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Draft Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program

Western and Central South Dakota (counties included but not limited to: Bennett, Brule, Buffalo, Butte, Charles Mix, Corson, Custer, Dewey, Fall River, Gregory, Haakon, Harding, Hughes, Hyde, Jackson, Jones, Lawrence, Lyman, Meade, Mellette, Oglala Lakota, Pennington, Perkins, Stanley, Todd, Tripp, and Ziebach)

PPQ and CEQ Identification Number: SD-25-01-EAXX-005-32-24P- 1754659733

Prepared by:
Animal and Plant Health Inspection Service
314 South Henry
Suite 200
Pierre, SD 57501

August 2025

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Acronyms and Abbreviations

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

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Draft Site-Specific Environmental Assessment

Rangeland Grasshopper and Mormon Cricket Suppression Program

Western and Central South Dakota (counties included but not limited to: Bennett, Brule, Buffalo, Butte, Charles Mix, Corson, Custer, Dewey, Fall River, Gregory, Haakon, Harding, Hughes, Hyde, Jackson, Jones, Lawrence, Lyman, Meade, Mellette, Oglala Lakota, Pennington, Perkins, Stanley, Todd, Tripp, and Ziebach)

I. Need for Proposed Action

A. Purpose and Need Statement

An infestation of grasshoppers or Mormon crickets may occur in Western and Central South Dakota. 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 including: Rural economies depend on rangelands that managed for productive forage to provide for livestock grazing. A reduction in forage has significant impact on cattle health and gain which adversely impacts producers and their livelihoods. Besides these direct market values, rangelands also provide important ecosystem services, such as purification of air and water, water conservation, generation and preservation of soils and renewal of their fertility, detoxification and decomposition of wastes and pollutants, pollination of crops and natural vegetation, dispersal of seeds, cycling and movement of nutrients, control of potential agricultural pests, maintenance of biodiversity, and aesthetic beauty. The goal of the proposed suppression program analyzed in this EA is to reduce grasshopper populations below economic injury levels in order to protect the natural resources of rangeland ecosystems, the value of livestock and wildlife forage, and cropland adjacent to rangeland.

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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 June 1st to July 14th in Western and Central South Dakota (counties included but not limited to: Bennett, Brule, Buffalo, Butte, Charles Mix, Corson, Custer, Dewey, Fall River, Gregory, Haakon, Harding, Hughes, Hyde, Jackson, Jones, Lawrence, Lyman, Meade, Mellette, Oglala Lakota, Pennington, Perkins, Stanley, Todd, Tripp, and Ziebach.

This EA is prepared in accordance with the requirements under the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq*.); Council on Environmental Quality's (CEQ) regulations implementing NEPA (40 CFR 1500 *et seq*.); USDA (7 CFR Part 1b) and APHIS NEPA Implementing Procedures (7 CFR Part 372). APHIS make and issue a decision based on the analysis presented in this EA, the results of public involvement, and consultation with other agencies and individuals. A selection of one of the program alternatives will be made by APHIS for the Control Programs for Western and Central South Dakota.

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

B. Background Discussion

1. Grasshopper Ecology

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

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

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

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

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

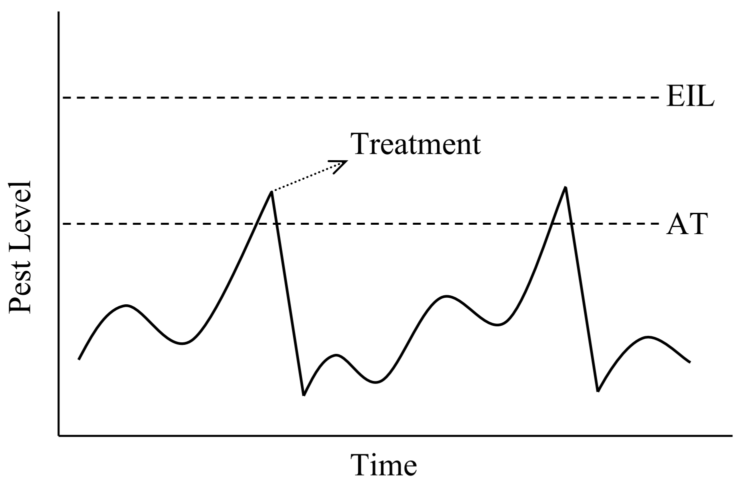

Figure 1. Diagram of the typical relationship between the economic injury level (EIL) and action threshold (AT) for applying pest treatments (Rashford et al., 2012).

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

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

2. Grasshopper Population Control

Grasshopper populations sometimes build to economic injury levels despite even the best land management and other efforts to prevent outbreaks. South Dakota landowners have been proactive in treating their privately owned lands with pesticide to control grasshoppers. 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

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information needed to make economically and environmentally sound grasshopper treatment decisions.

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

The site-specific data used to make treatment decisions in real time is gathered during spring nymph surveys. Surveys help to determine general areas, among the millions of acres where harmful grasshopper infestations may occur in the spring of the following year. Survey data provides the best estimate of future grasshopper populations, while short-term climate or environmental factors change where the outbreak populations occur. The general site-specific data include: grasshopper densities, species complex, dominant species, dominant life stage, grazing allotment terrain, soil types, range conditions, local weather patterns (wind, temp., precipitation), slope and aspect for hatching beds, animal unit months (AUM's) present in grazing allotment, forage damage estimates, number of potential AUM's consumed by grasshopper population, potential AUM's managed for allotment and value of the AUM, estimated cost of replacement feed for livestock, rotational time frame for grazing allotments, number of livestock in grazing allotment. South Dakota rangeland is widely variable in grassland species composition, productivity, and applied management practices. Drought conditions can drastically reduce productivity from one year to the next. This level of variability complicates the decision making process and grasshoppers per square yard is the most consistent metric. Density numbers obtained from Spring survey efforts combined with drought monitoring data are the most important factors when determining treatment feasibility. These are all factors that are considered when determining the economic injury level.

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. When treating with growth regulators in South Dakota, treatments typically are completed in the second half of June. During this time frame, very few grasshoppers species have reached adulthood and the majority of problem species have recently hatched. By aligning treatments with peak nymphal numbers, the grasshopper life cycle can be broken which is vital in successful treatments. Pesticide applications made later in the summer are typically less effective since many of the grasshoppers have reached maturity and are already laying eggs. In the Affected Environment Section below, 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 Western and Central South Dakota 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).

In October 2015, 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 #15-8100-0870-MU, October 15, 2015). 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.

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

C. About This Process

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

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

As previously discussed in Grasshopper Population Control, 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 Western and Central South Dakota to account for the wide geographic areas in which grasshoppers and Mormon crickets occur on rangelands. Then, when grasshopper populations grow to nuisance levels, program managers examine the proposed treatment area to ensure that this EA applies to the specific areas where control activities will be conducted and can act quickly. At the same time, the Program strives to alert the public in a timely manner to its more concrete treatment plans and avoid or minimize harm to the environment in implementing those plans.

Section 1619 of the Farm Bill (7 USC 8791) also prohibits disclosure of certain information from agricultural producers who provide information to participate in programs of the department. Intergovernmental 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.

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 South Dakota.

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To assist with understanding applicable issues and reasonable alternatives to manage grasshopper outbreaks in rangelands and to ensure that the analysis is complete for informed decision making, APHIS has made this Draft EA available for a 30-day public review and comment period. Public outreach notification methods for this EA include local newspapers including the Rapid City Journal and The Lakota Times, Regulations.gov, Stakeholder Registry notice, and direct electronic mailings to previously engaged parties. 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.

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 made a draft of this EA available for a 30-day public review and comment period. Public outreach notification methods for this EA included local newspapers including the Rapid City Journal and The Lakota Times, Regulations.gov, Stakeholder Registry notice, and direct electronic mailings to previously engaged parties. After reviewing and considering received comments, APHIS has revised and published this Final EA, 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). APHIS uses the scoping process to enlist land managers and the public to identify alternatives and issues to be considered during the development of a grasshopper suppression program. The process can occur formally and informally through meetings, conversations, or written comments from individuals and groups.

Scoping was completed through informal communication and conversations with Bureau of Land Management, Forest Service, and several local grazing associations utilizing Federal rangeland.

APHIS reviewed and considered all comments in preparing the draft EA.

II. Alternatives

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

1. Alternative 1: No action alternative, which would maintain the status quo of allowing applications of two pesticides (carbaryl, 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 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 Western and Central South Dakota 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 314 South Henry, Suite 200, Pierre, SD 57501. These documents are also available at the Rangeland Grasshopper and Mormon Cricket Program web site, http://www.aphis.usda.gov/plant-health/grasshopper.

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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 Western and Central South Dakota. 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. The insecticides available for use by APHIS include the U.S. Environmental Protection Agency (USEPA) registered chemicals: carbaryl and diflubenzuron. These chemicals have varied modes of action. Carbaryl works by inhibiting acetylcholinesterase (enzymes involved in nerve impulses). Chlorantraniliprole activates insect ryanodine receptors which causes an uncontrolled release of calcium, impairing insect muscle regulation and leading to paralysis. Diflubenzuron inhibits the formation of chitin by insects which causes weak exoskeletons. APHIS would make a single application per year to a treatment area and could apply insecticide at an APHIS rate conventionally used for grasshopper suppression treatments, or more typically 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 application would likely only be utilized in a crop protection program where a buffer is treated on Federal lands to stop grasshopper encroachment onto private crop lands.

APHIS selects which insecticides and rates are appropriate for suppression of a grasshopper outbreak based on several biological, logistical, environmental, and economical criteria. The primary biological factor is the grasshopper species and the most common life stage of the dominant species of concern. When grasshoppers populations are mostly comprised of the first three instars diflubenzuron is typically selected because it is 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. If the window for the use of diflubenzuron closes, as a result of treatment delays, then carbaryl is the remaining control option. The circumstances where the use carbaryl bait would be best are reduced because of the higher cost per acre than liquid insecticide formulations. Only certain species 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*). Carbaryl is unlikely to be used under normal conditions, but could be considered for crop protection programs where prompt lethality of adult grasshoppers is necessary to mitigate impact to affected crop lands.

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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):

- 8.0 fluid ounces (0.25 lbs a.i./ac sprayed) of carbaryl spray;
- 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; or

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 carbaryl (liquid) and 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 X 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.

