronic endpoint for amphibians from a 30-d NOEC value of > 45 µg/L for rainbow trout (Hansen & Garton, 1982) is used to assess chronic effects of diflubenzuron to amphibians.

For terrestrial invertebrates, there are a large amount of data available for diflubenzuron, but toxicity can vary by taxonomic group depending on the Order of insect and the life stage being exposed. Available toxicity data for diflubenzuron exposed to adult honeybees indicates that it is practically non-toxic (Chandel & Gupta, 1992), (Mommaerts, Sterk, & Smagghe, 2006), (Nation, Robinson, Yu, & Bolten, 1986). However, diflubenzuron is moderately to highly toxic to developing bees based on residues reported in pollen but not on nectar or honey (Mullin, et al., 2010). Again, this makes sense considering the mode of action of diflubenzuron. The BA discusses other studies confirming similar results (see BA p.44). Other insect Orders such as grasshoppers, beetles, and Lepidoptera at the immature stages are more susceptible than other terrestrial invertebrates, including the bee species discussed above (Eisler, 2000), (Murphy, Jepson, & Croft, 1994), (USDA Forest Service, 2004). Within this group, grasshoppers appear to be the most sensitive; however, the rates used in the above studies based on label recommendations for Dimilin 2L® are still more than 48-50% more than the rates used in the APHIS program (0.75-1.0 fluid oz/acre; see Table 3-6 in the BA). Diflubenzuron is also moderately toxic to spiders and mites, but there are no listed arachnids in the program action area.

Diflubenzuron treated grasshoppers fed to darkling beetles showed significant mortality but at doses 2,000 times the rate of diflubenzuron applied in the grasshopper/cricket APHIS program (Smith & Lockwood, 2003).

For terrestrial plants, toxicity is low due to low absorption and translocation of diflubenzuron residues on plant surfaces (Eisler, R., 1992). (Hatzios & Penner, 1978) determined exposure to diflubenzuron had no effect on photosynthesis, respiration, and leaf structure of soybeans at doses of up to 0.269 kg a.i./ha.

Toxicity of metabolites of carbaryl, chlorantraniliprole, and diflubenzuron

For carbaryl and chlorantraniliprole, toxicity data indicate the parent compounds are more toxic or have comparable toxicity to the metabolites discussed (see BA page 49 and Table 3-2 and page 59 and Table 3-7). Diflubenzuron has several metabolites that are discussed in detail in the BA (see pages 20 and 39). Environmental degradation of diflubenzuron can result in four primary metabolites, including CO2. The other three are 4-chlorophenyl urea, 2-6, diflurobenzoic acid, and 4-chloroaniline. 4-chloroaniline is slightly more toxic than diflubenzuron to fish and aquatic invertebrates (see p. 39 and Table 3-4). Both 2-6, diflurobenzoic acid and 4-chlorophenyl urea are considered less toxic or comparable in toxicity to diflubenzuron based on available data for fish and aquatic invertebrates (see p. 39 in the BA). 4-chloroaniline has also been shown to be slightly carcinogenic in long-term mammalian studies (a NOEL for 4-chloroaniline was slightly higher than the NOEL for diflubenzuron) (USDA Forest Service, 2004).

Risk Assessment and Effects Determinations

Aquatic Species

The distribution of acute and sub-lethal chronic effects data for fish for carbaryl, chlorantraniliprole, and diflubenzuron are compared to the estimated concentrations in aquatic systems under different applications for the APHIS Program. These values are below the range of response data provided. In addition, where data are not available for any program insecticide for aquatic phase amphibians, fish toxicity data is used as discussed above and below in the "Terrestrial Species" section of this document. The residues estimated using AgDrift also suggests that direct acute and sublethal risk of exposure to fish in small, static waterbodies is not expected. Estimated expected residues would range from 0.09 – 1.14 µg/L for carbaryl, 0.009 – 0.4 µg/L for chlorantraniliprole, and 0.007 – 0.21 µg/L diflubenzuron, (see Figures 4-1, 4-2, and 4-3 and Table 2-3 of the BA) when different buffer sizes are applied for the different application types. Field data collected from monitoring of program applications also support these findings (see discussions in BA p. 66 and 75 for carbaryl and diflubenzuron, respectively). The BA also discusses actual run-off related residues from program applications for carbaryl and diflubenzuron from different years and different states (2003 – 2022; see p. 27-30 in the BA).

