CM2
Cooperative Mobility for Competitive Megaregions

The Role of MPOs in Megaregional Transportation System Resilience Planning

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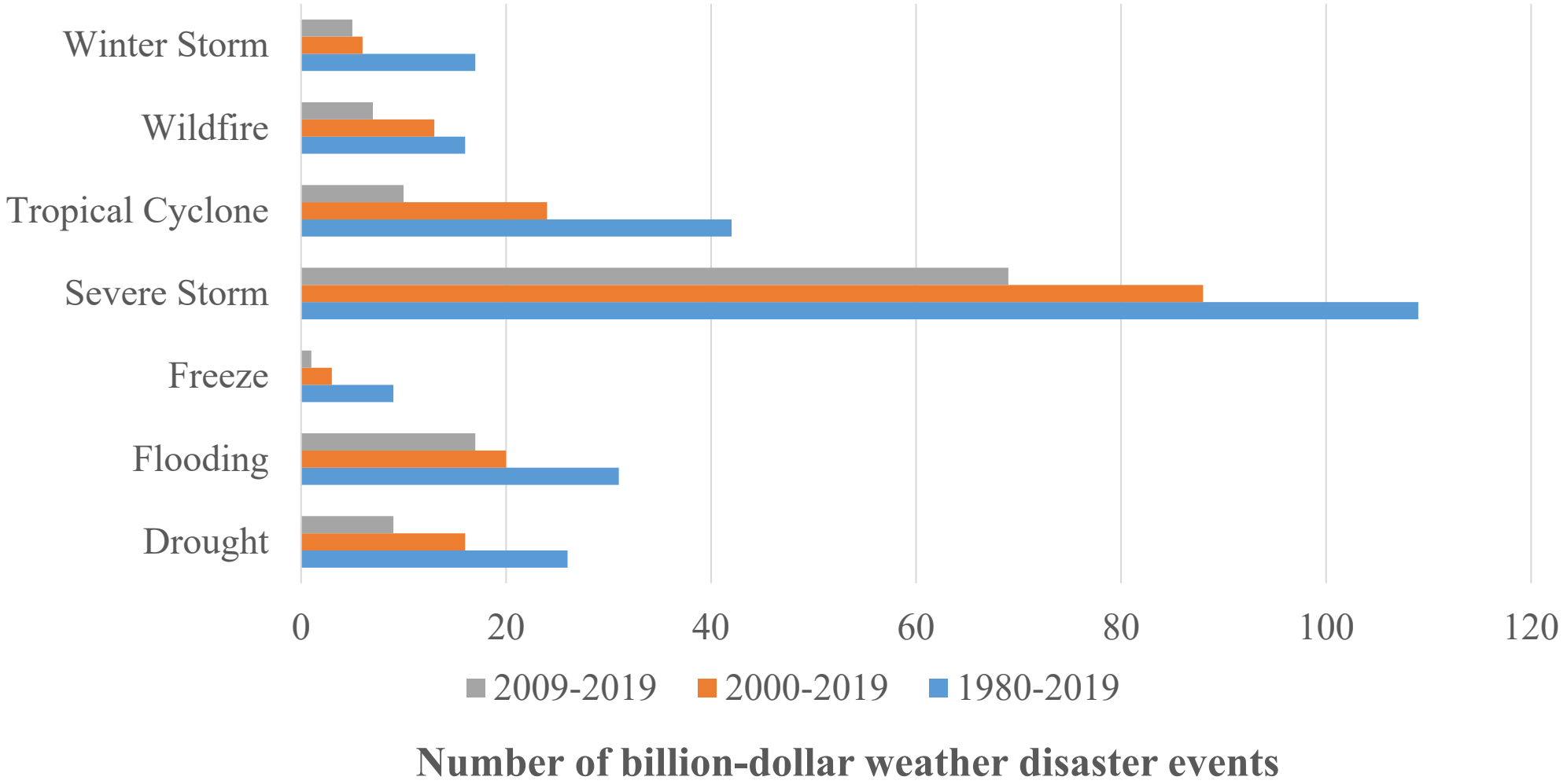
Background Context

- Our previous work researched and provided recommendations on how MPOs could play a stronger role in megaregional transportation planning within the Texas Triangle.
- During this time seminal climate change induced events impacted many U.S. megaregions: hurricanes, wildfires, torrential downpours, freezes.
- This led us to asking the question on how MPOs could/should play a role in developing resiliency planning for transportation.
- As this was occurring federal regulations required
  - USDOT/FHWA to Integrate consideration of resilience in transportation decision making. 23 U.S.C. § 503(b)(3)(B)(viii), directs USDOT "to carry out research and development activities … to study vulnerabilities of the transportation system to … extreme events and methods to reduce those vulnerabilities."

