FEMA's National Risk Index

FEMA

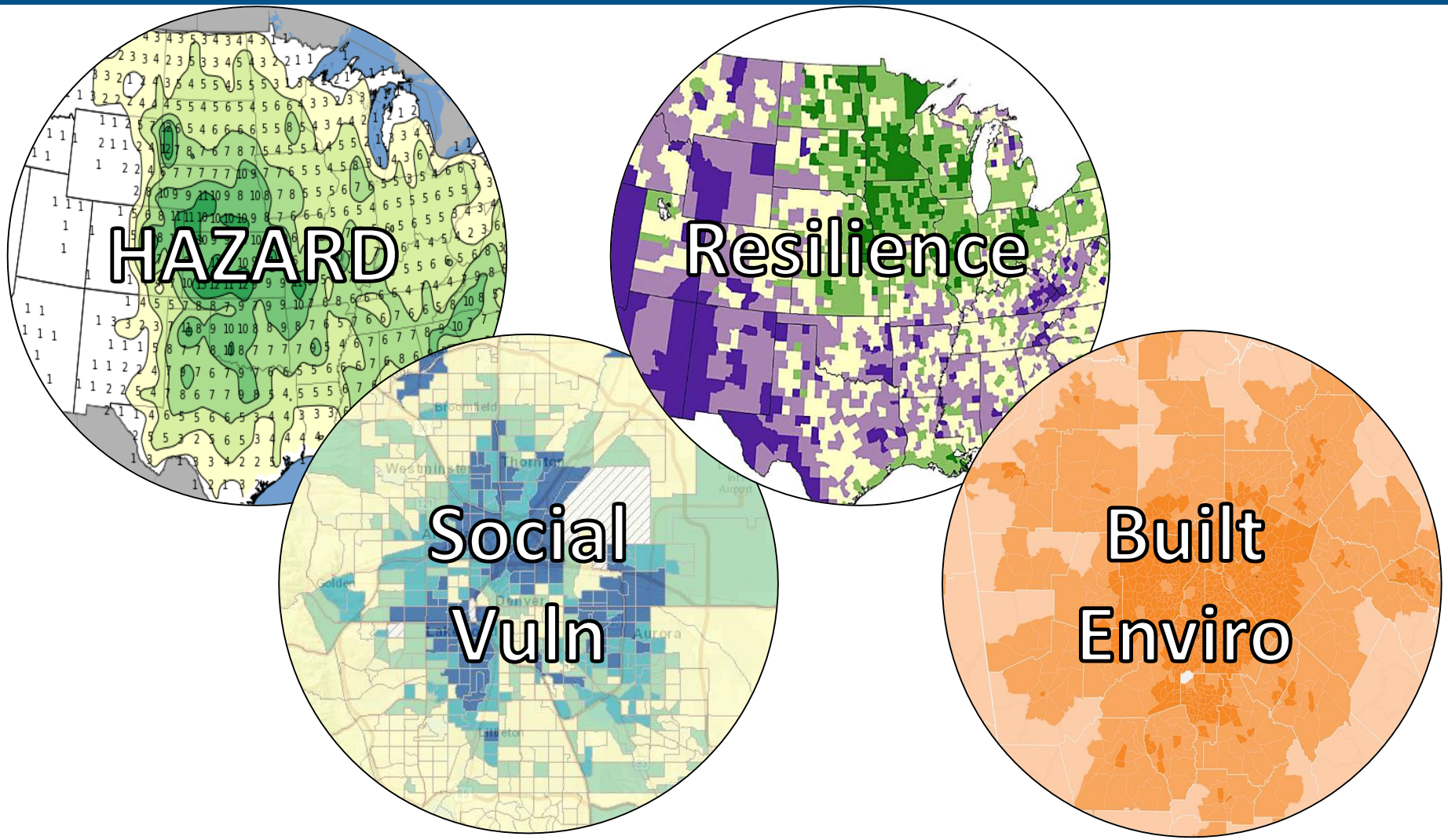
Agenda

- **National Risk Index (NRI) Background**
- **NRI Working Groups**
- **Calculating and NRI**
  - Hazard Data
  - Resilience Score
  - Social Vulnerability and Resilience Data
  - Built Environment Data
- **User Experience**
- **NRI Delivery Timeline**

Project Goal

- **To develop a Nationwide Natural Risk Index**
  - To include national set of hazard-specific risk indices
  - To be used independently, or combined to create a multi-hazard index
  - Aim to represent a level/rank/indicator of risk and will leverage existing baselines and datasets as much as possible.
  - To include numerous authoritative geospatial datasets (hazard layers/areas, previous events data, risk layers, etc.).
  - Interactive online viewer that will allow the user to:
    - Develop risk index for defined geographic region
    - Export tabular and geospatial results for each hazard
    - Generate maps and reports to be compatible for direct insertion into Hazard Mitigation Plans
- **Enhance FEMA Initiatives**
  - The outputs from this project will serve to inform regional project prioritization, resource allocation, mitigation/land use planning, and community engagement strategies across FEMA.
- **SUPPORT National Stakeholders**
  - This data can be incorporated into State Business Plans, State and Local Mitigation Plans, inform the Areas of Mitigation Interest (AOMI) dataset to prioritize funding, and be used to identify action to reduce future risk.

