Pollinator Use of Recently Burned Prairie – Cheryl Fimbel, CNLM, August 2012

Objective
To investigate pollinator use of recently burned prairie habitat in relation to unburned habitat.

Approach
Conduct surveys of flower-visiting insects, referred to as 'pollinators', in permanently established burn and control (no-burn) plots prior to and after a late summer burn treatment.

Methods
Field Surveys
Paired 100 m x 50 m plots were established in 2011 at Mima Mounds Natural Area Preserve and at Scatter Creek North Wildlife Management Area. At each site, the paired plots consisted of one plot located within the perimeter of a 2011 scheduled prescribed burn, and the second plot outside this area. Paired plots were separated by $\geq$ 50 m. Pollinator surveys in the paired plots always occurred on the same day at a given site to ensure uniformity in weather and general site conditions. Each survey included 30 or 45 minutes of random walking at ~ 1 km/hr to search for flower-visiting insects throughout each plot. The survey time was divided into 15 minute periods, alternating between paired plots at a single site to minimize the influence of time of day on plot comparisons. Surveys were restricted to the hours of 11:00 – 15:30 and weather conditions that promoted insect flight: enough sun to cast a shadow, $\geq 13^{o}$C, and wind speed < 15-25 kph.

Pollinator surveys involved observations of a) flower visitors and b) flying insects known to visit flowers and provide pollination services, even if they were not visiting a flower at the time of observation. For example, most bees are known to visit flowers and transfer pollen among flowers, whereas many moths do not habitually visit flowers. Therefore, if a bee was observed on the wing, rather than at a flower, I included the observation of that bee in the pollinator survey because most bees are known to transfer pollen among flowers. If a moth was observed flying, however, I did not record the observation of that moth in the plot, because I did not have evidence of flower-visitation for that species. The flower-visitors, along with flying bees, syrphid flies and butterflies, collectively termed 'pollinators', were identified to species, genus, family or sub-order, depending upon ease of identification. I also recorded the floral resource visited. In 2012, flower resources were quantified for each survey by counting the number of flowers or flower heads, depending on species, within a 1 m x 100 m transect through the center of each plot. Differences in floral abundance between burned and control plots were tested using the Chi-square goodness of fit test, using a P value ≤ 0.05 to determine significance.

Three surveys were conducted in 2011 at each site, one per month between 17 May and 22 July, totaling 210 minutes at each site, yielding 237 pollinator observations at Mima Mounds and 210 pollinator observations at Scatter Creek. In 2012, four surveys totaling 210 minutes were conducted between 11 May and 19 July at Mima Mounds, yielding 413 pollinator observations; and two surveys totaling 120 minutes were conducted between 15 May and 15 June at Scatter Creek, yielding 102 pollinator observations.

Data Analysis

Pre-burn pollinator observations collected in 2011 were grouped by pollinator categories (see results) and the abundance for each group analyzed at each site to test for background differences between the paired plots using the Chi-square goodness of fit test ($P \leq 0.05$). To examine differences in use of burned and unburned prairie habitat, 2012 pollinator observations were similarly categorized, and their abundance compared between burned plots and control plots within sites using the Chi-square goodness of fit test. The 2011 data were not compared to the 2012 data to look for differences in use by treatment (eg. comparing 2011 pre-burn to 2012 post-burn observations) because pollinator activity varies considerably among years and even on a daily basis, depending on the weather and quality and quantity of floral resources. Therefore, comparisons were only made between plots where surveys were conducted on the same day.

Results

The 2011 pollinator observations yielded no significant differences in the abundance of pollinators by category in the pre-burn and control plots at Mima Mounds and at Scatter Creek North, suggesting no background differences between paired plots at each site.

The 2012 observations yielded a higher abundance of ochre ringlet butterflies (*Coenonympha tullia eunomia*) in control (unburned) plots compared to burned plots at Mima Mounds ($X^2 = 18.7$, 1 df, $P < 0.001$), and Scatter Creek ($X^2 = 13.3$, 1 df, $P < 0.001$) (Figure 7). Based on relatively few observations (9 total), unknown species of blue butterflies (likely silvery blues, *Glaucopsyche lygdamus columbia*) were more frequently observed in the burned plot compared to the control plot at Scatter Creek ($X^2 = 5.4$, 1 df, $P < 0.025$) during the 15 May survey (Figure 8). Identifications of the blue butterflies were not confirmed to species because the author did not carry a net during surveys to facilitate access to this site.

At Mima Mounds, flower visiting flies were more frequently observed in the control plot compared to the burned plot ($X^2 = 44.1$, 1 df, $P < 0.001$), however, the number of solitary bees and cleptoparasitic bees observed was greater ($X^2 = 21.6.1$, 1 df, $P < 0.001$; $X^2 = 6.4$, 1 df, $P < 0.025$, respectively) in the burned plot compared to the control plot (Figure 7).

