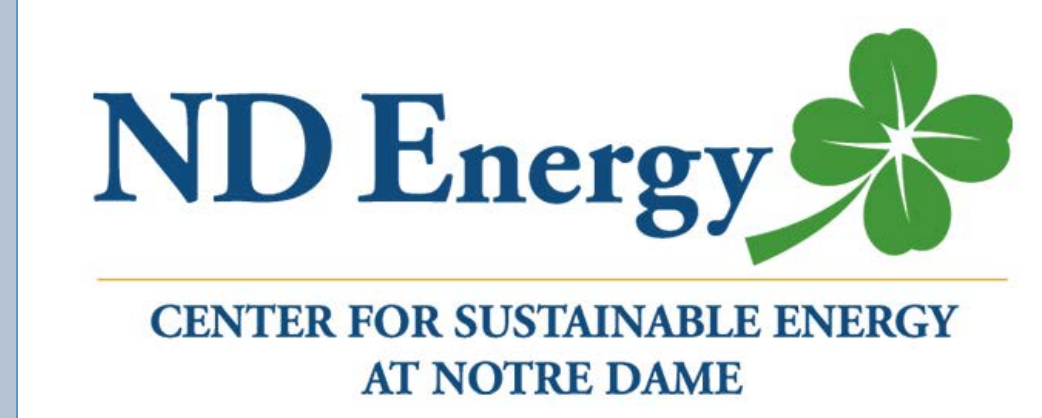


Species Reintroduction & Associated Factors Management & Protection of Endangered Species

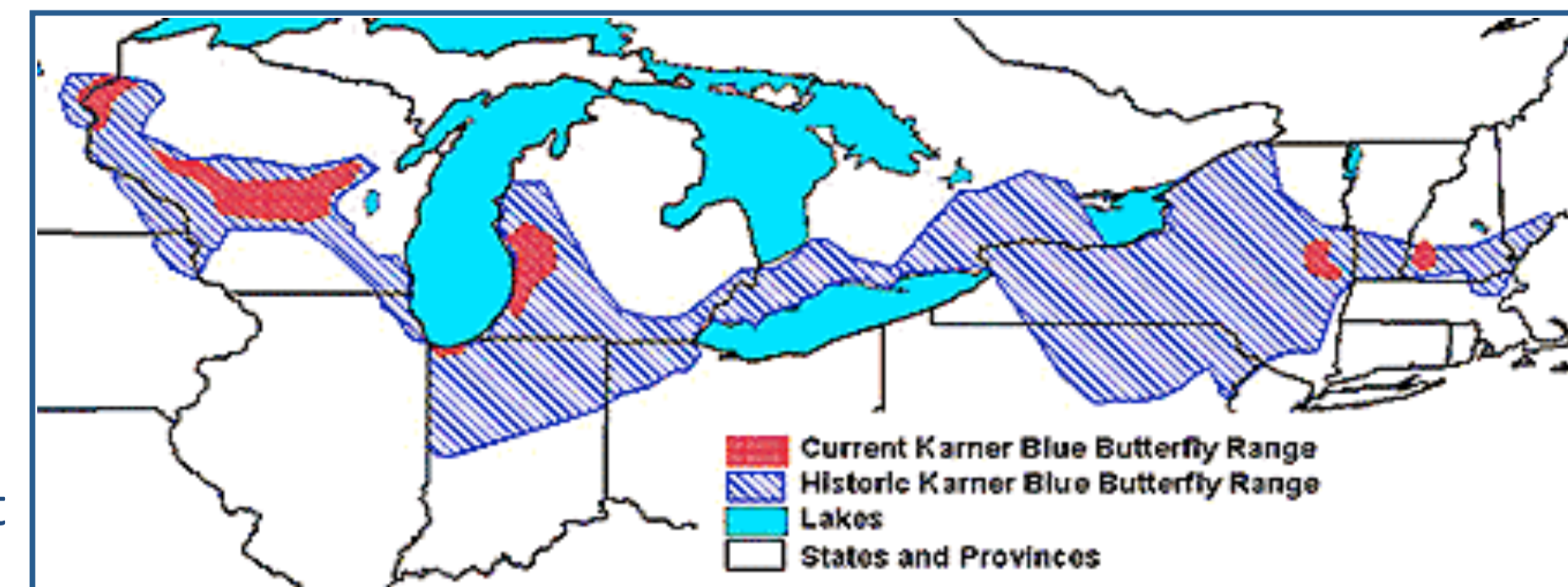
Research Experience for Teachers
June 15-July 31, 2015

