Temperatures Predict Bird Biodiversity

Birds are pretty sensitive when it comes to temperature. Some species struggle to keep warm during cold winters. Other birds have expanded their range northward as global climate has warmed. It turns out scientists can use this close relationship between temperatures and bird behavior to predict bird biodiversity.

To map temperature patterns across the continental United States, Elsen and colleagues compiled data acquired from 2013 to 2018 by the Thermal Infrared Sensor (TIRS) on Landsat 8. They focused on data from December through February, the cold winter months when birds are most affected by temperature. Then the researchers compared their temperature maps with existing ground-based surveys for large and small resident (non-migratory) birds.

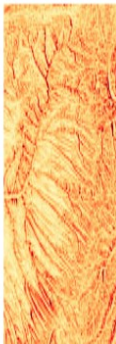
Ground-based survey data indicated that both small and large birds tend to prefer locations with higher overall winter temperatures. Detailed maps show, however, that there can be quite a bit of variation on local scales. Places that are generally cold in winter can still have areas of relative warmth and potential bird habitat.

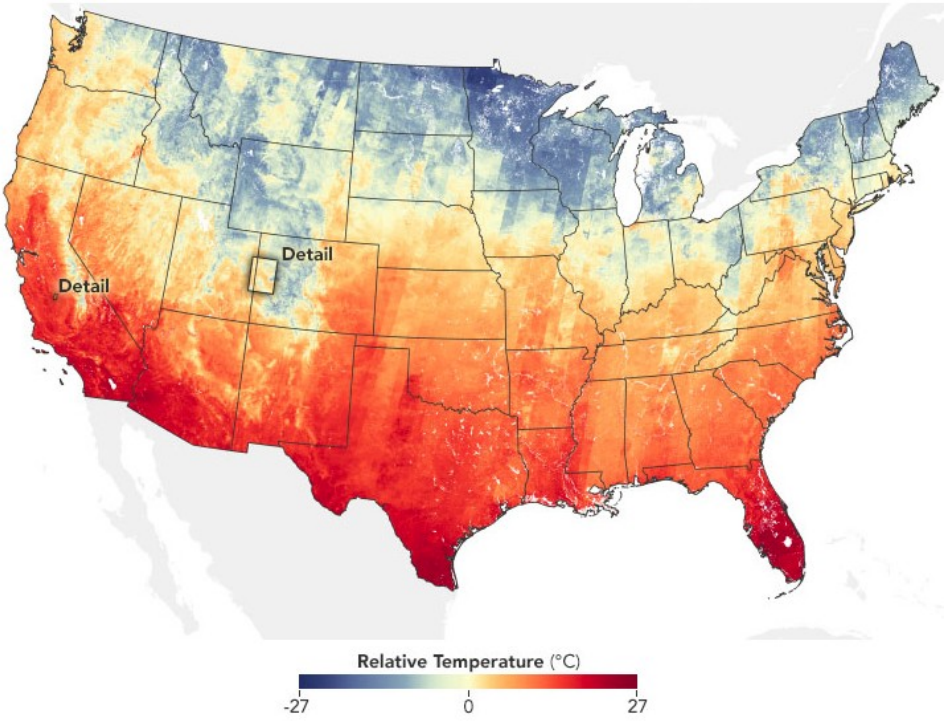
“Land cover also influences the thermal environment, and we can really see that in the agriculture map,” Elsen said. “This is a very flat landscape, but there are a lot of different temperatures because there are different kinds of crops creating different local temperature conditions.”

Small birds do not regulate their body temperature as well as large birds, and they generally do not move as far in search of warmer environments. Ground-based survey data confirm that small birds prefer landscapes with larger thermal differences, likely because they offer more opportunities to find refuge from the cold.

In their paper, Elsen and colleagues go on to show that the relationship between temperatures and bird behavior can be used in models to accurately predict bird species richness during the winter. “That means we can make some fairly good predictions about how species might respond to future temperature changes,” Elsen said.

https://earthobservatory.nasa.gov/images/146800/temperatures-predict-bird-biodiversity

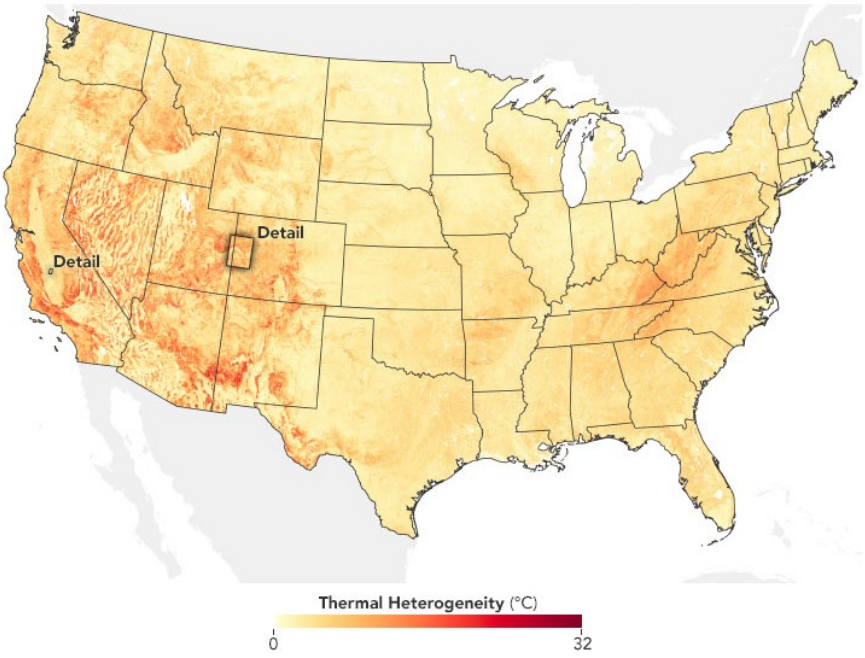




Thermal Birdhouse

Your task: NASA has hired yo
to build a thermal birdhouse tc
help small birds in the winter
keep warm in their own homes

Requirements: Build a model
a birdhouse that can keep a 5
mL beaker of water at a given
temperature for 15 minutes.



