Invasive Species Research Project

For middle and high school classrooms

Day 1: Introduction to invasive species

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Day 1: Project introduction

What is an invasive species?

Objectives:
1. Brainstorm
2. Introduction video
3. Project introduction
4. Research

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Day 1: Project introduction

What is an invasive species?

Think – Pair – Share

- What you know about invasive species?
- Where you have heard this term?
- Do you know of any examples?

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Day 1: What is an invasive species?

Videos:

- [The threat of invasive species](#)
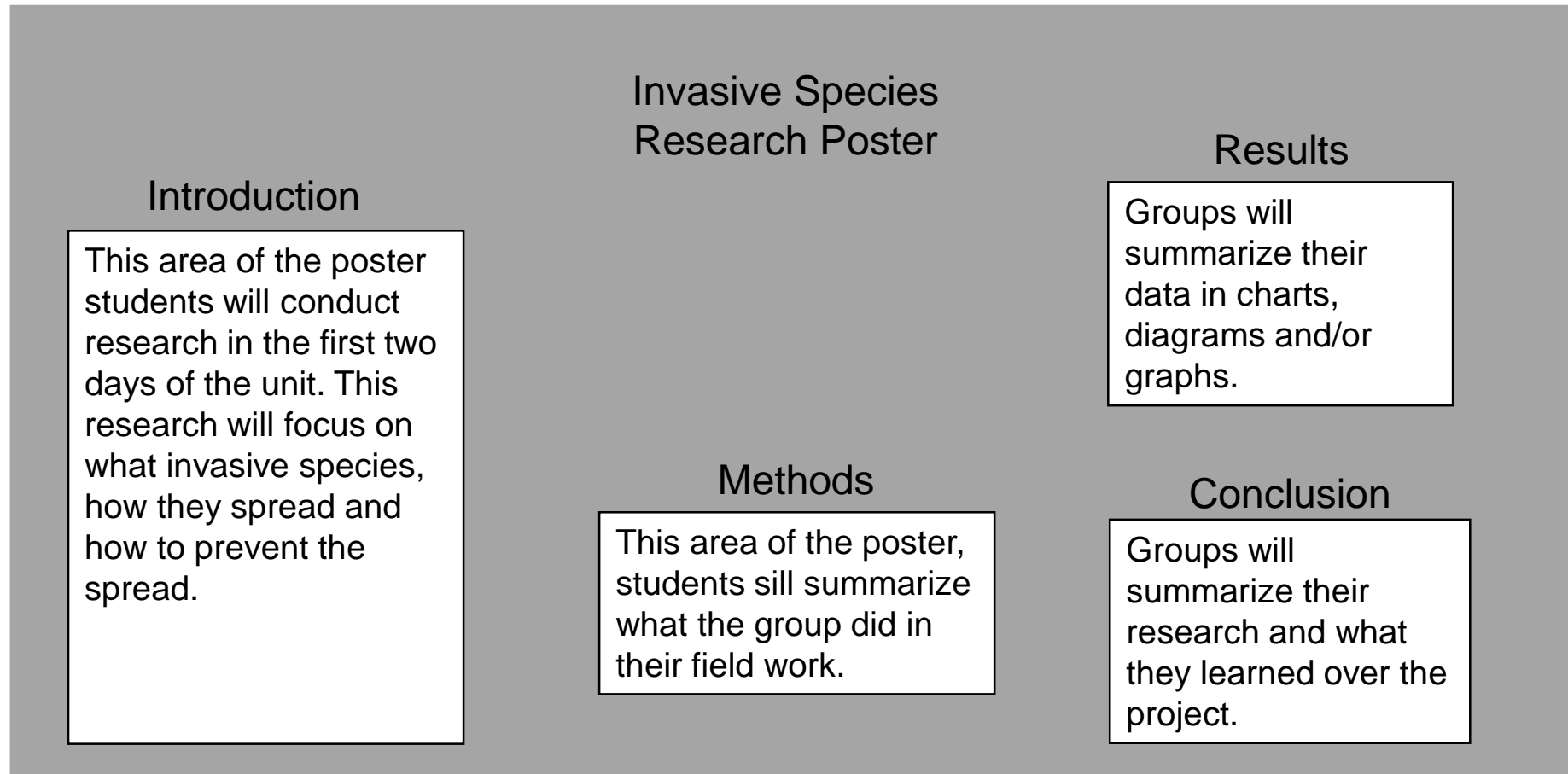- [Preventing the introduction and spread of invasive species in New York](#)

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Day 1: Student groups

Day 1: What are you doing in your research groups?

- Each group will be conducting their own research to develop a scientific poster.

- This research will be done over the next two weeks of class.
  - Including field research (the class going outside to collect data)

- Each day groups will be working on different parts of the scientific poster. These parts include:
  1. Introduction. 2. Methods. 3. Results. 4. Conclusion.

- At the end of the unit, each group will present their research in a poster session.
  - Poster sessions are like a science fair where people walk around and discuss their research.

Day 1: Research poster example

Invasive Species
Research Poster

Introduction

This area of the poster students will conduct research in the first two days of the unit. This research will focus on what invasive species, how they spread and how to prevent the spread.

Results

Groups will summarize their data in charts, diagrams and/or graphs.

Methods

This area of the poster, students sill summarize what the group did in their field work.

Conclusion

Groups will summarize their research and what they learned over the project.

Day 1: Research poster

- **Introduction**:
  - This part of the poster is to introduce the reader on the background of your project
  - Research questions:
    - What is an invasive species?
    - How do invasive species impact our lives?

Day 2: Risk of spread

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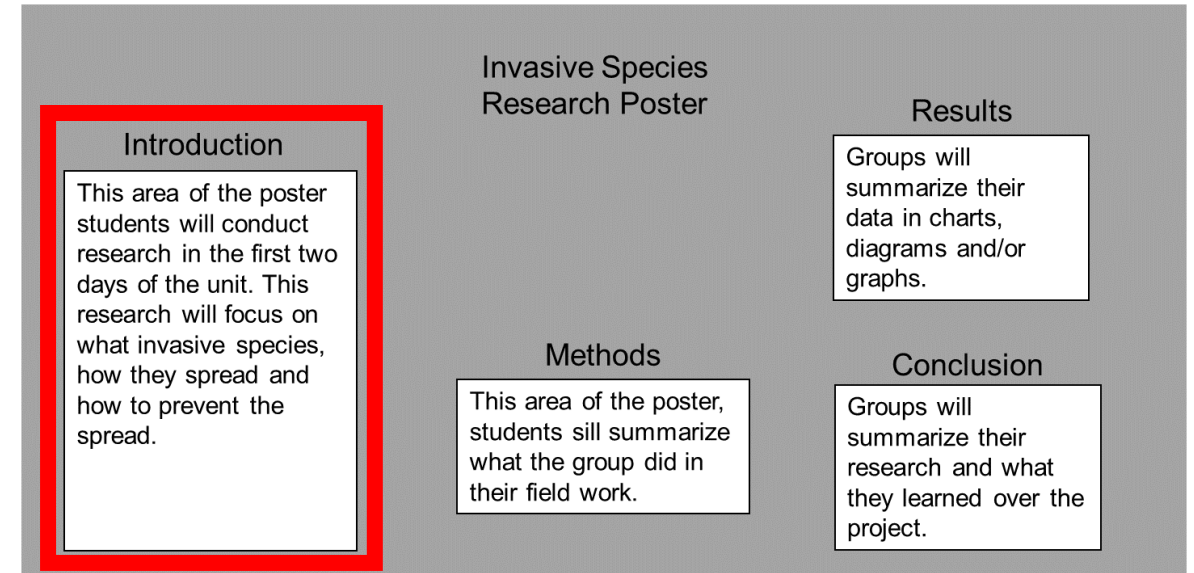
Day 2: Risk of spread

Objectives:

1. Map analysis
2. Research
3. Introduction writing

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Day 2: Map exploration

- Use Google maps or paper maps to observe the different natural and man-made transportation pathways.

