CURRICULUM 2: *Phragmites australis* (common reed)

REFERENCE MATERIALS

https://www.invasive.org/publications/PHRAGFIELDGUIDE.pdf

https://www.invasive.org/publications/PHRAGFIELDGUIDE.pdf
Phragmites Field Guide (Distinguishing Native and Exotic Forms of Common Reed (Phragmites australis) in the United States

https://www.invasive.org/browse/subinfo.cfm?sub=3062

Phragmites australis (Cavenilles) Trinius ex Steudel
(INVASIVE.ORG Center for Invasive Species and Ecosystem Health)
https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_phau7.pdf
USDA NRCS Plant Guide for COMMON REED *Phragmites australis (Cav.) Trin. ex Steud*
Alternate Common Names: Giant reed, Giant reedgrass, yellow cane, Phragamite, Carrizo, Danube grass, Roseau cane
Alternate Scientific Names: *Arundo australis* Cavanilles; *A. phragmites* L. *P. berlandieri* Fourn; *P. communis* Trinius

TEACHER GUIDE for Common Reed
https://www.westchestergov.com/combating-invasive-species/specific-species/278-planting-westchester/native-plants/9357-teaching-guides-for-educators

https://www.greatlakesphragmites.net/phragbasics/spread/

https://www.nrcs.usda.gov/plantmaterials/mtpmctn13314.pdf
USDA NRCS Technical Note No. MT-35 January 2018)
INVASIVE SPECIES TECHNICAL NOTE
Ecology and Management of Phragmites (*Phragmites australis* ssp. *australis*)

https://www.sciencedirect.com/science/article/abs/pii/S1049964401909946?via%3Dihub
Tewksbury et al, 2002 (Casagrande, Blossey, Hafliger, Schwarzlander)
Potential for Biological Control of phragmites australis in North America

https://repository.lsu.edu/cgi/viewcontent.cgi?article=1941&context=biosci_pubs
Cronin et al, 2016 (Kiviat, Meyerson, Bhattarai, Allen
Biological control of invasive Phragmites Australis will be detrimental to native P. Australis

https://www.invasive.org/biocontrol/9CommonReed.cfm
Blosset et al, (Schwarzlander, Hafliger, Casagrande, Tewksbury)
In: Van Drieschm R., et al., 2002, Biological Control of Invasive Plants in Eastern United States, USDA Forest Service Pub lication FHTET-2002-04, 413p.
Common Reed

https://www.mdpi.com/2073-4441/12/6/1770

Milke et al. 2020 (Gatcyzynska, Wrobel)
The Importance of Biological and Ecological Properties of Phragmites Australis (Cav.) Trin. Ex. Steud, in Phytoremediation of Aquatic Ecosystems— The Review

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Teachers and researchers are building curriculum for students near natural areas that are infested with common reed (*Phragmites australis* spp. *australis*), a listed noxious weed.

BASIC CONCEPT OBJECTIVES:

• What is a **Weed**?

• What does that word mean? (any plant that grows where you don't want it to grow)

• What characteristics make a plant an invasive Weed? (economic and environmental damage)

• How does the common reed *Phragmites australis* spp. *australis* become an **invasive Weed**? (introduction from native range such as **from** overseas where the plant might be an ornamental or native plant where it has lived for years into **new** ecosystems without natural enemies known for their biological control of plants in their native range — such as the insects and pathogens from the plants native range that evolved together to keep them under control and not spreading).

• Where does the non-native phragmites spread? (roadways, sidebars, shoreline development, construction sites for canals or drainage ditches, by recreational vehicle use in sensitive areas — leaving open spaces that are open free for competitive plant species to easily establish. Non-native phragmites seeds can be easily spready by these open corridors. Also, nutrient enrichment of wetlands through agricultural run-off or lawn fertilization, emboldens common reed production of more biomass and more dense colonies.)

• Why do we care about the **impacts** of common reed (*Phragmites australis*) in natural areas such as the Forest Reserve adjacent to Avery Cooney Elementary School or Gwendolyn Brooks College Prep? (economic and environmental damage specific to the site, to the extent that legal authorities name the plant a noxious weed that must be controlled from spreading)

Module 1 Unit 1 — What a *Phragmites australis* needs to survive
Module 1 Unit 2 — *Phragmites* Spread Mechanisms
Module 1 Unit 3 — Invasive Plants and their Biocontrols

Curriculum 2: *Phragmites australis* (common reed)

Module 1 Unit 1 — What a *Phragmites australis* needs to survive

BASIC CONCEPT OBJECTIVES:

• What is a **Weed**?

• What does that word mean? (any plant that grows where you don't want it to grow)

• What characteristics make a plant an invasive Weed? (economic and environmental damage)

• How does the common reed *Phragmites australis* spp. *australis* become an **invasive Weed**? (introduction from native range such as **from** overseas where the plant might be an ornamental or native plant where it has lived for years into **new** ecosystems without natural enemies known for their biological control of plants in their native range — such as the insects and pathogens from the plants native range that evolved together to keep them under control and not spreading).

• Where does the non-native *phragmites* spread? (roadways, sidebars, shoreline development, construction sites for canals or drainage ditches, by recreational vehicle use in sensitive areas — leaving open spaces that are open free for competitive plant species to easily establish. Non-native *phragmites* seeds can be easily spready by these open corridors. Also, nutrient enrichment of wetlands through agricultural run-off or lawn fertilization, emboldens common reed production of more biomass and more dense colonies.)

