GEOGRAPHY

2018 Spring Newsletter
University of Colorado Boulder

Inside this issue:

Emily Yeh: Message from the Department Chair

Professor Emily Yeh

Greetings to CU Boulder Geography alumni and friends, near and far! This is the last column I will be writing as my term as Department Chair comes to an end after four years. I'm delighted that Professor **Bill Travis** will be the next chair of the department.

This semester has seen some important transitions. Distinguished Professor Emeritus **Roger Barry** passed away on March 19, 2018, at the age of 82. Professor Barry had a long career conducting path-breaking research on polar climates, mountain climates, and climate change. He authored hundreds of articles and chapters, and was also an avid author of textbooks. Roger joined our department in 1968 and retired in 2010 after 42 years of research, teaching and service. He also served as the director of the National Snow and Ice Data Center from 1976-2008 and was the recipient of many fellowships and other national and international honors. He will be greatly missed. Please see our news article on the Geography website for details.

This year also saw the loss of Professor Emeritus **Kenneth Erickson**, who passed away December 22, 2017 at the age of 83. Ken joined the department in 1968 and stayed on until his retirement 28 years later in 1996. Known for his calm and inspirational teaching, he taught Cartography and GIS to hundreds of students over many years. The department's KESDA (Kenneth Erickson Spatial Data Analysis) Lab in the basement of Guggenheim is named in his honor. Please see our news article on the Geography website for more information.

In less solemn news, Professor **John Pitlick** and Professor **Mark Williams** are both joining the ranks of professor emeritus at the end of this semester.

Mark Williams is Professor of Geography as well as a Fellow of INSTAAR (Institute of Arctic and Alpine Research) and a member of the faculty of the Environmental Studies Program, who has published over 150 peer reviewed articles and chapters over three decades of research on the ecology of mountainous areas, snow hydrology, hydrochemistry, and biogeochemistry. He has worked in mountain ranges around the world, including the Rocky Mountains, the Andes, the Alps, and the Himalayas, and has been a Fulbright scholar twice, in Ecuador and Nepal. Mark was elected a Fellow of the American

Professor Mark Williams

Geophysical Union in 2012 and served for many years as the Principal Investigator of the Niwot Ridge Long Term Ecological Research (LTER) program. Mark is well known for his penchant for wearing Hawaiian shirts. We wish him well in spending more time with his family in retirement.

Professor John Pitlick has been a highly productive scholar, mentor, and teacher since he arrived at CU Boulder in 1990. He is widely recognized for his research on surface water hydrology and geomorphology in high-gradient research systems, and has published extensively on his research in Colorado, the Pacific Northwest, the northern Rocky Mountains, and the French Alps. He was elected in 2012 as a Fellow of the Geological Society of America in recognition of his scholarly accomplishments and he continues to be research-active. He has been deeply involved in the CU Boulder Hydrologic Sciences graduate program as well as the undergraduate Hydrology Certificate. Through to his last year on the faculty, he has continued to teach large introductory lecture classes as well as doing extensive service to the department, including a four-year term as Associate Chair and Director of Graduate Studies. It has been an immense pleasure for me to work with him in this role, given how proactive he is in always striving to improve the experiences of and increase opportunities for the department's graduate students. See his personal reflections on retirement later in this newsletter. Students, faculty, and parents alike will miss him for his guitar and voice performances in class and at commencement. We wish him a fun and productive retirement with his wife Becky and his continuing research in fluvial systems around the world.

Because this is my last newsletter, I would like to briefly recap some highlights and important events in the department over the past four years. Among many other awards and honors, **Tom Veblen** was named Distinguished Professor of Geography and **Mark Serreze** was named Professor of Distinction in the College of Arts and Sciences. Associate Professor **Joe Bryan** received an Outstanding Graduate Student Mentor award from the university. Assistant Professor **Jennifer Balch** was selected to receive University of Colorado Grand Challenge Funding to establish the Earth Lab Initiative, which includes an education initiative (see the newsletter article about the new professional certificate in Earth Data Analytics), scientific projects, and an analytics hub that provides tools, training and support for data processing, analysis and visualization for Earth Lab as well as the broader scientific community.