- Predict different "hotspots" that invasive species are likely to be found
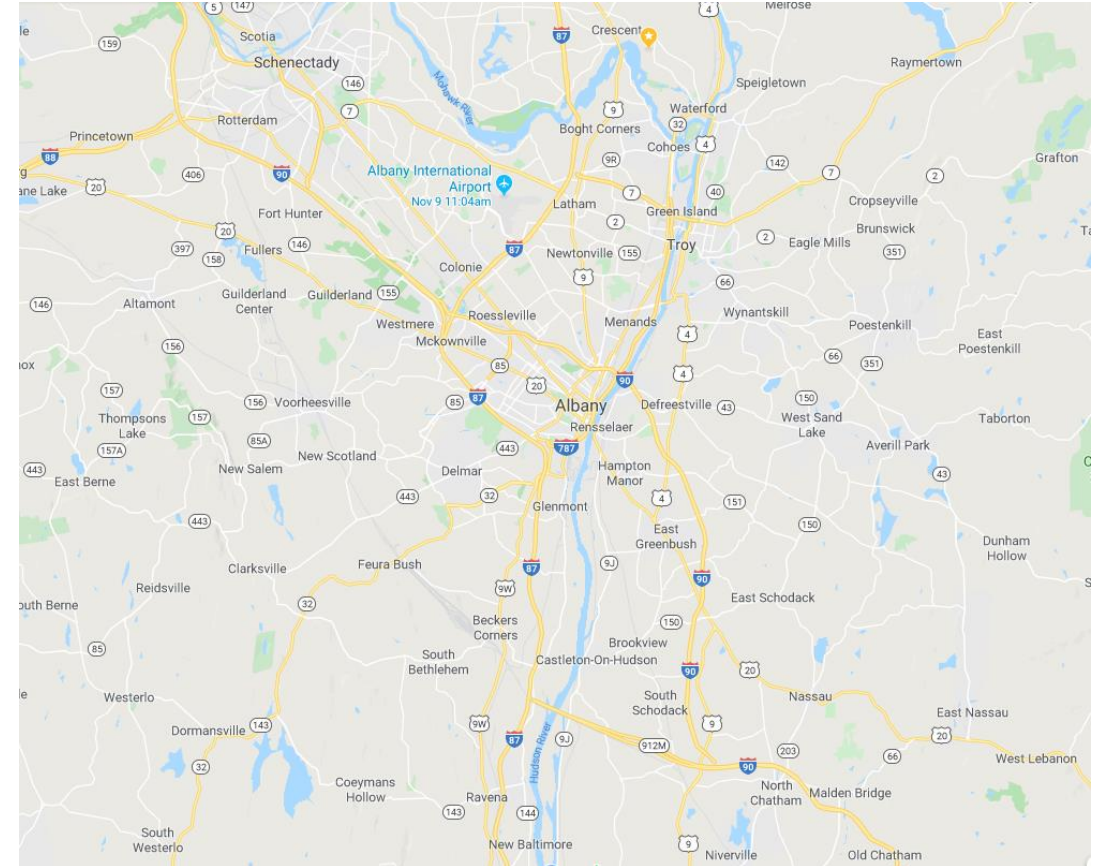
Day 2: Research poster

- Continue writing the introduction of your research poster
- Research questions:
  - What is an invasive species?
  - How do invasive species impact our lives?
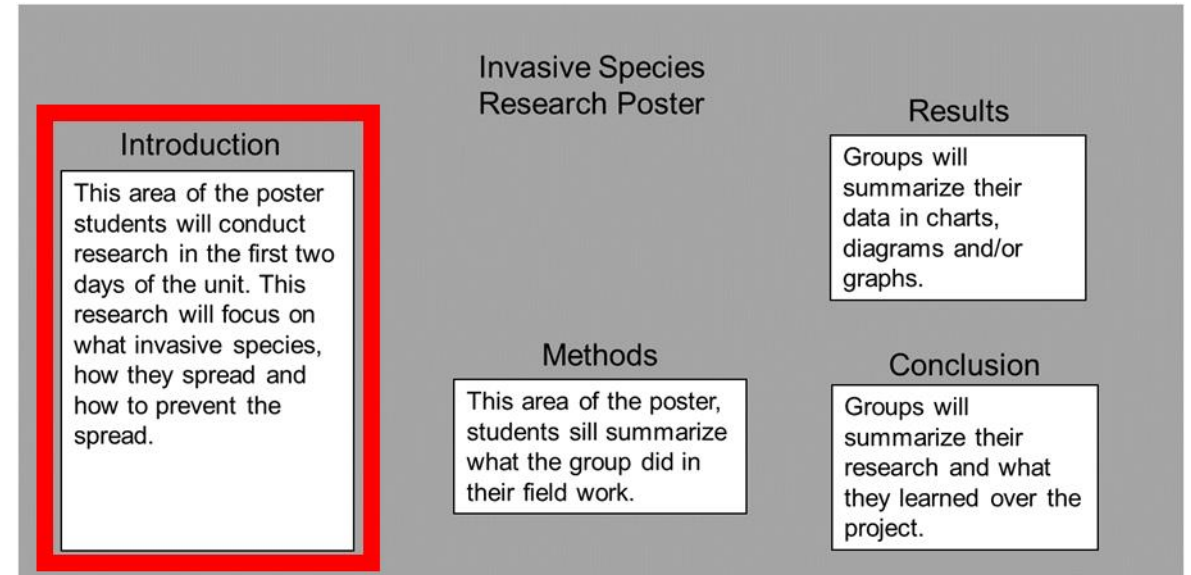
Day 3: Plant identification

Day 3: Plant identification

Goals:
1. Invite speaker or teacher lead discussion
2. Plant identification workshop
3. Student observation

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Name	Leaves	Stem	Flower	Fruit
Multiflora rose (*Rosa multiflora*)	- Compound leaves* - 5-11 leaflets with jagged, saw-like edges 	- Smooth - Green - Thorny 	- White - 5 petals 	- Red "hips" - Produced late summer
Common reed (*Phragmites australis*)	- Alternately arranged* - >1 ft. in length - -Smooth and lance shaped 	- Hollow - Rough texture 	- Feathery texture 	- Grayish seeds; appear fluffy due to the silky hairs that cover each seed

Name	Leaves	Stem	Flower	Fruit
Oriental bittersweet (*Celastrus orbiculatus*)	- Alternately arranged* - Teardrop shaped 	- Young growth is green - Old growth is brown Climbs along other plants and trees 	- Small and green - 5 petals - Clusters of 3-7 	- Form clusters of 1-3 along the stem - Bright red - Can persist through winter
Japanese barberry (*Berberis thunbergii*)	- Alternately arranged* - Paddle-shaped - Various colors 	- Gray/brown bark - Sharp thorns along the stem 	- Pale yellow - Forms small clusters 	- Shiny red egg-shaped berries

Name	Leaves	Stem	Flower	Fruit
Japanese knotweed (*Fallopia japonica*)	- Alternately arranged* - Broad shield-shaped leaves with a flat base	- Zig-zag shaped - Green and speckled with purple coloration	- Creamy white in color - Form clusters of spikes along the stem	- Small winged fruits - Seeds are triangular, shiny, small ~2.5 mm long
Common buckthorn (*Rhamnus cathartica*)	- Alternately arranged* - Oval shaped and deeply veined	- Gray - Stem tips often crowned with sharp thorns	- Yellow-green in color	- Produces many round shiny purple-black berry-like fruits in Aug. & Sept.

Name	Leaves	Stem	Flower	Fruit
Mugwort (*Artemisia vulgaris*)	- Alternately arranged* - Oval shaped - Deeply lobed* 	- Greenish-white in color - Smooth 	- Greenish in color - Not easily visible 	- Small - ~1 mm in diameter
Honeysuckle (*Lonicera spp.*)	- Oppositely arranged* - Oval shaped 	- Hollow stem with shredded bark 	- Fragrant delicate flowers are typically white, yellow or light pink 	- When fruiting, many small red berries are produced in pairs along the stem

Name	Leaves	Stem	Flower	Fruit
Garlic mustard (*Alliaria petiolata*)	- 1st year: small rosette of hoof shaped leaves with scalloped edges; 2nd year: heart shaped leaves with toothed edges	- Smooth and green	- Rounded cluster at the top of the plant - 4 small white petals per flower	- Thin pods that extend outward; contain black seeds - Produced in the second year form
Purple loosestrife (*Lythrum salicaria*)	- Oppositely arranged* or in whorls* - Lance shaped; small hairs	- Green - Stiff and square in shape	- Stems end in a bushy flower spike; 5-7 petals each	- Small – less than 1 mm in length

Day 3: Plant identification

*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.

Day 3: Plant identification

*Key definitions:

- **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.

Day 3: Plant identification

*Key definitions:

- **Lobed**: Leaves with distinct protrusions, either rounded or pointed.

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Day 3: Observation instruction

- Groups will divide the species examples, in the classroom, up between group members. Each member will become an "expert" on the chosen species.

- Students will record the name of the species and draw a leaf, stem and flower (if available) on the observation sheets.
  - **Observations are detailed drawing of a specimen. This does not require for you to be an artist however each drawing should take time and be detailed.**

- When students are finished with their observations, group members will share their observations with their group.

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Day 4: *i*MapInvasives introduction

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How do you report an invasive species?

