

▶ **CMR Community Working Group**

▶ Improving Grasshopper Management through Collaborative Problem-Solving

▶ **10/22/20**

▶ **Gary D. Adams**  
**State Plant Health Director**  
**(406) 657-6282**

**[Gary.D.Adams@usda.gov](mailto:Gary.D.Adams@usda.gov)**



United States Department of Agriculture  
Animal and Plant Health Inspection Service  
Plant Protection and Quarantine



# Plant Protection and Quarantine



# USDA, APHIS

**VS:** Veterinary Services

**WS:** Wildlife Services

**AC:** Animal Care

**IES:** Investigative & Enforcement Services

**BRS:** Biotechnology Regulatory Services

**PPQ:** Plant Protection and Quarantine

# **PPQ Mission**

**Safeguard Agriculture & Natural Resources**

**Ensure High Quality, Abundant & Varied Food Supply**

**Strengthen Marketability of U.S. Agriculture**

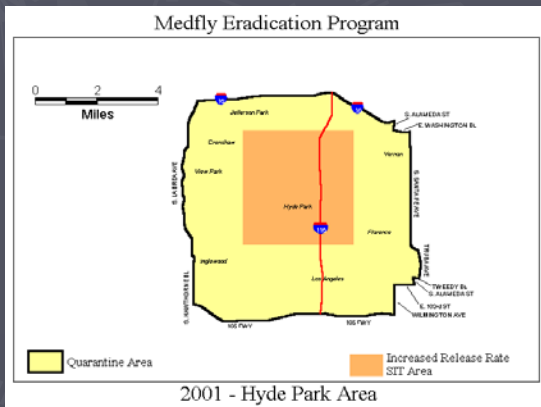
**Contribute to Preservation of Global Environment**



# Domestic Programs

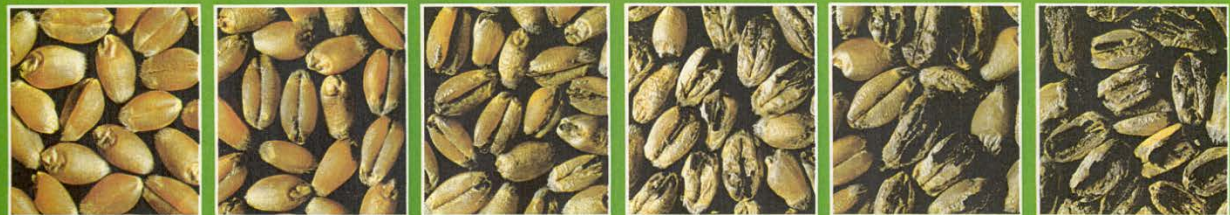


- ▶ Exotic Pest Surveys
- ▶ Biological Control
  - Weeds
  - Insects
- ▶ Gypsy Moth
- ▶ Japanese Beetle
- ▶ Biotechnology
- ▶ Export Certification
- ▶ Grasshopper & Mormon Cricket



## Karnal Bunt

(*Neovossia indica*, syn. *Tilletia indica*)



Healthy seed showing no infection.

Point or trace infection at the embryo end.

10% infection; slight disease progress along crease.

30% infection; disease has progressed about 1/3 along crease.

50% infection; disease has progressed about 1/2 along crease.

100% infection; endosperm totally replaced

# Grasshopper and Mormon Cricket

- ▶ Survey
- ▶ Technical Assistance



- ▶ **Suppression Programs**
  - **Border Protection treatments**
  - **Rangeland Protection treatments**
    - **Cost Share**
    - **RAATs**





# Authority: Plant Protection Act

[https://www.aphis.usda.gov/aphis/ourfocus/plant-health/plant-pest-and-disease-programs/pests-and-diseases/grasshopper-mormon-cricket/ct\\_grasshopper\\_mormon\\_cricket](https://www.aphis.usda.gov/aphis/ourfocus/plant-health/plant-pest-and-disease-programs/pests-and-diseases/grasshopper-mormon-cricket/ct_grasshopper_mormon_cricket)



Western Rangeland is a valuable resource for livestock and provides an important habitat for wildlife

Populations can reach outbreak levels

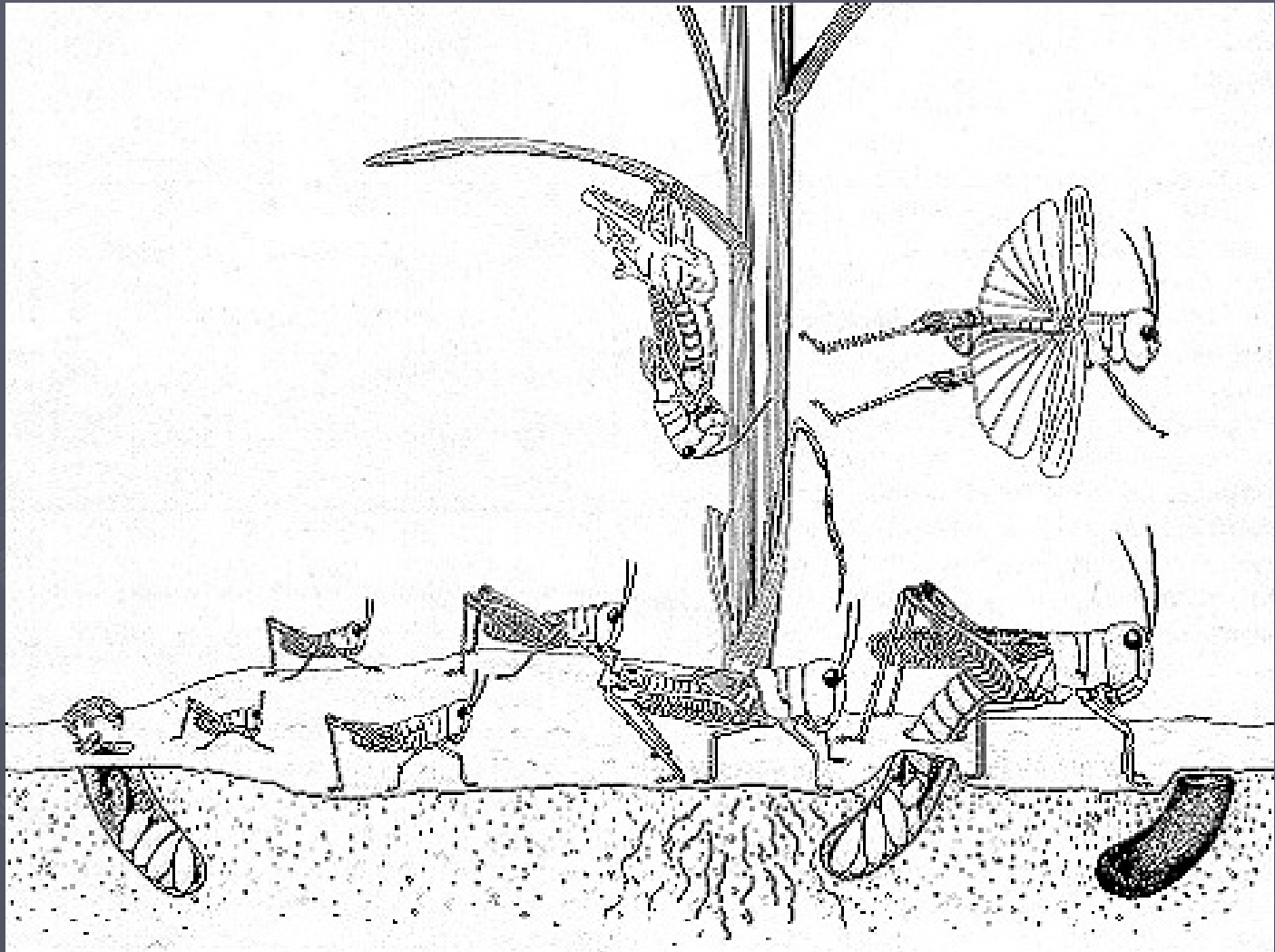
Federal land management agencies, Native American tribes, State agriculture departments, county and local governments, private groups, and/ or individuals can request assistance from the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) to suppress rangeland grasshopper populations.



