Residential Land Stewardship: Impact on Biodiversity

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Abstract. From 2001 to 2006, the diversity of easily viewed wildlife and plants was monitored in a central-Ohio city yard as it transitioned from heavily, chemically treated lawn/garden with ornamental non-native plants (traditional) to organically treated lawn/garden with a wide-variety of native plants (habitat).

Biodiversity of insects, mammals, and birds increased exponentially in the habitat as chemicals were reduced as non-native, invasive plants removed, and as the diversity of native plants increased. A functioning, mini-ecosystem naturally formed as diverse native wildlife prey and predators were observed. The habitat demonstrated global impact when long-distance migrating birds began exploiting it as a refueling site in 2005.

In 2005 and 2006, the habitat and an adjacent, traditional yard, identical in all ways except stewardship, were studied to compare biodiversity. The traditional yard had significantly fewer species of wildlife counted during the same weather conditions and in the same length of survey periods. It also had more plant-parasitic nematodes and less beneficial nematodes. Both sites are in central Ohio.

Keywords. Biodiversity, Native, Invasive, Habitat, Bird, Insect, Mammal, Ecosystem, Wildlife

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Introduction

Ohio became primarily forested after the last glacier, but was cleared for farming and development beginning ~ 1750. Recently, suburbs have sprawled at an uncontrolled rate, and invasive, non-native plants choke out the few native species remaining.

Lawn is often excessively watered, excessively fertilized and 101 million pounds of pesticide are applied in non-commercial applications on home lawns and gardens annually. This includes insecticides, herbicides, rodenticides, and fungicides (epa.gov/oppbead1/pestsales/01pestsales/table_of_contents2001.html).

Biodiversity was chosen for this study because "*When we try to pick out anything by itself in nature, we find it hitched to everything else in the Universe*." (Muir, John, *My First Summer in the Sierra,* 1911)

US Forest Service Research (University. of Massachusetts 1972) indicated that wildlife habitat could be effectively scaled down to the size of a typical city yard.

The purpose of the following study was to validate that this approach could be successfully applied to a well-developed, human-dominated ecosystem in Columbus, Ohio.

Study 1: Traditional to Habitat Transition

Theory, Hypothesis and Method

The theory was to discover if a functioning mini-ecosystem could be created in a small Columbus, Ohio residential yard in a mature developed area by adding native plants as found in natural areas and enhancing and maintaining the yard similar to naturally occurring surroundings in this eco-region.

Hypothesis:
1. Expected little or no increase in wildlife the first two years
2. Expected wildlife to increase beginning with the third growing season

Assumptions:
1. Recovery from prior use of chemicals takes 10 years
2. Native plants grow down before they grow out to provide wildlife cover
3. It takes up to 3 years to put down deep taproots (native plant adaptation for drought)
4. Native plants need to be established for three years before producing berries

The method of validation was to maintain an accurate list of wildlife by year before and during the transition, by documenting wildlife that is easily observed in the front and back yards and by tracking plants yearly, grouped by Ohio native and exotic (not native).

Transition to Habitat

Educating neighbors in advance, putting up the Certified Wildlife Habitat sign, and adding stepping stones, a garden arch and garden statues addressed local perceptions.

Re-landscaping was done to create a gradual, smooth blend of ecosystems linked to the housing development's pre-existing canopy tree line, to maximize the edge effect by increasing the ecotone (area of transition between two adjacent ecosystems) and to create three seasons of blooms. The goals were to benefit wildlife, to increase the diversity of mobile animals (birds, flying insects, etc), and to increase complex native vegetation matrices, which helps decrease habitat fragmentation.

In the back yard, native, canopy trees (Celtis occidentalis and Prunus serotina) were retained and invasive Lonicera maackii and Alliaria petiolata were dug out with shovels. In their place, examples of plants added included native sub-canopy trees (Prunus virginiana), small, shade-tolerant trees (Viburnum lentago, Cornus racemosa) and bushes (Lindera benzoin). Groundcover and vines that provide fruit (Parthenocissus quinquefolia), woodland plants (Helianthus strumosus), native ferns (Osmunda cinnamonea) and native herbs (Hypericum punctatum) were planted on the forest floor.

In the front yard, lawn was removed and a tiny meadow was planted for butterflies with a mixture of host plants for caterpillars and nectar plants for adults. A hummingbird garden was created near the front window including Lonicera sempervirens, Silene regia, and Lobelia cardinalis.

