PREPARED FOR ENVIRONMENTAL CHANGE GRAND CHALLENGE INITIATIVE

ENVIRONMENTAL RESILIENCE INSTITUTE

INDIANA UNIVERSITY

Hoosier Resilience Index User Manual

NOVEMBER 2019

PREPARED FOR ENVIRONMENTAL CHANGE GRAND CHALLENGE INITIATIVE

ENVIRONMENTAL RESILIENCE INSTITUTE

The Hoosier Resilience Index

hri.eri.iu.edu

For more information, contact:

Environmental Resilience Institute
717 E 8th Street
Bloomington, IN
eri.iu.edu

eri@iu.edu | 812-855-8539 | @Prepared4Change

The Hoosier Resilience Index was developed by researchers at Indiana University with experience in a wide range of disciplines related to climate science, data analytics, and resilience and mitigation policies and programs. The Environmental Resilience Institute eagerly sought and gratefully received input from local government officials and staff, and many other external parties along the way. Two counties and two municipalities participated in a beta test of the Index and provided invaluable feedback.

Table of Contents

I. Introduction

Scientific evidence shows that the climate is changing in the Midwest. In Indiana, average annual temperatures have increased 1.2°F since 1895 and by the late 21st century are projected to increase an additional 6-10°F. Precipitation is becoming heavier and more damaging in the winter and spring, and water is becoming less plentiful in the summer and fall, with implications for agriculture, ecosystems, and flood frequency and severity. To help the state of Indiana prepare for these impacts, Indiana University's Environmental Resilience Institute developed the Hoosier Resilience Index, available at hri.eri.iu.edu.

Being resilient means we will be able to deal with change in ways that equitably protect the health, welfare, and economic vitality of our human and ecological communities. Being resilient is not about running away from our way of life or waiting for the worst to happen, but growing toward stronger, cleaner, healthier, safer, and more vibrant communities. Staff at the Environmental Resilience Institute have been traveling around the state of Indiana, and have learned that local leaders and residents want their communities to become more resilient. The Hoosier Resilience Index helps users understand the gravity of climate change, that adaptation and mitigation are important, and that preparedness is necessary, feasible, and unique to each community. The Index also allows communities to understand their specific risks, strengths, and weaknesses to help them set priorities.

Designed to help local decision makers understand the path to making their communities more resilient to climate change, this tool provides:

- Current data and future projections for extreme heat and extreme precipitation events (see the HRI homepage);
- A platform local government officials and employees can use to evaluate how sensitive their residents and developed, natural, and agricultural areas may be to increasing heat and precipitation (see the HRI *Climate Vulnerability* page); and
- A series of self-evaluation worksheets and scores to help local governments understand their current preparedness and identify and prioritize new initiatives and policies to increase resilience (see the HRI *Readiness Assessment* page).

Climate change will not impact every city, town, and county in the same way, nor to the same extent. To lower community risk, local governments have a responsibility to ensure that critical community structures and services are prepared, and that preparedness is equitably addressed across neighborhoods and households.

The Environmental Resilience Institute intends for the Hoosier Resilience Index to be easy to use and understand, informative, objective, inspiring, and accessible to the diverse array of cities, towns, and counties within the state and beyond. It uses Indiana-specific data about future environmental conditions. Although the tool has been initially designed for an Indiana audience (and the data are Indiana specific), the Index is intended to be relevant across a range of community sizes in the Midwest. The Index helps communities understand where to

focus their attention and provides a methodology for measuring progress towards resilience. The Index is intended to complement, not duplicate, existing tools for climate-related vulnerability assessments.

The Index has two parts: *Climate Vulnerability* and the *Readiness Assessment*, each of which is described in more detail in the sections that follow.

Part 1, *Climate Vulnerability,* presents data on four metrics—heat, precipitation, land use, and sociodemographics—for every incorporated city and town and every county within the state of Indiana. All data come from credible, publicly available government or university sources. The information in this part of the Index is available to anyone through the Hoosier Resilience Index user-friendly website.

Part 2, the *Readiness Assessment*, is available only to local governments that wish to complete the self-guided worksheets and obtain a readiness score. Users apply for a unique Assessment, which allows them to evaluate their community's readiness using the worksheets provided, from which staff at the Environmental Resilience Institute will calculate three readiness scores: for extreme heat, for precipitation events, and for river flooding. It is up to each community to decide what process it will use and scores will not be available to the general public on the Index website.

