Wind energy facility altered seed-set and pollinator assemblages along a 28 km gradient

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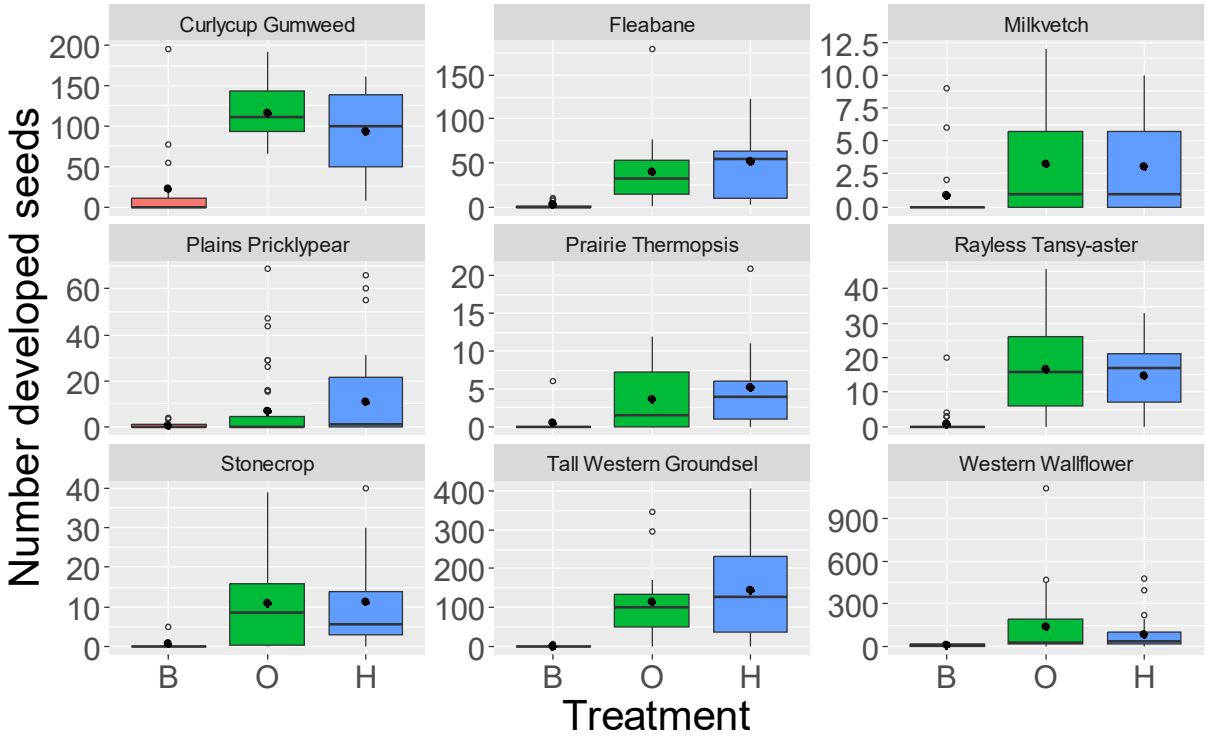
Supplemental Material

For Western Wallflower, the bagged treatment produced the fewest developed seeds (3 on average) compared to the open and hand-pollinated treatments on average (44 seeds; Supplemental Table 1); however, the number of developed seeds produced by Milkvetch did not differ among treatments. None of the plants were limited by pollen as indicated by comparing the open vs. hand-pollinated treatments. Only the number of developed Fleabane seeds in the bagged treatment differed between sites.

