

# LAND USE IMPACTS ON FRESHWATER TURTLE POPULATIONS: INSIGHTS FROM A NATIONAL FACULTY/UNDERGRADUATE STUDENT COLLABORATIVE RESEARCH PROJECT

David R. Bowne, Ph.D.  
Department of Biology  
Elizabethtown College  
Elizabethtown, PA  
[bowned@etown.edu](mailto:bowned@etown.edu)

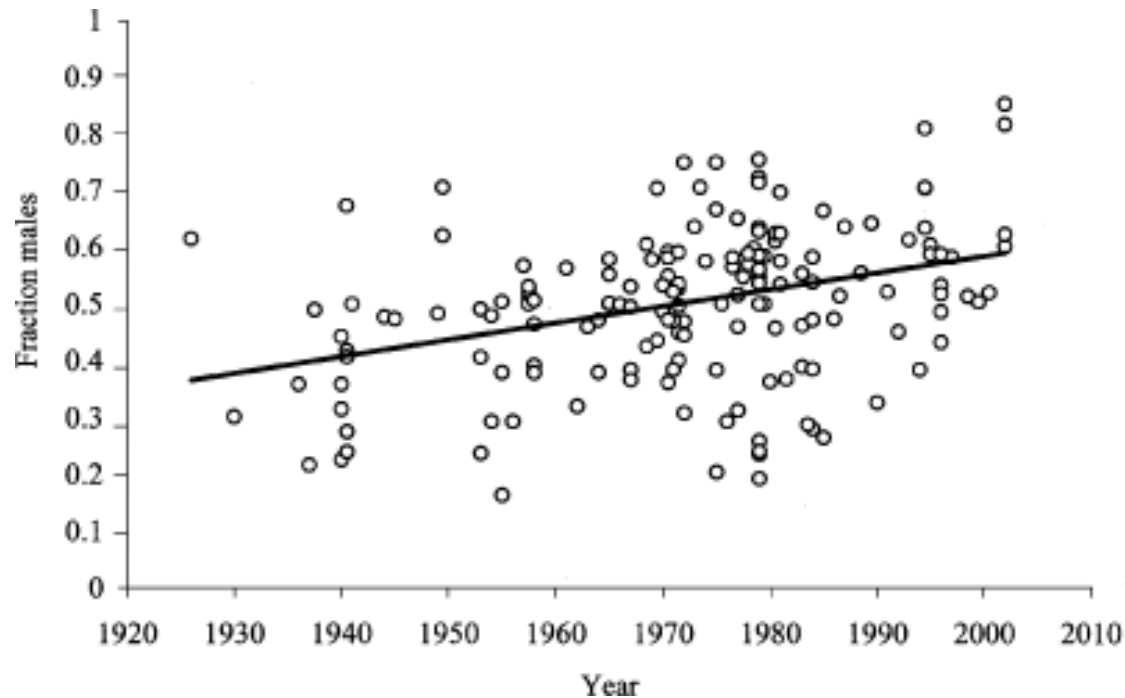


**EREN**

ECOLOGICAL RESEARCH AS EDUCATION NETWORK



# Trends in sex ratio in freshwater turtles



**Figure 1. Relationship between fraction of males in a turtle population versus year study was conducted ( $n = 165$ , adjusted  $R^2 = 0.126$ ,  $p = 0.0001$ ) in the United States over the last century.**

Gibbs, J.P. and D.A. Steen. 2005. Trends in Sex Ratios of Turtles in the United States: Implications of Road Mortality. *Conservation Biology*. 19(2):552-556

# What factors are driving this trend in turtle sex ratio?

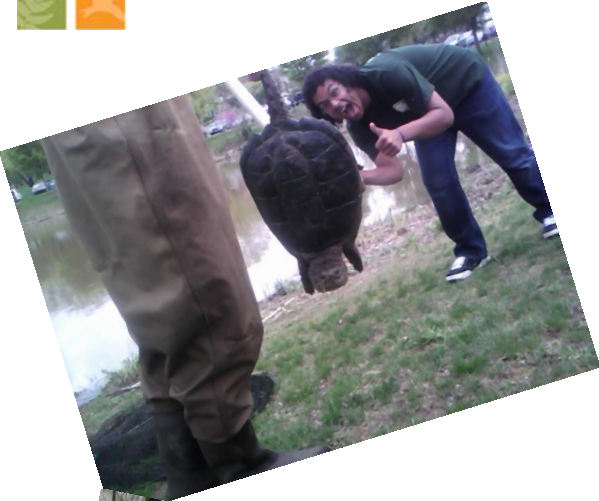
## ❑ Turtle life history

- Environmental sex determinism
- Terrestrial activity
  - Nesting
  - Interpond movement

