Methodology for Statewide Vulnerability Assessment

Overview of Approach

Figure 1 below shows a general flowchart of the methodology developed for this study.

Regions and Subregions

The first step in the process is to define the study region and select subregions for analysis. Analysis of risk measures is performed at the subregion level, and then subregion scores are aggregated together through summation to measure overall risk to the study region (or any other combination of subregions desired).

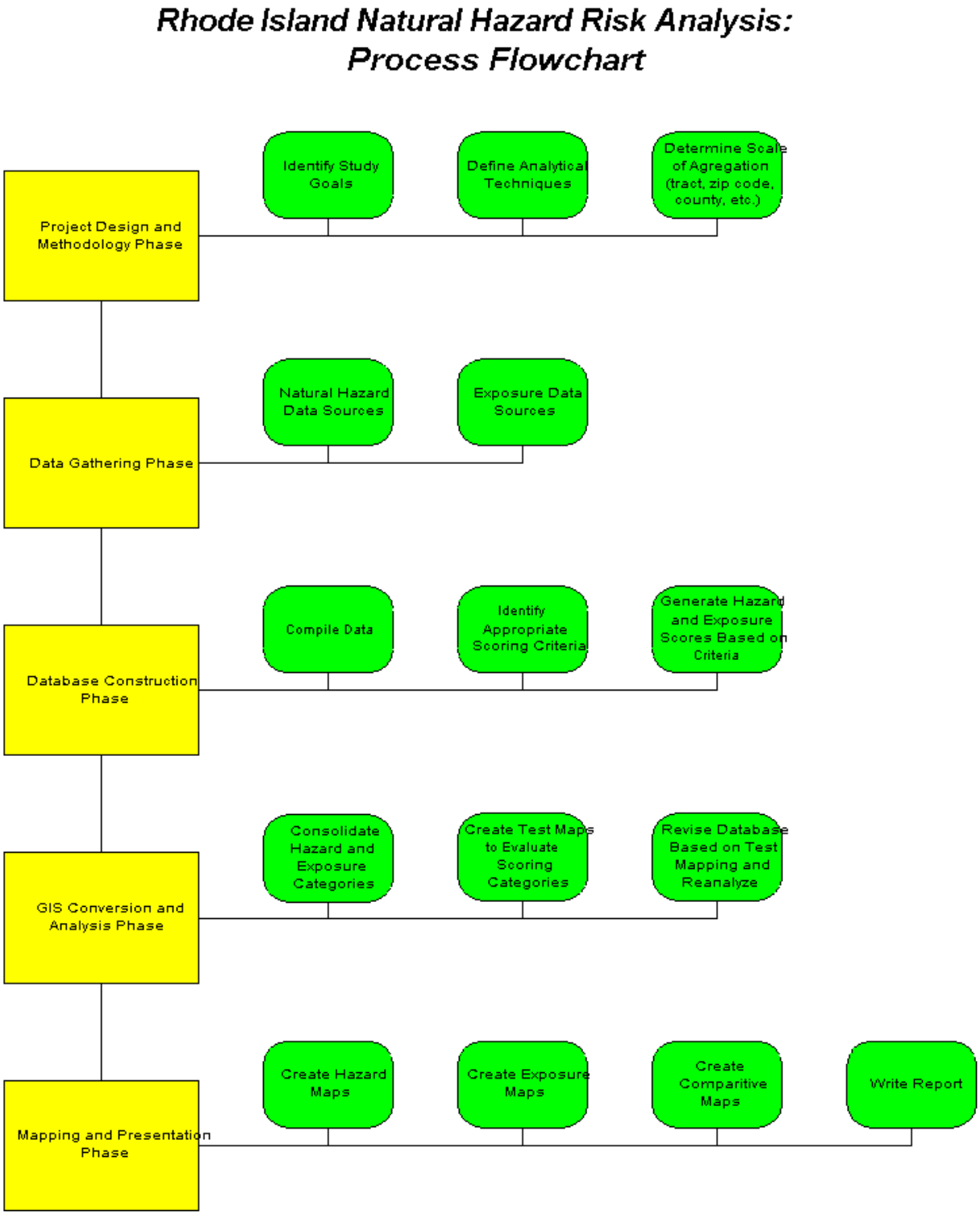
Using the approach described in this report, the study region can theoretically be of any size, ranging from an individual community to an entire country. The main constraint on the study region chosen is that it must be divisible into standardized geographic subregions that are mutually exclusive and collectively exhaustive (i.e., subregions must not overlap, and when added together they must represent the entire region of interest).

Regions and subregions selected in the analysis process provide a critical link between statewide planning and community level planning. Statewide analysis of combined subregions can be used to identify communities with high mitigation needs. Data collected in the statewide analysis can then be directly incorporated into community level mitigation planning. Conversely, community-level data can be used to validate results from the statewide analysis. For example, we have taken flood data collected from a community-specific study of the City of Warwick and used it as a validation case for the statewide results.