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# Life cycle





# Clearwinged grasshopper



1



2

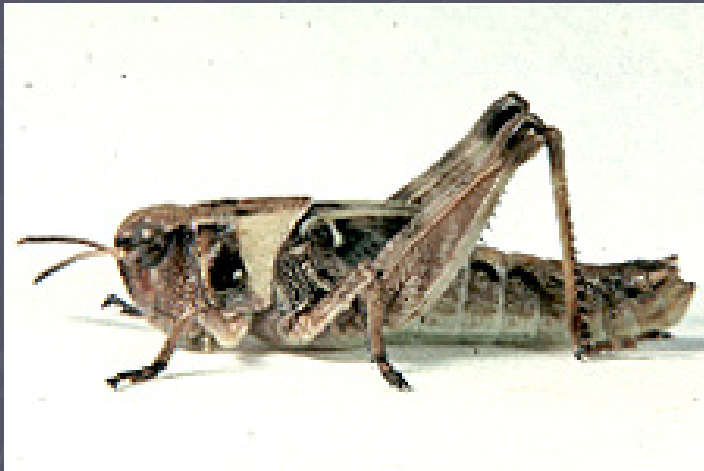


3



4

Nymphal development: 26-40 days (~1 wk/instar)



5



Adult

# # Species

- ▶ There are more than **400 known species** of grasshoppers in the Western United States, only about **two dozen** are considered pest species capable of producing economic damage.
- ▶ A few species are actually beneficial because they eat undesirable plants.

# Common Montana Species

<i>Aeoloplides turnbulli</i> (Thomas)	Russianthistle grasshopper	<i>Melanoplus borealis</i> (Fieber)	Northern grasshopper
<i>Aeropedellus clavatus</i> (Thomas)	Clubhorned grasshopper	<i>Melanoplus bowditchi</i> Scudder	Sagebrush grasshopper
<i>Ageneotettix deorum</i> (Scudder)	Whitewiskered grasshopper	<i>Melanoplus bruneri</i> Scudder	Bruner spurthroated grasshopper
<i>Amphitornus coloradus</i> (Thomas)	Striped grasshopper	<i>Melanoplus confusus</i> Scudder	Pasture grasshopper
<i>Anabrus simplex</i> Haldeman	Mormon cricket	<i>Melanoplus dawsoni</i> (Scudder)	Dawson grasshopper
<i>Arphia conspersa</i> Scudder	Specklewinged grasshopper	<i>Melanoplus devastator</i> Scudder	Devastating grasshopper
<i>Arphia pseudonietana</i> (Thomas)	Redwinged grasshopper	<i>Melanoplus differentialis</i> (Thomas)	Differential grasshopper
<i>Aulocara ellioti</i> (Thomas)	Bigheaded grasshopper	<i>Melanoplus femurrubrum</i> (DeGeer)	Redlegged grasshopper
<i>Aulocara femoratum</i> Scudder	Whitexcrossed grasshopper	<i>Melanoplus gladstoni</i> Scudder	Gladston grasshopper
<i>Boopedon nubilum</i> (Say)	Ebony grasshopper	<i>Melanoplus infantilis</i> Scudder	Little spurthroated grasshopper
<i>Brachystola magna</i> (Girard)	Plains lubber grasshopper	<i>Melanoplus keeleri</i> (Thomas)	Keeler grasshopper
<i>Bruneria brunnea</i> (Thomas)	Bruner slantfaced grasshopper	<i>Melanoplus lakinus</i> (Scudder)	Lakin grasshopper
<i>Camnula pellucida</i> (Scudder)	Clearwinged grasshopper	<i>Melanoplus occidentalis</i> (Thomas)	Flabellate grasshopper
<i>Chorthippus curtipennis</i> (Harris)	Meadow grasshopper	<i>Melanoplus packardii</i> Scudder	Packard grasshopper
<i>Chortophaga viridifasciata</i> (DeGeer)	Greenstriped grasshopper	<i>Melanoplus rugglesi</i> Gurney	Nevada sage grasshopper
<i>Cordillacris crenulata</i> (Bruner)	Crenulatewinged grasshopper	<i>Melanoplus sanguinipes</i> (Fabricius)	Migratory grasshopper
<i>Cordillacris occipitalis</i> (Thomas)	Spottedwinged grasshopper	<i>Mermiria bivittata</i> (Serville)	Two-striped slantfaced grasshopper
<i>Derotmema haydeni</i> (Thomas)	Hayden grasshopper	<i>Metator pardalinus</i> (Saussure)	Bluelegged grasshopper
<i>Dissosteira carolina</i> (Linnaeus)	Carolina grasshopper	<i>Oedaleonotus enigma</i> (Scudder)	Valley grasshopper
<i>Dissosteira longipennis</i> (Thomas)	High Plains grasshopper	<i>Opeia obscura</i> (Thomas)	Obscure grasshopper
<i>Encoptolophus costalis</i> (Scudder)	Dusky grasshopper	<i>Orphulella speciosa</i> (Scudder)	Slantfaced pasture grasshopper
<i>Eritettix simplex</i> (Scudder)	Velvetstriped grasshopper	<i>Phlibostroma quadrimaculatum</i> (Thomas)	Fourspotted grasshopper
<i>Hadrotettix trifasciatus</i> (Say)	Threebanded grasshopper	<i>Phoetaliotes nebrascensis</i> (Thomas)	Largeheaded grasshopper
<i>Hesperotettix viridis</i> (Thomas)	Snakeweed grasshopper	<i>Psoloessa delicatula</i> (Scudder)	Brownspotted grasshopper
<i>Hypochlora alba</i> (Dodge)	Cudweed grasshopper	<i>Spharagemon collare</i> (Scudder)	Mottled sand grasshopper
<i>Melanoplus alpinus</i> Scudder	Alpine grasshopper	<i>Spharagemon equale</i> (Say)	Orangelegged grasshopper
<i>Melanoplus angustipennis</i> (Dodge)	Narrowwinged sand grasshopper	<i>Trachyrhachys kiowa</i> (Thomas)	Kiowa grasshopper
<i>Melanoplus bivittatus</i> (Say)	Two-striped grasshopper	<i>Xanthippus corallipes</i> (Haldeman)	Redshanked grasshopper



