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Draft Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program

Carbon, Emery, Grand & San Juan Counties, Utah

PPQ and CEQ Identification Number: UT-26-05-EA26-005-32-24P-1753184113

Austrian pine and range total defoliation G. Abbott 6/12/24

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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
UDAF	Utah Department of Agriculture and Food
UDWR	Utah Division of Wildlife Resources
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

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Draft Site-Specific Environmental Assessment

Rangeland Grasshopper and Mormon Cricket Suppression Program
Carbon, Emery, Grand & San Juan Counties, Utah

I. Need for Proposed Action

A. Purpose and Need Statement

An infestation of grasshoppers or Mormon crickets may occur in Carbon, Emery, Grand, and San Juan Counties, Utah. The Animal and Plant Health Inspection Service (APHIS) 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 summer). 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. Some benefits of preventing high populations of grasshoppers include saving rangeland forage for wildlife and livestock feeding, along with preventing the loss of sensitive plant species by herbivorous insects.

Rural economies depend on rangelands for productive forage to provide for wildlife and livestock grazing. A reduction in forage has a significant impact on cattle health and weight 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.

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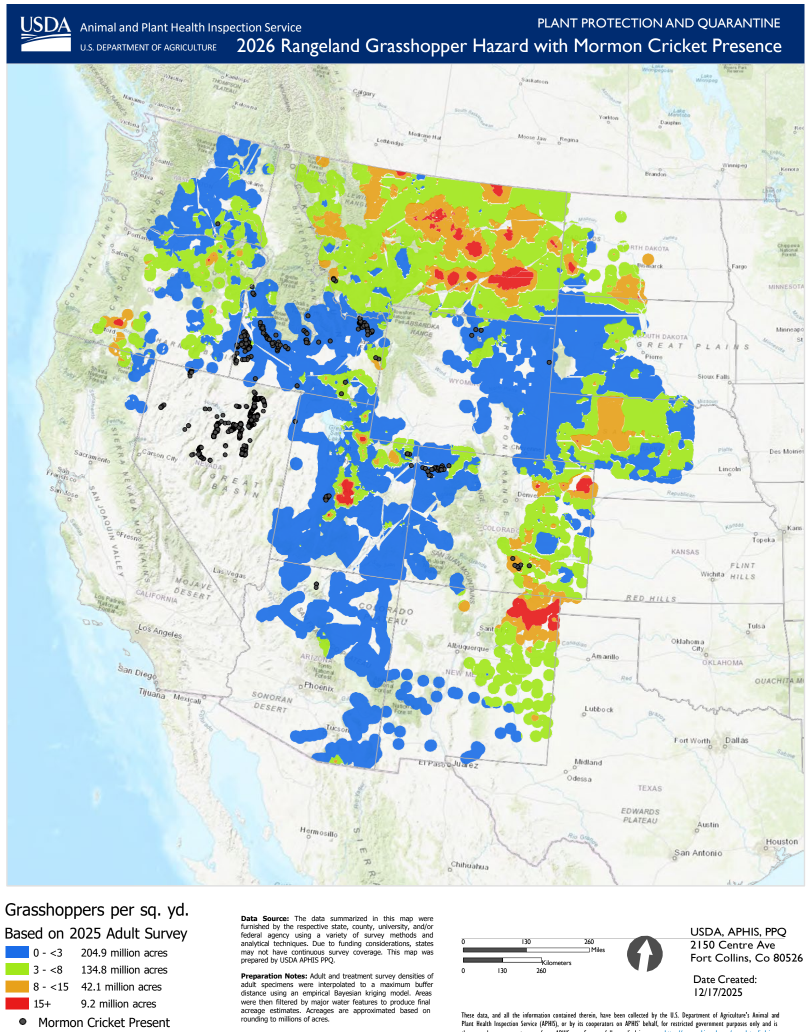
Figure 1. 2026 Rangeland Grasshopper Hazard With Mormon Cricket Presence Map



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. This EA analyzes potential effects of the proposed action and its alternatives. This EA applies to a proposed suppression program that would take place from May 1st to September 30th in Carbon, Emery, Grand, and San Juan Counties, Utah. Areas to be excluded from treatments are listed in section III.B of this EA.

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 future possible Control Programs for Carbon, Emery, Grand, and San Juan Counties, Utah.

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

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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 2). Action thresholds can be developed in a variety of ways including subjective determinations based on local experience, to objective functions of the EIL.

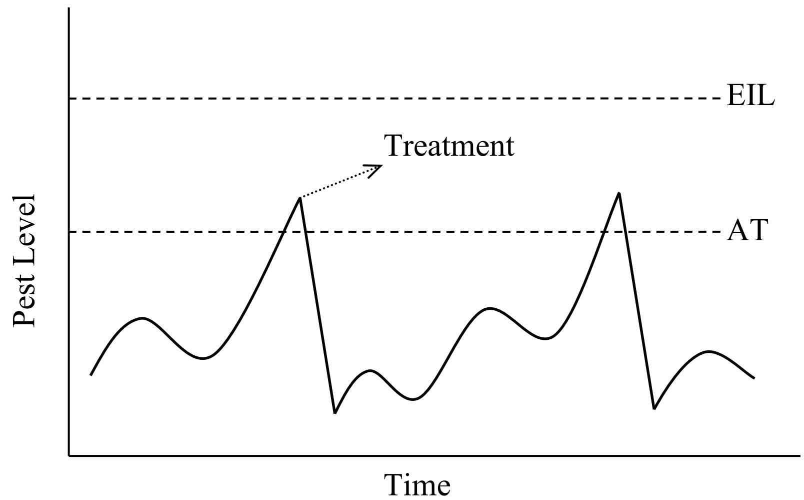

Figure 2. Diagram of the typical relationship between the economic injury level (EIL) and action threshold (AT) for applying pest treatments (Rashford et al., 2012).

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. Prevention of overgrazing, cultural

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disruption of egg beds (i.e., raking or disking), biological control and irrigation where possible, all help to prevent grasshopper infestations. 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

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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. Grasshopper surveys in Utah typically begin in May or early June and continue into August and September. 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. This information is typically collected, accumulated and analyzed each year in some detail by the land managing entity. It includes grasshopper species complex, population densities, dominant life stage, and local weather conditions. Other criteria for determining necessity and prioritization of treatments include public safety issues (paved roads and freeways), threatened crop areas, grazing usage, and possible urban impact. Surveys also include hazard (water, structures, topography, vegetation, etc.) determination for buffers or elimination of areas all together. Private landownership and their willingness to pay also plays a role, especially when private property fills in the holes of a larger treatment area. These are all factors that are considered when determining the economic injury level of the potential treatment area.

In Utah, the year 1848 saw a large outbreak of Mormon crickets which threatened the crops of the Mormon settlers in the Salt Lake Valley. According to traditional accounts, numerous California Gulls appeared and ate mass quantities of crickets over a two week period. The California Gull was later made the state bird of Utah in remembrance of this event. Utah's next largescale grasshopper outbreak occurred in 1890, lasting about twelve years. Grasshoppers next became an issue in the 1930s during the Dust Bowl, and this infestation lasted nearly sixteen years. Close to forty years later, another large outbreak of grasshoppers began in the 1980s and lasted over ten plus years. Overall, large scale grasshopper infestations in Utah occur every 30-40 years, persisting for ten or more years before populations decrease. Since 2017, surveys have shown Grand and Carbon to have two years of small-scale grasshopper outbreaks in parts of both counties during the time period. The other counties covered by this EA could experience grasshopper outbreaks in the future.

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. There are eight to ten economically impacting species of grasshoppers in Utah which can begin hatching in April all the way through mid-August, depending upon the species. Treatment must take place during early nymphal development in order to be effective, so timing of treatment is imperative albeit difficult to predict due the dynamic nature of infestations and the short life span of Orthopterans. There is always the need to respond quickly when a determination is made that treatment is warranted. In the Description of the Affected Environment section below (Chapter III, section A), 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 in Carbon, Emery, Grand, and San Juan Counties 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 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).

The Utah Agricultural Code, Section 4-35, provides for certain actions authorized by this "Insect Infestation Emergency Control Act." It authorizes the Utah Commissioner of Agriculture to appoint members to a Decision and Action Committee who are directly affected and involved in the current insect infestation emergency. The committee establishes a system of priorities for any insect infestation emergency. Members of USDA, APHIS, PPQ in Utah have served on the committee and have been asked to help address the grasshopper and Mormon cricket problem which this document analyzes. The Commissioner of Agriculture, with the consent of the governor, typically prepares a declaration explaining how the current infestation jeopardizes property, lists recourses, and designates actions based on APHIS surveys of the affected areas. This has initiated operations to control the problem in those designated areas and has led APHIS to enter into a cooperative agreement with the Utah Department of Agriculture and Food (UDAF) to cooperatively attack the infestations and mitigate consequences related thereto.

In January 2022, APHIS and the Bureau of Land Management (BLM) signed a memorandum of understanding (MOU) detailing cooperative efforts between the two groups on suppression of grasshoppers and Mormon crickets on BLM lands (Document # 22-8100-0870-MU, January 11, 2022). This MOU clarifies that APHIS will prepare and issue to the public site-specific environmental documents that evaluate potential impacts associated with proposed measures to suppress economically damaging grasshopper and Mormon cricket populations. The MOU also states that these documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the BLM.

The MOU further states that the responsible BLM official will request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on BLM land is necessary. The BLM must also prepare a Pesticide Use Proposal (Form FS-2100-2) for APHIS to treat infestations. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document and BLM prepares and approves the Pesticide Use Proposal.

In August 2024, APHIS and the Forest Service (FS) signed an MOU detailing cooperative efforts between the two groups on the suppression of grasshoppers on FS system lands (Document # 24-8100-0573-MU, August 16, 2024). This MOU clarifies that APHIS would prepare and issue to the public site-specific environmental documentations that evaluate potential impacts associated with the proposed measures to suppress economically damaging grasshopper populations. The MOU also states that these documents would be prepared under the APHIS NEPA implementation procedures with cooperation and input from the FS.

The MOU further states that the responsible FS official would request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on FS land is necessary. The FS must also prepare a Pesticide Use Proposal (Form: FS-2100-2) for APHIS to treat infestations. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document and FS prepares and 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. Other land management practices available to landowners to suppress pestiferous grasshopper outbreaks which are researched and provided by USDA in the GIPM, include:

- Altering grazing practices such as intensity and timing;
- Increasing thatch and biomass at the soil level to create conditions conducive to grasshopper parasites and diseases;
- Reducing weeds and erosion to limit adult egg laying sustenance and habitat;

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- Tilling or prescribed fire to increase non-viability of eggs in soil;
- Encouraging kestrel nesting sites and other insectivorous vertebrate predator species.

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) guidance[1] 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 Chapter I section B.2. of this EA, 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 Carbon, Emery, Grand, and San Juan Counties, 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. If treatments occur on Tribal lands intergovernmental agreements between APHIS and cooperators with Tribal Nations may preclude 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 Nations.

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[1] This EA was started prior to the Council on Environmental Quality (CEQ)'s rescission of its NEPA implementing regulations in 40 C.F.R. parts 1500-1508, which became effective on April 11, 2025. On February 19, 2025, CEQ issued a memorandum regarding the implementation of NEPA and stated that "although CEQ is rescinding its NEPA implementing regulations at 40 C.F.R. parts 1500-1508, agencies should consider voluntarily relying on those regulations in completing ongoing NEPA reviews." Feb. 19, 2025 CEQ memorandum available at https://ceq.doe.gov/docs/ceq-regulations-and-guidance/CEQ-Memo-Implementation-of-NEPA-02.19.2025.pdf. USDA APHIS PPQ is following this guidance. The Agency used the CEQ NEPA implementing regulations in place as of July 1, 2024 to prepare this EA.

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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 Utah.

When the program receives a treatment request and determines that treatment is necessary, the specific site within the state will be evaluated to determine if environmental factors were thoroughly evaluated in the Draft EA. If all environmental issues were accounted for in the Draft EA, the program will prepare a Final EA and FONSI. Once the FONSI has been finalized copies of those documents will be sent to any parties that submitted comments on the Draft EA, and to other appropriate stakeholders. To allow the program to respond to comments in a timely manner, the Final EA and FONSI will be posted to the APHIS website.

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 a draft of this EA available for a 30-day public review and comment period. Public outreach notification methods for this EA include local newspapers – Deseret News and Salt Lake Tribune; APHIS website; Stakeholder Registry Notice; and public meetings. After reviewing and considering all timely received comments, APHIS will issue a decision and will notify the public of the decision using the same methods as for the advertising the availability of the Draft EA.

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). Scoping is different from the public notice, Draft EA 30-day comment period and our responses in the Draft EA. Scoping occurred before the EIS was written and was part of our stakeholder engagement before writing the Draft EA, for example, meetings occurred with beekeeper associations, local rancher/farmer groups and County Commissions.

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 has received numerous comments through emails, phone calls, texts and in-person meetings. APHIS reviewed and considered all comments in preparing the draft EA, and the vast majority advocated the suppression of damaging grasshopper infestations in order to protect homes and gardens, recreational vehicle campgrounds, agricultural resources, rangeland grazing resources for wildlife and livestock and to minimize the destruction of sensitive plant species.

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

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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 two pesticides (carbaryl and diflubenzuron). 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; and
3. **Alternative 3**: Preferred alternative updates the information and allows use of two pesticides (carbaryl and diflubenzuron). 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 Carbon, Emery, Grand, and San Juan Counties, Utah to analyze more site-specific impacts. The EA tiers to the 2019 programmatic EIS and incorporates by reference the carbaryl and diflubenzuron HHERAs also published in 2019. Copies of the 2019 programmatic EIS and ROD are available for review at 1860 West Alexander St., West Valley City, UT 84119. 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 Carbon, Emery, Grand, and San Juan Counties, Utah. 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 Conventional Rates or Reduced Agent Area Treatments with Adaptive Management Strategy (Preferred Alternative)

Under Alternative B, the Preferred Alternative, APHIS would manage a grasshopper treatment program using techniques and tools discussed hereafter to suppress outbreaks. Modern GPS technology provides for accurate application and documentation of treatments and is a program requirement. Weather conditions, public safety, buffering of sensitive sites and other supervision work is conducted by APHIS for every treatment, as proscribed policy in annual Treatment Guidelines (Appendix A), Environmental Monitoring Plans and Environmental Monitoring Reports, to ensure that treatments occur with minimal drift and adequate buffering of sensitive sites.

The insecticides available for use by APHIS and considered for use in Utah include the U.S. Environmental Protection Agency (USEPA) registered chemicals carbaryl (bait) and diflubenzuron (liquid). Carbaryl works by inhibiting acetylcholinesterase (enzymes involved in nerve impulses). 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 a rate conventionally used for grasshopper suppression treatments as reduced agent area treatments (RAATs). RAATs are the most common application method for all program insecticides, and only rarely do rangeland pest conditions warrant full coverage and higher rates. Full coverage and higher rates may be more beneficial in areas with dense vegetation for the pesticide to have the desired effect. Higher grasshopper densities and the need for higher grasshopper mortality can also warrant full coverage and higher rates. This holds true for protecting resources in peril such as cropland that can be decimated by grasshopper outbreaks.

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 grasshopper populations are mostly comprised of the first three instars diflubenzuron is typically selected because it is effective, economical, 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. The circumstances where the use of carbaryl bait would be best are reduced because of the higher cost per acre than liquid insecticide formulations. Only certain species consume 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 meet these criteria are clearwinged grasshopper (*Camnula pellucida*) and Mormon crickets (*Anabrus simplex*).

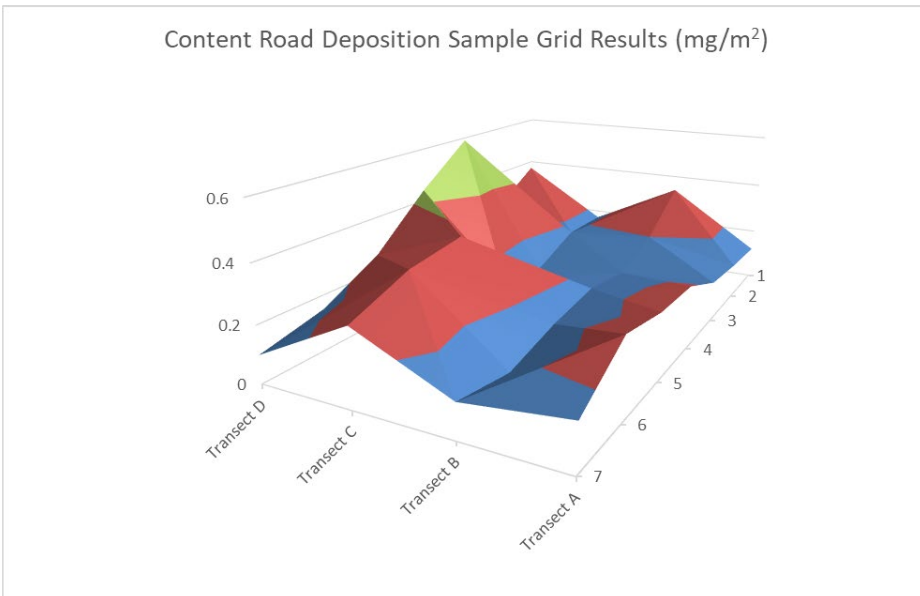
The RAATs strategy is effective for grasshopper suppression because the insecticide controls grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not directly treated. RAATs can decrease the rate of insecticide applied by either using lower insecticide concentrations 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 or 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;
- 0.75 or 1.0 fluid ounce (0.012 lbs a.i./ac sprayed) of diflubenzuron.

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. For aerial applications, the recommended skipped swath width is typically no more than 100 feet for diflubenzuron. 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. 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 3 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 3 – 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).

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Typical aerial treatment designs in Utah have historically used 1.0 fl. oz. of diflubenzuron per acre with 50% coverage (single swath skips). Dependent on the size of the treatment and the aircraft capabilities, previous treatments had spacings of 150-foot swath widths alternating between treated and untreated swaths. The aim of these treatments is to take place sometime between the end of May and the end of June. Aerial treatment blocks consist mainly of public land possibly interspersed with private or state parcels. However, the number of blocks treated in a year depends on many factors such as the budget, and the severity of the infestation that year. The length of a treatment varies substantially due to weather conditions, personnel available, and scope of the treatments to name a few. No aerial treatments have occurred in Utah for over ten years due to the lack of treatable grasshopper populations.

One example of a prior treatment from 2002 was the first aerial treatment for Mormon crickets by USDA, APHIS. It was an 18,000-acre block from central Utah where there were over two Mormon crickets per square yard (Over two tends to be the threshold for MC treatments). Single skip swathing or 50% coverage was used, so 9,000 acres were sprayed with diflubenzuron. Overall, the 2002 aerial program took about three days to complete, and was successful enough for the program to continue treating future Mormon cricket outbreaks aerially with diflubenzuron.

