

Long-term effects of electrical right-of-way vegetation management on floral and faunal communities

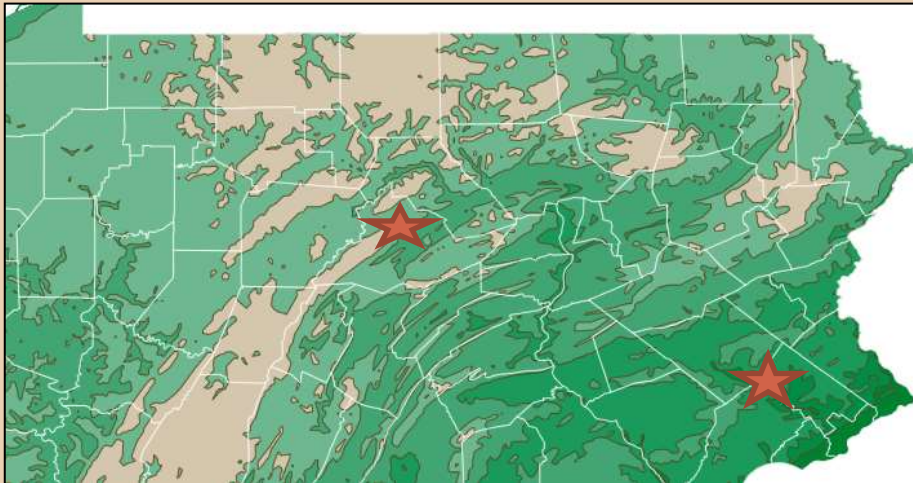
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Center for Pollinator
Research
Penn State

Research and Demonstration Areas in PA

- State Game Lands 33 Research and Demonstration Area, Centre County, PA - Studied Since 1953
- Green Lane Research and Demonstration Area, Montgomery County, PA - Studied Since 1987



SGL33 and GLR&D Incorporate Wire-Border Zone Method

- “Wire-border Zone” integrated vegetation management (IVM) approach implemented on the entire SGL 33 ROW
- IVM: Integrated Vegetation Management; chemical, herbicide, biological approaches to shape plant community---maintain what you want/remove what you don't
- Wire Zone = 75 ft (10 ft beyond wires) grasses, forbs, and low shrubs
- Border Zone = 50 ft/side including low to mid-size shrubs (10-15 ft 2016)



Table 1. Liters of herbicide applied/hectare (ha) in 2012 and number of trees/ha (< 0.3 m in height) in wire zones of 14 treatment sections on State Game Lands 33 Rights-of-Way Research and Demonstration Area, Centre County, PA in 2016. Dominant (> 50% of area) cover type (forb, grass, or shrub) for wire zone is also presented.					
Liters of herbicide applied/ha	Number of stems of trees/ha ^a	Native species richness of compatible flowering plant species ^b	Integrated Vegetation Management Herbicide (H) versus Mechanical (M) treatment	Herbicide application (selective [backpack spray] or nonselective [broadcast spray])	Cover type
0	1482	7	M (Mowing)	N/A	Shrub
0	2718	9	M (Mowing)	N/A	Forb
0	11613	11	M (Handcutting)	N/A	Shrub
0	3459	25	M (Handcutting)	N/A	Shrub
0.75	494	8	H (Glyphosate, Imazapyr) ^c	Selective	Grass
0.75	741	8	H (Glyphosate, Imazapyr)	Selective	Forb
0.75	494	6	H (Glyphosate, Imazapyr)	Selective	Forb
6.27	247	7	H (Aminopyralid, Imazapyr, Triclopyr) ^d	Selective	Forb
29.93	1729	15	H (Aminopyralid, Imazapyr, Triclopyr)	Broadcast	Forb
31.99	741	10	H (Aminopyralid, Imazapyr, Triclopyr)	Broadcast	Shrub
168.37	0	19	H (Aminopyralid, Imazapyr) ^e	Broadcast	Forb
241.33	494	10	H (Aminopyralid, Imazapyr)	Selective	Shrub
436.82	200	5	H (Aminopyralid, Glyphosate, Imazapyr, Picloram, Triclopyr) ^f	Broadcast	Grass
436.82	100	7	H (Aminopyralid, Glyphosate, Imazapyr, Picloram, Triclopyr)	Broadcast	Forb