Emily at the Oct 2017 Alumni Event

Over the last four years, the department has also made some important educational innovations at the undergraduate level. We introduced four tracks for Geography majors, allowing them to have a more structured specialization in Human Geography, Environment-Society Geography, Physical Geography or Geographical Information Science, while also retaining the option of a more general Geography degree. We also created a new undergraduate certificate in GIS and Computational Science, jointly with the Department of Computer Science. In addition to the longstanding Hydrology certificate, our faculty have also been involved in the creation and teaching in several new certificate programs including the Arctic Studies Certificate, the Public Health Certificate, and the Native American and Indigenous Studies Certificate.

I'm also very pleased that over the past four years we have been able to offer summer research fellowships to 3-4 undergraduates each year, to conduct mentored research

with a faculty member. Each cohort of students has given excellent presentations at our department colloquium, and recipients have gone on to use these mentored research projects for honors theses. For an example of the type of research that's been done, see the story by Dylan Lanka in this newsletter. Fellowship recipients have also presented their work at conferences and have reported how helpful the research was in finding employment in Geography-related fields after graduation.

In order to continue this successful program, the department must now engage in a new round of fundraising. We are immensely grateful to our alumni who have responded to our calls for support thus far. As I've mentioned in several past columns, despite being a public university, only 4.4% of CU Boulder's total budget comes from the state. While this is part of a national trend, Colorado unfortunately ranks 48th nationally in state funding for higher education. This makes our department's many accomplishments and national reputation all the more remarkable, but it also makes us dependent upon the generosity of private supporters. At the same time, we need a public conversation about why public universities today no longer receive state funding.

Indeed while our public funding is diminished, our mission of education and research is more important than ever. We find ourselves in an unsettling moment in US history, with broad and sustained attacks on the value of research, data, and rigorous scholarship across the natural and social sciences and humanities. The geographical inquiry conducted by our faculty, graduate students, and undergraduates is crucial — whether on global climate change, Earth's fire regime and Arctic ice cover, indigenous struggles for territorial rights, transnational migration, political violence, public health, affordable housing, urbanization, or inequality. In this context, we move forward with a deepened commitment to evidence-based inquiry, social and environmental justice, academic freedom, and mutual respect.

John Pitlick: Guggenheim in the Rearview Mirror

It might have been during my last year of graduate school, or during my time as a post-doc with USGS, when my wife, Becky, asked me: "If you had your choice of working at any university, where would it be?" I gave it a little thought — maybe 20 seconds — and said, "CU-Boulder". Then along came an opening for faculty position in the Geography Department at CU-Boulder, and whaddaya know, I got the job!

John is retiring after 28 years of teaching and research.

That was 1990, and much has changed since then. Gone are the days when we constructed graphs and maps using Rapidiograph pens and Zip-a-Tone lettering. Now we waste hours of time worrying about the length of tick marks and the hue of congressional districts populated by equal numbers of Republicans and Democrats. Climate change was just emerging as an important scientific/social issue, but I'm sorry to say that while we have since learned much about climate change, we have not gotten enough clear-thinking people on board to do much of anything about it. Up until recently, I had pretty good command of the organization of papers and lecture notes in my file cabinets.

Not so much now. And I decided that in order to keep my name out of the newspapers I should probably stop doing the beer can experiment in GEOG 1011 (actually, I didn't stop doing the experiment, I just switched to using cans of expensive Italian soda). Never stopped playing music in class though, and it brings a smile to my face when some kid says "my grandparents love that band" (Talking Heads).

Some things have stayed the same though. I can still count current-meter clicks from sunup to sundown, and I can do pebble counts better than anyone on Earth (many people have told me this). I love operating the total station, but I never get to because I'm always the one who has to wade the streams because I'm the tallest. I'm bummed that we can't go to the map store now to buy 7.5 minute quadrangles (that's what got me interested in this stuff in the first place), so I try to surround myself with smart young people who can show me how to use the Topo App on my iPhone. But we still use "Rite in the Rain" notebooks, and I'm grateful for all the time spent with grads and undergrads putting information in those notebooks … in all sorts of conditions in all sorts of places: Alaska, California, Idaho, Wyoming, Utah, Washington, New Zealand, China, France, and throughout Colorado. I am fortunate too that Becky has been a willing and able companion on many of these field trips; the total station is not her friend, but she is world-class when it comes to recording pebble count data (in contrast to her husband, who almost never gets the book-keeping right).

