Draft Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program

Wyoming
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Acronyms and Abbreviations

ac	acre
a.i.	active ingredient
AChE	acetylcholinesterase
APHIS	Animal and Plant Health Inspection Service
ATV	All Terrain Vehicle
BIA	Bureau of Indian Affairs
BCF	bioconcentration factor
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
ºF	degrees Fahrenheit
FAASSTT	Field Aerial Application Spray Simulation Tower Technique
Fl. Oz.	fluid ounce
FONSI	finding of no significant impact
FR	Federal Register
FS	Forest Service
IMP	Interim Management Policy
HHERA	human health and ecological risk assessments
i.e.	in explanation (Latin, id est "in other words.")
IPM	integrated pest management
lb	pound
LWG	Local Working Group
MBTA	Migratory Bird Treaty Act
ml	milliliters
MOU	memorandum of understanding
MRAATs	Modified reduced agent area treatments
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
SGCN	Species of Greatest Conservation Need
S&T	Science and Technology
UAS	Unmanned Aircraft Systems
ULV	ultra-low volume
U.S.C.	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service

USFWS	United States Fish and Wildlife Services
WGFD	Wyoming Game and Fish Department
WGSGCP	Wyoming Greater Sage-Grouse Conservation Plan
WSA	Wilderness Study Area

Draft Environmental Assessment

Rangeland Grasshopper and Mormon Cricket Suppression Program Wyoming

I. Need for Proposed Action

A. Purpose and Need Statement

An infestation of grasshoppers or Mormon crickets may occur in Wyoming. The Animal and Plant Health Inspection Service (APHIS) and any cooperating agency, based on location of infestation 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 otherwise noted.

Populations of grasshoppers that trigger the need for a suppression program are normally considered on a case-by-case basis. Participation is based on potential damage such as reduced forage and benefits of treatments including reduction of pest outbreak populations and control of incipient pest populations. The goal of the proposed suppression program analyzed in this EA is to reduce grasshopper populations to economically acceptable levels in order to protect rangeland ecosystems or cropland adjacent to rangeland.

This EA analyzes potential effects of the proposed action and its alternatives. This EA applies to a proposed suppression program that would take place from March 1 to September 31, 2021 in Wyoming.

This EA is prepared in accordance with the requirements under the National Environmental Policy Act of 1969 (NEPA) (42 United States Code § 4321 *et. seq.*) and the NEPA procedural requirements promulgated by the Council on Environmental Quality, United States Department of Agriculture (USDA), and APHIS. A decision will be made by APHIS 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 2021 Control Program for Wyoming.

B. Background Discussion

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 (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.

In rangeland ecosystem areas of the United States, grasshopper populations can build up to economic infestation levels[1] despite even the best land management and other efforts to prevent outbreaks. At such a time, a rapid and effective response may be requested and needed to reduce the destruction of rangeland vegetation. In some cases, a response is needed to prevent grasshopper migration to cropland adjacent to rangeland.

APHIS surveys grasshopper populations on rangeland in the Western United States, provides technical assistance on grasshopper management to land owners and land managers, and may cooperatively suppress grasshoppers when direct intervention is requested by a Federal land management agency or a State agriculture department (on behalf of a State or local government, or a private group or individual). The need for a 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 the response available to APHIS to rapidly suppress or reduce, but not eradicate, grasshopper populations and effectively protect rangeland.

In June 2002, APHIS completed an environmental impact statement (EIS) document concerning suppression of grasshopper populations in 17 Western States (Rangeland Grasshopper and Mormon Cricket Suppression Program, Environmental Impact Statement, June 21, 2002). The EIS described the actions available to APHIS to reduce 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 an updated EIS to incorporate the available data and analyze the environmental risk of new program tools. The risk analysis in the 2019 EIS is incorporated by reference.

APHIS will follow all state laws regarding pesticide application including Wyoming State Statutes §35-7-350 through §35-7-375 (http://legisweb.state.wy.us/lsoweb/wystatutes.aspx) and Chapter 28 Rules and Regulations, State of Wyoming, (http://soswy.state.wy.us/Rules/default.aspx).

In November 2019, APHIS and the United States Forest Service (USFS) signed a Memorandum of Understanding (MOU) detailing cooperative efforts between the two groups on suppression of grasshoppers and Mormon crickets on National Forest system lands (Document #19-8100-0573-MU, November 6, 2019). This MOU clarifies that APHIS will prepare and issue to the public 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

[1] The "economic infestation 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 infestation 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. Additional 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.

documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the USFS.

The MOU further states that the responsible USFS official will request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on national forest land is necessary. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document.

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 environmental documents that evaluate potential impacts associated with proposed measures to suppress economically damaging grasshopper and Mormon cricket populations. The MOU also states that these documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the BLM.

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

In September 2016, APHIS and the Bureau of Indian Affairs (BIA) signed a Memorandum of Understanding (MOU) detailing cooperative efforts between the two groups on suppression of grasshoppers and Mormon crickets on BIA lands (Document #10-8100-0941-MU, September 16, 2016). This MOU clarifies that APHIS will prepare and issue to the public 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 BIA.

The MOU further states that the responsible BIA official will request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on BIA land is necessary. The request should include the dates and locations of all tribal ceremonies and cultural events, as well as “not to be treated” areas that will be in or near the proposed treatment block(s). According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document.

C. About This Process

The EA process for grasshopper management is complicated by the fact that there is very little time between requests for treatment and the need for APHIS to take action with respect to those requests. Surveys help to determine general areas, among the scores of millions of acres that potentially could be affected, where grasshopper infestations may

occur in the spring of the following year. There is considerable uncertainty, however, in the forecasts, so that framing specific proposals for analysis under NEPA is not possible. 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.

The current EIS provides a solid analytical and regulatory foundation; however, it may not be enough to satisfy NEPA completely for actual treatment proposals, and the "conventional" EA process will seldom, if ever, meet the program's timeframe of need. Thus, a two-stage NEPA process has been designed to accommodate such situations. For the first stage, this EA will analyze aspects of environmental quality that could be affected by grasshopper treatment in Wyoming. This EA and finding of no significant impact (FONSI) will be made available to the public for a 30-day comment period. If comments are received during the comment period, they will be addressed in stage 2 of the process. For stage 2, when the program receives a treatment request and determines that treatment is necessary, the specific site within Wyoming will be extensively examined to determine if environmental issues exist that were not covered in this EA. This stage is intended mainly to ensure that significant impacts in the specific treatment area will not be experienced. A supplemental determination will be prepared to document this finding and would also address any comments received on this EA. Supplemental determinations prepared for specific treatment sites will be provided to all parties who comment on this EA.

II. Alternatives

To engage in comprehensive NEPA risk analysis APHIS must frame potential agency decisions into distinct alternative actions. These program alternatives are then evaluated to determine the significance of environmental effects. The 2002 EIS presented three alternatives: (A) No Suppression; (B) Insecticide Applications at Conventional Rates and Complete Area Coverage; and (C) Reduced Agent Area Treatments (RAATs), and their potential impacts were described and analyzed in detail. The 2019 EIS was tiered to and updated the 2002 EIS. The 2019 EIS provides updates to the program with new information and technologies that were not analyzed in the 2002 EIS. Copies of the complete 2002 and 2019 EIS documents are available for review at USDA APHIS PPQ, 5353 Yellowstone Road, Suite 208, Cheyenne, Wyoming. These documents are also available at the Rangeland Grasshopper and Mormon Cricket Program web site, http://www.aphis.usda.gov/plant-health/grasshopper.

The 2019 EIS is intended to explore and explain potential environmental effects associated with grasshopper suppression programs that could occur in 17 western states (Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming). The 2019 EIS outlines the importance of grasshoppers as a natural part of the rangeland ecosystem. However, grasshopper outbreaks can compete with livestock and wildlife for rangeland forage and cause devastating damage to crops and rangeland ecosystems. Rather than opting for a specific proposed action from the alternatives presented, the 2019 EIS analyzes in detail the environmental impacts associated with

each programmatic action alternative related to grasshopper suppression based on new information and technologies.

All insecticides used by APHIS for grasshopper suppression are used in accordance with applicable product label instructions and restrictions. Representative product specimen labels can be accessed at the Crop Data Management Systems, Incorporated web site at www.cdms.net/manuf/manuf.asp. Labels for actual products used in suppression programs will vary, depending on supplier. All insecticide treatments conducted by APHIS will be implemented in accordance with APHIS' treatment guidelines and operational procedures, included as Appendix 1 to this draft EA.

A. No Suppression Program Alternative

Under Alternative A, the No Suppression alternative, APHIS would not fund or participate in a program to suppress grasshopper infestations within Wyoming. Under this alternative, APHIS may opt to provide limited technical assistance, but 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.

B. 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 grasshopper outbreaks. The insecticides available for use by APHIS include the U.S. Environmental Protection Agency (USEPA) registered chemicals malathion, carbaryl, and diflubenzuron. These chemicals have varied modes of action: carbaryl and malathion work by inhibiting acetylcholinesterase (enzymes involved in nerve impulses); and diflubenzuron is a chitin inhibitor. 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 and area treatments (RAATs). APHIS selects which insecticides and rates are appropriate for suppression of a grasshopper outbreak based on several biological, logistical, environmental, and economical criteria. The identification of grasshopper species and their life stage largely determines the choice of insecticides used among those available to the program. RAATs are the most common and preferred application method for all program insecticides, and only rarely do rangeland pest conditions warrant full coverage and higher rates.

The RAATs strategy is effective for grasshopper suppression because the insecticide controls grasshoppers within treated swaths while conserving natural grasshopper predators 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 one or more treatment swaths. Both options are most often incorporated simultaneously into RAATs. Either malathion, carbaryl, or diflubenzuron would be considered under this alternative (with diflubenzuron being the preferred chemical) typically at the following application rates:

- 8.0 fluid ounces (0.25 pounds active ingredient (lb a.i.)) of carbaryl ULV spray per acre;
- 10.0 pounds (0.20 lb a.i.) of 2 percent carbaryl bait per acre;
- 0.75 or 1.0 fluid ounce (0.012 lb a.i.) of diflubenzuron per acre
- 4.0 fluid ounces (0.31 lb a.i.) of malathion per acre.

The width of the area not directly treated (the untreated swath) under the RAATs approach is not standardized but has minimum and maximum parameters. 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). 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. Currently 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 skipped swath width is typically no more than 20 feet for malathion, 100 feet for carbaryl and 200 feet for diflubenzuron. The selection of insecticide and the use of an associated swath width is site dependent. Rather than suppress grasshopper populations to the greatest extent possible, the goal of this alternative is to suppress grasshopper populations to a desired level.

Insecticide applications at conventional rates and complete area coverage, is an approach that APHIS has used in the past but is currently uncommon. Under this option, malathion, carbaryl, or diflubenzuron would cover all treatable sites within the designated treatment block per label directions. The application rates under this option are typically at the following application rates:

- 16.0 fluid ounces (0.50 lb a.i.) of carbaryl spray per acre;
- 10.0 pounds (0.50 lb a.i.) of 5 percent carbaryl bait per acre;
- 1.0 fluid ounce (0.016 lb a.i.) of diflubenzuron per acre
- 8.0 fluid ounces (0.62 lb a.i.) of malathion per acre.

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

C. Research Treatments Alternative

APHIS PPQ continues to refine its methods of grasshopper and Mormon cricket management in order to improve the abilities of the Rangeland Grasshopper and Mormon Cricket Suppression Program (herein referred to as the Program) to make it more economically feasible, and environmentally acceptable. These refinements can include reduced rates of currently used pesticides, improved formulations, development of more target-specific baits, development of biological pesticide suppression alternatives, and improvements to aerial (e.g., incorporating the use of Unmanned Aircraft Systems (UAS)) and ground application equipment. A division of APHIS PPQ, Science and

Technology's (S&T) Phoenix Lab is located in Arizona and its Rangeland Grasshopper and Mormon Cricket Management Team (Rangeland Unit) conducts methods development and evaluations on behalf of the Program. The Rangeland Unit's primary mission is to comply with Section 7717 of the Plant Protection Act and protect the health of rangelands (wildlife habitats and where domestic livestock graze) against economically damaging cyclical outbreaks of grasshoppers and Mormon crickets. The Rangeland Unit tests and develops more effective, economical, and less environmentally harmful management methods for the Program and its federal, state, tribal, and private stakeholders.

To achieve this mission, research plots ranging in area from less than one foot to 640 acres are used and often replicated. The primary purpose of this research is to test and develop improved methods of management for grasshoppers and Mormon crickets. This often includes testing and refining pesticide and biopesticide formulations that may be incorporated into the Program. These investigations often occur in the summer (May-August) and the locations typically vary annually. The plots often include "no treatment" (or control) areas that are monitored to compare with treated areas. Some of these plots may be monitored for additional years to gather information on the effects of utilized pesticides on non-target arthropods. Note that an Experimental Use Permit is not needed when testing non-labeled experimental pesticides if the use is limited to laboratory or greenhouse tests, or limited replicated field trials involving 10 acres or less per pest for terrestrial tests.

Studies and research plots are typically located on large acreages of rangelands and the Rangeland Unit often works on private land with the permission of landowners. Locations of research trials will be made available to the appropriate agencies in order to ensure these activities are not conducted near sensitive species or habitats. Due to the small size of the research plots, no adverse effects to the environment, including protected species and their critical habitats, are expected, and great care is taken to avoid sensitive areas of concern prior to initiating studies.

1. Methods Development Studies

Methods development studies may use planes and all-terrain vehicles (ATVs) to apply labeled pesticides using conventional applications and the reduced agent area treatments (RAATs) methodology. This research may include the use of an ultra-low volume sprayer system for applying biopesticides (such as native fungal pathogens). Mixtures of native pathogens and low doses of pesticides may be conducted to determine if these multiple stressor combinations enhance mortality. Aircraft will be operated by Federal Aviation Administration licensed pilots with an aerial pesticide applicator's permit.

The Rangeland Unit often uses one square foot micro plots covered by various types of cages depending on the study type and species used. These types of study plots are preferred for Mormon cricket treatments and those involving non-labeled research pesticides or biopesticides. The most common application method for micro plots is simulating aerial applications via the Field Aerial Application Spray Simulation Tower Technique (FAASSTT). This system consists of a large tube enclosed on all sides except

for the bottom, so micro plot treatments can be accurately applied to only the intended treatment target. Treatments are applied with the FAASSTT in micro doses via a syringe and airbrush apparatus mounted in the top.

The Rangeland Unit is also investigating the potential use of Unmanned Aerial Systems (UAS) for a number of purposes related to grasshopper and Mormon cricket detection and treatment. UAS will be operated by FAA licensed pilots with an aerial pesticide applicator's permit.

2. Pesticides and Biopesticides Used in Studies

Pesticides likely to be involved in studies currently include those approved for Program use:

1) Liquids: diflubenzuron (e.g., Dimilin 2L and generics: currently Unforgiven and Cavalier 2L) and carbaryl (e.g., Sevin XLR-PLUS). Program standard application rates are: diflubenzuron - 1 fl. oz./acre in a total volume of 31 fl. oz./acre; carbaryl – 16 fl. oz/acre in a total volume of 32 fl. oz./acre. Research rates often vary, but the doses are lower than standard Program rates unless otherwise noted.

2) Baits: carbaryl. Program standard application rates: 2% bait at 10 lbs./acre (2 lbs. AI/acre) or 5% bait at 4 lbs./acre (2 lbs. AI/acre).

3) LinOilEx (Formulation 103), a proprietary combination of easily available natural oils and some commonly encountered household products, created by Manfred Hartbauer, University of Graz, Austria. Note that LinOilEx (Formulation 103) is experimental; for more information, see "Potential Impacts of LinOilEx Applications" in the section "Information on Experimental Treatments."

Biopesticides likely to be involved in studies currently include:

1) *Metarhizium robertsii* (isolate DWR2009), a native fungal pathogen. Note that *Metarhizium robertsii* (isolate DWR2009) is experimental; for more information, see "Potential Impacts of *Metarhizium robertsii* Applications" in the section "Information on Experimental Treatments."

2) *Beauveria bassiana* GHA, a native fungal pathogen sold commercially and registered for use across the U.S.

At this time, we are unsure where in the 17 states we will be doing most of the following proposed research field studies. The final location decision is dependent upon grasshopper and/or Mormon cricket population densities, and availability of suitable sites.

Possible Study 1: Building on research undertaken in 2020, we plan to further evaluate the efficacy of aerial treatments of Program insecticides using UAS. This study plans to use replicated 10 acre plots. Mortality will be then be observed for a duration of time to

determine efficacy. Possible variants of this study (all of which will adhere to FAA regulations) may include night flights and treating with multiple UAS simultaneously (swarming).

Possible Study 2: Evaluate persistence of the experimental biopesticide DWR2009 in bait form by coating wheat bran with the pathogen. A species of local abundance will be placed into replicated microplot cages and fed the baits by hand. Mortality and sporulation will be then be observed for a duration of time to determine persistence in both the field and lab.

Possible Study 3: Evaluate efficacy of the experimental biopesticide DWR2009 in bait form by coating wheat bran with the pathogen. A species of local abundance will be placed into replicated microplot cages and fed the baits by hand. Mortality and sporulation will be then be observed for a duration of time to determine efficacy in both the field and lab.

Possible Study 4: A stressor study to evaluate efficacy of the experimental biopesticide DWR2009 in liquid form when combined with Dimilin 2L. The FAASSTT will be utilized to apply varying dose levels of Dimilin 2L (below label rates) in order to compare efficacy, starting at the rate of 1.0 fl. oz./acre. Replicated microplots will be treated and then a species of local abundance will be placed into each cage. Mortality will be then be observed for a duration of time to determine efficacy.

