

# INVASIVE SPECIES CURRICULUM

For Middle & High School Students



Department of  
Environmental  
Conservation

[www.dec.ny.gov](http://www.dec.ny.gov)

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## ACKNOWLEDGMENTS

The New York State Department of Environmental Conservation would like to thank the following people for assisting in the planning, writing, and implementation of the invasive species curriculum:

**EMILY CABOOT**

State University of New York at Albany and New York State Department of Environmental Conservation intern

**EMMA ANTOLOS**

New York State Department of Environmental Conservation

**JENNIFER DEAN**

New York Natural Heritage Program, *iMapInvasives*

**LAURA LEHTONEN**

Capital District BOCES

**AMANDA ZULLO**

New York State Education Department

**ANN CROTTY**

New York State Education Department

**MATTHEW AIELLO**

Pace University

**DONNA CASSIDY-HANLEY**

Cornell University

**MIKE JABOT**

State University of New York, College at Fredonia

**MEGAN PHILLIPS**

New York State Department of Environmental Conservation



This project was made possible through funding from the Environmental Protection Fund, which is administered by the New York State Department of Environmental Conservation.



**Department of  
Environmental  
Conservation**

## BACKGROUND

The purpose of this unit is to bring students through the scientific process to develop their own scientific research poster focusing on the statewide issue of invasive species. The process will occur over about two weeks and includes a visiting speaker, fieldwork, optional field trip, and a summary scientific poster session. The groups will be led through prompts to research invasive species topics, including:

- ◆ What are invasive species?
- ◆ How do they impact students' lives?
- ◆ How do they travel?
- ◆ Do the school campus and local areas have invasive species?
- ◆ What can be done to manage and prevent invasive species from coming to the area?

| DAY 1                       | DAY 2                           | DAY 3   | DAY 4  | DAY 5  |
|-----------------------------|---------------------------------|---|--|--|
| What are invasive species?  | How do invasive species spread? | What do invasive species look like?                       | What invasive species are an issue locally?      | What invasive species are on the school grounds? |
| <i>Introduction writing</i> | <i>Introduction writing</i>     | <i>Optional speaker and hands-on plant identification</i> | <i>Methods writing and field day preparation</i> | <i>Campus fieldwork</i>                          |

| DAY 6  | DAY 7  | DAY 8  | DAY 9                    | DAY 10   |
|--|--|--|--------------------------|--|
| Are there any patterns in the class's data?                | What are land managers doing about invasive species? | What is being done in New York State about invasive species? | What did students learn? | Service-learning day                                   |
| <i>Data analysis, results writing, and methods editing</i> | <i>Optional field trip</i>                           | <i>Conclusion writing</i>                                    | <i>Poster session</i>    | <i>Optional invasive species community service day</i> |

### Aims and objectives

Students will be able to:

- ◆ Create a group research poster summarizing their invasive species study;
- ◆ Analyze their field data to be used in their invasive species study; and
- ◆ Summarize what invasive species are and how they impact humans.

## STANDARDS

### MIDDLE SCHOOL STANDARDS

#### MS-LS2-4.

Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. *[Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about shifts in populations due to changes in the ecosystem.]*

#### MS-LS2-5.

Evaluate competing design solutions for maintaining biodiversity and protecting ecosystem stability. *[Clarification Statement: Examples of ecosystem protections could include water purification, waste management, nutrient recycling, prevention of soil erosion, and eradication of invasive species. Examples of design solution constraints could include scientific, economic, and social considerations.]*

#### MS-ESS3-3.

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. *[Clarification Statement: Examples of the design process could include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts could include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]*

### HIGH SCHOOL STANDARDS

#### HS-LS2-2.

Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. *[Clarification Statement: Examples of mathematical representations could include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]*

#### HS-LS2-7.

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *[Clarification Statement: Examples of human activities could include urbanization, building dams, and dissemination of invasive species. Examples of solutions could include simulations, product development, technological innovations, and/or legislation.]*

#### HS-LS4-5.

Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. *[Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, introduction of invasive species, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]*

# DAY 1: INTRODUCTION TO INVASIVE SPECIES

## 40-MINUTE LESSON

### Driving questions

- ◆ What are invasive species?
- ◆ How do invasive species impact our lives?

### Objectives

Students will be able to:

- ◆ Summarize what invasive species are and how they impact society.

### Materials

- ◆ Chromebooks/laptops/desktop computers
- ◆ Pre-assessment survey (see page 19)
- ◆ Research note sheet (see pages 20-21)
- ◆ Student working poster
- ◆ Colored pencils/markers/construction paper (if handwriting intro)

### Entry Event

To begin the unit, the students will brainstorm what they already know about invasive species using the assessment worksheet (see page 19) for Day 1. Students will first brainstorm independently what they know about invasive species. After a few minutes, each student will pair with a neighbor and add new facts and topics to the partner section of the worksheet. Then the teacher will open the discussion to the group and have students share their ideas. The teacher will record students' ideas on a sheet of paper, whiteboard, smartboard, etc. The ideas list should be left up for the duration of the class period to act as a starting point in the groups' research. This activity will introduce students to concepts they will learn over the course of the unit (5 minutes).

### Activity

Teacher will begin the unit PowerPoint, available here: <https://www.nyMapInvasives.org/educator-resources>. The first slides contain a video that explains what invasive species are, how they are transported, and how they impact communities. These are the major topics that students will be researching for the introduction of their poster (5 minutes).

Teacher will continue to use the PowerPoint for the rest of the lesson. Students will be split into their working groups for the project. Teacher should decide if groups are pre-picked, randomized, or student-chosen depending on the class. When the groups have been created, students will be introduced to the group projects they will be working on; PowerPoint will be used to explain the group projects to students.

Teacher will show groups the example of the poster in PowerPoint (see example on page 7). Teacher will hand out permission slips for students to download the *iMapInvasives* app on smartphones or tablets (10 minutes).

*Note: you can create an iMapInvasives account for your classroom. Students **do not** need to make their own accounts. If downloading the app is not preferable or poses an issue, students can use the worksheets on pages 24–27 and enter the data manually onto the iMapInvasives website.*

The student groups will begin their research, focusing on two questions: (1) What are invasive species? and (2) How do they impact our lives? These questions should be visible to the students while they are researching and can be found on a slide within the unit PowerPoint.

