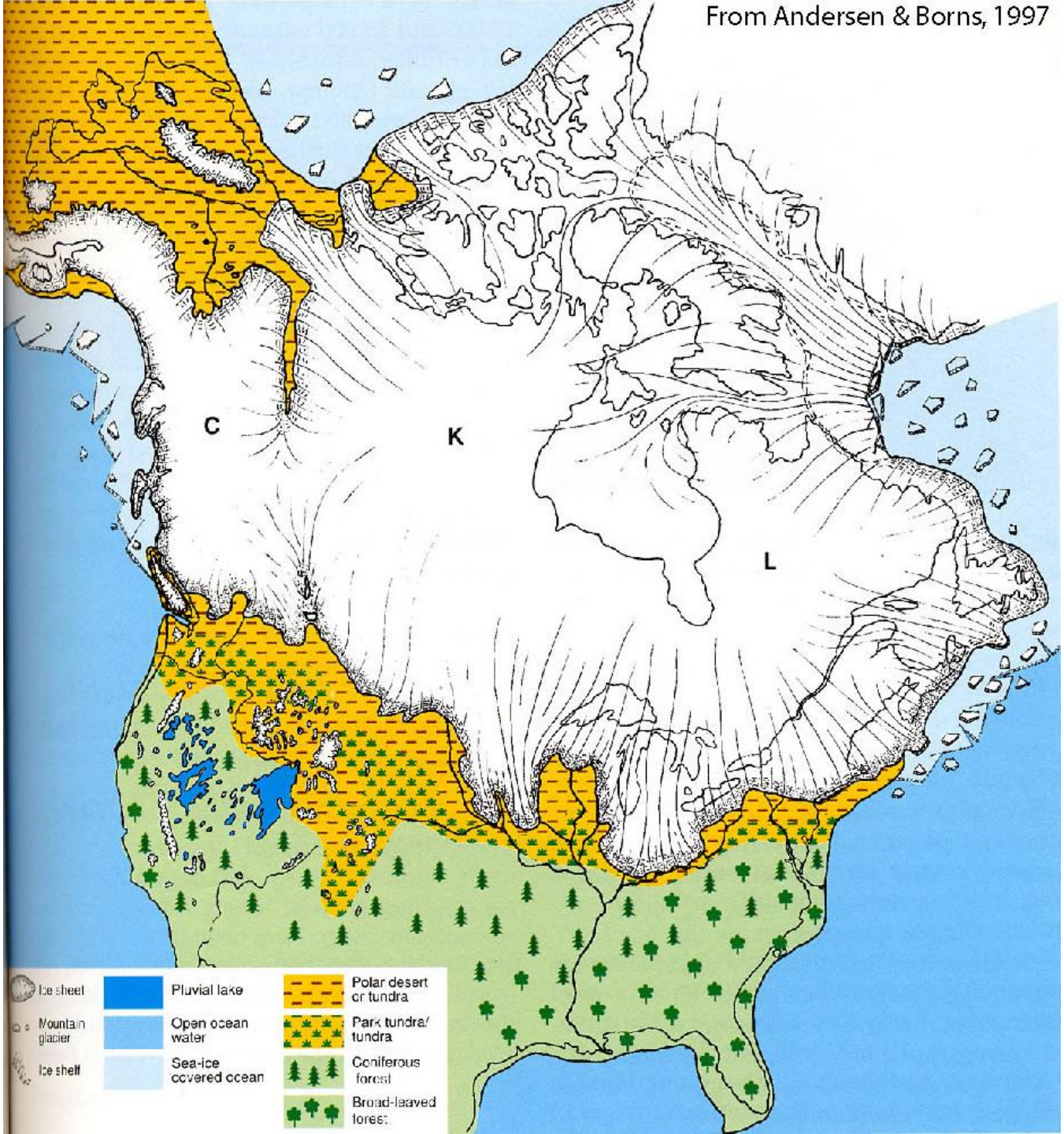
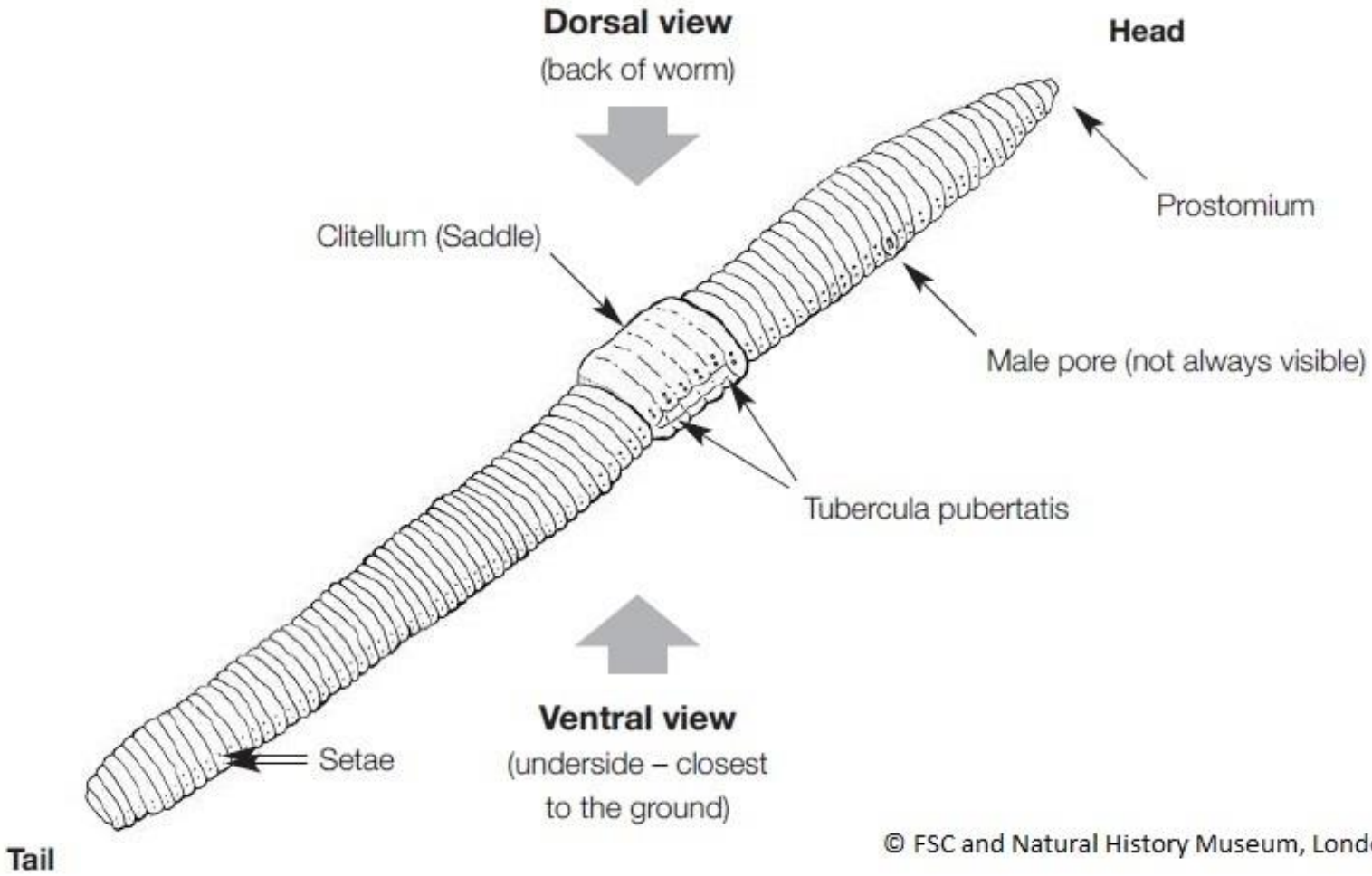
# Assessing the impact of earthworms on forest ecosystems on the White Memorial Foundation.

James Fischer
Research Director
White Memorial Conservation Center, Inc.

