

Insects Surveyed on Flowers in Native and Reconstructed Prairies (Minnesota)

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Insects—the small, often-forgotten members of functioning ecosystems—have, unfortunately, received relatively little attention from restorationists. We have yet to answer several questions about insect populations as they relate to our planning and evaluation of prairie restorations. For example, which insect species readily colonize a prairie restoration and how long does this take? How do insect populations change as the prairie matures? How do they compare with those of remnant sites? Do different combinations of prairie plants attract different types of insects?

Seeking answers to these and other questions, I collected insects on four restored prairies (Carpenter Nature Center, Crow Hassan Park, Afton State Park, Long Lake Regional Park) and four remnant prairies (Cedar Creek Natural History Area, Lost Valley State Natural Area, Afton Remnant, Point Douglas Cemetery) in southeast Minnesota for three summers beginning in 1990. Each of the larger prairie sites, including my study areas, were burned in sections over different years, while the smaller sites were burned completely every few years.

I collected insects from late May to late September on sunny or partly cloudy days between 9:00 am and 4:00 pm when the temperature ranged from 20 to 35 C (68 to 95 F). On these days, I aerially-netted insects only on the flowers of forb species with at least 100 flowers or inflorescences. After making limited collections during 1990, I made 507 collections—218 on remnant sites and 289 on restored sites—during the summers of 1991 and 1992. These collections yielded 3,702 insects representing 298 species of which 83 were from remnant sites only, 73 from restorations only, and 129 from both types of sites. (I also observed, but did not collect, 13 other species.) Insect distribution was patchy. Of the 298 species, I found 121 on only one site, while I collected just six species—a halictid bee (*Augochlorella stricta*), a leaf-cut-

ting bee (*Megachile latimanus*), three bumble bees (*Bombus bimaculatus*, *B. griseocollis*, and *B. vagans*), a syrphid fly (*Toxomerus marginatus*) on all eight sites. Moreover, each site had at least one species found on no other site.

My results suggest that many insects are able to colonize restored prairies, and that plants receive roughly equal numbers of visits in both restored and remnant sites. Phenological differences between the two types of sites may, however, explain why some insects inhabit native but not restored prairies. The restored prairies, most of which were planted during the mid-1980s, were more mesic and had more earlier-blooming forb species (both native and alien). These included large populations of ox-eye sunflower (*Heliopsis helianthoides*), bee balm (*Monarda fistulosa*), yellow coneflower (*Ratibida pinnata*) and black-eyed Susan (*Rudbeckia hirta*). On the other hand, the native prairies generally had more species of forbs in bloom and greater numbers of individual flowers during the late summer and fall. This difference in phenology may account for the slightly greater insect species richness on the native sites because the later-flowering asters and goldenrods have more specialist bee species than do the earlier flowers. In addition, there are more insect predators and parasitoids along with their corresponding prey and hosts during the late summer.

Table 1 is a list of the species I collected, the number of individuals of each species, and the number of restored and remnant sites that each species was collected on.

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Table 1: Order, family, species and number of individual insects collected. Numbers are the number of sites each species was found on. Rec = Reconstructed prairies

Hymenoptera: Colletid bees		
	Native	Rec
<i>Colletes aberrans</i> Cockerell—4		2
<i>Colletes americanus</i> Cresson—1	1	
<i>Colletes brevicornis</i> Robertson—1	1	
<i>Colletes kincaidii</i> Cockerell—5		2
<i>Colletes mandibularis</i> Smith—1		1
<i>Colletes robertsoni</i> Dalla Torre—1		1
<i>Colletes simulans armatus</i> Cresson—16	2	2
<i>Colletes susannae</i> Swenk—10		3
<i>Colletes willmattae</i> Cockerell—1		1
<i>Hylaeus affinis</i> (Smith)—72	2	4
<i>Hylaeus illinoensis</i> (Robertson)—1		1
<i>Hylaeus mesillae cressoni</i> (Cokerell)—27	3	3
<i>Hylaeus modestus</i> Say—6	2	
<i>Hylaeus verticalis</i> (Cresson)—1	1	

(continued)