Students may use online sources, pamphlets, fliers, or texts from the school library. Students should take notes on these two focusing questions, including their citations in the student note sheet (see pages 20–21) (10 minutes).

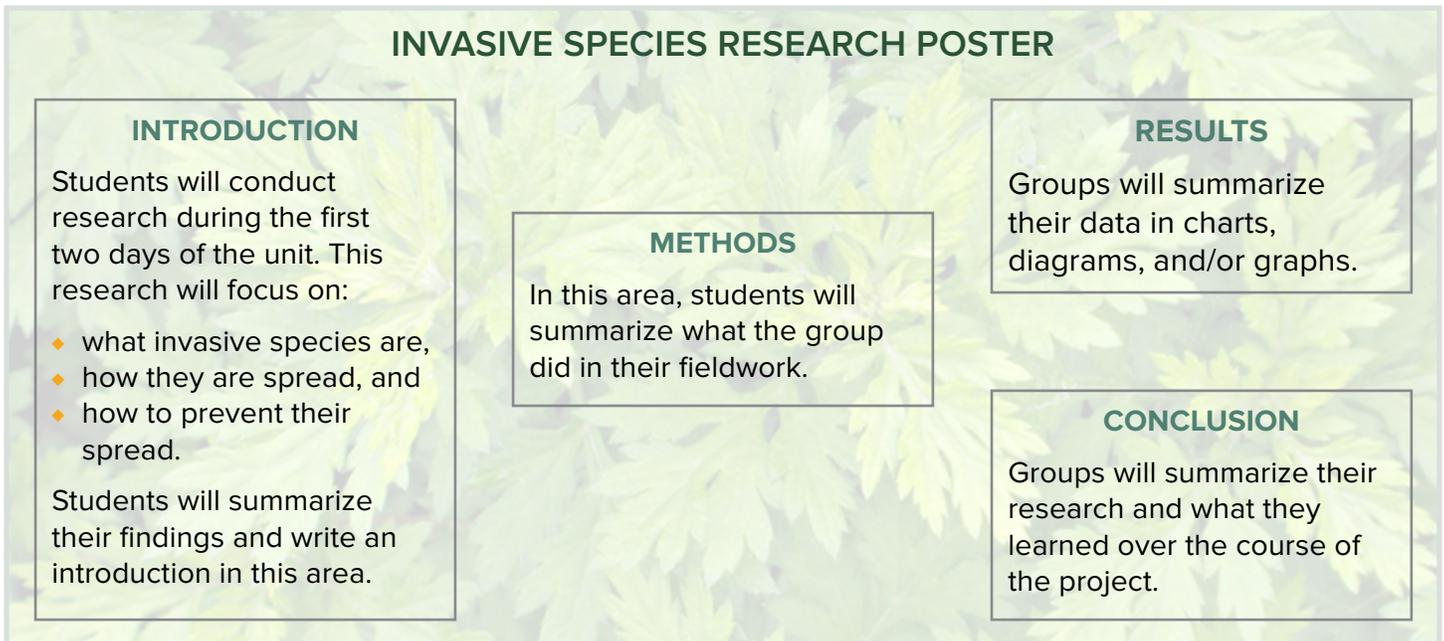


Figure 1: Example of an Invasive Species Research Poster

## Summary

To finish the class period, students will begin writing the introduction for their research poster. This part of the introduction is intended to explain what invasive species are and how they impact human lives. Students will use their notes, citing their sources, to develop a paragraph or two on these topics. This can be written on a sheet of paper or typed in a Word or Google Doc, to be added to the poster in the following class (10 minutes).

## Teacher Tips

- ◆ Teachers should create an *iMapInvasives* account for their classroom ahead of time. If there are any issues, please contact the *iMapInvasives* team at [iMapInvasives@dec.ny.gov](mailto:iMapInvasives@dec.ny.gov).
- ◆ Teachers can utilize the pre-assessment worksheet (see page 19) to measure students' knowledge at the beginning of the unit. At the end of the unit, use the post-assessment worksheet (see page 30) to show students their growth over time.
- ◆ A PowerPoint is available for download at <https://www.nyIMapInvasives.org/educator-resources>. Teachers may wish to modify the PowerPoint, such as adding student groups into the blank slide, to assign project groups.
- ◆ The video to introduce the unit is a TED Talk that explains what invasive species are: [https://www.youtube.com/watch?v=spTWwqVP\\_2s](https://www.youtube.com/watch?v=spTWwqVP_2s).
- ◆ After the TED Talk video, teachers may show the following video by The Nature Conservancy, which describes specific invasive species and examples in New York State: [https://www.youtube.com/watch?v=\\_P76NJire3A](https://www.youtube.com/watch?v=_P76NJire3A).

## DAY 2: RISK OF SPREAD

### 40-MINUTE LESSON

#### Driving questions

- ◆ How do invasive species arrive in NY?
- ◆ What are some simple steps people can take to prevent introductions?

#### Materials

- ◆ Chromebooks/laptops/desktop computers
- ◆ Notes sheet (see pages 20–21)
- ◆ Student working poster
- ◆ Colored pencils/markers/construction paper (if hand-writing intro)

#### Entry Event

The unit PowerPoint

(<https://www.nyMapInvasives.org/educator-resources>) will instruct student groups to analyze maps (Google maps or paper maps), looking specifically at the methods of transportation within New York State (land and water). Students should have a few minutes to become comfortable in using the maps, looking at the key, and understanding the scale and the icons. When students have identified the key transportation pathways in New York State, groups should pinpoint areas which may be invasive species hot-spots (areas which have many pathways coming together/highly trafficked areas like cities) (10 minutes).

#### Activity

Groups will conduct new research for the second part of their introduction. In this class, students will focus their research on the following questions: (1) How do invasive species spread? and (2) How can people prevent the spread of invasive species? The teacher will project the focusing questions to the class via the unit PowerPoint. Students will use research methods such as the previous lesson, an internet search (web list), pamphlets, or library books. Students will take notes, recording their sources, and then use these notes in their introduction (15 minutes).