Research Motivation

Natural disasters have been increasing in frequency and intensity.

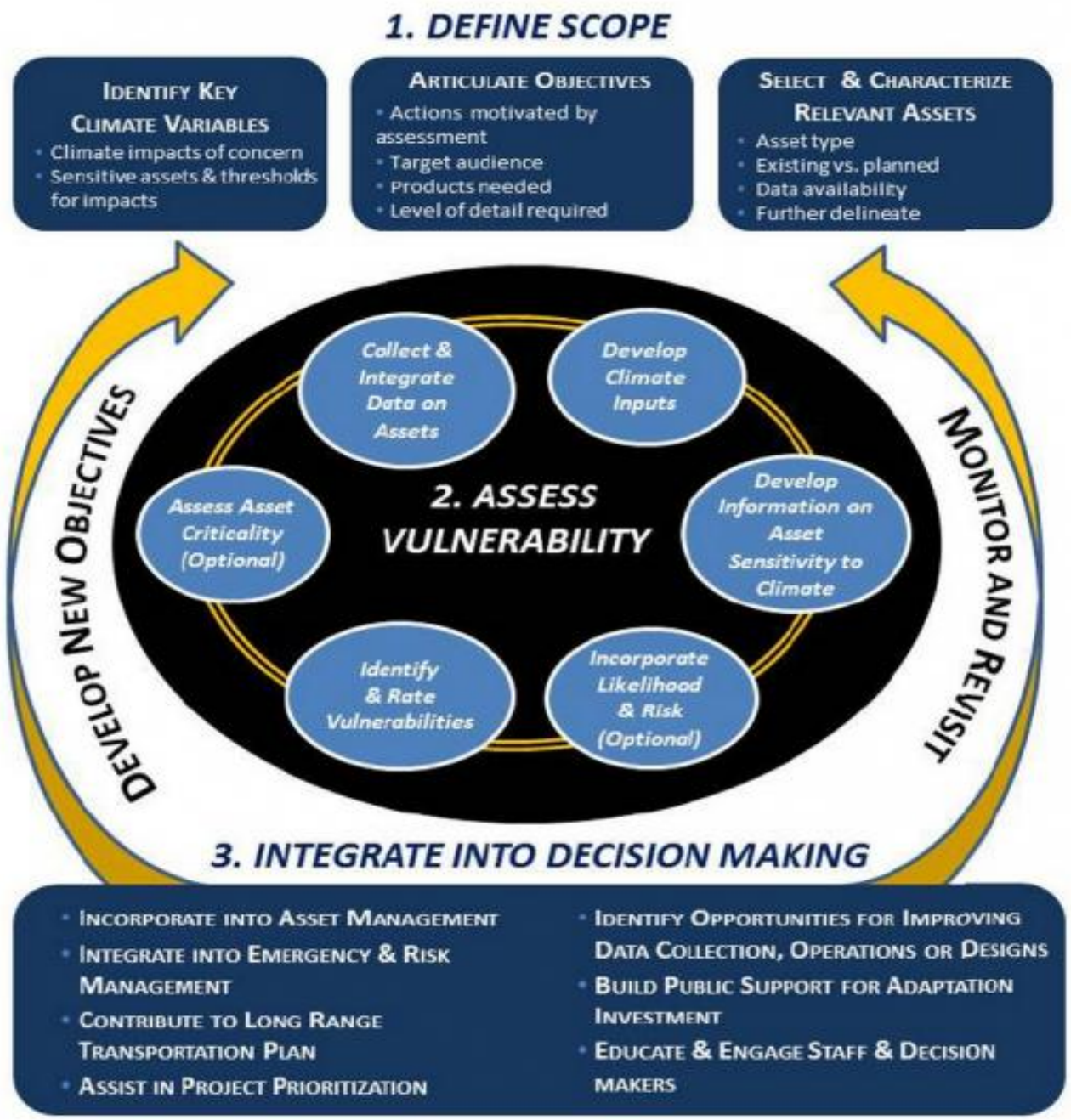


Background Context

- In addition:
  - 23 USC 134, 23 CFR 450 requires State and metropolitan transportation planning should now include resilience as a planning factor
  - Risk-based asset management plans must address risks associated with current and future environmental conditions (23 CFR 515)
  - Assets requiring repeated repair require analysis of alternatives (23 CFR 667)
  - Metropolitan transportation plans shall include an assessment of capital investment and other strategies to… reduce the vulnerability of the existing transportation infrastructure to natural disasters (23 CFR 450.324(f)(7))
  - FHW”A Order 5520 committed FHWA to integrate extreme weather risk into programs.
  - USDOT 2018-2022 Strategic Plan integrated Extreme Weather Resilience Policy
- All of these elements served as background context for our decision to evaluate the role of MPOs in building resilient transportation systems.

FHWA Vulnerability Assessment and Adaptation Framework

https://toolkit.climate.gov/tool/climate-change-extreme-weather-vulnerability-assessment-framework



Guiding Questions

We sought out to explore the concept of **megaregional resilience** through investigating:

- What makes a megaregion resilient? How might “resilience” in megaregions be defined?
- The economic impact of natural disasters on a megaregion, specifically on transportation infrastructure systems and agencies
- The role that MPOs play in building more resilient transportation infrastructure systems

Why does resilience matter to a megaregion?

- Resilience is a critical aspect of economic competitiveness
  - Supply chain disruptions
    - 2011 Tokou earthquake and tsunami in Japan: damages to transportation infrastructure led to a 50% decrease in Japanese automobile production
  - Facilitation of movement of goods
    - Storms or flooding that damage port infrastructure can lead to decreased economic activity in a region or geography
  - Economic growth in employment is based on geography
    - How quickly can employees begin going back to work?

Early insights

- Information about efforts for integrating resilience into transportation systems is in many different places, and it can be hard to find.
  - EX: USDOT, EPA, NOAA – and specific branches of all of these agencies
- Information of economic impact of natural disasters to transportation agencies is (in many cases) not publicly available, making it difficult to aggregate to the megaregion level
- Federal grants began in 2010 to support piloting projects for resilient transportation, and state DOTs and MPOs around the nation have participated
- Our research would be best positioned as foundational to provide a module that can be built on by future research

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We decided to:

Begin the conversation on:

Transportation resilience + Megaregions

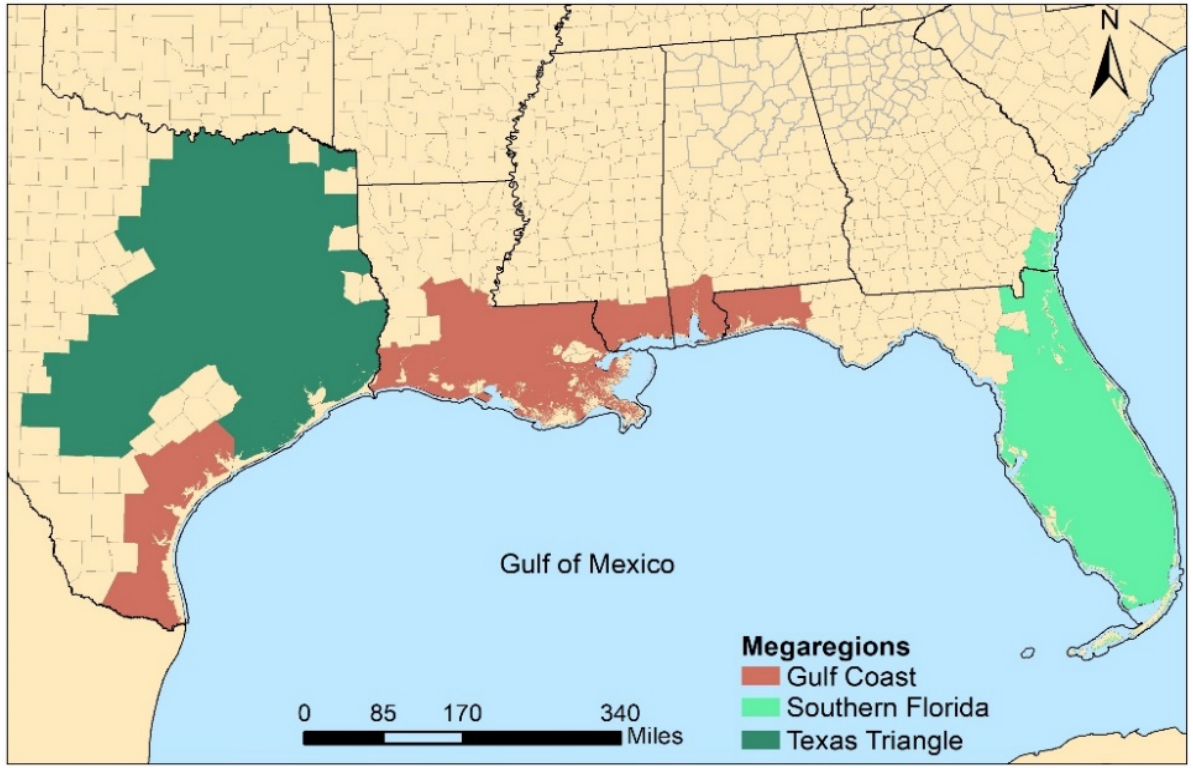
by

1) Collecting and organizing existing data sources that do exist
2) Exploring the concept of spatial resilience of megaregions
3) Create a set of 3 pagers that frame each megaregion in terms of biggest