

# From Preparedness to Action Hoosier Resilience

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Indiana University Environmental Resilience Institute

2019 Indiana Environmental Conference  
October 9, 2019



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## Today's presentation....

1. Environmental changes in Indiana and how they are affecting our health, economy and communities
2. Brief overview of IU's Prepared for Environmental Change Grand Challenge
3. Update on programs available for cities and towns
4. Focus on the Hoosier Resilience Index– a new tool for communities coming this fall



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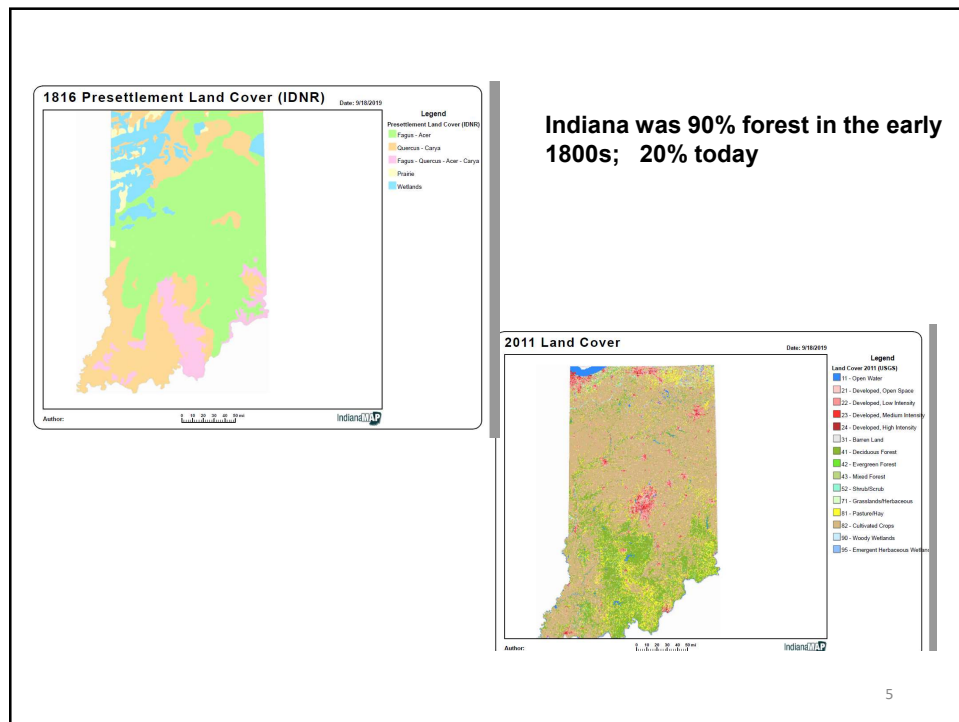
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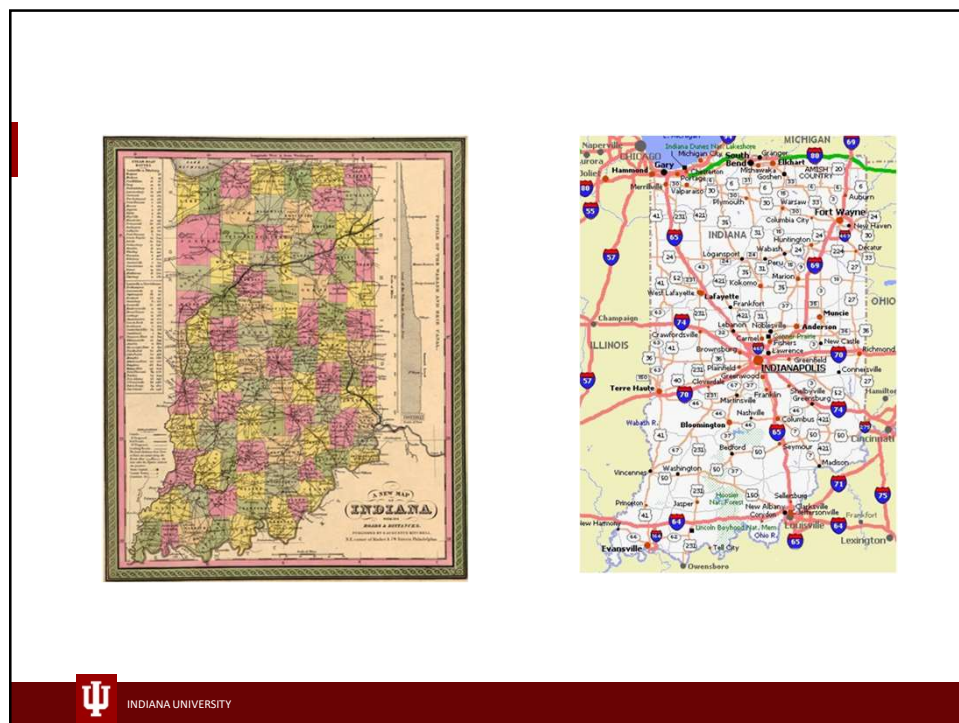
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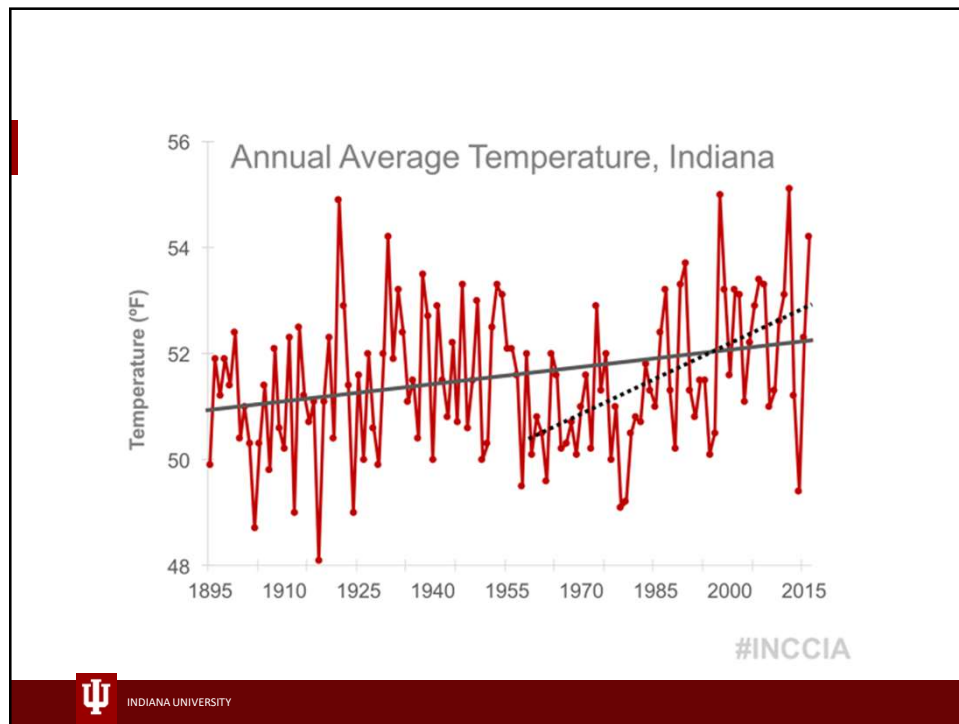
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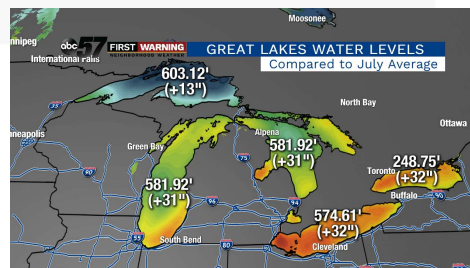
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## Beaches get smaller as Lake Michigan water levels continue to rise