The Effects of Integrated Vegetation Management on Richness of Native Compatible Flowering Plants and Abundance of Noncompatible Tree Species on a Right-of-Way in Central Pennsylvania, USA J. Arbor Urb For 2020

Carolyn G. Mahan, Bradley D. Ross, and Richard T. Yahner







Rights-of-Way Ecology at Penn State

Plant and animal community response to long-term vegetation management on rights-of-way
sites.psu.edu/transmissionlineecology



Bird Population & Nesting Studies

Main Discussion Points - Birds

- IVM on ROW provides early successional habitat mgmt. for bird conservation
- Herbicide vs Mechanical support for selective use of herbicides which are not same as insecticides
- **Importance of Borders** along edges esp during early IVM cycle
- Early Successional bird communities dynamic as influenced by time since IVM (point in mgmt. cycle)

Early Successional Breeding Bird Species

- Early successional bird species declining in Northeast US - many of Conservation Concern (Audubon Society Watchlist Species)
- Long-term studies conducted since 1982 & 87 examining use of ROW by breeding bird community
- Field Sparrow, Eastern Towhee, Chestnut-sided Warbler, Common Yellowthroat, Prairie Warbler, and Gray Catbird



Importance of Maintaining Transitional Border Zones

Border Zone contained 2-4 times the abundance of birds compared to the Wire Zone---prior to 'cut back' in 2016



IVM Cycle Influences Early Successional Breeding Bird Species

- Avian Nesting Success: High of 68% in early 1990's SGL 33 to 50% in early 2000's and 2016 breeding season. Low 44% in 2003-4 at Green Lane and **2018 at SGL33**. Only one incidence of parasitism.
- Not “ecological traps.” Nest production is positive.



Integrated Vegetation (Habitat) Management permits Native plants to dominate without planting

Early successional habitat

- Nesting cover
- Insect food
- Sustainable nesting success rate (>40%)



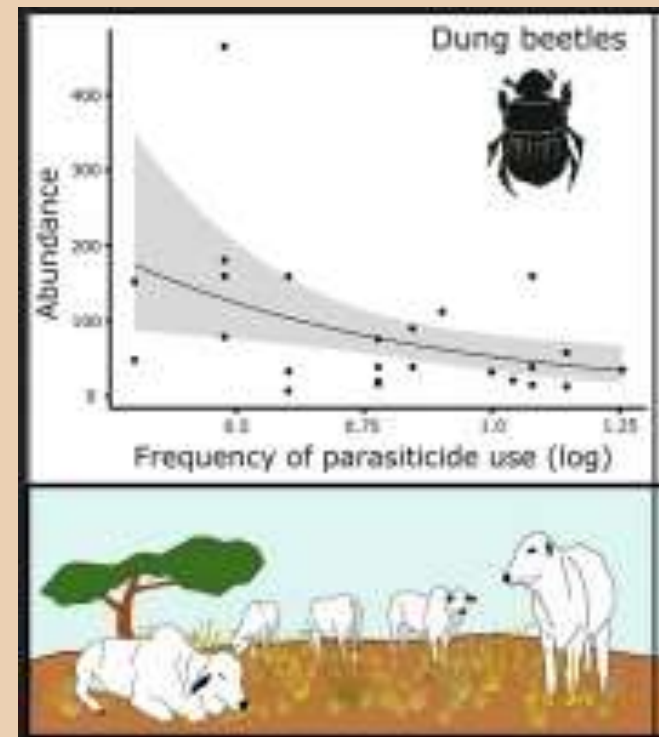
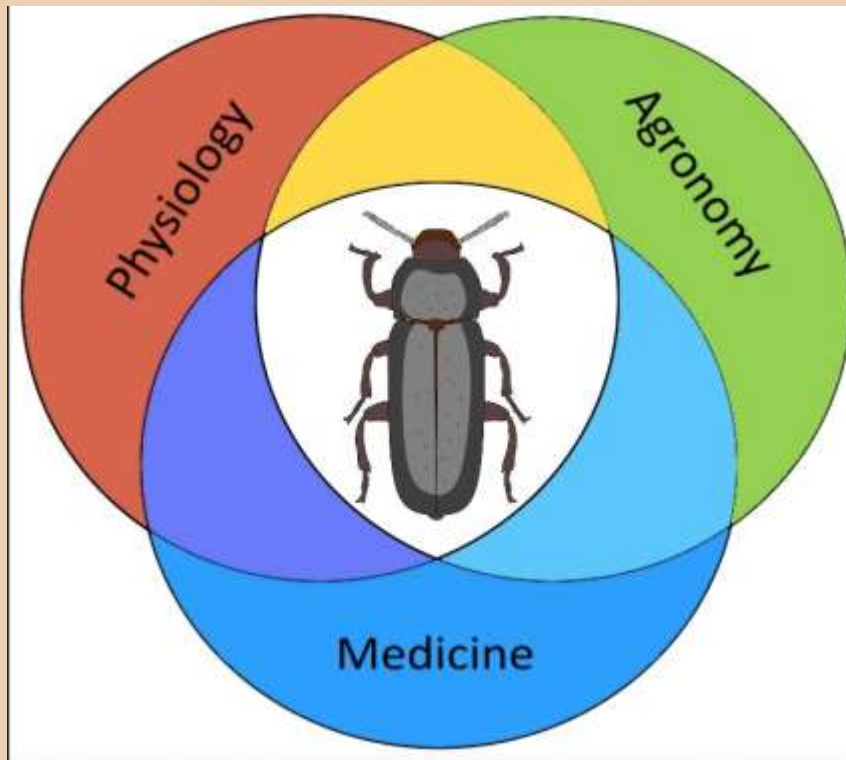
Birds-Avian Community

