Understanding how Vegetation Management Practices Impact Rights-of-Way Ecosystems

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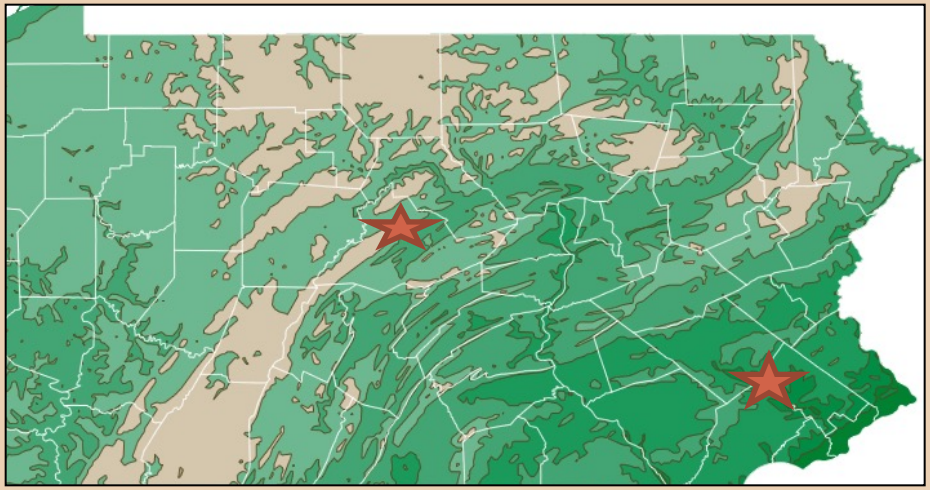
Research and Demonstration Areas in PA

- 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: chemical, herbicide, biological approaches to shape plant community---Keep 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 including low to mid-size shrubs (10-15 ft 2016)

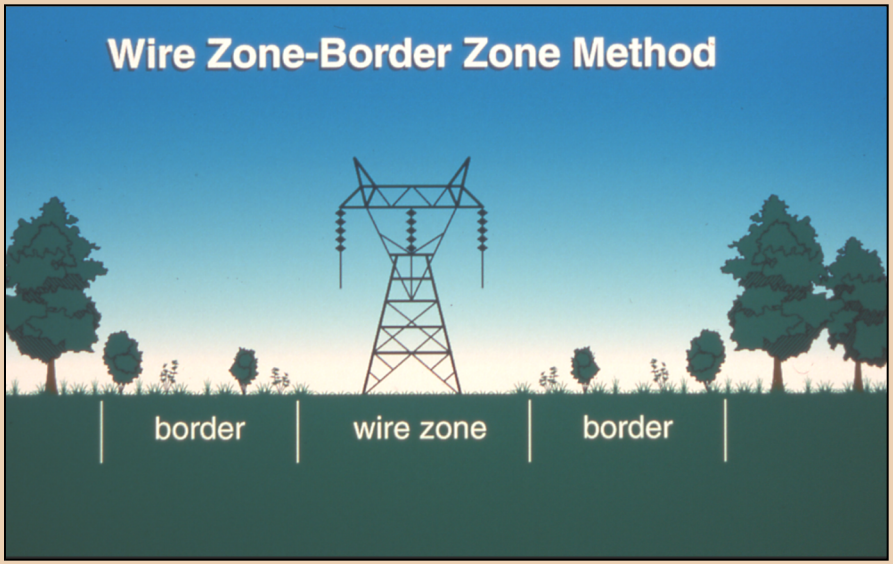


Table 1. Liters of herbicide applied/hectare (ha) in 2012 and number of trees/ha (< 0.3 m in height) in wire zones of 14 treatment sections on State Game Lands 33 Rights-of-Way Research and Demonstration Area, Centre County, PA in 2016. Dominant (> 50% of area) cover type (forb, grass, or shrub) for 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


2012 © Peter M. Dziuk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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’

IVM Cycle Influences Early Successional Breeding Bird Species

- Avian Nesting Success: High of 68% in early 1990's SGL 33 to right around 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.

