Rare Plants and Pollinators

Colorado Native Plant Society Annual Conference 2015

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Some of the people working on rare plants and pollinators in Colorado:

- **Vince Tepedino and colleagues at USU**
- **Sarah Clark, USU**
- **Becky Hufft Kao, Anna Sher, and colleagues at DBG**
- **CNAP**
- **USFWS**
- **Susan Panjabi and colleagues at CNHP**
- **Krissa Skogen, CBG**
- **Ron Abbott**

Key Rare Plant Genera in Colorado

- **Astragalus (45 spp)**
- **Penstemon (28 spp)**
- **Carex (24 spp)**
- **Physaria (19 spp)**
- **Eriogonum (18 spp)**
- **Draba (16 spp)**
- **Oreocarya (13 spp)**
- **Botrychium (12 spp)**
- **Mentzelia (8 spp)**
- **Aletes (8 spp)**
- **Oenothera (8 spp)**
- **Phacelia (8 spp)**
- **Asclepias (7 spp)**

Today we'll talk about…

- Astragalus (45 spp)
- Penstemon (28 spp)
- Carex (24 spp)
- Physaria (19 spp)
- Eriogonum (18 spp)
- Draba (16 spp)
- Cacti
- Orchids
- Conservation

But won't have time to go into:

- Oreocarya (13 spp)
- Botrychium (12 spp)
- Mentzelia (8 spp)
- Aletes (8 spp)
- Oenothera (8 spp)
- Phacelia (8 spp)
- Asclepias (7 spp)

Astragalus (45 spp)

- **Papilionaceous**
- Bumblebees, digger bees, mason bees, honeybee.
- Dipterans (flies) and Coleoptera (beetles) are not likely to be important pollinators
- Some Geitonogamy, some obligate outcrossers

Astragalus cronquistii G2S2
Photo by Steve O'Kane

Astragalus linifolius G3QS3
Photos by Lori Brummer

Astragalus schmolliae G1S1

- Anthophorid bees, Megachilid bees
- Flowers are “tripped” by the bees

Astragalus

Penstemon (28 spp)

- White, blue, and purple *Penstemons*: Bees, and the wasp *Pseudomasaris vespoides*.
- Pink and Red *Penstemons*: Hummingbirds

Plate 9: Common pollinators of plants in the genus ***Penstemon*** (photographs by Paul Wilson).

The Insects That Visit Penstemon Flowers

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Penstemon grahamii G2S1

- Specialized flowers
- May be Self-compatible, autogamous and geitonogamous

Pseudomasaris wasp visiting *P. grahamii*
Photo by Dee Malone

Penstemon harringtonii G3S3

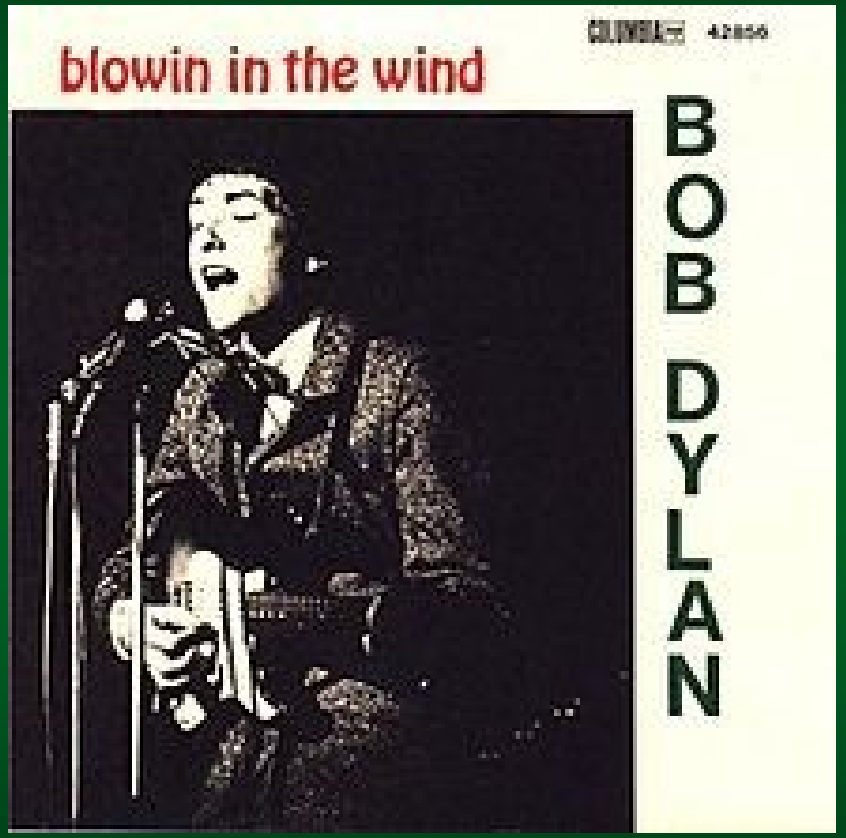
- Specialized flowers
- *Osmia* appears to be extremely important for their pollination
- Self-compatible, autogamous and geitonogamous
- But far better seed production when outcrossing