Greenland
Ice Sheet
Cordilleran
Ice Sheet
Laurentide
Ice Sheet

From Andersen & Borns, 1997



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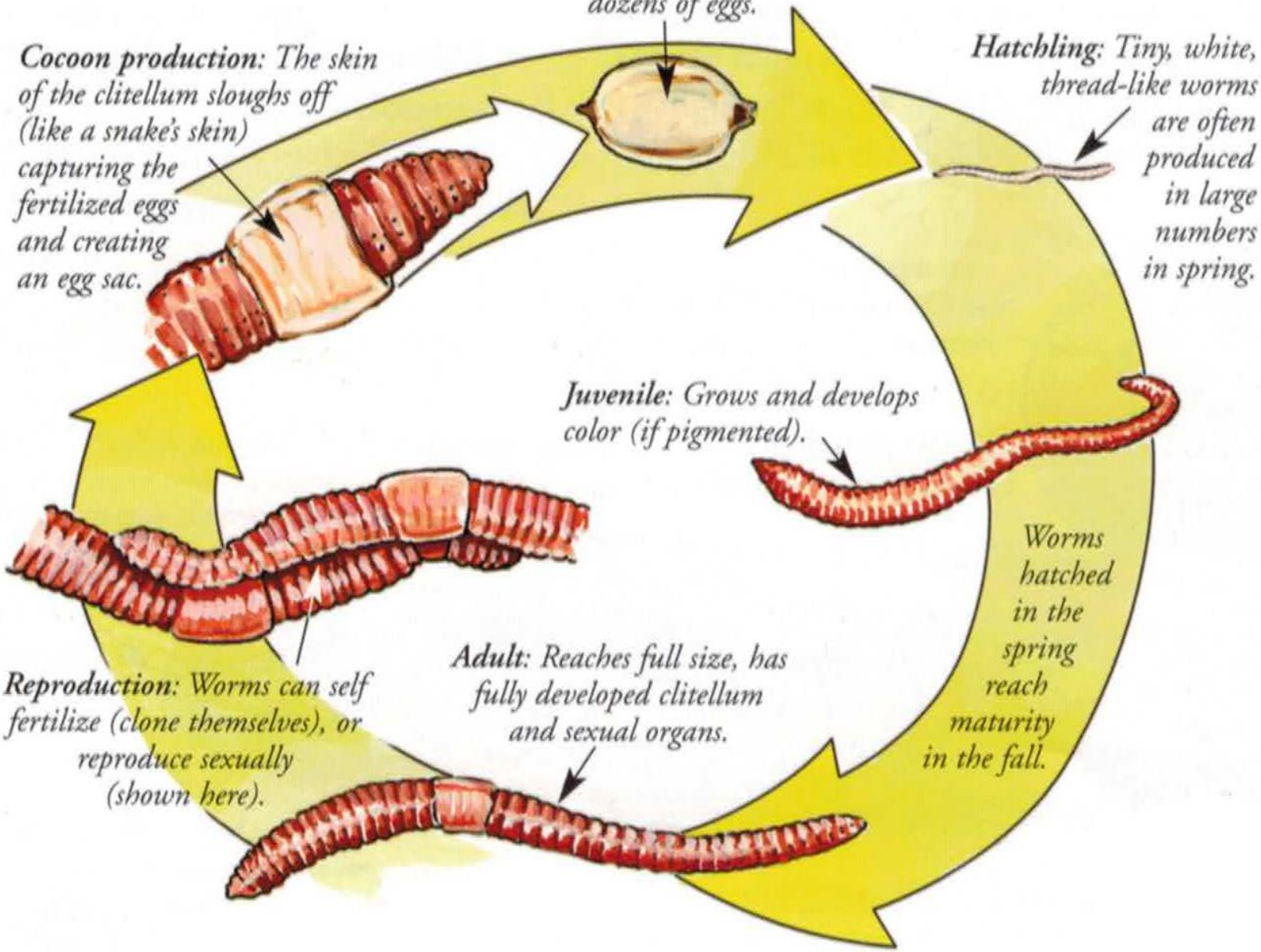
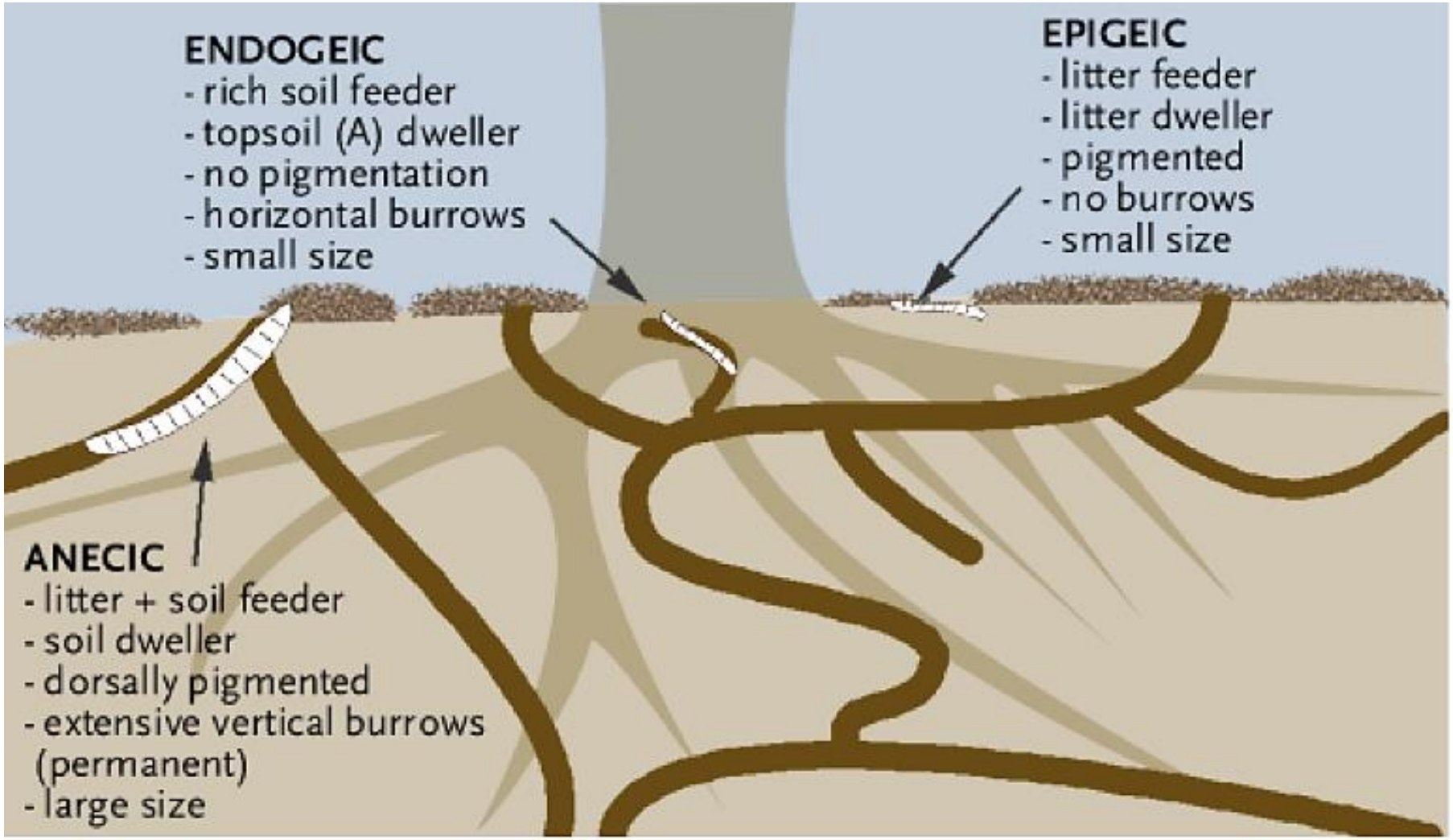
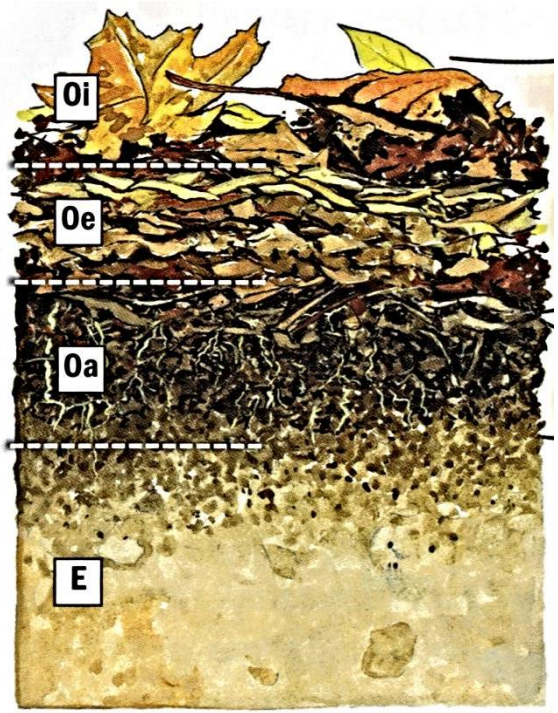
# *Life cycle of the earthworm*