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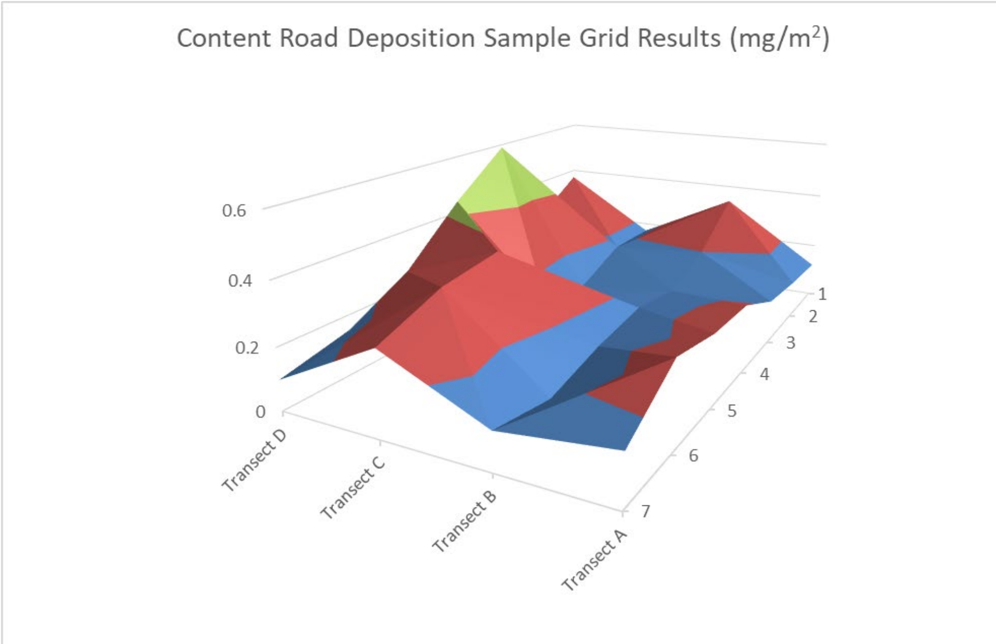
Figure 1 – Diflubenzuron concentration on dye cards placed 150 feet apart in a grid



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).

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

- 16.0 fluid ounces (0.50 lbs a.i./ac sprayed) of carbaryl spray;
- 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

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

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

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

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

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

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

APHIS grasshopper treatments must follow all applicable Federal, State, tribal, and local laws and regulations regarding pesticide use, including all USEPA- and State-approved

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label instructions. APHIS has also implemented several measures that go beyond label instructions to protect workers and the environment. All aircraft must have a positive on/off system that will prevent leaks from the nozzles and a positive emergency shutoff valve between the tank and the pump. Whenever possible, applicators must avoid aerial ferrying and turnaround routes over water bodies and sensitive habitats (USDA APHIS, 2013). This will reduce the risk of accidental release of insecticides into aquatic habitats and other sensitive habitats. All applications will be completed by State and/or Federally licensed pesticide applicators who by law will follow all label regulations as outlined by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

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

The program has also established treatment restriction buffers around water bodies to protect those features from insecticide drift and runoff. The labels for all program insecticides prohibit direct application to water (defined as reservoirs, lakes, ponds, pools left by seasonal streams, springs, wetlands, and perennial streams and rivers). APHIS maintains the following additional buffers for water bodies that are not designated critical habitat for listed aquatic species: 500-foot buffer for aerial sprays, 200-foot buffer for ground sprays, and a 50-foot buffer for bait applications (USDA APHIS, 2013).

Contractors utilize GPS navigation equipment 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 over 26 million acres.

1. Location and size

The western portion of the affected environment is comprised of 22 counties west of the Missouri River. This area takes in approximately 26,422,272 acres, of which approximately 21% is cropland, 67% is pasture or rangeland and less than 1% is woodland. (U.S. Department of Commerce, 1997). In addition, there are four counties that border the east side of the Missouri River that are also considered under the affected environment. The land use percentages of these four counties represent an increase in cropland with approximately 50% of the acres crop and 50% pastureland. Brule, Buffalo, Charles Mix and Hughes counties encompass approximately 1,527,558 acres.

The complete affected environment includes the counties of: Bennett, Brule, Buffalo, Butte, Charles Mix, Corson, Custer, Dewey, Fall River, Gregory, Haakon, Harding, Hughes, Jackson, Jones, Lawrence, Lyman, Meade, Mellette, Oglala Lakota, Pennington, Perkins, Stanley, Todd, Tripp and Ziebach.

2. Topography, soils and vegetation

Land and resource management can be broken down accordingly: Federal/Public Lands-Non Indian Lands (approximately 3,451,164 acres) including: U.S. Forest Service, Bureau of Land Management, U.S. Corps of Engineers, National Park Service. U.S. Fish and Wildlife Service, Bureau of Reclamation, and Indian Reservation (approximately 4,934,294 acres) (personal communication, Pat Keatts, 2005) Reservations include: Lower Brule (138,916), Crow Creek (134,039), Standing Rock (569,299 in SD), Pine Ridge (1,773,716), Cheyenne River (1,397,752), Rosebud (883,691), and Yankton (36,741).

State Lands are mainly comprised of School and Public Lands (760,000 acres; personal communication; Jennings) and Game, Fish and Parks Land (129,538 acres; personal communication; Coughlin and Nedved)

Topography and soils in western South Dakota can be broken down into five soil zones; (Westin and Malo, 1978).

1) Cool, Moist Forest (Typic Boralfs)
   These soils have developed under a humid climate (an annual precipitation of 20 to 25 inches and an average annual air temperature between 40 to 45 F); soil composite includes limestone, sandstone, and local alluvium from igneous, sedimentary, and metamorphic rocks and a topography which is undulating to mountainous.
2) Cool, Very Dry Plain (Ardic Borolls)
   These soils have developed under a cool, semi-arid climate (an annual precipitation of 12 to 16 inches and an average annual air temperature between 42 to 45 F); soil composite includes sandstones, sandy shales, shales, silty shales and siltstones; and a topography which is undulating to strongly sloping with buttes and mesas
3) Warm, Very Dry Plain (Aridic Ustols)

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These soils have developed under a warm, semi-arid climate (an annual precipitation of 14 to 17 inches and an average annual air temperature between 44 to 47 F); soil composite includes shales, siltstones and sandstones; and a topography which is gently undulating to rolling in the shale areas, and undulating to strongly sloping with buttes and plateaus in the siltstone and sandstone areas; badlands are common in areas occupying the bluffs of the large river valleys and the sides of the larger buttes.

4) Cool, Dry Plain (Typic Borolls)
   These soils have developed under a cool sub humid climate (an annual precipitation of 15 to 19 inches and an average annual air temperature between 42 to 45 F); soil composite includes sandy shales, shales, sandstones and siltstones; and topography which is gently undulating to rolling with buttes and mesas; areas adjacent to the Missouri River typically have steep hilly slopes and shale breaks where the native vegetation is sparse and is primarily composed of mid to short grasses.
5) Warm, Dry Plain (Typic Ustolls)
   These soils have developed under warm, dry, sub humid climate (an annual precipitation of 17 to 24 inches and an average annual air temperature between 44 to 49 F); soil composite includes sands, sandstone, siltstone, silts, shale and clays; and a topography which is gently undulating to rolling; areas adjacent to the Missouri River are steep, hilly and shale breaks where native vegetation is sparse and is composed of mid to short grasses.

Exclusive of the Black Hills, the western portion of South Dakota can be characterized as a mixed grass prairie, in which shorter grasses have tended to displace midgrasses due to decreased rainfall. Predominate short grasses include: include blue grama, needle and thread, western wheat grass, prairie June grass and little blue stem (Johnson and Nichols, 1982; Westin and Malo, 1978). Wooded draws are found throughout western South Dakota in addition to the large forest component of the Black Hills and smaller forested areas in the north and southern counties.

3. Climate

The climate of western South Dakota is a semi-arid and comprised of long, cold winters and short hot summers. The average summer temperature is 80 degrees and average January winter temp is 24 degrees decreasing to less than 10 degrees. The areas first frost occurs around the early part of October and the last frost date falls in late April or early May. Precipitation is sporadic and low ranging from 13-20 inches per year with 25% of that precipitation falling as snow. Extensive drought and shorter dry spells contribute to the grasshopper problems and are quite common.

4. Grasshopper populations

APHIS- PPQ routinely conducts both adult and nymphal grasshopper surveys throughout western South Dakota and four counties east of the Missouri River. Due to reduced funding, USDA-APHIS did not conduct a statewide grasshopper survey in 1997. In 1998 and 1999 the SD Department of Agriculture conducted statewide surveys. In 2000 APHIS resumed those activities which will continue in 2022. These surveys are used to assess grasshopper populations during the current year as we provide indications of future trends.

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Based on 2021 grasshopper surveys, the attached map (Appendix C) illustrates an estimate of acres infested during the current year. The adult survey map identifies areas where grasshopper populations are considered economic (generally more than eight grasshoppers per square yard) as well as populations that are sub economic.

Of the over 110 different grasshopper species found in South Dakota, approximately 12 are economically damaging to rangeland.

5. Human population

The largest city in western South Dakota is Rapid City with a population of approximately 79,000 people. Several other cities ranging in population from 3,000-14,000 do occur as well as some that are substantially smaller, isolated and average 500 to 3,000. Outside these communities these counties are comprised of primarily rural areas with many families reside on ranches. These communities are largely dependent on a thriving agriculture economy for their survival.

6. Surface Waters

South Dakota's landscape is essential divided east and west in half by the Missouri River. The river has a dam system incorporating three dams at Pierre, Ft. Thompson and Pickstown. Western South Dakota's primary water sources are smaller tributary rivers such as the White, Morreau, Grand, Cheyenne and several reservoirs such as Shadehill, Angostura, Belle Fourche and Pactola. This area is dotted with miscellaneous small stock dams, intermittent creeks, ponds and wetlands however this area is considered to be in general an arid area.

7. Agriculture practices

Western South Dakota is primarily rangeland with some crop production of wheat, sunflowers, and millet/sorghum. Cattle and sheep production in western South Dakota comprises nearly 40% and 50% respectively of the overall livestock produced in the state. The effects of economic grasshopper populations on pasture and range can potentially impact a major industry in South Dakota (Cerney, 1993). Tourism also plays a major role in the economy of the area surrounding the Black Hills.

8. Forest lands

The wooded component for western South Dakota includes two National Forests (Black Hills and Custer), wooded draws and shelterbelts that cover approximately 194,890 acres (Castonguay, 1982). Forest vegetation in the Black Hills ranges from xerophytic Bur Oak (Quercus macrocarpa) dominated vegetation at the warmer, drier, lower elevations to the mesophytic Black Hills Spruce (Picea glauca) dominated vegetation at the cooler, moister, higher elevations (Hoffman and Alexander, 1987). Ponderosa pine (Pinus ponderosa) is the dominant vegetation type across the Black Hills. Other forested lands include miscellaneous woody draws, shelterbelts, state parks and forested reservation lands.

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9. Wildlife refuges and recreation areas

One Federal wildlife refuge and several state wildlife production areas are found throughout the assessment area. These areas are critical for the production and migration of wildlife throughout the area. State wildlife refuges can be located at http://www.sdgfp.info/Wildlife/index.htm. The eight Federal refuges in South Dakota can be found at http://www.fws.gov/refuges/.

Recreation areas and public access areas to public federal and state lands are widely distributed throughout the assessment area. However, treatment is not likely to occur in these 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. APHIS only treats areas that are requested, and land managers will identify areas to be excluded. All areas of critical habitat and federally protected species are discussed, and mitigations measures are addressed in the 2025 Biological Assessment and consulted on with the USFWS. APHIS and land managers identify and exclude Wilderness Study Areas and areas of Critical Environmental Concern as well as critical habitat for T&E species. Any treatments on Reservations would work with Tribal officials to identify and avoid any culturally sensitive sites.

