



Outline

A Story for the Ages: Plant-Insect Interactions

- Herbivory and Pollination
- Predation and Parasitism

Tying it all together: Plants, Insects, and the Urban Environment



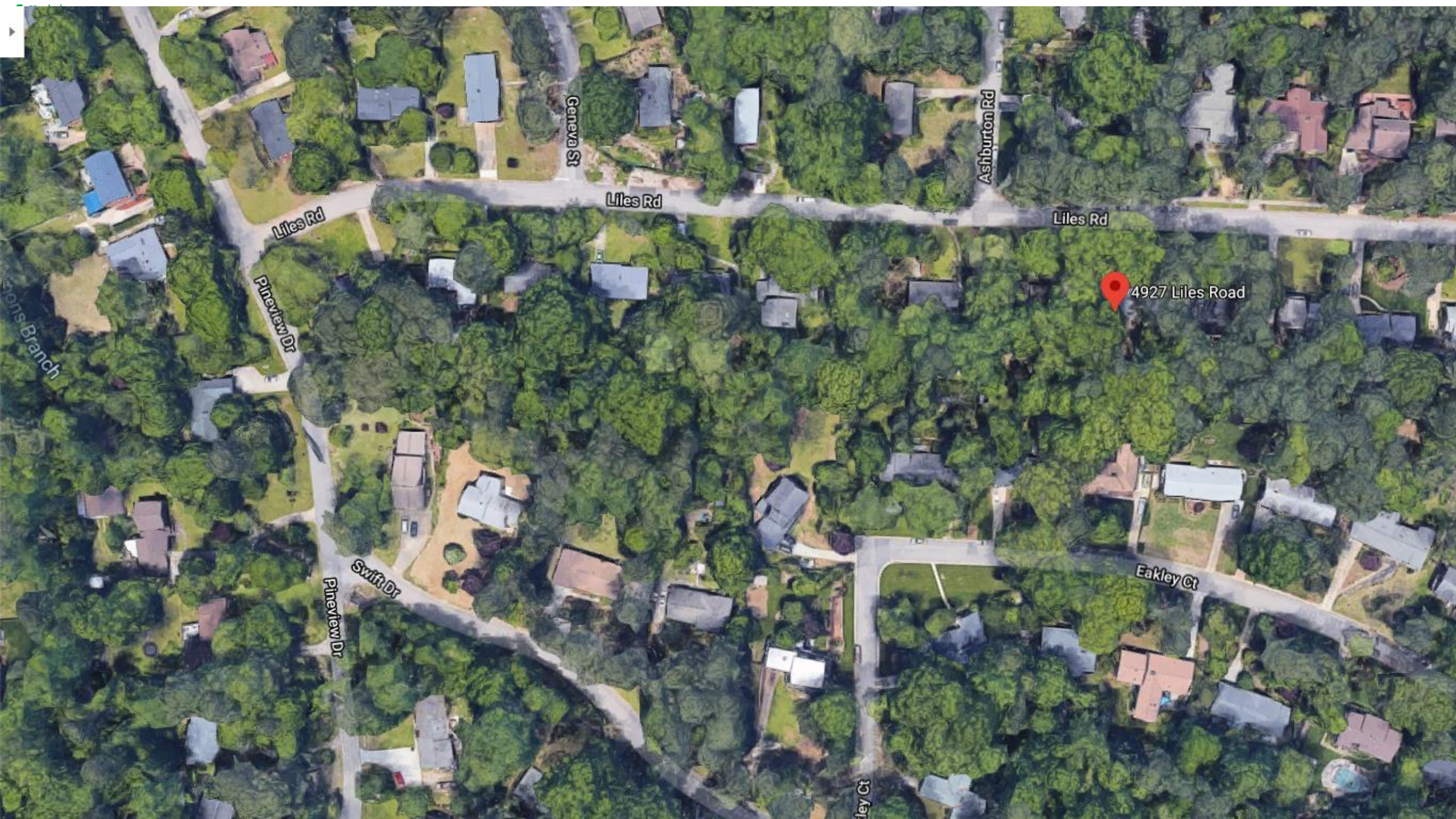


Plants, Insects, and Urbanization

Urban Environments

- Highly disturbed systems that are vastly understudied
- Heterogeneous mixture:
 - Established neighborhoods vs new developments
 - Native “versus” non-native plantings
 - Monoculture plantings
 - Diversity of bees in low-income, less populated areas is higher than in high-income neighborhoods (Lowenstein, 2014)
 - The effects of climate change may be more pronounced
 - Overuse and misuse of pesticides





Geneva St

Ashburton Rd

Liles Rd

Liles Rd

Liles Rd

Pineview Dr

ions Branch

Swift Dr

Pineview Dr

Eakley Ct

ley Ct

4927 Liles Road

125 ft

Search this area

140

Millington Ct

Stone Harbor Pl

Província Dr

Royal Pine Ct

Spring Pine Ct NE

Southern Pine Dr

Pine Harbor Way

Island Pine Way

Greenidge Way

Parkland Way





Plants, Insects, and Urbanization

Urban Environments

- Neighborhoods with higher vegetational diversity and structural complexity may provide more favorable microhabitats for arthropods (Raupp et al., 2009)
- Increased plant diversity enhances species richness, evenness, diversity, and abundance of arthropods



Your yard and the landscape

Made up of 5 vegetative layers:

- 5—Canopy
- 4—Mid-story
- 3—Shrub layer
- 2—Herbaceous ground cover
- 1—Lawn/grass cover

Diversity at each of these layers is key!