# Significant Montana Species

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**Aulocara ellioti** (Thomas)

**Camnula pellucida** (Scudder)

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Bigheaded grasshopper

Clearwinged grasshopper

Twostriped grasshopper

Dawson grasshopper

Redlegged grasshopper

Little spurthroated grasshopper

Migratory grasshopper

Obscure grasshopper

Fourspotted grasshopper

Largeheaded grasshopper

Kiowa grasshopper

Mormon cricket

Adults  
*Melanoplus sanguinipes*  
Migratory Grasshopper

Male  
20-26 mm

Female  
20-29 mm



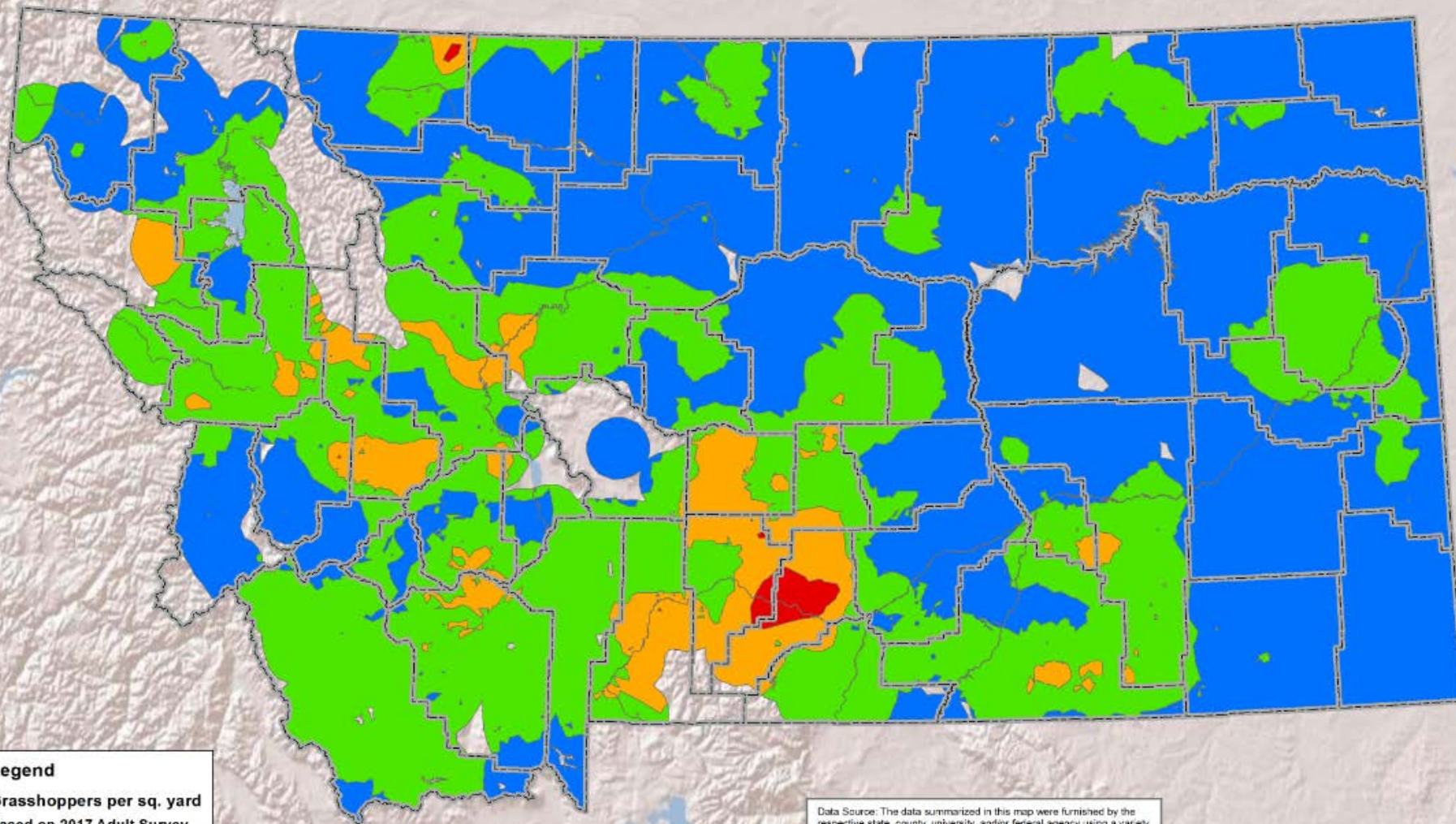


# Surveys

- ▶ **Nymphal surveys**
- ▶ **Delimitation**
- ▶ **Pre Treatment**
- ▶ **Post Treatment**
- ▶ **Adult**

