

# Inter-university Training in Continental-scale Ecology (ITCE):

Collaborations, Knowledge and Skills to Advance Spatial Ecosystem Science in the NEON Era

Jim Ehleringer, Gabe Bowen, and Thure Cerling (University of Utah) and 43 additional faculty instructors [Http://itce.utah.edu](http://itce.utah.edu)

Intensive, 2-week courses (26 lectures & 55 lab hours each)

- **IsoCamp** – stable isotope ecology (air, water, biology, terrestrial, marine)
- **SPATIAL** – large-scale spatial analyses of isotope and other data sets
- 43 faculty instructors from USA and abroad give lectures and run labs

2012 – 2015: IsoCamp and SPATIAL trained a diverse group of students

213

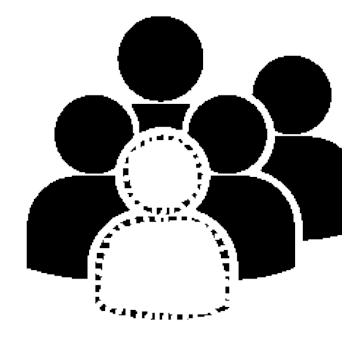
graduate students & postdocs



comprised of

>18%

under-represented groups



from

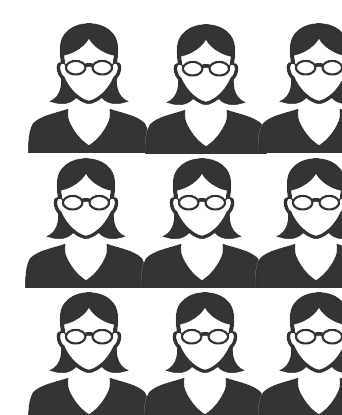
24

different countries



65%

female students



129

institutions

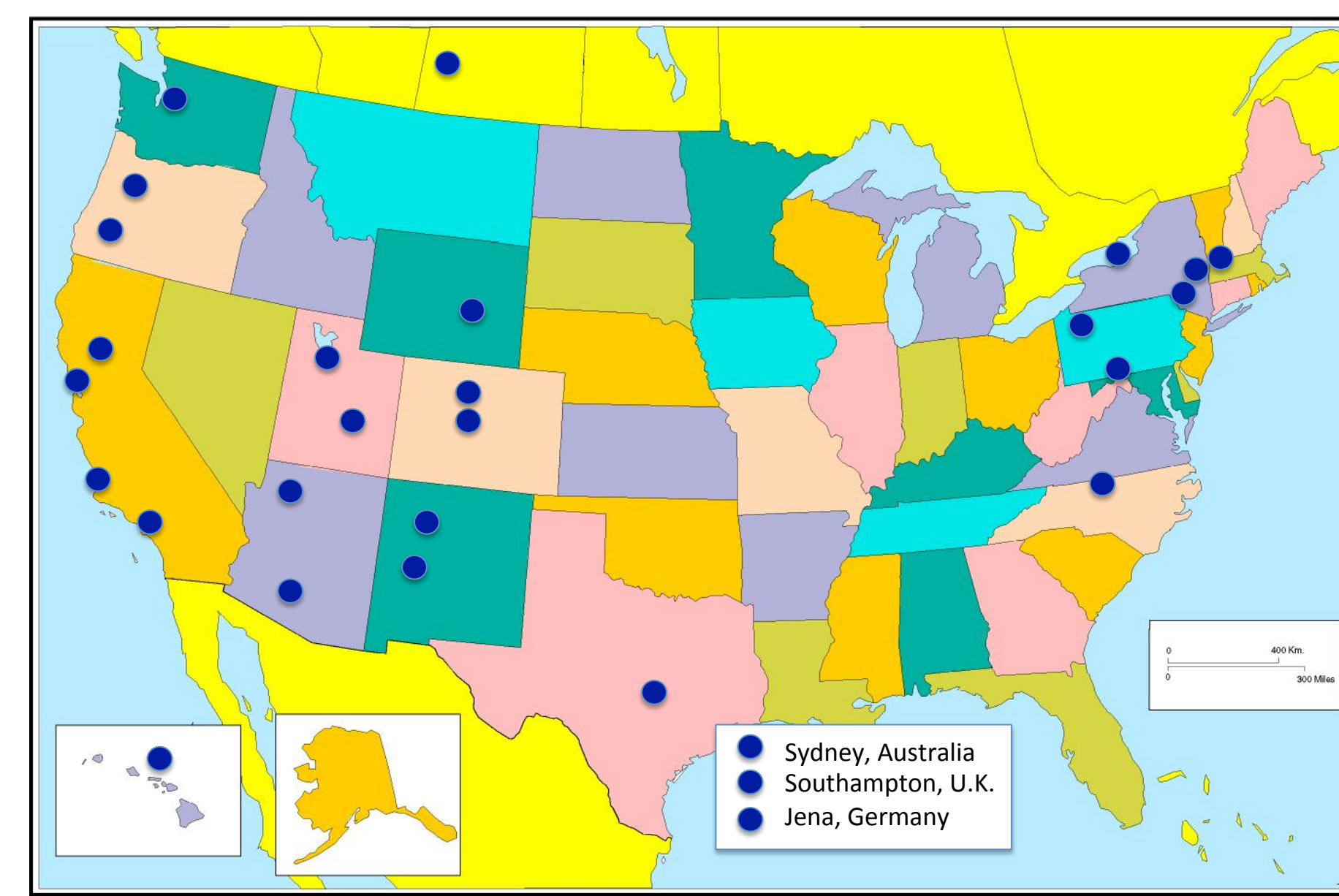


27

different disciplines



Locations from which our 43 faculty instructors have come



An Integrated Training Program for Continental-Scale Ecology with a Focus on Spatial Processes and Patterns

- Two 2-week morning lecture courses covering fundamental of stable isotope ecology, NEON-related spatial processes
- Two 2-week laboratory courses providing intensive project-based analytical and modeling experiences
- Faculty instructors come to lecture and run labs from across the US and internationally
- Skills development – team building, cohort building, network development, communication skills, analytical skills
- Skills development – managing/using large data sets, data curation, approaches to quality assurance and quality control
- Career considerations – small college, federal agencies, research university, exploring postdoctoral opportunities
- Research-in-residence program for PhD students to broaden their thesis at another university, learn additional skills
- Postdoctoral research and training program in process/spatial ecology with multiple faculty mentors

### Educational and Training Products

- Recorded lectures available online, being parsed into 15-minute module segments for broader distribution
- Hands-on, step-by-step laboratory modules on both isotope ratio methods and spatial analysis methods
- Coming online with web-based modules for handling spatial data sets, isotope fractionation models, and isoscape mapping

### Long-term networking developments

- Twitter, FaceBook, AGU sessions, additional student research opportunities such as research-in-residence
- Interdisciplinary, multi-university approach to broaden perspectives and engaged 2-week opportunity with followup
- Opportunities for faculty to develop background and initiate networking as “students” in the course



Project-based group projects for students in IsoCamp and SPATIAL Labs

- Student-developed, faculty lead projects related to isotopes and spatial processes
- 4-6 students work together as a team for data collection, analyses, and presentation
- Students exposed to latest analytical approaches, including full instrumentation access
- Students exposed to GIS approaches for data integration of data and pattern analyses

