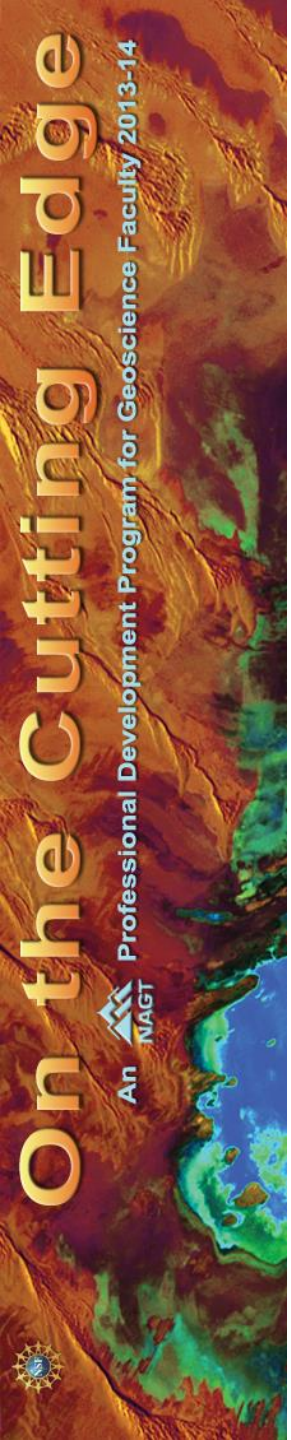
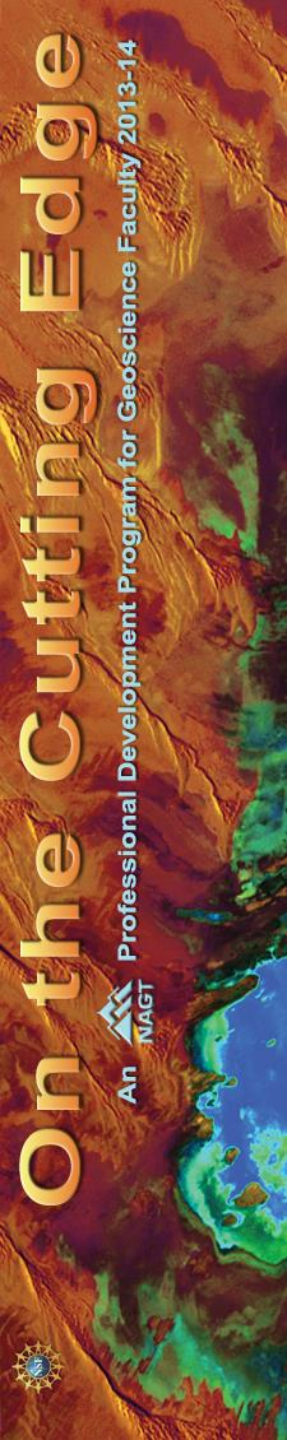