Goals:

1. iMap database and mobile walk-through
2. Field work introduction
3. Methods writing

Day 4: *i*MapInvasives introduction

- *i*MapInvasives is New York's invasive species database and mapping tool
- It is used to document and share invasive species observations
- Website: https://www.nyimapinvasives.org
- Mobile app: Download app from Google Play or iOS AppStore(search for "imapinvasives")

Day 4: How to log onto *i*MapInvasives
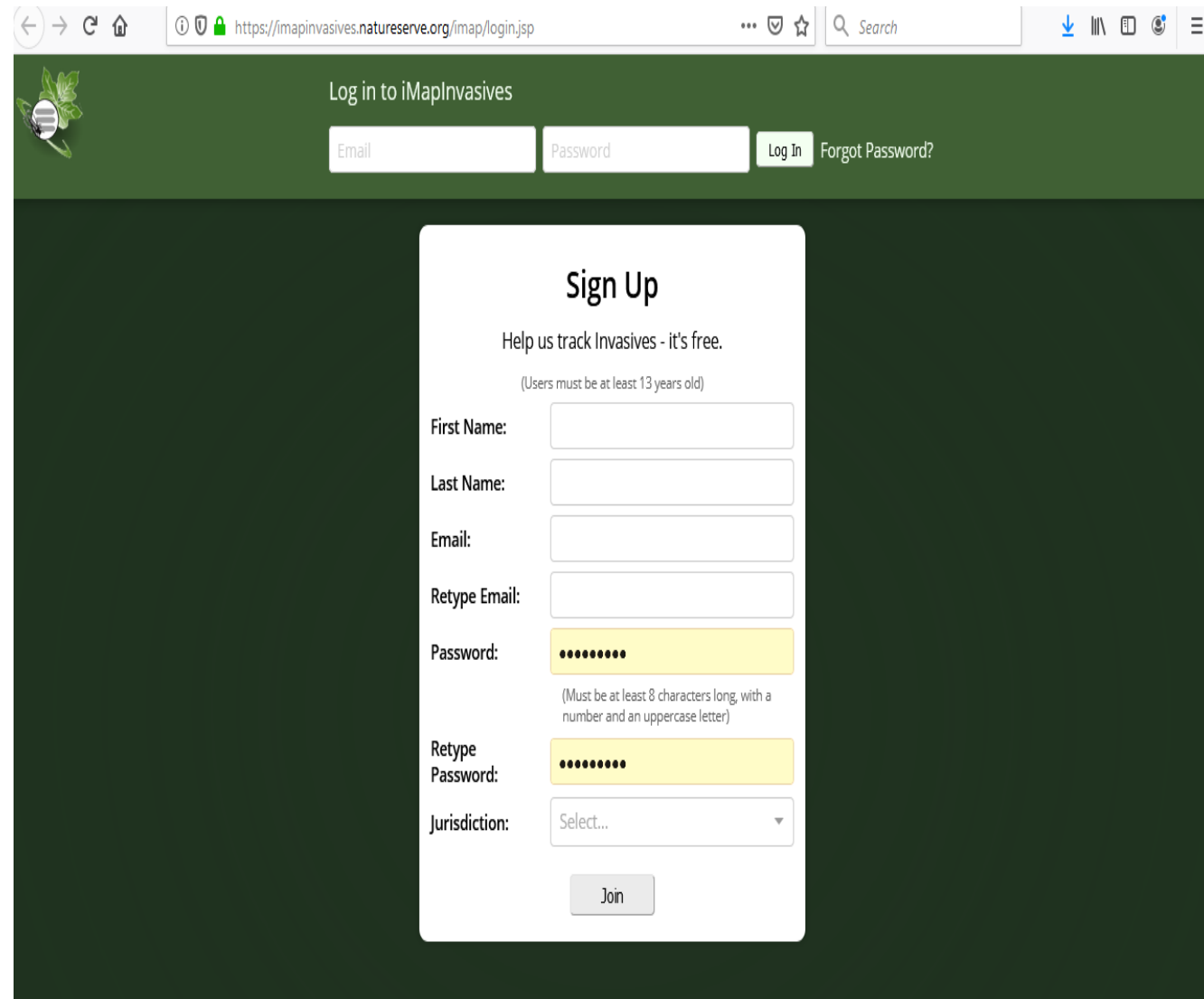
- Go to https://www.nyimapinvasives.org/
- Press the login button in the upper right
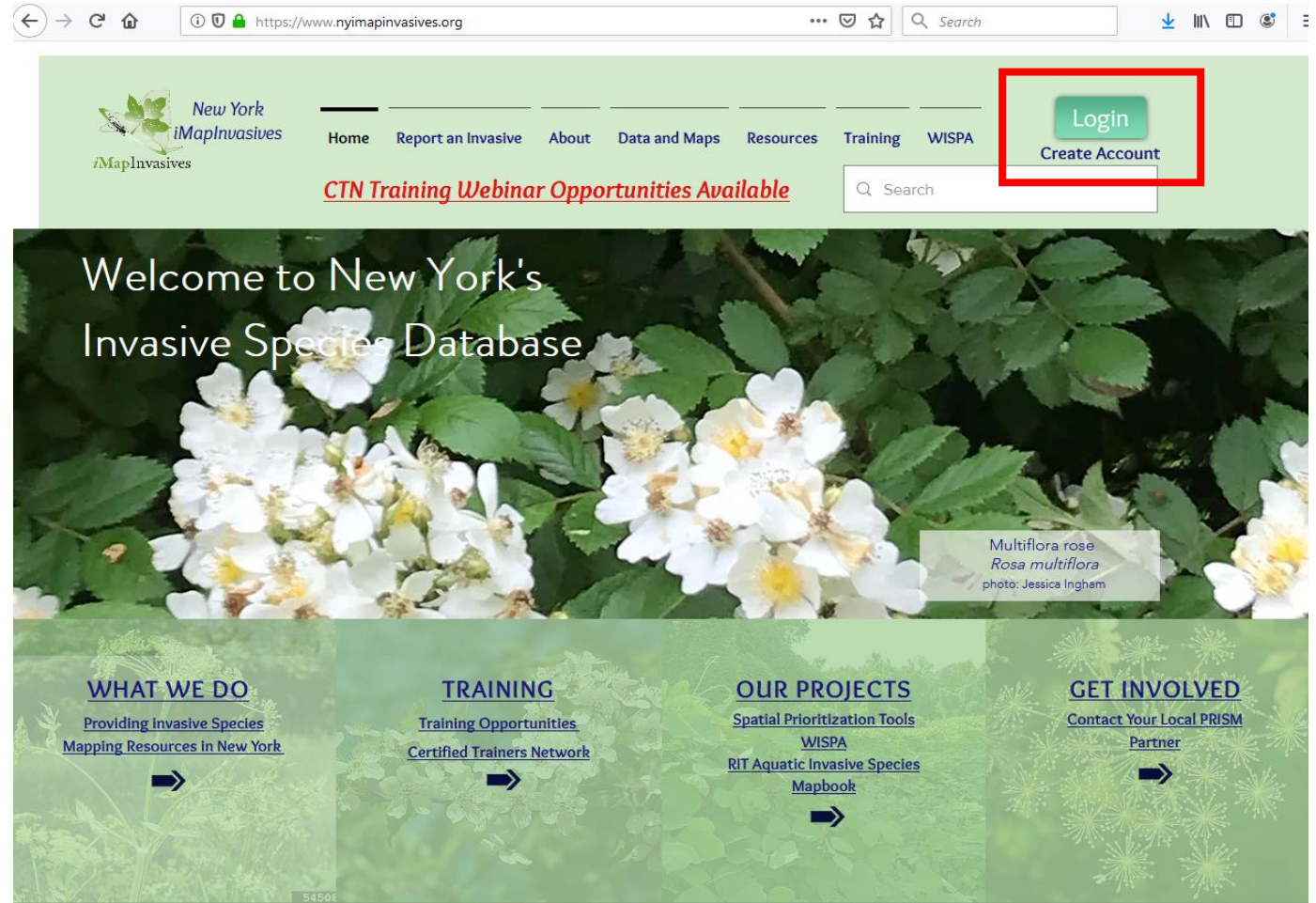
Day 4: How to log onto *i*MapInvasives

- Login with the email and password that your teacher provides
  - If over the age of 13, you may create your own account

