CURRICULUM 1: JUMPING WORMS *Amynthas agrestis*

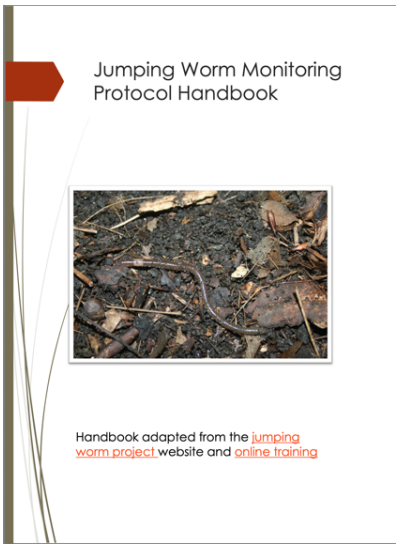
REFERENCE MATERIALS

Resource links for jumping worms curriculum:

https://extension.umd.edu/resource/invasive-jumping-worms/
Invasive Jumping Worms |University of Maryland Extension

https://jwp.cfans.umn.edu/meet-jumping-worm#:~:text=Setae%3A%20Tiny%20hairs%20called%20setae,or%20more%20around%20each%20segment.

https://jwp.cfans.umn.edu/sites/jwp.cfans.umn.edu/files/2021-09/PDF%20handbook.pdf
Jumping Worm Monitoring Protocol Handbook



Download this Handbook for references to Curriculum 1: Jumping Worms *Amynthas agrestis*
This guidebook is meant to give background information on the jumping worm to learn more about their keys to identification (ID), their effects on our environment, and next steps to control spread.

- Program Overview
- Glacial history and spread of worms
- Meet the jumping worm
- How you can help
- Jumping worm ID

CURRICULUM 1: Jumping worms *Amynthas agrestis*

Teachers and researchers are building curriculum for K-12 students near natural areas that are infested with or in risk of being infested by jumping worms, a listed invasive species.

BASIC CONCEPTS BACKGROUND AND OBJECTIVES:

• ***What is a jumping worm?***

Jumping worms are an invasive species that are documented having negative impacts on our nature (forests) and human-disturbed (gardens) ecosystems.

• ***How did jumping worms get to this natural area?***

During the ice age, glaciers carved out the landscape and killed off any native earthworms we may have had in our area. As the glaciers receded, our region went through a process in which tundra evolved into the forests we have today. As the climate warmed, our landscapes changed to prairies and deciduous forests.

From bedrock and the appearance of lichens and mosses that were able to decompose enough organic matter for early tree growth, our forests were able to grow strong and widespread without disturbances caused by earthworms. Trees and forest plants recycled their growth with fire and wind events that brought trees to the ground for the fungi to slowly breakdown over time. This process built up a layer of organic matter that played an important role in how our forests function.

When **earthworms** were introduced to our region, they started eating all that organic matter that was built up over time. This rapid change in the soil profile has altered the way some of our forests regenerate their growth. From exposing seeds that hide in the organic matter to making it easier for fast growing plants to grow fast and big across the landscape.

Scientists monitored and mapped their observations of earthworms and found that European earthworms were the first ones to enter North America. They arrived as early as the 1600's with European settlers. The Asian earthworms (**jumping worms**) have only been documented in North American over the last 100 years. Earthworms do not naturally travel long distance on their own. Jumping worm spread is largely aided by human behaviors and activities. To stop problems with more invasive worms, perhaps the best practice is to not introduced them in the first place.

• ***What is a Natural Ecosystem?***

Natural ecosystems are ones that have not been disturbed by humans.

Researchers report seeing more European species than Asian jumping worms in these ecosystems: **Native forests, Prairie land, and Wilderness areas**

• ***What is a Human-disturbed Ecosystem?***

Human disturbed ecosystems are areas where humans have altered the landscape. This is where scientists and investigators are finding negative environmental and economic impacts from jumping worms. Some examples of human-disturbance include landscaping, gardening, build trails and public parks.

Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 1 —

Where a Jumping Worm Lives (20 minutes)

The objective of this activity gives students an opportunity to understand the physical anatomy differences between earthworms and jumping worm species. These differences explore characteristics that enhance the jumping worm's ability to outcompete native earthworms and cause environmental and economic impacts enough to be labeled "invasive".

Activity: Where a Jumping Worm Lives (45 minutes)

Before the next two activities, print the graphic "Nature of Science" that clearly shows the differences between earthworm and jumping worm anatomy.

Begin the activities by explaining that students will first be determining where a jumping worm lives, followed by playing a **game, a race so to speak,** that will help students understand how jumping worms outcompete beneficial earthworms.

Remind students that we know jumping worms are invasive and cause serious damage to the environment and to the economy. Ask your students ***What more should we know about a jumping worm? What makes a jumping worm invasive?*** Allow the students to share their ideas about what they need to know.

Ask the students ***What physical characteristics might make jumping worms superior competitors for space, water and nutrients? Let's look at a jumping worm's usual physical behavior and how it might be different from the usual physical behavior of European earthworms.***

We can start by looking at where each species live.

Explain the Latin name for jumping worm, an earthworm that is called "jumping" because of an unusual behavior when disturbed, is *Amynthas* spp. The jumping worm moves like a snake and sometimes appear to be jumping.

Jumping worms live and feed in the leaf litter layer on the soil and in the top few inches of the soil.

Use the Nature of science graphic to help explain that jumping worms are an **epi-endogeic** species of earthworm. **Ask** your students what they think **epi-endogeic** might mean.

Epigeic is Greek for 'upon the earth', and **endogeic** is Greek for 'within the earth'.

Soil-dwelling earthworms fall into three main niche groupings: ***epigeic, endogeic***, and ***anecic***.