Interdisciplinary Teaching in and beyond Geoscience: Thinking outside the Box

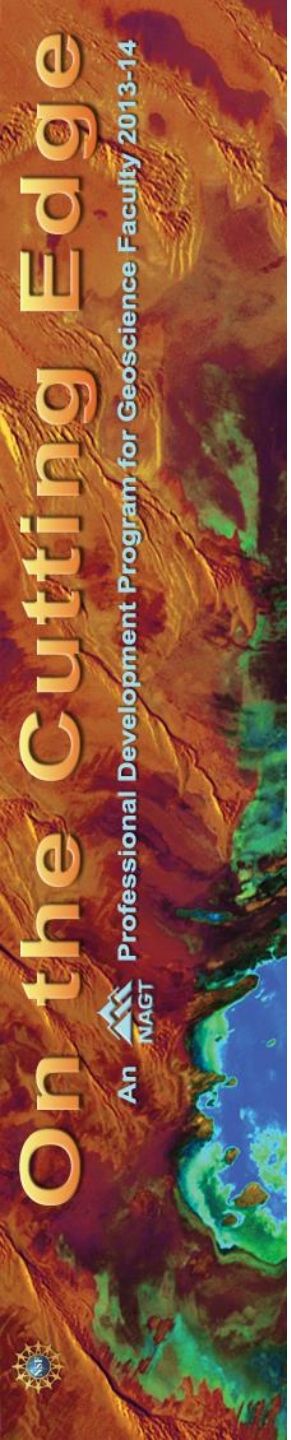
Rosemary Capo, University of Pittsburgh

Kyle Fredrick, California University of PA



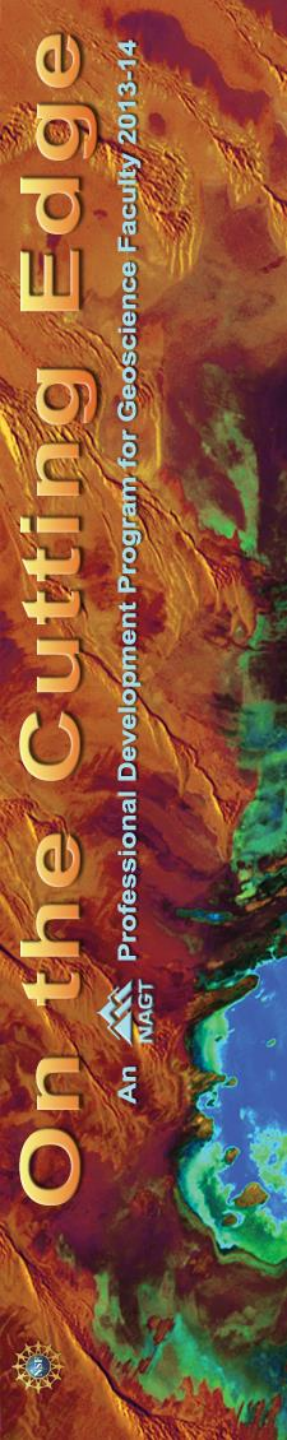
Interdisciplinary Teaching

- Introductory Courses
  - Unlimited opportunities to enhance relevance and take advantage of diversity
  - Recruiting tool!
- Upper-level Courses
  - Cross-course, cross-department, cross-institution
  - Research and publication opportunities for faculty and students



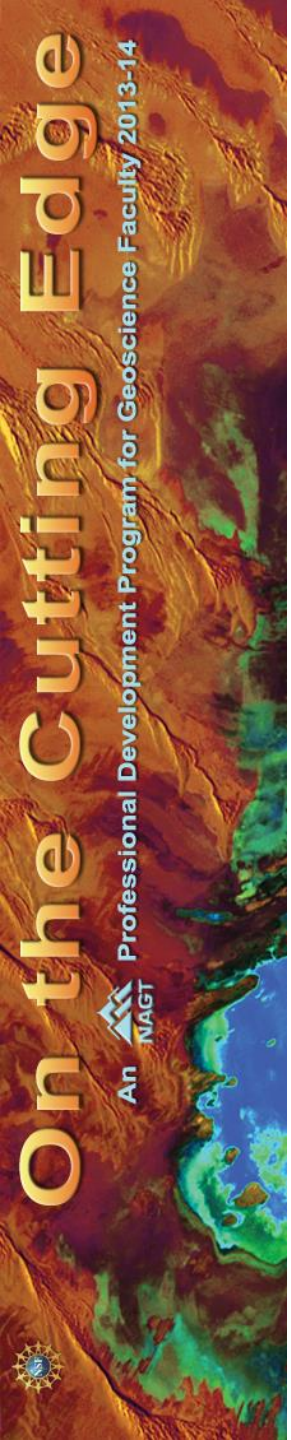
Intro Courses

- Introduce relevance through external topics to increase interest and participation
  - "News of the Day"
  - Students of varying majors can connect their interests and experiences in lab and in-class activities
  - Inclusive topics:
    - Human Impacts on the environment
    - Resource exploration, exploitation and dependence
    - Natural Hazards
- Recruiting Tools
  - Identify geology careers, especially in non-geologic fields (i.e. Insurance, Construction, Land development, etc.)
  - Disciplinary demand for increased diversity!



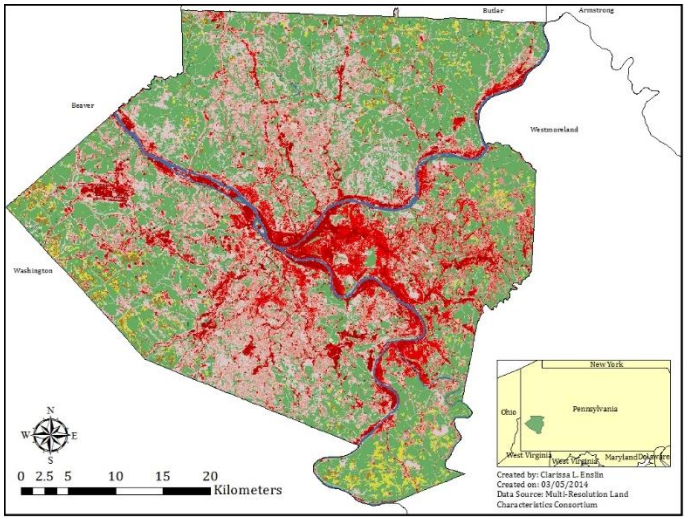
Upper-level Geology

- Endless opportunities for collaborative teaching across disciplinary boundaries
  - *The only limitation is lack of imagination!*
- Opportunities
  - Cross-discipline activities and projects
  - Course development (blending courses)
    - May help streamline curriculum
    - Helps in recruitment and establishing relevance
  - Undergraduate Research