Ground treatments using 2 or 5% carbaryl bait are conducted by USDA, APHIS, PPQ in Utah using ATVs with attached bait spreaders. Due to Utah's rough terrain, ground treatments are performed in areas where an aerial treatment wouldn't be feasible. About two pounds of bait are used per acre, with an area being treated once per year. The carbaryl bait pesticide labels do however allow for two treatments per year if there is a minimum retreatment interval of 14 days. To limit cumulative effects however, the program will only treat an area once. The size of ground treatments varies, usually with several hundred acres treated at a time. These treatments are utilized to target grasshopper hotspots, especially later in the season when diflubenzuron is less effective. Recent program treatments (Table 1) in Utah have all been small scale ground treatments to reduce grasshopper hotspots in different counties around the state.

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 and diflubenzuron would cover all treatable sites within the designated treatment block per maximum treatment rates following label directions:

- 4.0 pounds (0.20 lbs a.i./ac treated) of 5 percent carbaryl bait;
- 1.0 fluid ounce (0.016 lbs a.i./ac sprayed) of diflubenzuron; or

The generalized potential environmental effects of the application of carbaryl or diflubenzuron 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 or clean crop 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

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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. Pre-treatment training of the aerial contractors and daily contractor and APHIS staff briefings throughout the duration of each project, help ensure against accidental releases into sensitive areas.

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. Diflubenzuron formulations are mixed with significant amounts of heavy crop oil in tank mixtures which decreases drift potential since individual droplet weights increase.

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).

Contractors' use of Trimble GPS Navigation equipment is used to navigate and capture shapefiles of the treatment areas. All sensitive sites are buffered out of the treatment area using flagging which is highly visible to the 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 the EA encompasses 10,745,192 acres (16,789 sq. miles) within southeastern Utah. This represents 21.3% of the land in Utah.

Approximately 79.7% of the land within the four- county area is classified as federal, 9.7% of the acreage is state owned, and the remaining 10.6% of the land is private.

Carbon and Emery Counties lie within the Green River drainage which consists of semi-arid lowlands, the Tavaputs Plateau and Roan Cliffs in the northeast, and the high elevation (10,000 ft.) Wasatch Plateau on the west. The Green River forms the eastern boundary of both counties and is approximately 4,100 ft. in elevation. The general area of concern is 5,500 ft. in elevation, primarily level to gently sloping to the east. The area has diverse topography of Mancos shale lowlands and open country with low-lying rolling hills and the Wasatch Plateau escarpment to the west.

Grand and San Juan Counties are located in the upper Colorado River Region and have diverse topography. The topography ranges from Mancos shale lowlands to fertile valleys dominated by high plateaus and mesa tops, with deep gorges and gullies, and also includes unique rock formations.

Within Carbon and Emery Counties, the area is semi-arid with an average rainfall of 6 to 11 inches per year in the lowlands and averages of up to 30 inches at mountain elevations. In Grand and San Juan Counties, the average rainfall is 5 to 10 inches per year in the lowlands and 12-16 inches in the higher elevations.

Within the four-county area, the length of the growing season is related to elevation, ranging from 20-160 days. The climate is characterized by low relative humidity, rapid evaporation, generally clear skies and daily and annual fluctuations in temperatures (i.e., cold winters and hot summers).

The soils in Carbon and Emery Counties are of sedimentary origin and are in climatic soil groups including desert, semi desert, Upland Mountain and High Mountain, with some riparian groups and some badlands, rock outcroppings, and irrigated soils. Some soils have been identified as saline, usually associated with the Mancos formation or some older marine sediments around the San Rafael Swell.

Grand and San Juan Counties are generally characterized within the Colorado Plateau. The soils are mainly arid soils and are relatively fertile; they support forested areas. Soils derived from the Mancos Shale formation (portions of the Cisco desert) are susceptible to erosion, have saline-alkali characteristics and low site productivity. Once the soils are disturbed, the impact is generally long-lasting.

Within Carbon, Emery, Grand, and San Juan Counties, native vegetation is primarily desert saltbush including greasewood, blackbrush, saltbushes and shad scale, with some sagebrush steppe vegetation mixed with pinyon-juniper and mountain browse as the elevation increases. A small portion of higher elevation mountain slopes contain stands of aspen, mountain shrubs and Douglas fir.

Agricultural areas within the four counties includes native and improved rangeland, irrigated pastures, cropland, and some orchards.

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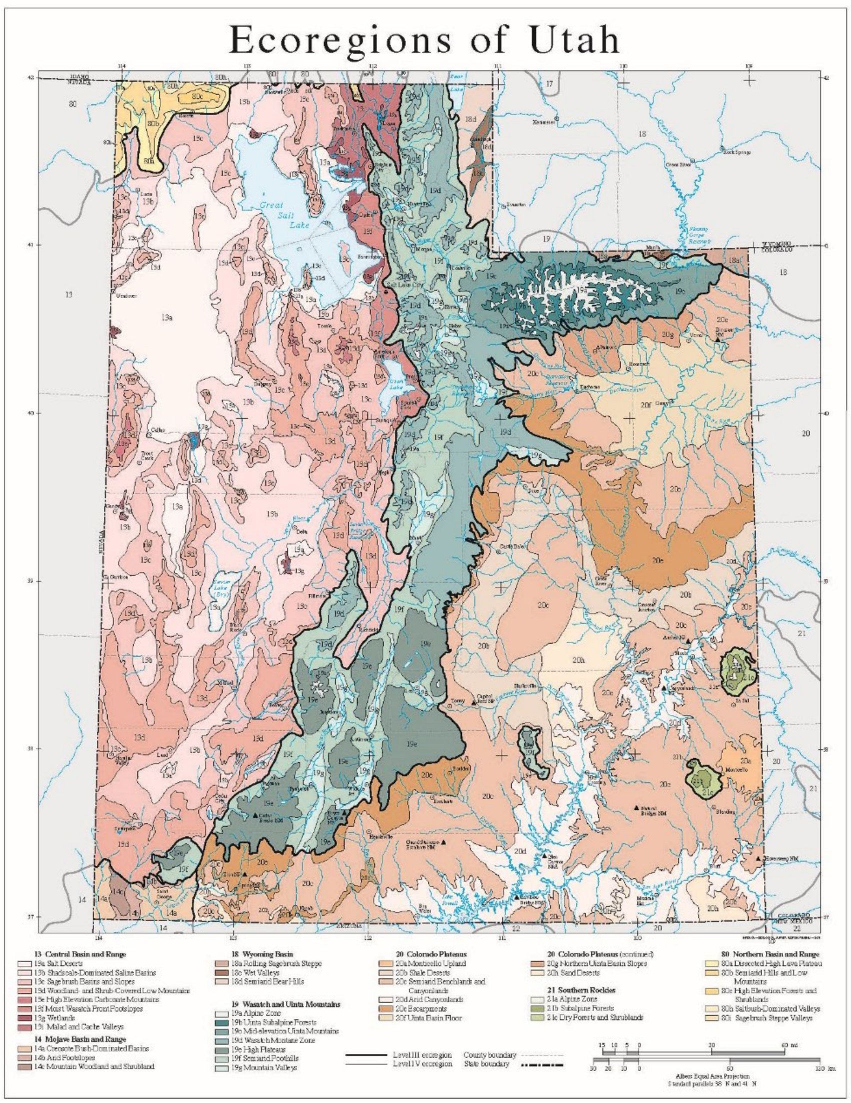
Surface water resources in Grand and San Juan counties generally consist of the upper Colorado River basin with other portions located in the Delores and Green River Basins. Typically the headwaters in the Book Cliffs meet State Class C water quality standards. The lower reaches often exceed one or more parameters. Parameters typically exceeded are total dissolved solids and sodium. Flash flooding often follows the intense summer and fall thunderstorms that occur in the area. Sediments and salts are transported to the Colorado River during these periods of high runoff and intermittent flows. Most of the Perennial streams are found in Book Cliffs and La Sal Mountain drainages.

Within Carbon and Emery Counties, surface water resources consist of the Green, Muddy, Price, and San Rafael Rivers, some intermittent live streams, ponds, reservoirs, stock tanks and troughs, seeps and springs. The Green River provides excellent recreational opportunities, while several of the rivers and streams support fisheries. Many of the water resources provide adequate water for wildlife and domestic livestock use, as well as habitat for aquatic species.

Figure 4, Ecoregions of Utah



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The 18 counties covered by the Utah EAs can be divided into six 'level three' ecoregions which can be found in the program area. Utah is made up of arid deserts and canyonlands, salt flats, wetlands, semiarid shrublands, irrigated valleys, woodlands, forested mountains, and glaciated peaks. Ecological diversity is enormous in Utah and most ecoregions continue into ecologically similar parts of adjacent states.

There are three distinct ecoregions that make up the land area covered in this EA:

<u>Wasatch and Uinta Mountains:</u> This ecoregion is composed of high, glaciated mountains, dissected plateaus, foothills, and intervening valleys. It includes the extensively glaciated Uinta Mountains, the Wasatch Range, and the Wasatch Plateau. Agricultural valleys occur especially in the eastern part of the Wasatch Range. The Wasatch Front is steeper, more rugged, and wetter than more easterly parts of the Wasatch Range. Alkaline dust from the Great Basin does not buffer high elevation surface waters against acidification. Streams draining the quartzite-dominated Uinta Mountains and portions of the Wasatch Front that are underlain by acidic intrusive volcanics tend to be non-alkaline, low in nutrients, and low in total dissolved solids. Above an elevation of about 11,000 feet, alpine meadows, rockland, and talus slopes occur and are especially widespread in the Uinta Mountains. Between about 8,000 and 11,000 feet elevation, subalpine forests, Douglas-fir forests, and aspen parkland are widespread with ponderosa pine and limber pine also occurring on the high volcanic plateaus. Between approximately 5,000 and 8,000 feet elevation, juniper-pinyon woodland and mountain mahogany-oak scrub communities occur, with the latter more prevalent in the north than in the south. Lodgepole pine is less widespread and summer livestock grazing is more common than in the Middle Rockies. Unlike in the maritime-influenced Northern Rockies, Pacific indicator tree species such as grand fir are absent from this ecoregion. The ecoregion is used for logging, recreation, homes, and summer grazing. Due to the varied elevations of this ecoregion, only ground treatments will be performed in ATV accessible areas.

<u>Colorado Plateau:</u> The Colorado Plateau is an uplifted, eroded, and deeply dissected tableland. Its benches, mesas, buttes, salt valleys, cliffs, and canyons are formed in and underlain by thick layers of sedimentary rock. Juniper-pinyon woodland dominates higher elevations and is far more extensive than in the Wyoming Basin. Saltbush-greasewood and blackbrush communities are common at lower elevations but are generally absent from the higher Arizona/New Mexico Plateau. Summer moisture from thunderstorms supports warm season grasses not found in the Central Basin and Range. Many endemic plants occur and species diversity is greater than in Ecoregion 13. Several national parks are located in this ecoregion and attract many visitors to view their arches, spires, and canyons. Major gas and oil fields are found in the Uinta Basin portion of Ecoregions 20c, 20f, and 20g. Historically this ecoregion has experienced grasshopper outbreaks so program treatments can be expected in this ecoregion.

<u>Southern Rockies:</u> In Utah, the Southern Rockies are made up of isolated, laccolithic mountains that protrude from the dry expanses of the Colorado Plateaus. The La Sal and Abajo mountains are closer to the Rocky Mountains than the Wasatch Range and have faunal affinities with the southern Rockies in Colorado. Vegetation, soils, and land use are elevationally banded. Low to middle elevations are grazed and support Gambel oak, widely-spaced ponderosa pine, and mountain brush. Higher elevations are not as heavily

grazed as lower elevations and are largely covered by subalpine fir, Engelmann spruce, Douglas-fir, aspen parkland, and mountain brush. In contrast to Ecoregion 19, lodgepole pine is absent from the Southern Rockies. The highest elevations have alpine characteristics. Due to the varied elevations of this ecoregion, only ground treatments will be performed in ATV accessible areas.

B. Special Management Areas

APHIS is aware there are areas that have greater scenic and environmental value within 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.

Within Utah's program area, there are a plethora of wilderness study areas (WSA), critical habitats, and wilderness areas (WA). In recent times, the program has not seen any outbreaks, or treated any designated wilderness areas, WSAs, or critical habitat. Therefore, future outbreaks and treatments are not expected to occur at or near these locations. Furthermore, critical habitats would not be treated due to buffers enforced for threatened and endangered species. The WAs and WSAs containing water features would also not be treated because of the program's water buffers. Many of the remaining WAs and WSAs are mountain habitats where the topography makes treatments nearly impossible.

The Wilderness Study Areas covered by this EA include Jack Canyon, Desolation Canyon, Turtle Canyon, Mexican Mountain, Sid's Mountain, Devil's Canyon, Link Flats ISA, Muddy Creek, Crack Canyon, San Rafael Reef, Floy Canyon, Coal Canyon, Spruce Canyon, Flume Canyon, Westwater Canyon, Lost Spring Canyon, Negro Bill Canyon, Mill Creek Canyon, Behind the Rocks, Indian Creek, Bridger Jack Mesa, Butler Wash, Dark Canyon ISA, Cheese Box Canyon, Mancos Mesa, Grand Gulch ISA, Road Canyon, Fish Creek Canyon, Mule Canyon, Cross Canyon, and Squaw/Papoose Canyon. Wilderness Areas encompass Desolation Canyon, Turtle Canyon, Nelson Mountain Wilderness, Mexican Mountain, Sid's Mountain, Cold Wash, Eagle Canyon, Devil's Canyon, San Rafael Reef, Lower Last Chance, Muddy Creek, Red's Canyon, Little Ocean Draw, Horse Valley, Little Wild Horse Canyon, Middle Wild Horse Mesa, Big Wild Horse Mesa, Labyrinth Canyon, and Dark Canyon Wilderness.

Other special management areas include Scofield State Park, Huntington State Park, Jurassic National Monument, San Rafael Swell Recreation Area, Goblin Valley State Park, Green River State Park, Arches National Park, Manti-La Sal National Forest, Canyonlands National Park, Bears Ears National Monument, Natural Bridge National Monument, Edge of the Cedars State Park, Hovenweep National Monument, Goosenecks State Park, and Glen Canyon National Recreation Area. Species with critical habitat in the area covered by this EA include Bonytail, Colorado pikeminnow, Gunnison sage-grouse, Humpback chub, Mexican Spotted Owl, Razorback sucker, Southwestern willow flycatcher, and Yellow billed-Cuckoo.

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.

APHIS does provide some survey and technical guidance to private producers on the use of program methods and materials (without overseeing treatments) with the goal of assisting land-manager requests while reducing pesticides use overall. APHIS does not collect data on the treatment of grasshoppers by private land managers unless they are organized as part of a larger APHIS supervised treatment. Private land is very rarely treated by APHIS in Utah, and crop land never is, so any contribution of program treatments to overtreatment of private land or crop land is extremely unlikely.

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. 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. 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

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area previously treated for grasshoppers is unlikely to cause an accumulation of insecticides from previous program treatments.

Nearly 65% of Utah's land is under federal management, so most grasshopper treatments are conducted on BLM or US Forest Service land. May through July is a busy time for both agencies, their partners (weed districts, conservation districts), and permittees (mines, rights-of-way holders, geothermal plants, etc.) to treat weeds with herbicides. Treatments at this time of year are ground-based using backpacks, trucks, all-terrain vehicles (ATVs) and utility-terrain vehicles (UTV) with mounted sprayers targeting actively growing weeds. BLM mostly use Trichlopyr and Rodeo in riparian areas and Milestone in rangeland situations. The Forest Service implements Milestone, 2,4-D and Tordon to spot spray infested areas of noxious weeds in rangeland. Before any APHIS program is conducted, discussions would be held with land-managing officials to ensure that the two programs would not cause increased injurious effects to any treatment area.

UDAF manages the Utah Rangeland Pests Cost Share Program to help Utah producers mitigate the costs and impacts of grasshoppers and Mormon cricket outbreaks. The program provides 100% cost-share reimbursement for chemical treatments using the RAATs method. This cost share program covers a single treatment, including the chemical and adjuvant, used to suppress grasshopper and Mormon cricket populations on privately owned property. Participants are responsible for application costs and cannot combine the costs of treating other pests into reimbursement. UDAF also provides grasshopper bait to producers for border, buffer, and boundary treatments. This bait is not intended for large-scale applications but rather for suppressing populations migrating from adjacent unmanaged lands or small acre properties. Applicants are eligible for one cost-share reimbursement per year and are encouraged to collaborate with their communities on larger, more biologically sound projects. In 2024, the program approved 45 cost-share applications, supporting treatments on 73,156 acres and suppression efforts on 146,312 acres. Additionally, UDAF provided nearly 100 producers with 13 pallets of bait for small-acre suppression efforts (UDAF 2024).

Figure 5 below shows the estimated annual agricultural pesticide use by major crop or crop groups for Utah, 1992-2017, released by the US Geological Survey. A total of 592 kgs of diflubenzuron were used in alfalfa fields between 1992-2017 in Utah. Carbaryl saw more usage over the same timeframe, with around 56,383 kgs used on a variety of crops including alfalfa, orchards, vegetables, and fruits. Most years saw no more than 4,000 kgs of carbaryl used throughout the entire state on crops. Therefore, APHIS treatments are unlikely to overlap with cropland treatments that occur throughout Utah.

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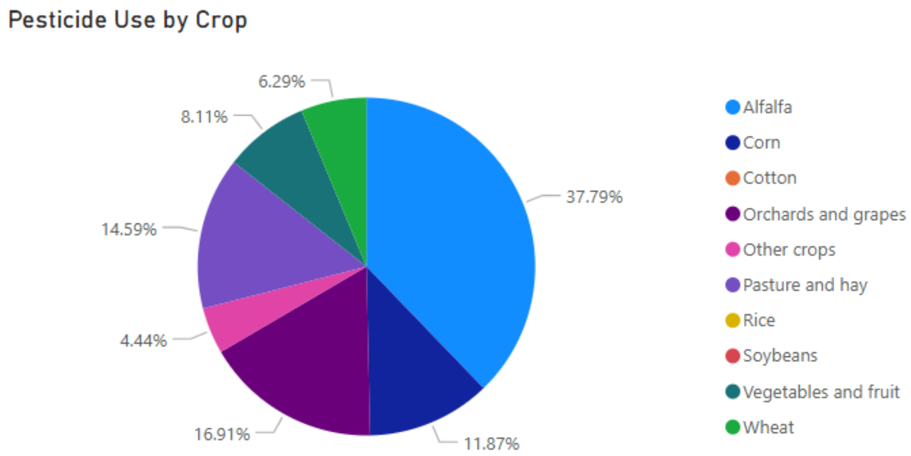
Figure 5, Pesticide use by crop in Utah from 1992-2017



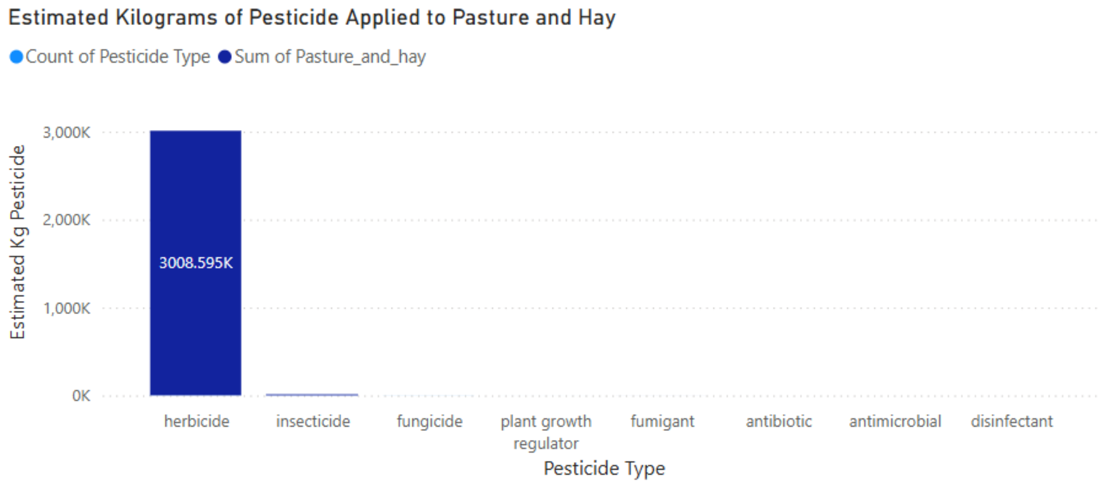


Figure 6, estimated kilograms pf pesticide applied to pasture and hay in Utah from 1992-2017

Applications such as county mosquito control, *Phragmites* eradication, or crop treatments are not likely to cause any cumulative impacts in rangeland situations because the treatment areas are very unlikely to overlap. Mosquito control and *Phragmites* eradication occur in riparian areas that are buffered by the program, and cropland is not treated by the program.