Possible Study 5: Evaluate efficacy of the experimental biopesticide DWR2009 in liquid and bait form (by coating wheat bran with the pathogen) using ultra-ultra low volume RAATs (involves a timing device and ULV nozzles) and a 10 acre plot. ATV-mounted liquid and bait spreaders will be utilized to apply DWR2009. Specimens will be periodically collected to observe mortality and sporulation for a duration of time to determine efficacy.

Possible Study 6: Evaluate efficacy of the experimental, non-traditional pesticide LinOilEx (Formulation 103). A micro-FAASSTT (airbrush system mounted on a 5 gal bucket) will be utilized to apply varying dose levels in order to compare efficacy, starting at the base rate of 6.64 ml/cage. A species of local abundance will be placed into replicated microplot cages and sprayed directly. Mortality will be then be observed for a duration of time to determine efficacy.

III. Affected Environment

A. Description of Affected Environment

This EA covers the State of Wyoming. Additionally, APHIS recognizes that concerns outside this area could necessitate protection buffers that extend into this area.

The size of this region is approximately 97,914 square miles (62,664,960 acres). The total relief is 10,690 feet and ranges from 3,114 feet to 13,804 feet at Gannett Peak.

Grasshopper and Mormon cricket treatments occur primarily between 3,640 feet and 7,500 feet in this region. Pine forests dominate the higher elevation. No treatments are anticipated in these forested areas. Annual precipitation in the primary area of concern ranges from 6 inches to 22 inches. Precipitation is higher in the mountains. Temperatures can be extremely variable at any location. Summer temperatures in the 90's and low 100's are common in the lower elevations. Winter low temperatures are often well below 0 degrees Fahrenheit (ºF). The yearly mean temperatures for the region are 40 ºF to 48 ºF.

Croplands are concentrated along major rivers where irrigation is possible. Less than 3 percent of the region is cultivated. The major crops are:

CROP	ACRES	CROP	ACRES
Alfalfa	530,000	Corn	110,000
Other Hay	550,000	Oats	23,000
Wheat	145,000	Sugar Beets	31,300
Barley	100,000	Dry Beans	32,000

(Acreage figures are from National Agricultural Statistics Service, Wyoming Agriculture Statistics, 2015 Crop Acres Planted). Damage to these croplands is expected when migrating bands of Mormon crickets and grasshoppers enter these fields.

Information on the species composition of grasshoppers is available from USDA APHIS PPQ in Cheyenne, Wyoming through the Wyoming Grasshopper Information System. The species of major economic importance are: *Ageneotettix deorum, Amphitornus coloradus, Anabrus simplex, Aulocara elliotti, Aulocara femoratum, Camnula pellucida, Cordillacris crenulata, Cordillacris occipitalis, Melanoplus bivittatus, M. differentialis, M. femurrubrum, M. infantilis, M. occidentalis, M. sanguinipes, Phlibostroma quadrimaculatum, Phoetaliotes nebrascensis,* and *Trachyrhachys kiowa*. Approximately 96 other lesser important species are represented in surveys from this region. These 96 species may become economic pests if part of a high density species complex. Warm, dry weather is generally the most favorable for high populations, and severe loss of forage most often occurs in conjunction with drought.

The major population centers are in the towns of Cheyenne and Casper. Smaller towns are located throughout the region. The total population is approximately 563,626 (2010 census figure).

Major recreational areas in this region include eleven State parks and eight National Forests. The top five most visited State Parks in Wyoming are Hot Springs State Park with 1,821,006 visitors, Glendo State Park with 300,801 visitors, Bear River State Park with 261,540 visitors, Sinks Canyon State Park with 212,019 visitors and Keyhole State Park with 187,324 visitors in 2014 (Wyoming State Parks Visitor Use Program, 2016). Statistics for 2015 are pending publication. Wyoming's eight National Forests total 9.7 million acres (National Forest Service, 2016). The roads through the region are a major thoroughfare for tourist traffic to and from Wyoming's two National Parks, two National

Monuments and over twenty National Historic Sites and Trails. Yellowstone National Park recorded 4,095,317 visitors for 2015 alone and has recorded between 2.8 million and 3.6 million visitors per year since 2000 (Yellowstone National Park Visitor Statistics, 2016).

Domestic honeybee yards are found throughout Wyoming. Approximately 268 hobbyist (10 hives or less) apiarists and 163 general commercial apiarists make up the total registered 431 apiarists who operate 48,000 bee yards and over 100 million bee hives in Wyoming. A large number of these colonies seasonally migrate to California to pollinate the almond orchards. Wyoming also has a hearty alfalfa seed production industry and alfalfa leafcutter bees are commonly used in some areas covered by this EA. Site specific locations can be found through apiary registrations at the Wyoming Department of Agriculture or checking with alfalfa seed producers in the case of leafcutter bees (WDA, 2015).

Many species of big game (antelope, mule deer, whitetail deer, elk, and others) and smaller animals (rabbits, squirrels, muskrats, beavers, minks, weasels, badgers, coyotes and foxes) range within the varied habitats. Livestock ponds, streams and reservoirs within the proposed treatment area provide a nesting and breeding habitat for waterfowl. Many nongame birds migrate through or nest in the region. Golden eagles, peregrine falcons and other raptors nest within the region and game birds (ringed necked pheasant, greater sage-grouse, wild turkey, Hungarian partridge, chukar and dove) are present. Recreational hunting is very important to the local economy.

B. Other Considerations

1. Human Health

The 2002 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. The following discussion summarizes the hazards, potential exposure, and risk to workers and the general public for operations in Wyoming. Operational procedures identified in Appendix 1 would be required in all cases and further mitigation measures are identified in this section, as appropriate.

No treatment will occur over congested areas, recreation areas, or schools and if appropriate, a buffer zone will be enacted and enforced. Refer to the Operational Procedures for ground and aerial treatments listed in Appendix 1. Further Treatment information can be found in the Grasshopper Guidebook Provisional online at https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/grasshopper-mormon-cricket/ct_grasshopper_mormon_cricket.

Groundwater wells are a major source of domestic water supplies. Groundwater and surface water are the major rural and livestock water source. No impact is anticipated. Strict adherence to label requirements and USDA treatment guidelines (Appendix 1) will be followed in regard to treatments bordering open surface waters.

Malathion and carbaryl are cholinesterase inhibitors. Cholinesterases (including acetylcholinesterase) are enzymes that function at the nerve synapse. The nerve synapse is the point where information in the form of electrical impulses is relayed or transmitted by chemical messengers (called transmitters) from one nerve cell to another. Cholinesterase then inactivates or destroys the transmitter chemical (like acetylcholine) after it completes its job, otherwise the transmitter would continue indefinitely and precise control of the enervated tissue (muscle or organ) would be lost. Refer to the 2015 guidelines (Appendix 1) for further information on mitigating exposure to cholinesterase inhibitors.

No human health effects are likely from exposure to diflubenzuron if it is used according to label instructions. A human exposure assessment was done in detail for diflubenzuron and can be found in APHIS's "Chemical Risk Assessment for Diflubenzuron Use in Grasshopper Cooperative Control Program".

2. Nontarget Species

Sensitive non-target species within the area include plants, terrestrial vertebrates and invertebrates, bats, resident and migratory birds, biocontrol agents, pollinators, aquatic organisms, and Federal and State listed threatened and endangered species. APHIS will use an Integrated Pest Management (IPM) approach to ensure non-target effects are reduced. APHIS will also consult with local agency officials to determine appropriate protective measures. Appropriate protective measures will be considered within an IPM framework. These strategies may include but are not limited to chemical selection, reduced rates, reduced coverage areas, buffer zones, timing restrictions and environmental monitoring. If such a request occurs and the grasshopper or Mormon cricket management option selected poses a clear threat to any of these species, APHIS will confer with the land managers, the U.S. Fish and Wildlife Service and/or Wyoming Game and Fish personnel to agree on protective measures.

a) Threatened and Endangered Species and Sensitive Species of Concern

The following are federally listed threatened and endangered species that reside in Wyoming.

FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES:

Animals	Latin Name	Listed Status
Northern long-eared Bat	*Myotis septentrionalis*	Threatened
Grizzly Bear	*Ursus arctos horribilis*	Threatened
Humpback Chub	*Gila cypha*	Endangered

Yellow-Billed Cuckoo	*Coccyzus americanus*	Threatened
Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*	Endangered
Black-footed Ferret	*Mustela nigripes*	Endangered / Experimental
Canada Lynx	*Lynx Canadensis*	Threatened
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Threatened
Colorado Pikeminnow	*Ptychocheilus Lucius*	Endangered
Piping Plover	*Charadrius melodus*	Threatened / Endangered
Least Tern	*Sterna antillarum*	Endangered
Wyoming Toad	*Anaxyrus baxteri*	Endangered
Western Glacier Stonefly	*Zapada glacier*	Threatened

Plants	Latin Name	Listed Status
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
Western prairie fringed orchid	*Platanthera praeclara*	Threatened
Blowout Penstemon	*Penstemon haydenii*	Endangered
Desert Yellowhead	*Yermo xanthocephalus*	Threatened

A summary of species determinations and impact minimization measures can be found in Appendix 3. In the absence of a recent national biological opinion, local section seven consultations are conducted yearly with Fish and Wildlife Service to mitigate impacts that grasshopper suppression programs may have on listed threatened and endangered species. These correspondences can be found in Appendix 2.

b) Greater Sage-Grouse (*Centrocercus urophasianus*)

The Wyoming Game and Fish Department (WGFD) and Bureau of Land Management (BLM) have indicated concern regarding the impacts of a grasshopper suppression programs on greater sage-grouse, hereafter referred to as sage-grouse. Concerns to sage-grouse include the toxicity effects of the chemicals in question, the effects to the food base of the greater sage-grouse, and the physical disturbance factors related to a grasshopper suppression program. Wyoming historically supports larger populations of sage-grouse than other states due to the approximately 50 percent of land area that is composed of sagebrush habitats (Patterson 1952). "Sage-grouse numbers have declined throughout Wyoming in the second half of the 20th century" according to Wyoming greater sage-grouse Conservation Plan (WGSGCP), 2003. In order to break this trend WGFD has adopted the WGSGCP.

As part of the WGSGCP, Local Sage-Grouse Working Groups (LWGs) were created to develop and facilitate implementation of local conservation plans for the benefit of sage-grouse, their habitats, and whenever feasible, other species that use sagebrush habitats. The plans identify management practices and the financial and personnel means to accomplish these practices, within an explicit time frame, for the purpose of improving sage-grouse numbers and precluding the need for listing under the Endangered Species Act. These groups are made up of individuals from varying interest groups including federal land managers, conservation groups, mineral industry representatives, agriculture producers, and others.

Concern and protection of sage-grouse in Wyoming has been a priority for leaders in Wyoming for many years and has been expressed partly through the Governor's Executive orders 2008-2, 2010-4, 2011-5, and 2013-3 with 2015-4 superseding all previous executive orders. The Governor's sage-grouse implementation team developed the sage-grouse core area concept in order to protect critical habitat from further degradation. The BLM has issued Instruction Memorandum WY 2012-019 regarding Greater Sage-Grouse habitat management policy on Wyoming BLM administered public lands including the federal mineral estate.

Sage-grouse as a species of concern was addressed in the 2002 EIS and is addressed in the updated 2019 EIS. While it is clear that diflubenzuron poses less direct toxicity to greater sage-grouse than both carbaryl and malathion, toxicities were analyzed in the risk assessment and concluded that grasshopper suppression RAATs alternatives would not directly affect greater sage-grouse for any of the proposed insecticides.

The effect of grasshopper suppression programs to the food base of the greater sage-grouse can be important during the early brood rearing timing of the sage-grouse life cycle. Study results indicate that sage-grouse chicks require insects for survival until about three weeks of age (Johnson, May 1987). For most of Wyoming, this timing coincides with the earliest likely timing of grasshopper suppression programs. In order to limit the effects to the food base of the greater sage-grouse APHIS PPQ will utilize grasshopper suppression RAATs alternatives within greater sage-grouse core areas. By using the RAATS method, effects to non-target insects and grasshoppers will be reduced. The Governor's executive order 2015-4 specifically lists Grasshopper / Mormon cricket control following Reduced Agent-Area Treatments (RAATS) protocols as an exempt activity under Attachment C Exempt ("de minimis") Activities.

In extreme cases grasshopper infestations may be so damaging that crucial sage-grouse habitat is compromised. These areas may not be apparent in time to use diflubenzuron and a faster knockdown may be required to protect the habitat. For these situations APHIS reserves the ability to use carbaryl and malathion in greater sage-grouse core areas. If treatments are late enough in the season that diflubenzuron is deemed ineffective then it is also most likely that sage-grouse chicks will be mature enough that they will have adjusted their diet to a mixture of forbs and sage brush versus insects only. Situations that require the use of carbaryl or malathion within sage-grouse core areas will be considered on a case by case situation only with input from the land manager, land owner and Wyoming Game and Fish Department.

In 2015 the FWS requested data from 11 western states, including Wyoming, to aide in the ESA listing decision of the sage-grouse. The data included sage-grouse populations' status, trends and numbers, habitat status and trends, hunting and other uses, disease and predation, impacts from pesticides, contaminants, recreational activities, and any literature pertinent to the FWS status review. The compiled data demonstrated Wyoming's commitment and assurance to sage-grouse conservation and the determination of the western states to logistically and financially conserve sage-grouse

habitat and protect the sage-grouse species. Reviews of the complied data lead to the United States Department of Interior determining that listing the greater sage-grouse range wide as a threatened or endangered species is currently precluded making it a candidate species which will not receive statutory protection under the ESA and that individual states will continue to be responsible for their management. If grasshopper suppression treatments are requested in sage-grouse core areas, APHIS PPQ will consider additional conditions and mitigation measures outlined in the request. Discussions with local entities such as WGFD and BLM will also occur to determine appropriate steps to suppress grasshopper populations and protect sage-grouse populations and habitat ranges.

c) Species of special concern to the Wyoming Game and Fish Department

The Wyoming Game and Fish lists Species of Greatest Conservation Need (SGCN). This list may be found in State Wildlife Action Plan, 2017, which can be found at https://wgfd.wyo.gov/Habitat/Habitat-Plans/Wyoming-State-Wildlife-Action-Plan.

WGFD has specific concerns regarding greater nongame birds and bats with respect to grasshopper suppression programs.

i. Nongame birds

The following species appear on the SGCN list and the Wyoming Partners in Flight Priority Species list, and may be negatively affected by grasshopper control in areas where they nest and forage: burrowing owl, short-eared owl, Brewer's sparrow, sage sparrow, Baird's sparrow, McCown's longspur, loggerhead shrike, sage thrasher, vesper sparrow, lark sparrow, lark bunting, dickcissel, bobolink, black-billed cuckoo, black throated gray warbler, Clark's nutcracker, MacGillivray's warbler, Scott's oriole, Virginia's warbler, Bewick's wren, canyon wren and snowy plover. In particular, the following species consume large amounts of grasshoppers and/or Mormon Crickets; therefore the impact of grasshopper control on these species is likely to negatively affect both adult and young birds during the nesting season: McCown's longspur, loggerhead shrike, sage thrasher, lark bunting, black-billed cuckoo, Virginia's warbler, Bewick's wren, mountain plover and snowy plover. APHIS would use RAATs methodologies for treatments in most cases, as RAATs with diflubenzuron is the preferred methodology. This method is expected to result in 80 to 95% control, which is approximately 5 to 15% lower mortality than with a conventional (higher rate, blanket coverage) treatment (University of Wyoming, 2010). RAATs methods are expected to leave adequate prey base for insectivorous species. At no time will APHIS strive to eradicate grasshopper populations.

ii. Bats

In previous years the Wyoming Game and Fish has raised concerns about possible impacts of this program on spotted bats. The spotted bat is a nocturnal feeder on flying insects primarily around desert water holes. The bat and its food source are protected by the buffers associated with water. Additional protective measures, such as the use of bait or RAATs, will be negotiated with the Wyoming Game and Fish if proposed pesticide applications directly conflict with sites having recent spotted bat activity.

d) Bald and Golden Eagle Protection Act

The Eagle Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb'' means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

As listed in the National Bald Eagle Management Guidelines (FWS, May 2007) the following mitigation measures will be followed when practical:

> "Category G. Helicopters and fixed-wing aircraft. Except for authorized biologists trained in survey techniques, avoid operating aircraft within 1,000 feet of the nest during the breeding season, except where eagles have demonstrated tolerance for such activity. In addition, Category A (Agriculture) and Category D (Off Road Vehicle Use) both provide the same guidance for use of ATV's or trucks: No buffer is necessary around nest sites outside the breeding season. During the breeding season, do not operate off-road vehicles within 330 feet of the nest. In open areas, where there is increased visibility and exposure to noise, this distance should be extended to 660 feet."

Most bald eagles nest close to their food source, typically waterways, by policy and label restrictions APHIS will not conduct suppression activities within 500 feet of water bodies providing some inherent protection for Bald Eagles.

e) Aquatic Species not previously listed

The malathion label warns of its toxicity to fish, shrimp, and crabs and prohibits its use over water. EPA lists carbaryl and malathion as pesticides that may affect endangered aquatic species (EPA, 1986).

Diflubenzuron is the main ingredient in Dimilin® 2L, Cavalier 2L and Unforgiven. These chemical products are listed as Restricted Use Pesticides due to toxicity to aquatic invertebrate animals including insects and it cannot be applied directly to water or to areas where surface water is present.

