

## **Jumping Worm Testimony**

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**for Legislative Committee on Agriculture, Food Resiliency, and Forestry**

### **Earthworms in Vermont and the Northeast:**

Glacial ice that covered Vermont 12,000 years ago removed any native earthworms which may have evolved with our forests. Since European human colonization, European and Asian earthworm species have been spread across the landscape through soil and plant materials, composting material, and as fish bait. Nineteen species are currently known to occur in Vermont. On our landscape, many forests converted from agriculture have residual earthworm populations, while those without this land use history, such as forests at higher elevations, may still be earthworm-free but are at high risk for change with invasion. A Vermont study found that forest sites with high earthworm diversity have reduced forest floor depth (soil organic layers) and higher mineral soil carbon (organic matter moved deeper in soil).

Earthworms change many of the natural ecosystem functions of forest floors:

- Reduce forest floor organic matter
- Relocate carbon lower in soil profile
- Reduce herbaceous layer
- Alter seed bed and reduce germination
- Change forest habitat structure, possibly affecting salamanders and birds
- Alter soil temperature, moisture, and water filtration

2009 publication, NY study:

Non-native earthworm invasions cause a reduction in leaf litter on the forest floor, and such loss of forest leaf litter is commonly associated with declines in forest fauna, including amphibians. A mark-recapture study of woodland salamander abundance indicated that salamander abundance declined exponentially with decreasing leaf litter volume. The loss of leaf litter layers due to non-native earthworm invasions appeared to be negatively affecting woodland salamander abundance, in part, because of declines in the abundance of small arthropods that are a stable resource for salamanders.

In Wisconsin (2011), ground nesting birds (Hermit Thrush, Ovenbird) had lower densities in relation to European earthworm presence, as well as lower survival probabilities of nestlings associated with increased sedge cover and decreased litter depth, factors related to earthworm invasions.

Cornell (2009):

Earthworm biomass was negatively associated with cover of native woody and most herbaceous plants and with litter volume. Graminoid cover was positively associated with non-native earthworm biomass and non-native plant cover. Patterns identified in the study suggest earthworm invasion, rather than non-native plant invasion, is the driving force behind changes in forest plant communities in northeastern North America, including declines in native plant species, and earthworm invasions appear to facilitate plant invasions in these forests.

## **Jumping Worms – The Second Wave of Earthworm Invasion:**

### **What are jumping worms?**

Three species currently known in Vermont, *Amyntas agrestis*, *Amyntas tokioensis* and *Metaphire hilgendorfi*, all of Asian origin. Two of these make up 95% of VT populations. First reported from Vermont in 2012.

Jumping worms have been in the U.S. since at least the early 1900's, with *Amyntas agrestis* reported in Baltimore in 1939. They are now being reported from much of the eastern U.S. and West Coast, as well as places in southern Canada. They are a matter of concern in many states, as they disrupt the native forest ecology by affecting soil structure and chemistry. Jumping worms are confirmed in all Vermont counties except for Essex and Orleans.

### **What makes jumping worms different?**

*Identification:* Their most distinctive feature is the clitellum, the pale, flat band that entirely encircles its body on adult worms. By contrast, the clitellum of common earthworms does not extend completely around the body and is darker and slightly raised.

Jumping worms grow more rapidly, maturing in as little as 60 days, reproduce more quickly and consume more nutrients than other earthworms. Jumping worms do not burrow far into soil – they live on the soil surface in debris and leaf litter. They quickly transform soil into dry, granular pellets with a texture like discarded coffee grounds. This altered soil structure is often unaccommodating to ornamental and garden plants, and inhospitable to many native plant species.

Unlike most other earthworm species, jumping worms pose a greater threat to human activities like gardening, lawn care, and some agriculture.

### **Life history**

Adult jumping worms don't live through the winter, but their cocoons (eggs) do. Because these are so small, it's difficult to see them. The cocoons hatch in spring when temperatures are above 50 degrees Fahrenheit. Adults will be present in summer, producing more cocoons. As temperatures drop in the fall, adult worms die.

Jumping worms are mostly parthenogenetic so that it only takes one worm to found a new colony. Each worm produces about 1 cocoon every other day enough to bring juvenile numbers to a peak ranging from 180 to 300 per square meter (20 to 33 per square foot).

Jumping worms grow during the summer and the adults start laying eggs in August. Populations grow rapidly, reaching peak abundance in late summer/early fall, outcompeting other species.

Jumping worms are considered *epi-endogeic*: earthworms that feed on the forest floor and organic rich mineral soils, and mix the organic and mineral horizons. Feeding activity of these species can significantly affect forests.

*Amyntas* species' faster reproduction rate and their ability to reproduce asexually (parthenogenesis) has contributed to their spread into the United States.

The worms reach maturity in 60-90 days, with one to two generations per year. Eggs are wrapped in small cocoons, which overwinter while the adults die off at the first freeze each year. The young then emerge the next spring.

### **Impacts to natural systems**

These worms appear to threaten regeneration of canopy and understory plant species. They consume organic material at a much higher rate than other species. Since their activity occurs primarily in the leaf litter layer, it can affect not only physical characteristics, but also ecological functions and species interactions within that biological zone.

#### *Ecological threat:*

- *Alteration of soil temperature, chemistry and moisture.*
- *Reduction of forest floor organic matter & herbaceous layer.*
- *Alteration of soil can affect seed banks.*
- *Change in forest habitat structure, possibly affecting salamanders, birds and the maple sugar industry.*
- *Their presence may facilitate the spread of invasive plant species.*

#### **Impacts in anthropogenic environments**

Jumping worms are a threat to home gardens, agriculture and woodlands as their presence disrupts the soil structure and chemistry, depletes nutrients in the soil and can result in plant death or loss of vigor.

#### *Threat to human landscapes:*

- *Can destabilize soil, increase nutrient leaching and erosion, increase drought vulnerability, cause turf detachment from the soil and unstable rooting, root desiccation, and low germination.*
- *Severe damage of lawns due to abundant castings have been reported in Connecticut.*
- *Garden plants may show signs of wilt that indicate drought despite enough moisture.*

#### **Management**

Unfortunately, there are currently no approved pesticides or other treatment to prevent or eradicate jumping worms.

In their various stages of life, jumping worms can arrive in soil, compost, mulch and manure delivered to our gardens. They also hide in the soil of potted plants. Egg cocoons probably present the greater challenge for identifying presence.

#### *For gardens and compost:*

- *Consider minimizing the application of mulch, compost, and soil to your gardens.*
- *Sell, purchase, or trade only compost and mulch that was heated to appropriate temperatures and duration following protocols that reduce pathogens. [To kill the cocoons, temperatures have to go below 12 degrees F or above 104 degrees F consistently & thoroughly.]*
- *Consider soil solarization, a nonchemical method for controlling soilborne pests using high temperatures produced by capturing radiant energy from the sun.*
- *Avoid practices that spread earthworms into untreated soil or compost:*
- *Plant bare root stock or seeds when possible.*
- *Take care when swapping plants or purchasing at annual plant sales; even local soils may be harboring jumping worms. Plants can be removed from pots and the roots washed.*
- *Nursery plants and trees with root balls should be inspected before planting.*
- *Do not buy jumping worms for composting, vermicomposting, gardening, or bait.*