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

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and cropland. In addition, State and private land managers could apply insecticides to manage grasshopper populations however, land managers may opt not to use RAATs, which would increase insecticides applied to the rangeland. Increased insecticide applications from the lack of coordination or foregoing RAATs methods could increase the exposure risk to non-target species. In addition, land managers may not employ the extra program measures designed to reduce exposure to the public and the environment to insecticides.

Potential cumulative impacts associated with the Preferred Alternative are not expected to be significant because the program applies an insecticide application once during a treatment season. The program may treat an area with different insecticides but does not overlap the treatments. The program does not mix or combine insecticides. 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 area previously treated for grasshoppers is unlikely to cause an accumulation of insecticides from previous program treatments.

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

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

APHIS has prepared this EA for Western and Central South Dakota because treatments could be request by if grasshopper populations reach outbreak levels. Past experience and continuing drought and increasing grasshopper populations 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. Treatments may be requested and may not occur for various reasons including grasshopper populations and life stage, staffing and funding shortages, contractor availability, and meeting program criteria.

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Due to the parameters and requirements of Federal programs many individual producers choose to work together to control economic grasshopper populations outside of Federal programs. These programs are outside the control of APHIS and are typically all private land. South Dakota Department of School and Public Lands partnered with some lessees to cost share control costs on their lands associated with private land control blocks.

Other non-APHIS pesticide application activities may or may not take place in the vicinity of grasshopper suppression treatment areas. They may be undertaken by private applicators, members of the public, or state and county governments for a variety of reasons and without APHIS involvement.

D. Site Specific Considerations and Environmental Issues

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

1. Human Health

The rangeland areas where treatments may occur are sparsely populated by isolated ranch units having mainly cattle operations and "ranchettes" (homesteads generally five acres or less). Rangeland grazing is the predominant livestock feeding method. Average population density in rural areas of less than five persons per square mile (United States Census Bureau, 2018).

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, hospitals and tribal agencies will be notified prior to any treatment as an advisory to access any safety risk, the treatment date and location and contact personnel.

The suppression program would be conducted on federally managed rangelands that are not inhabited by humans. Human habitation may occur on the edges of the rangeland. Most habitation is comprised of farm or ranch houses, but some rangeland areas may have suburban developments nearby. Average population density in rural areas of less than five persons per square mile (United States Census Bureau, 2018).

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-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

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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.

a. Wildlife Resources

According to annual surveys completed by the South Dakota Department of Game, Fish and Parks (GF&P), western South Dakota supports moderate to some of the highest game productions in South Dakota for selected species. In particular, gallinaceous game birds such as ringed-necked pheasant *(Phasianus colchicus)*, wild turkey (*Meleagris gallopavo)*, greater prairie chicken *(Tympanuchus cupido)*, sharp-tailed grouse *(Tympanuchus phasianellus)*, and Northern Bobwhite Quail *(Colinus virginianus)* reach some of the highest concentrations for counties bordering the Missouri River. Big game species such as white-tailed deer *(Odocoileus virginianus)*, mule deer *(Odocoileus hemionus)*, elk *(Cervus elaphus nelsoni)*, and pronghorn *(Antilocapra americana)* have relatively high population concentrations in western South Dakota. Both elk and pronghorn have large populations in the Black Hills and northwestern part of the state, respectively (Sharps and Benzon, 1984; Trautman, 1982).

Most game species reach their highest densities in the breaks and riparian zones along the Belle Fourche, Cheyenne, Grand, Moreau and White Rivers.

Resident waterfowl populations are low when compared to the remainder of South Dakota, although there are scattered pockets of relatively high concentrations of breeding pairs. Due to the lack of natural wetlands, most waterfowl reproduction occurs in conjunction with stock ponds or small dams.

Fish populations in western South Dakota are located mainly in the Missouri and Cheyenne Rivers, their tributaries, streams and lakes in the Black Hills, and select, isolated stock dams. Selected stock dams provide excellent fishing for largemouth bass *(Micropterus salmoides)*. Many of the streams and lakes throughout the Black Hills are noted for their trout (*Oncorhynchus mykiss, Salmo trutta, Salvelinus fontinalis)*. The Cheyenne River does provide a fishery for catfishes *(Ictalurus spp.)*. Fish populations tend to achieve their greatest diversity and population density in the Missouri River. The tail waters and lakes below the three dams are very productive for walleye *(Stizostedion vitreum)*, sauger *(Stizostedion canadense)*, white bass *(Morone chrysops)*, salmon *(Onocorhynchus spp.)* and recently introduced smallmouth bass *(Micropterus dolomieui)*. Populations of sturgeons *(Scaphirhynchus spp.)* and paddlefish *(Polyodon spathula)* also occur in the Missouri River. As of January 1991, both the pallid sturgeon *(Scaphirhynchus albus)* and shovelnose sturgeon *(Scaphirhynchus platorynchus)* became protected species.

In addition to game species, western South Dakota supports large populations of nongame species. The prairie habitat, combined with the major rivers, support a variety of different bird species.

b. Water Resources and Aquatic Species

Under no action, increased sedimentation of water resources could occur because of loss of vegetative cover (USDA, APHIS 2019).

The hazards of carbaryl estimated exposures and risks to representative species are analyzed in detail in APHIS FEIS 2019.

Current operational procedures Appendix B state that all label recommendations will be followed. Guidelines state no direct application to water is allowed. Reservoirs, lakes, ponds (including livestock and recreational ponds), pools left by seasonal streams, springs, wetlands (i.e., swamps, bogs, marshes, and potholes), perennial streams, and rivers are included in this definition. The no-treatment buffers will be expanded as necessary to respond to on-site (site specific) conditions.

c. Domestic Bees

Nationally, South Dakota ranks second in the nation for honey production with approximately 17,820,000 pounds being produced. The state is noted for its clover honey (Reiners, 2018). Honey flow begins to increase in late June as the colonies increase and strengthen, and peaks during July when as much as two-thirds of the annual production will be realized. This flow is especially large during years when climatic conditions favor yellow sweet clover *(Melilotus officinalis)* growth and development. Yellow sweet clover blooms from late May through August, with peak bloom occurring from late June through mid-July.

The apiary industry in South Dakota is regulated by South Dakota Codified Law 38-18. The statute requires that all apiarists register locations of their bee yards with the South Dakota Department of Agriculture. It also provides that apiaries must not be located any closer than three miles to another registered location.

In the event of an aerial control program, all registered beekeepers in the concerned area will be alerted by the South Dakota Department of Agriculture. Beekeepers will be advised to move their bees at least two miles from the spray block boundaries. Notification will be through the U.S. Postal Service mail of the possibility of a treatment and the proposed acres to be treated. Beekeepers will receive a second notification when project plans are finalized. Project maps and projected treatment dates will be included with the second notice. In all cases a two-mile buffer zone will be observed around a bee yard.

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

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

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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 South Dakota or states having similar habitat. Density estimates may be for adults or all age classes. Population estimates based on potential habitat includes further extrapolation and speculation. The lowest estimate is assumed to be the minimum population. Habitat suitability indices, localized density fluctuations, and immigration or emigration are may not be factored into these calculations, nor is density based on quantity of habitat. 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 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 insecticide's role in this decrease is not clear. Existing research serves to outline the impact of these pesticides on pollinators of the order Hymenoptera and Lepidoptera primarily but also delves into pollinators of other orders to a lesser extent.

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

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

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

The Xerces society promotes a symbiotic relationship between pollinators and rangelands, with each benefitting from the others existence (Buxton et al.). Noting rangelands provide large contiguous areas of food and shelter habitat for pollinators. Likewise, the pollination of a wide array of wildflowers produces valuable forage for cattle and wildlife, supports soil health, and makes grasslands more resilient. Information about rangeland pollinators species is generally limited, with most of it coming from "uncoordinated, short-term, small-scale sampling focusing on bees and butterflies" (Hanberry et al). Though this information is limited, studies on bees of the Great Plains indicate that about two-thirds of the bee species in rangelands are generalists, which use many families of plants for nectar and nesting. With this information about generalist nature of bees in rangelands, and the increased biodiversity caused by grazing, pollinators of the rangelands are very likely widespread in both species and location, which can increase their resiliency to disturbances.

Therefore, pesticides applications will also potentially impact a much more abundant and rich collection of pollinators due to the unique qualities of rangeland habitats. Additionally, the presence of agrochemicals and other pesticides have been found in samples of bee tissue from the Great Plains, likely due to the conversion of land from pollinator friendly rangeland to crop fields (Hladik et al 2016, Otto et al 2016).

According to a sampling of native bees 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.

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

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

Two non-target invertebrate species of potential concern, which have been previously brought up in public scoping for the program, are Leona's little blue butterfly (*Philotiella leona*) and the monarch butterfly (*Danaus plexippus*). The monarch butterfly may potentially be found throughout Western and Central South Dakota and is being considered for ESA protections. (As such it will be discussed in detail in IV. Environmental Consequences, B.6. Endangered Species Act and/or B.8. Additional Species of Concern.)

Vertebrates occurring in rangelands of Western and Central South Dakota 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), omnivores (e.g. badgers, mice, bats). Birds comprise a large portion of the vertebrate species complex, and they also include exotic and native species. Some exotic game birds, like pheasant and partridge, have been deliberately introduced into the area, and other species such as starlings and pigeons have spread from other loci of introduction. Sage obligate bird species, typified by sage grouse, are present in North Western South Dakota rangeland. Herbivorous vertebrate species compete with some species of grasshoppers for forage, while omnivorous and predacious species utilize grasshoppers and other insects as an important food source.

A diverse community of terrestrial plants occurs within the proposed suppression area. Many are considered as non-native, invasive weeds including annual grasses (e.g. cheat grass, venenata), annual forbs (e.g. diffuse knapweed, Scotch thistle, yellow starthistle), perennial forbs (e.g. Canada thistle, Russian thistle, leafy spurge, white top), and woody plants (e.g. Russian olive, tamarisk). A full complement of native plants (e.g. sagebrush, bitterbrush, numerous grasses and forbs) have coevolved with and provide habitat for native and domesticated animal species, while providing broad ecological services, such as stabilizing soil against erosion.

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

Finally, sundry other organisms (e.g. fungi and fungus-like organisms, algae and lichens, non-vascular plants, earthworms and other annelids, both terrestrial and aquatic microorganisms) are often less visible in rangelands of Western and Central South Dakota but are nonetheless present and contribute to these ecosystems in various ways.]

Section 7 of the Endangered Species Act (ESA) and its implementing regulations require Federal agencies to ensure their actions are not likely to jeopardize the continued existence of listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. Within the area under consideration by this EA there are 17 federally listed species, although not all occur within or near potential grasshopper suppression areas.

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:

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

APHIS will also continue to consult with USFWS field offices at the local level to ensure listed species habitats are properly buffered during grasshopper suppression treatments.

APHIS completed a programmatic Section 7 consultation with NMFS for use of carbaryl 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:

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- 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 in a 3,500 foot buffer zones for carbaryl, or applied within a 1,500 foot buffer zones 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.

The following assessments were prepared for the listed species that may be present in a potential control block to assist in determining if the species or its habitat would be affected by program actions.

1) Black-footed ferret (Mussel nigripes)

Status: The black-footed ferret was determined to be an endangered species as early as 1967 (32 FR 4001, March 11, 1967; 35 FR 8491-8498, June 2, 1970).