• Why do we care about the **impacts** of common reed (*Phragmites australis*) in natural areas such as the Forest Reserve adjacent to Avery Cooney Elementary School or Gwendolyn Brooks College Prep? (economic and environmental damage specific to the site, to the extent that legal authorities name the plant a noxious weed that must be controlled from spreading)

ACTIVITY — Native Plant Species Game (20 minutes)

Begin by telling the students that they are now going to look at how invasive to look at how noxious weeds invade a landscape and out-compete native plant populations. Have the students hypothesize what happens when non-native species of plants are introduced into a habitat. Students should determine that there will be competition for **water** and **space** leading to a decline in the native population and possible extinction depending on the invasive species' characteristics.

Explain to your students that one of the most serious threats to the natural communities of plants and animals today is the introduction of non-native plants and species by humans. When a certain non-native or exotic (from another place) plant species is allowed to invade a natural native plant population, the results can be devastating for the native. Often natural diseases or predators are not brought with the plant to their new homes, therefore stress on the plants is not as great and populations may grow faster and larger. This can lead to a decrease in native plant and animal diversity in a region as these uncontrolled species increase in number. The non-native often outcompete native in obtaining the essential requirements for growth.

This decrease in diversity affects many different food chains and may lead to a monoculture of plants and animals where once there was a variety. Loss of endemic or native species may mean loss of valuable genetic material, which could someday provide valuable medicines or foods. Loss of diversity make our world a little less interesting and less beautiful. The following game will introduce students to the dilemma of the noxious invaders.

Before Play Begins
Designate a playing area by placing cones or flags at edges/corners of the playing field (30' x 60' area works well for 20 students). Scatter playing cards throughout the area (each difference colored card represents a different need for a native plant to survive. The White card = SPACE, Red card = NUTRIENTS, Blue card = WATER. Be sure to provide enough cards so each player nay collect one card of each color during the first round in order to survive for the second round.

Round One
All players begin as native plants in the specific area. Everyone will line up along the edges of the playing field at the start of each round. At the designated signal, players will enter the playing field, collect one of the three different colored cards and return to the edge of the playing field. The players goes back into the playing field again to collect a second playing card of a different color. The players go back into the playing field a third time and collect the third color card they need to have everything they need (SPACE, NUTRIENTS and WATER). After a player collects all three colors of cards, the player moves to the sidelines to wait for the signal to end the round. All players should survive the first round. Give the signal to end Round 1

Round Two
This round will be played the sane as Round One, but will now include non-native species. Two players wearing colored signs represent a non-native species. The non-native species are more aggressive and will be allowed to collect two cards per trip into the playing field. The non-native will also be allowed to return to the playing field as often as they are able but must collect three different colors in order to survive. The native species will be considered a survivor if he or she collects three different colored cards as they had done in Round One. Give the signal to end Round 2.

Round Three
Native species that did not survive Round Two become non-native for this round. Give each new non-native a sign. Continue to play Round Three just like Round Two. At the end of Round Three most, if not all, of the native population should not survive, but to actually take over the entire playing field.

Bring students together for a discussion
After Round Three, wrap up by discussing with your students what they observed as they were playing the game. As a group, have them begin to figure out how and why those students who played as the initial non-native species were not only able to survive, but to actually take over the entire playing field.

Why are all of the native species gone from the playing field?
What happened to the landscape — the water, nutrients, and space?
What are some things we might have done to stop the non-native species from taking over the landscape?

CURRICULUM 2: *Phragmites australis* (common reed)

BASIC CONCEPT OBJECTIVES

Module 1 Unit 2: *Phragmites* Spread Mechanisms
https://www.greatlakes*phragmites*.net/phragbasics/spread/

Students learn the differences between the native *Phragmites australis* spp. ***americanus*** and the invasive *Phragmites australis* spp. **australis** to understand why the invasive common reed is listed as a noxious weed for its negative environmental and economic impacts in natural areas.

• What mechanisms of spread do *Phragmites* ***australis*** spp. ***australis*** compared with *Phragmites* ***australis*** spp. ***americanus***?

(*Note* that one spp. ***australis*** spreads horizontally by sending out rhizome runners that can grow 10 or more feet in a single growing season if conditions are optimal. Also note that while the predominant form of spread to new areas is via seed dispersal, ***Phragmites australis*** *spp.* ***australis*** can also spread to new areas when pieces of rhizomes or stolons. Stolons are stems connected to the parent plant that grow along the soil surface and can form roots and shoots. They allow the plant to expand around an area where the plant is already established.)

COMMON REED GRASS (PHRAGMITES AUSTRALIS) - NN IMAGE

Phragmites australis is a non-native, invasive, wetland, perennial reed grass. Phragmites spreads aggressively by rhizomes and seeds and quickly outcompetes and displaces native salt marsh vegetation while providing little or no food or shelter for most saltmarsh-dependent wildlife. Additionally, Phragmites can eliminate small intertidal channels and decimate pool habitats that should offer natural refuge food for invertebrates, fish and waterbirds. Non-native Phragmites is distinctive due to the extensive dense colonies it forms and plume-like seedheads that generally persist through the winter on canes that range in height from 6 feet-15 feet tall and remain standing throughout the year. For more information go to the Bugwood wiki site. To best remove very small stands: Hand-dig, being sure to remove the entire rhizome system; or smother by covering with heavy-duty black plastic (after cutting and removing stems) for at least two years; or cut stems repeatedly below water level. Replant with native species. Removing larger stands will need professional removal and monitoring to protect the surrounding habitat during the process and ensure successful removal.