National Risk Index



Intended Applications & Use Cases

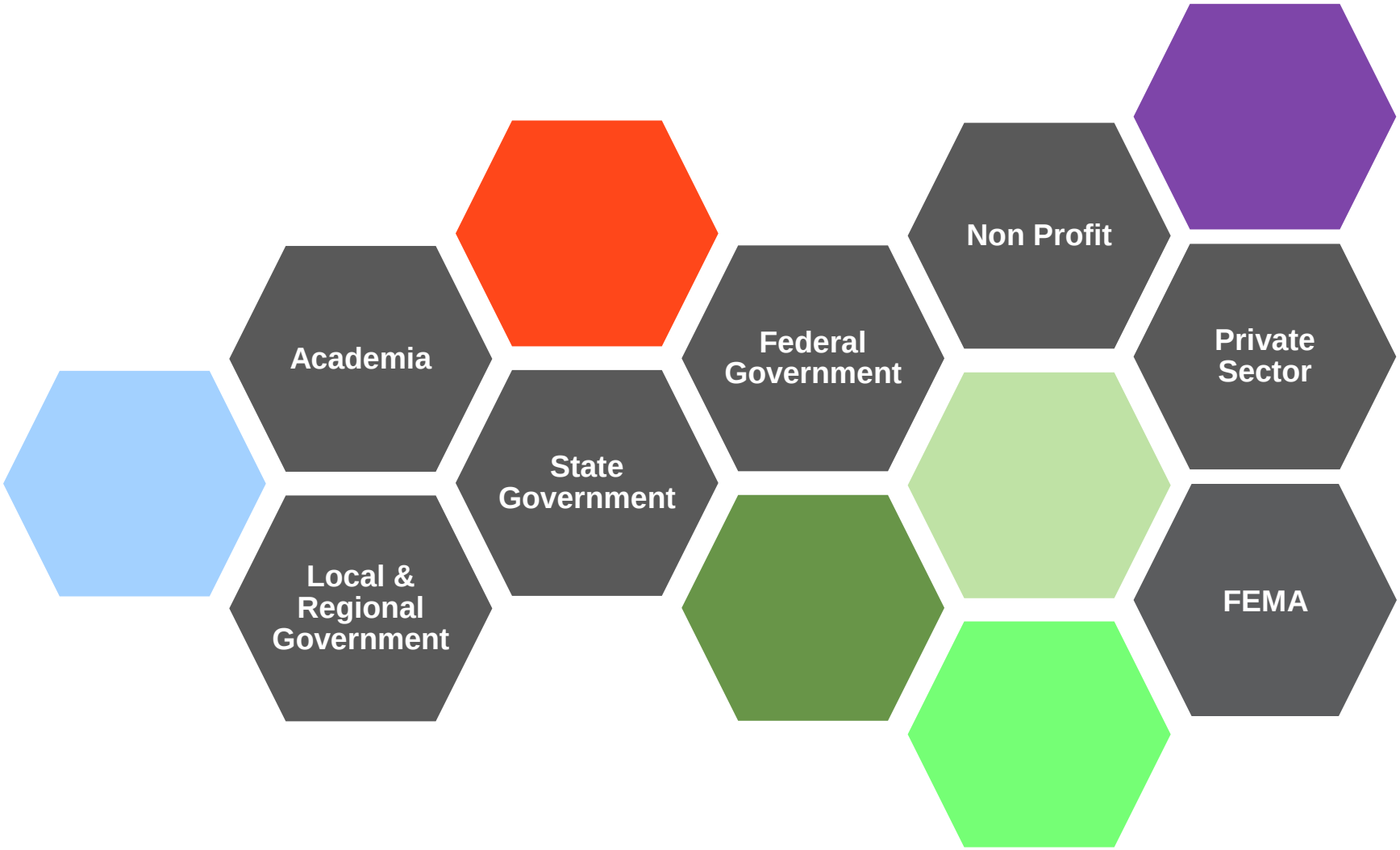
Intended Applications – Public Serving

- Hazard Mitigation Planning
- RiskMAP
- THIRA
- Long Term Recovery
- Operations Planning
- Programmatic outreach (earthquake program, NFIP hurricane program, etc.)
- Research community
- Local officials,
- Emergency managers,
- Community planners

Possible Use Cases – Public Serving

- State/County/Tribal/Local Hazard Mitigation Planning
- General risk awareness for the public
- Hazard Mitigation Grant Program application/prioritization
- Targeted investment of Federal risk reduction programs
- Baseline risk assessment for highlighting areas that could benefit from more detailed analysis
- Encouraging community engagement in identifying risk reduction strategies