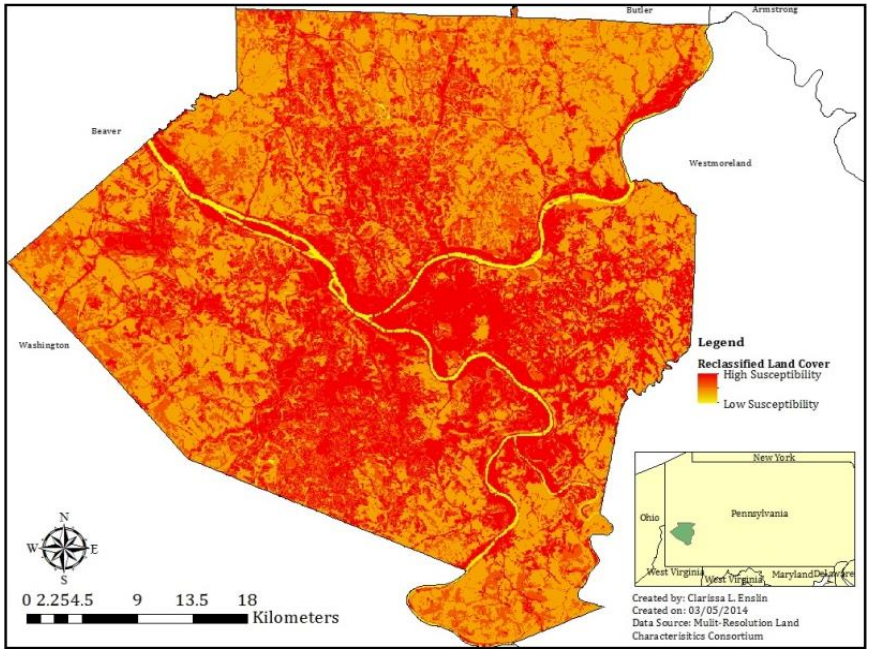
Cross-discipline Activities (In-course)

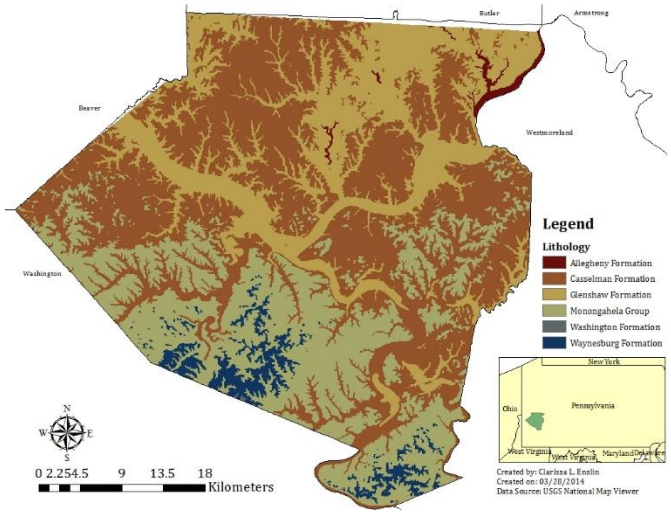
- Can enhance learning by creating connections from course to course
  - Reinforces previous concepts
  - Exposure to upcoming content
- Example 1:
  - Landslide correlation w/ stratigraphy
    - 300-level Geomorphology
    - Combines Sed/Strat and GIS (at least!)
    - GIS Indexing project → Landslide susceptibility using factor maps