Species	May			June			July			Aug.			Sept.			Oct.		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
<i>Ageneotettix deorum</i>		Yellow	Yellow	Yellow	Yellow	Yellow	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple
<i>Aulocara ellioti</i>		Yellow	Yellow	Yellow	Yellow	Teal	Teal	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple
<i>Camnula pellucida</i>		Yellow	Yellow	Yellow	Yellow	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Dark	Dark	Dark
<i>Melanoplus infantilis</i>		Dark	Yellow	Yellow	Yellow	Dark	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Dark	Dark	Dark	Dark
<i>Trachyrhachys kiowa</i>		Dark	Dark	Yellow	Yellow	Yellow	Teal	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple
<i>Melanoplus dawsoni</i>		Dark	Dark	Dark	Yellow	Yellow	Yellow	Dark	Purple	Purple	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark
<i>Phoetaliotes nebrasciensis</i>		Dark	Dark	Dark	Dark	Yellow	Yellow	Yellow	Teal	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple	Purple
<i>Arphia conspersa</i>		Purple	Purple	Purple	Purple	Purple	Purple	Purple	Dark	Dark	Yellow	Yellow	Yellow	Yellow	Dark	Dark	Dark	Dark

# Montana 2018 Rangeland Grasshopper Hazard



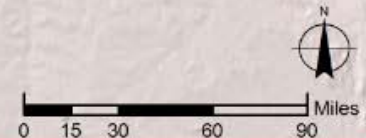
### Legend

#### Grasshoppers per sq. yard Based on 2017 Adult Survey

	0 - <3	48.2 million acres
	3 - <8	32.3 million acres
	8 - <15	5.4 million acres
	15+	378,811 acres

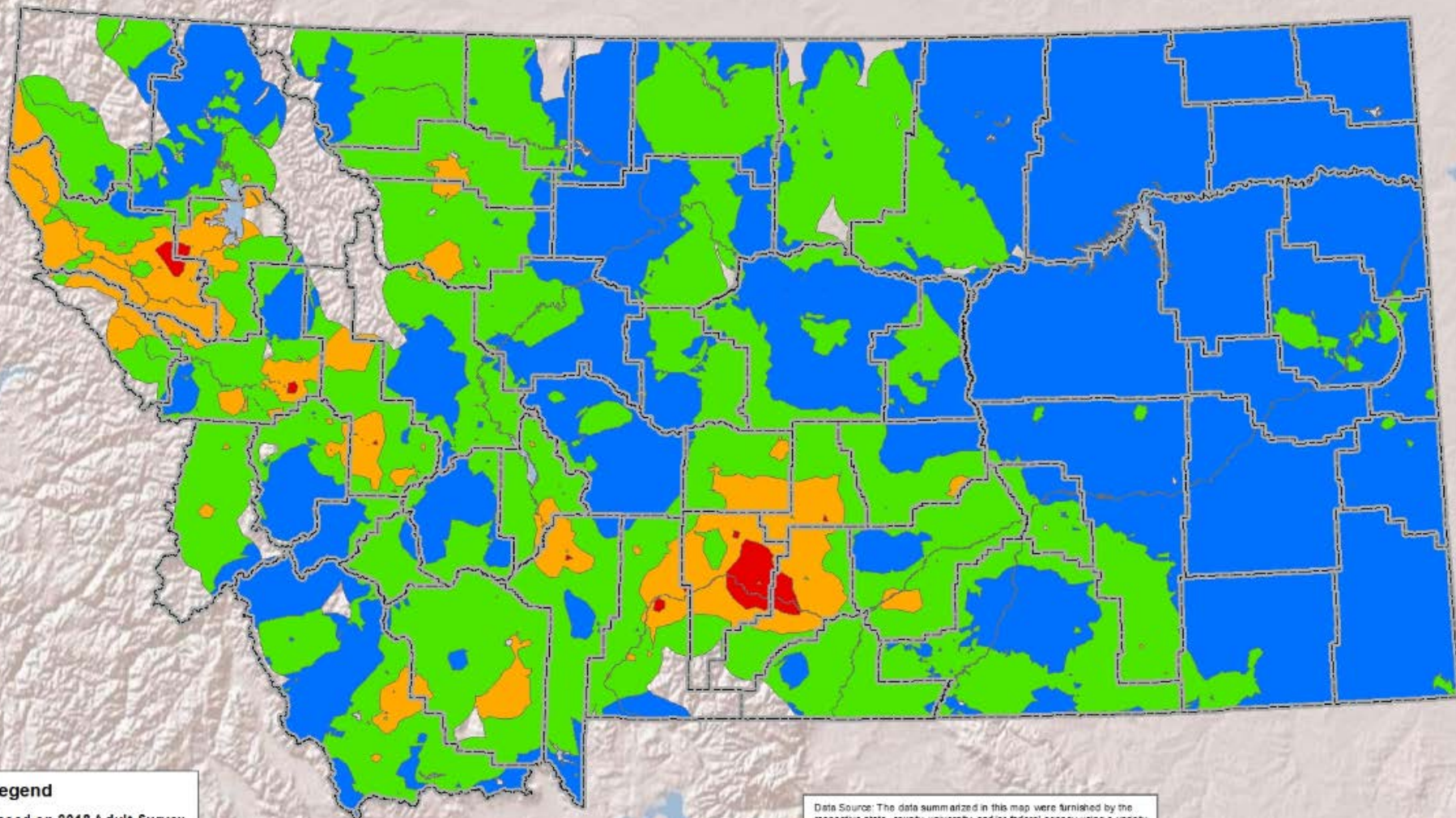
**Data Source:** The data summarized in this map were furnished by the respective state, county, university, and/or federal agency using a variety of survey methods and analytical techniques. Due to funding considerations, states may not have continuous survey coverage. This map was prepared by USDA/APHIS PPQ in cooperation with CPHST.

**Preparation Notes:** Adult and treatment survey densities of adult specimens were interpolated to a maximum buffer distance using an empirical Bayesian kriging model. Areas were then filtered by major water features to produce final acreage estimates. Acreages are approximated based on rounding to millions of acres.





