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USDA, APHIS, Plant Protection and Quarantine

3/29/22

2022 Rangeland Grasshopper and Mormon Cricket Program

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Today's Objectives

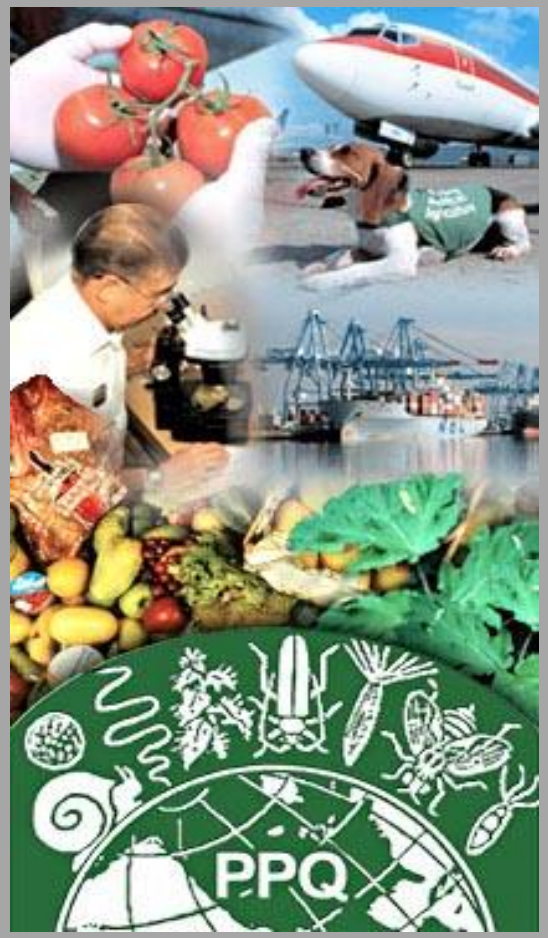
- Who is USDA, APHIS?
- Who is USDA, APHIS, PPQ?
- Brief overview of PPQ Programs
- Rangeland Grasshopper and Mormon Cricket Program
  - Biology
  - Management options
  - How you can request assistance.

USDA, APHIS

- **VS:** Veterinary Services
- **WS:** Wildlife Services
- **AC:** Animal Care
- **BRS:** Biotechnology Regulatory Services
- **PPQ:** Plant Protection and Quarantine

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

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

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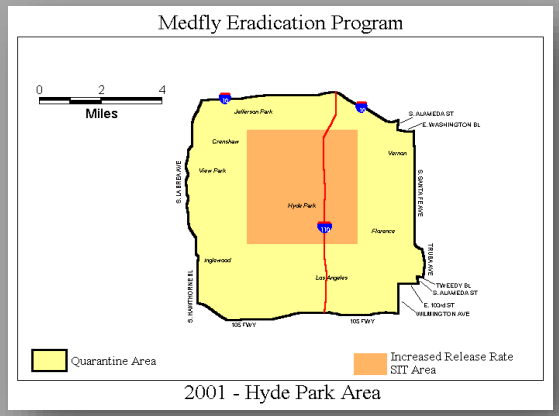
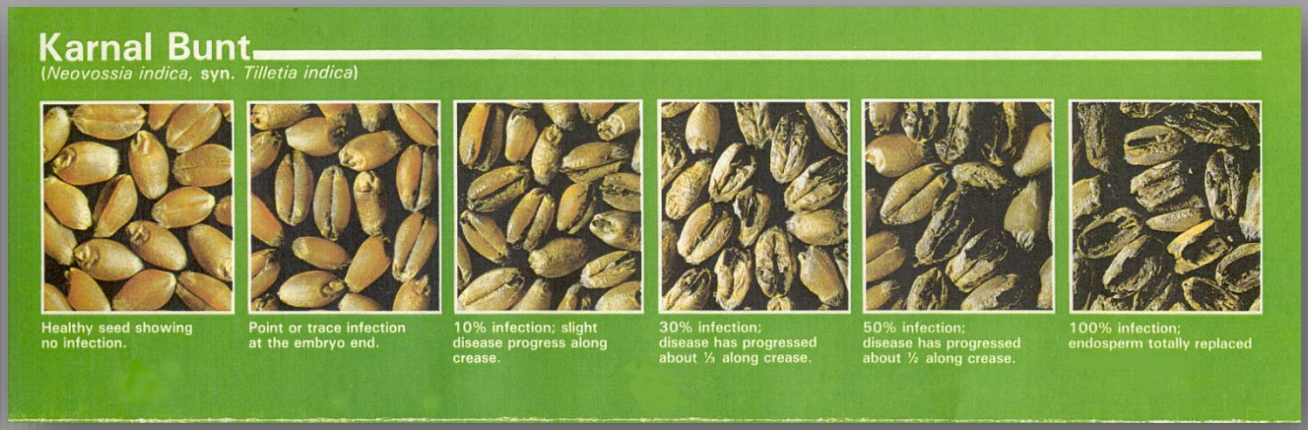
Domestic PPQ Programs