Important game fish in the region include: Walleye, Sauger, Cutthroat trout, Brown trout, Rainbow trout, Brook trout and Lake trout.

Programmatic protection for federally listed endangered and threatened species of aquatic animals is covered in the 2002 EIS, Biological Assessments and the Biological Opinions. These procedures will ensure protection of sensitive aquatic species from any adverse effects caused by grasshopper control.

f) Bees

i. Domestic Honey Bees (*Apis mellifera*)

Beekeepers are given notice when definitive treatment areas are identified. Treatment block maps will be available for beekeeper review at the County offices of the Weed and Pest Districts. Beekeepers will be advised to move their bees at least two miles from the spray block boundaries. In all cases when using malathion or carbaryl where beekeepers fail to move or otherwise protect their bees, a two mile buffer zone will be observed around the bee yard. The above procedures will ensure that there will be no significant impact on domestic bee production.

ii. Alfalfa Leafcutter Bees (*Megachile rotundata*)

Alfalfa leafcutter bees are managed for pollination of alfalfa in the area. The areas with these bees are mostly centered at Basin, Burlington, Emblem, Powell, Byron, Lovell and Riverton. Notification is on a case-by-case basis. Beekeepers will be advised to move their bees at least four miles from the spray block boundaries. In all cases when using malathion or carbaryl where beekeepers fail to move or otherwise protect their bees, a four mile buffer zone will be observed around the bee yard. The above procedures will ensure that there will be no significant impact on alfalfa leafcutter bee activity.

g) Wildlife Habitat Reservations and Wilderness Areas

The Wyoming Game and Fish Department operates 39 Wildlife Habitat Management Units in Wyoming. These can be located on the web at https://wgfd.wyo.gov/accessto/whmas.asp. If a request for treatment involves any of these lands APHIS will negotiate locally with the habitat biologist located at the nearest Game and Fish regional office for any protective measures necessary, additional to the operation procedures.

h) Bureau of Land Management Wilderness Study Areas

In Wyoming there are 43 Bureau of Land Management (BLM) administered Wilderness Study Areas (WSA), encompassing 588,150 acres. These can be located on the web at https://www.blm.gov/programs/national-conservation-lands/wyoming. These WSA's are managed under BLM's Interim Management Policy (IMP).

The objective of the IMP is to continue resource uses within the WSA's in a manner that maintains the area's suitability for preservation as wilderness until Congress either designates these lands as wilderness or releases them for other purposes.

Handbook H-8550-1 (Interim Management Policy for Lands under Wilderness Review) provides guidance regarding how BLM will manage the WSA's. H-8550-1 does provide for insect and disease control by chemical or biological means under certain conditions as discussed in Chapter 3, Section D Rangeland Management, 4 e.

Because of the special requirements found in H-8550-1, including NEPA related requirements, before conducting any Grasshopper and Mormon cricket project involving a WSA, the BLM Field Office administering the specific WSA will be consulted with and involved in the project.

i) Migratory Birds

In accordance with various environmental statutes, APHIS routinely conducts programs in a manner that minimizes impact to the environment, including any impact to migratory birds. In January 2001, President Clinton signed Executive Order (EO) number 13186 to ensure that all government programs protect migratory birds to the extent practicable. 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 minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.

j) Protective Mitigation Measures of Above Species

Protective mitigation measures that may be taken by APHIS in the grasshopper treatment areas covered by this EA may include, but is not limited to buffer zones and/or skip swaths. It is important to note that treatment goals are to reduce grasshopper populations to an economic threshold, not eradication. At no time will APHIS strive to reduce populations below levels encountered in non-outbreak years. This will help ensure grasshopper populations sufficient to provide food sources and biodiversity for species of concern.

If after specific program boundaries have been set and if it has been determined by Fish and Wildlife Services or the land manager that species of concern are within the specific area, mitigation measures as described in Appendix 3 or site specific documentation will be followed.

3. Socioeconomic Issues

The possible treatment areas are subject to reoccurring drought. A combination of drought and grasshopper damage causes economic stress to landowners and permittees.

The control of grasshoppers and Mormon crickets in this area would have beneficial economic impacts to local landowners (or permittees). The forage not utilized by grasshoppers will be available for wildlife consumption, livestock consumption, and harvesting. This will allow greater livestock grazing, decreased needs for supplemental feed, and increased monetary returns. The control of migrating bands of Mormon crickets is most important in protection of crops but if populations are extreme, damage to rangeland forage will occur.

4. Cultural Resources and Events

To ensure that historical sites, monuments, buildings, artifacts or known areas of cultural events and/or observances of special concern are not adversely affected by program treatments, APHIS will confer locally with Tribes, state and federal land managers on proposed treatment areas.

In previous years, BLM has expressed concerns regarding the effect of pesticide applications on cation ratio dating techniques of pictographs and petroglyphs. There is presently no information on this subject. Until such information is available, USDA APHIS will confer with BLM on a local level to protect known sites on BLM managed lands.

Where tribal lands are involved, APHIS will confer locally with Tribal Officials and with the BIA office to ensure that the timing and location of planned program treatments do not coincide or conflict with cultural events and/or observances on Tribal and/or allotted lands. APHIS will confer locally with Tribal Officials and with the BIA office on possible cultural impacts of proposed grasshopper/Mormon cricket treatment where native plant gathering areas on tribal land are identified to APHIS.

5. Special Considerations for Certain Populations

a) Executive Order Number 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (EO) number 12898, Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations, was signed by President Clinton on February 11, 1994 (59 *Federal Register* (FR) 7269). This EO requires each Federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Consistent with this EO, APHIS will consider the potential for disproportionately high and adverse human health or environmental effects on minority populations and low-income populations for any of its actions related to grasshopper suppression programs.

Consistent with EO number 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, APHIS considered the potential for disproportionately high and adverse human health or environmental effects from the proposed treatment is minimal and is not expected to have disproportionate adverse effects to any minority or low income populations.

b) Executive Order Number 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 EO

number 13045, Protection of Children From Environmental Health Risks and Safety Risks (62 FR 19885). This EO 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).

The human health risk assessment for the 2002 EIS analyzed the effects of exposure to children from three insecticides. The 2019 EIS updates and replaces the 2002. Based on review of all four insecticides and their use in the grasshopper program, the risk assessment concluded that the likelihood of children being exposed to insecticides is very slight and that no disproportionate adverse effects to children are anticipated over the negligible effects to the general population. Treatments are primarily conducted on open rangelands where children would not be expected to be present during treatment, or enter should there be any restricted entry period after treatment. No treatment will occur over congested areas or schools and if appropriate, a buffer zone will be enacted and enforced.

Impacts on children will be minimized by the implementation of the treatment guidelines as further described in Appendix 1:

Aerial Broadcast Applications of Liquid Insecticides

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

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

Aerial Application of Dry Insecticidal Bait

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

Ultra-Low-Volume Aerial Application of Liquid Insecticides

- Do not spray while school buses are operating in the treatment area.
- Do not apply within 500 feet of any school or recreational facility.

IV. Environmental Consequences

Each alternative described in this EA potentially has adverse environmental effects. The general environmental impacts of each alternative are discussed in detail in the 2002 and 2019 EIS. The specific impacts of the alternatives are highly dependent upon the particular action and location of 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; and non-target fish and wildlife along with its environmental fate in soil, air, and water. The assessments rely on data required by the USEPA for pesticide product registrations, as well as peer-reviewed and other published literature. The HHERAs are heavily referenced in this draft EA. These Environmental Documents can be found at the following website: http://www.aphis.usda.gov/plant-health/grasshopper.

A. Environmental Consequences of the Alternatives

Environmental consequences of the alternatives are discussed in this section.

1. No Suppression Program Alternative

Under this alternative, APHIS would not organize or fund a program to suppress grasshoppers. If APHIS does not participate in any grasshopper suppression program, Federal land management agencies, State agriculture departments, local governments, private groups or individuals, may not effectively combat outbreaks in a coordinated effort. Without the technical assistance and coordination that APHIS provides during grasshopper outbreaks, the uncoordinated programs 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). It is not possible to accurately predict the environmental consequences of the No Suppression alternative because the type and amount of insecticides that could be used in this scenario are unknown. However, the environmental impacts could be much greater than under the APHIS led suppression program alternative due to lack of treatment knowledge or coordination among the groups.

The potential environmental impacts from the No Suppression alternative, where other agencies and land managers do not control outbreaks, stem primarily from grasshoppers consuming vast amounts of vegetation in rangelands and surrounding areas. Grasshoppers are general 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 rangeland is removed, valued at a dollar adjusted amount of $900 million. 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 pest outbreaks in rangeland.

Vegetation damage during large-scale grasshopper outbreaks may be so severe that grasses and forbs are destroyed, resulting in poor or impaired plant growth for several years. Grasshoppers in unsuppressed outbreaks would consume agricultural and nonagricultural plants. Rare, threatened or endangered plants may be consumed during critical times of development such as seed production, and loss of important plant species, or seed production may lead to reduced diversity of rangeland habitats, potentially creating opportunities for the expansion of invasive and exotic weeds (Lockwood and Latchininsky, 2000). 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).

When the density of grasshoppers reaches significantly high 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. Ranchers could also incur economic losses from personal attempts to control grasshopper damage. Local communities could see adverse economic impacts to the entire area. Grasshoppers that infest rangeland could move to surrounding croplands. 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 their byproducts.

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 malathion, carbaryl, or diflubenzuron, depending upon the various factors related to the grasshopper outbreak and the site-specific characteristics. The use of an insecticide would typically occur at half the conventional application rates following the RAATs strategy. APHIS would apply a single treatment to affected rangeland areas in an attempt 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. 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, 2018a).

The offsite movement and deposition of carbaryl after treatments is unlikely because it does not significantly vaporize from the soil, water, or treated surfaces (Dobroski et al., 1985). 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 is not persistent in soil due to multiple degradation pathways including hydrolysis, photolysis, and microbial metabolism. 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).

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, 2018a).

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; Gramlich, 1979); however, the doses were twice those proposed for the full coverage application 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.

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, 2012c). 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.

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. Laboratory studies have indicated that bees are sensitive to carbaryl applications but the studies were at rates above those proposed in the program. The reduced rates of carbaryl used in the program and the implementation of application buffers should significantly reduce exposure of carbaryl applications to pollinators. In areas of direct application where impacts may occur, alternating swaths and reduced rates (i.e., RAATs) would reduce risk. 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).

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, 2017a).

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, 2012c). 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 carbaryl when applied according to label directions and use of personal protective equipment (PPE) (e.g., long-sleeved shirt and long pants, shoes plus socks, chemical-resistant gloves, and chemical-resistant apron) (USEPA, 2012c) 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.

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.

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; Schaefer et al., 1980). 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). 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, 2018c).

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.

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 the occurrence of methemoglobinemia (a condition that impairs the ability of the blood to carry oxygen). Minimal direct risk to amphibians and reptiles is expected, although there is some uncertainty due to lack of information (USDA APHIS, 2018c; USEPA, 2018).

Risk is low for most non-target species based on laboratory toxicity data, USEPA approved use rates and patterns, and additional mitigations such as the use of lower rates and RAATs that further reduces risk. Risk is greatest for sensitive terrestrial and aquatic invertebrates that may be exposed to diflubenzuron residues.

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 much 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, 2018c). 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, 2018c). 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).

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.

Adverse human health effects from ground or aerial ULV applications of diflubenzuron to control grasshoppers are not expected based on the low acute toxicity of diflubenzuron and low potential for human exposure. 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).

Program workers adverse health risks are not likely when diflubenzuron is applied according to label directions that reduce or eliminate exposures. 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.

c) Malathion

Malathion is a broad-spectrum organophosphate insecticide widely used in agriculture on various food and feed crops, homeowner yards, ornamental nursery stock, building perimeters, pastures and rangeland, and regional pest eradication programs. The chemical's mode of action is through AChE inhibition, which disrupts nervous system function. While these effects are desired in controlling insects, they can have undesirable impacts to non-target organisms that are exposed to malathion. The grasshopper program currently uses the malathion end-use product Fyfanon® ULV AG, applied as a spray by ground or air.

Volatility is not expected to be a major pathway of exposure based on the low vapor pressure and Henry's Law constant that have been reported for malathion. The atmospheric vapor phase half-life of malathion is five hours (NIH, 2009b). Malathion's half-life in pond, lake, river, and other natural waters varied from 0.5 days to ten days, depending on pH (Guerrant et al., 1970), persisting longer in acidic aquatic environments. The reported half-life in water and sediment for the anaerobic aquatic metabolism study was 2.5 days at a range of pH values from 7.8 to 8.7 (USEPA, 2006). The persistence of malathion in soils depends primarily on microorganism activity, pH, and organic matter content. The persistence of malathion is decreased with microbial activity, moisture, and high pH (USEPA, 2016a) and the half-life of malathion in natural soil varies from two hours (Miles and Takashima, 1991) to 11 days (Neary, 1985; USEPA, 2006).

Malathion and associated degradates, in general, are soluble and do not adsorb strongly to soils (USEPA, 2000a). Inorganic degradation of malathion may be more important in soils that are relatively dry, alkaline, and low in organic content, such as those that predominate in the western program areas. Adsorption to organic matter and rapid degradation make it unlikely that detectable quantities of malathion would leach to groundwater (LaFleur, 1979). Malathion degradation products also have short half-lives. Malaoxon, the major malathion degradation product of toxicological concern, has half-lives less than one day in a variety of soil types (USEPA, 2016a). The half-life of malathion on foliage has been shown to range from one to six days (El-Refai and Hopkins, 1972; Nigg, 1986; Matsumara, 1985; USDA FS, 2008).

While livestock and horses may graze on rangeland the same day that the land is treated with malathion, the products used by the grasshopper program are labeled with rates and treatment intervals that are meant to protect livestock. Tolerances are set for the amount of malathion that is allowed in cattle fat (4 ppm), meat (4 ppm), and meat byproducts (4 ppm) (40 CFR Parts 180.111). The grasshopper program would treat at application rates indicated on product labels or lower, which would ensure approved residues levels. In addition, the program would make only one application a year.

USEPA found malathion moderately toxic to birds on a chronic basis, slightly toxic to mammals through dietary exposure, and acutely toxic to aquatic species (including freshwater as well as estuarine and marine species) (USEPA, 2000b, 2016b). Toxicity to aquatic vertebrates such as fish and larval amphibians, and aquatic invertebrates is variable based on test species and conditions. The data available on impacts to fish from malathion suggest effects could occur at levels above those expected from program

applications. Consumption of contaminated prey is not expected to be a significant pathway of exposure for aquatic species based on expected residues and malathion's BCF (USEPA, 2016a; USDA APHIS, 2018d). Indirect effects to fish from impacts of malathion applications to aquatic plants are not expected (USDA APHIS, 2018d).

USEPA considers malathion highly toxic to bees if exposed to direct treatment on blooming crops or weeds. The Fyfanon® ULV AG label indicates not to apply product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area (USEPA, 2012a). Toxicity to other terrestrial invertebrates is variable based on the test organism and test conditions however malathion is considered toxic to most terrestrial invertebrates (USEPA, 2016b).

Indirect risks to mammals resulting from the loss of plants that serve as a food source would also be low due to the low phytotoxicity of malathion. The other possible indirect effect that should be considered is loss of invertebrate prey for those mammals that depend on insects and other invertebrates as a food source. Insects have a wide variety of sensitivities to malathion and a complete loss of invertebrates from a treated area is not expected because of low program rates and application techniques. In addition, the aerial and ground application buffers and untreated swaths provide refuge for invertebrates that serve as prey for insectivorous mammals and would expedite repopulation of areas that may have been treated.

APHIS expects that direct avian acute and chronic effects would be minimal for most species (USDA APHIS, 2018d). The preferred use of RAATs during application reduces these risks by reducing residues on treated food items and reducing the probability that they will only feed on contaminated food items. In addition, malathion degrades quickly in the environment and residues on food items are not expected to persist. Indirect effects on birds from the loss of habitat and food items are not expected because of malathion's low toxicity to plants and the implementation of RAATs that would reduce the potential impacts to invertebrates that serve as prey for avian species. Several field studies did not find significant indirect effects of malathion applications on avian fecundity (Dinkins et al., 2002; George et al., 1995; Howe, 1993; Howe et al., 1996; Norelius and Lockwood, 1999; Pascual, 1994).

Available toxicity data demonstrates that amphibians are less sensitive to malathion than fish. Program malathion residues are more than 560 times below the most sensitive acute toxicity value for amphibians. Sublethal effects, such as developmental delays, reduced food consumption and body weight, and teratogenesis (developmental defects that occur during embryonic or fetal growth), have been observed at levels well above those assessed from the program's use of malathion (USDA APHIS, 2018d). Program protection measures for aquatic water bodies and the available toxicity data for fish, aquatic invertebrates, and plants suggest low indirect risks related to reductions in habitat or aquatic prey items from malathion treatments.

Available data on malathion reptile toxicity suggest that, with the use of program measures, no lethal or sublethal impacts would be anticipated (USDA APHIS, 2015). Indirect risk to reptiles from the loss of food items is expected to be low due to the low

application rates and implementation of preferred program measures such as RAATs (USDA APHIS, 2018d).

The risk to aquatic vertebrates and invertebrates is low for most species; however, some sensitive species that occur in shallow water habitats may be at risk. Program measures such application buffer zones, drift mitigation measures and the use of RAATs will reduce these risks.