Day 4: How to log onto *i*MapInvasives

- Once logged in, you will see the screen on the right
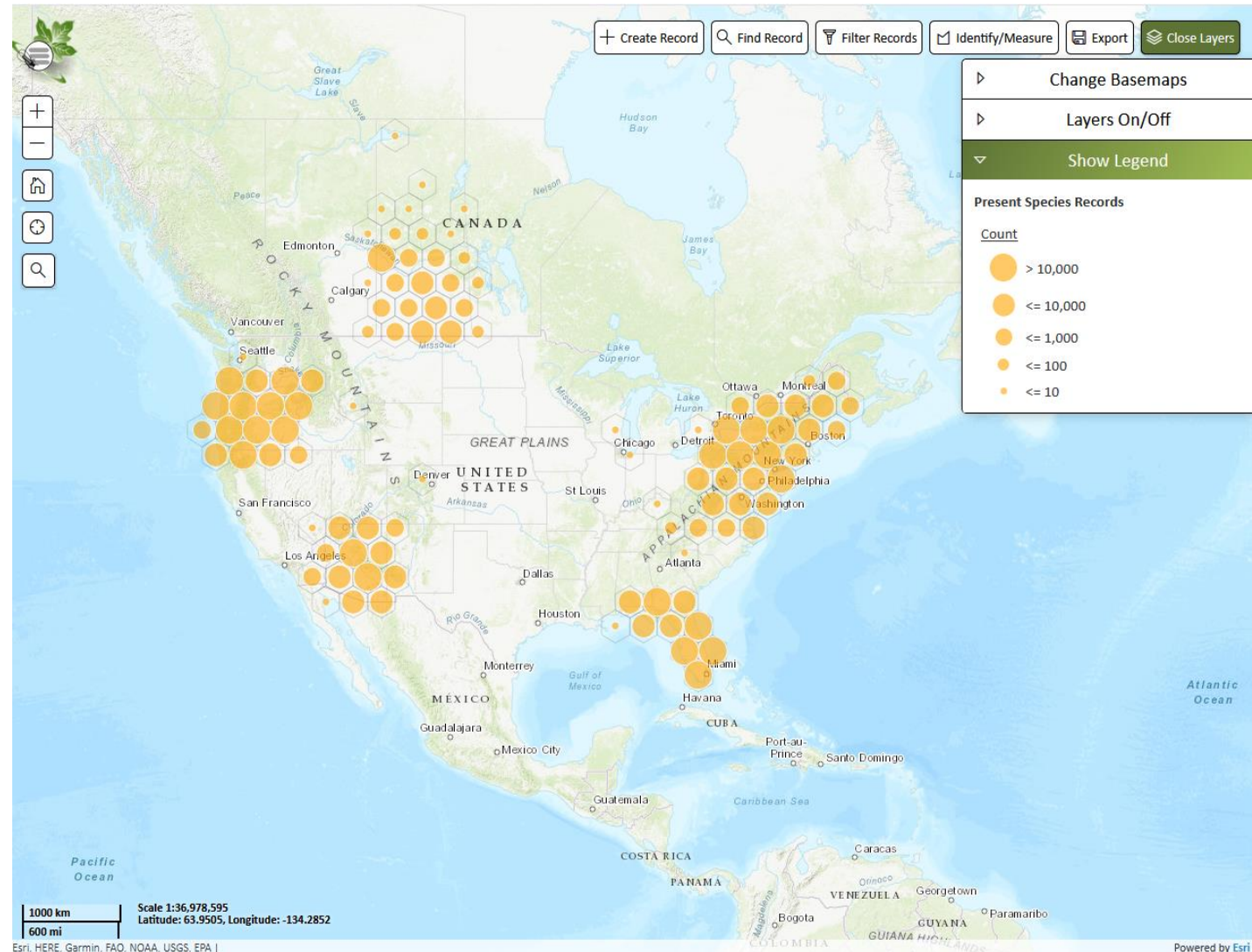
Day 4: How to use the online map

- Zoom in or out using the + or – buttons

- You can change the base maps to topographic, satellite, etc.
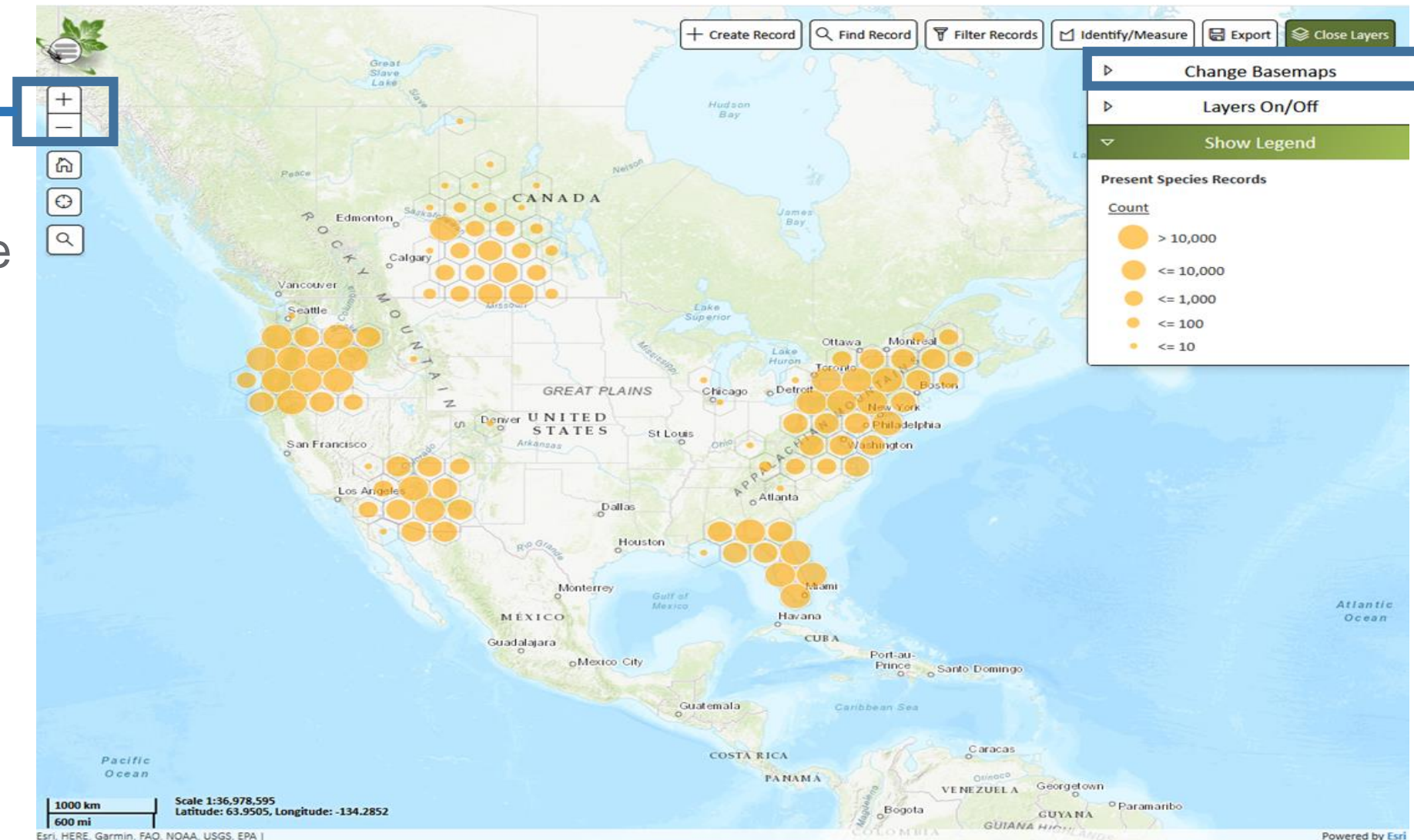
Day 4: How to use the online map

- You can search for a specific location by entering an address or GPS coordinates by using the 'magnifying glass' tool
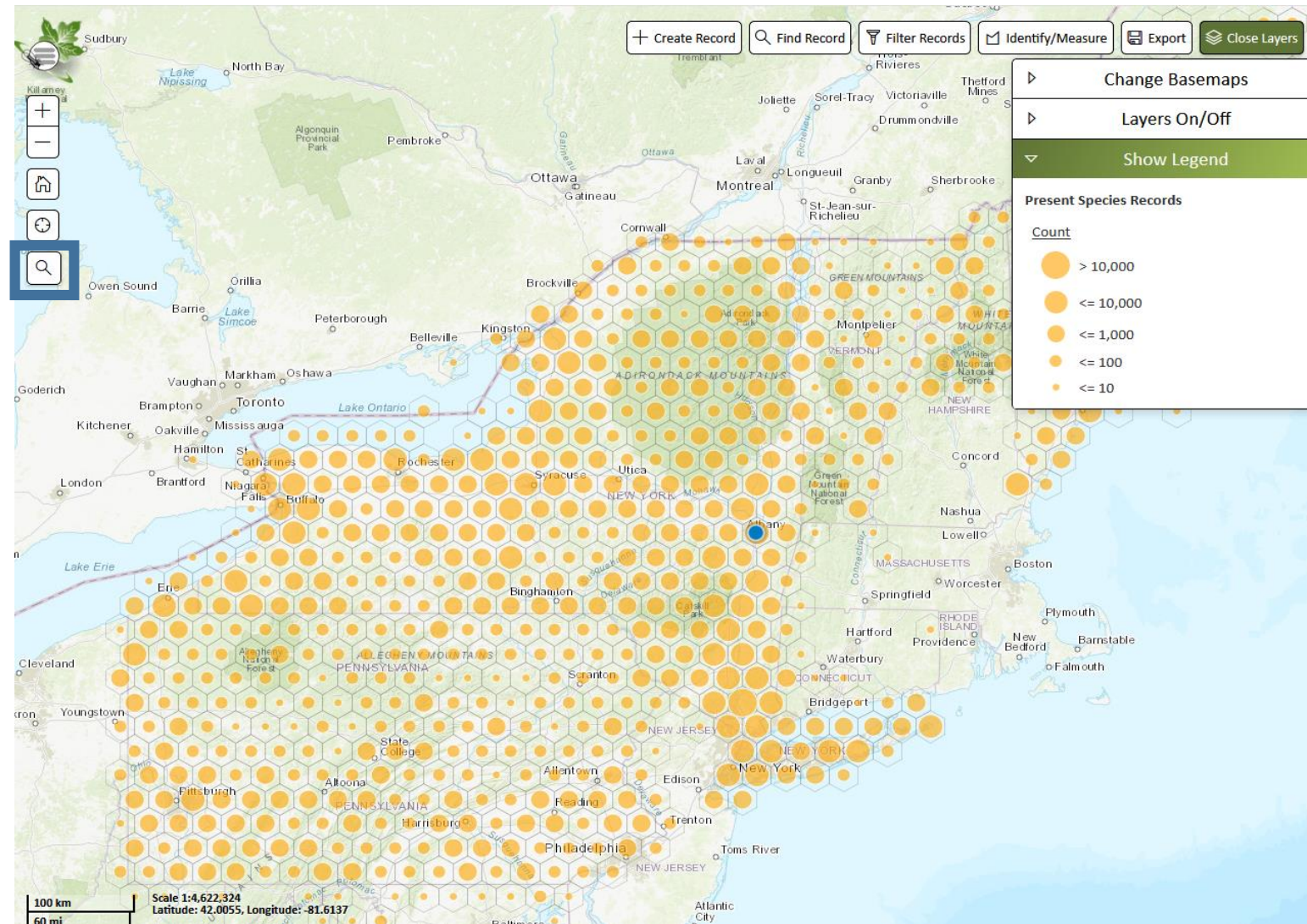
Day 4: How to use the online map

- You can input data by pressing the 'Create Record' button
  - If you want to test creating a record, try using the 'Fake species (for testing)' option!