• What does the water level have to do with spread of the invasive ***australis*** species?

(*Note* that the spread into a wetland is often limited by water depth (too much water), however, it can spread into newly exposed areas when water levels drop. Once established in an area, non-native ***Phragmites*** can persist in water up to 6 ft (1.8m) deep.

• What are seed size and quantity of seed production comparisons between *Phragmites australis* spp. ***australis*** and spp. ***americanus***?

(*Note* that one spp. ***australis*** plant can produce up to 1,000-2,000 seeds each year that can be distributed by wind or waterways — and thus, the primary mechanism of spread. Once established, genetic diversity of seeds between native and non-native *phragmites* flowers that cross pollinate increase the number of stands.)

Native

Typically lighter yellow-green

Introduced

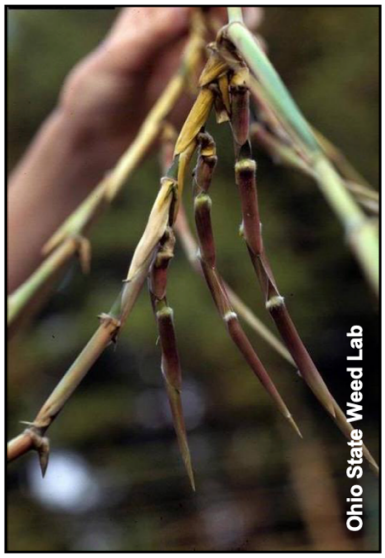
Typically darker blue-green

Growth and Spread

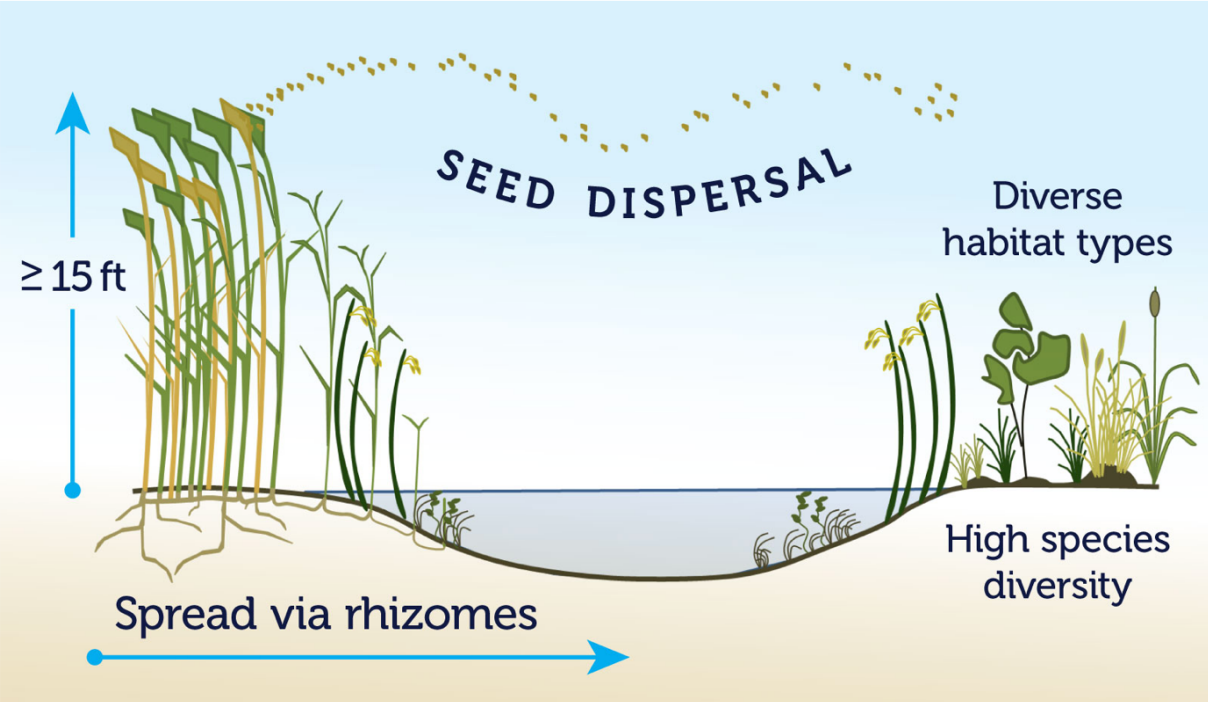
Spread of *Phragmites* to new locales is through seed, which is dispersed by wind and water, and vegetative means, through the movement of rhizomes or rhizome fragments. Individual *Phragmites* plants produce hundreds to thousands of seeds per year. While seed

Florets of *Phragmites australis* taking flight.

viability is highly variable and there appears to be a great deal of inter-annual variation in fecundity, sufficient seed is dispersed to overcome these impediments.



Rhizomes of introduced *Phragmites australis:* (L) Rhizomes exposed by wave action (R. E. Meadows); (R) Close-up view of rhizomes (Ohio State Weed Lab Archive, The Ohio State University).