These values also indicate the measured environmental concentrations in waterbodies within the standard 500-foot buffer or several miles downstream from the application site are still well below the effect data thresholds for aquatic organisms.

For indirect effects, consumption of contaminated prey or loss or reduction in prey items is also not expected to adversely impact fish based on low residues and a low bioconcentration factor (BCF) value for carbaryl (15; values greater than 1,000 are considered to bioconcentrate whereas values lower than 20 are considered compounds with very little ability to bioconcentrate) (USDA Forest Service, 2008). Based on the distribution of available fish and aquatic invertebrate toxicity data for carbaryl, chlorantraniliprole, and diflubenzuron, and the estimated residues discussed above, the adverse risks of exposure to prey items for listed fish species such as other fish or aquatic invertebrates are not expected based on the different application scenarios modeled in the BA. For aquatic plants, risk is discussed with respect to providing habitat and food for other aquatic species. For carbaryl, chlorantraniliprole, and diflubenzuron, no adverse impacts to aquatic plants are anticipated, and residues in water are anticipated to be 400-1600 times below the NOEC value for carbaryl (see BA p. 65), four orders of magnitude below the lowest effect concentration (see BA p. 82) for chlorantraniliprole, and 2,000 times below the NOEC concentrations for diflubenzuron (see BA p. 74).Therefore, the proposed action is not likely to adversely affect listed aquatic species because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on aquatic species, such that the effects cannot be meaningfully measured, detected, or evaluated.

Terrestrial Species

For the terrestrial vertebrate risk characterization, insecticide exposure was considered based on the most significant route: ingestion through the diet. Exposure can also occur through dermal contact, ingestion from preening, and water consumption, but the extent of exposure through these means is expected to be minor in comparison to that of ingestion of pesticides through diet. Exposure levels on different types of vegetation or other terrestrial non-target invertebrates as dietary items were calculated using the Terrestrial Residue Exposure Model (T-REX) (US EPA, 2012). To assess the acute and chronic risk to mammals, the most sensitive acute and chronic endpoints were used and compared to the T-REX estimated residues on dietary items with consideration for the size of the bird or mammal. Indirect risk to mammals was evaluated by reviewing impacts on habitat or prey base. For carbaryl, direct effects to mammals of all class sizes that feed on grasses, RQ values exceeded 1 (i.e., likely to cause adverse effects). For chlorantraniliprole, RQs were below 1 (i.e., not likely to cause adverse effects) for all mammalian class sizes and for diflubenzuron, there is a slight risk to small mammals consuming short grass (see Table 4-8 in the BA). For indirect effects for all three pesticides, there is some concern for those mammals that rely on terrestrial invertebrate as prey items than for those consuming terrestrial or aquatic plants or other small mammals (see p. 69, 83, and 77 in the BA). However, the proposed action is not likely to adversely affect listed mammals because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on mammals, such that the effects cannot be meaningfully measured, detected, or evaluated.

To assess the acute and chronic risk to birds the most sensitive acute and chronic endpoints were used and compared to residue values on respective dietary items (based on the size of the bird), estimated using T-REX calculations discussed on pages 69, 78, and 84 to generate RQ values. RQs greater than 1 were reduced by implementing the proposed buffers to address impacts from program insecticides. For carbaryl, which shows a slight acute risk to birds that consume contaminated prey (see Table 4-5 p. 70 in the BA), additional buffers for carbaryl applications were applied for known locations of adults (see Appendix A–9).

