MPG Ranch Bee Monitoring Update

Marirose Kuhlman

December 2014

Image 1. A leafcutter bee (*Megachile spp.*) rests on a blanketflower (*Gaillardia aristata*).

Summary

- This update documents a multi-year project to collect baseline data on native bees.
- We found 132 species, 74 of which are new records for Montana. This is a 30% increase in bee species documented in the state.
- We collected specimens of *Megachile apicalis*, a non-native invasive bee species that appears to be expanding its range.
- A preliminary result is that one genus appeared to track disturbance.

Table of Contents

Introduction

Restoration projects aim to return diverse plant communities and ecosystem function to disturbed landscapes. Bees play a critical role in this effort to increase biodiversity because they are the main pollinating taxon (NRC 2007). Diverse

Photo credits: MK=Marirose Kuhlman, SB=Skyler Burrows

pollinator assemblages influence the persistence of functional plant communities (Fontaine, et al. 2006) and robust pollinator-plant mutualisms are foundational in functional ecosystems.

Bees require suitable floral communities and species-specific nesting substrates for survival and reproduction. Unlike other pollinating insect taxa such as butterflies and hoverflies, bees provision a nest with pollen and must stay within an efficient foraging distance of the nest (Michener 2007, Jauker, et al. 2009). Body size affects bees' foraging ranges, with smaller bees traveling shorter distances and larger bees able to venture farther (Greenleaf, et al. 2007, Gauthmann and Tscharnke 2002). Bee species differ in their responses to disturbance type. The type of disturbance influences bee community composition (Williams, et al. 2010). In this way, bee community composition may be used as a response variable in restoration efforts, where managers hope to see increased community function over time.

Monitoring animal or plant communities requires baseline data, but such information is lacking with respect to native North American bee populations (NRC 2007), and no known bee monitoring efforts exist in our area. With this in mind, we initiated a bee monitoring program using a standardized method (LeBuhn, et al. 2003) on MPG Ranch in 2013. The goals of this project are threefold: We aim to:

1. Document bee species richness and abundance at the intensive monitoring plots (IMPs)
2. Monitor how bee communities change in response to restoration treatments
3. Contribute to the knowledge base regarding bees in our area, including providing baseline data about bee community composition.

Methods

We sampled at the established intensive monitoring plots in 2013 and 2014 (Image 2, page 3). Other monitoring efforts occurring at these sites includes plant phenology, plant community change, bird point counts, soil moisture and soil temperature measurements. IMPs represent a range of community types and are easily accessible by road.

We followed sampling protocol outlined in "The Bee Inventory (BI) Plot" by LeBuhn, et al. (2003), with some modifications in the amount of time spent netting bees. Data yielded from this protocol can be used to inform conservation planning, to test hypotheses regarding bee-habitat relationships, and for assessing local and site-specific bee species' richness and abundance (LeBuhn, et al., 2003).