• What are root depth and stalk height comparisons between ***australis*** and ***americanus*** sub-species? (*Note* that the ***australis*** sub-species stalk can reach a height greater than or equal to 15 feet in height.)

• Roads are important pathways for spread — increasing landscape connectivity. Roadsides frequently have high inputs of salts and contaminants, all of which favors the establishment of non-native *phragmites*.

Module 1 Unit 2: *Phragmites* Spread Mechanisms (30-45 minutes)

Prior to the Activity, download photos from
https://www.greatlakesphragmites.net/phragbasics/spread/
or take your students to the natural area where they can see phragmites species in the landscape.

Begin by asking students to get their journals and pencils out and find a place to sit and sketch a native and non-native common reed plant in its environment (or in the photos). Ask students to label the parts of the common reed plant and think about how high the non-native *phragmites* climbs up in the sky compared to the native *phragmites*.

Ask your students to think about how they feel as they sketch the landscape with *phragmites*.

Ask your students to visualize what the landscape might have looked like before non-native common reed was introduced from Asia, and then how it spread in fishing tackle, soil amendments, water systems, construction, development, transportation systems, and agricultural run-off.

Wrap-Up by bringing students together to share their drawings and discuss what it meant to them to think about this landscape before and now and what it might look like as non-native *phragmites* and native *phragmites* continue to cross-pollinate and continue to spread at greater speed.

Explain that the next Module 1 Unit 3 activity will focus on things we can do to stop that spread.

CURRICULUM 2: *Phragmites Australis* (common reed)

Module 1 Unit 3 — Invasive Plants and their Biocontrols

BASIC CONCEPT OBJECTIVES

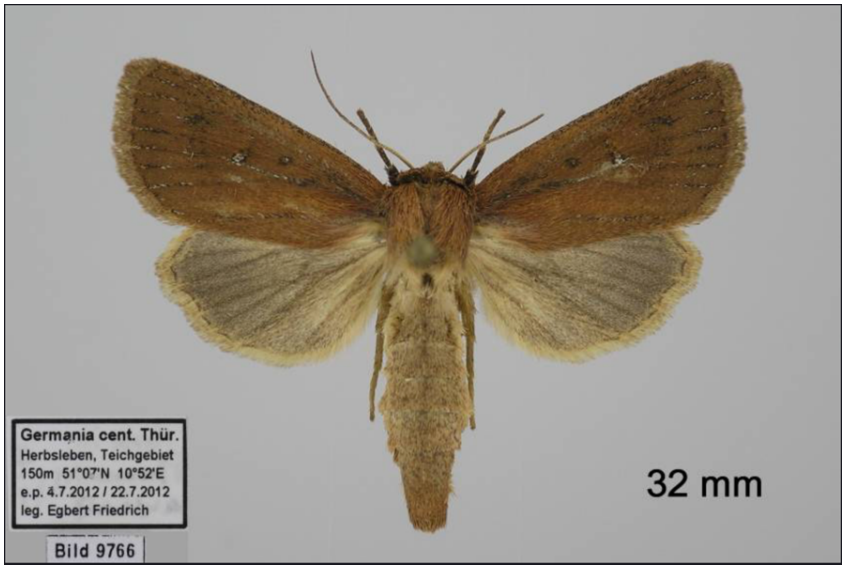
• What **native insects** feed on *Phragmites australis* spp. ***americanus****?*

• What **non-native insects** from the native range of the introduced *Phragmites australis* spp. ***australis*** feed on *Phragmites australis* spp. ***australis?***

• What tools can teachers and students use in this natural area to reduce the negative impacts of *Phragmites australis* spp. ***australis*** in our natural area?

• Why is biocontrol of *Phragmites australis* spp. ***australis*** a useful tool to reduce these impacts?

2 young larva 2a larvae after final moult, the pupa is seen inside the hollow stem



Archanara geminipuncta

CURRICULUM 2: *Phragmites Australis* (common reed)

Module 1 Unit 3 —

ACTIVITY — *Phragmites* and Biocontrols (30 minutes)

Materials
Weed and Biological Control Insect Models (Photos, Plastic bouquet, pinned insects, live samples)
Weed ID Cards each with tie-string - one for each weed model
20 pencils (20 Students) - one for each student
Note card (20 Students) - one for each student
Large clean plastic sheet

Prior to your activity
Prepare for this activity by working with the land manager of the site or sites (if possible) to gather living specimens of non-native plants and weeds, plus any biological control insects that may be available during the season of your activity. These insects may be feeding inside the root or stem, leaves or flower seedheads, or feeding on the plant itself depending on the time of year. You may also be able to find other forms of biocontrols in the form of rust.

Otherwise utilize plastic weed replica if available from Extension Services in your area. Montana State University Extension Services Store has models and bouquet(s) easy to order online at *https://store.extension.org/Departments/Weed-Models.aspx*


Weed Model Stems


Weed Model Bouquets

Weed Model ID Cards

You may be able to collect and pin biological control insects (or create this activity with your students during the activities) or capture photographs of insects and the damage they do during your activity (such as shotgun-like pinholes in leaves, rust, or chewed-on roots, insect fras (poop) inside the stem or rhyzome). Obtain a book on biocontrols from your local Extension or State/County Weed Management Organization. Excellent resources are available at The Bugwood Wiki at this URL *https://wiki.bugwood.org/Biocontrol_In_Your_Backyard*

Briefly review with your students the objectives from
Unit 1 What a Plant Needs to Survive (space (sunshine), water, and nutrients)
Unit 2 *Phragmites* Spread Mechanisms (rhizomes, stolon, seeds)

Before Activity Begins
Designate a place on the ground or table top to lay out a large plastic sheet for the purpose of preventing invasive plant seeds and plant parts from reaching the ground where they may leave seeds and plant parts that can grow and spread. Spread the invasive plants gathered prior to the workshop out onto the plastic tarp with enough room on the tarp between plants for 4-5 students to

inspect each plant one at a time. Label each plant with a number (#'d card with a tie) beginning at #1 through however many plants you collected.