The purpose of this User's Manual is to provide a clear and plain language explanation of the elements of the Hoosier Resilience Index and how to use it. As with any tool, the Index will improve as people use it and provide feedback to staff at the IU Environmental Resilience Institute. Please send any comments or feedback to resindex@iu.edu.

II. Understanding Climate Vulnerability

In the 2010s, scientists and decision makers from across the state began working together to understand how a changing climate would affect Indiana. This effort produced the Indiana Climate Change Impacts Assessment, which identified rising temperatures, increasing precipitation, and a longer growing season as the key climate changes in the state.[a] The first step in preparing a community for climate change is understanding how these impacts will affect a community because they lead to a variety of secondary impacts, ranging from public health and safety to ecosystem and economic stability.

The Hoosier Resilience Index provides data on four metrics. The first two address climate exposure: *extreme heat* and *extreme precipitation* provide information about current and projected future climate conditions. The second two establish vulnerability: *floodplain land use* determines the impact a community will experience from river flooding, and *social vulnerability* offers information on the location of lower-income and other marginalized or more generally vulnerable communities that may have limited capacity to cope with climate impacts when they occur. This combination of climate exposure and vulnerability provides a community with information to help them understand their climate risks.

The maps and charts on the homepage and the Climate Vulnerability page of the Hoosier Resilience Index website allow users to explore these data statewide and within individual cities, towns, and counties. Viewing the Index's exposure and vulnerability data and maps can help a local government understand how their climate risks will affect their community's residents, infrastructure, and economy.

The data displayed throughout the Hoosier Resilience Index are based on observational weather data and on climate projection data from the Indiana Climate Change Impacts Assessment. The 2050s data are based on climate projections for medium and high greenhouse gas emission scenarios.

> The *medium emissions scenario* assumes that countries around the globe will simultaneously and effectively reduce greenhouse gas emissions.[b]
>
> The *high emissions scenario* assumes that countries around the globe do not try to achieve greenhouse gas reductions, resulting in a high level of greenhouse gas emissions.[c]

View the Technical Document to find more information on the source and processing of the data provided.

Homepage Maps and Charts

The map on the homepage of the Hoosier Resilience Index enables users to visually explore data on extreme heat, extreme precipitation, and developed land in the floodplain county by county.

Current and 2050s projection data on extreme heat and precipitation are displayed on the map, as is information on the amount of land that has been developed in the floodplain in each county. Toggle the radio dials to view a combination of extreme heat and extreme precipitation for the different time periods and emission scenarios (see the data definitions section below to understand the meaning of these scenarios), or a combination of extreme precipitation and developed land in the floodplain.

There are two intentional restrictions built into this map.

- The visualizations for extreme heat and developed land in the floodplain cannot be viewed at the same time.
- The radio dials for extreme heat and extreme precipitation only allow users to view the same time periods and emissions scenarios at once. For example, when you select "Current" under *Extreme Heat Events*, "Current" will also be selected under *Extreme Precipitation Events*. And when you select "2050s Medium Emissions Scenario" under Extreme Heat Events, "2050s Medium Emissions Scenario" will be automatically selected under *Extreme Precipitation Events*.

To view the values associated with extreme heat, extreme precipitation, and how land is used in the floodplain, select a county on the map and scroll down to the charts. The *Climate Exposure* chart displays extreme heat and extreme precipitation data for the current and 2050s time periods under two greenhouse gas emission scenarios. The second chart displays the amount of acres in the floodplain categorized by how the land is used (as of 2010; the Index does not attempt to predict future land use).

What can I learn from this information?

The data displayed on the homepage map demonstrate that the entire state are expected to experience more extreme heat and precipitation events.

Toggle between the current and 2050s data projections to see that counties in the south and the southeast are expected to experience the greatest increase in the number of extreme heat events, as indicated by the dark red colors. All counties are expected to experience more days above 90°F and nights above 68°F than they are experiencing now. Note that counties in the central and northern parts of the state are likely to experience significant temperature increases, as well.

Toggle between the current and 2050s data projections to see a visual representation of the frequency of extreme precipitation events for each county. All counties are expected to experience more precipitation events at or above two (2) inches. Counties in the southeast part

of Indiana will likely see the greatest number of extreme precipitation events, as indicated by a county displaying more rain drops.

> **Note that these data display the number of days of extreme heat and extreme precipitation events; the data do not convey how hot the days will get or how large the storms will be. Furthermore, it is possible that the number of projected precipitation events is lower than what a community is currently experiencing per decade, on average. In such a case, this would not indicate that a community will receive less total rain, because it is possible that a community will experience fewer extreme precipitation events, but with the precipitation amounts being larger.
>
> **Also note that the projections for temperature and precipitation, on average across the state, are expected to continue to increase past 2050s. Refer to the Indiana Climate Change Impacts Assessment to see 2080 projections.

