



# FOREST ADAPTATION PLANNING AND PRACTICES

~ ONLINE COURSE ~

## Session 2: Understanding and Evaluating Climate Change Vulnerabilities

Tuesday, January 29, 2019

### Web session etiquette:

- Mute your phone/microphone unless you are speaking to the group.
- If using the phone, turn off your computer speakers to avoid feedback and terrible noises.



# Welcome Back!

Please turn on your webcams if you have them.

Please turn off your computer speakers if using phone for audio.

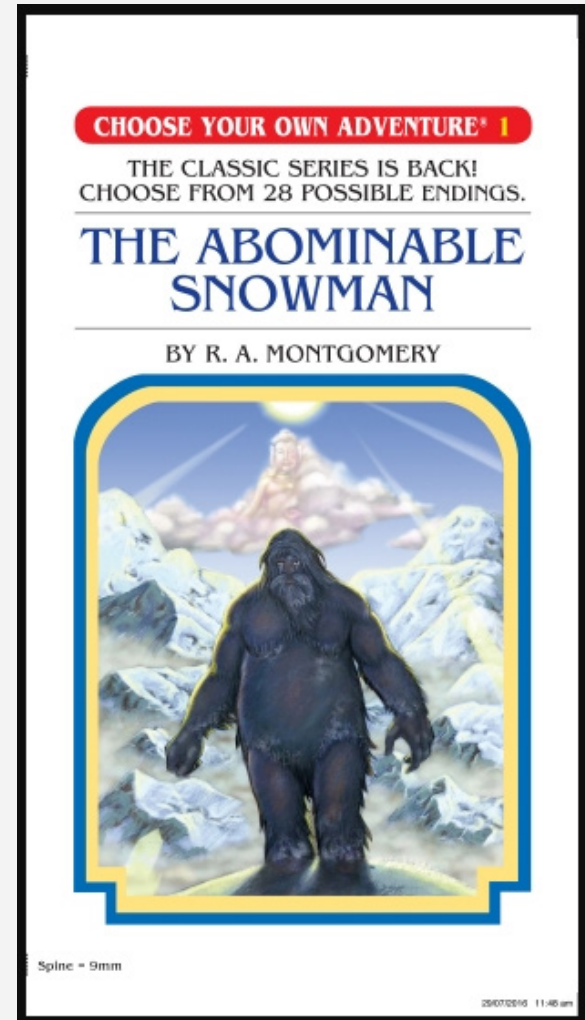
# Today's Agenda

## Discussion: 10:00-10:45 am

- Homework Review
- Share your project ideas
- 3 min/ project

## Lecture: 10:45-11:30 am

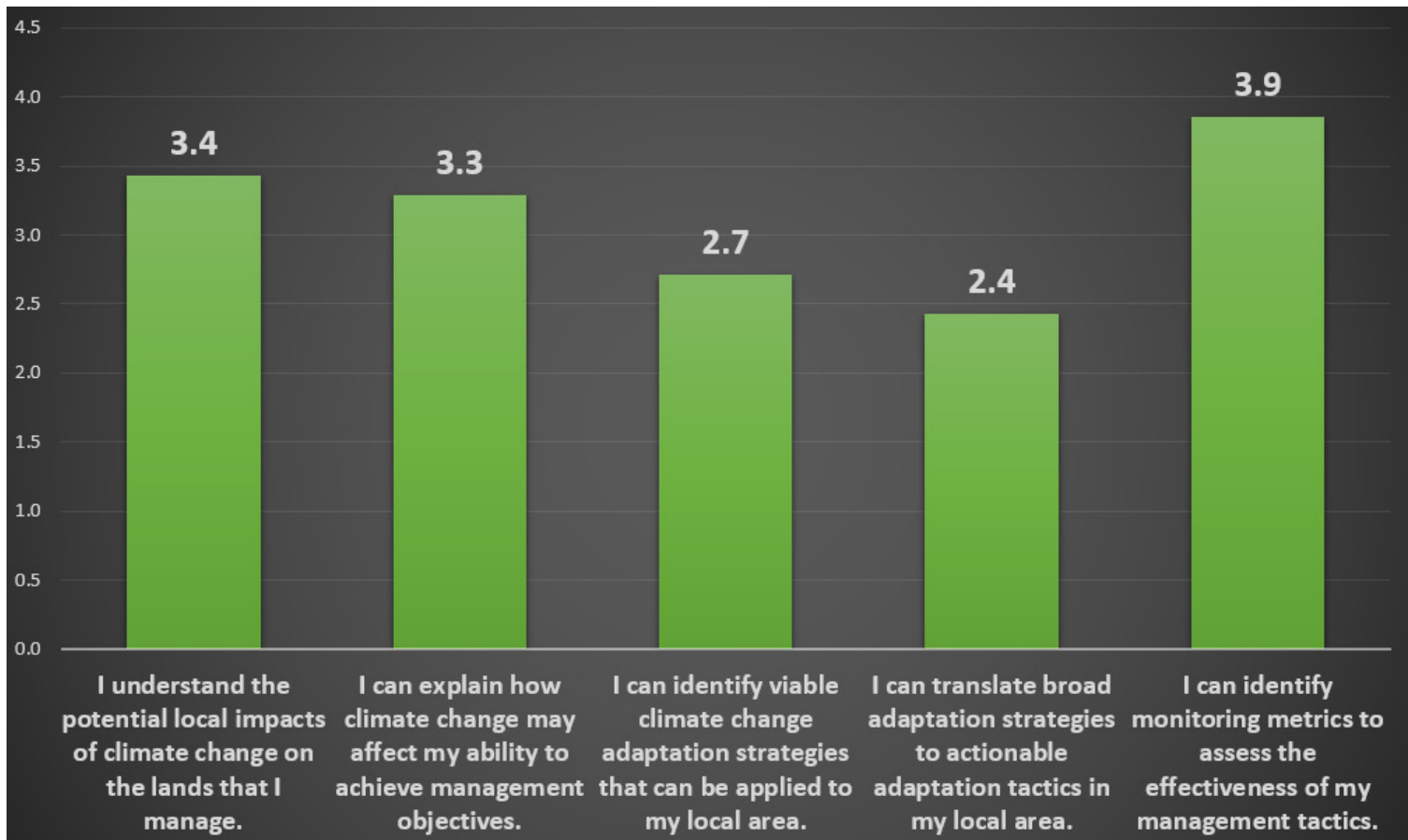
- Step 2 introduction
- Key resources and concepts
- Assignment #2 due Monday, February 4



# Where are we now?

*Average response*

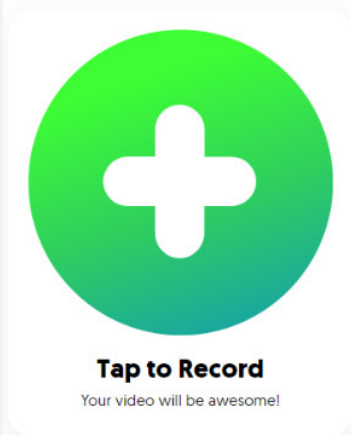
Respondents: 6 groups  
Rating: Disagree 1 to Agree (5)



# Topics you are interested in:

Topic	When we'll cover it
How land managers plan adaptation strategies on a variety of scales	Throughout the course
Expected shifts in forest composition due to climate change and the likelihood of natural migration of species	Step 2
Climate change impacts on the urban forest	Step 2
Deeper understanding on how assisted species migration might affect local forest ecosystems	Step 2
What exactly is "climate resilience" and how can we manage forests for climate resiliency.	Step 4
Understand the concept of Resistance, Resilience, and Transition along with their corresponding strategies	Step 4
How to use the Adaptation Workbook, how to assess and identify vulnerabilities for different regions, becoming more familiar with vulnerabilities and impacts of climate change and appropriate responses/alternative management options	Throughout the course

# Get to know your classmates

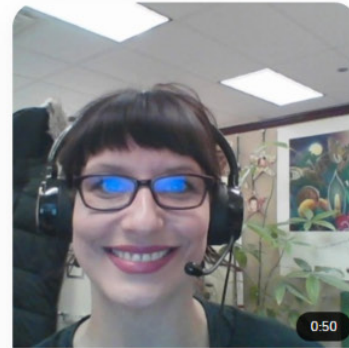


**Joan M A.**

Fairfax County Urban Forest Management



**Michael E.**



**Stacey C.**



**Patricia L.**

Some of us have slacked, add your video today!

<https://flipgrid.com/3df15679>

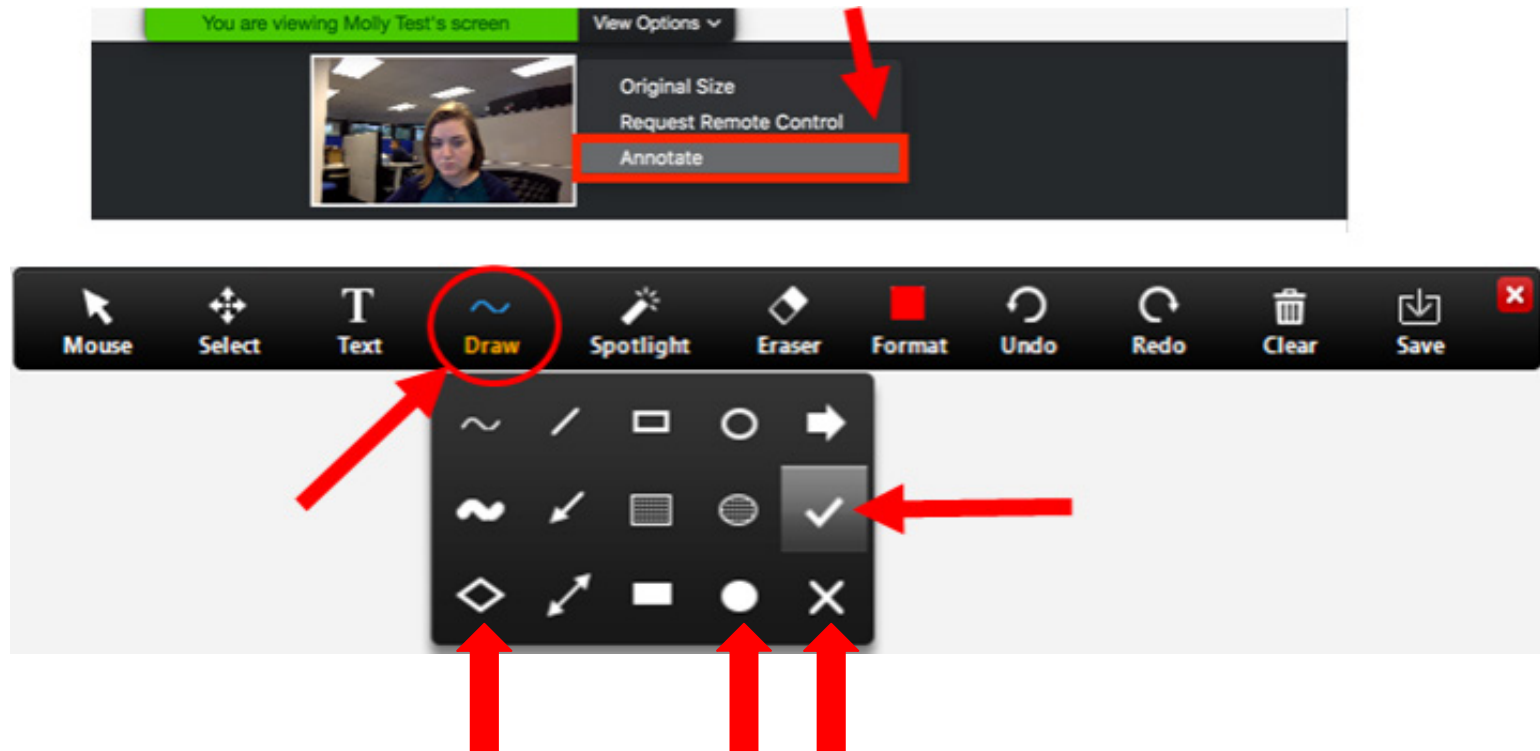
# Introduce your project

- Your name(s)
- Organization
- Project location
- What are your key goals and objectives?



# Show us where your project is located!

- Use the Zoom **“annotate”** feature to add a **symbol** describing your project location.