Constraints

Blueprint

Draw your blueprint here

Stations:

Station	Before Temperature Celcius	After Temperature Celcius	Difference	Observation
1				
2				
3				
4				
5				
6				

RERUN:

Station 1:

Materials: Aluminum foil lined box, Clamp light, Thermometer, 2 popsicle sticks, BLACK CONSTRUCTION PAPER

Instructions: Place the two popsicle sticks on either side of the thermometer flat in the middle of the aluminum lined box. Place the BLACK CONSTRUCTION PAPER on top of the thermometer. Record the before temperature then turn on the light, wait 1 minute, turn off the light, and record the after temperature. Calculate the difference between the before and after temperature and create an observation for this station.

Station 2:

Materials: Aluminum foil lined box, Clamp light, Thermometer, 2 popsicle sticks, BLACK FOAM

Instructions: Place the two popsicle sticks on either side of the thermometer flat in the middle of the aluminum lined box. Place the BLACK FOAM on top of the thermometer. Record the before temperature then turn on the light, wait 1 minute, turn off the light, and record the after temperature. Calculate the difference between the before and after temperature and create an observation for this station.

Station 3:

Materials: Aluminum foil lined box, Clamp light, Thermometer, 2 popsicle sticks, WHITE CONSTRUCTION PAPER

Instructions: Place the two popsicle sticks on either side of the thermometer flat in the middle of the aluminum lined box. Place the WHITE CONSTRUCTION PAPER on top of the thermometer. Record the before temperature then turn on the light, wait 1 minute, turn off the light, and record the after temperature. Calculate the difference between the before and after temperature and create an observation for this station.

Station 4:

Materials: Aluminum foil lined box, Clamp light, Thermometer, 2 popsicle sticks, WHITE FOAM

Instructions: Place the two popsicle sticks on either side of the thermometer flat in the

middle of the aluminum lined box. Place the WHITE FOAM on top of the thermometer. Record the before temperature then turn on the light, wait 1 minute, turn off the light, and record the after temperature. Calculate the difference between the before and after temperature and create an observation for this station.

Station 5:

Materials: Aluminum foil lined box, Clamp light, Thermometer, 2 popsicle sticks, MYLAR

Instructions: Place the two popsicle sticks on either side of the thermometer flat in the middle of the aluminum lined box. Place the MYLAR on top of the thermometer. Record the before temperature then turn on the light, wait 1 minute, turn off the light, and record the after temperature. Calculate the difference between the before and after temperature and create an observation for this station.

Station 6:

Materials: Aluminum foil lined box, Clamp light, Thermometer, 2 popsicle sticks, ALUMINUM FOIL

Instructions: Place the two popsicle sticks on either side of the thermometer flat in the middle of the aluminum lined box. Place the ALUMINUM FOIL on top of the thermometer. Record the before temperature then turn on the light, wait 1 minute, turn off the light, and record the after temperature. Calculate the difference between the before and after temperature and create an observation for this station.

Name: _____

Graffiti Vocab

Directions: Choose one of the following terms (*Insulator, Conductor, Convection, Conduction, or Radiation)* and create a colorful display of the term including its definition and examples.

Graffiti Vocab

Term:	1	2	3	4
Color	No color only black and white	Color is used but not incorporated into the overall design	Color is incorporated into the overall design	Color is incorporated into the overall design and adds to the overall appearance
Graphic	No visuals	Visuals are not related to the term	Visuals are related to the term	Visuals are related to the term and are incorporated into the overall

				design
Term	Term is not included	Term is illegible and/or misspelled	Term is legible and spelled correctly	Term is legible, spelled correctly, and incorporated into the overall design
Definition	No definition	The definition is included either in words or examples	The definition is included either in words and examples	The definition is included either in words, examples, and is incorporated into the overall design

Total: _____/16

Initial testing Day

Group	Start temperature Celsius	After Temperature Celsius

Initial Testing Day Analysis

1. Which group had the best results?

2. What did that group do differently than your group?

3. Which group had the worst results?

4. What did that group do differently than your group?

5. What can your group do to modify your birdhouse to have better results? List and explain at least two modifications.

Modification

Please record all modifications completed by your group in both written and visual form.

Group Members: _____

Keep the Heat Rubric

RERUN

5 points: RERUN

5 points: Labeled diagram

2 points Submission of device

3 points Minimize Heat Transfer

3 points: Keeps the heat for given time +/- 0-2 degrees

Before Temperature: _____°C

After Temperature: _____°C

2 points: Keeps heat for given time +/- 2-5 degrees
1 point: Keeps heat for given time +/- 5-10 degrees
0 point: Does not keep the heat

Total: _____/15 Points