#### Objectives

Students will be able to:

- ◆ Describe how invasive species spread; and
- ◆ List preventative steps to stop invasive species from entering an area or spreading.

#### Summary

Students will summarize their research on how invasive species spread. Students should also use this time to ensure their introduction from the previous class aligns with today's research (15 minutes).

*Homework: Students can watch a video or read an article to introduce them to basic botany terms and characteristics.*

#### Teacher Tips

- ◆ It is highly recommended that teachers become comfortable on the *iMapInvasives* site before having students work with the maps.
- ◆ Homework examples include:  
<https://www.youtube.com/watch?v=5Aj82u2he6s>  
<https://basicbiology.net/plants/physiology/leaves>

## DAY 3: PLANT IDENTIFICATION

### 40-MINUTE LESSON

#### Driving questions

- ◆ How can we identify which plant species are invasive?
- ◆ Are there any native look-alikes?

#### Objectives

Students will be able to:

- ◆ Identify key plant characteristics of the 10 common invasive species of NYS; and
- ◆ Sketch two to three common invasive species brought into the classroom.

#### Materials

- ◆ Invasive species specimens (collected the day before or the morning of)
- ◆ 10 common invasive species list (see pages 32–33)
- ◆ Observation worksheet (see pages 22–23)

#### Optional Entry Event

A speaker will come in to discuss invasive species in the area, how land managers are addressing the invasive species, and what they do in their profession. Land managers oversee the development of natural areas such as forests, rangelands, etc.

Teachers will need to reach out to the Partnerships for Regional Invasive Species Management (PRISM) to find an individual to speak to their class. Contact list included (see pages 34–35). If a representative from the PRISM is unable to come in to the classroom, the PRISM will know of groups or volunteers who may have better availability (10–15 minutes).

#### Activity

Student groups will be given the 10 common invasive species list (see pages 32–33) to follow along when going over plant characteristics. The teacher and/or speaker will walk students through the specimens brought into the classroom. Students will be introduced to botany terminology to describe plant structure. Student groups will be given the 10 common invasive species identification list (see pages 32–33) to use to identify invasive species the speaker and/or teacher has brought into the classroom. Teachers should look on the school grounds and on the edges of woods and along travel ways to find invasive species (10 minutes).

Within student groups, students will choose one to three invasive species (depending on time) that they will become a specialist on, observe the species, and sketch drawings of the ones they choose on the observation worksheet (see pages 22–23) (15 minutes).

#### Summary

Students will share their sketches with their groups, going over key characteristics (5 minutes).

*Homework: Each group member will go through the Midwest Invasive Species Information Network's tutorial or the Alice Ferguson Foundation's interactive dichotomous key (see links below) to further their identification skills.*

#### Teacher Tips

- ◆ When doing the observation drawings, students do not need to be artists. Students should focus on details of the observations (leaf's edges, veins, stems, flowers).
- ◆ If the teacher is unable to find a speaker for the day, the lesson should be changed into a hands-on workshop for students to learn the different characteristics of each common invasive species.
  - Skip the introduction event and take students through the 10 common invasive species list (see pages 32–33). Many of these invasive species can be found on the edges of properties, roads, and other disturbed areas. Students should focus on more than just one invasive species when conducting and sketching their observations.
  - If the teacher is uncomfortable with teaching the characteristics, and students have individual internet availability, students can work through the Midwest tutorial (see below) to become familiar with invasive species.
- ◆ Alice Ferguson Foundation: <http://fergusonfoundation.org/btw-students/plant-identification/>
- ◆ Midwest invasive species trainings: <https://www.misin.msu.edu/species-training/>
- ◆ The teacher should download the iMapInvasives app to a smart device (Android or Apple) before beginning the next lesson.

## DAY 4: iMAPINVASIVES INTRODUCTION

### 40-MINUTE LESSON

#### Driving questions

- ◆ Which species are an issue on a local scale?

#### Objectives

Students will be able to:

- ◆ Plan the procedure for their group's field work for the following lesson; and
- ◆ Use the *iMapInvasives* website map.

#### Materials

- ◆ Apple or Android smart device with the *iMapInvasives* application downloaded (1 per group)
- ◆ Field research forms (see pages 24–47)
- ◆ Chromebooks/laptops/desktop computers
- ◆ Procedure note sheet (see page 28)
- ◆ Colored pencils/markers/construction paper (if handwriting intro)

#### Entry Event

Students will be introduced to *iMapInvasives*. The class will walk through a step-by-step tutorial that introduces the app and shows the process for logging in, setting the preferences, and sending a test point. Students will then go through a walk-through of how to use the *iMapInvasives* website. If using the app, **students will need to download the app prior to this lesson**. If not using the app, students will need to fill out the data on the field form (see pages 24–27) and input data onto the *iMapInvasives* website instead (15 minutes).

#### Activity

The teacher will go over the procedure for the next class, the field day. Student groups will take notes so they can write up their procedure for their poster at the end of class (see page 28). Teacher will need to define concepts of size and dimension (e.g., 10 sq. ft. vs. 10 acres) that will be encountered while entering data into *iMapInvasives* (10 minutes).

#### Summary

Student groups will summarize the methods they will be completing in the following lesson. This will only be a draft; students will revisit their methods following the field day to change anything that was different when executing the field work (15 minutes).

If time allows, students should complete the activity below. If not, students can explore *iMapInvasives* for homework.

Students will log into *iMapInvasives* and investigate the local area, looking for different invasive species. Group members will each choose a different invasive species, to see the known locations of each in the local area. It is important to explain to students these are not the only places where the given invasive species is found. The locations of invasive species within the database are areas where people have identified and uploaded data into *iMapInvasives*; the data does not always reflect the true extent of a population of invasive species. Students will then compare the locations of the species. Are they in similar or different areas? Is a single species all clumped together or spread out? (~10 minutes).

