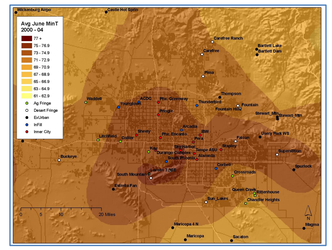
Creating a cross-disciplinary unit for middle school children on the Urban Heat Island.

Elser, M.[1], T. Ganesh[2], S. Harlan[3], G. Hupton[1], D. Medina[4], and E. Ortiz[5].

[1]Global Institute of Sustainability, Arizona State University, PO Box 875402, Tempe, AZ 85287-5402; [2]School for Engineering of Matter, Transport, & Energy, Ira A. Fulton Schools of Engineering, Arizona State University, PO Box 876106, Tempe, AZ 85287-6106;[3]School of Human Evolution and Social Change, Arizona State University, PO Box 872402, Tempe, AZ 85287-2402;[4]School of Social and Family Dynamics, Arizona State University, PO Box 873701, Tempe, AZ 85287-3701; and [5]Biosciences Department, Phoenix College, 1202 W. Thomas Rd., Phoenix, AZ 85013



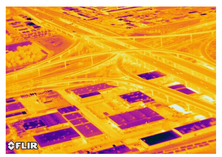
Investigating the Urban Heat Island in the Phoenix area has involved many ASU researchers. Over the past several years, we have had the opportunity to create and implement a 7/8th grade unit focusing on the Urban Heat Island with input from natural scientists associated with CAP LTER, social scientists associated with the NSF-funded Urban Vulnerability to Climate Change project, and engineering education faculty associated with an NSF-funded Innovative Technology Experiences for Students and Teachers grant. Various components of the unit were tested in after-school programs and in the Junior Ace program of Phoenix College. We present here the parts of the unit.

Exploring The Local Environment (5 lessons)

Overall Theme: How do people interact with and change the natural environment?

Sample Learning Objectives (after completing this unit student will be able to…):

- list three examples of the natural and built environment affecting each other.
- discern patterns in surface temperature on a variety of surfaces around the school grounds.
- design an experiment to compare surface temperatures with temperatures at 3m
- learn to use IR thermometers for determining temperature
- use infrared images for comparing temperature
- define Urban Heat Island



Lesson Resources: Day/Night Infrared Images

Metal Sewer Cover	Sun	160°
Fountain	Sun	75°
Ice Cream	Inside	24.9°
Side Walk	Sun	147°
Flag Poles	Sun	108°
Dirt	Sun	162°
Black Shirt	Sun	91°

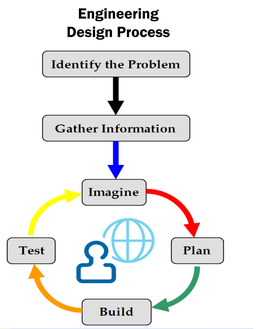
Student Collected Data

Exploring Building Materials & Building Design (3 Lessons)

Overall theme: Which types of building material and building design would keep us cooler in the summer

Sample Learning Objectives (student will be able to…):

- design an experiment to investigate the impact of surface color on surface temperature.
- design an experiment to investigate the impact of different insulation materials on surface temperature.
- design and construct a model house using the Engineering Design Process so the inside temperature is at least 8-10ºF lower than the outside temperature on a sunny day in an Urban Heat Island environment.



Students designing and testing their model houses

Responding to Temperature (4 lessons)

Overall Theme: How do living things respond to changing temperatures in the local environment?

Sample Learning Objectives (after completion of the unit students will be able to….)

- compare and contrast different ways that organisms respond to microclimates in their environment
- design an experiment to document the cooling effect of evaporation
- document that plants release water through evapotranspiration
- differentiate among heat-related health issues (heat stroke, heat exhaustion)
- take pictures documenting UHI in their neighborhood

Example lesson: Photovoice Assignment:

- Take **27 pictures** showing how **temperature** relates to the biotic and abiotic parts of the urban ecosystem.
- Research Focus: Variables that affect temperature in your environment, and the effect of temperature on you, your friends and neighbors.
- Discuss the photographs in class

Photovoice is a process by which people can identify, represent, and enhance their community through a specific photographic technique (Wang & Burris, 1997).

For one my dog got shaved because it's so hot and he is in the shade to cool off. And it effects him because it's so hot! Good thing he got shaved because he would be burning up. This one is one of my favorites because, well he's my dog….Tajah

This is my next favorite picture because I like dogs and I play with them which makes me sweaty and thirsty. You should drink plenty of water during the day. When you run, walk the dog, play sports, or even work outside. you always need to drink water…B. Escalante

This picture is a nest of a Gila Woodpecker and it doesn't make a nest in the tree because it's cooler inside the cactus. I took this picture because it's a great example on how animals adapt to heat…M Gamboa

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Photovoice was easy to do		1	6	2	2
Photovoice was fun to do	1		2	4	4
Photovoice was meaningful	1		4	4	2

Future Directions:

Will post modified unit on Ecology Explorers Website:
http://ecologyexplorers.asu.edu

Will post units on Chain Reaction Website:
http://www.chainreactionkids.org

Will present unit to teachers:
Spring 2011 workshop
Summer 2011 workshop

Will use with students:
Summer 2011 Jr. Ace Program, Phoenix College
ASU Summer 2011 Kid's Camp

Course Schedule: Phoenix College Jr. Ace Program

1 June	Introduction How to Make Observations	--
2 June	Bird Identification; Bird Census Scientific Method	1. Chain Reaction 4: What is Urban Ecology? P.12-13 2. Chain Reaction 2: Phoenix: A City for the Birds P.29-30 3. Chain Reaction 2: Listen to the Birds P.32-33
7 June	Phoenix Temperatures Natural vs Built Environments	4. Chain Reaction 2: At Home in the Sonoran Desert P.8-11 5. Chain Reaction: How do Scientists Study the Environment?, pgs. 30-31
8 June	Exam I Heat and Health	6. New York Times Article: Pro Football - For Vikings, Reflection Hits Hard. 7. Chain Reaction 2: Thermoregulation P.38-40
9 June	**Social Science** **Photovoice Intro**	8. Chain Reaction 4: How do Scientists Study the Environment? P.30-32 9. What is Photovoice? 10. Photo voice board sheds light on area's homeless youth
14 June	Exam II **PhotoVoice Project Time**	
15 June	Thermal Images Day vs Night	11. Chain Reaction 4: Where People Are P. 14-15 12. An Island in the Sun
16 June	Land Use Activity Bird Data Summary	13. Chain Reaction 2: Numbers Tell the Story P. 34-35 14 Chain Reaction 4: Good Life for Birds P. 16-17
21 June	Exam III Color and Heat	
22 June	Color and Heat Temperature Data Summary	15. Chain Reaction 4: A Shady Situation P. 18-19
23 June	**PhotoVoice Project Time** Work on Presentations	
28 June	Ecosystem Services Work on Presentations	16. Nature: Silence of the bees 17. Ecosystem Services (ESA)
29 June	Presentations	--
30 June	Final Exam	--

ASU GLOBAL INSTITUTE of SUSTAINABILITY
ARIZONA STATE UNIVERSITY

NSF CAP LTER Central Arizona-Phoenix Long-Term Ecological Research
ECOLOGY EXPLORERS