

PREPARING FOR THE EMERGING GEOSCIENCE WORK DYNAMICS FOR THE NEXT GENERATION, TODAY

Christopher Keane
Leila Gonzales
Jonathan Arthur

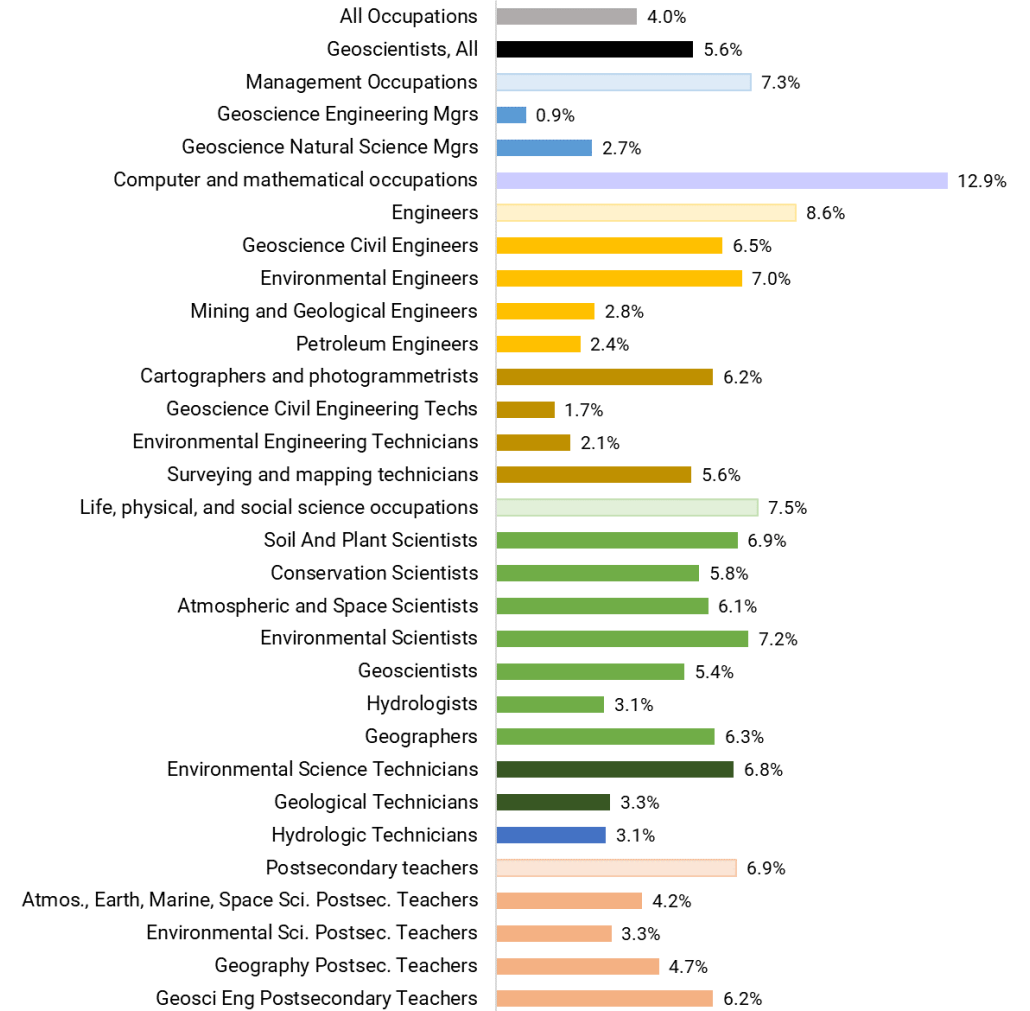
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Geoscience Work Evolves

Or is it punctuated equilibrium?

- Increased AI/Automation is facilitating higher-value work
- Place and presence have new meaning
- On to a limited future workforce
 - 10% below GDP Growth Curve
 - Geoscience is outperforming