Day 4: How to use the online map

- The lasso tool allows you to click and draw a boundary around features you want to ID.

- Click the 'Identify/Measure' button and draw a boundary. Double-click to close the boundary and click 'See What's Here' to open a list of all the invasive species found in that area.

Day 4: How to use the online map

Day 4: How to use the mobile app

- Search " imapinvasives" on your phone's app store
- Download is FREE
- Android Users- Play Store
- iPhone Users- App Store
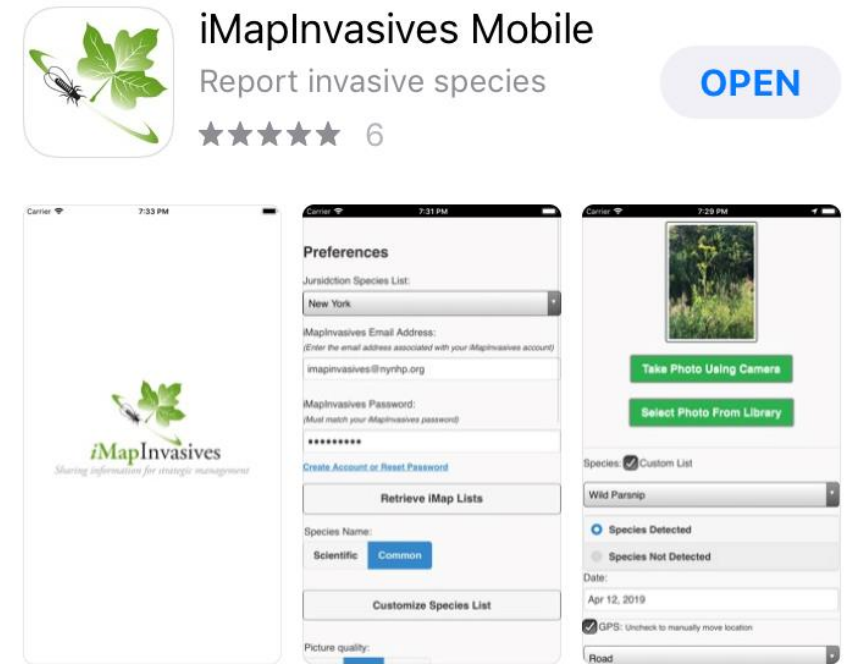
Day 4: How to use the mobile app

During download:

- Allow iMap to access your location
- **iPhone Users**: Settings-Privacy-Location Services (camera)- iMapApp
- **Android Users**: Settings- Privacy & Safety- Locations- On

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Day 4: How to use the mobile app

- Once the app is downloaded you will see a welcome screen similar to the one pictured
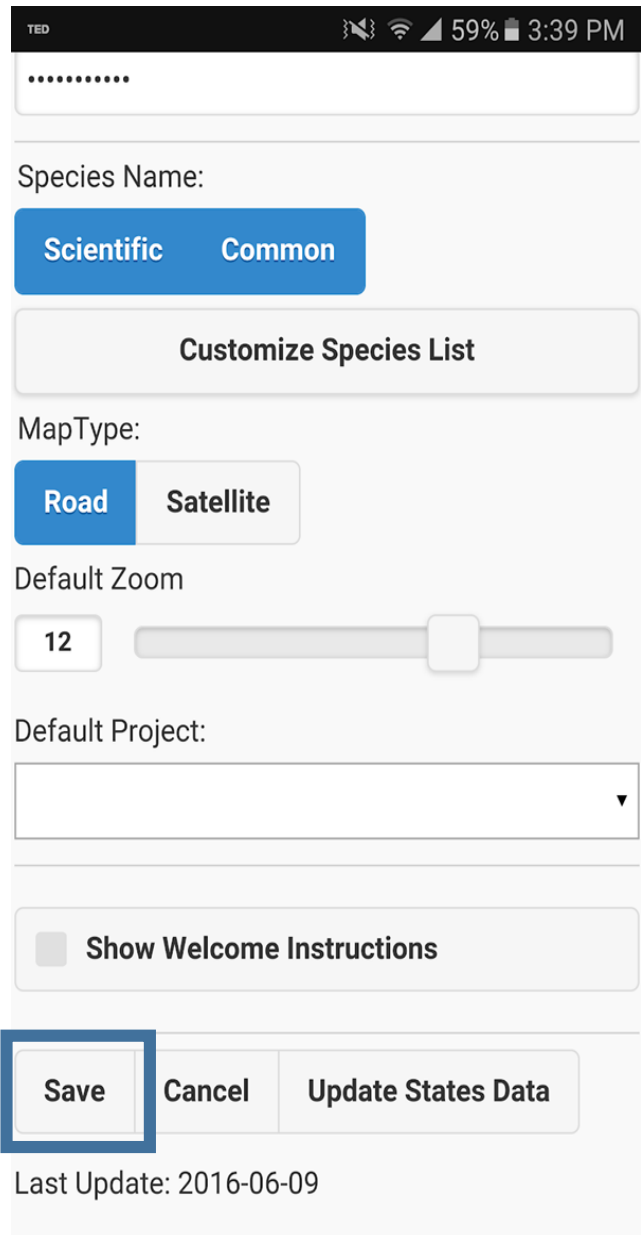
Day 4: How to use the mobile app

- The first thing you will need to do before using the app is to set your preferences

- **Set Preferences (Required):**
  - Main Menu- Preference
  - State = New York
  - iMap Username and Password
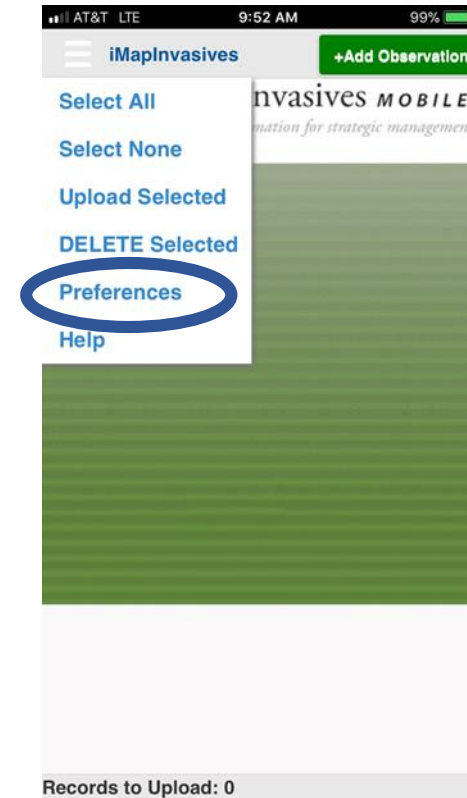
Day 4: How to use the mobile app

- Change how the species names are displayed in your app. You can select either one or both.

- **Customize Species List**: Allows you select to the species with which you'll be working with most often. This can be time efficient as you will not have to scroll through the entire species list every time you enter a point. This can be changed at any time.

- Always hit "**Save**" after you've made your changes to lock them in.

