

Place, community, and biosphere: An overview of the TERC Life Science Initiative's climate education work

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TERC

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Introduction

- Practicing scientists in Ecology
- Ecological perspective
- Training and assumptions about ecosystems, systems thinking, complexity, etc.



Early work 1

- **The Global Lab**

- The first network of schools using “telecommunication”
- Making and sharing environmental measurements
- Included a unit on measurements related to climate change



Early work 2

- **Ecology: A systems approach**
 - Adopted a systems approach to studying ecosystems
 - Placed issue of carbon cycling and climate change in the broad context of ecology and evolution



Biocomplexity and the habitable planet

- Year long capstone high school course
- Built around cases local-to-global, focused on land use, resource use and conservation
- Introduces new science

Biocomplexity and the habitable planet

Home Urban Biocomplexity Suburban Sprawl Amazonia Arctic

Home

Biocomplexity Resources

5



Biocomplexity

SOCIAL CONTEXT

Ecosystem Services

- Ecosystem processes on which humans depend

NATURAL SYSTEMS

Landscapes

- Spatial context and its structure and patterns

Coupled natural & human (CNH) systems

- Considering humans, their social institutions and behaviors as part of all ecosystems

Experiencing research first hand...

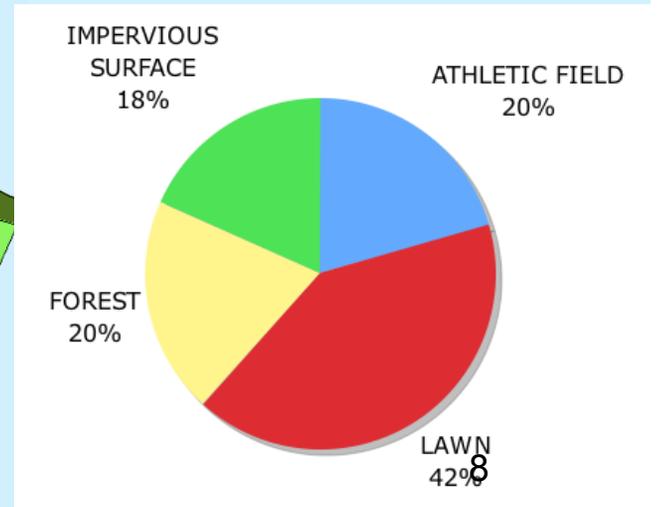
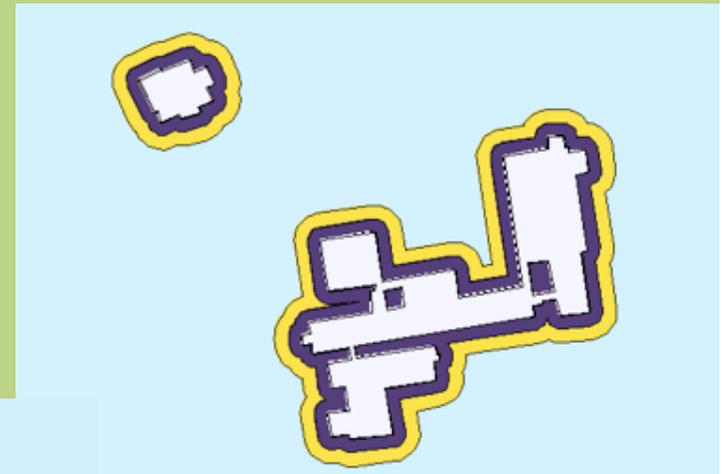


BIRDS		
American crow		
American goldfinch		
American robin		
Barn swallow		
Blue jay		
Canada goose		
Carolina chickadee		
Carolina wren		
Cedar waxwing		
Chipping sparrow		
Common grackle		
Downy woodpecker		
Eastern kingbird		
European starling		
Gray catbird		
Green heron		
House sparrow		
Mourning dove		
Northern cardinal		
Northern flicker		
Ringed-bill gull		
Sharp-shinned hawk		
Song sparrow		
Tufted titmouse		
Turkey vulture		
White-breasted nuthatch		
Yellow-crowned night heron		
[Unidentified large raptor]		