# Project Locations



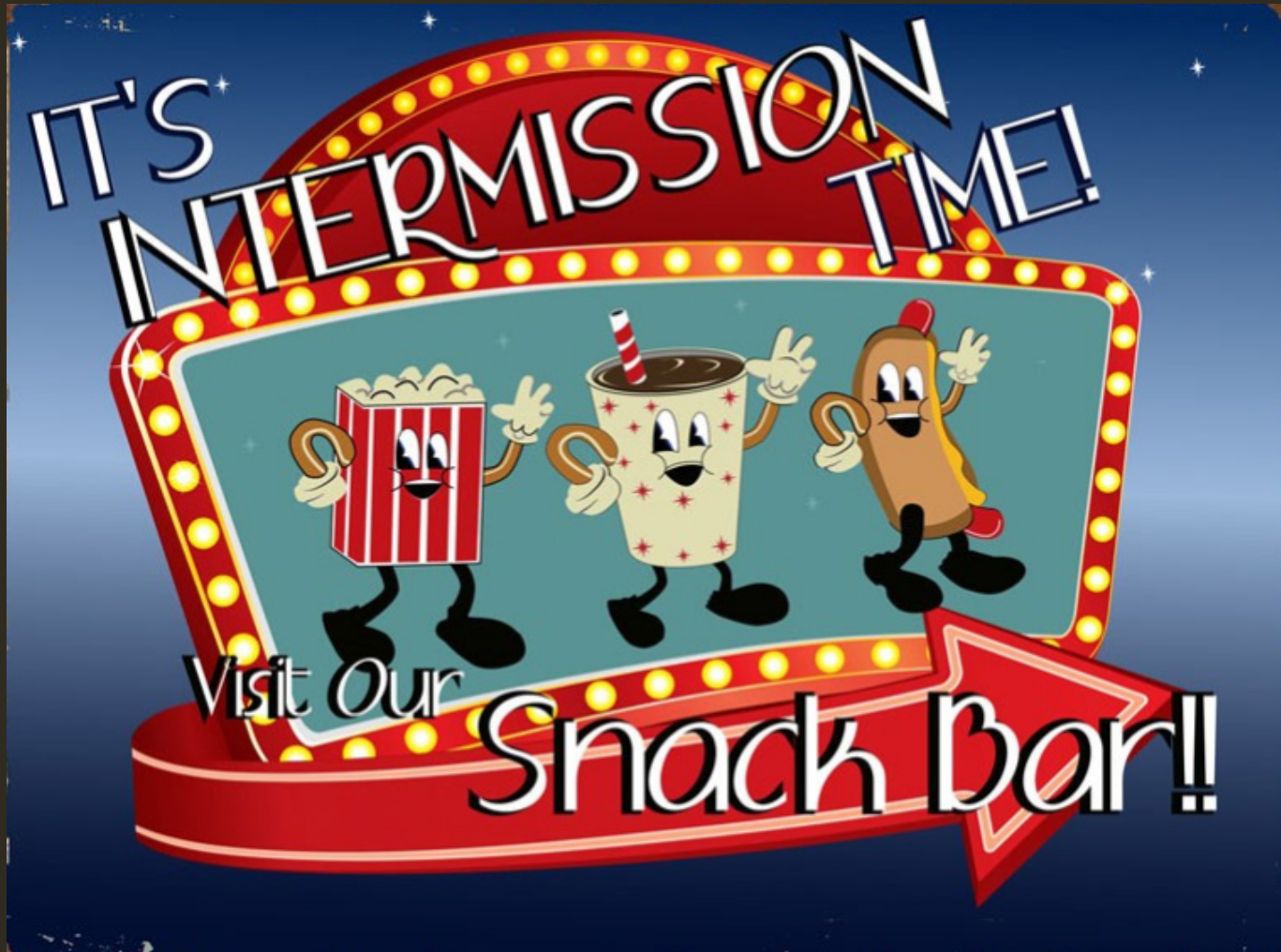
# Questions?

About Step #1?

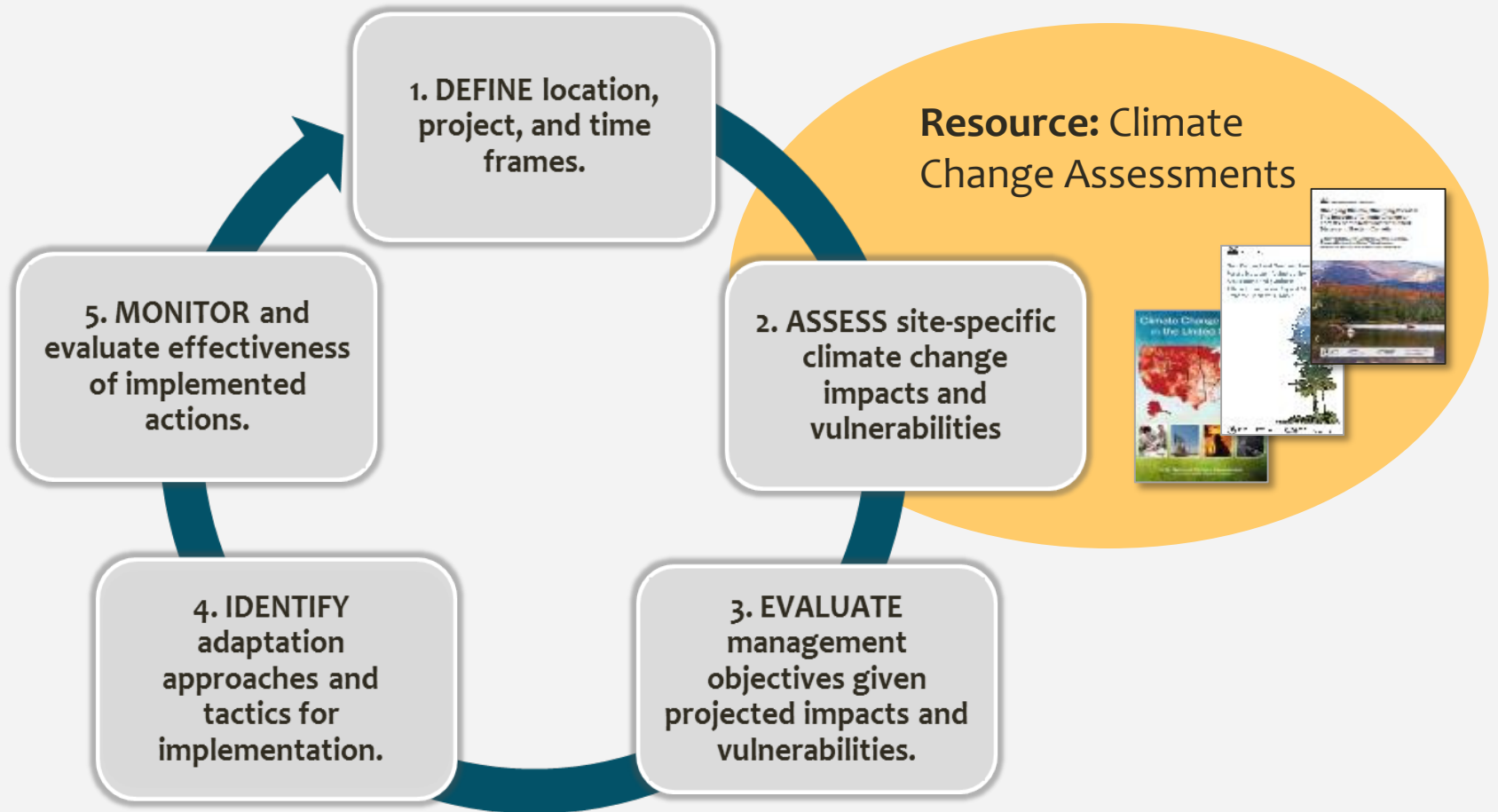
Additional  
Tools or  
Resources?

Technological  
Difficulties?

Need a break?

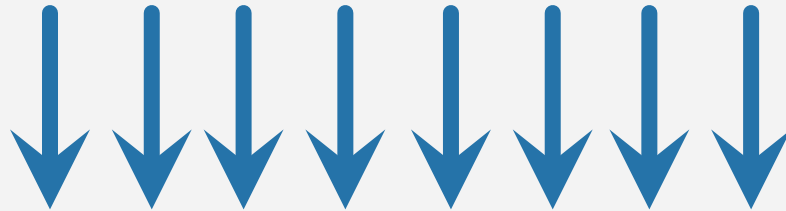
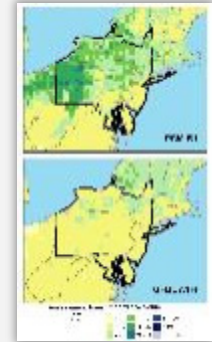
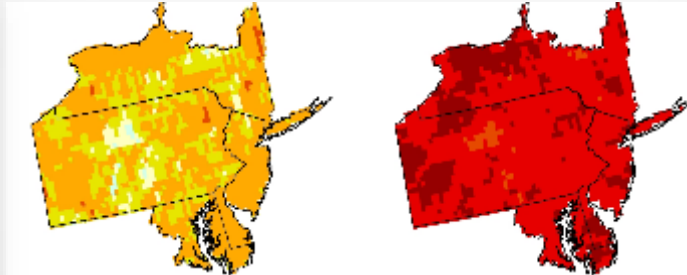
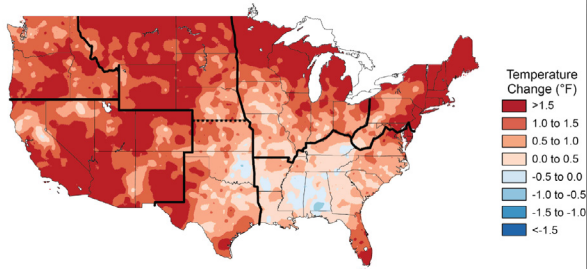


# Adaptation Workbook – Step 2!



# Considering Climate Change

Observed U.S. Temperature Change



# Step 2

## **Key Question:**

- How might the area be uniquely affected by climatic change and subsequent impacts?
- How might regional impacts be different in the project area?

# Step 2

## Regional Impacts:

Warmer temperatures

Altered precipitation

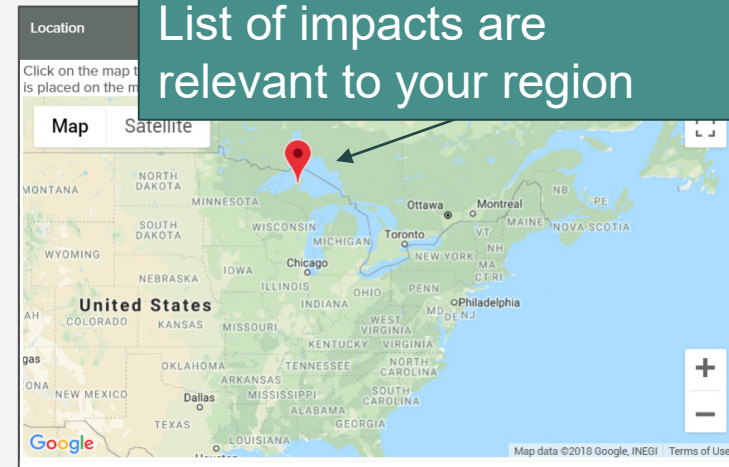
Longer growing seasons

Rising sea levels

More extreme events

Altered forest habitat

List of impacts are relevant to your region



**How will  
my site be  
uniquely  
affected???**

# Step 2

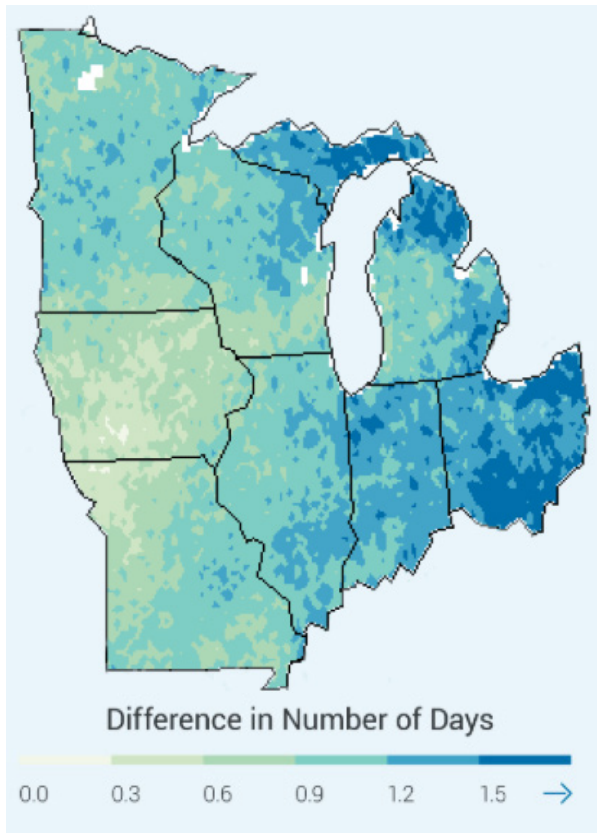
## Regional Climate Impacts

- Based on regional info



## Site-specific Impacts

- Based on your expertise



**Projected increase in the frequency of days with very heavy precipitation (the wettest 2% of days), raising the risk of floods and nutrient pollution.**