Side yards included plants such as Helianthus mollis, Echinacea purpurea and Silphium perfoliatum, selected for small seeds to feed native birds in late winter.

6-year Habitat Study Results

See Figures 1a and 1b.

Diversity	Year 2001	Year 2002	Year 2003	Year 2004	Year 2005	Year 2006
Native Plants	3	10	59	79	94	113
Other Insects	13	16	35	39	44	51
Birds	2	9	30	31	33	37
Butterflies	2	3	16	18	32	33
Mammals	2	4	8	8	9	9

Figure 1a

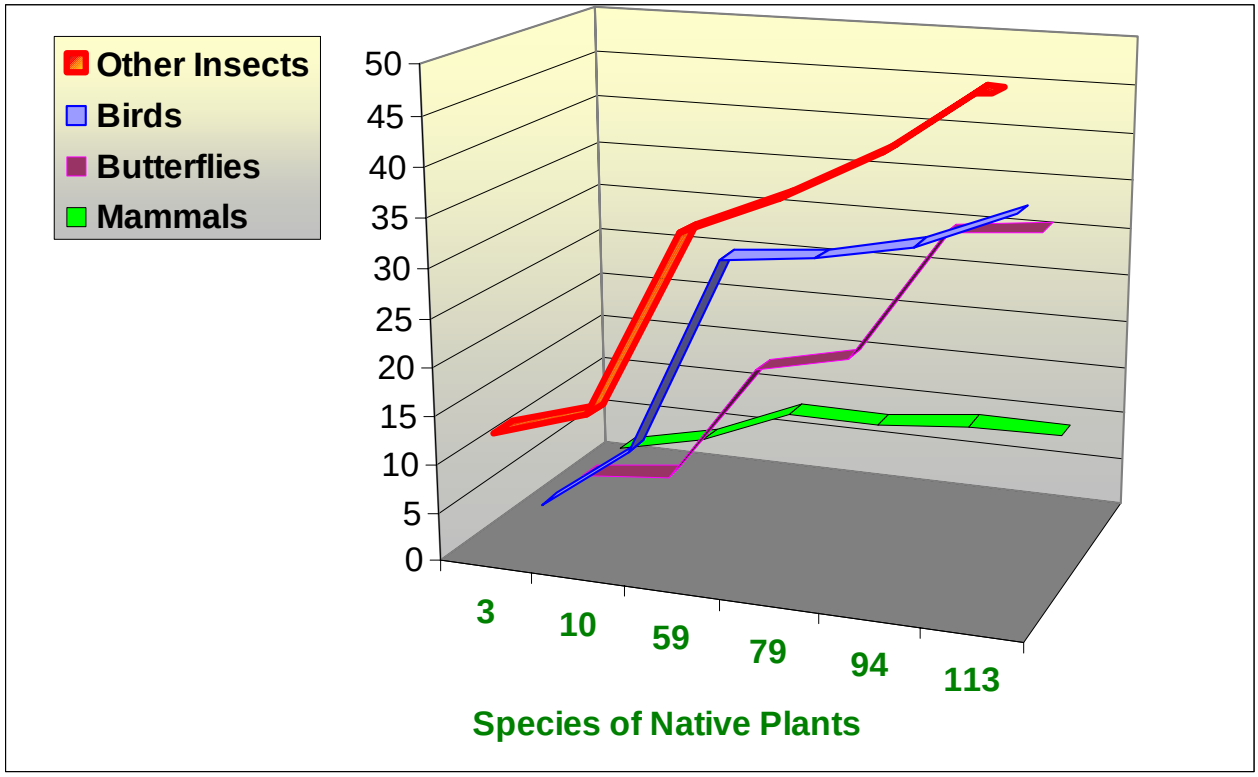

Figure 1b

These counts were accumulated each year, and indicate that the biodiversity in the habitat yard correlated to the diversity of chemical-free, native plant species.

In 2005 and 2006, the habitat took on global significance as migratory birds, such as the Swainson's thrush (Catharus ustulatus), began exploiting the habitat yard as a refueling stop.

Study II: Habitat vs. Adjacent Traditional

Comparison

The two adjacent study sites are nearly identical in construction date, lot size and house square footage. In construction of the habitat lot, a row of native trees was left at the back of the lot, whereas the traditional lot was bulldozed entirely. Both houses have one canopy tree in the front yard.