The 2002 EIS Appendix B, Environmental Risk Assessment for Rangeland Grasshopper Suppression Program—Insecticides, analyzed effects of various insecticide formulations and treatment rates in detail and found minimal negative impacts of any kind for either carbaryl bait or diflubenzuron. Cumulative and synergistic effects were also analyzed and found to be minimal or non-existent for these. "Diflubenzuron is only reported to be synergistic with defoliant DEF (NLM, 1988)" (page 134). Def is a defoliant registered for use in cotton crops, which is no longer a commercially significant crop in Utah, with the active ingredient Tribuphos (S,S,S-Tributyl phosphorotrithioate). No record of this or related chemicals being used in Utah was found. For carbaryl in general (all Page | 35

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formulations): "The only studies of chemical interactions with carbaryl indicate that toxicity of organophosphates combined with carbaryl is additive not synergistic (Keplinger and Deichmann, 1967; Carpenter et al, 1961)" (page 130).

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 Carbon, Emery, Grand, and San Juan Counties, Utah, because treatments could be requested by federal land managers and private landowners if grasshopper populations reach outbreak levels. Past experience and continuing land use, climate conditions, and 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. Note that treatments may be requested and may not occur for various reasons (i.e., grasshoppers do not emerge in sufficient numbers to require suppression), or treatment areas change for various reasons (especially in the case of migrating bands of Mormon crickets).

Table 1, Utah GHMC Treatments 2016-2025

Date Start	Date Complete	GH/MC	RAATS	Act Acres Treated	Protected Acres Treated	Fed Acres	State Acres	Comments
6/21/2016	6/21/2016	GH	YES	60	200	30	30	Carbaryl Bait
6/24/2019	6/24/2019	MC	YES	15	150	15	0	Carbaryl Bait
7/13/2021	7/16/2021	GH	YES	20	200	20	0	Carbaryl Bait
7/13/2022	7/13/2022	GH	YES	5	10	5	0	Carbaryl Bait
6/22/2023	6/27/2023	MC	YES	18	200	18	0	Carbaryl Bait
6/18/2024	6/19/2024	GH	YES	18	40	18	0	Carbaryl Bait

Only six APHIS treatments to control grasshoppers have occurred between 2016 and 2025 within Utah as shown in Table 1. All of these were ground treatments using carbaryl bait and the RAATs method, with around 136 acres being treated in the timeframe. The three

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counties where ground treatments occurred were Beaver, Uintah, and Tooele. The program in Utah would have minuscule effects on the environment, if any, with such sparse treatments targeting grasshopper hotspots over the time period. However, an outbreak of *Melanoplus sanguinipes,* the lesser migratory grasshopper, occurred in 2024 throughout some of the counties covered here, and significant range damage resulted. During 2026, APHIS anticipates requests for treatment relief as 2025 saw several small scale grasshopper infestations. APHIS attempts with all spray projects to obtain sufficient landowner participation to minimize reinfestation potential. This obviates the need for additional treatments within the next three to five years, and therefore relieves impacts of repeated treatments while maintaining healthy rangeland ecosystems for wildlife cover and forage.

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

Carbon county has a human population of about 20,412. The county seat and largest city is Price with a population of around 8,200. There are five public elementary schools in Carbon County; two middle schools; one high school; and Utah State University Eastern. Castleview Hospital is located in Price. Other communities that are apart of Carbon County include East Carbon, Helper, Wellington, and Scofield. The county is best known for coal mining and dinosaur fossils.

Emery County has a human population of about 9,825. Its county seat is Castle Dale, and its largest city is Huntington with a population of close to 1,900. In the county, there are two high schools, two middle schools, and six elementary schools. Emery Medical Center is located in Castle Dale. Some other communities are Ferron, Green River, Orangeville, Clawson, Cleveland, Elmo, and Emery. Emery County is Utah's second highest producing county of coal.

Grand County has a human population of about 9,669. The county seat and largest city is Moab with a population of about 5,400. Moab has two elementary schools, one middle school, one high school, and a Utah State University Campus. Moab Regional Hospital is also located in Moab. Other communities in the county are Castle Valley, Thompson Springs, Cisco, Dewey, and Westwater. The county serves as a gateway to both Arches and Canyonlands National Parks.

San Juan County in southeast Utah has a human population of about 14,518, and its county seat is Monitcello. The largest city is Blanding with a population around 3,400 people. The city is also home to the San Juan School District and a local Utah State University Campus. San Juan Hospital is located in Monticello. Some other communities in the county are Bluff, Aneth, Halchita, Halls Crossing, La Sal, Mexican Hat, Montezuma Creek, Navajo Mountain, Olijato-Monument Valley, Spanish Valley, Tselakai Dezza, and White Mesa. San Juan County is bordered by more counties than any other county in the United States, at 14.

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 (such as stock tanks) will have a buffer of 200 feet. Federal highways and State roads will have a buffer of 25 feet. Local law enforcement, fire departments, emergency medical services, and tribal agencies will be notified prior to any treatment before program activities occur. Coordination with local governments on proposed treatments will be conducted as needed.

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.

Recreationists may use the rangelands for hiking, camping, bird watching, hunting, falconry, or other uses. Ranchers and sheepherders 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. Some rural schools may be in areas near the rangeland which might be included in treatment blocks. 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-

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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.

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.

Common reptiles found throughout the area of EA coverage include the sagebrush lizard, side-blotched lizard, collared lizard, short-horned lizard, gopher snake, and Great Basin rattlesnake. Amphibians include the Great Basin spadefoot toad, boreal chorus frog, Northern leopard frog, Western or boreal toad, and tiger salamander. Some common fish found in this four-county area are brook and cutthroat trout as well rainbows, brown and various hybrids as well as yellow perch, blue gill, walleye, crappie, and large and smallmouth bass. All water resources these species inhabit would be buffered out of any project. Other habitats include sandy flats, alluvial fans, along washes, grasslands, shrublands, at the edges of dunes, and rocky areas. These areas could be treated and are not buffered.

Birds comprise a large portion of the vertebrate species complex, and they also include exotic and native species. Several bird species within Carbon, Emery, Grand, and San Juan Counties, as well as statewide, that are of concern to the Utah Division of Wildlife Resources are: white-faced ibis, long-billed curlew, western snowy plover, mountain plover, American white pelican, double-crested cormorant, Caspian tern, purple martin, Williamson's sapsucker, grasshopper sparrow, osprey, Lewis' woodpecker, western bluebird, ferruginous hawk, Swainson's hawk, and burrowing owl. These species' populations are either declining or are limited in their distribution. Upland game birds which occur in the area include sage grouse, ring-necked pheasant, ruffed and blue grouse, chukar, wild turkey, Hungarian partridge, sharp-tailed grouse, mourning dove, and quail. Shorebirds, seagulls, waders, and other waterfowl occur in wetland and mash habitats. Most of the migratory and yearly birds that inhabit the program area are classified as least concern, meaning their population size and trends are above the vulnerable threshold. Accurate population estimates for bird species that inhabit the program area are unavailable.

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Program mitigation measures such as the RAATs method and ULV applications reduce the effects program pesticides might have on birds in the program area. 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. Predacious species that feed on grasshoppers have varied diets and can find other food sources in the event that treatments drastically reduce grasshopper numbers.

Vertebrates occurring in rangelands of Carbon, Emery, Grand, and San Juan Counties include introduced livestock and pets (e.g. cows, goats, sheep, horses, poultry, cats, dogs) and native species including carnivores (e.g. coyotes, foxes, wolves, cougars), large herbivorous mammals (e.g. deer, elk, pronghorn antelope, bighorn sheep), smaller ones (e.g. rabbits, gophers), and omnivores (e.g. badgers, mice, bats).

A diverse community of terrestrial plants occurs within the proposed suppression area. Many are considered as non-native, invasive weeds including annual grasses (e.g. cheat grass), annual forbs (e.g. diffuse knapweed, Scotch thistle, Dalmatian toadflax), perennial forbs (e.g. Canada thistle, 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. Utah has 2602 plant species in all plus 393 subspecies or varieties. With 247 endemics Utah has an endemism rate of 8.2%. Many of these endemic plants are concentrated in the Colorado Plateau region of south and east Utah. On the Plateau, erosion has exposed a long succession of different rock layers, and the rock has weathered into a patchwork of locally unique soils, and these isolated or peculiar soil types act as nurseries for endemics. Fine textured soils, saline soils, or those that are highly alkaline are associated with highest levels of endemism. Environmental extremes in the desert such as high temperature or low rainfall prompt evolutionary adaptations that eventually lead to speciation. For example, cushion plants are common on the Plateau—these are compact, low growing, mats often with large and deep tap roots adapted to slow growth in a nutrient-poor and water-restricted environment. In Utah deserts, many different buckwheat and milkvetch species adopted the cushion plant structure thus forming new species. Variations in elevation can isolate species and create localized versions of widespread plants. High elevation areas act as sky islands within the Colorado Plateau separating plants into distinct populations until they diverge over time. The La Sal, Abajo, and Henry Mountains form mid-high elevation islands whose resident species are becoming more and more unique, forming endemics such as Chatterly onion, La Sal daisy, Cronquist’s buckwheat, Navajo Mountain penstemon, and Dwarf mountain butterweed (Strand 2019). Historically, these sky islands of increased biodiversity have not experienced grasshopper outbreaks or been treated in Utah. Moreover, treatments would not be feasible due to the topography, land ownership, and program buffers. The rangeland areas where treatments occur contain communities of sagebrush adapted plant life which are prevalent throughout the state. Covering such a large area, it’s impossible to get population numbers for the various plant species, including those that are invasive. A number of sagebrush species in the program area flower during the late summer to fall, after grasshopper treatments have occurred. This helps minimize the effects treatments could have on pollinators of sagebrush. Treatments may also benefit many of the plant species by reducing outbreak numbers of grasshoppers

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feeding on them. Lastly, any sensitive plant species can be buffered from treatments as requested by the landowner.

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 scope of this EA but are nonetheless present and contribute to these ecosystems in various ways.

The grasshopper program is unlikely to adversely affect state listed species by direct or off-target pesticide treatments due to the low rates and toxicity levels of the chemicals used as well as the mitigation measures and buffer zones implemented during treatments.

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 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.

The Utah Natural Heritage Program is a database of rare native Utah species found on the Utah Division of Wildlife's (UDWR) website at https://wildlife.utah.gov. It compiles information on Utah's species from a variety of sources, including scientific literature, museum collections, and field surveys. Government agencies, businesses, researchers, land managers, conservation groups, and the public may have access to this information. Moreover, Utah's Species of Greatest Conservation Need by County which lists the species found in each county can be located here. The UDWR also maintains a "Utah Wildlife Action Plan" which also may be found on the Division website. Wildlife habitats are well-defined and prioritized for species protection, but there is little discussion about pollinators within the Plan. The Bureau of Land Management provides a list of sensitive species within

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the state on the "Utah BLM Sensitive Species List." There are separate lists for Sensitive Plants and Sensitive Animals as determined by Utah BLM. In total, Utah has 166 sensitive species included on the BLM State Directors sensitive species list for BLM-administered lands. Included on this list are 58 animal (fish, amphibians, reptiles, birds, insects, mammals) and 108 plant sensitive species. These sensitive species inhabit many different areas of Utah including snow-capped mountain peaks, lush forests, expansive lakes, winding rivers, and vast, stunning red deserts. The many varied and unique habitats promote extraordinary biodiversity in the state that can be attributed to climate and geological processes specific to each region, leading to endemism in species. Due to this, terrestrial species endemic to specific highlands would be protected since treatments would not occur at higher elevations. State listed aquatic species throughout the program area will not be affected by treatments because of enacted buffers for water bodies. Reptiles, birds, and mammals that are insectivorous may experience a decrease in available prey, although treatment areas are relatively small compared to the larger environment. The mobility of these organisms along with RAATs treatments will allow them to find food in untreated locations. One impact to state listed monocots and dicots could be the loss of pollinators as a result of treatments. These plants with known locations could be buffered similarly to federally listed plants to offer more complete protection. Other program procedures such as ULV treatments and RAATs will help to mitigate treatment effects on state listed plants and their pollinators. The program will buffer or exclude any sensitive species from a proposed treatment as desired by the land manager.

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 Utah 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 may not be factored into these calculations, nor is density based on quantity of habitat. Little up to date information on current population estimates is available from any of these sources. All population estimates are considered to be conservative, as we have used the lowest population estimate among the ranges of those available in the literature.

The complexities of Utah's topography and climate result in biologically diverse habitats. Important habitat types in Utah include a diversity of wetlands, sagebrush steppe and shrublands, mountain shrub and pinyon-juniper woodlands, aspen-conifer forests, and desert grasslands and shrublands. Riparian areas are the richest habitat type in terms of species diversity and wildlife abundance. Over 75% of Utah's wetlands occur along the northern and eastern shorelines of Great Salt Lake, which is a desert oasis for migrating birds. The lake provides essential stopover habitat for a great diversity of shorebird and waterfowl species, numbering in the millions of individuals. Aspen-conifer communities are second to riparian areas in wildlife species diversity and abundance (UDWR 2015). The program in Utah does not treat riparian areas or aspen-conifer communities due to buffers, topography, and a lack of economically damaging grasshopper numbers. The majority of treatments occur on the sagebrush steppe, therefore many of the species that reside in the richest habitat types of Utah will be protected from program treatments. Due to their unique soil characteristics and vegetative compositions, unique hotspot habitats can be identified and excluded from treatments to protect the high levels of biodiversity they foster, especially when it comes to pollinators such as butterflies and moths.

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.

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 insecticides' 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., 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

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unrelated to grazing during two of the three study years. According to Gilgert and Vaughan, 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 benefiting 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). 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 the general 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).

According to a sampling of native bee communities across broad Canadian ecoregions Kohler et al, found climate and geographic variables caused differences in species abundance, richness, and composition, indicating that assessments on impacts may not be generalizable across the entire rangeland ecosystem. The researchers found bee community composition was significantly different across regions (i.e., Canadian grassland, parkland and boreal areas) and between land use types (i.e., rangeland and canola cropland). Within rangeland communities it may be difficult to understand the best conservation measures for bees due to the variance in responses on a larger scale.

Utah is home to approximately 17 historically native species of bumble bee; many of which are common such as the central, two-form, and Nevada bumble bees (*B. centralis, B. bifarius, B. nevadensis*); some of which are uncommon or rare such as the golden-belted bumble bee (*B. balteatus*), yellow-banded bumble bee (*B. terricola*), Suckley's Cuckoo bumble bee (*B.suckleyi*), and western bumble bee (*B. occidentalis*). Overall, there are a total of 1167 described bee species for the state of Utah, and species richness is higher in the southern part of the state. At the family level, *Andrenidae, Apidae*, and *Megachilidae* are represented by the most species, each having over 300 species in the state, followed by *Halictidae* with 131 species, *Colletidae* with 54 species, and *Melittidae* with only six species. One possible reason for Utah's higher bee species richness compared to other states could be its seasonal patterns of bee diversity. The spring bee fauna is quite distinct from the late summer bee fauna in Utah, with relatively few species being present across the

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entire season. Another reason is the high number of distinct habitats resulting from Utah's varied topography, climate, and elevation ranges, as well as the unique weather patterns associated with different portions of the state. There are multiple ecoregions in Utah spanning hot deserts, cold deserts, canyonlands, semiarid shrublands and forested mountains, woodlands, and high alpine peaks. Many bee and other pollinator species in Utah are associated with unique ecoregions and endemism is common (Wilson et al. 2025). No grasshopper treatments have occurred in the four Utah counties that have the highest bee species abundance in over ten years (Fig. 7). Mentioned previously, only ground treatments have been conducted in Utah recently. These treatments have no effect on bees who are unable to feed on the carbaryl bait used. If any aerial treatments are planned in the future, program protocols such as RAATs, ULV applications, and one treatment at a location per year will help to minimize the program's effects on Utah's numerous bee species.

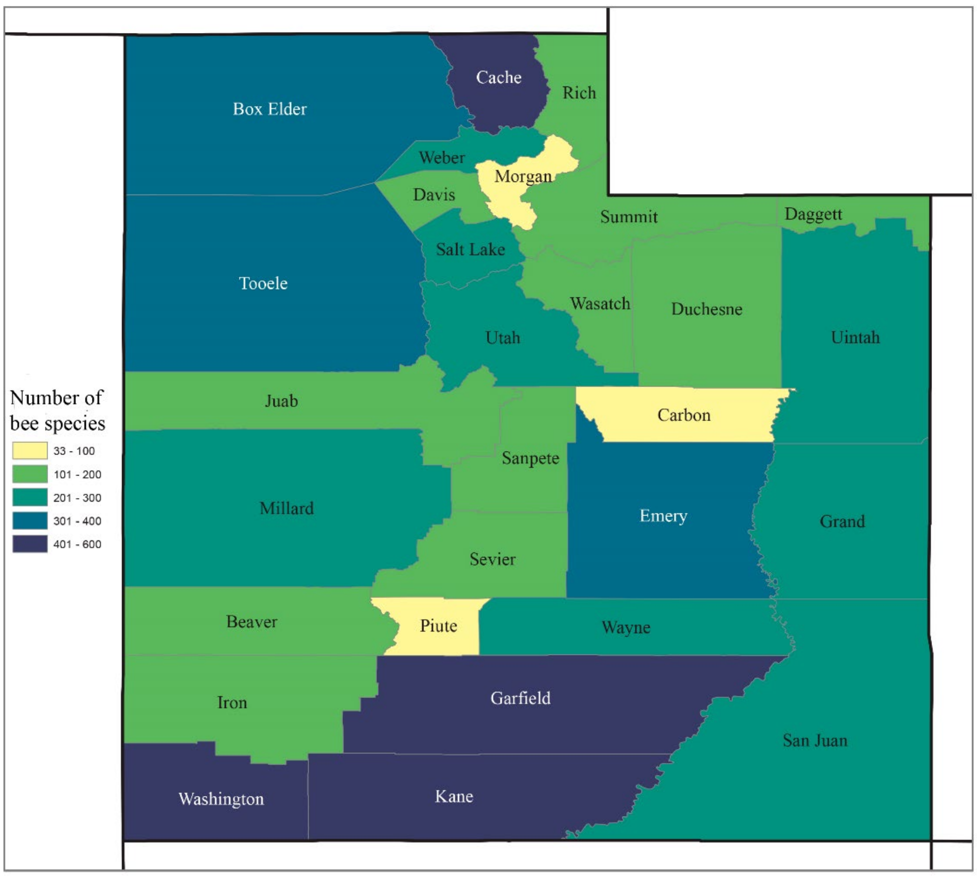

Figure 7, Utah Bee Species Richness by County

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

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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. Accurate population estimates are not possible for this group of organisms due to the sizeable program area. Program activities, such as aerial treatments using diflubenzuron, may affect invertebrate populations in those smaller treatment areas. Immature grasshoppers, beetle larvae, lepidopteran larvae, and chewing herbivorous insects appear to be more susceptible to diflubenzuron than other invertebrates. The RAATs method is meant to limit the number of non-target insects affected by aerial treatments (Appendix C).

