

# A Superior Research Reader

Volume 23, April 2017



Photo Credit: Ecowatch, US Forest Service, Rodales Organic Life

Greetings and welcome to *A Superior Research Reader*, a monthly reader on what we believe is current and relevant research to science and resource management on the Superior.

## This Month's Edition: Earthworms

Spring has officially arrived in the Northland and that means you're likely to see earthworms out and about again. While these wiggling, tubular life forms might benefit your summer garden by improving nutrient availability and converting your left over organic waste into vermicompost, there is a sinister side to earthworms in our area: these critters are not native to the Great Lakes region and, although small in size, they pack a big punch and can wreak havoc on our forests negatively impacting everything from plant community composition to tree regeneration.

In this month's issue of the *Reader*, we present you information on the effects non-native earthworms have on North American forests. Impacts of earthworms on seed germination and seedling survival, the linkage between these tubular critters and sugar maple forests, and management considerations for angler education and commercial bait trade for preventing invasive species introductions. As you read through these articles, brainstorm some ways that we on the Superior can help educate anglers about the dangers of dumping their bait and can make sure that operators on the forest have properly cleaned their equipment to stop the spread of worms on tire treads. Send us any ideas you come up with!

Here's to warmer weather and a bright spring season, happy reading!

*Pooja and Katie*

Editors of *A Superior Research Reader*

[poojaskanwar@fs.fed.us](mailto:poojaskanwar@fs.fed.us) and [kfrerker@fs.fed.us](mailto:kfrerker@fs.fed.us)

1. [Craven](#) and others provide a meta-analysis discussing the effects of non-native earthworms on North American forests.
2. [Research](#) from our Canadian neighbors examines the impacts of non-native earthworms on seed germination and seedling survival in temperate and boreal tree species.
3. [Melanie Drouin](#) and her team share more research with us, this time exploring the effects of earthworms on sugar maple forests.
4. [The Institute for Great Lakes Research](#) assesses angler education and bait trade regulations in an effort to prevent invasive species introductions in the Laurentian Great Lakes.



### [The unseen invaders: introduced earthworms as drivers of change in plant communities in North American forests \(a meta-analysis\)](#)

Craven et al. 2016. *Global Change Biology*.

**ABSTRACT:** Globally, biological invasions can have strong impacts on biodiversity as well as ecosystem functioning. While less conspicuous than introduced aboveground organisms, introduced belowground organisms may have similarly strong effects. Here, we synthesize for the first time the impacts of introduced earthworms on plant diversity and community composition in North American forests. We conducted a meta-analysis using a total of 645 observations to quantify mean effect sizes of associations between introduced earthworm communities and plant diversity, cover of plant functional groups, and cover of native and non-native plants. We found that plant diversity significantly declined with increasing richness of introduced earthworm ecological groups. While plant species richness or evenness did not change with earthworm invasion, our results indicate clear changes in plant community composition: cover of graminoids and non-native plant species significantly increased, and cover of native plant species (of all functional groups) tended to decrease, with increasing earthworm biomass. Overall, these findings support the hypothesis that introduced earthworms facilitate particular plant species adapted to the abiotic conditions of earthworm-invaded forests. Further, our study provides evidence that introduced earthworms are associated with declines in plant diversity in North American forests. Changing plant functional composition in these forests may have long-lasting effects on ecosystem functioning.

### [Non-native anecic earthworms \(\*Lumbricus terrestris\* L.\) reduce seed germination and seedling survival of temperate and boreal trees species](#)

Drouin et al. 2013. *Applied Soil Ecology*.

**ABSTRACT:** Recent studies have shown that the introduction of non-native earthworms in previously earthworm-free soils may have negative impacts on the recruitment of certain understory plant species in northern temperate forests. There is a need, therefore, to understand the mechanisms that may underlie this phenomenon. A microcosm study was conducted to test the effects of the anecic earthworm, *Lumbricus terrestris* L., on the number of days for germination, % seed germination, seedling survival and seedling biomass of 14 tree species native to southern Quebec (Canada). Seeds of these species were germinated and grown in the presence or absence of *L. terrestris*. The presence of earthworms significantly reduced % seed germination of seven tree species, as well as seedling survival of three tree species. The germination date of three tree species was significantly affected, either positively or negatively, by the presence of earthworms. Earthworms had no effect on seedling biomass. Results suggest that the introduction of *L. terrestris* into forested ecosystems of southern Québec may potentially alter overstorey composition through several mechanisms that differentially affect the recruitment of various tree species in the understory.

### [Linkage between exotic earthworms, understory vegetation and soil properties in sugar maple forests](#)

Drouin et al. 2016. *Forest Ecology and Management*.

**ABSTRACT:** The comminuting and soil mixing activities of earthworms can affect soil physical, chemical and biological properties, which in turn can influence plant growth and survival. Accordingly, there is growing concern that the spread of exotic earthworms into northern temperate forests may compromise biodiversity and tree species recruitment. We report on a study where we sampled earthworms, soils, and understory plants in plots established in 40 mature sugar maple stands distributed over 3 areas in the Eastern Townships of Southern Québec (Canada). Earthworms were found in 19 of 40 plots, and earthworm frequency of occurrence ( $E_{fo}$ ) as well as the complexity of earthworm communities reflected human accessibility to the plots. Plant species richness decreased, and species evenness increased, with  $E_{fo}$ . The  $E_{fo}$  was related to a decrease in the cover of 5 plant species, and to an increase in the cover of 2 other plant species or plant functional groups. We discuss the possible mechanisms by which earthworms might directly or indirectly alter understory plant community composition. By considering the location and land use management of each study site, our study provides further evidence that the spread of exotic earthworms in sugar maple stands of Southern Québec may be linked to human activities, with implications for further research and conservation issues.

### [An assessment of angler education and bait trade regulations to prevent invasive species introductions in the Laurentian Great Lakes](#)

Nathan et al. 2014. *Management of Biological Invasions*.

**ABSTRACT:** The commercial bait trade is one pathway for aquatic invasive species (AIS) introductions, as non-target bait species can be accidentally sold to anglers who either inadvertently or intentionally release them while fishing or as excess bait. Prevention of AIS introductions via the bait trade requires a two-tiered management approach, which includes both regulation of the bait industry and angler education. Retail bait shops may offer opportunities for public education regarding AIS, however it is unknown how often shops are targeted for such purposes and how viable this method of angler education is on a temporal scale. The goals of this research were to 1) quantify the current distribution of AIS signage in retail bait shops in the Great Lakes region and 2) estimate the long term viability of using retail bait shops as platform for angler education. Additionally, we present an up-to-date summary of bait industry regulations across the Great Lakes jurisdictions. Of the 525 bait shops visited in 2012 and 2013, 22% displayed some form of AIS educational materials or signage. Additional signs were distributed during initial visits and, during revisits after one calendar year, 54% of shops still displayed the provided signage. The presented summary of bait regulations for Great Lakes jurisdictions indicates multiple discrepancies across the region, which may hinder successful management strategies. Future management goals should consider additional methods of angler education and coordinating regulations across the Great Lakes to improve upon AIS prevention.