Indirect risk to birds was evaluated by reviewing impacts on habitat or prey base. For carbaryl, direct effects to birds in the 20 and 100 g class sizes that feed on grasses, had RQ values exceeding 1 as mentioned above (see Table 4-5). For chlorantraniliprole and diflubenzuron, RQs were below 1 for all avian class sizes (see p. 69, 84, and 78 in the BA). For indirect effects for all three pesticides, RQ values discussed for small mammals which could be prey items for larger birds, are discussed above. For small birds as prey items for other avian species, RQ values are discussed above as well. For bird species that feed on insects, RQ values were >1 for 20 g and 100 g birds for carbaryl, but were well below 1 for chlorantraniliprole and diflubenzuron (see p. 69,70, 76, and 84). Indirect effects to bird species based on impacts to dietary items (insects) for insectivorous birds from exposure to diflubenzuron is also discussed. However, the rates used in the APHIS Program are such that they would not reach levels or concentrations that would significantly reduce the availability of prey items for these avian species.

Therefore, the proposed action is not likely to adversely affect listed birds because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on birds, such that the effects cannot be meaningfully measured, detected, or evaluated. There are no data for all three pesticides used in the APHIS program to assess risks of exposure to reptiles. Although there is uncertainty in making the assumption that the range of sensitivities for birds is representative for reptiles, we make this assumption in the absence of data. Based on the risk characterization and conclusions described above for birds, for both direct and indirect effects, we expect that all three pesticides will have insignificant effects on listed reptile species.

Therefore, the proposed action is not likely to adversely affect listed reptiles because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on reptiles, such that the effects cannot be meaningfully measured, detected, or evaluated.

For amphibians, direct risk of exposure was determined by using the highest aquatic concentration in water and comparing that to the acute and chronic values for each pesticide used in the APHIS program. For carbaryl, the highest value in water used was the value discussed above for bait considerations and compared to the toxicity threshold values discussed below for the carbaryl bait application exposures. For chlorantraniliprole, there are no data for amphibians. Instead, we rely on the fish toxicity data. This assumption is similar to using the toxicity data for birds to represent effects for reptiles. While this approach has uncertainty associated with whether the data capture the range of sensitivities to amphibians from chlorantraniliprole, we make this assumption based on the risk characterization described above for fish exposed to chlorantraniliprole. Chlorantraniliprole toxicity in fish is considered low based on available toxicity data reporting mortality above the solubility limit (1 mg/L). Two early life-stage tests in the rainbow trout (*Onchorhynchus mykiss*) and sheepshead minnow (*Cyprinodon variegatus*) showed chlorantraniliprole may have effects at 0.11 and 1.28 mg/L, respectively.

For diflubenzuron, using the fish data, the 30-d NOEC value of > 45 µg/L for rainbow trout (Hansen & Garton, 1982) is compared to the highest residue calculated (0.04 µg/L; described in Section II in the BA). Indirect effects to amphibians can include loss of habitat and dietary items. For habitat, effects to terrestrial and aquatic plants were considered. Carbaryl, chlorantraniliprole, and diflubenzuron at all program rates poses minimal risk to aquatic and terrestrial plants. This is discussed more in the BA on pages 65, 73, 74, 81, 82, and 85 for the program chemicals. For amphibians that feed on aquatic invertebrates or other aquatic vertebrates, risk of exposure from all three program insecticides is discussed above in the "Aquatic Species" section of this Risk Characterization. We anticipate that the effects to these species will be insignificant because pesticide residues for aquatic plants, aquatic invertebrates, or fish do not exceed any toxicity endpoint for these taxonomic groups. For the potential indirect terrestrial route of exposure to amphibians, terrestrial invertebrates could serve as a food source for amphibians (see below discussion). However, the selectivity of diflubenzuron to developing insects would not cause significant decreases in food availability for amphibians, nor does it bioconcentrate if an amphibian were to consume a contaminated insect. Similarly, for carbaryl or chlorantraniliprole, these insecticides do not bioconcentrate. Carbaryl is very highly toxic to insects at label rates (see discussion in BA), and chlorantraniliprole is most toxic to those developing insects such as Lepidoptera and Coleoptera larvae via ingestion and not as toxic via contact exposure (see BA p. 63). Thus, the reduced program application rates would not eliminate the insect prey base entirely and would not reduce the availability of prey items to amphibians in other insect Orders from exposure to carbaryl or chlorantraniliprole. In addition, chlorantraniliprole is not toxic to soil dwelling invertebrates such as isopods, or earthworms (see BA p. 63), which could also be considered for terrestrial based dietary items for amphibians.