Andrenid bees		
	Native	Rec
<i>Andrena asteris</i> Robertson—25	3	3
<i>Andrena carlini</i> Cokerell—1	1	
<i>Andrena commoda</i> Smith—5	1	2
<i>Andrena crataegi</i> Robertson—8		1
<i>Andrena cressoni cressoni</i> Robertson—12		1
<i>Andrena erythrogaster</i> (Ashmead)—2		1
<i>Andrena helianthi</i> Robertson—47	3	3
<i>Andrena hirticincta</i> Provancher—24	4	3
<i>Andrena miranda</i> Smith—1		1
<i>Andrena nubecula</i> Smith—27	2	1
<i>Andrena placata</i> Mitchell—26	1	3
<i>Andrena rudbeckiae</i> Robertson—13	2	2
<i>Andrena simplex</i> Smith—28	2	1
<i>Andrena virginiana</i> Mitchell—1	1	
<i>Andrena wilkella</i> (Kirby)—5	1	2
<i>Andrena wilmattae</i> Cockerell—1	1	
<i>Andrena ziziae</i> Robertson—3		1
<i>Heterosarus parvus</i> (Robertson)—1	1	
<i>Perdita albipennis palidipennis</i> Graenicher—2		1
<i>Perdita perpallida citrinella</i> Graenicher—1		1
<i>Perdita swenki</i> Crawford—1		1
<i>Protandrena bancrofti</i> Dunning—2		1
<i>Pterosarus albitarsis</i> (Cresson)—1		1
<i>Pterosarus nebracensis</i> (Crawford)—11	3	2

Sweat bees		
<i>Agapostemon sericeus</i> (Forster)—15	4	2
<i>Agapostemon splendens</i> (Lepeletier)—6	1	1
<i>Agapostemon texanus</i> Cresson—13	1	2
<i>Agapostemon virescens</i> (Fabricius)—38	3	3
<i>Augochlora pura</i> (Say)—1	1	
<i>Augochlorella striata</i> (Provancher)—76	4	4
<i>Augochloropsis metallica</i> (Fabricius)—7	3	1
<i>Dialictus albipennis</i> (Robertson)—10		2
<i>Dialictus anomalus</i> (Robertson)—9	1	
<i>Dialictus coeruleus</i> (Robertson)—1	1	
<i>Dialictus cressonii</i> (Robertson)—5	3	1
<i>Dialictus heterognathus</i> Mitchell—23	1	
<i>Dialictus illinoensis</i> (Robertson)—3	1	
<i>Dialictus imitatus</i> (Smith)—56	2	1
<i>Dialictus lineatulus</i> (Crawford)—23	1	3
<i>Dialictus near laevissimus</i> —6	2	1
<i>Dialictus near rohweri</i> —9	1	1
<i>Dialictus near paradmirandus</i> —7		1
<i>Dialictus nymphaeorum</i> (Robertson)—3		2
<i>Dialictus perpunctatus</i> (Ellis)—6		1
<i>Dialictus pictus</i> (Crawford)—22		2
<i>Dialictus pilosus</i> (Smith)—193	4	3
<i>Dialictus pruinosus</i> (Robertson)—15	1	3
<i>Dialictus supraclypeatus</i> Mitchell—1	1	
<i>Dialictus tegularis</i> (Robertson)—5	1	1
<i>Dialictus vierecki</i> (Crawford)—11	1	2
<i>Dialictus zephyrus</i> (Smith)—2	1	1
<i>Dufourea monardae</i> (Viereck)—61	3	2
<i>Evyllaes cinctipes</i> (Provancher)—5	3	
<i>Evyllaes pectoralis</i> (Smith)—17	3	2
<i>Evyllaes truncatus</i> (Robertson)—1	1	

	Native	Rec
<i>Halictus confusus</i> Smith—45	3	3
<i>Halictus ligatus</i> Say—66	4	2
<i>Halictus parallelus</i> Say—3	1	1
<i>Halictus rubicundus</i> (Christ)—4	2	
<i>Lasioglossum acuminatum</i> McGinley—4	1	1
<i>Lasioglossum athabascense</i> (Sandhouse)—1		1
<i>Lasioglossum coriaceum</i> (Smith)—3	2	1
<i>Lasioglossum leucozonium</i> (Schrank)—2	2	
<i>Lasioglossum paraforbesii</i> McGinley—9	2	2
<i>Sphécodes</i> spp.—19	1	2

Leaf-cutting bees		
<i>Anthidium psoraleae</i> Robertson—1	1	
<i>Coelioxys alternata</i> Say—1	1	
<i>Coelioxys modesta</i> Smith—1	1	
<i>Coelioxys octodentata</i> Say—1	1	
<i>Coelioxys rufitarsus</i> Smith—3		1
<i>Heriades carinata</i> Cresson—45	3	4
<i>Hoplitis cylindrica</i> (Cresson)—5	1	1
<i>Hoplitis pilosifrons</i> (Cresson)—25		2
<i>Hoplitis producta</i> (Cresson)—2	1	1
<i>Megachile brevis</i> Say—5	3	1
<i>Megachile gemula</i> Cresson—1	1	
<i>Megachile latimanus</i> Say—71	4	4
<i>Megachile mendica</i> Cresson—3	1	1
<i>Megachile montivaga</i> Cresson—1	1	
<i>Megachile pugnata</i> Say—7	1	2
<i>Megachile relativa</i> Cresson—10	2	1
<i>Osmia distincta</i> Cresson—5	1	
<i>Osmia simillima</i> Smith—1		1