National Climate Assessment (2014)  
2041-2070 compared to 1971-2000  
(High emissions A2 scenario). NOAA  
NCDC / CICS-NC



Source: KQED



# Step 2

## Regional Climate Impacts

- Based on regional info



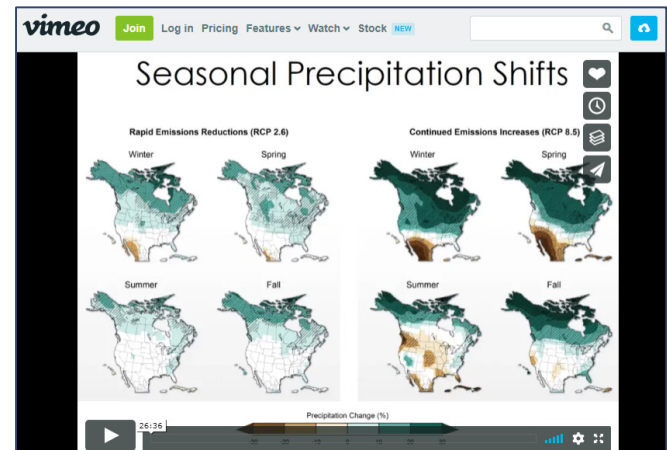
## Site-specific Impacts

- Based on your expertise

Mgmt. Unit/ Topic	Climate Change Impacts and Vulnerabilities	
	Regional From vulnerability assessments	For the Property or Project Area Based on your knowledge of the site
<b>Forest in Lot C</b>	More extreme precipitation events	<b>Slope</b> on east side of property may deliver nutrients from neighboring ag fields
<b>Riparian forest</b>	Boreal species will face increasing stress	Hemlock is projected to decline; loss of our hemlock riparian trees may contribute to increased water temperatures

# Before you begin this step

1. Watch the video for your region or urban forests (~ 30 min)
2. Assemble information about your project location, such as:
  - Tree species lists/inventories.
  - Landover, and flood maps
  - Soil maps
  - Digital elevation/topographic maps
  - Facilities, road & culvert
3. Review information specific to your project area as listed in the course materials.



**Watch a video:  
Step 1 Course Materials**

# Step 2 landing page

**Adaptation Workbook**

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  - Tactic Recommendations
- Step 5
  - Homework 4

**Climate Impacts and Vulnerability instructions**

**Step 2 course materials**

Review Session 2 slides Review Session 2 recording

Assignment 2

Complete the following tasks by Monday, February 4. Set aside 3-4 hours for completion since this is a more involved step.

- Continue reviewing regional climate impacts to prepare for Step 2. You can either view a recorded presentation or read one of the following reports for your region:
  - Central Hardwoods (MO, IL, IN):
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  - Central Appalachians (OH, WV):
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**NIACS REGIONAL ASSESSMENTS**

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Additional Resources and Reading

- State-wide Climate Summaries from NOAA** can be found [here](#).
- Additional information on **tree species vulnerability**, and shifts in **heat and hardiness zones**, found here:
  - Find tree species habitat suitability information for the entire Midwest, Northeast and Southeast at the [USFS Tree Atlas tool](#) or select your location-specific information for these areas:
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    - Urban Example (Indiana)
  - Explore Shifts in Growing Degree Days, Plant Hardiness Zones, and Heat Zones using this [interactive story map](#) (maps display for the contiguous USA)

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# NOAA State Summaries



NOAA National Centers for Environmental Information | State Summaries 149-VA

## VIRGINIA

### KEY MESSAGES

Average annual temperature has increased by about 1.5°F since the beginning of the 20th century. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century.

Naturally occurring droughts are projected to be more intense because higher temperature and evaporation rates, depleting soil moisture more rapidly and adversely affecting agriculture.

The number and intensity of extreme heat and extreme precipitation events are projected to increase, while the number and intensity of cold waves are projected to be less intense.

Virginia has a humid climate with very warm summers and moderately cold winters. The regional variation due to the state's diverse geographic elements, which include the Appalachian Blue Ridge Mountains in the west and the Atlantic coastal region in the east. Temperature patterns are highly influenced by these geographic features with the west and north being cooler than the eastern coastal region. Statewide average temperatures range from 35°F in January to 71°F in July. Annual rainfall generally decreases toward the west. For example, total annual precipitation is 45 inches in the central mountain region of the state compared to around 50 inches along the tidal region.

Since the beginning of the 20th century, temperatures have risen approximately 1.5°F. The 1930s were very warm, followed by a period of generally below average temperatures during the 1940s and 1980s (Figure 1). Although the 5-year average highest number of very hot days (maximum temperature above 95°F) and corresponding number of very warm nights (minimum temperature above 75°F) occurred in the 1930s (Figures 2a and 2b), gradual warming has occurred since the early 1990s. Average annual temperatures in the 21st century (2000–2014) have exceeded the previous highs of the 1930s. A winter warmer than the below average number of very cold nights (minimum temperature below 0°F) since the 1930s; summer temperatures in the most recent decade (2005–2014) exceeded those in the early 1930s.

Observed and Projected Temperature Change

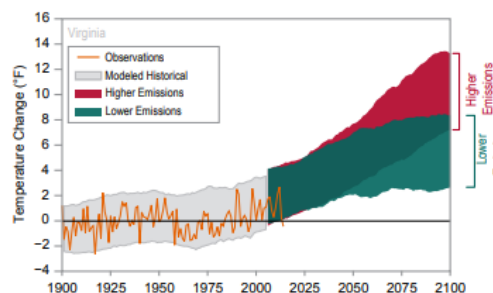


Figure 1: C (compared to 1901–1960 average) in near-surface air temperature for Virginia. Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Virginia (orange line) have risen about 1.5°F since the beginning of the 20th century. Shading indicate the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during the 21st century. Less warming is expected under a lower emissions future (the coldest years being about as warm as the hottest year in the historical record; green shading) and more warming under a higher emissions future (the hottest years being about 11°F warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA.

\*Technical details on models and projections are provided in an appendix, available online at: <https://statesummaries.noaa.gov>



NOAA National Centers for Environmental Information | State Summaries 149-IL

## ILLINOIS

### KEY MESSAGES

Average annual temperature has increased by about 1°F since the beginning of the 20th century. There has been seasonal variation in this warming, with average spring temperature increasing by about 2°F and average summer temperature increasing very little. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century.

Precipitation in spring and summer has generally been above average over the past two decades, affecting agriculture in both positive (adequate soil moisture) and negative (delays in spring planting) ways. Precipitation in winter and spring is projected to increase, which poses a continuing risk of spring planting delays.

Severe flooding and drought have occurred periodically in recent years. Future increases in extreme precipitation events and in evaporation rates may increase the intensity of both floods and droughts.

Illinois's location in the interior of the North American continent exposes it to a climate with large ranges in temperature with warm, humid summers and cold winters. The lack of mountains to the north or south allows very cold air masses from the Arctic in the winter and warm, humid air masses from the Gulf of Mexico in the summer to move into the state, further increasing the range of conditions that affect Illinois. Temperature varies widely across the state, with a range of about 10°F from north to south. In northeastern Illinois, Lake Michigan moderates the temperature, causing cooler summers and warmer winters. Topography and urban areas also have local impacts on climate.

Since the beginning of the 20th century, temperatures in Illinois have risen approximately 1°F (Figure 1). Temperatures in the 2000s have been higher than any other historical period, with the exception of the early 1930s "Dust Bowl" era. Warming has been concentrated in winter and spring while summers have not warmed substantially in the state, a feature characteristic of much of the Midwest (Figure 2). The lack of summer warming is reflected in a below average occurrence of very hot days (days with maximum temperature above 95°F) since the mid 1950s (Figure 3a) and no overall trend in very warm nights (minimum temperature above 75°F) since the beginning of the 20th century (Figure 3b). The winter warming trend is reflected in a below average number of very cold nights (minimum temperature below 0°F) over the past 25 years (Figure 3c).

Observed and Projected Temperature Change

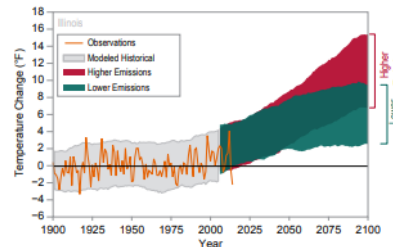


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Illinois. Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Illinois (orange line) have risen about 1°F since the beginning of the 20th century. Shading indicate the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during the 21st century. Less warming is expected under a lower emissions future (the coldest years being about as warm as the hottest year in the historical record; green shading) and more warming under a higher emissions future (the hottest years being about 10°F warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA NCEI.

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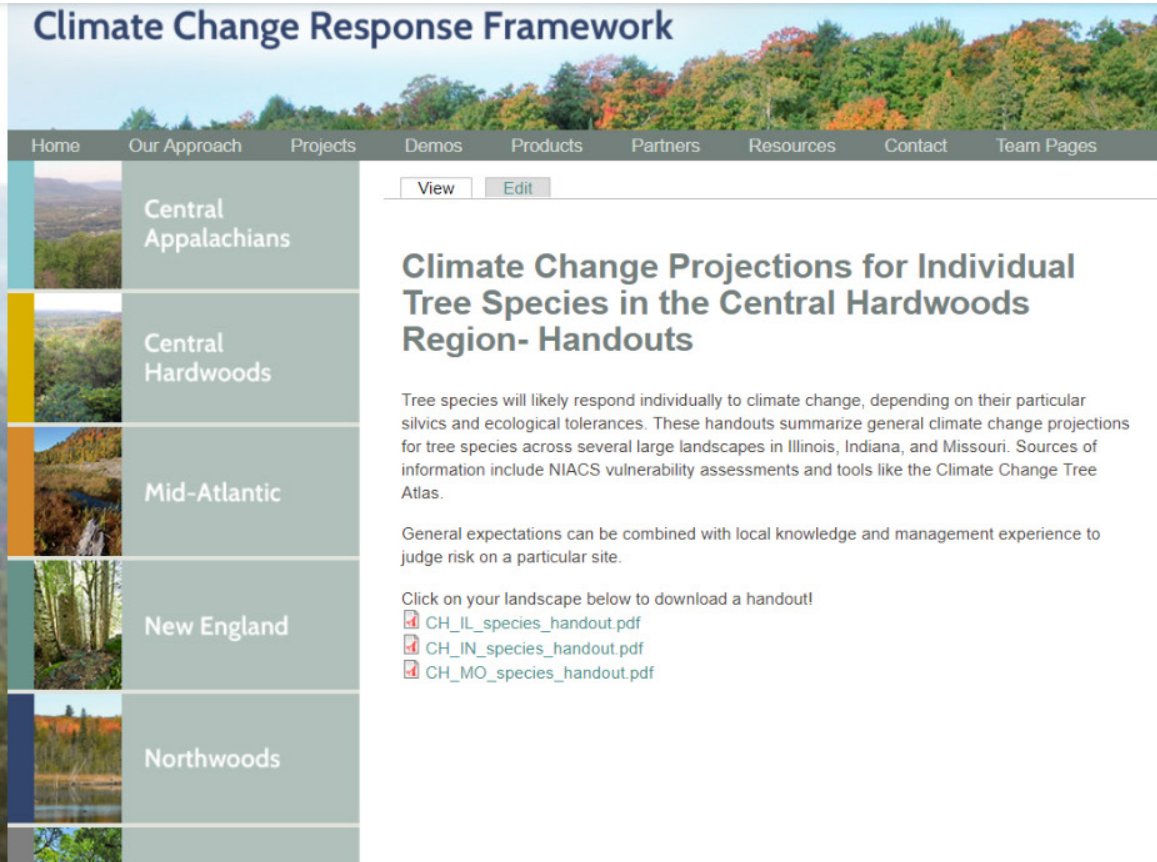
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# Tree Vulnerability Information



**Climate Change Response Framework**

Home Our Approach Projects Demos Products Partners Resources Contact Team Pages

View Edit

- Central Appalachians
- Central Hardwoods**
- Mid-Atlantic
- New England
- Northwoods

## Climate Change Projections for Individual Tree Species in the Central Hardwoods Region- Handouts

Tree species will likely respond individually to climate change, depending on their particular silvics and ecological tolerances. These handouts summarize general climate change projections for tree species across several large landscapes in Illinois, Indiana, and Missouri. Sources of information include NIACS vulnerability assessments and tools like the Climate Change Tree Atlas.