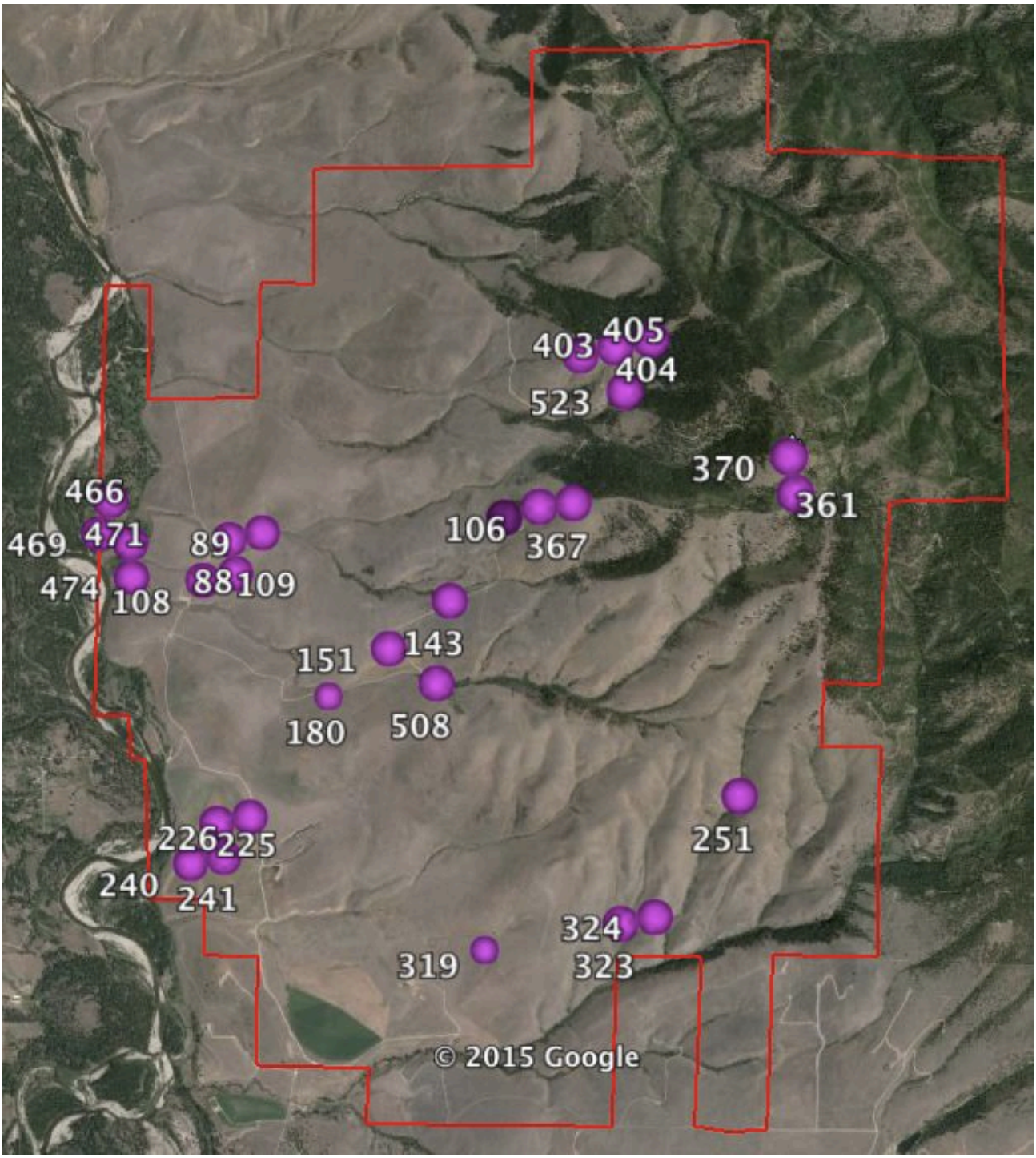

Image 2. Magenta dots on this map of MPG Ranch indicate locations of intensive monitoring points.

Image 3. We use small bowls filled with soapy water to capture bees.

Image 4. Bowl-trapped bees are stored in a preservative until shipment to the Logan Bee Lab for identification.

At each plot, we established two 50m transects intersecting at plot center. We placed a total of 21, 3.25oz Solo cups filled with soapy water about 5m apart along the transects and at plot center. We spray-painted these bowl traps fluorescent blue, fluorescent yellow, or left them white (Image 3). During sampling, each plot received seven traps of each of the three colors. We placed traps out by 9am and collected the contents after 3pm the same day. We transferred trapped bees into 4oz Whirl-Pak bags with 70% isopropanol and kept them frozen until shipment to the USDA-ARS Bee Biology and Systematics Lab (BBSL) in Logan, Utah, for identification (Image 4).

In 2013, we netted at each plot for 30 minutes on sampling days (Image 5). Netting took place between 9am and 12pm on the same day as bowl-trapping, or the following day. We placed netted bees in small sample containers and kept them frozen until shipment to the BBSL (Image 6).

Image 5. We netted bees at each plot for 30 minutes during each sampling period.

Image 6. Netted bees are stored frozen in sample tubes until shipment.

Plot Locations

We sampled at 24 of 28 intensive monitoring plots in 2013, omitting plots in Whaley Draw due to the presence of managed honeybee colonies in that area. In 2014, sampling took place at 26 of 29 IMPs, plus an additional site located in a non-native grassland east of the Top House (Plot 319). Since Plot 319 may eventually undergo restoration treatments, pre-treatment bee community data can provide baseline data and another aspect to assess the success of the restoration efforts.

Timing

Monitoring occurs every 2-4 weeks throughout the field season. In 2013, we sampled 5 times from mid-June until early September. In 2014, we collected 7 times, beginning in May and ending in September. Inclement weather limits sampling: bees are most active on warm, sunny days with little to no wind (LeBuhn, et al. 2003). Because bee communities vary throughout the season and year-to-year, a minimum of five years of data collection is necessary to draw meaningful conclusions about MPG bee communities and populations (LeBuhn, et al. 2003).

Significance of MPG Bee Monitoring

There are 318 documented bee species in Montana, although the actual number of species present is probably higher (Terry Griswold, personal communication). Bee sampling at MPG Ranch in 2013 resulted in identification of 132 bee species from 32 genera and 5 families (Table 1, page 7). 74 of these species are new records for Montana. This is a 30% increase in the number of documented bee species for the state. Our sampling efforts represent a major contribution to the knowledge base regarding bees present in our area, including range expansions for several species and the discovery of a bee species that may be new to science. We expect that the information from the 2014 samples will increase the number of identified bee species documented for the area.