Ask your students, ***"What might a word that combines*** *epigeic* ***and*** *endogeic* ***as in*** *epi-endogeic* ***mean?"***

Jumping worms live and feed in the leaf litter layer on the soil and in the top few inches of the soil. This makes them an **epi-endogeic** species of earthworm. **Epigeic** is Greek for 'upon the earth', and **endogeic** means 'within the earth', and *aneic* means "out of the earth".

Ask your students, if they think being **epi-endogeic** — living **on** the earth and **within** the earth — might make jumping worms more competitive than European earthworms.

Link to Earthworm niche groupings for additional background information
https://www.trees.com/gardening-and-landscaping/types-of-earthwrms#:~:text=These%20three%20main%20types%20of,to%20find%20sources%20of%20

1. Epigeic earthworms

'Epigeic' is the Greek translation for 'on the earth,' because these worms do not build burrows, and instead reside amongst decaying organic matter on the soil surface. These are also sometimes called compost earthworms, or surface-dwelling earthworms, as they live on the surface of the soil amongst piles of leaves or compost heaps. They feed on decaying plant matter, leaf litter, and dung. They are weak burrowers, and therefore prefer to live amongst loose organic materials and topsoil.

2. Endogeic earthworms

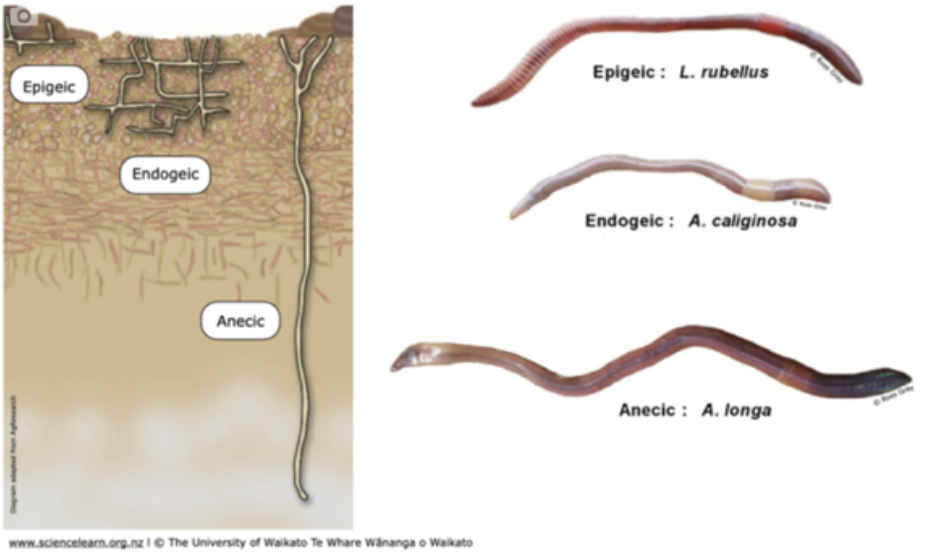
'Endogeic' translates from Greek to mean 'within the earth,' and accordingly, these worms burrow within the top layers of soil and rarely come up to the surface, preferring instead to literally live within the earth. They are most commonly found in the uppermost layers of soil where they create semi-permanent, horizontal burrows or under rocks and logs, though some will burrow deep into the soil. They typically only make an appearance on the ground surface in instances of heavy rain, as the extra moisture prevents them from drying out.

3. Anecic earthworms

'Anecic' is greek for 'out of the earth,' because although these worms live below ground, they come up to soil level for their food. These worms are those that burrow vertically in the mineral layers of soil, creating permanent burrows as deep as six feet below surface level. Their burrow systems are quite extensive and can be as big as one inch in diameter. These worms collect food from above ground in the form of organic matter such as fallen leaves and drag them back underground to their burrows. They are also known to eat soil and some litter.

Nature of science

Scientists often use curious terms. Sometimes, the words go back to their Latin or Greek origins. The three groups of earthworms are identified by their place within the soil. Epigeic is Greek for 'upon the earth', endogeic means 'within the earth' and anecic is Greek for 'out of the earth'.



Rights: The University of Waikato Te Whare Wānanga o Waikato

Earthworm niche groupings

Soil-dwelling earthworms fall into three main niche groupings: epigeic, endogeic and anecic. The lines represent the types and depths of the various burrows.

Illustration by AgResearch and earthworm photos by Ross Gray.

ACTIVITY — Where a Jumping Worm Lives (35 Minutes)

Ask your students if they think that <u>where</u> jumping worms and earthworms <u>live</u> — in the soil and/or on the soil; or, eating on top of the soil coming up from living deep in the soil — is enough to make the jumping worms more invasive that European earthworms.

Then, ask your students to break into pairs (2 students) and to take out their journals and pencils. Each team will be comprised of two students. One will identify as an earthworm and the other a jumping worm. Both students in each team will draw quick sketches of where they live (either "upon the earth" and/or "within the earth".

Ask your students to label their jumping worm's location in their drawing to illustrate that the jumping worm is behaving as either *upon* the earth "epigeic" or *within* the earth "endogeic", or both *upon* and *within* the earth "epi-endogeic".