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





Grasshopper and Mormon Cricket

- Survey
- Technical Assistance

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

Surveys

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

Conducting Surveys

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

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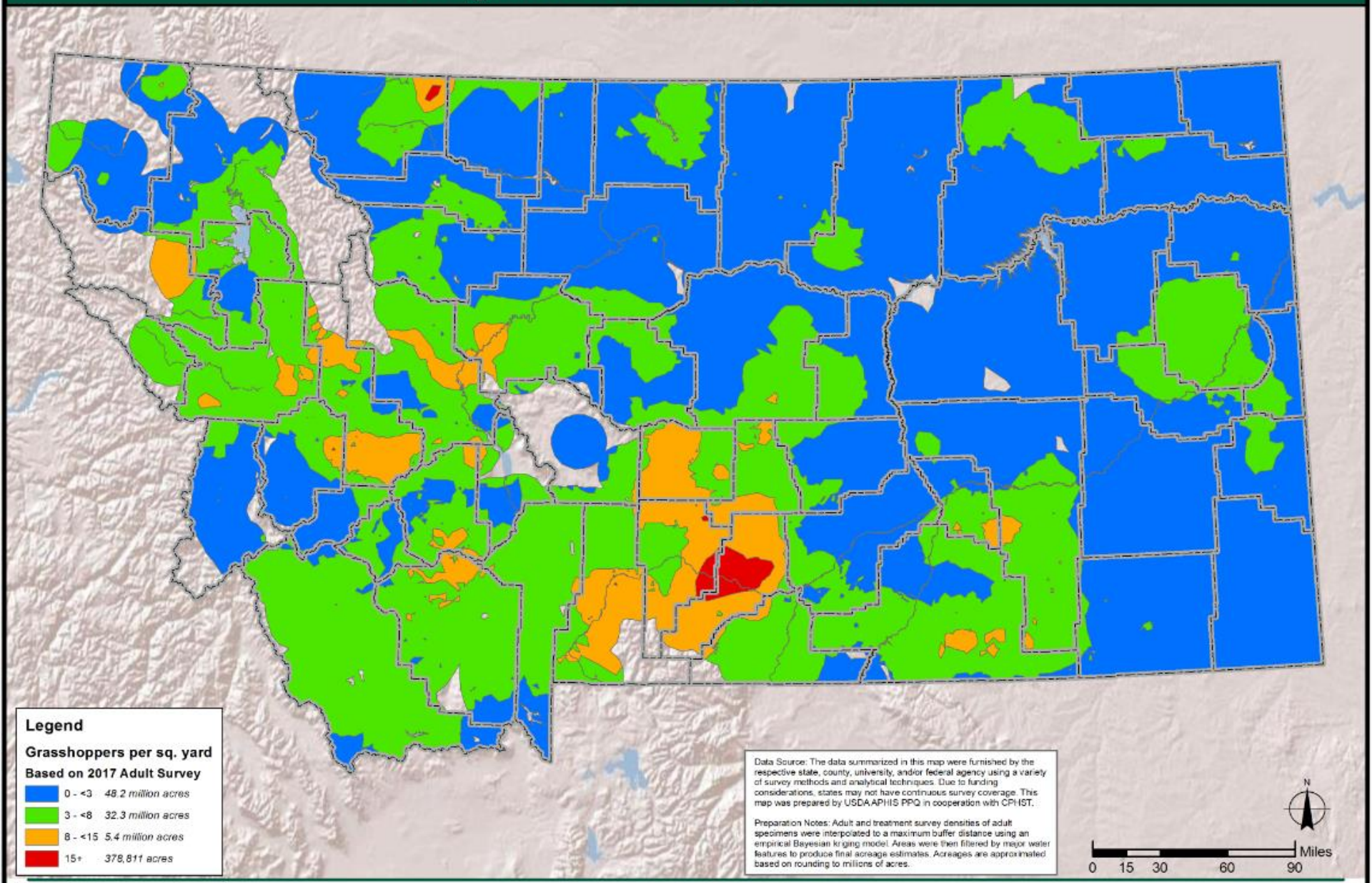
Montana 2018
Rangeland Grasshopper Hazard



USDA-APHIS-PPQ
1220 Cole Avenue
Helena, MT 59601

Data source: APHIS-PPQ, ESRI, TeleAtlas
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet
Date: 2/8/2018

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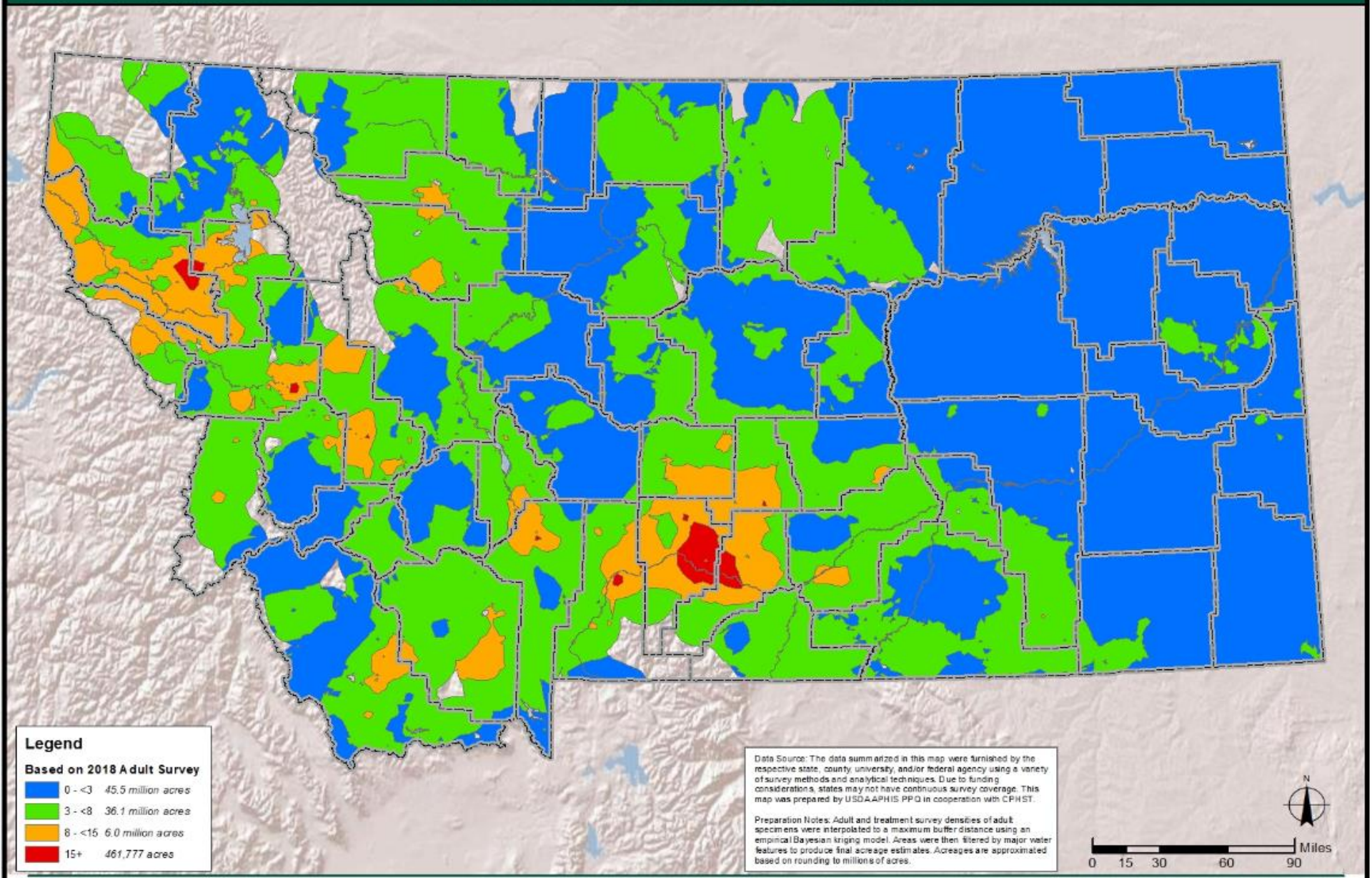
Montana 2019
Rangeland Grasshopper Hazard