Jill McNabney, Dr. Jessica Hellmann, & Lainey Pasternak



Why Local Extinction?

- Climate Change:
 - Changes in temperature and precipitation patterns
 - Lupine (the host plant Karner larvae feed on) may be emerging earlier and Karner egg hatching could possibly no longer match
- Decline of the oak-savanna ecosystem:
 - Incompatible fire regime
 - Urbanization
- Canopy Cover:
 - Too much canopy discourages flying around and mating
 - Too little canopy discourages laying eggs and larval development
- Lack of Genetic Diversity:
 - Mating within a small area (because of the Karner's low dispersal range) increases inbreeding, which decreases genetic diversity



Discussion

- Climate change:
 - Warmer climates speed up development times and lead to smaller butterflies with altered reproductive patterns
 - Moving the population farther north may help to mitigate some of this stress (Michigan success) Warmer climates can trigger more than two generations per summer (2012), running the risk of not making it to the adult stage.
 - They won't mate or lay eggs, and will dramatically decrease the number that survive into the next year (2013)
 - The Indiana population was depleted at the time of the 2012 early spring and hot summer and not able to recover
 - The Michigan population in 2012 was larger and has since rebounded
- Habitat sustainability:
 - Management techniques to restore the habitat where lupine flourishes are slightly different in MI and IN (Michigan success)
 - Mitigating strategies to help the Karner escape extinction are being developed
 - Providing more suitable habitats for lupine to grow
 - Possibly relocating the Karner to different locations

