HABITAT FOR POLLINATORS: IMPROVING MANAGEMENT OF REGIONALLY SIGNIFICANT XERIC GRASSLANDS, BARRENS, AND WOODLANDS IN THE NORTHEAST

2018 Summary Report

Prepared for
The Northeast Association of Fish and Wildlife
U.S. Fish and Wildlife Service

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Goals and objectives achieved in 2018

A standardized pollinator protocol was developed for the 2018 season of the Xeric Grassland, Barren, and Woodland Pollinator Conservation Project anticipated to improve the ability of Northeast states to implement cost-effective habitat management to benefit native pollinators and Regional Species of Greatest Conservation Need that depend on these priority habitats. A network of twelve organizations (state, federal, and not-for-profit), representing eight states (VA, MD, NJ, NY, MA, NH, VT, ME) enrolled to participate in the first year of this project. The sites were located in seven ecoregions within the eastern United States. All participants received the necessary equipment to collect and mail bee specimens to a central lab at the University of Massachusetts-Amherst to be processed and identified. Through a webinar, all participating sites were provided training on how collect bees using bee bowls (pan traps) and hand netting. Each site received a copy of the RCN pollinator protocol to assist in their collection efforts. An undergraduate student was hired as a summer intern to help process bees in the lab. Over the course of the season a total of 3237 bees representing 5 families, 25 genera, and 125 species have been identified to the lowest taxonomic level possible. Three species listed on State Wildlife Action Plans (SWAP) were collected. Baseline bee datasets developed from these surveys will help guide future treatment and management activities to create and restore xeric grasslands, barrens, and woodland communities.

Methods:

A network of twelve organizations (state, federal, and not-for-profit-organizations), representing eight states (VA, MD, NJ, NY, MA, NH, VT, ME) enrolled to participate in the first year of the project. (Table 1). The sites were located in seven ecoregions within the eastern United States (Fig. 1). All participants received the necessary equipment to collect and mail bee specimens to a central lab at the University of Massachusetts-Amherst to be processed and identified (see attached "RCN Equipment list for participants"). Through a webinar developed for the program, all participating sites were provided training on how collect bees using bee bowls and hand netting. Each site received a copy of the RCN pollinator protocol (see attached "RCN Bee Sampling Protocol_2018").

Bees were collected in transects consisting of 24 bee bowls (fluorescent blue, yellow, or plain white) placed 5m apart in alternating colors along a 120m transect deployed for 24 hours on four occasions. Bowls were deployed during four sample windows to reflect the regional range of flight activity. In addition, bees were collected through targeted netting for 30 minutes at each site within one meter of the bowl transects either before or after the bee bowls were deployed.

Bees were collected by a staff member from each organization and sent to a lab at the University of Massachusetts-Amherst where they were processed, pinned, labeled and identified species or

morphospecies using keys by Mitchell (1960, 1962), Gibbs (2010, 2011), Sheffield et al. (2011), and online sources (Discoverlife.org). The bidentate Nomada, Halictus ligatus/poeyi, and female Hylaeus affinis/modestus were left as morphospecies because at this time keys do not exist to key them out definitively. The majority of the identifications were made by Joan Milam (University of Massachusetts-Amherst), with some outside assistance from Michael F. Veit (Townsend, MA), and Rob Jean (Environmental Solutions & Innovations, Inc.).

Three bee species were listed on State Wildlife Action Plans (SWAP): Maryland, *Lasioglossum arantium* (State Rare/Watchlist), and *L. georgeickworti* (Status uncertain); and Maine, *Bombus griseocolis.* See attached spreadsheet for specific locations.

Table 1. The abundance and species richness of bees collected from sites participating in the bees in xeric barrens project listed by organization, town and state, transect(s), latitude and longitude, and EPA ecological region.

Organization	Town/ State	Latitude	Longitude	Ecoregion	Species Richness	Abundance
Linda Loring Nature Foundation						
Linda Loring NF; Transect 1	Nantucket, MA	41.2241	-70.1743	84 - Atlantic Coastal Pine Barrens	17	114
Linda Loring NF; Transect 2	Nantucket, MA	41.2903	-70.1799	84 - Atlantic Coastal Pine Barrens	28	350
MD Dept. Nat. Resources						
Foster Tract, Pocomoke S.F.	nr. Snow Hill, MD	38.245	-75.5036	63 - Middle Atlantic Coastal Plain	24	79
Furnace Tract, Pocomoke S.F.	nr. Snow Hill, MD	38.2044	-75.4747	63 - Middle Atlantic Coastal Plain	14	83
GRSF Slider SWHA (Unit 8)	Town Creek, MD	39.6202	-78.5688	67 - Ridge and Valley	31	193
MassWildlife						
Frances Crane WMA	Falmouth, MA	41.6413	-70.5596	84 - Atlantic Coastal Pine Barrens	14	45
SE Pine Barrens WMA	Plymouth, MA	41.8254	-70.6841	84 - Atlantic Coastal Pine Barrens	4	7
Nantucket Conservation Foundation, Inc.						

Head of the Plains; Transect 1	Nantucket, MA	41.2636	-70.1686	84 - Atlantic Coastal Pine Barrens	23	520
Head of the Plains; Transect 2	Nantucket, MA	41.2635	-70.1784	84 - Atlantic Coastal Pine Barrens	24	457
Head of the Plains; Transect 3	Nantucket, MA	41.2659	-70.1745	84 - Atlantic Coastal Pine Barrens	26	204
NY State Dept. of Env. Conservation						
Rocky Point	Suffolk, NY	40.9055	-72.9143	84 - Atlantic Coastal Pine Barrens	11	19
The Nature Conservancy - Katama Plains						
Katama	Edgartown, MA	41.3577	-70.5239	84 - Atlantic Coastal Pine Barrens	19	160
The Nature Conservancy - NH						
Ossipee Pine Barrens	Madison, NH	44.8437	-70.1836	58 - Northeast Highlands	12	24
The Nature Conservancy - Maine						
Kennebunk Plains	York, ME	43.4066	-70.628	59 - Northeastern Coastal Zone	14	128
Wells Barrens Preserve	Wells, ME	43.3752	-70.647	59 - Northeastern Coastal Zone	10	29
The Trustees of Reservations						

