

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

Rio Arriba County, NM
EA Number: NM-23-01

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Acronyms and Abbreviations

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

[Draft] Site-Specific Environmental Assessment

Rangeland Grasshopper and Mormon Cricket Suppression Program Rio Arriba County, NM

I. Need for Proposed Action

A. Purpose and Need Statement

An infestation of grasshoppers or Mormon crickets may occur in Rio Arriba County, NM. The Animal and Plant Health Inspection Service (APHIS) may, upon request by land managers or State departments of agriculture, conduct treatments to suppress grasshopper infestations as part of the Rangeland Grasshopper and Mormon Cricket Suppression Program (program). The term “grasshopper” used in this environmental assessment (EA) refers to both grasshoppers and Mormon crickets, unless differentiation is necessary.

Populations of grasshoppers that trigger the need for a suppression program are normally considered on a case-by-case basis. Land managers and property owners request APHIS assistance to control grasshopper outbreaks because of the potential to damage grassland areas and benefits of treatments including the protection of rangeland resources. Some benefits of preventing high populations of grasshoppers include increased forage for cattle and native species. The goal of the proposed suppression program analyzed in this EA is to reduce grasshopper populations below economical infestation levels in order to protect the natural resources of rangeland ecosystems, the value of livestock and wildlife forage, 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 May 1, 2023 to October 31, 2023 in Rio Arriba County, NM.

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 2023 Control Program for New Mexico.

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 levels¹ 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. In most circumstances, APHIS is not able to accurately predict specific treatment areas and treatment strategies months or even weeks before grasshopper populations reach economic infestation levels. The need for rapid and effective response when an outbreak occurs limits the options available to APHIS to inform the public other than those stakeholders who could be directly affected by the actual application. The emergency response aspect is why site-specific treatment details cannot be known, analyzed, and published in advance.

The site-specific data used to make treatment decisions in real time is gathered during spring nymph surveys. The general site-specific data include: grasshopper densities, species complex, dominant species, dominant life stage, grazing allotment terrain, soil types, range conditions, local weather patterns (wind, temp., precipitation), slope and aspect for hatching beds, animal unit months (AUM's) present in grazing allotment, forage damage estimates, number of potential AUM's consumed by grasshopper population, potential AUM's managed for allotment and value of the AUM, estimated cost of replacement feed for livestock, rotational time frame for grazing allotments, number of livestock in grazing allotment. Baseline thresholds for Mormon crickets are two per square yard and grasshoppers are eight per square yard, though neither of those thresholds guarantees justification for treatment alone. These are all factors that are considered when determining the economic infestation level.

APHIS surveys grasshopper populations on rangeland in the Western United States, provides technical assistance on grasshopper management to landowners and 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). APHIS' enabling legislation provides, in relevant part, that 'on request of the administering agency or the agriculture department of an affected State, the Secretary, to protect rangeland, shall immediately treat Federal, State, or private lands that are infested with grasshoppers or Mormon crickets'... (7 U.S.C. § 7717(c)(1)). The need for rapid and effective response when an outbreak occurs limits the options available to APHIS. The application of an insecticide within all or part of the outbreak area is the response available to APHIS to rapidly suppress or reduce grasshopper populations and effectively protect rangeland.

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.

In June 2002, APHIS completed an environmental impact statement (EIS) 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 (USDA APHIS, 2019).

APHIS has authority under the Plant Protection Act of 2000 (PPA) (7 United States Code (U.S.C.) § 7701) to take actions to control and minimize the economic, ecological, and human health impacts that harmful plant pests can cause. APHIS uses this authority to protect U.S. agriculture, forests, and other natural resources from harmful pest species. Section 417 of the PPA (7 U.S.C. § 7717) authorizes APHIS' efforts to minimize the economic impacts of grasshoppers. Section 417(a) states that subject to the availability of funds, the Secretary "shall carry out a program to control grasshoppers and Mormon crickets on all Federal lands to protect rangeland." Section 417(c) (1) states that "Subject to the availability of funds pursuant to this section, on request of the administering agency or the agriculture department of an affected State, the Secretary, to protect rangeland, shall immediately treat Federal, State, or private lands that are infested with grasshoppers or Mormon crickets at levels of economic infestation, unless the Secretary determines that delaying treatment will not cause greater economic damage to adjacent owners of rangeland." Section 417(c)(2) states, "In carrying out this section, the Secretary shall work in conjunction with other Federal, State, and private prevention, control, or suppression efforts to protect rangeland." APHIS has the authority to implement Section 417 of the PPA through the Rangeland Grasshopper and Mormon Cricket Suppression Program. The priorities of the APHIS program are: • to conduct surveys for grasshopper and Mormon cricket populations on rangelands in the western United States, • to provide technical assistance on grasshopper management to landowners/managers, and • subject to the availability of funds, to suppress grasshoppers and Mormon crickets on rangeland when direct intervention is requested by the landowner/manager. 4 Additional information regarding technical assistance and other aspects of the program can be obtained from the USDA Agricultural Research Service site at <https://www.ars.usda.gov/plains-area/sidney-mt/northern-plains-agricultural-research-laboratory/pest-management-research/pmru-docs/grasshoppers-their-biology-identification-and-management/grasshopper-site-highlights/>. On September 16, 2016, APHIS and the Bureau of Indian Affairs (BIA) signed a Memorandum of Understanding (MOU) detailing cooperative efforts between the two groups on suppression of grasshoppers on BIA managed lands. This MOU clarifies that APHIS will prepare and issue to the public, site-specific environmental documents that evaluate potential impacts associated with the proposed measures to suppress economically damaging grasshopper populations. The MOU also states that these documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the BIA. The MOU further states that the responsible BIA official will request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on BIA land is necessary. The BIA must also approve a Pesticide Use Proposal for APHIS to treat infestations. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document and BIA approves the Pesticide Use

Proposal. On November 6, 2019, APHIS and the Forest Service (FS) signed a Memorandum of Understanding (MOU) detailing cooperative efforts between the two groups on suppression of grasshoppers on FS managed lands (Document #19-8100-0573-MU, November 6, 2019). This MOU clarifies that APHIS will prepare and issue to the public, site-specific environmental documents that evaluate potential impacts associated with the proposed measures to suppress economically damaging grasshopper populations. The MOU also states that these documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the FS. The MOU further states that the responsible FS official will request in writing the inclusion of appropriate lands in the APHIS suppression project when treatment on FS land is necessary. The FS must also approve a Pesticide Use Proposal for APHIS to treat infestations. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document and FS approves the Pesticide Use Proposal. On October 15, 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 on BLM managed lands (Document #15-8100-0870- MU, October 15, 2015). This MOU clarifies that APHIS will prepare and issue to the public, site-specific environmental documents that evaluate potential impacts associated with the proposed measures to suppress economically damaging grasshopper populations. The MOU also states that these documents will be prepared under the APHIS NEPA implementing procedures with cooperation and input from the 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 approve a Pesticide Use Proposal for APHIS to treat infestations. According to the provisions of the MOU, APHIS can begin treatments after APHIS issues an appropriate decision document and BLM approves the Pesticide Use Proposal.

The New Mexico Department of Agriculture has in place an act that covers grasshopper and other rangeland pests. The “Grasshopper and Other Range Pest Control Act” provides for the establishment of control districts for grasshopper and other range pests, collection and disposition of assessments. The text of this act can be found here: [Chapter 76 - Agriculture - NMOneSource.com](#)

APHIS supports the use of Integrated Pest Management (IPM) principles in the management of grasshoppers and Mormon Crickets. APHIS provides technical assistance to Federal, Tribal, State and private land managers including the use of IPM. However, implementation of on-the-ground IPM activities is limited to land management agencies and Tribes, as well as private landowners. In addition, APHIS’ authority under the Plant Protection Act is to treat Federal, State and private lands for grasshoppers and Mormon cricket populations. APHIS’ technical assistance occurs under each of the three alternatives proposed in the EIS.

In addition to providing technical assistance, APHIS completed the Grasshopper Integrated Pest Management (GIPM) project. One of the goals of the GIPM is to develop new methods of suppressing grasshopper and Mormon cricket populations that will reduce non-target effects. Reduced agent area treatments (RAATs) are one of the methods that has been developed to reduce the amount of pesticide used in suppression activities and is a component of IPM. APHIS continues to evaluate new suppression tools and methods for

grasshopper and Mormon cricket populations, including biological control, and as stated in the EIS, will implement those methods once proven effective and approved for use in the United States.

C. About This Process

The NEPA 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 act swiftly with respect to those requests. Surveys help to determine general areas, among the millions of acres where harmful grasshopper infestations may occur in the spring of the following year. Survey data provides the best estimate of future grasshopper populations, while short-term climate or environmental factors change where the specific treatments will be needed. Therefore, examining specific treatment areas for environmental risk analysis under NEPA is typically 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.

Public involvement under the CEQ Regulations for Implementing the Procedural Provisions of NEPA distinguishes federal actions with effects of national concern from those with effects primarily of local concern (40 CFR 1506.6). The grasshopper and Mormon cricket suppression program EIS was published in the Federal Register (APHIS-2016-0045) and met all applicable notice and comment requirements for a federal action with effects of national concern. This process provided individuals and national groups the ability to participate in the development of alternatives and provide comment. Our subsequent state-based actions have the potential for effects of local concern, and we publish them according to the provisions that apply to federal actions with effects primarily of local concern. This includes the USDA APHIS NEPA Implementation Procedures, which allows for EAs and findings of no significant impact (FONSIs) where the effects of an action are primarily of regional or local concern, to normally provide notice of publication in a local or area newspaper of general circulation (7 CFR 372.7(b)(3)). These notices provide potentially locally affected individuals an additional opportunity to provide input into the decision-making process. Some states, including New Mexico, also provide additional opportunities for local public involvement, such as public meetings. In addition, when an interested party asks to be informed, APHIS ensures their contact information is added to the list of interested stakeholders.

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

APHIS uses the scoping process to enlist land managers and the public to identify alternatives and issues to be considered during the development of a grasshopper or Mormon cricket suppression program. Scoping was helpful in the preparation of the draft EAs. The process can occur formally and informally through meetings, conversations, or written comments from individuals and groups.

The current EIS provides a solid analytical foundation; however, it may not be enough to satisfy NEPA completely for actual treatment proposals. The program typically prepares a Draft EA tiered to the current EIS for each of the 17 Western States, or portion of a state, that may receive a request for treatment. The Draft EA analyzes aspects of environmental quality that could be affected by treatments in the area where grasshopper outbreaks are anticipated. The Draft EA will be made available to the public for a 30-day comment period. The program will prepare a Final EA and FONSI when the program determines that grasshopper suppression treatments are possible within a portion of the state, and that all environmental issues were accounted for in the Draft EA. Once the FONSI has been finalized copies of those documents will be sent to any parties that submitted comments on the Draft EA, and to other appropriate stakeholders. To allow the program to respond to requests for treatments in a timely manner, the Final EA and FONSI will be posted to the APHIS website. The program will also publish a notice of availability in the same manner used to advertise the availability of the Draft EA.