Turn on the land use layer, which cannot be viewed at the same time as the extreme heat layers, to see the distribution of developed land across the state. Dark green counties have a higher number of developed acres in the floodplain compared to the rest of the state. Not surprisingly, the areas with the largest amount of developed land in the floodplain are in the state's largest cities. *With the land use layer turned on, toggle between the precipitation layers* to consider how land use could be impacted by increasing amounts of precipitation.

The charts contain the values associated with the information displayed on the map. To review the definitions of the data categories, hover over the information markers "(i)" next to the radio dial options or refer to the data definitions section in this document.

Climate Vulnerability Page Maps and Charts

Each city, town, and county in Indiana will be impacted by climate change in a different way. Impacts depend on a community's proximity to the floodplain, the characteristics of residents and infrastructure, and many other factors. The *Climate Vulnerability* page provides information and guidance to help communities in Indiana complete the four steps of a vulnerability assessment[d]:

- **Climate Exposure** – Identify the specific climate hazards that will impact your community
- **Community Sensitivity** – Identify the people, resources, ecosystems, businesses, and services that will be impacted
- **Potential Impact** – Evaluate the degree to which these people, resources, ecosystems, businesses, and services will be impacted
- **Adaptive Capacity** – Evaluate the preparedness of these people, resources, ecosystems, businesses, and services

To view this information for a specific location in Indiana, type in a city, town, or county into the "Enter Location" box, and scroll down to the page to interact with the climate vulnerability data.

Climate Exposure

This section provides information on the two main climate impacts that the state of Indiana can expect – extreme heat and extreme precipitation. To review data definitions, hover over the information markers "(i)" next to the chart title or refer to the data definitions section in this document.

> **As mentioned above, note that these data display the number of days of extreme heat and extreme precipitation events; the data do not convey how hot the days will get or how large the storms will be. Furthermore, it is possible that the number of projected precipitation events is lower than what a community is currently experiencing per decade, on average. In such a case, this would not indicate that a community will receive less total rain, because it is possible that a community will experience fewer extreme precipitation events, but with the precipitation amounts being larger.
>
> **Also note that the projections for temperature and precipitation, on average across the state, are expected to continue to increase past 2050s. Refer to the Indiana Climate Change Impacts Assessment to see 2080 projections.

Community Sensitivity

This section provides an interactive map through which users can evaluate land use in their communities and identify the people and infrastructure that will be impacted by more extreme heat days and nights as well as more extreme precipitation events. It can be helpful to review the definitions of each set of data using the information icons, before using this map.

- Turn on the land use layer(s) to see a visual display of categorized land use types. Toggle the 100-year and 500-year floodplain layers to see how the land in the floodplain is currently used. Alternatively, turn off the land use layer(s) and turn on the aerial photo to see a photographic image of a community combined with the floodplain lines to identify the properties, neighborhoods, buildings, forests, fields and other community amenities that are within or near the floodplain.
- Turn on the floodplain layers along with one social vulnerability layer at a time to see which census tracts intersect the floodplain.
- Toggle between the social vulnerability layers to identify the census tracts that may be most vulnerable to extreme heat.

This section also provides two charts. The *Land Use in the Floodplain* chart displays the amount of acres in the floodplain categorized by how the land is used, and the second chart displays the percentile ranking for social vulnerability overall and for each of the four social vulnerability categories. Because these data are only viewable at the census tract level, click on a census

tract on the map while one of the social vulnerability map options is selected to view values in the *Social Vulnerability* chart.

The *Social Vulnerability* chart displays percentile rankings based on comparisons within Indiana. To download a report that contains a set of data that provide the number and percentage of people in a community that fall into various census categories, use Headwaters Economics' Populations at Risk tool.

What can I learn from these maps and charts?

Consider these questions as you toggle between the different map layers to visualize who and what could be impacted by extreme heat and extreme precipitation.

Extreme Heat Events

- Which census tracts contain residents who may be more susceptible to health impacts from high temperatures? Which census tracts contain residents who may be immunocompromised, such as the young, the elderly, and those already struggling with heath conditions?
- Households without air conditioning are often correlated with those that are low-income. Which census tracts are more likely to not have access to air conditioning? Do the residents in these areas have access to a community cooling center? Are they physically able to reach a cooling center if one exists?