Flowers and flower heads were generally more abundant within transects in the burned plots compared to the unburned plots at both sites. At each site, several species were significantly more abundant in the burned plots, especially during the May surveys (Figure 9 and Figure 10).

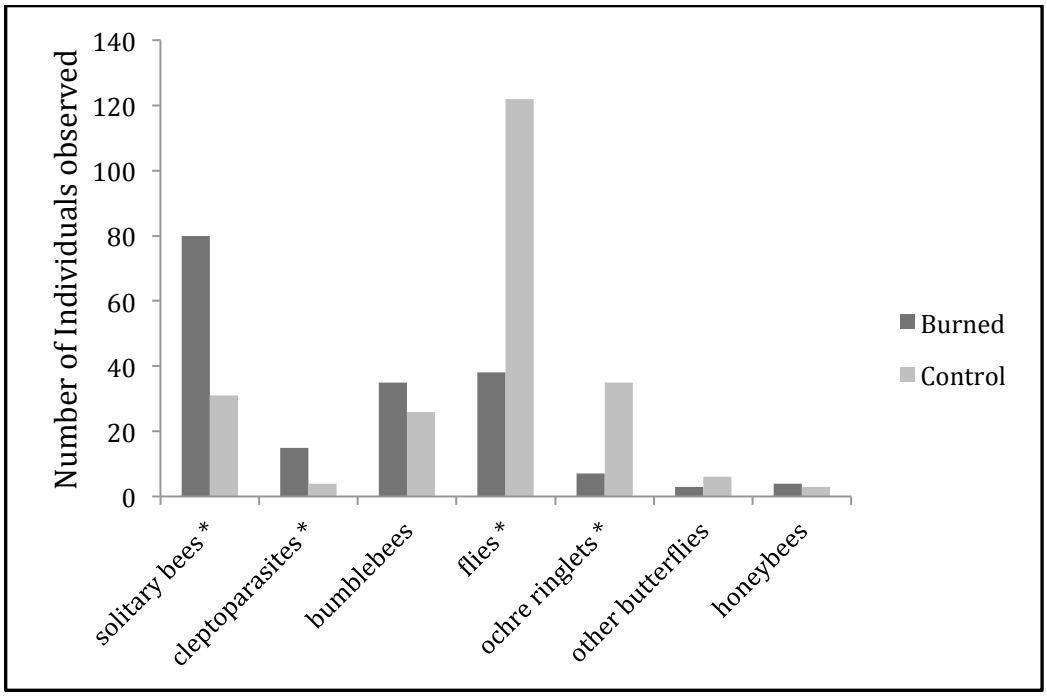

Figure 7. Abundance of pollinators by taxonomic groups observed during 4 visits totaling 105 minutes /treatment/site between 11 May and 19 July, 2012 at burned and control plots at the Mima Mounds Natural Area, Thurston County, WA. Group names followed by an asterisk indicate significant ($P < 0.05$) differences in abundance between burned and control plots.

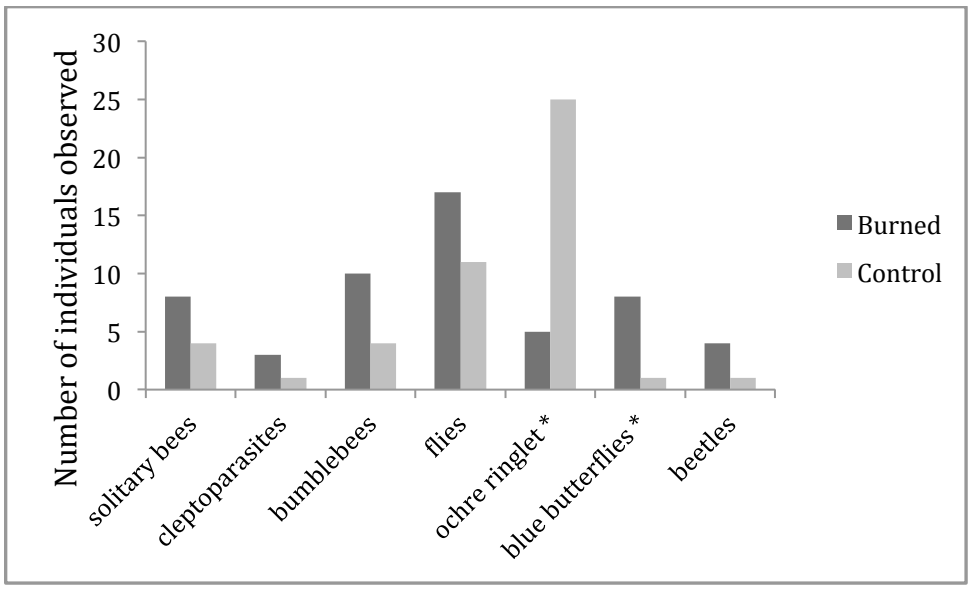

Figure 8. Abundance of pollinators by taxonomic groups observed during 2 visits totaling 60 minutes/treatment/site between 15 May and 15 June, 2012 at burned and control plots at the Scatter Creek WMA, Thurston County, WA. Group names followed by an asterisk indicate significant ($P < 0.05$) differences in abundance between burned and control plots.