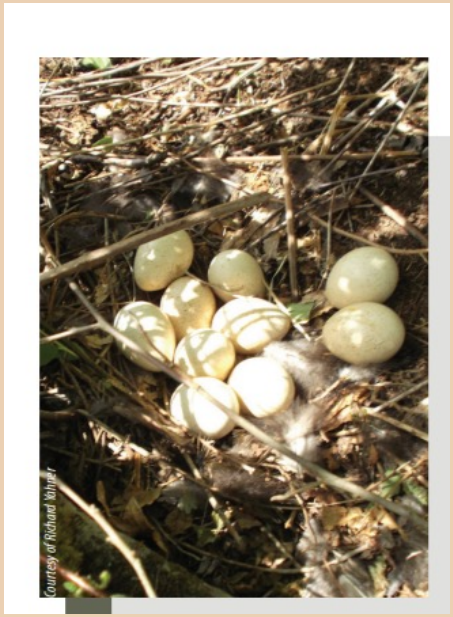
Integrated Vegetation (Habitat) Management permits Native plants to dominate without planting

Early successional habitat

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

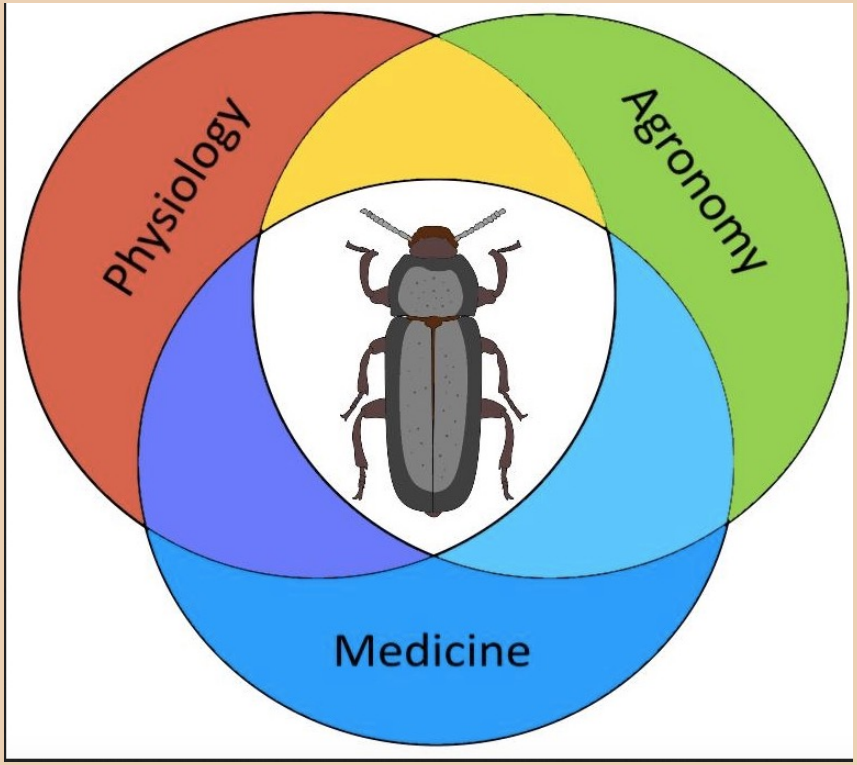
Birds-Avian Community

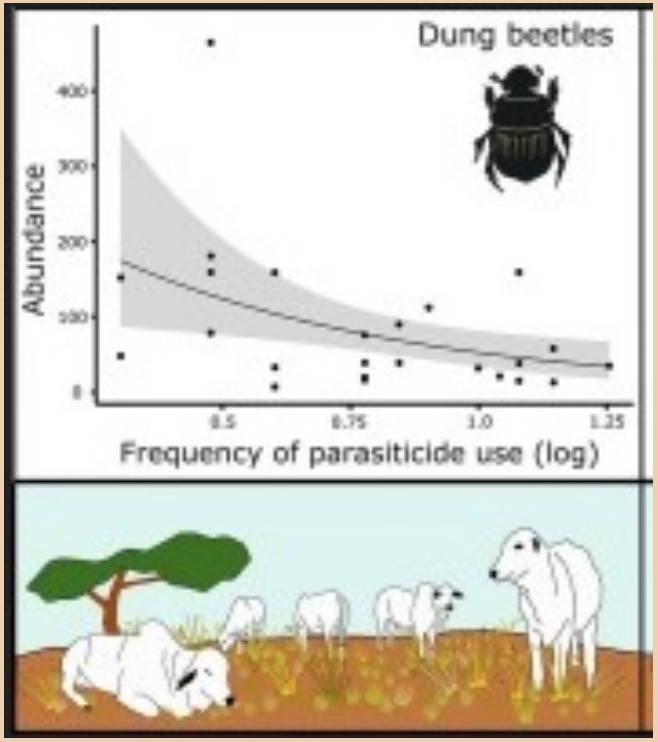
- Songbirds