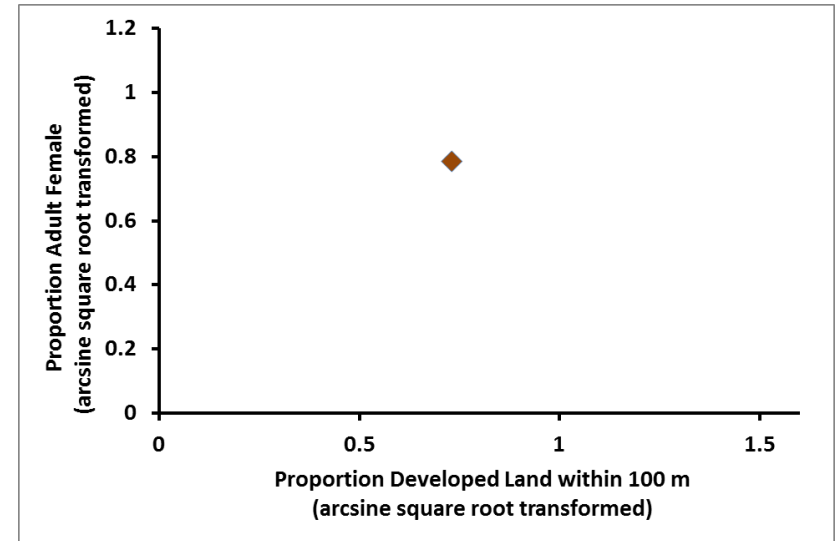
## ❑ Anthropogenic land use



# At Elizabethtown College, students study turtle demography in several courses and as independent research



# Can landscape characteristics explain Etown data?





# Need more data, but how to get many sites for landscape analysis?

## Answer: Collaborate



- ❑ **Ecological Research as Education Network (EREN)**  
([www.erenweb.org](http://www.erenweb.org))
- ❑ **EREN Mission**  
To create a model for collaborative ecological research that generates high-quality, publishable data involving undergraduate students and faculty at primarily undergraduate institutions (PUIs).
- ❑ **Specific Goals of EREN**
  - Develop collaborative research projects among PUIs that fit within the constraints of scientists with significant teaching responsibilities.
  - Enhance the roles of PUI scientists and their students in existing and emerging ecological research networks.
  - Maximize student engagement in authentic science while generating publication quality data.
  - Create an online database of data sets collected by the PUI network.
- ❑ **Funding**  
EREN is currently funded by a grant from the National Science Foundation's Research Coordination Network program.

# TurtlePop: Population Structure of Freshwater Turtles along an Urbanization Gradient (<http://erenweb.org/project/turtle-pop-project/>)

## Research objectives

- To determine how freshwater turtle populations are impacted by land use.
- H: The secondary sex ratio of turtles will be more male-biased as urbanization increases.
- H: The age distribution will be more biased towards adults as urbanization increases.

## Teaching objectives

- To enhance undergraduate understanding of how wildlife is studied
- Pop. estimation via mark-recapture
- Measuring individuals
- Species identification
- To appreciate how landscape-scale processes impact ecology

# Making TurtlePop happen



- ❑ **Protocols:** <http://erenweb.org/new-page/turtle-pop-project/turtlepop-bowne-v2-july2-2012/>
- ❑ **Recruitment:** EREN website, presentations at ESA, word-of-mouth
- ❑ **Equipment:** EREN funding for 4 traps per school; other materials supplied by each participating school



# Making TurtlePop happen

## ■ Training of faculty (professional development)

Demonstration at ESA conference, Austin, TX

Hands-on (claws-on?) at EREN meeting @ Meredith College, NC, June 2012

Individual training at Elizabethtown College

Online Videos:

[https://www.youtube.com/channel/UCRJ\\_o8zzZg9vhRSa8kDiEzA?feature=watch](https://www.youtube.com/channel/UCRJ_o8zzZg9vhRSa8kDiEzA?feature=watch)



