Rosebud/Treasure Counties
04/19/21

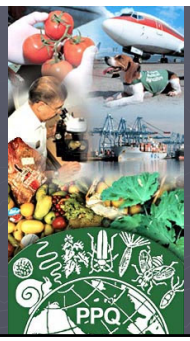
USDA, APHIS, PPQ
Rangeland Grasshopper Suppression Program, 2021.

Gary D. Adams
State Plant Health Director
(406) 657-6282
Gary.D.Adams@usda.gov

1

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

Plant Protection and Quarantine



2

USDA, APHIS

VS: Veterinary Services
WS: Wildlife Services
AC: Animal Care
IES: Investigative & Enforcement Services
BRS: Biotechnology Regulatory Services
PPQ: Plant Protection and Quarantine

3

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

4

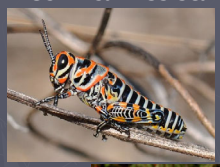
Domestic Programs

- Exotic Pest Surveys
- Quarantine and eradication
- Gypsy Moth/Japanese Beetle
- Biological Control
- Biotechnology
- Grasshopper & Mormon Cricket

5

Grasshopper and Mormon Cricket

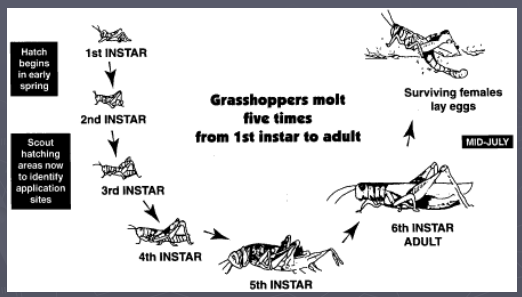
- Survey
- Technical Assistance



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

6

Life cycle



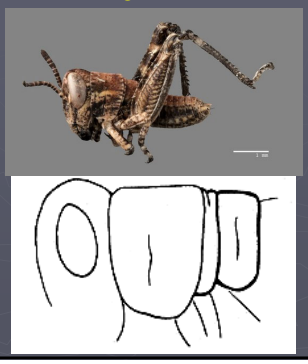
7

Life Stages

- Eggs

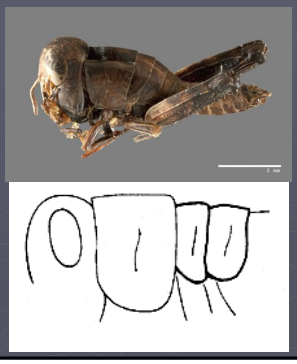
8

1st Instar
4-6 mm



9

2nd Instar
6-8 mm

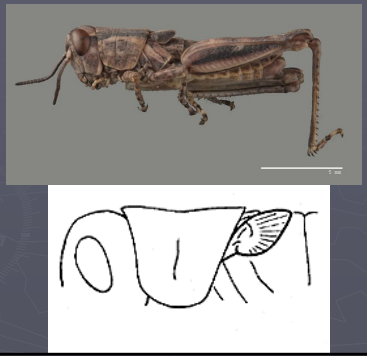


10

3rd Instar
8-11mm (1 cm)

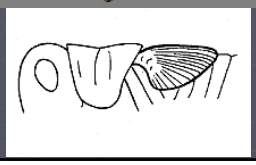
11

4th Instar
11-16 mm



12

5th Instar
16-23 mm



13

Clearwinged grasshopper

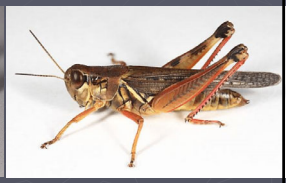
Nymphal development: 26-40 days (~1 wk/instar)

14

Adults
Melanoplus sanguinipes
Migratory Grasshopper

Male
20-26 mm

Female
20-29 mm



15

Melanoplus dawsoni
Dawson Grasshopper

Male
14-19mm

Female
17-22 mm

16

Dissosteira carolina (Linnaeus)
Carolina Grasshopper

Male
29-32 mm

Female
36-39 mm

17

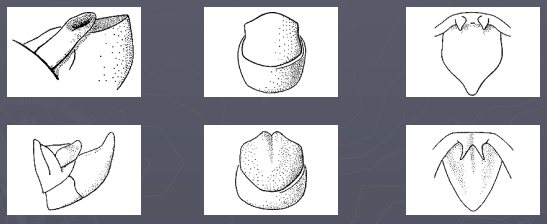
Boopedon nubilum (Say)
Ebony Grasshopper