USDA-APHIS-PPQ
1220 Cole Avenue
Helena, MT 59601

Data source: APHIS-PPQ, ESRI, TeleAtlas
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500 Feet
Date: 2/1/2019

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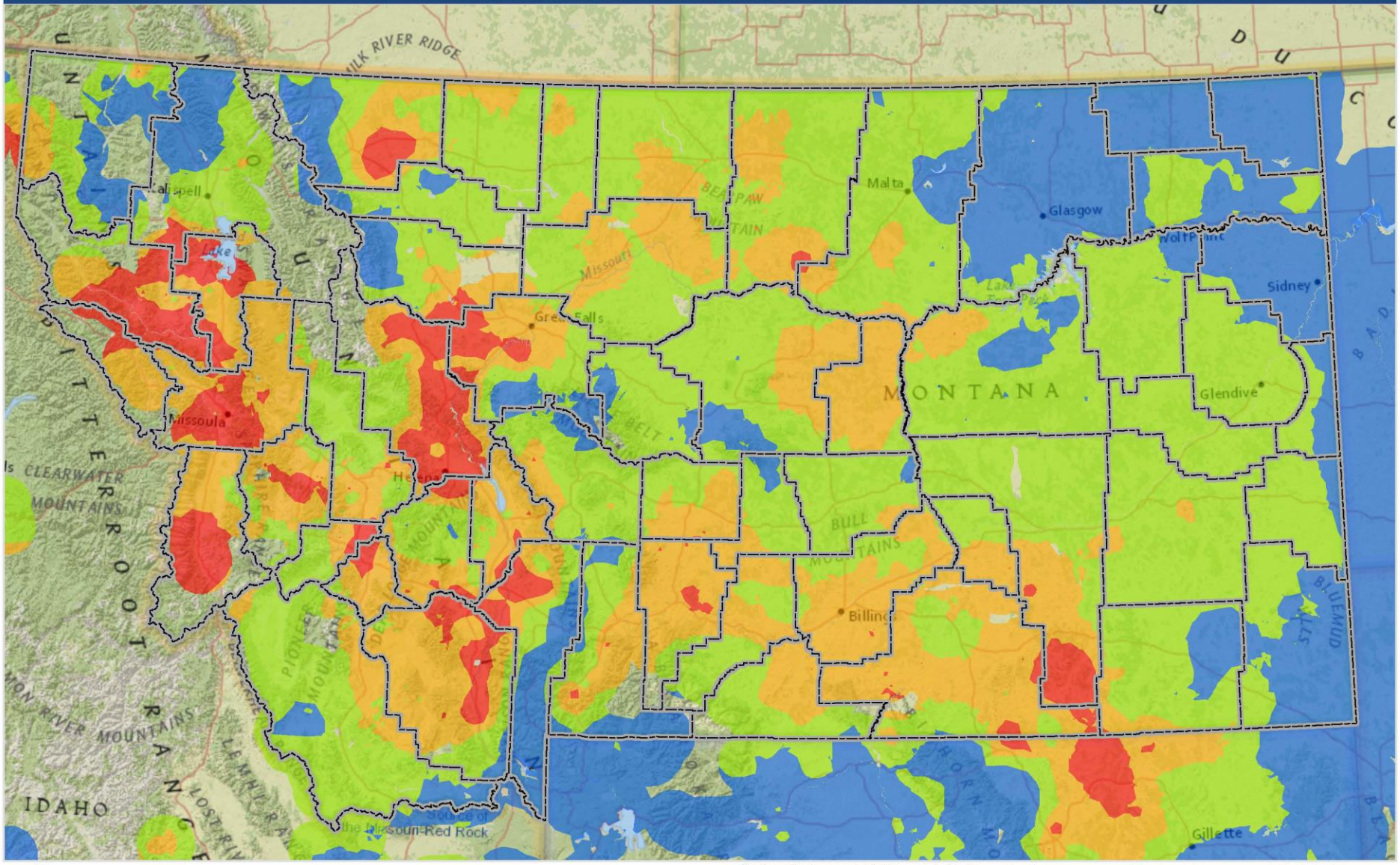
Montana
2020 Rangeland Grasshopper Hazard



County Boundary

Grasshopper Density

- 0 - <3
- 3 - <8
- 8 - <15
- 15+

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.

Data Source: ESRI, PPQ

Date Created: 10/21/2020

USDA, APHIS, PPQ
5353 Yellowstone Rd. Ste 208
Cheyenne, WY 82009

Document Path: E:\Programs\Grasshopper\2019\Montana\MapFiles\GHMC_Hazard_2020.mxd Coordinate System: NAD 1983 StatePlane Wyoming West Central FIPS 4903 Feet