II. Alternatives

To engage in comprehensive NEPA risk analysis APHIS must frame potential agency decisions into distinct action alternatives. These program alternatives are then evaluated to determine the significance of environmental effects. The 2002 EIS presented three alternatives: (A) No Action; (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. Therefore the 2019 EIS considered the environmental background or 'No Action' alternative of maintaining the program that was described in the 2002 EIS and Record of Decision. The 2019 EIS also considered an alternative where APHIS would not fund or participate in grasshopper suppression programs. The preferred alternative of the 2019 EIS allowed APHIS to update the program with new information and technologies that not were analyzed in the 2002 EIS. Copies of the complete 2002 and 2019 EIS documents are available for review at USDA-APHIS-PPQ, 270 South 17th Street, Las Cruces, NM 88005 address. These documents are also available at the Rangeland Grasshopper and Mormon Cricket Program web site, <http://www.aphis.usda.gov/plant-health/grasshopper>.

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 supply issues. 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.

This [Draft] EA analyzes the significance of environmental effects that could result from the alternatives described below. These alternatives differ from those described in the 2019 EIS because grasshopper treatments are not likely to occur in most of Rio Arriba County, NM and therefore the environmental baseline should describe a no treatment scenario.

A. No Suppression Program Alternative

Under Alternative A, the No Action alternative, APHIS would not conduct a program to suppress grasshopper infestations within Rio Arriba County, NM. 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 outbreaks. The insecticides available for use by APHIS include the U.S. Environmental Protection Agency (USEPA) registered chemicals carbaryl, chlorantraniliprole, diflubenzuron, and malathion. These chemicals have varied modes of action. Carbaryl and malathion work by inhibiting acetylcholinesterase (enzymes involved in nerve impulses). Chlorantraniliprole activates insect ryanodine receptors which causes an uncontrolled release of calcium, impairing insect muscle regulation and leading to paralysis. Diflubenzuron inhibits the formation of chitin by insects which causes weak exoskeletons. APHIS would make a single application per year to a treatment area and could apply insecticide at an APHIS rate conventionally used for grasshopper suppression treatments, or more typically as reduced agent area treatments (RAATs). 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 application method for all program insecticides, and only rarely do rangeland pest conditions warrant full coverage and higher rates.

Typically, the decision to use diflubenzuron, the pesticide most commonly used by the program, is determined by the life stage of the dominant species within the outbreak population. Diflubenzuron can produce 90 to 97% grasshopper mortality in nascent populations with a greater percentage of early instars. If the window for the use of diflubenzuron closes, as a result of treatment delays, then carbaryl, chlorantraniliprole or rarely malathion are the remaining control options. Certain species are more susceptible to carbaryl bait, and sometimes that pesticide is the best control option.

The RAATs strategy is effective for grasshopper suppression because the insecticide controls grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not directly treated. RAATs can decrease the rate of insecticide applied by either using lower insecticide concentrations or decreasing the deposition of insecticide applied by alternating treated and untreated swaths. Both options are most often incorporated simultaneously into RAATs. Either carbaryl, chlorantraniliprole, diflubenzuron, or malathion would be considered under this alternative, typically at the following application rates (i.e. sprayed or spread directly from the aircraft or vehicle):

- 8.0 fluid ounces (0.25 lbs a.i./ac sprayed) of carbaryl spray;
- 10.0 pounds (0.20 lbs a.i./ac treated) of 2 percent carbaryl bait;

- 4.0 fluid ounces (0.013 lbs a.i./ac sprayed) of chlorantraniliprole;
- 0.75 or 1.0 fluid ounce (0.012 lbs a.i./ac sprayed) of diflubenzuron; or
- 4.0 fluid ounces (0.31 lbs a.i./ac sprayed) of malathion.

The width of the area not directly treated (the untreated swath) under the RAATs method is not standardized. The proportion of land treated during RAATs is a complex function of the rate of grasshopper movement, which is a function of developmental stage, population density, and weather (Narisu et al., 1999, 2000), as well as the properties of the insecticide (insecticides with longer residuals allow wider spacing between treated swaths). Foster et al. (2000) left 20 to 50% of their study plots untreated, while Lockwood et al. (2000) left 20 to 67% of their treatment areas untreated. 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 recommended skipped swath width is typically no more than 100 feet for carbaryl (liquid), chlorantraniliprole, and diflubenzuron, and 25 feet for malathion. However, many federal government-organized treatments of rangelands tend to prefer to use a 50% skipped swath width, meaning if a fixed-wing aircraft's swath width is, for example, 150 ft., then the skipped habitat area will also be 150 ft. The selection of insecticide and the use of an associated swath widths is site dependent. Rather than suppress grasshopper populations to the greatest extent possible, the goal of this method is to suppress grasshopper populations to less than the economic infestation level.

Any programs that are either contracted or Agency performed will use GPS navigation equipment (i.e. SatLoc ®, or other equipment) to navigate and capture shapefiles of the treatment areas. All sensitive sites will be buffered out of the treatment area zone using visual aids such as flags which are highly visible to the applicator in addition to the applicators' GIS shape file which outlines treatment areas. All sensitive sites will be reviewed in the daily briefing with APHIS personnel including the applicator working on the treatment site.

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 alternative, carbaryl, chlorantraniliprole, diflubenzuron, or malathion would cover all treatable sites within the designated treatment block per label directions. The application rates under this alternative are typically at the following:

- 16.0 fluid ounces (0.50 lbs a.i./ac sprayed) of carbaryl spray;
- 4.0 pounds (0.20 lbs a.i./ac treated) of 5 percent carbaryl bait;
- 8.0 fluid ounces (0.027 lbs a.i./ac sprayed) of chlorantraniliprole;
- 1.0 fluid ounce (0.016 lbs a.i./ac sprayed) of diflubenzuron; or
- 8.0 fluid ounces (0.62 lbs a.i./ac sprayed) of malathion.

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

III. Affected Environment

A. *Description of Affected Environment*

The proposed suppression program included in this 2023 EA encompasses the central portions of Rio Arriba County, NM. The estimated area of treatment is 26,000 acres. For New Mexico, APHIS in this document considers mainly four ecologic regions to exist, these are: the short-grass prairie of the southern extent of Great Plains (Southern High Plains and the Southwestern Tablelands in the eastern counties), the Arizona/New Mexico Plateaus and Mesas (in the northwestern counties), the southern Rocky Mountains with the Arizona and New Mexico Mountains (north-central and west central counties), the Chihuahuan Desert (in the southern counties). These four basic designated eco-regions are at the northeastern reach of the greater southwest desert area that extends from western Texas to south-central California.

The main watershed basins that dissect New Mexico are Upper Rio Grande and Upper Colorado (San Juan) being fed from the state of Colorado, the Arkansas- White-Red (Southern Canadian), Pecos, Lower Colorado (Zuni and Gila), Lower Rio Grande, Central Closed (Estancia and Tularosa and Salt Basins), Southwest Closed (Mimbres), and Texas-Gulf (Southern High Plains).

New Mexico soils are of three basic soil orders: Aridisols (being most common in arid zones), Entisols (incipient soil process), and Mollisols (usually associated with the mountains).

Basically, there are four weather zones found in New Mexico; Northern Chihuahuan Desert, Southern High Plains, Southern Rockies and Arizona-New Mexico Plateau. These zones are affected by colder temperatures increasing with elevation year-round. Higher elevations of the upper mountain zones are associated with coniferous and alpine plants; receive more rain, snow and ice than lower mountain elevations. Average annual minimum temperature may reach -25 to -20 degrees Fahrenheit (°F). The intermediate elevations and mountain transition zone below 9,600 feet as 1 to 7,000 feet above sea level is dominated by mixed coniferous; fir and spruce and deciduous trees such as aspen, and some shrubs, such as bearberry, mountain mahogany, and barberry, which receive slightly less moisture during the year with average minimum temperature lows of -15 to -10 °F.

Elevation below 7,000 to 4,500 feet are general considered the marginal limit of the Upper Sonoran Zone with most vegetation consisting of pine, juniper, oak, buckbrush, sagebrush and sagewort, rabbitbrush, wolfberry, hackberry, Apache plume and winterfat.

Elevation below 4,500 to 2,500 or the Lower Sonoran Zone has predominant vegetation consisting of mesquite, cottonwood, Jerusalem thorn, acacia, creosote bush, tarbush, greasewood, turpentine bush, sand shinnery, whitebrush, yucca, agave, desert willow, beargrass, desert candle, and various cacti, and along riparian zones willows, Russian olive, seep willow and salt cedar.

The elevations below 5,400 feet are mostly open rangeland areas with the milder southwest part of the state having winter temperature lows between 15° F and 10° F, and rainfall averages of 12 inches annually. As one goes eastward, rainfall averages increase to 16 inches or more, and winter temperatures fall to 5° F to 0° F lows. Further decreasing average lows naturally occur as one moves northward in the state.

Public land management covers about 50% of the New Mexico's 33 counties that contain the state's 77.67 million acres (121,356 mi²). Of these 38.83 million acres of public land, the land surface management responsibility is mainly divided between the Bureau of Land Management (16.5%) and the U.S Forest Service (12.0%), the State Land Office (11.9%) and Indian Trust Lands (9.6%).

APHIS mainly does grasshopper suppression programs on level to rolling hill topography, avoiding water resources, over grassland vegetation during daytime in warm weather with wind speeds less than 10 mph. Treatment activities are monitored by direct APHIS-Plant Protection and Quarantine (PPQ) supervision and are found in Appendix 1.

For site specific information, maps, or other visual representations of the suppression program area, please reference the materials included in the Appendix.

B. Site-Specific Considerations

1. Human Health

The rangeland areas where treatments may occur are sparsely populated by isolated ranch units having mainly cattle operations and "ranchettes" (homesteads generally five acres or less). Rangeland grazing is the predominant livestock feeding method. A buffer of 1.25 miles from the treatment area to the perimeter of any town and other communities will be used. Ranch buildings and structures (such as stock tanks) will have a buffer of 200 feet. Federal highways and State roads will have a buffer of 25 feet. Potential exposures to the general public from conventional application rates are infrequent and of low magnitude. The RAATs approach reduces this potential even further by using reduced rates and less actual directly treated area. The proposed program should benefit human and environmental health by reducing the risk of insect annoyance, blowing dust, higher light reflection, and higher temperature on the semi-arid land surface. Sensitive areas to the public will have designated buffers. Local law enforcement, fire departments EMS, hospitals and tribal agencies will be notified prior to any treatment as an advisory to access any safety risk, the treatment date and location and contact personnel.