- Wild turkey, American woodcock, ruffed grouse



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

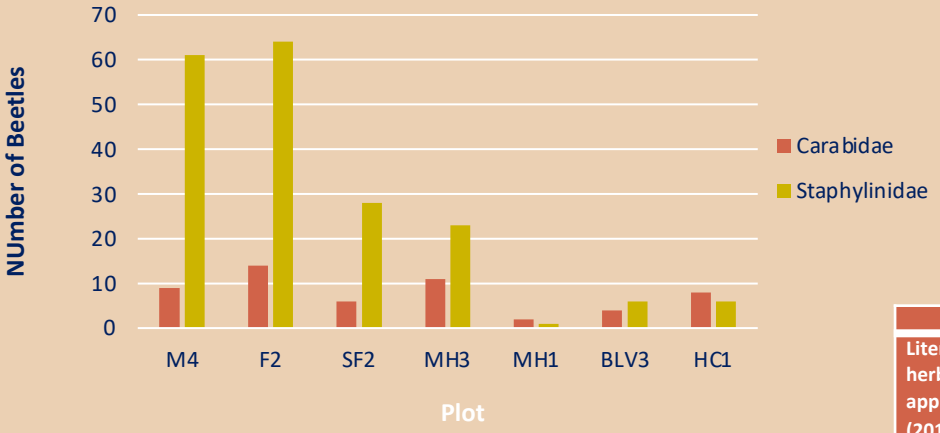
Cicindela tranquebarica = oblique-lined tiger beetle (Carabidae)

Family: Staphylinidae –rove beetles

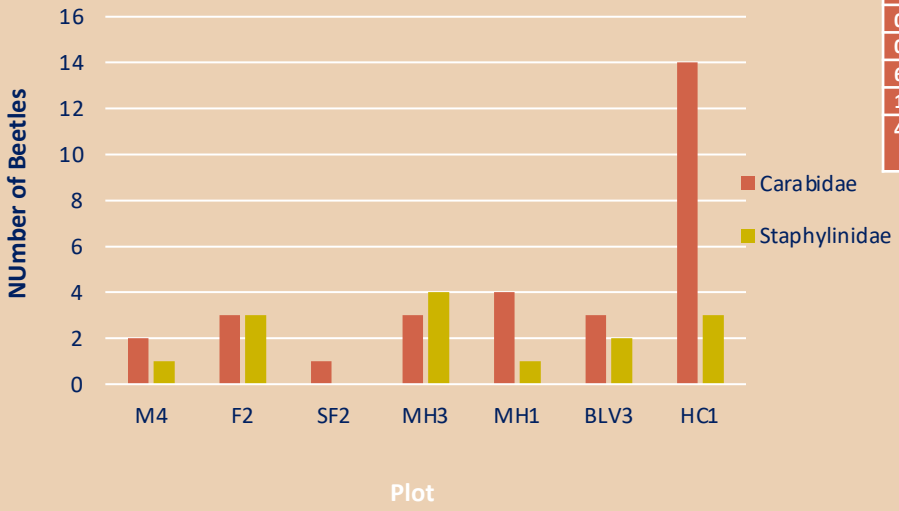
Platydracus maculosus = a large (~25mm) rove beetle (Staphylinidae)