By: JoLynn Bruney. [Facebook](#) | [Twitter](#)

Posted: May 20, 2019 6:39 AM EST



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Corn! Indiana State Department of Agriculture 2012



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**Increases in disease-bearing vectors**



As recently as 2009, the Indiana Dunes National Park hosted one of the country's healthiest populations of the endangered Karner blue. By 2015, they had mostly disappeared.

*New York Times April 25, 2019*


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## Armadillos in Indiana rare, but they're here

### Dead one found at U.S. 41 and Fort Harrison on Friday

By Sue Loughlin Tribune-Star Aug 10, 2018


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## Indiana Climate Change Impacts Assessment


**IN CCIA**  
 Indiana Climate Change  
 Impacts Assessment

  
Climate

  
Health

  
Forest Ecosystems

  
Urban Green Space

  
Agriculture


  
Aquatic Ecosystems

  
Tourism & Recreation


  
Water

  
Energy

  
Infrastructure

  
Assessment Summary

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### LAKE COUNTY: State of the Climate

Weather records show that Indiana has become warmer and wetter, with more heavy downpours. Indiana scientists have concluded these climate trends will continue and intensify, affecting the health and wellbeing of all Hoosiers.

<b>Number of &gt;95°F days per year</b>		<b>Average hottest day of the year</b>	
1	31	95°F	105°F
PAST	2050s	PAST	2050s
<b>Average coldest day of the year</b>		<b>Projected change in SPRING rainfall</b>	
-12°F	-3°F	+16%	
PAST	2050s	2050s compared to PAST	

Above data show a comparison of past and future conditions for **Lake County, Indiana**, except SPRING rainfall which shows statewide average data. Past data are average values from **1971 to 2000**. Future data (2050s) are average values from **2041 to 2070** based on a high emissions scenario (assumes no reduction in the addition of heat-trapping gases to the atmosphere).