Begin the activity by telling the students there are **many ways to manage invasive plants** (plants that have moved into natural areas without their natural enemies). Ask students to describe what they know about some of the ways people control weeds (invasive plants) in their neighborhood (spray/apply herbicide, pulling, mowing, fire, grazing, biocontrol insects...). Explain that these tools are available for land managers to choose from in what they call a **"tool box"** to meet their land management objectives.

Tell students that today you will be focusing on **insects** in the tool box, and explain that using all of the tools that work for a specific species is called **integrated pest management** or **integrated weed management**. These tools are different and specific for each different weed species. **Ask your students** what ways land managers fight weeds (pulling, cultivating, herbicide, grazing, biocontrols, fire, etc.) For this activity, the focus lies on one tool in the tool box called **BIOCONTROLS. Biocontrol** is short for biological control to stop the spread of invasive plants.

NOTE: Each biocontrol insect is selective in what plant species it will feed on. Years of research and testing are required to introduce biocontrol insects that feed on a precise invasive plant species and to make sure that the insects **do <u>not</u> feed on other desirable native plant species**.

Next, describe for the students the difference between a "WEED" and a "NOXIOUS WEED", emphasizing that a "WEED" is any plant growing where you don't want it to grow; and, a ***"NOXIOUS WEED" is a plant that causes extensive environmental and/or economic damage to the extent that governments label it a noxious weed that must be controlled to keep it from spreading and doing more harm.***

Then, explain the concept of **natural enemies** — the insects that evolved over long periods of time with host plants that keep the native plants from becoming invasive in their homeland. **Ask your students** how a plant that is native to a foreign country or state might be moved by people, animals, floods, or wind to another geographic setting where an it becomes an invading plant — arriving without the insects and pathogens that naturally feed on them in their original homeland.

Explain that collecting and using these insects that feed on the invasive plant's point of origin as a **BIOCONTROL is a tool in the land manager's tool box**. Using these <u>plant **host specific** insects</u> help land managers slow the invading plant's ability to spread by setting in motion that long period of time necessary to acclimate and increase in numbers in their new setting with the imported invasive plant.

Begin by providing each student with a **pencil and a blank hard card** on which they will be instructed to write either "Weed" or "Noxious Weed". Ask the students to number their hard cards from #1 to the number of however many plants you collected.

Once students cards are #'d, instruct the students to look at each weed and decide if the plant is merely a weed ("WEED") or a noxious weed ("NOXIOUS WEED"). Once they decide, ask students to write the word "WEED" or "NOXIOUS" on their cards matching up the number they wrote on their card with the number on the card that is tied to the plant. You have not yet fully

explained details *by weed species* what a "noxious" weed is other than economic or environmental damage.

When students finish filling out their cards, bring them together and look at one weed at a time. For each plant, ask the students to raise their hands if they think it is a "WEED". Count the hands. Then, ask the students to raise their hands if they think the plant is a "NOXIOUS" weed. Ask the students to explain why they thought it was a weed, or why they thought it was a noxious weed. With each weed, confirm its status, and if "noxious", explain the law in your state or county law that requires control and why this particular plant is a problem for the natural area. You may also ask students why they think it is noxious, what damage it does in wetlands, natural areas, croplands, school yards...reinforce economic and environmental damage by describing specific instances of which you have first-hand knowledge.

Wrap Up by returning to each weed on the tarp. Select, one at a time, a specific plant that exhibits evidence of biocontrol activity: shotgun holes in the leaves; burrowing in the seed head, stem or root; larvae in the seedhead (or flower); larvae inside the root or stem; or other symptoms specific to the noxious weed species on the tarp. Allow your students ample time to appreciate the subtle signs of biocontrol activity and explain what they see.

CURRICULUM 2: *Phragmites Australis* (common reed)

Module 1 Unit 3 —

ACTIVITY — *Phragmites* and their Biocontrols (30 minutes)

Kids having fun in natural areas is the objective of the curriculum in this section. Engagement in the Natural Area is a number one priority as we provide teachers and students with safe and effective activities that have the potential to reduce negative impacts of *Phragmites australis* in the field and wetland each time they return.

BASIC CONCEPT OBJECTIVES

• Be a Naturalist! Explore the natural world.

• Skill sets a Naturalist will use to understand the wetland:
  - journaling, discussing, mapping, drawing, investigating, examining, observing, sensory awareness

• Concepts that support skill sets:
  - scientific investigation using observation tools;
  - measurements and data collection;
  - inquiry process;
  - structure and functions of living things;
  - micro and macro environments

OBJECTIVES: Students will use their senses to make observations of the world around them. Students will use skills of journaling, sketching, and mapping to investigate the natural world. Students will make a map of the natural area to include the extent of *Phragmites australis* and discuss a plan to shrink the extent to reduce the negative impacts on the natural environment. In the process of mapping, students will explore evidence of biocontrols in the *Phragmites australis* communities and learn to identify the insect's cycle of life and the point of attack in different times of the year.