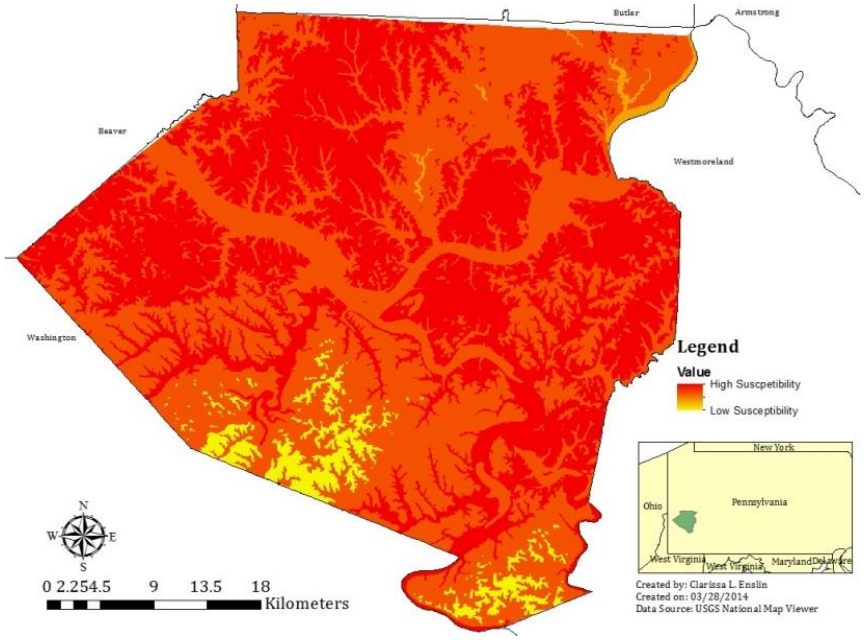
Land Cover

Reclassification Process



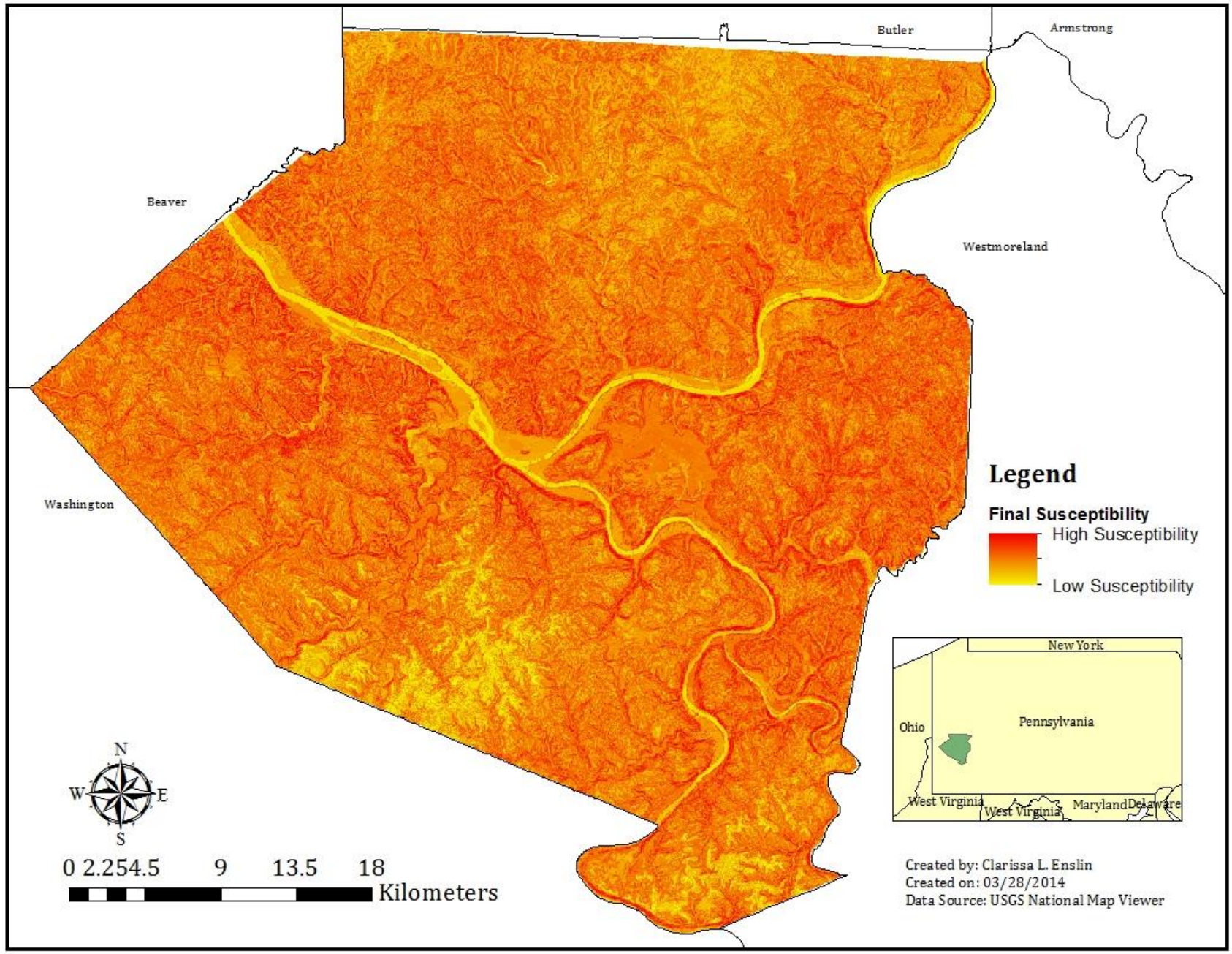


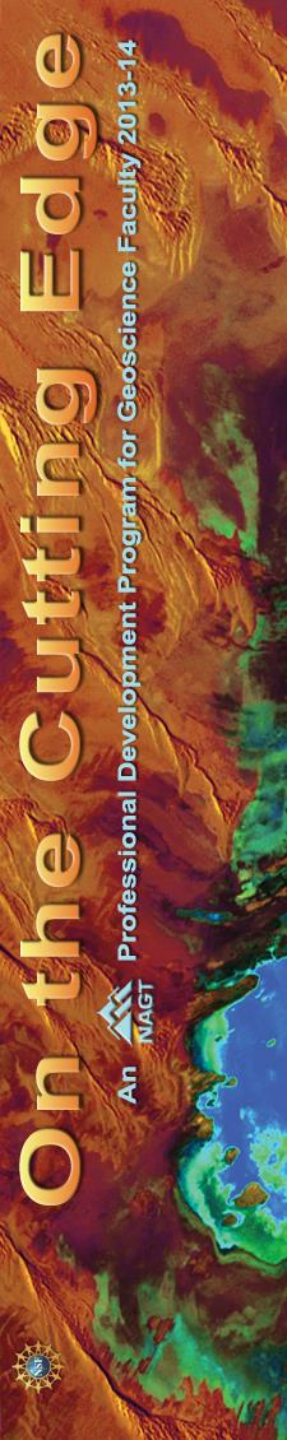
Lithology



On the Cutting Edge

An NAGT Professional Development Program for Geoscience Faculty 2013-14