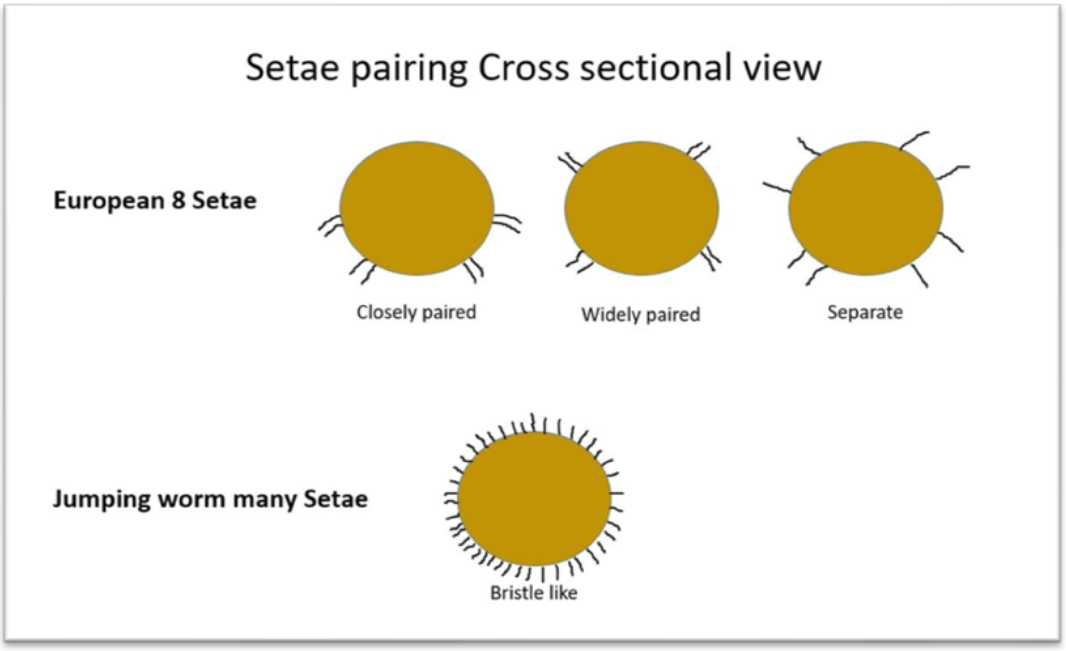
Wrap-Up the activity by discussing with your students the benefits for being "epi-endogeic" as a means of help jumping worms do more damage to soil and other plant habitat than earthworms.

Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 1 —

ACTIVITY — Being a Jumping Worm (20 minutes)

Prior to the next activity, explain to your students how setae (small hairs) differ between the earthworm and the jumping worm.



Movement: The European earthworms we are accustomed to move slowly. Their setae include eight around each segment. They inch their way forward using the setae on their body. Used to moving slowly, earthworms inch their way forward using the setae on their boy.

Jumping worms have as many as 40 setae around each segment which allow them to be in contact with more of the ground. They use these extra setae to move very sporadically and "un-worm-like". Jumping worms have more setae which allow them to be in contact with more of the ground.

When disturbed, jumping worms will secrete a yellow mucus as it tries to get away. Mild aggravation could even cause the worm to drop its tail to escape.

Follow this link to see a short video showing the jumping worms movement. The first 20 seconds show good examples of the jumping worms' movement and the tail breaking off.

Link: Jumping Worms: What Anglers Should Know
https://www.youtube.com/watch?v=BrFDSYzqIUI

Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 1 —

ACTIVITY — Being a Jumping Worm (20 minutes for a class of 20 students)
(40 minutes for 20 students to participate both as an earthworm and then as a jumping worm)

Materials:
3 long cords to represent the length of the 20-foot race track by setting each cord about 4 to 6 feet apart to make two racing paths
20 (2 soft ties per half the # of students): one to tie elbows to the waist and one to tie ankles loosely together for each European earthworm player
1 starting whistle *optional* (the race-master can raise an arm and yell START!)
1 record card and pencil for one designated student to call out and collect race results
20 (one per student) Cards with numbers for racers (1-20) *optional*
1 red flag to signal the winning racer *optional*

Begin by asking your students **if they think that the differences in "structure" and/or "number" of tiny, little hairs called "setae" on earthworms and jumping worms** might make one species more or less competitive (invasive potential — ability to spread to other areas quickly).

Explain the definition of setae. Setae are tiny hairs on each segment around the jumping worm's body that help it move. Setae may be tough to see with just your eyes. You may want to use a hand lens or zoom in on a picture to identify the setae. Jumping worms have as many as **40 setae or more around each segment.** The bristle-like setae of the jumping worm has no specific arrangement, they will encompass the entire segment. The European earthworm has but **4 setae on each segment**.

Set up the game by asking the students if they think the setae are responsible for the jumping worm's ability to move so fast in so many different ways.

Explain that to play the game, **"Being a Jumping Worm"**, half of the students will pretend to be European earthworms with their upper arms bound at the elbows to their sides — leaving only their forearms to help with movement (representing 4 setae on each segment). The earthworm ankles will be bound so the rear of the earthworm can only wobble forward or backward (no ability to take jump-like action). Option to binding ankles — ask students to keep their heels close together and wobble awkwardly down the race track. Both the ankle-bound or non-ankle-bound students must move carefully and creep ever so slowly down the race track so as not to tip over.

The other half of the students have no bindings, representing bristle-like and dense setae in every segment of their long jumping worm bodies.

Tell the unbound students to rapidly wiggle their arms up and down and side to side like a jumping worm's setae (while standing up) hop or jump carefully (not fast) down the race track.

Line Up one student at a time (earthworm) at the starting point of one race track, and one student (jumping worm) at the starting point of the adjacent race track. Space the tracks far enough apart that the two worms do not engage each other as they move down the track.

Signal the students by raising an arm to the sky and dropping it as you yell "Start!".

A flag person at the finish point must **call out** the winner (by name or number) of each race as they cross the finish line.

After every student has an opportunity to be an earthworm or jumping worm, switch them up and repeat so that every student has an opportunity to be an earthworm for one race and a jumping worm for the second race or vice-versa.

Wrap up the activity by asking students to share their thoughts about jumping worms using mass quantities of setae to achieve "invasive" behavior while European earthworms movement is more restrictive.