Therefore, the proposed action is not likely to adversely affect listed amphibians because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on amphibians, such that the effects cannot be meaningfully measured, detected, or evaluated.

For terrestrial invertebrates, risk of exposure from all three program insecticides differs among various insect Orders. This is discussed in more detail on pages 72, 73, 79, and 85 in the BA. A variety of field studies under a variety of application setting, including monitoring from the APHIS program applications have been conducted and demonstrate minimal residues of diflubenzuron. Minimal to no impacts to non-target arthropods such as honey bees, moths, and other insect Orders such as Coleoptera, Diptera, Trichoptera, Heteroptera, Homoptera, Neuroptera, and Plecoptera were demonstrated from diflubenzuron exposure (Emmett & Archer, 1980), (Atkins, Anderson, Kellum, & Heuman, 1976), (Johansen, Mayer, Eves, & Kious, 1983), (Schroeder, Sutton, & Beavers, 1980), (Robinson A. F., 1979) (Deakle & Bradley, 1982), (Sample, Cooper, & Whitmore, 1993), (Catangui, Fuller, & Walz, 1993), (Weiland, Judge, Pels, & Grosscourt, 2002), (Tingle, 1996) (Graham, Brasher, & Close, 2008). In addition, the extensive buffers determined via AgDrift modeling and confirmed with field assessments indicates the proposed buffers from 250 ft for ground applications and up to 1 mile for some aerial applications (buffers of 1,320 ft reduce drift by approximately 89-98%; see BA p. 73) address the impacts to listed terrestrial invertebrates within the program action area. In addition, the program applications rates (0.75 fl. oz/ acre and 1.0 fl. oz/acre for ground and aerial applications, respectively) are well reduced from label rates recommended for Orthoptera, Coleoptera, Homoptera, and Lepidoptera (see Table 3-6 in the BA) and combined with the aforementioned extensive buffers indicates very minimal risk of adverse effects to listed terrestrial invertebrates within the action area.

Therefore, the proposed action is not likely to adversely affect listed terrestrial invertebrate species because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on terrestrial invertebrate species, such that the effects cannot be meaningfully measured, detected, or evaluated.

Risk of adverse effects to terrestrial plants from all three APHIS program insecticides is considered minimal. Based on the available toxicity data discussed above for carbaryl, chlorantraniliprole, and diflubenzuron, phytotoxic effects are not anticipated from program insecticide applications. However, potential indirect effects of carbaryl on pollinators is considered. As discussed above in the Effects of the Action section for carbaryl and terrestrial invertebrates, laboratory studies have indicated several species of honeybees and bumblebees are sensitive to carbaryl, but these are at rates above those used in the program, and effects have not been measured extensively in field studies. One study based on a carbaryl application rate of 0.80 lb a.i./acre in a fruit orchard indicated no effects on honeybee mortality or behavior 7 days post application. Any potential impacts to honey bees or bumble bees may also be mitigated by the reduced application rates for the program, the RAATs (alternating swaths where the insecticide is applied), as well as use of carbaryl bait as opposed to ground or aerial spray applications (Peach, Alston, & Tepedino, 1994), (Peach, Alston, & Tepedino, 1995).