- Songbirds
- Wild turkey, American woodcock, ruffed grouse



Front. Physiol., 28 March 2019
<https://doi.org/10.3389/fphys.2019.00319>

Beetles as Model Organisms in Physiological, Biomedical and Environmental Studies – A Review



New line of research: Ground beetles as bioindicators (2020)







Because **tiger beetles** are so sensitive to changes in the environment, they are among the first species to react to pesticides, misuse of habitats, and climate change.

We call them **bioindicators**

because we can use them to more quickly see if something is wrong in the environment.

Coleoptera (Order)

Family: Carabidae – ground beetles



Cicindela sexguttata = six-spotted tiger beetle



Cicindela tranquebarica = oblique-lined tiger beetle (Carabidae)

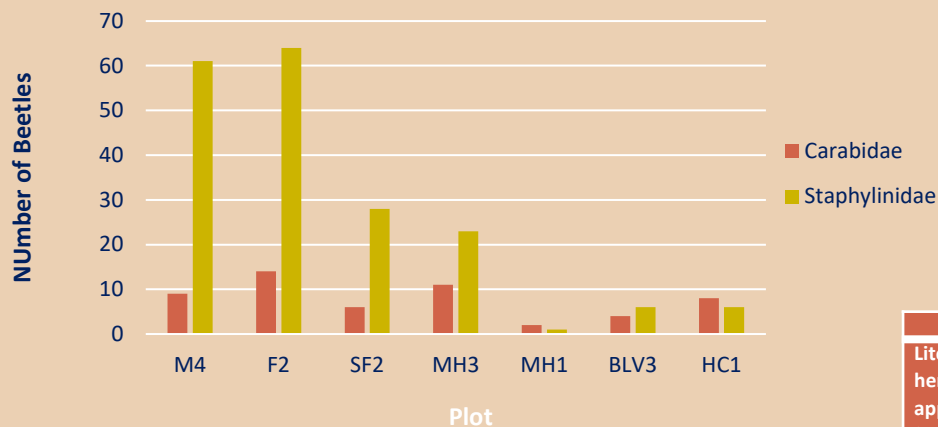
Family: Staphylinidae –rove beetles



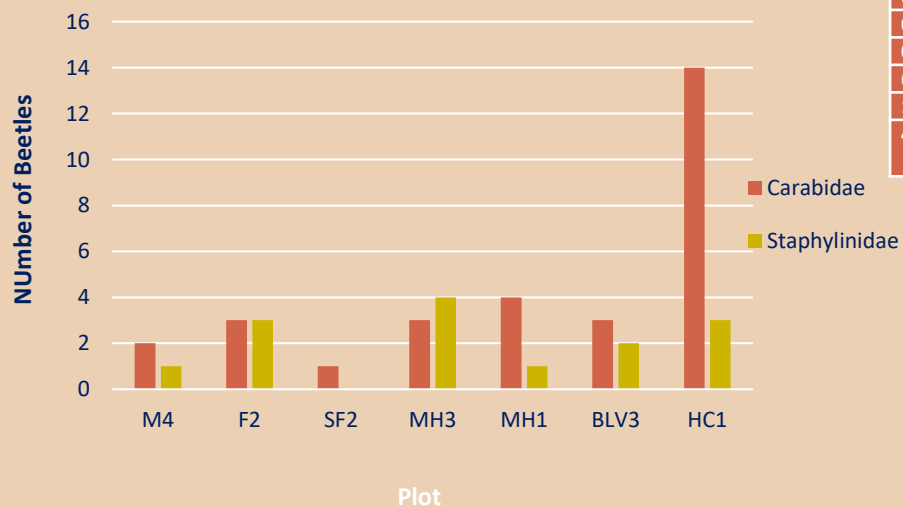
Platydracus maculosus = a large (~25mm) rove beetle (Staphylinidae)

A Cornell University entomologist learned that a **tiger beetle** can run at a speed of 5.6 miles per hour or about 125 body lengths per second. They're considered to be the **fastest land** insects in the world.

Carabidae + Staphylinidae Abundance by Plot
Week 1: 5-8 June 2020



Carabidae + Staphylinidae Abundance by Plot
Week 5: 3-6 July 2020



Liters of herbicide applied/ha (2016 treatment cycle)	Integrated Vegetation Management Herbicide (H) versus Mechanical (M) treatment	Herbicide application (selective [backpack spray] or nonselective [broadcast spray])	Name
0	M (Mowing)	N/A	M
0	M (Handcutting)	N/A	HC
0.75	H (Glyphosate, Imazapyr)	Selective	BLV
6.27	H (Aminopyralid, Imazapyr, Triclopyr)	Selective	SF
168.37	H (Aminopyralid, Imazapyr) ^e	Broadcast	MH
436.82	H (Aminopyralid, Glyphosate, Imazapyr, Picloram, Triclopyr) ^f	Broadcast	F

2016-17 SGL33 and Green Lane Bee Collections

2834 individuals

156 unique taxa

rare, specialist, &
“Vulnerable” species

3 new PA state records



Heriades leavitti a new PA record (2016)

Macropis ciliata a rare specialist

Bombus fervidus Vulnerable (IUCN)

Bee Diversity – Comparisons

Pennsylvania

Andrenidae **104** species
Apidae **133** species
Colletidae **32** species
Halictidae **168** species
Megachilidae **88** species
Melittidae **4** species

TOTAL = 450 species

SGL33 and Green Lane 2016-17

Andrenidae **34** species
Apidae **37** species
Colletidae **8** species
Halictidae **44** species
Megachilidae **32** species
Melittidae **1** species