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

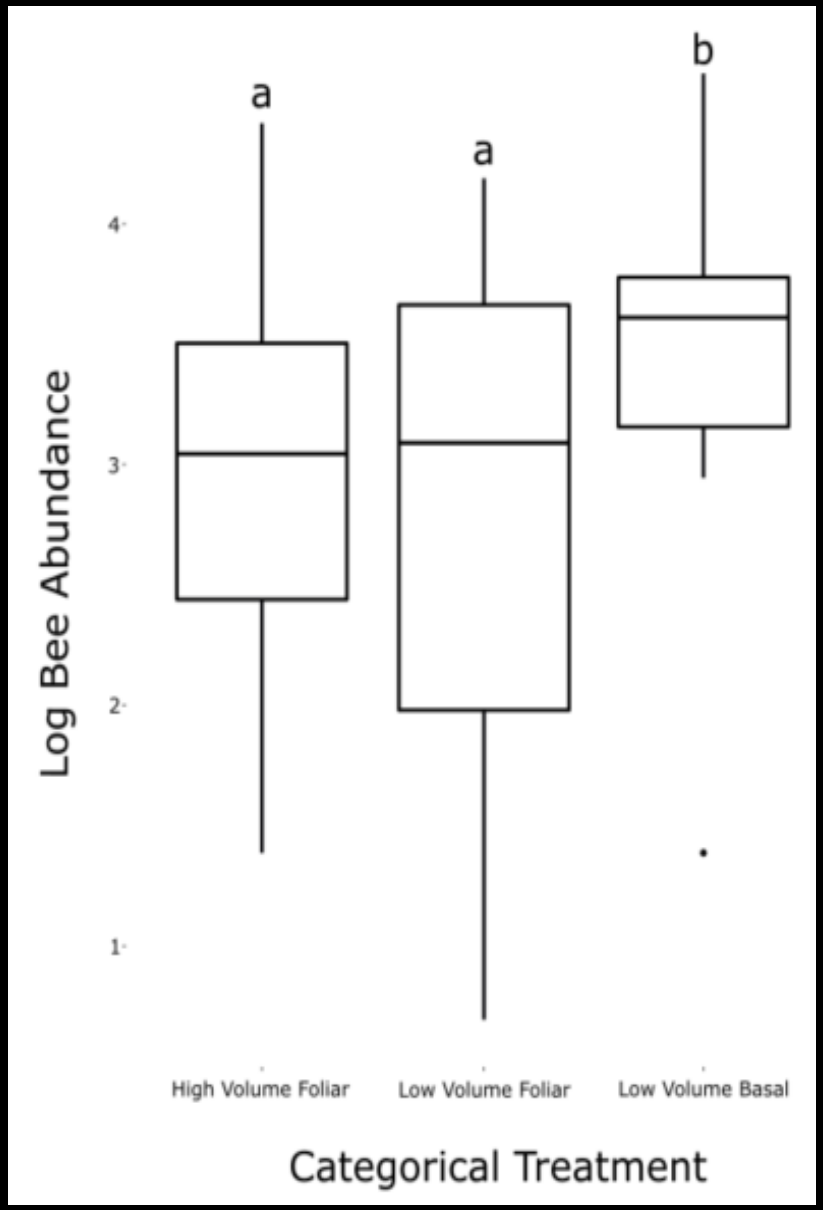
Heriades leavitti **a new PA record (2016)**