John delighted many commencement audiences with his musical talents.

To me, one of the most interesting and gratifying parts of this experience is that, entering in, you have only a vague idea of what you must do to succeed. You are given some resources and time to get your 'program' off the ground, but otherwise you have tremendous leeway and freedom to develop your own identity as a scientist and educator. In my case, I was fortunate to land in a place — Boulder, CO — that could serve as a fruitful staging area for my research interests and skills. And, thanks to several like-minded students, it wasn't long before we got involved in studies of streams and rivers throughout Colorado. I was equally fortunate to join a university with a well-established reputation in geomorphology, and to have the opportunity to work alongside Nel Caine and Peter Birkeland. Bill Lewis and Tom Veblen introduced me to the fields of aquatic ecology and biogeography, and this helped set the stage for an expansion of our research into fields outside of geomorphology. I give a lot of credit too to the faculty and staff in the Geography Department: The current group is fun to be around, hard-working, and committed to making the department a better place. I don't intend to leave this behind — not immediately at least — and Becky and I are not planning to move, so please give me a shout next time you're in Boulder so we can share stories of life, love, and LiDAR over a beer.

Stefan Leyk: *Extracting Geospatial Data From Historical Maps*

We know a lot about the contemporary environment, the landscape and our urban systems thanks to rich data coming from satellite images, surveys and web-based data collection efforts. We know less about the past simply because less data were available, and we definitely have very limited knowledge prior to the remote sensing era. This is important because in order to be able to predict the impact and implications of future development in our society we need to understand the past and the evolution of the complex system we are living in.

Professor Stefan Leyk

These are the reasons why my colleagues and I are so obsessed with historical data that help us to shed light on the past and allow us to study how humans have shaped the environment but also how environmental processes have influenced how and where people have settled. In order to tackle such challenges I am leading various research efforts at the intersection of geospatial data science, computer science and geographical analysis to create different historical geospatial data products and make them accessible for high-impact interdisciplinary research.
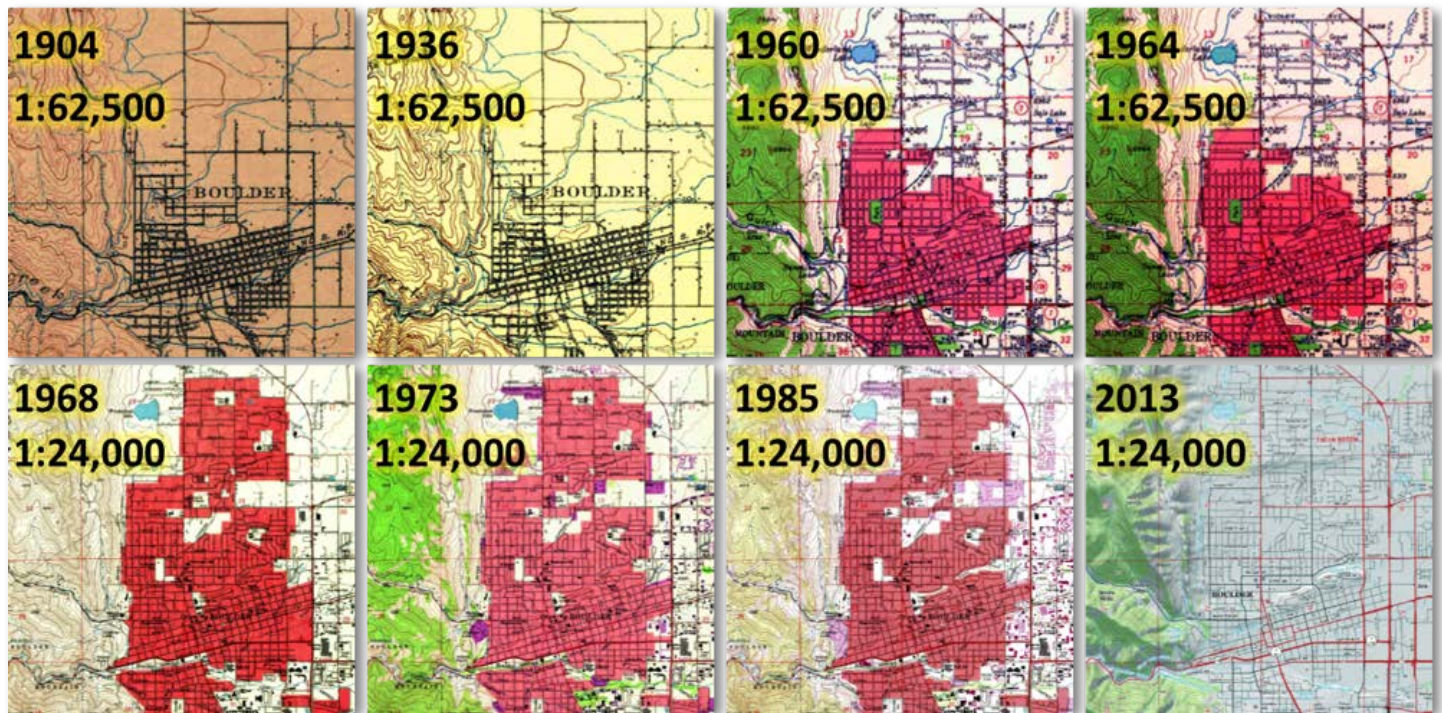
Fig. 1: An example series of USGS topographic map sheets for Boulder, CO, between 1904 and 2013. *Figure created by Johannes Uhl, Geography.*