#### Teacher Tips

- ◆ If the classroom is flipped or the teacher is willing to assign such homework, students can review the walk-through PowerPoint before class. This will give students more time in class to go over the procedure for the field day and to work on their methods and other areas of their group poster.
  - ▶ A great tool to use for the PowerPoint is EdPuzzles at <https://edpuzzle.com>. Edpuzzle is an easy-to-use platform where you can make any video or PowerPoint into a multiple-choice quiz to ensure your students are watching or listening to the presentation. Check out an example here: <https://edpuzzle.com/media/5b04517a31e825408328d9f8>.
- ◆ Before this lesson, the teacher should explore *iMapInvasives* to predict potential issues that students may need help understanding. Focus on the map, which has many different tools and layers for students to use.

## DAY 5: CAMPUS FIELD WORK

### 40-MINUTE LESSON BUT CAN VARY

#### Driving questions:

- ◆ Which invasive species are on the school grounds?

#### Objectives:

Students will be able to:

- ◆ Use the 10 common invasive species list to identify invasive species on the school grounds (see pages 32–33).

#### Materials:

- ◆ 10 common invasive species list (see pages 32–33)
- ◆ 1 field research form per group (see pages 24–27)
- ◆ 1 clipboard per group
- ◆ 1 smart device per group (if applicable)
- ◆ 1 or more hand lens per group
- ◆ Pencils
- ◆ Observation sheets (see pages 22–23 —completed in day 3 lesson)

#### Entry Event

The class will review the key characteristics for common invasive species in the area; the teacher can use any leftover specimens for students to review. Students will look over the 10 common invasive species list (see pages 32–33) and the drawings they made from the plant identification lesson (see pages 22–23) (5–10 minutes).

Students will need to bring the following tools with them into the field:

- ◆ Clipboard with field research form (see pages 24–27)
- ◆ 10 common invasive species list (see pages 32–33)
- ◆ Smart device with the *iMapInvasives* app already downloaded, logged into, and preferences set (if applicable)
- ◆ Lenses

#### Activity

The teacher will need to preview areas on the campus that are safe for students and have invasive species. Students will go to these areas in their groups and identify one invasive species. They will record the species and information about the species on the field research form and then plot where the invasive is on the campus using the *iMapInvasives* app. If not using the app, students can go back to the classroom and input data onto the *iMapInvasives* website. It is recommended that the teacher blocks off areas for each class to monitor. This will help when students are trying to analyze their data in the next lesson. Student groups should add more observations in the field form for analysis in their projects (30+ minutes).

#### Summary

Students will return to class and upload observations, using Wi-Fi to save data.

#### Teacher Tips

- ◆ Preparation for this day should include: a survey of the school grounds, marking the different class areas (to ensure students are surveying a good portion of the campus and not a small corner), and preparing group materials.
  - ▶ A student helper could assist in preparing these materials for the lesson.
- ◆ This would be an ideal day to have a volunteer, the speaker, come to help students identify and determine densities of the invasive species.
- ◆ Each student group should only plot one invasive species on the *iMapInvasives* app. This is to ensure the *iMapInvasives* team is not overloaded with the same or similar data. It is also important to share with students that they should be certain with species identification and define the density. Adding multiple points in the same area is not as effective at defining the infestation as is inputting one point that describes the density and size. Mention to students that this data will be utilized by scientists and natural resource professionals in New York State so they value the importance of their accuracy and their contributions.

## DAY 6: ANALYSIS OF CLASS DATA

### 40-MINUTE LESSON BUT CAN VARY

#### Driving questions:

- ◆ Are there any patterns in the class’s data?

#### Materials

- ◆ Chromebooks/laptops/desktop computers
- ◆ Completed field form (see pages 24–27)
- ◆ Colored pencils/markers/construction paper (if handwriting intro)

#### Entry Event

Students will look at their class’s data. The previous day, students should have stayed in a specific area, to allow for students to know where each class took data. Students will log onto the *iMapInvasives* website, and in their groups, students will analyze the class data by looking at patterns of species or locations. Students will need to use the “Identify/Measure” tool on *iMapInvasives* to show all the data for a given area. Students will then hypothesize two methods in which the invasive species could have arrived on the school grounds. As groups come up with these hypotheses, students should write them on the board for the class to see. There should be no duplicate hypotheses; challenge students to think outside of the box (20 minutes).

#### Activity

Student groups will use their field forms (see pages 24–27) to summarize the data they collected in the field and update their research posters. Students are to summarize their information in complete sentences. Images or data tables (density or town comparative data) are appropriate for this section of the poster (10 minutes).

#### Objectives:

Students will be able to:

- ◆ Assess the research methods and modify for any changes that may have occurred in the field; and
- ◆ Separate class data to point out issue areas on campus.

#### Summary

Students will review their methods sections and edit any part of the procedure they may have changed while in the field to update their research poster (10 minutes).

#### Teacher Tips

- ◆ The “Identify/Measure” tool is the circled image below. When using the “Identify/Measure” tool, click to create multiple points around the area the students want to see data for, creating a polygon, and double-click to finish the area. This will show the current data points in the area. Students may have to create a few different polygons at different scales to find data. There may not be data in a small scale depending on where you are looking. A few trials may be necessary.



## DAY 7: FIELD TRIP (OPTIONAL)

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### LENGTH WILL VARY

#### Driving questions:

- ◆ Can invaded landscapes recover?
  - ◆ What should the goal of restoration be?
  - ◆ Will invasive species return to a restored area?
- 

### Entry Event

Before the field trip, students will look at the geography of the park/preserve/land they will be visiting. Students will analyze the different transportation pathways, surrounding land types, and different human developments that may affect the land.

### Activity

When arriving at the park/preserve/land, students should try to identify different invasive species they may see, and note where they find them (side of the road, in the woods, etc.). Students will then listen to a presentation from a park/preserve official or land manager on how they deal with or manage invasive species.

Some discussion points for the presenter could be:

- ◆ What invasive species are on the land?
- ◆ Are they managing the invasive species? If not, why not?
- ◆ Are there any preventative measures they are taking to prevent invasive species from coming in?
- ◆ Are there any measures that visitors and students can take when coming to and leaving the park?

### Summary

Students will each write a thank-you letter to park staff discussing one thing they took away from the field trip. In the thank-you letter, students can provide suggestions on how staff and visitors can prevent the spread of invasive species.