# Making TurtlePop happen



## □ Curriculum

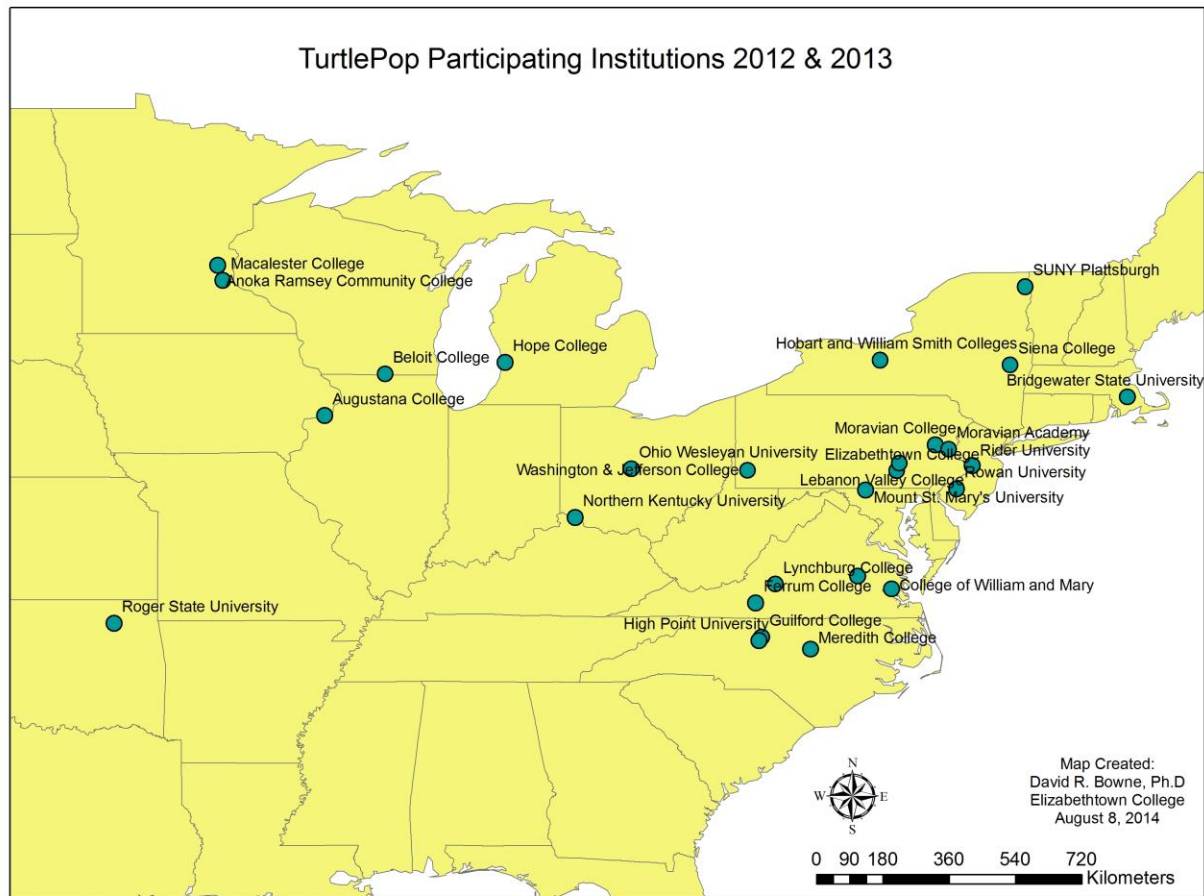
- General Biology, Ecology courses: stand-alone exercise

Student learning outcomes:

- 1) Perform a basic technique (mark-recapture) to survey a wildlife population
- 2) Estimate size of a wildlife population from the mark-recapture study using the Lincoln-Petersen Index.
- 3) Identify basic external turtle anatomy.
- 4) Identify turtle species and sex
- 5) Handle and measure individual turtles.