# Montana 2019 Rangeland Grasshopper Hazard



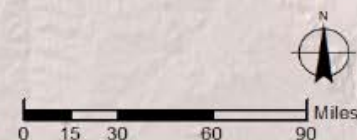
## Legend

### Based on 2018 Adult Survey

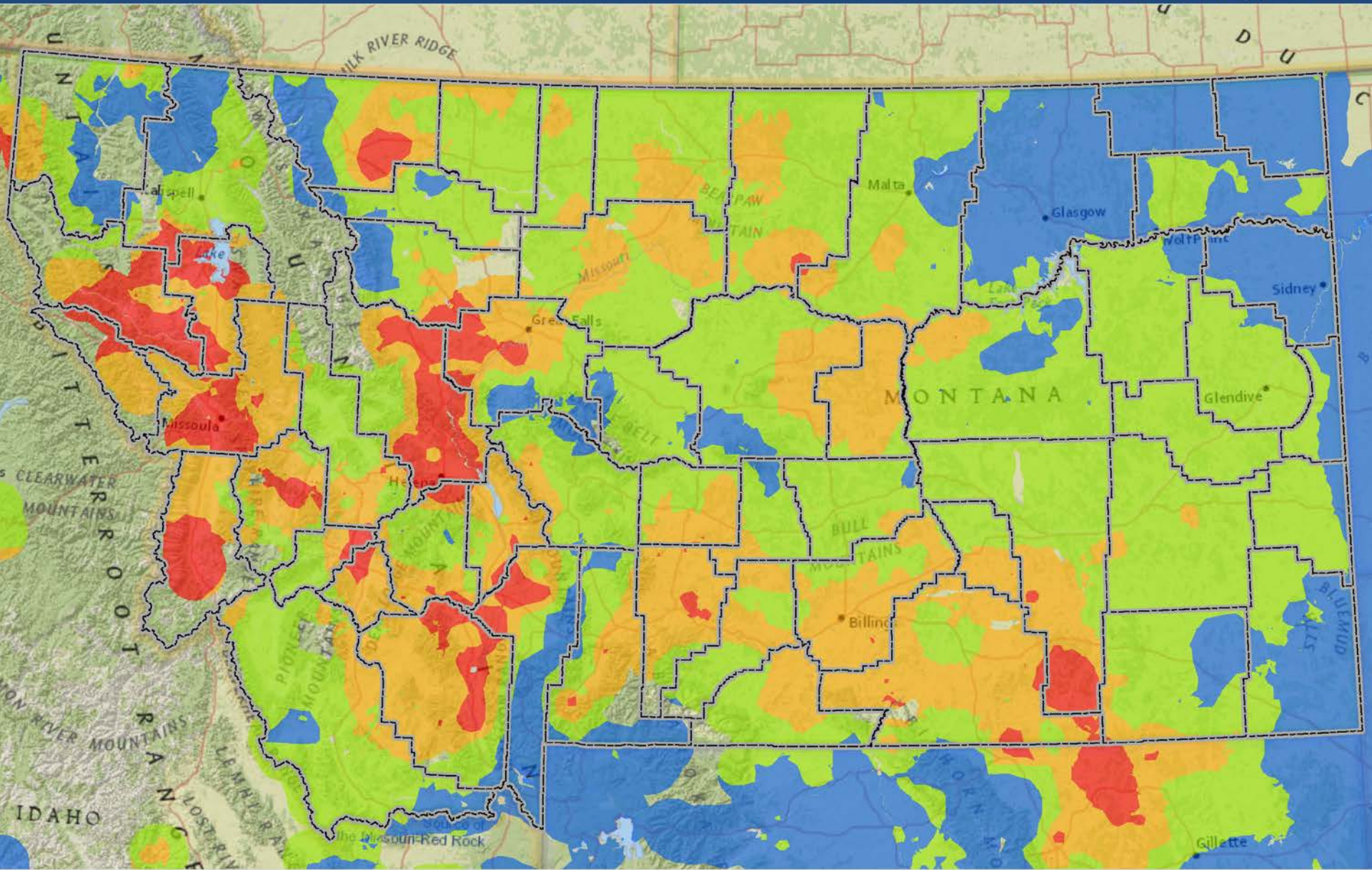
<span style="color: blue;">■</span>	0 - <3	45.5 million acres
<span style="color: green;">■</span>	3 - <8	36.1 million acres
<span style="color: orange;">■</span>	8 - <15	6.0 million acres
<span style="color: red;">■</span>	15+	461,777 acres