For the purposes of this study, the study region was the State of Rhode Island, and subregions were selected to be census tracts. Other subregions that could be used include zip codes and counties. If smaller subregions are chosen, higher resolution can be obtained in mapping risk measures. However, this consideration must be balanced with the availability of data for these subregions.

In the case of Rhode Island, adequate data exists at the census tract level for hazards and exposure for our purposes. In addition, census tracts allow flexibility for aggregation into cities, counties, and other regional combinations for further study.

Figure 1


Rhode Island Natural Hazard Risk Analysis:
Process Flowchart
Project Design and Methodology Phase
Identify Study Goals
Define Analytical Techniques
Determine Scale of Agregation (tract, zip code, county, etc.)
Data Gathering Phase
Natural Hazard Data Sources
Exposure Data Sources
Database Construction Phase
Compile Data
Identify Appropriate Scoring Criteria
Generate Hazard and Exposure Scores Based on Criteria
GIS Conversion and Analysis Phase
Consolidate Hazard and Exposure Categories
Create Test Maps to Evaluate Scoring Categories
Revise Database Based on Test Mapping and Reanalyze
Mapping and Presentation Phase
Create Hazard Maps
Create Exposure Maps
Create Comparitive Maps
Write Report

Hazard Type Identification

The second step in the process is to determine the hazard types for consideration. The list should be comprehensive and include any hazard type with a reasonable probability of occurring within the study region in a given one year period. However practical limits exist on data availability that may limit consideration of certain hazard types.

The sources for hazard type identification can include emergency management personnel, building officials, weather officials, seismologists, engineers, insurance professionals, and others with knowledge of potential disasters that can impact a region.

For the purposes of this study, the following hazard types were considered based on the experience of the project team:

- Floods
- Extreme Wind (Nor'easters and Hurricanes)
- Snowstorms
- Hailstorms
- Tornadoes
- Earthquakes
- Temperature Extremes

These hazards were judged to have a reasonable probability of occurring within the study region in a given one-year period.

Define Analytical Requirements

This step consisted of determining the appropriate techniques for computing risk measures. The following key requirements guided selection of the risk scoring system used in this study:

- Use of basic Community Vulnerability Assessment Tool approach, but expanded to better model statewide and regional risk
- Ability to compare and contrast different hazards and exposures
- Ability to aggregate individual risk measures into summary risk measures through algebraic summation

- Ability to utilize publicly available, non-proprietary data for analysis
- Flexibility for incorporation of diverse categories of hazards and exposures
- Linkage to established standards for hazards, such as model building codes, to ensure validity of results and parallelism with established practices in hazard mitigation

Data Collection

The following table outlines sources for data collection that were identified early in the project to guide the study.

Table 1. Data Collection

Category	Data Types	Possible Data Sources
Hazards	Extreme Wind Events, Flood, Nor'easter, Earthquake, Snow/Ice, Temperature Extremes, Tornado, Environmental Hazards	National Hurricane Center FEMA, NOAA, National Weather Service, United States Geological Survey, National Climatic Data Center RIGIS (online GIS database for State of Rhode Island) National Flood Insurance Program (NFIP) Insurance Companies
Critical Facilities	Shelters, Schools, Hospitals and Nursing Homes, Fire and Rescue, Police, Utilities Communications, Transportation, Government	Rhode Island Building Commissioner Rhode Island Department of Administration Rhode Island Department of Transportation RIGIS (online GIS database for State of Rhode Island)

Category	Data Types	Possible Data Sources
Critical Populations	Minority Populations Households below poverty level Population over age 65 Single parent with child families Population with no high school diploma Households with public assistance income Housing units with no vehicle available Rental units	U.S. Census Rhode Island Department of Administration RIGIS (online GIS database for State of Rhode Island) Red Cross
Economic Centers	Hotels/Motels, Agriculture, Construction, Manufacturing, Transportation, Wholesale and Retail, Services, Finance/Insurance, Real Estate	United States Economic Census Rhode Island Economic Development Corporation Rhode Island League of Cities and Towns Rhode Island Department of Transportation RIGIS (online GIS database for State of Rhode Island)
Environmental Resources	Hazardous Materials, Toxic Release Sites, Oil Facilities Ports, Marinas, Discharge Sites Scenic Vistas Beach Erosion and Shoreline Change	Rhode Island Department of Environmental Management Rhode Island Coastal Resources Management Council RIGIS (online GIS database for State of Rhode Island)

Category	Data Types	Possible Data Sources
Mitigation Opportunities	Policy Status, Undeveloped Land, Population Projections, Land Cover Change, Zoning	Rhode Island Department of Environmental Management Rhode Island Building Commissioner RIGIS (online GIS database for State of Rhode Island)