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NAME DATE

This guide will provide instructions for using the Climate Change Tree Atlas (Part 1) and Bird Atlas (Part 2). Follow the steps and answer the questions on this worksheet. Once you are on the Atlas website, do not follow any link to the new Climate Change Atlas website.

Things to Know Before You Get Started

AS YOU NAVIGATE THE WEBSITE, look for this green help button. You can click this button to get more information about specific areas of the website.

The Atlas uses three global climate models to show a range of projected changes in the year 2100, and for each model you can view projections under two carbon-emission scenarios. In addition, the Atlas includes results for both emission scenarios using an average from all three models.

Global Climate Models

1. Parallel Climate Model (PCM)
2. Hadley CM3 model (Hadley)
3. Geophysical Fluid Dynamics Laboratory model (GFDL)

Emission Scenarios

1. High emission scenario (where little conservation efforts are taken to reduce atmospheric carbon dioxide)
2. Low emission scenario (where significant efforts are taken to reduce atmospheric carbon dioxide)

In total, you can view projected changes in eight combinations of models and scenarios:

1. Hadley-High
2. Hadley-Low
3. PCM-High
4. PCM-Low
5. GFDL-High
6. GFDL-Low
7. Avg. of 3-High
8. Avg. of 3-Low

Generally, the Hadley-High model shows the worst-case scenario (greatest effects from climate change, with highest emissions), while PCM-Low shows the best-case scenario (least effects from climate change, with lowest emissions). Because these two models provide the full range of possible projected changes, they will be the focus for most of the activity.

Part 1: Tree Atlas

- Open the Climate Change Tree Atlas on your web browser: www.nrs.fs.fed.us/atlas/tree

First, we'll look at projected temperature and precipitation changes in your state and see how the assumptions in the different models and scenarios change these projections.

- Click the ***Summary of Predictors*** button on the right side of the screen under *134 Species Combined/Compared*.

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- Click ***Maps of Actual Predictors Used in the Model*** under *Predictor Values*.

- By default, this page will load maps under the *Average Temperature* tab in the *Climate* category. The map on the left shows *Average Annual Temperature* under *Current* climate conditions and the map on the right shows projected *Average Annual Temperature* under the *Hadley-High* model.

1. Read the map legends and compare the two maps. According to the *Hadley-High* model for the end of this century, how might average temperature in your area change?

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- By hovering over the ***Climate Scenario Menu*** button, you should see that, in addition to the *Current* map, there are eight different maps to view for average temperature. Each map uses a different combination of global climate models and emission scenarios.

- By clicking on one of the options in the ***Climate Scenario Menu*** button, you can select a model for one map and compare it to a different model in the other map. In the map on the left, choose *PCM-Low*. Keep the map on the right set for *Hadley-High*.

2. Describe the difference between the average temperature maps for the *PCM-Low* and *Hadley-High* scenarios.

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- Now click the ***Precip.*** tab. Note: Each time you click a new tab, the maps will reset to *Current* and *Hadley-High*.

3. Read the map legends and compare the two maps. According to the *Hadley-High* scenario for the end of this century, how is the precipitation in your state expected to change compare to *Current* conditions?

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- By clicking on the ***Climate Scenario Menu*** button in the map on the left, choose *PCM-Low*. Keep the map on the right set for *Hadley-High*.

4. Describe the difference between the precipitation maps for the *PCM-Low* and *Hadley-High* scenarios.

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- Next, compare the current map with maps based on the average of three high scenarios (*Avg. 3-high*) and the average of three low scenarios (*Avg. 3-low*) for average temperature and precipitation.

5. Summarize the differences that could occur in the southeastern U.S. in terms of changes in temperature and precipitation. List the places under one of the average models where temperature and precipitation are projected to remain the same.

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Next we'll look at potential changes for forest types in the eastern U.S. under different climate scenarios.

- Look just below the brown menu bar at the top of the page and click ***Tree Atlas*** in the *You are here* line.

- Click on the ***Combined Species Output*** button on the right of the screen under *134 Species Combined/Compared.*

- Click the ***Modelled Future Habitats*** tab, and then click ***Potential Changes by Forest Types***. Just as before, you can compare two maps and change the models that were used to make the maps.

- The *Current Forest Inventory and Analysis* (FIA) map on the left side identifies the forest types found in your state, using the data collected on forest inventory plots by the U.S. Forest Service. The forest type shown in a particular map location is the dominant forest type found there. Note that in any given location, there may be other nondominant forest types present that are not represented on the map.

6. Read the legend for the *Current FIA* map. Describe the forest types found in your state (general locations and abundance). *Hint: Click the green help button at the top of the page to see the full titles for forest types and the list of the major tree species in each.*

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- Use the ***Climate Scenario Menu*** button to compare how suitable habitat for the forest types in your state will change under the different models and scenarios. Make sure to look at the *Hadley-High* and *PCM-Low* scenarios. You can also click the ***View Summary of Changes*** button to compare several scenarios at once.