2. Nontarget Species

Non-target species such as pollinators and other beneficial insects, which may be impacted, by the suppression program are those present during application in the sprayed swathes by direct chemical contact, or by feeding upon the contacted surface of vegetation, litter or on affected grasshoppers. Some migratory and nesting birds in contact with the application may temporarily be affected, mainly by feeding on treated grasshoppers or other insects, but not adversely. These suppression applications avoid water bodies and aquatic life, and due to the timing of these applications and their short residual life, the risk of their movement into seasonal or permanent water is minimal. Pre-treatment monitoring will identify any potential nearby water source to ensure that adequate buffers are used to protect these areas. Phytotoxicity has not been found to be a concern to rangeland plants when these chemicals are applied at the recommended rates.

Currently the F&WS has 52 Endangered and Threatened Species and 2 Candidate Species listed for New Mexico. There are currently 14 threatened and endangered species and two candidate species listed for Rio Arriba County. The list of these species is found for individual species details at these three following links:

<https://ipac.ecosphere.fws.gov/project/6XMULLDRO5ALRBJVIQPFMR6NLU/resources>, <http://www.fws.gov/endangered/>,

<http://www.fws.gov/southwest/es//NewMexico/>, The New Mexico Department of Game and Fish has a list of 120 endangered and threatened species found at: <http://www.bison-m.org/>.

3. Socioeconomic Issues

New Mexico has many historic and recreation sites, and unique natural features throughout the state. Most of these occur on federal, state, or tribal lands. The majority of these visitor sites and natural features are not found on rangeland, except with low frequency. Lava flow fields, geological landmarks and outcroppings, ancient archaeological sites, man-made reservoirs, lakes and dams, and historical ranch or church sites, and old military forts are sometimes visited within this rangeland environ.

Some county fairgrounds outside of town are located adjacent to rangelands; however, these events occur in late summer or early autumn. Golf courses, racing tracks, rodeo arenas, FFA and 4-H livestock shows are located at the margins of towns and would be protected by the designated program buffers.

4. Cultural Resources and Events

Native American fiesta days and Colonial Hispanic ceremonies are not performed on rangeland, but in towns and pueblos. Old, abandoned community graveyards or “camposantos” and Indian burial grounds would be excluded as are heritage and historic, petroglyphs and pictographs sites that are protected and preserved in the National Park Service areas or in New Mexico State parks and monuments. These ancestral cultural areas are under the protection of the federal 1906 Antiquities Act and the 1965 National Heritage Act, and the NM State provisions with the Habitat Protection Act (NMSA 17-6-1 et seq.) and the Rangeland Protection Act (NMSA 76-7B) and are excluded from any APHIS grasshopper program.

5. Special Considerations for Certain Populations

a) Executive Order No. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (E.O.) 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 E.O. 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 E.O., 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.

New Mexico is a minority/majority state. As such, low-income and minority populations are scattered throughout the state as well as Rio Arriba County. In this area of concern, the central portion of Rio Arriba County, there is one Reservation adjacent to, but not included in the proposed treatment area. This is the Jicallia Apache Nation. We will communicate with the Tribe to address any concerns. Low-income, mainly Anglo and Latino, populations are scattered throughout the areas of concern.

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

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

The percentage of the human population within the areas of concern are unknown. Any areas of human habitation, outside of isolated homesteads (these are buffered), are excluded from any program. New Mexico will identify any day care operations, schools or large concentrations of children and exclude these areas from any program operations. These may include buffers or completely excluding from the program any populated areas.

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 the grasshopper infestation. The principal concerns associated with the alternatives are: (1) the potential effects of insecticides on human health (including subpopulations that might be at increased risk); and (2) impacts of insecticides on nontarget organisms (including threatened and endangered species).

APHIS has written human health and ecological risk assessments (HHERAs) to assess the insecticides and use patterns that are specific to the program. The risk assessments provide an in-depth technical analysis of the potential impacts of each insecticide to human health, non-target wildlife, and its environmental fate in soil, air, and water. The assessments rely on data required by USEPA for pesticide product registrations, as well as peer-reviewed and other published literature. The HHERAs are heavily referenced in the EIS and this

[Draft] is likewise tiered to that analysis. These Environmental Documents can be found at the following website: <http://www.aphis.usda.gov/plant-health/grasshopper>.

A. Environmental Consequences of the Alternatives

Site-specific environmental consequences of the alternatives are discussed in this section.

1. No Suppression Program Alternative

Under this alternative, APHIS would not conduct 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 Action alternative because the types and amounts 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 Action 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 generalist feeders, eating grasses and forbs first and often moving to cultivated crops. High grasshopper density of one or several species and the resulting defoliation may reach an economic threshold where the damage caused by grasshoppers exceeds the cost of controlling the grasshoppers. Researchers determined that during typical grasshopper infestation years, approximately 20% of forage on western rangeland is removed, valued at a 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 grasshopper outbreaks in rangeland.

Vegetation damage during serious grasshopper outbreaks may be so severe that all grasses and forbs are destroyed causing impaired plant growth for several years. Rare plants may be consumed during critical times of their development such as during seed production, and loss of important plant species, or seed production may lead to reduced biological diversity of the rangeland habitats, potentially creating opportunities for the expansion of invasive and exotic weeds (Lockwood and Latchininsky, 2000). 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 economic infestation 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 to rangeland. 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 other agricultural products.

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

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

a) Carbaryl

Carbaryl is a member of the N-methyl carbamate class of insecticides, which affect the nervous system via cholinesterase inhibition. Inhibiting the enzyme acetylcholinesterase (AChE) causes nervous system signals to persist longer than normal. While these effects are desired in controlling insects, they can have undesirable impacts to non-target organisms that are exposed. 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). However, adherence to label requirements and additional program measures designed to prevent carbaryl from reaching sensitive habitats or mitigate exposure of non-target organisms will reduce environmental effects of treatments.

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; Bondarenko et al., 2004). Degradation in the latter study was temperature dependent with shorter half-lives at higher temperatures. Aerobic aquatic metabolism of carbaryl reported half-life ranged of 4.9 to 8.3 days compared to anaerobic (without oxygen) aquatic metabolism range of 15.3 to 72 days (Thomson and Strachan, 1981; USEPA, 2003). Carbaryl's degradation in aerobic soil varies from rapid to slow with half-lives ranging from 4 to 253 days (USEPA, 2017a). Half-lives decrease with increasing pH from acidic to alkaline conditions. Under anaerobic soil

conditions, carbaryl has a half-life of 72 days. Little transport of carbaryl through runoff or leaching to groundwater is expected due to the low water solubility, moderate sorption, and rapid degradation in soils. There are no reports of carbaryl detection in groundwater, and less than 1% of granule carbaryl applied to a sloping plot was detected in runoff (Caro et al., 1974).

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); 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, 2012a). The USEPA-approved use rates and patterns and the additional mitigations imposed by the grasshopper program, such as using RAATs and application buffers, where applicable, further minimize aquatic exposure and risk.

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 pollinators to carbaryl treatments for grasshopper suppression. In areas of direct application where impacts may occur, alternating swaths and reduced rates (i.e., RAATs) would reduce risk. 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, 2012a). The grasshopper program would treat at or below use rates that appear on the label, as well as follow all appropriate label mitigations, which would ensure residues are below the tolerance levels.

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

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

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

b) Chlorantraniliprole

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

Chlorantraniliprole is considered practically nontoxic via oral, dermal, and inhalation exposures (DuPont, 2011; USEPA, 2008). Median lethality values (LD50) from oral and dermal exposure to the active ingredient, chlorantraniliprole, and the proposed formulation exceeded the highest concentration tested (5,000 milligrams/kilogram (mg/kg)). Inhalation toxicity is also very low for the technical material and the formulation with median lethality values exceeding the highest test concentration (2.1 mg/L). Available acute toxicity data suggests that the acute toxicity between the active ingredient and the formulation are comparable. Prevathon® is not considered an irritant to the eyes or skin and is not a skin sensitizer. In addition, chlorantraniliprole is not considered to be carcinogenic or mutagenic, and is not known to cause reproductive or developmental toxicity. The no observable effect level (NOEL) in reproductive and developmental toxicity studies was 1,000 mg/kg/day, or the highest concentration tested (USEPA, 2008). Studies designed to assess neurotoxicity and effects on the immune system show no effects at a range of doses from the low mg/kg range to greater than 1,000 mg/kg.

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

Toxicity to most non-target organisms is low based on available toxicity data. Acute fish toxicity is low with median lethality values (LC50) for freshwater and marine test species above the highest test concentration. Amphibian toxicity data does not appear to be available however based on the reported toxicity values for fish, the toxicity to amphibians is expected to be low. Aquatic invertebrates are more sensitive to the effects of

chlorantraniliprole with median lethality and effect concentrations ranging from 0.0098 milligrams per liter (mg/L) for the freshwater cladoceran, *Daphnia magna*, to 1.15 mg/L for marine mysid shrimp (Barbee et al., 2010; EPA, 2012b). Chronic no observable effect concentrations (NOEC) range from 0.0045 mg/L for *D. magna* to 0.695 mg/L for a marine mysid (USEPA, 2012b). Available aquatic plant toxicity data suggests low toxicity of chlorantraniliprole to diatoms, algae, and aquatic macrophytes with median effect concentrations exceeding the highest test concentration (USEPA, 2008). Primary and secondary metabolites that could occur in aquatic environments are less toxic than the parent material when comparing toxicity values for the freshwater cladoceran, *D. magna* (USEPA, 2012b).

The exposure and risk to aquatic organisms from the proposed applications of Prevathon[®] will be negligible based on the low toxicity of chlorantraniliprole, and program restrictions regarding applications near surface water. The Program currently uses a 200-foot ground and 500-foot aerial application buffer from surface water. Using standardized drift modeling at the highest application rate proposed in this study results in shallow water residues of chlorantraniliprole that are approximately ten-fold below the most sensitive sublethal endpoint for aquatic invertebrates (USDA APHIS, 2018b). Residue values were also approximately ten-fold below the most sensitive acute toxicity value for aquatic vertebrates and four orders of magnitude below the acute toxicity values for fish. No indirect effects would be expected for aquatic vertebrates that depend on aquatic plants and invertebrates for habitat and prey from the proposed use of Prevathon[®].