Pertinent species information: The black-footed ferret is larger than most weasels. They are closely associated with prairie dog towns, are considered nocturnal and spend much of their time below the surface in prairie dog burrows. Food consists primarily of prairie dogs, with other small mammals making up the remainder of the diet (Chapman and Feldhamer, 1982).

The most successful reintroduction program is found in Pennington County, the Conata Basin of South Dakota. Other populations can be found in Corson, Dewey, Todd, Ziebach, and southeast Lyman counties. Ferrets have also been reintroduced to Wind Cave National Park in Custer County. All these populations, except the Lower Brule reintroduction effort in Lyman County, the Standing Rock Sioux Tribe 2021 reintroduction in Corson County, Stanley County Bad River Ranch, and the Wind Cave populations, are considered as non-essential experimental populations. In addition, populations can be found in Canada, Mexico, and U.S States of Arizona, Colorado, Kansas, Wyoming, Montana, New Mexico, and Utah.

Reintroduction of the black-footed ferret into the black-tailed prairie dog (Cynomys ludovicianus) ecosystem in the Conata Basin/Badlands area of South Dakota occurred from 1994 through 2000. A multi-agency committee guides the reintroduction plan. Immediate goals were met by realizing sufficient survivorship in the breeding population to lead to recruitment of wild- born young into the population. There were 197 known ferrets within the Conata Basin/Badlands population in 2022 reduced from a peak population of 355 in 2007 due to plague outbreaks. Plague management activities occur annually to help grow the population. This population is considered a nonessential experimental population established according to section 10(j) of the Endangered Species Act. The last reared introduction of kits occurred in 2000. The population is currently surviving and reproducing without reared introductions and serves as a nursery for other populations.

Assessment: The black-footed ferret was analyzed in the January 1987 APHIS Biological Assessment (USDA, APHIS, 1987) for possible effects resulting from the Rangeland Grasshopper Cooperative Management Program. The APHIS/FWS ESA formal consultations concluded that the species continued existence would not be jeopardized by the proposed program if program personnel consulted with local FWS prior to any control programs. APHIS will adopt these measures and will consult at least five days prior to any treatments in South Dakota to develop adequate protection measures for documented and verified occurrences of the ferret. Based on these measures program activities will result in no effects to the ferrets or their habitats.

2) Whooping crane (Grus americana)

Status: The whooping crane has been determined to be an endangered species (32FR; 48; March 11, 1967: p. 4001; 35 FR 8491-8498, June 2, 1970).

Pertinent species information: The whooping crane is one of the rarest birds in North America. Whooping cranes generally mate for life. Delayed sexual maturity may prevent breeding until cranes are four to six years old. Nesting usually occurs in potholes around bulrush (Scirpus validus), cattail (Typha sp.), sedge (Carex aquatilis), and other plant species.

The wild breeding population of whooping cranes annually migrates between breeding grounds at Wood Buffalo National Park, Northwest Territories, Canada and primary wintering areas at Aransas National Wildlife Refuge and Matagorda Island, Texas. The southward migration from Wood Buffalo generally begins from mid to late September, and all cranes have generally arrived in the Aransas area by mid-November. Spring departure from the Aransas area generally begins around early April and may extend over a period as long as 44 days, with first arrivals at Wood Buffalo occurring in late April. Rarely, a few cranes may spend the summer at the Aransas area. The Aransas/Wood Buffalo wild breeding population is the only self-sustaining population of whooping cranes remaining.

A non-migratory population of whooping cranes currently exists in Florida and an eastern migratory population has been established that moves between Wisconsin and Florida.

Whooping cranes have also been recently reintroduced in Louisiana in an effort to establish a non-migratory population there.

Marshes, river bottoms, potholes, prairies and occasionally cropland are the habitats of the whooping crane. Depending upon seasonal availability, the whooping crane subsists on a diet of blue crabs, clams, frogs or fish. During migration, they will utilize cropland.

Assessment: Although there are reported occurrences, critical habitat has not been designated in South Dakota (50 FR; 17.95 (b). The whooping crane may occur statewide with preferred stopovers in shallow wetlands or streams with sparse vegetation and good horizontal visibility (Lewis, 1995). However, most of the Aransas/Wood Buffalo National

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Park population will have likely migrated to more northern latitudes in Canada during the proposed program period of mid- May or later.

Based on the timing of the proposed action, label compliance and the historical information stating most of the cranes from the Wood Buffalo National Park/Aransas National Wildlife Refuge will have already reached their wintering or nesting destinations prior to any proposed treatment there will be no effect on the species from the treatment of grasshoppers in South Dakota.

3) Piping plover (Charadrius melodus)

Status: The piping plover has been determined to be an endangered species in the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio and Pennsylvania, and a threatened species in other states (50 FR 50726-50733, December 11, 1985). Critical habitat has been designated for this species (67 FR 57637-57717, September 11, 2002)

Pertinent species information: The piping plover is a shorebird associated with sandy flats and riverbanks. Unvegetated, sandy areas are generally preferred for breeding habitat. Grassy dunes that may be as small as 200 to 300 feet long may be used. The interior population favors the open shorelines of shallow lakes, especially salt-encrusted shorelines with gravel, sand or pebbly mud.

Although their food habits are not well studied, piping plover are known to prefer aquatic worms, fly larvae, beetles, crustaceans, and mollusks. The birds tend to forage singly but may arrive and depart feeding areas in flocks.

Birds begin to arrive in South Dakota in April and spread out over nesting beaches. The birds tend to be territorial, sometimes not allowing other birds within 100 feet of their nest. In South Dakota, piping plovers nest mainly in suitable habitat found along the Missouri River, including barren areas of the reservoirs. There are a few locations where piping plovers have nested in northeast South Dakota along saline wetlands, but these areas are inconsistent nesting areas.

Critical habitat has been formally designated along portions of the Missouri River in South Dakota.

Assessment: This species was addressed in the 1987 APHIS/FWS, Section 7 Consultation in which FWS determined that to avoid the potential for food contamination, it would be necessary to establish buffers around nesting areas and designated critical habitat. A 0.25 mile no-chemical spray buffer would be maintained around known nesting areas for a distance of 2.5 miles upstream and downstream. Also, where carbaryl bran bait is to be used, a 500 foot no-treatment buffer would be maintained around nesting birds. To determine specific nesting areas, program personnel would contact the local office of FWS five days prior to program activities to determine nesting areas. However, based on the buffer areas which will prevent contamination of food sources and impacts to nesting areas no effect will occur to critical habitat or the specie.

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4) Pallid Sturgeon (Scaphirhynchus albus)

Status: The pallid sturgeon was determined to be endangered October 9, 1990. (55 FR 36641- 36647, September 6, 1990)

Pertinent species information: The pallid sturgeon is a large fish known to occur in the Missouri River, the Mississippi River downstream of the Missouri River and the lower Yellowstone River. Pallid sturgeons require large, turbid free-flowing riverine habitat with rocky or sandy substrate.

They are well adapted to life on the river bottom and inhabit areas of swifter water more so than the related but smaller shovelnose sturgeon. Critical habitat has not been designated at this time. The decline of pallid sturgeons is apparently through habitat modification, lack of natural reproduction, commercial harvest and hybridization with the shovelnose sturgeon in parts of its range. In South Dakota, this fish is known to occur primarily in the Missouri River, and occasionally is found within its larger tributaries.

Assessment: In concurrence with the April 16, 1990, FWS Biological Opinion, a 0.25 mile no- aerial ULV buffer would be implemented from known habitats. Within the 0.25 mile, only carbaryl bran bait will be used. These measures are in conformance with previous FWS Biological Opinions for listed fish occurring in large rivers and should result in no effect for the Pallid Sturgeon.

5) American burying beetle (Nicrophorus americanus)

Status: The American burying beetle was proposed for listing as an endangered species, October 11, 1988, and listed as endangered June 12, 1989 (FR 54:29652-29655). The species was down listed to threatened on October 15, 2020; effective November 16, 2020 (85 FR 65241).

Pertinent species information: The American burying beetle (ABB) known also as the giant carrion beetle falls within the family Silphidae. This carrion beetle is the largest of its genus in North America and its biology is similar to other species of Nicrophorus. Adult American burying beetles are strongly nocturnal. It has been observed that when exposed to daylight, the adults quickly retreat underground and bury themselves under the rangeland plant litter and soil (Backlund, 2010). In South Dakota, the species is associated with sub-irrigated meadows used for ranching and hay production (Hoback et al. 2021). The adult beetles feed on carrion by smell where adults will fight other adults for the carcass (World Wildlife Fund, 1990). The carcass is then buried, and a brood chamber is constructed for the eggs. Both parents remain with the eggs and tend the larvae, which do not survive without parental care. The young beetles have been observed emerging in July and August.

Prior to 1995, only four populations of the beetle were known to exist, one in eastern Oklahoma, one on a New England island, one near Valentine, Nebraska and one in Arkansas. Per the down listing rule (85 FR 65241): “Based on the last 15 years of surveys, the American burying beetle occurs in portions of Arkansas, Kansas, Oklahoma, Nebraska, South Dakota, and Texas; on Block Island off the coast of Rhode Island; and in reintroduced populations on Nantucket Island off the coast of Massachusetts and in southwest Missouri, where a nonessential experimental population (NEP) was established in 2012 under section 10(j) of the Act (77 FR 16712; March 22, 2012)."

A population of ABB was discovered in south central South Dakota in 1995. This population has remained relatively stable in abundance and distribution. A population estimate completed in 2005 for 100 square miles of the distribution area revealed 442 beetles in June and 901 in August. Backlund (2008) estimated 800 square miles were occupied in South Dakota. The population center is in southern Tripp County and extends into southwestern Gregory County and eastern Todd County with one additional find on the southeastern corner of Bennett County in 2007. In August of 2008 additional surveys were conducted in Bennett County and no additional beetles were trapped. A single ABB find is not indicative of an established population (Backlund, 2010). The general survey conducted in the known populated areas of Tripp and Gregory County during 2009 yielded expected results with nothing significant discovered (personal communication, Backlund, 2010). Based on surveys from 1995-2009, the population estimate was conservative (Backlund, 2009). A second population estimate in the state was conducted in June and August of 2018-2020 (Hoback et al. 2021). The new population estimate found that central Tripp County supports more than 500 ABB in an area of about 20,000 acres, and although the total area occupied represents almost 960,000 acres, the occurrence of ABB was estimated to be about 0.07 beetles/acre in the hotspot for occurrence (in Tripp County) (Hoback et al. 2021). Population expansion appears limited by soil types in north and western parts of the range and by row crops and prey base in north and east (Hoback et al. 2021). The population estimate on N. americanus in South Dakota exceeds the minimal population size required by the American Burying Beetle Recovery Plan (Raithel, 1991).

Decline of the ABB may be the result of an interplay of several complex factors including artificial lighting that decreases populations of nocturnally active insects, changing sources of carrion because of habitat alterations, isolation of preferred habitat because of land use changes, increased edge effect harboring more vertebrate competitors for carrion and the possibility of reduced reproduction because of some genetic characteristic of the species. (Nebraska Game and Parks Commission, 1995)

Assessment: To date, the American burying beetle has been found in Gregory, Todd and Tripp Counties and one location in Bennett County of South Dakota. Maps provided by Doug Backlund, SD Game Fish and Parks indicate the beetle has only been found in areas of those counties that are south of Highway 18 (Hoback et al. 2021).