General expectations can be combined with local knowledge and management experience to judge risk on a particular site.

Click on your landscape below to download a handout!

- [CH\\_IL\\_species\\_handout.pdf](#)
- [CH\\_IN\\_species\\_handout.pdf](#)
- [CH\\_MO\\_species\\_handout.pdf](#)

# Tree Vulnerability Information



## CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES



### ILLINOIS

The region's forests will be affected by a changing climate during this century. A team of forest managers and researchers created an assessment that describes the vulnerability of forests in the Central Hardwoods region (Brandt et al. 2014). This report includes information on the current landscape, observed climate trends, and a range of projected future climates. It also describes many potential climate change impacts to forests and summarizes key vulnerabilities for major forest types. This handout is summarized from the full assessment.

#### TREE SPECIES INFORMATION:

This assessment uses two climate scenarios to "bracket" a range of possible futures. These future climate projections were used with one forest inventory (Tree Atlas) to provide information about how individual tree species respond to a changing climate. More information on the climate and forest impacts can be found in the assessment. Results for "low" and "high" climate scenarios can be compared on page 2 of this handout.

SPECIES	ADDITIONAL CONSIDERATIONS
<b>LIKELY TO DECREASE</b>	
Black cherry	Limited drought tolerance and susceptible to some insects
Shagbark hickory	Susceptible to insects and fire topkill
Shingle oak	Tolerant of a wide range of soils
Sugar maple	Disperses and regenerates easily but drought-intolerant
White ash	Susceptible to emerald ash borer
White oak	Tolerant of fire
<b>MIXED MODEL RESULTS</b>	
American elm	Needs a particular type of habitat, affected by Dutch elm disease
Black oak	Drought-tolerant
Black walnut	Susceptible to thousand cankers disease
Common persimmon	Tolerant of shade and a wide range of soils
Green ash	Susceptible to emerald ash borer
Hackberry	Drought-tolerant
Honeylocust	Intolerant of shade
Northern red oak	Susceptible to some insect pests
Pignut hickory	Susceptible to insects and intolerant of drought

#### FUTURE PROJECTIONS

Data for the end of the century are summarized for the Climate Change Tree Atlas ([www.fs.fed.us/nrs/atlas](http://www.fs.fed.us/nrs/atlas)) under two climate change scenarios. Tree Atlas models future suitable habitat; additional data are available in the assessment.

##### ▲ INCREASE

Projected increase of >20% by 2100

##### ● NO CHANGE

Little change (<20%) projected by 2100

##### ▼ DECREASE

Projected decrease of >20% by 2100

##### ★ NEW HABITAT

Tree Atlas projects new habitat for species not currently present

#### ADAPTABILITY

Factors not included in the Tree Atlas model, such as the ability to respond favorably to disturbance, may make a species more or less able to adapt to future stressors.

##### + high

Species may perform better than modeled

##### · medium

Species may perform worse than modeled

SPECIES	LOW CLIMATE CHANGE (PCM B1)	HIGH CLIMATE CHANGE (HAD A1FI)	ADAPT	SPECIES	LOW CLIMATE CHANGE (PCM B1)	HIGH CLIMATE CHANGE (HAD A1FI)	ADAPT
American basswood	▼	▲	·	Ohio buckeye	▼	▼	·
American beech	●	▲	·	Osage-orange	▲	▲	+
American elm	●	▲	·	Overcup oak	●	▲	·
American hornbeam	▲	▲	·	Pawpaw	▲	▼	·
Baldcypress	●	●	·	Pecan	●	●	·
Bitternut hickory	●	●	+	Pignut hickory	●	▼	·
Black cherry	▼	▼	·	Pin oak	●	●	·
Black hickory	▲	▲	·	Post oak	▲	▲	+
Black locust	▲	▲	·	Red maple	●	●	+
Black oak	●	▼	·	Red mulberry	▲	▲	·
Black walnut	●	▼	·	River birch	▲	▲	·
Black willow	●	●	·	Sassafras	●	▼	·
Blackgum	▲	▲	·	Scarlet oak	●	▼	·
Blackjack oak	▲	▲	+	Shagbark hickory	▼	▼	·
Boxelder	●	▲	+	Shellbark hickory	●	●	·
Bur oak	▲	▲	+	Shingle oak	▼	▼	·
Butternut	▼	▼	·	Shortleaf pine	▲	▲	·
Cedar elm	★	★	·	Shumard oak	▼	▲	+
Cherrybark oak	▲	▲	·	Silver maple	●	▲	+
Chestnut oak	▼	▲	+	Slash pine	★	★	·
Chinkapin oak	▲	▼	·	Slippery elm	●	●	·
Common persimmon	●	▲	+	Southern red oak	▲	▲	+
Eastern cottonwood	▲	▲	·	Sugar maple	▼	▼	+
Eastern hophornbeam	●	▲	+	Sugarberry	▲	▲	·
Eastern red cedar	▲	●	·	Swamp chestnut oak	▼	▼	·
Eastern redbud	▲	●	·	Swamp tupelo	●	●	·
Eastern white pine	▼	▼	·	Swamp white oak	▼	▼	·
Flowering dogwood	●	●	·	Sweetgum	▲	▲	·
Green ash	●	▲	·	Sycamore	●	▼	·
Hackberry	●	▼	+	Water locust	★	★	·
Honeylocust	●	▲	+	Water oak	★	★	·
Jack pine	▼	▲	·	White ash	▼	▼	·
Kentucky coffeetree	●	●	·	White oak	▼	▼	+
Loblolly pine	▲	▲	·	Wild plum	●	▲	·
Mockernut hickory	●	●	+	Willow oak	●	●	·
Northern catalpa	●	●	·	Winged elm	▲	▲	·
Northern pin oak	▼	▲	+	Yellow-poplar	▲	▼	+
Northern red oak	●	▼	+				

SOURCE: Brandt, L.; He, H.; Iverson, L.; Thompson, F.R., III; Butler, P.; Handler, S.; Janowiak, M.; Shannon, P.D.; Swanson, C.; Albrecht, M.; Blume-Weaver, R.; Deizman, P.; DePuy, J.; Dijk, W.D.; Dinkel, G.; Fei, S.; Jones-Farrand, D.T.; Leahy, M.; Matthews, S.; Nelson, P.; Oberle, B.; Perez, J.; Peters, M.; Prasad, A.; Schneiderman, J.E.; Shuey, J.; Smith, A.B.; Studvin, C.; Tirpak, J.M.; Walk, J.W.; Wang, W.J.; Watts, L.; Weigel, D.; Westin, S. 2014. Central Hardwoods ecosystem vulnerability assessment and synthesis: a report from the Central Hardwoods Climate Change Response Framework project. Gen. Tech. Rep. NRS-124. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 254 p. <https://www.nrs.fs.fed.us/pubs/49430>



[www.forestadaptation.org](http://www.forestadaptation.org)

[www.forestadaptation.org](http://www.forestadaptation.org)





- Adaptation Workbook
- My dashboard
- Log out
- Resources ▾
- test
- Progress Summary
- Step 1
  - Define Management Topics
  - Management Goals and Objectives
  - Homework 1
- Step 2
  - Climate Impacts and Vulnerability **>**
  - Vulnerability Determination
  - Homework 2
- Step 3
  - Evaluate Objectives

## Step 2.1: Assess climate change impacts

The Adaptation Workbook allows you to consider how general climate change impacts might be modified by the unique characteristics of your property. The first section on this page asks you to think about how **regional** impacts might affect your particular management area and forests. The following sections ask you to think about more specific climate impacts related to **your chosen forest types and management topics**.

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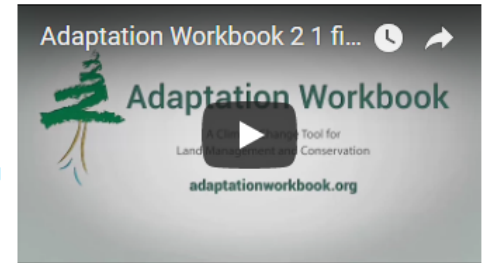
Several climate impact statements are presented from published resources for your general location and the pre-defined forest types you selected in Step 1.1. Please take time to explore the supporting information (click the "Show Evidence" button, or visit our resource library) to learn more about the projected risks and opportunities climate change may present for your location.




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For example:

Most areas in the country are expected to experience warmer temperatures by the end of the century. If your property sits on a north-facing slope, a sheltered landscape position, or next to a large water body, projected temperature increases might be moderated. You'd want to make note of that in the appropriate sections below.

 [Climate Impacts and Vulnerability Resources](#)



-  Hover to learn more about a particular item
-  Expand/collapse a section
-  Click to add a comment or specific information about your property


« Previous

Homework 1

Next »

Vulnerability Determination

Precipitation patterns will be altered, with projected increases in annual precipitation and potential for reduced growing season precipitation in New England and northern New York.

How might this affect your property or project area? 

Interse precipitation events will continue to become more frequent in New

# Climate Change Tree Atlas

The screenshot shows the website's header with the USDA logo and Northern Research Station name. A navigation bar includes links for Forest Service Home, About the Agency, and Contact the National Office. The main content area features a large image of an American goldfinch, a search box for trees and birds, and several informational boxes. The search box includes a text input field and links for 'List of Trees' and 'List of Birds'. The 'About the Climate Change Atlas' box provides details on the atlas's scope, mentioning 134 tree species and 147 bird species. Below this are boxes for 'Featured Research' (Central Appalachians forest ecosystem) and 'Combined Species Outputs' (Potential Changes by Region, State), each with a small thumbnail image. A 'Climate Change Atlas Resources' box lists a 'Hands-on Guide to Atlas' PDF and 'Videos' including a 'Quick Start Guide' and an 'Introduction to the Climate Change Atlas' video.

USDA United States Department of Agriculture  
Forest Service

Northern Research Station

Forest Service Home | About the Agency | Contact the National Office

You are here: [Northern Research Station Home](#) / [Tools & Applications](#) / Climate Change Atlas

## Climate Change Atlas



Visit the Bird Atlas. *American goldfinch: Mdf via Wikimedia Commons*

Search for Trees & Birds:  
  
Enter a common or scientific name  
[List of Trees](#) | [List of Birds](#)

**About the Climate Change Atlas**  
The Climate Change Atlas documents the current and possible future distribution of **134 tree species** and **147 bird species** in the Eastern United States and gives detailed information on environmental characteristics defining these distributions. Please be sure to read the **warnings, cautions and questions**.  
You can also **browse and view the previous version of the Tree Atlas**.