The Farm Institute	Edgartown, MA	41.3576	-70.5196	84 - Atlantic Coastal Pine Barrens	20	130
Smithsonian Conservation Biology Inst.						
SCB1	Front Royal, VA	38.8884	-78.1685	66 - Blue Ridge	28	118
VT. Fish and Wildlife Dept.						
Sandbar WMA	Milton, VT	44.6199	-73.2138	83 - Eastern Great Lakes and Hudson Lowlands	41	493
Dept. Env. Protection NJ						
Warren Grove Range	Bass River, NJ	39.7291	-74.4488	84 - Atlantic Coastal Pine Barrens	15	78

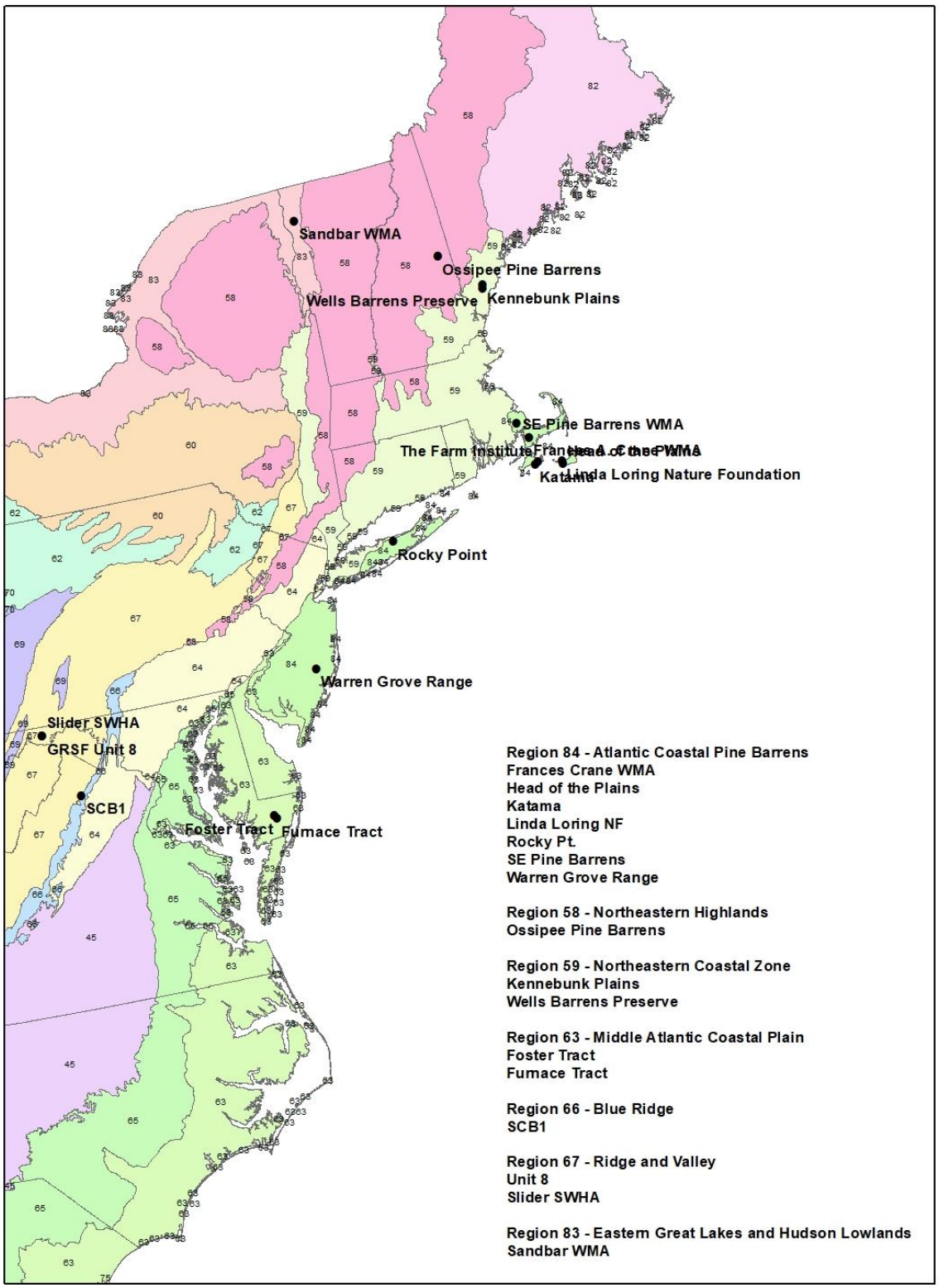

Figure 1. EPA Ecoregion associations of the twelve sites participating in the Habitat for Pollinators: Improving Management of Regionally Significant Xeric Grasslands, Barrens, and Woodlands in the Northeast Project from May through September, 2018. Note that Unit and Slider SWHA are actually one site.

Results:

Over the course of the 2018 season 3,237 bees from 5 families, 25 genera, and 125 species were collected (Table 2) on four separate sampling events (Tables 3 & 4) by the twelve participating organizations (Table 1, Appendix 1). Of the bee species collected, ninety-two species (74%) were represented by fewer than 10 individuals, and of these, 43 were represented by singletons (34%). *Augochlorella aurata*, the most commonly collected species, accounted for nearly half of all specimens collected (47%). Tables of bee species for each site were created (Appendix 2).

Species richness varied greatly by site and sampling effort (Fig. 2). Estimated actual species richness generated using the USGS SPECRICH calculator (Burnham and Overton, 1979) was considerably higher for most sites.