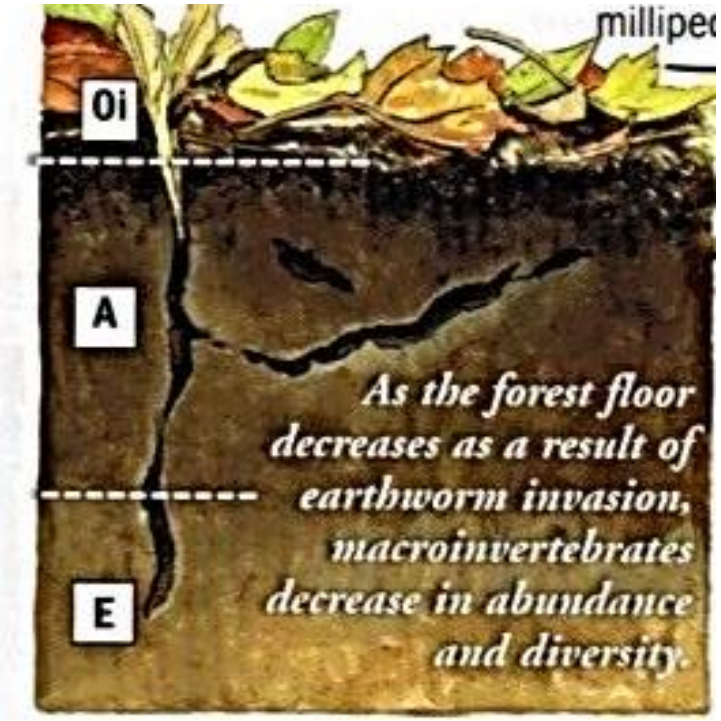


# Ecological Groups






Earthworm-Free




Earthworm Heavily-Impacted

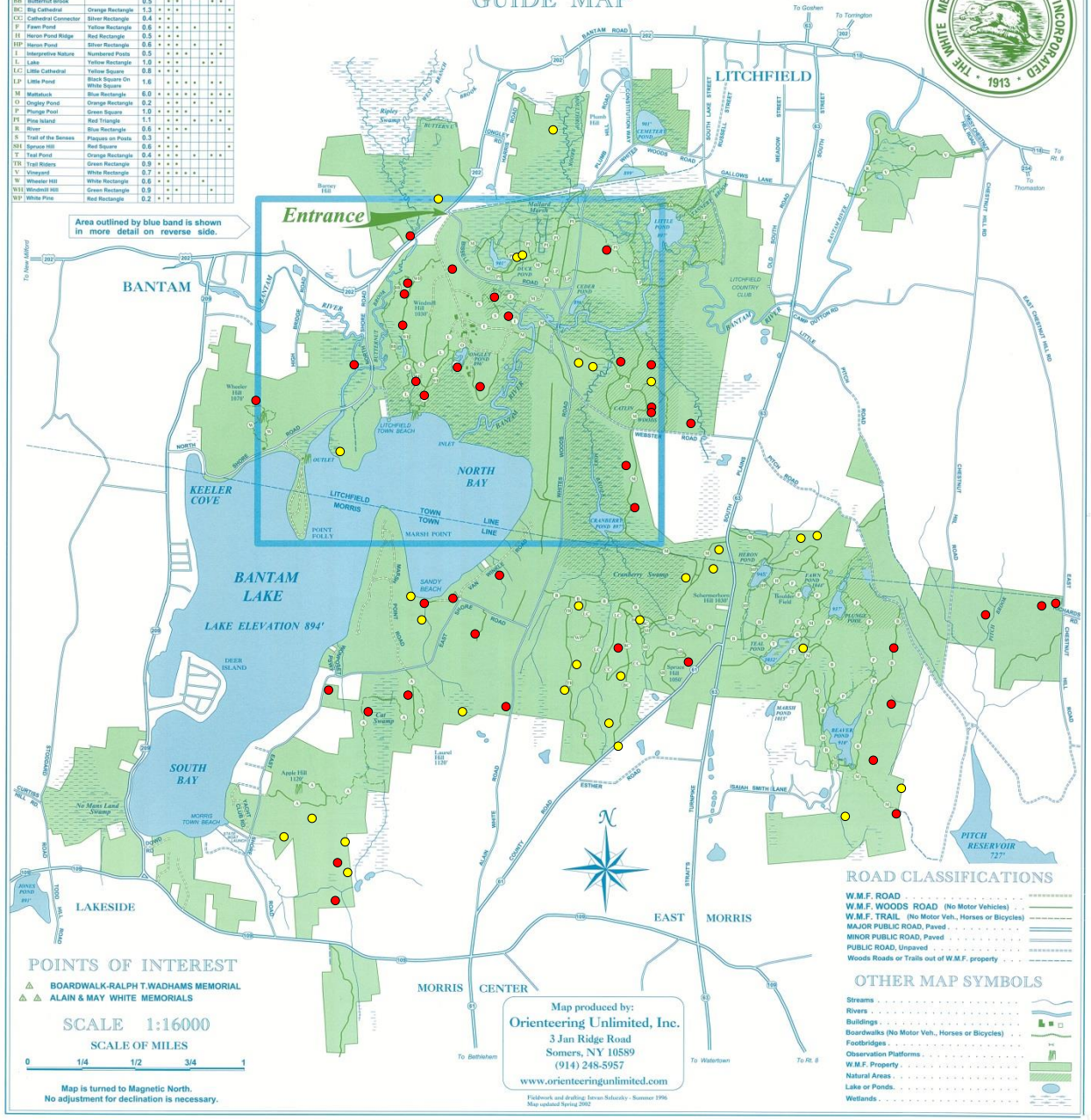
# THE WHITE MEMORIAL FOUNDATION, INC.

## GUIDE MAP

THE WHITE MEMORIAL FOUNDATION, INCORPORATED · 1913 ·

## TRAIL LEGEND

| SYMBOL | TRAIL NAME | BLAZE | LENGTH (Miles) | Hilly | Wooded | Brook | River | Pond | Lake | Marsh | Beaver | Rocky |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Apple Hill | Blue Rectangle | 2.0 | • | • | • | | | • | • | • | • |
| B | Beaver Pond | White Rectangle | 2.8 | • | • | • | | • | | • | • | • |
| BB | Butternut Brook | | 0.5 | | • | • | | | | • | • | |
| BC | Big Cathedral | Orange Rectangle | 1.3 | • | • | • | | | | | | • |
| CC | Cathedral Connector | Silver Rectangle | 0.4 | • | • | • | | | | | | |
| F | Fawn Pond | Yellow Rectangle | 0.6 | • | • | • | | • | | | | • |
| H | Heron Pond Ridge | Red Rectangle | 0.5 | • | • | • | | | | | | |
| HP | Heron Pond | Silver Rectangle | 0.6 | • | • | • | | • | | | • | |
| I | Interpretive Nature | Numbered Posts | 0.5 | | • | • | • | | | • | • | |
| L | Lake | Yellow Rectangle | 1.0 | • | • | • | | | • | • | | |
| LC | Little Cathedral | Yellow Square | 0.8 | • | • | • | | | | | | |
| LP | Little Pond | Black Square On White Square | 1.6 | | • | • | • | • | | • | • | |
| M | Mattatuck | Blue Rectangle | 6.0 | • | • | • | • | • | | • | • | • |
| O | Ongley Pond | Orange Rectangle | 0.2 | • | • | • | | • | | • | | |
| P | Plunge Pool | Green Square | 1.0 | • | • | • | • | | | | • | • |
| PI | Pine Island | Red Triangle | 1.1 | | • | • | | • | | • | • | |
| R | River | Blue Rectangle | 0.6 | • | • | • | • | | | | | • |
| S | Trail of the Senses | Plaques on Posts | 0.3 | | • | | | | | | | |
| SH | Spruce Hill | Red Square | 0.6 | • | • | • | | | | | | • |
| T | Teal Pond | Orange Rectangle | 0.4 | • | • | • | | • | | • | • | |
| TR | Trail Riders | Green Rectangle | 0.9 | • | • | • | | | | | | |
| V | Vineyard | White Rectangle | 0.7 | • | • | • | • | • | | | | |
| W | Wheeler Hill | White Rectangle | 0.6 | • | • | | | | • | | | |
| WH | Windmill Hill | Green Rectangle | 0.9 | • | • | • | | | | • | | |
| WP | White Pine | Red Rectangle | 0.2 | • | • | | | | | | | |




## POINTS OF INTEREST

- △ BOARDWALK-RALPH T.WADHAMS MEMORIAL
- △ △ ALAIN & MAY WHITE MEMORIALS

## SCALE 1:16000

SCALE OF MILES

0 1/4 1/2 3/4 1

Map is turned to Magnetic North.
No adjustment for declination is necessary.

Map produced by:
Orienteering Unlimited, Inc.
3 Jan Ridge Road
Somers, NY 10589
(914) 248-5957
www.orienteeringunlimited.com