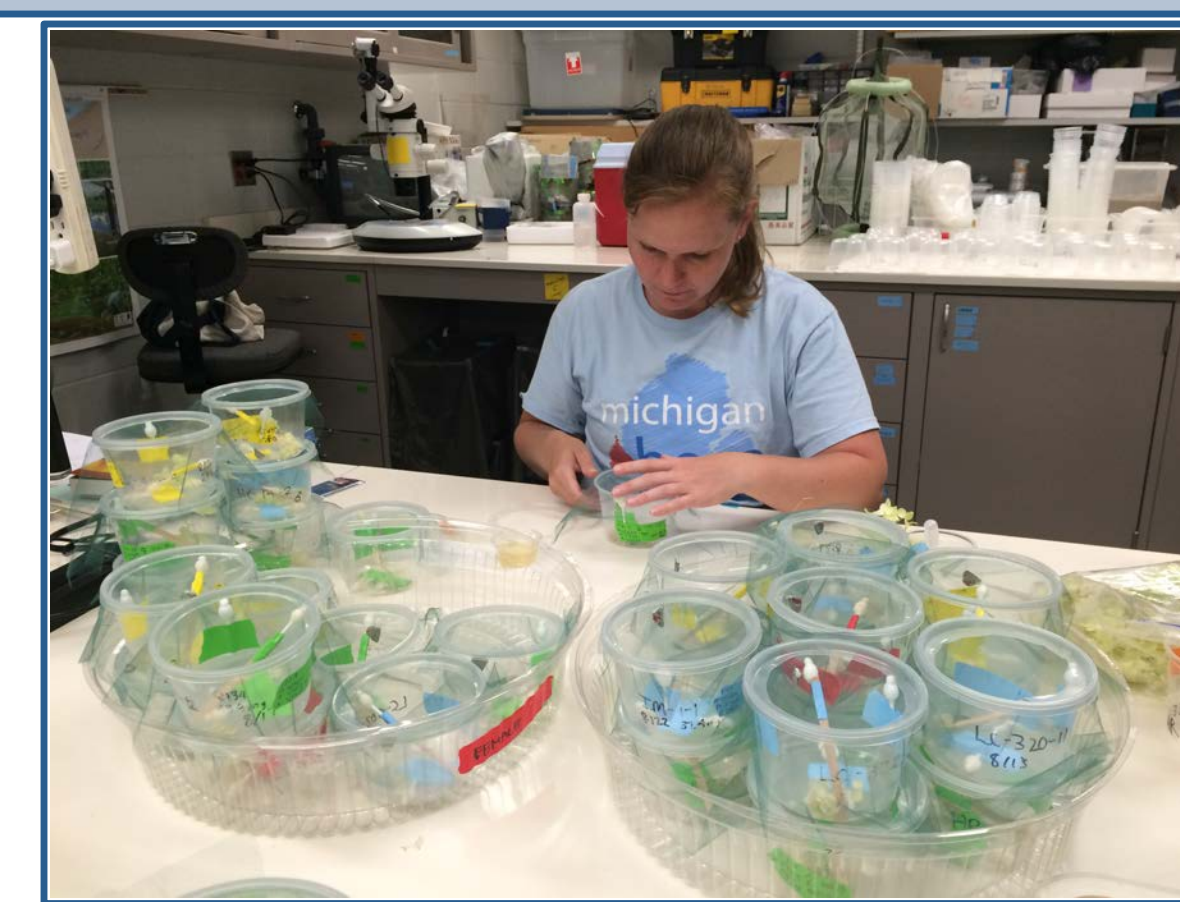


Connection to the Classroom

- Using the Karner Blue butterfly as a local endangered species case study
- Opportunity to analyze actual scientific data and draw conclusions
- Examining both the impacts of climate change and mitigating strategies to help the Karner
- Looking at reintroduction and the many factors that must be considered before it can occur

Driving Questions

- How should endangered species be managed and protected?
- Why are individual species important? And why is biodiversity important?
- What factors should be considered when reintroducing a species into an ecosystem?
- Should the Karner be reintroduced into the Indiana Dunes and/or another location?