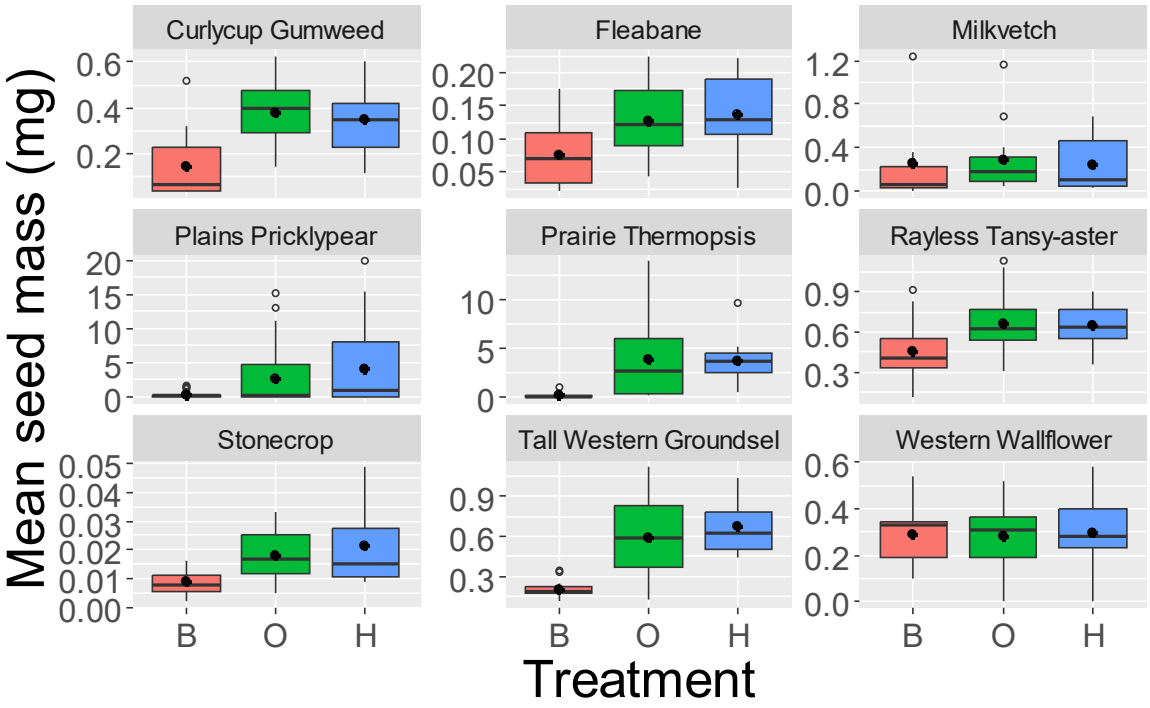
The mean mass of seeds produced varied among species with Stonecrop producing the lightest seeds (0.016 mg) and Prairie Thermopsis making the heaviest seeds on average (2.8 mg). Seeds in the bagged treatment had the lowest mass for each plant species; however, Milkvetch or Western Wallflower are able to self-pollinate as evidenced by the lack of difference among treatments (Table 3, Supplemental Figure 2). None of the plant species were limited by pollen (open vs. hand-pollinated treatments), but Plains Pricklypear produced marginally heavier seeds in the hand-pollinated treatment which may warrant monitoring in the future. Mean seed mass of Plains Pricklypear and Rayless Tansy-aster differed among sites. Plains Pricklypear produced more developed seeds in the hand-pollinated treatment at the site 7 km away compared to the operating wind facility (emmeans, $p = 0.26$). Self-polination by Rayless Tansy-aster produced more developed seeds at the 4 km site compared to the nearby operating wind facility (emmeans, $p = 0.0013$).

Supplemental Table 1. We measured seed-set for 9 plant species at 6 locations. Seed-set was measured at one location except 4 species were measured at 2 locations. We estimated differences in the number of developed seeds and seed mass in the bagged (B; self-pollinated), open (O; pollinated by local insects) and hand-pollinated treatment (H; excess pollen applied by hand). Differences among treatments were calculated using the emmeans package. We estimated differences between sites for plants measured at 2 sites.