- Panjabi, S. S., and D.G. Anderson 2006. Penstemon harringtonii Penland (Harrington's beardtongue): A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project.
- Tepedino, V.J. 1996. The reproductive biology of rare rangeland plants and their vulnerability to insecticides. Available online at http://tomclothier.ort.net/page08.html

Penstemon

Carex (24 spp)

- **Wind pollinated**
- ***Carex* is the ancestor of *Cyperus*, which can be insect pollinated**



Wragg, P.D. and S.D. Johnson. 2011. Transition From Wind Pollination to Insect Pollination in Sedges: Experimental Evidence and Functional Traits. New Phytologist 191: 1128-1140.

Physaria (19 spp)

- ***Physaria congesta* G1S1:**
  - **Requires pollination**
  - **Most pollinators are bees**

Dudley Bluffs Bladderpod by Sarah Clark, USU

Clark, S. 2011. The Importance of Pollinators to Rare Plants in the Piceance Basin. The Field Press- CNAP. Volume 13 (1): P4.

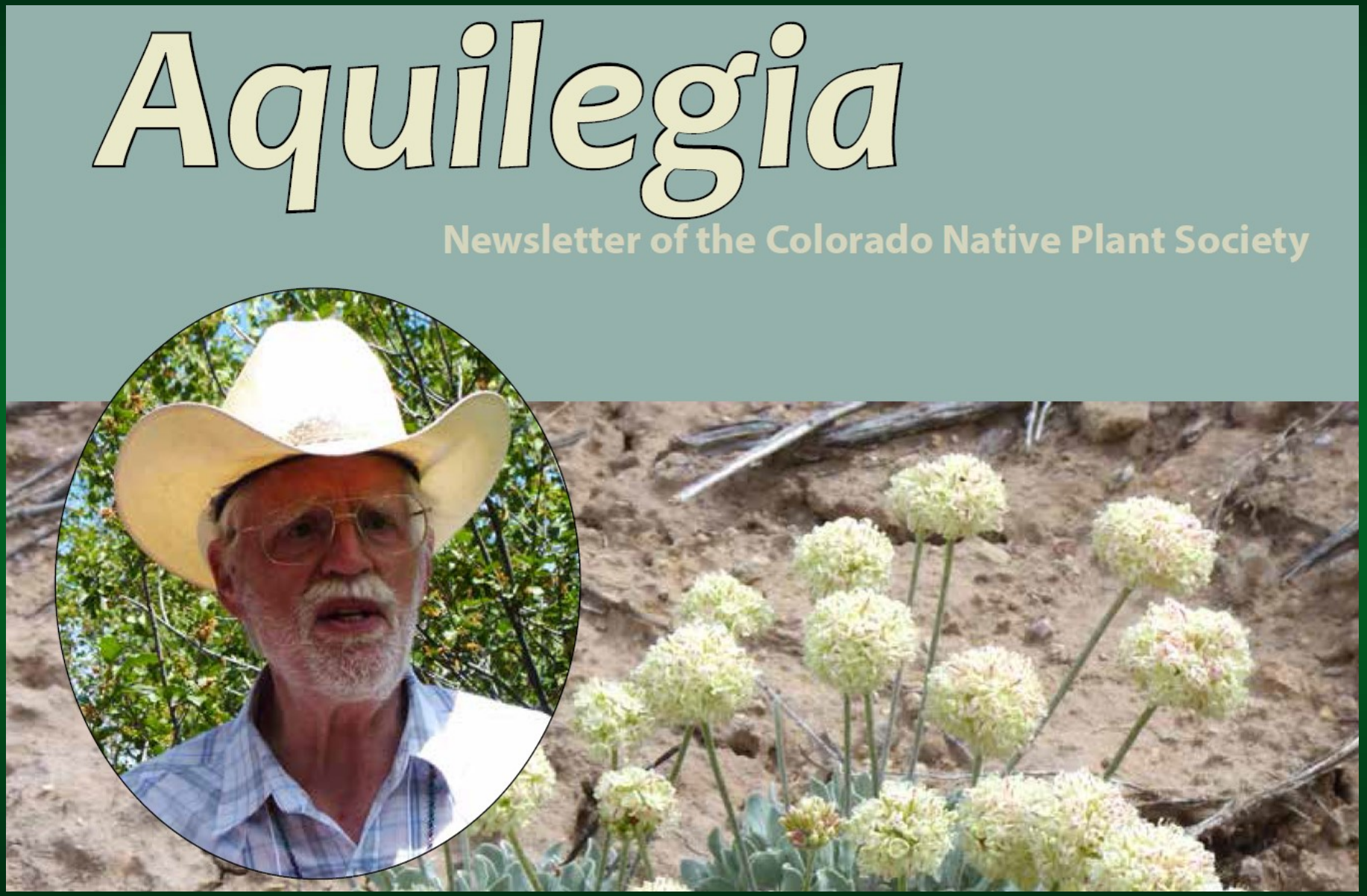
Physaria

- ***Physaria obcordata* G1G2S1S2:**
  - **Requires pollination**
  - **Most pollinators are native ground nesting bees (Andrenidae and Halictidae)**

Tepedino, V.J. 2009. The Pollination Biology of a Piceance Basin Endemic, Physaria obcordata (Cruciferae). Report Prepared for the Colorado Natural Areas Program, Denver, CO

Physaria

Eriogonum (18 spp)



Eriogonum (18 spp)

- Some species propogate clonally
- Most *Eriogonum* species throughout Western North America are pollinated by a broad range of generalist pollinators
- *E. pelinophilum,* G1S1 has the highest number of pollinator species observed in the genus (Taliga and Glenne 2011).
- No clear examples of specialization

Taliga, C.E. and Glenne, G. 2011. Plant Guide for clay-loving wild buckwheat (*Eriogonum pelinophilum*). USDA-Natural Resources Conservation Service, Colorado State Office. Denver, CO 80225-0426.