Curriculum 1: Jumping Worms: *Amynthas agrestis*

Module 1 Unit 2 —

BASIC CONCEPTS BACKGROUND AND OBJECTIVES:

The objectives of this module provides students with tools to observe and document what they sense and learn about the behavior of jumping worms in natural areas. Students will learn about opportunities to engage with local and national educational programs that collect data to track jumping worm progression as it moves through the Midwest.

Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 2 —

ACTIVITY — Identifying and Observing Jumping Worms

Begin this activity by asking your students, ***Where are we likely to find jumping worms?***

Jumping worms in and on the soil appear in gardens, compost, mulch, flowerpots, yards and forests.

Tell your students that they can find jumping worms in high densities within the top 4 to 6 inches of the soil. Preferred habitats for jumping worms are in flowerbeds, mulch and compost piles. Jumping worms can also be found under logs and in shady moist areas. Jumping worms spread when humans share infested compost, left over fishing bait, and buy horticulture/landscaping needs that have jumping worms hiding in the soil.

Ask your students what they think jumping worms do to soil profiles in native landscapes.

Ask your students what they think jumping worms do to nutrient cycling process.

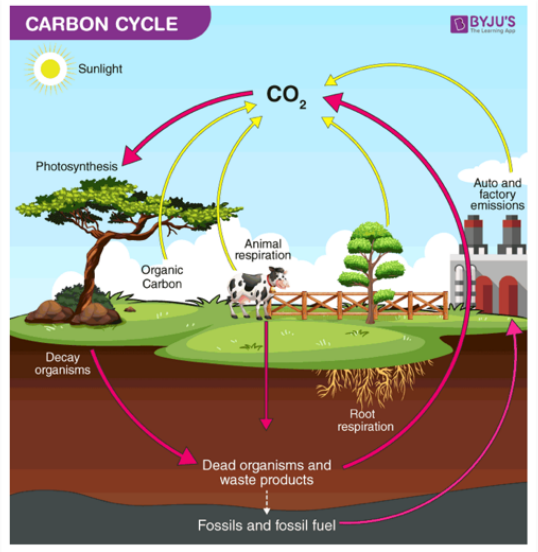
What is nutrient cycling process?

Nutrient cycling is a cyclic (circular) process that encompasses the movement of nutrients from the physical environment to living organisms and back to the environment.

The 4 main nutrient cycles are:

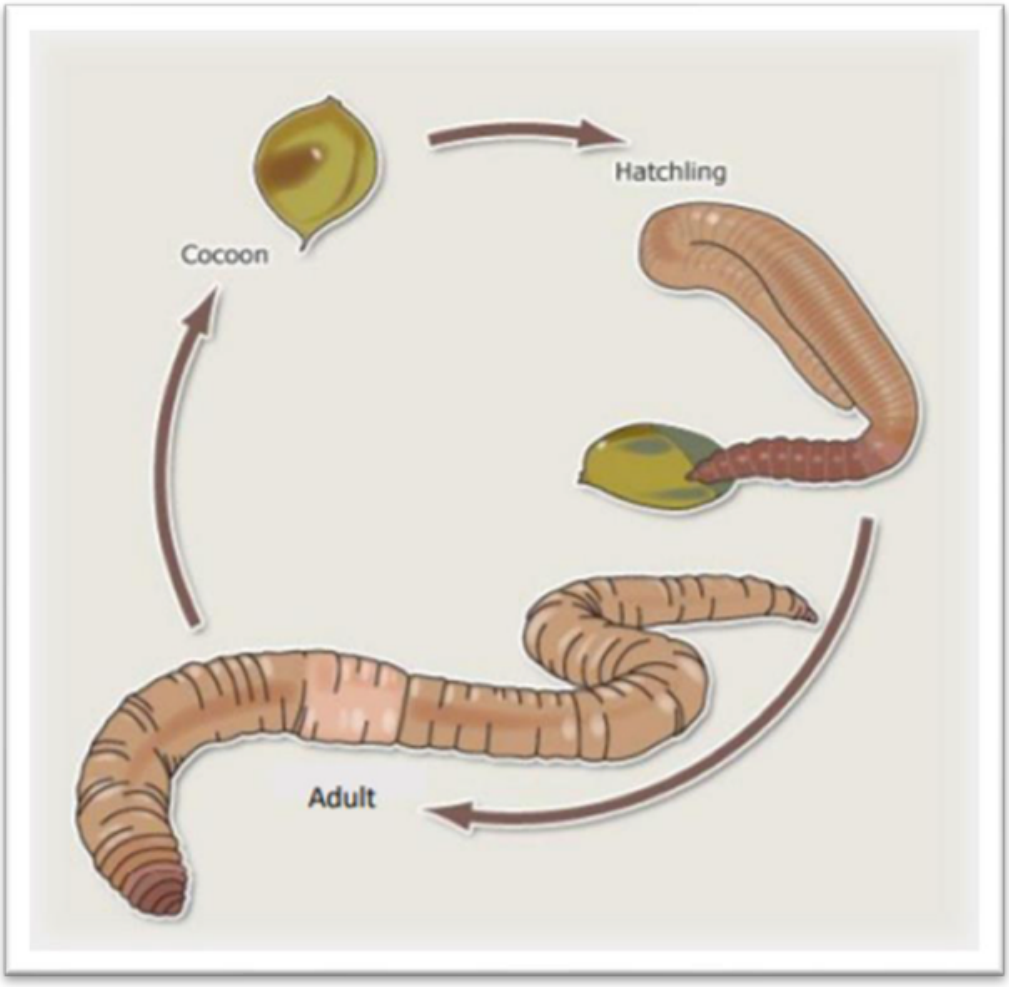
1.Carbon Cycle

Carbon is the main constituent of all the living cells. All the organic matter and biomolecules contain carbon.