Day 4: How to use the mobile app

- How to add an observation:
  - Make sure your phone's GPS is on and able to interact with the app
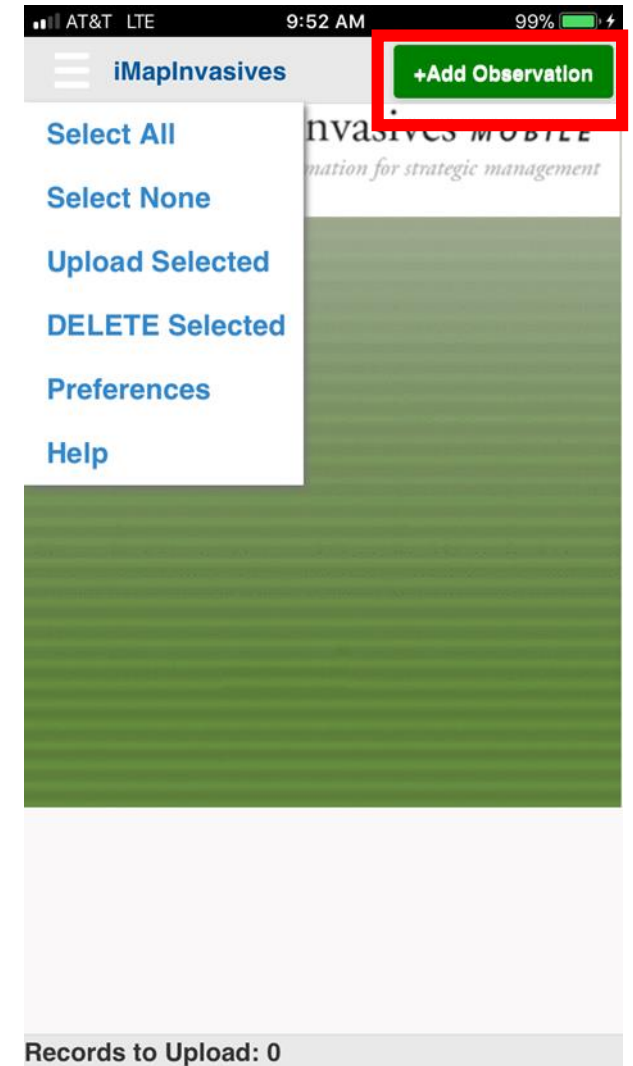
Day 4: How to use the mobile app

- How to add an observation:

Take photo with camera

Upload photo from library

Enable your custom species list

Select Species

Select Detected or Not Detected

Select Date

Take Photo Using Camera

Select Photo From Library

Species: ☑ Custom List

None Selected

⬤ Species Detected

⬤ Species Not Detected

Date:

04/09/2019

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Day 4: How to use the mobile app

- How to add an observation:

Your location

Your coordinates: If 0,0 is displaying in the Location box, make sure your GPS is enabled on your device

Day 4: How to use the mobile app

- How to add an observation:

iMap 3 Project: (Optional)

iMap 3 Organization: (Optional)

Time Searched (in minutes):

Observation Comments:

Save   Cancel
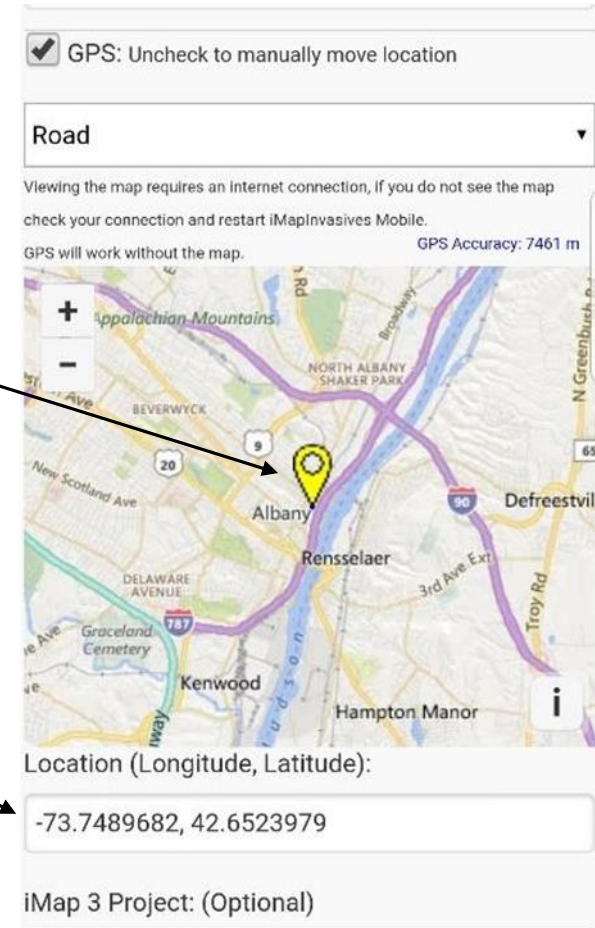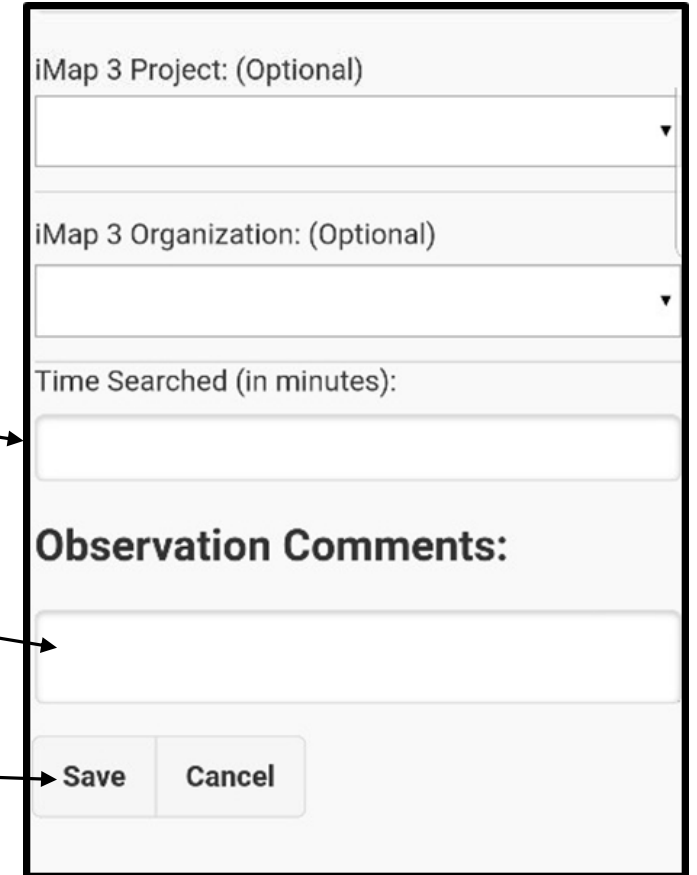
Enter the approximate time you were searching for invasive species

Add any comments that may enhance the quality of your observation report

Don't forget to save your changes!

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Day 4: How to use the mobile app

Uploading your observations:

If you do not want to upload all points at this time, you can manually select the ones to be uploaded

Day 4: Field day procedure

- Each student group will have the following materials:
  - Clipboard with field form
  - Pencil
  - Hand lenses
  - One smart device with *i*Mapinvasives downloaded and set preferences.
- All students will move outdoors to the class survey section.
- Each group will stay together to collect data. Groups will survey the area and find one invasive species to add to the *i*Mapinvasives database. After adding the data, groups will fill out the information on the field sheet to be used the next day for analysis.
- Class groups should spread out over the designated area to find different infestations.

Day 4: Field day procedure

- **Each student group should only plot one invasive species on the *i*Mapinvasives app.** This is to ensure the *i*Mapinvasives 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. Multiple points in the same area are not as effective as defining the infestation as is inputting one point that describes the density and size.

Day 5: Field work

Day 5: Field day

What invasive species are on the school campus?

Goals:

1. Field review
2. Field work
3. Upload data

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Day 5: Tools each group needs:

- Clipboard
- Field sheet
- 10 common invasive species sheet
- Student observation (from plant ID day)
- Hand lenses
- Pencil
- One Smart Device

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Day 6: Data analysis

Day 6: Data analysis

What did groups find?

Goals:

1. iMap observations
2. Field sheet data summary
3. Methods review

Day 6: Data analysis

- Student groups should start their analysis by logging on to *i*MapInvasives and review the class observations.

- Following, groups will review their data and create a chart or graph for the research poster.

- After data is added to the poster, students should review the methods and finalize.

Invasive Species
Research Poster

Introduction
This area of the poster students will conduct research in the first two days of the unit. This research will focus on what invasive species, how they spread and how to prevent the spread.

Methods
This area of the poster, students sill summarize what the group did in their field work.

Results
Groups will summarize their data in charts, diagrams and/or graphs.

Conclusion
Groups will summarize their research and what they learned over the project.

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Day 7: Optional field trip

Day 8: Big picture

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Day 8: Big picture

What are scientists and natural resource professionals doing about invasive species?