Projected Changes in Employment by Occupation
2023-2033



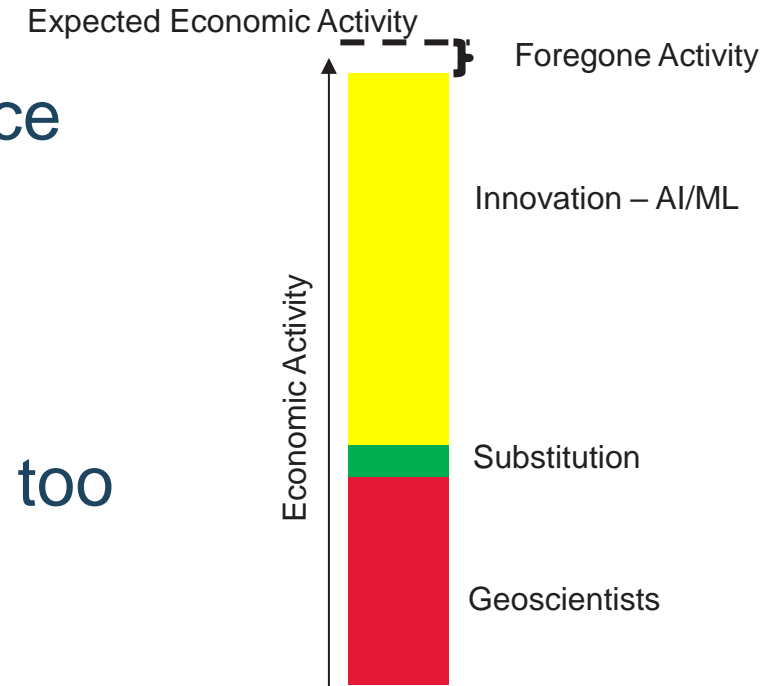
AI and Climate Change are Now Evident

Geoscience jobscape has evolved

- AI is underlying driver for what is driving change for skills in demand
 - This is doubling down on science for application
- Climate Change is no longer a policy/societal debate
 - Policy, investment, and innovation are about **implementing solutions to address climate change impacts**
 - NCSL discourse demonstrated this fundamental shift; Insurance disruption is the driver.

The Forces of Change

- Fewer qualified workers are the quickest way to force increased automation
- When technology meets the need, permanent replacement of labor occurs
- Ancillary, how the remaining workers work changes too



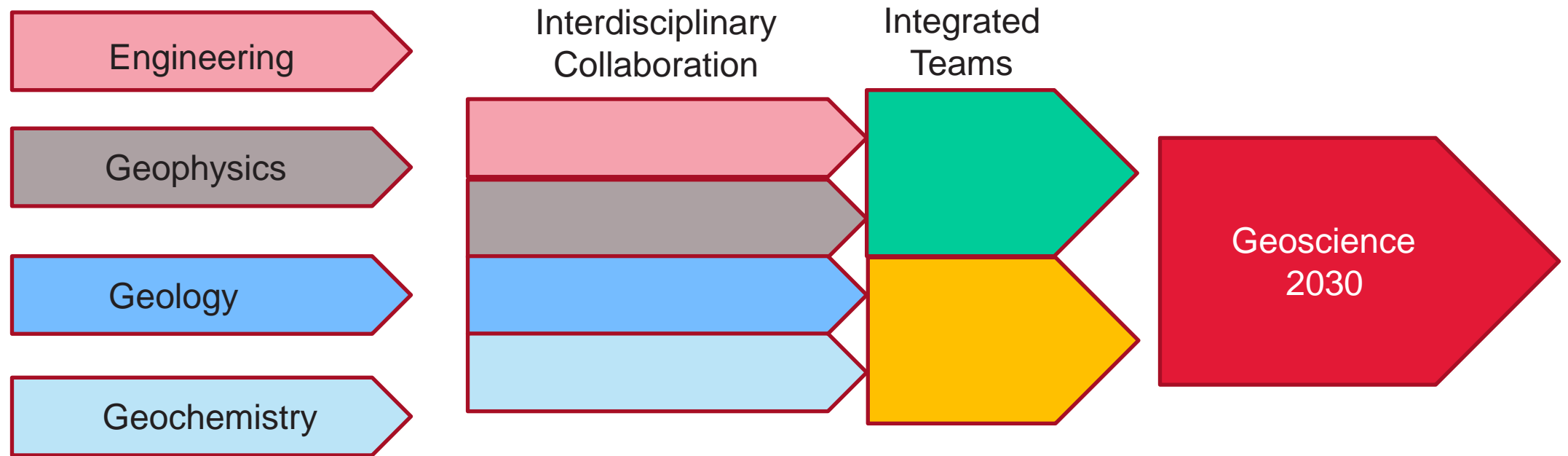
Challenges for the Next Generation of Geoscientists

- Middle skill jobs are disappearing
 - Loss of a key “training space”
- Rapid change in skills redefine what employers seek
- Perceived result is a skills mismatch, increasingly viewed as escalation of “entry level” work
- It is challenging for academia to adapt as fast as specific skill needs change

When employers want 10 years experience before you turn 20



Integration Evolution



The Disconnect isn't New

- “With every retirement we destroy a geoscience job. With every new hire we are creating a geoscience job we can’t even begin to describe. The new hires will define these jobs of the future.” - Daniel Malchuk, BHP at PDAC 2018
- University Administrators see students as customers seeking a chit to get a job; the problem is faculty still think they are giving degrees. – VP Academic Affairs, PSU 2016

A portrait of Queen Victoria in her coronation regalia, seated on an ornate golden throne. She wears a large, jeweled crown, a red velvet cape over a white lace dress, and multiple necklaces. The background is a soft-focus view of a grand building with a large dome, likely St. Paul's Cathedral in London. In the bottom left corner, there is a decorative arrangement of pink and white roses.

Many Geology Curricula Echo from a Victorian Era Framework

With a couple ideas stapled on.