- Carbon is present mainly as carbon dioxide and methane in the atmosphere
- There is a continuous exchange of carbon between biotic and abiotic components by the process of photosynthesis and respiration
- Atmospheric carbon dioxide is fixed by plants in the process of photosynthesis
- All the living organisms release carbon dioxide during respiration
- Carbon is released into the atmosphere by burning of fossil fuels and auto emissions
- Organic carbon from dead and decaying organisms and waste products is released into the atmosphere after decomposition

• ***What is the life cycle of a*** *Amynthas* spp. ***jumping worm?***



Annual life cycle of jumping worms: cocoons in late summer and early autumn.
Cocoons: cold-hardy and short maturation time.
Asexual (parthenogenetic) and mature in just 60-90 days
High peak abundances: summer — exceeding 100 individuals per meters squared
Hatching: may be triggered by temperatures exceeding 50º Fahrenheit

Ask your students to get out their sketch books and pencils. Tell them to draw the life cycle of a jumping worm from observing the worms themselves (if possible) or from the illustration in the graphic image above.

Wrap-Up by asking students to describe the annual life cycle of a jumping worm, and based upon the **time of year of your workshop**, ask the students to predict what stage of the cycle the jumping worms would be in right now if present in their nearby natural area.

ACTIVITY for Curriculum 1: Jumping Worms: *Amynthas agrestis*
Module 1 Unit 2

Activity: Ode to a Jumping Worm (30 minutes) add (20+ minutes if performed by students)

While students still have their journals and pencils, **Begin** this activity by asking students to think about what they know so far about how the jumping worm arrived here from Asia. Ask your students to think about the life cycle and nutrient cycling of the non-native jumping worm. Then, discuss the mechanisms of movement in and on the soil and how quickly it can be spread to other areas.

Next, explain that your students are going to use this information about jumping worms to create an "Ode to a Jumping Worm" poem (the style can be a free form of poetry or a specific/designated style). Encourage your students to use vocabulary words (setae, epi-endogeic, hatchling, cocoon, adult, stolon, stalk, plume, seeds, nutrients, sun, space, wetland, natural area, disturbed ecosystem) and descriptive adjectives.

Ask the students "What is an Ode?" An ode is a lyric (musical vocal) poem in the form of an address to a particular subject, often elevated in style or manner and written in varied or irregular meter. That means a poem meant to be sung. For example, a student might think it amazing that a worm can jump and writes and sings a poem about the student's respect for that jumping act and what it might mean of significance to something else. Another student might think it brilliant that the jumping worm has the ability to lose its own tail in order to escape a bad situation. It's okay to sing a poem that shows respect for a characteristic of a jumping worm to celebrate its badness because it helps us all become aware of how important the topic of invasive species is to our natural areas.

Once students have completed their poem (ode), they may also draw a picture in their journal to display with their **Ode to a Jumping Worm**. Ask students to volunteer and sing, chant, or share their **Ode to a Jumping Worm** with the class.

Wrap-Up by confirming that there are many ways to slow the spread of jumping worms in the Mid-West. One of them is connecting with existing student programs to monitor and map the. movement of jumping worms and sharing that information in a national database.

Curriculum 1: Jumping Worms: *Amynthas agrestis*

Module 1 Unit 3 —

BASIC CONCEPTS BACKGROUND AND OBJECTIVES:

The objectives of this module provide students with skill sets to identify earthworms and jumping worms in order to monitor their movement. The first activity explores physical coloration to distinguish pigmentation differences. The second activity explores physical difference to distinguish

between the earthworm and the jumping worm. The third activity provides connections to programs that inspire in-depth identification and access to national databases. Students will learn how to access these resources to follow and/or report the movement of jumping worms in the Mid-West.

Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 3 —

ACTIVITY — KEY TO ID: Jumping Worms (45 minutes)

Jumping Worms are Pigmented earthworms (coloration)

Materials:
Pastels/colored pencils: white, opal white, coral, light blue, orange, maroon, brown, black
Print-out or pdf file of the Jumping Worm Monitoring Protocol Handbook
https://jwp.cfans.umn.edu/sites/jwp.cfans.umn.edu/files/2021-09/PDF%20handbook.pdf

Begin the KEY to ID: Jumping Worms activity by asking students to get out their journals and pencils.

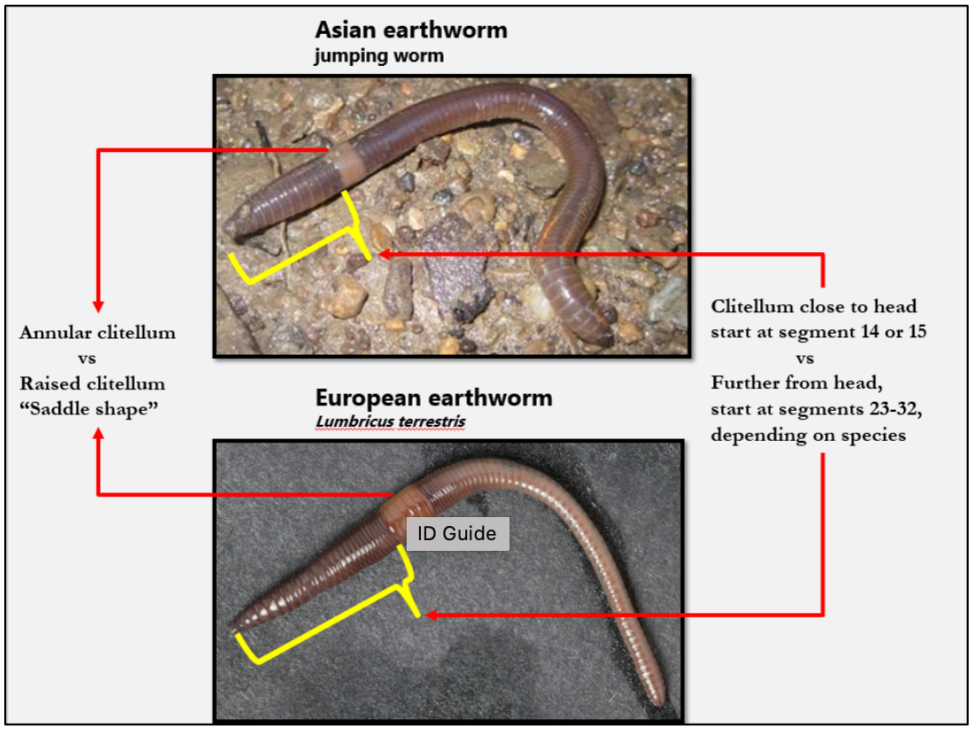
Tell your students that you will be looking at how pigmentation is a primary identifying characteristic to help single out the jumping worm from other worms.