### Teacher Tips

- ◆ Grants are available through NYS Office of Parks, Recreation and Historic Preservation to get funding to transport students of Title 1 schools to parks and recreational areas in New York State. For more information, visit <https://parks.ny.gov/environment/connect-kids/grant-program.aspx>.

## DAY 8: BIG PICTURE

### 40-MINUTE LESSON

#### Driving questions:

- ◆ What is New York State doing about invasive species?
- ◆ Is it realistic for scientists and land managers to eradicate all invasive species?

#### Objectives:

Students will be able to:

- ◆ Differentiate the infestation levels of invasive species; and
- ◆ Evaluate and summarize their research and learning for the group project.

#### Materials

- ◆ Poster
- ◆ Colored pencils/markers/construction paper (if handwriting)

#### Entry Event

On this final work day, students will be looking at the big picture of invasive species issues in New York State. Student groups will interact with the NYS-specific invasion curve within the unit PowerPoint, which explains what each level/part means and what some examples of each on the scale are. The PowerPoint then brings students through examples of prohibited and regulated species as defined by DEC (10 minutes).

#### Activity

The class or groups will look at a few examples of invasive species management in the state and how current science is powering each project. The PowerPoint focuses only on three examples, but students are encouraged to search for more examples online. This will show students that all infestations aren't manageable (15 minutes).

Students will then have time to summarize their project. Groups will develop the conclusion of their research posters (10 minutes). Information in this section should answer these questions:

- ◆ What did the group learn?
- ◆ What are some prevention strategies the school and students can take to stop invasive species from spreading?

#### Summary

Students will put any finishing touches on their research posters (5 minutes).

#### Teacher Tips

- ◆ There are many invasive species management projects occurring across the state. By reaching out to your PRISM (see pages 34–35), you can find out more about management projects that are occurring in your area.
- ◆ The prohibited and regulated species list is developed by DEC and can be found here: <http://www.dec.ny.gov/animals/99141.html>.

## DAY 9: POSTER SESSION

### 40-MINUTE LESSON

#### Driving questions:

- ◆ What have students learned about what invasive species are, how they arrive in new places, and how they can be managed and prevented?

#### Objectives:

Students will be able to:

- ◆ Reframe their research to their peers.

#### Materials

- ◆ Posters
- ◆ Question prompt sheets (see page 29)

#### Entry Event

Student groups will set up their posters spread out around the classroom or other location. Students will decide the order in which they will stay with the poster as a spokesperson. The poster session will be broken up into 5-minute segments to give students the opportunity to stand with the poster and describe their research to their peers (10 minutes).

#### Activity

Students will walk around and see other groups' posters and discuss their research with their peers, like a science fair. The session will be broken into 5-minute segments. Teacher will need to keep time so students can switch correctly at the poster. Students who are roaming the classroom will use prompts (see page 29) to start research conversations where they will record discussion points (20 minutes).

#### Summary

Students will clean up their posters and complete the independent post-unit assessment (see page 30). This worksheet asks students what they now know about invasive species and what they wish they learned more about during the unit. After the lesson, student work can be displayed outside the classroom or elsewhere in the school to show off their hard work! (10 minutes)

#### Teacher Tips

- ◆ Invite different audience members for students to present to and discuss their work with. Examples are: custodians, grounds personnel, administrators, and other classes, like elementary students working on plant units.

## DAY 10: ACTION/SERVICE-LEARNING DAY (OPTIONAL)

### 40-MINUTE LESSON BUT CAN VARY

#### Driving questions:

- ◆ How do natural resource professionals manage invasive species?
- ◆ What are some challenges that they face?

#### Materials

- ◆ Computers/Chromebooks/laptops/tablets
- ◆ Proper fieldwork clothing

#### Entry Event

The teacher and students will research the location where the class will be visiting. This may be a park, forest, preserve, or other natural area recommended by the local PRISM. The teacher will need to find a property that has an active land manager willing to work closely with the class and discuss what management strategies are feasible. Students should get a general idea of the layout of the location (geography, roads, public areas) as well as the recorded invasive species by using *iMapInvasives*, if any have been reported.

Students should keep the invasion curve in mind, from day 8, when researching and participating in the removal day.

#### Activity

Land managers carefully evaluate each site before any management activities take place.

#### PREVENTION:

If the natural area does not seem to have many invasive species, students will survey for the 10 common invasive species using *iMapInvasives* (see pages 32–33). Students should survey parking lots, forest edges, paths, and open areas for possible infestations.

#### ERADICATION:

If the natural area has a small infestation, students will work with land managers to remove invasive species. This will require students to pull, dig up, or use other methods desired by the manager, to remove the species. This species may not be one of the 10 common invasive species, so additional research may be needed in the entry event.

#### Objectives:

Students will be able to:

- ◆ Complete service-learning tasks to aid professionals in the invasive species management process; and
- ◆ Reflect on their experience managing invasive species.

#### CONTAINMENT:

If the natural area has an infestation that is too large to be eradicated, keeping the infestation from spreading is the ideal management strategy. If this is the case for the location the class is visiting, students will help contain the infestation by removing plants that have spread from the containment area or using other strategies the manager has planned. This will vary by species and management area.

#### LONG-TERM MANAGEMENT:

When an infestation has become so widespread that the previous levels of management will not be financially feasible or will require a lot of time and effort, using biological controls may be an option. Biological control (bio-control) is a method of controlling invasive species by using other organisms, such as insects. Bio-control species are carefully researched in a lab, where scientists measure the potential impacts the bio-control species may have on the environment. If they believe the bio-control species may have a negative impact on the environment, they will not recommend it for release. If the bio-control species has been shown to reduce an invasive species population without a negative impact on the environment, scientists may recommend it for release into the wild.

Student groups can choose one bio-control insect for purple loosestrife to research and develop a letter or poster to present/give to the local land manager. The different insects that students can choose to research are *Galerucella californiensis*, *G. pusilla*, *Nanophyes marmoratus*, and *Hylobius transversovittatus*.