Indirect risk to terrestrial plants from impacts to pollinators from chlorantraniliprole is not expected to be significant. Grasshopper nymphs appear to be the most impacted compared to other insect groups. Various laboratory and field data indicate low toxicity to other insect groups such as honeybees and bumblebees (i.e., those groups more likely to be pollinators to terrestrial plants), where no mortality or sublethal effects were observed (see Effects of the Action section for terrestrial invertebrates discussed above), and application rates 4 to 10 times higher than program rates are shown to have better efficacy in controlling Lepidoptera and other insect pests. Indirect risk to terrestrial plants is also not expected from impacts to pollinators from diflubenzuron. As discussed above in the Effects of the Action section for terrestrial invertebrates, a variety of field studies under a variety of application settings, including monitoring from the APHIS program applications, have been conducted and demonstrate minimal residues of diflubenzuron have minimal to no impacts to non-target arthropods such as honeybees, moths, and other insect Orders. Negative effects have been observed in honeybees in some studies, but this was observed at application levels and periods of time that exceed those expected to be used in the program. (Robinson & Johansen, 1978) found that diflubenzuron application rates as high as 0.125 to .25 lbs. a.i./acre (10 and 20 times the program rate for diflubenzuron) resulted in no effect on adult mortality and brood production in honeybees. As discussed above, the use of RAATS provide additional protection by limiting the area of treatment within the spray block to further reduce the potential risk of exposure to pollinators.

Therefore, the proposed action is not likely to adversely affect listed terrestrial plant species because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on terrestrial plant species, such that the effects cannot be meaningfully measured, detected, or evaluated.

Bait Applications of Carbaryl

Bait formulations of carbaryl are primarily composed of a grain such as wheat bran or rolled whole grain or a pellet mixed with the carbaryl. They are used mostly to control crickets as some species of grasshopper do not eat the bait, but some other advantages are that they primarily act through ingestion, affect fewer non target organisms, and generate very little drift (Foster, 1996), (Latchininsky & Van Dyke, 2006), (Peach, Alston, & Tepedino, 1994)

For bait applications of carbaryl, direct risk of exposure to mammals was calculated using the LD_{50}'s per square foot method described in the BA (Section IV A. Insecticide Risk Assessment Methodology). When the LD_{50} per square foot is greater than 1, there is an assumed risk as a conservative estimate that the mammal (or bird as the same approach is used for birds) will consume the entire bait. RQs were above 1 for all mammals except the 1,000 g group, when no application buffer is applied. With an adjusted buffer of 500 feet, the RQs are below 1.0 for all mammalian size classes (see Table 4-3 and p. 68 in the BA), and all estimated residues from bait applications are anticipated to be below the acute NOEL value (10mg/kg).

Therefore, the proposed action is not likely to adversely affect listed mammals because the proposed conservation measures are expected to lower the estimated environmental concentrations of carbaryl bait to levels that would have an insignificant effect on mammals, such that the effects cannot be meaningfully measured, detected, or evaluated.

For carbaryl bait applications, direct risk of exposure to birds was also assessed. The lowest acute avian LD_{50} value of 16 mg/kg (European starling; see Carbaryl toxicity section discussed above) was used. RQ values were greater than 1 for all size classes without an application buffer; however, drift reductions are observed when a 500-ft buffer is applied, and RQ values fall below 1 (see Table 4-6 in the BA). As previously discussed, we assume similar impacts from carbaryl bait applications to reptiles as to that of birds. Indirect effects from carbaryl bait to both mammals and birds are also not expected. We do not expect indirect effects to plants used as habitat or dietary items for birds and mammals; we also do not expect indirect effects to small mammals, small birds, or terrestrial invertebrates exposed to carbaryl bait used as dietary items for birds and mammals. This discussion is covered in more detail in the BA p 68-73.