Risks to terrestrial invertebrate populations are anticipated based on the available toxicity data for invertebrates and the broad spectrum activity of malathion (Swain, 1986; Quinn et al., 1991). The risk to terrestrial invertebrates can be reduced by the implementation of application buffers and the use of RAATs, which would reduce exposure and create refuge areas where malathion impacts would be reduced or eliminated. Smith et al. (2006) conducted field studies to evaluate the impacts of grasshopper treatments to non-target terrestrial invertebrates and found minimal impacts when making reduced rate applications with a reduced coverage area (i.e. RAATs) for a ULV end-use product of malathion. Impacts to pollinators have the potential to be significant, based on available toxicity data for honeybees that demonstrate high contact toxicity from malathion exposures (USDA APHIS, 2018d). However, risk to pollinators is reduced because of the short residual toxicity of malathion. In addition, the incorporation of other mitigation measures in the program, such as the use of RAATs and wind speed and direction mitigations that are designed to minimize exposure, reduce the potential for population-level impacts to terrestrial invertebrates.

Adverse human health effects from ULV applications of malathion to control grasshopper are not expected based on the low mammalian acute toxicity of malathion and low potential for human exposure. Malathion inhibits AChE in the central and peripheral nervous system with clinical signs of neurotoxicity that include tremors, salivation, urogenital staining, and decreased motor activity. USEPA indicates that malathion has "suggestive evidence of carcinogenicity but not sufficient to assess human carcinogenic potential" (USEPA, 2016c).

Adverse health risks to program workers and the general public from malathion exposure are also not expected due to low potential for exposure. APHIS treatments are conducted in rangeland areas consisting of widely scattered, single, rural dwellings in ranching communities, where agriculture is a primary industry. Label requirements to reduce exposure include minimizing spray drift, avoidance of water bodies and restricted entry interval. Program measures such as applying malathion once per season, lower application rates, application buffers and other measures further reduce the potential for exposure to the public.

d) Reduced Area Agent Treatments (RAATs)

The use of RAATS is the most common application method for all program insecticides and would continue to be so except in rare pest conditions that warrant full coverage and higher rates. The goal of the RAATs strategy is to suppress grasshopper populations to a desired level, rather than to reduce those populations to the greatest possible extent. This strategy has both economic and environmental benefits. 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 concentrations, or by alternating one or more treatment swaths. Usually RAATs applications use both options. The RAATs strategy suppresses grasshoppers within treated swaths, while conserving grasshopper predators and natural enemies in swaths that are not treated.

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 traditional blanket insecticide application) at a significantly lower cost and less insecticide, and with a markedly higher abundance of non-target organisms following application (Lockwood et al., 2000; Deneke and Keyser, 2011). Levels of control may also depend on variables such as body size of targeted grasshoppers, growth rate of forage, and the amount of coverage obtained by the spray applications (Deneke and Keyser, 2011). Control rates may also be augmented by the necrophilic and necrophagic behavior of grasshoppers, in which grasshoppers are attracted to volatile fatty acids emanating from cadavers of dead grasshoppers and move into treated swaths to cannibalize cadavers (Lockwood et al., 2002; Smith and Lockwood, 2003). Under optimal conditions, RAATs decrease control costs, as well as host plant losses and environmental effects (Lockwood et al., 2000; Lockwood et al., 2002).

The 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.

RAATs reduces treatment costs and conserves non-target biological resources in untreated areas. The potential economic advantages of RAATs was 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.

Reduced rates should prove beneficial for the environment. All APHIS grasshopper treatments using malathion, carbaryl, or diflubenzuron are conducted in adherence with USEPA-approved label directions. Labeled application rates for grasshopper control tend

to be lower than rates used against other pests. In addition, use rates proposed for grasshopper control by APHIS are lower than rates used by private landowners.

3. Research Treatments Alternative

a) Research *Metarhizium robertsii* Applications

Metarhizium is a common entomopathogenic fungus genus containing several species, all of which are host-restricted to the Arthropoda, with some having greater host specificity to an insect family, or even a group of related genera. Once considered a single species based on morphology but split into a number of species based on DNA sequence data, the genus is found worldwide and is commonly used as a management alternative to chemicals (USDA, 2000; Lomer et al., 2001; Zimmerman, 2007; Roberts, 2018; Zhang et al. 2019). Two *Metarhizium*, *M. brunneum* strain F52 and *M. anisopliae* ESF1, are registered with the USEPA as insecticides and are commercially used against a range of pest insects.

No harm is expected to humans from exposure to *Metarhizium* by ingesting, inhaling, or touching products containing this active ingredient. No toxicity or adverse effects were seen when the active ingredient was tested in laboratory animals. *M. anisopliae* has undergone extensive toxicology testing for its registration in Africa and the registration of Green Guard in Australia. There has been no demonstrated adverse effect on humans from these products. There is a potential for an allergic reaction to dry conidia if a person is extensively exposed to the product and has a preexisting allergy to fungal spores. *Metarhizium* use in this program is not expected to cause adverse impacts to soil, water, or air. No adverse impacts from the use of *Metarhizium* biopesticides have been observed in almost 20 years of field trials in other countries.

From 2005 to 2017, a massive project (led by Donald W. Roberts, Utah State University, in collaboration with USDA and others, and funded by APHIS PPQ S&T) was undertaken to collect 38,052 soil samples from across the 17 western states, from areas that were historically known to have large populations of grasshoppers and/or Mormon crickets. The purpose of these collections was to locate a domestic alternative to the nonindigenous *M. acridum*, used around the world for management of grasshopper (usually locust) populations, particularly in Australia and sub-Sahelian Africa, but also in Mexico and Brazil. The use of such a pathogen would be highly useful to the Program as a biopesticide. Approximately 2,400 new isolates of *Metarhizium* spp., *Beauveria spp*. and other entomopathogenic fungi were found. Many of these fungi isolates were selected for lab and field trials with grasshoppers and Mormon crickets, the most promising being strain DWR2009 belonging to the species *M. robertsii* (Bischoff et al., 2009). The DWR2009 isolate is still undergoing lab and field testing for efficacy against orthopterans. This species is closely related to *M. anisopliae*, which is commonly found worldwide and discernible only on the basis of diagnostic DNA sequences (Roberts, 2018).

There is the potential for prolonged persistence in the environment of a domestic isolate from one area brought to another. Despite this possibility, potential environmental impact

is minimal given the widespread and common nature of *Metarhizium* in the western United States and because the DWR2009 isolate have been chosen for their optimized effects on orthopterans (Roberts, 2018). Although entomopathogenic fungi can reduce grasshopper populations, a substantial portion of the treated population are able to resist the infection through thermoregulation. Molecular systematics analyses (by the Roberts Lab; Bischoff et al., 2009; Kepler et al., 2014; Mayerhofer et al., 2019) revealed DWR2009 is very closely related to many other strains within *M. robertsii*, all of which are basically biologically equivalent to each other. In fact, *Metarhizium robertsii* can only be really differentiated from other species by a multiplexed PCR assay based on two gene sequences. Furthermore, it is likely that persistence effects would mirror those found to be the case for *M. anisopliae* and *M. acridum*. Both of these species need optimal temperature ranges to thrive, as well as relatively humid conditions (Zimmerman, 2007; EA, 2010). In particular, *M. acridum* does not persist in semi-arid and arid environments, which is what rangeland habitats are, where U.S. grasshopper outbreaks occur (EA, 2010). If the DWR2009 strain derived biopesticide is spread outside of the research plots exceptional rates of fungal infection are not anticipated. Since *M. anisopliae* is a generalist entomopathogen, lethal effects on non-target arthropods have been reported, but are more commonly observed in laboratory experiments than in the field. Plus, such effects are dependent on how the pathogen is applied; i.e., its intended target and application method play roles in non-target effects (Zimmerman, 2007). During research experiments, the Rangeland Unit will spray ultra-low volumes (on 10 acres or less) of DWR2009 on grasshopper and Mormon cricket species from aircraft, or through the FAASSTT system. The Rangeland Unit may also coat small amounts of grasshopper bait with the DWR2009.

For the following four reasons, overall environmental impact by research studies utilizing *Metarhizium robertsii* applications should not be significant: 1) various strains of the pathogen are already common in rangeland habitats; 2) "behavioral fever" enables species to often "burn out" the infection by basking, allowing infected grasshoppers and Mormon crickets to escape death by mycosis; 3) fungal pathogens are fairly susceptible to heat and ultraviolet light, greatly reducing the environmental persistence of spores to a few days on treated foliage or ground; and 4) at least three days of 98-100% relative humidity is required for fungal outgrowth and sporulation (reproduction) from infected cadavers (Lomer et al., 2001; Zimmerman, 2007; EA, 2010; Roberts, 2018).

b) Research LinOilEx Applications

LinOilEx (Formulation 103) is a non-traditional pesticide alternative still in the early stages of development. Its mode of action appears to be topical, often inducing a "freezing" effect in treated specimens whereby they appear to have been mid-movement when they die. Previous studies by its creator using locusts and katydids showed promise in its efficacy (Abdelatti and Hartbauer, 2019), so the Rangeland Unit decided to test it. Initial Mormon cricket microplot field studies and grasshopper lab studies are intriguing and warrant further field investigations via microplot cage research experiments. The formulation is proprietary, but includes linseed oil, lecithin, wintergreen oil, and caraway oil mixed into a bicarbonate emulsion.

Target effects on locusts and katydids in initial studies were high while non-target results were mixed, with one tested beetle species, as well as wheat seedlings, experiencing almost no impact. Another tested beetle species did experience relatively high mortality, but well-below target levels (Abdelatti and Hartbauer, 2019). The mode of action appears to be topical, meaning that direct contact with the formulation is needed to induce mortality. The Rangeland Unit's initial studies demonstrated that indirect contact, by spraying vegetation, did not induce mortality. Together, these data suggest that overall environmental impact by research studies utilizing LinOilEx applications is expected to be relatively minimal.

B. Other Environmental Considerations

1. Cumulative Impacts

Cumulative impact, as defined in the Council on Environmental Quality (CEQ) NEPA implementing regulations (40 CFR § 1508.7) "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 Suppression alternative where APHIS would not organize or fund any grasshopper suppression programs include the continued increase in grasshopper populations and potential expansion of populations into neighboring range and cropland. In addition, State and private land managers could apply insecticides to manage grasshopper populations however, land managers may opt not to use RAATs, which would increase insecticides applied to the environment. Increased insecticide use from the lack of coordination and RAAT applications where suitable could increase the exposure risk to non-target species and the environment. In addition, land managers may not employ the extra program measures designed to reduce exposure to the public and the environment.

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. 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.

Potential cumulative impacts resulting from the use of insecticides include insect pest 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 increasing 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 land owners or managers are very uncommon making possible cumulative or synergistic chemical effects extremely unlikely.

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.

The proposed research treatments are short-term and would take place in a very limited area. The purpose of the field tests conducted by the Rangeland Unit will help determine whether APHIS would eventually include the following as options for the Program: 1) the use of UAS to aerially apply Program insecticides, 2) the use of the biopesticide *Metarhizium robertsii* (isolate DWR2009), and 3) the use of the non-traditional insecticide LinOilEx. The data generated by these studies would likely be used as part of the EPA registration process for this biopesticide. Inclusion of effective and environmentally friendly insecticides would provide the Program additional control options for grasshoppers and Mormon crickets in sensitive habitats. If successful, the use of *M. robertsii* could decrease the amount of chemical insecticides used in rangeland against grasshoppers and Mormon crickets.

2. Endangered Species Act

Under the Endangered Species Act of 1973, Section 7, federal agencies are required to consult with the U.S. Fish and Wildlife Service regarding the degree of impact to federally proposed and listed species and critical habitat from the program action and the necessary protective measures to avoid or minimize adverse effects. Informal consultation between APHIS and the FWS may be used to determine whether any adverse effects to species or habitat by the proposed action can be avoided or summarily minimized.

The last formal consultation resulted in the 1998 biological assessment prepared by APHIS and the 1995 biological opinion issued by FWS. This environmental assessment uses information from past formal consultations in determining protective measures.

Malathion and carbaryl have been included in consultation procedures in the past. The 1995 biological opinion has summarized the language from former assessments and opinions on the effects of both pesticides:

Carbaryl:

In general, carbaryl demonstrates low to moderate mammalian toxicity, low toxicity to birds, and moderate toxicity to fish. It is very toxic to aquatic invertebrates and many terrestrial insects. Carbaryl remains effective on vegetation for approximately seven days and 28 days in anaerobic soils (U.S. Fish and Wildlife Service, 1995).

Malathion:

Malathion is relatively low in toxicity to mammals and birds. It is moderately to highly toxic to fish and amphibians. Malathion is extremely toxic to aquatic invertebrates and highly toxic to most insects, including bees. Malathion is relatively non-persistent in soil, water, plants, and animals. Its half-life in alkaline soils is generally less than one day; in water, the half-life is generally less than two days. Malathion residues in plants persist up to five to seven days. Malathion does not bioaccumulate in animals; it is rapidly excreted after exposure ceases (U.S. Fish and Wildlife Service, 1995).

Diflubenzuron:

The chemical, diflubenzuron, has been added to the treatment program, as described in the 2002 EIS. This chemical is new to the consultation process and will be locally consulted on at a site-specific level and included in the forthcoming biological assessment.

Further information on carbaryl, malathion, and diflubenzuron is included earlier in this EA and in the 2002 EIS.

Due to the incomplete formal consultation, local informal consultations have been completed. Correspondence regarding local consultations between APHIS and FWS are included in Appendix 2 “FWS/NMFS Correspondence”.

3. Monitoring

Monitoring involves the evaluation of various aspects of the grasshopper suppression programs. There are three aspects of the programs that may be monitored. The first is the efficacy of the treatment. APHIS will determine how effective the application of an insecticide has been in suppressing the grasshopper population within a treatment area and will report the results in a Work Achievement Report to the Western Region. Work achievement reports are available from the Cheyenne, Wyoming USDA APHIS PPQ office for specific spray blocks upon request. No treatments were conducted in 2012, 2013, 2014, 2015, or 2016 by PPQ in Wyoming.

The second area included in monitoring is safety. This includes ensuring the safety of the program personnel through medical monitoring conducted specifically to determine risks of a hazardous material. The cholinesterase health monitoring program is mandatory and prevents and/or reduces overexposure to cholinesterase inhibiting compounds such as carbamate and organophosphate pesticides. Since the effect of these pesticides is cumulative during a period of exposure, it is mandatory that all exposed individuals be

monitored. The APHIS cholinesterase monitoring program will help protect employees from pesticide poisoning and will also help monitor the use and condition of personal protective equipment. APHIS program personnel are also provided proper hearing protection equipment. Chemical application equipment such as planes, trucks and sprayer motors may affect hearing if exposed for long periods of time. (See APHIS Safety and Health Manual, USDA APHIS, 1998 located online at https://www.aphis.usda.gov/aphis/resources/manualsandguidelines)

The third area of monitoring is environmental monitoring. APHIS Directive 5640.1 commits APHIS to a policy of monitoring the effects of Federal programs on the environment. Environmental monitoring includes such activities as checking to make sure the insecticides are applied in accordance with the labels, and that sensitive sites and organisms are protected. The environmental monitoring recommended for grasshopper suppression programs involves monitoring sensitive sites such as bodies of water used for human consumption or recreation or which have wildlife value, habitats of endangered and threatened species, habitats of other sensitive wildlife species, edible crops, and any sites for which the public has expressed concern or where humans might congregate (e.g. schools, parks, hospitals).

The current environmental monitoring plan can be found at https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/sa_emt/ct_support_docs. Past years environmental monitoring reports are available upon request from the Cheyenne, Wyoming USDA APHIS PPQ office.

Treatments conducted by PPQ in 2010 amounted to 1,027,099 protected acres. All treatments in 2010 were conducted using Dimilin 2L and RAATS methodology.

Treatments conducted by PPQ in 2011 amounted to 81,527 protected acres. All treatments in 2011 were conducted using Dimilin 2L and RAATS methodology.

No treatments were conducted by PPQ in Wyoming during 2012, 2013, 2014, 2015, 2016, 2017 and 2018.

Treatments conducted by PPQ in 2019 amounted to 130,902 protected acres. All treatments in 2019 were conducted using Dimilin 2L and RAATs methodology.

4. Fires and Human Health Hazards

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 for each insecticide as well as recommendations for PPE. The PPE is similar 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.

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Appendix 1: APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program FY-2021 Treatment Guidelines

Version 2/5/2021

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, the Federal government will bear the cost of treatment up to 100 percent on Federal and Tribal Trust land, 50 percent of the cost on State land, and 33 percent of cost on private land. There is an additional 16.15% charge, however, on any funds received by APHIS for federal involvement with suppression treatments.