Two non-target invertebrate species of potential concern, which have been previously brought up in public scoping for the program, are Suckley's cuckoo bumblebee (*Bombus suckleyi*) and the monarch butterfly (*Danaus plexippus*). The monarch butterfly may potentially be found throughout in Carbon, Emery, Grand, and San Juan Counties and is being proposed for ESA protections. There are 17 species of milkweed native to Utah, but many are either infrequently encountered or are restricted to specific micro-climates, soil type or other restrictive feature and therefore of limited applicability to monarch conservation practices. Two are especially valuable for monarch habitat plantings in Utah. Perhaps the most abundant milkweed species in Utah is showy milkweed. This species is common along ditch banks, roadsides, pastures and meadows throughout the state up to elevations of about 7,500 ft. Like all milkweeds, showy milkweed is toxic to livestock, and in many cases it has been managed against for decades in agricultural areas. As a result, incidences of milkweed in the program area that have been treated for grasshoppers are extremely limited, mostly occurring in small patches in roadside ditches. This is not ideal caterpillar habitat due to patch size limitations and disturbances caused by traffic, and would be buffered already if a state hi-way or interstate. One slightly less common milkweed that can be found in Utah is swamp milkweed. It is more limited in distribution than showy milkweed, but it is highly attractive to monarchs and grows in the wetter areas where monarchs are known to congregate. Swamp milkweed occurs naturally along river banks and pond shores throughout most of North America but is primarily found in wet areas in northern Utah (NRCS 2019). Northern Utah has rarely seen grasshopper outbreaks in the past, and water buffers help to protect this species from treatments. The Western Monarch Milkweed Project is part of a collaborative effort to map and better understand monarch butterflies and their host plants across the western United States. This site can be cross referenced with proposed treatment areas to alert the program of any monarch activity or host plants in the area. Due to methods and materials, impacts to flowering plants, including pollination services, are not anticipated to be significant by proposed actions, except for the no action alternative, which may result in fewer such plants due to herbivory by damaging grasshopper population outbreaks. The Suckley's cuckoo bumblebee, in contrast, is a rare species possibly found in certain portions of the area covered in this EA. Avoidance measures are described in Appendix C. Table 4 from the USFWS special species assessment for Suckley's cuckoo bumblebee shows most occurrence points in Utah occurring in the Northern part of the state for this bumblebee between 1893-2022 (USFWS, 2024a). As mentioned, treatments in northern Utah are infrequent, and APHIS is unlikely to encounter Suckley's cuckoo bumblebee. USFWS is developing further guidance on this

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species and mapped areas, called High Potential Zones, which are meant to narrow the possible range of the species, are being developed. Upon USFWS' release of the mapped areas, APHIS will review them and determine whether further actions to protect the species is warranted.

In addition to the benefits of general biodiversity, specific groups of beneficial invertebrates are identified as providing important ecological services. Biological control organisms (species that feed on and help control pests) in particular help control pests and are crucial to sustaining diverse ecosystems. Predatory arthropods (carnivores including insects, arachnids, and chilopods such as centipedes) help to regulate herbivorous populations and maintain balanced food-webs generally. Overuse of broad-spectrum pesticides and other artificial disturbances can disrupt the herbivore control and pollination services which populations of beneficial invertebrates provide. IPM is largely the practical science of creating the least disruption to invertebrate communities, while reducing the population of target pest(s), to prevent larger ecological problems from artificial imbalance in these communities. For crop producers this may mean preventing a 'flush' of very difficult to control pestiferous mites, or the costly replacement of honeybees, resulting from overuse of pesticides which broadly impact insects, such as organophosphates. For stewards of natural resources, IPM is also crucial for maintaining an overall balance of invertebrate biodiversity, not due to cost calculations, but as a primary goal of grasshopper outbreak suppression efforts.

In public comments, concern is often raised about impacts on beneficial invertebrates from blanket, broad-spectrum insecticide applications, which have been found to result in significant mortality of beneficial invertebrates, including those with the greatest potential to help regulate grasshopper populations over the long term (Branson et al 2006). This EA does not consider using such methods. An important body of research investigated how methods and materials which were previously used to control grasshopper outbreaks on rangelands, such as blanket, broad-spectrum insecticide applications, were unsustainable and counterproductive. Similar and supporting research developed the IPM techniques currently preferred for control of grasshopper outbreaks, being both ecologically and economically far superior to those known to science previously. The USDA Grasshopper IPM User Handbook (https://www.ars.usda.gov/plains-area/sidney-mt/northern-plains-agricultural-research-laboratory/pest-management-research/pmru-docs/grasshoppers-their-biology-identification-and-management/ipm-handbook/ipm-handbook-table-of-contents/), as well as the ARS Grasshopper Management website (https://www.ars.usda.gov/plains-area/sidney-mt/northern-plains-agricultural-research-laboratory/pest-management-research/pmru-docs/grasshoppers-their-biology-identification-and-management/management/management-information/), share this research with the public. APHIS promotes and helps to summarize these IPM resources to land-managers seeking guidance on this topic.

Biological pest control is a broad topic that is studied and presented in great detail in these resources, and for good reason since it is a cornerstone of any ecological pest control methodology. Rarely however is biological control ever a stand-alone alternative to all other control methods. Indeed, that would arguably take away from the concept of 'integrated' potentially as much as relying only on insecticide treatments alone. Specifically as it relates to controlling grasshopper outbreaks, biological controls typically become

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saturated and decrease in effectiveness during pest outbreaks. This is one of the findings in the USDA Grasshopper IPM User Handbook, including in VII.14 Grasshopper Population Regulation (www.ars.usda.gov/ARSUserFiles/30320505/grasshopper/Extras/PDFs/IPM%20Handbook/VII14.pdf). This study aims to describe relationships between available food, weather, and abundance of natural enemies, as ecological factors contributing to the regulation of grasshopper populations. Public comments citing this study as indicating that grasshopper populations have a high potential for being limited by natural enemies. While this is generally presented in the study as a sort of ecological first principle, equated in the text to how wolves have a strong potential to regulate deer, it is not the conclusion of the study generally. It does not draw any overarching conclusion as to the effectiveness of biological control on known outbreaks of grasshoppers. Rather it attempts to describe specific instances where survey of grasshopper populations may not be necessary due to limiting factors including biological control, weather, and food availability.

Biological control, specifically conservation biological control (which is the encouragement of endemic natural enemies to control a pest species) is generally recognized as an important factor in the eventual regulation of outbreaks, particularly as caused by disease when combined with difficult weather and food scarcity conditions, and is utilized broadly by default. Even where treatments occur however, the methods and materials of the program fully support conservation biocontrol (including limiting when treatments occur based on survey results, providing non-treated swaths with RAATs, and selecting targeted pesticides which do not kill a broad spectrum of invertebrates on contact). Conservation biological control agents which help to control grasshopper pests in the Western US are listed in the following table, drawn from the GIPM User Handbook made available to the public at ARS: www.ars.usda.gov/pa/nparl/pmru/IPMHandbook. The methods and materials developed for GIPM that are utilized by APHIS and transferred to land managers in direct consultation and public meetings, support populations of these 'beneficials' to help prevent future outbreaks and improve rangeland ecosystem health and productivity.

Table 2. Arthropod Predators & Parasites of Grasshoppers in the Western US.

Arthropod Predators & Parasites of Grasshopper Pests in Western US	
Arachnida	**Mites and Spiders**
Mites	3 families of mites are known to parasitize grasshoppers but aside from reducing egg viability, population regulation is considered minimal.
Spiders	Web-building spiders and hunting spiders, both ground dwelling (e.g. 'wolf spiders') and foliage dwelling (e.g. 'jumping spiders'), are often abundant.
Coleoptera	**Beetles**
Carabidae	Ground beetle adults and larvae are generalist predators, including of grasshopper eggs, that can have significant impacts.
Meloidae	Blister beetle larvae attack grasshopper eggs significantly, however adults are herbivorous and can be crop pests, also can cause blisters on human skin.

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Cleridae, Tenebrionidae & Trogidae	Generalist predators that may feed on grasshopper eggs.
Diptera	**Flies**
Parasitoids	Internal parasites that kill their host, many species of flies target grasshoppers (in families Anthomyiidae, Nemestrinidae, Sarcophagidae, & Tachinidae).
Asilidae	'Robber flies' are the raptors of the insect world and many prefer grasshoppers; in one 6 year WY study, they reduced grasshopper populations by 11-15%.
Bombyliidae	'Bee fly' species can resemble bumble bees and many species are considered important predators, with larvae that hunt grasshopper eggs in the soil.
Calliphoridae & Chloropidae	Generalist predators that may feed on grasshopper eggs.
Hymenoptera	**Ants and Wasps**
Formicidae	Ants are localized, general predators, especially of eggs and newly hatched grasshoppers, with little impact on larger instars or distances from colonies.
Scelionidae	Large family of wasp that parasitize insect and spider eggs, including about 20 species that specialize on grasshoppers; very small (1-3 mm, 1/16-1/8").
Sphecidae & Crabronidae	Large families of solitary wasp with about 30 species that capture grasshoppers to provision their nests (e.g. 'digger wasps'); distribution & control varies.
Odonata	**Dragonflies and Damselflies**
	Generalist predators that breed in aquatic habitats but can fly into crop fields or rangelands.
Orthoptera - Mantidae	**Mantids**
Litaneutria minor	The 'agile ground mantis' or 'minor ground mantid' is a generalist ground hunting predator in dry habitats of the arid mountain west, 30 mm, 1.2" long.

Two other methods of natural pest control are referred to as kinds of biological control:

Classical biological control is the intentional release of natural enemies from an exotic pest's native range. Since pestiferous grasshoppers in the US are generally considered native species, this categorically does not apply a viable control strategy.

Augmentative biological control is the artificial release of a large number of natural enemies to overwhelm pest populations, and is not currently a viable control option for APHIS to use effectively, though it remains an area of study. For example, organic formulations of biopesticide with active ingredients of fungi are registered for grasshopper control by the EPA, and are available to the public.

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Table 3. Entomopathogens of Grasshoppers in the Western US.

Entomopathogens of Grasshopper Pests in Western US	
Fungi	***Infect on contact--useful for conservation biocontrol or biopesticide***
Beauveria bassiana	-a mold causing white "powdered sugar" coating - can be purchased
Metarhizium anisopliae	-a mold causing green "powdered sugar" coating
Aspergillus flavus	-a mold causing green "powdered sugar" coating - more saprophytic
Entomophaga grylli	-causes "summit disease" since insects grip top of stems in death
Microsporidia	***Protozoa have been studied for use biopesticide but results irregular.***
Nosema	"Protozoa" are spore-forming unicellular parasites…
Antonospora	…that can persist in host populations.
Vairimorpha	-attacks Mormon cricket
Bacteria	***Bacteria have been studied for biopesticide use, but with no success.***
Bacillus thuringiensis	-limited impacts so far, unlike *Bt kurstaki* in moths
Viruses	***Viruses have potential as biopesticides, but difficult to mass-produce.***
entomopox	-infects fat body tissue - sluggishness/slow growth/death
crystalline array	-too similar to mammalian viruses to study as biopesticide

Most insect pests are susceptible to fungal pathogens. In contrast to bacteria, protozoa (including microsporidia in old classifications) and viruses, which need to be ingested by the target arthropod, entomopathogenic fungi penetrate the host cuticle upon contact. Thus, fungi are more effective in infecting their hosts than most other entomopathogens.

The keys for mycoinsecticide success lie in three main areas: formulation development, application, and understanding the biology of the host-pathogen relationship in the field. Formulation products have been a goal of grasshopper control for many years, and they come in different forms, such as dust, wettable powders, granules, and baits, liquid formulations formed from biomass suspensions in water or oils, or a mixture of solids and liquids in emulsions. Dust and baits are regularly used for small-scale applications, and sprays are more suitable for large-scale operations. Baits are safer than sprays for non-target organisms and for the applicator, but on a larger scale sprays are more cost-efficient. Bait formulations are cheaper than sprays for small-scale operations, and baits have a high potential because they may be improved in the future with added attractants and chemicals that protect the spores from UV exposure. Current program chemicals have use limitations where there are endangered or threatened non-target animals and plants. There is a pressing need for environmentally friendly yet efficacious control measures to manage grasshopper populations in these natural habitats. Using microbial pesticides as an alternative to the registered chemical pesticides is a relatively environmentally benign treatment tool for grasshopper hotspots. Biopesticides such as bacteria, nematodes, microsporidia, fungi, and viruses would be useful tools for agricultural and environmental management systems, and hopefully further breakthroughs can make them more applicable to grasshopper treatments (Dakhel et al. 2020).

a) Endangered Species Act: Section 7

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 area under consideration by this EA there are seven federally listed species although not all occur within or near potential grasshopper suppression areas. For information, including avoidance measures on the T&E species within the area of concern, see Appendix C, "Threatened & Endangered Species Determinations for Utah APHIS 2026 Grasshopper/Mormon Cricket Suppression Projects."

The endangered species within Carbon, Emery, Grand, and San Juan Counties are Southwestern willow flycatcher, Bonytail, Colorado pikeminnow, Razorback sucker, Barneby reed-mustard, San Rafael cactus, Shrubby reed-mustard, and Wright's fishhook cactus. The threatened species are comprised of Utah prairie dog, Gunnison Sage-grouse, Mexican Spotted Owl, Yellow-billed Cuckoo, Humpback chub, Silverspot, Heliotrope milk-vetch, Jones Cycladenia, Last Chance townsendia, Navajo sedge, Uinta Basin hookless cactus, Welsh's milkweed, Winkler cactus, and Ute Ladies'-tresses. Suckley's cuckoo bumble bee is the only proposed endangered species in the program area, and the Monarch butterfly is the only proposed threatened species. Although proposed species receive no protection under the ESA, APHIS has taken measures to reduce treatment effects on these species such as buffers, habitat exclusions, ULV pesticide treatments, and local consultations with FWS (Appendix C).

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 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:

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> "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. Proposed treatment maps will be shared with local USFWS who will provide APHIS with pertinent listed species information before a treatment ensues. Descriptions and protective measures for listed species in the program area are located at the end of Appendix C.

APHIS completed a programmatic Section 7 consultation with NMFS for use of carbaryl, malathion, and diflubenzuron to suppress grasshoppers in the 17-state program area because of the listed salmonid (*Oncorhynchus* spp.) and critical habitat. To minimize the possibility of insecticides from reaching salmonid habitat, APHIS implements the following protection measures:

- RAATs are used in all areas adjacent to salmonid habitat
- ULV sprays are used, which are between 50% and 66% of the USEPA recommended rate
- Insecticides are not aerially applied within a 1,000-foot buffer zone for diflubenzuron along stream corridors
- Insecticides will not be applied when wind speeds exceed 10 miles per hour. APHIS will attempt to avoid insecticide application if the wind is blowing towards salmonid habitat
- Insecticide applications are avoided when precipitation is likely or during temperature inversions

APHIS determined that with the implementation of these measures, the grasshopper suppression program may affect, but is not likely to adversely affect listed salmonids or designated critical habitat in the program area. NMFS concurred with this determination in a letter dated April 12, 2010.

b) Additional Species of Concern Protection Measures

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.

Birds of Conservation Concern (BCC) in the program area include the American Avocet, American White Pelican, Bendire's Thrasher, Black Rosy-finch, Black Swift, Black Tern, Black-chinned Sparrow, Bobolink, Broad-tailed Hummingbird, Brown-capped Rosy-finch, California Gull, Calliope Hummingbird, Cassin's Finch, Clark's Grebe, Clark's Nutcracker, Evening Grosbeak, Flammulated Owl, Forster's Tern, Franklin's Gull, Grace's Warbler, Lawrence's Goldfinch, Lesser Yellowlegs, Lewis's Woodpecker, Long-eared Owl, Marbled Godwit, Mountain Plover, Northern Harrier, Olive-sided Flycatcher, Pectoral Sandpiper, Pinyon Jay, Red Knot, Rufous Hummingbird, Sage Thrasher, Thick-billed Longspur, Virginia's Warbler, Western Grebe, Willet, and Williamson's Sapsucker. This list consists of both migratory and non-migratory birds. Treatments could affect non-migratory and breeding birds within the program, while migrants that use the program area as a stopover before reaching their breeding grounds would be less affected. The shorebirds and waterfowl of this group should not be affected by treatments because the bodies of water they inhabit are inherently buffered. Other species that are found in montane zones will also not be impacted since they live in terrain that is untreatable. For the remaining species, the proposed action is not likely to adversely affect BCC 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.

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 young eagles 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.

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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, sage grouse and pinyon jay populations have declined throughout most of their entire range, with habitat loss being a major factor in their decline.

The pinyon jay (*Gymnorhinus cyanocephalus)* occurs in parts of the western United States, and is a common bird of the pinyon-juniper forests of Utah. Pinyon jays are often found in loose flocks that consist of multiple breeding pairs and the offspring of those pairs from previous nesting seasons. Each flock has an established home range, but may become somewhat nomadic and move long distances when food is scarce. These birds mainly consume pinyon and other pine seeds, but also eat berries, small seeds, grains, and insects. When pine seeds are abundant, flocks may communally cache large numbers of seeds. Moreover, the timing and location of breeding is tied to pine seed availability as pinyon jays have been recorded breeding in every month except December. The survival of young is decreased in years when pinyon jays have to rely on other food sources, such as periodic cicadas (Ligon 1978). While insects can be a part of the pinyon jay diet, including nestlings, much of their success is dependent on cached seeds. These jays are morphologically adapted or preadapted to use widely dispersed foods as they are strong, long distance fliers and possess an expandable esophagus that permits transport of large quantities of food per nest visit, thereby making foraging over large areas feasible (Ligon 1978). Due to this, they would be able to travel and find food in the event that grasshopper treatments reduce insect numbers in an area, as is in their nomadic nature. Nesting doesn't always occur when insects are plentiful, and can take place almost anytime throughout the year. Furthermore, the pinyon-juniper woodlands where pinyon jays breed and forage are not ideal for rangeland treatments due to their tree cover and usual variance in elevation. The program's use of RAATs, ULV treatments, and one treatment per year will also reduce the effects of treatments on insects the pinyon jay may consume.