## Summary

When students return to school, research groups will gather and discuss the benefits as well as the challenges they faced during the management activity. Students should focus on the following questions.

- ◆ What are some successes of the invasive species removal workday?
- ◆ Was this an easy or difficult task?
- ◆ What are some challenges you faced?
- ◆ Was this economically feasible?
- ◆ What are some ways to prevent this invasion? If it is a large infestation, what are some ways it could have been prevented from getting to this size?

After students have had an opportunity to discuss with their research group, students will come together, in a large circle, to discuss the same questions with the entire class.

## Teacher Tips

- ◆ Contact your local PRISM (see pages 34–35) to learn about projects your students can assist with.
- ◆ Make sure students are equipped with appropriate gear, such as sunscreen, sturdy shoes, long-sleeved shirts, long pants, etc.
- ◆ One bio-control that went terribly wrong was the cane toad in Australia. The video below describes how the bio-control didn't work as planned. Students could also watch the video, in addition to conducting research, then compare the differences between the bio-controls: <https://www.youtube.com/watch?v=6SBLf1tsoaw>.

# SUPPLEMENTAL MATERIALS

Name:

Date:

## WHAT ARE INVASIVE SPECIES?

What do *you* know about invasive species?

WRITE WHAT YOU ALREADY KNOW ABOUT INVASIVE SPECIES OR ABOUT WHERE YOU HAVE HEARD THE TERM BEFORE.

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What are some new facts you *learned from a partner* about invasive species?

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Name:

Date:

Group:

Day 1 & 2

## INVASIVE SPECIES RESEARCH NOTES

| Notes: | Source: |
|--------|---------|
|        |         |

| Notes: | Source: |
|--------|---------|
|        |         |

Name:

Date:

Group:

Day 3

## INVASIVE SPECIES OBSERVATIONS

| Species name: | Observation notes: | Observation drawing |
|---------------|--------------------|---------------------|
|               |                    |                     |

| Species name: | Observation notes: | Observation drawing |
|---------------|--------------------|---------------------|
|               |                    |                     |

Group Name:

Date:

Class:

Day 4

## FIELD RESEARCH FORM

Student group will choose a location in the class area to survey. This location should be spaced out from other groups.

The group will survey their location and identify any invasive species in the area. If there is more than one invasive species, the group should choose to focus on one, but should record if they saw other invasive species in the area in the “Notes” section.

|                                 |  |
|---------------------------------|--|
| Invasive species name           |  |
| Drawing/sketch                  |  |
| Stem count per 1m x 1m          |  |
| Approximate size of infestation |  |
| Infestation is (circle one)     | Single                  Sparse                  Clumped                  Saturated |

|   |  |
|---|--|
| <p><b>Map</b><br/>(please add a photo of the study area, aerial if available)</p> |  |
| <p><b>Notes</b></p>   |  |

|                                 |        |        |         |           |
|---------------------------------|--------|--------|---------|-----------|
| Invasive species name           |        |        |         |           |
| Drawing/sketch                  |        |        |         |           |
| Stem count per 1m x 1m          |        |        |         |           |
| Approximate size of infestation |        |        |         |           |
| Infestation is (circle one)     | Single | Sparse | Clumped | Saturated |

|   |  |
|---|--|
| <p><b>Map</b><br/>(please add a photo of the study area, aerial if available)</p> |  |
| <p><b>Notes</b></p>   |  |

Name:

Date:

Class:

Day 4

## PROCEDURE NOTE SHEET

|     |
|-----|
| 1.  |
| 2.  |
| 3.  |
| 4.  |
| 5.  |
| 6.  |
| 7.  |
| 8.  |
| 9.  |
| 10. |

Name:

Date:

Class:

Day 9

## POSTER SESSION QUESTION PROMPT SHEET

| Question:  | Discussion 1 | Discussion 2 |
|--|--------------|--------------|
| 1. What invasive species did your group find in the field?                         |              |              |
| 2. What can we do in our everyday lives to prevent the spread of invasive species? |              |              |
| 3. What did you learn from this project?   |              |              |
| 4. What part of the project did you enjoy most?                                    |              |              |
| 5. How could you continue research on invasive species following this project?     |              |              |

Name:

Date:

## WHAT ARE INVASIVE SPECIES?

What have you learned about invasive species?

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Are there any topics during the unit that you wish we talked about more?

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# ADDITIONAL RESOURCES

## 10 COMMON TERRESTRIAL INVASIVE SPECIES OF NEW YORK

| Name  | Leaves  | Stem  | Flower   | Fruit  |
|---|---|---|--|--|
| <b>Multiflora rose</b><br><i>Rosa multiflora</i>            | <ul style="list-style-type: none"> <li>• Compound leaves*</li> <li>• 5-11 leaflets with jagged, saw-like edges</li> </ul>                    | <ul style="list-style-type: none"> <li>• Smooth</li> <li>• Green</li> <li>• Thorny</li> </ul>    | <ul style="list-style-type: none"> <li>• White</li> <li>• 5 petals</li> </ul>    | <ul style="list-style-type: none"> <li>• Red "hips"</li> <li>• Produced late summer</li> </ul>    |
| <b>Common reed</b><br><i>Phragmites australis</i>           | <ul style="list-style-type: none"> <li>• Alternately arranged*</li> <li>• &gt;1 ft. in length</li> <li>• Smooth and lance shaped</li> </ul>  | <ul style="list-style-type: none"> <li>• Hollow</li> <li>• Rough texture</li> </ul>    | <ul style="list-style-type: none"> <li>• Feathery texture</li> </ul>   | <ul style="list-style-type: none"> <li>• Grayish seeds; appear fluffy due to the silky hairs that cover each seed</li> </ul>                            |
| <b>Oriental bittersweet</b><br><i>Celastrus orbiculatus</i> | <ul style="list-style-type: none"> <li>• Alternately arranged*</li> <li>• Teardrop shaped</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Young growth is green</li> <li>• Old growth is brown</li> <li>• Climbs along other plants and trees</li> </ul>  | <ul style="list-style-type: none"> <li>• Small and green</li> <li>• 5 petals</li> <li>• Clusters of 3-7</li> </ul>           | <ul style="list-style-type: none"> <li>• Forms clusters of 1-3 along the stem</li> <li>• Bright red</li> <li>• Can persist through winter</li> </ul>  |
| <b>Japanese barberry</b><br><i>Berberis thunbergii</i>      | <ul style="list-style-type: none"> <li>• Alternately arranged*</li> <li>• Paddle shaped</li> <li>• Various colors</li> </ul>               | <ul style="list-style-type: none"> <li>• Gray/brown bark</li> <li>• Sharp thorns along the stem</li> </ul>   | <ul style="list-style-type: none"> <li>• Pale yellow</li> <li>• Forms small clusters</li> </ul>                              | <ul style="list-style-type: none"> <li>• Shiny, red, egg-shaped berries</li> </ul>    |
| <b>Japanese knotweed</b><br><i>Fallopia japonica</i>        | <ul style="list-style-type: none"> <li>• Broad shield-shaped leaves with a flat base</li> </ul>    | <ul style="list-style-type: none"> <li>• Zig-zag shaped</li> <li>• Green and speckled with purple coloration</li> </ul>                                  | <ul style="list-style-type: none"> <li>• Creamy white in color</li> <li>• Form clusters of spikes along the stem</li> </ul>  | <ul style="list-style-type: none"> <li>• Small winged fruits</li> <li>• Seeds are triangular, shiny, small ~2.5 mm long</li> </ul>                    |