Goals:

1. Invasion curve
2. Current management
3. Project summary writing

Day 8: the invasion curve

Prevention: Low-cost way to stop the establishment of new invasive species. How:
- Trade restrictions on plants and animals.
- Education
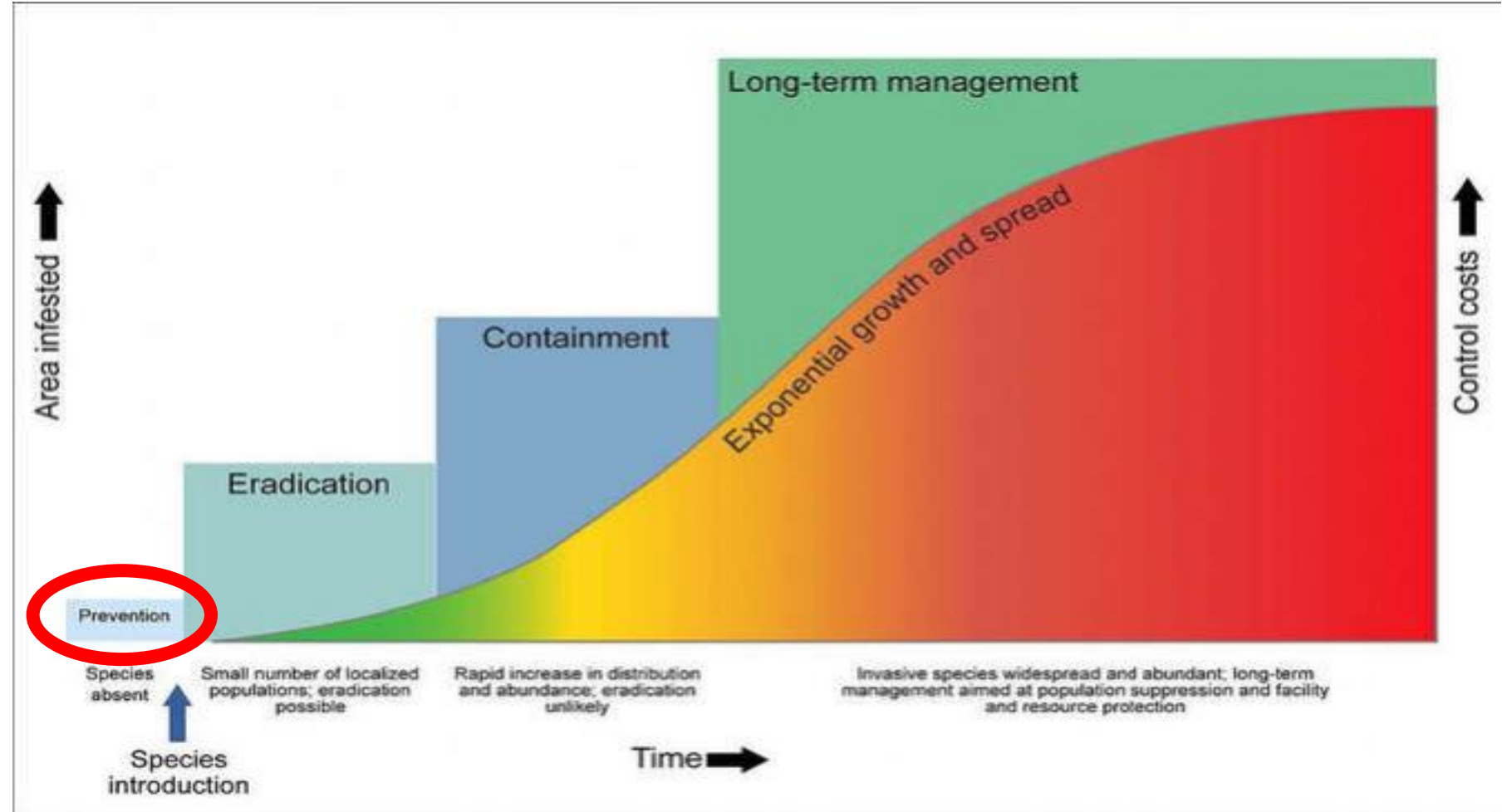
The invasion curve shows how time continues, without intervention, invasive specie will increase in infested are and how much they will cost to control (axes)

Day 8: the invasion curve

Eradication: small infestations allow for the removal of the entire invasive species in an area. This is more expensive than prevention. Early detection and Rapid response (EDRR) are important to ensure the infestation doesn't get to the next level of the curve. Citizen science programs are extremely useful for EDRR.
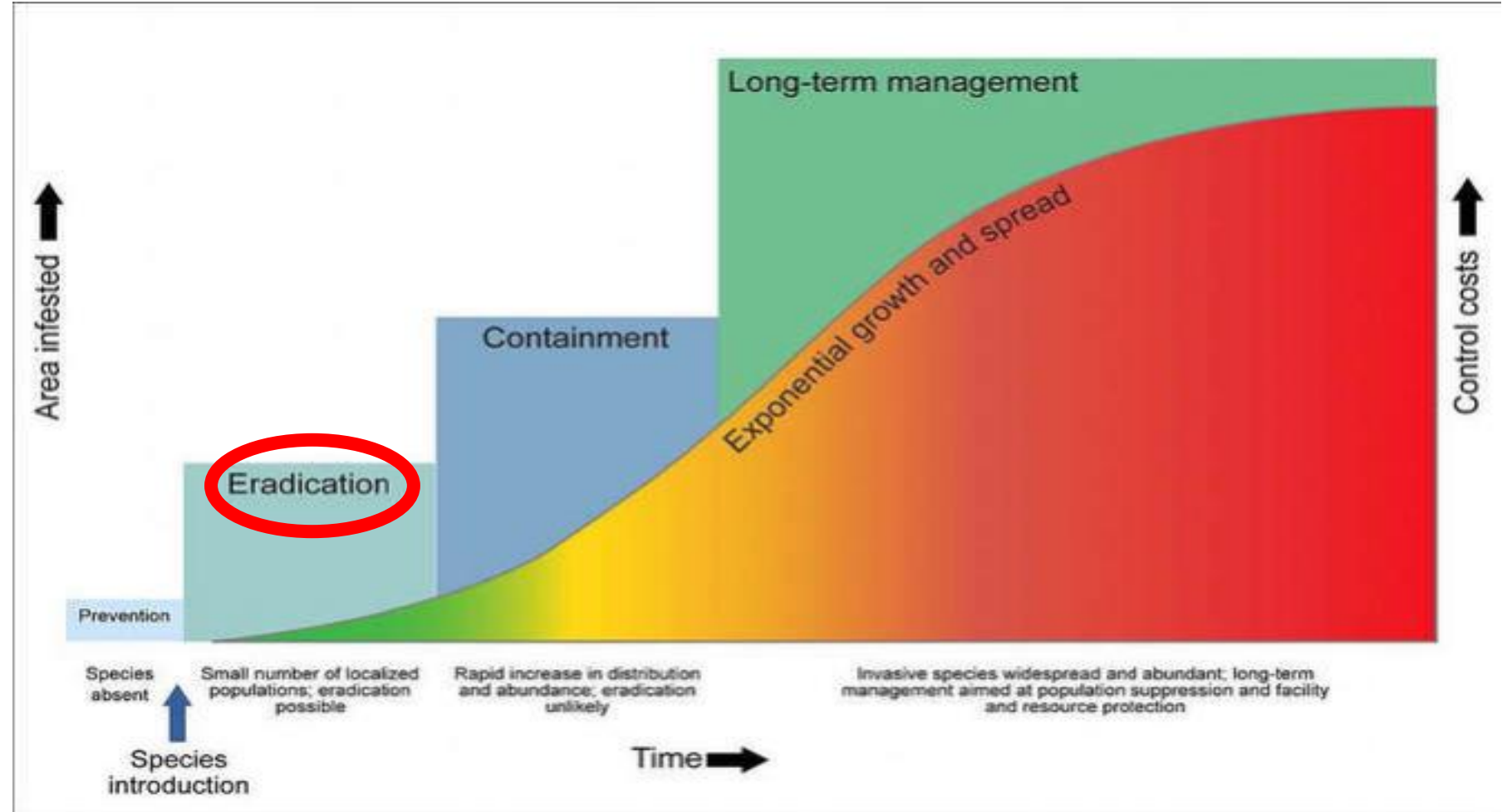
The invasion curve shows how time continues, without intervention, invasive specie will increase in infested are and how much they will cost to control (axes)