climate threats, recent natural disaster risks and their impact to transport, and MPO-led/funded resilience projects

Spatial Resilience

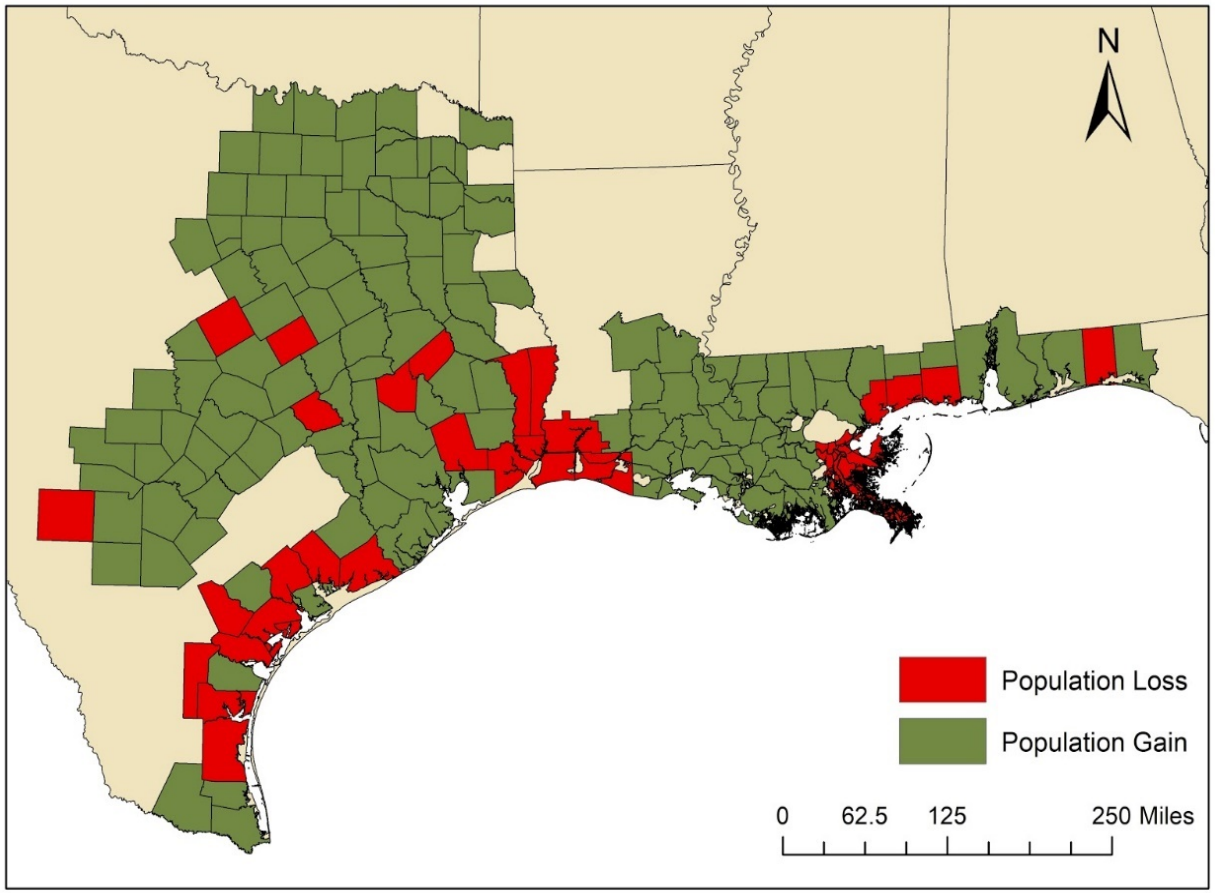
Evaluated changes in population and total employment in three megaregions before and after a hurricane season:

- Texas Triangle and Gulf Coast
  - 2005 Hurricane Season
- Southern Florida
  - 2004 Hurricane Season

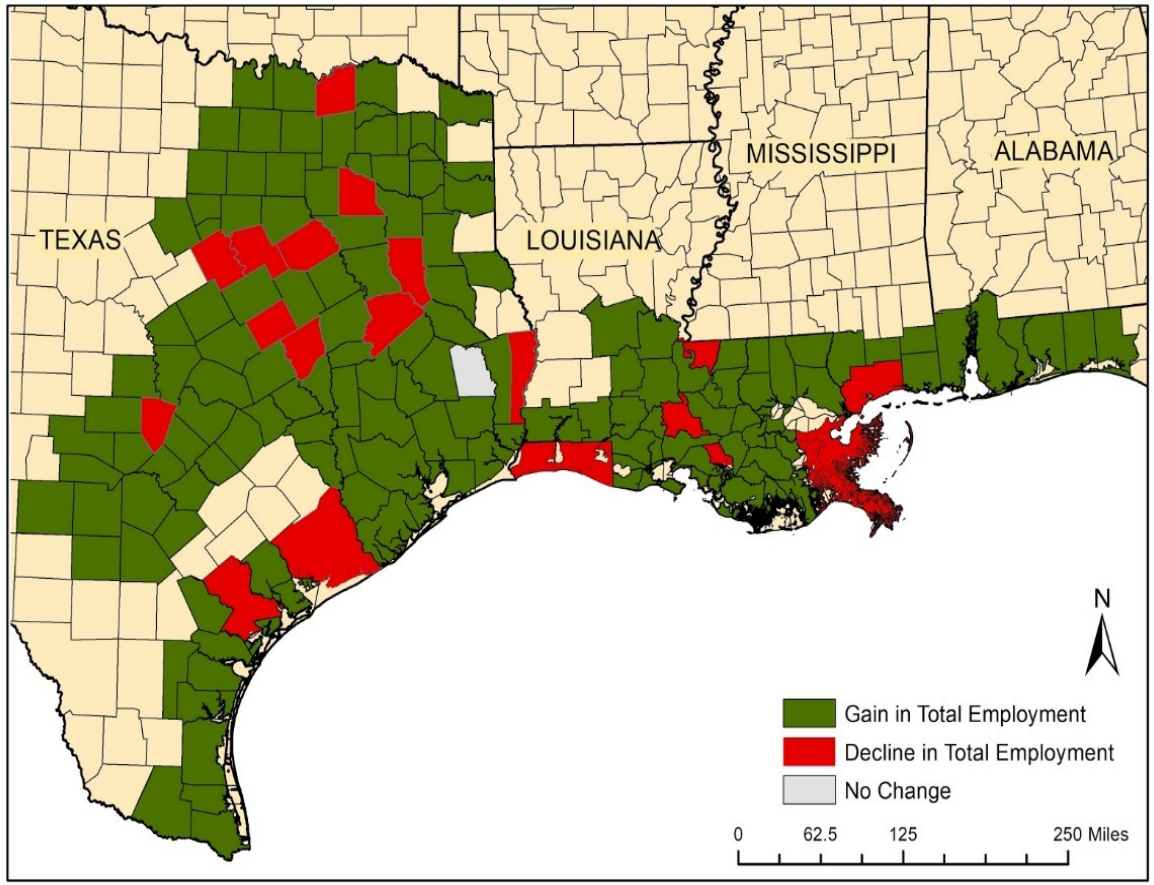


Three megaregions included in this. The Texas Triangle (dark green), Gulf Coast (red), and Southern Florida (green).