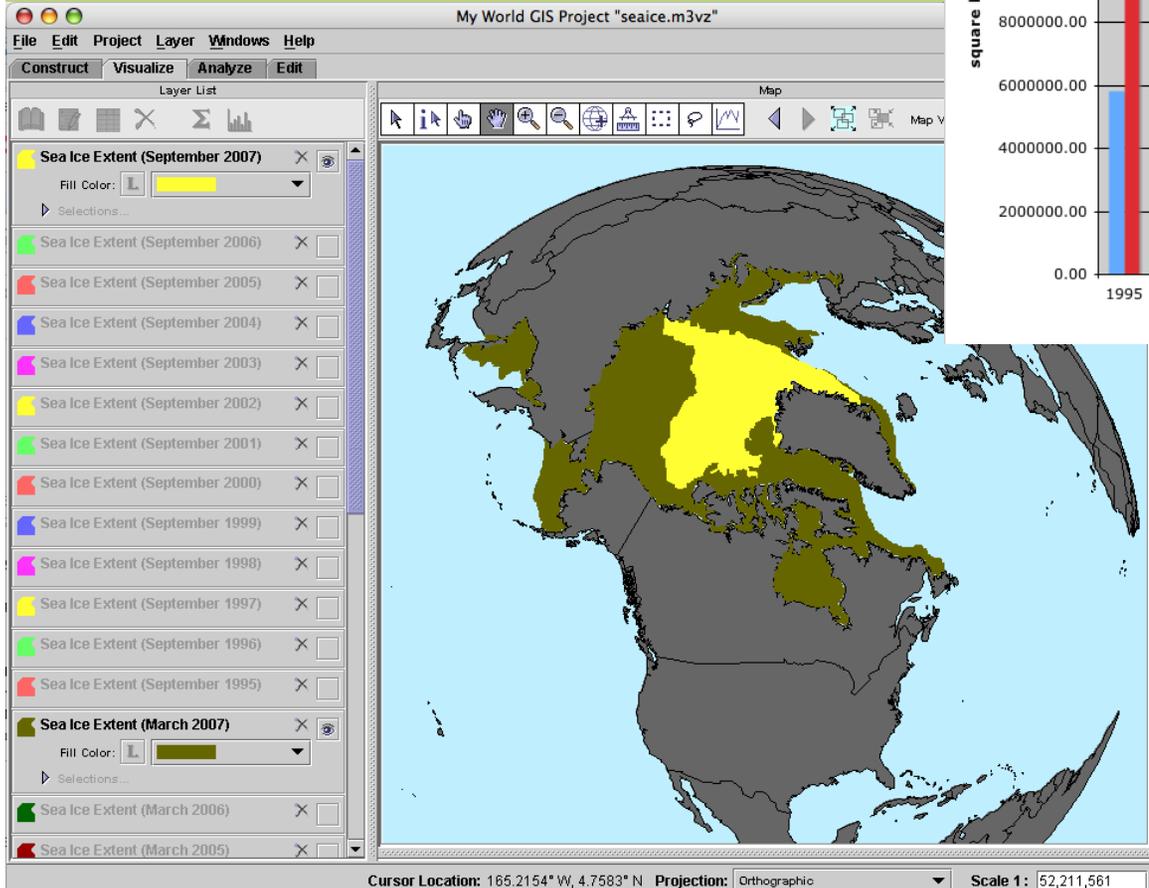
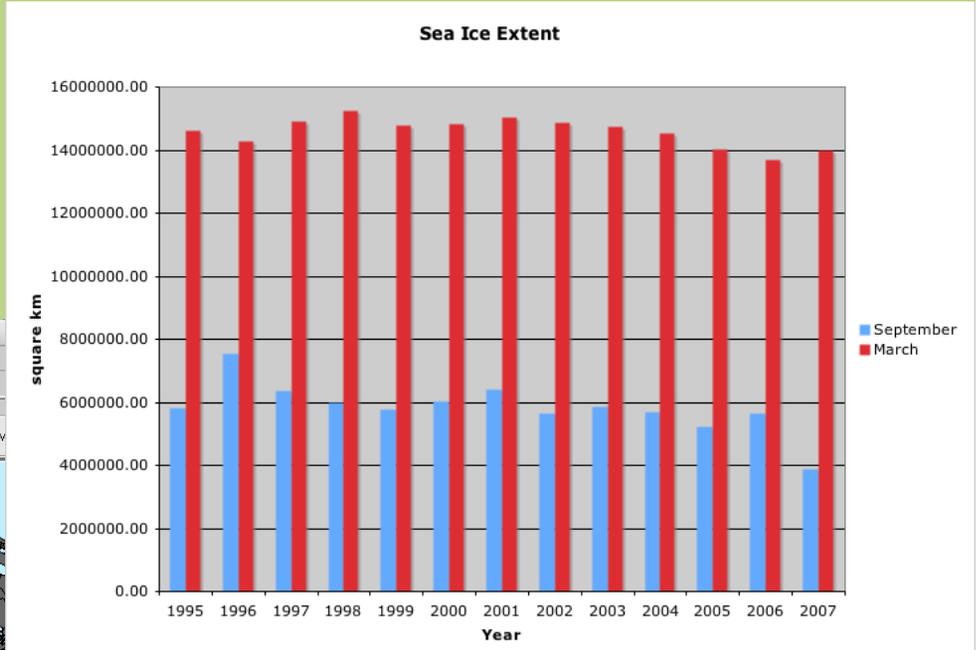
Use Real Data as Evidence