| Name  | Leaves   | Stem  | Flower  | Fruit  |
|---|--|---|---|--|
| <p><b>Common buckthorn</b><br/><i>Rhamnus cathartica</i></p>  | <ul style="list-style-type: none"> <li>• Alternately arranged*</li> <li>• Oval shaped and deeply veined</li> </ul>    | <ul style="list-style-type: none"> <li>• Gray</li> <li>• Stem tips often crowned with sharp thorns</li> </ul>  | <ul style="list-style-type: none"> <li>• Yellow-green in color</li> </ul>   | <ul style="list-style-type: none"> <li>• Produces many round shiny purple-black berry-like fruits in August and September</li> </ul>                  |
| <p><b>Mugwort</b><br/><i>Artemisia vulgaris</i></p>           | <ul style="list-style-type: none"> <li>• Alternately arranged*</li> <li>• Oval shaped</li> <li>• Deeply lobed*</li> </ul>   | <ul style="list-style-type: none"> <li>• Greenish-white in color</li> <li>• Smooth</li> </ul>                  | <ul style="list-style-type: none"> <li>• Greenish in color</li> <li>• Not easily visible</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Small - ~1 mm in diameter</li> </ul>   |
| <p><b>Honeysuckle</b><br/><i>Lonicera spp.</i></p>            | <ul style="list-style-type: none"> <li>• Oppositely arranged*</li> <li>• Oval shaped</li> </ul>    | <ul style="list-style-type: none"> <li>• Hollow stem with shredded bark</li> </ul>                            | <ul style="list-style-type: none"> <li>• Fragrant delicate flowers are typically white, yellow, or light pink</li> </ul>                 | <ul style="list-style-type: none"> <li>• When fruiting, many small red berries are produced in pairs along the stem</li> </ul>                       |
| <p><b>Garlic mustard</b><br/><i>Alliaria petiolata</i></p>    | <ul style="list-style-type: none"> <li>• 1st year: small rosette of hoof-shaped leaves with scalloped edges; 2nd year: heart-shaped leaves with toothed edges</li> </ul>  | <ul style="list-style-type: none"> <li>• Smooth and green</li> </ul>   | <ul style="list-style-type: none"> <li>• Rounded cluster at the top of the plant</li> <li>• 4 small white petals per flower</li> </ul>  | <ul style="list-style-type: none"> <li>• Thin pods that extend outward; contain black seeds</li> <li>• Produced in the second-year form</li> </ul>  |
| <p><b>Purple loosestrife</b><br/><i>Lythrum salicaria</i></p> | <ul style="list-style-type: none"> <li>• Oppositely arranged* or in whorls*</li> <li>• Lance shaped; small hairs</li> </ul>   | <ul style="list-style-type: none"> <li>• Green</li> <li>• Stiff and square in shape</li> </ul>               | <ul style="list-style-type: none"> <li>• Stems end in a bushy flower spike; 5-7 petals each</li> </ul>                                  | <ul style="list-style-type: none"> <li>• Small — less than 1 mm in length</li> </ul>    |

All photographs from Bugwood.org unless otherwise noted: Multiflora rose: 1. Chris Evans, University of Illinois 2. Rob Routledge, Sault College 3. Rob Routledge, Sault College 4. Chris Evans, University of Illinois **Common reed**: 1. Richard Gardner 2. Leslie J. Mehrhoff, University of Connecticut 3. Caleb Slemmons, National Ecological Observatory Network 4. Bruce Ackley, The Ohio State University **Oriental bittersweet**: 1. Chris Evans, University of Illinois 2. Chris Evans, University of Illinois 3. Leslie J. Mehrhoff, University of Connecticut 4. Leslie J. Mehrhoff, University of Connecticut **Japanese barberry**: 1. Chris Evans, University of Illinois 2. James H. Miller, USDA Forest Service 3. Leslie J. Mehrhoff, University of Connecticut 4. Barry Rice, sarracenia.com **Japanese knotweed**: 1. Barbara Tokarska-Guzik, University of Silesia 2. Nanna Borcherdt, Sitka Conservation Society 3. Milan Zubrik, Forest Research Institute - Slovakia 4. Jan Samanek, Phytosanitary Administration **Common buckthorn**: 1. Paul Wray, Iowa State University 2. Leslie J. Mehrhoff, University of Connecticut 3. Rob Routledge, Sault College 4. Chris Evans, University of Illinois **Mugwort**: 1. Ansel Oommen 2. Ohio State Weed Lab, The Ohio State University 3. Ohio State Weed Lab, The Ohio State University, 4. Bruce Ackley, The Ohio State University **Honeysuckle**: 1. David Cappaert 2. Leslie J. Mehrhoff, University of Connecticut 3. John M. Randall, The Nature Conservancy 4. Ryan Armbrust, Kansas Forest Service **Garlic mustard**: 1. Chris Evans, University of Illinois 2. Bruce Ackley, The Ohio State University 3. Chris Evans, University of Illinois 4. Chris Evans, University of Illinois **Purple loosestrife**: 1. Bruce Ackley, The Ohio State University, 2. Rob Routledge, Sault College 3. Linda Wilson, University of Idaho 4. Gary L. Piper, Washington State University

## \*KEY DEFINITIONS

### COMPOUND:

A leaf whose leaflets are attached to a single stem but have their own stalks.