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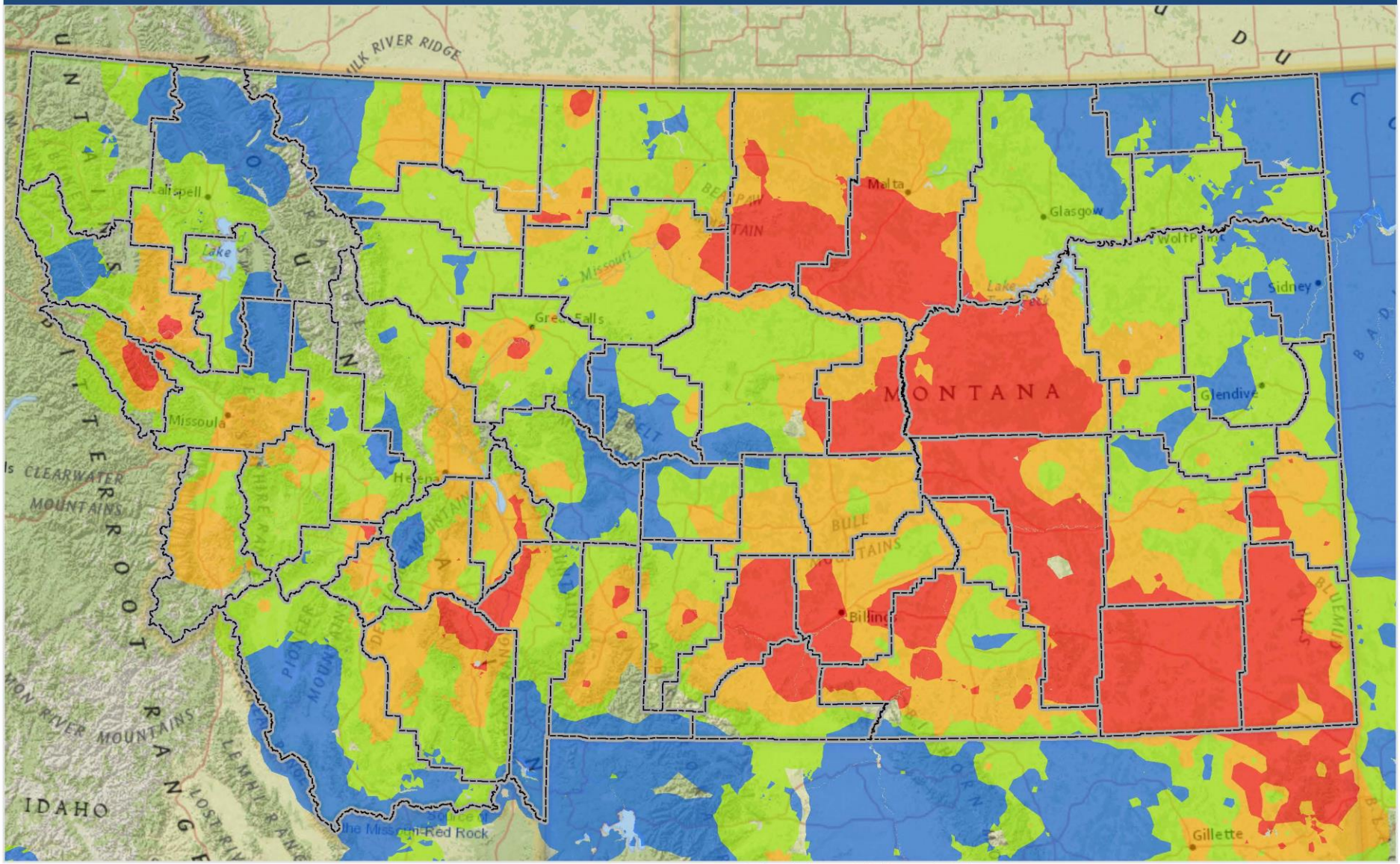
Montana
2021 Rangeland Grasshopper Hazard



Grasshopper Density

- 0 - <3
- 3 - <8
- 8 - <15
- 15+
- County Boundary

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Data Source: ESRI, PPQ

Date Created: 10/8/2020

USDA, APHIS, PPQ
5353 Yellowstone Rd. Ste 208
Cheyenne, WY 82009

Document Path: E:\Programs\Grasshopper\2020\Wyoming\MapFiles\YearEnd\GHMC_Hazard_2021.mxd Coordinate System: NAD 1983 StatePlane Wyoming West Central FIPS 4903 Feet

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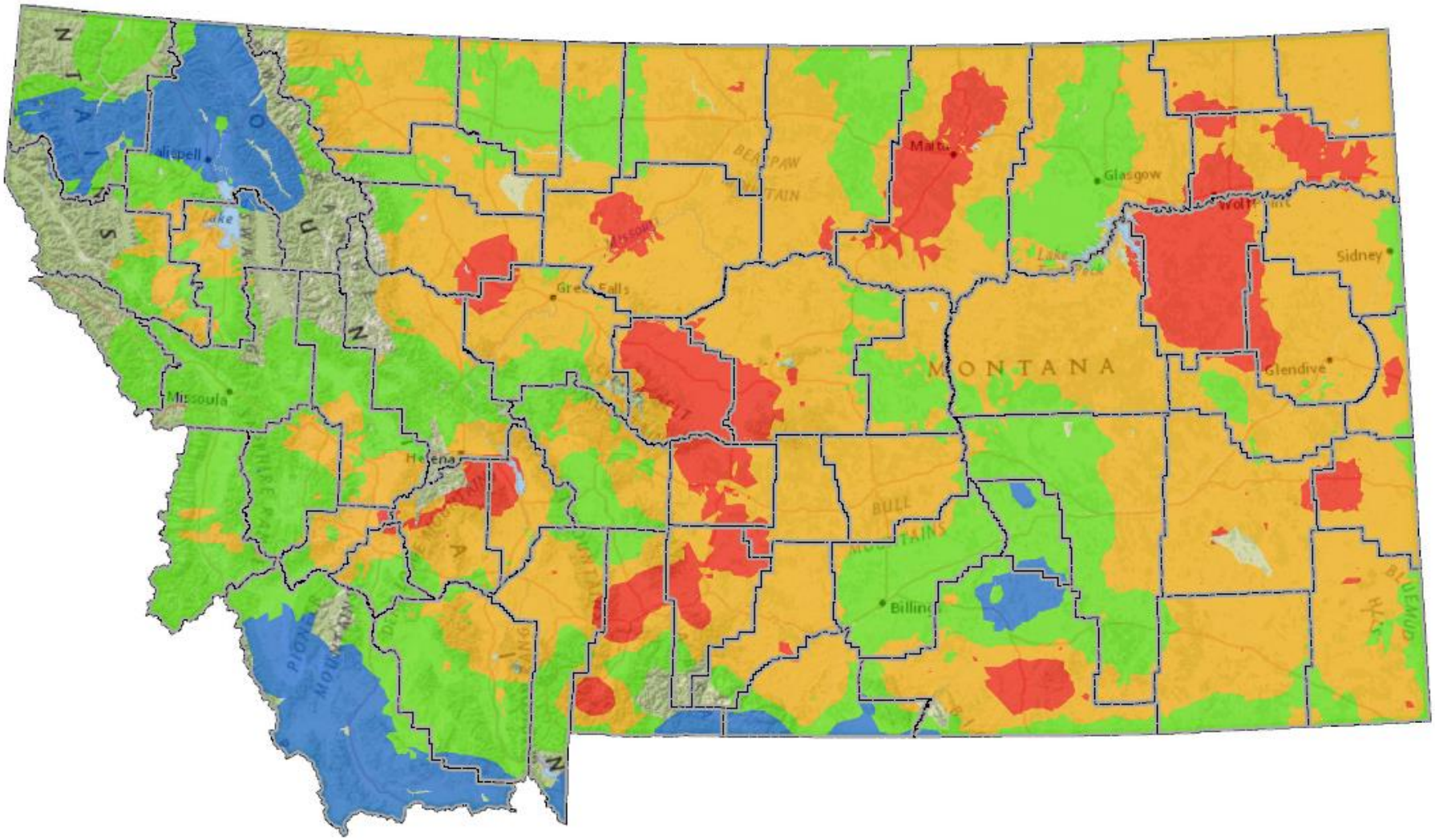
MONTANA
2022 Rangeland Grasshopper Hazard