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

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

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

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

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

<u>Operational Procedures</u>

GENERAL PROCEDURES FOR ALL AERIAL AND GROUND APPLICATIONS

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

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

3. One of the following insecticides that are labeled for rangeland use can be used for a suppression treatment of grasshoppers and Mormon crickets:
   A. Carbaryl
      a. solid bait

b. ultra-low volume (ULV) spray

B. Diflubenzuron ULV spray

C. Malathion ULV spray

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 can be found in the APHIS Grasshopper Program Guidebook: http://www.aphis.usda.gov/import_export/plants/manuals/domestic/downloads/grasshopper.pdf

SPECIFIC PROCEDURES FOR AERIAL APPLICATIONS

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

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

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

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

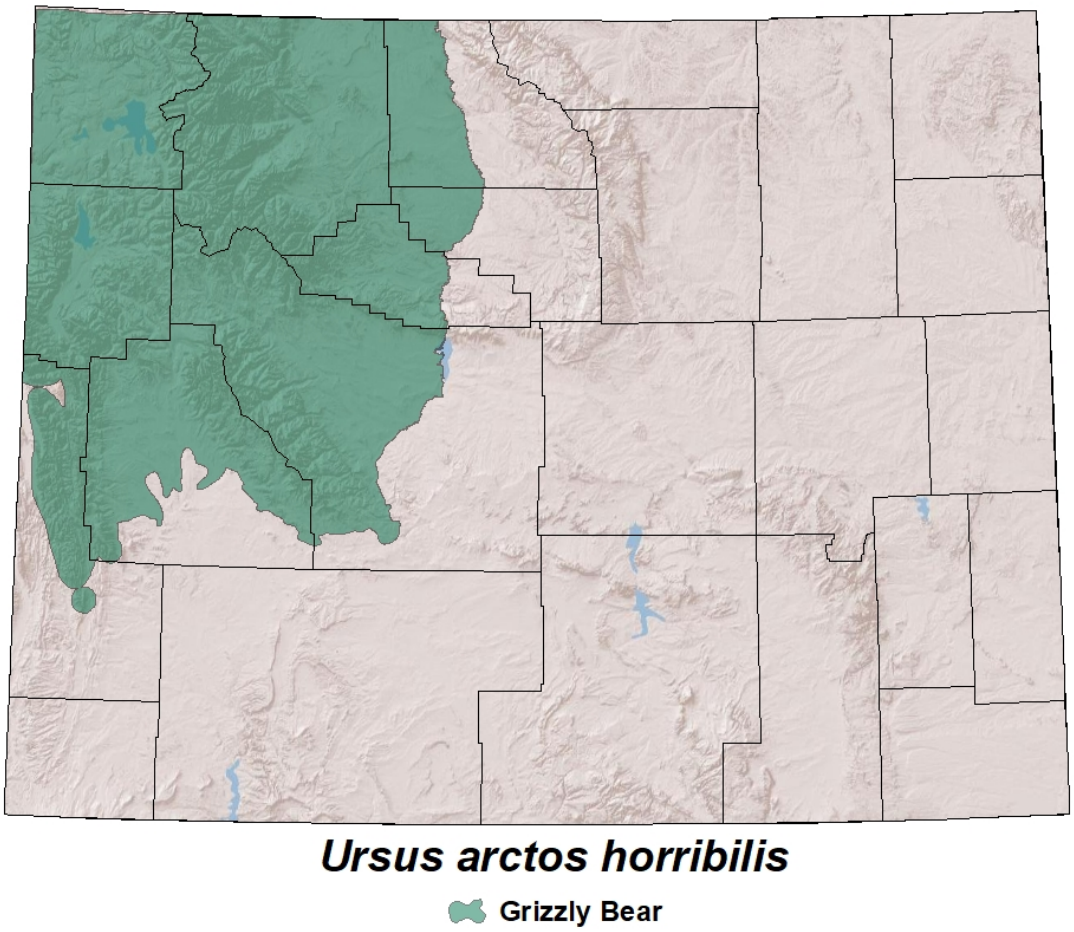
4. Application aircraft will fly at a median altitude of 1 to 1.5 times the wingspan of the aircraft whenever possible or as specified by the COR or the Treatment Manager.

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

Appendix 2: FWS/NMFS/WGFD Correspondence

Appendix 3: Summary of Species Determinations and Impact Mitigation Measures

1. Grizzly bear; *Ursus arctos horribilis*
   a. Species Status Map

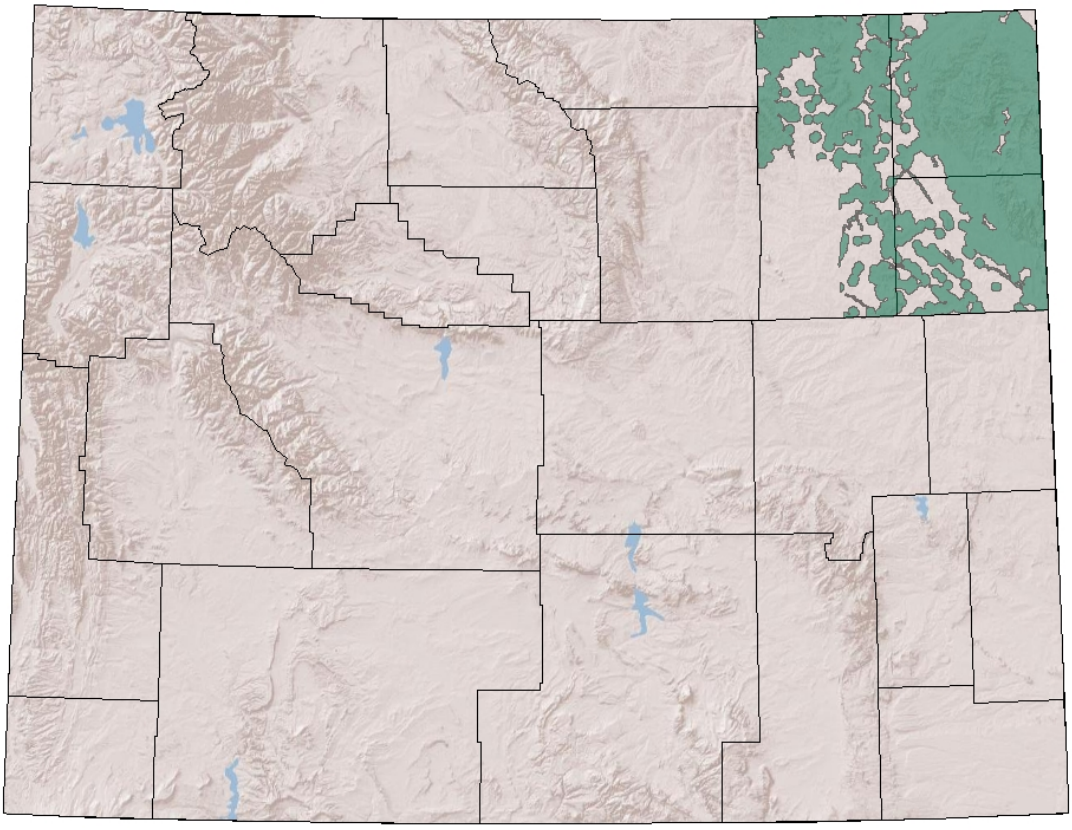


   b. FWS status: Threatened

APHIS grasshopper suppression programs will have no effect on the grizzly bear. It is not likely that APHIS grasshopper suppression programs will occur in areas of the bear's preferred habitat, montane forests. If a suppression program does overlap with the habitat areas of the grizzly bear then a site specific consultation will be initiated with FWS.

2. Northern Long-Eared Bat; *Myotis septentrionalis*

a. Species Status Map



Myotis septentrionalis

Northern Long Eared Bat

b. FWS Status: Threatened with a 4(d) rule

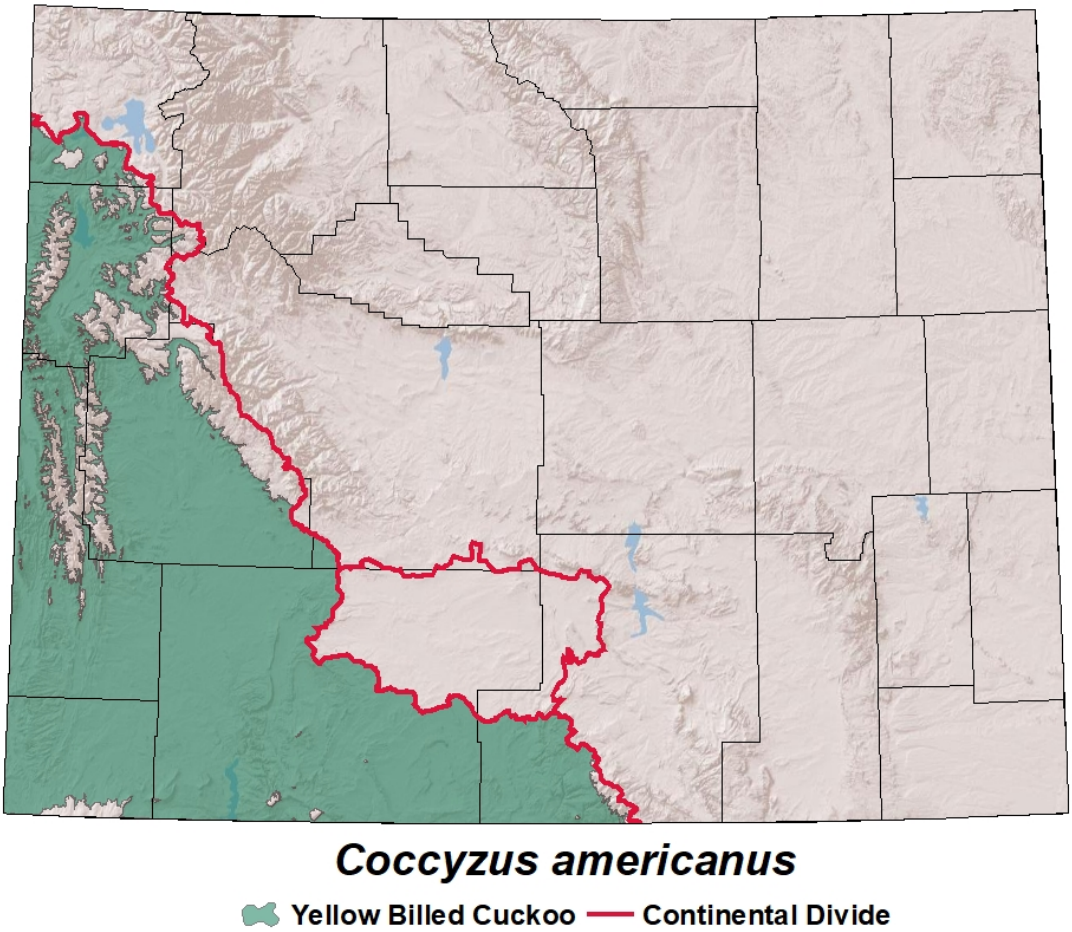
APHIS grasshopper suppression programs may affect but are not likely to adversely affect the Northern Long-Eared Bat.

Wyoming is on the edge of the species range and there are few known active maternity areas in Wyoming. These known locations are all within the Black Hills National Forest of northeastern Wyoming. APHIS would use RAATs methodologies for treatments in most cases and this would be expected to leave adequate prey base for insectivorous species such as the NLEB. The preferred foraging areas for the NLEB are forested areas that would not receive grasshopper or Mormon cricket treatments. In addition, treatments would not occur during peak foraging activity reducing the potential for exposure to program insecticides. Dietary exposure from ingestion of contaminated prey or water is also not anticipated to be a major pathway of exposure for the NLEB. Indirect impacts to the NLEB from loss of invertebrate prey items due to program treatments are not anticipated. There may be insignificant or discountable effects to foraging resources or water due to grasshopper suppression programs outside of (but near to) the NLEB roosting and foraging areas. However, grasshoppers and Mormon crickets are not the typical or primary prey for the NLEB.

Please see Appendix 5 for additional risk summary information.

3. Yellow billed Cuckoo; *Coccyzus americanus*

a. Species Status Map



b. FWS Status: Threatened

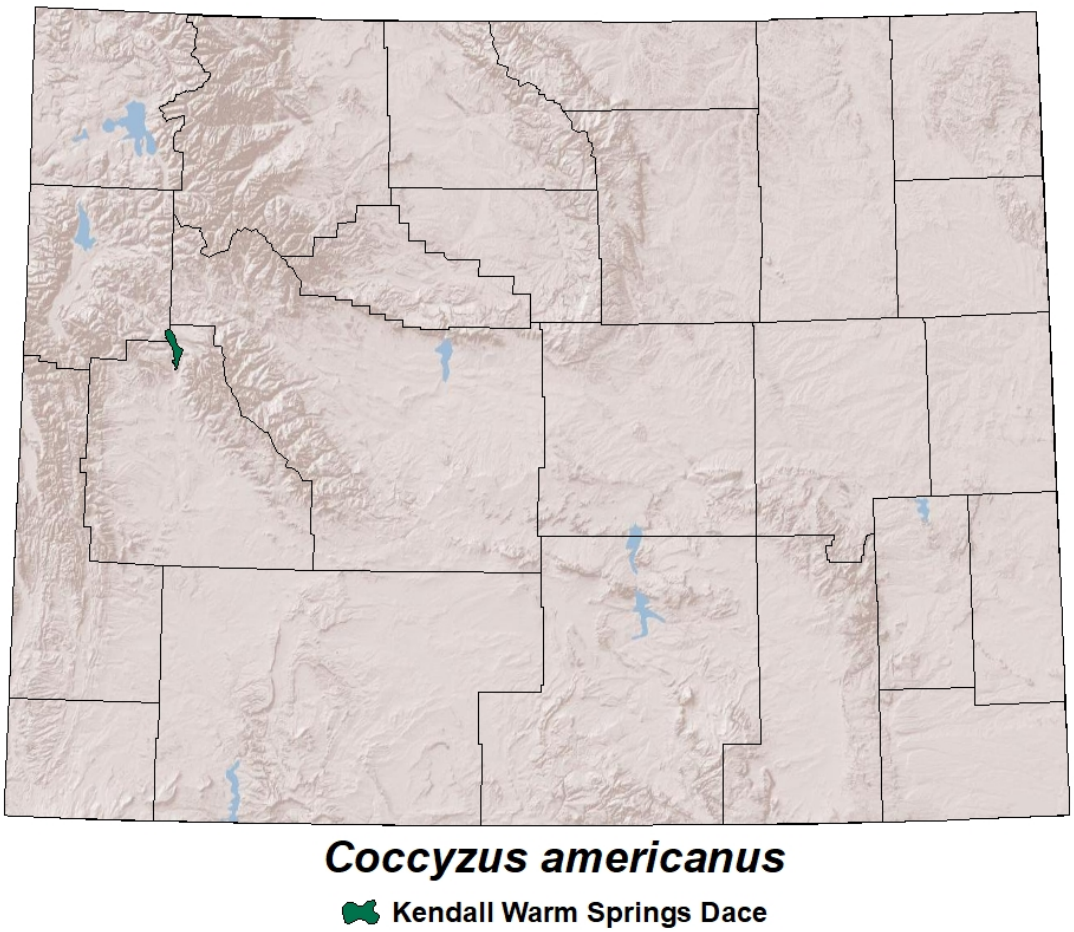
The distinct population segment of the yellow-billed cuckoo west of the Continental Divide is listed under the ESA as a threatened species. Wyoming APHIS grasshopper suppression programs may affect but are not likely to adversely affect the yellow billed cuckoo. The following mitigation measures will be followed:

1. Carbaryl bait: 500 foot ground buffer and 750 foot aerial buffer at the edge of known locations of yellow-billed cuckoos or their suitable habitat.
2. Diflubenzuron: 500 foot ground buffer and 1000 foot aerial buffer at the edge of known locations of yellow-billed cuckoos or their suitable habitat.
3. Malathion and carbaryl ULV: 500 foot ground buffer and 1320 foot aerial buffer at the edge of known locations of yellow-billed cuckoos or their suitable habitat.

Please see Appendix 4 for additional risk summary information.

4. Kendall Warm Springs dace; *Rhinichthys osculus thermalis*

a. Species Status Map

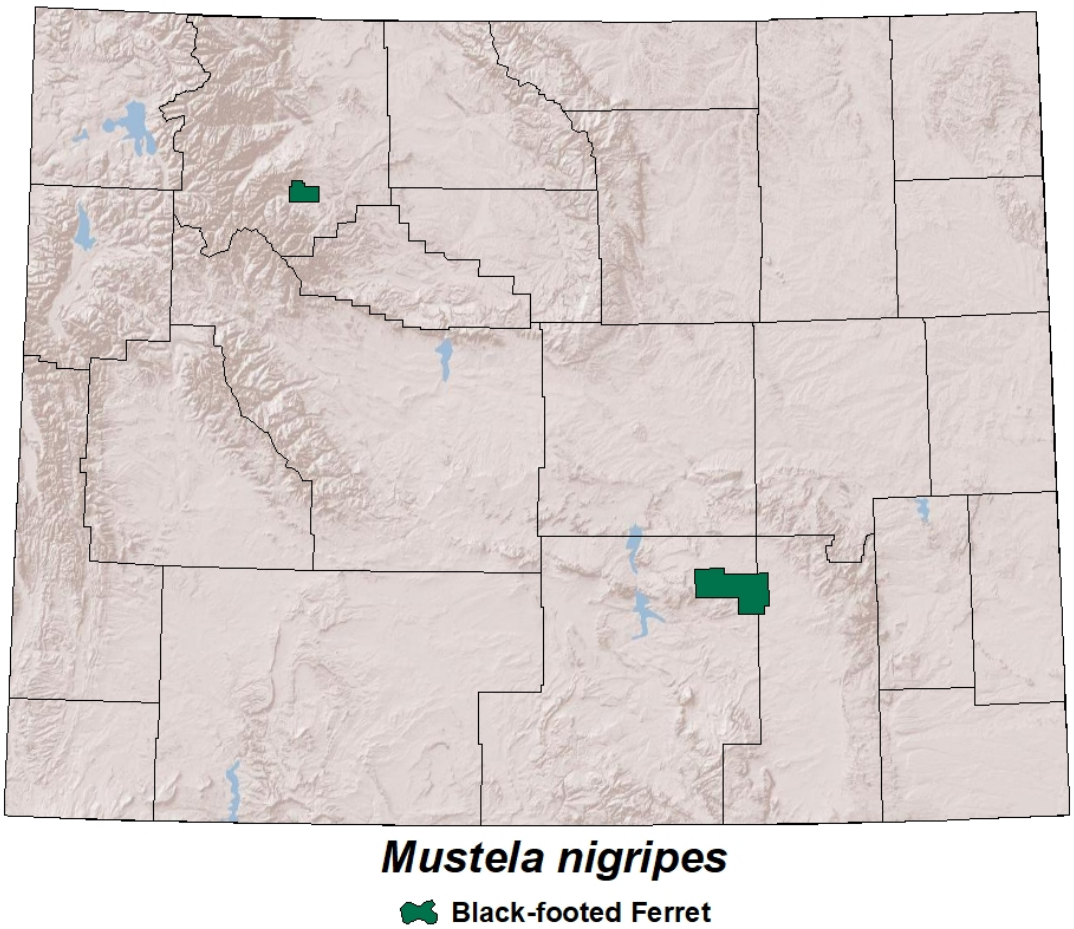


b. FWS status: Endangered

Grasshopper suppression activities in Wyoming are not likely to adversely affect the Kendall warm springs dace. It is not likely that APHIS grasshopper suppression activities will occur in the vicinity of Kendall warm springs. If suppression activities are conducted in Sublette County then the following impact minimization efforts will be utilized. A 0.25 mile buffer shall be maintained around the Kendall warm springs site for all chemicals, and ground applications of malathion. For aerial applications of malathion, a 1 mile buffer will be maintained.

