

An Undergraduate Certificate in Natural-Hazards Preparedness and Mitigation (HazPM)

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Natural hazards pose risks to people, economics, institutions, and infrastructure. These risks are rendered more extreme, more complex, and more challenging to manage due to the effects of global climate change. Recent extreme events in the US and around the world, including massive wildfires, severe storms, floods, and droughts, reveal a need for a more robust system of preparation for and mitigation of natural hazards: implemented at the state and national level and reproducible elsewhere. This is a challenge for geoscientists, environmental scientists, engineers, GIS specialists, and social scientists, as hazards originate and occur in the interfaces between natural and social systems. Research results indicate that better-educated societies with savvy decision-makers are best equipped to prepare for, mitigate, and recover from natural disasters. We have collaborated with hazards-related employers and colleagues at the community-college and university level; and conducted mixed-methods surveys of employment and market trends in hazards-related fields in order to characterize knowledge, skills, and dispositions required of graduates who will enter the natural-hazards workforce. The **Certificate in Natural Hazards Preparedness and Mitigation** is designed to be accessible and professionally valuable to hazards-minded students majoring in geosciences and other natural sciences, social sciences, engineering, planning, information science, sustainability, and other fields. Courses will train students in the science of natural hazards, systems and spatial thinking, and in collaborative and communications skills, overlaying broadly applicable natural-hazards expertise on the disciplinary expertise students concurrently accrue in their majors. Knowledge and skills from the program respond to expectations that potential employers have for new employees. By design the curriculum includes both lower division and upper-division courses, so that students in Arizona community colleges can begin earning course credit toward the Certificate even before they transfer to the university. students majoring in geoscience and other natural sciences, social sciences, engineering, planning, sustainability, and many other fields.

GOAL: Establishment of an undergraduate certificate program in **natural-hazards planning and mitigation (HazPM)** fully informed by community and employer needs, accessible to and inclusive of diverse two-year and four-year college students, and useful to those seeking hazards-related careers. **METHODS:** Maximize stakeholder input through a staged process of data gathering and analysis that is summarized in the sections below.

Review of Hazards in Arizona



Arizona is exposed to many natural hazards, with **flooding**, **wildfire**, and **landslides** being the most prevalent. We focused on employers that deal with these hazards.

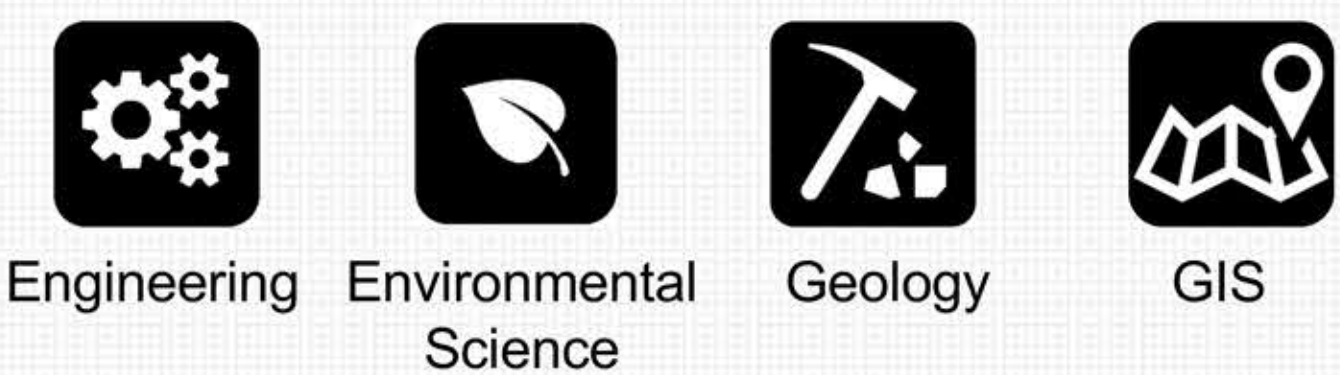
Job Advertisement Analysis

We collected and analyzed **48** hazards-related **job ads** from August 2017 to January 2018. All were from governmental agencies in Arizona with involvement in hazards preparedness, mitigation, or response.

Agencies most represented



Top 4 majors



Top 3 job titles

Engineer, Hydrologist, GIS Specialist

Focus Groups with Employers



Questions posed to the focus groups:

- *What are the natural hazards your organization is concerned about?*
- *What are your organization's biggest challenges in addressing natural hazards?*
- *What are your organization's workforce needs?*
- *What knowledge and skills should students learn to best prepare them to work in your organization?*
- *What learning experiences and instruction best enable students to learn these?*
- *What are the knowledge gaps in your entry-level employees?*
- *With what other organizations do you work most closely?*
- *What future opportunities do you envision for your organization?*
- *What future threats do you envision for your organization?*

What emerged from our combined analyses and focus groups:
knowledge and skills most in demand by Arizona hazards-related agency employers:



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Market Survey

Using the data-retrieval and analysis software from *Lightcast*, we compiled a survey report in August 2022 on labor-market demand, relevant skills, and the current employment landscape related to Natural-Hazards Preparedness and Mitigation.