- Geographic Information Systems: protocols written

# TurtlePop Participants 2012, 2013



# Participating schools

Lead Faculty	Institution	State	Number of Ponds (max)	Trapped 2012	Trapped 2013
Carol Mankiewicz	Beloit College	WI	1	Yes	Yes
Chris Bloch	Bridgewater State University	MA	6	Yes	No
Craig Zimmermann	Roger State University	OK	3	Yes	Yes
Daniel Druckenbrod	Rider University	NJ	1	Yes	Yes
Danielle Garneau	SUNY Plattsburgh	NY	3	Yes	Yes
David Bowne	Elizabethtown College	PA	1	Yes	Yes
Erin Lindquist	Meredith College	NC	1	Yes	Yes
Frank T. Kuserk	Moravian College	PA	1	Yes	Yes
Greg Eaton	Lynchburg College	VA	1	Yes	No
Jeffery Simmons	Mount St. Mary's University	MD	1	Yes	Yes
Jerald Dosch	Macalester College	MN	1	Yes	Yes
K. Greg Murray and Kathy Winnett-Murray	Hope College	MI	1	Yes	Yes
Laurie Anderson	Ohio Wesleyan University	OH	2	Yes	No
Lynn Moseley	Guilford College	NC	1	Yes	No
Mary Beth Kolozsvary	Siena College	NY	1	Yes	Yes
Peter Kish	Moravian Academy	PA	1	Yes	Yes
Randy Chambers	College of William and Mary	VA	1	Yes	Yes
Rebecca Urban	Lebanon Valley College	PA	1	Yes	Yes
Richard Durtsche	Northern Kentucky University	KY	1	Yes	No
Sandra Cooke	High Point University	NC	1	Yes	Yes
Tim Muir	Augustana College	IL	1	Yes	No
Todd Fredericksen	Ferrum College	VA	3	Yes	Yes
Brad Cosentino	Hobart and William Smith Colleges	NY	1	No	Yes
James March	Washington & Jefferson College	PA	3	No	Yes
Kristen Genet	Anoka Ramsey Community College	MN	2	No	Yes
Patrick Crumrine	Rowan University	NJ	2	No	Yes
Peter Smallwood	University of Richmond	VA	5	No	Yes