Malathion and carbaryl are broad spectrum insecticides which can be expected to exhibit little, if any, selective toxicity against target or nontarget insects. One study, where applications of 12 and 16 ounce applications of malathion were conducted over a four year period, revealed immediate adverse effects on ladybird beetles, sycmnus beetles, hooded beetles and soft-winged flower beetles. Malathion is also registered for use against various crops.

Carbaryl is known to have adverse effects on ladybird beetles (USDA, 1987) and is registered for use against the Japanese beetle in rangeland (Union Carbide, 1987). Direct toxic effects from the use of carbaryl bait are not expected.

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Diflubenzuron is also a treatment option for program activities. Diflubenzuron is a chitin inhibitor or growth regulator that has allows for negligible impact on the adult burying beetles as diflubenzuron only impacts immature life stages. In this case where the immature stages of ABB spend their life underground and emerge only as adults. Diflubenzuron residues that don't contact the plant surface during application and land on soil are not anticipated to persist or dissolve into water present in interstitial areas in soil. Diflubenzuron has low solubility in water and prefers to sorb to soils based on available environmental fate data in a variety of soil types.

Sorption to soil reduces the bioavailability of diflubenzuron to most soil invertebrates unless they consume soil as part of their diet. Diflubenzuron residues are not anticipated to persist in soil based on available information that demonstrate half-lives under field conditions from approximately one week to about 19 days. Multiple studies assessing impacts to soil invertebrates from diflubenzuron applications at higher rates than those proposed for the grasshopper program have shown a lack of significant impacts to a variety of soil invertebrates' populations. The impacts from diflubenzuron would be minimal.

In all cases RAATs will be the preferred option except in crop protection programs were 100% coverage in the ¼ to ½ mile buffer is necessary to prevent the migration of grasshoppers from federal rangeland to the private agricultural ground.

Most developmental stages of the ABB beetle occur below ground. When the overwintering adults emerge in late May to early June, they maintain a strong nocturnal behavior as they search out a mate and a food source for rearing their young. Once a suitable food source has been located the beetles bury the food and move underground tending their young and feeding until they emerge as adults in late July or early August. The nocturnal activity of beetles searching for carrion peaks three hours after sunset and concludes by sunrise (Bedick et al., 1999).

The majority of grasshopper control programs that protect forage occur in late June to mid-July when fewer adult beetles are found above ground. When above ground and exposed to daylight they quickly bury themselves under plant litter and soil (Backlund, 2010). Their nocturnal activity and underground life stages will serve as a natural protection measure if areas inhabited by ABB are inadvertently treated by program insecticides during daylight hours.

However due to the potential effects of program treatments to beetle populations, the historical trapping of beetles in Bennett, Gregory, Tripp and Todd Counties, APHIS agrees not to conduct grasshopper control treatments in areas south of Highway 18 in Gregory and Tripp Counties.

Furthermore, APHIS agrees to a two-mile buffer around known beetle finds in Todd and Bennett Counties. Program personnel will contact the local office of FWS five days prior to program activities for consultation. When the protection measures are implemented grasshopper program activities are not likely to adversely affect the American burying beetle populations.

6) Western prairie fringed orchid (Platanthera praeclara)

Status: The western prairie fringed orchid was proposed for listing October 11, 1988, and listed as threatened September 28, 1989. (54 FR 187:39857-39863).

Pertinent species information: This member of the family Orchidaceae exists in approximately four populations in eight states west of the Mississippi River and one Canadian Province. These states include Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma and South Dakota (FWS, 1988). FWS indicated the possible occurrence of the western prairie fringed orchid in Bennett, Brookings, Clay, Hutchinson, Lake, Lincoln, McCook, Miner, Minnehaha, Moody, Roberts, Shannon, Todd, Turner, Union and Yankton in South Dakota.

The fringed orchid is a perennial herb usually found in tall grass prairies, full sunlight and calcareous silt loam or sub irrigated sand. Flowering normally begins by late June to early July and pollination by night-flying hawkmoths is required for seed production. The fringed orchid shows an adaptation to prairie fires which includes regeneration from tuber rootstock. Critical habitat has not been designated at this time.

Assessment: In response to APHIS' request for species for the 1989 Rangeland Grasshopper Program, FWS indicates that potential habitat for the plant may occur in Bennett, Shannon and Todd Counties, South Dakota of this EA's coverage area. Suitable habitat for the orchid per FWS, still exists in these and other South Dakota counties despite the fact no specimens have been found in recent years.

There could be a potential effect on the pollination of this orchid through a reduction in hawkmoths resulting from the use of program pesticides. Ten hawk moths that have been identified as being potential pollinators of P. praeclara based on eye width and proboscis (Phillips 2003). Only four occur in South Dakota. Of the four occurring in South Dakota only one has been confirmed to be a P. praeclara pollen vector. Eumorpha achemon is a confirmed pollinator but is only documented to occur in one county within the coverage area of this EA, Fall River County, South Dakota. (Cuthrell,1994 and G. Fauske, personal communication 1993). E.achemon caterpillar hosts include grape (Vitis spp.) and Ampelopsis spp. (Opler et al., Butterflies and Moths of North America, 2010) These species, should they be found within the control area would be localized to drainages and higher moisture environments, such as draws, intermittent streams or drainages. Because of their proximity to water those areas would be included in an untreated buffer area that would protect the larval stages of this moth from non- target impacts.

Diflubenzuron is our preferred product choice. Diflubenzuron does not impact adult Lepidoptera spp. When this product is applied at labeled rates for grasshopper control, the rate is substantially lower than labeled rates for control of Lepidopteran pests.

APHIS would contact the local office of FWS five days prior to conducting treatments in the above listed counties to determine specific habitat locations. No chemical spray applications of pesticides would be made within three miles of known occupied orchid habitat. Within the three-mile buffer, only carbaryl bran bait would be used.

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These measures confirm with the FWS' Biological Opinion for the 1989 APHIS Rangeland Grasshopper Program and there should be no effect to the prairie fringed orchid from APHIS activities based on the protective measures described.

7) Rufa Red Knot (Calidris canutus rufa)

Status: The rufa red knot was listed as threatened on December 11, 2014. (USDOI, FWS, 2014).

Pertinent Species Information: (From USDOI, FWS 2014) The rufa red knot is a medium-sized shorebird about 9 to 11 inches (in) (23 to 28 centimeters (cm)) in length.

The red knot migrates long distances annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States, the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. During both the spring and fall migrations, red knots use key staging and stopover areas to rest and feed.

Wintering areas for the red knot include the Atlantic coasts of Argentina and Chile, the north coast of Brazil, the Northwest Gulf of Mexico from the Mexican State of Tamaulipas through Texas to Louisiana, and the Southeast United States from Florida to North Carolina. This species that winter exclusively in coastal habitats are more likely than interior wintering birds to make long flights to specific regions of North America during spring migration. Red Knots overfly the central plains as they proceed northward. During migration, Red Knots occur in large numbers along the shores of large lakes of Saskatchewan but are rare elsewhere in the interior.

Habitats used by red knots in migration and wintering areas are similar in character, generally coastal marine and estuarine (partially enclosed tidal area where fresh and saltwater mixes) habitats with large areas of exposed intertidal sediments. In North America, red knots are commonly found along sandy, gravel, or cobble beaches, tidal mudflats, salt marshes, shallow coastal impoundments and lagoons, and peat banks. In many wintering and stopover areas, quality high tide roosting habitat (i.e., close to feeding areas, protected from predators, with sufficient space during the highest tides, free from excessive human disturbance) is limited. The supra-tidal (above the high tide) sandy habitats of inlets provide important areas for roosting, especially at higher tides when intertidal habitats are inundated.

The primary prey of the rufa red knot in non-breeding habitats include blue mussel (Mytilus edulis) spat (juveniles); Donax and Darina clams; snails (Littorina spp.), and other mollusks, with polycheate worms, insect larvae, and crustaceans also eaten in some locations. A prominent departure from typical prey items occurs each spring when red knots feed on the eggs of horseshoe crabs, particularly during the key migration stopover within the Delaware Bay of New Jersey and Delaware. Delaware Bay serves as the principal spring migration staging area for the red knot because of the availability of horseshoe crab eggs.

Assessment: A primary threat to the red knot is destruction and modification of its habitat and forage, particularly the decline of key food resources resulting from reductions in

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horseshoe crabs. Competition with other species for limited food resources, coastal wind turbine farms, and climate change are also threats.

Based on the biology of the species, specifically its migration patterns, prey diet and habitat requirements there is a low probability that a rufa red knot would be found in program areas. In addition, because diflubenzuron, our preferred treatment choice, is a chitin inhibitor that disrupts insects from forming their exoskeleton, organisms without a chitinous exoskeleton, such as mammals, fish, and plants are largely unaffected by diflubenzuron. Subsequently this leads to a no effect determination for the rufa red knot.

8) Northern long-eared bat, (Myotis septentrionalis)

Status: The northern long-eared bat was listed as threatened effective on February 16, 2016, with the publication of the final rule (USDOI, FWS, 2016). The species was uplisted to endangered on November 30, 2022 (73488 FR 87); effective March 31, 2023.

Pertinent Species Information: A medium-sized bat species, the northern long-eared bat adult body weight averages five to eight grams (0.2 to 0.3 ounces), with females tending to be slightly larger than males (Caceres and Pybus, 1997). Average body length ranges from 77 to 95 millimeters (mm) (3.0 to 3.7 inches (in)), tail length between 35 and 42 mm (1.3 to 1.6 in), forearm length between 34 and 38 mm (1.3 to 1.5 in), and wingspread between 228 and 258 mm (8.9 to 10.2 in) (Caceres and Barclay, 2000; Barbour and Davis, 1969). Pelage colors include medium to dark brown on its back, dark brown, but not black, ears and wing membranes, and tawny to pale-brown fur on the ventral side (Nagorsen and Brigham, 1993; Whitaker and Mumford, 2009). As indicated by its common name, the northern long-eared bat is distinguished from other Myotis species by its long ears (average 0.7 in).

The northern long-eared bat's range extends from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to the Florida panhandle (Whitaker and Hamilton, 1998; Caceres and Barclay, 2000; Amelon and Burhans, 2006).

However, throughout the majority of the species' range it is patchily distributed, and historically was less common in the southern and western portions of the range than in the northern portion of the range (Amelon and Burhans, 2006).

Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines. Hibernacula used by northern long-eared bats are typically large, with large passages and entrances (Raesly and Gates, 1987), relatively constant, cooler temperatures (0 to 9 °C (32 to 48 °F) (Raesly and Gates, 1987; Caceres and Pybus, 1997; Brack, 2007), and with high humidity and no air currents (Fitch and Shump, 1979; Van Zyll de Jong, 1985; Raesly and Gates, 1987; Caceres and Pybus, 1997). This habitat is present in the Black Hills region of South Dakota. Additionally, hibernacula has been identified along the Missouri River at the border of Nebraska and South Dakota in limestone cliffs (White et al. 2020). Other locales in South Dakota may provide suitable winter habitat for this species.