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## IU's Prepared for Environmental Change Grand Challenge



“Making ourselves more resilient in the face of environmental change means protecting ourselves from invasive species, conserving plants and animals that sustain us, defending ourselves from weather disasters and creating more livable cities.”

Ellen Ketterson, Director of the Environmental Resilience Institute



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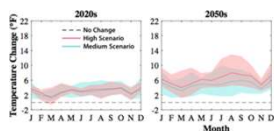
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## Environmental Resilience Institute

Three Pillars—Interdisciplinary Work—External Partners

### Accurate Predictions



Indiana Climate Change Impacts Assessment

### Feasible Solutions





### Effective Communication



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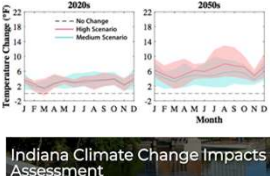
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## Environmental Resilience Institute

Three Pillars—Interdisciplinary Work—External Partners


Accurate Predictions





Feasible Solutions



Effective Communication






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## Tools for Indiana Communities and Businesses


- Environmental Resilience Institute Toolkit (ERIT)
- Hoosier Resilience Index
- Prepared for Environmental Change Webinar Series
- Sustainability Externship Program
- 2019 Resilience Cohort
- General Assistance for Cities

<https://eri.iu.edu/prepare/for-officials.html>



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## ERIT: Environmental Resilience Institute Toolkit



25 Case Studies from the Midwest

- Geographically tailored information.
- Search for resources on topics that interest you.
- Stories direct from cities and towns. 25+ midwestern case studies
- Information, tools and resources that focus on Indiana, the Midwest, and on small and mid-size communities.

<https://eri.iu.edu/ERIT>


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## ERIT: Environmental Resilience Institute Toolkit

**New Case Studies**

- Aurora and Lawrenceburg Bike Share
- Ball State University Geothermal
- Bedford Community Garden
- Benton County Wind Energy
- Bloomington Creek Naturalization
- Cincinnati Greenhouse Gas Inventory
- East Chicago Propane School Bus
- Gary Green Infrastructure
- Goshen Tree Canopy Assessment
- Indiana Dunes Adaptation Plan
- Indianapolis LED Streetlamps
- Knox County Invasives Ban
- Lake County, IL Wetland Restoration Tool
- Michigan City Energy Upgrades
- South Bend Smart Sewers
- Vigo County Solar
- Whiting Recycling




<https://eri.iu.edu/ERIT>

Many more case studies are in process



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## Additional ERIT Additions / Improvements

ERIT Homepage	
Tailor Your Search	• Adaptation Strategy Reorganization
Implications of Climate Change	• New Adaptation Strategy Pages
Adaptation Planning	• Over 30 New Tools
Adaptation Strategies	• Over 15 New Online Trainings
Case Studies	• New Library Additions
Tools	• Links to Case Studies from Other Sources
Online Training	• Integrated the 4 <sup>th</sup> IPCC Report
Funding & Technical Assistance	• Culling out information not relevant to the Midwest
Library	
Underlying Science	
Additional Support Centers	


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## Prepared for Environmental Change Webinar Series

October 9, 12 – 1PM (ET): Identifying Public Health Solutions for Climate Change Impacts

November 13 12-1PM (ET): The Hoosier Resilience Index: Understand Your Community's Preparedness

**Archived webinars:**

- Using Greenspace and Vegetation as an Adaptive Strategy
- Planning for More Frequent River Flooding
- Environmental Changes Expected in Indiana
- Installing Solar Energy in Your Community
- Planning for Electric Vehicles

[Eri.iu.edu/prepare/webinars.h  
tml](http://Eri.iu.edu/prepare/webinars.html)





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## ISDP Sustainability Externship Program

Expand your capacity with a student extern, who could join your team for 10 weeks in summer 2020 to work on a sustainability project.

Externs have helped:

- Cities and towns across Indiana
- Businesses, such as Cummins and Hillenbrand
- Community organizations such as Thrive Michiana and IU Health
- and many more...




Learn More  
<https://sustain.iu.edu/research/ISDP>

Applications Due Annually  
December for following  
Summer




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## 2019 Resilience Cohort

- 14 Indiana local governments (city, county, town) completed Community Greenhouse Gas Inventory during summer 2019.
- Supported by the IU Sustainability Extern Program.
- Supported by ICLEI—Organization that works globally to support local government action on sustainability and resilience.
- Inventories provide baseline and starting point for communities to prioritize actions around energy efficiency, clean energy, clean community development


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## 2019 Resilience Cohort

- Bloomington
- Carmel
- Columbus
- Delaware County / Muncie
- Evansville
- Fishers
- Fort Wayne
- Gary
- Greencastle
- Goshen
- Michigan City
- Oldenburg
- Richmond
- West Lafayette



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## The Hoosier Resilience Index

Another practical tool being made available to Indiana local governments to help them understand and address threats from increasing heat, extreme weather and flooding.