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

Exposure and risk to terrestrial vertebrates that may consume treated plant material or insects in the proposed spray blocks will be negligible. USEPA exposure models to this group of non-target organisms from treated plant material and insects at maximum Prevathon[®] rates show that residues are at least two orders of magnitude below the most sensitive toxicity endpoint for wild mammals or birds (USDA APHIS, 2015). Indirect risk to this group of organisms is also not anticipated based on the selectivity of chlorantraniliprole to certain insect taxa and the relatively small areas of treatment. Additionally, the selective nature of chlorantraniliprole to certain insect taxa and the low application rates suggest that impacts to all terrestrial invertebrates would not be anticipated. Any decrease in chlorantraniliprole-sensitive terrestrial invertebrate numbers would be expected to be local in nature due to the size of the treatment plots and recovery would occur more rapidly than in larger treatment areas due to immigration and the selective nature of chlorantraniliprole to certain life stages of invertebrates.

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

c) Diflubenzuron

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

USEPA considers diflubenzuron relatively non-persistent and immobile under normal use conditions and stable to hydrolysis and photolysis. The chemical is considered unlikely to contaminate ground water or surface water (USEPA, 1997). The vapor pressure of diflubenzuron is relatively low, as is the Henry's Law Constant value, suggesting the chemical will not volatilize readily into the atmosphere from soil, plants or water. Therefore, exposure from volatilization is expected to be minimal. Due to its low solubility (0.2 mg/L) and preferential binding to organic matter, diflubenzuron seldom persists more than a few days in water (Schaefer and Dupras, 1977). Mobility and leachability of diflubenzuron in soils is low, and residues are usually not detectable after seven days (Eisler, 2000). Aerobic aquatic half-life data in water and sediment was reported as 26.0

days (USEPA, 1997). Diflubenzuron applied to foliage remains adsorbed to leaf surfaces for several weeks with little or no absorption or translocation from plant surfaces (Eisler, 1992, 2000). Field dissipation studies in California citrus and Oregon apple orchards reported half-life values of 68.2 to 78 days (USEPA, 2018). Diflubenzuron persistence varies depending on site conditions and rangeland persistence is unfortunately not available. Diflubenzuron degradation is microbially mediated with soil aerobic half-lives much less than dissipation half-lives. Diflubenzuron treatments are expected to have minimal effects on terrestrial plants. Both laboratory and field studies demonstrate no effects using diflubenzuron over a range of application rates, and the direct risk to terrestrial plants is expected to be minimal (USDA APHIS, 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 greatly reduced risk because the lack of effects seen in multiple field studies on other taxa of invertebrates at use rates much higher than those proposed for the

program. Shifting diets in insectivorous birds in response to prey densities is not uncommon in undisturbed areas (Rosenberg et al., 1982; Cooper et al., 1990; Sample et al., 1993).

Indirect risk to fish species can be defined as a loss of habitat or prey base that provides food and shelter for fish populations, however these impacts are not expected based on the available fish and invertebrate toxicity data (USDA APHIS, 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).

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

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

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

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.

d) 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 (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).

The products used by the grasshopper program are labeled with rates and treatment intervals that are meant to protect livestock. Livestock and horses may graze on rangeland the same day that the land is treated with malathion. 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, 2012c). 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 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 (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.

e) 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 spray concentrations, or by alternating one or more treatment swaths. Usually RAATs applications use both lower concentrations and skip treatment swaths. The RAATs strategy suppresses grasshoppers within treated swaths, while conserving grasshopper predators and parasites in swaths that are not treated.

The concept of reducing the treatment area of insecticides while also applying less insecticide per treated acre was developed in 1995, with the first field tests of RAATs in Wyoming (Lockwood and Schell, 1997). Applications can be made either aerially or with ground-based equipment (Deneke and Keyser, 2011). Studies using the RAATs strategy have shown good control (up to 85% of that achieved with a total area insecticide application) at a significantly lower cost and less insecticide, and with a markedly higher abundance of non-target organisms following application (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 were proposed by Larsen and Foster (1996), and empirically demonstrated by Lockwood and Schell (1997). Widespread efforts to communicate the advantages of RAATs across the Western States were undertaken in 1998 and have continued on an annual basis. The viability of RAATs at an operational scale was initially demonstrated by Lockwood et al. (2000), and subsequently confirmed by Foster et al. (2000). The first government agencies to adopt RAATs in their grasshopper suppression programs were the Platte and Goshen County Weed and Pest Districts in Wyoming; they also funded research at the University of Wyoming to support the initial studies in 1995. This method is now commonly used by government agencies and private landowners in States where grasshopper control is required.

Reduced rates should prove beneficial for the environment. All APHIS grasshopper treatments using carbaryl, chlorantraniliprole, diflubenzuron, or malathion 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.

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 Action alternative where APHIS would not take part in any grasshopper suppression program include the continued increase in grasshopper populations and potential expansion of populations into neighboring range and cropland. In addition, State and private land managers could apply insecticides to manage grasshopper populations however, land managers may opt not to use RAATs, which would increase insecticides applied to the rangeland. Increased insecticide applications from the lack of coordination or foregoing RAATs methods could increase the exposure risk to non-target species. In addition, land managers may not employ the extra program measures designed to reduce exposure to the public and the environment to insecticides.

Potential cumulative impacts associated with the Preferred Alternative are not expected to be significant because the program applies an insecticide application once during a treatment season. The program may treat an area with different insecticides but does not overlap the treatments. The program does not mix or combine insecticides. 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 pesticides include insecticide resistance, synergistic chemical effects, chemical persistence, and bioaccumulation in the environment. The program use of reduced insecticide application rates (i.e. ULV and RAATs) are expected to mitigate the development of insect resistance to the insecticides. Grasshopper outbreaks in the United States occur cyclically so applications do not occur to the same population over time further eliminating the selection pressure that increases the chances of insecticide resistance.

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

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.

2. Executive Order No. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Federal agencies identify and address the disproportionately high and adverse human health or environmental effects of their proposed activities, as described in E.O. 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.”

APHIS has evaluated the proposed grasshopper program and has determined that there is no disproportionately high and adverse human health or environmental effects on minority populations or low-income populations.

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

Federal agencies consider a proposed action’s potential effects on children to comply with E.O. 13045, “Protection of Children from Environmental Health Risks and Safety Risks.” This E.O. requires each Federal agency, consistent with its mission, to identify and assess

environmental health and safety risks that may disproportionately affect children and to ensure its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. APHIS has developed agency guidance for its programs to follow to ensure the protection of children (USDA APHIS, 1999).

APHIS' HHERAs evaluated the potential exposure to each insecticide used in the program and risks associated with these insecticides to residents, including children. The HHERAs for the proposed program insecticides, located at <http://www.aphis.usda.gov/plant-health/grasshopper>, suggest that no disproportionate risks to children, as part of the general public, are anticipated.

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

4. Tribal Consultation

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

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

5. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

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

transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.

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

6. Endangered Species Act

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

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

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

- RAATs are used in all areas adjacent to salmonid habitat
- ULV sprays are used, which are between 50% and 66% of the USEPA recommended rate
- Insecticides are not aerially applied in a 3,500 foot buffer zones for carbaryl or malathion, or applied within a 1,500 foot buffer zones for diflubenzuron along stream corridors
- Insecticides will not be applied when wind speeds exceed 10 miles per hour. APHIS will attempt to avoid insecticide application if the wind is blowing towards salmonid habitat
- Insecticide applications are avoided when precipitation is likely or during temperature inversions

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

APHIS submitted a programmatic biological assessment for grasshopper suppression in the 17-state program area and requested consultation with USFWS on March 9, 2015. With the incorporation and use of application buffers and other operational procedures APHIS anticipated and continues to believe any impacts associated with the use and fate of program insecticides will be insignificant and discountable to listed species and their habitats. Based on an assessment of the potential exposure, response, and subsequent risk characterization of program operations, APHIS concluded in the programmatic biological assessment the proposed action is not likely to adversely affect listed species or critical habitat in the program area. APHIS has requested concurrence from the USFWS on these determinations. Until this programmatic Section 7 consultation with USFWS is completed, APHIS will primarily conduct consultations with USFWS field offices at the local level.

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

APHIS-PPQ New Mexico has submitted a draft BA to Fish and Wildlife Services for review on February 17th 2023. Consultation is pending at this time.

7. Bald and Golden Eagle Protection Act

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

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

8. Additional Species of Concern

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

Grasshopper suppression programs reduce grasshoppers and at least some other insects in the treatment area that can be a food item for sage grouse chicks. As indicated in previous sections on impacts to birds, there is low potential that the program insecticides would be toxic to sage grouse, either by direct exposure to the insecticides or indirectly through immature sage grouse eating moribund grasshoppers.

Because grasshopper numbers are so high in an outbreak year, treatments would not likely reduce the number of grasshoppers below levels present in a normal year. Should grasshoppers be unavailable in small, localized areas, sage grouse chicks may consume other insects, which sage grouse chicks likely do in years when grasshopper numbers are naturally low. By suppressing grasshoppers, rangeland vegetation is available for use by other species, including sage grouse, and rangeland areas are less susceptible to invasive plants that may be undesirable for sage grouse habitat.

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

9. 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 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.

10. Cultural and Historical Resources

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

V. Literature Cited

- Barbee, G.C., McClain, W.R., Lanka, S.K. and M.J. Stout. 2010. Acute toxicity of chlorantraniliprole to non-target crayfish (*Procambarus clarkii*) associated with rice–crayfish cropping systems. *Pest Manag. Sci.* 66: 996–1001.
- Beauvais, S. 2014. Human exposure assessment document for carbaryl. Page 136. California Environmental Protection Agency, Department of Pesticide Regulation.
- Belovsky, G. E., A. Joern, and J. Lockwood. 1996. VII.16 Grasshoppers—Plus and Minus: The Grasshopper Problem on a Regional Basis and a Look at Beneficial Effects of Grasshoppers. Pages 1-5 in G. L. Cunningham and M. W. Sampson, editors. *Grasshopper Integrated Pest Management User Handbook*, Technical Bulletin No. 1809. U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Washington, DC.
- Belovsky, G. E. 2000. Part 1. Grasshoppers as integral elements of grasslands. 1. Do grasshoppers diminish grassland productivity? A new perspective for control based on conservation. Pages 7-29 in J. A. Lockwood et al, editor. *Grasshoppers and Grassland Health*. Kluwer Academic Publishers, Netherlands.
- Bonderenko, S., J. Gan, D. L. Haver, and J. N. Kabashima. 2004. Persistence of selected organophosphate and carbamate insecticides in waters from coastal watershed. *Env. Toxicol. Chem.* 23:2649-2654.
- Bradshaw, J. D., K. H. Jenkins, and S. D. Whipple. 2018. Impact of grasshopper control on forage quality and availability in western Nebraska. *Rangelands* 40:71-76.
- Branson, D., A. Joern, and G. Sword. 2006. Sustainable management of insect herbivores in grassland ecosystems: new perspectives in grasshopper control. *BioScience* 56:743-755.
- Broyles, G. 2013. Wildland firefighter smoke exposure. Page 26. U.S. Department of Agriculture, Forest Service.
- Brugger, K.E., Cole, P.G., Newman, I.C., Parker, P., Scholz, B., Suvagia, P., Walker, G. and T.G. Hammond. 2010. Selectivity of chlorantraniliprole to parasitoid wasps. *Pest Manag. Sci.* 66: 1075–1081.
- Buckner, C. H., P. D. Kingsbury, B. B. McLeod, K. L. Mortensen, and D. G. H. Ray. 1973. The effects of pesticides on small forest vertebrates of the spruce woods provincial forest, Manitoba. *The Manitoba Entomologist* 7:37-45.
- Burling, I., R. Yokelson, D. Griffith, T. Johson, P. Veres, J. Roberts, C. Warneke, S. Urbanski, J. Reardon, D. Weise, W. Hao, and J. de Gouw. 2010. Laboratory measures of trace gas emissions from biomass burning of fuel types from the southeastern and southwestern United States. *Atmospheric Chemistry and Physics* 10:11115-111130.