Whose Helping Develop the NRI



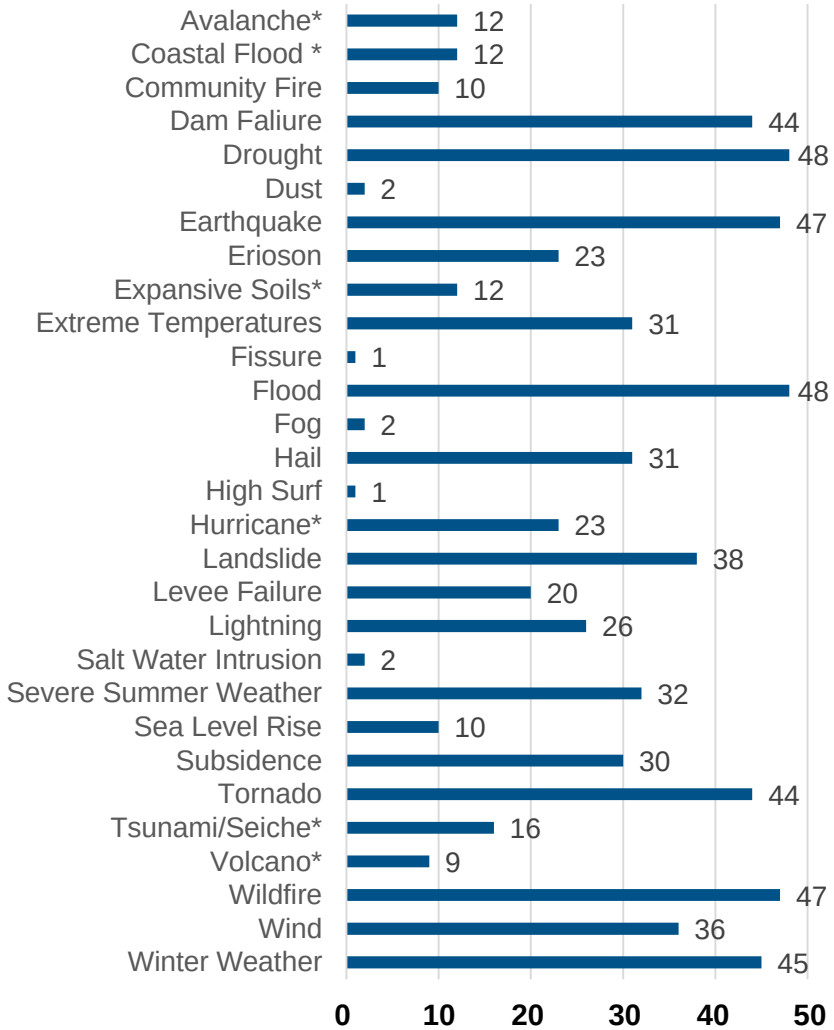
Developing the NRI

Task: Identify Hazard Types & Dataset Sources

Task: Develop recommendations for symbology, aggregation, normalization, and index methodologies for each dataset

Task: Design & Develop a National Hazards and Vulnerability Risk Index Tool based upon recommendations

Hazards



- **Reviewed the 50 State Hazard Mitigation Plans**
- **Natural Hazards Only**
- **Identified hazards to include and potential data sources**
  - Must be nationally applicable/available
  - Public
  - Probabilistic or Frequency based
  - Census Tract level

Hazards to include

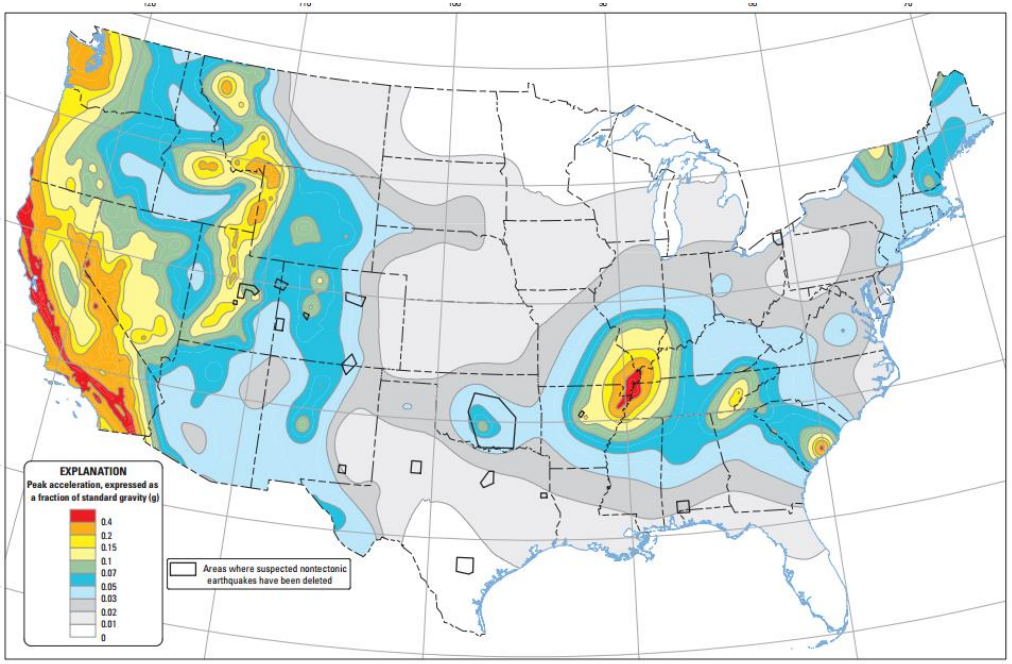
- **Drought**
- **Earthquake**
- **Extreme Temperature**
  - Hot and Cold
- **Flooding**
  - Riverine Flooding
- **Hurricane**
  - Wind
  - Surge
- **Mass Movement**
  - Avalanche
  - Landslide/Mudslide
- **Sea Level Rise**
- **Severe Weather**
  - Hail
  - Lightning
  - Strong Winds
  - Tornado
- **Tsunami/Seiche**
- **Volcano**
- **Wildfire**
  - Wildfire
  - Grassland Fire
- **Winter Weather**
  - Snowstorm/Blizzard
  - Ice Storm