Existing Site vs. the 3 Scenarios



Arctic

	A	B	C
1	Year	September	March
2	1995	5804653.50	14612152.63
3	1996	7529641.00	14287196.94
4	1997	6350118.50	14911608.44
5	1998	5992598.00	15224399.00
6	1999	5764920.00	14791946.63
7	2000	6016656.50	14810169.50
8	2001	6411767.00	15015106.88
9	2002	5657139.50	14855622.63
10	2003	5862068.00	14734680.13
11	2004	5686248.00	14532936.56
12	2005	5207504.50	14004288.25
13	2006	5645656.50	13696842.44
14	2007	3862648.75	13989895.25
15			



GIS Analysis of Arctic Sea Ice Extent over Time



Polar bear

Bowhead



Little Auk



Red
Knot



Caribou



New approaches? The problem

- Science of climate change is complex
- Learning about it is difficult
 - Results from Yale study group
 - Research findings from the classroom
 - Public discourse about climate change



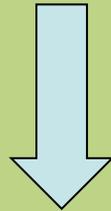
New approach? A conjecture

- Learning about climate change is difficult because:
 - Science is abstract
 - Complex, diffuse and probabilistic causality (Grotzer)
 - Effects seem distant in space and time (Leiserowitz)
 - Science practices are unfamiliar (Osborne, Krajcik)
 - Learning is also influenced by emotional dimension (Saunders, Moser)
- Therefore, we conjecture that a place-based approach can counter these difficulties



New approaches?

- Stories
- Local (New England) examples



- The importance of Place



Biosphere and Climate

Understanding Climate Change in New England



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[Species Impact List](#)

[Science Updates](#)

[Good News](#)

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Latest Updates:

New species added to the Peer Reviewed Changes list

Curriculum Sample



Title: Your Town in Past, Present, and Future

Grade Level: 3-5

Source: National Geographic

[Other curriculum studies](#)

Collaborating to Teach the Ecology of Climate Change in New England



Mammalian responses to climate change

Abe Drayton posted on Jul 08, 2014

In our last post, we reported on a study of how lungless salamanders are responding to climate change. This week, we're reading a literature review of mammal studies in North America.



Christy McCain and Sarah King examined 1050 papers that took a look at the ways in which human-caused climate change is affecting mammals in North America. They took pains to include only works that could exclude other factors that might be causing changes, such as habitat destruction

The first thing to note about this study is that the authors sought, and found no publication bias. Science deniers often claim that there is a bias toward "popular" results, that is, studies that seem tilted to support mainstream opinion.. McCain

Case Studies



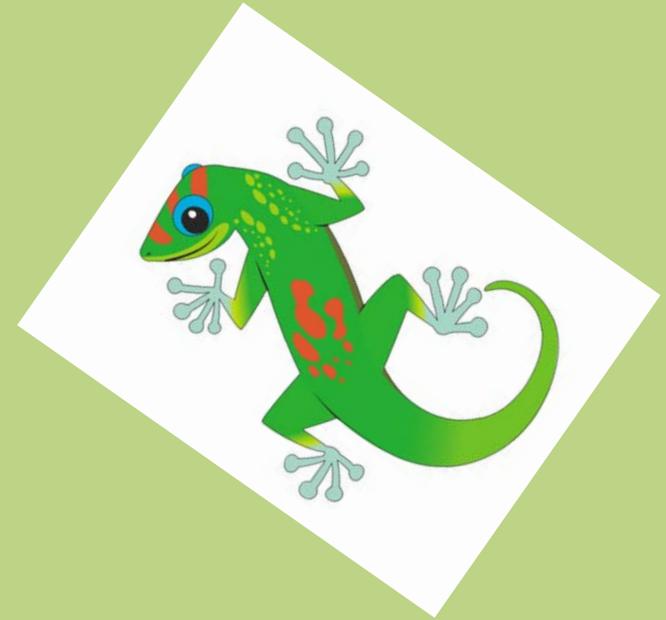
Northern Shrimp (*Pandalus borealis*)