Male
22-22.5 mm

Female
36-38 mm

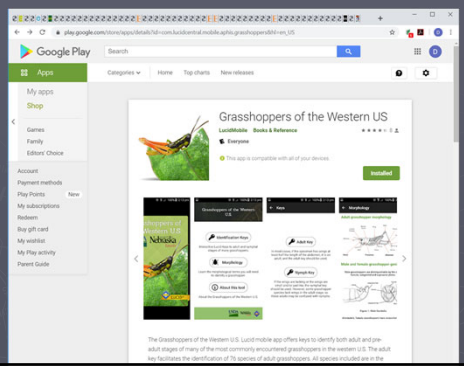
18

Identification



19

Free USDA grasshopper identification app available in iPhone and Android app stores



20

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.

21

Common Montana Species

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

22

Economic Montana Species

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

23

Economic Montana Species

Ageneotettix deorum (Scudder)
Aulocara elliotti (Thomas)
Camnula pellucida (Scudder)
Melanoplus bivittatus (Say)
Melanoplus dawsoni (Scudder)
Melanoplus femurrubrum (DeGeer)
Melanoplus infantilis (Scudder)
Melanoplus sanguinipes (Fabricius)
Opeia obscura (Thomas)
Phlibostroma quadrimaculatum(Thomas)
Phoetaliotes nebrascensis (Thomas)
Trachyrhachys kiowa (Thomas)

Anabrus simplex (Haldeman)

Whitewhiskered grasshopper
Bigheaded grasshopper
Clearwinged grasshopper
Twostriped grasshopper
Dawson grasshopper
Redlegged grasshopper
Little spurthroated grasshopper
Migratory grasshopper
Obscure grasshopper
Fourspotted grasshopper
Largeheaded grasshopper
Kiowa grasshopper

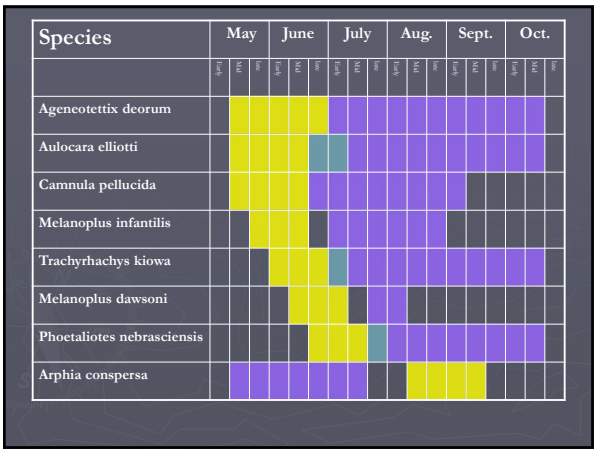
Mormon cricket

24

Surveys

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

25



26

Conducting Surveys

- Visualize a square foot ahead of you on range
- Walk toward imaginary Ft^2
- Count # GHs that jump out
- Repeat 18 times
- Divide total by 2
- Gives total GH/yd^2

27

USDA United States Department of Agriculture

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**

28

Do I treat?

- **Decision Support Software**
  - CARMA http://www.sdvc.uwyo.edu/grasshopper/carma.htm
- **≥ 8 grasshoppers per yd^2**
- **≥ 15 grasshoppers per yd^2**
- **Is there grass to save? (drought)**
- **Should I just buy hay?**
- **Can I wait for mother nature?**

29

- Do I manage by self?
- Do I ask USDA for assistance?
  - Authorized by Plant Protection Act.