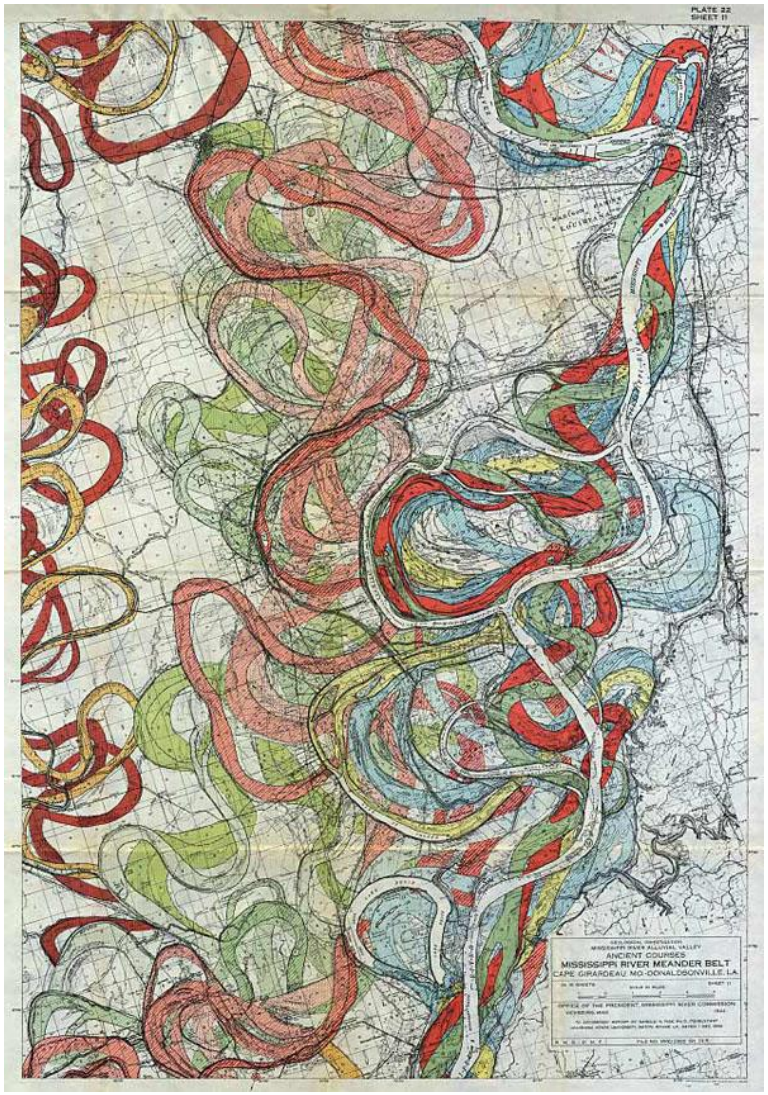


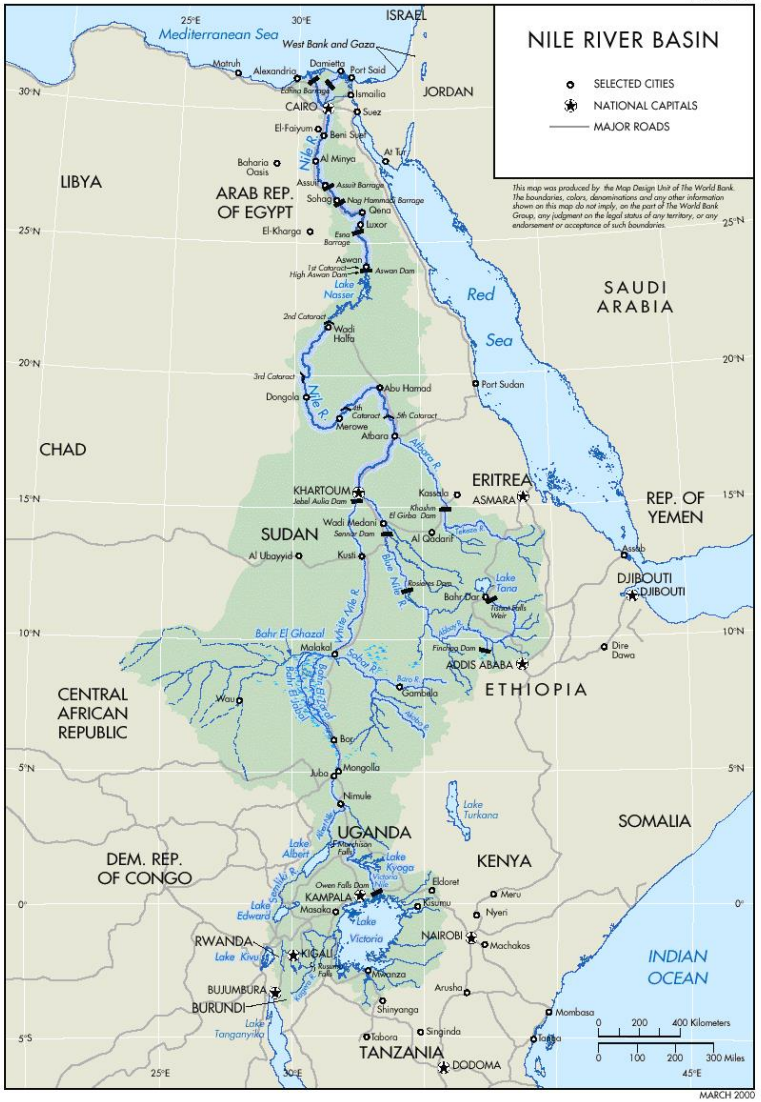
Cross-discipline Activities (In-course)

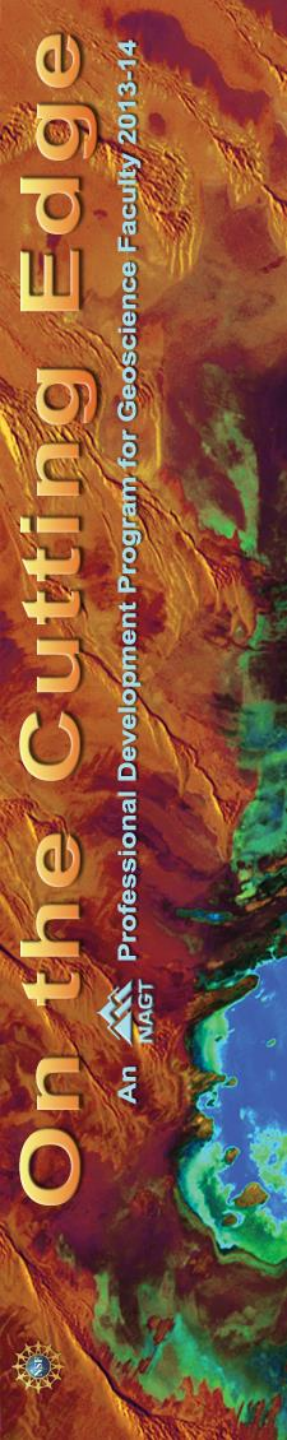
- Can enhance learning by creating connections from course to course
  - Reinforces previous concepts
  - Exposure to upcoming content
- Example 2:
  - Rivers, Politics, and Change
    - 300-level Hydrology
    - Establishes relevance of discharge, lateral migration, human impacts, etc.
    - Lower Mississippi River meanders, Nile River and political/cultural divides