Fieldwork and drafting: Istvan Sulozsky - Summer 1996
Map updated Spring 2002

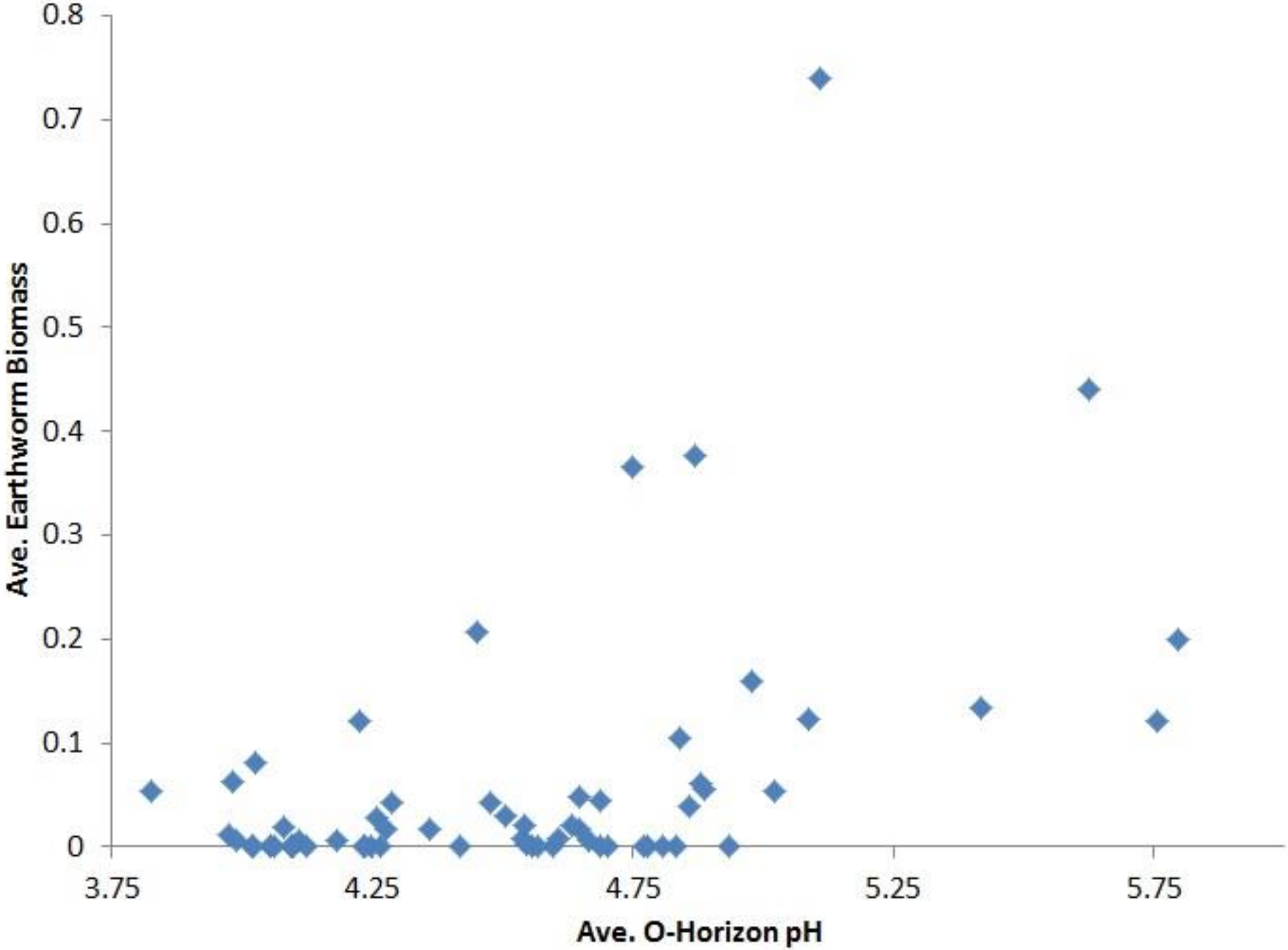
## ROAD CLASSIFICATIONS

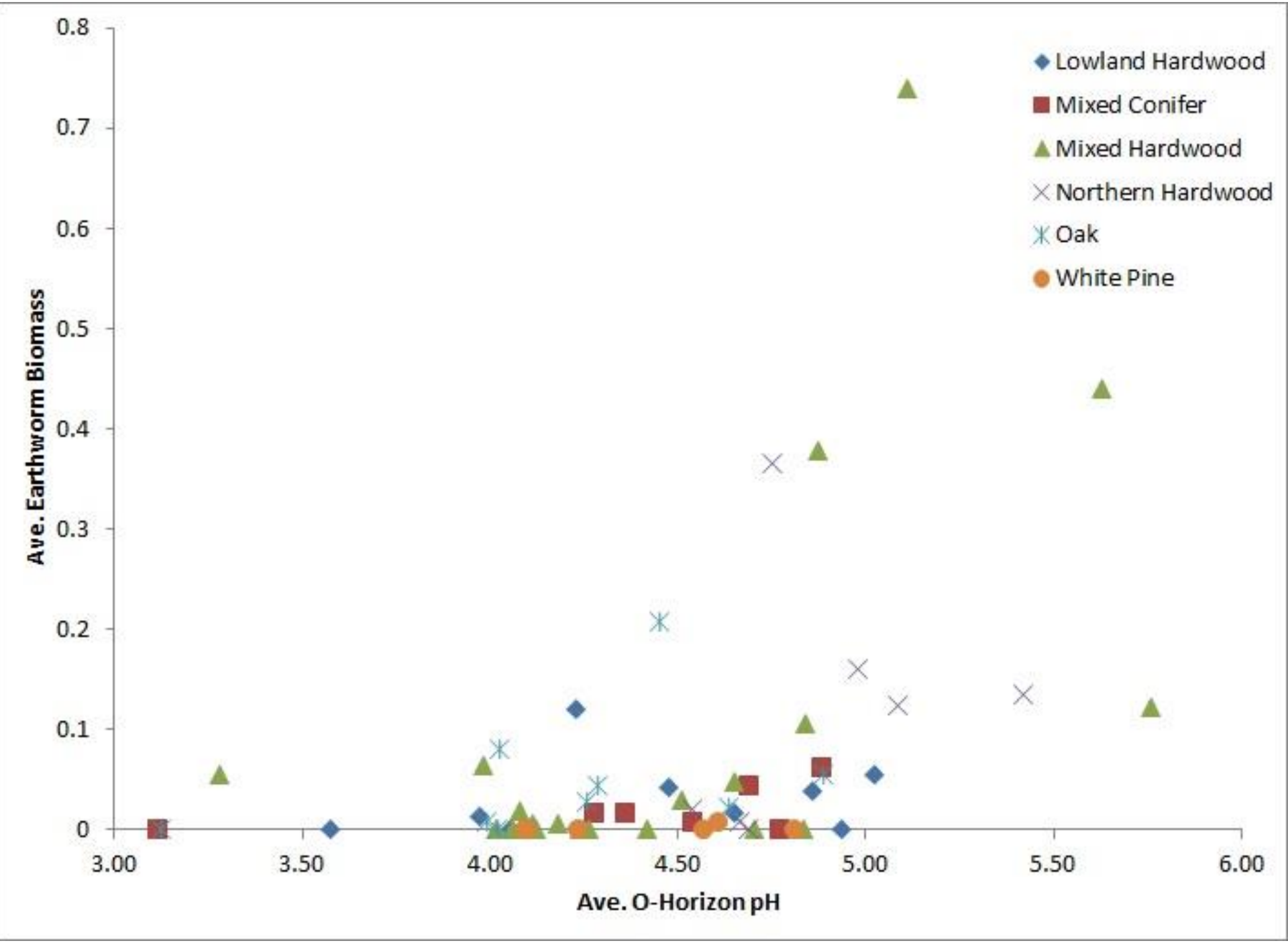
- W.M.F. ROAD
- W.M.F. WOODS ROAD (No Motor Vehicles)
- W.M.F. TRAIL (No Motor Veh., Horses or Bicycles)
- MAJOR PUBLIC ROAD, Paved
- MINOR PUBLIC ROAD, Paved
- PUBLIC ROAD, Unpaved
- Woods Roads or Trails out of W.M.F. property

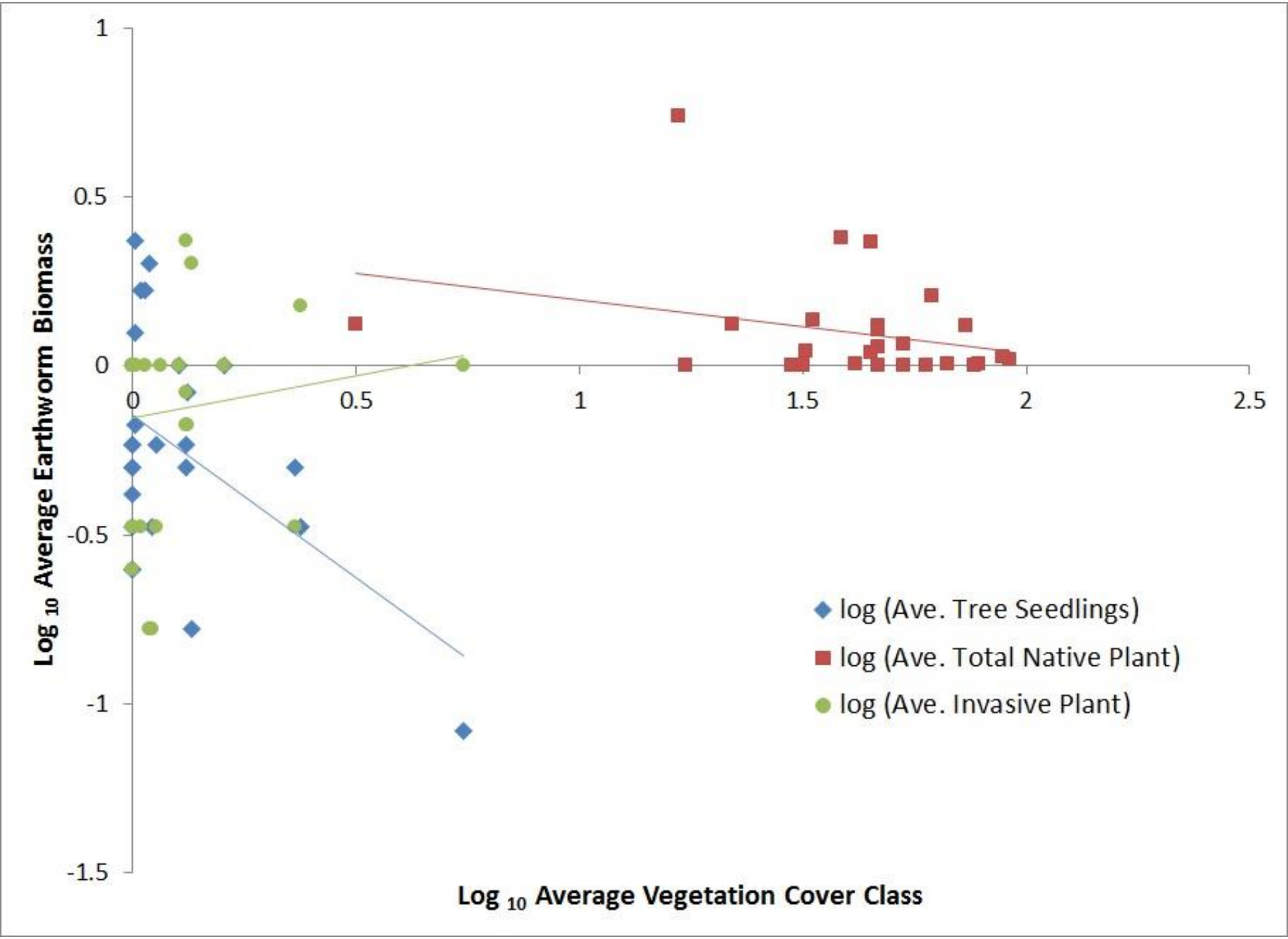
## OTHER MAP SYMBOLS

- Streams
- Rivers
- Buildings
- Boardwalks (No Motor Veh., Horses or Bicycles)
- Footbridges
- Observation Platforms
- W.M.F. Property
- Natural Areas
- Lake or Ponds
- Wetlands