Surface and River Flooding

- Which census tracts are most vulnerable to river flooding? Are the residents living within those census tracts able to evacuate if necessary? Will they understand news and instructions in English, or will they need an interpreter or translated materials? Will their homes be able to withstand a flood event? Do they have the resources they need to cope with the aftereffects of a flood?
- Where are all of the most vulnerable census tracts located in the community? Could they be impacted by surface flooding?
- What critical infrastructure (hospitals, schools, pumping stations, nursing homes, grocery stores, roads, bridges, etc.) are located in or near the floodplain?
- Where are the remaining critical facilities located? What is the chance that these locations could be impacted by surface flooding?
- What businesses could be impacted by river or surface flooding? Would that flooding impact employment, the provision of goods and services, or both?
- Although no information is provided through the Hoosier Resilience Index on dams and levees, consider what neighborhoods and critical structures may be impacted by a dam or levee break.
- What planned developments are located in or near the floodplain?
- What land is in or near the floodplain that would be okay to flood? What wetlands are located in or near the floodplain?
- What natural ecosystems are in or near the floodplain, and what within those ecosystems is at risk from a flood event?

Why should I care about developments that are near a floodplain, but not in a floodplain?
The Hoosier Resilience Index provides information on the number of 2'' or greater precipitation events; it does not provide information on the size of these storms. The 100-year and 500-year floodplain lines are updated regularly by the Indiana Department of Natural Resources to account for the changing definitions of 100-year and 500-year rain events. These definitions change because, as more and more greenhouse gas emissions are trapped in the atmosphere, and the severity of climate change increases, the amount of rain calculated as having a one in 100 chance of happening increases.

Potential Impact

Now that you have identified the people and resources in your community that are at risk of being impacted by extreme heat and extreme precipitation, the *Potential Impact* section on the website provides a brief list of questions to help local governments assess the extent to which these people and resources could be impacted. To address the questions in this section, it can be helpful to assemble a team of internal and external experts based on the services provided in the community.[e] The members of this team will depend on the specific impacts that are likely to occur within your jurisdiction; the government operations, infrastructure, and policies that will be addressed; the diversity of individuals that live in your community; and how the local government intends to interact with stakeholders and other entities in the region. One piece of guidance is to include at least one representative from every department likely to be affected by climate change.[f] An example list of needed expertise could include community services, ecological systems, meteorology or climate science, planning and zoning, public health, stormwater management, transportation, wastewater treatment, and water supply.

Adaptive Capacity

The next step in the vulnerability assessment process is to assess the community's readiness for anticipated impacts, and inventory the corresponding resources and barriers. The Hoosier Resilience Index's Readiness Assessment is designed to assist with this analysis.

To complete the Readiness Assessment, click "Do the Readiness Assessment" and submit the form on the *Readiness* Assessment tab. Refer to the User Manual's Readiness Assessment section below for a detailed overview of the Assessment process.

Data Definitions

Extreme Heat and Extreme Precipitation

Extreme heat and extreme precipitation data are provided for two time periods: current and 2050s. The current data are based on observational weather data between 1971 and 2000, and the 2050s data are based on climate projection data for "medium" and "high" greenhouse gas emission scenarios. The medium and high emissions scenarios used in the Hoosier Resilience Index are the same as those used in the Indiana Climate Change Impacts Assessment; they are

determined by scientists and climate modelers and follow standard practice in climate modeling.

> "Medium Emissions Scenario" assumes that countries around the globe will simultaneously and effectively reduce greenhouse gas emissions.[g]
>
> "High Emissions Scenario" assumes that countries around the globe do not try to achieve greenhouse gas reductions, resulting in a high level of greenhouse gas emissions.[h]

The Hoosier Resilience Index defines extreme heat events as days with highs 90°F or greater and nights with lows 68°F or greater. Increasing daytime and nighttime temperatures are hazardous to human health, especially for sensitive populations (e.g. children, the elderly, low-income households, outdoor workers).[i] The extreme heat data provided only account for the frequency of extreme temperatures, and do not explicitly include humidity. Nighttime low temperatures, however, provide a close approximation of the dewpoint temperature (and, therefore, humidity). Increased humidity exacerbates the health implications of extreme heat.

> **High Heat Days** – Number of days, on average per year, where daily high temperature is 90°F or greater and daily low temperature is less than 68°F.
>
> **High Heat Nights** – Number of days, on average per year, where daily high temperature is less than 90°F and daily low temperature is 68°F or greater.
>
> **High Heat Days with High Heat Nights** – Number of days, on average per year, where the daily high temperature is 90°F or greater and daily low temperature is 68°F or greater.