Risk Approaches

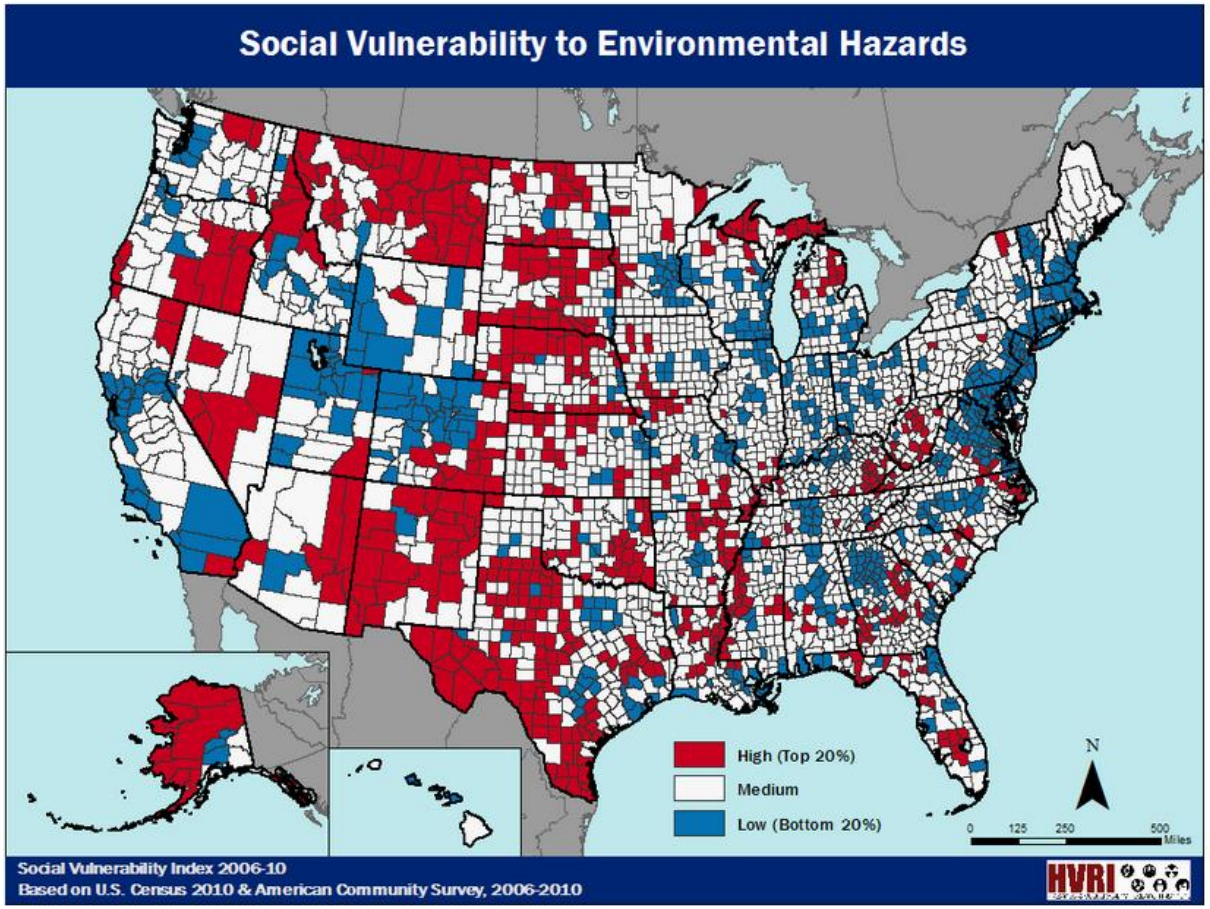
- We have discussed multiple approaches:
  - **Historic**
    - A record of incidents that have already occurred
      - For example, a map showing that over the past 50 years, 3 major hurricanes occurred in the same Florida county
  - **Probabilistic**
    - A probability of an event occurring based on the magnitude of the event
      - For example, 100-year storms or 1000-year storms where the rate of occurrence of an event is linked to the severity of a storm
  - **Annualized**
    - The probability that a risk will occur in a particular year
      - For example, if insurance data suggests that a serious fire is likely to occur once in 25 years, then the annualized rate of occurrence is 1/25 = 0.04 (or 4%)
  - **Loss Estimation**
    - Based on the economic impact of an incident
      - For example, average dollar losses per year