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis, 1969; Amelon and Burhans, 2006). Northern long-eared bats have also been observed roosting in colonies in human made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and in bat houses (Mumford and Cope, 1964; Barbour and Davis, 1969; Cope and Humphrey, 1972; Amelon and Burhans, 2006; Whitaker and Mumford, 2009; Timpone et al., 2010; Joe Kath, 2013, pers. comm.).

The northern long-eared bat appears to be somewhat opportunistic in tree roost selection, selecting varying roost tree species and types of roosts throughout its range, including tree species such as black oak (Quercus velutina), northern red oak (Quercus rubra), silver maple (Acer saccharinum), black locust (Robinia pseudoacacia), American beech (Fagus grandifolia), sugar maple (Acer saccharum), sourwood (Oxydendrum arboreum), and shortleaf pine (Pinus echinata) (e.g., Mumford and Cope, 1964; Clark et al., 1987; Sasse and Perkins, 1996; Foster and Kurta, 1999; Lacki and Schwierjohann, 2001; Owen et al., 2002; Carter and Feldhamer, 2005; Perry and Thill, 2007; Timpone et al., 2010). Northern long-eared bats most likely are not dependent on a certain species of trees for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark and the bats will use them opportunistically (Foster and Kurta, 1999). Carter and Felhamer (2005) speculated that structural complexity of habitat or available roosting resources are more important factors than the actual tree species.

Many studies have documented the northern long-eared bat's selection of live trees and snags, with a range of 10 to 53 percent selection of live roosts found (Sasse and Perkins, 1996; Foster and Kurta, 1999; Lacki and Schwierjohann, 2001; Menzel et al., 2002; Carter and Feldhamer, 2005; Perry and Thill, 2007; Timpone et al., 2010).

In tree roosts, northern long-eared bats are typically found beneath loose bark or within cavities and have been found to use both exfoliating bark and crevices to a similar degree for summer roosting habitat (Foster and Kurta 1999; Lacki and Schwierjohann, 2001; Menzel et al., 2002; Owen et al., 2002; Perry and Thill, 2007; Timpone et al., 2010).

Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids pup development (Perry and Thill, 2007). Fewer trees surrounding maternity roosts may also benefit juvenile bats that are starting to learn to fly (Perry and Thill, 2007).

Northern long-eared bats hibernate during the winter months to conserve energy from increased thermoregulatory demands and reduced food resources. In general, northern long-eared bats begin moving to hibernacula in August or September, enter hibernation in October and November, and leave the hibernacula in March or April (Caire et al., 1979; Whitaker and Hamilton, 1998; Amelon and Burhans, 2006). In the Black Hills, hibernacula are generally occupied October 1 through May 15. However, hibernation may begin as early as August (Whitaker and Rissler, 1992) and bats may emerge as early as March (White et al. 2020)

While the northern long-eared bat is not considered a long-distance migratory species, short migratory movements between summer roost and winter hibernacula between 35 miles 55 miles have been documented (Nagorsen and Brigham,1993; Griffin, 1945).

Northern long-eared bats switch summer roosts often (Sasse and Perkins, 1996), typically every two to three days (Foster and Kurta, 1999; Owen et al., 2002; Carter and Feldhamer, 2005; Timpone et al., 2010). Bats switch roosts for a variety of reasons, including, temperature, precipitation, predation, parasitism, and ephemeral roost sites (Carter and Feldhamer, 2005).

Breeding begins in late summer or early fall when males begin swarming near hibernacula. After copulation, females store sperm during hibernation until spring, when they emerge from their hibernacula, ovulate, and the stored sperm fertilizes an egg. This strategy is called delayed fertilization. After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats, although larger maternity colonies have been observed. Most females within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending on where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth.

Most mortality for northern long eared and many other species of bats occurs during the juvenile stage (Caceres and Pybus, 1997). Adult northern long-eared bats can live up to 19 years.

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles (Nagorsen and Brigham, 1993; Brack and Whitaker, 2001; Griffith and Gates, 1985), with diet composition differing geographically and seasonally. The most common insects found in the diets of northern long-eared bats are lepidopterans (moths) and coleopterans (beetles) (Feldhamer et al., 2009; (Brack and Whitaker, 2001)) with arachnids (spiders) also being a common prey item (Feldhamer et al., 2009).

Foraging techniques include catching insects in flight and gleaning in conjunction with passive acoustic cues (Nagorsen and Brigham, 1993; Ratcliffe and Dawson, 2003). Observations of northern long-eared bats foraging on arachnids (Feldhamer et al., 2009), presence of green plant material in their feces (Griffith and Gates, 1985), and non-flying prey in their stomach contents (Brack and Whitaker, 2001) suggest considerable gleaning behavior. Northern long-eared bats have the highest frequency call of any bat species in the Great Lakes area (Kurta, 1995).

Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect these high frequency echolocation calls (Faure et al., 1993). Emerging at dusk, most hunting occurs above the understory, 3 to 10 feet above the ground, but under the canopy (Nagorsen and Brigham, 1993) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker, 2001; LaVal et al., 1977). This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats (Caceres and Pybus, 1997). Occasional foraging also takes place over forest clearings and water, and along roads (van Zyll de Jong, 1985). Foraging patterns indicate a peak activity period within 5 hours after sunset followed by a secondary peak within 8 hours after sunset (Kunz, 1973).

No other threat is as severe and immediate to the northern long-eared bat's persistence as the fungal disease, white-nose syndrome (WNS). This disease was first observed in New York in 2006 and has spread quickly from there. WNS was first documented in South

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Dakota in May of 2018. Throughout the Northeast, the northern long-eared bat has disappeared completely from many hibernation sites. Experts agree where it spreads, WNS will have the same impact on the northern long-eared bat as seen in the Northeast and populations will decline; reduced capture rates in the Black Hills have been documented.

Some habitat has been lost, degraded, or fragmented, primarily through the disturbance of hibernacula and land development. Mortality caused by wind turbines is expected to increase.

Assessment: During our summer program months, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non- reproductive females may also roost in cooler places, like caves and mines. These areas are primarily found in the Black Hills of South Dakota but have been detected along the Missouri River (White et al. 2020). Because of the minimal rangeland component associated with the Black Hills, program activities in this area are unlikely and have not occurred to date.

The Northern long eared bat has also been recorded in northwest South Dakota as well as along the Missouri River. All program activities require a .25-mile buffer along the Missouri River. Again, program activities in these areas are unlikely due to the increase in cropland and reduction of rangeland.

Diflubenzuron is always our preferred choice. Because it is a chitin inhibitor that disrupts insects from forming their exoskeleton, organisms without a chitinous exoskeleton, such as mammals, fish, and plants are largely unaffected by diflubenzuron.

Program personnel will contact the local office of FWS five days prior to program activities for consultation. Based on information presented it appears that the probability is extremely low that the northern long eared bats would be encountered in areas potentially affected by the rangeland grasshopper program But even in areas in which the grasshopper program and the bat's reported distribution overlap, the species reported reliance on intact interior forests and harborages such as cave or mines describes a habitat that is not present in the rangeland portions of the grasshopper survey area in which suppression might actually be conducted. When the protection measures are implemented grasshopper program activities are not likely to adversely affect or jeopardize the northern long eared bat.

9) Other Species

No effect expected to Dakota Skipper, Poweshiek Skipperling, Topeka shiner, Leedy's Roseroot, Scaleshell mussle, Higgins's eye pearly mussel, Rusty patched bumblebee, gray wolf, and Eskimo curlew. These species could occur in Eastern South Dakota, riparian corridors, or other areas where no grasshopper control activities will be completed.

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

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

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

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

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

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

There is special concern about the role of grasshoppers as a food source 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 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. Should grasshoppers be unavailable in small, localized areas, sage grouse chicks 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 habitat.

3. Physical Environment Components

a) Geology and Soils

Topography and soils in western South Dakota can be broken down into five soil zones; (Westin and Malo, 1978).

1) Cool, Moist Forest (Typic Boralfs)

These soils have developed under a humid climate (an annual precipitation of 20 to 25 inches and an average annual air temperature between 40 to 45 F); soil composite includes limestone, sandstone, and local alluvium from igneous, sedimentary, and metamorphic rocks and a topography which is undulating to mountainous.

2) Cool, Very Dry Plain (Ardic Borolls)

These soils have developed under a cool, semi-arid climate (an annualprecipitation of 12 to 16 inches and an average annual air temperature between 42 to 45 F); soil composite includes sandstones, sandy shales, shales, silty shales and siltstones; and a topography which is undulating to strongly sloping with buttes and mesas.

3) Warm, Very Dry Plain (Aridic Ustols)

These soils have developed under a warm, semi-arid climate (an annual precipitation of 14 to 17 inches and an average annual air temperature between 44 to 47 F); soil composite includes shales, siltstones and sandstones; and a topography which is gently undulating to rolling in the shale areas, and undulating to strongly sloping with buttes and plateaus in the siltstone and sandstone areas; badlands are common in areas occupying the bluffs of the large river valleys and the sides of the larger buttes.

4) Cool, Dry Plain (Typic Borolls)

These soils have developed under a cool sub humid climate (an annual precipitation of 15 to 19 inches and an average annual air temperature between 42 to 45 F); soil composite includes sandy shales, shales, sandstones and siltstones; and topography which is gently undulating to rolling with buttes and mesas; areas adjacent to the Missouri River typically have steep hilly slopes and shale breaks where the native vegetation is sparse and is primarily composed of mid to short grasses.

5) Warm, Dry Plain (Typic Ustolls)

These soils have developed under warm, dry, sub humid climate (an annual precipitation of 17 to 24 inches and an average annual air temperature between 44 to 49 F); soil composite

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includes sands, sandstone, siltstone, silts, shale and clays; and a topography which is gently undulating to rolling; areas adjacent to the Missouri River are steep, hilly and shale breaks where native vegetation is sparse and is composed of mid to short grasses.

Exclusive of the Black Hills, the western portion of South Dakota can be characterized as a mixed grass prairie, in which shorter grasses have tended to displace midgrasses due to decreased rainfall. Predominate short grasses include:include blue grama, needle and thread, western wheat grass, prairie June grass and little blue stem (Johnson and Nichols, 1982; Westin and Malo, 1978). Wooded draws are found throughout western South Dakota in addition to the large forest component of the Black Hills and smaller forested areas in the north and southern counties. [Describe the significant topographic features of the area under consideration and their geological substrate. Describe the primary (most common) soil map units or complexes. Detailed data is available at https://websoilsurvey.nrcs.usda.gov/app/.]

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

b) Hydrology and Water Resources

South Dakota's landscape is essentially divided east and west in half by the Missouri River. The river has a dam system incorporating four dams at Pierre, Ft. Thompson, Pickstown, and Yankton. Western South Dakota's primary water sources are smaller tributary rivers such as the White, Moreau, Grand, Cheyenne and several reservoirs such as Shadehill, Angostura, Belle Fourche and Pactola. This area is dotted with miscellaneous small stock dams, intermittent creeks, ponds and wetlands however this area is considered to be in general an arid area.

c) Air Quality and Climate

The climate of western South Dakota is a semi-arid and comprised of long, cold winters and short hot summers. The average summer temperature is 80 degrees and average January winter temp is 24 degrees decreasing to less than 10 degrees. The areas first frost occurs around the early part of October and the last frost date falls in late April or early May. Precipitation is sporadic and low ranging from 13-20 inches per year with 25% of that precipitation falling as snow. Extensive drought and shorter dry spells contribute to the grasshopper problems and are quite common.