	Habitat Yard	Traditional Yard
Yard Care	Removed exotic invasive plants	Remove everything except planted exotics and vegetables
Fall Yard Maintenance	Leaves left in beds, seed heads left standing	Cut plants to ground, cover with mulch
Lawn Care	Organic since 8/02; Before Chemicals 4 times/year	Since 1983, chemicals 1 to 2 times per year
Fertilizers	Seaweed Emulsion in baskets since 8/02; Before Miracle Grow in garden	Chemical
Pesticides	Before chemical spray house; since granular chemical base of slab	Chemical sprays on plants
Other Chemicals	None	Moth balls, lawn and garden chemical weed killers and fertilizers

2006 Stewardship comparisons

The method of validation was to randomly observe wildlife during similar weather conditions through the habitat house windows or from across the street with binoculars. Surveys were conducted at the same times for the two sites.

'05-'06 Comparison Study Results

Diversity of Plant Species
2005 Habitat: 94 native, 80 non-native*
2005 Traditional: 0 native, 28 non-native*
2006 Habitat: 113 native, 77 non-native*
2006 Traditional: 0 native, 27 non-native*

*non-invasive

Bird Species in 20-minute survey period
2005 Habitat: 11 - Traditional: 1
2006 Habitat: 16 - Traditional: 6

Insect Species in 40-minute survey period
2005 Habitat: 35 - Traditional: 7
2006 Habitat: 47 - Traditional: 11

Chimney Swift passes for bugs
2005 Habitat: 4 - Traditional: 0
2006 Habitat: 6 - Traditional: 0

Dragonfly hunting flights
2005 Habitat: 35 - Traditional: 0
2006 Habitat: 35 - Traditional: 14*

*back yard over swimming pool cover filled with water attracting mosquitoes

Annual Cicada Calls
2005 Habitat: Front & Back
2005 Traditional: None
2006 Habitat: Front & Back
2006 Traditional: None

Firefly blink average of 4 minutes
2005 Habitat: 39 - Traditional: 29
2006 Habitat: 73 - Traditional: 22

Firefly blink location
2005 Habitat: Grass and flowerbed
2005 Traditional: Flowerbed only*
2006 Habitat: Grass and flowerbed
2006 Traditional: Grass only*

*Coincided with most recent chemical use

2006: Nematodes indicate soil food web condition, environmental disturbance, and pollution levels. Samples of soil nematode communities are easy to identify, count and use as indicators for assessing the condition of the soil environment. Nematodes are in direct contact with dissolved soil chemicals through their permeable membranes and react rapidly to disturbance and contaminants.

Plant Parasitic Nematodes in 10g soil
2006: Habitat 68 - Traditional 101

Beneficial Nematodes (FLN) in 10g soil
2006: Habitat 337 - Traditional 205

Soil Health Indicators:

Structure Index
2006: Habitat 32.11 – Traditional 14.29

Higher Structure Index = more diverse and stable soil food web

Maturity Index
2006: Habitat 1.82 – Traditional 1.79

Higher MI (Maturity Index) = less disturbance/pollution to the system

Soil Organic Matter
2006 Habitat 10.02 – Traditional 7.74

SOM (Soil Organic Matter) = good for functions of soil system

Microbial Biomass Nitrogen
2006 Front Yard Habitat 74.70* – Traditional 83.54
2006 Back Yard Habitat 118.17 – Traditional 83.54

*Unexpected as other important parameters/indices better in Habitat

Comparison Study Summary

See Figure 2. Results suggest that the abundance of biodiversity correlates to chemical-free native plant species.

Interested in more detail? Complete data is available in PowerPoint and Excel. Interested in helping? Get involved at this site or add your own survey sites.