Lawn Plant Diversity and Vegetative Complexity

Simple-
Simple

Simple-
Complex



Diverse/
Simple

Diverse/
Complex



Table 5. Diversity and abundance (mean±SE) of aerial beneficial, pest, and nonpest arthropods collected from suction sampling in lawns of varying diversity and surrounding vegetative structural complexity. Raleigh, North Carolina, 2011 and 2012. Letters in the same column that are the same indicate no significant difference between lawn types.

Functional Group	Simpson Index	Shannon Index	Evenness Index	Abundance
Beneficial				
Simple-Simple	0.31±0.02a	1.11±0.064a	0.34±0.02a	18.3±2.2a
Simple-Complex	0.30±0.2a	1.08±0.06a	0.33±0.02a	15.5±2.3a
Diverse-Simple	0.19±0.03b	1.28±0.06b	0.40±0.02a	15.6±2.1a
Diverse-Complex	0.17±0.03b	1.42±0.07c	0.43±0.02b	21.2±2.5b
F	3.75	3.65	3.65	2.03
df	3,302	3,294	3,294	3,302
p	0.01	0.01	0.01	0.07
Herbivore Pests				
Simple-Simple	0.65±0.04a	0.31±0.04a	0.13±0.02a	25.9±6.4a
Simple-Complex	0.64±0.04a	0.38±0.04a	0.16±0.02a	21.6±6.7a
Diverse-Simple	0.61±0.04a	0.46±0.04a	0.20±0.02b	30.4±6.1a
Diverse-Complex	0.62±0.04a	0.55±0.05b	0.24±0.02c	51.9±7.1b
F	0.15	3.93	3.93	3.75
df	3,302	3,302	3,289	3,302
P	0.92	0.009	0.009	0.01
Herbivore Non-Pests				
Simple-Simple	0.04±0.03a	0.08±0.12a	0.05±0.06a	0.20±0.05a
Simple-Complex	0.02±0.04a	0.04±0.14a	0.02±0.08a	0.17±0.05a
Diverse-Simple	0.12±0.03a	0.11±0.1a	0.05±0.05a	0.38±0.05b
Diverse-Complex	0.15±0.04a	0.36±0.1b	0.20±0.04b	0.57±0.06c
F	1.24	3.14	3.14	11.6
df	3,302	3,302	3,66	3,302
P	0.29	0.03	0.03	<0.0001

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Urban Environments

- Neighborhoods with higher vegetational diversity and structural complexity may provide more favorable microhabitats for arthropods (Raupp et al., 2009)
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Plants, Insects, and Urbanization

Where do Native Plants Fit in?

- Native plants increase arthropod diversity and abundance (Tallamy, 2017)
- What about cultivars of native plants? (Poythress and Affolter, 2018; Baisden et al., 2018)



Coreopsis 'Tequila Sunrise'



Coreopsis lanceolata



Plants, Insects, and Urbanization

A New Wrinkle

- Neighborhoods with higher vegetational diversity and structural complexity may provide more favorable microhabitats (Raupp et al., 2009)
- Increased plant diversity enhances species richness, evenness, and abundance
 - How does that play out for pest management and enhanced ecological services?
- Evidence suggests that resource concentration is also a consideration for some species (Baker and Potter, 2019)