Photo: Lori Brummer

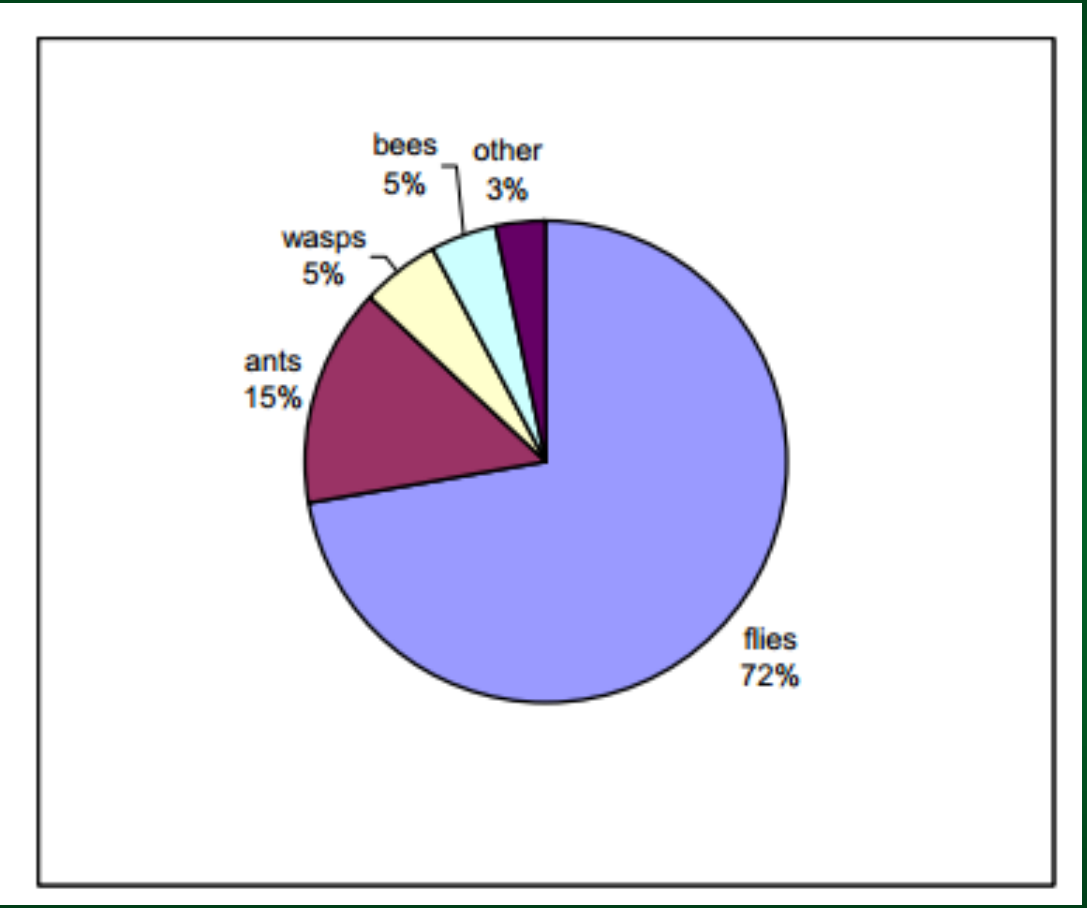
Eriogonum brandegeei G1G2S1S2

Photo: Michelle De Pringer-Levin

Photo: Susan Panjabi

Eriogonum brandegeei

- **Floral Visitors to *E. brandegeei* (Panjabi 2004)**



Panjabi, S.S. 2004. Visiting Insect Diversity and Visitation Rates for Seven Globally-Imperiled Plant Species in Colorado's Middle Arkansas Valley. Report prepared for Native Plant Conservation Alliance, NFWF.

Draba (16 spp)

- **Apomixis- asexual reproduction through seeds**
- **“Microspecies” concept by Grant (1981)**
- **Pollination is not required but may play a role in gene flow**

Decker, K. 2006. *Draba weberi* Price and Rollins (Weber’s draba): A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

Draba

Cactaceae


Photo: Bernadette Kuhn

Sclerocactus glaucus
G3S3


Photo: Jeff Hollenbeck, University of Florida


Photo: Becky Hufft Kao

- *Sclerocactus wetlandicus* and *brevispinus*
  - Oucrossed and self incompatible.
  - Pollinated largely by native (ground nesting) halictid bees.

- Tepedino, V.J., T.L. Griswold, W.R. Bowlin. 2010. Reproductive Biology, Hybridization, and Flower Visotors of Rare *Sclerocactus* Taxa in Utah's Uintah Basin. Western North American Naturalist 70(3): 377-386

Orchidaceae

- “Why do Orchids have so many perfect contrivances for their fertilisation? I am sure that many other plants offer analogous adaptations of high perfection; but it seems that they are really more numerous and perfect with the Orchideae than with most other plants.” –Charles Darwin (1888)