**Will be released Fall 2019**



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## Hoosier Resilience Index: Two Parts

**What are the specific environmental threats to Hoosier communities?**

- Hotter summers
- More flooding
- Changes in precipitation patterns


How will these affect YOUR community?

**How resilient are we?**

**Where should we focus?**

- Infrastructure
- Planning
- Public education
- Policies


What is happening in YOUR community?





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## Hoosier Resilience Index

A tool to help local governments in Indiana:

- Understand the climate vulnerabilities relevant to their specific geographic area,
- Measure their readiness to respond to long-term climatic changes and immediate impacts,
- Select the most important preparedness initiatives to tackle next, and
- Track their progress over time

**Benefits:** proactive planning helps communities **save money** in the long-term, protect **public safety**, improve **quality of life**, and assess **preparedness**

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## Basic principles

- All data should be from credible sources, locally relevant, publicly available, and updated
- The tool should serve the purposes of the community;
  - Not a statewide ranking exercise
  - Readiness assessment (Part II) is done by the local government itself, not by some other entity for you
  - Local government can choose its own process for completing the Index (The Institute can provide assistance if requested)
- Beta test with 2 cities/towns and 2 counties has provided valuable input
- November release will be HRI 1.0; to be improved as communities use it and provide feedback



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## Traits of Resilient Systems

**“...system’s capacity to sustain function and well-being after disturbance, including an ability to persist, transition, or transform as necessary.”**

Walker & Salt, 2012; Biggs *et al.*, 2015

**Diversity:** material for adaptation to change

**Redundancy:** insurance against loss

**Modularity:** ease of replication after damage

**Connectivity:** dispersal, migration, and information flow

**Regenerative Ability:** recovery after damage

**Equitability:** avoids weak links in system



Reynolds *et al.*, forthcoming

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## Hoosier Resilience Index

**Part I. Vulnerability Info**

- Extreme Heat
- Extreme Precipitation
- River Flooding by Land-Use Type
- Social Vulnerability


**Part II. Readiness Score**

- Community Analysis of Readiness Actions



Seven Worksheets

- Built Environment
- Emergency Management
- Energy and Public Utilities
- Food and Agriculture
- Natural Resources
- Public Health and Safety
- Planning and Land Use

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## Hoosier Resilience Index

**Part I. Vulnerability Info**

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**Part II. Readiness Score**

- Community Analysis of Readiness Actions



Information provided by ERI

Information provided by community;  
 Score calculated by ERI

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## Hoosier Resilience Index

### Part I. Vulnerability Info



#### Information Provided

- Extreme Heat
  - number of high heat and extreme heat days & nights
  - [from Indiana Climate Change Impacts Assessment data]
- Extreme Precipitation
  - number of extreme precipitation days
  - [from Indiana Climate Change Impacts Assessment data]
- Land Use in Flood Plain
  - acres and % of land in 100-yr and 500-yr flood plains
  - [from IDNR's Best Available flood maps and USEPA's Integrated Climate and Land Use Scenarios tool]
- Social Vulnerability
  - 15 categories
  - [from US Census and the CDC's Social Vulnerability Index]