There is special concern about the role of grasshoppers as a food source sage grouse, and other bird species. Grasshopper suppression programs reduce grasshoppers and at least some other insects in the treatment area that can be a food item for those species including sage grouse chicks. As indicated in previous sections on impacts to birds, there is low potential that the program insecticides would be toxic to sage grouse, either by direct exposure to the insecticides or indirectly through immature sage grouse 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. That density is normally none to less than one per square yard. Should grasshoppers be unavailable in small, localized areas, sage grouse chicks, for example, may consume other insects, which they likely do in years when grasshopper numbers are naturally low. By suppressing grasshoppers, rangeland vegetation is available for use by other species, and rangeland areas are less susceptible to invasive plants that may be undesirable for sage grouse and other species' habitat.

The 2024 Utah Greater Sage-grouse Lek Count Report compiled by UDWR provided updates on lek activity within the state. Statewide 398 leks were counted at least once with males observed on 246 leks. Leks are associated with critical nesting and early brood-

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rearing habitats, and generally located within nesting habitat used by nesting sage-grouse hens, with the majority nesting within 3 miles of a lek. Some leks can be found in remote areas, in areas with impassable roads, or areas that are otherwise inaccessible, thereby excluding them from treatments (UDWR 2024). For aerial applications of diflubenzuron, no applications will occur within three miles of active and undetermined (lek with displaying males observed, but they were either discovered this year, seen in previous years without males being documented in subsequent years, or had only one male observed) sage grouse leks during the intervals of one hour before sunrise to two hours after sunrise, and from two hours before sunset to one hour after sunset between the months of March and May. Ground applications will use carbaryl baits to mitigate potential impacts to non-target species. No carbaryl bait will be applied within three miles of any active or undetermined sage grouse lek and will also comply with the time frame constraints consistent with that of the aerial applications of diflubenzuron.

APHIS will always work with BLM, state and any other appropriate agencies when grasshopper treatments are proposed in areas where sage grouse are present, or any other species that is known to be of special interest or concern to federal or state agencies or to the public. Figure 8 from Utah's Conservation Plan For Greater Sage-Grouse shows the management areas for Sage-Grouse within Utah. Proposed treatments can be cross referenced with these areas to determine if further discussions need to be had with a land manager regarding provisions for Greater Sage-grouse (UDWR 2019).

Figure 8, Utah Greater Sage-Grouse Management Areas

APHIS implements several best management practices in our treatment strategies that are designed to protect nontarget invertebrates, including pollinators. APHIS minimizes insecticide use by using lower than labeled rates for all program insecticides, alternating swaths during treatment, making only one application per season, and minimizing use of liquid broad-spectrum insecticides. APHIS also continues to evaluate new monitoring and control methods designed to respond to economically damaging populations of grasshoppers and Mormon crickets while protecting rangeland resources such as pollinators.

3. Physical Environment Components

a) Geology and Soils

Utah is comprised of parts of three major physiographic provinces, each with characteristic landforms and geology. These include the Basin and Range Province, the Middle Rocky Mountains province, and the Colorado Plateau province. An overlapping of two of these provinces essentially forms a fourth physiographic region. The Basin and Range - Colorado Plateau transition zone extends through central and southwestern Utah, and contains physiographic and geologic features similar to both the Basin and Range and Colorado Plateau Provinces. The Basin and Range Province in western Utah is noted for numerous north-south oriented, fault-tilted mountain ranges separated by intervening, broad, sediment-filled basins. The mountain ranges are typically 12 to 30 miles apart and 30 to 50 miles long. Typical mountain ranges are asymmetric in cross section, having a steep slope on one side and a gentle slope on the other. The steep slope reflects an erosion-modified fault scarp, and the range is a tilted fault block. The Middle Rocky Mountains province in northeastern Utah consists of mountainous terrain, stream valleys, and alluvial basins. It includes the north-south trending Wasatch Range and the east-west trending Uinta Mountains. The Colorado Plateau province is a broad area of regional uplift in southeastern and south-central Utah characterized by essentially horizontal, ancient sedimentary rocks. Plateaus, buttes, mesas, and deeply incised canyons distinguish this province. Three much younger, intrusive volcanic mountain ranges are present in southeastern Utah. The Transition Zone is a broad region in central Utah containing geological characteristics of both the Basin and Range Province to the west, and the Colorado Plateau province to the east. The boundaries are the subject of some disagreement, resulting in various interpretations using different criteria. Essentially, east-west tectonic "stretching" of the Basin and Range has been superimposed upon the adjacent Colorado Plateau and Middle Rocky Mountains (with their very different rocks and terrains), forming a 60-mile wide zone of transitional geological and geographical characteristics (UDWR 2015).

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 and is also the home for many insects and microorganisms. Regarding formation, 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 Basin, 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.

The soils in Carbon and Emery Counties are of sedimentary origin and are in climatic soil groups including desert, semi desert, Upland Mountain and High Mountain, with some riparian groups and some badlands, rock outcroppings and irrigated soils. Some have been identified as saline, usually associated with the Mancos formation or some older marine sediments around the San Rafael Swell.

In San Juan County, the primary soil type is the Mivida soil, which is characterized as a deep, well-drained soil formed from eolian sediments and local alluvium derived from sandstone. This soil is located on structural benches and cuestas on the Colorado Plateau, typically at elevations from 5,000 to 6,500 feet, with annual precipitation ranging from 9 to 13 inches. The Mivida soil is associated with semi-desert ecological sites and is used for grazing and wildlife management. This soil contains a mix of essential minerals, organic matter, and other elements that support plant health and growth. The balance of nutrients in Mivida soil is particularly conducive to root development and helps retain moisture, which benefits many plants. The soil texture, generally a loamy or slightly sandy consistency, allows for excellent drainage while retaining enough moisture to sustain plants.

Grand County has a variety of soils, primarily classified into three types: loamy, sandy, and clay. Loamy soil is common in the region and provides good drainage and fertility, while sandy soil is found in areas with rocky terrain and are well-drained. Clay soil is prevalent in the southeastern part of the county, and is known for its ability to retain moisture and nutrients. Additionally, Mivida soil is notable, characterized by its unique properties found mainly in the Colorado Plateau region in valley bottoms, alluvial fans, and gentle slopes where water movement allows for sediment deposits. It’s derived from the sandy parent material in the lower Mesozoic sandstone, which is common around Southeast Utah.

b) Hydrology and Water Resources

Wetlands in Utah are incredibly varied, ranging from small, isolated spring complexes in the West Desert, to cottonwood and willow stands stretching for miles along some of Utah’s larger rivers like the Colorado or Green. Other unique wetlands in Utah include the hanging gardens of the Colorado Plateau like the Weeping Rock of Zion National Park, montane fens and wet meadows like Christmas Meadows in the Uinta National Forest, and large, unvegetated, highly saline playas in desert basins such as Sevier Lake and the Bonneville Salt Flats.

Surface water resources in Grand and San Juan counties generally consist of the upper Colorado River basin with other portions located in the Delores and Green River Basins. Typically the headwaters in the Book Cliffs meet State Class C water quality standards. The lower reaches often exceed one or more parameters. Parameters typically exceeded are total dissolved solids and sodium. Flash flooding often follows the intense summer and fall thunderstorms that occur in the area. Sediments and salts are transported to the Colorado River during these periods of high runoff and intermittent flows. Most of the Perennial streams are found in Book Cliffs and La Sal Mountain drainages.

Within Carbon and Emery Counties, surface water resources consist of the Green, Muddy, Price, and San Rafael Rivers. Some intermittent live streams, ponds, reservoirs such as Joe’s Valley and Scofield, stock tanks and troughs, seeps and springs are also present. The

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Green River provides excellent recreational opportunities, while several of the rivers and streams support fisheries. Many of the water resources provide adequate water for wildlife and domestic livestock use, as well as habitat for aquatic species.

The last National Rivers and Streams Assessment (NRSA) was published for 2018-2019. During spring and summer of 2018 and 2019, 61 field crews sampled 1,851 sites, using standardized sampling procedures to collect data on biological, chemical, physical, and human health indicators. The measured values were compared to benchmarks developed specifically for NRSA, to EPA recommended water quality criteria, or to EPA fish tissue screening levels to assess river and stream condition. Nationally, 28% of river and stream miles were in good biological condition, while almost half were in poor condition. The most widespread stressors were excess nitrogen, phosphorus, and riparian vegetation cover, with poor conditions in 44%, 42%, and 27% of river and stream miles, respectively. Moreover, just over one-third (35%) of river and stream miles had healthy fish communities. The NRSA found that the percentage of river and stream miles in poor biological condition could be reduced by 20% if excess nutrient levels could be reduced from poor to good or fair. Finally, bacteria exceeded EPA's recreational benchmark in 20% of river and stream miles (USEPA, 2024).

c) Air Quality and Climate

The Southeast portion of Utah is known as Castleland, and consists of Carbon, Emery, Grand, and San Juan Counites. Cold winters, hot summers, little rainfall, and poor soils make Castleland one of the state's most difficult regions for growing and maintaining landscapes. The climate of southeastern Utah is very diverse. Frost-free seasons range from 220 days along the lower Colorado River to 20 days in the La Sal Mountains and Roan Plateau. Most communities have frost free seasons of 100–180 days. Castleland has an average annual precipitation rate of 6–12 inches. The average high temperature for this region is 89 degrees in the summer and 17 degrees in the winter. Air quality is relatively good since the area covered by this EA is mainly rural with scattered small towns; hence, air pollution is rarely a factor.

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).

The public uses rangelands in the proposed suppression area for a variety of recreational purposes including hiking; camping; general wildlife viewing and bird watching, insect collecting and watching; hunting; falconry; shooting; plant collecting; rock and fossil collecting; artifact collecting; sightseeing; and dumping. Members of the general public traverse rangelands in or near the proposed suppression area by various means including on foot, horseback, all-terrain vehicles, bicycles, motorcycles, four-wheel drive vehicles, snowmobiles, and aircraft.

Recreation use is moderate over most of the affected areas. There are several dispersed camping sites. Hunting seasons increase recreation use in the form of dispersed camping and general hunting activity. Hunting season occurs later in the year during a time when grasshopper and cricket populations have begun to dwindle such that fewer insects are present, so hunters probably will not be affected. ATV use is fairly prevalent throughout. The presence of high densities of grasshoppers or Mormon crickets will result in fewer people engaging in recreational activities during the spring and summer within the affected areas. High insect densities in a campsite detract considerably from the quality of the recreational experience as crickets tend to get into unsecured tents and food. The quality of the recreational experience for ATV users and horseback riders also will be indirectly impaired by high densities of grasshoppers and/or crickets. Such numbers crossing roads and trails are killed by vehicle traffic, leaving windrows of dead insects in the travel way as well as providing a vehicular safety hazard by leaving slick residues on local roads.

People who normally recreate in areas that are heavily infested will likely relocate to areas that are not infested. Displacement of users will be more of an inconvenience to the public than an actual effect on the recreational values of the area. Displacement will also increase pressure on other public lands as people move to new locations to camp and to engage in other recreational activities. The potential for user conflict will increase, in particular as motorized recreationists displace to other already heavily used areas. Such locations will experience more pressure and may experience site degradation. Areas currently not impacted or used by dispersed campers may become subjected to use and development as people look for areas for recreation which are not infested with grasshoppers. Small towns near the affected areas receive limited business from recreationists who visit public lands. Many local gas stations and public stores rely fairly heavily on summer business to support their operations.

Livestock grazing is one of the main uses of most of the affected area, which provides summer range for ranching operations. Permittees may run cattle, sheep and horses for a season that runs generally from the first of June to the end of September, weather and vegetation conditions permitting. A substantial threat to the animal productivity of these rangeland areas is the proliferation of grasshopper populations. These insects have been serious pests in the Western States since early settlement. Weather conditions favoring the hatching and survival of large numbers of insects can cause outbreak populations, resulting in damage to vegetation. The consequences may reduce grazing for livestock and result in loss of food and habitat for wildlife.

Livestock grazing on public lands contributes important cultural and social values to the area. Intertwined with the economic aspects of livestock operations are the lifestyles and culture that have co-evolved with Western ranching. Rural social values and lifestyles, in conjunction with the long heritage of ranching and farming continue to this day, dating back to the earliest pioneers in Utah, who shaped the communities and enterprises that make up much of the state. The rural Western lifestyle also contributes to tourism in the area, presenting to travelers a flavor of the West through tourist-oriented goods and services, photography of sheep bands or cattle in pastoral settings and scheduled events.

Ranchers displaced from public lands due to early loss of forage from insect damage will be forced to search for other rangeland, to sell their livestock prematurely or to purchase feed hay. This will affect other ranchers (non-permittees) by increasing demand, and consequently, cost for hay and/or pasture in the area. This will have a beneficial effect on those providing the hay or range, and a negative impact on other ranchers who use these same resources throughout the area. In addition, grazing on private lands resulting from this impact will compound the effects to vegetation of recent drought conditions over the last six years (e.g., continual heavy utilization by grasshoppers, wildlife and wildfire), resulting in longer-term impacts (e.g., decline or loss of some preferred forage plant species) on grazing forage production on these lands.

The lack of treatment would result in the eventual magnification of grasshopper problems resulting in increased suppression efforts, increased suppression costs and the expansion of suppression needs onto lands where such options are limited. For example, control needs on crop lands where chemical options are restricted because of pesticide label restrictions.

Under the no action alternative, farmers would likely experience economic losses. The suppression of grasshoppers in the affected area would have beneficial economic impacts to local landowners, farmers and beekeepers. Crops near infested lands would be protected from devastating migrating insects, resulting in higher crop production; hence, increased monetary returns.

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.

A variety of activities have occurred throughout the area of concern that affect cultural resources. These activities and any cumulative impacts associated with them will occur regardless of whether or not grasshoppers or Mormon crickets are treated.

Federal and state public lands that are part of the region's visual and cultural resources include Scofield State Park, Huntington State Park, Jurassic National Monument, San Rafael Swell Recreation Area, Goblin Valley State Park, Green River State Park, Arches National Park, Manti-La Sal National Forest, Canyonlands National Park, Bears Ears National Monument, Natural Bridge National Monument, Edge of the Cedars State Park, Hovenweep National Monument, Goosenecks State Park, and Glen Canyon National Recreation Area.

To ensure that historical or cultural sites, monuments, buildings or artifacts of special concern are not adversely affected by program treatments, APHIS will confer with BLM, Forest Service, Tribes, or other appropriate land management agency on a local level to protect these areas of special concern. APHIS also will confer with the appropriate tribal authority and with the BIA office at a local level to ensure that the timing and location of planned program treatments do not coincide or conflict with cultural events or observances, such as sun dances, on tribal lands.

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).

Treatments used for grasshopper programs are primarily conducted on open rangelands where children would not be expected to be present during treatment or enter during the restricted entry period after treatment. Based on review of the insecticides and their use in programs, the risk assessment concludes that the likelihood of children being exposed to

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insecticides from a grasshopper or Mormon cricket program is very slight and that no disproportionate adverse effects to children are anticipated over the negligible effects to the general population.

Impacts on children would be minimized by the implementation of the Treatment Guidelines:

Aerial Broadcast Applications of Liquid Insecticides

- Notify all residents in treatment areas, or their designated representatives, prior to proposed operations. Advise them of the control method to be used, the proposed method of application, and precautions to be taken (e.g., advise parents to keep children and pets indoors during ULV treatment). Refer to label recommendations related to restricted entry period.

- No treatments would occur over congested urban areas. For all flights over congested areas, the contractor must submit a plan to the appropriate FAA District Office and this office must approve of the plan; a letter of authorization signed by the city or town authorities must accompany each plan. Whenever possible, plan aerial ferrying and turnaround routes to avoid flights over congested areas, bodies of water, and other sensitive areas that are not to be treated.

Aerial Application of Dry Insecticidal Bait

- Do not apply within 500 feet of any school or recreational facility. Ultra-Low-Volume

Aerial Application of Liquid Insecticides

- Do not spray while school buses are operating in the treatment area.

- Do not apply within 500 feet of any school or recreational facility.

Based on the analysis in the protection measures, we have determined that there would likely be no significant impact within any potential treatment zone of the area of concern.

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 draft 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 in Carbon, Emery, Grand, and San Juan Counties, the responsibility would rest with BLM, Forest Service, Indian tribes, state agriculture departments, local governments, and industry groups likely to perform grasshopper control treatments. APHIS estimates that up to 100,000 acres would be treated per year. The conventions of IPM that APHIS has incorporated into our standard program procedures could be too burdensome for other agencies to observe. While the economic benefits of suppressing grasshoppers by using a RAATs method have been widely publicized, less frequent treatments by other agencies might encourage widespread complete coverage treatments to "eradicate" grasshopper populations. Adverse environmental effects, particularly on nontarget species, could be much greater than under the APHIS led suppression program alternative due to lack of operational knowledge or coordination among the groups.

(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 land owners 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. Nonetheless, 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 consume 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 in 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 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 bait or 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 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. 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

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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).

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 contributes 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

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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) 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 include 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, the 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).

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 IC50 (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 had a 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

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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 honey bee 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 (Kaplan Meier, chi-squared = 3.1, $p = 0.5$), 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 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 caused 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 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

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Laboratory for analysis to determine the concentration of diflubenzuron residue both one 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 one day 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 14 samples without insecticide residues were collected in between spray swaths (i.e. within skip swaths).

Many of the flower samples were collected from the same, adjacent or nearby locations during the 24-hour and 14-day sampling events. Laboratory analysis showed five of the nine flower samples collected within spray swaths and six of the 16 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.

Six of the 11 contaminated 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. Diflubenzuron residues on nine of the 25 flower samples collected immediately after the 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. The locations where two floral samples were collected 24 hours after the treatment were not resampled 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. The laboratory analysis results are provided in Table 4.