Density per sq. yard

- 0 - <3 *6.3 million acres*
- 3 - <8 *26.8 million acres*
- 8 - <15 *45.8 million acres*
- 15+ *8.6 million acres*
- County Boundary

0 30 60 Miles

Data Source: ESRI, PPQ

Date Created: 11/17/2021

USDA, APHIS, PPQ
5353 Yellowstone Rd. Ste 208
Cheyenne, WY 82009

Document Path: E:\Programs\Grasshopper\GIS Files\Montana\MapFile\MT_GHMC_AdultHazard2022.mxd Coordinate System: NAD 1983 StatePlane Wyoming West Central FIPS 4903 Feet

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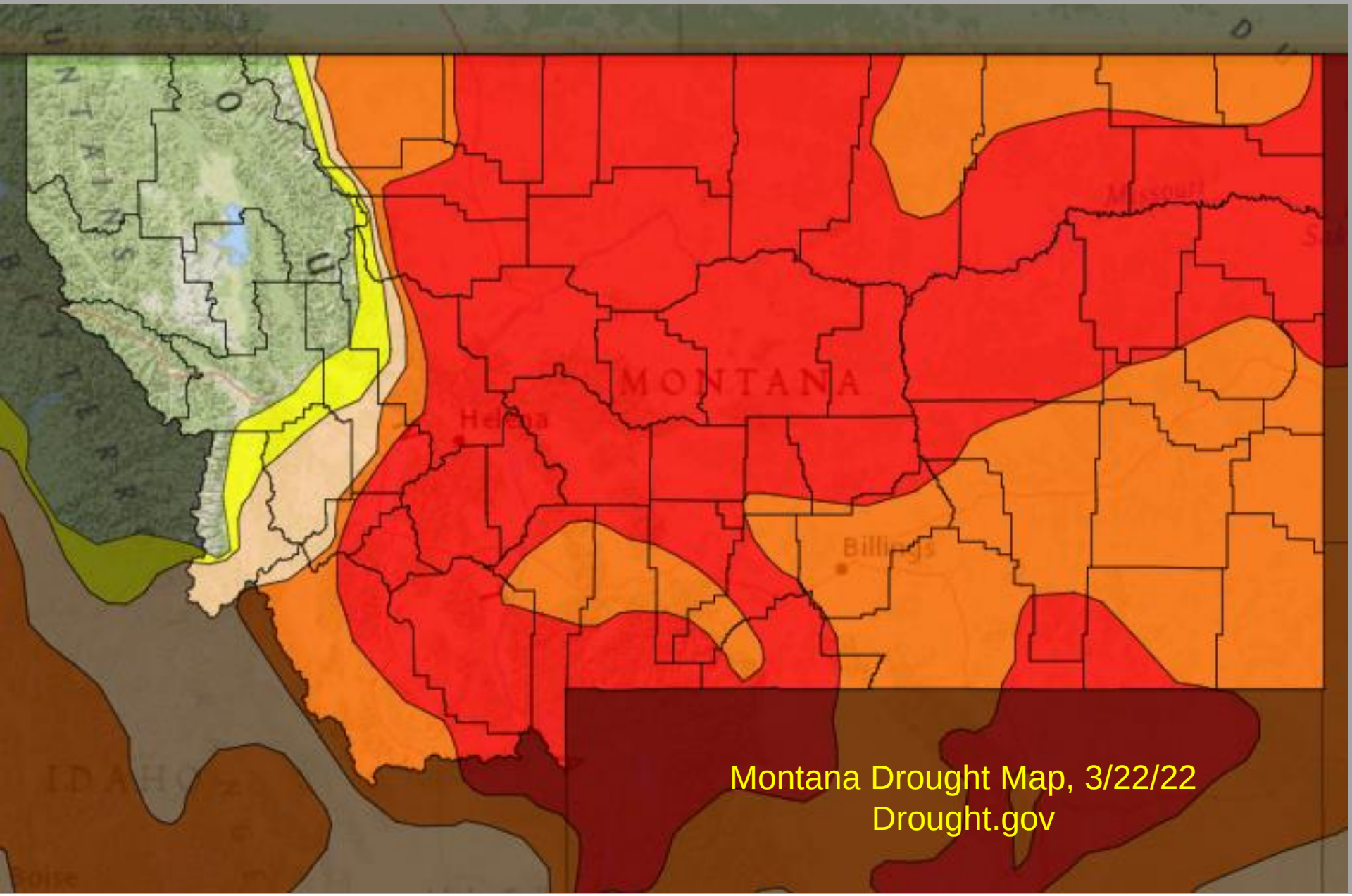

Montana Drought Map, 3/22/22
Drought.gov

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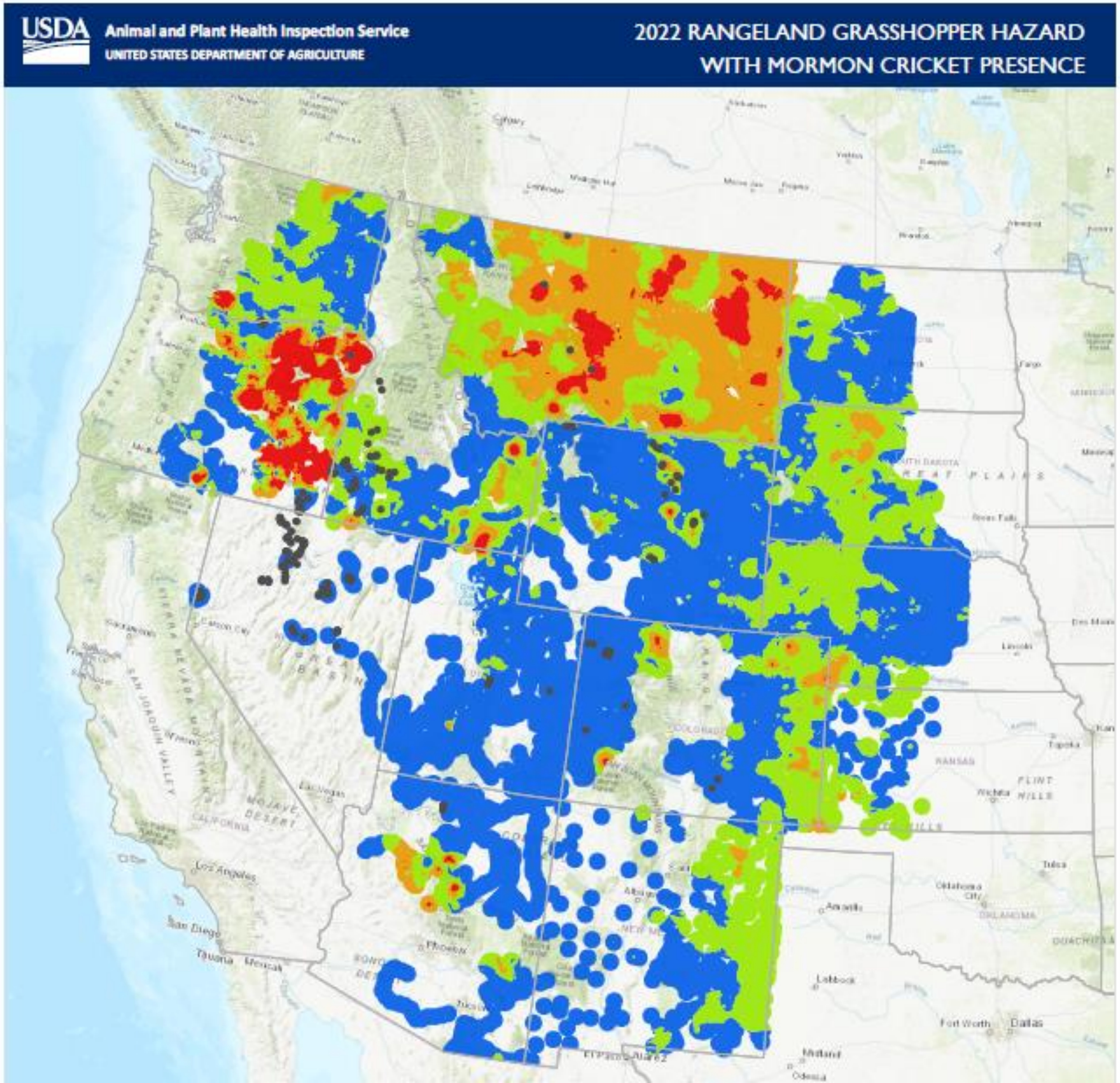