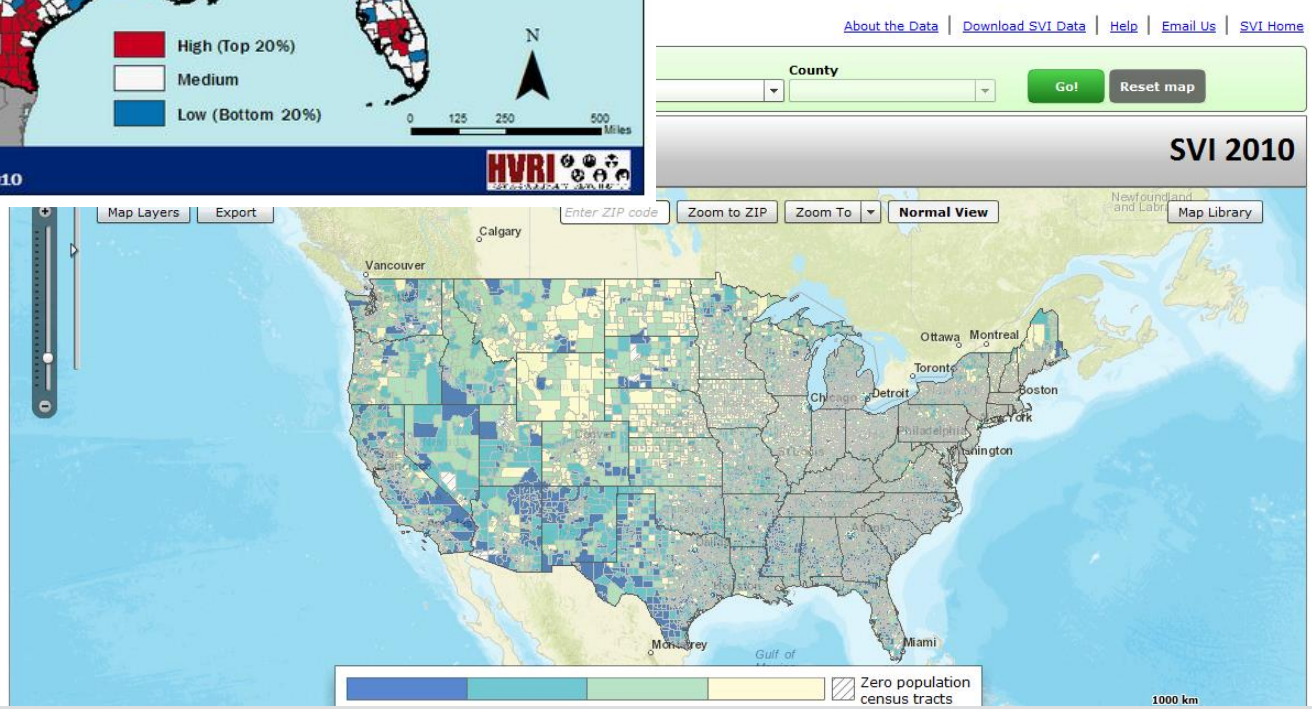
Concluding Risk Approach

- **We landed on a probabilistic approach to be comparable**
  - Challenge is that there isn't probabilistic data nationally available for every hazard
    - Looked at grouping frequency for each hazard - Number of events/time
  - Documentation available for data processing methodology



The USGS National Seismic Hazard Map, however, takes an probabilistic approach, showing peak ground accelerations likely to be exceeded in a 50 year period


Social Vulnerability to Environmental Hazards
High (Top 20%)
Medium
Low (Bottom 20%)
N
0 125 250 500 Miles
Social Vulnerability Index 2006-10
Based on U.S. Census 2010 & American Community Survey, 2006-2010
HVRI


About the Data | Download SVI Data | Help | Email Us | SVI Home
County
Go!
Reset map
SVI 2010
Map Layers
Export
Enter ZIP code
Zoom to ZIP
Zoom To
Normal View
Map Library
Calgary
Vancouver
Ottawa
Montreal
Toronto
Detroit
Boston
Miami
Zero population census tracts
1000 km

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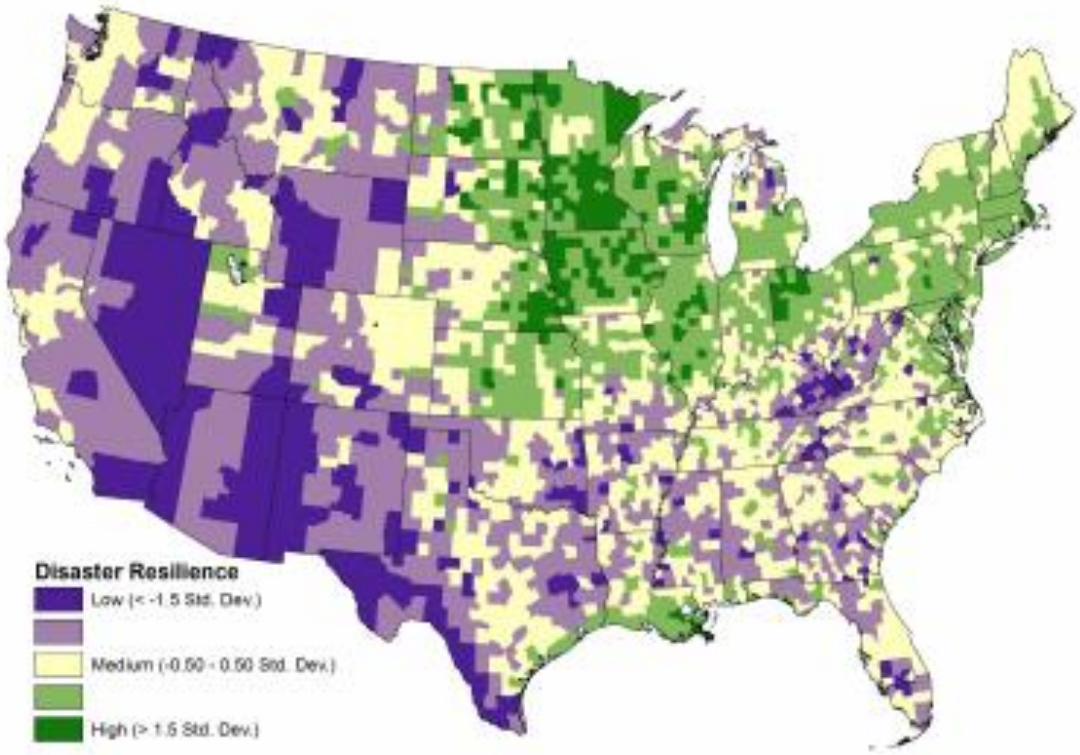
Social Vulnerability Indices: SoVI

- **Developed by the University of South Carolina's HVRI**
  - Grouped into 7 components with 29 variables (SoVI 2010):
    1. Race and class (7 variables);
    2. Wealth (5 variables);
    3. Elderly residents (6 variables);
    4. Hispanic ethnicity (5 variables);
    5. Special needs individuals (2 variables);
    6. Native American ethnicity (1 variables); and
    7. service industry employment (2 variables).
  - Data used: five-year American Community Survey estimates (Census), the Geographic Names and Information System (GNIS), and model-based Small Area Health Insurance Estimates (SAHIE) (Census)
  - Comparative index at the county or subcounty level
  - Positive and Negative component loading

Calculating Resilience

- **Leveraging Baseline Resilience Indicators for Communities (BRIC) dataset for 2010-2014**

- 6 category scores, plus total score
- Identified set of quantitative baseline indicators for measuring disaster resilience at the county level.
- Indicators analyze the relationship between resilience, vulnerability, and the relative impact of disasters on rural and non-rural places.