30

Control Alternatives for PPQ

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

31

No Action

- Non economic levels of grasshoppers
- Environmental Factors
- Threatened or Endangered Species Factors

32

Insecticides

- Malathion
- Carbaryl
  - Liquid
  - Bait
- Diflubenzuron: Dimilin
- Chlorantraniliprole: Prevathon

33

Malathion

- Short Residual
  - Days
- Mode of Action:
  - ChE inhibitor
  - Contact
  - Ingestion
- Available
- Cost

34

Carbaryl

- Residual
  - Week(s)
- Mode of Action:
  - ChE inhibitor
  - Ingestion
  - Contact
- Available
- Liquid and bait formulations
  - 5% Carbaryl bran bait
  - $1.00-$2.00/pound

35

Diflubenzuron (Dimilin)

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

$200-$300/gallon

36

Chlorantraniliprole (Prevethon)

- **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
  - Not currently labeled

37

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

38

USDA United States Department of Agriculture

1980's Treatment strategies

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

39

USDA United States Department of Agriculture

40

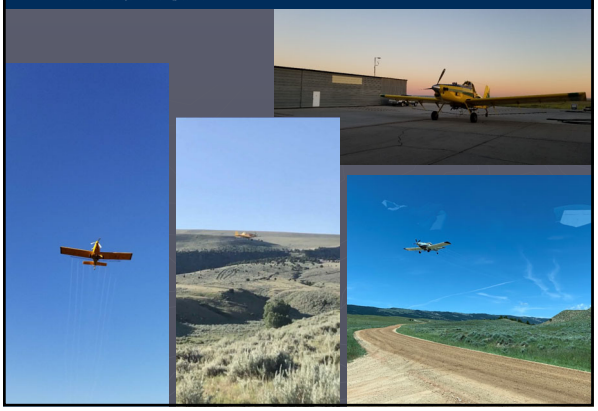
USDA United States Department of Agriculture

2000's Treatment strategies

- New EIS - 2002
- More environmentally sound
- NEPA regulations
- Smaller planes
- Better navigation/guidance systems
- Better chemical choices
- RAATs

41

USDA United States Department of Agriculture



42

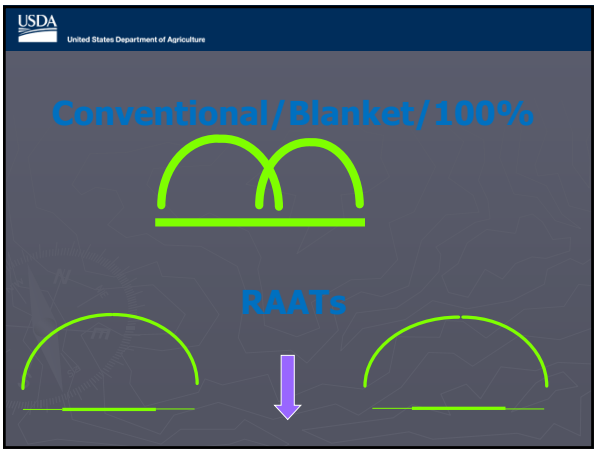
USDA United States Department of Agriculture

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

43

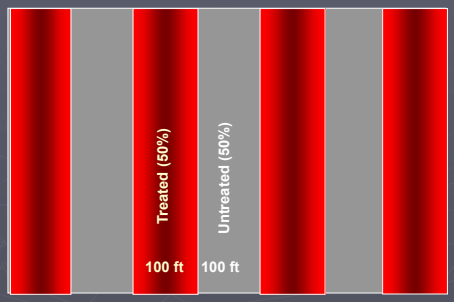
USDA United States Department of Agriculture



44

USDA United States Department of Agriculture

RAATs Example



45

USDA United States Department of Agriculture

Reduced Agent and Area Treatments (RAATs)

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

46

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

47

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

48

MODIFIED Reduced Agent Area Treatments (RAATS) Alternative

- Maintain conventional rate
- Skip swaths.

49

ATV-RAATs:

50

Boom Buster nozzles

51

Boomless nozzle spray pattern

52

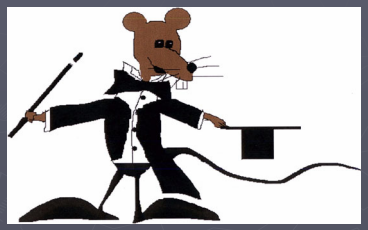
Practical?