Atlantis Fritillary (*Speyeria atlantis*)

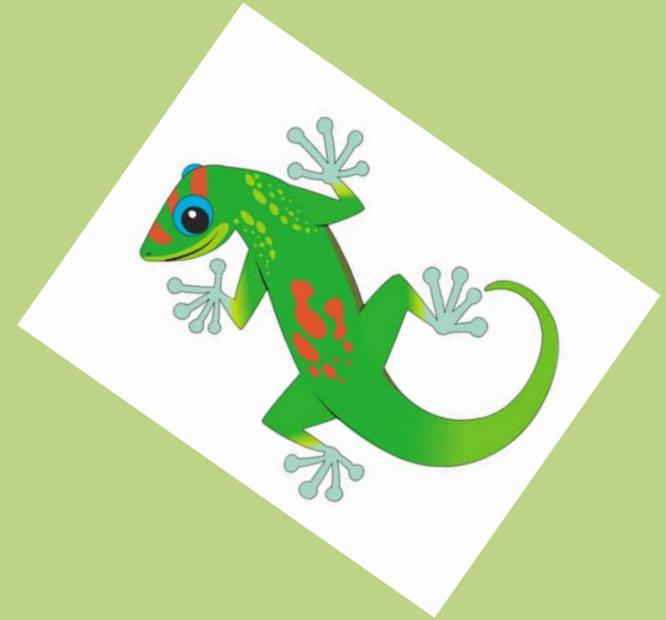


GECCo





GECCo

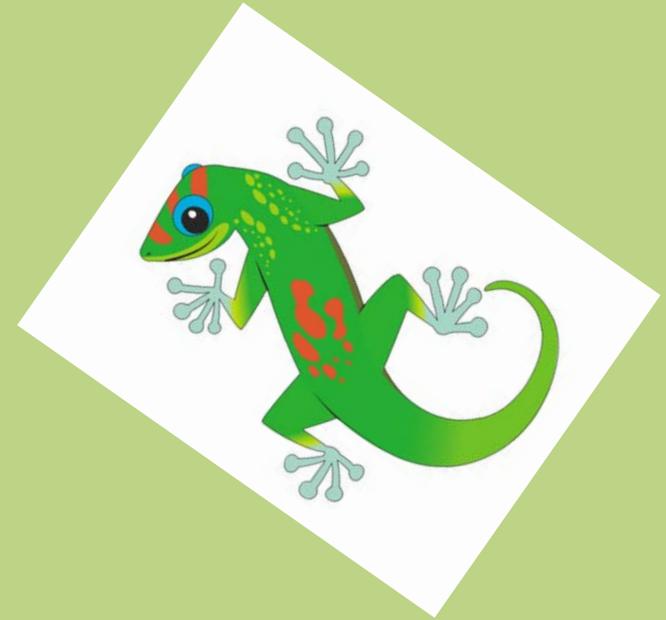


Girls

- Learn about energy conservation
- Learn about climate change and their own connection to it
- Take action by saving energy
- “Tell the world” about why conservation is important



GECCo



Theoretical framework:

- Social norms
- Conservation psychology
- Theories of behavior change



Current projects

- **Place identity** – A component of personal identity, a process by which, through interaction with places, people describe themselves in terms of belonging to a specific place.
- **Environmental identity** – A sense of identity that transcends the individual and encompasses one's place in an ecosystem



Climate Conversations

- **Communities as the agents of climate change education**



- **Coordinated vision of climate change**
- **Skills and insights of each sector**



Climate Conversations

- Cross-sector Climate Conversations
- Work with communities with nature centers as “anchors” or “trusted messengers”
 - Build knowledge of climate change
 - Build educational capacity
 - Build social capital for community action
- Conduct research on mechanisms and effectiveness via a focus on the microgenesis of ideas