Therefore, the proposed action is not likely to adversely affect listed birds because the proposed conservation measures are expected to lower the estimated environmental concentrations of carbaryl bait to levels that would have an insignificant effect on birds, such that the effects cannot be meaningfully measured, detected, or evaluated.

Direct risk of exposure to amphibians from carbaryl bait applications was assessed by taking the highest estimated concentration of carbaryl in an aquatic system (1.10 µg/L) and comparing that to the acute and chronic values for amphibians. Impacts of carbaryl bait applications on amphibians are minimal based on the LC_{50} values reported for tadpoles (1.73–22.02 mg/L) at approximately 1,572 to 20,018 times below the highest calculated carbaryl residue, suggesting minimal acute risk of bait applications (and ULV applications based on the same toxicity endpoint used for both application methods). Sublethal effects to amphibians are also not anticipated based on chronic studies with a NOEC for swimming behavior of 1.25 mg/L and a tadpole NOEC for mean age at metamorphosis (0.16 mg/L).

Therefore, the proposed action is not likely to adversely affect listed amphibians because the proposed conservation measures are expected to lower the estimated environmental concentrations of carbaryl bait to levels that would have an insignificant effect on amphibians, such that the effects cannot be meaningfully measured, detected, or evaluated.

Direct risk of exposure to terrestrial invertebrates from carbaryl bait applications is considered but is less likely to impact most Orders of terrestrial insects. Studies with carbaryl bran bait have found that no sublethal effects were observed on adult or larval alfalfa leaf cutting bees (Peach, Alston, & Tepedino, 1994), (Peach, Alston, & Tepedino, 1995) and see also p. 73 in the BA). Carbaryl bait also poses a low risk to most insect Orders as it is preferentially consumed by grasshoppers. There also is less exposure to Hymenoptera or Lepidoptera because the active ingredient is contained in the bait and not available for dietary or contact exposure (it is not sprayed) and would not be found on floral resources that would be visited by Lepidoptera or Hymenoptera during normal activities.

Therefore, the proposed action is not likely to adversely affect listed terrestrial invertebrate species because the proposed conservation measures are expected to lower the estimated environmental concentrations of carbaryl bait to levels that would have an insignificant effect on terrestrial invertebrate species, such that the effects cannot be meaningfully measured, detected, or evaluated.

Critical Habitat

For critical habitat, APHIS reviewed the primary constituent elements (PCEs) or physical and biological features (PBFs) to determine if the program activities would cause destruction or adverse modification of these features. For many species, designated critical habitat PCEs or PBFs are aspects of the physical landscape such as geomorphological features, soil types, hydrologic regimes, as well as the necessary vegetative features. None of the program insecticides are expected to impact geomorphological formations or hydrologic regimes. Other PCEs or PBFs for certain species involve an adequate source of invertebrate prey items (many listed bird species and fish), specified water quality parameters for certain aquatic species to support a healthy system (pH, adequate dissolved oxygen, low salinity, lack of pollutants, low turbidity, low ammonia, etc.), and the absence of predators or invasives.

As discussed earlier, there is minimal risk to designated critical habitat PCEs or PBFs involving any vegetative structures for habitat or other plants these species may rely on for feeding, breeding, or sheltering, because the program's proposed use of the insecticides is not expected to result in phytotoxic effects.

There is some risk that the program activities could affect designated critical habitats with PCEs or PBFs described as an adequate prey base of terrestrial invertebrates or aquatic invertebrates. However, the standard program mitigation involving 500 ft buffers for aerial applications, 200 ft buffers for ground applications, and 50 ft for bait applications to all water bodies will minimize the impacts to aquatic invertebrate prey items from drift. Table 5-2 in the BA provides a list of all proposed buffers to protect fish and designated critical habitats. Program designated buffers and reduced application rates along with RAAT applications will also minimize impacts to the terrestrial invertebrate prey base for designated critical habitats. For example, because nesting success and brood survival are directly linked to adequate invertebrate prey available to developing lesser prairie chicken chicks, and ultimately lesser prairie chicken success, adequate buffers protecting lesser prairie chicken are warranted. Adults rely on a variety of food items throughout the year but predominantly vegetation during the fall, winter, and early spring (US FWS, 2012). Additional buffer distances to protect leks and allow for adequate prey items for adults and developing chicks were applied for carbaryl, as it demonstrated some toxicity to terrestrial invertebrates as discussed above (see also p. 52-53 and 93 in the BA). Similar mitigations are also applied for other prairie birds, such as the Gunnison and greater sage grouse.