Texas Triangle and Gulf Coast

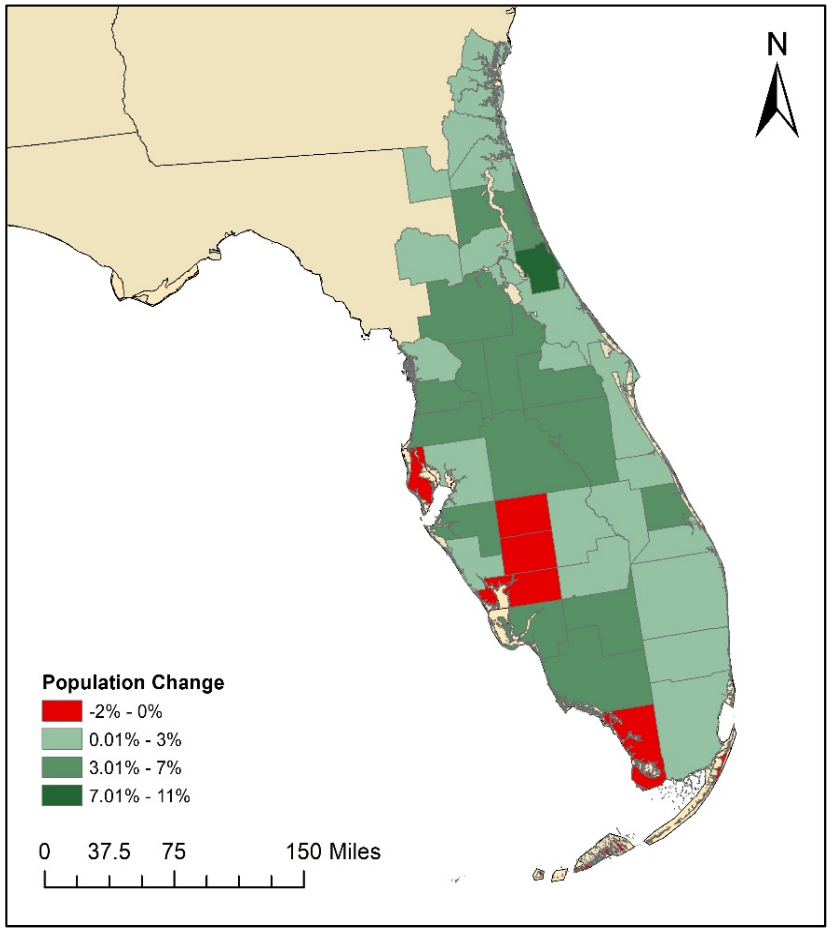


Population impacts by county between 2005-2006

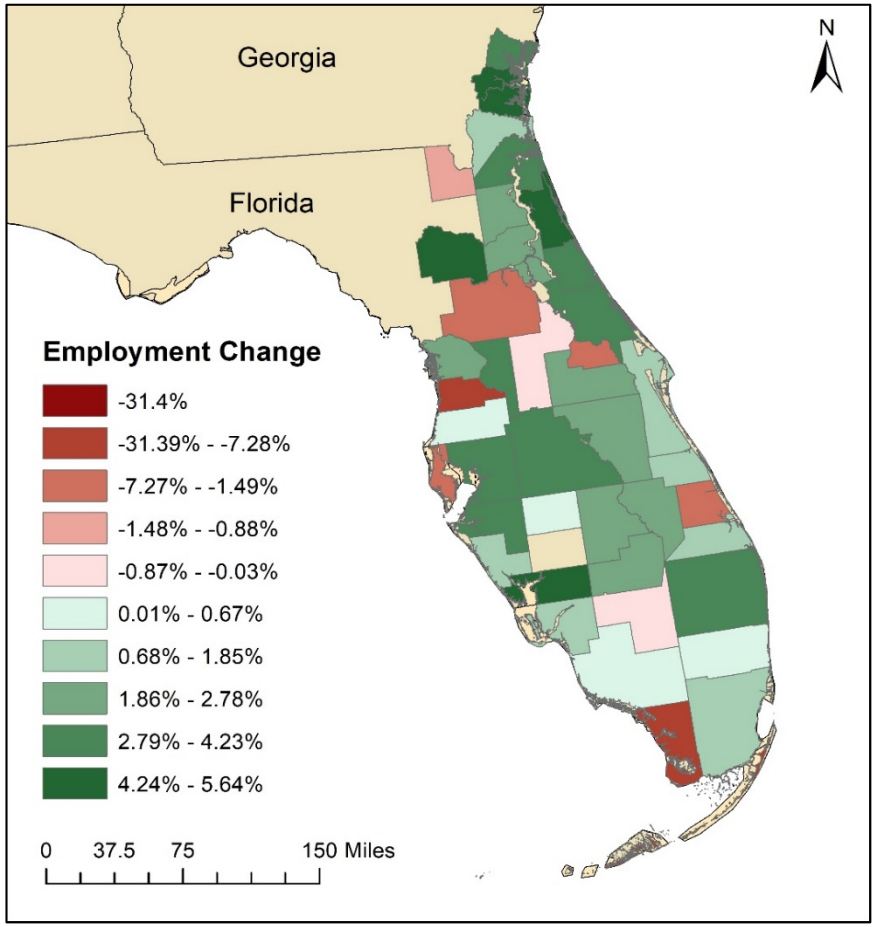


Total Employment level impacts by county between 2005-2006

Southern Florida



Population impacts by county between 2004-2005



Total Employment level impacts by county between 2004-2005

Federally funded Pilot Programs

2010 – 2011: Vulnerability Assessments

2013-2015: Vulnerability Assessments and Adaptation Options

2016-2017: Nature-based Resilience for Coastal Highways

2017-2019: Asset Management, Extreme Weather, and Proxy Indicators

2018 – 2020/2024: Resilience and Durability to Extreme Weather

Resilience Reference Profiles

3.2 Cascadia

The Cascadia megaregion is home to the Cascade Mountain Range and known for its wet winters and mild temperature summers. Gradual temperature changes have led to a decrease in the amount of total snowfall precipitation, and a change in precipitation patterns year-round.[82] While summers are projected to see a decrease in the frequency of precipitation events, they are projected to increase in the amount of rain per event. The projected increase in global sea level rise will dramatically impact existing high populations of people and infrastructure that are concentrated in and around the Seattle area. The EPA notes that "Flooding, seawater inundation, and erosion are expected to threaten coastal infrastructure, including properties, highways, railways, wastewater treatment plants, stormwater outfalls, and ferry terminals."[83] Erosion of coastlines also increase the vulnerability of transportation infrastructure to storm events. Flooding, erosion, and increased intense rain events can lead to very dangerous secondary reactions like mudslides.

In March 2014, a deadly mudslide overtook an entire neighborhood in Oso, Washington, killing 44 people and making it the deadliest mudslide event in U.S. history.[84] In addition to its devastating human impacts, the mudslide made major damage to portions of State Highway 530. Reporters and scientists claim multiple factors contributed this event include local development, logging industries, and mudslide events from previous years.[85] One element of this issue is pervasive no matter the number of contributing factors: rain events continue to increase in intensity and contribute to the occurrence of known risks like mudslide and landslides.[86] Transportation officials in the Pacific Northwest will be increasingly forced to grapple with the realities of increased risks of flooding, erosion, and landslides affecting roadways and other transportation infrastructure.