Cuckoo, digger, and carpenter bees		
<i>Anthophora furcata terminalis</i> Cresson—19	1	1
<i>Ceratina calcarata</i> Robertson or <i>C. dupla</i> Say—107	4	3
<i>Epeolus scutellaris</i> Say—2	1	
<i>Melissodes agilis</i> Cresson—22	3	3
<i>Melissodes bimaculata bimaculata</i> (Lepeletier)—4	2	
<i>Melissodes dentiventris</i> Smith—13	1	2
<i>Melissodes desponsa</i> F. Smith—21	2	1
<i>Melissodes gelida</i> LaBerge—1	1	
<i>Melissodes illata</i> Lovell—5	1	2
<i>Melissodes rustica</i> (Say)—15	2	2
<i>Melissodes subillata</i> LaBerge—22	3	3
<i>Melissodes trinodis</i> Robertson—43	3	3
<i>Nomada</i> spp.—15	1	3
<i>Svastra obliqua obliqua</i> (Say)—10	1	2
<i>Synhalonia dubitata</i> Cresson—18		1
<i>Synhalonia hamata</i> Bradley—2		1
<i>Triepeolus</i> sp.—3	2	

Honeybees and bumblebees		
<i>Bombus affinis</i> Cresson—42	4	3
<i>Bombus auricomus</i> (Robertson)—32	3	4
<i>Bombus bimaculatus</i> Cresson—98	4	4
<i>Bombus borealis</i> Kirby—6	2	1
<i>Bombus fervidus</i> (Fabricius)—98	3	4
<i>Bombus griseocollis</i> (Degeer)—165	4	4
<i>Bombus impatiens</i> Cresson—81	4	3
<i>Bombus pennsylvanicus</i> (Degeer)—14	1	2

(continued)

	Native	Rec
<i>Bombus ternarius</i> Say—9	1	1
<i>Bombus terricola</i> Kirby—2	1	1
<i>Bombus vagans</i> Smith—154	4	4
<i>Psithyrus ashtoni</i> (Cresson)—3	2	1
<i>Psithyrus citrinus</i> (Smith)—3	1	1
Braconid wasps		
<i>Cardochiles</i> sp—1	1	
<i>Chelonus sericeus</i> (Say)—5		2
<i>Rogas terminalis</i> (Cresson)—1	1	
Ichneumon wasps		
<i>Campoplex</i> sp—1		1
<i>Ceratogastra ornata</i> Say—4		1
<i>Cremastus hyalinipennis</i> (Cresson)—1		1
<i>Exetastes angustoralis</i> Cushman—2	1	
<i>Temelucha ferruginea</i> (Davis)—1		1
Pteromalid wasps		
<i>Perilampus hyalinus</i> Say—4	1	1
Cuckoo wasps		
<i>Ceratochrysis kansensis</i> (Viereck)—1		1
Mud daubers, sand wasps, cicada killers		
<i>Ammophila urnaria</i> Lepeletier—4	2	1
<i>Anacrabro ocellatus</i> Packard—3	1	1
<i>Bembix americana spinolae</i> Lepeletier—6	2	2
<i>Bembix belfragei</i> Cresson—3	2	
<i>Bembix sayi</i> Banks—6		1
<i>Bicyrtes quadrifasciata</i> (Say)—1	1	
<i>Bicyrtes ventralis</i> (Say)—2	1	1
<i>Cerceris clypeata</i> Dahlbom—3	2	
<i>Cerceris deserta</i> Say—4	2	2
<i>Cerceris nigrescens</i> Smith—1		1
<i>Cerceris</i> sp 1—3	1	2
<i>Cerceris</i> sp 2—1	1	
<i>Cerceris</i> sp 3—1		1
<i>Cerceris</i> sp 4—1		1
<i>Cerceris</i> sp 5—1		1
<i>Chlorion aerarium</i> Patton—2	1	1
<i>Ectemnius continuus</i> (Fabricius)—2	1	1
<i>Ectemnius lapidarius</i> (Panzer)—2	1	1
<i>Ectemnius maculosus</i> (Gmelin)—2		2
<i>Ectemnius</i> sp.—1		1
<i>Eremnophila aureonotata</i> (Cameron)—2	1	
<i>Oxybelus sublatatus</i> Robertson—1		1
<i>Philanthus bilunatus</i> Cresson—7	3	1
<i>Philanthus gibbosus</i> (Fabricius)—2	1	
<i>Philanthus politus</i> Say—2		2
<i>Philanthus sanbornii</i> Cresson—1		1
<i>Philanthus ventilabris</i> Fabricius—9	1	3
<i>Podalonia mickeli</i> Murray—2	1	
<i>Sphex ichneumoneus</i> (Linnaeus)—2		2
<i>Sphex pennsylvanicus</i> Linnaeus—4	1	2
<i>Tachytes crassus</i> Patton—2		2
<i>Tachytes pennsylvanicus</i> Banks—5	1	1