Macropis ciliata **a rare specialist**

Bombus fervidus **Vulnerable (IUCN)**

Bee Diversity – Comparisons

Pennsylvania		SGL33 and Green Lane 2016-17	
Andrenidae	**104** species	Andrenidae	**34** species
Apidae	**133** species	Apidae	**37** species
Colletidae	**32** species	Colletidae	**8** species
Halictidae	**168** species	Halictidae	**44** species
Megachilidae	**88** species	Megachilidae	**32** species
Melittidae	**4** species	Melittidae	**1** species
TOTAL = 450 species		**TOTAL = 156 species**	


a
a
b
Log Bee Abundance
4
3
2
1
High Volume Foliar
Low Volume Foliar
Low Volume Basal
Categorical Treatment

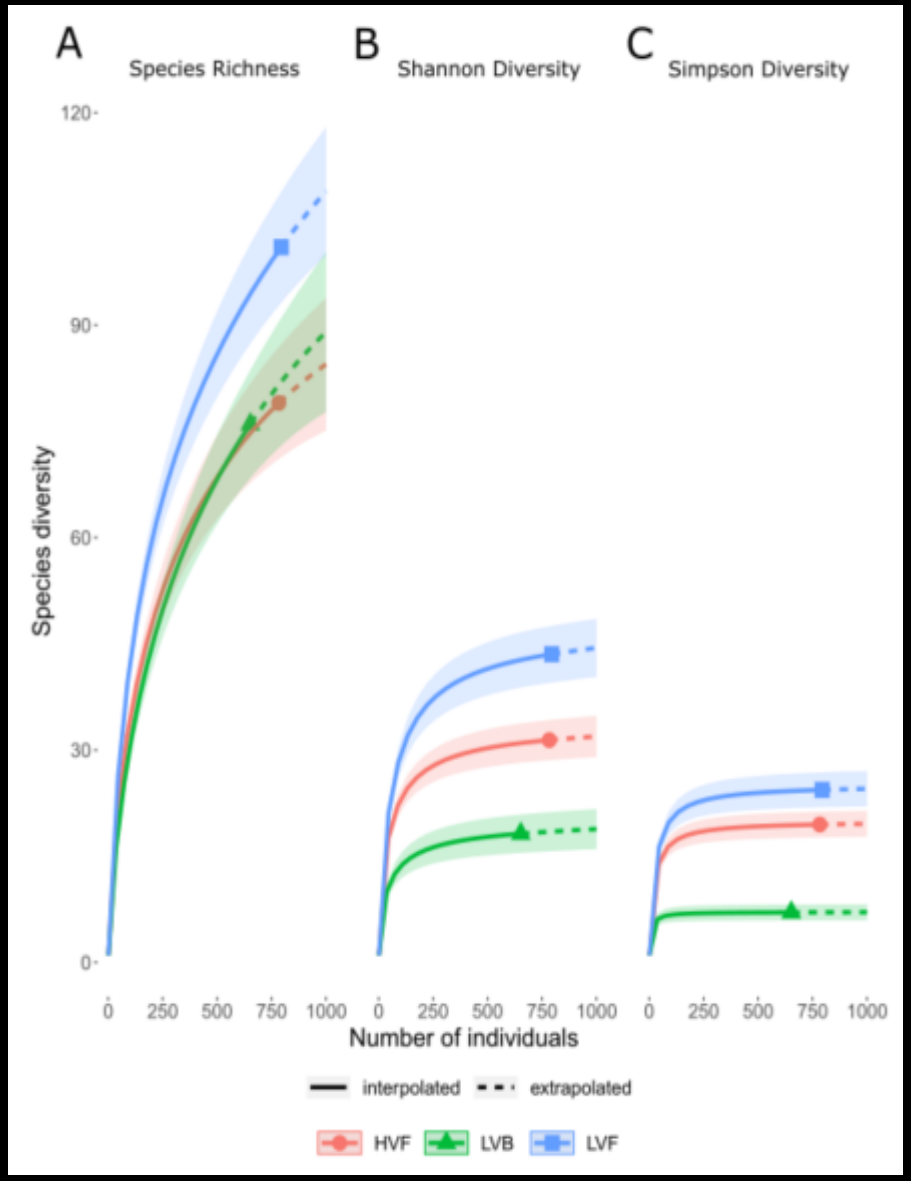
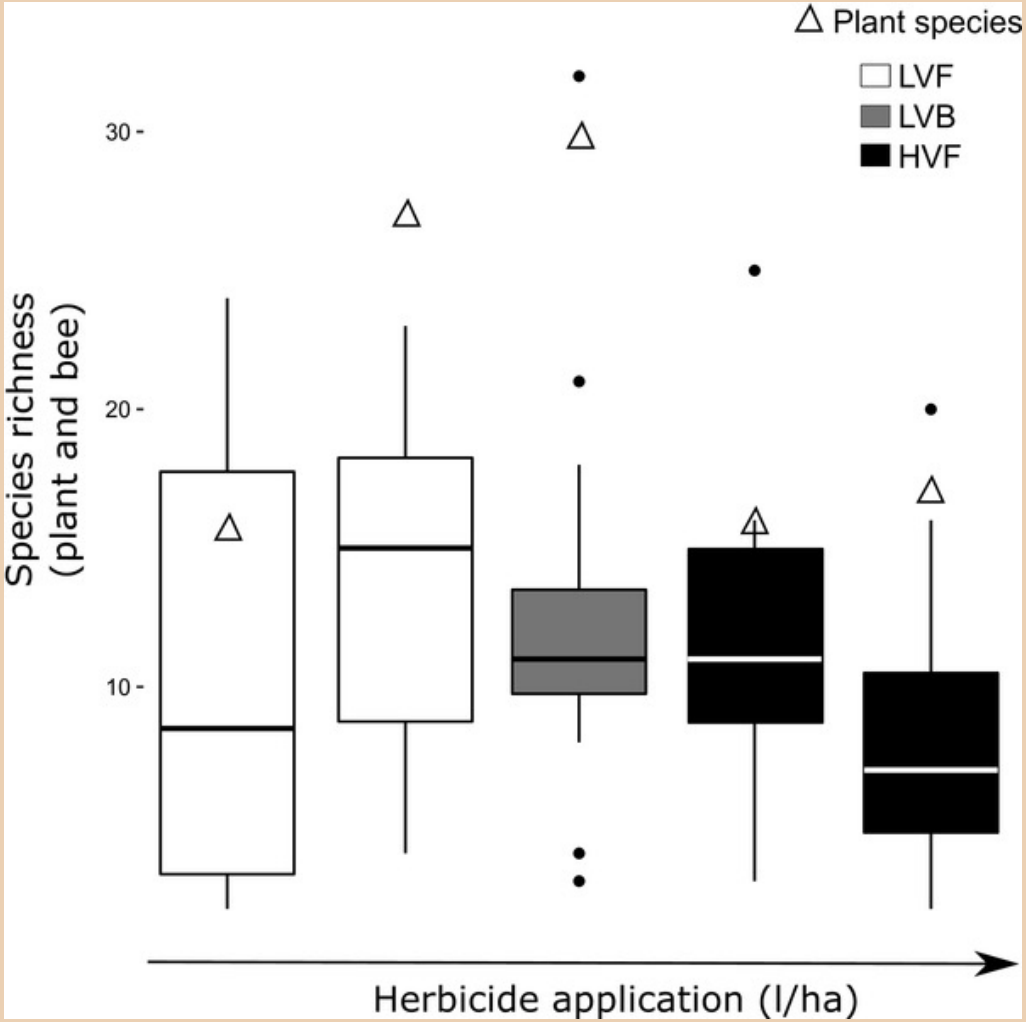

A
Species Richness
B
Shannon Diversity
C
Simpson Diversity
Species diversity
120
90
60
30
0
0
250
500
750
1000
Number of individuals
interpolated
extrapolated
HVF
LVB
LVF