Lasioglossum floridanum was captured only at Maryland's Furnace and Foster tracks, and was the most abundant species at Furnace track. This is similar to the bee survey work by Selfridge et al. (2017) that found *L. floridanum* to be the most abundant species collected in their study. Maryland captured 3 *Lasioglossum arantium*, a species that has only been collected in dune habitats in Maryland and New Jersey (Selfridge et al. 2017, Gibbs 2011). Few(n=7) *Lasioglossum pilosum* were collected by the twelve sties. *L. pilosum* is considered a sand loving bee (Goldstein and Ascher 2016) that was expected to be more abundant at the xeric communities sampled. Milam (unpublished data) found *L. pilosum* to be very abundant at the Montague Plains Wildlife Management Area in Montague, MA, a pitch pine-scrub oak barren; however, the Danforth lab at Cornell reports that this bee is apparently declining in the Northeast (https://pollinator.cals.cornell.edu/wild-bees-new-york/species-list-bees-new-york/).

Table 2. The number of specimens collected from all sites within each family and genus.

Family/genera	Number of specimens
Andrenidae	**45**
Andrena	38
Calliopsis	3
Perdita	4
Apidae	**281**
Anthophora	1
Apis	58
Bombus	89
Ceratina	96
Epeolus	2
Habropoda	6
Melissodes	2
Nomada	24
Xylocopa	3
Colletidae	**52**
Colletes	15
Hylaeus	37
Halictidae	**2770**
Agapostemon	133
Augochlora	4
Augochlorella	1527
Augochloropsis	2
Halictus	96
Lasioglossum	1005
Sphecodes	4
Megachilidae	**120**
Coelioxys	1
Hoplitis	20
Megachile	38
Osmia	61

Table 3**.** Detailed breakdown of samples showing the number of bees in each round of bowls and netting from each site.

	Bowl Transect Round			Total # bees in bowls	Netting Round			Total # bees netted
Site	**April-May**	**June-July**	**August-Sept.**		**April-May**	**June-July**	**August-Sept.**	
				Massachusetts				
Frances Crane WMA	no sample	33	12	**45**	no sample	no sample	no sample	**0**
Head of the Plains								
Head of the Plains; Transect 1	73	417	9	**499**	9	9	3	**21**
Head of the Plains; Transect 2	96	330	6	**432**	4	8	13	**25**
Head of the Plains; Transect 3	24	155	13	**192**	4	6	2	**12**
Katama	48	100	3	**151**	2	7	no bees	**9**
Linda Loring Nature Foundation								
Linda Loring Nature Foundation; Transect 1	32	68	7	**107**	no bees	1	6	**7**
Linda Loring Nature Foundation; Transect 2	112	188	43	**343**	no bees	5	2	**7**
SE Pine Barrens WMA	no sample	no sample	7	**7**	no sample	no sample	no sample	**0**
The Farm Institute	5	87	27	**119**	3	5	3	**11**
				Maryland				
Foster Tract	31	8	6	**45**	24	8	3	**35**
Furnace Tract	14	23	35	**72**	9	lost bees	2	**11**
GRSF Slider SWHA (U8)	46	93	18	**115**	**10**	19	7	**36**
				New Hampshire				

Ossipee Pine Barrens	11	8	3	**22**	no sample	2	no bees	**2**
			New Jersey					
Warren Grove Range	10	51	17	**78**	no sample	no bees	no sample	**0**
			New York					
Rocky Point	8	7	no sample	**15**	4	no sample	no sample	**4**
			Virginia					
SCB1	no sample	63	no sample	**63**	no sample	55	no sample	**55**
			Vermont					
Sandbar WMA	349	60	49	**458**	no sample	7	30	**37**
			Maine					
Kennebunk Plains	no sample	104	no sample	**104**	no sample	24	no sample	**24**
Wells Barrens Preserve	no sample	27	no sample	**27**	no sample	2	no sample	**2**

Table 4. Number of sampling rounds (rounds of bowl transects and netting) per site, broken down by month. Sites are abbreviated as follows: Foster Tract= FOT, Frances A Crane WMA= FC WMA, Furnace Tract = FUT, Green Ridge State Forest Slider SWHA = GRSF SSWHA (U8), Head of the Plains Transect # = HAPT#, Katama = KT, Kennebunk Plains = KP, Linda Loring Nature Foundation Transect # = LLNFT#, Ossippee Pine Barrens = OPB, Rocky Point = RP, Sandbar WMA = SAWMA, Smithsonian Conserv. Bio. Inst. 1 = SCB1, SE Pine Barrens WMA = SE PB WMA, The Farm Institute = FI, Warren Grove Range = WGR, Wells Barrens Preserve = WBP.

Month	FOT	FUT	GRSF SSWHA (U8)	FC WMA	SE PB WMA	SA WMA	HAPT1	HAPT2	HAPT3	KT	KP	OPB	RP	SCB1	FI	LLNFT1	LLNFT2	WGR	WBP	Grand Total
Apr	1																			**1**
May	1	1	1			1	1	1	1	1		1	2		1	1	1	1		**15**
Jun				1		1	1	1	1	1			1	2		1	1	1		**12**
Jul	1	1	1				1	1	1	1	1	1		1	1	1	1	1	1	**15**
Aug	1	1				1						1								**4**
Sep			1	1	1		1	1	1	1		1			1	1	1	1		**12**
Grand Total	**4**	**3**	**3**	**2**	**1**	**3**	**4**	**4**	**4**	**4**	**1**	**4**	**3**	**3**	**3**	**4**	**4**	**4**	**1**	**59**