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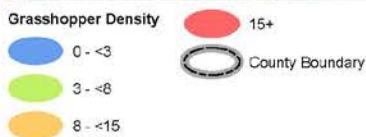
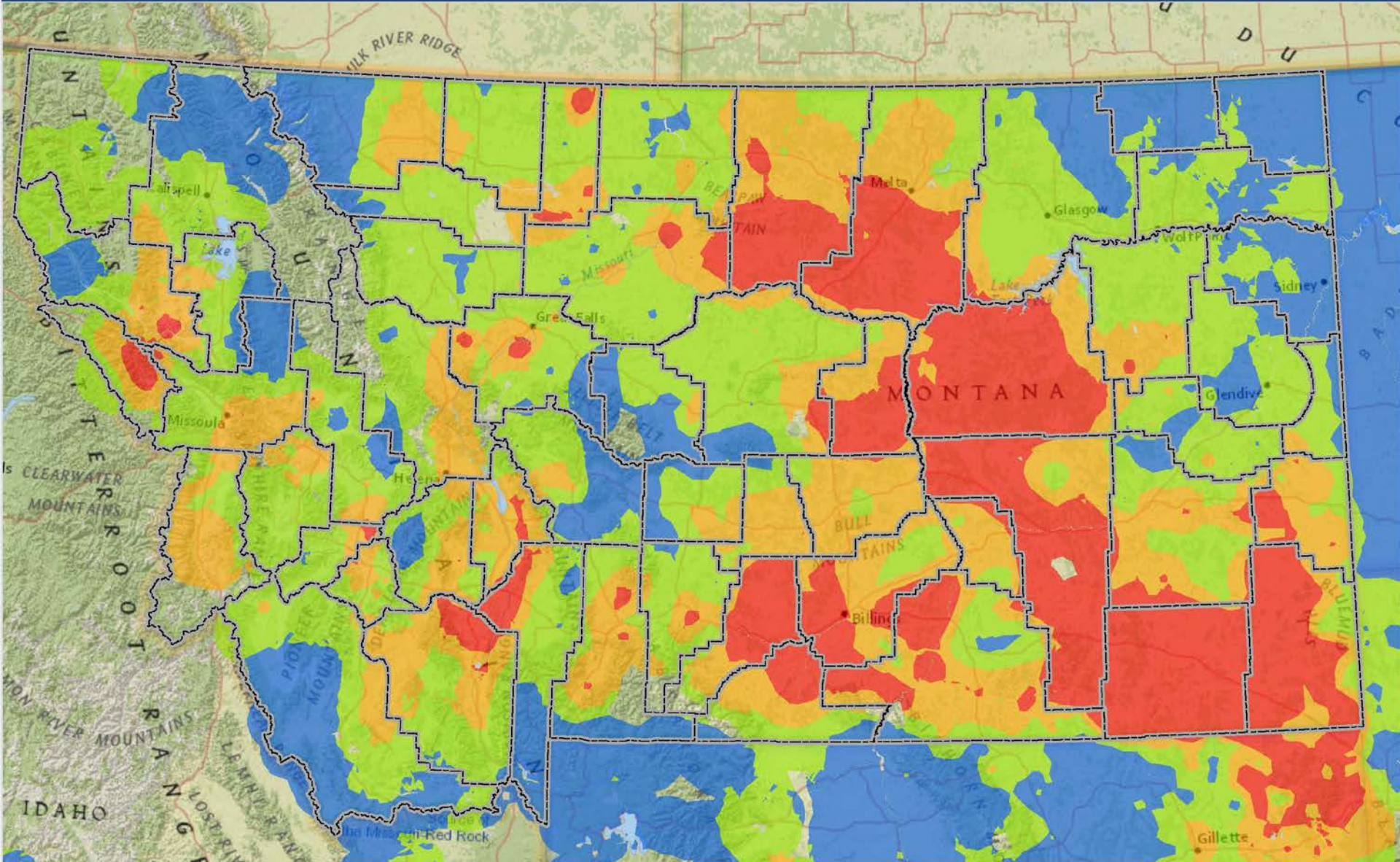




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 Preparation Notes: Adult and treatment survey densities of adult grasshoppers were used to estimate hazard.

Data Source: ESRI, PPQ  
 Date Created: 10/21/2020  
 USDA, APHIS, PPQ  
 5353 Yellowstone Rd. Ste  
 Cheyenne, WY 82009





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**Date Created:** 10/8/2020  
 USDA, APHIS, PPQ  
 5353 Yellowstone Rd. Ste 208  
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These data, and all the information contained therein, have been collected by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), or by its contractors on APHIS' behalf, for restricted purposes. These data are not to be used for any other purpose without the express written permission of APHIS. For full disclosure, see the data availability notice.



# Why?

## ▶ 2019

- Wet spring and summer
- Plenty of vegetation (sweet Clover)
- Late fall

## ▶ 2019-20 Winter

- Very mild

## ▶ 2020

- Every egg made it
- Hot and dry, grasshopper flourished.

# How much do they eat?



A grasshopper can eat about its own weight or destroy up to 6 times its own weight of vegetation daily

# Control Alternatives for PPQ

- ▶ **No Action**
- ▶ **Insecticide Applications at Conventional Rates and Complete Area Alternatives**
- ▶ **Reduced Agent Area Treatments (RAATS) Alternative**

# No Action

- ▶ No Request to take action.
- ▶ Non economic levels of grasshoppers
- ▶ Environmental Factors
- ▶ Threatened or Endangered Species Factors

Suppress  
Populations  
w/  
Insecticides



# Insecticides

▶ **Malathion**

▶ **Carbaryl**

- Liquid
- Bait

▶ **Diflubenzuron: Dimilin**

▶ **Chlorantraniliprole: Preveathon**



# Malathion

- ▶ **Short Residual**

- Days

- ▶ **Mode of Action:**

- ChE inhibitor
- Contact
- Ingestion

- ▶ **Available**

- ▶ **Cost**

# Carbaryl

- ▶ **Residual**

- Week(s)

- ▶ **Mode of Action:**

- ChE inhibitor
- Ingestion
- Contact

5% Carbaryl bran bait

- ▶ **Available**

- ▶ **Liquid and bait formulations**

# DiFlubenzuron (Dimilin)

- ▶ **Long Residual**
- ▶ **Mode of Action:**
  - Chitin inhibitor
  - Ingestion
- ▶ **Arthropod specific**
- ▶ **Must be used before adult stage**



# Chlorantraniliprole (Preveathon)

- ▶ Long Residual
- ▶ Mode of Action: *Anthranilic diamide*
  - Inhibits feeding
- ▶ Pros:
  - Safety (No caution word)
  - Ingestion and contact
  - Works on nymphs and adults
- ▶ Cons:
  - Unfamiliar (added to 2019 EIS)
  - Cost is unknown
  - Availability unknown

# Insecticide Applications at Conventional Rates and Complete Area Alternatives

## ▶ Malathion:

- 8 fl oz (0.62 lb a.i.)/acre

## ▶ Carbaryl:

- Liquid: 16 fl oz (0.5 a.i.)/acre
- Bait: 10 lbs (0.50 lb a.i.) 5% bait/acre

## ▶ Diflubenzuron

- Dimilin: 1 fl oz (0.016 lb a.i.)/acre

# 1980's Treatment strategies

- Very large areas
- Large planes
- Blanket treatments
- Malathion was chemical of choice
- Less environmental concerns





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# 2000's Treatment strategies

- New EIS - 2002
- More environmentally sound
- NEPA regulations
- Smaller planes
- Better pesticide choices
- RAATs





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# Reduced Agent and Area Treatments (RAATs)

- Basically skip swathing
- GH mortality in treated swaths
- GHs move from non-treated to treated swaths
- More predacious insects and parasitoids survive
- Birds and predators continue naturally feeding on GHs