Day 8: the invasion curve

Containment: this phase begins when the infestation becomes too large to remove all of the invasive species; it is unrealistic to eradicate. It is more effective for managers to contain the species in the one area and prevent the spread. This is when the public becomes aware.
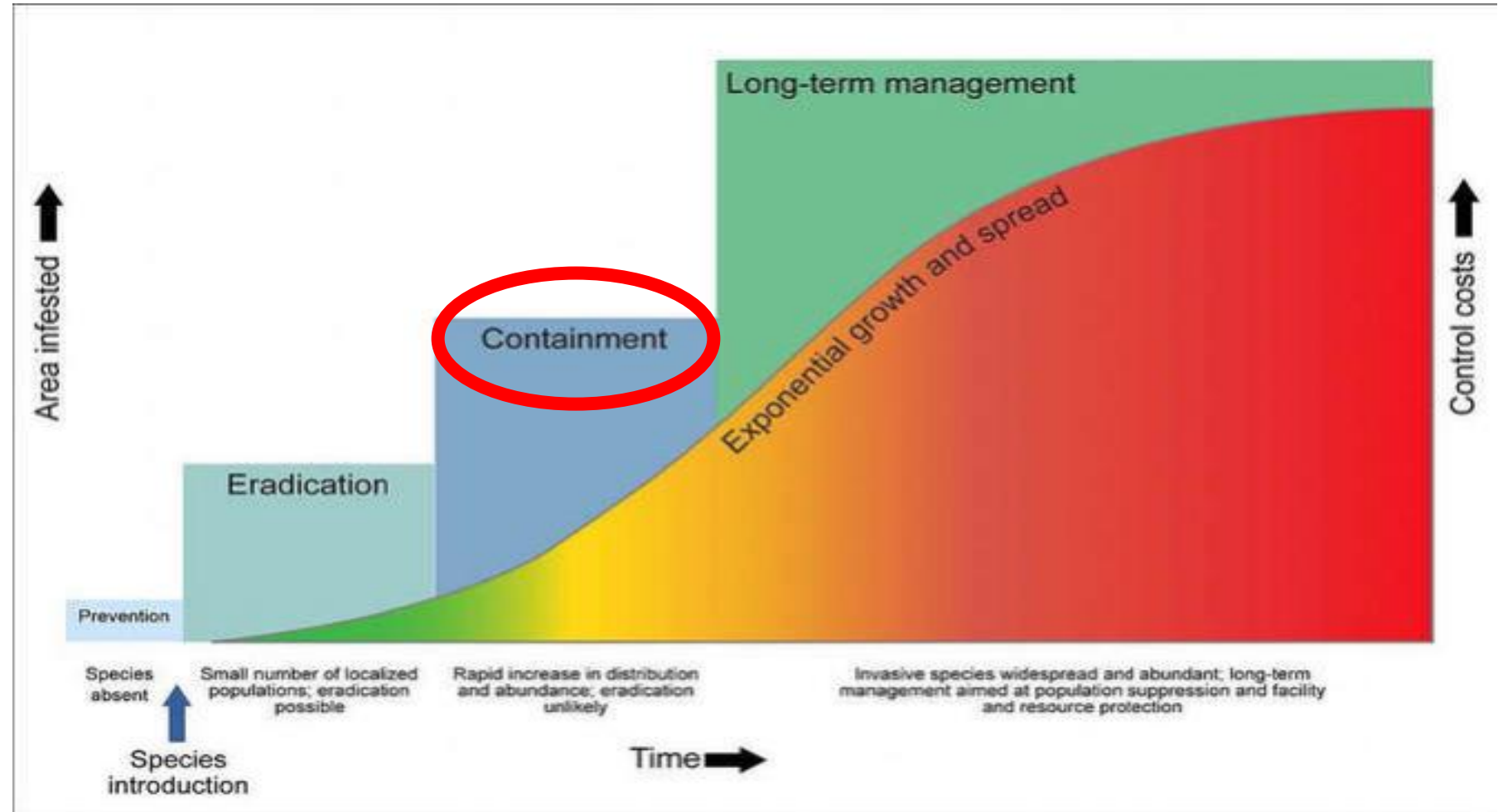
The invasion curve shows how time continues, without intervention, invasive specie will increase in infested are and how much they will cost to control (axes)

Day 8: the invasion curve

Long-term management: This phase occurs when the invasive species is widespread (a full state). Methods are developed and tested to decrease the number of invasive species in an area. This is done to protect resources and native species.
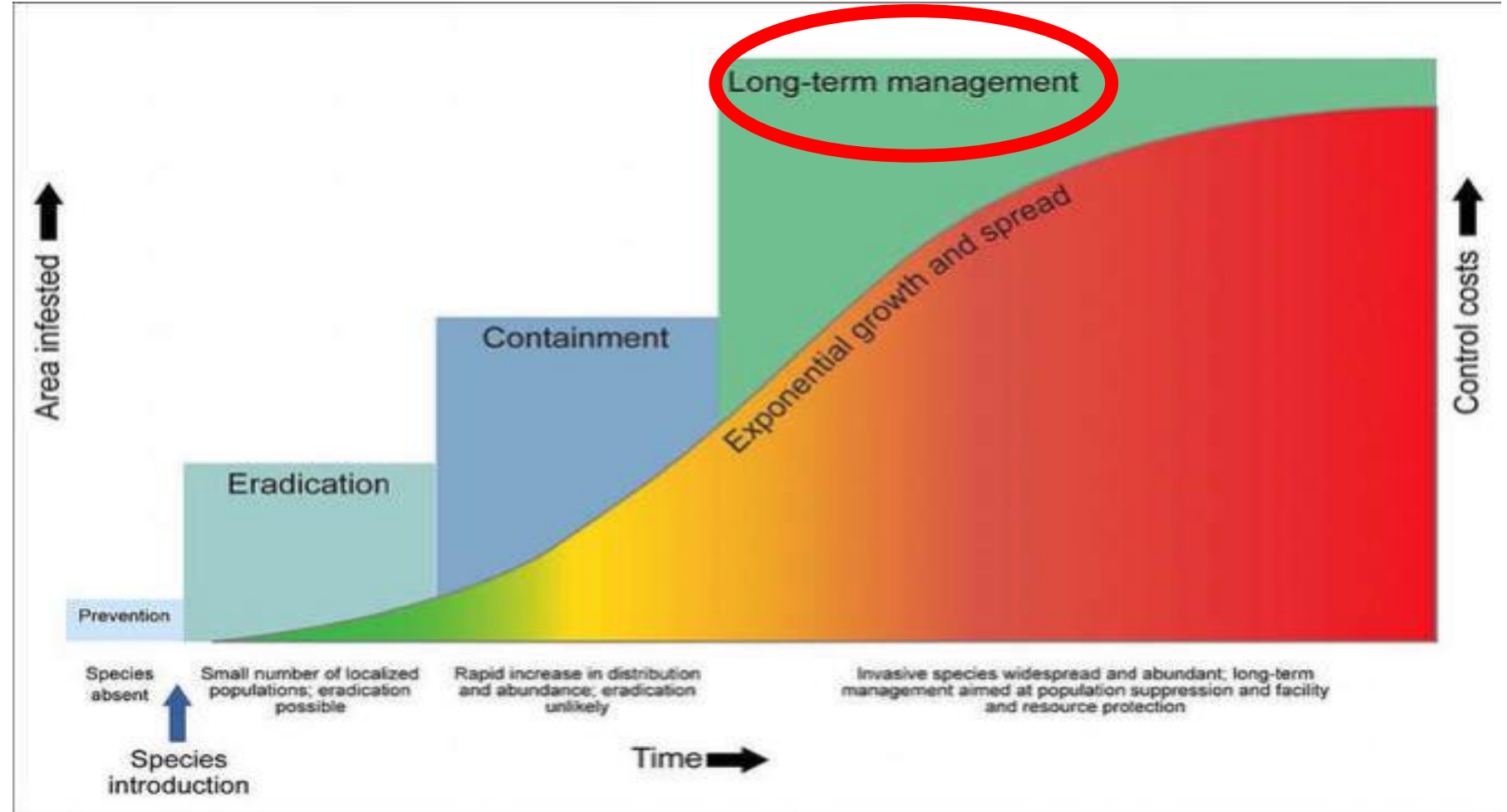
The invasion curve shows how time continues, without intervention, invasive specie will increase in infested are and how much they will cost to control (axes)

Day 8: What are scientists doing to manage invasive species?

- Mile-a-minute pull

- Removal of giant hogweed – NYS DEC

- Purple loosestrife biocontrol (release 1997)

Day 8: Project conclusion

- What did the group learn?

- What are some prevention strategies the school, and students, can take to prevent invasive species from spreading?

Day 9: Poster session

Day 9: Poster session

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

Goals:

1. Poster session set up
2. Gallery walk and talk
3. Clean up

Day 9: Poster session prep

- Groups set up poster around the classroom. Posters should not be right next to each other.
- Groups need to set up an order to stay with the poster and present to audience members.

Day 10: Action/service-learning day (optional)

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Goals:

1. Assist natural resource professionals in invasive species management process
2. Reflect on experience

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Day 10: Action/service-learning day (optional)

Management strategies:

- **Prevention**: protecting what sites have not yet been infected by invasive species
  - Less expensive than management for an infested area
  - Case study: spotted lanternfly (*Lycorma delicatula*)

Day 10: Action/service-learning day (optional)

Management strategies:

- **Eradication:** practiced when an invasive species is present in an area, but the infestation is small or all individual plants or animals can be removed.

  - For eradication to be successful, the invasive species must be found soon after its release or after it was first found in the ecosystem

  - Case study: Asian longhorned beetle (*Anoplophora glabripennis*)

Day 10: Action/service-learning day (optional)

Management strategies:

- **Containment:**
  - Containment is practiced when eradication is not possible and management switches from trying to get rid of an invasive to keeping it from spreading to other locations.
  - Containment is successful when invasive species are kept from spreading beyond a designated containment area. Monitoring is important to ensure that the infestation is not spreading.
  - Case study: Mile-a-minute (*Persicaria perfoliata*)

Day 10: Action/service-learning day (optional)

Management strategies:

- **Long-term management:**

- When eradication or containment of an invasive species is no longer possible, long-term management to protect the ecosystem is the last option. Though management is used for places where the species will never be eliminated, it's important to continue prevention for other areas that have not been infected

- Management usually involves biocontrol, management that uses other organisms or insects to attack the problem invasive species. Biocontrol requires extensive research, so a new pest is not created

- Case study: Purple loosestrife (*Lythrum salicaria*) & biocontrol insects (*Galerucella calmariensis, G. pusilla, Nanophyes marmoratus* and *Hylobius transversovittatus*)