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).

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.

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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).

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 document 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.

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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 Western and Central South Dakota the responsibility would rest with private parties. No other federal agencies would lead the effort. The most economical choice of pesticides available to private landowners would be diflubenzuron. The conventions of IPM 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 effect 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 land owners might notify residents within treatment areas to reduce the potential for incidental exposure to residents including children. None the less, treatments would occur on open rangelands where children would not be expected to be present during treatment or to enter should there be any restricted entry period after treatment. The APHIS grasshopper program also implements mitigation measures beyond label requirements to ensure that no treatments occur within the required buffer zones from structures, such as a 500-foot treatment buffer zone from schools and recreational areas. Also, program insecticides are not applied while school buses are operating in the treatment area (USDA

APHIS, 2016). There is a reasonable expectation that treatments conducted by third parties would also avoid spraying chemicals where children are present or congregate.

b) No Grasshopper Population Control

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

(1) Human Health

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

(2) Nontarget Species

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

(3) Physical Environment Components

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

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(4) Socioeconomic Issues

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

(5) Cultural Resources and Events

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

(6) Special Considerations for Certain Populations

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

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

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

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

a) Carbaryl

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

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(1) Human Health

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

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

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

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

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

(2) Nontarget Species

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

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

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

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

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

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

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

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

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

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

Researchers analyzed persistence of pesticides in agroecosystems in the Emilia-Romagna region of northern Italy (Bogo et al. 2024). They investigated pesticide residue in beebread by analyzing 100 samples collected in 25 BeeNet national monitoring project stations in March and June of 2021 and 2022. They looked at the diversity and concentration of the chemicals, their correlation with land use, and the risk they posed to the bees. They calculated a toxicity-weighted concentration (TWC) of chemicals by computing the ratio between the measured concentration in beebread and the oral acute toxicity (LD_{50}) of that chemical for bees. For risk evaluation a risk threshold was assigned by dividing the TWC

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by an order of magnitude to account for chemical degradation, harmful synergistic interaction with other chemicals and chronic exposure causing sublethal effects. The risk threshold was exceeded in four beebread samples out of 100; one for carbaryl, fipronil, imidacloprid and thiamethoxam (Bogo et al. 2024).

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

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

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

(3) Physical Environment Components

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

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

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

(4) Socioeconomic Issues

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

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effective treatment at reduced costs. The economics of the RAATs strategy has been studied by both Foster et al. (2000), and Lockwood and Schell (1997). In summarizing both studies (which used various rates of insecticide below the conventional rates for suppression of rangeland grasshoppers and treated less area), the results concluded that treatment costs, under this alternative, when compared to the costs for conventional treatments for rangeland grasshopper infestations, were reduced 57 to 66% with carbaryl.

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

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

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

(5) Cultural Resources and Events

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

(6) Special Considerations for Certain Populations

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

APHIS grasshopper insecticide treatments are conducted in rural rangeland areas, where agriculture is a primary industry. The areas consist of widely scattered, single, rural

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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 includes loss of habitat or food items. Mice on treated plots consumed fewer lepidopteran (order of insects that includes butterflies and moths) larvae compared to controls; however, the total amount of food consumed did not differ between treated and untreated plots. Body measurements, weight, and fat content in mice collected from treated and non-treated areas did not differ.

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

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

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

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

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

For example, in the Mommaerts et al. study researchers exposed bees via a contact application of 288 mg/L aqueous concentration which was topically applied to the dorsal thorax of each worker with a micropipette. Bumblebees also ingested orally sugar/water treated with the same concentration of diflubenzuron solution over a period of 11 weeks. Pollen was sprayed with the same concentration of diflubenzuron until saturation and then supplied to the nests. The bumble bees were not restricted in how much of these contaminated solutions they could consume. The researchers estimated mean LC50

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concentrations based on the chronic exposure routes described above. These were 25 mg a.i/L dermal contact, 0.32 mg a.i/L ingested sugar-water, and 0.95 mg a.i/L pollen. The researchers noted, “In practice, bumblebees will rarely be exposed to such high concentrations,” and elaborated, “it is necessary that the laboratory-based results are validated with risk assessments for these insecticides in field related conditions.”

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

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

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

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

A researcher found that exposure to diflubenzuron in a 10 ppm sucrose solution resulted had significant effect on the number of larvae successfully eclosing from eggs three days after collection. The researcher posited that bee embryos with poorly formed cuticle could initiate egg eclosion and perhaps complete it, though the survivorship of the resultant larvae would likely be compromised. The results she reported for diflubenzuron suggest that the

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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 honeybee colonies, the exposure did not have an observable effect on egg production. However, successful hatching rates were significantly decreased in response to diflubenzuron, a chitin synthesis inhibitor (Fine 2020).

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

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

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

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

During June 2024 the USDA Agricultural Research Service collected 58 plant tissue samples from flowers within a grasshopper treatment area in Prairie County, Montana. The

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samples were sent to the USDA Agricultural Marketing Service – National Science 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 flower samples collected within spray swaths and six samples collected within skip swaths, 24 hours after the aerial spray treatment had diflubenzuron residues. Of the 24 samples collected 14 days after the treatment, 16 did not have detectable amounts of diflubenzuron. Five of the eight samples that had diflubenzuron residues 14 days after treatment were collected in skip swaths.

Nine 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. Five flower samples with diflubenzuron residues that were 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. Specifically, two samples collected adjacent to the 11 contaminated samples had greater diflubenzuron concentrations and the amount of insecticide in three nearby samples did not diminish significantly 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 X.

Table X. 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)**

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Sample Number	Flower Species	Swath Type	Time since Treatment	Results (ppm)	Duplicate or Adjacent Sample Locations and Results
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)**
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 0.36 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

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the standard deviation was 0.51 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 LD50 value for the honeybee, Apis mellifera, is reported at greater than 114.8 µg a.i./bee while the oral LD50 value was reported at greater than 30 µg a.i./bee. USEPA (2018) reports diflubenzuron toxicity values to adult honeybees are typically greater than the highest test concentration using the end-use product or technical active ingredient. The lack of toxicity to honeybees, as well as other bees, in laboratory studies has been confirmed in additional studies (Nation et al, 1986; Chandel and Gupta, 1992; Mommaerts et al, 2006). Mommaerts et al 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 LC50 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 LC50 determined by the researchers. The average concentration was close to the LC50 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 (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 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 after 14 days 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 LD50 (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 LD50 was used as LD50 was not consistently available for bumble and solitary bees.

HQ (24 hours) = 360 ppb (0.36 ppm) ÷ 114.8 μg diflubenzuron per bee = 3.136

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.

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

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

(3) Physical Environment Components

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

(4) Socioeconomic Issues

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

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

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

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

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(1) 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.

(2) 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.

(6) Special Considerations for Certain Populations

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

IV. Conclusions

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

In June 2002, APHIS completed an EIS describing the agency’s most effective methods of reducing the damage caused by grasshopper populations to rangeland in the western United States. During November 2019, APHIS published HHERA for the use of carbaryland diflubenzuron. 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

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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 and diflubenzuron depending upon the 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).

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VI. Listing of Agencies and Persons Consulted

Luke Toso, Field Supervisor
ND/SD Ecological Service U.S. Fish and Game Service
3425 Miriam Avenue
Bismarck, ND 58501
luke_toso@fws.gov
720-793-6797

Cory Neuharth
Bureau of Land Management
309 Bonanza Street
Belle Fourche, SD 57717
cneuhart@blm.gov
605-892-7031

Sonya Germann, State Director
Bureau of Land Management -Montana Dakotas District Office
5001 Southgate Drive
Billings, MT59101
sonya.germann@blm.gov
406-896-5012

Tony Sunseri, State Conservationist
USDA NRCS
200 4th Street SW Room 203
Huron, SD 57350
Tony.sunseri@usda.gov
605-352-1200

Brenda Sievers, Plant Industry Program Manager
South Dakota Department of Agriculture and Natural Resources
501 E. Capitol Ave., Foss Bldg
Pierre, SD 57501
Brenda.sievers@state.sd.us
605-773-3623

Olivia Steve, Regional Director
BIA Great Plains Regional Office
Indian Affairs
115 4th Avenue Southeast Ste 400
Aberdeen , SD 57401

`

Janet Alkire, Tribal Chairwoman
Standing Rock Sioux Tribe
PO Box D
Fort Yates, ND 59539
info@standingrock.org
(701) 854-8500

Ryman Lebeau, Chairman
Cheyenne River Sioux Tribe
PO Bpx 590
Eagle Butte, SD 57625
chairmanlebeau@crstmail.com
605/964-4155

Kathleen Woodenknife, President
Rosebud Sioux Tribe
PO Box 430
Rosebud, SD 57570
Kathleen.woodenknife@rst-nsn.gov
605-474-2381

Peter Lengkeek, Chairman
Crow Creek Sioux Tribe
PO Box 50
Fort Thompson, SD 57339
peterlengkeek@yahoo.com
605-245-2221

Frank Star Comes Out, President
Oglala Sioux Tribe
PO Box 2070
Pine Ridge, SD 57770
fstarcomesout@oglala.org
605-867-8420

Sharon Selvaggio
Pesticide Program
The Xerces Society for Invertebrate Conservation
1631 NE Broadway Street, #821
Portland, OR 97232
Sharon.selvaggio@xerces.org
855-232-6639

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Lori Ann Burd, Environmental Health Director and Senior Attorney
Center for Biological Diversity
P.O. Box 11374 Portland, OR 97211
laburd@biologicaldiversity.org
971-717-6405

Appendix A

APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program
FY-2023 Treatment Guidelines
Version 01/09/2023

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.

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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 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.

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

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

Furthermore, provide the following buffers for water bodies:

- 500-foot buffer with aerial liquid insecticide.
- 200-foot buffer with ground liquid insecticide.
- 200-foot buffer with aerial bait.
- 50-foot buffer with ground bait.

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

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

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

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

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

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

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

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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.