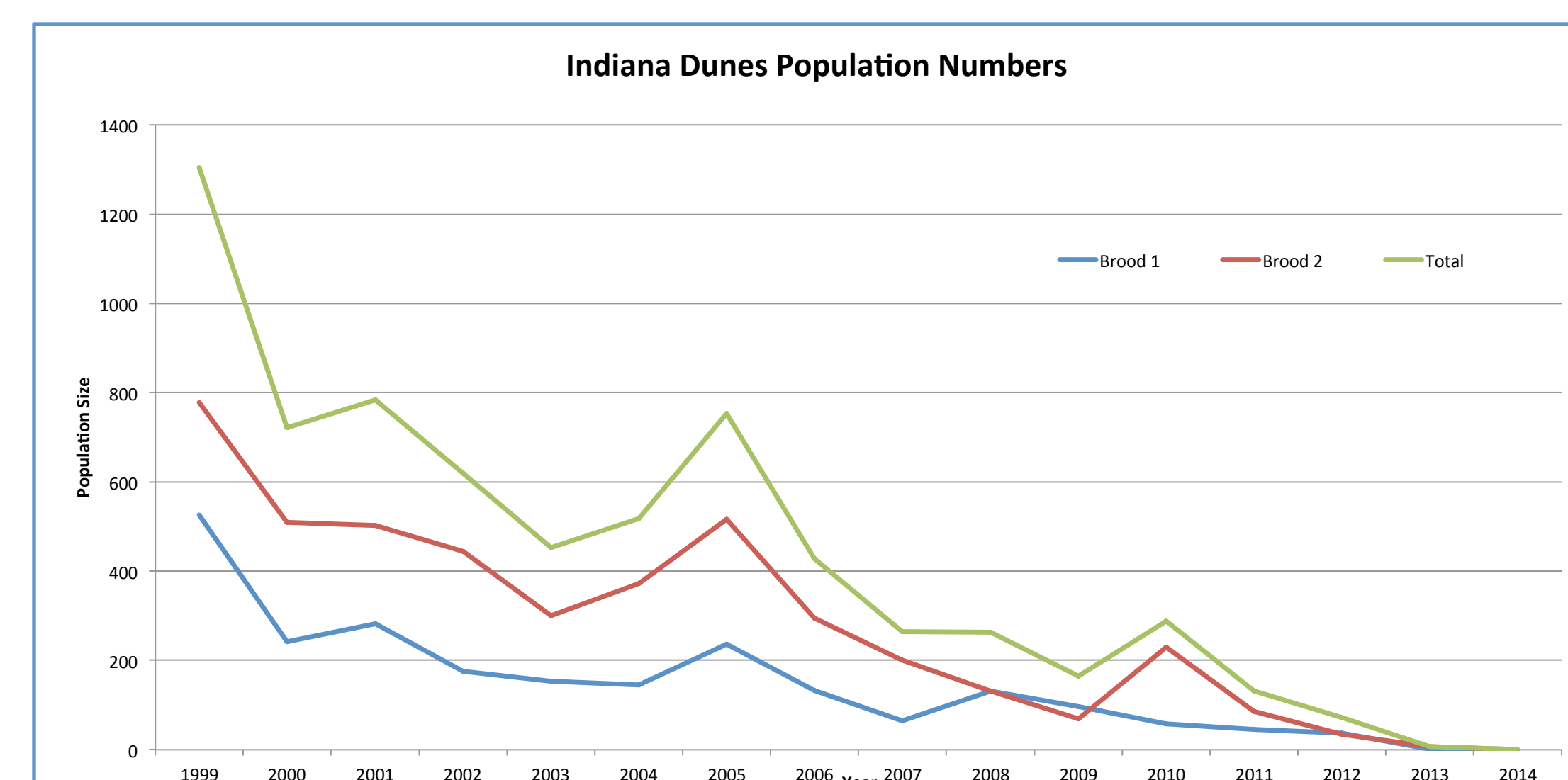


Data Collection

- Presence/absence surveys were used to collect population numbers
- Individual surveys within a habitat site were completed in a single day under favorable conditions*
- Observer walked along established route and counted all Karners seen
- Process was repeated approximately every 7 days, walking the same route, at the same time of day, with the same effort

Indiana Dunes National Lakeshore:

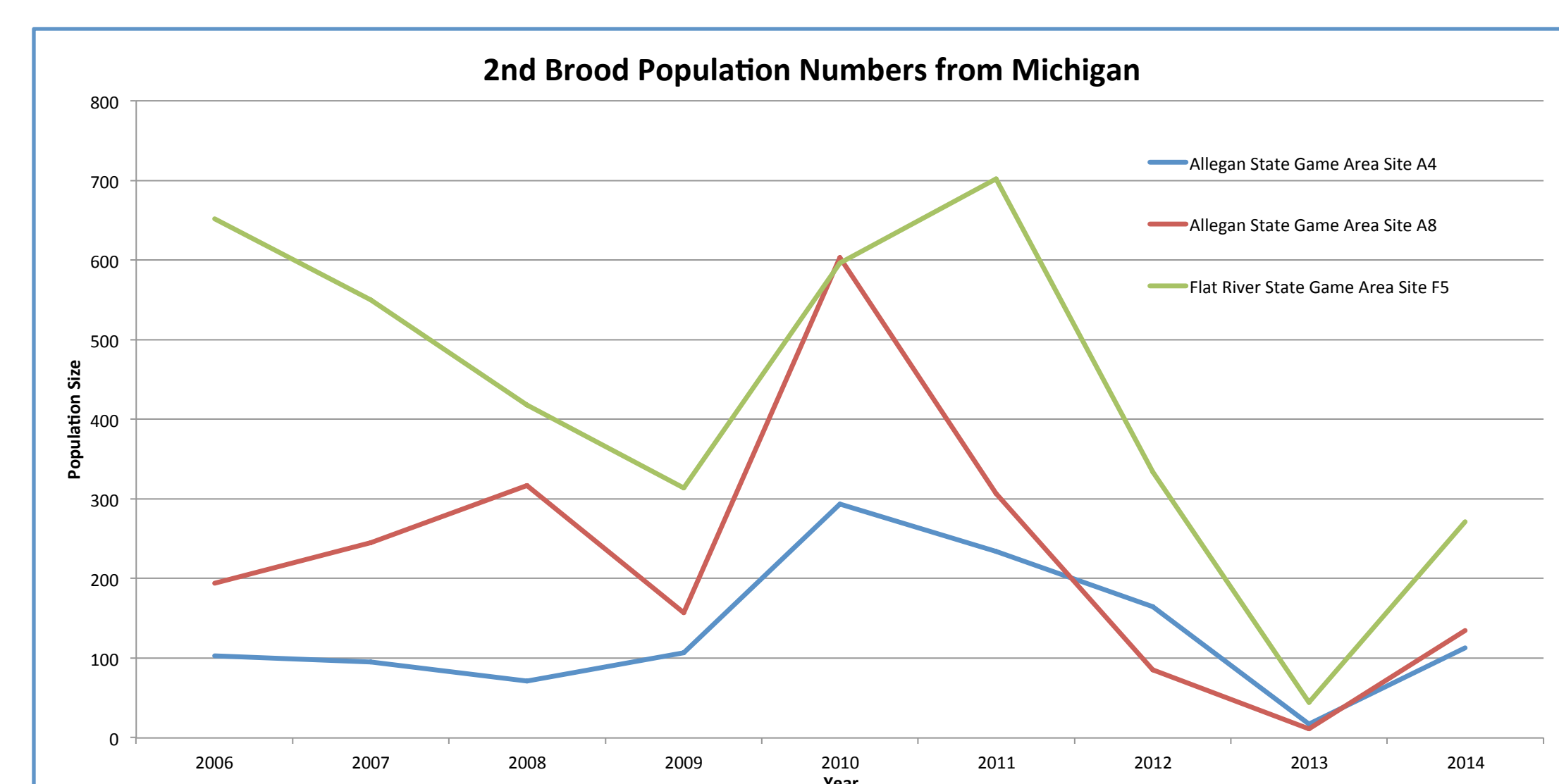
- Population has been in steady decline since 1999
- In 2014 the Karner was officially extirpated
- Extirpation has held true for 2015 as well



Michigan Sites:

- Karner has had relative success since at least 2006 (earlier data not available)
- Experienced steep declines in 2012 and 2013
- Current population seems to have rebounded from the dramatic 2013 decline

* Numbers collected from surveys may or may not reflect actual Karner population numbers



Curriculum Highlights

Activity 1: Photo Project in the Grand Mere Dunes (4 Days)

- Field trip to the Grand Mere Dunes to photograph and identify plants
- Gather information on the plant species (species interconnections and specific roles in the ecosystem)

Activity 2: Endangered Species Reading & Online Discovery (1 Day)

- Endangered species reading and research
- Generating questions on endangered species and posing those questions to a scientist from the NRDC

Activity 3: Wolf Reintroduction Lesson (1 Day)

- Examine the successful Yellowstone wolf reintroduction
- Evaluate the factors that were considered before reintroduction

Activity 4: Karner Blue Butterfly Lecture & Data Analysis (1 Day)

- Assess data on Karner population numbers
- Figure out why the Karner is not found in the Grand Mere Dunes

Activity 5: Karner Blue Butterfly Reintroduction Lesson (1 Day)