TOTAL = 156 species

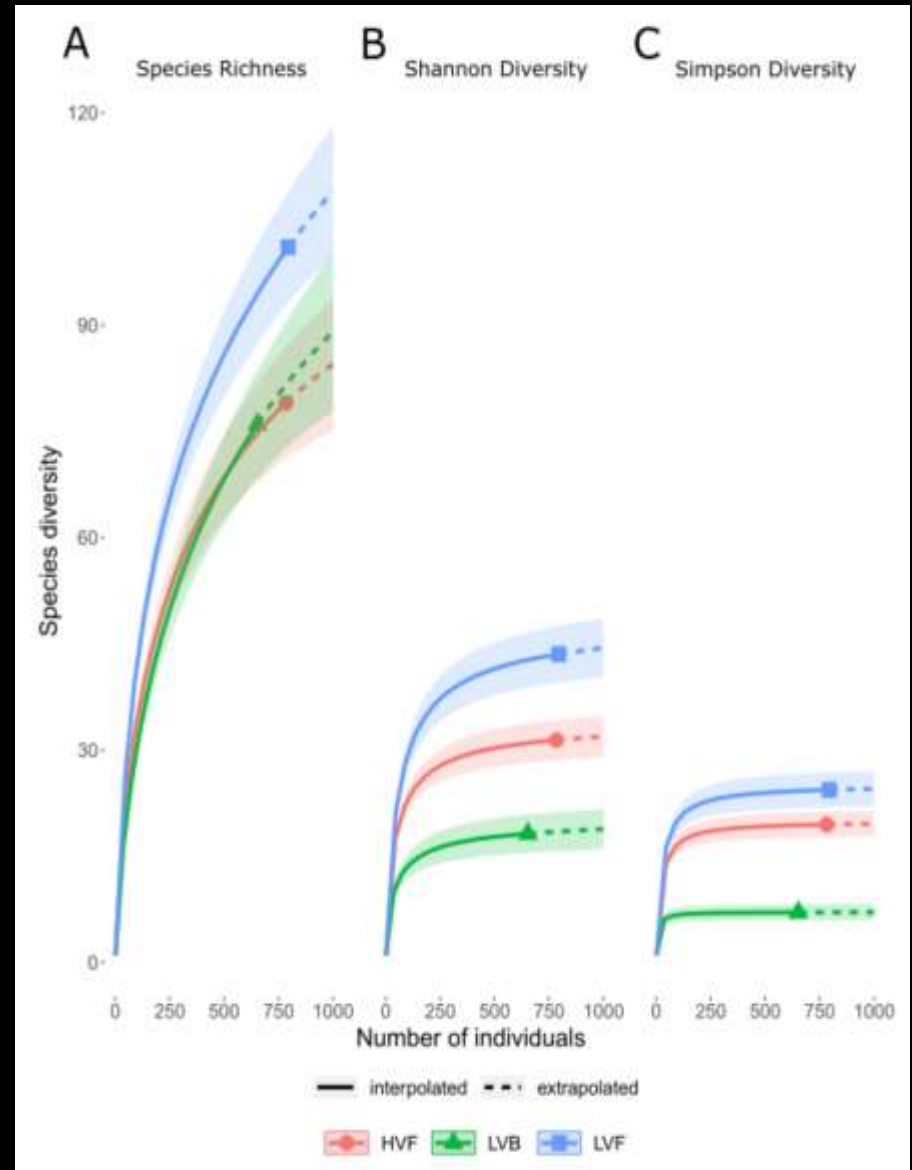