# TurtlePop Protocols

## Turtles

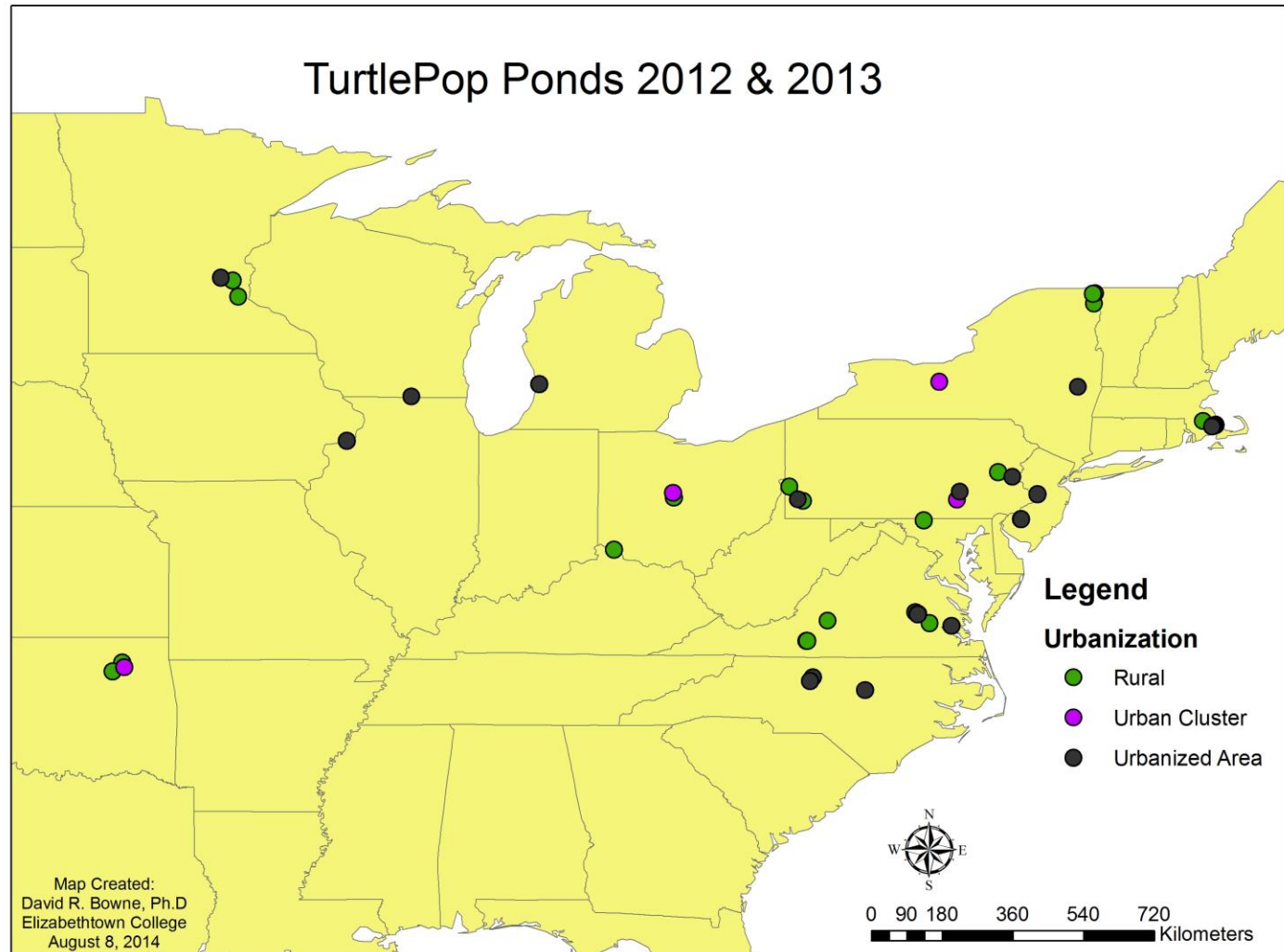


## Landscape

- ❑ Proportion of land use within 100, 250, 500, 1000, and 2500 m
- ❑ Density of road network within 100, 250, 500, 1000, and 2500 m



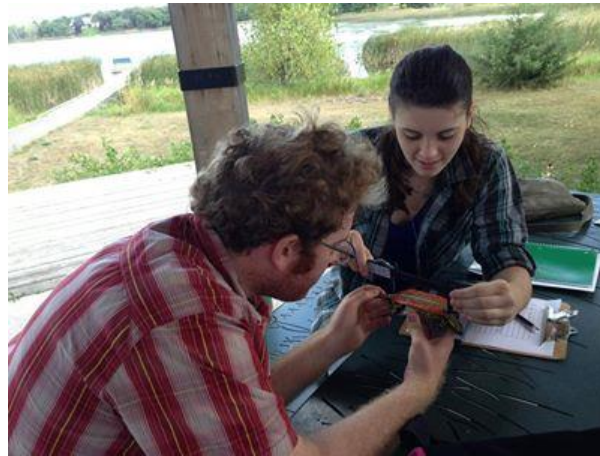
# TurtlePop Urbanization Pattern 2012, 2013