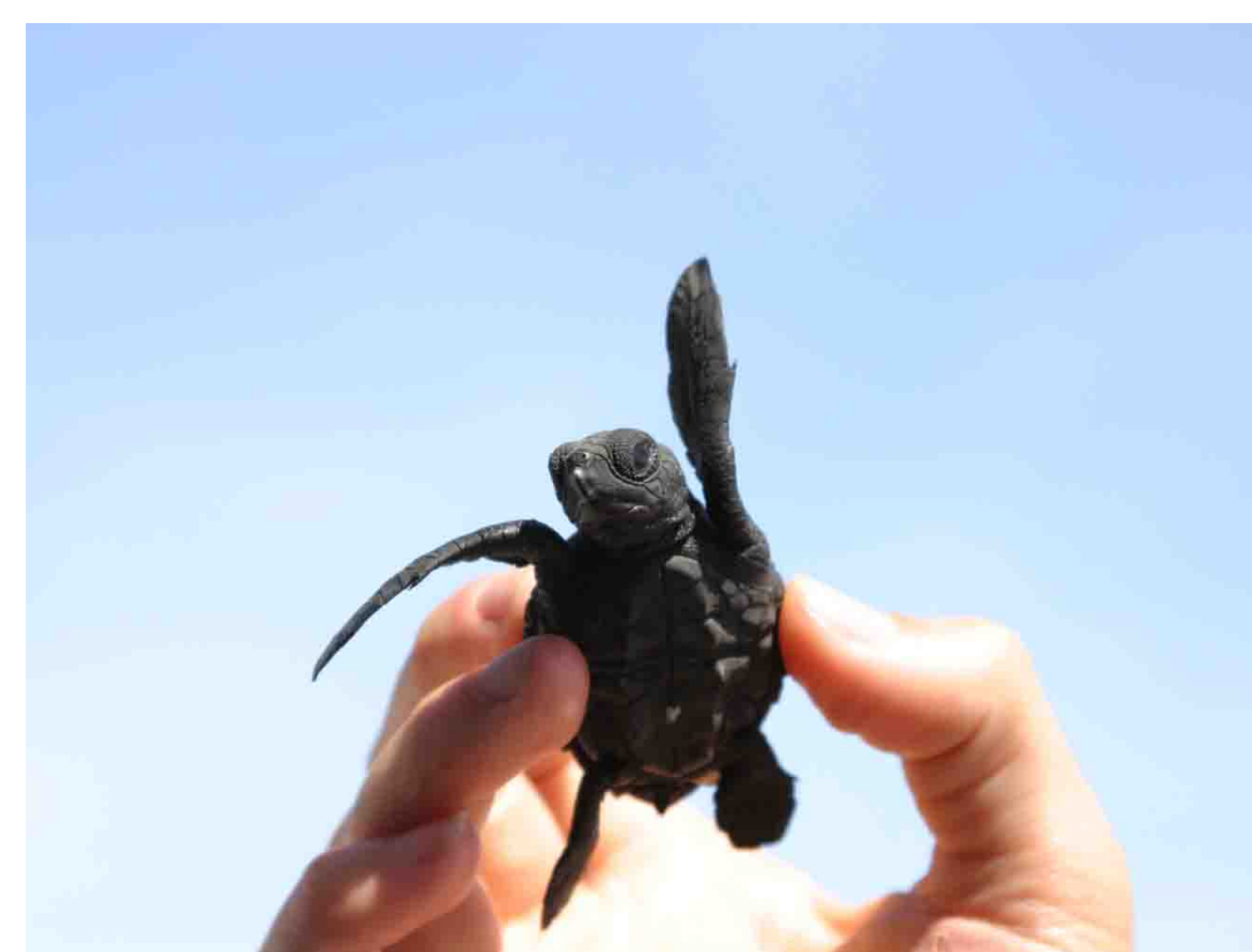


Trainee Feedback:

- “The program helped me to refine my research framework...to think about ways to better understand various systems using isotopes.”
- “...one of the most memorable experiences of my education and training.”
- “This camp has helped me see my way forward through some grad student frustration. The instructors are not only great thinkers; a number of them make themselves approachable as mentors...Iso-Camp has provided me added confidence beyond learning skills in the lab, physics of IRMS, and in isotope basics.”

Research-in-residence training

- Offered to IsoCamp/SPATIAL students; ideas explored during/following short courses
- 1-3 month research opportunity in another lab with IsoCamp/SPATIAL mentor(s)
- Conduct new research to complement thesis research and add thesis chapter
- Broaden student exposures to research-mentoring-networking at hosting institution
- Products are thesis chapters, publications, and presentations at national meetings



Postdoctoral training with two faculty mentors at different institutions

- Testing a new training approach with faculty co-advisers at different institutions
- Two-year, research-based postdoctoral training on spatially-relevant topics
- Postdocs are also actively engaged as co-instructors in IsoCamp/SPATIAL courses

ITCE postdoctoral trainees over the past two years:

**Stephen Good,**  
spatial analyses of water isotopes in hydrology from catchment to continental scales



**Hannah vander Zanden,**  
spatial analyses of migration using stable isotopes in marine mammals



**Logan Mitchell,**  
fine-scale analyses urban carbon dioxide concentrations across spatial and temporal dimensions



**Jennifer Cotton,**  
spatial analyses of paleo and modern carbon isotopes in bison to reconstruct C3/C4



**Daniel Mendoza,**  
high-resolution database development and spatial modeling of emissions of carbon dioxide and pollutant gases at parcel scale in urban systems