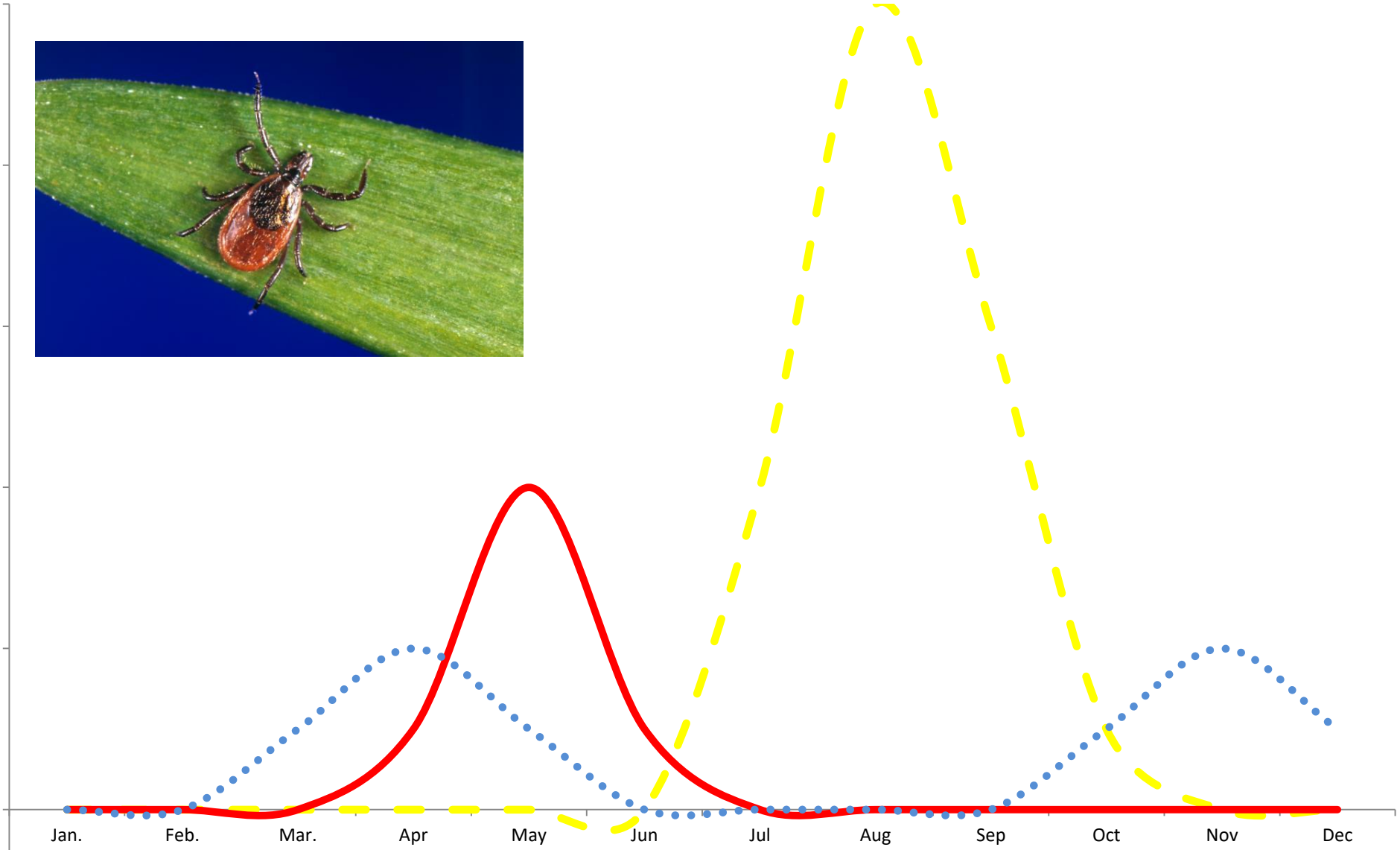
| Earthworms<br>FAMILY<br>*Genus species* | Number of Specimens Collected | Vegetative Cover Types | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mixed Hrdwds. | Lowland Hrdwds. | Northern Hrdwds. | Oak | Hickory | White Pine | Mixed Conifer | Hemlock | Marsh | Shrub |
| **LUMBRICIDAE** | | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| *Aporrectodea* spp. (E) | 137 | ● | ● | | | | | ● | | ● | ● |
| *Aporrectodea longa* (E) | 1 | | | | | | | | | | ● |
| *Aporrectodea rosea* (E) | 1 | ● | | | | | | | | | |
| *Aporrectodea calignosa* comp. (E) | 3 | ● | | | | | | | | | |
| *Aporrectodea tuberculata* (E) | 5 | ● | | | | | | | | | ● |
| *Dendrobaena octaedra* (E) | 107 | ● | ● | | | | ● | ● | | | |
| *Dendrodrilus rubidus* (N) | 223 | ● | ● | ● | ● | | | ● | ● | ● | ● |
| *Eisenoides lonnbergi* (N) | 4 | | | | ● | | | ● | | | |
| *Lumbricus* spp. (E) | 197 | ● | ● | ● | ● | | | ● | | ● | ● |
| *Lumbricus rubellus* (E) | 38 | ● | ● | | ● | | | ● | | ● | ● |
| *Lumbricus terrestris* (E) | 10 | ● | | | ● | | | | | | |
| *Octolasion* spp. (E) | 5 | ● | | | | | | | | | |
| *Octolasion tyrtaeum* (E) | 1 | ● | | | | | | | | | |
| **MEGASCOLECIDAE** | 250 | ● | ● | ● | ● | | ● | ● | | | |
| *Amynthas agrestis* (E) | 1 | | | | | | ● | | | | |
| *Metaphire hilgendorfi* (E) | 1 | ● | | | | | | | | | |
| *Amynthas tokioensis* (E) | 2 | ● | | | | | | | | | |
| | | | | | | | | | | | |
| Total Earthworms Collected | 993 | | | | | | | | | | |
| Total Number of Plots Sampled | | 26 | 12 | 10 | 11 | 1 | 8 | 7 | 3 | 1 | 3 |


0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Ave. Earthworm Biomass
3.75
4.25
4.75
5.25
5.75
Ave. O-Horizon pH


Lowland Hardwood
Mixed Conifer
Mixed Hardwood
Northern Hardwood
Oak
White Pine
Ave. Earthworm Biomass
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3.00
3.50
4.00
4.50
5.00
5.50
6.00
Ave. O-Horizon pH