**Featured Research**  
  
[Central Appalachians forest ecosystem](#)

**Combined Species Outputs**  
  
[Potential Changes by Region, State,](#)

**Climate Change Atlas Resources**  
[Hands-on Guide to Atlas](#) (pdf)  
**Videos**  
[Quick Start Guide](#)  
[An Introduction to the Climate Change Atlas: How does it work?](#)

[www.fs.fed.us/nrs/atlas](http://www.fs.fed.us/nrs/atlas)

# Heat and Hardiness Zones

## Climate Change Pressures in the 21st Century

Office of Sustainability Climate



### Growing Degree Days

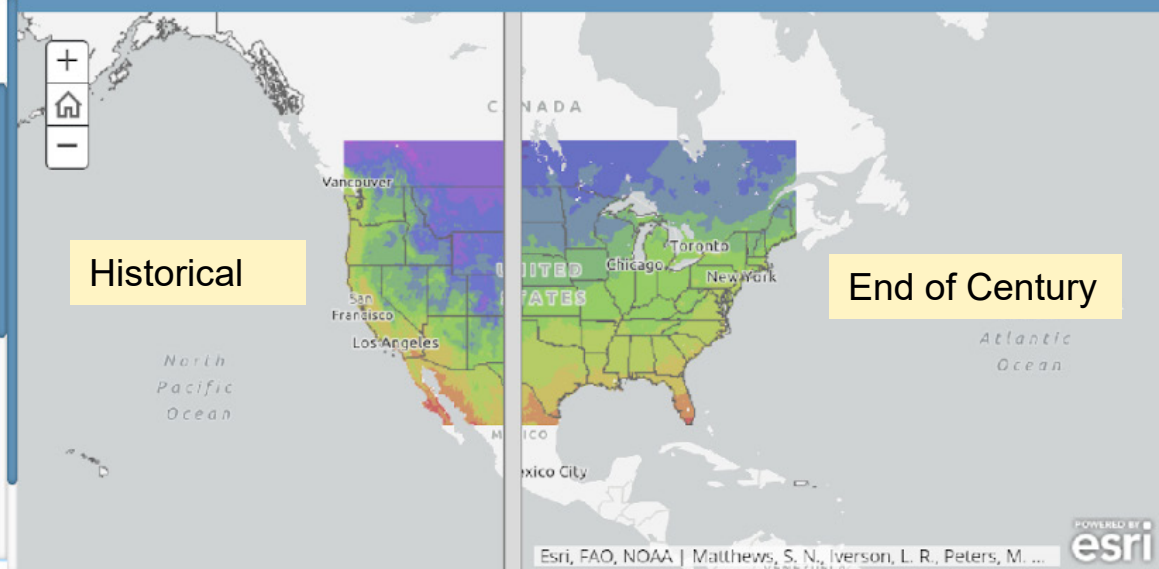
### Plant Hardiness Zones

Plant hardiness zones (PHZs) can indicate the extent of winter stress that plants experience due to cold temperatures. These zones are based on the average annual extreme minimum temperatures (extreme winter lows). Horticulturists use this information to evaluate the cold hardiness of plants. The zones displayed here are based on the 30-year average of the absolute minimum temperature achieved in each year, which are then categorized into 2.8 °C (5 °F) increments.

Winter temperatures have been rising dramatically across much of the country, and this trend is expected to continue into the future. For example, minimum winter temperature could rise at least 8–9 °C (14.4–16.2 °F) across much of the Northeast and Midwest under a high emissions scenario.

### Plant Hardiness Zones

Historical (1980-2010) [Left] ↔ Future (2070-2099) [Right]



<https://goo.gl/iPpZCw>

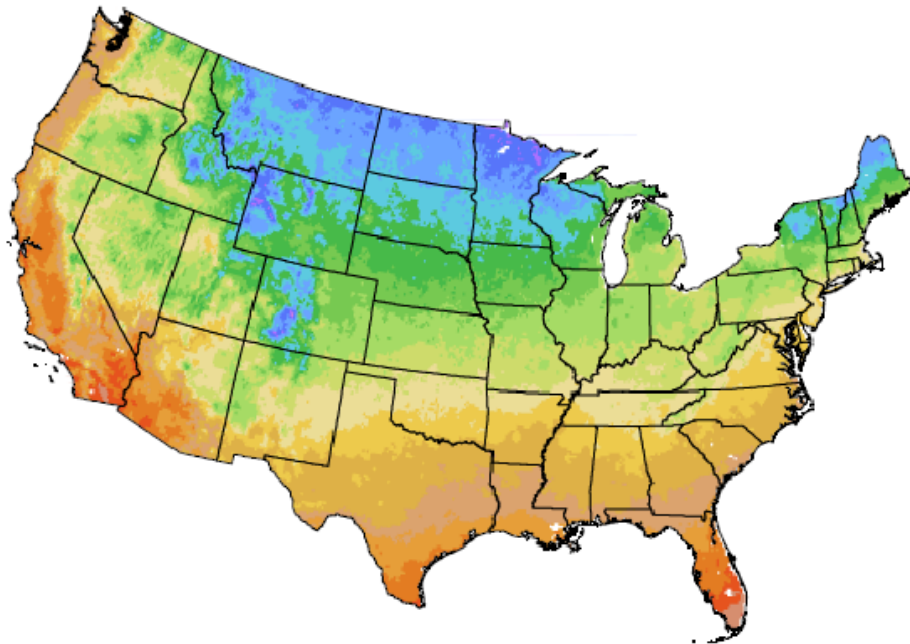
Explore “current” and projected end of century (high emissions: RCP 8.5):

- growing degree days
- plant hardiness zones
- heat zones

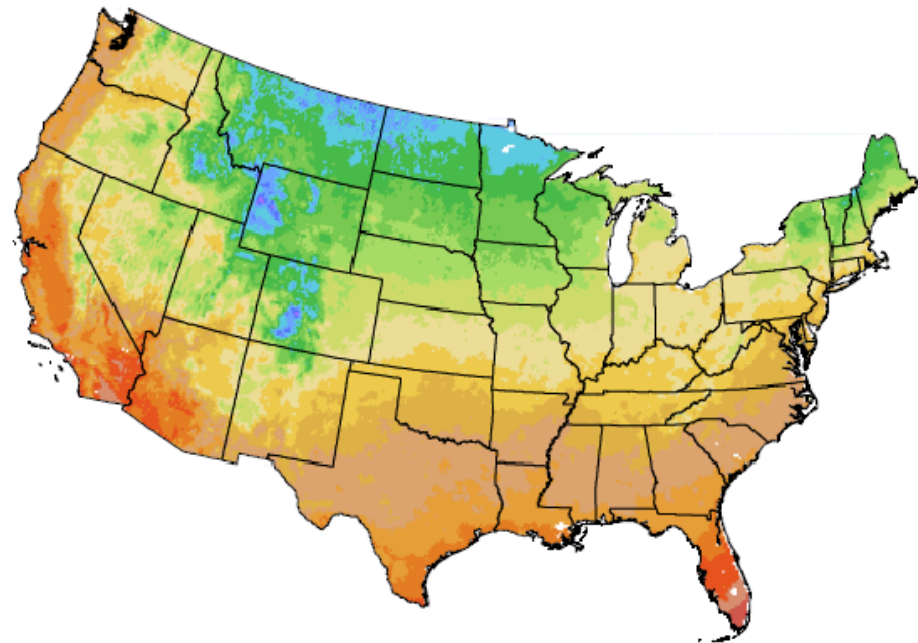
# Non-natives, Cultivars, Rare

- Compare species heat and hardiness zone range tolerance to future, projected heat and hardiness zones.

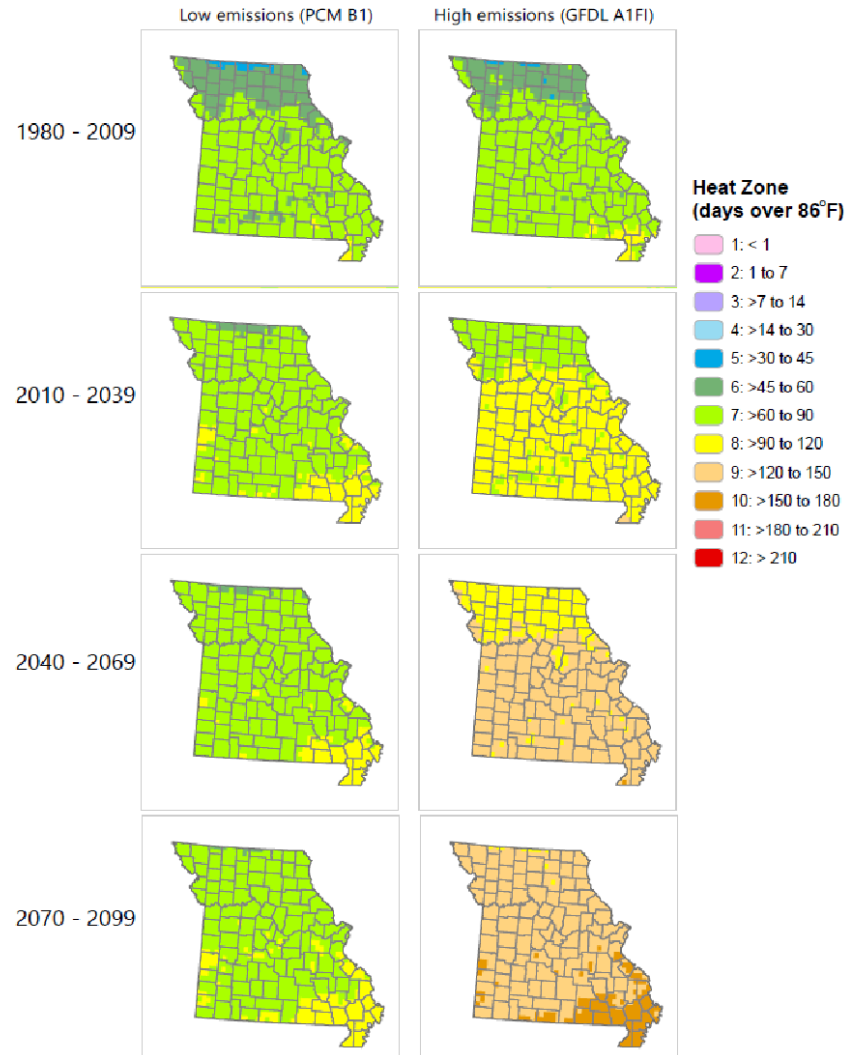
Low emissions (PCM B1)



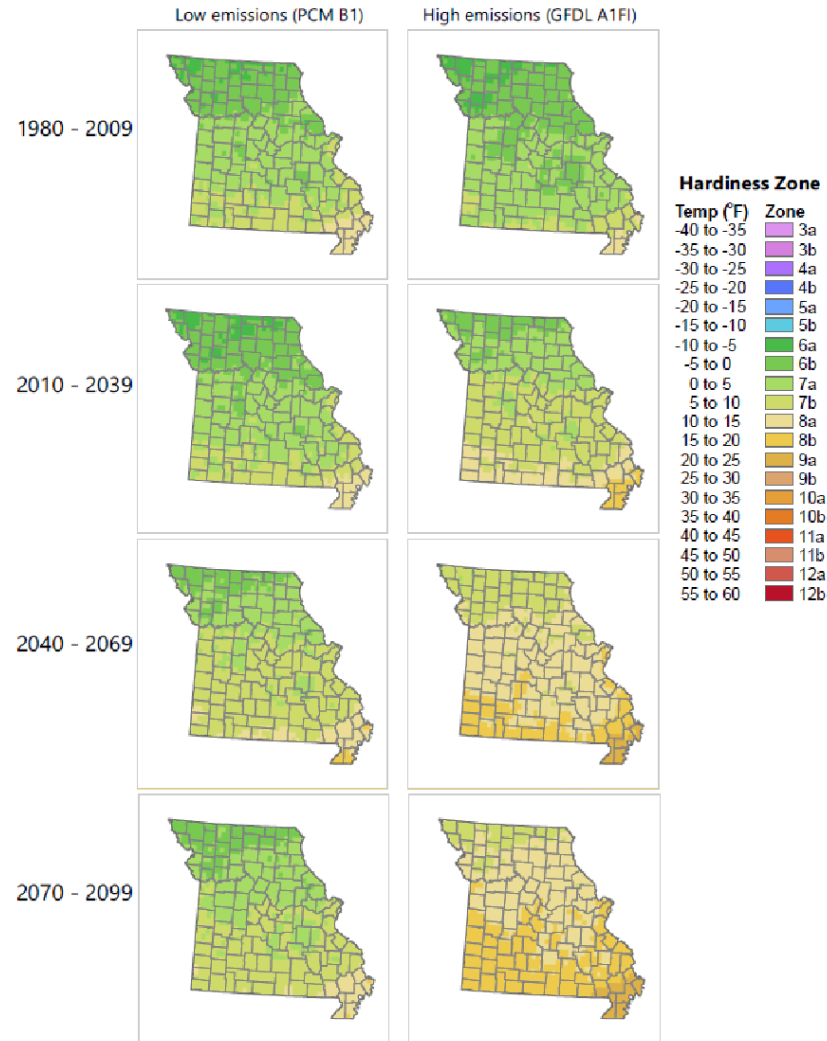
High emissions (GFDL A1FI)