5. Black-footed ferret; *Mustela nigripes*

a. Species Status Map



b. FWS status: Endangered

Grasshopper suppression activities in Wyoming are not likely to adversely affect black-footed ferrets. This determination is based on the fact that there are no known non-reintroduced black-footed ferret populations in Wyoming.

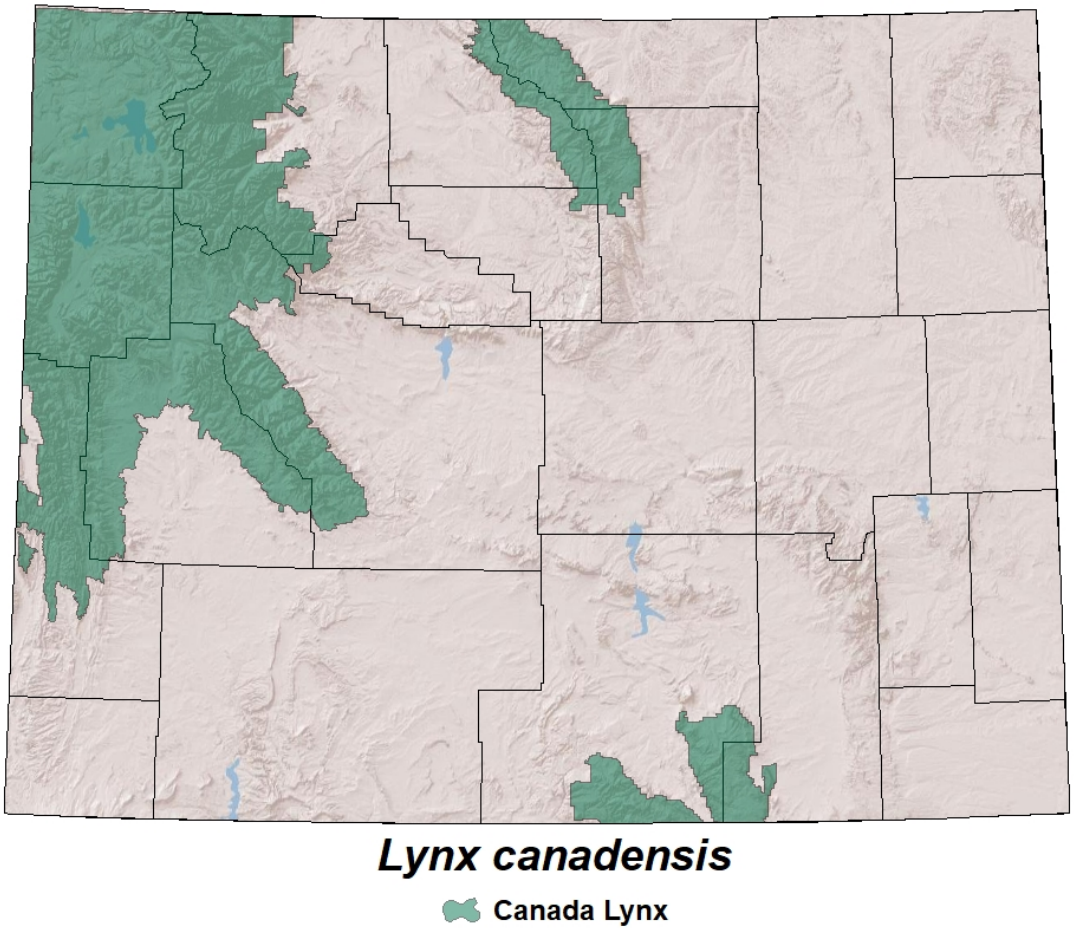
c. FWS Status: Experimental (Shirley Basin population)

There is one non-essential experimental population of black-footed ferrets in Wyoming. Located in the Shirley Basin, ferrets were reintroduced in 1991.

Grasshopper suppression activities in Wyoming are not likely to jeopardize the continued existence of the species based on the fact, by definition; any effects to an experimental non-essential population of any species will not jeopardize the continued existence of the species. The Shirley Basin recovery area has historically not been a high grasshopper density area so APHIS does not expect to have treatments in this area.

6. Canada Lynx; *Lynx canadensis*

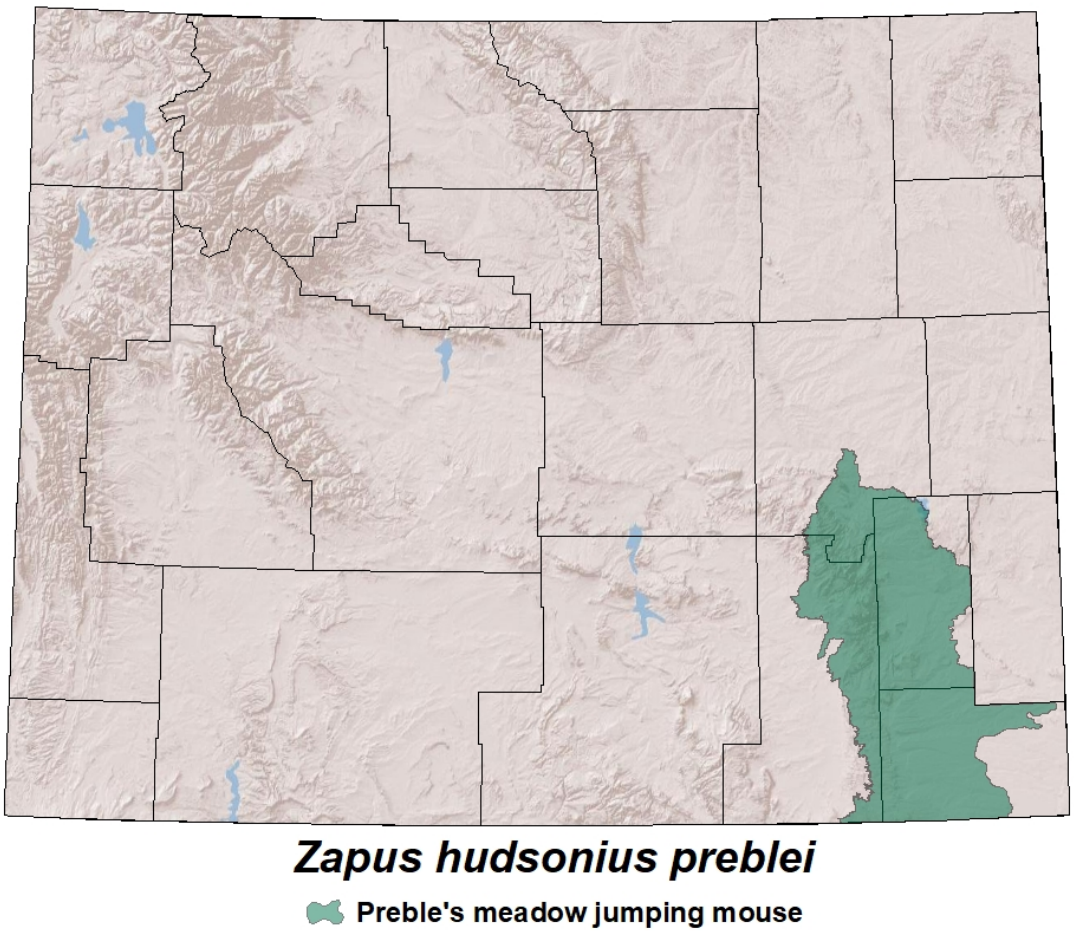
a. Species Status Map



b. FWS status: Threatened, Critical Habitat designated

APHIS grasshopper suppression programs will have no effect on the Canada Lynx or its designated critical habitat. It is not likely that APHIS grasshopper suppression programs will occur in areas of the lynx preferred habitat, boreal forests. If a suppression program does overlap with the critical habitat areas of the Canada Lynx then a site specific consultation will be initiated with FWS.

7. Preble's meadow jumping mouse; *Zapus hudsonius preblei*
   a. Species Status Map



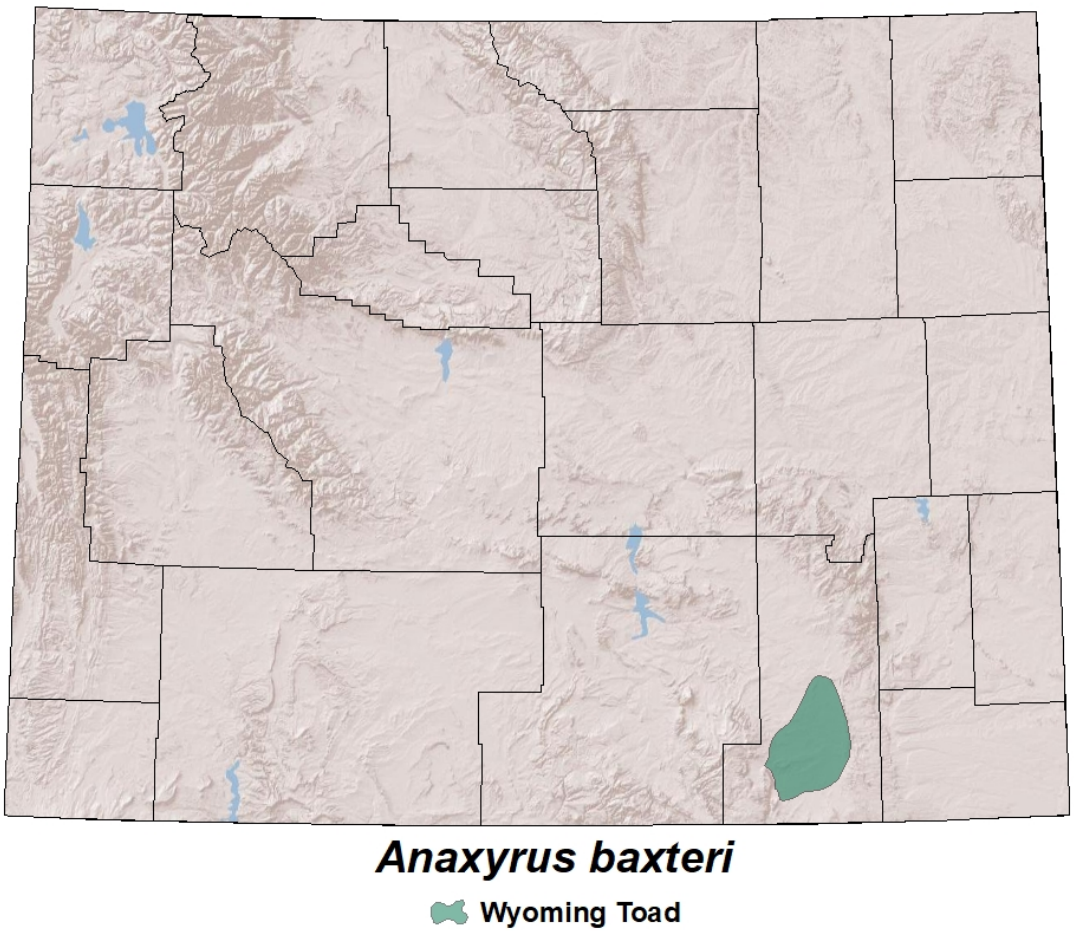
   b. FWS status: Threatened, Critical Habitat designated: Colorado only

Grasshopper suppression activities in Wyoming are not likely to adversely affect the Preble's meadow jumping mouse. It is not likely that APHIS grasshopper suppression programs will occur in areas of the mouse's preferred habitat due to a buffer placed around water and riparian areas. As per APHIS Grasshopper and Mormon cricket suppression program treatment guidelines, the following mitigation measures will be followed:

1. 500 foot standard programmatic buffer around water and riparian areas for aerial suppression programs.
2. 50 foot standard programmatic buffer around water and riparian areas for ground suppression programs will be increased to 500 foot buffer in Preble's meadow jumping mouse suitable habitat within the range of the species.

8. Wyoming toad; *Anaxyrus baxteri*

a. Species Status Map

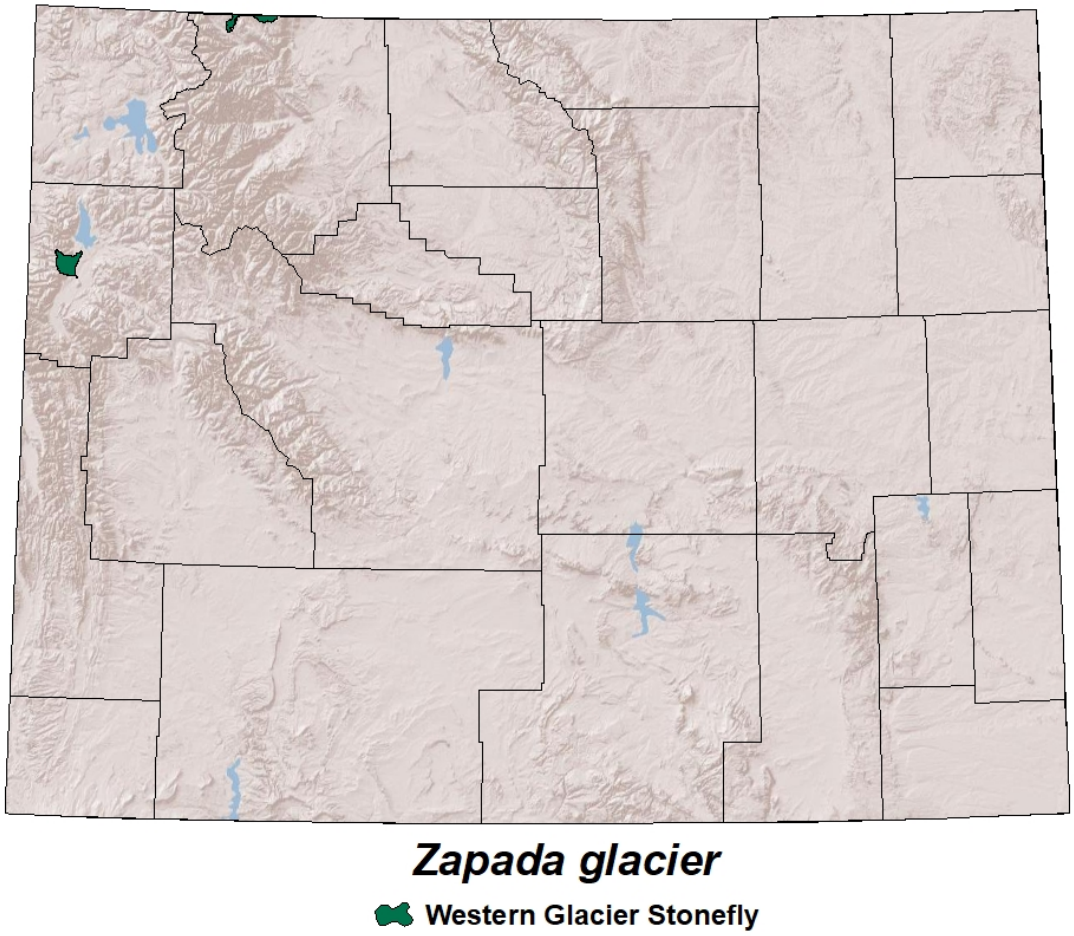


b. FWS status: Endangered

Grasshopper suppression activities in Wyoming are not likely to adversely affect the Wyoming toad. It is not likely that APHIS grasshopper suppression activities will occur in the vicinity of Mortenson Lake. If suppression activities are conducted in Albany County then the following impact minimization efforts will be put into place. A one mile buffer for aerial spray shall be maintained on each side of the Little Laramie River and no treatments will be applied within a one mile buffer of Mortenson NWR.