# TurtlePop across the country



Rider University, NJ



Anoka Ramsey Community College, MN



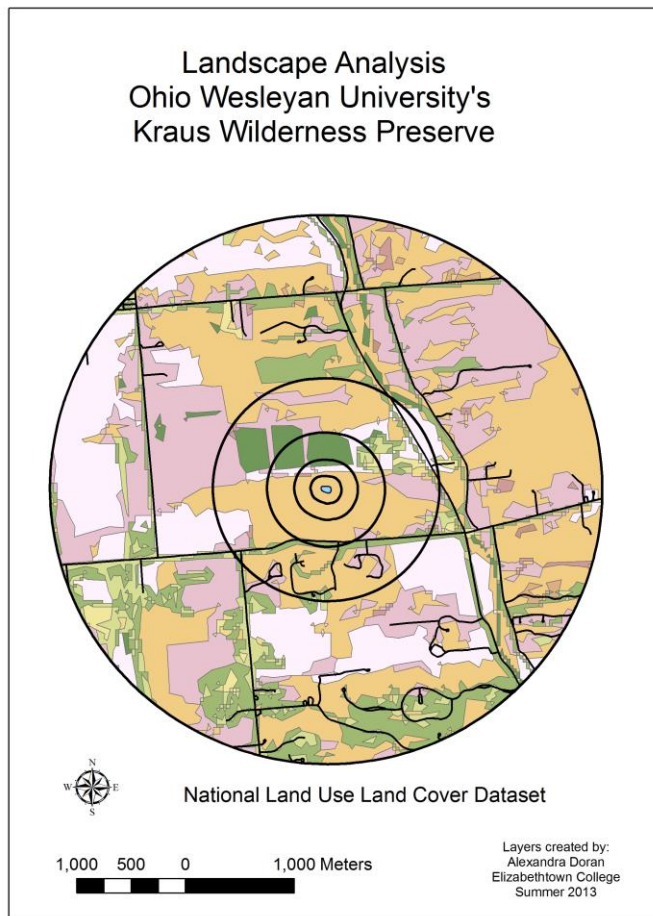
Hope College, MI



Moravian Academy, PA



# Landscape analysis using ArcGIS



Performed by Alexandra  
Doran at Elizabethtown  
College

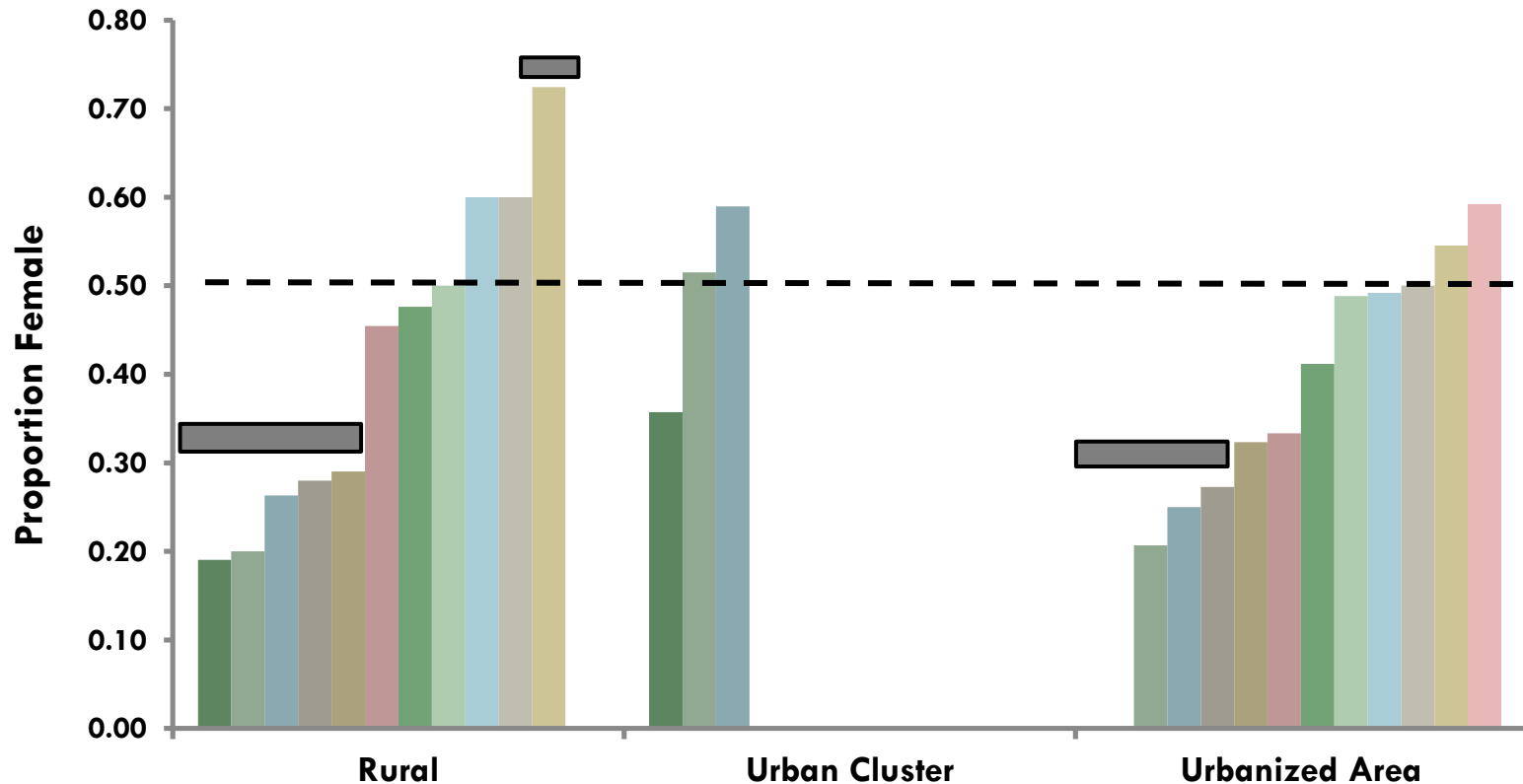
# TurtlePop: Preliminary results for *Chrysemys picta* (painted turtle), 2012-2013.



Table 1. Results of Chi-square Goodness of Fit test in which adult *Chrysemys picta* female:male ratios were expected to be 1:1. Significant deviation from expected is assessed at alpha of 0.05.