# Heat Zone Maps



# Hardiness Zone Maps



# Making a climate informed species list: Native species with Tree Atlas Information

Species Name	Model Projections-low emissions	Model Projections-high emissions	Adaptive Capacity	Vulnerability
Red maple	No change	No change	High	Low
Red oak	No change	No Change	Medium	Medium
Sugar maple	Decrease	Decrease	Medium	Medium-high
Paper birch	Decrease	Decrease	Low	High

# Making a climate informed species list: Species with *no* Tree Atlas information

Species Name	Effect from zone shift-low emissions	Effect from zone shift-low emissions	Adaptive Capacity	Vulnerability
Gingko	No change	No change	High	Low
Korean Fir	No change	No Change	Medium	Medium
Norway maple	Medium	Decrease	High	Medium
Gray birch	Decrease	Decrease	Low	High



# Starting Step 2.1

- Adaptation Workbook
- My dashboard
- Log out
- Resources ▾
- Marsh-Billings National Historic Park
- Progress Summary
- Step 1
  - Define Management Topics
  - Management Goals and Objectives
  - Homework 1
- Step 2
  - Climate Impacts and Vulnerability >
  - Vulnerability Determination
- Homework 2
- Step 3
  - Evaluate Objectives
  - Homework 3
- Step 4
  - Adaptation Actions
  - Tactic Recommendations

## Step 2.1: Assess climate change impacts

The Adaptation Workbook allows you to consider how general climate change impacts might be modified by the unique characteristics of your property. The first section on this page asks you to think about how **regional** impacts might affect your particular management area and forests. The following sections ask you to think about more specific climate impacts related to **your chosen forest types and management topics**.


This is your opportunity to consider the particular site conditions that might affect whether your property is more or less vulnerable to climate change. Some of the things you will want to consider include **species and structural composition, soils, topography, past management, forest health issues, and the surrounding landscape**.




Several climate impact statements are presented from published resources for your general location and the pre-defined forest types you selected in Step 1.1. Please take time to explore the supporting information (click the "Show Evidence" button, or visit our resource library) to learn more about the projected risks and opportunities climate change may present for your location.

If you think any of the suggested impacts don't apply to your property, you can remove them from the list. If you want to add more climate impacts to the regional list or for any of your forest types, you can **add custom climate impact statements** at the end of each section.

For example:

Most areas in the country are expected to experience warmer temperatures by the end of the century. If your property sits on a north-facing slope, a sheltered landscape position, or next to a large water body, projected temperature increases might be moderated. You'd want to make note of that in the appropriate sections below.

 [Climate Impacts and Vulnerability Resources](#)

-  Hover to learn more about a particular item
-  Expand/collapse a section
-  Click to add a comment or specific information about your property



### Potential Climate Impacts - Pastures, hay fields

Identified 2 Potential Climate Impacts

Precipitation patterns will be altered, with projected increases in annual precipitation and potential for reduced growing season precipitation in New England and northern New York. ⓘ ✕

How might this affect your property or project area? 💬

Intense precipitation events will continue to become more frequent in New England and northern New York. ⓘ ✕

How might this affect your property or project area? 💬

Warmer temperatures and altered precipitation in New England and northern New York will interact to change soil moisture patterns throughout the year, with the potential for both wetter and drier conditions depending on the location and season. ⓘ ✕

How might this affect your property or project area? ⌵

« Previous

Homework 1

Next »

Vulnerability Determination

# Step 2.1: List of impacts

REMOVE  
IMPACT  
IF IT DOES  
NOT APPLY

The screenshot displays a web application interface for 'Climate Impacts and Vulnerability'. On the left is a dark sidebar with navigation options: 'Adaptation Workbook', 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1' (Define Management Topics, Management Goals and Objectives, Homework 1), 'Step 2' (Climate Impacts and Vulnerability - selected, Vulnerability Determination, Homework 2), 'Step 3' (Evaluate Objectives, Homework 3), 'Step 4' (Adaptation Actions, Tactic Recommendations, Homework 4).

The main content area is titled 'Climate Impacts and Vulnerability' and includes a sub-section 'Step 2 Course Materials'. A list on the left shows three categories: 'Potential Climate Impacts - Regional' (12 impacts), 'Potential Climate Impacts - Park' (0 impacts), and 'Potential Climate Impacts - riparian buffer' (0 impacts). The main panel displays 'Potential Climate Impacts - Regional' with a list of six items, each with a description, evidence level, and a 'Remove' button (marked with an 'x').

Annotations include: a bracket above the first item; a large downward arrow pointing to the first item; a smaller downward arrow pointing to the 'Remove' button of the first item; and a box on the right with the text 'REMOVE IMPACT IF IT DOES NOT APPLY' pointing to the 'Remove' button of the first item.

Impact Description	Evidence / Agreement	Remove Button
Mean annual temperature in the Chicago area is projected to increase by 2.3 ° to 8.2 ° F by the end of the 21st century, with temperature increases across all seasons.	Robust   Agreement: High	Yes
Precipitation in the Chicago area is projected to increase in winter and spring over 21st century, but projections for summer and fall precipitation are less clear	Robust   Agreement: Moderate	Yes
Heavy precipitation events in the Chicago area have been increasing and are projected to continue to increase further, which could increase runoff and local flooding from stormwater	Robust   Agreement: Moderate	Yes
Extreme and exceptional droughts in the Chicago area may increase in duration, frequency, and spatial extent compared to the end of the 20th century	Medium   Agreement: Moderate	Yes
Increases in temperature may lead to an increase of 1-2 hardiness zones and 2-4 heat zones in the Chicago area.	Medium   Agreement: Moderate	Yes
Species distribution modeling for native species suggests that suitable habitat may decrease for 15 primarily northern species and increase or become newly suitable for 47 species in the Chicago area.	Medium   Agreement: Moderate	Yes

# Step 2.1: Supporting documentation

The screenshot displays the 'Adaptation Workbook' interface. The left sidebar shows a navigation menu with 'Step 2' selected, and 'Climate Impacts and Vulnerability' highlighted. The main content area shows a report titled 'Climate Impacts and Vulnerability' with a callout box providing supporting documentation. The callout box contains the following text:

An analysis of vulnerability that combines model projections, shifts in heat and hardiness zones, and adaptive capacity showed that 15 percent of the trees currently present in the Chicago region have either moderate-high or high vulnerability to climate

Evidence: Medium | Agreement: Moderate

Overall vulnerability of trees in the Chicago region can be estimated by considering the impacts on individual trees using model projections or changes in heat or hardiness zone, together with the adaptive capacity of trees as described in the previous section. Two vulnerable species are nonnative (Japanese red pine and Katsura tree). Vulnerable species tend to be native to mountainous or northern areas. Examples include black cherry, red and white pine, balsam fir, quaking and big tooth aspen, white spruce, gray and paper birch, and Douglas fir. Common invasive species considered to have low vulnerability are European buckthorn, Amur honeysuckle, tree-of-heaven, and glossy buckthorn. Several common native trees are also considered to have low vulnerability including boxelder, hackberry, bur oak, and black locust. Species that are often used in cultivated settings that had low vulnerability were Freeman maple, littleleaf linden, maidenhair tree, and European hornbeam.

L. Brandt, A. Derby-Lewis, and others. May, 2017. [Chicago Wilderness region urban forest vulnerability assessment and synthesis](#). USDA Forest Service Northern Research Station.

An orange callout box with the text 'Click on reference to follow up' and an arrow pointing to the reference link is overlaid on the screenshot. The bottom of the screen shows a Windows taskbar with various application icons and a system tray displaying the time as 12:58 PM on 11/20/2017.

# Step 2.1: Add Local Information

The screenshot displays the 'Adaptation Workbook' interface. On the left is a navigation sidebar with sections for 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', and four 'Step' sections (Step 1 to Step 4). The main content area is titled 'Climate Impacts and Vulnerability instructions' and 'Step 2 Course Materials'. It features a list of 'Potential Climate Impacts' for 'Regional' (12 identified) and 'Park' (0 identified) areas. Below this, a list of specific climate impacts is shown, each with a title, evidence level, and agreement level. An orange callout box with a white border and arrow points to a text input field under the first impact, containing the instruction: 'Think specifically about the forest conditions, soils, topography, level of development, and other specific information about your project area that might modify this general climate impact.' Another orange arrow points from the top of the callout box to the text input field. The bottom of the interface shows navigation buttons for 'Previous' and 'Next', and a taskbar at the very bottom with various application icons and a system clock showing 1:43 PM on 11/20/2017.

Adaptation Workbook

My dashboard

Log out

Resources

Chicago project

Progress Summary

Step 1

Define Management Topics

Management Goals and Objectives

Homework 1

Step 2

Climate Impacts and Vulnerability

Vulnerability Determination

Homework 2

Step 3

Evaluate Objectives

Homework 3

Step 4

Adaptation Actions

Tactic Recommendations

Homework 4

Climate Impacts and Vulnerability instructions

Step 2 Course Materials

Climate Impacts and Vulnerability

Potential Climate Impacts - Regional  
Identified 12 Potential Climate Impacts

Potential Climate Impacts - Park  
Identified 0 Potential Climate Impacts

Potential Climate Impacts - Park  
Identified 0 Potential Climate Impacts

Get specific and tell us about the local factors that might modify the general climate impact

systems for... with the high... How might this affect your property or project area?

An analysis... Evidence: Medium | Agreement: Moderate  
How might this affect your property or project area?

Think specifically about the forest conditions, soils, topography, level of development, and other specific information about your project area that might modify this general climate impact.

Many invasive species, insect pests, and pathogens will increase or become more damaging in the Chicago area by the end of the century.  
Evidence: Medium | Agreement: Moderate  
How might this affect your property or project area?

The urban heat island effect can exacerbate the effects of increasing temperatures.  
Evidence: Medium | Agreement: High  
How might this affect your property or project area?

Impervious cover can exacerbate the effects of increased heavy precipitation events in urban areas.  
Evidence: Medium | Agreement: High  
How might this affect your property or project area?

« Previous  
Homework 1

Next »  
Vulnerability Determination

Custom Climate Impacts - Regional

1:43 PM  
11/20/2017

# Step 2.1: Add Custom Impact

The screenshot displays the 'Adaptation Workbook' interface. On the left is a sidebar with navigation options: 'Adaptation Workbook', 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1' (with sub-items 'Define Management Topics', 'Management Goals and Objectives', 'Homework 1'), 'Step 2' (with sub-items 'Climate Impacts and Vulnerability', 'Vulnerability Determination', 'Homework 2'), 'Step 3' (with sub-items 'Evaluate Objectives', 'Homework 3'), 'Step 4' (with sub-items 'Adaptation Actions', 'Tactic Recommendations', 'Homework 4').

The main content area is titled 'Climate Impacts and Vulnerability' and contains a list of impact categories:

- Potential Climate Impacts - Regional: Identified 12 Potential Climate Impacts
- Potential Climate Impacts - Park: Identified 0 Potential Climate Impacts
- Potential Climate Impacts - riparian buffer: Identified 0 Potential Climate Impacts

Below this list is a detailed view of a specific impact statement:

**An analysis of vulnerability that combines model projections, shifts in heat and hardness zones, and adaptive capacity showed that 15 percent of the trees currently present in the Chicago region have either moderate-high or high vulnerability to climate.**  
Evidence: Medium | Agreement: Moderate  
How might this affect your property or project area?