On the Cutting Edge

An AAPG Professional Development Program for Geoscience Faculty 2013-14

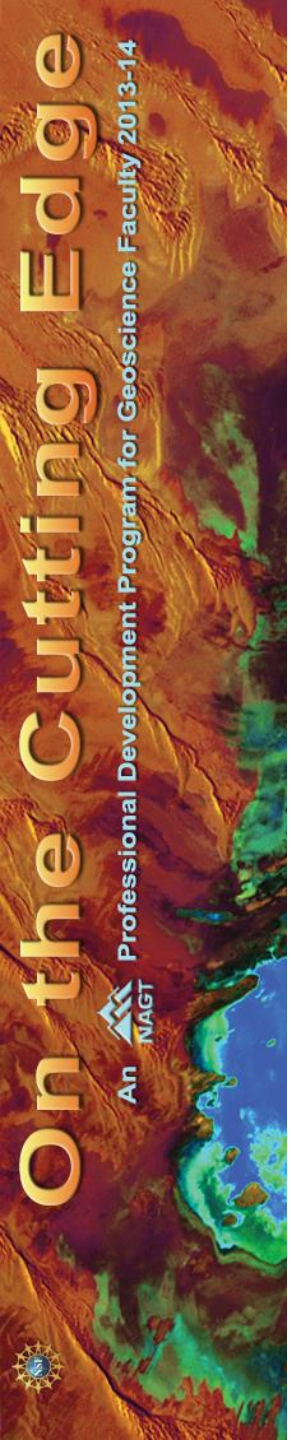






"Blended" Courses at CalU

- Math and Computer Science
  - MAT 400: Math Modeling
  - Geology students (often Math minors) are invited to use applications in geophysics, groundwater, flow modeling, etc. as their course project
- Art in Science
  - ART 130/BIO 130: Biological Illustration: Form and Function
  - Cross-listed, team-taught Fine Arts course
- Research Topics in Chemistry
  - CHE 491/492: Chemistry Research I & II
  - Chem majors (dual w/ Geology) and minors typically select Geochemical topics and are co-advised by Geology faculty

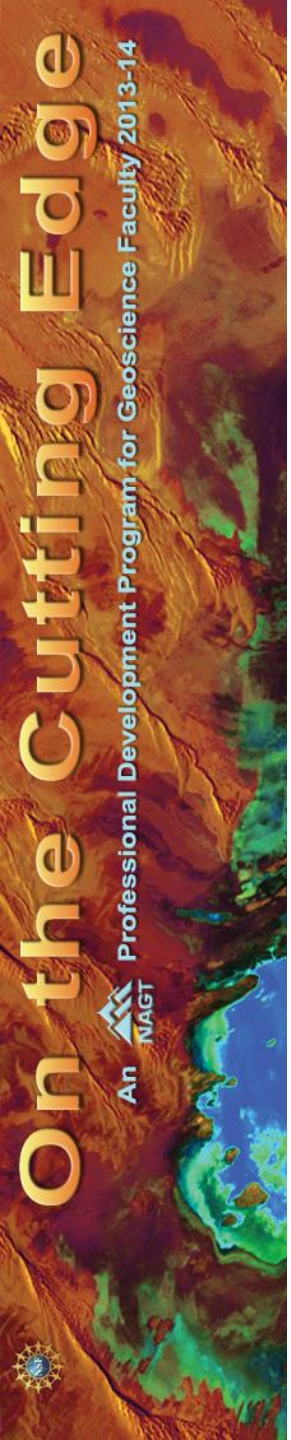


Undergraduate Research

- In-course Research
  - Leverage students' individual interests for course projects
  - Allows course to be more organic
    - Less time in development, more time in problem-solving and assessment
  - Potential for growth into…
- Extra-curricular Research