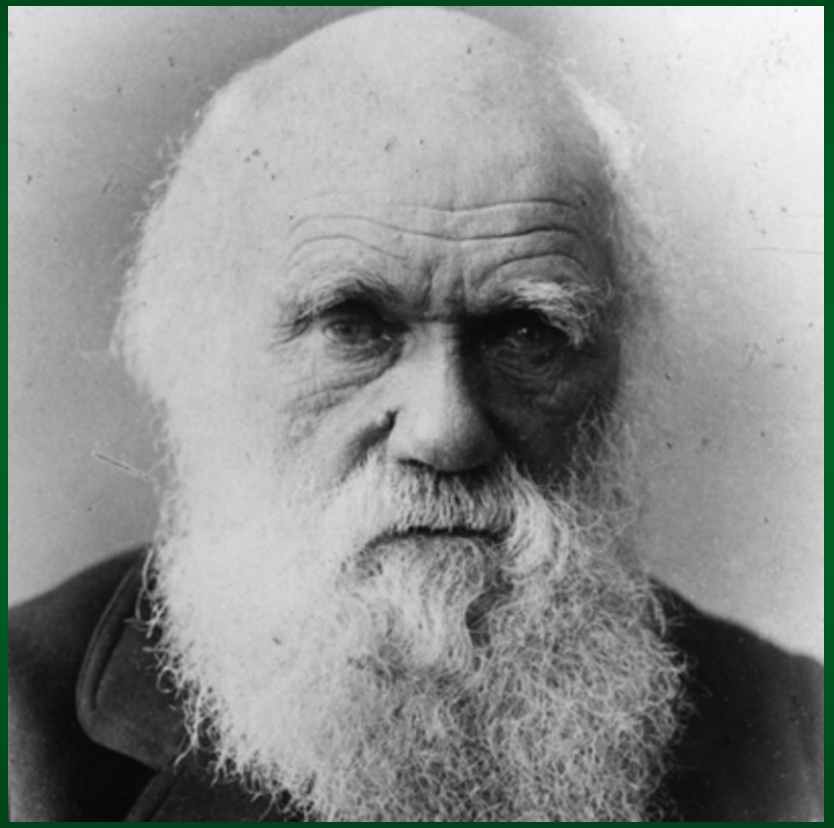



Photo: Steve Olson

Cypripedium parviflorum G5S2


Ceratina calcarata
Photo: Wikimedia Commons

- Most *Cypripediums*: Female *Andrena haemorrhoa* bees
- C. parviflorum: male lesser carpenter bees (*Ceratina calcarta*)

- Mergen, D.E. 2006. *Cypripedium parviflorum* Salisb. (Lesser yellow lady's slipper): A Technical Conservation Assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

How important are pollinators?

- Astragalus (45 spp) Critically important
- Penstemon (28 spp) Critically important
- Carex (24 spp) Not important
- Physaria (19 spp) Critically important
- Eriogonum (18 spp) Really important
- Draba (16 spp) Probably not important
- Oreocarya (13 spp) Usually important
- Botrychium (12 spp) Not relevant
- Mentzelia (8 spp) Critically important
- Aletes (8 spp) Probably important
- Oenothera (8 spp) Critically important
- Phacelia (8 spp) Many poorly known, important in most
- Asclepias (7 spp) Critically important

Pollinator Conservation

- Pollinators are a critical part of the equation for successful conservation of rare plants.

Pollinator Conservation

- Research
  - More funding needed
- Incentives
  - NRCS: Pollinator practices
  - Million Pollinator Garden Challenge
  - NWF
- Education
  - Xerxes Society, USFS
- Regulation
  - neonictinoid insecticides
- Policy
- Helping Pollinators
  - Bee boxes near rare plant occurrences