Key findings from Market Survey:

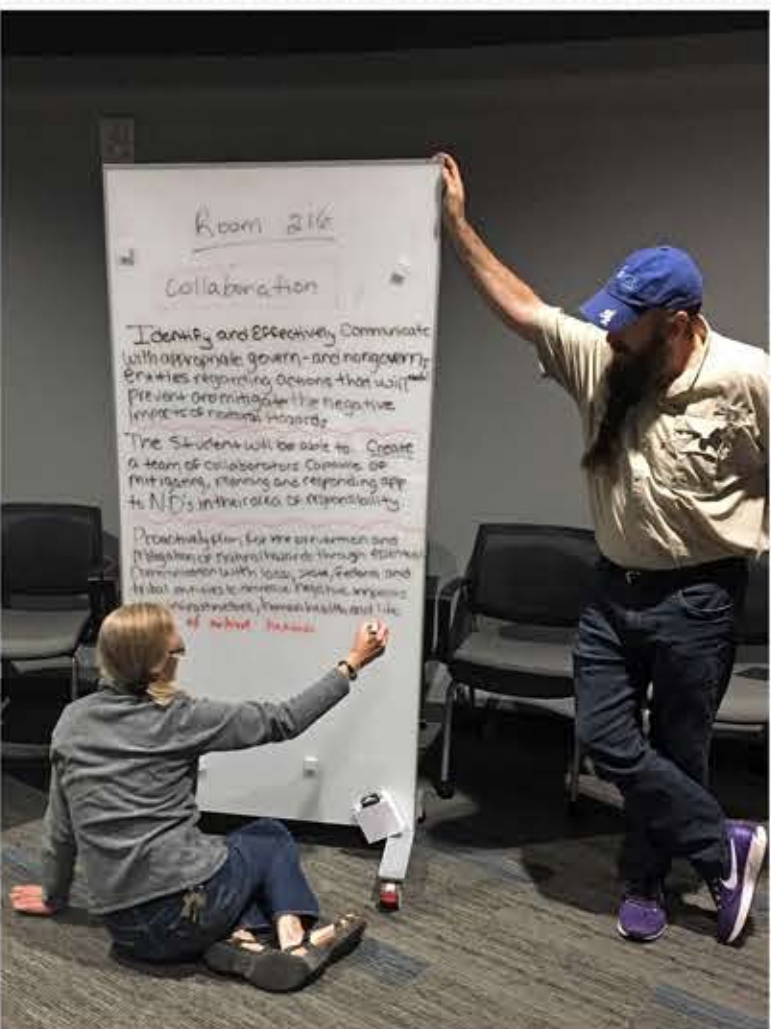
- Related degree and certificate **completions** at peer institutions increased 76% from 2012-2020.
- **Target occupations** include: civil engineers, architects, drafters, environmental scientists and specialists, natural sciences managers, conservation scientists, urban and regional planners, geoscientists, emergency-management directors, conservation scientists, hydrologists, and geographers.
- **Job postings** in these target occupations have increased steadily since mid-2020. Compared to other occupations and companies in the region, this is considered an average hiring effort.
- Regionally, **hiring is strongest** in CA, followed by TX, AZ, CO, and WA.
- Positions remain dominated by white males.

Collaborative Design Workshop

We conducted a **collaborative design workshop** in May 2019 with faculty from community colleges, tribal colleges, and several universities. We met our goal of designing learning outcomes and identifying courses for the HazPM certificate:

LEARNING OUTCOMES THAT EMERGED FROM WORKSHOP

- Evaluate short- and long-term preparedness for and mitigation of natural hazards in the context of physical processes, socioeconomics, public policy, and available resources.
- Identify and effectively communicate with appropriate governmental and non-governmental entities regarding action that will prevent and mitigate the negative impact of natural hazards.
- Proactively plan for the prevention and mitigation of of natural hazards through essential communication with appropriate stakeholders to decrease negative impacts of natural hazards.
- Develop and utilize strategies for fostering positive group dynamics and critically engage in natural hazards management across diverse landscapes and populations.
- Develop critical, spatial, and temporal understanding of natural hazards and identify and communicate solutions to those hazards.



HazPM Certificate Program Curriculum

GLG 110/111 ***Dangerous World [Geology of Hazards]*** (3 credit hours + 1 credit hour Lab)
GIS 205 ***Geographic Information Science I*** (3 credit hours)
GPH 210 ***Society and Environment*** (3 credit hours)
COM 250 ***Communication in the Workplace*** (3 credit hours)
Plus six credit hours of Electives in a choice of fields including: ***Critical Zone, Hydrogeology, Social Geography, Global Change, Volcanology, Field Methods, Hazards and Risk Management***

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