Discussion

Preliminary results show that in 2013 more heavily disturbed areas appear to harbor greater numbers of *Agapostemon* (Green Metallic Sweat Bees, Figure 1, page 6). These bees occur across MPG Ranch and throughout the field season with some seasonal variation in abundance (Figure 2, page 6). As restoration efforts progress, we may see a reduction in the population of *Agapostemon* bees in places like the North Pivot and Killed Crested areas.

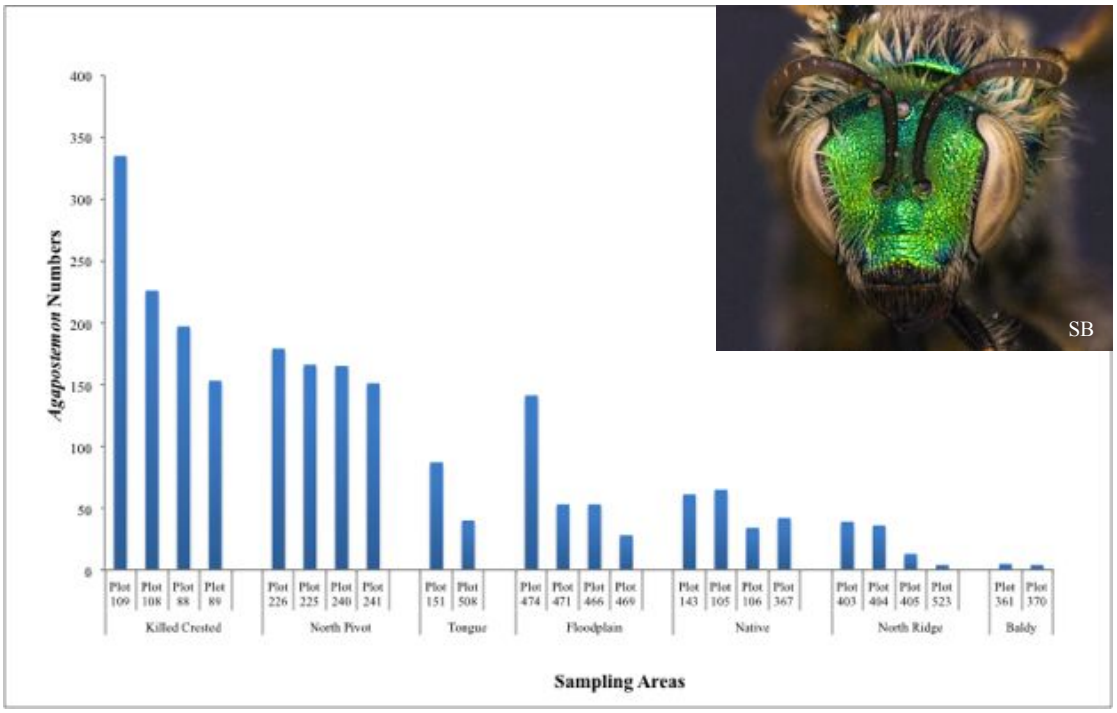

Figure 1. Green Metallic Sweat Bees (*Agapostemon*) show the highest abundance in heavily disturbed areas in 2013. Bars are grouped by generally similar sites.