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## Hoosier Resilience Index


### Part I. Vulnerability Info

#### Visualizations Provided

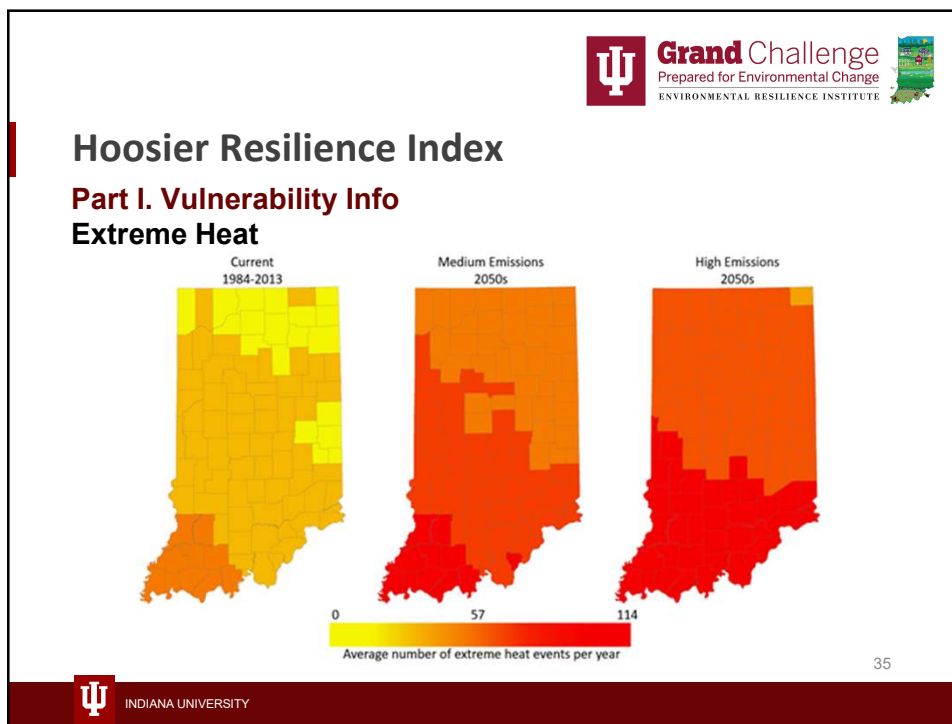
##### Current

- Heat (30-year average)
- Precipitation (30-year average)
- Land Use (2010)
- Social Vulnerabilities (2013-2017 US Census)
- 2050 projections
  - moderate emissions scenario
  - high emissions scenario
- Social vulnerabilities
  - by Census tract

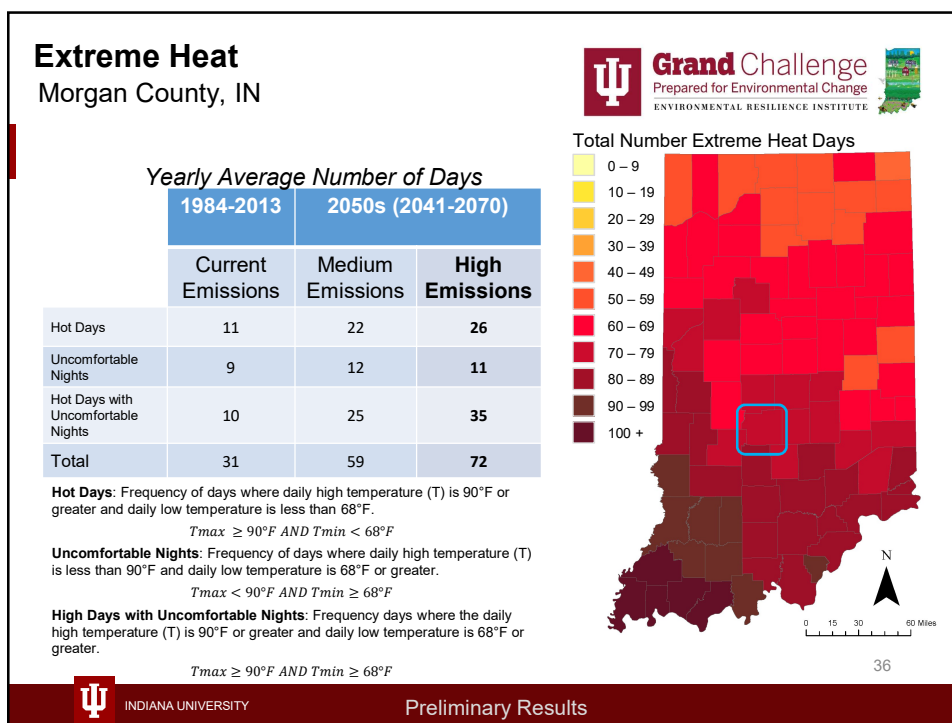
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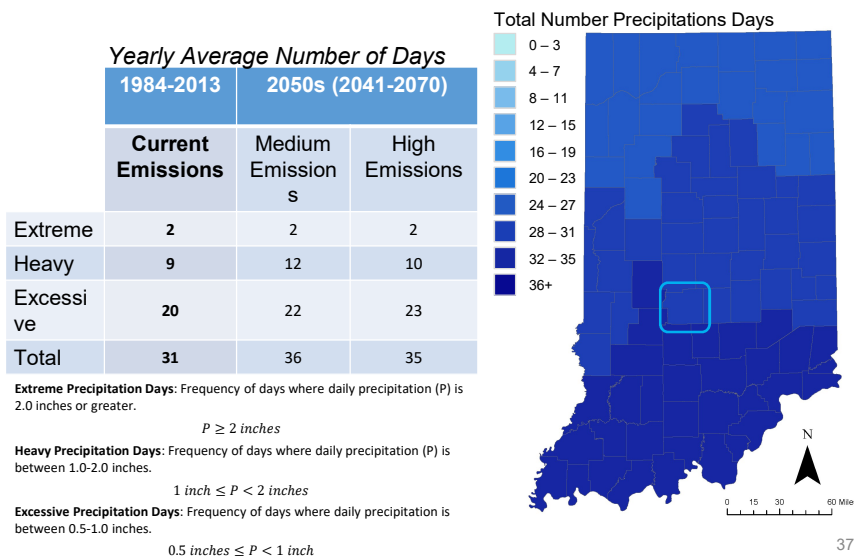
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## Extreme Precipitation