Species

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.

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Common Montana Species

Aeoloplides 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

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Economic Montana Rangeland Species

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Economic Montana Rangeland Species

Ageneotettix deorum (Scudder)	**Whitewhiskered grasshopper**
Aulocara elliotti (Thomas)	**Bigheaded grasshopper**
Camnula pellucida (Scudder)	**Clearwinged grasshopper**
Melanoplus bivittatus (Say)	**Twostriped grasshopper**
Melanoplus dawsoni (Scudder)	**Dawson grasshopper**
Melanoplus femurrubrum (DeGeer)	**Redlegged grasshopper**
Melanoplus infantilis (Scudder)	**Little spurthroated grasshopper**
Melanoplus sanguinipes (Fabricius)	**Migratory grasshopper**
Opeia obscura (Thomas)	**Obscure grasshopper**
Phlibostroma quadrimaculatum(Thomas)	**Fourspotted grasshopper**
Phoetaliotes nebrascensis (Thomas)	**Largeheaded grasshopper**
Trachyrhachys kiowa (Thomas)	**Kiowa grasshopper**
Anabrus simplex (Haldeman)	**Mormon cricket**

Variety of Species

Twostriped
female
1.1 g

Whitewhiskered
female
0.3 g

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Adults
Melanoplus sanguinipes
Migratory Grasshopper

Male
20-26 mm

Female
20-29 mm

Melanoplus dawsoni
Dawson Grasshopper

Male

14-19mm

Female

17-22 mm

Dissosteira carolina (Linnaeus) Carolina Grasshopper

Male

29-32 mm

Female

36-39 mm

Boopedon nubilum (Say)
Ebony Grasshopper

Male

22-22.5 mm

Female

36-38 mm

Some Common Grasshoppers of Montana Croplands or Rangelands				
		Food Types		
	Common name	Grasses	Grasses / Forbs	
Spur-throated grasshoppers:				
Melanoplus bivittatus	**Two-striped grasshopper**		**x**	**Small grains, alfalfa, corn**
Melanoplus differentialis	Differential grasshopper		x	Small grains, corn, alfalfa, vegetables, fruit trees
Melanoplus femurrubrum	Red-legged grasshopper		x	Small grains, alfalfa, clover, corn, vegetables
Melanoplus gladstoni	Gladston grasshopper		x	Winter wheat in Fall
Melanoplus infantilis	Little spur-throated grasshopper		x	Rangeland grasses and forbs
Melanoplus occidentalis	Flabellate grasshopper		x	Rangeland grasses and forbs
Melanoplus packardii	Packard grasshopper		x	Small grains, alfalfa
Melanoplus sanguinipes	**Migratory grasshopper**		**x**	**Small grains, alfalfa, corn, clover, vegetables, ornamentals**
Phoetaliotes nebrascensis	Large-headed grasshopper	x		Rangeland grasses, winter wheat in Fall
Xanthippus corallipes	Red-shanked grasshopper		x	Rangeland grasses, alfalfa
Slant-faced grasshoppers:				
Ageneotettix deorum	White-whiskered grasshopper	x		Rangeland grasses
Amphitornus coloradus	Striped grasshopper	x		Rangeland grasses
Aulocara elliotti	Big-headed grasshopper	x		Rangeland grasses
Aulocara femoratum	White-crossed grasshopper	x		Rangeland grasses
Chorthippus curtipennis	Meadow grasshopper	x		Rangeland grasses
Cordillacris occipitalis	Spot-winged grasshopper	x		Rangeland grasses
Mermiria bivittata	Two-striped slant-faced grasshopper	x		Rangeland grasses
Metator pardalinus	Blue-legged grasshopper	x		Rangeland grasses
Phlibostroma quadrimaculatum	Four-spotted grasshopper	x		Rangeland grasses
Band-winged grasshoppers:				
Camnula pellucida	**Clear-winged grasshopper**	**x**		**Rangeland grasses, small grains**
Dissosteira carolina	Carolina grasshopper		x	Rangeland grasses, wheat, alfalfa, corn
Dissosteira longipennis	High plains grasshopper	x		Rangeland grasses
Trachyrachis kiowa	Kiowa grasshopper	x		Rangeland grasses