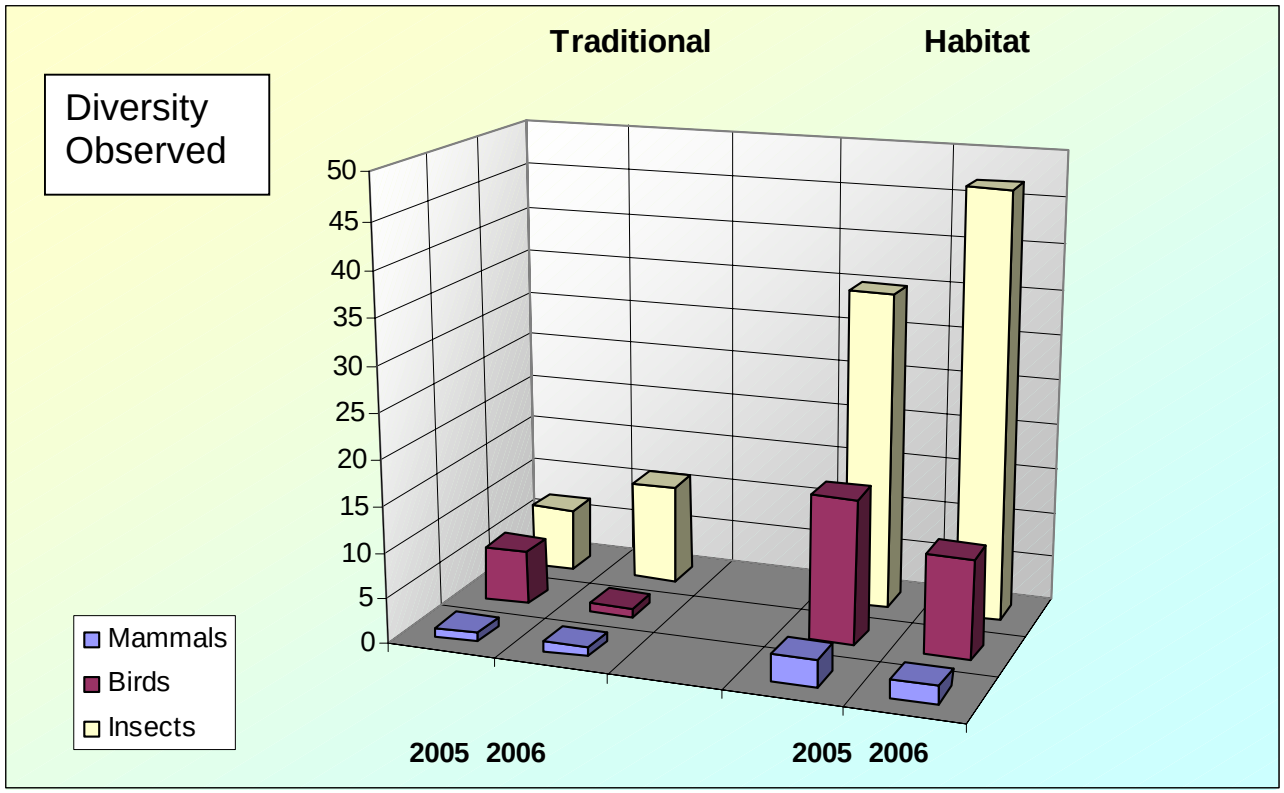

Figure 2 (Diversity Observed in Years 2005 and 2006)

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Birds of Ohio, James S. McCormac, Gregory Kennedy, 2004

Bee Pollinators in Your Garden, American Assoc. of Professional Apiculturists, 1999

Ohio Invasive Plant Research Conference, Circular 196, 2005 www.oipc.info and click on Resources

- Amanda D. Rodewald, Brian C. McCarthy, Bernd Blossey, John Maerz, Carrie Brown, Tarun K. Mal; M Banker, T. Poling, L. Jablonski, S. Felkey, D. Geiger, D. Cipollini, J. Mbagwu, K. Barto, C.-J. Hillstrom, S. Enright, Monica Dorning and Don Cipollini

ODNR brochures:

- Common Butterflies and Skippers of Ohio; Fighting Invasive Plants in Ohio; Aquatic Nuisance Plants in Ohio; Invasive Alien Species: impacts to fish and wildlife in Ohio

Resources

Certified Wildlife Habitat program, National Wildlife Federation, www.nwf.org/backyard

Enature from National Wildlife Federation, http://enature.com/native_invasive/natives.asp select native and invasive, select Ohio and plant type

Ohio Native Plant Booklet, Franklin County Extension, phone 866-6900 x201: http://ohioline.osu.edu/b865

Franklin Co. Native Plant List, Wild Ones, http://www.for-wild.org/chapters/columbus/

Worst Invasive Plants in Ohio pamphlet (helpful fact sheets include control options) ODNR, Div. of Natural Areas and Preserves www.ohiodnr.com/dnap/invasive/

Woody Plants of Ohio, E Lucy Braun

Vascular Plants of Ohio, Cooperrider, Cusick & Kartesz

Wild Ohio, Art Weber