Table 4. Diflubenzuron Residues on Flowers in a Grasshopper Treatment Area

Sample Number	Flower Species	Swath Type	Time since Treatment	Results (ppm)	Duplicate or Adjacent Sample Locations and Results
PC-FLW-01	Flodmann's Thistle	Skip	22 hours	ND	PC-FLW-35 **(ND)**
PC-FLW-02	Flodmann's Thistle	Skip	22 hours	ND	PC-FLW-36 **(ND)**
PC-FLW-03	Flodmann's Thistle	Spray	22 hours	ND	PC-FLW-37 **(0.121 ppm)**
PC-FLW-04	Flodmann's Thistle	Skip	Pretreatment	ND	PC-FLW-05 **(ND)**
PC-FLW-05	Flodmann's Thistle	Skip	Pretreatment	ND	PC-FLW-04 **(ND)**
PC-FLW-06	Flodmann's Thistle	Skip	Pretreatment	ND	No duplicate or adjacent sample
PC-FLW-07	Soapweed Yucca	Spray[1]	Pretreatment	ND	Adjacent to PC-FLW-08 **(ND)**
PC-FLW-08	Soapweed Yucca	Spray[1]	Pretreatment	ND	Adjacent to PC-FLW-07 **(ND)**
PC-FLW-09	Soapweed Yucca	Spray[1]	Pretreatment	ND	No duplicate or adjacent sample
PC-FLW-10	Yellow Sweetclover	Skip[2]	20 hours	0.391	PC-FLW-38 **(ND)**
PC-FLW-11	Yellow Sweetclover	Skip	20 hours	1.7	PC-FLW-17 **(0.132 ppm)**, PC-FLW-39 **(ND)**, PC-FLW-42 **(0.137 ppm)**
PC-FLW-12	Yellow Sweetclover	Spray	20 hours	0.538	PC-FLW-18 **(0.184 ppm)**, PC-FLW-40 **(ND)**, PC-FLW-43 **(0.279 ppm)**
PC-FLW-13	Wood's Rose	Skip[2]	24 hours	ND	PC-FLW-15 **(0.189 ppm)**, PC-FLW-44 **(0.141 ppm)**, PC-FLW-46 **(0.1.89 ppm)**
PC-FLW-14	Wood's Rose	Skip[2]	24 hours	0.304	PC-FLW-45 **(0.162 ppm)**, Adjacent to PC-FLW-13 **(ND)**, PC-FLW-15 **(0.189 ppm)**, PC-FLW-44 **(0.141 ppm)**, PC-FLW-46 **(0.1.89 ppm)**
PC-FLW-15	Wood's Rose	Skip[2]	24 hours	1.89	PC-FLW-13 **(ND)**, PC-FLW-44 **(0.141 ppm)**, PC-FLW-46 **(0.1.89 ppm)**
PC-FLW-16	White Milkwort	Skip	20 hours	ND	PC-FLW-41 **(ND)**
PC-FLW-17	White Milkwort	Skip	20 hours	0.132	PC-FLW-11 **(1.70 ppm)**, PC-FLW-39 **(ND)**, PC-FLW-42 **(0.137 ppm)**

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Sample Number	Flower Species	Swath Type	Time since Treatment	Results (ppm)	Duplicate or Adjacent Sample Locations and Results
PC-FLW-18	White Milkwort	Spray	20 hours	0.184	PC-FLW-12 **(0.538 ppm)**, PC-FLW-40 **(ND)**, PC-FLW-43 **(0.279 ppm)**
PC-FLW-19	Soapweed Yucca	Skip	25 hours	0.131	PC-FLW-49 **(ND)**, Adjacent to PC-FLW-20 **(ND)**, PC-FLW-47 **(0.815 ppm)**, PC-FLW-50 **(ND)**
PC-FLW-20	Soapweed Yucca	Skip	25 hours	ND	PC-FLW-47 **(0.815 ppm)**, PC-FLW-50 **(ND)**, Adjacent to PC-FLW-19 **(0.131 ppm)**, PC-FLW-22 **(ND)**, PC-FLW-49 **(ND)**
PC-FLW-21	Soapweed Yucca	Spray	25 hours	0.44	PC-FLW-48 **(0.397 ppm)**, PC-FLW-51 **(ND)**
PC-FLW-22	Flodmann's Thistle	Skip	25 hours	ND	Adjacent to PC-FLW-23 **(ND)**, PC-FLW-27 **(ND)**, PC-FLW-47 **(0.815 ppm)**, PC-FLW-50 **(ND)**
PC-FLW-23	Flodmann's Thistle	Skip[2]	25 hours	ND	Adjacent to PC-FLW-22 **(ND)**, PC-FLW-27 **(ND)**, PC-FLW-47 **(0.815 ppm)**, PC-FLW-50 **(ND)**
PC-FLW-24	Flodmann's Thistle	Spray	25 hours	0.146	No duplicate or adjacent sample
PC-FLW-25	Yellow Sweetclover	Spray	25 hours	0.187	PC-FLW-52 **(ND)**
PC-FLW-26	Yellow Sweetclover	Spray[1]	25 hours	ND	PC-FLW-53 **(ND)**, PC-FLW-54 **(ND)**, PC-FLW-55 **(ND)**, PC-FLW-56 **(ND)**, PC-FLW-57 **(ND)**, PC-FLW-58 **(ND)**
PC-FLW-27	White Milkwort	Spray[1]	25 hours	ND	Adjacent to PC-FLW-28 **(ND)**
PC-FLW-28	White Milkwort	Spray[1]	25 hours	ND	Adjacent to PC-FLW-27 **(ND)**
PC-FLW-29	Plains Pricklypear	Skip	Pretreatment	ND	No duplicate or adjacent sample
PC-FLW-30	Plains Pricklypear	Spray[1]	Pretreatment	ND	No duplicate or adjacent sample
PC-FLW-31	Plains Pricklypear	Spray[1]	Pretreatment	ND	No duplicate or adjacent sample
PC-FLW-32	Plains Pricklypear	Skip	24 hours	ND	No duplicate or adjacent sample
PC-FLW-33	Plains Pricklypear	Skip	24 hours	ND	PC-FLW-34 **(ND)**
PC-FLW-34	Plains Pricklypear	Skip	24 hours	ND	PC-FLW-33 **(ND)**
PC-FLW-35	Flodmann's Thistle	Skip	14 days	ND	PC-FLW-01 **(ND)**
PC-FLW-36	Flodmann's Thistle	Skip	14 days	ND	PC-FLW-02 **(ND)**
PC-FLW-37	Flodmann's Thistle	Spray	14 days	0.121	PC-FLW-03 **(ND)**
PC-FLW-38	Yellow Sweetclover	Skip[2]	14 days	ND	PC-FLW-10 **(0.391 ppm)**
PC-FLW-39	Yellow Sweetclover	Skip	14 days	ND	PC-FLW-11 **(1.70 ppm)**, PC-FLW-17 **(0.132 ppm)**, PC-FLW-42 **(0.137 ppm)**
PC-FLW-40	Yellow Sweetclover	Spray	14 days	ND	PC-FLW-12 **(0.538 ppm)**, PC-FLW-18 **(0.184 ppm)**, PC-FLW-43 **(0.279 ppm)**
PC-FLW-41	White Milkwort	Skip	14 days	ND	PC-FLW-16 **(ND)**
PC-FLW-42	White Milkwort	Skip	14 days	0.137	PC-FLW-11 **(1.70 ppm)**, PC-FLW-17 **(0.132 ppm)**, PC-FLW-39 **(ND)**
PC-FLW-43	White Milkwort	Spray	14 days	0.279	PC-FLW-12 **(0.538 ppm)**, PC-FLW-18 **(0.184 ppm)**, PC-FLW-40 **(ND)**
PC-FLW-44	Wood's Rose	Skip[2]	14 days	0.141	PC-FLW-13 **(ND)**, PC-FLW-15 **(0.189 ppm)**, PC-FLW-46 **(0.1.89 ppm)**, Adjacent to PC-FLW-14 **(0.304 ppm)**, PC-FLW-45 **(0.162 ppm)**
PC-FLW-45	Wood's Rose	Skip[2]	14 days	0.162	PC-FLW-14 **(0.304 ppm)**, Adjacent to **PC-FLW-13 (ND)**, PC-FLW-15 **(0.189 ppm)**, PC-FLW-44 **(0.141 ppm)**, PC-FLW-46 **(0.1.89 ppm)**
PC-FLW-46	Wood's Rose	Skip[2]	14 days	0.189	PC-FLW-13 **(ND)**, PC-FLW-15 **(0.189 ppm)**, PC-FLW-44 **(0.141 ppm)**, Adjacent to PC-FLW-14 **(0.304 ppm)**, PC-FLW-45 **(0.162 ppm)**
PC-FLW-47	Soapweed Yucca	Skip	14 days	0.815	PC-FLW-20 **(ND)**, PC-FLW-50 **(ND)**
PC-FLW-48	Soapweed Yucca	Spray	14 days	0.397	PC-FLW-21 **(0.44 ppm)**, PC-FLW-51 **(ND)**
PC-FLW-49	Soapweed Yucca	Skip	14 days	ND	PC-FLW-19 **(0.131 ppm)**
PC-FLW-50	Flodmann's Thistle	Skip	14 days	ND	PC-FLW-20 **(ND)**, PC-FLW-47 **(0.815 ppm)**
PC-FLW-51	Flodmann's Thistle	Spray	14 days	ND	PC-FLW-21 **(0.44 ppm)**, PC-FLW-48 **(0.397 ppm)**
PC-FLW-52	Flodmann's Thistle	Spray	14 days	ND	PC-FLW-25 **(0.187 ppm)**
PC-FLW-53	Yellow Sweetclover	Spray[1]	14 days	ND	PC-FLW-26 **(ND)**, PC-FLW-54 **(ND)**, PC-FLW-55 **(ND)**, PC-FLW-56 **(ND)**, PC-FLW-57 **(ND)**, PC-FLW-58 **(ND)**
PC-FLW-54	Yellow Sweetclover	Spray[1]	14 days	ND	PC-FLW-26 **(ND)**, PC-FLW-53 **(ND)**, PC-FLW-55 **(ND)**, PC-FLW-56 **(ND)**, PC-FLW-57 **(ND)**, PC-FLW-58 **(ND)**
PC-FLW-55	Yellow Sweetclover	Spray[1]	14 days	ND	PC-FLW-26 **(ND)**, PC-FLW-53 **(ND)**, PC-FLW-54 **(ND)**, PC-FLW-56 **(ND)**, PC-FLW-57 **(ND)**, PC-FLW-58 **(ND)**
PC-FLW-56	Soapweed Yucca	Spray[1]	14 days	ND	PC-FLW-26 **(ND)**, PC-FLW-53 **(ND)**, PC-FLW-54 **(ND)**, PC-FLW-55 **(ND)**, PC-FLW-57 **(ND)**, PC-FLW-58 **(ND)**
PC-FLW-57	Soapweed Yucca	Spray[1]	14 days	ND	PC-FLW-26 **(ND)**, PC-FLW-53 **(ND)**, PC-FLW-54 **(ND)**, PC-FLW-55 **(ND)**, PC-FLW-56 **(ND)**, PC-FLW-58 **(ND)**
PC-FLW-58	Soapweed Yucca	Spray[1]	14 days	ND	PC-FLW-26 **(ND)**, PC-FLW-53 **(ND)**, PC-FLW-54 **(ND)**, PC-FLW-55 **(ND)**, PC-FLW-56 **(ND)**, PC-FLW-57 **(ND)**

Samples collected June 14, 20 and 27, 2024. Samples analyzed by method MET-101 at AMS-NSL in Gastonia, North Carolina.
ND = diflubenzuron not detected.
1 – Sample collected at or near windward edge of spray swath
2 – Sample collected at or near leeward edge of spray swath

The average concentration of diflubenzuron residues detected on plant tissue samples collected one day after the aerial treatment was 0.297 ppm. To calculate the mean, 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. The maximum concentration detected was 1.89 ppm, and the standard deviation was 0.458 ppm. The average concentration of diflubenzuron on samples collected 14 days after the aerial treatment was 0.159 ppm, and the maximum concentration was 0.815 ppm. The reduction in the average and maximum values of the detected concentrations should be attributed to degradation of the chemical after application. The apparent increases in the concentration of diflubenzuron during the 14-day sampling period were likely caused by sampling of different plants and variation in chemical deposition. Diflubenzuron is not known to act as a systemic insecticide. 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 LD_{50} value for the honeybee, *Apis mellifera*, is reported at greater than 114.8 µg a.i./bee while the oral LD_{50} 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 and Thompson et al documented sublethal effects on reproduction-related endpoints for the bumble bee, *Bombus terrestris* and *A. mellifera*, respectively, testing a formulation of diflubenzuron.

The Mommaerts et al 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 researchers estimated mean LC_{50} concentrations based on the chronic exposure routes 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 maximum concentration of diflubenzuron detected on flowers collected one and 14 days after the treatment was greater than an order of magnitude below the LC_{50} determined by the researchers. The average concentration was close to the LC_{50} for ingested sugar-water, but this exposure scenario is extremely unlikely because the pesticide is applied as a foliar spray and the degradation of the chemical over time.

Research from Camp et al used Eastern bumble bee (Bombus impatiens) as surrogates to measure the effect that diflubenzuron has on bee behavior. Diflubenzuron concentrations (0.1, 1, 10, 100, 1,000 µg/liter) were 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-day IC_{50} (half-maximal inhibitory concentration) was calculated 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). The average concentration of diflubenzuron on plant tissues collected by USDA 14 days after the treatment was 0.159 ppm. Conversion to parts per billion (159 ppb) is straightforward but comparison of this tissue concentration to the sugar syrup concentration that caused reproductive effects (28.61 µg/liter approximately equivalent to 28.61 ppb) ignores the great uncertainty about how that conversion from tissue to nectar would occur in the field. Nonetheless, additional study of the deposition residues and resulting pollen and nectar concentrations resulting from aerial applications of diflubenzuron is warranted.

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. Honey bee LD_{50} was used as LD_{50} was not consistently available for bumble and solitary bees.

HQ (24 hours) = 297 ppb (0.297 ppm) ÷ 114.8 µg diflubenzuron per bee = 2.587
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.

The Bee-REX model is a screening level tool the U.S. EPA has created for use in a Tier I risk assessment to assess exposures of bees to pesticides and to calculate risk quotients. This model assesses exposures and effects on individual organisms (i.e., for honey bees), and is not intended for colony-level effects. Bee-REX estimates major routes of pesticide exposure relevant to bees (*i.e.*, through diet and contact). Bees foraging in a field treated with a pesticide through foliar spray could potentially be exposed to the pesticide through direct spray as well through consuming contaminated food.

The U.S. EPA Tier I risk assessment method generates “reasonably conservative” estimates of diflubenzuron exposure to honey bees, where reliable residue values (i.e., measured residue levels in pollen and nectar) are not available. These exposure estimates are based on adult and larval bees with the highest food consumption rates among bees. The conservatism of the Tier I screening-level risk quotient (RQ) value results primarily from the model-generated exposure estimates that, while intended to represent environmentally relevant exposure levels, are nonetheless considered high-end estimates.

Bee-REX calculates acute and chronic RQ values that can be compared to the corresponding level of concern (LOC) values for acute and chronic risk (*i.e.*, 0.4 and 1.0, respectively). Generally, if RQ values are below their respective LOCs, a presumption of minimal risk is made, since the Tier I risk estimation methods are designed to be conservative.

The contact Risk Quotient (RQcontact) was calculated 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 honey bee 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 honey bee 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 honey bees 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 on 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 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 of 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).

c) 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.

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(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 minority and low-income communities 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 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 or diflubenzuron depending upon the

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various factors related to the grasshopper outbreak and the site-specific characteristics. The use of 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).

V. Literature Cited

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VI. Listing of Agencies and Persons Consulted

A. Bureau of Land Management

Nebeker, Glenn, Field Manager, Fillmore, UT Field Office

Probert, R.B, Range Conservation, Fillmore, UT Field Office

Riding, Trevor, Range Specialist, Fillmore, UT Field Office

Robbins, Josh, State Weed Coordinator, State Office

B. Utah Department of Agriculture and Food

Hougaard, Robert, Director of Plant Industry

Watson, Kristopher, State Entomologist, Plant Industry

C. USDA, APHIS, PPQ

Caraher, Kai, Biological Scientist – Staff Officer

Rockermann, Peter, NV/UT State Plant Health Director, Reno, NV

Warren, Jim, Environmental Protection Specialist/Environmental Toxicologist

Vasquez, Ryan, GH/MC National Operations Manager

Wesela, William, GH/MC National Policy Manager

Wild, Alana, Former NV/UT State Plant Health Director

D. USDA, Forest Service

Hooper, Ethan, Cedar City, UT

Mark Bigelow, Cedar City, UT

E. USDA, Fish and Wildlife Service

Novak, Kate, T&E Specialist, Utah

Romin, Laura, Acting Field Supervisor, Utah

F. Utah Division of Wildlife Resources

Mumford, Vance, Southern Region Biologist

G. Utah State University Extension Service

Nelson, Mark, Beaver

Cooper, Troy, Duchesne

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Gale, Jody, Sevier County Agriculture Agent

Greenhalgh, Linden, Tooele

Hadfield, Jacob, Cache

Kitchen, Boyd, Uintah

Palmer, Matt, Sanpete

H. Utah County Commissioners

Brown, Ralph, Sevier County

Draper, Dean, Millard

Jensen, Greg, Sevier

Talbott, Will, Piute

I. Federal Legislators

Romney, Mitt, Utah Senator

VII. Appendix A

APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program

FY – 2025 Treatment Guidelines

[A national program document, not specific to this site-specific EA provided for the program in Utah.]

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 availability, 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.

VII. Appendix A

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.

Operational Procedures

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

VII. Appendix A

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.

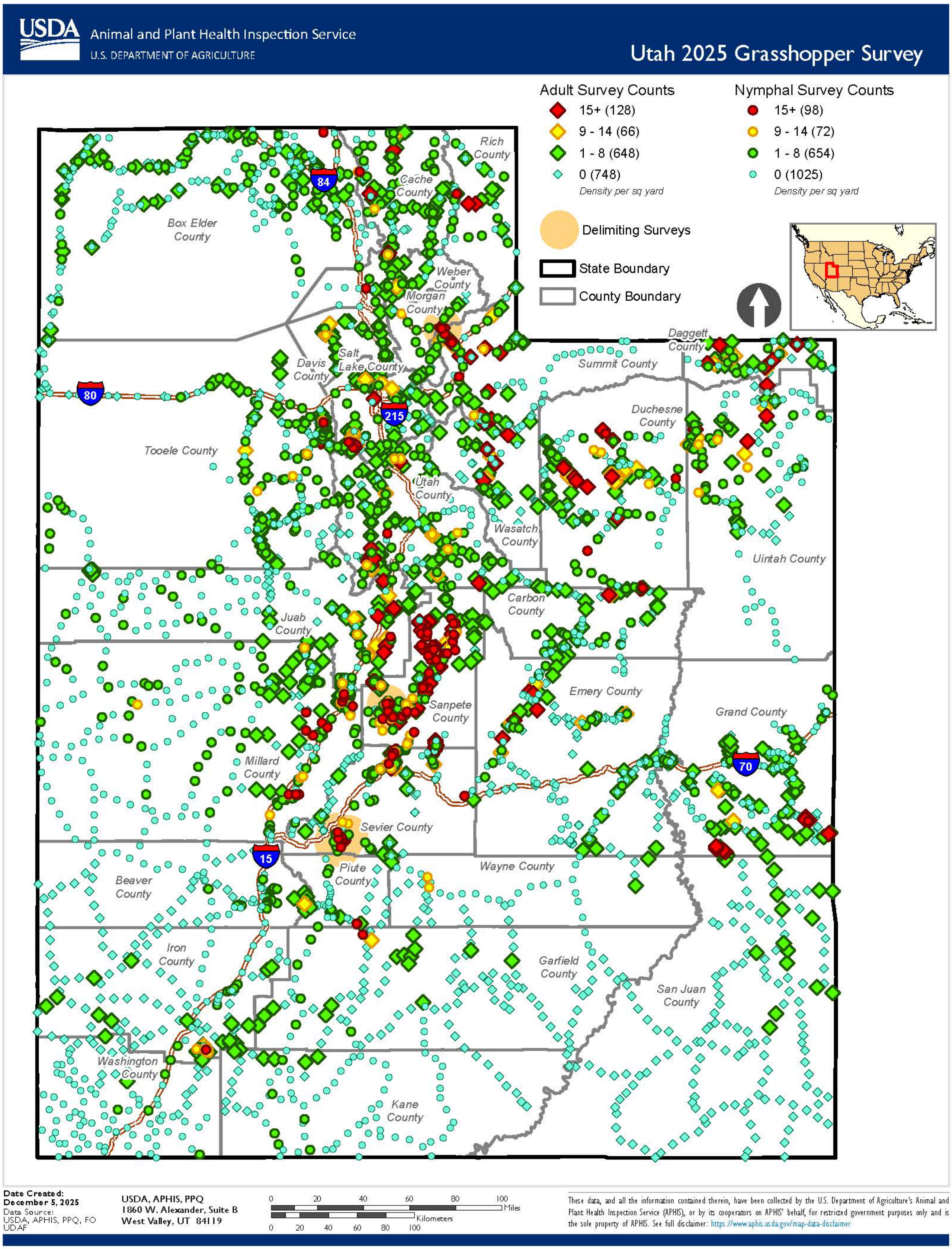
3. Weather conditions will be monitored and documented during application and treatment will be suspended when conditions could jeopardize the correct spray placement or pilot safety.