Morgan County, IN



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Preliminary Results

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## Floodplain Land Use

Morgan County, IN

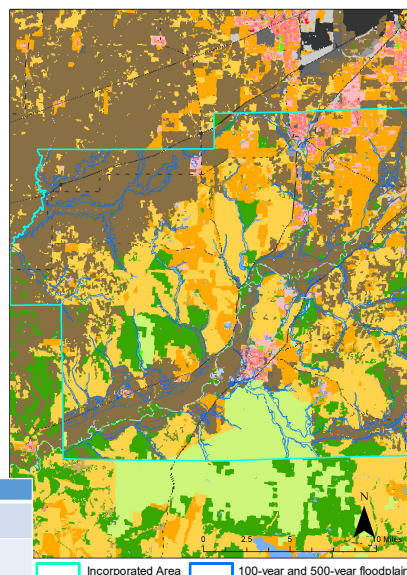
*Land Use within City/County Floodplains\**

	2010		2050s (2041-2070)			
	Current Emissions		Medium Emissions		High Emissions	
Land Use Group	Acres	%	Acres	%	Acres	%
Water	760	2%	760	2%	760	2%
Protected	1267	4%	1267	4%	1267	4%
Working	23269	72%	23269	72%	22859	70%
Developed	7206	22%	7206	22%	7616	24%

\*Acres of land within floodplains; percent of floodplains per land use type

**Land Use Type and Boundaries**

Water	Working/Production	Developed
Natural Water	Timber	Exurban, Low Density
Reservoirs/Canals	Grazing	Exurban, High Density
Wetlands	Pasture	Suburban
Protected	Cropland	Urban, Low Density
Recreation	Mining/Barren Land	Urban, High Density
Conservation		
		Parks/Golf Courses
		Commercial
		Industrial
		Institutional
		Transportation




35,502 floodplain acres  
12% of county

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Preliminary Results

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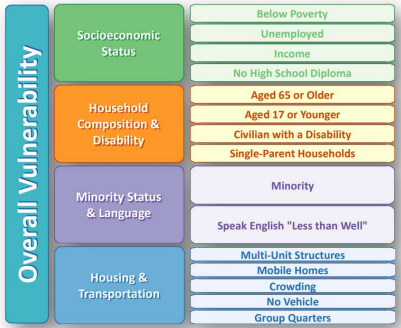



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## Community Vulnerability

**Social Vulnerability Index:**


- Percentile rank:
  - Socioeconomic Status
  - Household Composition
  - Race/Ethnicity/Language
  - Housing/Transportation
- Towns, cities, and counties
- 2013-2017 American Community Survey 5-year Estimate




The diagram shows the 'Overall Vulnerability' index composed of four main themes, each with specific indicators:

- Socioeconomic Status:** Below Poverty, Unemployed, Income, No High School Diploma
- Household Composition & Disability:** Aged 65 or Older, Aged 17 or Younger, Civilian with a Disability, Single-Parent Households
- Minority Status & Language:** Minority, Speak English "Less than Well"
- Housing & Transportation:** Multi-Unit Structures, Mobile Homes, Crowding, No Vehicle, Group Quarters

Centers for Disease Control's Social Vulnerability Index  
Four Main Themes


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## Social Vulnerability

### Morgan County, IN

### Overall

Lowest Vulnerability Highest

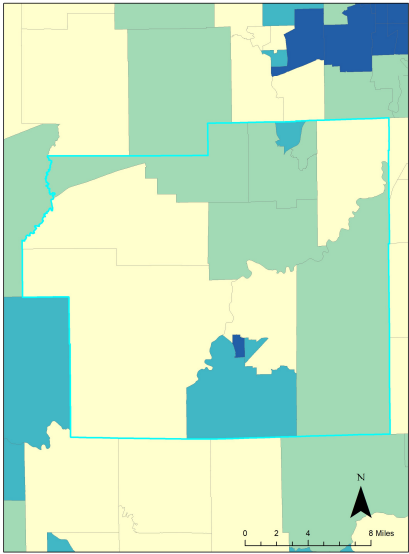
Bottom Quarter Top Quarter

**Socioeconomic Status:** Below Poverty, Unemployed, Income, No High School Diploma


**Household Composition & Disability:** Aged 65 or Older, Aged 17 or Younger, Civilian with a Disability, Single-Parent Households