Incorporating the Built Environment

- **Currently identified vulnerability and resiliency indices focus primarily on socio-demographic factors**
- **Quantitative metrics and tools for assessing built environment on a nationwide scale**
  - Using the overall infrastructure investment dollars in an area as a measure of potential consequence
  - Ability to incorporate into census tracts on a national scale
  - Incorporate the **Hazus GBS** (General Building Stock) Building Value in 2016 dollars

Components

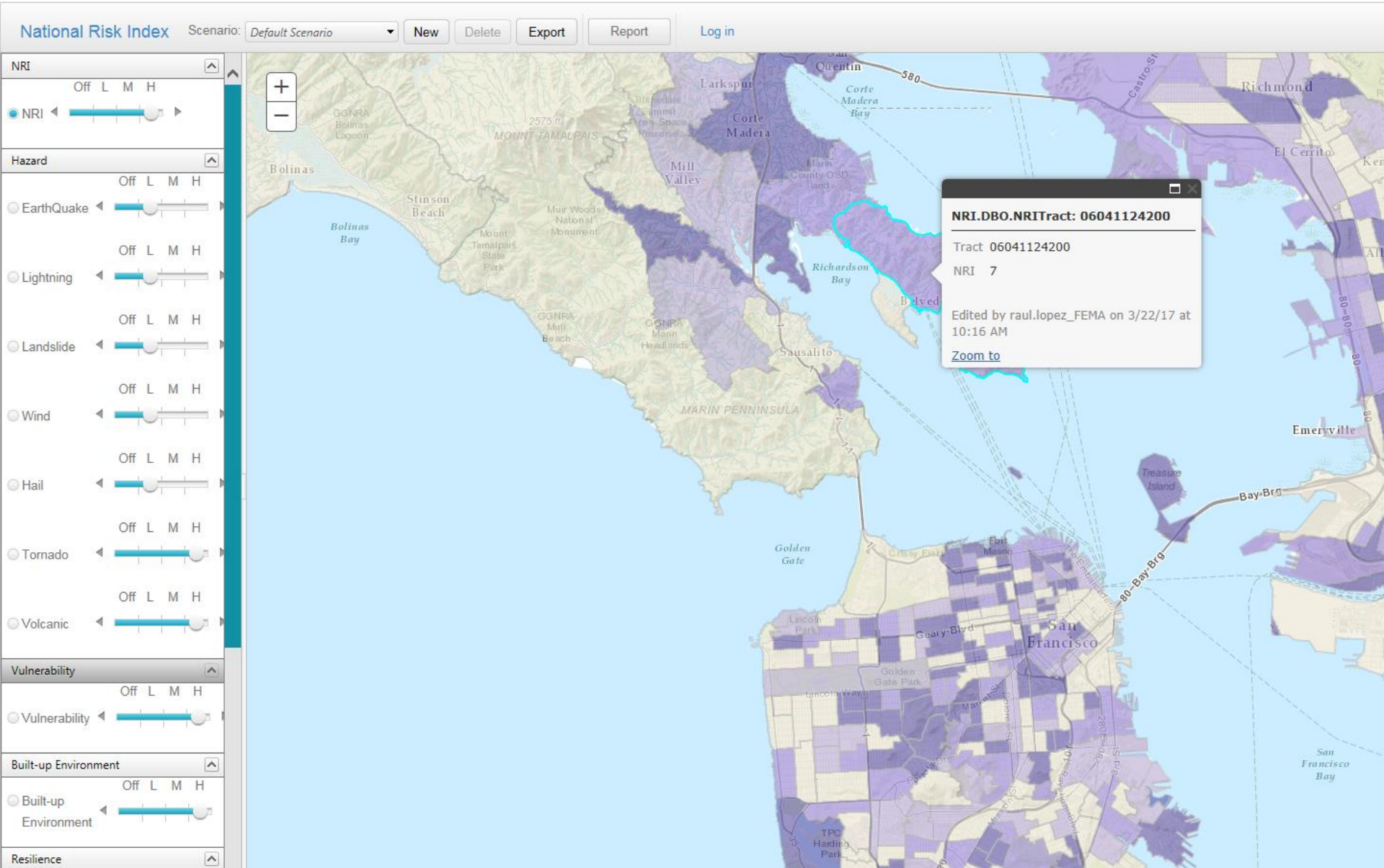
- **Social Vulnerability**: Susceptibility of social groups to the impacts of hazards such as disproportionate death, injury, loss, or disruption of livelihood
  - Social Vulnerability Index (SoVI) procured from HVRI-University of South Carolina
- **Resilience**: Ability to adequately recover from the impacts of hazards
  - BRIC - Nation-wide top-down index.
- **Built Environment**: The intersection of hazard and assets
  - FEMAs Hazus GBS - Built Environment Dollar Exposure (adjusted for inflation)
- **Hazard** – Authoritative Hazard Data Sources