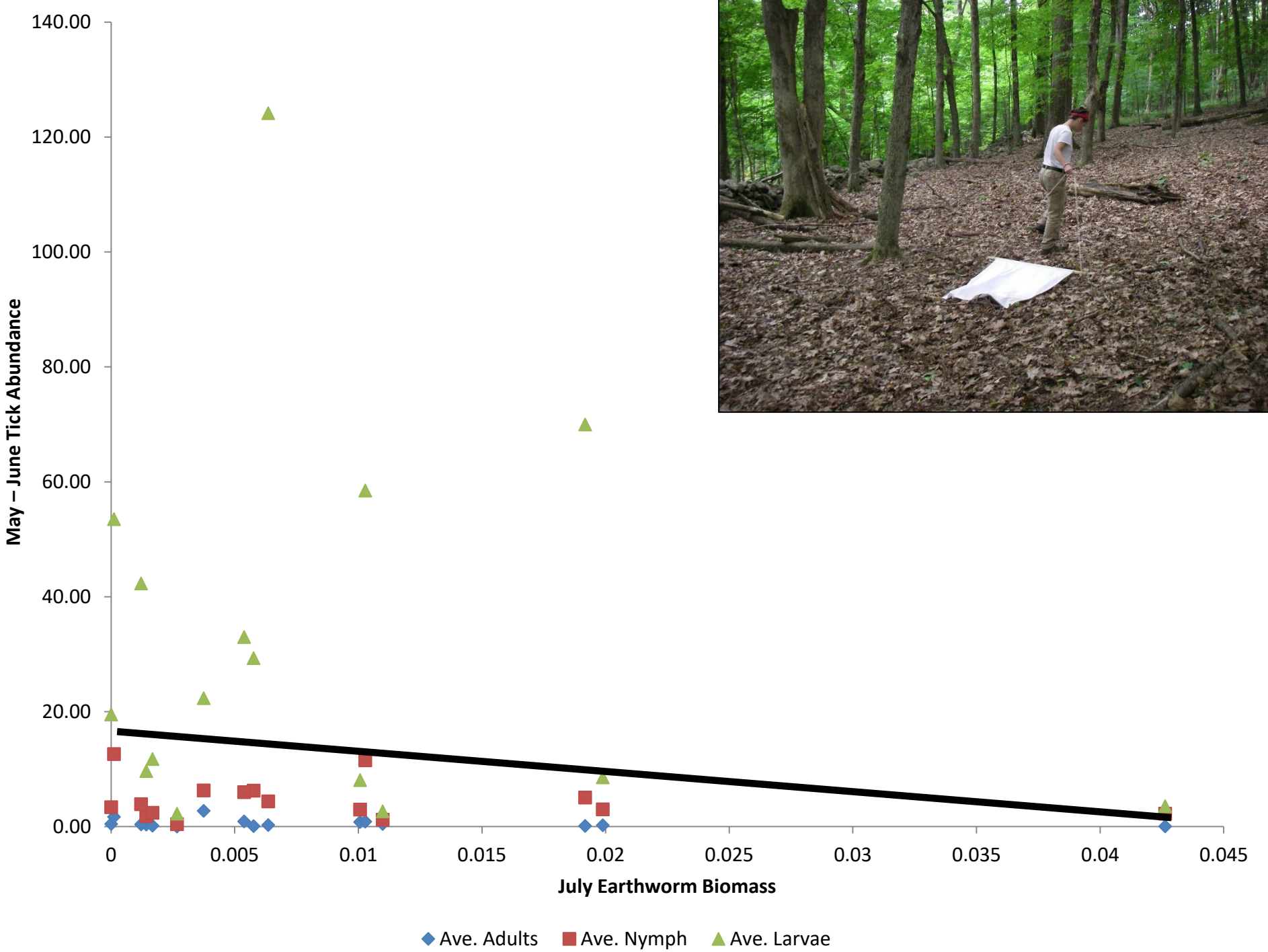

1
0.5
0
-0.5
-1
-1.5
0
0.5
1
1.5
2
2.5
Log 10 Average Earthworm Biomass
Log 10 Average Vegetation Cover Class
log (Ave. Tree Seedlings)
log (Ave. Total Native Plant)
log (Ave. Invasive Plant)