- Caro, J. H., H. P. Freeman, and B. C. Turner. 1974. Persistence in soil and losses in runoff of soil-incorporated carbaryl in a small watershed. *J. Agric. Food Chem.* 22:860-863.
- Catangui, M.A., Fuller, B.W., and Walz, A.W., 1996. Impact of Dimilin® on nontarget arthropods and its efficacy against rangeland grasshoppers. *In* U.S. Department of Agriculture, Animal and Plant Health Inspection Service, 1996. Grasshopper Integrated Pest Management User Handbook, Tech. Bul. No. 1809. Sec. VII.3. Washington, DC.
- Chandel, R.S., and P.R Gupta. 1992. Toxicity of diflubenzuron and penfluron to immature stages of *Apis cerana indica* and *Apis mellifera*. *Apidologie* 23:465-473.
- Cordova, D. E. E.A. Benner, M.D. Sacher, J.J. Rauh, J.S. Sopa, G.P. Lahm, T.P. Selby, T.M. Stevenson, L. Flexner, S. Gutteridge, D.F. Rhoades, L. Wu, R.M. Smith, Y. Tao (2006). Anthranilic diamides: a new class of insecticides with a novel mode of action, ryanodine receptor activation. *In Pesticide Biochemistry and Physiology* (pp. 196-214).
- Cooper, R. J., K. M. Dodge, P. J. Marinat, S. B. Donahoe, and R. C. Whitmore. 1990. Effect of diflubenzuron application on eastern deciduous forest birds. *J. Wildl. Mgmt.* 54:486-493.
- Deakle, J. P. and J. R. Bradley, Jr. 1982. Effects of early season applications of diflubenzuron and azinphosmethyl on populations levels of certain arthropods in cotton fields. *J. Georgia Entomol. Soc.* 17:189-200.
- Deneke, D. and J. Keyser. 2011. Integrated Pest Management Strategies for Grasshopper Management in South Dakota. South Dakota State University Extension.
- Dinkins, M. F., A. L. Zimmermann, J. A. Dechant, B. D. Parkins, D. H. Johnson, L. D. Igl, C. M. Goldade, and B. R. Euliss. 2002. Effects of Management Practices on Grassland Birds: Horned Lark Northern Prairie Wildlife Research Center. Page 34. Northern Prairie Wildlife Research Center, Jamestown, ND.
- Dinter, A., Brugger, K.E., Frost, N.M. and M.D. Woodward. 2009. Chlorantraniliprole (Rynaxypyr): A novel DuPont™ insecticide with low toxicity and low risk for honey bees (*Apis mellifera*) and bumble bees (*Bombus terrestris*) providing excellent tools for uses in integrated pest management. Hazards of pesticides to bees – 10th International Symposium of the ICP-Bee Protection Group. Pp. 84-96.
- Dupont. 2011. Material Safety Data Sheet - Prevathon®.
- Eisler, R. 1992. Diflubenzuron Hazards to Fish, Wildlife, and Invertebrate: A Synoptic Review. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C.
- Eisler, R., 2000. Handbook of chemical risk assessment: health hazards to humans, plants, and animals. Lewis Publishers, New York.
- El-Refai, A. and T. L. Hopkins. 1972. Malathion adsorption, translocation, and conversion to malaaxon in bean plants. *J. Assoc. Official Analytical Chemists* 55:526-531.
- Fischer, S. A. and L. W. Hall, Jr. 1992. Environmental concentrations and aquatic toxicity data on diflubenzuron (Dimilin). *Critical Rev. in Toxicol.* 22:45-79.
- Follett, R. F. and D. A. Reed. 2010. Soil carbon sequestration in grazing lands: societal benefits and policy implications. *Rangeland Ecology & Management* 63:4-15.
- Foster, R. N., K. C. Reuter, K. Fridley, D. Kurtenback, R. Flakus, R. Bohls, B. Radsick, J. B. Helbig, A. Wagner, and L. Jeck. 2000. Field and Economic Evaluation of Operational Scale Reduced Agent and Reduced Area Treatments (RAATs) for Management of Grasshoppers in South Dakota Rangeland. U.S. Department of

- Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Phoenix, AZ.
- George, T. L., L. C. McEwen, and B. E. Peterson. 1995. Effects of grasshopper control programs on rangeland breeding bird populations. *J. Range Manage.* 48:336–342.
- Gradish, A.E., Scott-Dupree, C.D., Shipp, L. and R. Harris. 2011. Effect of reduced risk pesticides on greenhouse vegetable arthropod biological control agents. *Pest Manag. Sci.* 67: 82–86.
- Guerrant, G. O., L. E. Fetzer, Jr., and J. W. Miles. 1970. Pesticide residues in Hale County, Texas, before and after ultra-low-volume aerial applications of Malathion. *Pesticide Monitoring J.* 4:14-20.
- Hannig, G.T., Ziegler, M. and P.G. Marcon. 2009. Feeding cessation effects of chlorantraniliprole, new anthralinic diamide insecticide, in comparison with several insecticides in distinct chemical classes and mode-of-action groups. *Pest Manag. Sci.* 65: 969–974.
- Havstad, K. M., D. P. Peters, R. Skaggs, J. Brown, B. Bestelmeyer, E. Fredrickson, J. Herrick, and J. Wright. 2007. Ecological services to and from rangelands of the United States. *Ecological Economics* 64:261-268.
- Howe, F. P., R. L. Knight, L. C. McEwen, and T. L. George. 1996. Direct and indirect effects of insecticide applications on growth and survival of nestling passerines. *Ecol. Appl.* 6:1314-1324.
- Keever, D. W., J. R. Bradley, Jr, and M. C. Ganyard. 1977. Effects of diflubenzuron (Dimilin) on selected beneficial arthropods in cotton fields. *J. Econ. Entomol.* 6:832-836.
- LaFleur, K. S. 1979. Sorption of pesticides by model soils and agronomic soils: rates and equilibria. *Soil Sci.* 127:94-101.
- Larsen, J. and R. N. Foster. 1996. Using Hopper to Adapt Treatments and Costs to Needs and Resources. U.S. Department of Agriculture, Animal and Plant Health Inspection Service Grasshopper Integrated Pest Management User Handbook, Washington, D.C.
- Latchininsky, A., G. Sword, M. Sergeev, M. Cigiliano, and M. Lecoq. 2011. Locusts and grasshoppers: behavior, ecology, and biogeography. *Psyche* 2011:1-4.
- Lockwood, J. A. and S. P. Schell. 1997. Decreasing economic and environmental costs through reduced area and agent insecticide treatments (RAATs) for the control of rangeland grasshoppers: empirical results and their implications for pest management. *J. Orthoptera Res.* 6:19-32.
- Lockwood, J., S. Schell, R. Foster, C. Reuter, and T. Rahadi. 2000. Reduced agent-area treatments (RAAT) for management of rangeland grasshoppers: efficacy and economics under operational conditions. *International Journal of Pest Management* 46:29-42.
- Lockwood, J. A. and A. Latchininsky. 2000. The Risks of Grasshoppers and Pest Management to Grassland Agroecosystems: An International Perspective on Human Well-Being and Environmental Health. Pages 193-215 in A. Latchininsky and M. Sergeev, editors. *Grasshoppers and Grassland Health*. Kluwer Academic Publishers.
- Lockwood, J., R. Anderson-Sprecher, and S. Schell. 2002. When less is more: optimization of reduced agent-area treatments (RAATs) for management of rangeland grasshoppers. *Crop Protection* 21:551-562.
- Matsumara, F. 1985. *Toxicology of insecticides*. Plenum Press, New York.