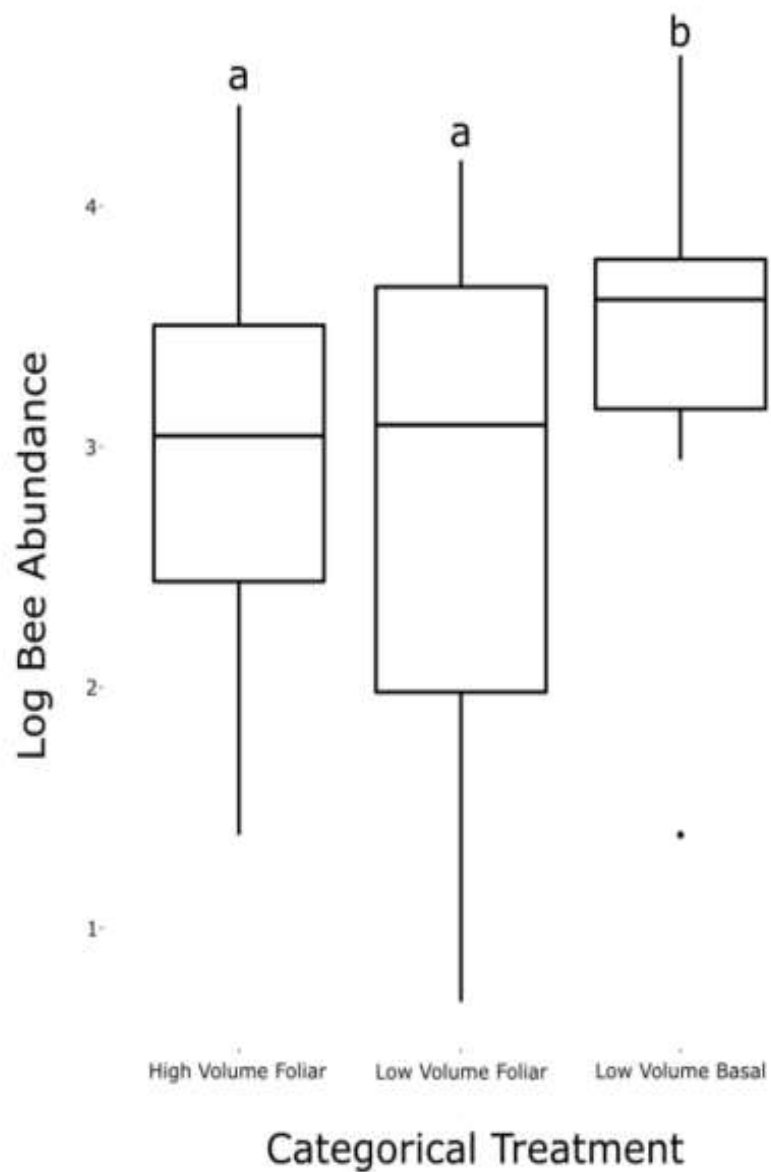