# Conventional/Blanket/100%

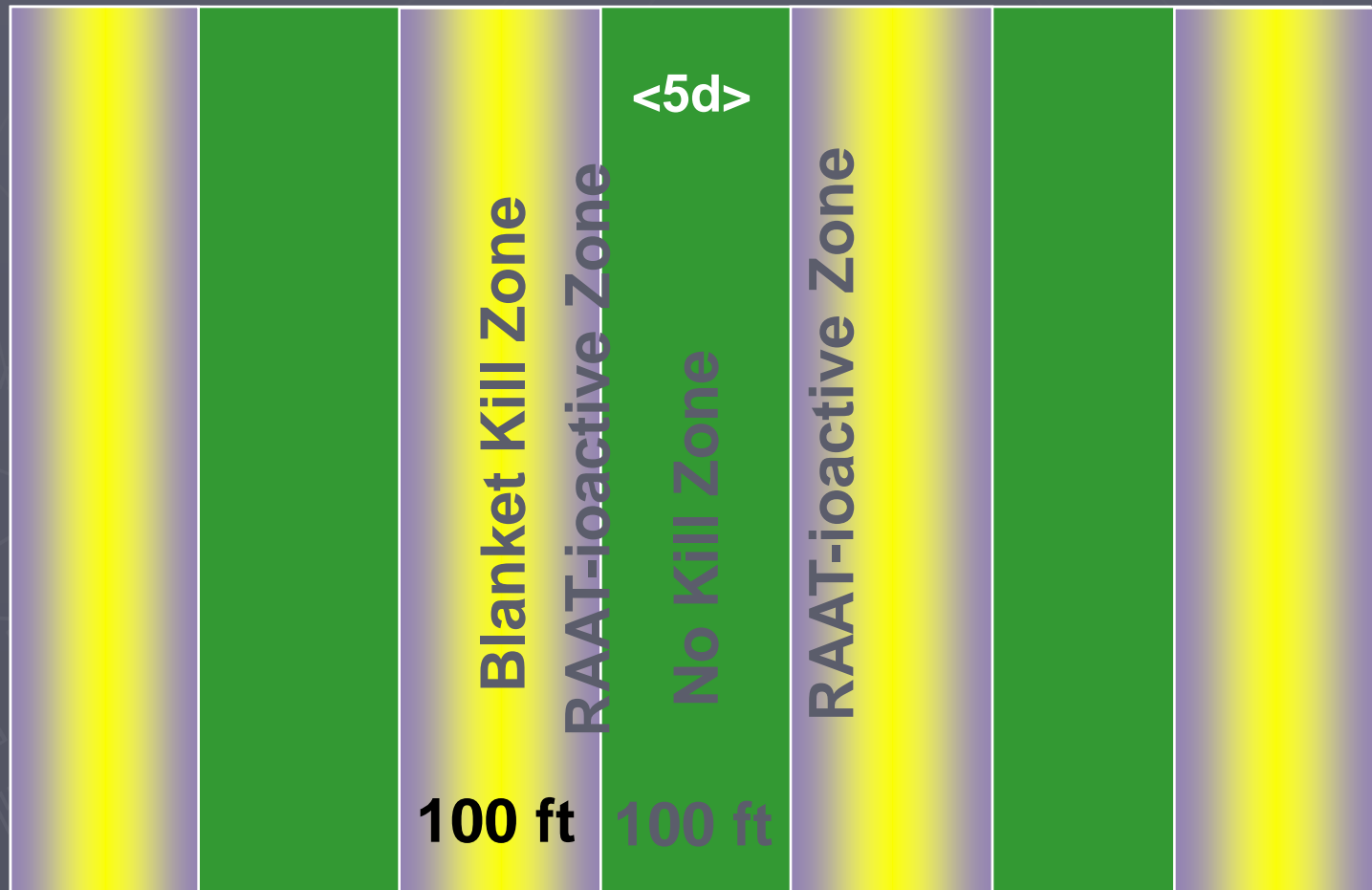


**RAATs**



# Aerial RAATs – 50% Coverage

Average daily grasshopper movement is approximately 10 feet.





# Reduced Agent and Area Treatments (RAATs)

- Skip distance greatly depends on the chemical used
- Low residual = less skip
- Longer residual = wider skip (within limitations)

# Reduced Agent Area Treatments (RAATS) Alternative

## ▶ Malathion:

- 4 fl oz (0.31 lb a.i.)/acre

## ▶ Carbaryl:

- Liquid: 8 fl oz (0.25 lb a.i.)/acre
- Bait: 10 lbs (0.50 lb a.i.) 2% bait/acre

## ▶ Diflubenzuron

- Dimilin: 0.75 fl oz (0.012 lb a.i.)/acre

# Reduced Agent Area Treatments (RAATS) Alternative

- ▶ Not standardized:
  - Determined on a case by case basis
- ▶ Aerial
  - Malathion: 80% coverage
  - Carbaryl: 50% coverage
  - Dimilin: 50% coverage



20 % coverage with ground applications.



# Bran Spreaders: ATV



# Bran Spreaders: Pickup





# Match Bran to Spreader





# Bran formulations



# Mormon crickets





# Bran Acceptance

Species Sensitive

(>55% control)

- ▶ Control is expected to average about 70%
- ▶ Worst-case and best-case scenarios will be about 55% and 85%, respectively

- *Melanoplus foedus*
- *Melanoplus infantilis*\*
- *Melanoplus occidentalis*\*
- *Melanoplus packardii*\*
- *Melanoplus sanguinipes*
- *Spharagemon equale*
- *Stenobothrus brunneus*
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- *Melanoplus confuses*
- *Melanoplus dawsoni*

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

# USDA, APHIS, PPQ Program

- ▶ Surveys
- ▶ Technical Assistance
- ▶ Treatment Programs



# Technical Assistance

- ▶ Presentations
- ▶ Meetings
- ▶ Field assistance

# Treatment Programs

- ▶ Plant Protection Act of 2000.
  - Border Treatments
  - Rangeland Treatments

# Border Treatments

- ▶ Federally-Administered Land Adjacent to Private Agricultural Land
- ▶ GH/MCs moving Fed → Private
- ▶ Written Request from Federal Land Manger
- ▶ PPQ treat  $\frac{1}{4}$  to  $\frac{1}{2}$  mile buffer
  - Aerial Contractor
  - PPQ Ground
- ▶ Contingent on Availability of Funds

# Rangeland Treatments

- ▶ **10,000 Acres Minimum**
- ▶ **Rangeland only**
  - 20% cropland (paid by landowner)
- ▶ **PPQ Cost Share**
  - 100% Federal/Trust land.
  - 50% State land.
  - 33% Private land.
    - ▶ 16.15% indirect charges.