Tiphiid wasps

	Native	Rec
<i>Myzinum maculatum</i> (Fabricius) 30	2	1
<i>Myzinum quinquecincta</i> (Fabricius)—49	3	3
<i>Paratiphia texana</i> Cameron—2	1	

Spider wasps

	Native	Rec
<i>Anoplius Anoplius illinoensis</i> (Robertson)—2	2	
<i>Anoplius Pompilinus marginatus</i> (Say)—3	1	2
<i>Anoplius</i> sp—1	1	
<i>Episyrion biguttatus biguttatus</i> (Fab)—3	1	1

Scoliid wasps

	Native	Rec
<i>Campsomeris plumipes confluenta</i> (Drury)—3	2	
<i>Campsomeris ephippium</i> (Say)—1	1	
<i>Scolia bicincta</i> Fabricius—1	1	

Potter wasps

	Native	Rec
<i>Ancistocerus catskill albophaleratus</i> (Saussure)—12	1	2
<i>Ancistocerus antilope antilope</i> (Panzer)—3	1	1
<i>Ancistocerus adiabatus adiabatus</i> (Saussure)—7	3	2
<i>Eumenes crucifera nearcticus</i> Provancher—5	2	
<i>Eumenes fraternus</i> Say—1	1	
<i>Euodynerus foraminatus foraminatus</i> (Saussure)—23	3	2
<i>Parancistroceras vagus vagus</i> (Saussure)—1	1	

Hornets, yellow jackets

	Native	Rec
<i>Polistes fuscatus</i> (Fabricius)—70	4	3
<i>Vespa arenaria</i> (Fabricius)—4	1	
<i>Vespa maculata</i> (Linnaeus)—1	1	
<i>Vespa vidua</i> (Saussure)—3	3	

Diptera: Anthomyiid flies

	Native	Rec
<i>Hylemya</i> sp—10	2	3

Bee flies

	Native	Rec
<i>Anastoechus</i> sp—3	1	
<i>Chrysanthrax</i> sp—5	1	
<i>Exoprosopa caliptera</i> (Say)—14	1	1
<i>Exoprosopa dorcadion</i> Osten Sacken—1		1
<i>Exoprosopa</i> sp—7	1	1
<i>Hemipenthes sinuosa</i> (Wiedemann)—1		1
<i>Lepidophora</i> sp—1	1	
<i>Paravilla</i> sp—3		1
<i>Phthiria</i> sp—7	1	
<i>Poecilanthrax</i> sp—3	1	1
<i>Sparnopolius</i> sp—2	1	
<i>Systoechus</i> sp—16	1	2
<i>Villa</i> sp 1—1	1	
<i>Villa</i> sp 2—3	1	1
Calliphoridae		
<i>Bufoleucilia</i> sp—1	1	

Thick-headed flies

	Native	Rec
<i>Physocephala tibialis</i> (Say)—2	2	
<i>Physoconops brachyrhynchus</i> (Macquart)—2	1	
<i>Physoconops obscuripennis</i> (Williston)—1	1	
<i>Thecophora</i> sp—1	1	

(continued)