Therefore, the proposed action is not likely to adversely affect designated critical habitat PCEs or PBFs because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on designated critical habitat PCEs or PBFs, such that the effects cannot be meaningfully measured, detected, or evaluated.

Summary and Conclusion

APHIS evaluated their grasshopper and Mormon cricket suppression program application of three insecticides, carbaryl, chlorantraniliprole, and diflubenzuron to listed species and their designated critical habitat as applicable. They provide an overview of the exposure and response analyses for terrestrial and aquatic invertebrate and vertebrate groups, as well as plants, and considered all the relevant pathways of exposure for each. As such they established several avoidance and minimization measures to ensure that the use of these insecticides for their program activities is not likely to adversely impact listed species and their designated critical habitat as applicable. APHIS ensures that buffers established based on modeled estimates and program application data will be applied during all program activities. In addition to substantial buffers used within species' ranges and designated critical habitats, reduced program application rates and RAAT treatment methods will minimize direct and indirect risk of adverse effects from exposure of pesticides to listed mammals, birds, reptiles, amphibians, fish, terrestrial insects, aquatic invertebrates, and plants. Therefore, the proposed action is not likely to adversely affect listed species and designated critical habitat because the proposed conservation measures are expected to lower the estimated environmental concentrations of these pesticides to levels that would have an insignificant effect on these species and their designated critical habitats.

Aquatic Species

For all listed aquatic species within the program action area, the following buffers are applied for each pesticide (Table 1, adapted from Table 5-2 see also Appendix A-9 in the BA or Enclosure B):

Table 1. Proposed Application Buffers for Aquatic Species and designated Critical Habitat Based on Application Method

Insecticide	Application type	Application buffer (feet)
Carbaryl	Aerial (ULV*)	2640
	Aerial Bait	750
	Ground	300
	Ground Bait	100
Chlorantraniliprole	Aerial (ULV*)	500
	Ground	200
Diflubenzuron	Aerial (ULV*)	1320
	Ground	200

*ULV = ultra-low volume

The estimated residues from the application methods and application concentrations in Table 1 are the expected range of concentrations where adverse effects to fish or amphibians are expected to occur. These buffers are applied as such because they are protective of all aquatic species as well as their designated critical habitats, as applicable, and any indirect effects to listed fish species' prey items such as aquatic invertebrates, or terrestrial invertebrates (which are more sensitive; see Figures 2-2, 2-3, and Table 2-3 in the BA for how these buffer distances were determined) are also minimized.

Terrestrial Species

For all listed terrestrial species within the program action area, the following buffers are applied for each pesticide (Table 2, see also Appendix A-9 in the BA or Enclosure B). We provide a range of buffers to demonstrate the differences that exist among the taxonomic groups described in the BA in terms of direct sensitivities to the insecticides as well as the indirect effects to dietary items upon which a species may rely and that may be integral to their survival and overall population level success (see p. 88-89 and p. 93 in the BA).