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.

VIII. Appendix B: Map of the Affected Environment

A. 2025 Utah Cumulative Survey



IX. Appendix C

A. USFWS Letter of Concurrence

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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THREATENED & ENDANGERED SPECIES DETERMINATIONS FOR UTAH APHIS 2026 GRASSHOPPER/MORMON CRICKET SUPPRESSION PROJECTS

BIRDS

1. <u>California condor</u> (*Gymnogyps californianus*) (Endangered): California condors were released as part of Recovery Program efforts in northern Arizona beginning in the late 1990's. Sightings of the birds that were released have since been made almost statewide. Condors prefer mountainous country at low and moderate elevations, especially rocky and brushy areas near cliffs. California condors eat carrion, usually feeding on large items such as dead sheep, cattle, and deer. Due to their foraging habits and preferences, the proposed APHIS grasshopper/Mormon cricket suppression program is unlikely to affect California condors. In addition, condors to date are occasional and temporary visitors to the state and are unlikely to contact suppression activities.

2. Gunnison Sage-Grouse (*Centrocercus minimus*) (Threatened): Found in Grand and San Juan Counties. Male Gunnison sage-grouse conduct an elaborate display when trying to attract females on breeding grounds, or leks in the spring. Nesting begins in mid-April and continues into July. Gunnison sage-grouse require a variety of habitats such as large expanses of sagebrush with a diversity of grasses and forbs and healthy wetland and riparian ecosystems. It requires sagebrush for cover and fall and winter food. Direct toxic effects from carbaryl bait are low (Peach *et al.,* 1994), but there may be minimal indirect effects since the young of this species depend upon arthropod groups for food. The use of carbaryl baits temporarily may lower the insect food base in the immediate area, though certainly not sufficiently to create adverse consequences to immature sage-grouse. Direct toxic effects from diflubenzuron are low since it is slightly to very slightly toxic to birds, but there may be minimal indirect effects such as a slight reduction in available prey items. The proposed APHIS suppression program will not likely adversely affect this species. PROTECTIVE MEASURES: No ground/aerial application will occur within 1 mile of known leks between March and July. Otherwise, no ground/aerial applications within 100/500 ft. of the edge of occupied habitat.

3. Mexican spotted owl (*Strix occidentalis lucida*) (Threatened): Possibly found in Carbon, Emery, Grand, Garfield, Iron, Kane, San Juan, Washington, and Wayne Counties. In Utah spotted owls occupy and nest in rocky canyon habitats. Nests are located on cliffs and in caves. Mexican spotted owls feed mainly on small rodents, but also consume rabbits and other small vertebrates, including birds, reptiles, and insects. Direct toxic effects from carbaryl bait are low since owls do not directly ingest it and since they do not depend on arthropod groups for food or seed dispersal. (George *et al*., 1992). Indirect toxic effects from carbaryl bait are low due to low application rates (10 pounds per acre or less) and small bait particle sizes, which preclude birds and small mammals from encountering sufficient quantities of toxin to cause adverse consequences to them or to owls which might consume them. APHIS only applies baits to areas of high grasshopper or Mormon cricket densities (8 or more per square yard), so any bait treatment is quickly and nearly totally consumed by the insects. Any remaining bait rapidly degrades from exposure to the elements (dew and higher soil pH's). Birds and rodents may prey upon debilitated insects, but rapid decomposition rates quickly make dead insects unpalatable. That, coupled with low application rates, makes it unlikely that spotted owls would be adversely affected by eating birds or small mammals that may prey upon insects debilitated by carbaryl bait treatments. APHIS ground baiting protocol excludes treatment near the canyon habitats that spotted owls use for nesting. Direct and indirect toxic effects from Dimilin are also low since diflubenzuron is slightly to very slightly toxic to birds (Wilcox and Coffey, 1978). The proposed APHIS suppression program will not likely adversely affect this species. PROTECTIVE MEASURES: The critical habitat for this species will be excluded from treatments, especially since a large portion of it occurs in areas already excluded from treatments including National Parks, Forests, and Recreation Areas in Utah.

4. Southwestern willow flycatcher (*Empidonax traillii extimus*) (Endangered): Possibly found in Kane, San Juan, and Washington Counties. The southwestern willow flycatcher utilizes dense riparian habitats. Forage items include insects, seeds and berries. Direct toxic effects from carbaryl bait are low (Peach *et al.,* 1994), but there may be minimal indirect effects since this species depends on arthropod groups for food. The use of carbaryl baits may temporarily lower the insect food base in the immediate area, though certainly not sufficiently to create adverse consequences to flycatchers. Direct toxic effects from Dimilin are low since diflubenzuron is slightly to very slightly toxic to birds, but there may be minimal indirect effects such as a slight reduction in available prey items. The proposed APHIS suppression program will not likely adversely affect this species. PROTECTIVE MEASURES: No aerial application will occur within 1 mile of suitable nesting habitat, and ground applications will be no closer than 0.25 mile to nesting habitat.

5. Yellow-billed Cuckoo (*Coccyzus americanus*) (Threatened): Found throughout Utah. The yellow-billed cuckoo uses wooded habitat with dense cover and water nearby. Its nests in the West are often placed in willows along streams and rivers, with nearby cottonwoods serving as foraging sites. They sometimes lay their eggs in other birds' nests. Cuckoos feed on insects (especially caterpillars), spiders, frogs, lizards, fruits, and seeds. Direct toxic effects from carbaryl bait are low (Peach *et al.,* 1994), but there may be minimal indirect effects since this species depends upon arthropod groups for food. The use of carbaryl baits may temporarily lower the insect food base in the immediate area, though certainly not sufficiently to create adverse consequences to cuckoos. Direct toxic effects from Dimilin are low since diflubenzuron is slightly to very slightly toxic to birds, but there may be minimal indirect effects such as a slight reduction in available prey items. The proposed APHIS suppression program will not likely adversely affect this species. PROTECTIVE MEASURES: No aerial application will occur within 1000 ft. and no ground application will occur within 500 ft. of the edge of known locations of yellow-billed cuckoos or their critical habitat.

FISHES

6. Big Spring spinedace (*Lepidomeda mollispinis pratensis*) (Threatened): Possibly found in western Iron County, Utah, the spinedace is restricted to a single population occurring in an approximate 8 km section of the Condor Canyon reach of Meadow Valley Wash northeast of Panaca in Lincoln County, Nevada. Big Spring spinedace no longer occupy the Panaca Big Spring outflow, the area they were first collected, due to habitat modification and the introduction of nonnative species. The upper limit of Big Spring spinedace habitat within Meadow Valley Wash is not currently known as it occurs on private property that has not been fully surveyed. The lower boundary of the habitat is the end of Condor Canyon where the stream flow is insufficient to support spinedace. Near the center of the canyon is Delmue Falls, which prevents fish from moving upstream from the lower limits of the canyon habitat to the upper limits. Therefore, the majority of the Big Spring spinedace population occurs above Delmue Falls with few individuals occurring below. Big Spring spinedace have been described by the Nevada Department of Wildlife (NDOW) in survey reports as being relatively abundant within Condor Canyon (NDOW 2001-2020). The greatest concentrations typically occur near the northern boundary of the designated critical habitat with decreasing numbers farther downstream. Direct toxic effects from carbaryl bait are low since APHIS ground applicators remain at least 50 feet from water which precludes any bait from entering a water body, even during and after heavy rains. Carbaryl rapidly decomposes in the presence of water and soils with higher pH's. Indirect effects from carbaryl bait are also low. Insects that ingest the bait are incapacitated by it within a matter of a minute or so; therefore, few could hop or fly into water bodies after bait consumption (APHIS personal experience). The use of bait near streams would not likely create an unnatural influx of contaminated grasshoppers or crickets into the water, so that fish might prey on them. Direct toxic effects from diflubenzuron are also low since it is only slightly toxic to fish (Willcox and Coffey, 1978; Julin and Sanders, 1978). Indirect effects from either carbaryl bait or diflubenzuron are minimal due to APHIS's standard practice of maintaining 50-foot buffers with ground applications of bait and 500-foot buffers with aerial sprays around water. The proposed APHIS suppression program will not likely adversely affect this species. PROTECTIVE MEASURES: No aerial applications within 1 mile of habitat or no ground treatments within 500 feet of habitat.

7. Bonytail (*Gila elegans*) (Endangered): Found in Carbon, Emery, Garfield, Grand, Kane, San Juan, Tooele, Uintah, Wayne, possibly Duchesne, and formerly Daggett Counties. Bonytail are opportunistic feeders, eating insects, zooplankton, algae, and higher plant matter. Although bonytail spawning in the wild is now rare, spawning occurs in the spring and summer over gravel substrate. Most bonytail are now produced in hatcheries and released into the wild as adults. The proposed APHIS suppression

program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

8. Colorado pikeminnow (*Ptychocheilus lucius*) (Endangered): Found in Carbon, Daggett, Emery, Garfield, Grand, San Juan, Uintah, Wayne, possibly Duchesne, and formerly Kane Counties. Colorado pikeminnows are primarily piscivorous (they eat fish), but smaller individuals also eat insects and other invertebrates. The species spawns during the spring and summer over riffle areas with gravel or cobble substrate. Eggs are randomly broadcast onto the bottom and usually hatch in less than one week. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

9. Humpback chub (*Gila cypha*) (Threatened): Found in Carbon, Daggett, Emery, Garfield, Grand, San Juan, Uintah, Wayne, possibly Duchesne, and formerly Kane Counties. Humpback chub primarily eat insects and other invertebrates, but algae and fishes are occasionally consumed. The species spawns during the spring and summer in shallow, backwater areas with cobble substrate. Young humpback chub remain in these slow, shallow, turbid habitats until they are large enough to move into white-water areas. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

10. Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*) (Threatened): The Lahontan cutthroat trout is a race of the cutthroat trout native to the Lahontan Basin of Oregon, California, and western Nevada. It has been introduced and become established in the Pilot Peak Range of western Box Elder County, Utah. Like other cutthroat races, the Lahontan cutthroat is an opportunistic feeder, with the diet of small individuals dominated by invertebrates, and the diet larger individuals composed primarily of fish. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

11. June sucker (*Chasmistes liorus*) (Threatened): Found in Box Elder, Salt Lake, Utah, and Weber Counties. June suckers are members of the sucker family, but they are not bottom feeders. The jaw structure of the June sucker allows the species to feed on zooplankton in the middle of the water column. June sucker adults leave Utah Lake and swim up the Provo River to spawn in June of each year. Spawning occurs in shallow riffles over gravel or rock substrate. Fertilized eggs sink to the stream bottom, where they hatch in about four days. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

12. Razorback sucker (*Xyrauchen texanus*) (Endangered): Found in Carbon, Daggett, Emery, Garfield, Grand, San Juan, Uintah, Wayne, possibly Duchesne, and formerly Kane Counties. The razorback sucker eats mainly algae, zooplankton and other aquatic invertebrates. The species spawns from February to June, and each female may deposit over 100,000 eggs during spawning. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

13. Virgin River chub (*Gila seminuda*) (Endangered): Found in Washington County. Virgin River chub are opportunistic feeders, consuming zooplankton, aquatic insect larvae, other invertebrates, debris and algae. Interestingly, the diet of many adults is composed primarily of algae, whereas the diets of younger fish contain more animal matter. The species spawns during late spring and early summer over gravel or rock substrate. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

14. Woundfin (*Plagopterus argentissimus*) (Endangered): Found in Washington County, the species is now restricted to the Virgin River system. Woundfin diets are quite varied, consisting of insects, insect larvae, other invertebrates, algae, and detritus. The species spawns during the spring in swift shallow water over gravel substrate. The proposed APHIS suppression program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 6.

FLOWERING PLANTS

15. Autumn buttercup (*Ranunculus aestivalis*) (Endangered): Found in Garfield County. Autumn buttercup produces abundant yellow flowers that can be seen from late-July to early October. It is found in low, herbaceous, wet meadow communities on islands of drier peaty hummocks, and sometimes in open areas, at elevations ranging from 1940 to 1965 meters. There are no direct toxic effects from carbaryl bait to this species. Indirect effects to plant pollinators from the use of carbaryl bait are low since insects must consume the bait in order to succumb to it. Target insects are unlikely pollinators of this species. There are no direct toxic effects from diflubenzuron, and the indirect effects to pollinators from the use of diflubenzuron are low since it is not toxic to adult insects. APHIS's low application rate of one ounce per acre, coupled with the practice of treating not more than every other swath, preclude significant adverse impacts to larval insects as well. Only insect nymphs that undergo incomplete metamorphosis (i.e., grasshoppers/crickets) manifest significant adverse effects at the low doses of APHIS projects. The proposed APHIS program will not likely adversely affect this species. PROTECTIVE MEASURES: No aerial applications within 3 miles of occupied habitat, and no ground treatments within 300 feet of occupied habitat.

16. Barneby reed-mustard (*Schoenocrambe barnebyi*) (Endangered): Found in Emery and Wayne Counties. Specimens have a branched woody base that gives rise to purple veined, white, or lilac flowers from late April to early June. Barneby reed-mustard grows in xeric, fine textured soils on steep eroding slopes of the Moenkopi and Chinle formations. It grows in sparsely vegetated sites in mixed desert shrub and pinyon-juniper communities, at elevations ranging from 1460 to 1985 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 16.

17. Barneby ridge-cress (*Lepidium barnebyanum*) (Endangered): Found in Duchesne County. This species grows in cushion-shaped tufts, has a thickened, branched woody base and produces abundant white to cream colored flowers that bloom in May and June. It grows along semi-barren ridges in pinyon-juniper woodlands, at elevations ranging from 1860 to 1965 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 16.

18. Clay phacelia (*Phacelia argillacea*) (Endangered): Found in Utah County. It is a narrow endemic to Spanish Fork Canyon, Utah County, Utah. A member of the waterleaf family, it has a scorpion tale-like inflorescence that continues, as it unrolls, to produce blue to violet flowers from June to August. This species is a winter annual and is found in fine textured soil and fragmented shale derived from the Green River Formation. It grows on barren, precipitous hillsides in sparse pinyon-juniper and mountain brush communities, at elevations ranging from 1840 to 1881 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect toxic effects and PROTECTIVE MEASURES same as # 16.

19. Clay reed-mustard (*Schoenocrambe argillacea*) (Threatened): Found in Uintah County. It is a plant that occurs in the Uinta Basin, Uintah County, Utah. A member of the mustard family, this species is a hairless perennial with a stout, woody base. It produces lilac to white, purple-veined flowers that bloom from mid-April through mid-May. Shrubby reed-mustard grows on the Evacuation Creek Member of the Green River Formation, where it is on substrates consisting of at-the-surface bedrock, scree, and fine-textured soils. It occurs on precipitous slopes in mixed desert shrub communities, at elevations ranging from 1439 to 1765 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

20. Dwarf bear-poppy (*Arctomecon humilis*) (Endangered): Found in Washington County. This plant is a narrow endemic to (occurs only in) Washington County, Utah. A member of the poppy family, this species is a perennial herb that produces abundant white flowers. The flowers bloom from mid-April through May, and are quite showy next to the red soils in which the plant grows. Dwarf bearclaw-poppy is found on gypsiferous clay soils derived from the Moenkopi Formation. It occurs on rolling low hills and ridge tops, often on barren, open sites in warm desert shrub communities, at elevations ranging from 700 to 1402 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

21. Gierisch mallow (*Sphaeralcea gierischii*) (Endangered): Found in Washington County. A member of the mallow family, this species is a flowering perennial which is only found on gypsum outcrops associated with the Harrisburg Member of the Kaibab Formation in northern Mojave County, AZ and Washington County, UT. It has a woody base and dies back to the ground during the winter and re-sprouts from the base during late winter and spring depending on daytime temperatures and rainfall. How its flowers are pollinated, seed-dispersal mechanisms, and the conditions under which seeds germinate are not yet known. Young plants have been observed on reclaimed portions within gypsum mining areas. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

22. Heliotrope milkvetch (*Astragalus montii*) (Threatened): Found in Sanpete and Sevier Counties. This is a plant that occurs on the southern Wasatch Plateau in Sanpete County and Sevier County, Utah. A member of the bean family, this species is a dwarf tufted perennial herb with pink purple petals that have white wing-tips. It blooms from June to August. Heliotrope milkvetch grows in barren areas on shallow and very rocky soils derived from Flagstaff Limestone, at elevations ranging from about 3230 to 3322 meters. It grows in subalpine communities of cushion plants and other low-growing species that are scattered within more extensive conifer, tall-forb, and grass communities. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

23. Holmgren milkvetch (*Astragalus holmgreniorum*) (Endangered): Found in Washington County. It occurs in Washington County, Utah, and in immediately adjacent Mohave County, Arizona. A member of the bean family, this species is a dwarf, tufted, stemless perennial herb. It has pinkish-purple flowers with unique white-tipped wings; it blooms in April and May. Holmgren milkvetch grows in topographic sites where water runoff occurs and where the soil surface is covered by a stony or gravelly erosional pavement. The soils are derived from the Moenkopi Formation. Holmgren milkvetch grows in warm desert shrub communities, at elevations ranging from 805 to 914 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