The Climate Lab

<https://www.manomet.org/climatelab>

The screenshot shows the Manomet Center for Conservation Sciences website. At the top left is the Manomet logo, a stylized globe with blue and white waves. To its right is the text "MANOMET Center for Conservation Sciences". Below this is a dark teal navigation bar with white text for "ABOUT", "PROGRAMS", "PUBLICATIONS", and "PRESS". The main content area features a large photograph of a man in a white shirt and glasses, likely a scientist or educator, interacting with a group of students in a forest. One student is holding a red clipboard. Below the photo is the heading "Climate Lab" and a breadcrumb trail: "Home » Programs » Connecting to Nature » Climate Lab". To the left of a smaller inset photo is a text block: "The impacts of climate change are already becoming apparent, and part of our response must be to prepare our children—the next generation of decision makers—to understand and deal with this altered landscape. Manomet Center for Conservation Sciences has partnered with curriculum experts at TERC to address this need through Climate Lab, a program through which students collect data on biological indicators of climate change." The inset photo shows a person's hands using a specialized tool to measure a plant stem.

MANOMET
Center for Conservation Sciences

ABOUT PROGRAMS PUBLICATIONS PRESS

Climate Lab

Home » Programs » Connecting to Nature » Climate Lab

The impacts of climate change are already becoming apparent, and part of our response must be to prepare our children—the next generation of decision makers—to understand and deal with this altered landscape. Manomet Center for Conservation Sciences has partnered with curriculum experts at TERC to address this need through Climate Lab, a program through which students collect data on biological indicators of climate change.



Innovate to Mitigate

[http://
innovatetomitigate
.org](http://innovatetomitigate.org)

Innovate to Mitigate



Climate Change Challenge

Innovate to Mitigate invites students to come up with ideas to reduce greenhouse gases.

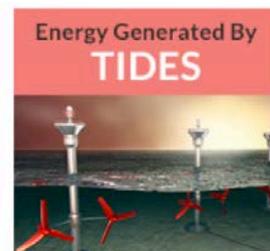
In this competition, students send in a brief statement describing one or more ideas (up to 250 words for each idea) for mitigating climate change. **The deadline for the first round is MONDAY MARCH 9.**

The most promising ideas qualify for a second round. Round 2 participants expand on how and why their idea(s) will work in a 2-minute video and a paper (max 1200 words). Prizes for Round 2 finalists: 1st prize \$4,000. 2nd prize \$2,500. Public choice award \$500.

Check it out at <http://innovatetomitigate.org>

Please [forward](#) this to anyone you know who might be interested, like us on [Facebook](#) and follow us on [Twitter](#). (If you click on the [social media toolkit](#) link on the website, you'll find samples to post on Twitter or your own Facebook page.)

What's Your Idea?





Innovate to Mitigate



VIDEO & POSTER COMPETITION

HOME

PRESENTATIONS

PRESENTERS

JUDGES

ABOUT

FILTER:

BY KEYWORD

- biofuel
- phytoplankton
- green roof
- carbon sink
- sequestration
- soil enrichment
- cell phone charger
- crank generator

BY INSTITUTION



NAME/TEXT SEARCH



SHOWING ALL 5 PRESENTATIONS



Colored Lights and Algae to Generate Biofuels

The Dry Ice Cubes



Renewable Energy Using Crank Generators

F=I3



Phytoplankton Behavior Through The Meticulous Introduction o

Intelligent Life Forms



Biochar For Soil Enrichment and Carbon Sequestration

FOCIS



Carbon Sequestration Using the Green Roof

The Carboneers



Building systems from Scratch

- **Affordances of student game design to learn about climate change**
- **Early evidence: Students are**
 - **Motivated**
 - **Persistent**
 - **Learn about aspects of climate change**

Building systems from Scratch



Results:

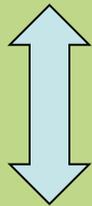
- Young people (YP) pick up programming quickly
- YP focus on subsystems in their game designs
- YP articulate tacit knowledge about larger Earth systems when asked





Conclusion

Project	Audience	Setting	Features
Biocomplexity	High school students	In school	Climate change from “biocomplexity” perspective
Biosphere and Climate	Broad community spectrum	Formal and informal	Biotic impacts of climate change as driver of learning
GECCo	Elem and Middle school girls	Informal	Energy conservation and personal action
The Climate Lab	Middle school students	In school	Biotic impacts of climate change as driver of learning
Climate Conversations	Broad community spectrum	Formal and informal	place-identity, community as agent of education
Innovate to Mitigate	Middle and High school students	Formal and informal	Climate mitigation as driver of learning
Scratch	Middle school students	Informal	Drawing on participatory pedagogy



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