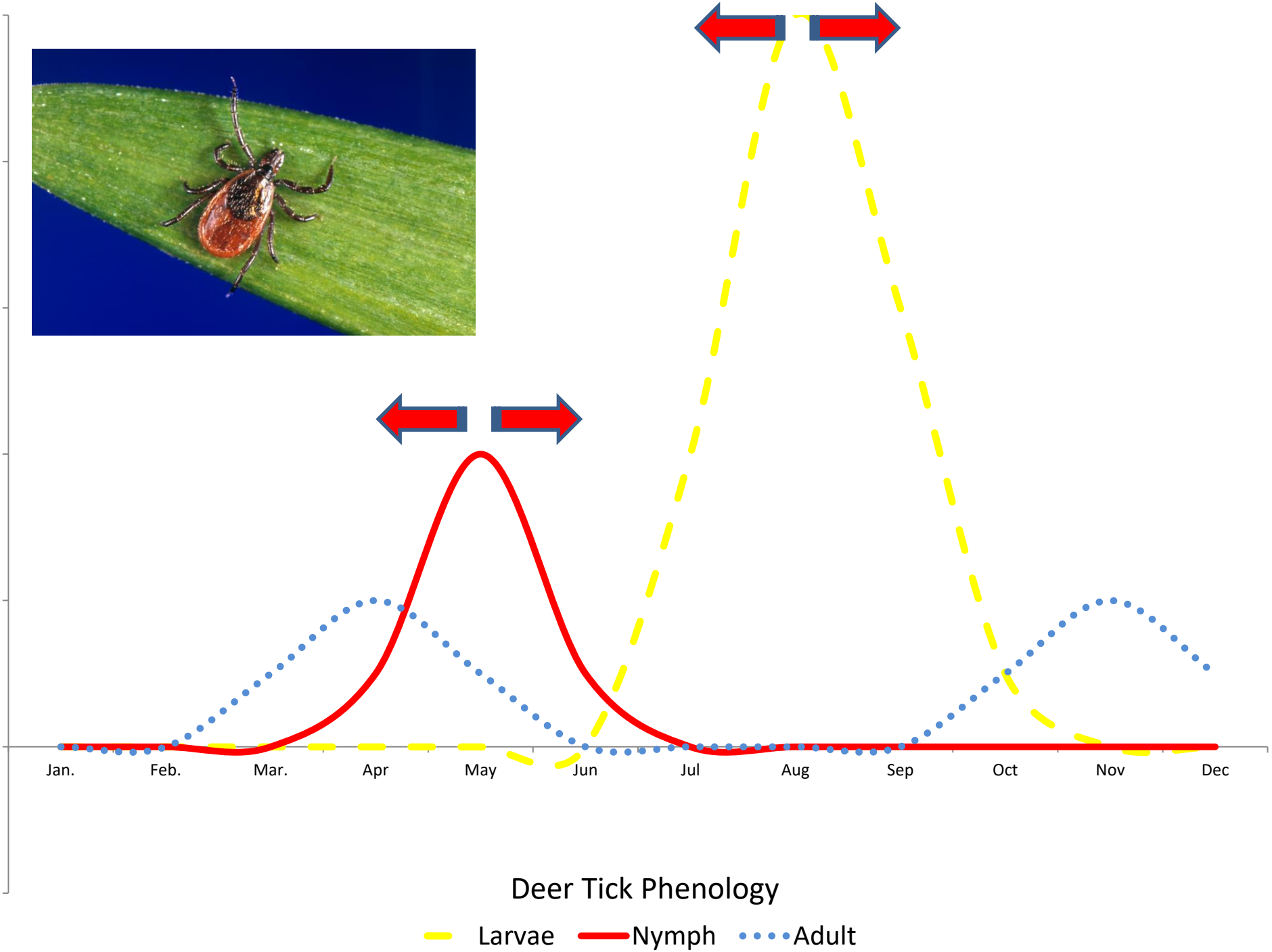
Hood



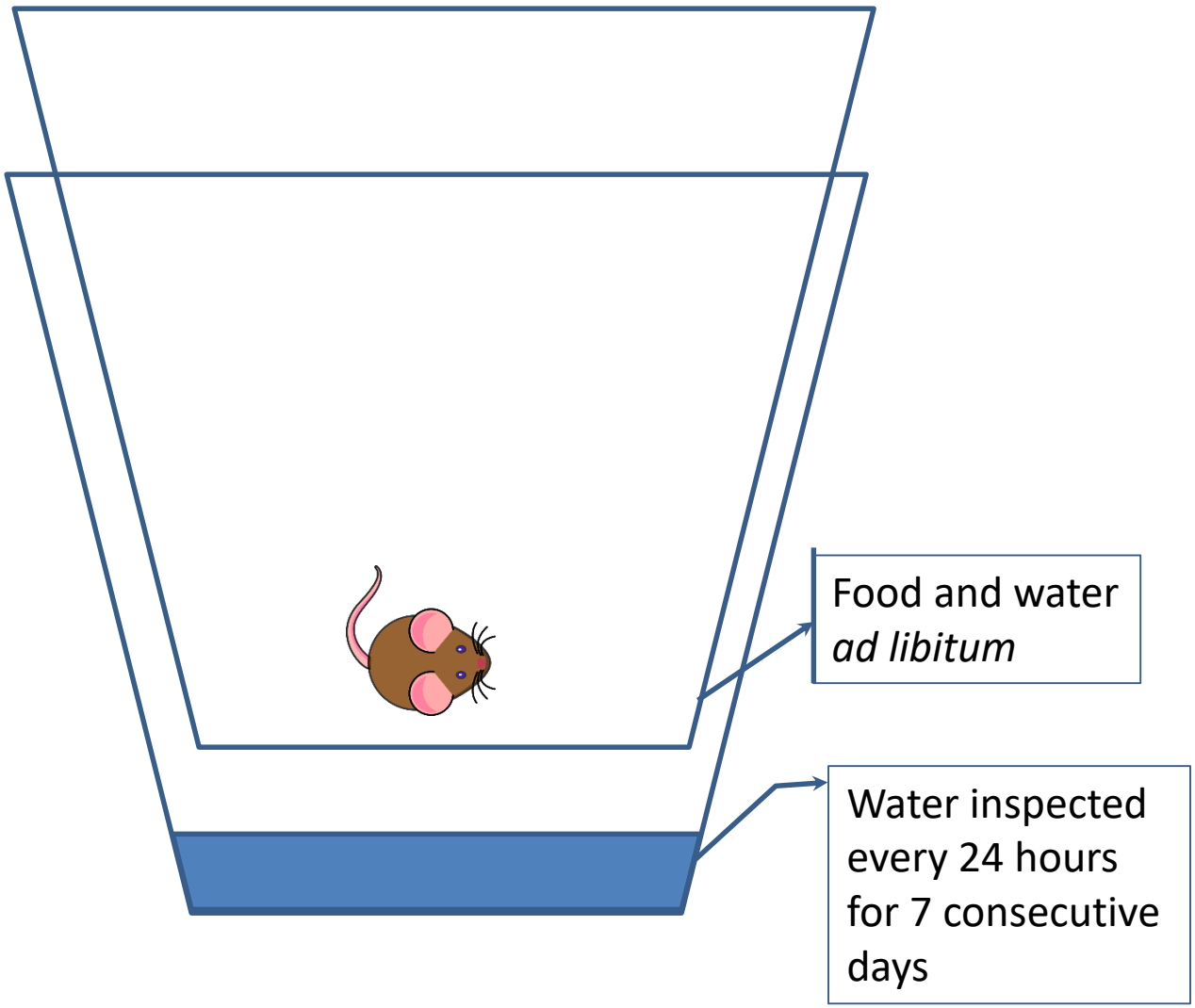

Deer Tick Phenology

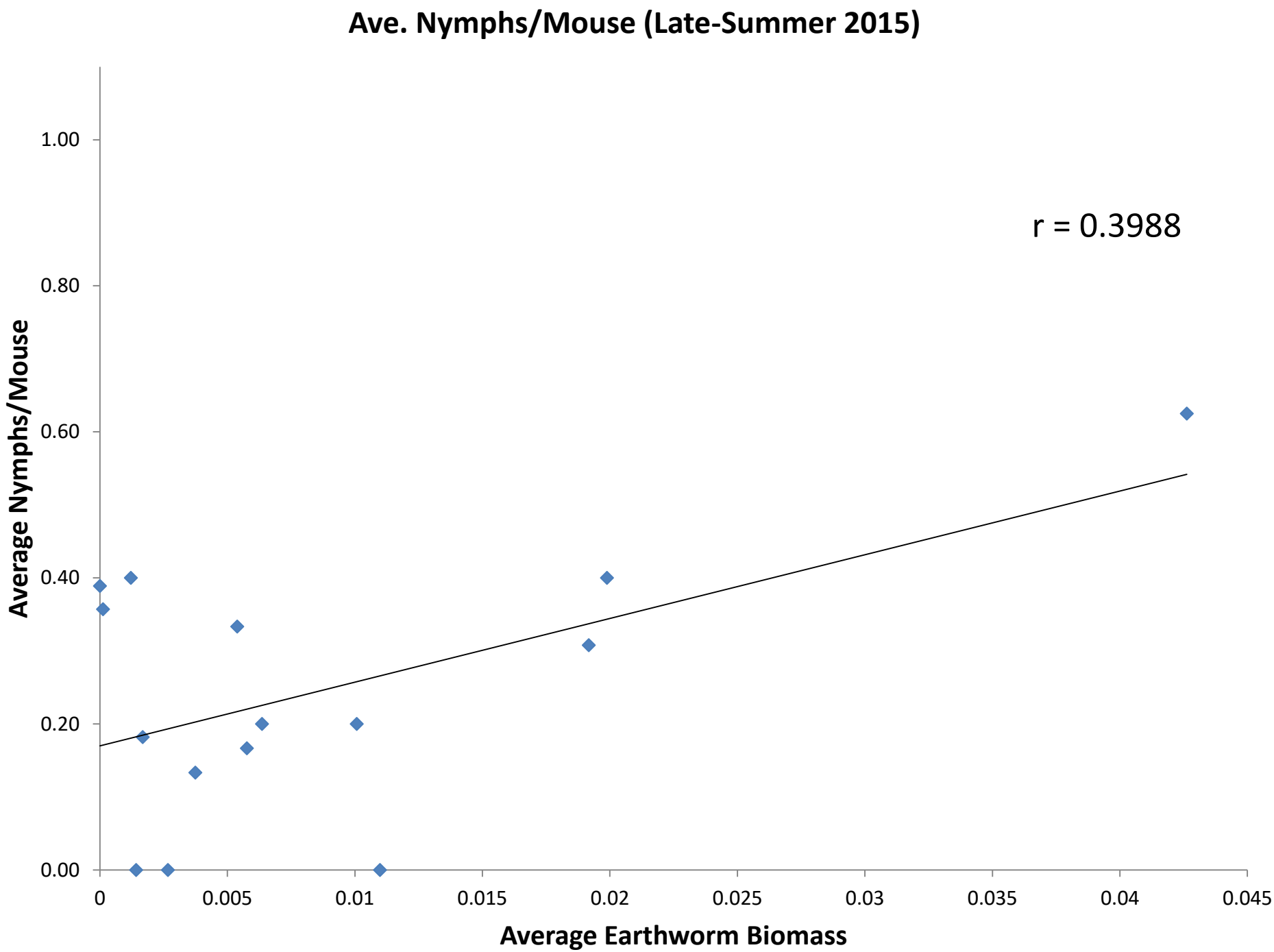
Larvae Nymph Adult

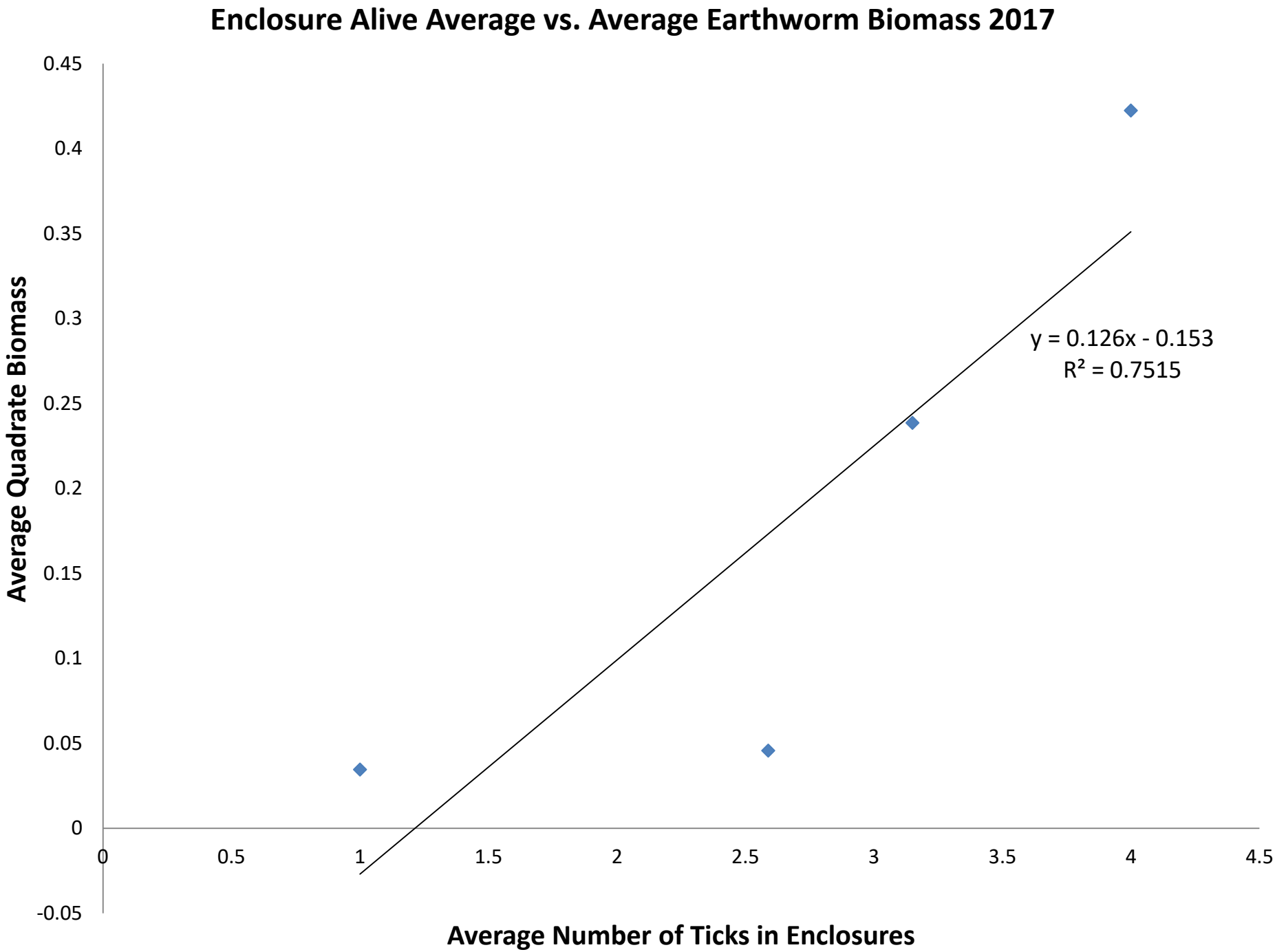

140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
May – June Tick Abundance
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
July Earthworm Biomass
Ave. Adults
Ave. Nymph
Ave. Larvae