CURRICULUM 2: *Phragmites Australis* (common reed)

Module 1 Unit 3 —

ACTIVITY — Be a Naturalist!

Exploration Concepts:

- Biocontrol of *Phragmites* Investigation and Monitoring Tools
- Data Collection
- Inquiry Process
- Structure and Functions of Living Things
- Micro and Macro Environments

Be a Naturalist! Let's explore Senses Investigation!
Prep 30 Minutes
Activity 1 Senses Investigations (45 minutes)
Activity 2 Back to Back Observation (30 minutes w/optional 45-min. advanced component)
Activity 3 (90 minutes)

This activity is designed for natural areas with *Phragmites australis* adjacent to schools in Illinois and may be easily adapted to other states and countries where *Phragmites australis* relocated from their native land.

Materials (20 student class-size)
Sketch book (journal) and pencil for each student
blindfolds - 1 per student
wrapped item (jellybean, licorice, lemon drop...check for allergies/restrictions) - 1 per student
3 cloth or paper bags each with a natural item inside
numbered jars with a lid containing a cotton ball, swabbed with scent (vanilla, cherry, root-beer, mint, lemon, orange, etc.) - 1 jar per student
graph paper - 1 per student
colored pencils - 1 per student
tape measures or meter sticks, stakes or flags, string or surveying tape
wrapped piece of candy (jellybean, licorice, lemon drop, etc.)

Lesson Overview
• Becoming a Naturalist - Senses Investigation (45 minutes)
• Micro Maps (45 minutes)

Background
A naturalist is someone who is curious about the natural world. We look at the plants, animals, insects, and landscape around us and ask questions. A naturalist wanders and wonders. If you could read a naturalist's thoughts, it might go like this: ***Being a naturalist is about asking questions and discovering answers.*** Naturalists keep their eyes and ears open—we observe the world around us. We record what we have seen and heard by writing down and sketching our observations. Sometimes, naturalists look at a single plant or animal. Other times we look at a whole community of plants and kinds of plants, animals, and other things in that community. This helps us develop research questions that can be tested and answered to learn more about the natural environment.

This activity is great for Grades 4-8 because it addresses the subjects of science, art, language arts, and mathematics. This activity helps students develop and improve skills of discussing mapping, drawing, investigating, examining, observing, and sensory awareness. This activity addresses important concepts of scientific investigation using observation, tools, measurements, and data collection. It also addresses the diversity of life; inquiry process; structure and function of living things; in both micro and macro environments.

ACTIVITY 1 — Senses Investigations: (45 minutes)

Materials
photos: French explorers Jacques Marquette and Louis Jolliet, Robert Kennicott, and Jane Goodall and/or (display) tools that naturalists use to allow the natural area to communicate its essence.

Activity Resources:
(pre-wrapped): jellybeans, licorice, or lemon drops (enough for each student to have one or all three depending on the time you want to take on this activity)
3 brown paper bags (or boxes), 3 different items: each bag (or box) with one item
5 (or more depending on time and number of students) small lidded jars containing a scent

For outdoor activity, gather items from nature that are easy to identify by the five senses

Begin this activity with a discussion of the term naturalist. It was French explorers Jacques Marquette and Louis Jolliet (a missionary and a fur trader), who arrived in Illinois in 1673. Robert Kennicott was an early professional naturalist in Illinois. ***"What does a naturalist do?"***

Ask your students, ***"When Kennicott first arrived in Illinois, what do you think he did?"*** and, then, ***"When Jane Goodall, one of the world's leading primatologists and conservationist (90th birthday in May 2024) was engaged in an evening of conversation at the Chicago Theatre, what do you think she talked about?"***

Ask your students what they think the kinds and types of tools that Goodall and Kennicott used to study the natural world. Review the five senses *(sight, hearing, smell, taste and touch)* that involve the eyes, nose, ears, tongue, and skin. Relate the five senses to the naturalist skills of journaling, drawing

and mapping. Ask your students ***"How do these tools help a naturalist study and understand the natural world?"***

Next, tell your students that they will be practicing using their naturalists skills in a senses investigation—using their senses of taste, sight, touch, smell, and hearing.

Taste: Blind Taste Test —Tell your students that you will be handing them something and they have to figure out what it is without using their sense of sight. Have students sit in a circle and blindfold each student. Tell the students that the blindfolds may not completely prevent them from using their eyes, but the blindfolds are friendly reminders to not use their eyes.

Hand each student a jelly bean ad ask for observations—***how does it smell? How does it feel?*** Ask the students to give you good descriptive words, not what the object actually is. Now ask the students if they think there is another sense that they could use to identify the object. **Taste!** Tell them to go ahead and taste the object. Ask: ***How does it taste? What is the object? What flavor do you think best matches the item*** *(*e.g., *jelly bean, licorice, lemon drop...)****?***

Wrap Up the Blind Taste Test by asking students how difficult they found using taste alone to determine a flavor. Ask them to describe the process they went through to determine their findings.