The Hoosier Resilience Index defines an extreme precipitation event as a day with precipitation of 2 inches or greater. Extreme precipitation events, especially rain, increase flooding risk, which can endanger lives, damage property, and wash fertilizer and sediment from agricultural fields.[j] The extreme precipitation data only account for how many days per decade an extreme precipitation event occurs and do not explicitly address the intensity of those events. For example, a 2 inch storm on one day is counted as one event, and a 4 inch storm on another day is also counted as one event. The severity of extreme precipitation impacts is dependent on many other factors, such as soil moisture, topography, land cover, and groundwater hydrology.[k]

> **Extreme Precipitation**: Number of days, on average per decade, where daily precipitation is 2 inches or greater.

Floodplain Land Use

The floodplain land use data are calculated for each Indiana county and incorporated city and town using 2010 observation-based land use data from the U.S. Environmental Protection Agency's Integrated Climate and Land Use Scenarios (ICLUS) tool and the floodplain dataset from the Indiana Best Available Floodplain Mapping dataset hosted by the Indiana Department of Natural Resources.

The Hoosier Resilience Index defines floodplain land as land within the 100-year and 500-year floodplains.

100-year flood – A flood event that statistically has a 1% (1 in 100) chance of occurring in a given year.

500-year flood – A flood event that statistically has a 0.02% (1 in 500) chance of occurring in a given year.

The Floodplain Land Use component presents the amount and percent of floodplain acres per land use type. ICLUS groups the land use types into four categories, which are defined below.

Agricultural Land – Land primarily devoted to growing crops, and raising and harvesting animals.

Developed Land – Land primarily devoted to human activity, such as living and working.

Forest and Vegetation – Land used primarily to preserve nature, which is generally inaccessible to the public.

Wetland – Land with permanently or seasonally waterlogged soil, such that conditions are suitable for water-loving vegetation.

Social Vulnerability

The social vulnerability data presented in the Hoosier Resilience Index were calculated for Indiana using the same model that the Centers for Disease Control and Prevention uses to calculate the Social Vulnerability Index for the entire United States. Refer to Figure 1 for a list and definitions of each variable.