### ALTERNATELY ARRANGED:

Leaves are attached to the stem singly and alternate sides along the stem.

### OPPOSITELY ARRANGED:

Leaves are attached to the stem in pairs that are directly across from one another.

### WHORLS:

Multiple leaves or branches growing from a node.

### NODES:

Structures on stems that hold leaves or buds.

### LOBED:

Leaves with distinct protrusions, either rounded or pointed.

## PARTNERSHIPS FOR REGIONAL INVASIVE SPECIES MANAGEMENT

### NEW YORK STATE PRISMs

Invasive species are organisms that are not native to an area, and that harm human health, the economy, or the environment.

#### What Are PRISMs?

Partnerships for Regional Invasive Species Management (PRISMs), comprising diverse stakeholder groups, were created to address threats posed by invasive species across New York State. PRISMs are key to New York's integrated approach to invasive species management. Partners include federal and state agencies, natural resource/land managers, non-governmental organizations, industry, outdoors enthusiasts, and interested community members. The New York State Department of Environmental Conservation provides financial support, via the Environmental Protection Fund, to the host organizations that coordinate each of the eight PRISMs, resulting in statewide coverage.

#### What Do PRISMs Do?

- ◆ Plan regional invasive species management activities
- ◆ Implement invasive species prevention programs
- ◆ Conduct surveillance and mapping of invasive species infestations
- ◆ Detect new infestations early and respond rapidly
- ◆ Implement control projects
- ◆ Implement habitat restoration and monitoring
- ◆ Educate stakeholders on invasive species and their impacts
- ◆ Coordinate PRISM partners
- ◆ Recruit and train volunteers
- ◆ Support research through citizen science in collaboration with the Invasive Species Research Institute: <http://www.nyisri.org/>.
- ◆ Report observations to iMapInvasives: <http://www.nyimainvasives.org/>.
- ◆ Act as regional communication hubs



## HOW DO I JOIN A PRISM?

| Regional PRISM Contacts                                       |   |   |   |
|---|---|---|---|
| PRISM   | Host  | Contact   | Listserv & Websites   |
| APIPP<br>Adirondack Park<br>Invasive Plant<br>Program         | The Nature<br>Conservancy                                 | Tamarra Van Ryn<br>518-576-2082<br>tammara.vanryn@tnc.org     | cce-apipp-l-request@cornell.edu<br><a href="http://adkinvasives.com/">http://adkinvasives.com/</a>                            |
| Capital Mohawk  | Cornell<br>Cooperative<br>Extension of<br>Saratoga County | Kristopher Williams<br>518-885-8995<br>kbw44@cornell.edu      | cce-capitalprism-l-request@cornell.edu<br><a href="http://www.capitalmohawkprism.org/">http://www.capitalmohawkprism.org/</a> |
| CRISP<br>Catskill Regional<br>Invasive Species<br>Partnership | Catskill Center for<br>Conservation and<br>Development    | John Thompson<br>845-586-2611<br>jthompson@catskillcenter.org | cce-crisp-l-request@cornell.edu<br><a href="http://catskillinvasives.com/">http://catskillinvasives.com/</a>                  |
| Finger Lakes  | Hobart and William<br>Smith Colleges                      | Hilary Mosher<br>315-781-4385<br>mosher@hws.edu               | cce-flprism-l-request@cornell.edu<br><a href="http://fingerlakesinvasives.org/">http://fingerlakesinvasives.org/</a>          |
| LIISMA<br>Long Island<br>Invasive Species<br>Management Area  | Long Island Native<br>Plant Initiative                    | Bill Jacobs<br>631-560-9945<br>liismaprism@gmail.com          | cce-liisma-l-request@cornell.edu<br><a href="http://www.liisma.org/">http://www.liisma.org/</a>                               |
| Lower Hudson  | New York -<br>New Jersey<br>Trail Conference              | Linda Rohleder<br>201-512-9348<br>lrohleder@nynjtc.org        | cce-hudsonprism-l-request@cornell.edu<br><a href="http://lhprism.org/">http://lhprism.org/</a>                                |
| SLELO<br>Saint Lawrence<br>and Eastern Lake<br>Ontario        | The Nature<br>Conservancy                                 | Rob Williams<br>315-387-3600<br>rwilliams@tnc.org             | cce-slelo-l-request@cornell.edu<br><a href="http://www.sleloinvasives.org/">http://www.sleloinvasives.org/</a>                |
| Western New York  | Buffalo State   | Andrea Locke<br>716-878-4708<br>lockeas@buffalostate.edu      | cce-westernprism-l-request@cornell.edu<br><a href="http://www.wnyprism.org/">http://www.wnyprism.org/</a>                     |

For more information on PRISM meetings and activities and how you can become involved, visit the website of the PRISM in which you are interested, or contact the coordinator listed above for the PRISM. To improve communication within and among PRISMs, email listservs, managed by the Cornell Cooperative Extension Invasive Species Program, have been established for each of the eight PRISMs. To subscribe to a PRISM listserv, email the appropriate listserv address in the table above. In the subject line, type the single word "join" (without the quotes). Leave the body of the message blank; do not include a signature block or any other text in the body of the email.

## Invasive Species Coordination Unit

Division of Lands and Forests, Bureau of Invasive Species and Ecosystem Health

NEW YORK STATE  
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

625 Broadway 5th Floor, Albany, NY 1223-4253  
P: (518) 402-9405 | [isinfo@dec.ny.gov](mailto:isinfo@dec.ny.gov)

[www.dec.ny.gov](http://www.dec.ny.gov)



Department of  
Environmental  
Conservation