Other visible impact statements include:

- Many invasive species, insect pests, and pathogens will increase or be damaging in the Chicago area by the end of the century. Evidence: Medium | Agreement: Moderate
- The urban heat island effect can exacerbate the effects of increasing temperatures. Evidence: Medium | Agreement: High
- Impervious cover can exacerbate the effects of increased heavy precipitation events in urban areas. Evidence: Medium | Agreement: High

At the bottom of the main content area, there is a section for 'Custom Climate Impacts - Regional' with a button labeled 'Add a Regional Climate Impact Statement'. An orange callout box with the text 'Add your own. Check out the list of regional impacts for additional Using the climate impacts viewer' has an arrow pointing to this button. Another orange arrow points from the bottom of the callout box to the 'Add a Regional Climate Impact Statement' button.

The bottom of the screen shows a Windows taskbar with various application icons and a system tray displaying the time '12:57 PM' and date '11/20/2017'.

# Pro Tip: Stick to Impacts

Don't think about how these impacts will affect your management just yet.

For now, just focus how climate change will affect the project area.



# Questions?



## Step 2.2: Vulnerability Determination

How vulnerable is the forest type or management topic to climate change?



# What is vulnerability?

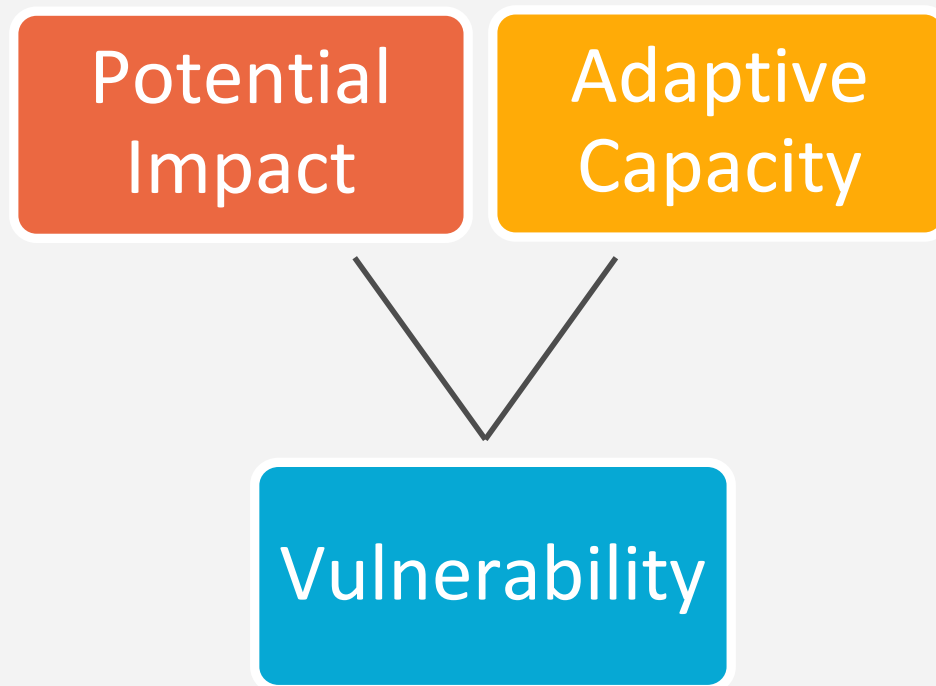
Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.

*in other words:*

Are climate change impacts going to cause substantial disruption to a particular system?

# What is vulnerability?

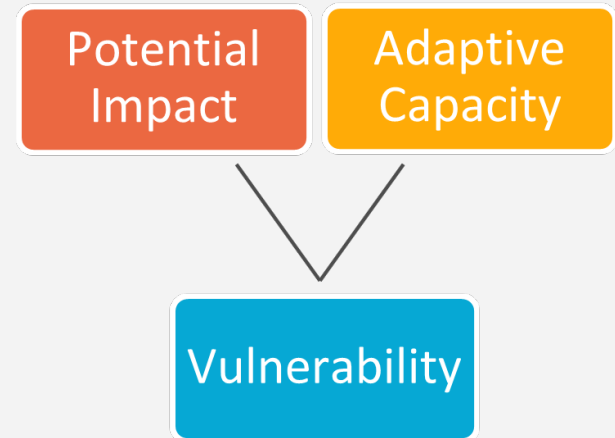
Two components:



# What is vulnerability?

## Potential Impacts consider

- What the system is **exposed** to
  - Changes in temperature, rainfall, storms, dominant species, stressors
- How **sensitive** the systems is to those changes



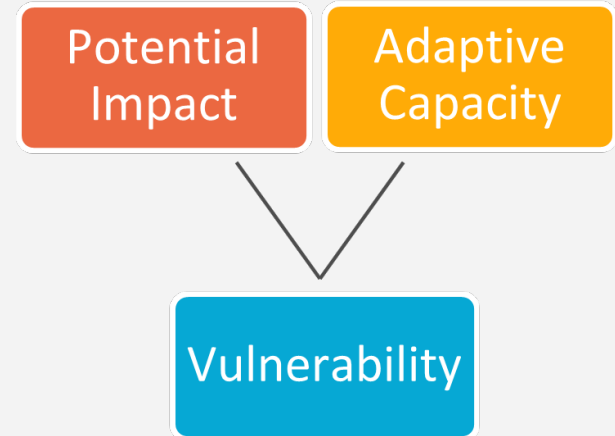
## Example

- Two forests could both be exposed to 3°F of warming
- A forest of spruce trees may be more sensitive to this impact than a forest of oak trees

# What is vulnerability?

**Potential Impacts** consider

- What the system is **exposed** to
  - Changes in temperature, rainfall, storms, dominant species, stressors
- How **sensitive** the systems is to those changes



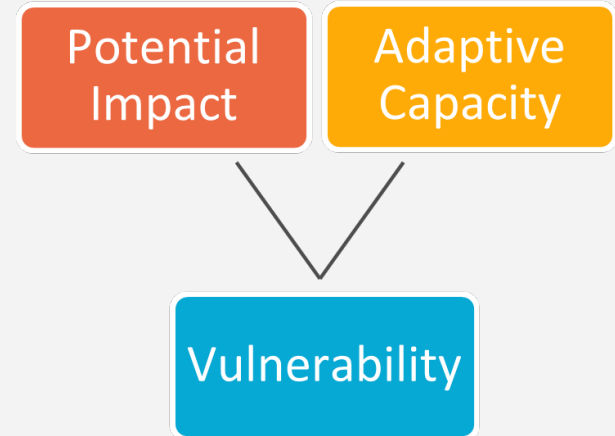
Big question:

Are the potential impacts likely to **support** or **disrupt** the health and function of the system?

# What is vulnerability?

**Adaptive capacity** considers

- How well the system can cope with the potential impacts.
- i.e., how resilient is the system?  
(assuming no change in management intervention)



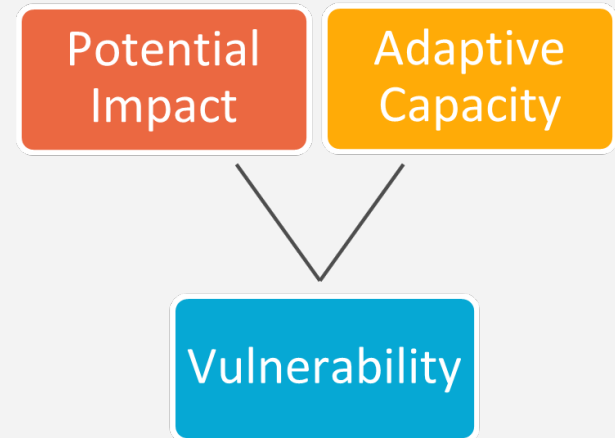
## Example

- A forest containing a variety of northern species may have a greater capacity to adapt to warming than a forest containing one northern species.

# What is vulnerability?

**Adaptive capacity** considers

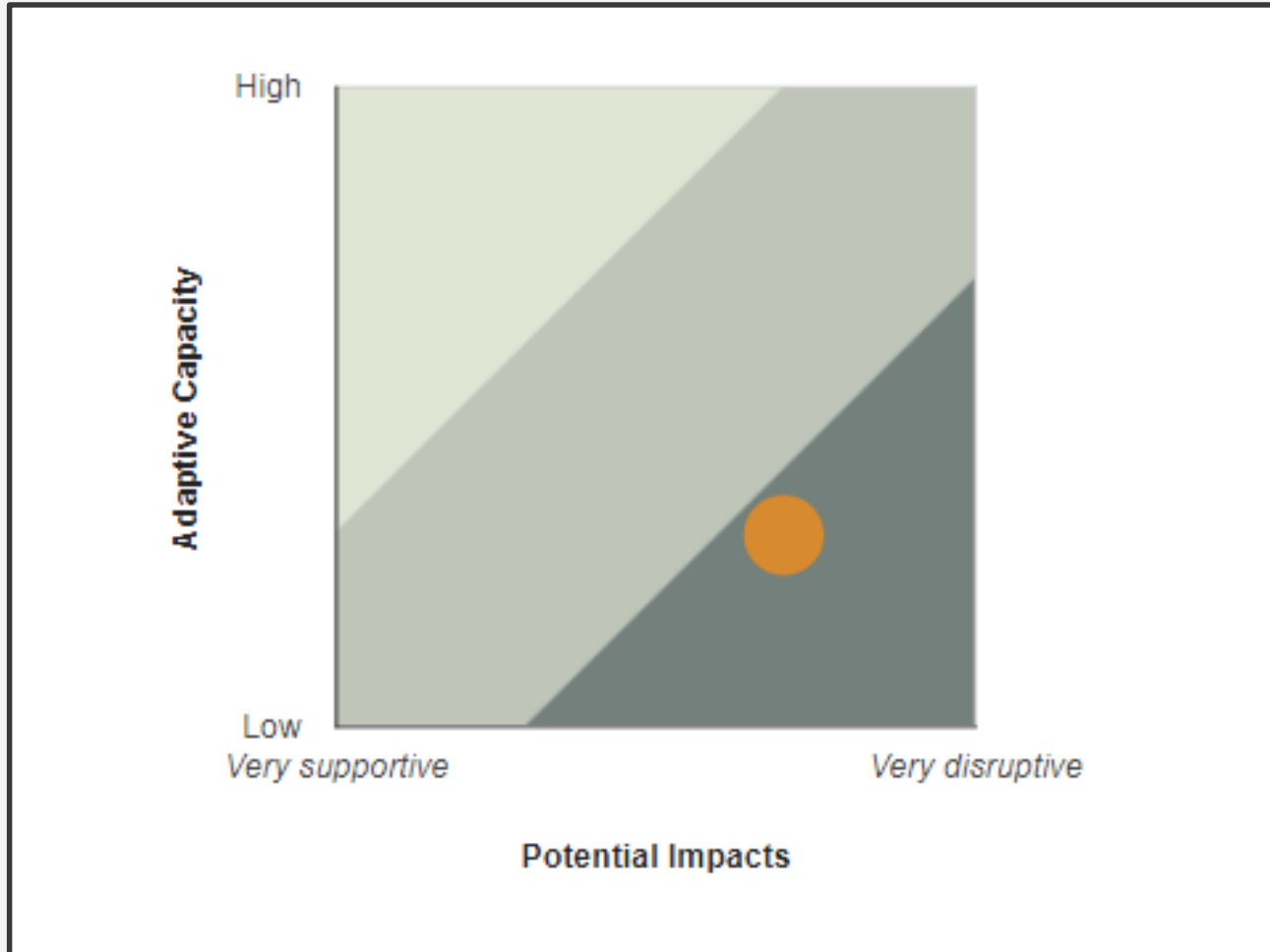
- How well the system can cope with the potential impacts.
- i.e., how resilient is the system?  
(assuming no change in management intervention)



Big question:

How **resilient** is the system to potential impacts?