- McEwen, L.C., Althouse, C.M., and Peterson, B.E., 1996. Direct and indirect effects of grasshopper integrated pest management (GHIPM) chemicals and biologicals on nontarget animal life. *In* U.S. Department of Agriculture, Animal and Plant Health Inspection Service, 1996. Grasshopper Integrated Pest Management User Handbook, Tech. Bul. No. 1809. Sec. III.2. Washington, DC.
- Miles, C. J. and S. Takashima. 1991. Fate of malathion and O.O.S. trimethyl phosphorothioate byproduct in Hawaiian soil and water. *Arch. Environ. Contam. Toxicol* 20:325-329.
- Mommaerts, V., Sterk, G., and G. Smaghe. 2006. Hazards and uptake of chitin synthesis inhibitors in bumblebees *Bombus terrestris*. *Pest Mgt. Science* 62:752–758.
- Murphy, C. F., P. C. Jepson, and B. A. Croft. 1994. Database analysis of the toxicity of antilocus pesticides to non-target, beneficial invertebrates. *Crop Protection* 13:413-420.
- Muzzarelli, R. 1986. Chitin synthesis inhibitors: effects on insects and on nontarget organisms. *CRC Critical Review of Environmental Control* 16:141-146.
- Narisu, J., A. Lockwood, and S. P. Schell. 1999. A novel mark-capture technique and its application to monitoring the direction and distance of local movements of rangeland grasshoppers (Orthoptera: Acrididae) in context of pest management. *J. Appl. Ecol.* 36:604-617.
- Narisu, J., A. Lockwood, and S. P. Schell. 2000. Rangeland grasshopper movement as a function of wind and topography: implications for pest movement. *J. Appl. Ecol.* 36:604-617.
- Nation, J.L., Robinson, F.A., Yu, S.J., and A.B. Bolten. 1986. Influence upon honeybees of chronic exposure to very low levels of selected insecticides in their diet. *J. Apic. Res.* 25:170–177.
- Nigg, H. N., R. D. Cannizzaro, and J. H. Stamper. 1986. Diflubenzuron surface residues in Florida citrus. *Bul. Environ. Contam. Toxicol.* 36:833-838.
- NIH. 2009a. Carbaryl, CASRN: 63-25-2. National Institutes of Health, U.S. National Library of Medicine, Toxnet, Hazardous Substances Database.
- NIH. 2009b. National Institutes of Health, U.S. National Library of Medicine, National Center for Biotechnology Information. PubChem. <https://pubchem.ncbi.nlm.nih.gov/compound/4004>
- Norelius, E. E. and J. A. Lockwood. 1999. The effects of reduced agent-area insecticide treatments for rangeland grasshopper (Orthoptera: Acrididae) control on bird densities. *Archives of Environmental Contamination and Toxicology* 37:519-528.
- Pascual, J. A. 1994. No effects of a forest spraying of malathion on breeding blue tits (*Parus caeruleus*). *Environ. Toxicol. Chem.* 13:1127–1131.
- Peach, M. P., D. G. Alston, and V. J. Tepedino. 1994. Bees and bran bait: is carbaryl bran bait lethal to alfalfa leafcutting bee (Hymenoptera: Megachilidae) adults or larvae? *J. Econ. Entomol.* 87:311-317.
- Peach, M. P., D. G. Alston, and V. J. Tepedino. 1995. Sublethal effects of carbaryl bran bait on nesting performance, parental investment, and offspring size and sex ratio of the alfalfa leafcutting bee (Hymenoptera: Megachilidae). *Environ. Entomol.* 24:34-39.
- Pfadt, R. E. 2002. Field Guide to Common Western Grasshoppers, Third Edition. Wyoming Agricultural Experiment Station Bulletin 912. Laramie, Wyoming.
- Purdue University. 2018. National Pesticide Information Retrieval System. West Lafayette, IN.

- Quinn, M. A., R. L. Kepner, D. D. Walgenbach, R. N. Foster, R. A. Bohls, P. D. Pooler, K. C. Reuter, and J. L. Swain. 1991. Effect of habitat and perturbation on populations and community structure of darkling beetles (Coleoptera: tenebrionidae) on mixed grass rangeland. *Environ. Entomol.* 19:1746-1755.
- Rashford, B. S., A. V. Latchininsky, and J. P. Ritten. 2012. *An Economic Analysis of the Comprehensive Uses of Western Rangelands*. U.S. Department of Agriculture, Animal and Plant Health Inspection Service.
- Reinhardt, T. and R. Ottmar. 2004. Baseline measurements of smoke exposure among wildland firefighters. *Journal of Occupational and Environmental Hygiene* 1:593-606.
- Reisen, F. and S. Brown. 2009. Australian firefighters' exposure to air toxics during bushfire burns of autumn 2005 and 2006. *Environment International* 35:342-353.
- Richmond, M. L., C. J. Henny, R. L. Floyd, R. W. Mannan, D. W. Finch, and L. R. DeWeese. 1979. Effects of Sevin 4-oil, Dimilin, and Orthene on Forest Birds in Northeastern Oregon. USDA, Pacific SW Forest and Range Experiment Station.
- Rosenberg, K. V., R. D. Ohmart, and B. W. Anderson. 1982. Community organization of riparian breeding birds: response to an annual resource peak. *The Auk* 99:260-274.
- Sample, B. E., R. J. Cooper, and R. C. Whitmore. 1993. Dietary shifts among songbirds from a diflubenzuron-treated forest. *The Condor* 95:616-624.
- Schaefer, C. H. and E. F. Dupras, Jr. 1977. Residues of diflubenzuron [1-(4-chlorophenyl)-3(2,6-difluorobenzoyl) urea] in pasture soil, vegetation, and water following aerial applications. *J. Agric. Food Chem.* 25:1026-1030.
- Smith, D. and J. Lockwood. 2003. Horizontal and trophic transfer of diflubenzuron and fipronil among grasshoppers and between grasshoppers and darkling beetles (Tenebrionidae). *Archives of Environmental Contamination and Toxicology* 44:377-382.
- Smith, D. I., J. A. Lockwood, A. V. Latchininsky, and D. E. Legg. 2006. Changes in non-target populations following applications of liquid bait formulations of insecticides for control of rangeland grasshoppers. *Internat. J. Pest Mgt.* 52:125-139.
- Stanley, J. G. and J. G. Trial. 1980. Disappearance constants of carbaryl from streams contaminated by forest spraying. *Bul. Environ. Contam. Toxicol.* 25:771-776.
- Tepedino, V. J. 1979. The importance of bees and other insect planetaries in maintaining floral species composition. *Great Basin Naturalist Memoirs* 3:139-150.
- Thompson, H.M, Wilkins, S. Battersby, A.H., Waite, R.J., and D. Wilkinson. 2005. The effects of four insect growth-regulating (IGR) insecticides on honeybee (*Apis mellifera* L.) colony development, queen rearing and drone sperm production. *Ecotoxicology* 14:757-769.
- Thomson, D. L. K. and W. M. J. Strachan. 1981. Biodegradation of carbaryl in simulated aquatic environment. *Bul. Environ. Contam. Toxicol.* 27:412-417.
- USDA APHIS— see U.S. Department of Agriculture, Animal and Plant Health Inspection Service
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service, 1999. APHIS Directive 5600.3, Evaluating APHIS programs and activities for ensuring protection of children from environmental health risks and safety risks. September 3, 1999. U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Riverdale, MD. [online] available: <https://www.aphis.usda.gov/library/directives/pdf/aphis-5600-3.pdf>

- U.S. Department of Agriculture, Animal and Plant Health Inspection Service, 2013. Rangeland grasshopper/Mormon cricket suppression program aerial application: statement of work. 41 pp.
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2015. Biological Assessment for the APHIS Rangeland Grasshopper and Mormon Cricket Suppression Program. Page 162. U.S. Department of Agriculture, Animal and Plant Health Inspection Service.
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2018a. Human Health and Ecological Risk Assessment for Carbaryl Rangeland Grasshopper and Mormon Cricket Suppression Applications. United States Department of Agriculture, Animal and Plant Health Inspection Service.
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2018b. Human health and Ecological Risk Assessment for Chlorantraniliprole used in Rangeland grasshopper and Mormon Cricket Suppression Program. United States Department of Agriculture, Animal Plant and health Inspection Service.
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2018c. Human Health and Ecological Risk Assessment for Diflubenzuron Rangeland Grasshopper and Mormon Cricket Suppression Applications. United States Department of Agriculture, Animal and Plant Health Inspection Service.
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2018d. Human Health and Ecological Risk Assessment for Malathion Rangeland Grasshopper and Mormon Cricket Suppression Applications. United States Department of Agriculture, Animal and Plant Health Inspection Service.
- U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2019. Rangeland Grasshopper and Mormon Cricket Suppression Program Final Environmental Impact Statement. United States Department of Agriculture, Animal and Plant Health Inspection Service.
- USDA FS. 2004. Control/eradication agents for the gypsy moth—human health and ecological risk assessment for diflubenzuron (final report). United States Department of Agriculture, Forest Service
- USDA FS. 2008. Malathion- Human Health and Ecological Risk Assessment. U.S. Department of Agriculture, Forest Service.
- USEPA – See U.S. Environmental Protection Agency
- U.S. Environmental Protection Agency. 1997. Reregistration Eligibility Decision (RED): Diflubenzuron. U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency. 2000a. Malathion Reregistration Eligibility Document Environmental Fate and Effects. Page 146. U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances.
- U.S. Environmental Protection Agency. 2000b. Reregistration Eligibility Decision (RED) for Malathion. U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency. 2003. Environmental Fate and Ecological Risk Assessment for Re-Registration of Carbaryl. U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency. 2006. Malathion Reregistration Eligibility Document. Page 147. U.S. Environmental Protection Agency, Office of Pesticide Programs.

- U.S. Environmental Protection Agency. 2007. Reregistration Eligibility Decision (RED) for Carbaryl. Page 47. U.S. Environmental Protection Agency, Prevention, Pesticides and Toxic Substances.
- U.S. Environmental Protection Agency, 2008. Pesticide fact sheet: Chlorantraniliprole. Office of Prevention, Pesticides and Toxic Substances. 77 pp.
- U.S. Environmental Protection Agency. 2012a. Sevin XLR Plus Label. Pages 1-40 Pesticide Product and Label System. U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency, 2012b. Ecotox database accessed at: <http://cfpub.epa.gov/ecotox/>
- U.S. Environmental Protection Agency. 2012c. Fyfanon ULV AG. U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency. 2015a. Annual Cancer Report 2015, Chemicals Evaluated for Carcinogenic Potential Page 34. U.S. Environmental Protection Agency, Office of Pesticide Programs.
- U.S. Environmental Protection Agency. 2015b. Memorandum - Diflubenzuron: human health risk assessment for an amended Section 3 registration for carrot, peach subgroup 12-12B, plum subgroup 12-12C, pepper/eggplant subgroup 8010B, cottonseed subgroup 20C, alfalfa (regional restrictions) and R175 Crop Group Conversion for tree nut group 14-12. Page 71 U.S. Environmental Protection Agency, Office of Pesticide Programs.
- U.S. Environmental Protection Agency. 2016a. Appendix 3-1: Environmental transport and fate data analysis for malathion. In: Biological Evaluation Chapters for Malathion ESA Assessment.
- U.S. Environmental Protection Agency. 2016b. Chapter 2: Malathion Effects Characterization for ESA Assessment. In: Biological Evaluation Chapters for Malathion ESA Assessment.
- U.S. Environmental Protection Agency. 2016c. Malathion: Human Health Draft Risk Assessment for Registration Review. Page 258. U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency. 2017a. Memorandum - Carbaryl: Draft Human Health Risk Assessment in Support of Registration Review. Page 113 U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency. 2018. Preliminary Risk Assessment to Support the Registration Review of Diflubenzuron.
- USFWS. 2007. National Bald Eagle Management Guidelines. Page 23 pp. U.S. Fish and Wildlife Service.
- Wakeland, C. and W. E. Shull. 1936. The Mormon cricket with suggestions for its control, Extension Bulletin No. 100. University of Idaho, College of Agriculture, Idaho Agricultural Extension.
- Zinkl, J. G., C. J. Henny, and L. R. DeWeese. 1977. Brain cholinesterase activities of birds from forests sprayed with trichlorfon (Dylox) and carbaryl (Sevin 4-oil). *Bul. Environ. Contam. Toxicol.* 17:379-386.