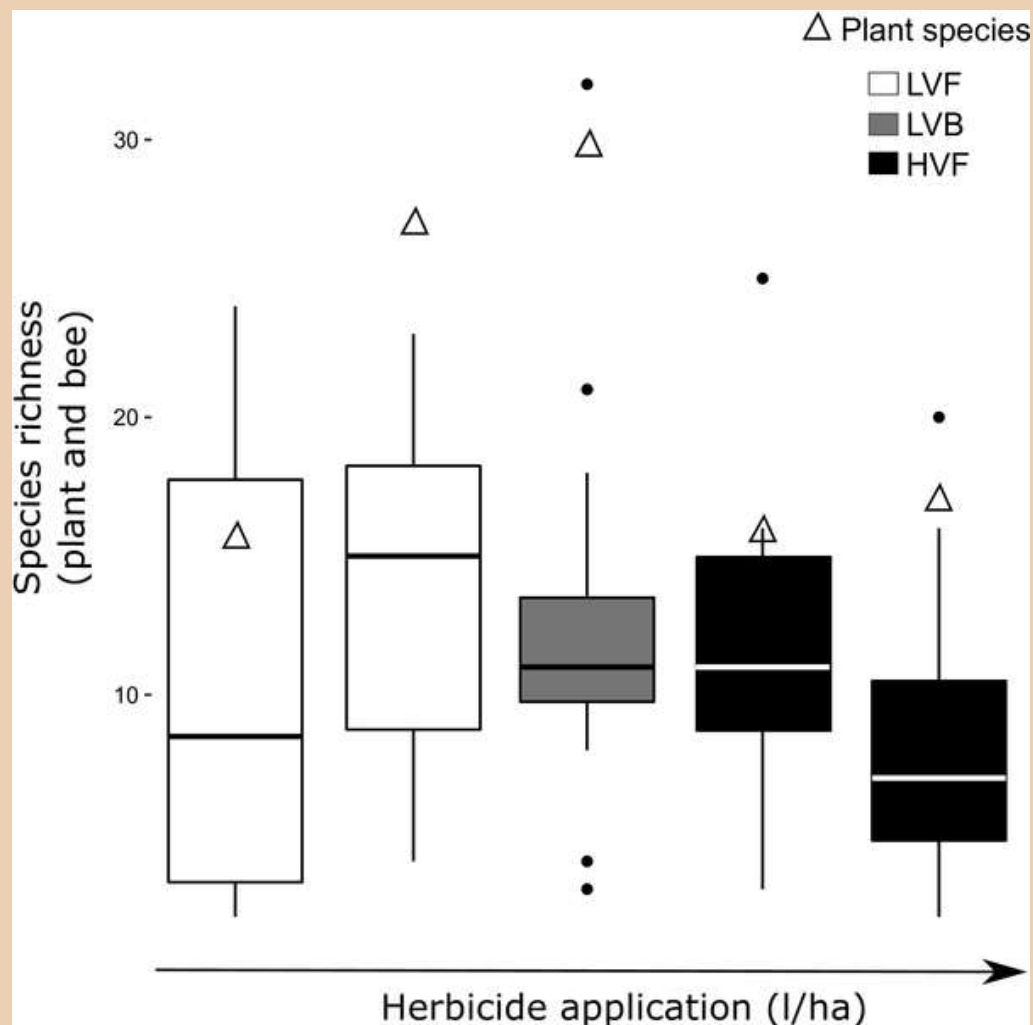