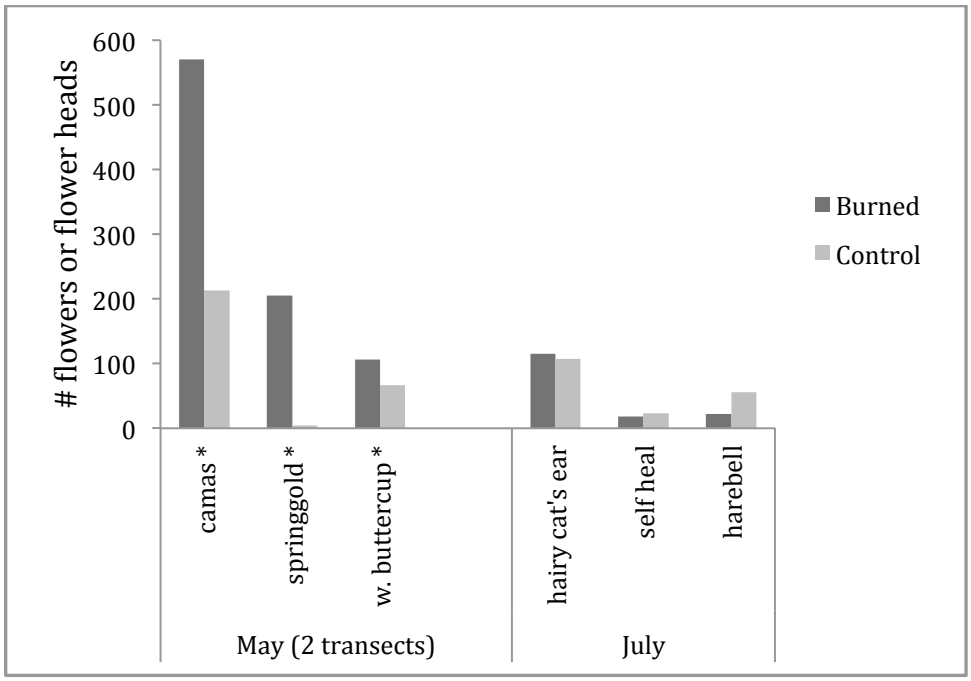

Figure 9. Number of flowers (camas, w. buttercup, hairy cat's ear, harebell) and flowerheads (springgold and self heal), representing the more common floral resources within a 100 m^2 transect in each plot at Mima Mounds NAP, Thurston County, 2012 (the extremely abundant barestem teesdalia is not represented here because it was so abundant in the burned plot that counting flowers for this species was not an efficient use of time). Plants followed by an asterisk indicate significant (P< 0.05) differences in species' abundance between burned and control plots.