# Endangered Species Act ESA

- ▶ USFWS: Section 7 Consultations
- ▶ Mitigation Measures
  - Buffers
  - Treatment Alternatives

# Montana Sage Grouse Habitat Conservation Program (Petroleum County 2020)

## ► Discussion:

- Exempt activities are identified in Executive Order 12-2015 (EO), as described in Attachment F. The exemptions include herbicide and pesticide use including Grasshopper and Mormon cricket control following reduced agent-Area Treatments (RAATS) protocol. Therefore, this activity is exempt per the EO.

# National Environmental Policy Act (NEPA)

- ▶ Final Environmental Impact Statement (FEIS) – 2019.
- ▶ Site Specific Environmental Assessments (EAs)
- ▶ Finding of No Significant Impact (FONSI)

# Rangeland Treatments

- ▶ Letter(s) of Request from all parties
- ▶ Cooperative Agreement(s) Signed
- ▶ Estimated Funds in Secured Account
- ▶ Planning early
  
- ▶ PPQ will contract with aerial applicator
  - (1-3 weeks)



# Environmental Monitoring

- ▶ Sensitive Sites
- ▶ Water
- ▶ Vegetation
- ▶ Quality Control

# PPQ vs Do it yourself

- ▶ PPQ contracting
- ▶ Local applicators?
- ▶ NEPA/ESA requirements

# Summary

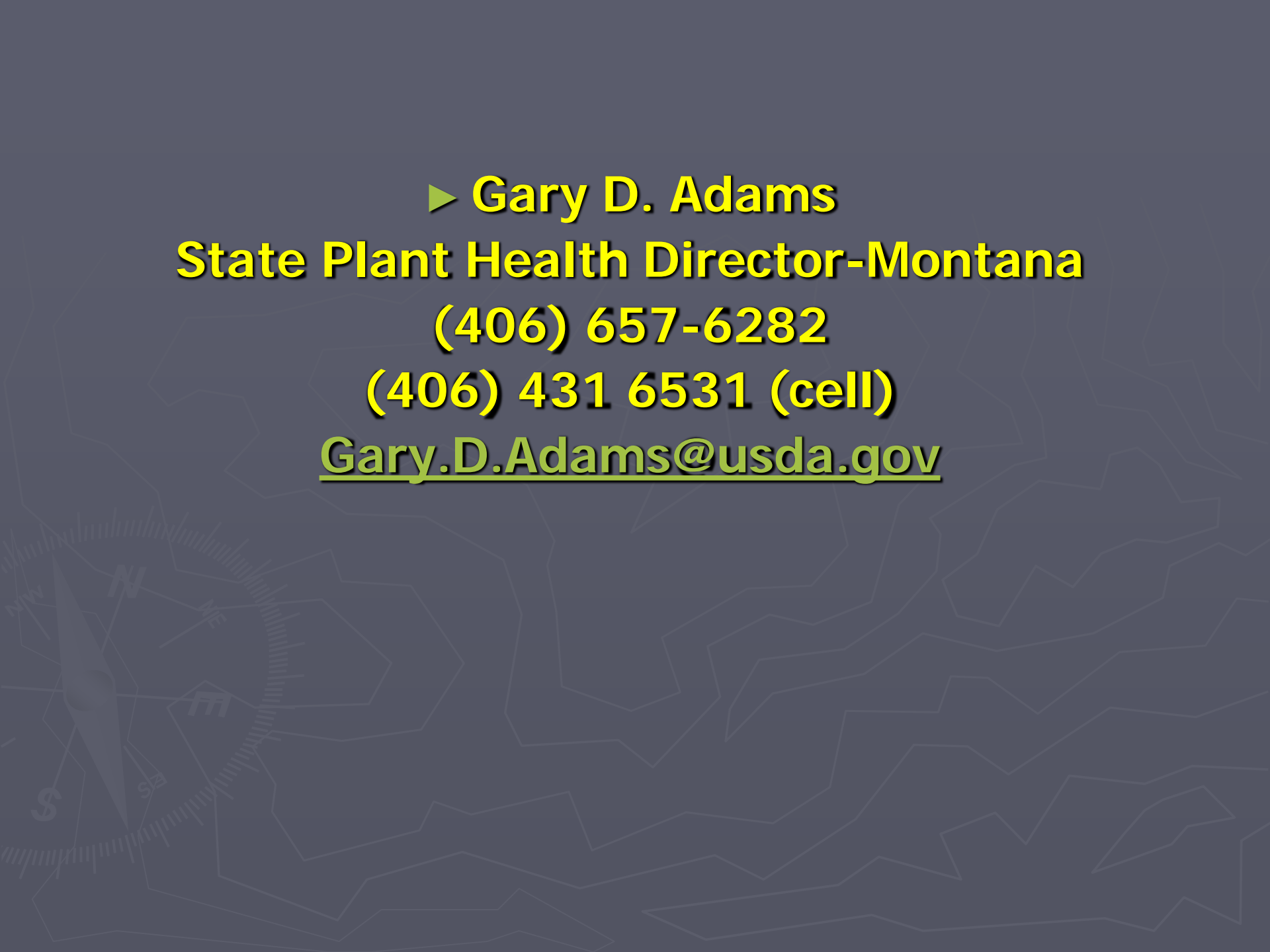
- ▶ Plan now
- ▶ Survey Early
- ▶ Weigh your alternatives
- ▶ Don't wait until.....

Going



**Going**

**Gone**

The background of the slide is a dark blue-grey color. It features a faint, light-colored map of the state of Montana. In the lower-left corner, there is a faint compass rose with a needle pointing towards the top-left. The text is centered and rendered in a bold, yellow font with a black drop shadow.

► **Gary D. Adams**  
**State Plant Health Director-Montana**  
**(406) 657-6282**  
**(406) 431 6531 (cell)**  
**[Gary.D.Adams@usda.gov](mailto:Gary.D.Adams@usda.gov)**