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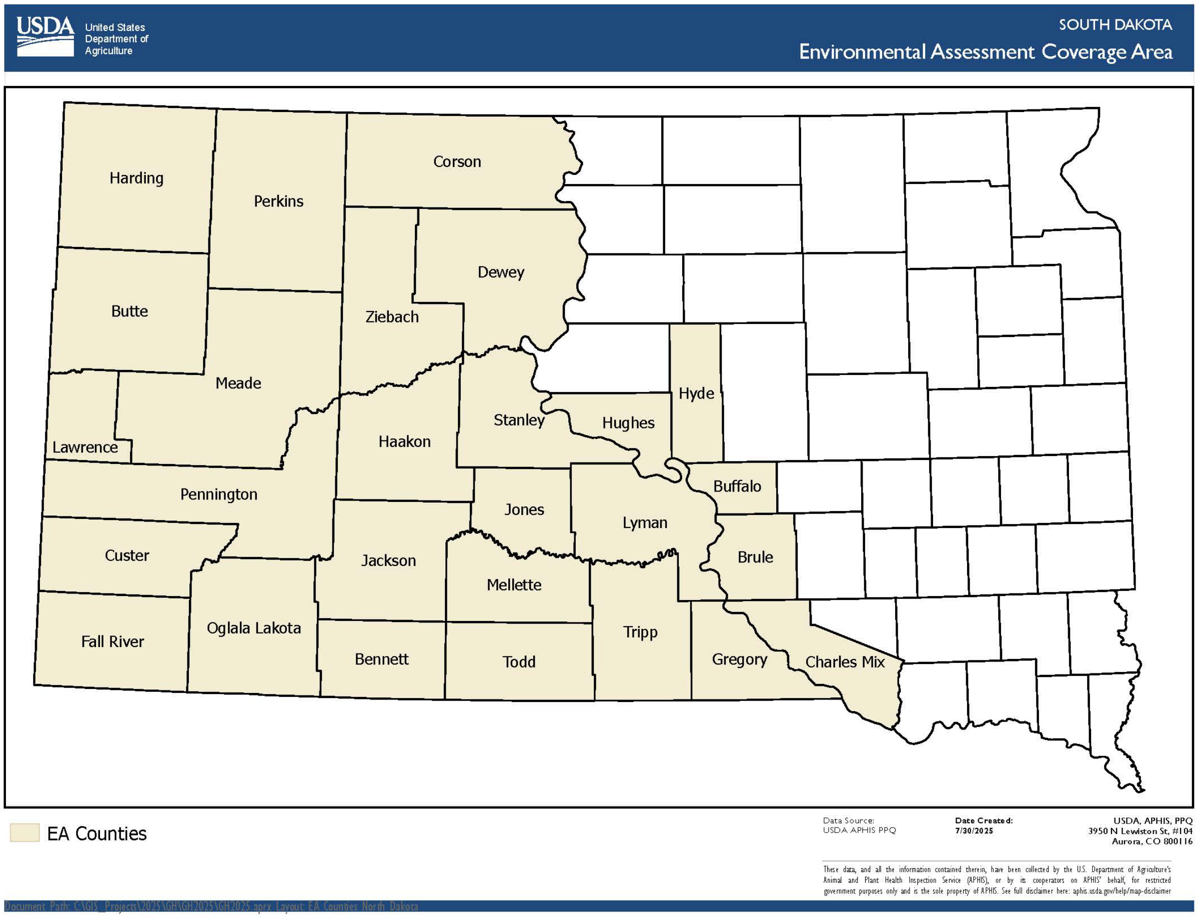
Appendix B: Map of the Affected Environment



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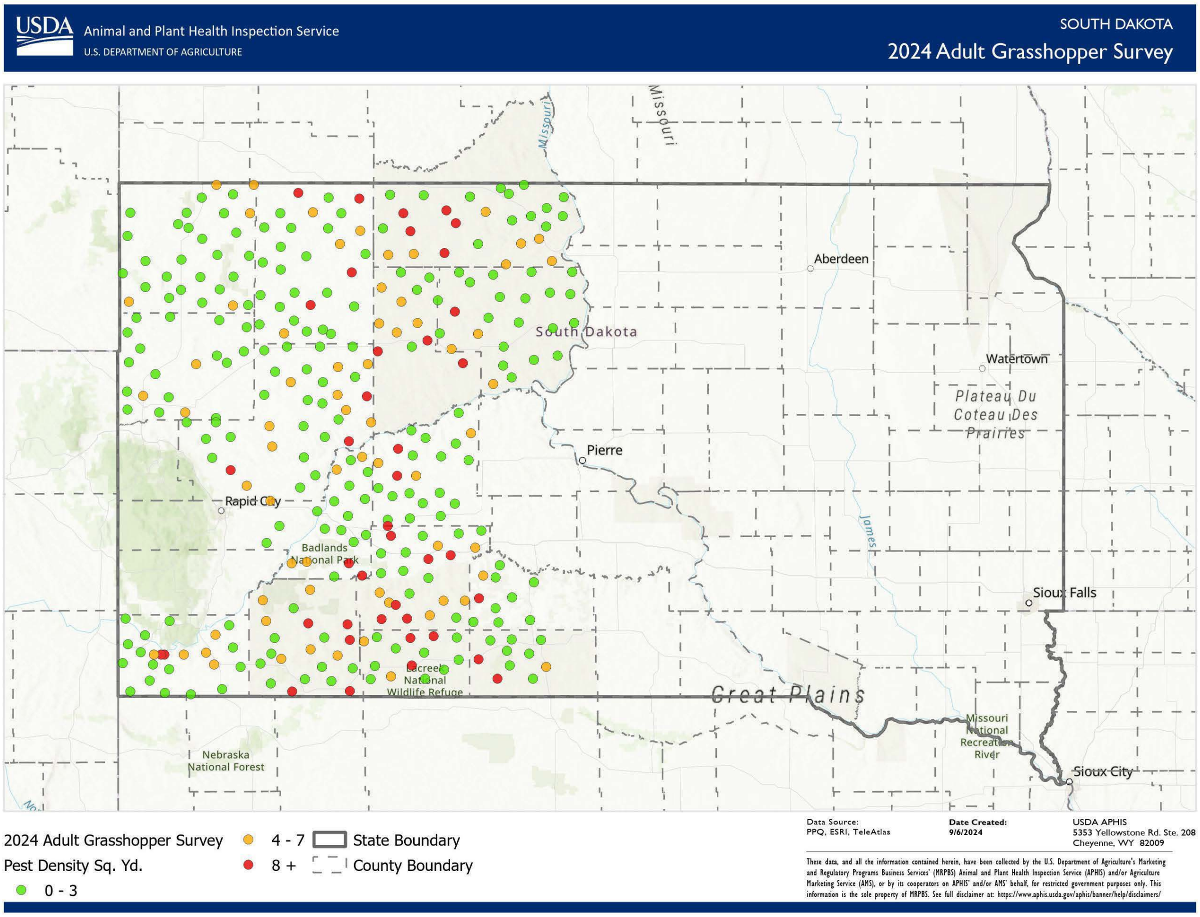

USDA
Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE
SOUTH DAKOTA
2024 Adult Grasshopper Survey
Missouri
Aberdeen
South Dakota
Watertown
Plateau Du Coteau Des Prairies
Pierre
Rapid City
James
Badlands National Park
Sioux Falls
Lacreek National Wildlife Refuge
Great Plains
Nebraska National Forest
Missouri National Recreation River
Sioux City
2024 Adult Grasshopper Survey
Pest Density Sq. Yd.
0 - 3
4 - 7
8 +
State Boundary
County Boundary
Data Source:
PPQ, ESRI, TeleAtlas
Date Created:
9/6/2024
USDA APHIS
5353 Yellowstone Rd. Ste. 208
Cheyenne, WY 82009
These data, and all the information contained herein, have been collected by the U.S. Department of Agriculture's Marketing and Regulatory Programs Business Services' (MRPBS) Animal and Plant Health Inspection Service (APHIS) and/or Agriculture Marketing Service (AMS), or by its cooperators on APHIS' and/or AMS' behalf, for restricted government purposes only. This information is the sole property of MRPBS. See full disclaimer at: https://www.aphis.usda.gov/aphis/banner/help/disclaimers/

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Appendix C: FWS/NMFS Correspondence

From: Stenson, Michael - MRP-APHIS
To: Gates, Natalie
Cc: chris_swanson@fws.gov; Mesman, Amy - MRP-APHIS
Subject: 2025 South Dakota Section 7 Consultation Grasshopper Program
Date: Monday, March 17, 2025 3:47:00 PM
Attachments: image001.png
FINAL_LOC_USDA_APHIS_MormonCricket_03202024 FOR SIGNATURE.pdf
Final FWS GH MC BA January 2024.pdf
Appendix A-9 Effects Determinations for FWS Species and CH 2024.xlsx

Greetings Natalie-

USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) is preparing for potential control programs to protect rangeland from economic infestations of grasshoppers in South Dakota in 2025. Please consider this to be our informal Section 7 consultation regarding the APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program.

In March of 2024 APHIS received national concurrence from FWS on the USDA, APHIS January 2024 Revised Programmatic Biological Assessment (BA). The agreed upon protection measures are identified in the attached Appendix 9 - Effects Determination spreadsheet.

We will consider these protection measures as our guidance should treatment be warranted. We will contact you directly to identify locations of listed species and critical habitat in any proposed treatment area five days prior to treatment.

The seven South Dakota threatened and endangered species are identified below.

Federally Listed Species in Assessment Area	Scientific Name	Status
Black-footed ferret	*Mustela nigripes*	Endangered
Whooping crane	*Grus americana*	Endangered
Piping plover	*Charadrius melodus*	Endangered
Pallid sturgeon	*Scaphhirhynchus albus*	Endangered
American burying beetle	*Nicrophorus americanus*	Threatened
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Northern long-eared bat	*Myotis septentrionalis*	Endangered

APHIS' authority for carrying out control programs is found in the Plant Protection Act (PPA), Title IV, Agricultural Risk Protection Act of 2000, Section 417. The PPA mandates that APHIS control economic infestations of grasshoppers/Mormon crickets to protect rangeland, when requested, and provided funding is available.

The USDA, APHIS, PPQ South Dakota Rangeland Grasshopper Environmental Assessment (EA) was a five-year EA set to expire in 2026. In May of 2022, a lawsuit was filed against the PPQ grasshopper program by several environmental groups. One of the resulting judgements was that all grasshopper states, including South Dakota, will be required to revise and update their EAs making significant changes.

We are actively working on the revisions; however, this process may not be complete prior to the 2025 field season resulting in our inability to treat grasshoppers should populations warrant control. Currently, we do not have any Federal control programs pending.

While we anticipate western South Dakota will continue to have areas of economic grasshopper populations, only a handful of small USDA control programs have been conducted in the last 20 years. Funding constraints and other environmental considerations have drastically reduced grasshopper/Mormon cricket suppression activities. Our 2024 survey indicated a slight reduction in overall numbers. Due to our current hiring freeze we may have limited or no seasonal staff to conduct surveys in 2025.

There are four chemical control options available to us for grasshopper treatment: diflubenzuron, Malathion, chlorantraniliprole and carbaryl. Chlorantraniliprole was not considered under the EA that expires in 2026 but will be considered in the revised EA that replaces it. As a growth regulator

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and chitin inhibitor, diflubenzuron is always our preferred choice based on the mode of action, chemical price and reduced impact to non-targets.

We utilize the reduced area/agent treatment application method known as RAATS or 'skip swathing' when conducting a control program. This method leaves 50% of the intended control area untreated. Only in the case of a crop protection program would 100% coverage be considered. These programs involve a quarter to half mile buffer treatment on federal rangeland directly adjacent to private agricultural lands to prevent grasshopper migration.

Currently, approximately $500,000 is available to support treatment across the 17 western grasshopper states. Available cost share for PPQ implemented programs consists of paying 100% of the costs on federal land, 50% of the costs on state land and 33% of the cost on private lands.

Please let me know if you have any questions, comments, or concerns.

Thanks,

USDA

Mike Stenson
Plant Health Safeguarding Specialist
APHIS PPQ
Office 605-224-1713
Mobile 605-222-3557