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Touch: *Mystery Bags*—Before the lesson, have three bags with three different natural items set up in the classroom. Tell your students that the bags are *mystery bags*, each bag having one item—***What sense do they think they will use to figure out what is in the bag*** *(or box)****?*** **Touch!**

Ask students one at a time to place their hand in the *mystery bag* to identify the objects inside each bag. After all the students have gone, ask for words describing the objects in each bag. Reveal the object dramatically—***Is this what they thought was in the bag?***

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Smell: Hand out numbered small jars with lids filled with different scents to the students. Ask your students to identify the smells of each of the numbered film canisters. Use the following questions for discussion jumping points. ***Without seeing what you smell can you tell what it is? What types of things smell good? What types of things smell bad? What types of smells are outside today?***

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Hearing (outside): Sounds—Ask students to sit quietly for 2 minutes with their eyes closed. Tell students to count how many noises they hear during this time on their fingers. ***What noises do you hear?***

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Sight (outside): Ask students to look at a hillside (or *phragmites* infestation) for 30 seconds. Then ask students to close their eyes. Ask your students questions about the hillside or *phragmites* patch and see if they can remember what they saw. ***Were their clouds in the sky?*** (eyes still closed) have them point to the location of the closest tree/bush, etc.

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Wrap UP: Ask you students to describe something significant to them about their experience using the senses a naturalist uses to come to know things about the wetland: to see without their eyes,

sense movement through the hairs on their arms, and more-—***allowing the natural area to communicate its presence.***

CURRICULUM 2: *Phragmites australis* (common reed)

Module 1 Unit 3 —

ACTIVITY 2 — Back to Back Observation (outdoors — 45 Minutes)

This activity builds skill sets in listening, interpreting, and sketching what one hears, interprets, and conveys onto the sketch book page for others to read and interpret.

Begin the activity by gathering students near a stand of *Phragmites australis* in the natural area.

Ask students ***What* are some observation you can make about *Phragmites*? *What does it look like? What are some of its distinguishing characteristics? What features make it easy to identify?***

Ask students to describe *Phragmites* in their journal (sketchbook), including details about each part of its noticeable features.

STEP ONE: Tell your students to pair up (two students). Make sure that each student has a sketchbook or journal and a pencil.

Tell the students that now they are going to take a closer look at different plants by doing back to back observations. Give one student of each pair a photograph or point at a plant nearby. The plant can be a weed or a native plant. Tell the students that their task is to describe the plant to their partner by describing the plant's details without using the name of the plant (example: the leaves are smooth with two pointed edges on the right side.)

Ask the students to focus on describing all the parts of the plant as well as the distinguishing characteristics. Their partner will try to draw the object in their journal using the details that are being described to them.

Optional follow-up at another time if necessary: (time permitting another 45 minutes)

This activity builds on the Back-To-Back exploration of the sense to describe plant parts by bringing plants into the landscape of the natural area.

Tell each pair of students to pair up with another student. Explain that they will be sitting back to back at a *place of their choosing* in the wetland (natural area) — noting that the focus is now on the landscape and the individual plants that make up the landscape. **Explain** that one student will describe what they ***see*** while the other student sketches what they ***hear*** with a pencil in their

sketchbook or journal. Then the roles will reverse so the sketching student becomes the describing student and the describing student becomes the sketching student. Tell the students that they will have 2 minutes to find a place to sit; 10 minutes each to describe what they see while their partner sketches what they hear; and 10 minutes reversing the roles.

Wrap Up. Another 15 minutes at the end will allow students to come back together and share their sketches and thoughts about the plants that make up the landscape. They may also share their feelings and senses changing as they begin to accept information as naturalists do — as information comes in from sources other than self — including the landscape, the air and breeze, the whisper of tree leaves in the wind, water on the rocks, and the tools of observing, listening, interpreting in sketches revealing more than self.

CURRICULUM 2: *Phragmites australis* (common reed)

Module 1 Unit 3 — *Phragmites* and their Biocontrols

ACTIVITY 3 — Micro Maps (45 minutes)

This activity builds skill sets a Naturalist will use to understand the wetland: journaling, discussing, mapping, drawing, investigating, examining, observing, sensory awareness.

Before beginning this activity, collect some historic printed pages or photographs of Kennicott's and Goodall's writings, sketches, and maps.

Begin the activity by reviewing the tools that a naturalist uses. Ask your students—***What types of things might*** Kennicott ***or*** Goodall ***do to show people what this phragmites site looks like.***

Kennicott and Goodall did journaling, sketching and made maps along their journeys to represent the landscapes, Kennicott in Illinois and Goodall in many countries.

Ask your students to look at the examples you collected and consider the tools necessary to journal, map and draw what one might investigate, examine and observe.

Tell students that they are going to be using naturalist skills of journaling, sketching and mapping to investigate the natural world adjacent to the school (or other location).

Take students outside with journaling, sketching, and mapping supplies. Ask your students to make observations of the outside space, using their senses. The students should record their observations in their journals or notebooks.

Next, tell your students that they will be doing a mapping project. Though, instead of a large map of an area, they will be creating a micro map — a close-up map that shows details of a small area (a plot).

Discuss the concept of scale and perspective with students as well. During this activity, they will be working in pairs or small groups to measure out a 1-meter square plot, using a tape measure or meter stick, and making the corners of their 1-meter square with stakes or flags. Next, they will run string or surveying tape between the stakes to mark the square.