Students will learn how to identify by color and location an annual **clitellum** located 14-15 segments away from the head that assists in the forming of a cocoon.

Explain that they will learn how to identify **castings**, the end products of worm digestion (from mulch and wood pieces), by the look and feel of coffee grounds as they lay next to holes that jumping worms make to burrow into the soil.

Instruct students to use the example photo shown above as a model and draw the outline of a jumping worm on their journal page.

Clitellum: The clitellum or "ring" around an earthworm is the reproductive organ which lets us know that the earthworm is a sexually mature adult. The clitellum is located near the head of the worm. European species have a saddle shaped clitellum that swells up and does not wrap around the entire body. Jumping worms have an annular clitellum that is less swollen, and it wraps around the entire body.



Describe the clitellum: The annual clitellum (a part of the body wall that is formed from glandular cells at maturity and that is involved with forming a cocoon is an opal white color — located 14-15 segments away from the head. Instruct the students to use the pastel sticks to paint the clitellum on their outlined drawing.

Once students have counted 14-15 segments away from the head and colored the clitellum ***opal white*** with the pastel, **ask** the students which side of the drawing (viewer's sight) is the head (left) and which is the tail (right).

The left hand edge of the photo is the head of the jumping worm, because there are roughly 14-15 segments on the visual left side of the clitellum, and hundreds of segments on the right side of the clitellum. The ***clitellum has many setae*** (a stiff structure resembling a hair or a bristle) that help it move more sporadic than other worms. This movement is what has given the "jumping" worm its name. European earthworms have eight setae around their body in each segment. Jumping worms have as many as 40 setae or more around each segment.

Build on color of pigmentation by suggesting that the jumping worm is a **pigmented** (colored) earthworm that lives and feeds near the surface. The jumping worm is streamlined with a dark coloration that is almost **shiny** or has a **sheen** to it.

Ask students to finish coloring the darker shiny pigmentation on their jumping worm sketches.

The jumping worms' **castings** look and feel like coffee grounds. The jumping worm has a unique ability to create an enzyme that helps break down woody materials like wood chips and mulch. Castings are the little mud-like piles deposited next to holes where earthworms burrow into the earth. These mud-like piles are an end product of worm digestion - one that can improve soil environments for indoor and outdoor plants.

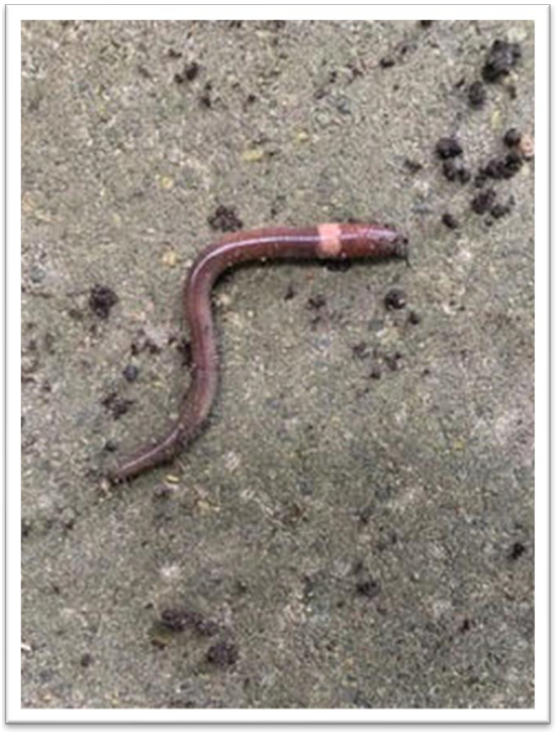


Photo by C Landstrom

A Note on Pigmentation: The pigmentation (coloring) of the worm acts as protection against sun. Worms that feed on or come to the surface are at risk of "sunburn" that can often be fatal. Worms will vary in pigmentation depending on their lifestyle.

Unpigmented

Photo by L Lavrov

Pigmented night crawler

Photo by H Graf

Pigmented jumping worm: Jumping worms have a darker pigmentation with an almost shine to their body.