Pond	State	Proportion Females	Significant
Curlew A	MA	0.32	YES
Ice Pond	MA	0.20	YES
Pond B	MA	0.28	YES
Pond C	MA	0.19	YES
Pond FA	MA	0.26	YES
Stu Visser Trails Pond	MI	0.21	YES
Lochness	MN	0.29	YES
Golf course pond	NC	0.25	YES
Ann Lee Pond	NY	0.00	YES
Krystal	NY	0.72	YES
Augustana Slough	IL	0.80	NO
Clear Pond	MA	0.33	NO
Turtle Pond	MD	0.48	NO
Meredith Pond	NC	0.41	NO
Abbott's Pond	NJ	0.55	NO
Centennial Lake	NJ	0.50	NO
Rowan Pond	NJ	0.27	NO
B3	NY	0.60	NO
Odell's Pond	NY	0.36	NO
Dempsey Middle School Wetland	OH	0.52	NO
Kreiderheim Pond	PA	0.59	NO
Mallard Pond	PA	0.45	NO
Weird Pond	PA	0.59	NO
Adams	VA	0.50	NO
Chapman	VA	0.60	NO
Westhampton Lake	VA	0.49	NO
Detention	WI	0.49	NO

# TurtlePop: Preliminary results for *Chrysemys picta* (painted turtle), 2012-2013.



**Figure 2. Proportion of females in populations of painted turtles versus urbanization category (U.S. Census). Grey box indicate reject equal sexual ( $p < 0.05$ , Chi-square test)**

# Rewards

- 
- ❑ Interacting with colleagues
  - ❑ Higher levels of student engagement – everyone likes turtles!
  - ❑ Professional development
  - ❑ More data at lower cost (no travel, free labor)

# TurtlePop offshoot projects



- ❑ Basking behavior (Rider University, NJ and Elizabethtown College, PA)
- ❑ Movement behavior (SUNY Plattsburgh, NY and Elizabethtown College, PA)
- ❑ Hybridization between *Trachemys scripta scripta* and *Trachemys scripta elegans* (High Point University, NC)
- ❑ Bait preferences (Moravian Academy, PA)