	Native	Rec
Zodion sp 1—2	1	
Zodion sp 2—1	1	
Milichiid flies		
<i>Eusiphona</i> sp—5	1	1
Horse flies, stable flies		
<i>Musca autumnalis</i> De Geer—1		1
<i>Stomoxys calcitrans</i> (Linnaeus)—1		1
Soldier flies		
<i>Heuriodiscus vertebratus</i> (Say)—1	1	
<i>Odontomia pubescens</i> Day—1		1
<i>Stratiomys obesus</i> Loew—4		2
Flower flies		
<i>Allograpta obliqua</i> (Say)—15	3	4
<i>Chrysotoxum</i> sp—1		1
<i>Epistrophe emarginata</i> (Say)—4	2	1
<i>Eristalis</i> sp 1—1		1
<i>Eristalis</i> sp 2—1		1
<i>Eristalis arbustorum</i> (Linnaeus)—3	2	
<i>Eristalis bardus</i> (Say)—4		2
<i>Eristalis dimidiatus</i> Wiedemann—43	3	3
<i>Eristalis latifrons</i> Loew—51	2	3
<i>Eristalis tenax</i> (Linnaeus)—8	2	3
<i>Eristalis transversus</i> Wiedemann—26	3	3
<i>Helophilus fasciatus</i> Walker—17	3	3
<i>Helophilus latifrons</i> Loew—7	1	1
<i>Lejops stipatus</i> Walker—10		1
<i>Mallota bautias</i> (Walker)—1	1	2
<i>Metasyrphus</i> sp—12	4	
<i>Neocnemodon</i> sp—1	1	
<i>Orthonevra</i> sp—3		2
<i>Parhelophilus laetus</i> Loew—1		1
<i>Parhelophilus</i> sp—1		1
<i>Platycheirus</i> sp—5	1	2
<i>Sphaerophoria contigua</i> Macquart—10	1	3
<i>Sphaerophoria</i> sp—10	2	4
<i>Spilomyia quadrifasciata</i> (Say)—2		1
<i>Syrirta pipiens</i> (Linnaeus)—7	1	1
<i>Syrphus</i> sp—23	3	4
<i>Toxomerus geminatus</i> (Say)—13	2	4
<i>Toxomerus marginatus</i> Say—106	4	4
<i>Tropidia</i> sp—1		1
Tabanid flies		
<i>Chrysops</i> sp—2	1	1
Tachinid flies		
<i>Archytas</i> sp—6	2	3
<i>Cylindromyia binotata</i> (Bigot)—5	1	
<i>Dinera</i> sp—1		1
<i>Gymnoclytia</i> sp 1—1	1	
<i>Gymnoclytia</i> sp 2—2	1	
<i>Leucostoma</i> sp—1		1
<i>Ptilodexia incerta</i> West—3		2
<i>Ptilodexia</i> sp—1	1	

	Native	Rec
Fruit flies		
<i>Orellia ruficauda</i> (Fabricius)—1		1
Lepidoptera: Skippers		
<i>Anatrytone logan</i> (Edwards)—12	2	3
<i>Epargyreus clarus</i> (Cramer)—3	1	1
<i>Euphyes conspicua</i> (Edwards)—1	1	
<i>Euphyes vestris</i> (Boisduval)—7	2	1
<i>Hesperia l. leonardus</i> Harris—2	1	
<i>Hesperia leonardus pawnee</i> Dodge—2	1	
<i>Polites coras</i> (Cramer)—1		1
<i>Polites origines</i> (Fabricius)—1	1	
<i>Polites themistocles</i> (Latreille)—1	1	
<i>Thorybes pylades</i> (Scudder)—2	2	
<i>Wallengrenia egeremet</i> (Scudder)—3		3
Whites and sulphurs		
<i>Colias eurytheme</i> Boisduval—9	2	3
<i>Colias philodice</i> Godart—7	2	1
Blues, coppers, and hairstreaks		
<i>Callophrys gryneus g.</i> (Hubner)—3	2	
<i>Celastrina argiolus</i> (Linnaeus)—1	1	
<i>Harknclenus titus</i> (Fabricius)—4	1	
<i>Satyrium edwardsii</i> (Grote and Robinson)—15	2	
Brush-footed butterflies		
<i>Asterocampa celtis</i> (Boisduval and Leconte)—1		1
<i>Cercyonis pegala</i> (Fabricius)—2		2
<i>Nymphalis milberti</i> (Godart)—1	1	
<i>Phyciodes tharos</i> (Drury)—1		1
<i>Speyeria aphrodite</i> (Fabricius)—4	2	1
<i>Speyeria cybele</i> (Fabricius)—1		1
<i>Vanessa cardui</i> (Linnaeus)—9	1	3
Sphinx moths		
<i>Hemaris diffinis</i> (Boisduval)—5	2	1
<i>Hemaris thysbe</i> (Fabricius)—2	2	
Army worms, underwings		
<i>Alypia octomaculata</i> Fabricius—1		1
Ctenuchid moths		
<i>Cisseps fulvicollis</i> (Hubner)—1	3	4
Other insects observed but not collected: Honeybee, monarch butterfly, goldenrod soldier beetle, black blister beetle, corn rootworms, flea beetle, locust borer, tarnished plant bug, assassin bug, stink bugs, and ambush bug.		
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