For example, in an NSF-funded project we are extracting geospatial data including hydrography, built structures, vegetation as well as transportation from thousands of scanned historical topographic map sheets published by the USGS since 1884.

Similar to methods for face or eye recognition, this research develops methods based on artificial intelligence to extract the data locked in these scanned images,

Stefan Leyk: Extracting Geospatial Data From Historical Maps

automatically. These methods must be able to process old documents of poor graphical quality and need to be highly efficient given the big data problem at hand. In another ongoing project, we are using property and housing databases to create unique historical distributions of human settlement for the whole United States at fine spatial detail and over more than 200 years. The work of **Johannes Uhl**, PhD student in the Geography Department, has been vital in these projects.
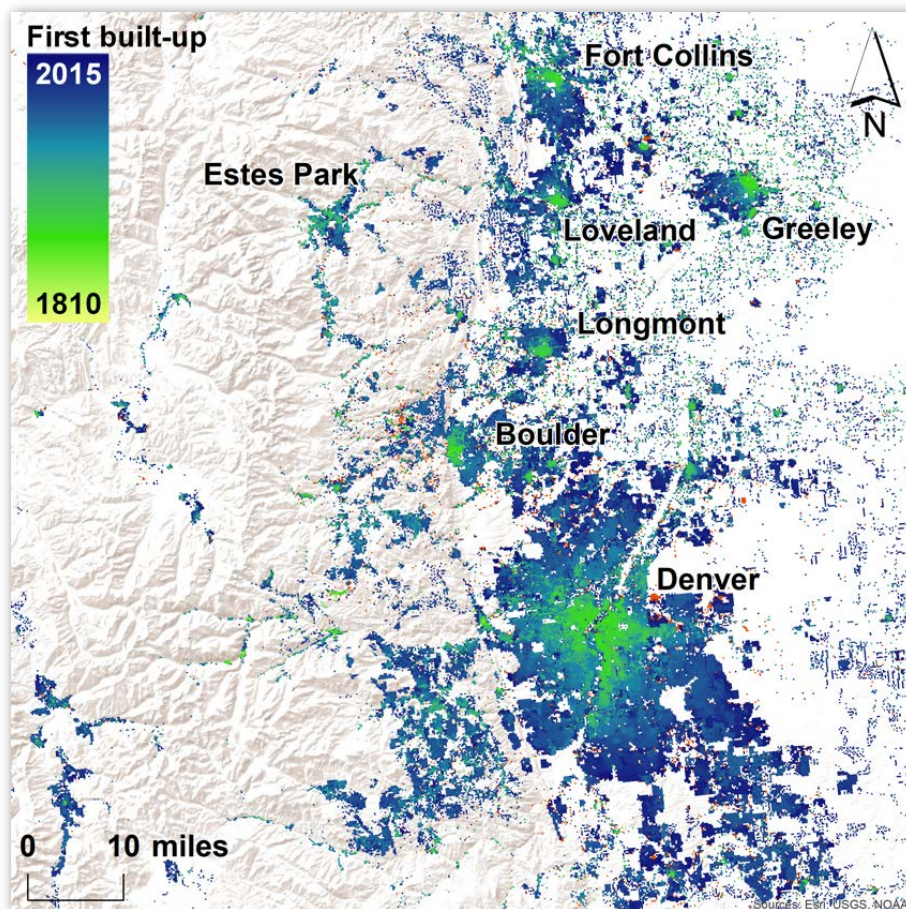