Photo by J Anderson

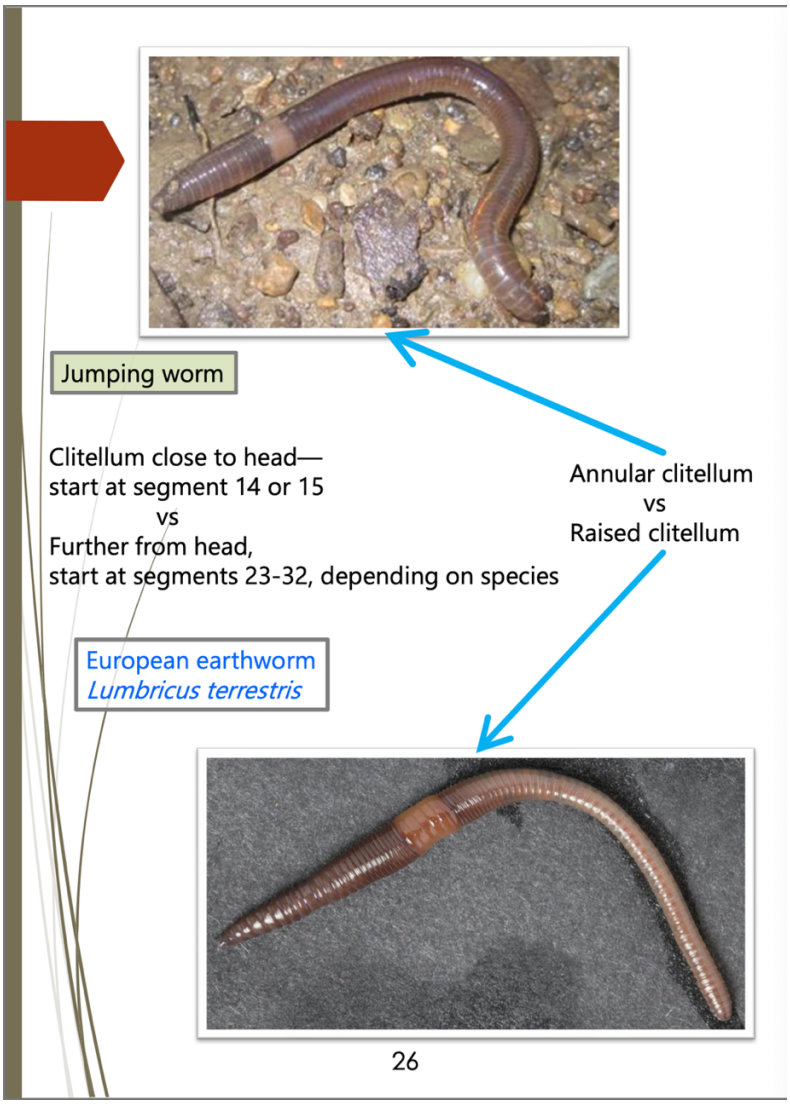
Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 3

Activity: KEY to ID — Jumping Worm vs European Earthworm

Clitellum *(a thickend glandular and nob-segmented section of the body wall near the head in earthworms that secretes a viscid sac in which eggs are stored)***:** The clitellum is the **earthworms'** reproductive organ. This is a good indicator that a worm is an adult that has reached sexual maturity. The clitellum is located closer to the head of the worm (further from its rear).

Jumping worms have an annular clitellum that is less swollen (see image below), and it wraps around the entire body. The clitellum is roughly 14-15 segments from the head. The jumping worm clitellum has a pale opal color. Most European species have a saddle shaped clitellum that raises from the body and does not encompass the worm.



Let's Recap! Fun Facts!

So, beneficial earthworms come from Europe and work the soils to the advantage of plants and native ecosystems. Jumping Worms, come from Asia, wiggle and flop easily moving fast through the ecosystem infesting 23 States in America, while European earthworms move more slowly.

The clitellum near the head in earthworms secrete a viscid sac in which eggs are stored — the band completely encircles the jumping worm body, is white to light gray, and is flush with the body. The European nightcrawler clitellum is raised (swells up) and reddish-brown in color and does not wrap entirely around the body (saddle shape).

European earthworms distribute their high nutrient-value castings throughout the soil. Jumping worms deposit castings on the soil surface, where the **nutrients are unavailable to plants**.

Jumping worms can die if temperatures reach 104 degrees F (University of Connecticut)

Natural enemies of jumping worms include birds, snakes, turtles, frogs, even slugs.

Jumping worms live upon and in the soil and are easily moved in bait, compost, and garden products.

23 States have jumping worms
https://www.prevention.com/life/a40092356/invasive-jumping-worms-amynthas-agrestis/
Alabama, Connecticut, Florida, Georgia, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin.

Curriculum 1: Jumping Worms *Amynthas agrestis*

Module 1 Unit 3

Activity: Jumping Worm Monitoring and Reporting — Join with Others

The objective of this activity is to provide students with resources and skill sets to help others learn about how jumping worms are moving across the Midwest and other locations in America. Students will share their observations and findings with EDDMaps, a national program for citizen scientists to document the movement of invasive species.

• ***How can we help others learn more about jumping worms?***

You can help gather information needed to locate the spread of the jumping worms. Programs like **Worm Ranger** in Minnesota have an online repository with a self-driven training manual to learn

how to monitor jumping worms and report findings to the EDDmaps national program. You can make observations of jumping worms and report your findings. If you find jumping worms, after you report your observations, you can dispose of the worms.

• ***How do I dispose of the jumping worms?***

The Worm Ranger program suggests the best practices include placing the worms in a bag and throwing them in the garbage.

• ***What happens to my data?***

The Worm Rangers team will analyze your observations to confirm your identification before inserting you information into a nationwide database that helps track the spread of jumping worms. In this way, the knowledge we create together will not only help Minnesota track this invasive species but will help the entire nation track the spread of these species.

