GEOG 9037: Climate Vulnerability and Resilience Assessments using GIS

Instructor

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Course Description

Using GIS, this course teaches current methods for assessing vulnerabilities and resilience to expected effects of climate change. Students will explore social and ecological vulnerabilities as well as adaptation actions to increase resilience. Climate change hazards may include extreme heat, aridification, major precipitation events, natural and urban flooding, and sea-level rise.

The course is designed to be an introduction to climate change hazard foundations and how society is planning for them and preparing communities and the environment. Students will work with a variety of spatial data and GIS workflows related to climate change, including:

- Climate futures/concentration pathways
- Climate change impacts
- Vulnerability indices (social and ecological)
- Vegetation and soil carbon stocks

Objectives

By the end of this course, you will be able to:

- Apply spatial data and GIS tools to assess the impacts of climate hazards such as extreme heat, wildfire regime changes, and sea level rise.
- Develop and implement social and ecological vulnerability indices using spatial analysis.
- Utilize geospatial techniques, including Zonal Statistics, Hot Spot Analysis, Raster Calculator, and the Enrich tool, to analyze environmental and demographic data.
- Communicate climate risk findings through maps and text.
- Propose data-driven adaptation and resilience strategies for communities and ecosystems based on geospatial analysis.

Prerequisites:

- GEOG 9003, *Introduction to Geographic Information Systems*
- GEOG 9013, *Spatial Analysis & Modeling*

Labs

1. **Extreme Heat Vulnerability Assessment**
   - Use spatial analysis tools (e.g., Zonal Statistics, Hot Spot Analysis) to identify areas with high exposure to extreme heat.
   - Integrate demographic data to assess social vulnerability to urban heat island effects.
   - Develop a composite vulnerability index for prioritizing adaptation strategies
2. **Wildfire Regime and Climate Change Impacts**
   - Analyze projected changes in wildfire frequency using climate model outputs.
   - Assess vegetation vulnerability to altered fire return intervals.
   - Calculate carbon dioxide emissions associated with changing fire regimes.
   - Identify priority areas for wildfire adaptation and mitigation based on environmental and social factors.
3. **Sea Level Rise and Community Resilience**
   - Use ArcGIS Online and Drive Time Areas to evaluate the impact of sea level rise on transportation networks and emergency healthcare access.
   - Compare demographic vulnerabilities between current and projected inundation scenarios.