Could you protect 160 to 320 acres in one day?

(It would take 32 tank loads to blanket treat 160 acres with a Model 140 nozzle)

53

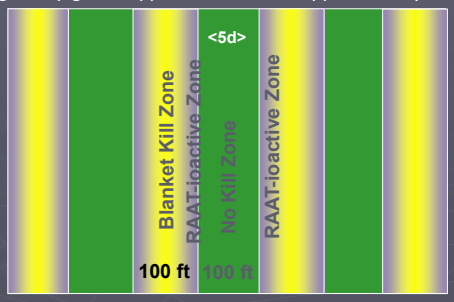
Apply the Magic of RAATs



54

Aerial RAATs – 50% Coverage

Average daily grasshopper movement is approximately 10 feet.



55

ATV-RAATs 20% Coverage

Conservatively, if you only spray one to two tank loads per hour (treating only 5-10 acres, but protecting 25-50 acres) over an 8 hour day you could **protect 200 to 400 acres!**

With a lower volume nozzle, the protected area increases to a full section per day.

Not the correct tool for a 10,000 acre block. However, the low cost makes it attractive for treating smaller infestations.

56

2003 Recommendations to get satisfactory control with ATV-RAATs

- Working hypothesis:
  - Percent coverage should equal grasshopper density (50% coverage should work in even extreme infestations)
- Use at least 1 oz. of Dimilin 2L per treated acre
  - 1 qt. of carbaryl or malathion 57 EC per acre
- Example:
  - If you have 40 grasshoppers/sq. yd. you need 40% coverage.
  - If your ATV sprays out a 15 ft. swath then 15 ft./40% means spraying a swath every 37.5 feet

57

BAIT / BRAN

58

Bran Spreaders

59

Bran Spreaders

60

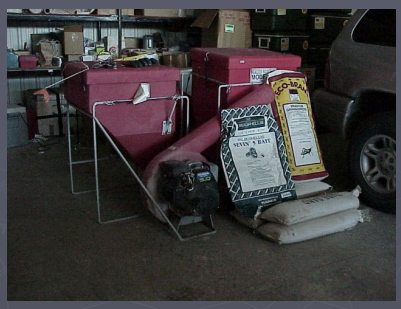
Bran Spreaders: ATV

61

Bran Spreaders: Pickup

62

Match Bran to Spreader



63

Bran formulations

64

Mormon crickets

65

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
- Mermiria bivittata*
- Ageneotettix deorum
- Anabrus simplex
- Aulocara elliotti
- Camnula pellucida
- Hadrotettix trifasciatus
- Melanoplus bivittatus*
- Melanoplus confuses
- Melanoplus dawsoni

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

66

Vulnerable (30% to 55% control)

- Control is expected to average about 42%
- Worst-case and best-case scenarios will be about 12% and 72%, respectively
  - Aulocara femoratum*
  - Eritettix simplex
  - Melanoplus femurrubrum
  - Oedaloenotus enigma
  - Opeia obscura
  - Phoetaliotes nebrascensis
  - Psoloessa delicatula

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

67

Nonsusceptible (<30-% control)

- Control is expected to average about 15%
- Worst-case and best-case scenarios will be about 0% and 30%, respectively
  - Aeropedellus clavatus
  - Amphitornus coloradus
  - Cordillacris crenulata
  - Cordallacris occipitalis
  - Hesperotettix viridis
  - Metator pardalinus
  - Phlibostroma quadrimaculatum*
  - Trachyrhachys kiowa

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

68

USDA, APHIS, PPQ Program

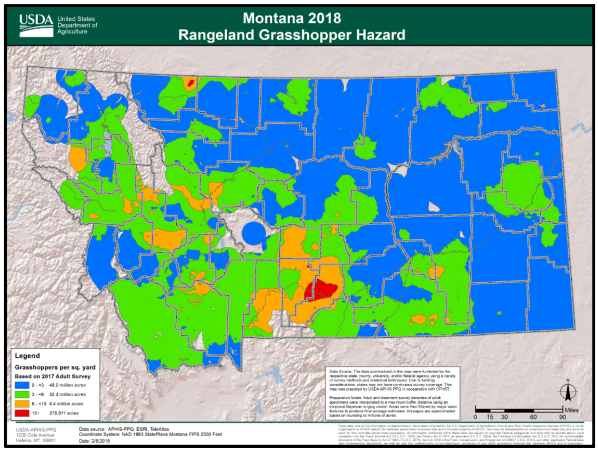
- Surveys
- Technical Assistance
- Treatment Programs