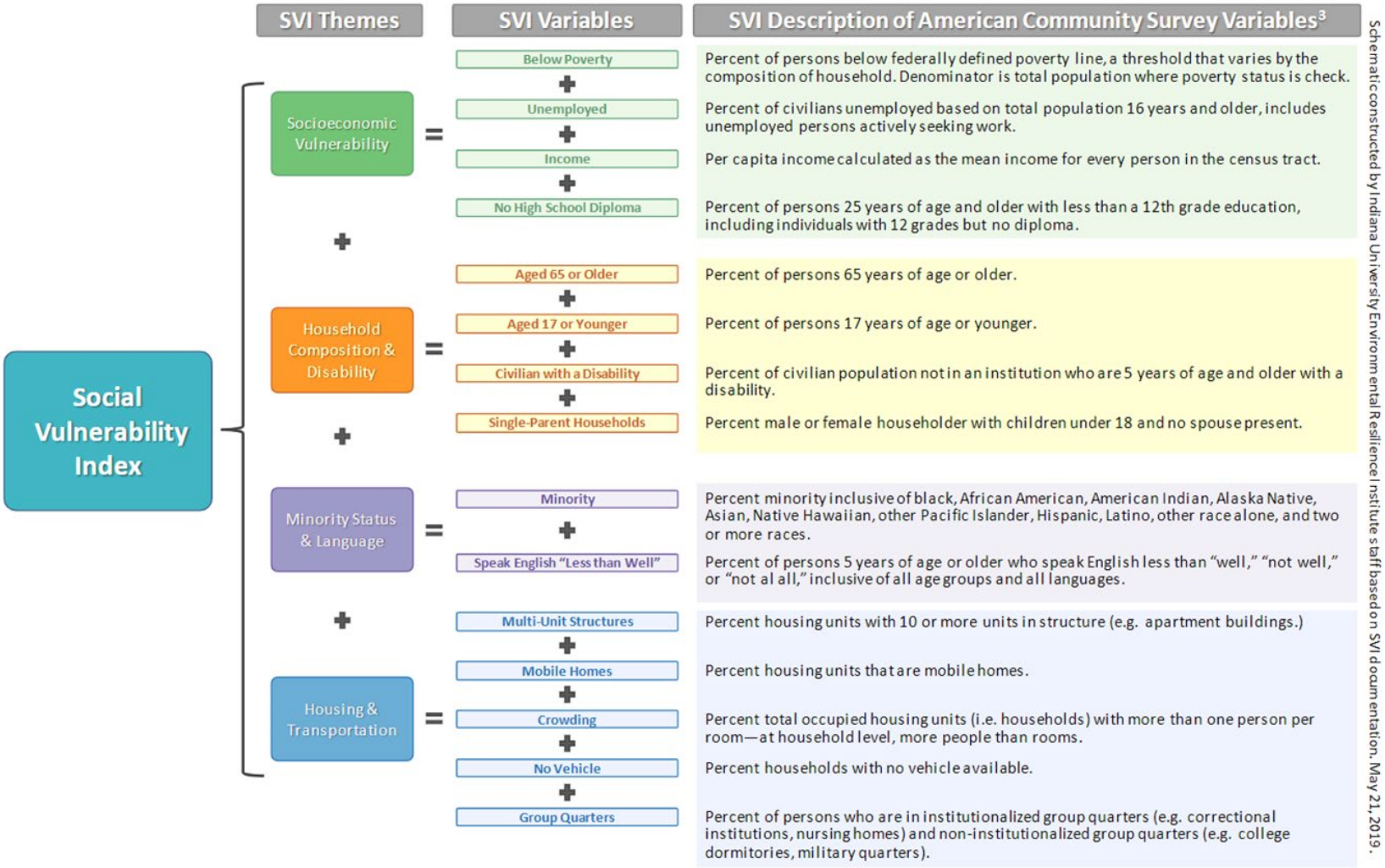

Figure 1. Breakdown of the tiered structure of CDC's Social Vulnerability Index. The index is comprised of four themes (Socioeconomic Vulnerability, Household Composition and Disability, Minority Status and Language, and Housing and Transportation) and each theme comprises thematically relevant census variables. (Schematic reconstructed and slightly modified by the Environmental Resilience Institute staff for clarity.)

III. Completing the Readiness Assessment

The Hoosier Resilience Index Readiness Assessment provides a method for a local government to evaluate its preparedness for climate risks, and to identify and prioritize next step actions to increase community readiness.

The Readiness Assessment is available to the public on the Hoosier Resilience Index *Readiness Assessment* tab as a downloadable PDF, but only a local government representative in a county or incorporated city or town in Indiana can complete the Assessment and submit it to the Environmental Resilience Institute to receive extreme heat readiness, extreme precipitation readiness, and floodplain land use readiness scores.

Receiving the Assessment

To receive their community's *tailored* Readiness Assessment, local government employees and officials need to request access through the *Readiness Assessment* tab on the Hoosier Resilience Index website. Participating communities should identify one local official or local government employee to serve as the point of contact. Each point of contact will be responsible for collecting responses to the questions in the assessment, and submitting them through their community's unique web address.

When a point of contact requests access to their community's tailored Readiness Assessment, the Environmental Resilience Institute will respond with an email containing a link to the unique web address along with instructions for completing the assessment. The questions on the unique web address appear one at a time and are navigable by section and impact through links positioned at the bottom of each page. The point of contact will also receive a link to a webpage where all of the questions contained within the tailored Readiness Assessment can be saved as a PDF to enable local governments to view all questions at once. This printable PDF can be used to collect responses from employees across departments. Responses can be entered into the website as collected or all at once at the end.

There is no time limit for completing the Readiness Assessment, and the questions can be answered in any order. Responses will be saved if a user closes the tab or browser and returns later.

What's in the Readiness Assessment?

There are 79 questions in the Readiness Assessment, but not all questions will be posed to every community. Participating communities will receive a set of questions that is tailored to their size, type of government, and location in relation to the floodplain.

The questions are divided into eight sections:

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

Each section, or "worksheet", contains between one and four climate change impacts. Each impact includes between one and seven actions that local governments can take to mitigate or prepare for each impact.

Each action is posed as a question with six response options: five answers that reflect increasing attentiveness to the particular issue and a sixth, which can be selected if the responder feels the question is not applicable to their community. The first five answers will be scored 1, 2, 3, 4 or 5; a score of 1 means the community has not thought about the issue at all, a score of 5 means the community is comprehensively addressing the issue, and 2-4 reflect increasing levels of planning and action in between.

The responder should select the description that best aligns with the programming and other initiatives that exist within the local government's operations or geographic jurisdiction. If not all of the statements within a description are true for the community, the responder should select a lower level or a description that best reflects the community's level of preparedness. In this way, the questions not only allow a community to assess its current state of preparedness for a particular impact; they also provide a specific roadmap for how the community can increase its preparedness. If a responder indicates that the question is not applicable, there will be a comments box in which to provide an explanation.