# What is vulnerability?



# Vulnerability Ratings

Forest community	Potential impacts	Adaptive capacity	Vulnerability
Montane Spruce-Fir	Negative	Low	High
Northern Hardwood	Moderate-Negative	Moderate	Moderate-High
Central Oak-Pine	Moderate-Positive	Moderate-High	Moderate-Low
Woodland, Glades, and Barrens	Positive	Moderate-High	Low
Lowland and Riparian Hardwood	Moderate	Moderate	Moderate
Lowland Conifer	Negative	Moderate-Low	High
Forest community	Potential impacts	Adaptive capacity	Vulnerability
Coastal Plain Swamp	Moderate	Moderate-High	Moderate-Low
Coastal Plain Tidal Swamp	Moderate-Negative	Moderate-Low	Moderate-High
Coastal Plain Oak-Pine-Hardwood	Moderate-Positive	High	Moderate-Low
Coastal Plain Pine-Oak Barrens	Moderate	Moderate	Moderate-Low
Coastal Plain Maritime Forest	Negative	Moderate-Low	High



# Forest Vulnerability

## Dry/Mesic Oak Forest

### Low-Moderate Vulnerability (medium evidence, medium-high agreement)

This ecosystem supports a high number of tree species and occurs over a wide range of habitats. Many species are tolerant of dry soil conditions and fire, although young regeneration may be sensitive to severe drought and fire. Southern oak and hickory species are likely to benefit from projected changes in climate.

### Positive-Neutral Potential Impacts

**Drivers:** Fire frequency was historically higher than it is currently, largely due to fire suppression over the last 50 years. Drier soil conditions in summer and fall, especially on south-facing slopes, may increase the risk of wildfire. Increased frequency of extreme weather events (e.g., windstorms and ice storms) may lead to more frequent large-gap disturbances. Increases in extreme precipitation events may increase the potential for erosion and channeling.

**Dominant Species:** Of the many species modeled, suitable habitat was generally projected to increase for the southern oaks and hickories, whereas other common species are projected to persist over a smaller extent. Models project that habitat suitability, basal area and trees per acre, and potential growth for pignut hickory and white oak will remain relatively stable or increase slightly under both scenarios. Results for northern red oak are highly variable across the assessment area, but suggest positive effects on regeneration where suitable habitat remains. Other common species are not expected to do as well, especially for GFDL A1F1: models project that suitable habitat, potential growth, and trees per acre will decrease for chestnut oak and scarlet oak. Black oak is projected to remain stable for PCM B1, but for GFDL A1F1 suitable habitat is expected to increase while growth potential and trees per acre decrease. Mockernut hickory and shagbark hickory were modeled only by the Tree Atlas, and both are projected to increase in suitable habitat.

**Stressors:** Increased drought risk, especially during the growing season, may increase susceptibility to red oak borer, ambrosia beetle, gypsy moth, armillaria root disease, and other insect pests and diseases. Ailanthus, Japanese stiltgrass, and garlic mustard, which often outcompete native herbs and shrubs in this ecosystem, are expected to do well in warmer temperatures. Low-severity late-season drought generally favors oak species, although severe drought may hinder regeneration, or combine with other stressors to make individuals more susceptible to mortality or reduced productivity.

### High Adaptive Capacity

A history of fire suppression and timber harvesting has facilitated a shift to more mesic soils and associated hardwood species (e.g., sugar maple, American beech, tulip tree). Increased fire frequency could help regenerate oak species and restore the understory composition. However, very frequent fires have the potential to kill young seedlings of any species, even those species that have relatively fire-resistant, thick bark as adults. This ecosystem is widely distributed, representative of a range of habitat conditions, and likely to expand on the landscape. American chestnut was historically a dominant canopy tree but now cannot grow past sapling size due to chestnut blight. Blight-resistant American chestnut variants are currently under development and experimental planting is already occurring, resulting in increased species diversity in select areas (Jacobs et al. 2013).



A mesic oak forest with maple regenerating in the understory. Photo by Brian Streets, West Virginia Division of Natural Resources, Natural Heritage Program, used with permission.



A dry oak forest with grasses dominating the open understory. Photo by Jim Vanderhorst, West Virginia Division of Natural Resources, Natural Heritage Program, used with permission.



A dry/mesic oak forest. Photo by Jim Vanderhorst, West Virginia Division of Natural Resources, Natural Heritage Program, used with permission.

# Step 2.2: Vulnerability Determination

The screenshot shows a web application interface for 'Vulnerability Determination'. On the left is a dark sidebar with navigation options: 'Adaptation Workbook', 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1' (Define Management Topics, Management Goals and Objectives, Homework 1), 'Step 2' (Climate Impacts and Vulnerability, Vulnerability Determination, Homework 2), 'Step 3' (Evaluate Objectives, Homework 3), 'Step 4' (Adaptation Actions, Tactic Recommendations, Homework 4).

The main content area is titled 'Vulnerability Determination' and includes a 'Vulnerability Determination instructions' dropdown and 'Step 2 Course Materials'. Below this, there are two entries for 'Vulnerability Determination - Park' and 'Vulnerability Determination - riparian buffer'. The 'Park' entry shows a 'Moderate' rating, while the 'riparian buffer' entry shows 'not determined'.

The main panel displays 'Review Potential Regional Climate Impacts' with a 'Vulnerability Determination: Moderate' result. It instructs users to 'Adjust sliders to represent your property or project area' and provides two sliders: 'Potential Impacts' (ranging from Supportive to Very disruptive, with a marker at Mixed/Neutral) and 'Adaptive Capacity' (ranging from Low to High, with a marker at Moderate). Below the sliders is a 2D matrix plot with 'Adaptive Capacity' on the y-axis and 'Potential Impacts' on the x-axis. The plot is divided into three shaded regions: light green (top-left), medium grey (middle), and dark grey (bottom-right). An orange dot is placed in the medium grey region, and an arrow points to it with the text 'Auto generates'.

Annotations include: a large orange arrow pointing to the 'Moderate' result; an orange box with the text 'Use the sliders to represent potential impacts, adaptive capacity' with arrows pointing to the sliders; and another orange box with the text 'Auto generates' with an arrow pointing to the matrix plot.

# Step 2.2: Vulnerability Determination

The screenshot shows a web application interface for 'Vulnerability Determination'. On the left is a dark sidebar with navigation options: 'Adaptation Workbook', 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1' (with sub-items: 'Define Management Topics', 'Management Goals and Objectives', 'Homework 1'), 'Step 2' (with sub-items: 'Climate Impacts and Vulnerability', 'Vulnerability Determination', 'Homework 2'), 'Step 3' (with sub-items: 'Evaluate Objectives', 'Homework 3'), 'Step 4' (with sub-items: 'Adaptation Actions', 'Tactic Recommendations', 'Homework 4').

The main content area is titled 'Vulnerability Determination' and includes a sidebar with two entries: 'Vulnerability Determination - Park' with a rating of 'High' and 'Vulnerability Determination - riparian buffer' with a rating of 'not determined'. Below this is a 'Review Potential Regional Climate Impacts' window. This window contains two sliders: 'Potential Impacts' (ranging from 'Very supportive' to 'Very disruptive', with a marker at 'Disruptive') and 'Adaptive Capacity' (ranging from 'Low' to 'High', with a marker at 'Low Moderate'). Below the sliders is a 2D plot with 'Adaptive Capacity' on the y-axis and 'Potential Impacts' on the x-axis. The plot is divided into three diagonal zones: light green (top-left), medium grey (middle), and dark grey (bottom-right). An orange dot is placed in the medium grey zone. A large orange arrow points from a box labeled 'High' to the 'Vulnerability Determination: High' text in the window header.

# Step 2.2: Vulnerability Determination

The screenshot shows a web application interface for 'Vulnerability Determination'. On the left is a dark sidebar with navigation options: 'Adaptation Workbook', 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1' (Define Management Topics, Management Goals and Objectives, Homework 1), 'Step 2' (Climate Impacts and Vulnerability, Vulnerability Determination, Homework 2), 'Step 3' (Evaluate Objectives, Homework 3), 'Step 4' (Adaptation Actions, Tactic Recommendations, Homework 4).

The main content area is titled 'Vulnerability Determination instructions' and 'Step 2 Course Materials'. It lists two items: 'Vulnerability Determination - Park' with a rating of 'High' and 'Vulnerability Determination - riparian buffer' with a rating of 'not determined'. Below this is a section titled 'Review Potential Regional Climate Impacts' which contains several paragraphs of text about climate projections for the Chicago area, including temperature increases, precipitation changes, drought frequency, and species distribution shifts. A large orange arrow points from the text 'Review potential regional climate impacts' to this section. Another orange arrow points from the right side of the text to a 'Collapse' button in the top right corner of the text area.

Below the text is a 'Vulnerability Determination: High' section with a slider for 'Potential Impacts'. The slider ranges from 'Very supportive' to 'Very disruptive', with 'Supportive', 'Mixed/Neutral', and 'Disruptive' in between. A red dot is positioned on the 'Disruptive' side. Below the slider is a question: 'Collectively, how will potential climate change impacts affect this Land Use/Management Topic in your property or project area?'. At the bottom, there is a section for 'Adaptive Capacity' with a question: 'How resilient to climate change impacts or disturbance is this'.

# Step 2 Homework!

The screenshot displays the 'Adaptation Workbook' interface. On the left is a dark sidebar with navigation options: 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1' (with sub-items 'Define Management Topics', 'Management Goals and Objectives', 'Homework 1'), 'Step 2' (with sub-items 'Climate Impacts and Vulnerability', 'Vulnerability Determination', 'Homework 2', 'Step 3'), 'Step 3' (with sub-item 'Evaluate Objectives'), 'Step 4' (with sub-items 'Adaptation Actions', 'Tactic Recommendations', 'Homework 4'), and 'Homework 4'. The main content area is titled 'Homework 2' and contains a text prompt: 'How vulnerable is your forest or project area to climate change? Briefly mention the broad-scale impacts and vulnerabilities most relevant to your project area, and why you flagged them as the most important for your forest. Are there other factors that affected your vulnerability determination?'. Below this is a text input field. The next section is 'Assessing Vulnerability: give your honest ranking of the following (remember, no grades assigned here!)'. It features a table with five columns: 'Low/disagree', 'Disagree', 'Neutral', 'Agree', and 'High/agree'. Each row contains a statement and five radio buttons for ranking. The statements are: 'I understand the potential local impacts of climate change on the lands that I manage.', 'I gave my forest or project area a climate change vulnerability ranking of...', 'I could easily identify the impacts that will be most severe for my forest/project area.', and 'If asked, I could explain to a colleague how vulnerability assessments make climate model projections relevant at the regional and local scales.'. Below the table is a question: 'Are you interested in sharing your project via our webpage (www.forestadaptation.org/demos) now or in the future?'. This is followed by another text input field. At the bottom left, there is a 'Previous' button labeled 'Vulnerability Determination'. At the bottom right, there is a 'Next' button labeled 'Evaluate Objectives'.

Adaptation Workbook

My dashboard

Log out

Resources

Chicago project

Progress Summary

Step 1

Define Management Topics

Management Goals and Objectives

Homework 1

Step 2

Climate Impacts and Vulnerability

Vulnerability Determination

Homework 2

Step 3

Evaluate Objectives

Homework 3

Step 4

Adaptation Actions

Tactic Recommendations

Homework 4

## Homework 2

How vulnerable is your forest or project area to climate change? Briefly mention the broad-scale impacts and vulnerabilities most relevant to your project area, and why you flagged them as the most important for your forest. Are there other factors that affected your vulnerability determination?

How vulnerable is your forest or project area to climate change? Briefly mention the broad scale impacts and vulnerabilities most relevant to your project area, and why you flagged them as the most important for your forest. Are there other factors that affected your vulnerability determination?

Assessing Vulnerability: give your honest ranking of the following (remember, no grades assigned here!)

	Low/disagree	Disagree	Neutral	Agree	High/agree
I understand the potential local impacts of climate change on the lands that I manage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I gave my forest or project area a climate change vulnerability ranking of...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I could easily identify the impacts that will be most severe for my forest/project area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If asked, I could explain to a colleague how vulnerability assessments make climate model projections relevant at the regional and local scales.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Are you interested in sharing your project via our webpage (www.forestadaptation.org/demos) now or in the future?

Are you interested in sharing your project via our webpage (www.forestadaptation.org/demos) now or in the future?

◀ Previous  
Vulnerability Determination

Next ▶  
Evaluate Objectives

# Questions?



# Homework

- **Look at climate change impacts and vulnerability resources for your state and/or area**
- **Watch the video presentation** Impacts of Climate Change on Urban Forests
- **Complete Step 2: Assessing Impacts & Vulnerability**
- **Complete the Homework** section following Step 2
- **Come to Session 3 (Tuesday, February 5th)** ready to talk about your project area's top vulnerabilities

# Questions?