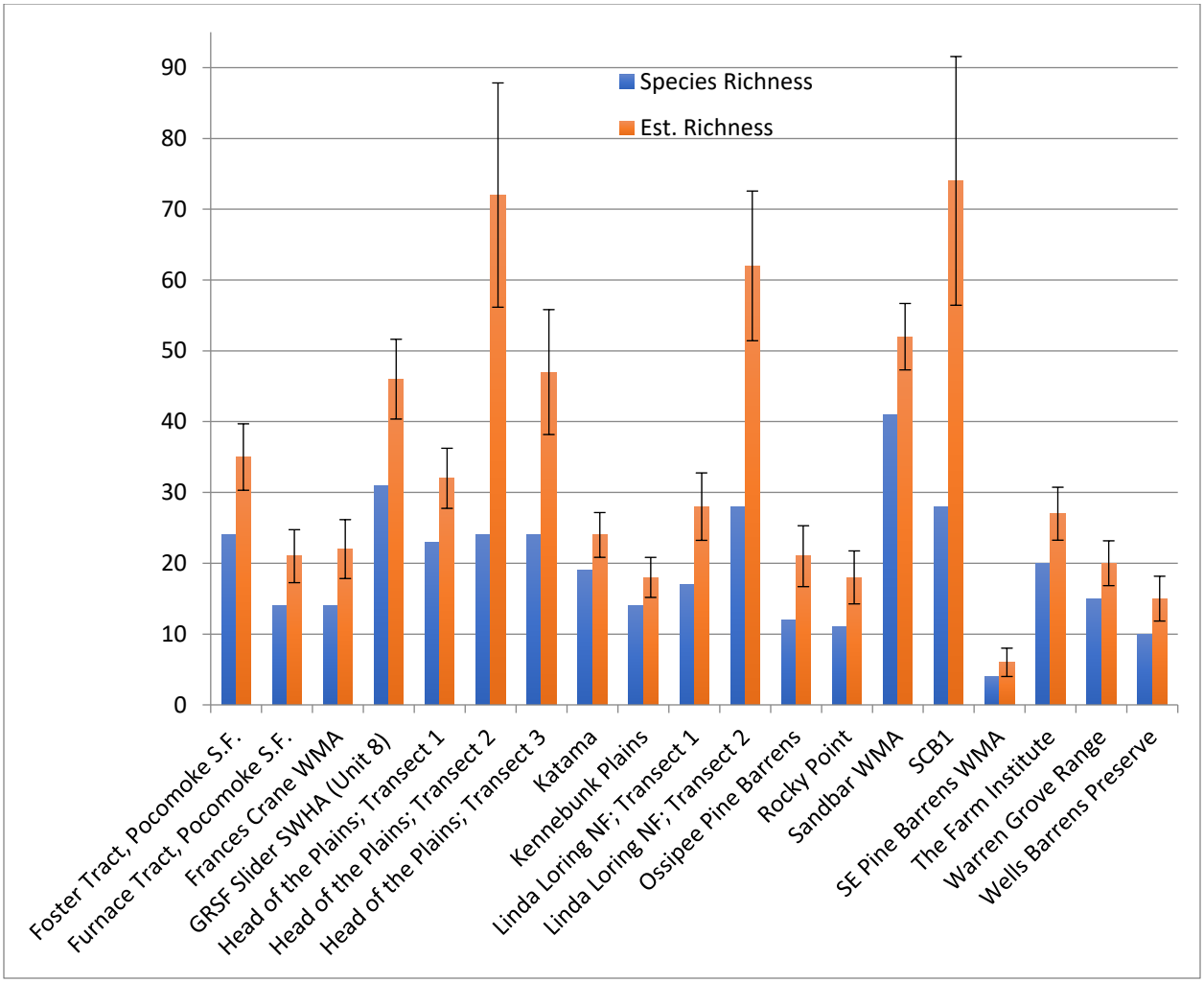

Figure 2. Species richness and estimated species richness for each site/ transect. Estimated species richness represents the Interpolated N from USGS SPECRICH calculator (Burnham and Overton, 1979). Error bars represent standard error.

Discussion:

Suggestions for the 2019 field season include updating the field sheet for easier participant usage and ensuring that Sharpie pens aren't used when labeling whirl-paks for bee specimens. Sharpie ink often leaks into whirl-paks staining bees making challenging to ID. Additionally, more work should be done with participants on netting skills to increase diversity of bee species collected. Notices should be sent to participants during the appropriate time of year indicating what bees we would like them to target with nets and on what flowers.

Acknowledgments:

Many thanks to staff members from each organization who deployed bee bowls and netted bees. And thanks to the summer interns, Aliza Fassler, Andrea Sroka-Rivera, and Phoebe Hynes, who helped process bees for the project. And thanks to Aliza Fassler for her help with data management and the creation of tables and figures.

Literature Cited:

Burnham, K.P., and W.S. Overton. (1979). Robust Estimation of Population Size When Capture Probabilities Vary Among Animals. Ecology 60(5). pp. 927-936. doi:10.2307/1936861.

Gibbs, J. (2010) Revision of the metallic species of Lasioglossum (Dialictus) in Canada (Hymenoptera, Halictidae, Halictini). Zootaxa, 2591, 1–382.

Gibbs, J. (2011) Revision of the metallic Lasioglossum (Dialictus) of eastern North America (Hymenoptera: Halictidae: Halictini). Zootaxa, 3073, 1–216.

Goldstein, P.Z. and J.S. Asher (2016) Taxonomic and behavioral composition of an island fauna: (Hymenoptera: Apoidea: Anthophila) on Martha's Vineyard, Massachusetts. Proc. of the Entomological Soc. of Washington, 118(1):37-92.

Mitchell, T.B. (1960) Bees of the Eastern United States: volume I. N. C. Agricultural Experimental Station Technical Bulletin, 141, 1–538.

Mitchell, T.B. (1962) Bees of the Eastern United States: volume II. N. C. Agricultural Experimental Station Technical Bulletin, 152, 1–557.

Sheffield, C.S., C. Ratti, C., Packer, L. & Griswold, T. (2011) Leafcutter and mason bees of the genus Megachile Latreille (Hymenoptera: Megachilidae) in Canada and Alaska. Canadian Journal of Arthropod Identification, 18, 1–107.

Selfridge, J.A., C.T. Frye, J. Gibbs, and R.P. Jean. (2017) The bee fauna of inland sand dune and ridge woodland communities in Worcester County, Maryland. The Northeastern Nat. 24(4):421-445.

Appendix 2. In this section the tables of species composition listed from most to least abundant at each site are presented alphabetically by the site name. This same information can be found in the attached Appendix 2.