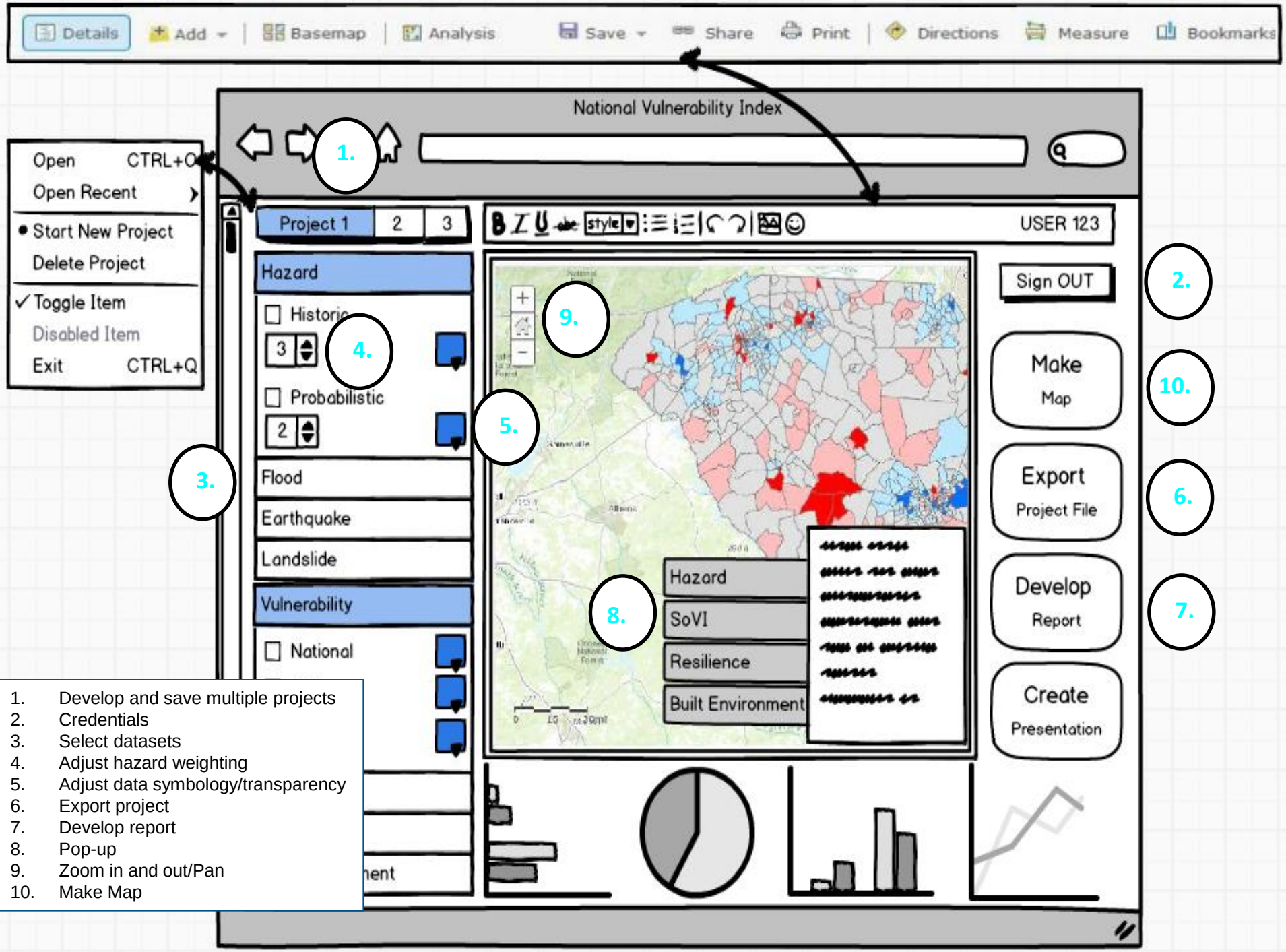
Composite Risk Score Calculation

$$Risk = (Hazard + Consequence) - Resilience$$

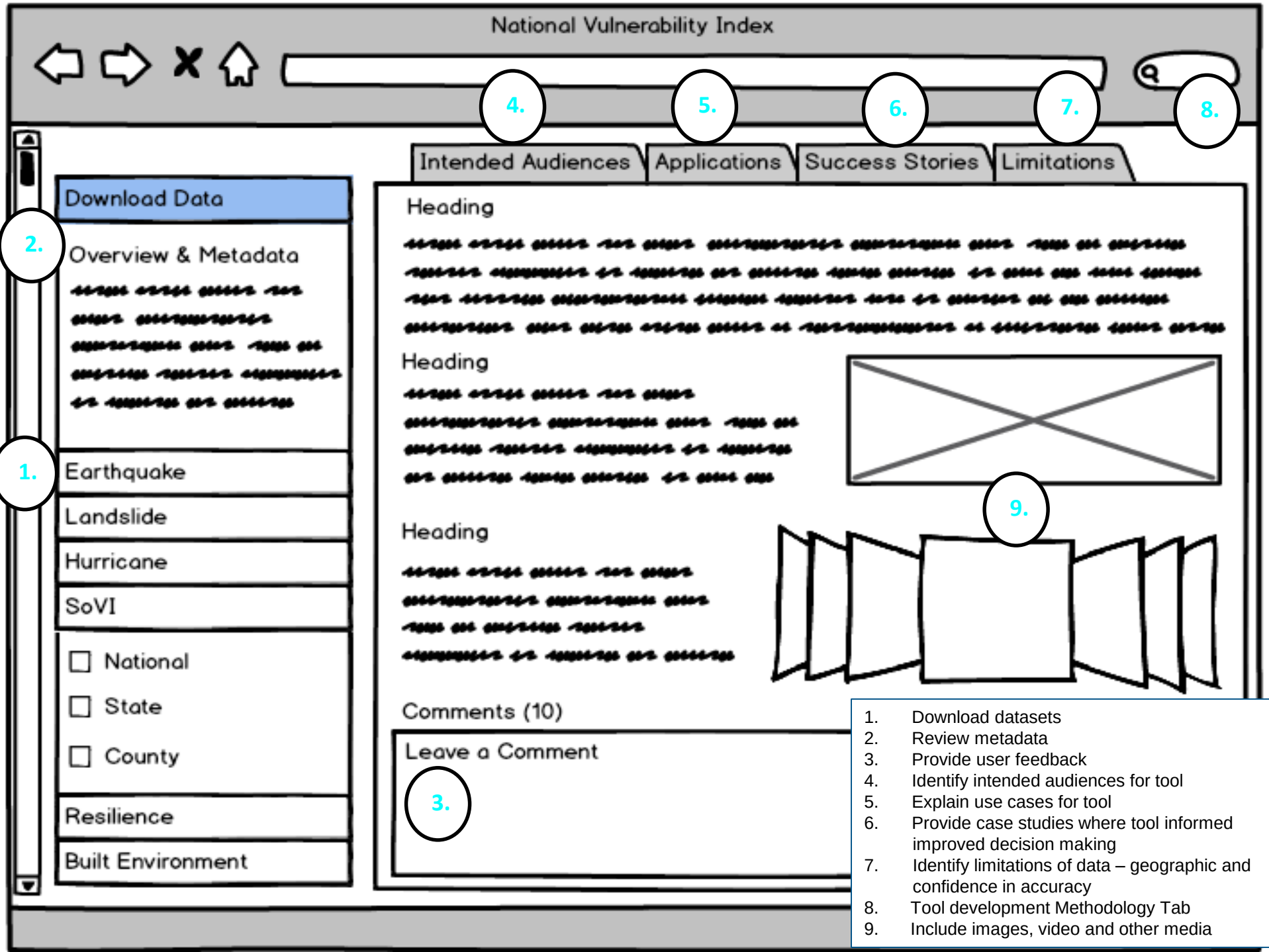
- **Likelihood** (Hazard) – is the probability or historic observed frequency of a hazard
- **Consequence** (Built Environment + SoVI) – exposure component of NRI
- **Resilience** (BRIC) – Communities ability to recover after a disaster

Prototype


National Risk Index
Scenario: Default Scenario
New
Delete
Export
Report
Log in
NRI
Off L M H
NRI
Hazard
EarthQuake
Lightning
Landslide
Wind
Hail
Tornado
Volcanic
Vulnerability
Vulnerability
Built-up Environment
Built-up Environment
Resilience
NRI.DBO.NRITract: 06041124200
Tract 06041124200
NRI 7
Edited by raul.lopez_FEMA on 3/22/17 at 10:16 AM
Zoom to
Larkspur
Corte Madera
Mill Valley
Bolinas
Stinson Beach
Sausalito
Richmond
El Cerrito
Emeryville
San Francisco
Golden Gate
Richardson Bay
Bolinas Bay
Treasure Island
San Francisco Bay
MARIN PENNINSULA
MOUNT TAMALPAIS
Bay Brg
80-Bay Brg



1. Develop and save multiple projects
2. Credentials
3. Select datasets
4. Adjust hazard weighting
5. Adjust data symbology/transparency
6. Export project
7. Develop report
8. Pop-up
9. Zoom in and out/Pan
10. Make Map



1. Download datasets
2. Review metadata
3. Provide user feedback
4. Identify intended audiences for tool
5. Explain use cases for tool
6. Provide case studies where tool informed improved decision making
7. Identify limitations of data – geographic and confidence in accuracy
8. Tool development Methodology Tab
9. Include images, video and other media

Reporting Functionality

- Graphic illustrations of results