Fig 3. Patterns of plant species richness (triangles), as surveyed in July 2016, and bee species richness in each of the plots in the ROW (boxplots and points).



Russo L, Stout H, Roberts D, Ross BD, Mahan CG (2021) Powerline right-of-way management and flower-visiting insects: How vegetation management can promote pollinator diversity. PLOS ONE 16(1): e0245146. <https://doi.org/10.1371/journal.pone.0245146>
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0245146>

Habitat loss and fragmentation are major threats to bees and wildlife.

There are **millions of acres** of transportation and utility ROWs in the U.S.

ROWs = OPPORTUNITY!

***Native flowering plants**

***Nesting habitat**

***Habitat connectivity**

60+ Years of Research on Rights-of-Way

Many Thanks to Project Leaders and Cooperators

- Asplundh (David Krause), First Energy (Shawn Standish), PECO (Alexander Brown), Corteva Agriscience (Travis Rogers), Tree Fund, PA Game Commission, and Penn State University

Additional Project Information Can Be Found:

- sites.psu.edu/transmissionlineecology





PennState

UTILITY RIGHTS-OF-WAY WILDLIFE RESEARCH

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History

Key Research Findings

Management Practices

Documents and Reports

Integrated Vegetation Management

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Cultivating Innovation

▼ Latest Research Findings: Plant and Animal Response to Right-of-Way Treatments



sites.psu.edu/transmissionlineecology/

- What are bees?: @BeesBackyard
- Freaks: *Apis mellifera*: USGS-BIML
- Andrenidae: Debbi Brusco (Bugguide.net)
Andrena, *Perdita minima*: @BeesBackyard

Photo Credits

- Apidae:
 - Apis mellifera*: Pat Cassidy (Bugguide.net)
 - Diadasia*: Barbara H. Swissler (Bugguide.net)
 - Euglossa dilemma*: Tamara Pokorny (Ruhr Universität Bochum)
 - Nomada*: Denis A. Doucet (Bugguide.net)
 - Peponapis pruinosa*: Ilona L. (Bugguide.net)
 - Trigona minima*: iskandarsyah31.blogspot.com
 - Xylocopa*: Michael Battenberg (Bugguide.net)
- Colletidae: Dave Beaudette (Bugguide.net)
 - Colletes*: Evan Dankowicz (Bugguide.net)
 - Hylaeus*: Sean McCann (Bugguide.net)
- Halictidae: RE Reed (Bugguide.net)
 - Augochlora pura*: Bugguide.net
 - Blue: Dossy Lewin
 - Copper: Will Stuart
 - Green: Hobo Joe
- Megachilidae: www.encyclopedia-universelle.net/abeille1/abeilles-solitaires-megachiliidae.html
 - Megachile pluto*: Carim Nahaboo (for an exhibition at the Oxford Story Museum, Oxford England. www.carimnahaboo.com)
 - Osmia lignaria*: Kim Phillips (Bugguide.net)
- Melittidae: *Macropis*: Joel Gardner (Bugguide.net)
- ROW, Solar: Audubon.org
- ROW, Highway: Arizona DOT
- Thank You! : virginia.edu/blandy
- Woodcok –L. Palmer (PSU)