Foster Tract species list

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	15
Halictus poeyi/*ligatus*	11
Lasioglossum (*Dialictus*) *vierecki* (Crawford, 1904)	10
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	8
Habropoda laboriosa (Fabricius, 1804)	5
Lasioglossum (*Dialictus*) *floridanum* (Robertson, 1982)	4
Lasioglossum (*Dialictus*) bruneri (Crawford, 1902)	3
Apis (*Apis*) *mellifera* Linnaeus, 1758	2
Bombus (*Cullumanobombus*) *griseocollis* (DeGeer, 1773)	2
Megachile (*Litomegachile*) *texana* Cresson, 1878	2
Nomada illinoensis Robertson, 1900	2
Osmia (*Osmia*) *lignaria* Say, 1837	2
Perdita (*Alloperdita*) *bradleyi* Viereck, 1907	2
Augochlora (*Augochlora*) *pura* (Say, 1837)	1
Ceratina (*Zadontomerus*) *dupla* Say, 1837	1
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	1
Lasioglossum (*Dialictus*) *coreopsis* (Robertson, 1902)	1
Lasioglossum (*Dialictus*) *oblongum* (Lovell, 1905)	1
Lasioglossum (*Hemihalictus*) *sopinci* (Crawford, 1932)	1
Megachile (*Litomegachile*) *brevis* Say, 1837	1
Megachile (*Litomegachile*) *mendica* Cresson, 1878	1
Megachile (*Melanosarus*) *xylocopoides* Smith, 1853	1
Osmia (*Melanosmia*) *pumila* Cresson, 1864	1
Sphecodes galerus Lovell and Cockerell, 1907	1
Total # of Species: 24	**79**

Furnace Tract species list

Taxon	Abundance of Taxon
Lasioglossum (*Dialictus*) *floridanum* (Robertson, 1982)	51
Lasioglossum (*Dialictus*) *vierecki* (Crawford, 1904)	10
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	6
Lasioglossum (*Dialictus*) *arantium* Gibbs, 2011	3
Lasioglossum (*Dialictus*) *pilosum* (Smith, 1853)	2
Megachile (*Xanthosarus*) *addenda* Cresson, 1878	2
Perdita (*Perdita*) *octomaculata* (Say, 1824)	2
Osmia (*Melanosmia*) *sandhouseae* Mitchell, 1927]	1
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	1
Coelioxys (*Coelioxys*) *immaculata* Cockerell, 1912	1
Habropoda laboriosa (Fabricius, 1804)	1
Hoplitis (*Alcidamea*) *producta* (Cresson, 1864)	1
Hoplitis (*Alcidamea*) *truncata* (Cresson, 1878)	1
Megachile (*Litomegachile*) *mendica* Cresson, 1878	1
Total # of Species: 14	
	83

Frances Crance WMA species list

Taxon	Abundance of Taxon
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	11
Augochlorella aurata (Smith, 1853)	11
Halictus (*Odontalictus*) *ligatus* Say, 1837	6
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	5
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	2
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	2
Andrena (*Melandrena*) *vicina* Smith, 1853	1
Bombus (*Pyrobombus*) *sandersoni* Franklin, 1913	1
Ceratina (*Zadontomerus*) *dupla* Say, 1837	1
Ceratina (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011	1
Hoplitis (*Alcidamea*) *truncata* (Cresson, 1878)	1
Lasioglossum (*Dialictus*) *admirandum* (Sandhouse, 1924)	1
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	1
Megachile (*Megachile*) *centuncularis* (Linnaeus, 1758)	1
Total # of Species: 14	**45**

Table 8. GRSF Slider SWHA (Unit 8) species list listed by abundance.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	82
Lasioglossum (Dialictus) versatum (Robertson, 1902)	31
Halictus poeyi/ligatus	16
Lasioglossum (Dialictus) tegulare (Robertson, 1890)	7
Lasioglossum (Dialictus) hitchensi Gibbs, 2012	6
Ceratina (Zadontomerus) dupla Say, 1837	5
Ceratina (Zadontomerus) mikmaqi Rehan and Sheffield, 2011	5
Andrena (Simandrena) nasonii Robertson, 1895	4
Bombus (Cullumanobombus) griseocollis (DeGeer, 1773)	4
Hylaeus affinis / modestus group	3
Bombus (Pyrobombus) impatiens Cresson, 1863	3
Augochlora (Augochlora) pura (Say, 1837)	3
Osmia (Diceratosmia) conjuncta Cresson, 1864	2
Andrena (Melandrena) carlini Cockerell, 1901	2
Halictus (Seladonia) confusus Smith, 1853	2
Lasioglossum (Dialictus) albipenne (Robertson, 1890)	2
Hoplitis (Alcidamea) pilosifrons (Cresson, 1864)	2
Lasioglossum (Dialictus) georgeickworti Gibbs, 2011	1
Lasioglossum (Hemihalictus) pectorale (Smith, 1853)	1
Agapostemon (Agapostemon) texanus Cresson, 1872	1
Bombus (Thoracobombus) fervidus (Fabricius, 1798)	1
Andrena (Iomelissa) violae Robertson, 1891	1
Ceratina (Zadontomerus) calcarata Robertson, 1900	1
Osmia (Melanosmia) pumila Cresson, 1864	1
Lasioglossum (Dialictus) admirandum (Sandhouse, 1924)	1
Andrena (Taeniandrena) wilkella (Kirby, 1802)	1
Andrena (Euandrena) algida Smith, 1853	1
Agapostemon (Agapostemon) virescens (Fabricius, 1775)	1
Lasioglossum (Dialictus) cressonii (Robertson, 1890)	1
Lasioglossum (Dialictus) ellisiae (Sandhouse, 1924)	1
Ceratina (Zadontomerus) strenua Smith, 1879	1
Total # of Species: 31	**193**