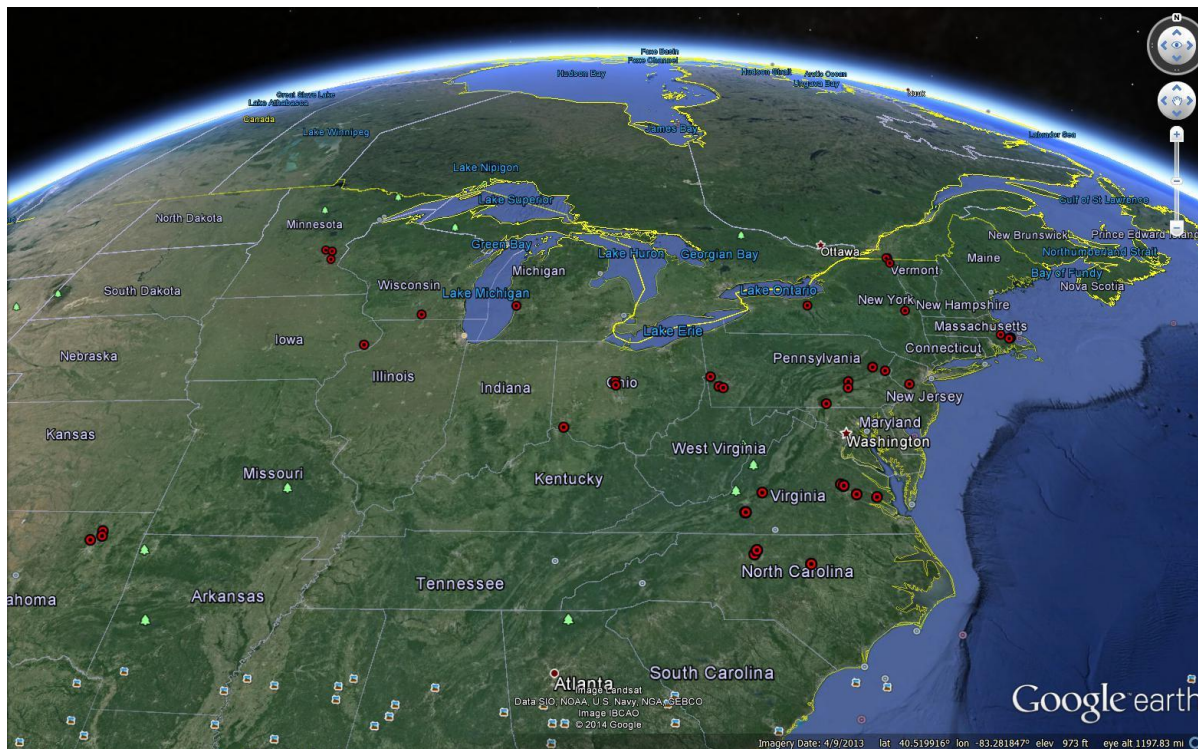
# Challenges: Scientific



- ❑ Data quality
- ❑ Data entry
- ❑ Data management

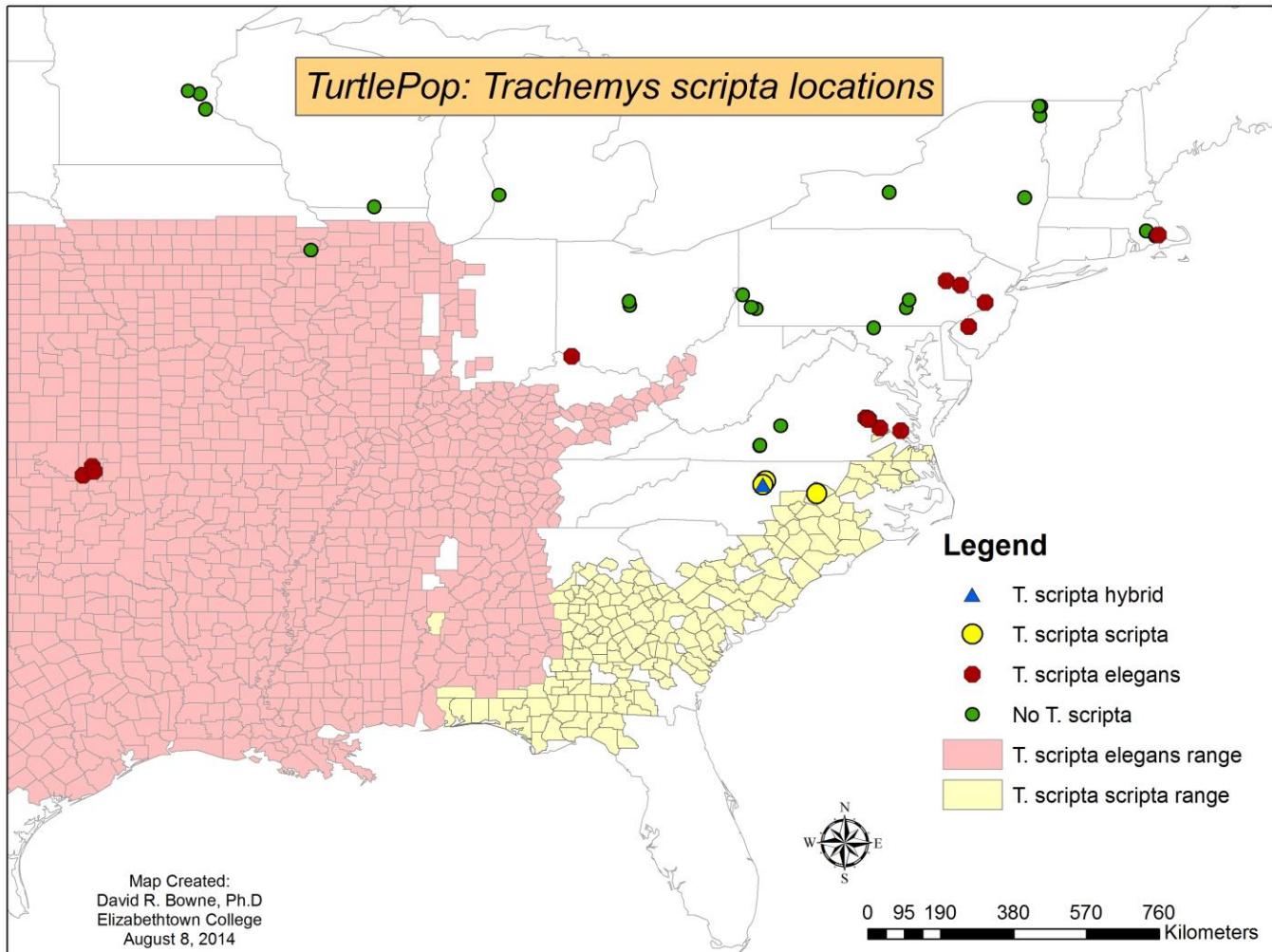
# Challenges: Educational

- ❑ Fostering interactions between institutions
  - ❑ Making use of multisite data
- Faculty or student driven novel questions





# What factors influence range of *Trachemys scripta*?



# Future

## Phase 1 (2012, 2013 data)

- ❑ Data analysis
- ❑ Manuscript preparation
- ❑ Authorship policy

## Phase 2 (2014 and beyond)

- ❑ Continue data collection (turtles live a long time...)
- ❑ Develop offshoot projects
- ❑ Grants

# Thank you! Questions?