The Readiness Assessment does not provide *every* action that could be taken to prevent or alleviate climate change impacts; instead, the Assessment includes actions that have been identified as the most useful based on feasibility, relevance in the state of Indiana, the technologies available, and the ability of an action to address cascading impacts. All of the actions included have been implemented by one or more local governments in the Midwest and are considered first order responses.

Communities in Indiana are already doing many of the actions included in the Assessment; the Readiness Assessment helps local governments think about how they can integrate resilience into community services already provided, such as increasing street sweeping schedules, addressing emergency flood response in Multi-hazard Mitigation Plans, and educating residents

about heat related illness and prevention through the County's health department or other outlets.

The actions in the Readiness Assessment were identified through individual expertise from academics and practitioners and a review of best practice literature. See the Hoosier Resilience Index Technical Document for a complete list of references.

What's not in the Readiness Assessment?

Just as the Readiness Assessment does not provide every action that could be taken to prevent or alleviate climate change impacts, it also does not address every impact Indiana communities may experience as a result of the changing climate. The Assessment focuses on impacts related to increasing temperatures and more extreme precipitation events because they are significant and widespread, and because of the opportunities local governments have to respond or prepare. The following impacts were not included, but should be considered, if pertinent, by all local governments in Indiana as they prepare their communities for climate change:

- Dam failures – The U.S. Army Corps of Engineers anticipates dam failures will become more frequent as a result of increased precipitation and the age of most dams across the state. Local governments should be aware of dam locations within their jurisdiction, and the areas at risk of flooding should a dam fail. The local government should have emergency response plans for this type of disaster.
- Landslides, sinkholes, and flooding made worse by bedrock formations – Some parts of Indiana and the Midwest have experienced an increase in sinkholes and landslides, often stemming from increases in precipitation. Bedrock formations influence flooding. The geographic formations, including karst topography, that lead to these events only exist in certain parts of the state. Maps of sinkholes, bedrock formations, and areas at greater risk of landslide are provided in the 2019 Indiana State Multi-Hazard Mitigation Plan.

Receiving Readiness Scores

To facilitate the submission of responses, it is recommended that points of contacts wait to submit the tailored Readiness Assessment online until all responses are collected.

Upon completion of the Assessment, the user will click "Submit Questionnaire" to receive their scores:

- Extreme Heat Readiness Score
- Extreme Precipitation Readiness Score
- Floodplain Land Use Score

Each score ranges from 1 to 10, and reflects a community's readiness based on their responses to the questions pertaining to the identified threat. A higher score indicates greater

preparedness. Communities without a floodplain will not receive a Floodplain Land Use Score; since river flooding is not a risk within the jurisdiction, this score is not applicable. Scores are not comparable between communities because each city, town, and county completes a unique set of questions in their Readiness Assessment. Scores are presented along with a list of resources to help communities improve their readiness.

Improving Your Scores

The Hoosier Resilience Index can be repeated as often as desired. The unique web address for a community does not change. The following resources are available to help local governments in Indiana increase their readiness for climate change impacts:

- Environmental Resilience Institute Toolkit (ERIT) – ERIT offers a multitude of resources to help local governments in the Midwest prepare for climate change.
    - Case studies database – Read case studies from Midwestern communities, the majority of which are in Indiana, that have a completed a climate adaptation project.
    - Funding opportunities organized by state
    - A list of Midwestern communities with links to their climate-responsive plans
    - Tools
- Prepared for Environmental Change Webinar Series – These free online trainings take place the second Wednesday of every month from noon to 1pm, covering a broad range of topics relevant to local governments in Indiana. All webinars are recorded and made available for viewing.
- Indiana Sustainability Development Program – This annual program connects local governments, businesses, and nonprofits in Indiana with Indiana University students, who work full-time for 10 weeks over the summer. Students are paid; hosts are asked, but not required, to contribute to their stipends. Applications are usually due the December prior.

Didn't see what you are looking for? Contact the Environmental Resilience Institute. We know about many more resources not listed here.

Use of Data

Information submitted through the Readiness Assessment and the scores received by each community will not be displayed to the public. Indiana University may use the information to study and report on resilience trends in Indiana, as well as other reasonable purposes consistent with the Environmental Resilience Institute's mission, including use of such information in public presentations and potential grant applications. Indiana University will not publish a list of ranked communities using the information collected through the Hoosier Resilience Index. Any questions about data use can be directed to the Environmental Resilience Institute.