To begin their micro-map, the students will draw a square on a piece of graph paper, which will be the method of recording what they find. Next, have the student sketch the larger and more general features in their plot. After, have the students get down on their knees and look very closely at their square plot. ***What do you see? Are their plants, insects, worms? Is the soil sandy or rocky?***

Remind students of different features on a map and using symbols to represent features in their plot. Using colored pencils, have them record the details of their plot on their map, working from one corner, outward until they have mapped the whole square meter.

Once the students have finished, ask them to use their observations and micro-maps to create a list of all the things that they have found. They may write a general list or a more detailed list with names of plants and animals.

Wrap Up. Ask for volunteers to share their findings with the class.

CURRICULUM 2: *Phragmites australis* (common reed)

Module 1 Unit 3 —

ACTIVITY — There are many ways to fight weeds! (2 hours 15 minutes)

Preparation (15 minutes)
What About Weed Skits Activity (60 minutes)
Weed Warrior Journaling (60 minutes)

Before beginning, gather specimens or photographs of native and non-native common reed and the biocontrol insects *Archanara neurica* and *Archanara geminipuncta.* Depending on the time of year, there may be insects in the Preserve infestation of *Phragmites australis,* ssp. *australis.* Materials for the activity include journals or notebooks and a pencil - 1 each per student.

Without any natural enemies, noxious weeds can easily outcompete native plants and take over entire landscapes. These weeds are tough and don't give up easily. In this activity students will learn about many tools we use to stop the spread of noxious weeds. Students will also create skits to demonstrate and participate in a journaling activity to discover how they could be "Weed Warriors."

ACTIVITY — What About Weeds Skits (60 minutes)

Begin the activity by asking students — ***what do we do about noxious weeds? How do we stop the spread of noxious weeds?*** List ideas on a board if indoors; or hold up cards with tools listed, such

as: mowing, hand pulling, grazing, cultural, herbicide/chemical, cultivating, biocontrol. Ask your students if they have any more ideas about how to control noxious weeds. Record their ideas on the board if indoors.

Explain that without natural enemies, noxious weeds (e.g., *Phragmites australis* ssp. *australis)* can easily outcompete native plants, such as the native reed (*Phragmites australis* ssp. *americanus)*. The non-native invasive reed (*australis*) reaches 7 to 15 feet in height and 9 feet in spread — likes moist to wet light, medium and dry soil. The native, beneficial reed (*americanus)* is shorter at 7 feet with an airy seedhead. It has yellowish-green leaves, which are lighter than the leaves on the invasive non-native reed (*australis* ssp. *australis)*. **Show photos or specimens, or point it out in the natural area if available.**

Explain that there are many ways to reduce the negative impacts of invasive plants (e.g., mowing, cultivating, burning, herbicide, biological). Without any natural enemies, the non-native *Phragmites* can easily outcompete native plants and take over whole landscapes. These weeds are tough and don't give up easily.

So, many different tools are used to stop the spread of noxious weeds — remember, a noxious weed is a weed growing where you don't want it to grow that creates environmental and economic damage to the extent that governments mandate it's control. Scientists call using many different tools to control spread of noxious weeds "integrated weed management" — no one way to control weeds — we can stop them only by using many different tools. Stopping weeds is like stopping a wildfire — when a forest burns, we respond by digging trenches in front of the fire.

Some weeds can be controlled by mowing them or pulling them out of the ground. This is hard work and some weeds respond by growing faster, producing sharp thorns or sap that can make it hurtful to pull or handle them. We can weaken some of the weeds by spraying or applying chemicals called "herbicides" on them. These chemicals soak into the plant and damage roots, which is where weeds store their food. Sometimes fields are burned to get rid of weeds. Goats and sheep will east some weeds, like leafy spurge. Some insects will eat weeds, too, and kids raise these insects at their school to later let them loose on weeds in the field In most cases, it takes several methods to stop weeds in their tracks. There are two species of moth that are specific to *Phragmites* that show promise as biological control agents (what we call insects and pathogens that feed on noxious weeds). Biocontrol agents (for short) as permitted for use after many years of research, testing to make certain that the insects only eat *Phragmites* and do not harm other beneficial species. Some biocontrol insects for noxious weeds are raised in classrooms where students raise then and when the time is right, release then in noxious weed-infested landscapes. In takes several (many) years for biocontrol insects to establish and begin knocking back the populations of invasive plants.

Next, Break students into small groups, 3-4 students per group. Tell your students that their task is going to be to create a skit about how to stop the spread of noxious weeds. Assign one method to each group. Give the students 10-15 minutes to create a skit. Skits can be funny or serious, but they must be informative. Give students pamphlets on noxious weed management if available.

Then, once the groups have their skits prepared, ask each of the groups to present their skit. After each skit, ask for comments from the students watching the skit. ***What method did the group portray? How effective is the method?***

Module 1 Unit 3 — Invasive Plants and their Biocontrols

ACTIVITY — Weed Warrior Journaling (60 minutes)

Begin by introducing the term "integrated weed management" to the students. Based on their skits, ***are there ways to combine methods of weed management to be more effective on suppressing a weed?***

Discuss with students the reasoning for using multiple methods of stopping the spread of noxious weeds. Ask the students if they agree with this approach — ***why or why not?***

Then, tell your students to imagine that they have become "Weed Warriors," people who work to stop the spread of noxious weeds. ***What are some things that they could do now in their own life to help prevent the spread of noxious weeds?*** Ask the students to number a piece of paper from 1 to 10 and write at least ten different things they could do to be "Weed Warriors."