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7. Looking at the *Hadley-High* and *PCM-Low* scenarios, how might the suitable habitat for forest types be affected by climate change in your state?

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Next we'll look at potential changes for individual tree species in the eastern U.S. under different climate scenarios.

- Look just below the brown menu bar at the top of the page and click ***Combined Species Outputs*** in the *You are here* line.
- Click the ***Modelled Future Habitats*** tab.
- Click ***Potential Species Winners and Losers by State*** and click on your state in the map.
- After clicking on your state, you will be directed to a sortable table of species and the relative abundance of a species (called *Importance Value*).
- The top row of the table contains abbreviations for each column in the table. Hover your mouse over each abbreviation to see the full title for each column. In columns 6 through 10, you'll see the titles for different climate models and emission scenarios.
- By clicking each model, you can determine which species are projected to lose or gain potential suitable habitat. You can sort the list from high to low numbers, or low to high numbers, by clicking the small orange arrow. *Hint: A species with a negative number is projected to lose suitable habitat; a species with a positive number is projected to gain suitable habitat. The species with a zero either do not grow in your state or are not projected to change in the future.*

8. For each model, name the top three species that would gain suitable habitat in your state. Put your answers in the following table.

	Hadley-High (HadHiDif)	PCM-Low (PcmLoDif)	Avg. 3 GCMs-High (Gcm3AvgHiDif)	Avg. 3 GCMs-Low (Gcm3AvgLoDif)
1 (highest score)				
2				
3				

From your table, which species are most commonly shown as gaining suitable habitat?

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9. For each model, name the top three species that would lose suitable habitat in your state. Put your answers in the following table.

	Hadley-High (HadHiDif)	PCM-Low (PcmLoDif)	Avg. 3 GCMs-High (Gcm3AvgHiDif)	Avg. 3 GCMs-Low (Gcm3AvgLoDif)
1 (highest score)				
2				
3				

From your table, which species are most commonly shown as losing suitable habitat?

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Part 2: Bird Atlas

For Part 2, we'll look at potential changes for bird species in the eastern U.S. under different climate scenarios.

- Open the Climate Change Bird Atlas on your web browser: www.nrs.fs.fed.us/atlas/bird/index.html
- Click ***Combined Species Outputs***.
- Click ***Modelled Future Habitats***.
- Click ***Potential Changes by State,*** and then click on your state in the map.
- Click on ***Winners and Losers at a Glance*** and maximize the table that appears in a new window. This table contains values for the current and modeled future relative abundance (incidence value) of different bird species in your state.

10. Which three bird species are currently most abundant in your state?
Hint: Look in the Current Modeled column *(labeled* CUPRD*), where the bird species are sorted in descending order by abundance value. The ten most abundant species are highlighted in green.*

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- The columns to the right of the current modeled data contain data for the eight climate scenarios. The values in those cells represent the difference from the modeled scenario and the current model.

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11. For the models below, name the top three species that would gain the most suitable habitat in your state. The top ten species that gain abundance in the various scenarios are highlighted in green. Put your answers in the following table.

	PCM-Low (PCMLO)	Hadley-High (HADHI)	Avg. of 3 Models-Low (GCM3LO)	Avg. 3 Models-High (GCM3HI)
1 (highest score)				
2				
3				

From your table, which species are most commonly shown as gaining suitable habitat?

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12. For each model, name the top three species that would lose the most suitable habitat in your state. The bottom ten species to have a loss in abundance are highlighted in pink. Put your answers in the following table.

	PCM-Low (PCMLO)	Hadley-High (HADHI)	Avg. of 3 Models-Low (GCM3LO)	Avg. 3 Models-High (GCM3HI)
1 (highest score)				
2				
3				

From your table, which species are most commonly shown as losing suitable habitat?

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Next, we'll look more closely at the bird species projected to gain or lose potential habitat in your state.

- Close the window *Winners/Losers at a Glance*.
- Return to the main ***Bird Atlas*** page using the *You are here* line under the brown menu bar.
- Sort the table of bird species by clicking on the ***Common Name*** header.
- Choose one of the species projected to **gain** potential habitat in your state, and click on that bird's common name in the list.
- The links provided under ***External Species Links*** will allow you to hear the calls of the individual bird species, see video of the birds in their natural habitat, and learn more information about the species.

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13. Using the links under *External Species Links*, complete the following table:

Common name:	
Scientific name:	
Habitat description:	
What do these birds eat?	
Where do these birds nest?	

- Return to the main ***Bird Atlas*** page using the *You are here* line under the brown menu bar.

14. Now choose one of the species projected to **lose** potential habitat in your state, click on that bird's common name in the list, and use the ***External Species Links*** to complete the following table:

Common name:	
Scientific name:	
Habitat description:	
What do these birds eat?	
Where do these birds nest?	