**Minority Status & Language:** Minority, Speak English "Less than Well"

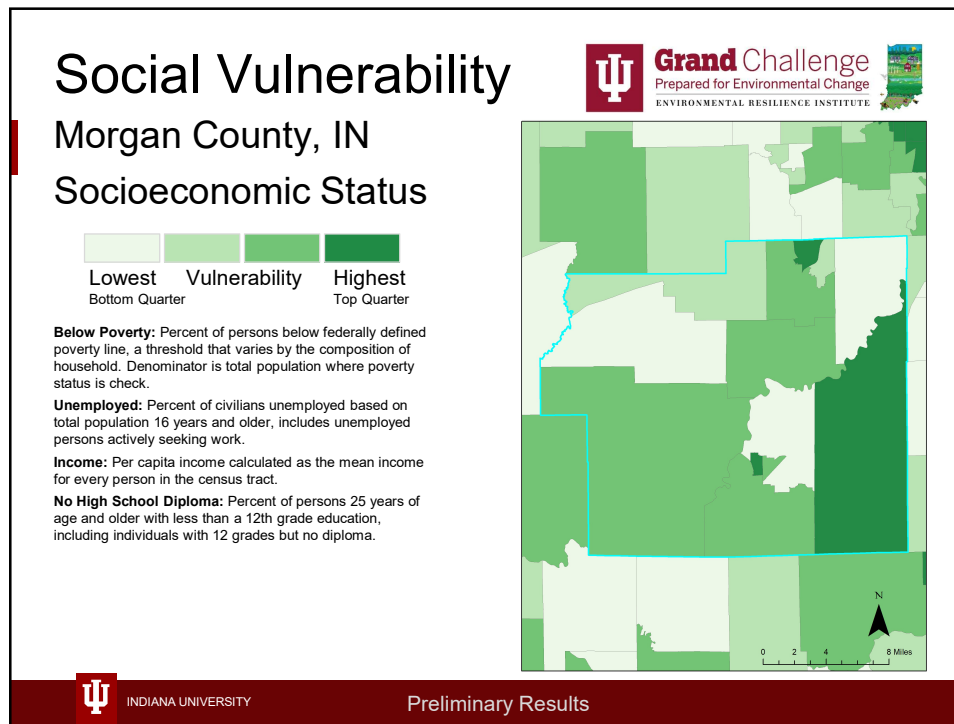
**Housing & Transportation:** Multi-Unit Structures, Mobile Homes, Crowding, No Vehicle, Group Quarters



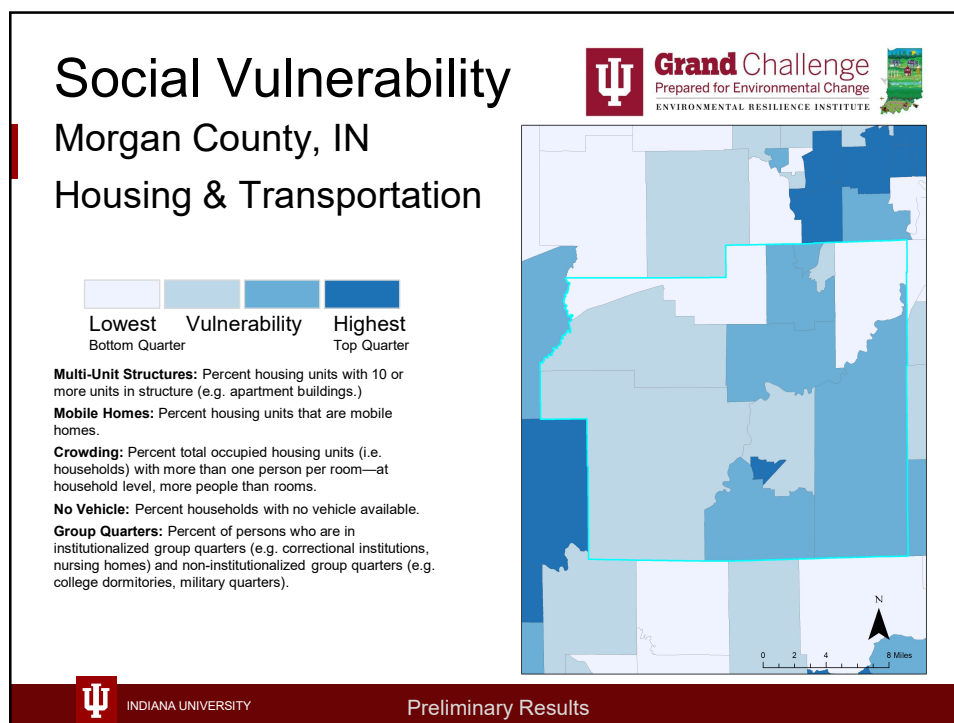
The map displays Morgan County, Indiana, divided into townships. The color coding indicates the level of social vulnerability: yellow for the lowest (bottom quarter), light green for the next level, teal for the next, and dark blue for the highest (top quarter). A north arrow and a scale bar (0 to 8 miles) are located in the bottom right corner of the map.