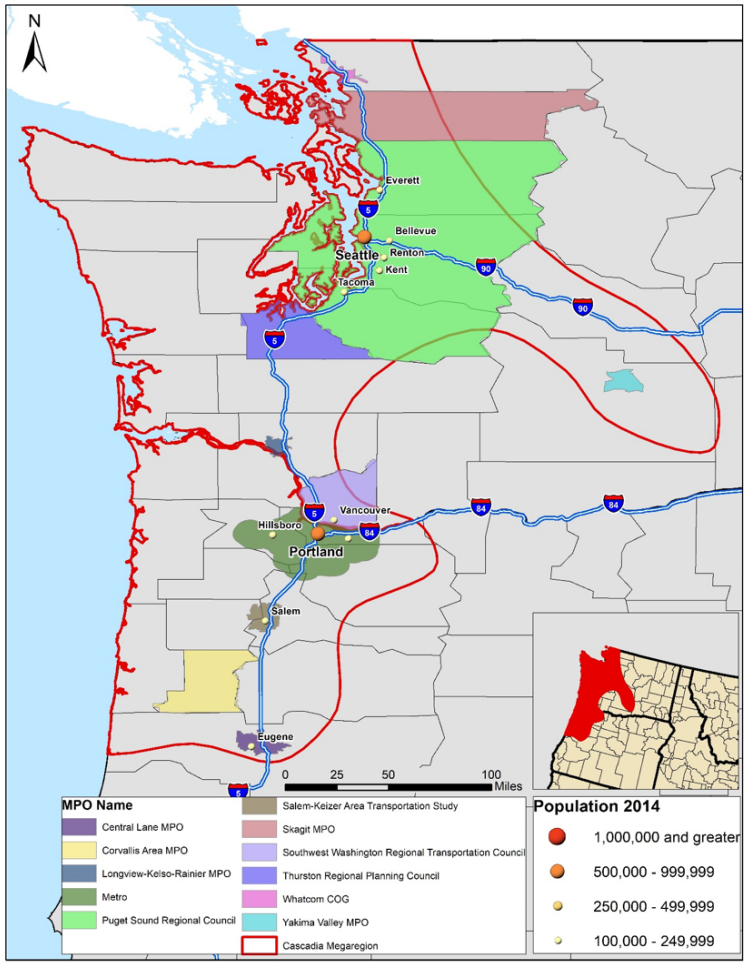


Figure 4: Cascadia Megaregion reference map.

CASCADIA

Principal Cities
1. Seattle, Washington
2. Portland, Oregon
3. Vancouver, British Columbia (not pictured)

Fast Facts
2000 Population: 7.4M
2010 Population: 8.4M
Projected 2050 Population: 11.8M
Percent of U.S GDP (2005): 3%
Percent of U.S Population (2010): 3%

Transportation Governance Structures
Number of State Organizations: 2
Metropolitan Planning Organizations: 11
Counties: 34

Most Common Natural Disaster Threats
Earthquakes, wildfires, volcanos, snowfall, flooding, landslides.

MPO AND STATE DOT INVOLVEMENT WITH USDOT RESILIENCE GRANTS:

Agency: Washington State Department of Transportation (WDOT)
Grant: Vulnerability Assessments (2010-2011)
Outcomes: WSDOT staff evaluated all state-owned highways and transportation assets for climate vulnerability to assess future facility risk. Through a close partnership with the University of Washington, WSODT modeled future vulnerability based on three different types of climates scenarios that included changes in sea level rise, frequency and amount of rain, and extreme events including increases in wildfires, storms and temperature changes.[87]

Agency: Oregon Department of Transportation (ODOT) & Washington State Department of Transportation (WDOT)
Grant: Vulnerability Assessments and Adaptation Options (2013-2015)
Outcomes: WSDOT worked in a multi-agency effort to assess a highly flood-prone region and identify flood risk reduction strategies. The project highlights the importance of collaboration across different transportation agencies in the state.[88] ODOT evaluated the vulnerability of highway infrastructure to extreme weather impacts like flooding, landslides, high sea levels and coastal erosion. The team created a GIS-based asset management system to develop adaptation strategies for specific roadways.[89]

Agency: Oregon Department of Transportation (ODOT)
Grant: Nature-based Resilience for Coastal Highways (2016-2017)
Outcomes: ODOT developed designs to reduce coastal erosion and vulnerability to storms on three major sections of the coastal highway (US 101).
They compared the effectiveness of multiple design strategies to develop recommendations for nature-based solutions.[90]

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THANK YOU