9. Western Glacier Stonefly; *Zapada glacier*

a. Species Status Map

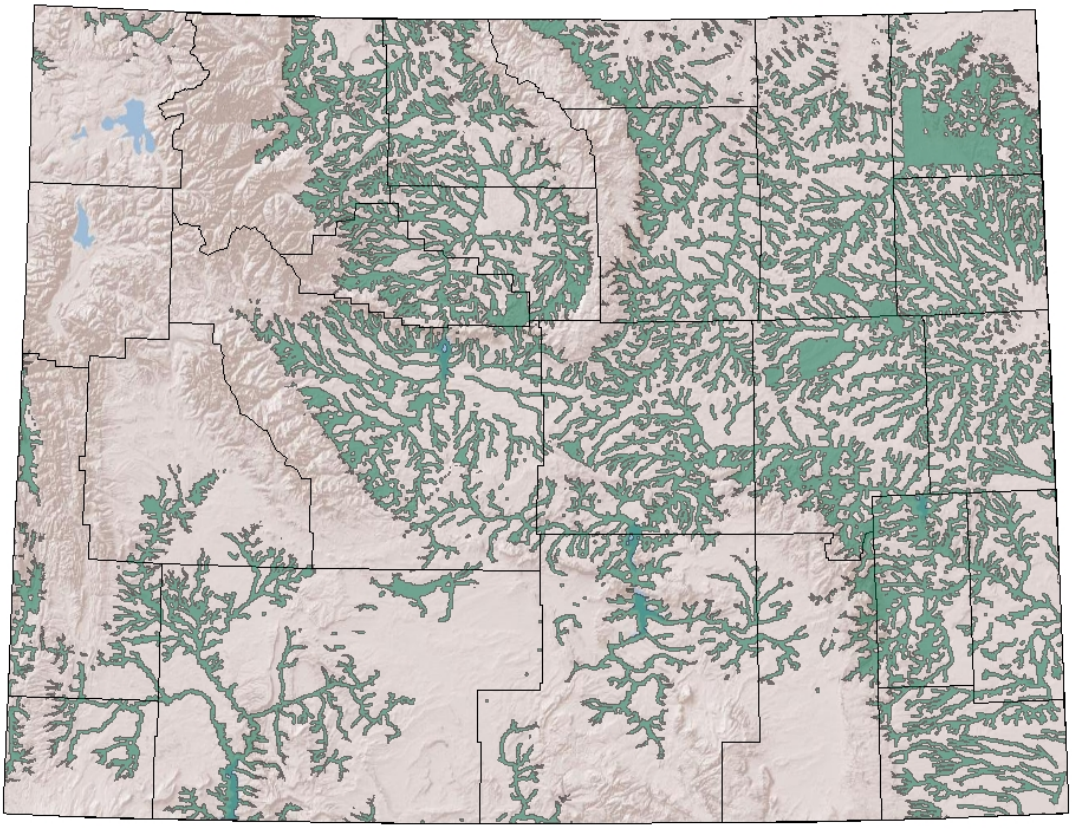


b. FWS status: Threatened, Critical Habitat designated

Grasshopper suppression activities in Wyoming are not likely to adversely affect the Western Glacier Stonefly. It is not likely that APHIS grasshopper suppression programs will occur in areas of the stonefly's habitat, riparian areas due to a programmatic buffer placed on either side of streams or water bodies. This 500 foot buffer is standard procedure for all USDA APHIS PPQ grasshopper aerial suppression programs. For those areas that may be treated using ground equipment the 50 foot buffer will be increased to 500 feet around waters and riparian areas that are Western Glacier Stonefly suitable habitat, within the range of the species.

10. Ute ladies' tresses; *Spiranthes diluvialis*

a. Species Status Map



b. FWS status: Threatened

Grasshopper suppression activities in Wyoming are not likely to adversely affect the Ute ladies' tresses. APHIS will take the following impact minimization measures for the protection of pollinators if a spray block occurs within known occupied habitat. The latest data available from WYNDD will be used to determine the known distribution of Ute ladies' tresses. If treatments occur after August 1st the following buffers will be put in place for areas of potential habitat and known populations of Ute ladies' tresses in addition to the programmatic 500 foot buffer from water bodies.

1) No aerial application of malathion or carbaryl or gamma-cyhalothrin within 3 miles of the known occupied habitat.

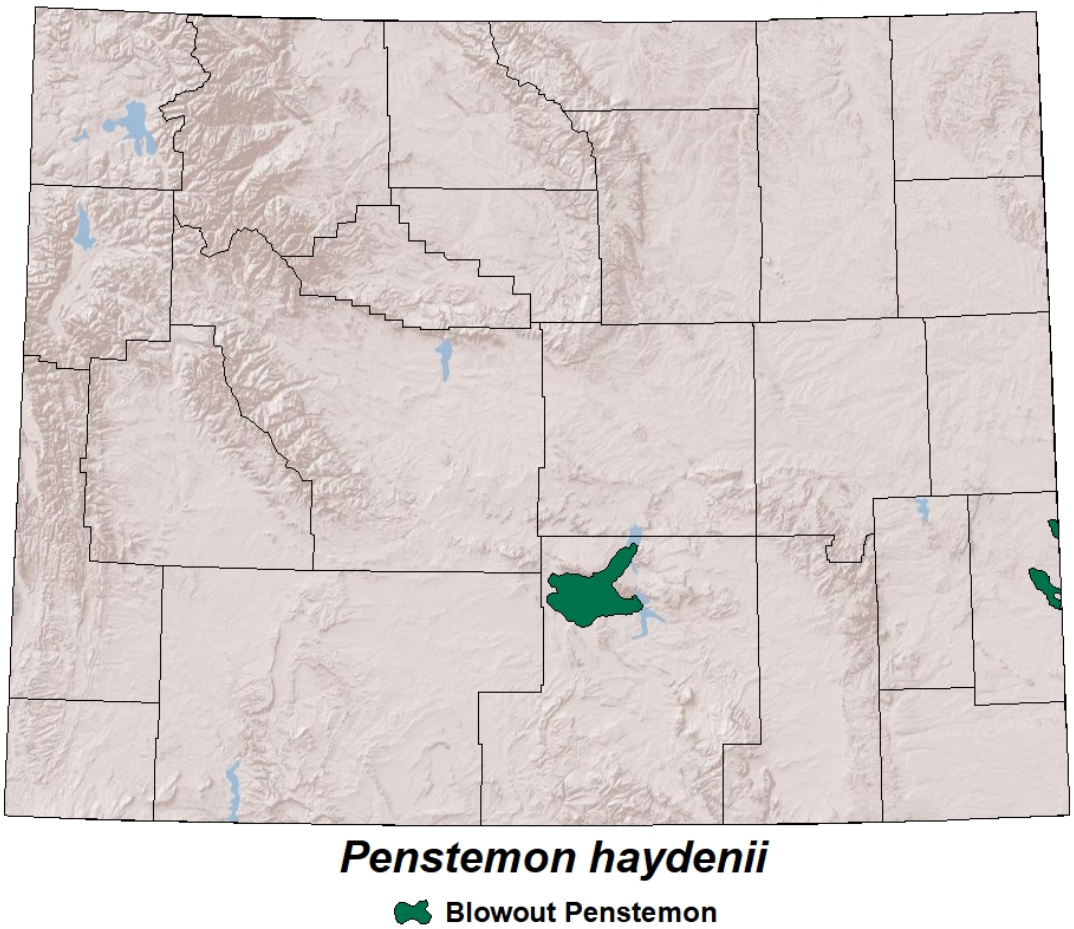
2) Only carbaryl bran bait or diflubenzuron combined with RAATS will be used within the 3 mile buffer.

3) No application of carbaryl bran bait will be applied within a 0.25 mile buffer of the potential range of species.

4) No buffer is required for diflubenzuron as they have no effect on adult insect pollinators. A 50 foot buffer for ground applications will be applied.

11. Blowout penstemon; *Penstemon haydenii*

a. Species Status Map



b. FWS status: Endangered

Grasshopper suppression activities in Wyoming are not likely to adversely affect the blowout penstemon. APHIS will take the following impact minimization measures for the protection of pollinators if a spray block occurs within the FWS potential range of species.

1) No aerial application of malathion or carbaryl or gamma-cyhalothrin within 3 miles of the potential range of species.

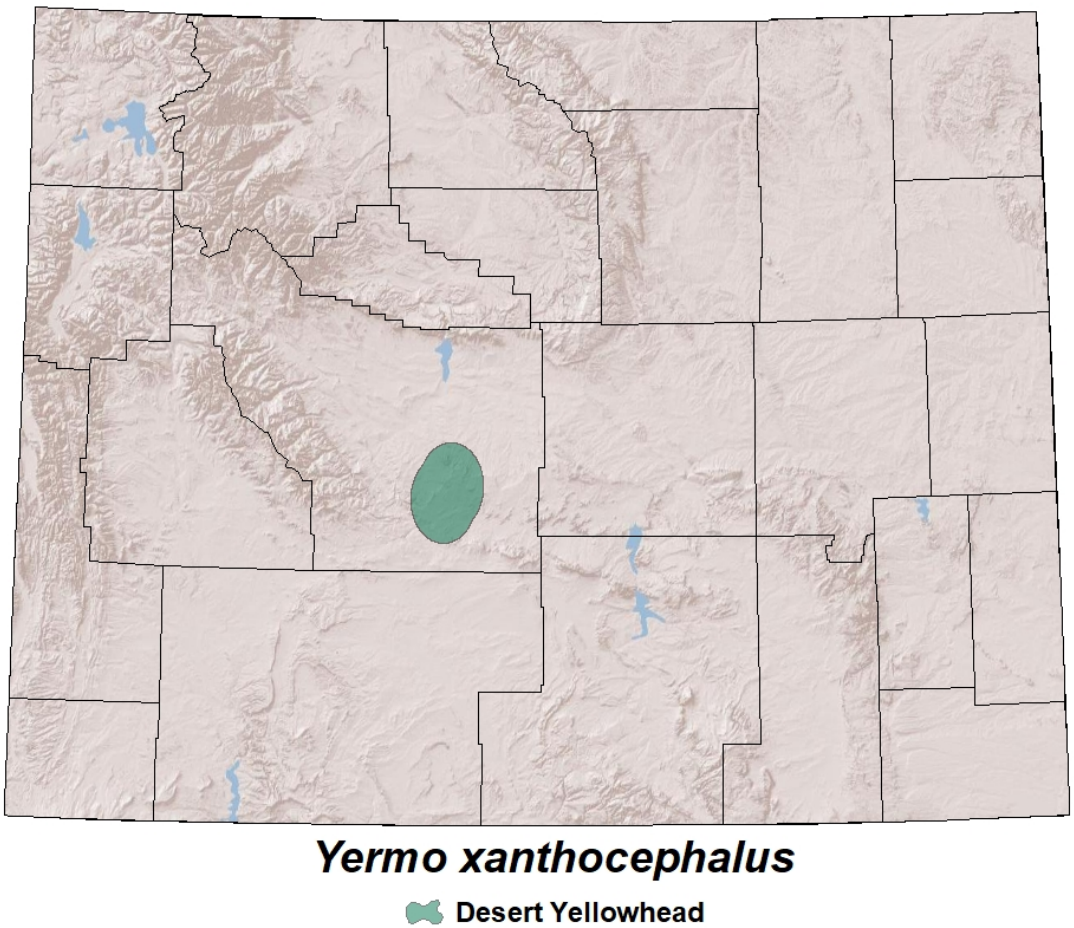
2) Only carbaryl bran bait or diflubenzuron combined with RAATS will be used within the 3 mile buffer.

3) No application of carbaryl bran bait will be applied within a 0.25 mile buffer of the potential range of species.

4) No buffer is required for diflubenzuron as they have no effect on adult insect pollinators. A 50 foot buffer for ground applications will be applied.

12. Desert Yellowhead; *Yermo xanthocephalus*

a. Species Status Map



b. FWS status: Threatened, Critical Habitat designated

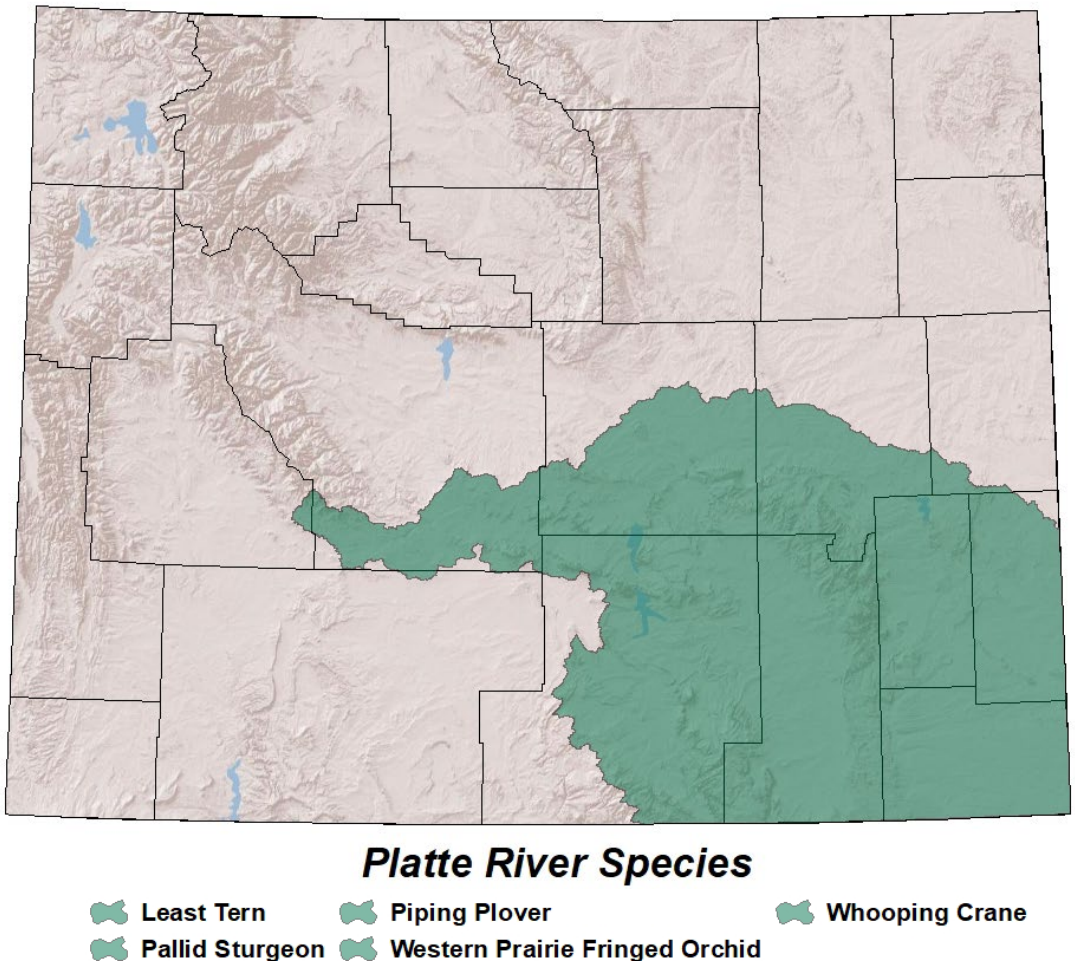
Grasshopper suppression activities in Wyoming are not likely to adversely affect the desert yellowhead or its designated critical habitat. APHIS will take the following impact minimization measures for the protection of pollinators if a spray block occurs within critical habitat or occupied habitat.

1. No aerial application of malathion or carbaryl or gamma-cyhalothrin within 3 miles of the critical habitat or known occupied habitat.
2. Only carbaryl bran bait or diflubenzuron combined with RAATS will be used within the 3 mile buffer.
3. No application of carbaryl bran bait will be applied within a 0.25 mile buffer of the potential range of species.
4. No buffer is required for diflubenzuron as they have no effect on adult insect pollinators. A 50 foot buffer for ground applications will be applied.

13. River Species

a. Platte River Species

Least Tern - Interior Population (*Sterna antillarum*) Status: Endangered
Pallid Sturgeon (*Scaphirhynchus albus*) Status: Endangered
Piping Plover (*Charadrius melodus*) Status: Endangered
Western Prairie Fringed Orchid (*Platanthera praeclara*) Status: Threatened
Whooping Crane (*Grus americana*) Status: Endangered



b. Colorado River Fish Species

Bonytail (*Gila elegans*) Status: Endangered
Coloradao Pikeminnow (*Ptychocheilus lucius*) Status: Endangered
Humpback Chub (*Gila cypha*) Status: Endangered
Razorback Sucker (*Xyrauchen texamus*) Status: Endangered

Grasshopper suppression activities in Wyoming will have no effect on any of the river species listed by the FWS. Suppression activities will not deplete any water sources listed as tributaries to the Platte or Colorado River system nor will any activities have any effect on water quality downstream from Wyoming.

Appendix 4: Yellow-billed cuckoo (YBC) risk summary for grasshopper and Mormon cricket suppression program

The distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*) west of the Continental Divide is listed under the ESA as a threatened species (FWS, Oct. 2014). Hereafter, the western distinct population segment of the YBC will be referred to as the YBC.

The acute toxicity of Program insecticides, in particular carbaryl and diflubenzuron, range from practically non-toxic to highly toxic for birds, in the case of carbaryl, and practically non-toxic in the case of diflubenzuron (USDA APHIS, 2015). Carbaryl avian toxicity is variable based on the test species with the European starling, (*Sturnis vulgaris*) being the most sensitive and the ring-necked pheasant, *Phasianus colchicus*, being the least sensitive bird species (USDA APHIS, 2015). Carbaryl acts by inhibiting the neurotransmitter, acetylcholinesterase, while diflubenzuron acts to inhibit chitin synthesis in developing invertebrates. Chronic toxicity between the two chemistries is similar with a lack of effects at field-relevant doses (USDA APHIS, 2015). The potential for risk to the YBC from the proposed use of program insecticides is related to the toxicity of each chemical and the probability of exposure which is discussed below.