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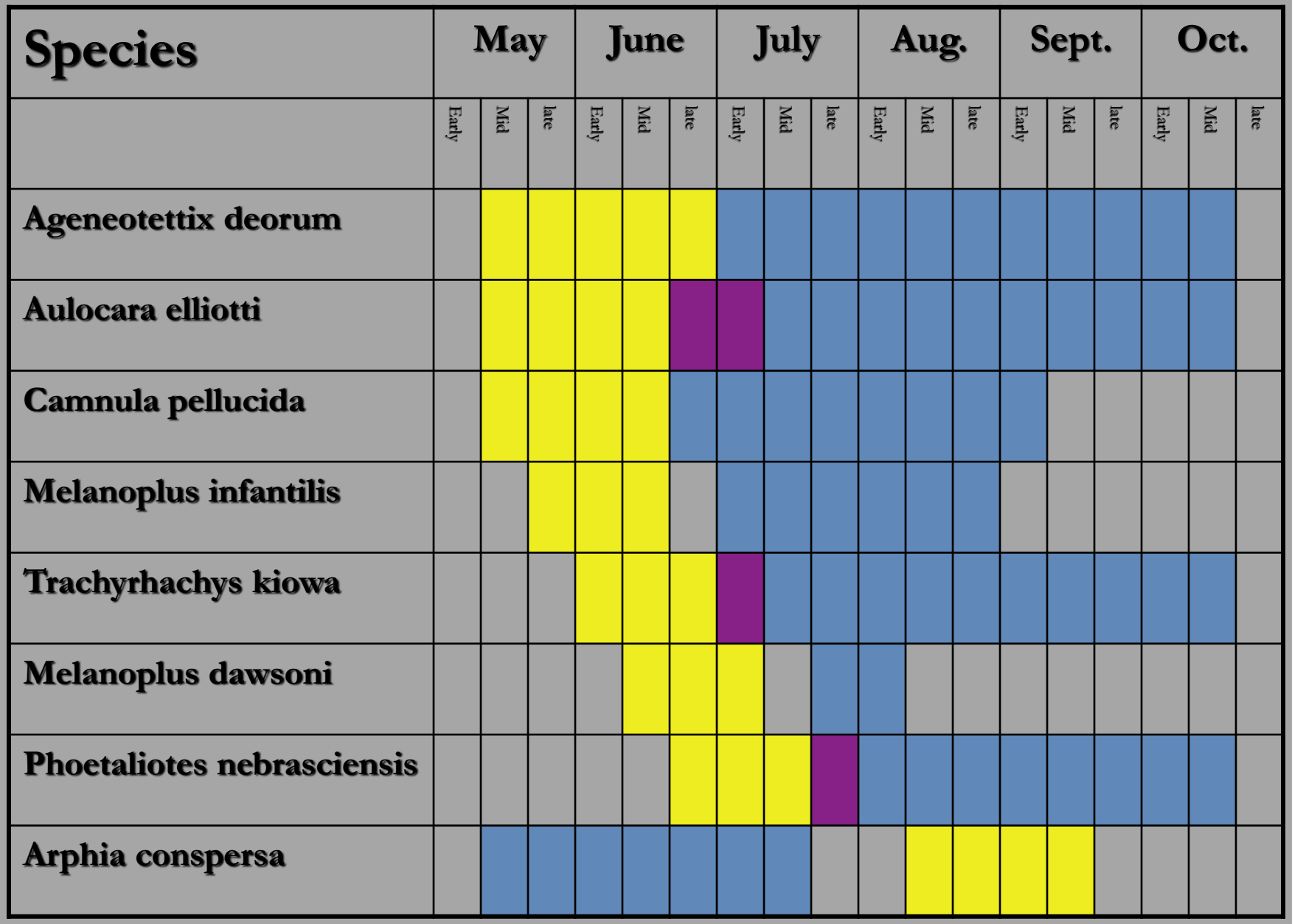


Migratory grasshopper developmental stages

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**

Do I treat?

- Decision Support Software
  - CARMA
    https://johnhastings.herokuapp.com/carma/
- ≥ 8 GH per yd^2
- ≥ 15 GH per yd^2
- Can I wait for mother nature?
- Is there grass to save? (drought)
- Should I just buy hay?

Control Alternatives

- **Biological Control**
  - **No classical biological control.**
    - Grasshoppers are native
  - ***Nosema locustae***,
    - Naturally occurring.
    - sick, eat less, and begin to die.
    - The disease spore spreads to healthy grasshoppers through cannibalism.
    - “In 2-4 weeks, 50% of the grasshopper population will die, and most survivors will be infected to continue spreading the disease. Infected survivors eat 75% less than healthy grasshoppers and lay fewer eggs. Will NOT harm people, pets or the environment.”
  - **Not considered for PPQ Suppression Programs**

Control Alternatives for PPQ

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

No Action

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

Insecticides

- Malathion
- Carbaryl
  - Liquid
  - Bait
- Diflubenzuron
- Chlorantraniliprole: Prevathon
- Ask your local contractor for other option.

Diflubenzuron (Dimilin)

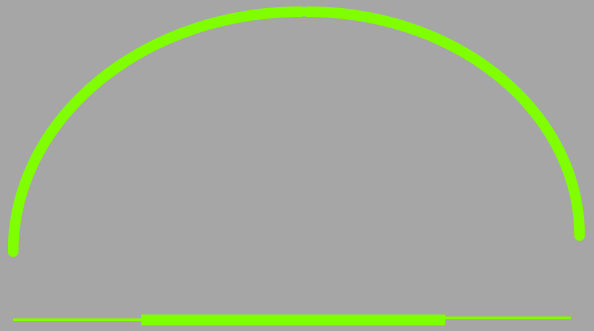
- Long Residual
- Mode of Action
  - Chitin inhibitor
  - Ingestion
- Arthropod specific
- Must be used before adult stage

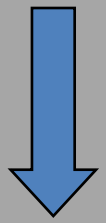
Reduced Agent and Area Treatments (RAATs)

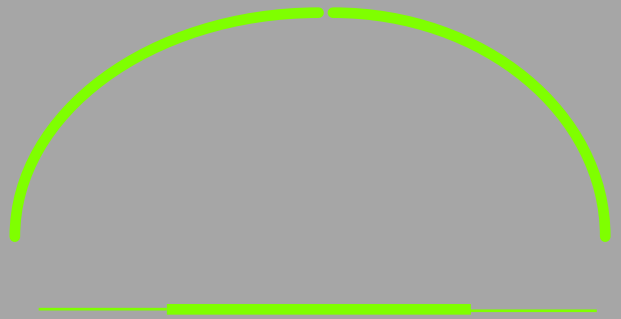
- Basically skip swathing
- GH mortality in treated swaths
- GHs move from non-treated to treated swaths
- More predacious insects and parasitoids survive
- Birds and predators continue naturally feedin on GH
- Arthropod specific
- Must be used before adult stage