69

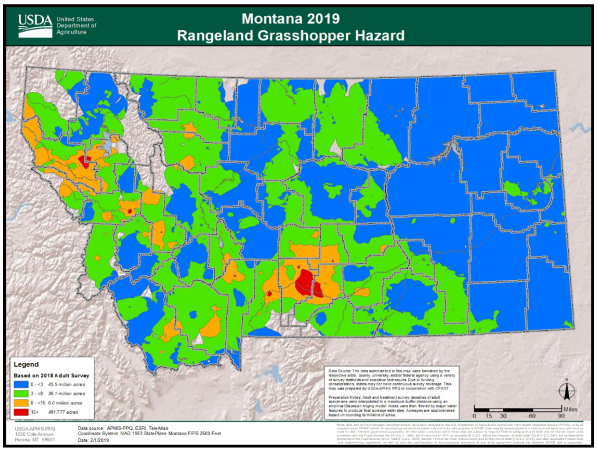
Surveys

- **Nymphal**
- **Delimiting**
- **Pre-Treatment**
- **Post-Treatment**
- **Adult/Forecast**

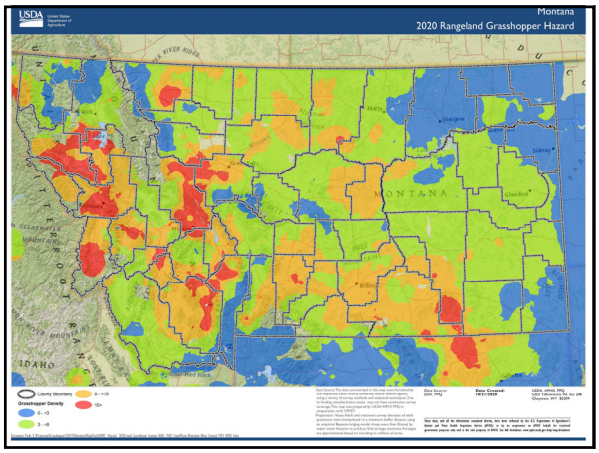
70



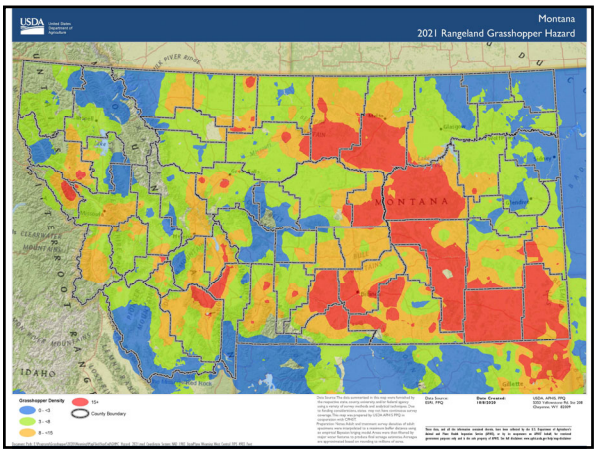
71



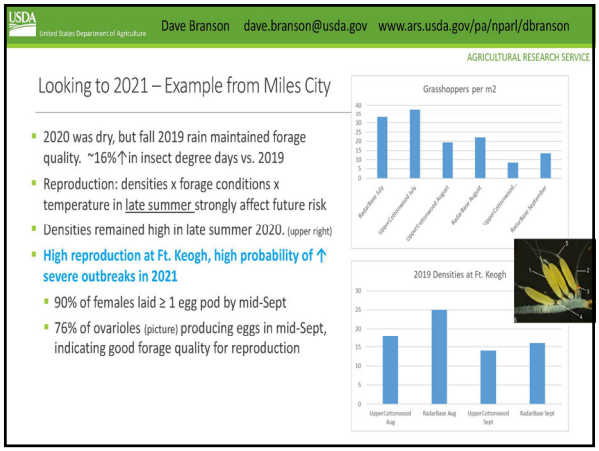
72



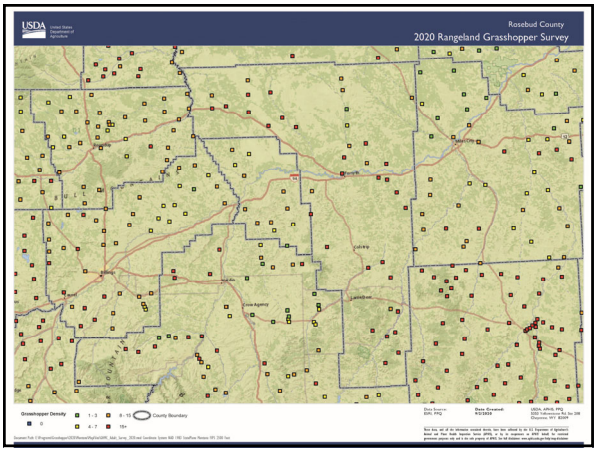
73



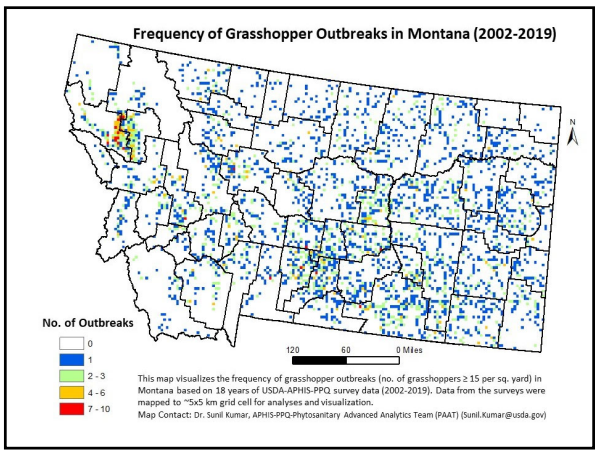
74



75



76



77

Technical Assistance

- Presentations
- Meetings
- Field assistance

78

Treatment Programs

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

79

Border Treatments

- Federally-Administered Land Adjacent to Private Agricultural Land
- GH/MCs moving Fed → Private
- Written Request from Federal Land Manger
- PPQ treat ¼ to ½ mile buffer
  - Aerial Contractor
  - PPQ Ground
- Contingent on Availability of Funds

80

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.

81

Rangeland Treatments

the most important slide of this presentation.

- Letter(s) of Request from all parties
- Cooperative Agreement(s) Signed
- Estimated Funds in Secured Account (Groups)
- Maps of all ownership/exclusions/boundaries.
- Sensitive sites/environmental considerations
- Planning early
- PPQ will contract with aerial applicator
  - (1-3 weeks) IDIQ may help with that.

82

What's it gonna cost?

- Primarily determined by Contractor Price
- Available and Competitive bids by contractors.
- Size of block
- % coverage/% exclusions.
- Ferry Distances
- Airport Location
- Water Sources
- Rates applied.
- Etc.

83

2020 Costs

- $1.78 - $2.60/protected acre YOUR Cost.
- No guarantees.

84

National Environmental Policy Act (NEPA)

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

85

Endangered Species Act ESA

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

86

Environmental Monitoring

- Water
- Quality Control
- Other, as needed.

87

PPQ vs Do it yourself

- PPQ Funding
  - **Needed requests/ estimates 12/18**
- Contracting
- Land-ownership.
- Local applicators?
- NEPA/ESA requirements

88

Summary

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

89

90

91

92

Gary D. Adams
State Plant Health Director-Montana
(406) 657-6282
(406) 431 6531 (cell)
Gary.D.Adams@usda.gov

Taelor Anderson - Billings
Taelor.O.Anderson@usda.gov

Joey Esilva – Helena
Joey.Esilva@usda.gov
406 449 5210

93