VI. Listing of Agencies and Persons Consulted

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

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

General Guidelines for Grasshopper / Mormon Cricket Treatments

1. All treatments must be in accordance with:
 - a. the Plant Protection Act of 2000;
 - b. applicable environmental laws and policies such as: the National Environmental Policy Act, the Endangered Species Act, the Federal Insecticide, Fungicide, and Rodenticide Act, and the Clean Water Act (including National Pollutant Discharge Elimination System requirements – if applicable);
 - c. applicable state laws;
 - d. APHIS Directives pertaining to the proposed action;
 - e. Memoranda of Understanding with other Federal agencies.
2. Subject to the availability of funds, upon request of the administering agency, the agriculture department of an affected State, or private landowners, APHIS, to protect rangeland, shall immediately treat Federal, Tribal, State, or private lands that are infested with grasshoppers or Mormon crickets at levels of economic infestation, unless APHIS determines that delaying treatment will not cause greater economic damage to adjacent owners of rangeland. In carrying out this section, APHIS shall work in conjunction with other Federal, State, Tribal, and private prevention, control, or suppression efforts to protect rangeland.
3. Prior to the treatment season, conduct meetings or provide guidance that allows for public participation in the decision-making process. In addition, notify Federal, State and Tribal land managers and private landowners of the potential for grasshopper and Mormon cricket outbreaks on their lands. Request that the land manager / landowner advise APHIS of any sensitive sites that may exist in the proposed treatment areas.
4. Consultation with local Tribal representatives will take place prior to treatment programs to fully inform the Tribes of possible actions APHIS may take on Tribal lands.
5. On APHIS run suppression programs, 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.

Operational Procedures

GENERAL PROCEDURES FOR ALL AERIAL AND GROUND APPLICATIONS

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

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

3. One of the following insecticides that are labeled for rangeland use can be used for a suppression

treatment of grasshoppers and Mormon crickets:

- A. Carbaryl
 - a. solid bait
 - b. ultra-low volume (ULV) spray
- B. Diflubenzuron ULV spray
- C. Malathion ULV spray
- D. Chlorantraniliprole

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

APHIS reporting requirements associated with grasshopper / Mormon cricket suppression treatments include:

- A. Completion of a post-treatment report (Part C of the Project Planning and Reporting Worksheet (PPQ Form 62)
- B. Providing an entry for each treatment in the PPQ Grasshopper/Mormon Cricket treatment database
- C. For aerial treatments, providing copies of forms and treatment/plane data for input into the Federal Aviation Interactive Reporting System (FAIRS) by PPQ's designee

SPECIFIC PROCEDURES FOR AERIAL APPLICATIONS

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

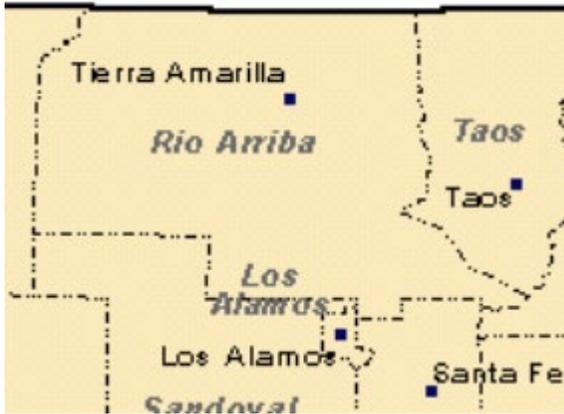
2. Minimize the potential for drift and volatilization by not using ULV sprays when the following conditions exist in the spray area:

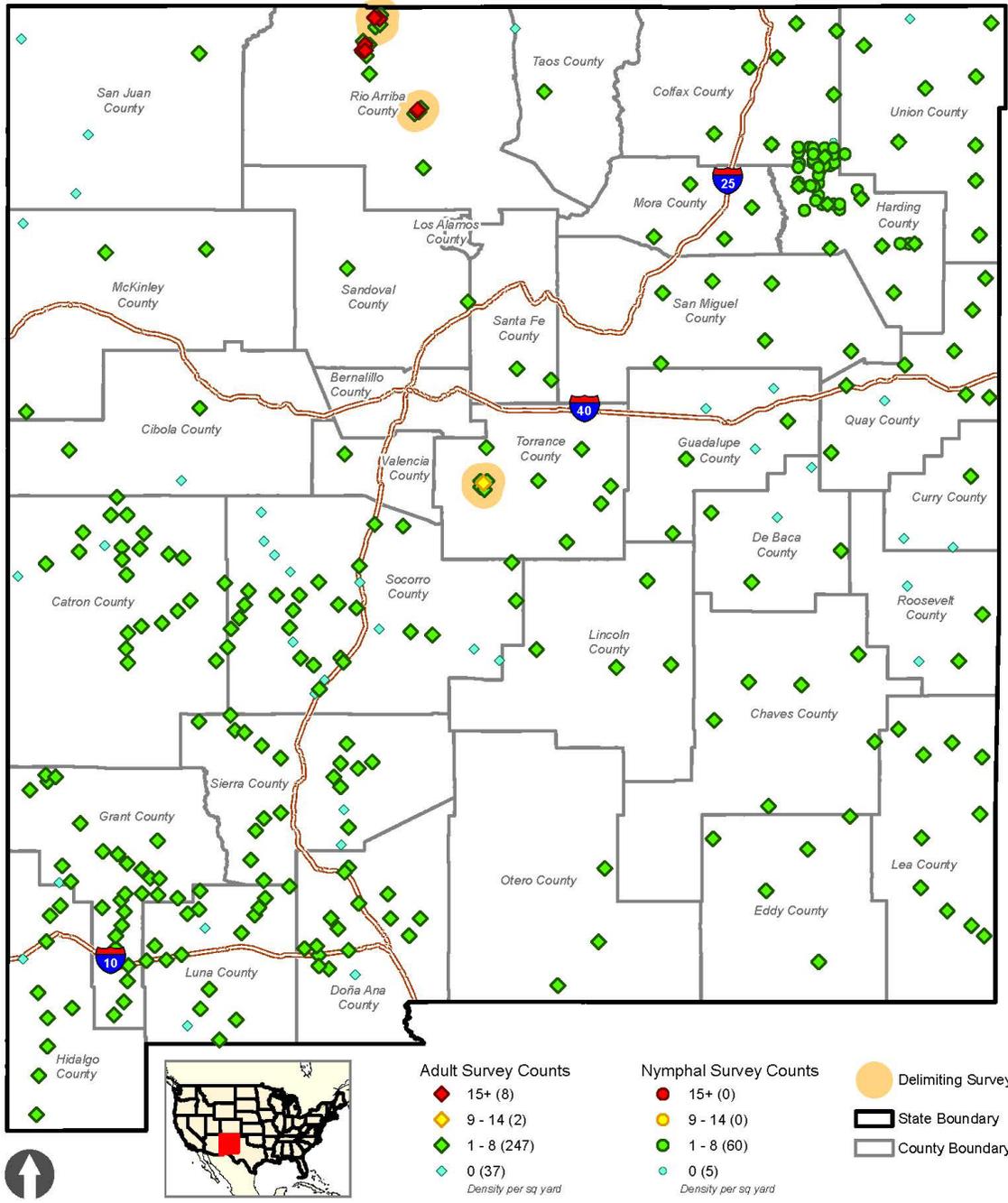
- a. Wind velocity exceeds 10 miles per hour (unless state law requires lower wind speed);
- b. Rain is falling or is imminent;
- c. Dew is present over large areas within the treatment block;
- d. There is air turbulence that could affect the spray deposition;
- e. Temperature inversions (ground temperature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

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

4. Application aircraft will fly at a median altitude of 1 to 1.5 times the wingspan of the aircraft whenever possible or as specified by the COR or the Treatment Manager.
5. Whenever possible, plan aerial ferrying and turnaround routes to avoid flights over congested areas, water bodies, and other sensitive areas that are not to be treated.

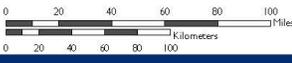
Appendix B - Map of the Affected Environment