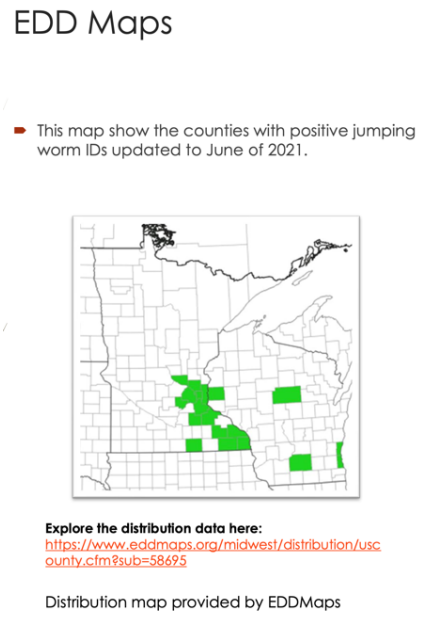


Photo by Beth Solie

• ***How do I use my observations and collect data for jumping worms?***

First, describe the location where you find the jumping worm(s).

To track the spread of the jumping worm, you can submit data using the Jumping Worm Project websites. *https://jwp.cfans.umn.edu*
https://jwp.cfans.umn.edu/jumping-worms-project

If you have data to submit, fill out the data form to the best of your knowledge. Even if you did not find jumping worms, the data is still useful in tracking the spread. Send your photos and short videos of suspected jumping worms. Experts can help ID the worms.

First, The location is important when tracking the spread of the jumping worm. The data form has a section for latitude and longitude. If you do not have access to a GPS, you can write in the nearest town/county. Additional information is for possible **"how the worms got there"** and for the physical place of the worms (garden, compost pile, mulch bed, under logs, etc.)

Taking pictures and videos: The purpose of pictures and videos is to clearly help others identify the worms from afar. To keep the file size small: limit videos to 5-15 seconds. Include the background in your picture — preferably clan, neutral colored backgrounds (tan or grey backgrounds work well). Make sure the photo is in focus before sending. Be aware of lighting, glares and reflections can distort the photo.

Photo by Beth Solie

NOTE the sampling method for reporting samples.

Sampling method

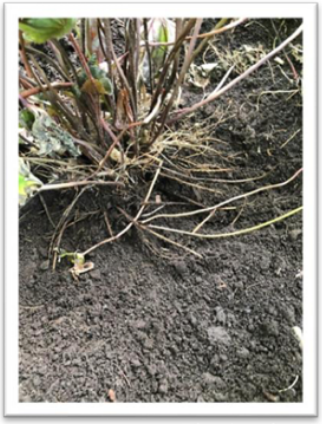
- The sampling method we are using for the jumping worm is called the "flip and strip". This method is hands-on and used to sample worms near the surface. To start the "flip" you can dig into the ground with your hands or use a utensil. Reach down 2-4 inches below the surface and pull up the soil. Once you have some soil pulled up you can roll it back over itself, this is the "strip" part. Roll the soil back about 12 inches and inspect the underside of the soil for jumping worms.

- 1st step: Visually inspect - Look at your yard, garden and woods for signs that earthworms are active. Do you see earthworms? Does your soil look like coffee grounds?

- 2nd step: Physically inspect - Flip logs & rocks, mulch, compost, soil, root around, under and through litter and see what you find.

- 3rd step: Found some - Do the worms move like a snake or "unworm like". Are they jumping worms - Use the physical characteristics you learn in this handbook to distinguish the jumping worm from the European earthworms.

- 4th step: Submitting data - Take a few pictures of the suspected jumping worms and submit your data into the requested section of the google form link.



Photos by Beth Solie

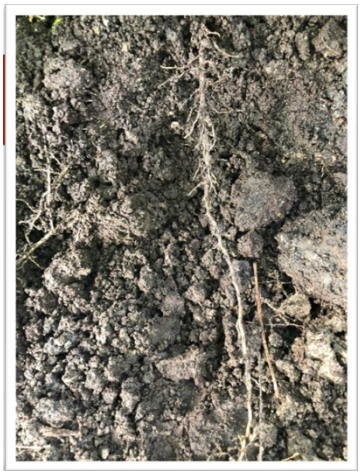
• ***What if I don't see any jumping worms?***

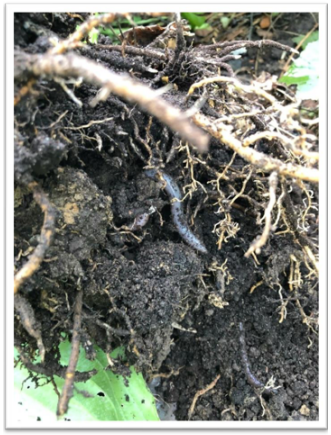
Although finding no jumping worms is preferable for our habitats, we still need to document your findings. All data is usable data. To track the spread of jumping worms, it is important to know where they are, but also to know where they are not. Jumping worms thrive in warm climates, but they have made their way northward. The Midwest is a unique position from which to track the northern most spread. Tracking the spread is the first step in controlling the species.

By identifying locations where jumping worms are and are not, we can create a northern boundary with the data that will further help research into this invasive species. Thank you for your help!

Photo by: Beth Solie

Castings





Photos by Beth Solie

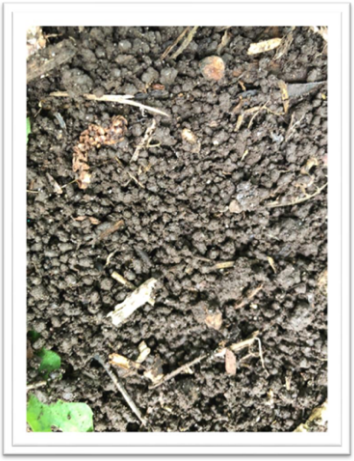


Photo by Beth Solie

The Boulder Lake Environmental Learning Center strives to provide educational programs that contribute to increased understanding and appreciation of sustainable natural resources management practices through the Boulder Lake Management Area.

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