Fig.2: Historical settlement layer showing for each location the year in which the first structure was built. *Figure created by Johannes Uhl, Geography.*

Such historical data products enable and inspire researchers in geography, demography, and land use science, but also landscape ecology and environmental science to develop new forms of data-intense scientific inquiry. Here at CU Boulder, we are beginning to employ such historical data in various directions. For example, together with colleagues at the Institute of Behavioral Science (Dylan Connor, Myron Gutmann, Lori Hunter), we are developing models of urbanization at the national scale over long time periods.

These models will integrate historical demographic data and provide new insights on how and at what pace urban systems have evolved. Other efforts that also involve colleagues from Earth Lab (**Jennifer Balch**, Nathan Mietkiewicz, Max Joseph, Anna Braswell) are aiming to study complex interactions between human settlement and environmental systems in a natural hazard context. For instance, we are planning to study the interrelationships between human settlement in rural regions and the changing frequencies of wildfire over long time periods to better understand whether certain patterns of development are related to increased wildfire risk. Furthermore, we will study how human settlement has fragmented landscape elements such as wetlands (which we find in historical topographic maps), and how such landscape modifications may be related to recent flooding events. These are but a few examples of research activities, empowered by a unique window into the past and driven by new methodological frameworks for data analytics and geographical modeling.

Fernando Riosmena: Is Climate Change A Driver of Migration?

Professor Riosmena

During the past year, I continued to do research on the drivers of migration with my ongoing research examining the relationship between climatic variability and migration out of Mexico. As part of these efforts, I led a study that was recently accepted in Population Development Review, one of the top journals in Demography and Population Studies, coauthored with Lori Hunter (CU - Sociology) and Raphael Nawrotzki (University of Minnesota).

The influence of climate change on international migration is a topic of particular interest for immigration officials and national security apparatuses in the Global North, based on the idea that climate change could spawn yet another migration crisis that will add to flows of refugees, asylum seekers, and irregular migrants. Although many of these views are deeply distorted and scholars generally agree that climate change is unlikely to result in massive numbers of international climate refugees at a global scale, increased migration (or disruptions) to international mobility could likely occur in specific flows and in some circumstances. Perhaps most clearly, international climate migration may be used as a strategy to cope with the impacts of weather anomalies among people within well-established migration systems because access to networks may reduce the costs of migration.

Mexico – US migration is a particularly interesting test case of the socioeconomic conditions that may elicit international climate migration given its longstanding history of growth and more recent record of decline. Rural Mexican communities are fairly susceptible to environmental events –and drought in particular– due to both their physiography and social and institutional makeup. In addition, these communities are characterized by longstanding, firmly-established connections to US labor markets, with international flows often dating back over a century.

Previous research linking climatic variability to Mexico-US migration had been limited to particular social conditions and high migration periods. Using the 2000 and 2010 Mexican censuses, my colleagues and I examined the climate-migration association across a broader set of socioeconomic conditions in sending areas and during periods of high and low US immigration, which allowed us to perform a more complete assessment of whether climate drives emigration out of Mexico. In general, we find that high temperatures or low rainfall relative to local/seasonal "normal" historical levels are associated with lower US migration from most of rural Mexico and under most climatic conditions. However, we do find some climate-related migration from the least and most marginalized municipalities, as well as from those with the highest migration intensities. Finally, our findings comparing these relationships across periods suggest that climate migration is affected by conditions in the United States to a similar or smaller degree than other forms of migration. Altogether, our study suggests that rural Mexico is unlikely to produce many international climate refugees, and that this low likelihood is not heavily influenced by US immigration policy.