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Preliminary Results


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## Hoosier Resilience Index

### Part II. Readiness Score

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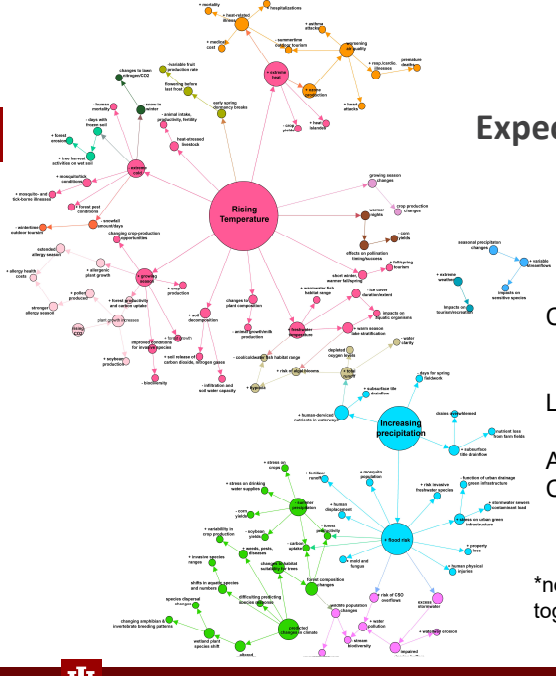

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## Expected Impacts of CC


### Risk Pathway Analysis of INCCIA Reports





Circle/node: climate change impact  
 Size: number of subsequent impact(s)  
 Line/edge: connecting subsequent impact(s)  
 Arrow: direction of impact subnetwork\*

\*nodes that share more connections together than compared to whole network

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## Hoosier Resilience Index

### Part II. Readiness Score



**Worksheet Categories**

- Built Environment
- Emergency Management
- Energy and Public Utilities
- Food and Agriculture
- Natural Resources
- Public Health and Safety
- Planning and Land Use

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## Hoosier Resilience Index

### Part II. Readiness Score

**Energy and Public Utility Impacts**

- Increased likelihood of power supply issues
- Increased likelihood of impacts on storm water management infrastructure
- Increased likelihood of impacts on drinking water sources and distribution infrastructure
- Increased stress on waste water treatment systems

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**Self-Guided Exercise**

**SECTION:** Built Environment

**IMPACT:** Increased stress on roadways and bridges

**ACTION:** Prepare bridge openings, culverts, and ditches for flooding

- ☐ The local government has not assessed which bridge openings (the area below a bridge), culverts, and ditches are prepared for heavier rain events and flooding. The local government has not considered increasing maintenance resources for these water flow areas.
- ☐ The local government has some idea which bridge openings, culverts, and ditches are not prepared for heavier rain events and flooding, but no retrofits have taken place. The local government has considered increasing maintenance resources for these water flow areas, but no action has been taken.
- ☐ The local government has some idea which bridge openings, culverts, and ditches are not prepared for heavier rain events and flooding, and some retrofits have taken place. The local government has begun planning and identifying funding for dealing with bridge scour and/or increasing bridge opening, culvert, and ditch maintenance.
- ☐ The local government has comprehensively assessed which bridge openings, culverts, and ditches are not prepared for heavier rain events and flooding, and some retrofits have taken place. The local government has identified funding for dealing with bridge scour and/or an increase in bridge opening, culvert, and ditch maintenance. Bridges are inspected every other year.
- ☐ The local government has comprehensively assessed which bridge openings (the area below a bridge), culverts, and ditches are not prepared for heavier rain events and flooding, and most or all retrofits have taken place. The local government has a plan and funding for dealing with bridge scour, and has funded and implemented an increase in bridge opening, culvert, and ditch maintenance. Bridges are inspected every other year.



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## Hoosier Resilience Index

### Timeline

Beta Completion: Late August/Early September 2019

Anticipated Launch: November 2019

Between now and then

- Continue internal and external outreach
- Finalize the index (user manual, technical manual, etc)
- Develop online platform



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## We can be resilient!


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## Questions?


[eri.iu.edu](http://eri.iu.edu)

Hoosier Resilience Hotline:  
833-ERI-ATIU (374-2848)

**Link just for mayors:**  
<https://eri.iu.edu/prepare/for-officials.html>

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