Table 9. Head of the Plains transect 1 species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	347
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	80
Lasioglossum (*Hemihalictus*) *pectorale* (Smith, 1853)	25
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	17
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	15
Megachile (*Xanthosarus*) *addenda* Cresson, 1878	5
Bombus (*Pyrobombus*) *bimaculatus* Cresson, 1863	4
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	4
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	3
Colletes validus Cresson, 1868	3
Colletes americanus Cresson, 1868	2
Halictus (*Protohalictus*) *rubicundus* (Christ, 1791)	2
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	2
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)	2
Andrena (*Melandrena*) *carlini* Cockerell, 1901	1
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	1
Colletes simulans armatus	1
Halictus (*Odontalictus*) *ligatus* Say, 1837	1
Lasioglossum (*Dialictus*) *admirandum* (Sandhouse, 1924)	1
Lasioglossum (*Dialictus*) *bruneri* (Crawford, 1902)	1
Lasioglossum (*Dialictus*) *versatum* (Robertson, 1902)	1
Megachile (*Litomegachile*) *brevis* Say, 1837	1
Osmia (*Melanosmia*) *atriventris* Cresson, 1864	1
Total # of species: 23	**520**

Table 10. Head of the Plains transect 2 species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	254
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	44
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	40
Lasioglossum (*Dialictus*) *admirandum* (Sandhouse, 1924)	27
Lasioglossum (Hemihalictus) *pectorale* (Smith, 1853)	17
Halictus (*Odontalictus*) *ligatus* Say, 1837	13
Apis (*Apis*) *mellifera* Linnaeus, 1758	11
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	9
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	7
Lasioglossum (*Dialictus*) *georgeickworti* Gibbs, 2011	6
Halictus (*Protohalictus*) *rubicundus* (Christ, 1791)	5
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	4
Colletes validus Cresson, 1868	3
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	3
Lasioglossum (*Dialictus*) *versatum* (Robertson, 1902)	3
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)	3
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	1
Ceratina (*Zadontomerus*) *calcarata* Robertson, 1900	1
Ceratina (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011	1
Hylaeus (*Prosopis*) *affinis* (Smith, 1853)	1
Lasioglossum (*Dialictus*) *bruneri* (Crawford, 1902)	1
Lasioglossum (*Dialictus*) *pruinosum* (Robertson, 1892)	1
Osmia (*Melanosmia*) *atriventris* Cresson, 1864	1
Osmia (*Melanosmia*) *pumila* Cresson, 1864	1
Total # of species: 24	**457**

Table 11. Head of the Plains transect 3.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	64
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	35
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	28
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	17
Lasioglossum (Hemihalictus) *pectorale* (Smith, 1853)	13
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	10
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)	6
Halictus (Odontalictus) *ligatus* Say, 1837	5
Lasioglossum (*Dialictus*) *bruneri* (Crawford, 1902)	4
Nomada articulata Smith, 1854	3
Halictus (Protohalictus) *rubicundus* (Christ, 1791)	2
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	2
Andrena(Andrena) *carolina* Viereck, 1909	1
Andrena(Melandrena) *vicina* Smith, 1853	1
Bombus (Psithyrus) *citrinus* (Smith, 1854)	1
Bombus (Pyrobombus) *bimaculatus* Cresson, 1863	1
Bombus (Pyrobombus) *impatiens* Cresson, 1863	1
Colletes validus Cresson, 1868	1
Lasioglossum (*Dialictus*) *cressonii* (Robertson, 1890)	1
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	1
Lasioglossum (*Dialictus*) *georgeickworti* Gibbs, 2011	1
Lasioglossum (*Lasioglossum*) *fuscipenne* (Smith, 1853)	1
Lasioglossum (*Dialictus*) *smilacinae* (Robertson, 1897)	1
Megachile (Xanthosarus) *addenda* Cresson, 1878	1
Nomada australis Mitchell, 1962	1
Osmia (Melanosmia) *atriventris* Cresson, 1864	1
Total # of species: 26	**204**

Table 12. Katama species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	70
Lasioglossum (*Dialictus*) *pruinosum* (Robertson, 1892)	32
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	9
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	9
Bombus (*Cullumanobombus*) *griseocollis* (DeGeer, 1773)	6
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	6
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	5
Andrena(*Simandrena*) *nasonii* Robertson, 1895	3
Halictus (*Odontalictus*) *ligatus* Say, 1837	3
Hylaeus (*Prosopis*) *affinis* (Smith, 1853)	3
Osmia (*Melanosmia*) *pumila* Cresson, 1864	3
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	2
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	2
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	2
Ceratina (*Zadontomerus*) *dupla* Say, 1837	1
Halictus (*Seladonia*) *confusus* Smith, 1853	1
Hylaeus (*Prosopis*) *modestus* Say, 1837	1
Lasioglossum (Hemihalictus) *pectorale* (Smith, 1853)	1
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	1
Total # of species: 19	**160**

Table 13. Kennebunk Plains species list.

Taxon	**Abundance of Taxon**
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	54
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	27
Augochlorella aurata (Smith, 1853)	15
Bombus (*Pyrobombus*) *bimaculatus* Cresson, 1863	8
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	5
Megachile (*Litomegachile*) *brevis* Say, 1837	5
Lasioglossum (*Dialictus*) *pruinosum* (Robertson, 1892)	3
Megachile (*Xanthosarus*) *latimanus* Say, 1823	3
Halictus (*Odontalictus*) *ligatus* Say, 1837	2
Lasioglossum (*Dialictus*) *admirandum* (Sandhouse, 1924)	2
Bombus (Cullumanobombus) *griseocollis* (DeGeer, 1773)	1
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	1
Lasioglossum (*Dialictus*) *smilacinae* (Robertson, 1897)	1
Melissodes (*Eumelissodes*) *druriella* (Kirby, 1802)	1
Total # of species: 14	**128**

Table 14. Linda Loring Nature Foundation transect 1 species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	84
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	9
Apis (*Apis*) *mellifera* Linnaeus, 1758	3
Andrena(*Melandrena*) *vicina* Smith, 1853	2
Colletes simulans armatus	3
Lasioglossum (*Dialictus*) *admirandum* (Sandhouse, 1924)	2
Lasioglossum (*Hemihalictus*) *pectorale* (Smith, 1853)	2
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	1
Andrena(*Melandrena*) *carlini* Cockerell, 1901	1
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	1
Halictus (*Odontalictus*) *ligatus* Say, 1837	1
Halictus (*Seladonia*) *confusus* Smith, 1853	1
Lasioglossum (*Dialictus*) *bruneri* (Crawford, 1902)	1
Lasioglossum (*Dialictus*) *cressonii* (Robertson, 1890)	1
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	1
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)	1
Sphecodes mandibularis Cresson, 1872	1
Total # of species: 17	**114**