Direct exposure to the YBC from proposed grasshopper and Mormon cricket applications is expected to be unlikely. In Wyoming, the YBC use riparian habitats that contain willow-cottonwood and other woodland habitats. Optimal habitat size for the YBC is 200 acres with nesting rarely occurring in sites that are less than 50 acres. Forested areas typically have dense closed canopies. Nesting usually occurs in willow trees of various species but may also occur in other riparian tree species (FWS, 2014). These are habitats that are not part of the Program for treatment and due to their proximity to water would have no application buffers regardless of whether they may contain YBC or their designated suitable habitat. In cases where there are YBC and/or suitable habitat APHIS increases the no application buffer which further reduces the potential for direct exposure to any Program applications. Estimates of drift from the use of proposed treatments and no application buffers suggest that any potential residues that could move into YBC habitat would be below any potential for direct risk (USDA APHIS, 2015). The presence of dense, closed canopies of riparian trees in YBC habitat would also serve to intercept and remove the small amount of insecticide that could drift into these types of habitat.

Dietary exposure from ingestion of contaminated prey or water is also not anticipated to be a major pathway of exposure for the YBC. There may be some incidental consumption of program insecticides that could be on the surface of some insect prey that receive a sublethal dose following treatment, however, there is not a plausible exposure scenario that could result in the ingestion of enough prey to result in risk to the YBC. Insects that receive a lethal dose would not be available for foraging by the YBC since they prefer live prey items. In the case of carbaryl bait applications, the probability of exposure would be less since the material is not applied as a liquid where it could result in residues on the surface of insects. Dietary exposure from the ingestion of contaminated surface water is also not anticipated to be a major pathway of exposure for the YBC. The program use of no application buffer zones from aquatic areas minimizes the potential for exposure to surface water.

Indirect impacts to the YBC from loss of invertebrate and vertebrate prey items due to program treatments are not anticipated. The YBC has a varied diet including invertebrates as well as some vertebrates including tree frogs and lizards. Diet studies show that approximately 45% of its diet consists of lepidopteran larvae, followed by tree frogs (24%), katydids (22%), grasshoppers (9%) and the remaining amount from various invertebrates including, but not limited to beetles, flies, spiders, caddisflies, dragonflies, crickets and cicadas (FWS, 2014). This preference may change based on availability of large invertebrate fauna. YBC prefer nesting and foraging in tree canopies along riparian corridors using a "sit and wait" strategy watching foliage movement for prey items (FWS, 2014). The primary constituent elements and preferred habitat of YBC for nesting and foraging are not areas where the Program will be making applications. Proposed no application buffers from suitable habitat and known locations of the YBC, as well as the use of Reduced Agent Area Treatments (RAATs) where applications will occur adjacent to habitat would mitigate the impacts to potential food items for the YBC. In cases where YBC would forage outside of their preferred habitat there would be adequate food items for foraging based on their varied diet and the lack of effects to terrestrial invertebrates and vertebrates in the no application buffer zones that have been proposed, as well as negligible impacts to non-target terrestrial invertebrates and vertebrates in treatment blocks. The impacts to non-target invertebrates within treatment blocks from Program applications are summarized below and show minimal impacts to most non-target terrestrial invertebrates.

Available field studies suggest the program insecticide applications have minimal impacts to non-target terrestrial invertebrates (Quinn et al., 1990; Swain, 1986; Smith et al., 2006). Smith et al. (2006) assessed changes in non-target arthropod populations following applications of diflubenzuron, carbaryl, or malathion using RAATs. In the 2-year study, post application surveys of the major insect fauna revealed that only ants were negatively affected by grasshopper applications within treatment areas. As stated previously, Weiland et al. (2002) assessed the impacts of Sevin XLR Plus applications at 750 g a.i./ha to several invertebrate groups over a 21-day period. This rate equates to 0.67 lb a.i./ac which is 1.34 times higher than the highest rate allowed in the program. Results from the study demonstrated no negative effects on abundance in the following insect groups: Homoptera, Hymenoptera, Coleoptera, Hemiptera, Lepidpotera, and Neuroptera. Previously conducted research, as well as field studies carried out as part of the grasshopper IPM project, indicates that diflubenzuron has minimal impact on most terrestrial nontarget arthropods (Catangui et al., 1996). Weiland et al. (2002) in Wyoming monitored the effects of Dimilin 25W for 21 days post-application on terrestrial invertebrates after full treatment applications of 17.5 and 52.5 g a.i./ha. From high and low sweep net captures, no effect on invertebrates in the orders Homoptera, Hymenoptera, Coleoptera, Hemiptera, Lepidoptera, or Neuroptera were found. There was a statistically significant increase in Diptera and a statistically significant decrease in Araneae (spiders) but the authors question the spider analysis since untreated populations dropped dramatically during the study. Tingle (1996) assessed the impacts of diflubenzuron applications in two field trials occurring in two separate years with applications of 93 g a.i./ha (0.08 lb a.i./ac). Based on an analysis of 28 taxonomic groupings only two were affected and included non-target grasshoppers and lepidopteran larvae. This effect only occurred in the treated areas but did not occur in the untreated buffer areas that were sampled. Grasshopper 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 7 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). No significant reductions in flying non-target arthropods, including honey bees, were reported. Within 1 year of diflubenzuron applications in a rangeland environment, no significant reductions of bee predators, parasites, or pollinators were observed for any level of diflubenzuron treatment (Catangui et al., 1996). Graham et al. (2008) evaluated the impacts of diflubenzuron treatments on aquatic and terrestrial invertebrates for Mormon cricket suppression in Utah. A majority of terrestrial invertebrate taxa were not significantly different pre- and post-treatment among three sites that were evaluated. There was a noted decrease in some ant genera but results were not consistent between sites and not all genera were impacted. Non-ant Hymenoptera showed increased numbers at two of the three sites and a decrease at a third site when comparing numbers pre- and post-treatment. Impacts to aquatic invertebrates, such as caddisflies and dragonflies, that may serve as prey for the YBC would be minimal due to the implementation of Program no-application buffer zones adjacent to aquatic habitat. Impacts to vertebrate food items for the YBC such as frogs and lizards would also be minimal based on risk estimates for each Program insecticide and the proposed mitigation to protect the YBC (USDA APHIS, 2015).

Based on the qualitative risk assessment above and the proposed mitigation for protection of YBC and its suitable habitat, APHIS has determined that the Program may affect but is not likely to adversely affect the YBC.

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Appendix 5: Northern long-eared bat (NLEB) risk summary for grasshopper and Mormon cricket suppression program

The acute toxicity of Program insecticides, in particular carbaryl and diflubenzuron, are considered moderate for mammals, in the case of carbaryl, and practically non-toxic in the case of diflubenzuron (USDA APHIS, 2015). Similar differences in toxicity between the two insecticides are seen in sublethal and chronic studies, as well. The difference in toxicity between the two insecticides is related to the mode of action. Carbaryl acts by inhibiting the neurotransmitter, acetylcholinesterase, while diflubenzuron acts to inhibit chitin synthesis in developing invertebrates. The potential for risk to the NLEB from the proposed use of program insecticides is related to the toxicity of each chemical and the probability of exposure.

Direct exposure to the northern long-eared bat from proposed grasshopper and Mormon cricket applications is expected to be minimal. Program applications will occur during the day when bats are not foraging and would be under bark on trees, in crevices, and in mines or caves where exposure to drift would be limited (FWS, 2014). Emerging at dusk, most hunting occurs above the understory, 1 to 3 meters (m) (3 to 10 feet (ft)) 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). The preferred foraging areas for the NLEB are areas that would not receive grasshopper or Mormon cricket treatments. In addition, treatments would not occur during peak foraging activity reducing the potential for exposure to Program insecticides.

Dietary exposure from ingestion of contaminated prey or water is also not anticipated to be a major pathway of exposure for the northern long-eared bat. There may be some incidental consumption of program insecticides that could be on the surface of some insect prey that receive a sublethal dose following treatment, however, there is not a plausible exposure scenario that could result in the ingestion of enough prey based on the daily food consumption rates for similar *Myotis* species. Insects that receive a lethal dose would not be available for foraging by the NLEB since they prefer live prey items. In the case of carbaryl bait applications, the probability of exposure would be less since the material is not applied as a liquid where it could result in residues on the surface of insects. Dietary exposure from the ingestion of contaminated surface water is also not anticipated to be a major pathway of exposure for the NLEB. The program use of no application buffer zones from aquatic areas minimizes the potential for exposure to surface water.

Indirect impacts to the NLEB from loss of invertebrate prey items due to program treatments are not anticipated. NLEB depends on a variety of invertebrates in its diet using foraging behaviors including hawking, and gleaning of insect prey from plant surfaces and water (Ratcliffe and Dawson, 2003). Its diet may include insects from the orders Lepidoptera, Neuroptera, Coleoptera, Trichoptera, Hymenoptera, Diptera, Hemiptera, and Homoptera (Thomas et al.,

2012; Feldhamer et al., 2009; Carter et al., 2003; Lee and McCracken, 2004). Coleoptera and Lepidoptera appear to make up the largest percentage of their diet, although proportions vary spatially and temporally, similar to other *Myotis* species, suggesting opportunistic feeding for available flying invertebrates (Griffith and Gates, 1985; Whitaker, 1972). Available field studies suggest the program insecticide applications have minimal impacts to non-target terrestrial invertebrates (Quinn et al., 1990; Swain, 1986; Smith et al., 2006). Smith et al. (2006) assessed changes in non-target arthropod populations following applications of diflubenzuron, carbaryl, or Malathion using RAATs. In the 2-year study, post application surveys of the major insect fauna revealed that only ants were negatively affected by grasshopper applications within treatment areas.

As stated previously, Weiland et al. (2002) assessed the impacts of Sevin XLR Plus applications at 750 g a.i./ha to several invertebrate groups over a 21-day period. This rate equates to 0.67 lb a.i./ac which is 1.34 times higher than the highest rate allowed in the program. Results from the study demonstrated no negative effects on abundance in the following insect groups: Homoptera, Hymenoptera, Coleoptera, Hemiptera, Lepidpotera, and Neuroptera. Previously conducted research, as well as field studies carried out as part of the grasshopper IPM project, indicates that diflubenzuron has minimal impact on most terrestrial nontarget arthropods (Catangui et al., 1996). Weiland et al. (2002) in Wyoming monitored the effects of Dimilin 25W for 21 days post-application on terrestrial invertebrates after full treatment applications of 17.5 and 52.5 g a.i./ha. From high and low sweep net captures, no effect on invertebrates in the orders Homoptera, Hymenoptera, Coleoptera, Hemiptera, Lepidpotera, or Neuroptera were found. There was a statistically significant increase in Diptera and a statistically significant decrease in Araneae (spiders) but the authors question the spider analysis since untreated populations dropped dramatically during the study. Tingle (1996) assessed the impacts of diflubenzuron applications in two field trials occurring in two separate years with applications of 93 g a.i./ha (0.08 lb a.i./ac). Based on an analysis of 28 taxonomic groupings only two were affected and included non-target grasshoppers and lepidopteran larvae. This effect only occurred in the treated areas but did not occur in the untreated buffer areas that were sampled. Grasshopper 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 7 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). No significant reductions in flying non-target arthropods, including honey bees, were reported. Within 1 year of diflubenzuron applications in a rangeland environment, no significant reductions of bee predators, parasites, or pollinators were observed for any level of diflubenzuron treatment (Catangui et al., 1996). Graham et al. (2008) evaluated the impacts of diflubenzuron treatments on aquatic and terrestrial invertebrates for Mormon cricket suppression in Utah.

A majority of terrestrial invertebrate taxa were not significantly different pre- and post-treatment among three sites that were evaluated. There was a noted decrease in some ant genera but results were not consistent between sites and not all genera were impacted. Non-ant Hymenoptera showed increased numbers at two of the three sites and a decrease at a third site when comparing numbers pre- and post-treatment. Impacts to aquatic invertebrates that may serve as prey would

be minimal due to the implementation of Program no-application buffer zones adjacent to aquatic habitat.

Based on the qualitative risk assessment above, APHIS has determined that the Program will not jeopardize the continued existence of the northern long-eared bat foraging and in roosts in the program area.

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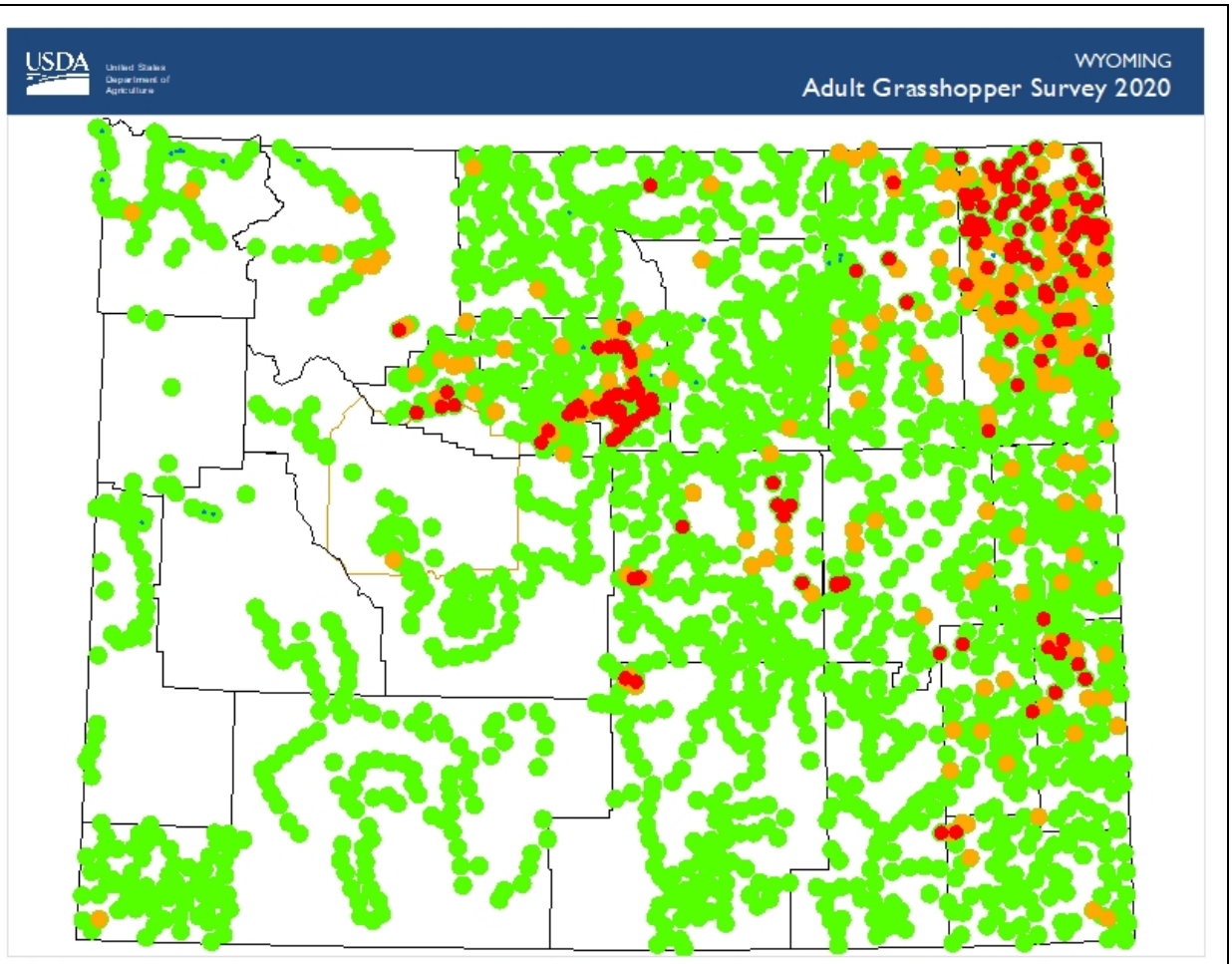
Appendix 6: Comments received during the open comment period

Appendix 7: 2020 Adult Grasshopper Survey Map



Grasshopper Density #/ Sq Yd

- 15 +
- 8 - 14
- 1 - 7
- Mormon Cricket
- County Boundary
- WRIR Boundary

Buffer Radius

Green	3.25 miles
Orange	3.00 miles
Red	2.50 miles
Blue	0.75 miles

GH per Sq. Yd.	8 to 14	15+	8+	MC
	Acres			
Private	994,463	1,039,070	2,033,533	6,293
BLM	211,866	272,682	484,548	5,177
State Lands	92,541	134,101	226,642	2,045
USFS	87,996	38,521	126,517	4,563
Wind River Indian Res.	6,391	6,545	12,936	0
Bureau of Reclamation	14,454	2,455	16,909	0
DOD	3,136	320	3,456	0
USFS, Grasslands	9,272	7,523	16,795	0
Bankhead Jones	31,168	12,493	43,661	0
National Park Service	36,481	332	36,813	5,550
Fish and Wildlife	0	0	0	0
Corps of Engineers	0	0	1,000	0
Total Acres Infested	1,487,768	1,514,042	3,001,810	23,628

This information is to be used by Land Managers and W&P Personnel in order to project possible outbreaks in spring of 2021. State wide 2,016 stops were surveyed between 7/1/2020 and 9/30/2020. Survey stops were collected by APHIS employees using the (18 sq. foot)/2 visual survey method. All data was collected as point data and displayed using a fixed buffer.

USDA, APHIS, PPQ
5353 Yellowstone Road, Suite 208
Cheyenne, WY 82009

Data Source:
ESRI, PPQ

Date Created:
9/17/2020

Appendix 8: Completed FONSI