Conventional/Blanket/100%

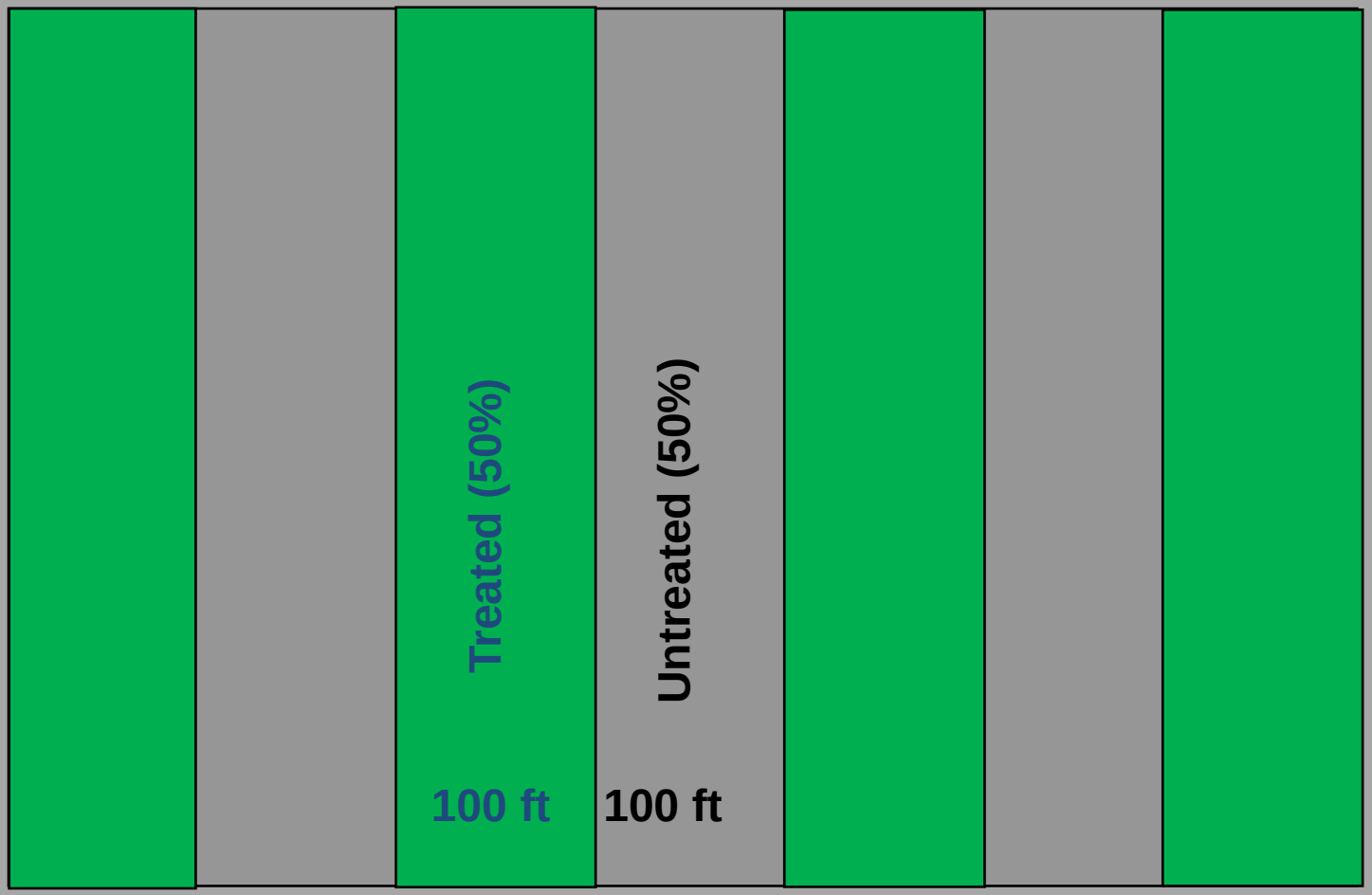
RAATs







RAATs Example



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

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

Methods Development

General Needs for Field Study Area

1) 3,000-4,000 acres currently estimated
2) Private land if possible (willing to entertain using public land, but hurdles to do so are often insurmountable in the time frames we need) – introduce us and we're happy to take it from there!
3) Untreated previously for at least beyond 1 year, preferably 2-3 years
4) Native rangeland habitats.
5) Relatively flat terrain (hills are fine, just not mountains/plateaus, etc.)
6) Sufficient populations of grasshoppers – at least 8/yd^2
7) Easily accessible – we come equipped with a UTV and several ATVs, which we plan to use as needed, but we prefer to be able to access the main site from a decent road/trail that can accommodate our main vehicles: panel truck (mobile HQ), SUV, pick-up, and our various trailers.
8) Shielded from the public/fenced – main reason is to not have studies disturbed
9) Access to a building/field station with water/power – we come prepared with a mobile HQ, but having stationary buildings with the ability to move study components inside, have access to a fridge/freezer, etc. is always very helpful

ATV-RAATs:

Boom Buster nozzles

Boomless nozzle spray pattern

BAIT / BRAN

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 scenario 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

Vulnerable (30% to 55% control)

- **Control is expected to average about 42%**
- **Worst-case and best-case scenario 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

Nonsusceptible (<30-% control)

- **Control is expected to average about 15%**
- **Worst-case and best-case scenario 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

Treatment Programs

- **Plant Protection Act of 2000**
  - **Border Treatments**
  - **Rangeland Treatments**
  - **Contingent on Availability of Funds**

Border Treatments

- **Federally-Administered Land Adjacent to Private Agricultural Land**
- **GH/MCs moving Fed → Private**
- **Written request from Federal Land Manager**
- **PPQ Treat ¼ to ½ mile buffer**
  - **Aerial Contractor**
  - **PPQ Ground**

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.**

Rangeland Treatments

- **Letter(s) of Request and Questionnaire from all parties**
  - **Tribe**
  - **BIA**
  - **Sensitive sites/environmental considerations**
- **Cooperative (reimbursable) Agreements(s) signed**
- **Maps of all ownership/exclusions/boundaries**
- **PPQ will contract with aerial applicator**
  - **(1-3 weeks)**

2020 Costs

- **Private land (your 2/3 cost):**
  - **2020: $1.78 - $2.60 / protected acre**
  - **2021: $1.69 - $2.01 / protected acre**
- **Federally-Managed land (trust): PPQ funded**

Endangered Species Act
ESA

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

USDA United States Department of Agriculture

National Environmental Policy Act (NEPA)

- **Find Environmental Impact Statement (FEIS) – 2019**
- **Site Specific Environmental Assessments (EAs)**
  - **Sent to all Tribes**
- **Finding of No Significant Impact (FONSI) 4/22/21**

Environmental Monitoring

- **Water bodies**
- **Pesticide and formulation Quality Control**

- **Other, as needed**

Summary

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


Going


Going


Gone

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