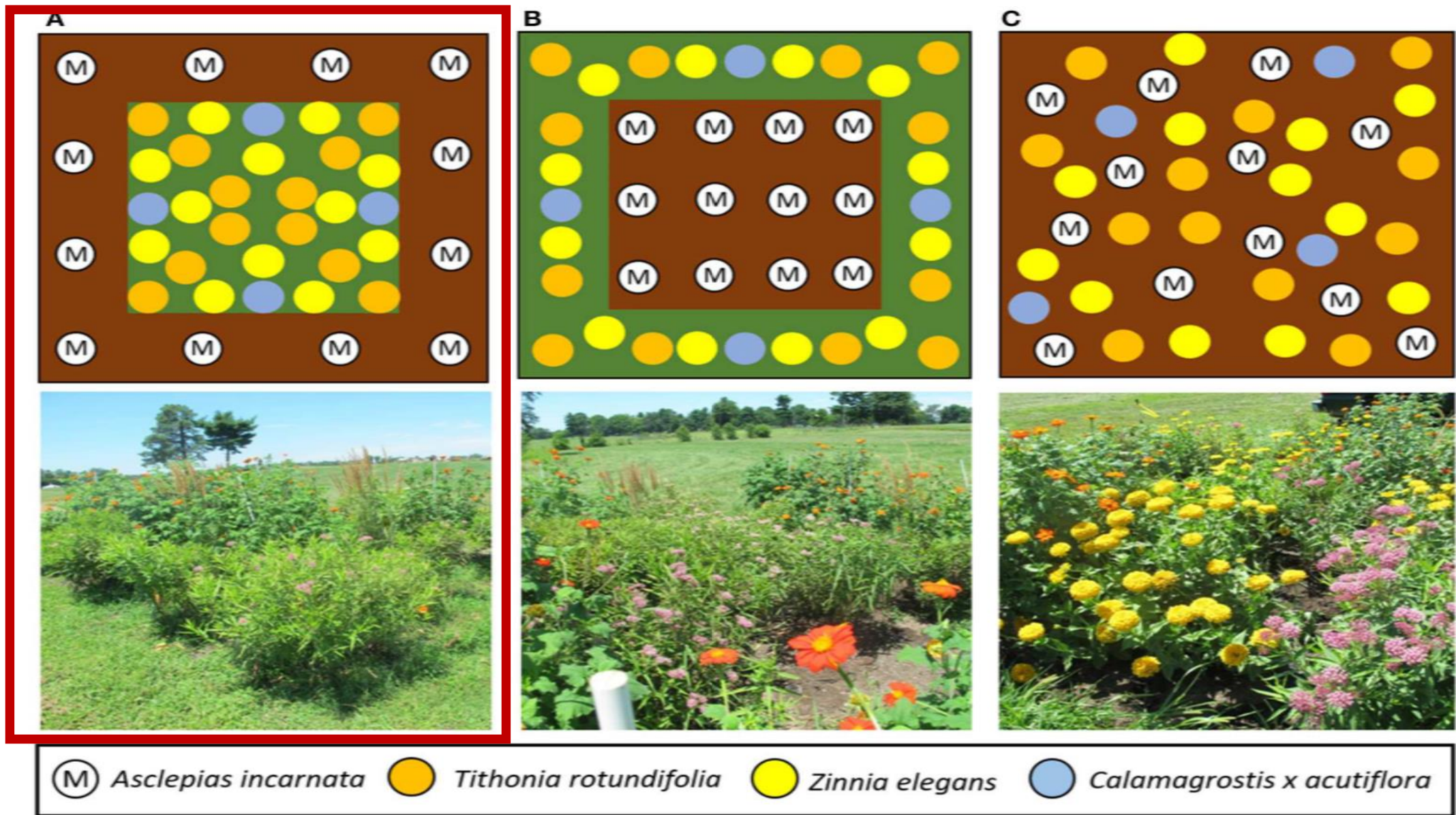


FIGURE 1 | Layout of the three garden designs tested. Top row, left to right: **(A)** milkweed plants on the perimeter of the garden (M), spacing with mulch (brown), nectar/camouflage plants on interior of garden [*Tithonia rotundifolia* (orange), *Zinnia elegans* (yellow), and *Calamagrostis x acutiflora* (blue)]; **(B)** milkweed on the interior of the garden and placement of the nectar/camouflage plants on exterior of garden; **(C)** no formal design to simulate a naturalized or mixed garden. Milkweed and nectar/camouflage plants were placed randomly throughout each quadrant in the gardens. Bottom row, left to right: gardens of the aforementioned designs, respectively, as they appeared in 2018.

*Do not burn yourselves out...it is not
enough to fight for the land; it is even
more important to enjoy it.*

-Edward Abbey





Further Reading and Selected Citations

- Baisden, Emily C., Douglas W. Tallamy, Desiree L. Narango, and Eileen Boyle. 2018. *Do cultivars of native plants support insect herbivores?* American Society for Horticultural Science. 28:5: 596-606.
- [Baker, Adam M and Daniel A. Potter. 2019. *Configuration and location of small urban gardens affect colonization by Monarch butterflies*. Frontiers in Ecology and Evolution. 7:474.](#)
- Eaton, Eric and Kenn Kaufman. 2007. *Field Guide to Insects of North America*. Houghton Mifflin Co., Boston. ISBN: 978-0-618-15310-7
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- Marshall, Stephen A. 2006. *Insects: Their Natural History and Diversity*. Firefly Books Ltd. Ontario, CA. ISBN: 978-1-55297-900-6.
- Overstreet, Leslie K. 2008. *Botanicals: Butterflies and Insects*. Assouline Publishing. New York, NY. ISBN: 978-2759402694.