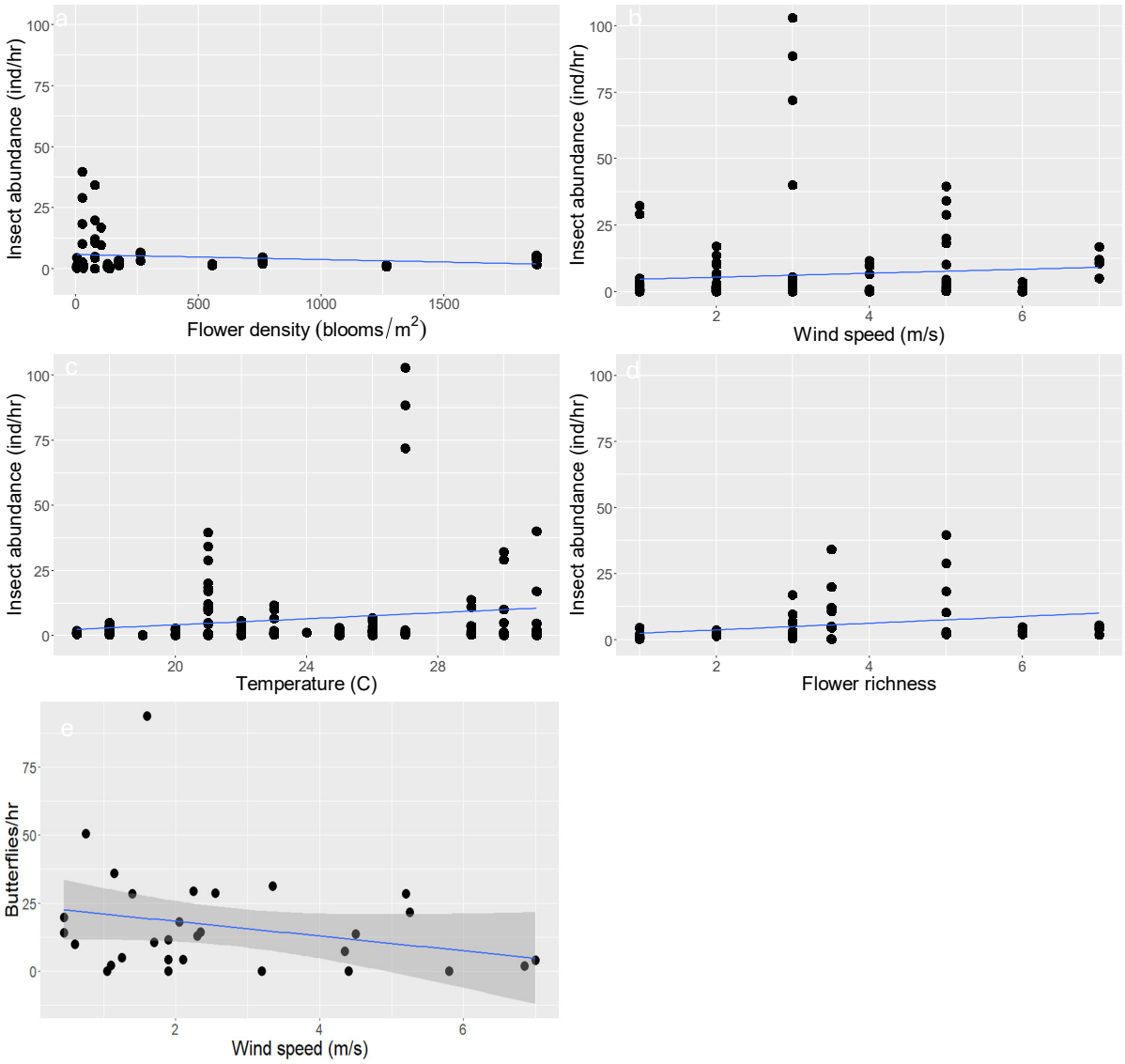
Plants		**Treatment**			**Site**	
Number developed seeds	**z-value**	**B vs. H**	**B vs. O**	**H vs. O**	**z-value**	**p-value**
Curlycup Gumweed	3.1-3.6	0.004	0.0009	0.87		
Fleabane	7.3-8.3	<0.0001	<0.0001		1.9	0.07
Milkvetch	1.6-1.8	0.23	0.17	1.0		
Plains Pricklypear	5.2-4.7	<0.0001	<0.0001	0.68	0.17	0.87
Prairie Thermopsis	3.1-3.5	0.0015	0.006	0.83		
Rayless Tansy-aster	0.87-8.7	<0.0001	<0.0001	0.66	0.77	0.44
Stonecrop	4.5-4.6	<0.0001	<0.0001	1.0		
Tall Western Groundsel	10.0-10.5	<0.0001	<0.0001	0.85		
Western Wallflower	4.3-5.8	<0.0001	<0.0001	0.24	1.0	0.31
Mean seed mass	**z-value**	**B vs. H**	**B vs. O**	**H vs. O**	**z-value**	**p-value**
Curlycup Gumweed	5.6-6.2	<0.0001	<0.0001	0.77		
Fleabane	4.3-4.8	<0.0001	<0.0001	0.75	0.68	0.50
Milkvetch	0.10-0.36	0.99	0.93	0.82		
Plains Pricklypear	5.1-6.5	<0.0001	<0.0001	0.16	1.7	0.09
Prairie Thermopsis	6.0-6.3	<0.0001	<0.0001	0.86		
Rayless Tansy-aster	4.6-6.4	<0.0001	<0.0001	0.83	3.6	0.0005
Stonecrop	2.4-3.2	0.004	0.04	0.64		
Tall Western Groundsel	5.0-5.3	<0.0001	<0.0001	0.70		
Western Wallflower	0.61-0.78	0.72	0.82	0.96	0.85	0.40



Supplemental Figure 1. The number of developed seeds was lowest in the bagged treatment (B) where pollinators could not access flowers suggesting that few seeds could be produced through self-pollination. None of the plants were pollen limited as evidenced by the lack of difference between the open (O; pollinated by local insects) and hand-pollinated treatments (H; excess pollen added). Bold line is the median, black circle is the mean, the lower and upper limits of the box are the 25th and 75th percentile, whiskers are the minimum and maximum values excluding outliers and the open circles are outlier values.



Supplemental Figure 2. The mean seed mass was lowest in the bagged treatment (B) where pollinators could not access flowers suggesting that a low proportion of seeds could be produced through self-pollination. None of the plants were pollen limited as evidenced by the lack of difference between the open (O; pollinated by local insects) and hand-pollinated treatments (H; excess pollen added). Bold line is the median, black circle is the mean, the lower and upper limits of the box are the 25th and 75th percentile, whiskers are the minimum and maximum values excluding outliers and the open circles are outlier values.



Supplemental Figure 3. Insect abundance in vane traps a) was negatively correlated with flower density, and b) positively related to wind speed and c) air temperature. d) The number of bees observed via target netting was positively related to flower richness. e) Butterfly abundance was negatively related to wind speed.