  (Tables, Charts and Maps)
- Tabular comparison of multiple scenario results
- Stock language explaining results for each component
  (Hazard, Social Vulnerability, Resilience and Built-Environment)
- Disclaimer for data and tool limitations

Application in State + Local Govt.

- **Update Hazard Mitigation Plans and Comprehensive Plans**
  - Zoning codes may be enhanced to assign appropriate land uses in high hazard areas.
- **Update Emergency Operations**
  - Emergency managers can identify low risk areas for potential evacuation, sheltering and distribution points for food and water.
- **Community Outreach and Education**
  - Local officials can use the information to communicate with property owners, business owners, and other citizens about their risks and mitigation opportunities.
- **Enhance Development Codes and Standards**
  - Planners and public works officials can use this information to support the update of more restrictive building codes and development standards in high risk areas.
- **Identify Need for more refined Risk Assessments**
  - Identify areas of high risk and vulnerability and prioritize data collection and development for structural level risk assessments that identify the need for specific mitigation actions.

Timeline

- **March 2017 – Prototype of tool delivered on Atkins server**
- **May 2017 – Deadline to Get feedback on prototype**
- **June 2017 – Beta Version of Tool released for testing**
- **June 2017 – Release of DRAFT report and tool documentation**
- **July 2017 – Final tool released**
- **After July – Training and outreach campaign**

Questions

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