Example at CalU: Watershed Evaluation

- EAS 448
  - Writing-intensive capstone; lots of pre-requisites
  - Spring ‘14: 22 students (mostly Seniors)
- Semester-long project
  - Students have free reign to select research, but topic must be approved
    - Helps link non-friend students to collaborate based on interest rather than social status
  - 4 “Topical Groups”
    - Included leader, secretary, scheduler
    - Geochemistry, Geomorphology, Flow (Hydrology), and Soils

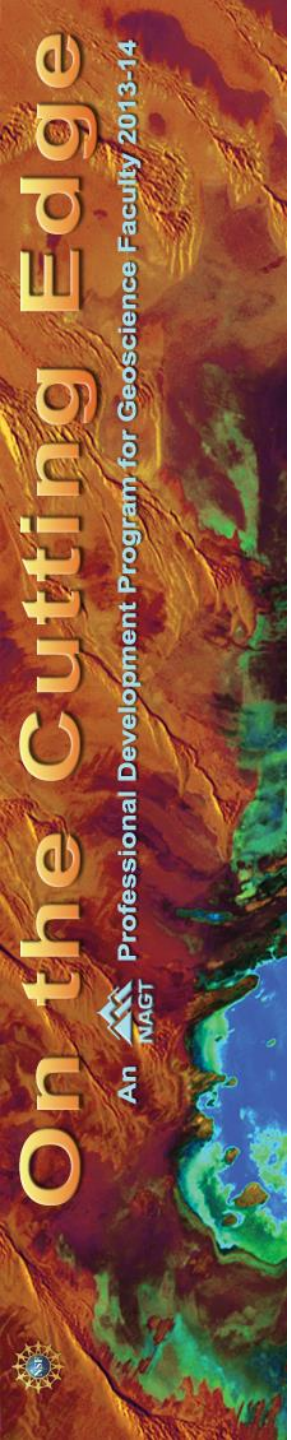


Undergraduate Research

- In-course Research
  - Leverage students' individual interests for course projects
  - Allows course to be more organic
    - Less time in development, more time in problem-solving and assessment
  - Potential for growth into…
- Extra-curricular Research
  - Allows you to be more selective
  - Promotes collaboration with other faculty within and without your dept.
  - May lead to evolution and augmentation of your own research and increase productivity

Extra-curricular Research

- A few of Kyle's examples:
  - T.M. Lahmers (Meteorology Student), K.C. Fredrick, T.R. Mueller (GIS Professor at CalU), M.S. Scott, *Effects of DEM Resolution on HAZUS Flood Mapping for the Monongahela River, California, Pennsylvania*, The Pennsylvania Geographer, Vol. 49, No. 1, 97-123, Spring/Summer 2011.
  - S. Ambrose (Geology Student) and K.C. Fredrick, *Fracture Correlation of the Pottsville Sandstone with the Youghiogheny River Course, Ohiopyle State Park, PA, ,* Geological Society of America Annual Meeting, Denver, Colorado, October 31-November 3, 2010.
  - C. Enslin (Geology Student) , K.C. Fredrick, T.M. Mueller, *Landslide Susceptibility Index Modeling in Allegheny county, Pennsylvania,* Geological Society of America, Northeastern Section Meeting, Lancaster, PA, March 23-25, 2014.
  - N. Patton (Geology/Chemistry Student) , K.C. Fredrick, and Min Li (Chemistry Professor at CalU) *, Investigation of inorganic species in Oregon Hollow Wetlands: Washington County, Pennsylvania*. PASSHE Undergraduate Research Conference in STEM, Nov. 15-16, 2013, Slippery Rock University.
  - C.B. Parrish (Geology Student), S.E. Kobs-Nawotniak (Post-doc at UB), K.C. Fredrick, and J. Enspindola (Professor at UNAM), *Petrologic and Petrographic Variation of youthful eruptive products in the Tuxtla Volcanic Field, Veracruz, Mexico,* American Geophysical Union Fall Meeting, San Francisco, California, December, 2010.
- Other examples:
  - S. J. Whitmeyer, et al., *Cross-Disciplinary Undergraduate Research: A Case Study in Digital Mapping, Western Ireland*, Abstract from AGU Fall Meeting 2008.
  - Aaron Beacom, *Sport in International Relations: A Case Study for Cross-disciplinary Investigation*, The Sports Historian, 20(2), Nov. 2000.



Questions, Please!