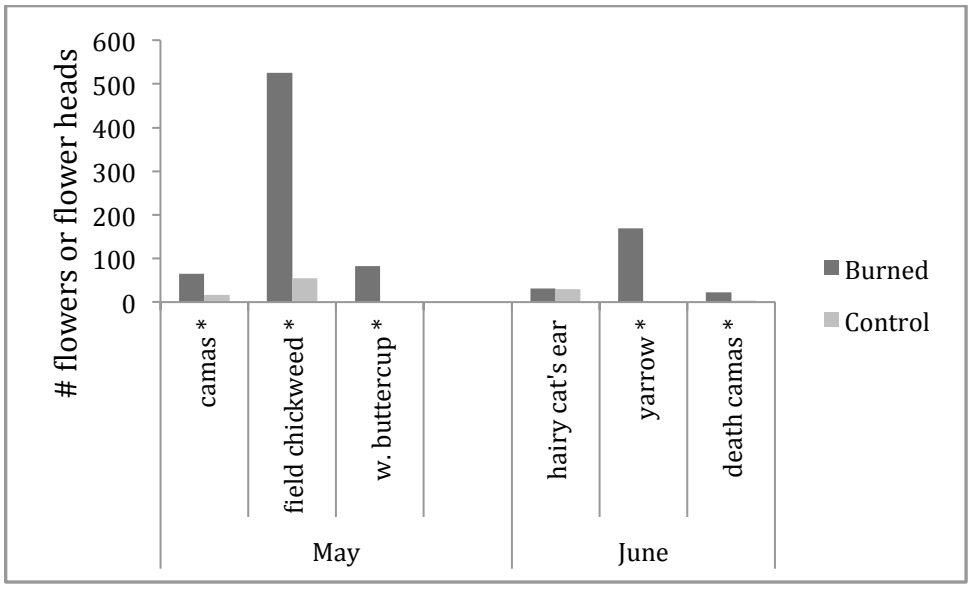

Figure 10. Number of flowers (camas, field chickweed, w. buttercup, and hairy cat's ear) and flowerheads (yarrow and death camas) for the most common floral resources within a 100 m^2 transect in each plot at Scatter Creek North WMA, Thurston County, 2012. Plants followed by an asterisk indicate significant (P< 0.05) differences in species' abundance between burned and control plots.

DISCUSSION

Late summer prairie fires often result in a flush of flowering resources the following spring, as evidenced in the greater abundance of the more common flowering plant species in the 2011 burned plots compared to the control plots at the two study sites. The greater abundance of floral resources was especially noteworthy during the month of May at Mima Mounds with the profusion of camas (*Camassia quamash*) and barestem teesdalia (*Teesdalia nudicaulis),* both popular with bees. Floral resource availability is known to be an important factor directly influencing bee population abundance (Roulston and Goodell 2011). Fire also frequently removes thatch and moss, thereby opening access to bare ground, an important nesting resource for most species of native bees. The combination of increased availability of food and access to nest sites may help to explain the higher abundance of solitary bees, cleptoparasitic bees, and May bumblebees, in the burned plot at Mima Mounds. The pollinator response to burned prairie was less evident at Scatter Creek North. This may have been due to the generally lower availability of floral resources known to be popular with pollinators, such as camas, at Scatter Creek North, compared to Mima Mounds.

Higher bee abundance in recently burned sites is not unique to the South Sound prairies. Changes in floral and nesting resources brought about by fire have resulted in higher abundance and species richness of bees in Mediterranean and European habitats (Moretti et al 2009), and higher abundance of bees following fire in Indiana (Grundel et al. 2010). Table 1 below provides additional comments on the differences in abundance observed in select pollinator groups.

Table 1. Additional information to aid understanding of differences in numbers of pollinators, by group, observed in burned and control (unburned) plots at Mima Mounds Natural Area Preserve and/or Scatter Creek Wildlife Management Area, Thurston County, spring-summer 2012.

Burned +	Control +
Solitary bees – There was a higher number of observations of several species of solitary bees, consisting primarily of small to medium sized sweat bees in the burned plot compared to the control plot at Mima Mounds. Many of these observations consisted of small solitary bees visiting *T. nudicauli* flowers, a non-native annual which frequently becomes abundant following a burn.	**Flies -** higher number of observations due largely to small flies visiting *Ranunculus occidentalis* flowers. This flower was actually more abundant in the burned plot, yet more flies were observed on the *R. occidentalis* in the control plot.
Cleptoparasites – There were a higher number of observations of cleptoparasitic bees in the burned plot compared to the control plot at Mima Mounds due largely to sphecoids flying in May close to the ground, potentially due to a higher abundance of sweat bees in the burned plot (see above) whose nests they commonly parasitize.	**Ochre Ringlets** - Ochre ringlet butterflies were seldom observed in burned plots at Mima Mounds and Scatter Creek, but commonly observed in the control plots at these prairies. Few ochre ringlets were observed nectaring or using any resources in either plot, and no explanation is known for the large difference in observations between burned and control plots.
Unknown Blues – Although there were relatively few blue butterfly observations at Scatter Creek, with the exception of one, they were all in the burned plot,	

primarily flying, with 3 visiting camas (*Camassia quamash*) flowers. **Bumblebees -** the difference in total number of bumblebees observed in the burned compared to the control plots at both sites was not statistically significant. The number of bumblebees observed in early May at Mima Mounds in the burned plots, however, was statistically higher ($P<0.05$) compared to the control plot. The higher observations in the burned plot in May consisted primarily of bumblebees visiting camas flowers, which were much more abundant in the burned plot compared to the unburned control plot.	

FUTURE DIRECTIONS

It would be helpful to continue to conduct surveys into late summer, and also repeat the surveys in 2013 to investigate use of prairie two years following a burn. A mid-August pollinator survey at Scatter Creek North resulted in an equal number of observations of ochre ringlets in the burned and control plots, and similar numbers of floral resources. It is likely that pollinator use of burned and unburned habitats will more closely approximate the pre-burn results (no difference in pollinator use) as the habitat returns to pre-burn composition and structure characteristics. It would be helpful for land managers to have this longer-term knowledge of pollinator use patterns to better understand and manage burned habitats for this important insect group.

LITERATURE CITED

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