Pollinator Conservation

- Education
  - American Mountaineering Center

The Neonictinoid Issue

Table 5.1 Toxicity of Neonicotinoids

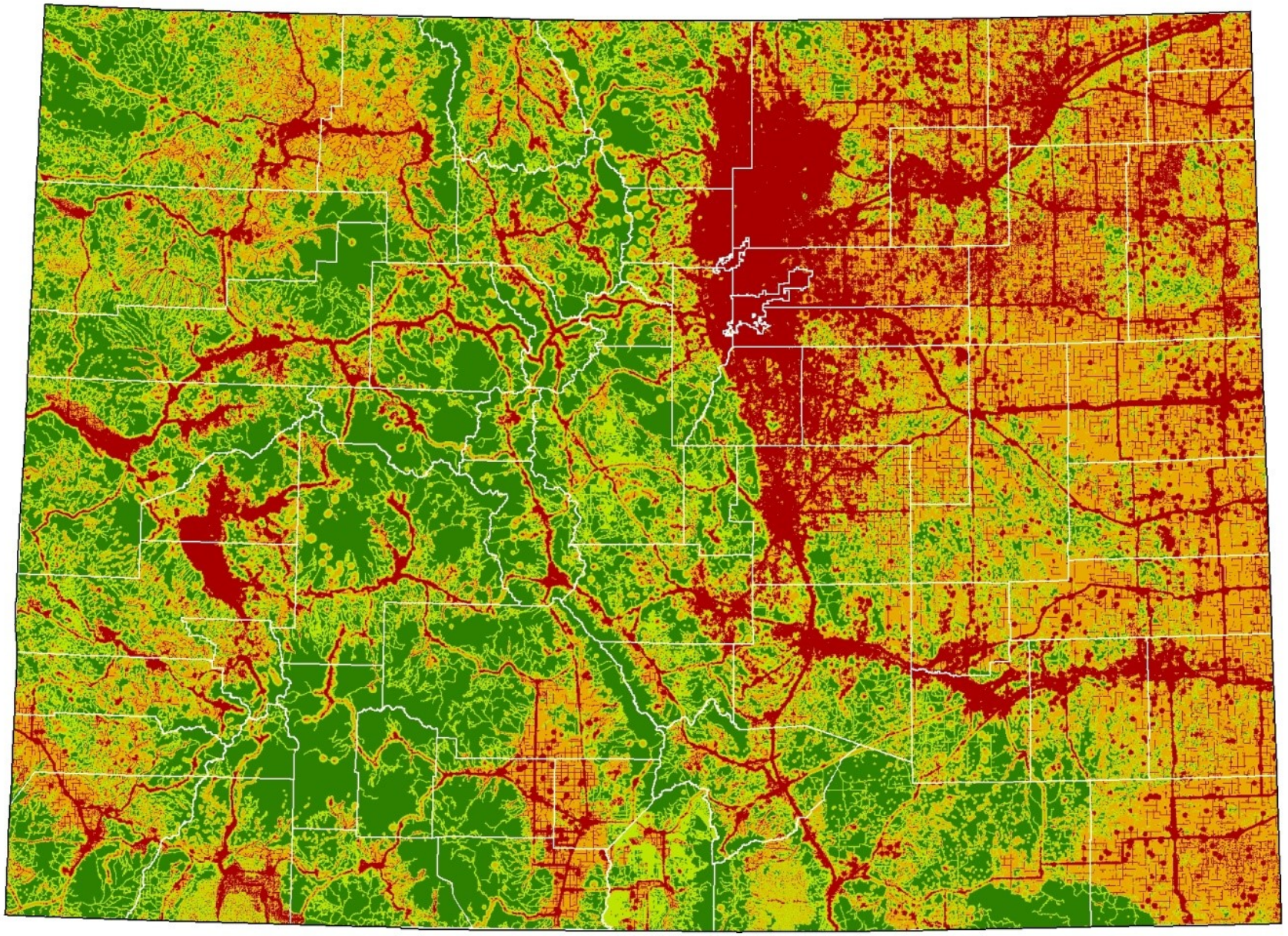
Neonicotinoid	Known Toxicity to Honey Bees[1]		
		Contact LD_{50}	Oral LD_{50}
Acetamiprid	M	7.1 µg/bee[2]–8.09 µg/bee[3]	8.85–14.52 µg/bee[3]
Clothianidin	H	0.022 µg/bee[2]–0.044 µg/bee[4]	0.00379 µg/bee[5]
Dinotefuran	H	0.024 µg/bee[2]–0.061 µg/bee[6]	0.0076–0.023 µg/bee[6]
Imidacloprid	H	0.0179 µg/bee[4]–0.243 µg /bee[7]	0.0037 µg/bee[7]–0.081 µg/bee[8]
Thiacloprid	M	14.6 µg/bee[2]–38.83 µg/bee[9]	8.51–17.3 µg/bee[9]
Thiamethoxam	H	0.024 µg/bee[10]–0.029 µg/bee[2]	0.005 µg/bee[10]

H = highly toxic; M = moderately toxic
Toxicity: Highly toxic: LD_{50} < 2 µg/bee; Moderately toxic: LD_{50} 2–10.99 µg/bee; Slightly toxic: LD_{50} 11–100 µg/bee; Practically non-toxic: LD_{50} >100 µg/bee.

Sources: 1. WSDA 2010; 2. Iwasa et al. 2004; 3. EC 2004b; 4. EPA 2003a; 5: EC 2005; 6. EPA 2004; 7. Schmuck et al. 2001; 8. Nauen et al. 2001 ; 9. EC 2004a; 10. Syngenta Group 2005.

- Impacts on native bees and other pollinators remain poorly understood

Colorado's Landscape Disturbance Index



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Thank You!

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