24. Jones cycladenia (*Cycladenia humilis var. jonesii*) (Threatened): Found in Emery, Garfield, Grand, and Kane Counties. This plant is restricted to the canyonlands of the Colorado Plateau in Emery County, Garfield County, Grand County, and Kane County, Utah, as well as in immediately adjacent Coconino County, Arizona. A member of the dogbane family, this species is a rhizomatous herb with round, somewhat succulent leaves, and small rose-pink hairy flowers that bloom from mid-April to early June. Jones' cycladenia grows in gypsiferous soils that are derived from the Summerville, Cutler, and Chinle formations; they are shallow, fine textured, and intermixed with rock fragments. The species can be found in Eriogonum-ephedra, mixed desert shrub, and scattered pinyon-juniper communities, at elevations ranging from 1219 to 2075 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

25. Kodachrome bladderpod (*Lesquerella tumulosa*) (Endangered): Found in Kane County. It is a plant that is a narrow endemic to (it occurs only in) Kane County, Utah. A member of the mustard family, this species is a perennial herb that forms densely matted and depressed mounds. It has a many-branched woody base with persistent leaf bases, has star-shaped hairs, and produces yellow flowers that bloom in May and early June. Kodachrome bladderpod is found on shallow soils that are fine textured, intermixed with shale fragments, and derived from the Winsor Member of the Carmel Formation. Kodachrome bladderpod grows on bare shale knolls and slopes in scattered pinyon-juniper communities, at elevations ranging from 1719 to 1845 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

26. Last Chance townsendia (*Townsendia aprica*) (Threatened): Found in Emery, Sevier, and Wayne Counties. This plant is a member of the sunflower family, and is a stemless perennial herb with flower heads submersed in its ground-level leaves. The flowers bloom in late April and May, and have yellow to golden petals. Last Chance townsendia is found in clay, clay-silt, or gravelly clay soils derived from the Mancos Formation; these soils are often densely covered with biological soil crusts. The species grows in salt desert shrub and pinyon-juniper communities, at elevations ranging from 1686 to 2560 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

27. Maguire primrose (*Primula maguirei*) (Threatened): Found in Cache County, this plant is a narrow endemic to (it occurs only in) Logan Canyon, Cache County, Utah. A member of the primula family, this species is a perennial herb with broad, spatula-shaped leaves. Stems are approximately four to fifteen cm tall, with each bearing one to three showy rose to lavender-colored flowers that bloom in late April and May. Maguire primrose is found on either north-facing or well shaded south-facing moss covered sites on damp ledges, in crevices, and on over-hanging rocks along the walls near the bottom of the canyon. It grows at elevations ranging from 1550 to 2012 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

28. Navajo sedge (*Carex specuicola*) (Threatened): Found in San Juan County, Utah, and in immediately adjacent Coconino County, Arizona. A member of the sedge family, this species is a loosely tufted perennial, 25 to 40 cm tall, with grass-like leaves that droop downward. Its flowers, seen in late June and July, are arranged in spikes, two to four spikes per stem. Navajo sedge is restricted to seep, spring, and hanging garden habitats in Navajo Sandstone, at elevations ranging from 1150 to 1823 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects of treatment are the same as # 20. PROTECTIVE MEASURES: No aerial applications within 3 miles of occupied habitat and no ground applications within 300 feet of springs, seeps and hanging gardens.

29. Pariette cactus (*Sclerocactus brevispinus*) (Threatened): Found in Duchesne and Uintah Counties. A member of the cactus family, this taxon is a Uinta Basin endemic in northeast Utah, Duchesne County. It is known from "a series of small scattered populations…near Myton (Heil and Porter (1994)." It inhabits "stoney, gravelly, low hilly terrain, growing with desert grasses or low vegetation (Hochstätter 1993)"; the soils on which it grows are derived from the Uinta Formation (Specht, pers. comm. 2005). The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

30. San Rafael cactus (*Pediocactus despainii*) (Endangered): Found in Emery and Wayne Counties. A member of the cactus family, this species is a small, subglobose to ovoid cactus with usually solitary stems; the crown of the stem is at or very near ground level. Its flowers are born near the tip of the stem, are yellow bronze to peach bronze, rarely pink in color, and bloom during April and May. San Rafael cactus is found in fine textured soils rich in calcium derived from the Carmel Formation and the Sinbad Member of the Moenkopi Formation. It occurs on benches, hill tops, and gentle slopes in pinyon-juniper and mixed desert shrub-grassland communities, at elevations ranging from 1450 to 2080 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

31. Shivwits milkvetch (*Astragalus ampullarioides*) (Endangered): Found in Washington County. It occurs in only Washington County, Utah. A member of the bean family, Shivwits milkvetch is a perennial herb. Specimens are 20 to 45 cm tall, each with an underground, branching woody base and an erect flower stalk bearing yellow-white flowers that bloom from late April to early June. Shivwits milkvetch grows on the unstable clay soil of Chinle Shale in warm desert shrub and pinyon-juniper communities, at elevations ranging from 872 to 1116 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

32. Shrubby reed-mustard (*Schoenocrambe suffrutescens*) (Endangered): Found in Duchesne and Uintah Counties. A member of the mustard family, this species is a perennial clump-forming herb that produces yellow flowers that bloom from May through June. Shrubby reed-mustard grows along semi-barren, white-shale layers of the Green River Formation (Evacuation Creek Member), where it is found in xeric, shallow, fine textured soils intermixed with shale fragments. It grows in mixed desert shrub and pinyon-juniper communities, at elevations ranging from 1554 to 2042 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

33. Siler pincushion cactus (*Pediocactus sileri*) (Threatened): Found in Kane and Washington Counties. It is a plant that occurs in adjacent Coconino and Mohave counties, Arizona; the center of its distribution is in Mohave County. A member of the cactus family, this species is a small, globose cactus with solitary, occasionally clustered, stems typically 10 cm tall (as great as 45 cm), and spines that become white with age. Its flowers are yellow with purple veins, and bloom during March and April. Siler pincushion cactus is found on the white, occasionally red, gypsiferous and calcareous sandy or clay soils derived from the various members of the Moenkopi Formation. It is sometimes found, however, on the nearly identical Kaibab Formation. Siler pincushion cactus occurs on rolling hills, often with a badlands appearance, in warm desert shrub, sagebrush-grass, and, at its upper limits, pinyon-juniper communities, at elevations ranging from 805 to 1650 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as # 16.

34. Uintah basin hookless cactus (*Sclerocactus wetlandicus*) (Threatened): Found in Carbon, Duchesne, and Uintah Counties, Utah and in Delta, Garfield, Mesa, and Montrose counties, Colorado. A member of the

cactus family, this species is a perennial herb with a commonly solitary, egg-shaped, three to twelve cm long stem that produces pink flowers late from April to late May. Uinta Basin hookless cactus is found on river benches, valley slopes, and rolling hills of the Duchesne River, Green River, and Mancos formations. It is found in xeric, fine textured soils overlain with cobbles and pebbles, growing in salt desert shrub and pinyon-juniper communities, at elevations ranging from 1360 to 2000 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

35. Ute ladies'-tresses (*Spiranthes diluvialis*) (Threatened): Found in Daggett, Duchesne, Garfield, Juab, Salt Lake, Tooele, Uintah, Utah, Wasatch, Wayne, and formerly Weber County. It also occurs in the states of Colorado, Idaho, Montana, Nebraska, Nevada, Washington, and Wyoming. A member of the orchid family, this species is a perennial herb with a flowering stem, 20-50 cm tall that arises from a basal rosette of grass-like leaves. The flowers are ivory-colored, arranged in a spike at the top of the stem, and bloom mainly from late July through August. Ute ladies'-tresses is found in moist to very wet meadows, along streams, in abandoned stream meanders, and near springs, seeps, and lake shores. It grows in sandy or loamy soils that are typically mixed with gravels. In Utah, it ranges in elevation from 1311 to 2134 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

36. Welsh's milkweed (*Asclepias welshii*) (Threatened): Found in Kane County, Utah as well as in immediately adjacent Coconino County, Arizona. A member of the milkweed family, this species is a stout, rhizomatous perennial herb with large oval leaves and spherical clusters of flowers that are cream-colored with pink-tinged centers. It blooms from June to August. Welsh's milkweed grows on dunes derived from Navajo Sandstone. It is found in sagebrush, juniper, and ponderosa pine communities, at elevations ranging from 1542 to 1993 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

37. Winkler cactus (*Pediocactus winkleri*) (Threatened): Found in Emery and Wayne Counties. A member of the cactus family, this species is a small, subglobose cactus with solitary or clumped stems; the crown of the stem is at or very near ground level. Its flowers are born near the tip of the stem, are peach to pink in color, and bloom late March to May. Winkler pincushion cactus is found in fine textured soils derived from the Dakota Formation and the Brushy Basin Member of the Morrison Formation. It occurs on benches, hill tops, and gentle slopes on barren, open sites in salt desert shrub communities, at elevations ranging from 1490 to 2010 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

38. Wright's fishhook cactus (*Sclerocactus wrightiae*) (Endangered): Found in Emery, Sevier, and Wayne Counties. A member of the cactus family, this species is a perennial herb with a solitary, hemispheric, ribbed, 6 to 12 cm tall stem that produces nearly-white to pink flowers from late April through May. Wright's fishhook cactus is found in soils that range from clays to sandy silts to fine sands, typically in areas with well-developed biological soil crusts. Wright's fishhook cactus grows in salt desert shrub and widely scattered pinyon-juniper communities, at elevations ranging from 1305 to 1963 meters. The proposed APHIS program will not likely adversely affect this species. Direct and indirect effects and PROTECTIVE MEASURES same as #16.

INSECTS

39. Monarch butterfly (*Danaus Plexippus*) (Proposed Threatened): Found in most counties throughout Utah at some point during the year, mostly during the summer months/breeding season. Monarchs are

pollinators that are well known for their impressive long-distance migration and their recent declines. Their bright coloration serves as a warning to predators that eating them can be toxic, & monarchs obtain these toxins (called cardenolides) by consuming milkweed plants. The species is native to North America but has spread to other parts of the world such that non-migratory populations exist from Pacific Ocean islands to the western edge of Europe. The majority of monarchs still exist and migrate in North America. Eastern monarch populations may fly more than 2,000 miles to overwintering sites in Mexico, while western populations will migrate around 300 to 1,000 miles where they overwinter in hundreds of groves of trees along the California coast and into northern Baja California and Mexico. This species' decline is attributed mostly to historical loss of habitat, which is areas of milkweed and nectar-producing flowering plants. The insects depend solely on milkweed during their egg and caterpillar stages, while adults require a diversity of flowering plants to fulfill their nutritional needs. Though not rare, milkweed plants (which support monarch butterfly) would be an example of a plant species that would be desirable to buffer, as requested by anyone involved. There are 17 species of milkweed native to Utah, but many are either infrequently encountered or are restricted to specific micro-climates, soil type or other restrictive feature and therefore of limited applicability to monarch conservation practices. Two are especially valuable for monarch habitat plantings in Utah. Perhaps the most abundant milkweed species in Utah is showy milkweed. This species is common along ditch banks, roadsides, pastures and meadows throughout the state up to elevations of about 7,500 ft. Like all milkweeds, showy milkweed is toxic to livestock, and in many cases it has been managed against for decades in agricultural areas. As a result, incidences of milkweed in the program area that have been treated for grasshoppers are extremely limited, mostly occurring in small patches in roadside ditches. This is not ideal caterpillar habitat due to patch size limitations and disturbances caused by traffic, and would be buffered already if a state hi-way or interstate. One slightly less common milkweed that can be found in Utah is swamp milkweed. It is more limited in distribution than showy milkweed, but it is highly attractive to monarchs and grows in the wetter areas where monarchs are known to congregate. Swamp milkweed occurs naturally along river banks and pond shores throughout most of North America but is primarily found in wet areas in northern Utah. Northern Utah has rarely seen grasshopper outbreaks in the past, and water buffers help to protect this species from treatments. There are no direct toxic effects from carbaryl bait to this species. Indirect effects to plant pollinators from the use of carbaryl bait are low since insects must consume the bait in order to succumb to it. There are no direct toxic effects from diflubenzuron, and the indirect effects to pollinators from the use of diflubenzuron are low since it is not toxic to adult insects. APHIS's low application rate of one ounce per acre, coupled with the practice of treating not more than every other swath, preclude significant adverse impacts to larval insects as well. The proposed APHIS program is not likely to adversely affect this species.

40. <u>Suckley's Cuckoo bumblebee</u> (*Bombus suckleyi*) (Proposed Endangered): May be found in certain portions of the area covered by this EA though they haven't been observed in the contiguous United States since 2016 despite widespread historical occurrence records and increased sampling effort for bumble bees. The Suckley's cuckoo bumblebee is a rare species that is threatened mostly by habitat degradation and declines in their host species caused by human population expansion. They are parasitic pollinators whose host is primarily the western bumblebee (*Bombus occidentalis*) which has seen significant declines in the last several years. Suckley's cuckoo bumblebee females emerge from overwintering in the spring and begin searching for host nests. They invade host nests and kill or subdue the host queen. The female cuckoo lays her eggs in the host nest where the offspring hatch and develop, aided by host workers. When both male and female cuckoos emerge, they mate, and the females select a spot to overwinter. The males and the original egg-laying female die at the onset of winter. The species has not been observed in the contiguous United States since 2016 despite widespread historical occurrence records and increased sampling effort for bumble bees. The APHIS program is not likely to adversely affect this species since it has not been located in the US since 2016. PROTECTIVE

MEASURES: No aerial applications of diflubenzuron within 1 mile of occupied habitat, and no ground treatments of carbaryl bait within 250 feet of occupied habitat.

41. Nokomis Silverspot butterfly (*Speyeria nokomis nokomis*) (Threatened): Found in its "pure" form in southeastern Utah and western Colorado, while some authors contend that it exists in northern Arizona and New Mexico north of Interstate 40 and the Mogollon Rim, including areas of the Navajo Nation. It is highly restricted to arid, riparian habitats in streamside meadows and open seepage areas within desert landscapes of the Upper Sonoran, pinon-juniper life zone. The only confirmed larval food source is the bog violet (*Viola nephrophylla*) though adults require additional nectar sources which they procure nearby. Other commonly associated plants in nokomis habitat include sedges (*Carex*), willows (*Salix*), both native and introduced thistles (*Cirsium, Carduus & Onopordon*), horsemint (*Agastache*) and joe pye weed (*Eupatorium maculatum*). Suitable nokomis habitat is sporadically found across vast stretches of desert, thus colonies are often isolated. All riparian zones are buffered for APHIS treatments (500 feet for diflubenzuron aerial & 200 feet for carbaryl ground bait). There are no direct toxic effects from carbaryl bait to this species. Indirect effects to plant pollinators from the use of carbaryl bait are low since insects must consume the bait in order to succumb to it. There are no direct toxic effects from diflubenzuron, and the indirect effects to pollinators from the use of diflubenzuron are low since it is not toxic to adult insects. APHIS's low application rate of one ounce per acre, coupled with the practice of treating not more than every other swath, preclude significant adverse impacts to larval insects. The proposed APHIS program is not likely to adversely affect this species. PROTECTIVE MEASURES: No aerial applications of diflubenzuron within 1 mile of occupied habitat, and no ground treatments of carbaryl bait within 250 feet of occupied habitat.

MAMMALS

42. Canada lynx (*Lynx canadensis*) (Threatened): The preferred habitat of the Canada lynx is montane coniferous forest. The proposed APHIS suppression program will have no effect on or cause no jeopardy to any population of Canada lynx since projects will avoid known or historic species habitat areas.

43. Utah prairie dog (*Cynomys parvidens*) (Threatened): Found in Beaver, Garfield, Iron, Kane, Millard, Piute, Sanpete, Sevier, and Wayne Counties. Direct toxic effects from carbaryl bait are moderate since prairie dogs may ingest it. However, 10 pounds per acre maximum application rates preclude ingestion of sufficient toxin to create behavioral anomalies, let alone mortality, due to the unlikelihood of encountering significant quantities. Since prairie dogs may consume insects, indirect effects from carbaryl bait are possible, but large quantities of contaminated insects would have to be consumed for such to occur. Rapid decomposition rates of dead insects, quickly making them unpalatable as food items, coupled with low application rates, minimize the risk of adverse effects on prairie dogs from carbaryl bait treatments. Direct toxic effects from Dimilin are low since diflubenzuron is slightly to very slightly toxic to mammals (Maas *et al.,* (1981). There would be no indirect effects from the use of Dimilin. The proposed APHIS suppression program would not likely adversely affect this species. PROTECTIVE MEASURES: Avoid using any pesticide within 1 mile of occupied habitat.

44. Wolverine (*Gulo gulo luscus*) (Threatened): Found in cold higher elevation locations in Utah where snowy conditions persist later into the warm season. They are opportunistic feeders, consuming a variety of foods depending on availability. They primarily eat carrion but prey on small mammals and birds and eat berries, fruits and insects. The availability of food is likely the primary reason wolverines tend to travel such long distances over rough terrain and deep snow. Home ranges of adults range from 38 to 348 square miles. Breeding generally occurs from late spring to early fall, and females undergo delayed implantation until the following winter/spring when active gestation lasts 30 to 40 days. Litters are born

between February and April wherein one to five kits are born. Female wolverines use birthing dens that are excavated in snow that is greater than 5 feet deep seems to be required for natal denning. Habitat and range loss are the primary threats to wolverines since they are restricted to high elevation areas of the West where snow cover is persistent into the spring. The preferred habitat of the wolverine is montane coniferous forest. The proposed APHIS suppression program will have no effect on or cause no jeopardy to any population of wolverines since projects will avoid known or historic species habitat areas.

REPTILES

45. Desert tortoise (*Gopherus agassizii*) (Threatened): Found in Washington County. Within its range, the desert tortoise can be found near water in deserts, semi-arid grasslands, canyon bottoms and rocky hillsides. Desert tortoises often construct burrows in compacted sandy or gravelly soil. Females nest under a large shrub or at the mouth of a burrow and lay one to three clutches of two to fourteen eggs from May to July; eggs hatch in late summer or fall. Burrows, which may contain many tortoises at once, are used for hibernation during cold winter months. The typical diet of the desert tortoise consists of perennial grasses, cacti, shrubs and other plant material. Historically APHIS has never received a request to treat in areas inhabited by desert tortoises, but if asked to do so, there would exist the threat of direct take by running over small tortoises with ground equipment. Direct toxic effects from the use of carbaryl bait are unknown, but the tortoises would not likely consume the bait at low application rates (10 pounds per acre) and given the small size and consistency of bait particles. Indirect effects are low since they do not depend on insects for food. No information was located about diflubenzuron's toxicity to reptiles, but it is likely that it is low, based on the selective nature of its toxic mode of action (i.e., it interferes with the synthesis of chitin in those organisms that produce exoskeletons). The relative toxicity of diflubenzuron to reptiles is expected to be similar to that of mammals and birds (APHIS EIS, 2002). Indirect effects are also expected to be low since desert tortoises do not depend on insects for food. It is unlikely that grasshoppers or Mormon cricket populations would ever reach outbreak levels and require APHIS treatments in desert tortoise habitat. The proposed APHIS suppression program will not likely adversely affect this species. PROTECTIVE MEASURES: No aerial or ground applications will occur in the Beaver Dam Slope; the Tortoise Preserve or other occupied habitats of Washington County. If APHIS does receive a request to treat using ground equipment, then APHIS would re-consult with the USFWS.