Notwithstanding the foregoing, Indiana University is a state agency subject to the provisions of the Indiana Open Records Law, I.C. 5-14-et-seq., and that disclosure of some or all information provided pursuant to the Readiness Assessment, and the assessment itself, may be compelled pursuant to that law. In the event that Indiana University is required by the Indiana Open Records Act, or any other law, to disclose a community's information relating to the Readiness Assessment, Indiana University will notify the community, consult with the community regarding whether there are legitimate grounds to narrow or contest such disclosure, and only disclose that information that Indiana University, in the opinion of its legal counsel, is obligated to disclose.

Environmental Resilience Institute
717 E 8th Street
Bloomington, IN 47408
resindex@iu.edu
@Prepared4Change
812-855-8539

[a] Purdue University, Purdue Climate Change Research Center, "Indiana Climate Change Impacts Assessment." Accessed 2018. Available at: https://ag.purdue.edu/indianaclimate/.

[b] Thomson, A.M., Calvin, K.V., Smith, S.J., Kyle, G.P., Volke, A., Patel, P., Delgado-Arias, S., Bond-Lamberty, B., Wise, M.A., Clarke, L.E., and J.A. Edmonds. (2011). RCP 4.5—A pathway for stabilization of radiative forcing by 2100. *Climatic Change*. 109: 77. Available at: https://doi.org/10.1007/s10584-011-0151-4.

[c] Riahi, K., Rao, S., Krey, V., Cho, C., Chirkov, V., Fischer, G., Kindermann, G., Nakicenovic, N., and P. Rafaj (2011). RCP 8.5—A scenario of comparatively high greenhouse gas emissions. *Climatic Change*. 109: 33. Available at: https://doi.org/10.1007/s10584-011-0149-y.

[d] Boswell, Michael R., Greve, Adrienne I., and Tammy L. Seale. *Climate Action Planning*. Washington: Island Press, 2019.

[e] Climate Impacts Group, King County, Washington, and ICLEI—Local Governments for Sustainability. (2007). Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments. Available at: http://www.cses.washington.edu/db/pdf/snoveretalgb574.pdf; https://www.adaptationclearinghouse.org/resources/preparing-for-climate-change-a-guidebook-for-local-regional-and-state-governments.html.

[f] Ibid.

[g] Thomson, A.M., Calvin, K.V., Smith, S.J., Kyle, G.P., Volke, A., Patel, P., Delgado-Arias, S., Bond-Lamberty, B., Wise, M.A., Clarke, L.E., and J.A. Edmonds. (2011). RCP 4.5—A scenario of comparatively high greenhouse gas emissions. *Climatic Change*. 109: 77. Available at: https://doi.org/10.1007/s10584-011-0151-4.

[h] Riahi, K., Rao, S., Krey, V., Cho, C., Chirkov, V., Fischer, G., Kindermann, G., Nakicenovic, N., and P. Rafaj (2011). RCP 8.5—A scenario of comparatively high greenhouse gas emissions. *Climatic Change*. 109: 33. Available at: https://doi.org/10.1007/s10584-011-0149-y.

[i] Filippelli, G.M., Widhalm, M., Filley, R., Comer, K., Ejeta, G., Field, W., Freeman, J., Gibson, J., Jay, S., Johnson, D., Mattes, R., Moreno-Madriñán, M.J., Ogashawara, I., Prather, J., Rosenthal, F., Smirat, J., Wang, Y., Wells, E., and J.S. Dukes. (2018). Hoosiers' Health in a Changing Climate: A Report from the Indiana Climate Change Impacts Assessment. Purdue Climate Change Research Center, Purdue University. Available at: https://ag.purdue.edu/indianaclimate/hoosier-health-report/.

[j] Widhalm, M., Hamlet, A. Byun, K., Robeson, S., Baldwin, M., Staten, P., Chiu, C., Coleman, J., Hall, E., Hoogewind, K., Huber, M., Kieu, C., Yoo, J., Dukes, J.S. (2018). Indiana's Past & Future Climate: A Report from the Indiana Climate Change Impacts Assessment. Purdue Climate Change Research Center, Purdue University. Available at: https://ag.purdue.edu/indianaclimate/indiana-climate-report/.

[k] Hoegh-Guldberg, O., D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K.L. Ebi, F. Engelbrecht, J. Guiot, Y. Hijioka, S. Mehrotra, A. Payne, S.I. Seneviratne, A. Thomas, R. Warren, and G. Zhou. (2018). Impacts of 1.5ºC Global Warming on Natural and Human Systems. In*: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Available at: https://www.ipcc.ch/sr15/chapter/chapter-3/.