Table 15. Linda Loring Nature Foundation transect 2 species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	281
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	15
Halictus (*Odontalictus*) *ligatus* Say, 1837	14
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	5
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	5
Lasioglossum (*Hemihalictus*) *pectorale* (Smith, 1853)	4
Andrena(*Melandrena*) *vicina* Smith, 1853	2
Ceratina (*Zadontomerus*) *calcarata* Robertson, 1900	2
Halictus (*Seladonia*) *confusus* Smith, 1853	2
Lasioglossum (*Dialictus*) *subviridatum* (Cockerell, 1938)	2
Andrena(*Holandrena*) cressonii Robertson, 1891	1
Andrena(*Melandrena*) *carlini* Cockerell, 1901	1
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	1
Ceratina (*Zadontomerus*) *dupla* Say, 1837	1
Colletes simulans Cresson 1868/ *armatus* Patton 1879	1
Colletes validus Cresson, 1868	1
Epeolus pusillus Cresson, 1864	1
Epeolus scutellaris Say, 1824	1
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	1
Lasioglossum (*Dialictus*) *georgeickworti* Gibbs, 2011	1
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	1
Lasioglossum (*Dialictus*) *marinum* (Crawford, 1904)	1
Lasioglossum (*Dialictus*) *oblongum* (Lovell, 1905)	1
Lasioglossum (*Dialictus*) *pruinosum* (Robertson, 1892)	1
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	1
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)	1
Megachile (*Litomegachile*) *brevis* Say, 1837	1
Melissodes (*Eumelissodes*) *druriella* (Kirby, 1802)	1
Triepeolus helianthi (Robertson, 1897)	1
Total # of species: 28	**350**

Table 16. Ossippee Pine Barrens species list.

Taxon	Abundance of Taxon
Lasioglossum (*Dialictus*) *subviridatum* (Cockerell, 1938)	9
Lasioglossum (*Dialictus*) *taylorae* (Gibbs, 2010)	3
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	2
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	2
Andrena(*Melandrena*) *nivalis* Smith, 1853	1
Calliopsis (*Calliopsis*) *andreniformis* Smith, 1853	1
Ceratina (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011	1
Lasioglossum (*Dialictus*) *cressonii* (Robertson, 1890)	1
Lasioglossum (*Dialictus*) *planatum* (Lovell, 1905)	1
Lasioglossum (*Dialictus*) *smilacinae* (Robertson, 1897)	1
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	1
Osmia (*Melanosmia*) *virga* Sandhouse, 1939	1
Total # of species: 12	**24**

Table 17. Rocky Point Species list.

Taxon	Abundance of Taxon
Osmia (*Melanosmia*) *virga* Sandhouse, 1939	6
Lasioglossum (*Lasioglossum*) *acuminatum* McGinley, 1986	2
Nomada maculata Cresson, 1863	2
Osmia (*Melanosmia*) *pumila* Cresson, 1864	2
Andrena(*Melandrena*) *carlini* Cockerell, 1901	1
Colletes thoracicus Smith, 1853	1
Lasioglossum (*Dialictus*) *subviridatum* (Cockerell, 1938)	1
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	1
Nomada bidentate, not *maculata*	1
Nomada imbricata Smith, 1854	1
Osmia (*Melanosmia*) *atriventris* Cresson, 1864	1
Total # of species: 11	**19**

Table 18. Sandbar WMA species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	247
Lasioglossum (*Dialictus*) *vierecki* (Crawford, 1904)	29
Ceratina (*Zadontomerus*) *dupla* Say, 1837	22
Ceratina (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011	22
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	22
Hylaeus (*Prosopis*) *affinis* (Smith, 1853)	21
Osmia (*Melanosmia*) *pumila* Cresson, 1864	20
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	17
Ceratina (*Zadontomerus*) *calcarata* Robertson, 1900	13
Bombus (*Cullumanobombus*) *griseocollis* (DeGeer, 1773)	9
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	6
Osmia (*Osmia*) *cornifrons* (Radoszkowski, 1887)	6
Andrena(*Melandrena*) *carlini* Cockerell, 1901	5
Lasioglossum (*Dialictus*) *cressonii* (Robertson, 1890)	5
Lasioglossum (*Hemihalictus*) *pectorale* (Smith, 1853)	5
Nomada bidentate, not *maculata*	4
Lasioglossum (*Dialictus*) *pilosum* (Smith, 1853)	3
Megachile (*Xanthosarus*) *latimanus* Say, 1823	3
Agapostemon (*Agapostemon*) *sericeus* (Förster, 1771)	2
Andrena(*Melandrena*) *vicina* Smith, 1853	2
Andrena(*Simandrena*) *nasonii* Robertson, 1895	2
Bombus (*Pyrobombus*) *bimaculatus* Cresson, 1863	2
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	2
Halictus (*Seladonia*) *confusus* Smith, 1853	2
Hylaeus (*Hylaeus*) *mesillae* (Cockerell, 1896)	2
Hylaeus affinis / *modestus* group (Say, 1837)	2
Lasioglossum (*Dialictus*) *versatum* (Robertson, 1902)	2
Nomada imbricata Smith, 1854	2
Nomada maculata Cresson, 1863	2
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872	1
Andrena(*Micrandrena*) *melanochroa* Cockerell, 1898	1
Andrena(*Tylandrena*) *erythrogaster* (Ashmead, 1890)	1
Anthophora (*Clisodon*) *terminalis*, Cresson, 1869	1
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)	1

Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	1
Lasioglossum (*Hemihalictus*) *macoupinense* (Robertson, 1895)	1
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)	1
Nomada bethunei Cockerell, 1903	1
Nomada composita Mitchell, 1962	1
Nomada obliterata Cresson, 1863	1
Sphecodes davisii Robertson, 1897	1
Total # of species: 41	**493**

Table 19. Smithsonian Conservation Biology Institute species list.