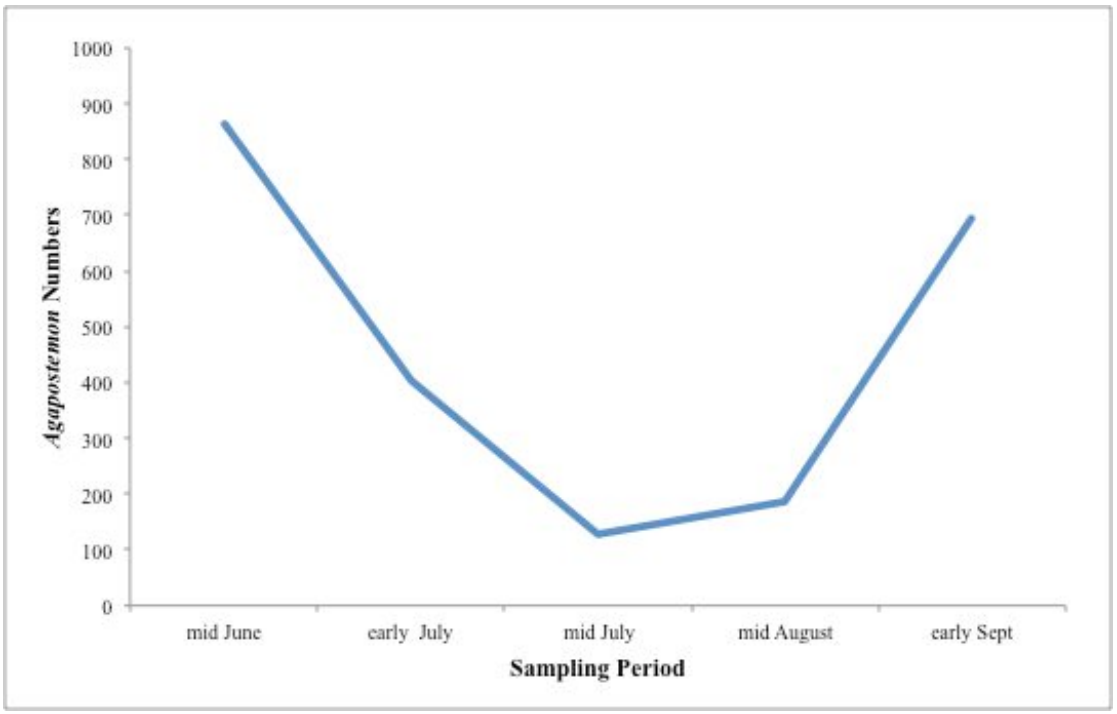

Figure 2. Green Metallic Sweat Bees (*Agapostemon*) appeared to peak in early summer and again in early fall, though captures occurred throughout the 2013 sampling season.

2013 MPG Ranch Bee Families and Genera

Family HALICTIDAE

Genus Name	# of Species
Agapostemon	3
Halictus	4
Lasioglossum	10
Sphecodes	8
Dufourea	2

Family ANDRENIDAE

Genus Name	# of Species
Andrena	13
Panurginus	2
Perdita	3

Family MEGACHILIDAE

Genus Name	# of Species
Anthidium	2
Dianthidium	3
Stelis	2
Coelioxys	2
Megachile	8
Ashmeadiella	1
Atoposmia	1
Heriades	2
Hoplitis	6
Osmia	20

Family APIDAE

Genus Name	# of Species
Anthophora	6
Apis	1
Bombus	6
Eucera	1
Melissodes	3
Melecta	2
Xeromelecta	1
Neopasites	1
Triepeolus	2
Nomada	5
Ceratina	3

Family COLLITIDAE

Genus Name	# of Species
Colletes	3
Hyleus	3

2013 TOTALS

5 Families

32 Genera

132 Species

10,870 individuals

Table 1. This table provides a breakdown and summary MPG's 2013 bee collection by family, genus, and number of species.

References

Fontaine, C, I. Dajoz, J. Meriguet, and M. Loreau (2006). Functional Diversity of Plant-Pollinator Interaction Webs Enhances the Persistence of Plant Communities. *PLoS Biology* 4(1): e1.

Gauthmann, A., and T. Tscharnke (2002). Foraging Ranges of Solitary Bees. *Journal of Animal Ecology* 71:757-764.

Jauker, F., T. Diekötter, F. Schwarzback, and V. Wolters (2009). Pollinator Dispersal in an Agricultural Matrix: Opposing Responses of Wild Bees and Hoverflies to Landscape Structure and Distance from Main Habitat. *Landscape Ecology* 24:547-555.

Goulson, D. (2003). Effects of Introduced Bees on Native Ecosystems. *Annual Review of Ecology, Evolution, and Systematics* 34:1-26.

Greenleaf, S. S., N. M. Williams, R. Winfree, and C. Kreen (2007). Bee Foraging Ranges and their Relationship to Body Size. *Oecologia* 153(3):589-596.

LeBuhn, G., T. Griswold, R. Minckley, S. Droege, T. Roulston, J. Cane, F. Parker, S. Buchmann, V. Tepedino, N. Williams, C. Kremen, and O. Messenger (2003). A Standardized Method for Monitoring Bee Populations – The Bee Inventory (BI) Plot. http://online.sfsu.edu/beeplot/pdfs/Bee%20Plot%202003.pdf

National Research Council. *Status of Pollinators in North America*. Washington, DC: The National Academies Press, 2007.

Michener, Charles D. (2007). *The Bees of the World*, 2nd ed. Baltimore: The Johns Hopkins University Press.

Williams, N. M., E. E. Crone, T. H. Roulston, R. L. Minckley, L. Packer, S. G. Potts (2010). Ecological and Life History Traits Predict Bee Species Responses to Disturbance. *Biological Conservation* 143:2280-2291.

Acknowledgments

Many, many thanks go to Skyler Burrows of the Logan Bee Lab for his meticulous bee identification skills and informative discussions. Also, my appreciation goes to the 2013 and 2014 Field Crew, as well as Teagan Hayes and Alanna Shaw, who have assisted with field collections. Thanks, as well, to my supervisor, Philip Ramsey, and to the Gurinas family for support of this project.