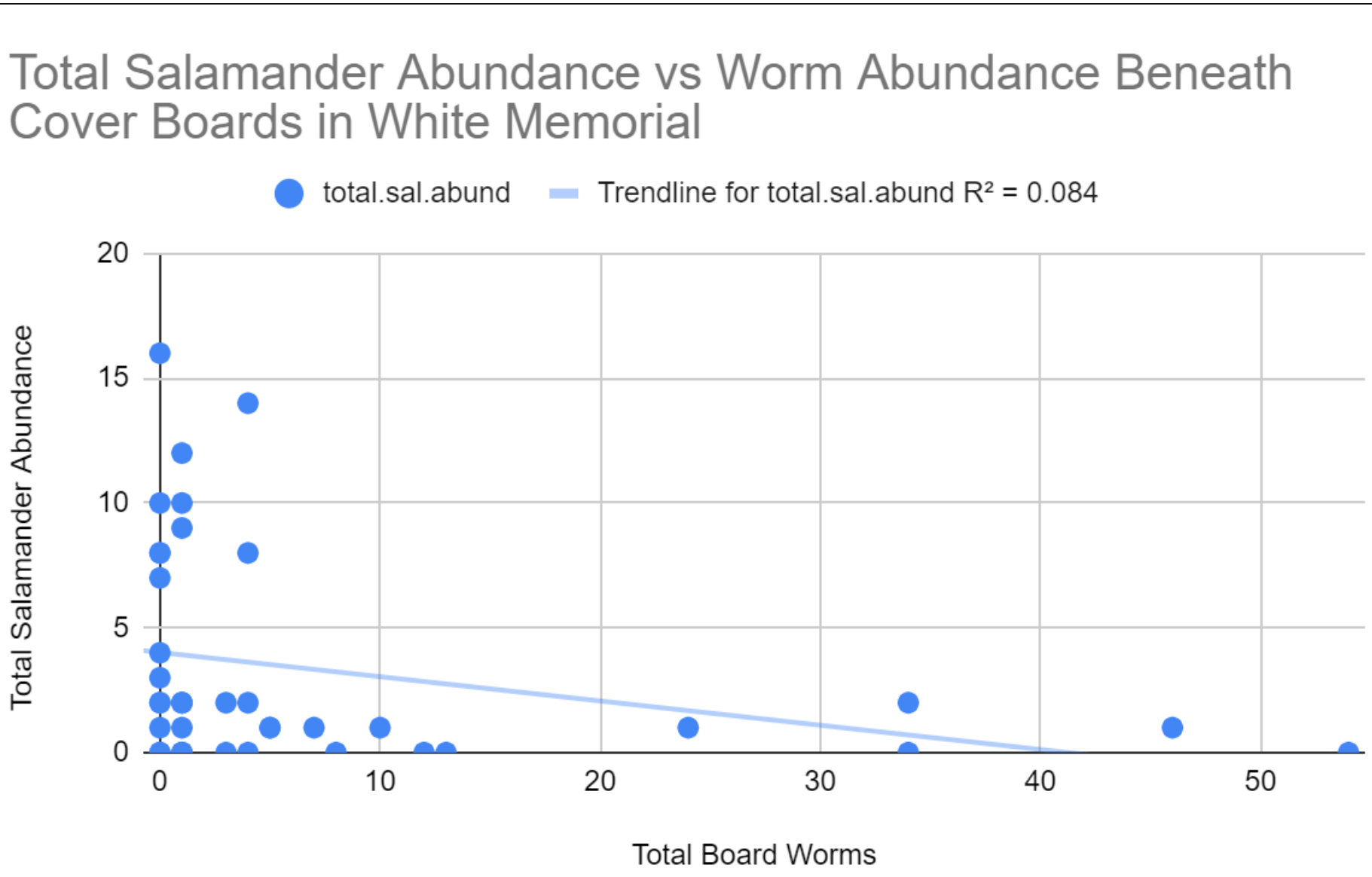

Jan.
Feb.
Mar.
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Deer Tick Phenology
Larvae
Nymph
Adult

Total body burden of *Ixodes* scapularis on *Peromyscus leucopus*



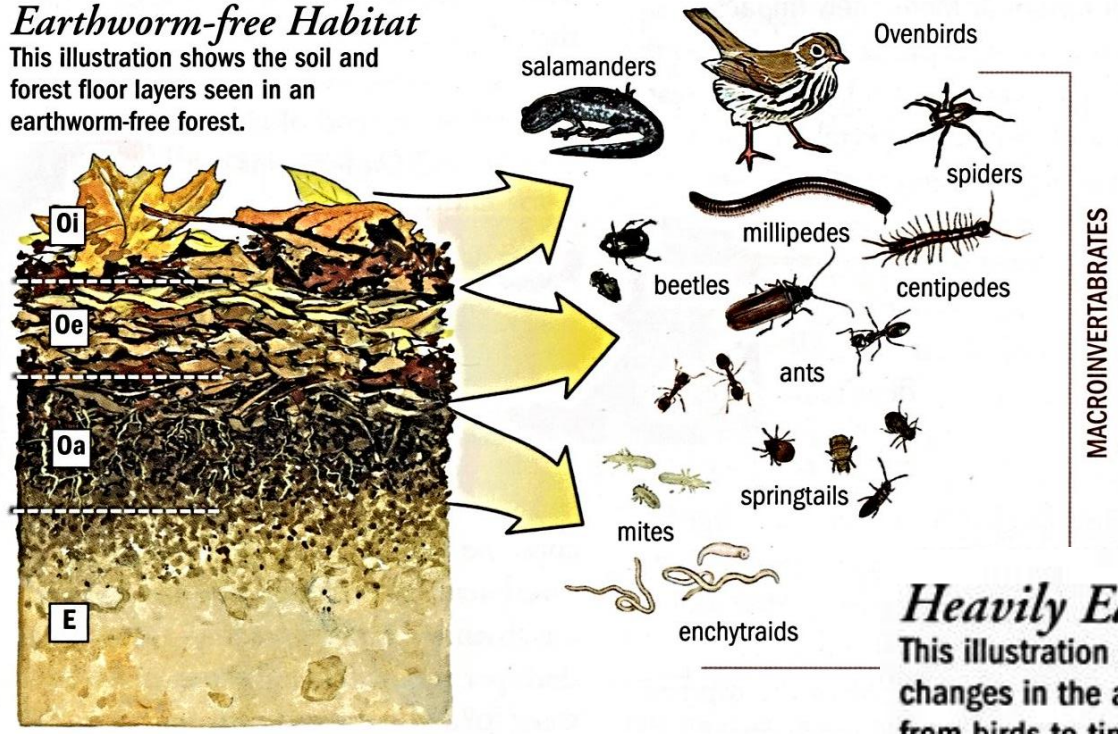

Ave. Nymphs/Mouse (Late-Summer 2015)
r = 0.3988
Average Nymphs/Mouse
1.00
0.80
0.60
0.40
0.20
0.00
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
Average Earthworm Biomass


Enclosure Alive Average vs. Average Earthworm Biomass 2017
Average Quadrate Biomass
Average Number of Ticks in Enclosures
y = 0.126x - 0.153
R² = 0.7515
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5


Total Salamander Abundance vs Worm Abundance Beneath Cover Boards in White Memorial
total.sal.abund
Trendline for total.sal.abund R² = 0.084
Total Salamander Abundance
20
15
10
5
0
0
10
20
30
40
50
Total Board Worms

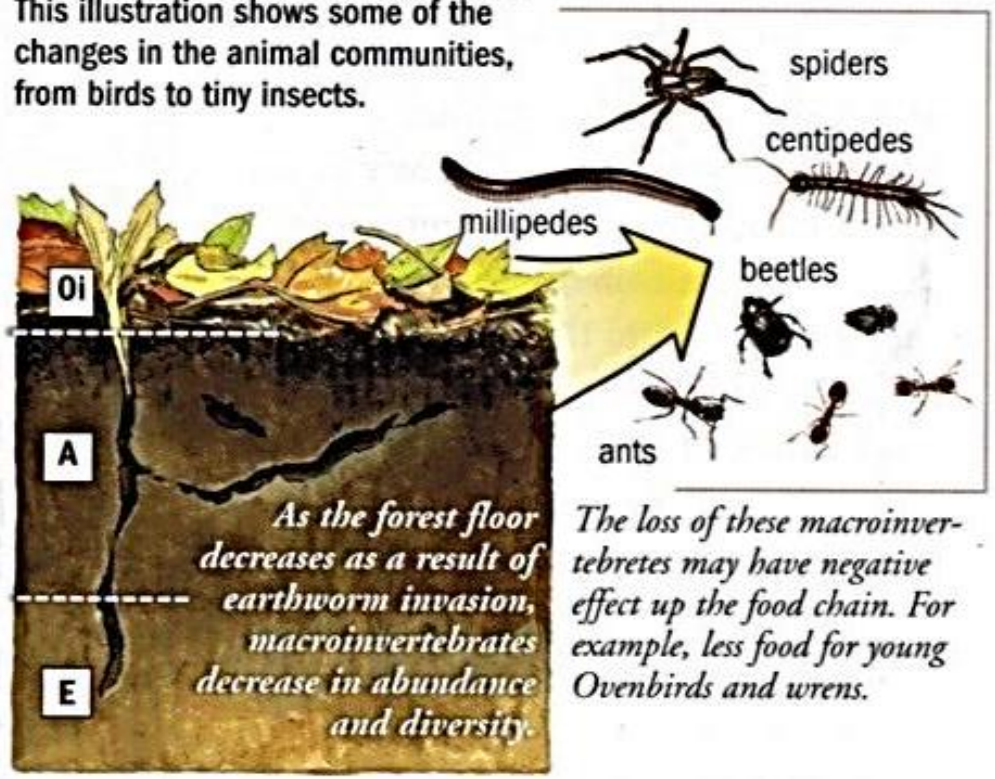
## *Earthworm-free Habitat*

**This illustration shows the soil and forest floor layers seen in an earthworm-free forest.**




## *Heavily Earthworm-impacted Habitat*

**This illustration shows some of the changes in the animal communities, from birds to tiny insects.**




*As the forest floor decreases as a result of earthworm invasion, macroinvertebrates decrease in abundance and diversity.*

*The loss of these macroinvertebretes may have negative effect up the food chain. For example, less food for young Ovenbirds and wrens.*