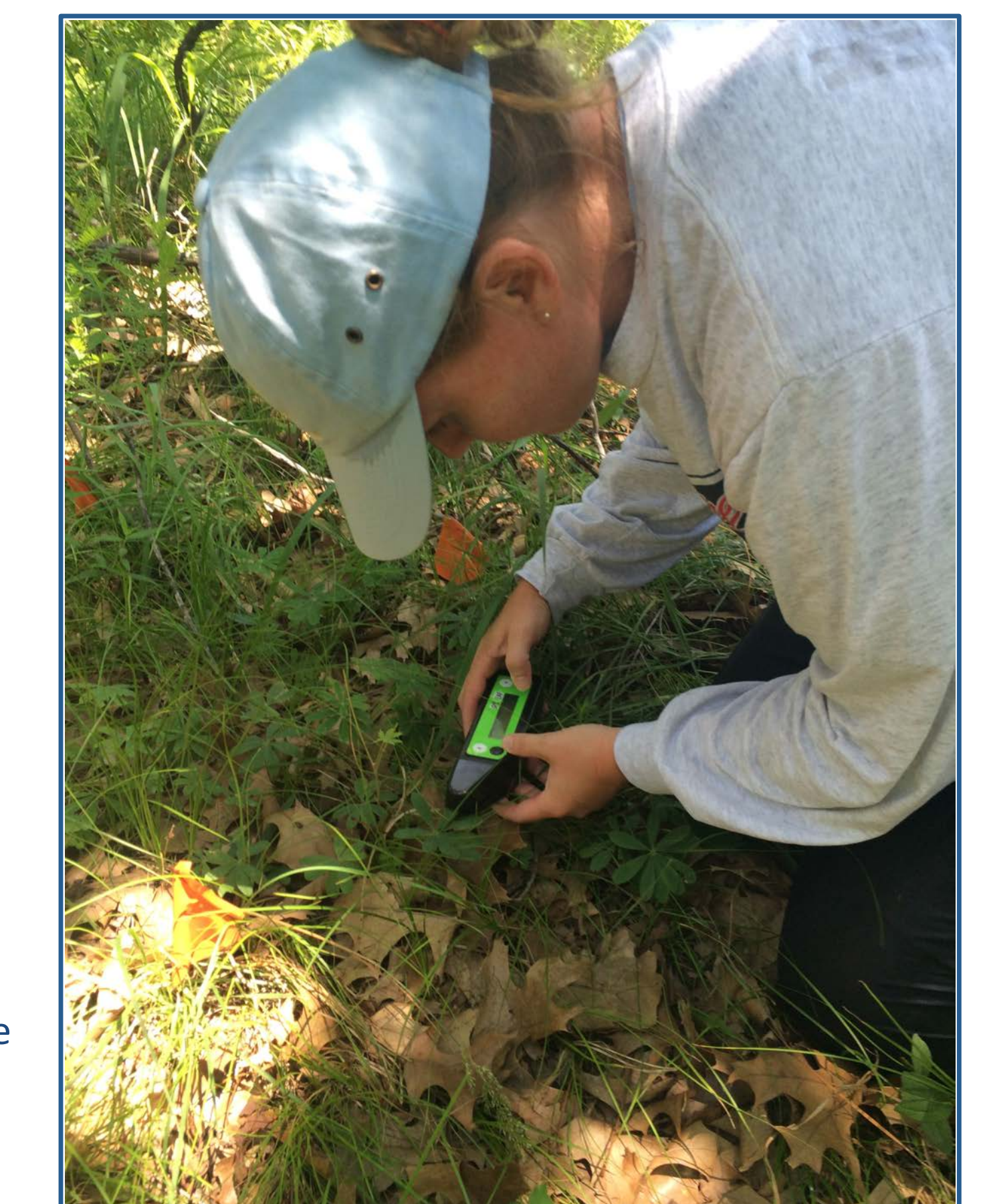
- Determine what ecological factors the Karner needs to be successful
- Examine why it is being extirpated, whether it should be reintroduced, and the impacts of climate change

Lesson Objectives:

- Explain how humans alter natural ecosystems
- Explain how environmental problems have cultural, social, and economic factors that are vital to the development of solutions
- Describe the impact that climate change is having on different organisms
- Analyze data and draw conclusions
- Explain how ecosystems are interconnected and how organisms within them are interdependent
- Explain the importance of biodiversity in terms of impacts on species and the stability of an ecosystem

Next Generation Science Standards Covered:

- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales
- HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem
- HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity
- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants



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