Skills Development isn't “Training”

**You can master the
theory, but without the
tools, the blueprint
remains unbuilt.**



Vectors for Change

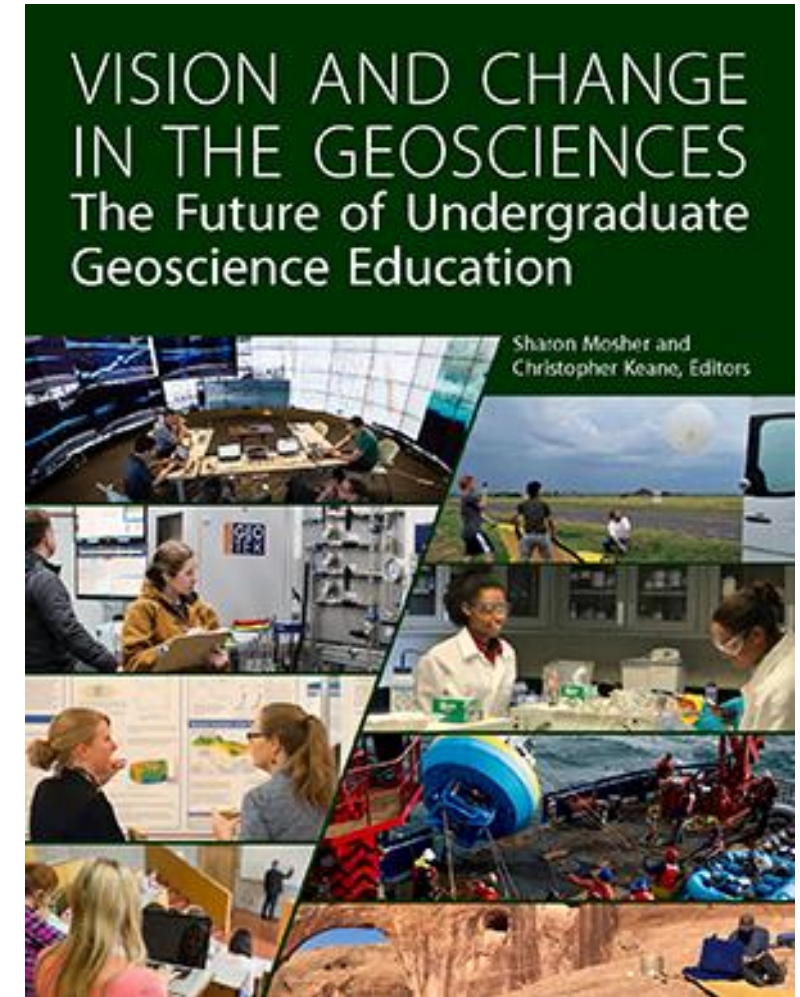
When used together, these interdependent factors lead to solutions that promote resilience.



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Roadmaps to Agility Exist

- Confident geoscience programs can adapt, the social engineering is the challenge
- Vision and Change does not itemize narrow actions, it fosters the big picture and agility
- Highlights critical thinking, numeracy, quantitative thinking, and multidisciplinary synthesis.



The Changes Real?

Machine Learning Impact

- Contrived problems had a 35x decrease in solution time using Watson than a senior geoscientist team
- First real-world problem:
 - Senior geoscientist team: 1080 person-hours to solve the problem
 - Nearly all of the time was in data management and processing.
 - Watson for Natural Resources: 14 minutes

IoT/Remote Activity Impact

- Mine operations going 100% remote
- Global mineral exploration teams working 24/7 across time zones
- Primary work is use of remote capture data
- Use local talent to run drones
- Down to about 2 days/year in field
- Kinematics remain a key on-the-ground issue
- The cost-benefit return is better, but not 100% as effective
- All developed through COVID necessity



Higher-Order Skills for the Future of Geoscience

- Define the higher-order skills needed: critical thinking, quantitative analysis, social/political awareness, and regulatory understanding.
- Highlight the importance of agility in addressing complex geoscience problems.
- Social Context of work impacts
- Impact chains/consequences

Geoscience is Professionalizing

- Oil and Gas, Mining, and Environmental industries are not the big source of direct employment
- ~40% of all US geoscientists now work in professional services
- Geoscientists are expected to work across the discipline on diverse problems
- This trend is universal globally

This is a good development, but can we embrace it?

Is the Current System an Impediment?

- The private sector evolves much faster than academia
- The airlines determined departments were impediments in pilot and mechanic preparation, so they establish direct, persistent relationships with students in Sophomore year
- In geoscience...
 - Brazil figuring can't change academia
 - Professional services building a farm system through apprenticeships

Emerging Workforce Entry Models

HS to Industry Apprenticeships

- Focus on work ethic; energy; potential
- Train as Geotech; JIT geoscience knowledge introduction
- With demonstrated potential, support for college degree

Brazilian Residency Model

- Universities are very poor at skill/application development
- Employ graduates for 2 years in Geological Survey
- Move around the org to learn many different areas
- Exit with strong skill portfolio and an awarded Master's Degree





Everything changes and nothing stands still

- Heraclitus

Questions?

keane@americangeosciences.org



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