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

PLOS ONE

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

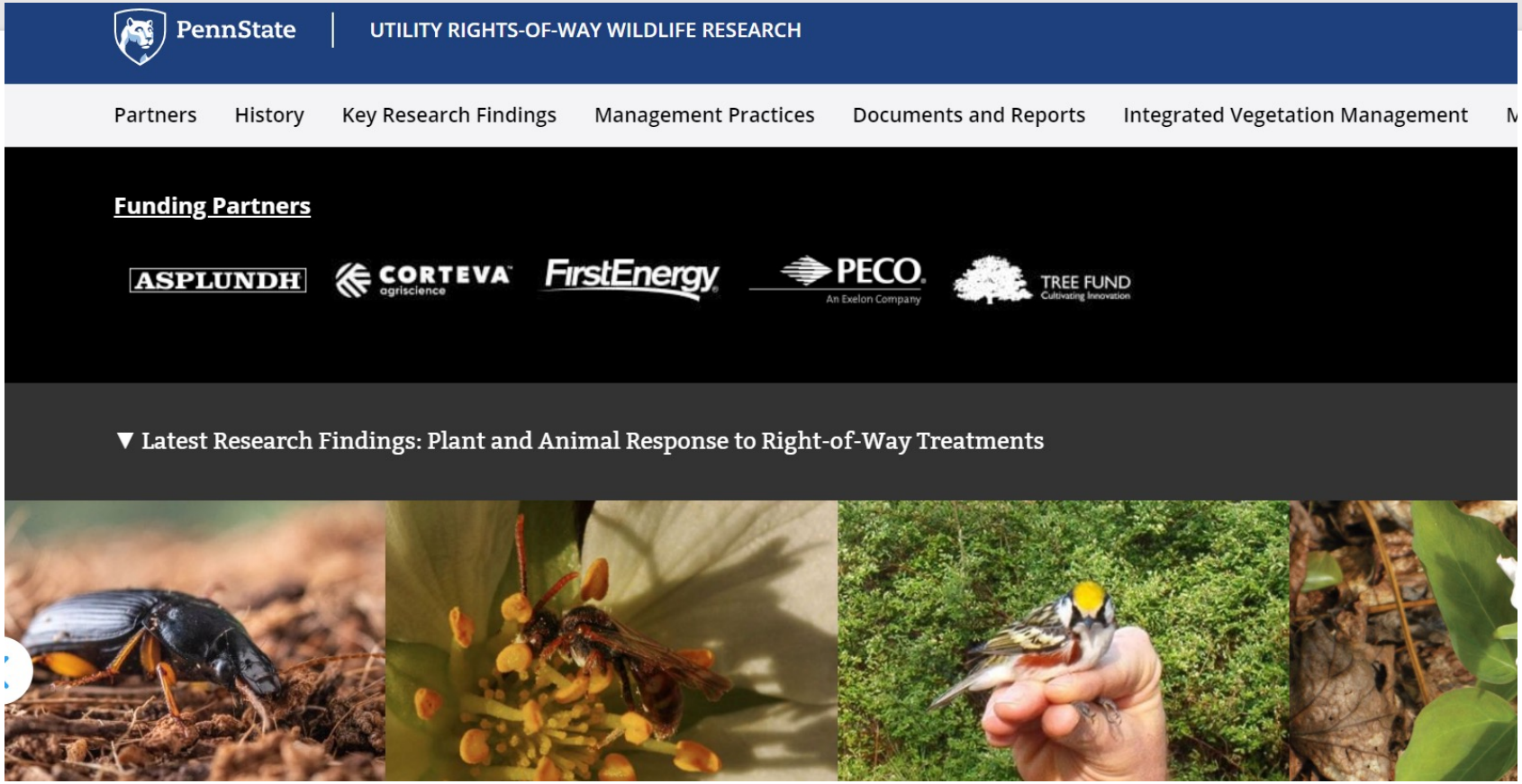


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Photo Credits

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