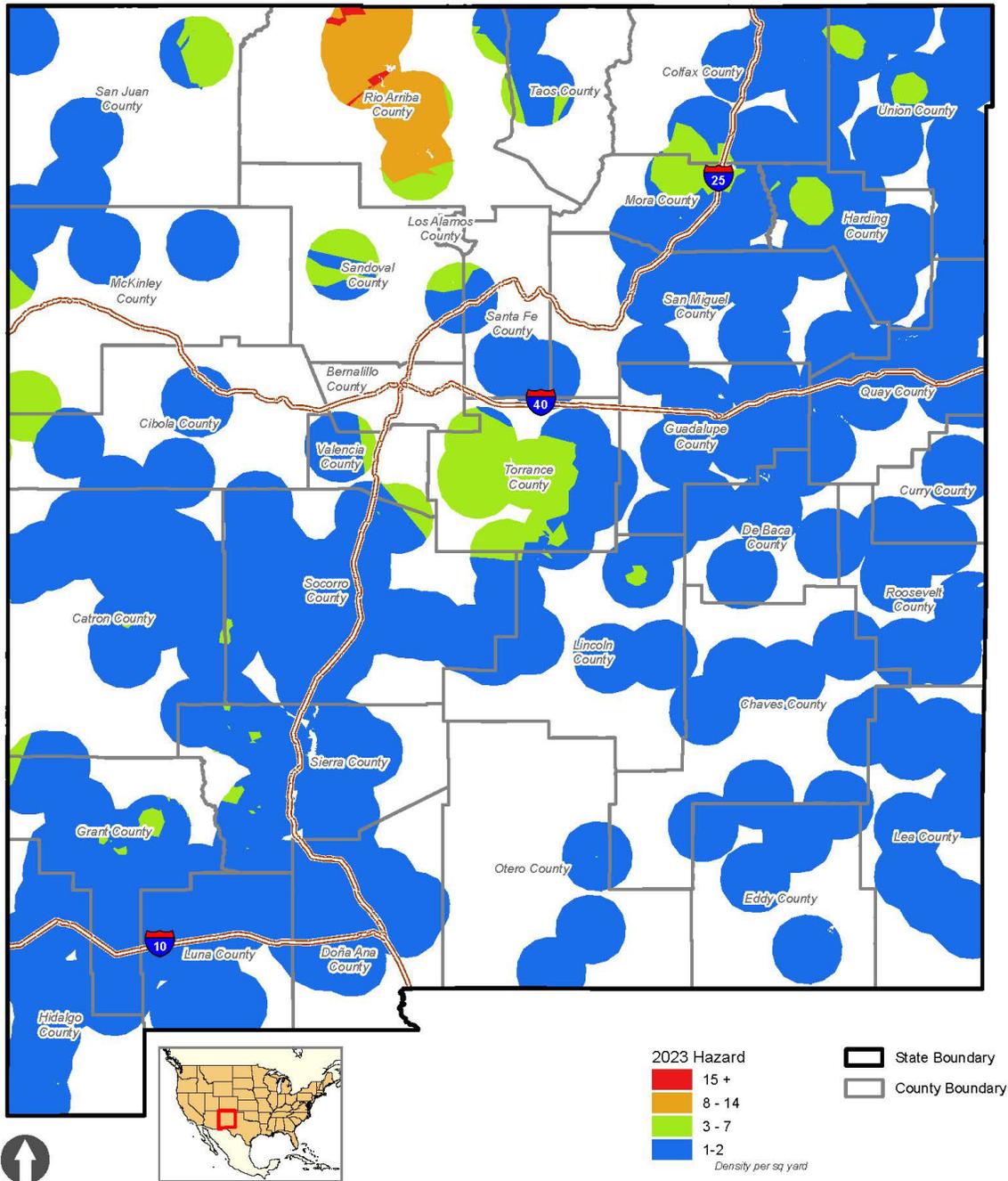


Data Source: USDA, APHIS, PPO, FO
Date Created: August 26, 2022

USDA, APHIS, PPO
270 South 17th St.
Las Cruces, NM 88005

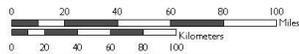


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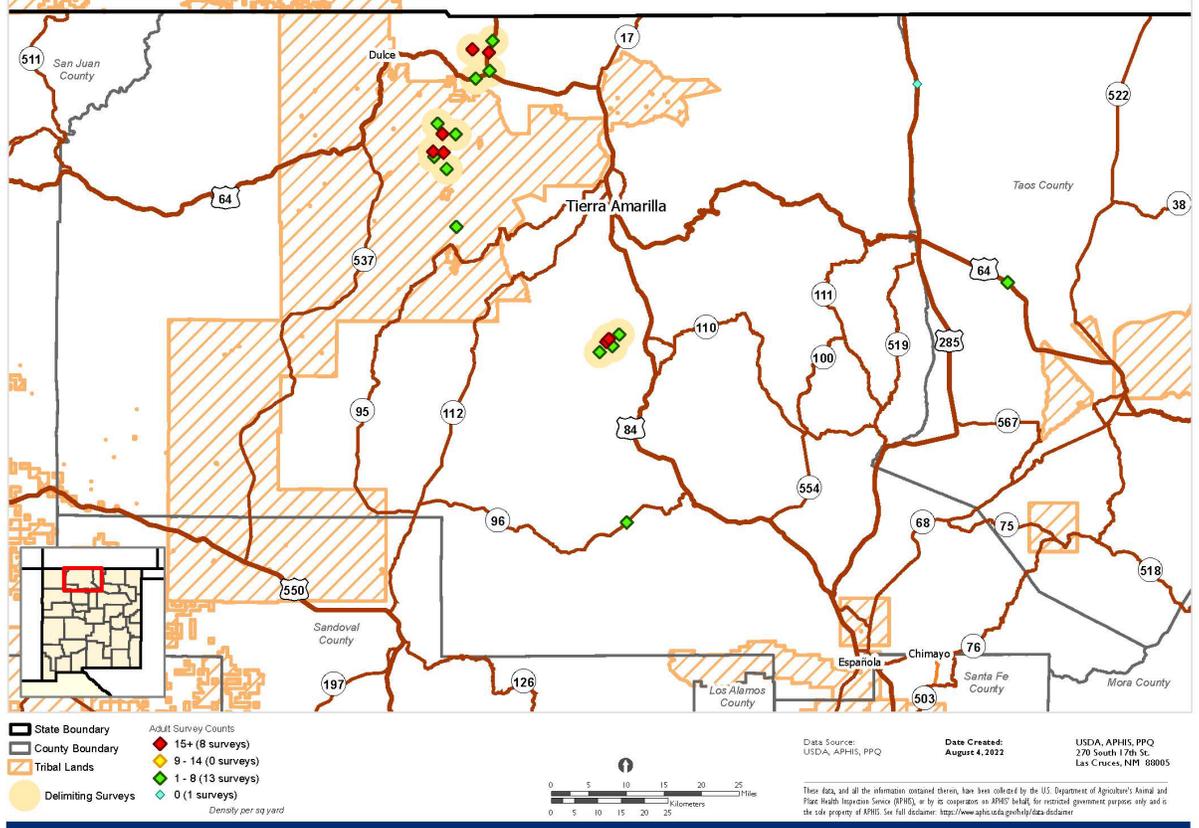


Date Create:
December 1, 2022
Data Source:
USDA, APHIS, PPQ, FO

USDA, APHIS, PPQ
270 South 17th St.
Las Cruces, NM 88005



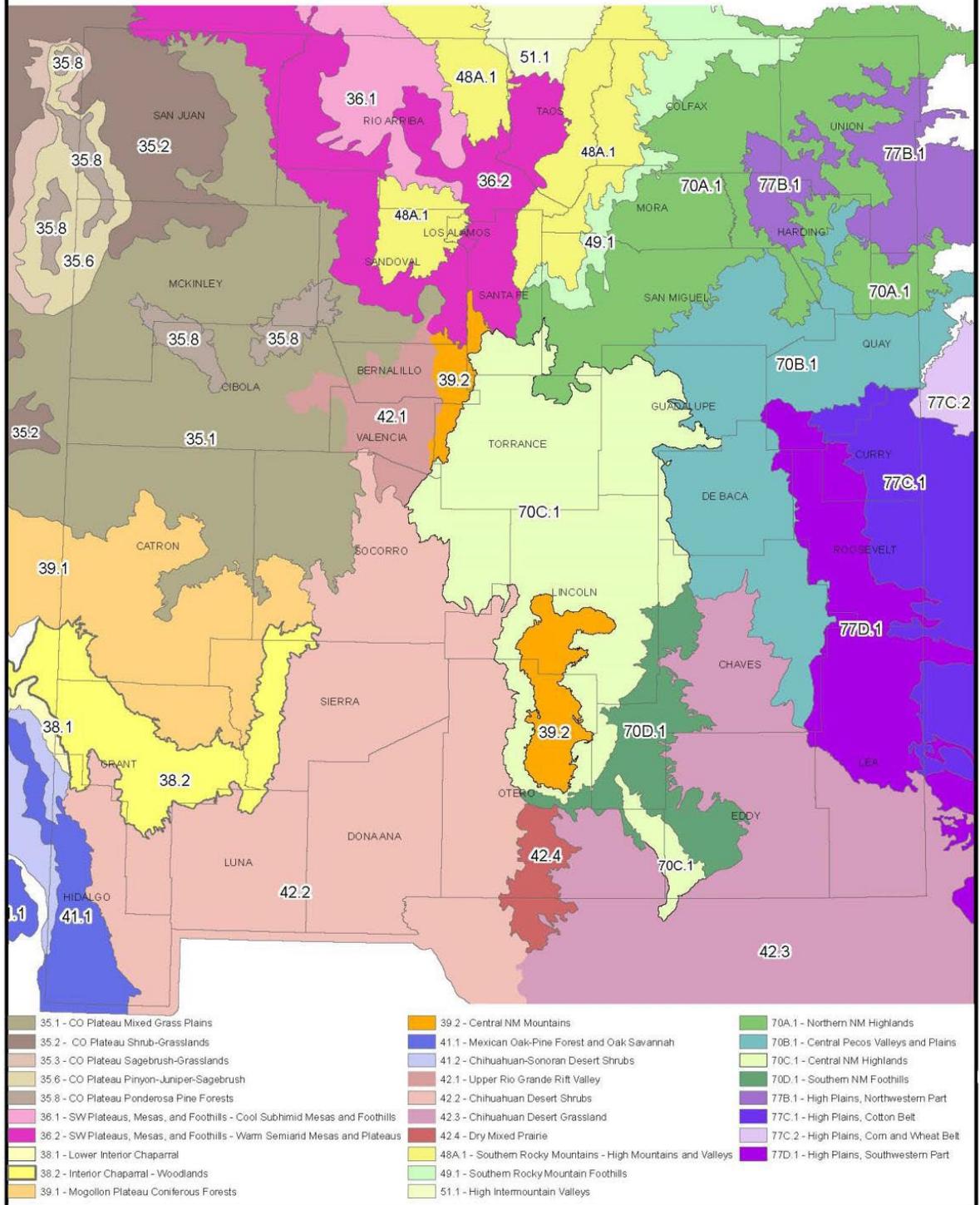
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New Mexico Common Resource Areas

Resource Inventories and Assessments
KKM, 1/15/13
e/map_templates/MXD/cra.mxd



Appendix C: FWS/NMFS Correspondence

- 1) 2005 Lincoln County B.A; FWS Consultation # 2-22-05-I-0460
- 2) 2006 New Mexico B.A; FWS Consultation # 22420-2006-I-0069
- 3) 2007 New Mexico B.A, FWS Consultation #22420-2006-I-0069a
- 4) 2008 New Mexico B.A, FWS Consultation #22420-2008-I-0062
- 5) 2009 New Mexico B.A, FWS Consultation #22420-2009-TA-0027
- 6) 2010 – 2015 New Mexico B.A, FWS Consultation #22420-2010-I-0047
- 7) 2015 – 2020 New Mexico B.A. FWS Consultation - #02ENNM00-2015-I-0244
- 8) 2023 New Mexico B.A FWS Consultation, pending

Appendix D: State and Tribal Species of Concern Review

- 1) Navajo Nation, Division of Natural Resources: Endangered Species List (Resource Committee Resolution No. RCS-41-08), September 10, 2008.
https://www.nndfw.org/nnhp/nnhp_nesl.pdf
- 2) New Mexico Energy, Minerals & Natural Resources Department, Forestry and Resource Conservation Division, Title 19, Chapter 21 Part 2.9 Endangered Plants Species List. August 31, 1995.
- 3) New Mexico Department of Game and Fish: Conservation Services Division; Threatened and Endangered Fishes of New Mexico by David L. Propst, 1999.
- 4) New Mexico Department of Game and Fish: Conservation Services Division: New Mexico Species of Concern – Status and Distribution. April 2003
<http://www.wildlife.state.nm.us/conservation/>
- 5) New Mexico Rare Plant Technical Council: New Mexico Rare Plants; home page, <http://nmrareplants.unm.edu> (last update: 09-04-2009)

Appendix E: APHIS response to public comments on the New Mexico draft EA (EA Number: NM-23-01)