Table 2. Proposed Ranges of Application Buffers for Terrestrial Species and Designated Critical Habitat

Insecticide	Application type	Application buffer range (feet)
Carbaryl	Aerial (ULV*)	500 - 5,280
	Aerial Bait	500 - 750
	Ground	100 - 5,280
	Ground Bait	50 - 5,280
Chlorantraniliprole	Aerial (ULV*)	500 - 5,280
	Ground	50 - 5,280
Diflubenzuron	Aerial (ULV*)	500 - 5,280
	Ground	50 - 5,280

*ULV = ultra-low volume

Bait Applications for Carbaryl

Run-off or drift from bait applications to water bodies is expected to be minimal as the active ingredient is contained within the bait/bran or grain mix and not susceptible to off-site transport via rain events or volatilization. Labels for carbaryl also do not allow the product to enter water bodies, and thus, to preclude the possibility of the bait moving into aquatic systems, there are standard buffers for water bodies used for all program activities, regardless of the presence of listed species or critical habitat. An example of such a scenario is described on p. 28 in the BA, where carbaryl was detected downstream from where bait applications were made when an area that was treated was irrigated. Residues were measured upstream and downstream of the discharge. Residue values upstream were 1.2 µg/L while residue values at 5.5 and 8.0 miles below the discharge were 2.0 and 1.6 µg/L, respectively. However, there is uncertainty regarding whether these values represent any contribution from APHIS applications.

APHIS also implements additional buffers for water bodies that are not designated as critical habitat for listed aquatic species: 500-foot buffer for aerial sprays, 200-foot buffer for ground sprays, and a 50-foot buffer for bait applications. Thus, the buffers for bait applications of carbaryl for aquatic species are uniformly applied for all species (see Appendix A-9 in the BA, Enclosure B, and Table 1 above) and are sufficiently protective to avoid the likelihood of any adverse effects.

Buffers for bait application of carbaryl vary by terrestrial species taxonomic group and habitat (see Appendix A-9 in the BA, Enclosure B, and Table 2 above). These buffers are generally less distance than for aerial or other ground application methods, except for what is applied for prairie birds or riparian mammals (see discussion below and on p. 93 in the BA, Appendix A-9 in the BA, or Enclosure B), as this application method results in less drift and therefore subsequently less exposure (see p. 6-7 in the BA). In addition, the nature of the bait is also such that because it is a solid and absorbed by the bran or other carrier (see p. 6 in the BA for bait preparation methods), it is less bioavailable, especially for potential dermal contact exposure for all terrestrial species. Drift reductions expected for all size classes of mammals and birds from the application of a 500-ft buffer are estimated at greater than 99% (see Tables 4-3 and 4-6 in the BA). For terrestrial invertebrates, program buffers for bait applications are similar to that of mammals and birds. Any indirect effects to listed species' prey items are discussed above for the different taxonomic groups, and effects to designated critical habitat for listed species from carbaryl bait applications is also expected to be insignificant.

As a result of the APHIS program conservation measures such as use of the buffer distances discussed above for all taxonomic groups and their designated critical habitats, as applicable, along with the reduced application rates as compared to label rates for each insecticide, and RAAT treatment procedures, any risk of exposure associated with the application of the three insecticides used under the APHIS grasshopper and Mormon cricket suppression program is expected to be minimal. Thus, any direct or indirect effects from the proposed action to listed species and their designated critical habitats are expected to be insignificant due to program conservation measures.

This concludes consultation. As stated in 50 CFR § 402.16, reinitiation of consultation is required and shall be requested by APHIS or the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) If new information reveals effects of the action that may affect listed species or critical habitat in a manner to an extent not previously considered; (2) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter; or (3) If a new species is listed or critical habitat designated that may be affected by the identified action.

We appreciate the collaboration your staff has provided. If you have any questions, please contact Sara Pollack at (703) 358-2371 or sara_pollack@fws.gov or Keith Paul at (703) 358-2675 or keith_paul@fws.gov in the Branch of National Consultations.

Sincerely,

JANE LEDWIN Digitally signed by JANE LEDWIN Date: 2024.03.21 19:47:50 -04'00'

Jane Ledwin
Chief, Branch of National Consultations
Ecological Services Program

Enclosures

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