Taxon	**Abundance of Taxon**
Lasioglossum (*Dialictus*) *hitchensi* Gibbs, 2012	28
Apis (*Apis*) *mellifera* Linnaeus, 1758	16
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	11
Ceratina (*Zadontomerus*) *dupla* Say, 1837	10
Bombus (*Cullumanobombus*) *griseocollis* (DeGeer, 1773)	9
Augochlorella aurata (Smith, 1853)	6
Lasioglossum (*Dialictus*) *versatum* (Robertson, 1902)	6
Bombus (*Pyrobombus*) *bimaculatus* Cresson, 1863	3
Lasioglossum (*Dialictus*) *fattigi* (Mitchell, 1960)	3
Lasioglossum (*Dialictus*) *trigeminum* (Gibbs, 2011)	3
Xylocopa (*Xylocopoides*) *virginica* (Linnaeus, 1771)	3
Hoplitis (*Alcidamea*) *producta* (Cresson, 1864)	2
Lasioglossum (*Dialictus*) *platyparium* (Robertson, 1895)	2
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	2
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	1
Andrena(*Melandrena*) *nivalis* Smith, 1853	1
Calliopsis (*Calliopsis*) *andreniformis* Smith, 1853	1
Ceratina (*Zadontomerus*) *calcarata* Robertson, 1900	1
Ceratina (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011	1
Halictus (*Protohalictus*) *rubicundus* (Christ, 1791)	1
Halictus poeyi/ligatus	1
Hoplitis (*Alcidamea*) *spoliata* (Provancher, 1888)	1
Lasioglossum (*Dialictus*) *anomalum* (Robertson, 1892)	1
Lasioglossum (*Dialictus*) i*mitatum* (Smith, 1853)	1
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	1
Lasioglossum (*Dialictus*) *obscurum* (Robertson, 1892)	1
Lasioglossum (*Sphecodogastra*) *truncatum* (Robertson, 1901)	1
Megachile (*Litomegachile*) *mendica* Cresson, 1878	1

Total # of species: 28	**118**

Table 20. Southeast Pine Barrens WMA species list.

Taxon	**Abundance of Taxon**
Agapostemon (*Agapostemon*) texanus Cresson, 1872	2
Augochlorella aurata (Smith, 1853)	3
Lasioglossum (*Dialictus*) anomalum (Robertson, 1892)	1
Lasioglossum (*Dialictus*) leucocomum (Lovell, 1908)	1
Total # of species: 4	**7**

Table 21. The Farm Institute Species list.

Taxon	**Abundance of Taxon**
Lasioglossum (*Dialictus*) *tegulare* (Robertson, 1890)	25
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	16
Augochlorella aurata (Smith, 1853)	15
Lasioglossum (*Hemihalictus*) *pectorale* (Smith, 1853)	12
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	12
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)	10
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	8
Lasioglossum (*Dialictus*) *pruinosum* (Robertson, 1892)	8
Apis (*Apis*) *mellifera* Linnaeus, 1758	7
Bombus (*Pyrobombus*) *impatiens* Cresson, 1863	3
Halictus (*Odontalictus*) *ligatus* Say, 1837	2
Halictus (*Protohalictus*) *rubicundus* (Christ, 1791)	2
Hylaeus affinis / *modestus* group	3
Bombus (*Cullumanobombus*) *griseocollis* (DeGeer, 1773)	1
Ceratina (*Zadontomerus*) *dupla* Say, 1837	1
Coelioxys (*Boreocoelioxys*) *rufitarsis* Smith, 1854	1
Lasioglossum (*Dialictus*) *anomalum* (Robertson, 1892)	1
Lasioglossum (*Dialictus*) *vierecki* (Crawford, 1904)	1
Megachile (*Xanthosarus*) *latimanus* Say, 1823	1
Osmia (*Melanosmia*) *atriventris* Cresson, 1864	1
Total # of species: 20	**130**

Table 22. Warren Grove Range species list.

Taxon	Abundance of Taxon
Augochlorella aurata (Smith, 1853)	29
Apis (*Apis*) *mellifera* Linnaeus, 1758	19
Lasioglossum (*Dialictus*) *oblongum* (Lovell, 1905)	6
Osmia (*Melanosmia*) *pumila* Cresson, 1864	4
Lasioglossum (*Dialictus*) *subviridatum* (Cockerell, 1938)	3
Osmia (*Melanosmia*) *virga* Sandhouse, 1939	4
Augochloropsis (*Paraugochloropsis*) *metallica* (Fabricius, 1793)	2
Bombus (*Cullumanobombus*) *griseocollis* (DeGeer, 1773)	2
Lasioglossum (*Hemihalictus*) *nelumbonis* (Robertson, 1890)	2
Nomada maculata Cresson, 1863	2
Bombus (*Pyrobombus*) *perplexus* Cresson, 1863	1
Bombus (*Pyrobombus*) *vagans* Smith, 1854	1
Lasioglossum (*Dialictus*) *smilacinae* (Robertson, 1897)	1
Lasioglossum (*Dialictus*) *trigeminum* (Gibbs, 2011)	1
Lasioglossum (*Dialictus*) *versatum* (Robertson, 1902)	1
Total # of species: 15	**78**

Table 23. Wells Barren Preserve species list.

Taxon	Abundance of Taxon
Lasioglossum (*Dialictus*) *leucocomum* (Lovell, 1908)	11
Augochlorella aurata (Smith, 1853)	4
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)	4
Lasioglossum (*Dialictus*) *katherineae* (Gibbs, 2011)	3
Lasioglossum (*Dialictus*) *pilosum* (Smith, 1853)	2
Calliopsis (*Calliopsis*) *andreniformis* Smith, 1853	1
Ceratina (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011	1
Hoplitis (*Alcidamea*) *spoliata* (Provancher, 1888)	1
Lasioglossum (*Dialictus*) *oceanicum* (Cockerell 1916)	1
Osmia (*Melanosmia*) *atriventris* Cresson, 1864	1
Total # species: 10	**29**