Undergraduate Research Articles

Dylan Lanka: Solifluction Erosion

Understanding the dynamics of the erosion of landscapes is an important way that people can gain insight into the ways the Earth's surface is changing over time. Solifluction is a type of erosion in which soil moves as a result of cycles of freezing and thawing. This process is related to local weather conditions since freeze-thaw action requires an adequate water supply so that the soil contains enough moisture to freeze into ice lenses.

My study attempted to measure solifluction on the high elevation area of Niwot Ridge through observing the downhill movement and vertical swelling (heave) of land features called lobes. I used a drone to take images of the landscape that could be compiled to make models of the differences in the structure of the surface from before and after the freezing of the soil between September 2017 and March 2018. Additionally, I analyzed INSTAAR weather data for temperature and precipitation on Niwot Ridge to see how these conditions are changing over time since these factors are strongly related to how much solifluction can occur.

Niwot Ridge: Dylan stakes down rebar to be used as a starting position reference for markers of downslope movement.

My findings were compared to a 1970 study by CU researcher James Benedict of solifluction occurring in the years 1962-1967 at the same area I studied to see if the impacts of this process of erosion have changed in the last 50 years. Some of the results were that solifluction is still active on Niwot Ridge and that drone imaging can be used to model changes in the structure of the surface caused by heaving in the cold season as well as to make measurements of changes in the ground distances between objects in the images.
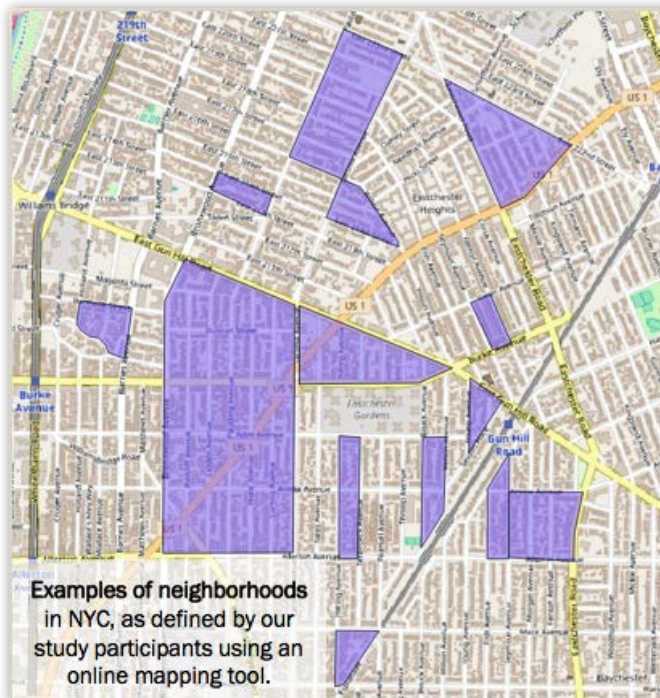
My analysis of changing weather conditions on Niwot Ridge over time showed that total precipitation per water year is increasing, mean air temperature is decreasing, and that temperatures are becoming more extreme.

Drone shot of Lobe 45, the main land feature observed in this study.

Kai Kresek: Perception of Neighborhood Space

My honors thesis is based on the hypothesis that neighborhood space is perceived by individuals differently based on both their demographics and the neighborhood's history of discriminatory mortgage lending (redlining). I was first inspired to explore the concept of perceived neighborhoods through my work with Dr. **Colleen Reid**, who applies perceived neighborhoods to the study of medical geography. Perceived neighborhoods are especially interesting to study because when scientists research topics such as public health, economics, demographics and more, on a spatial scale, they use neighborhoods. How researchers define these neighborhoods can drastically affect the results of their studies, a concept which is familiar to geographers as the modifiable areal unit problem. Additionally, given the prominence of issues such as gentrification and discriminatory lending practices in present-day America, I believe that examining the effect of historical redlining is vital to understanding some of the issues that currently face our urban spaces.

Examples of neighborhoods in NYC, as defined by our study participants using an online mapping tool.

This study was focused on New York City, and was based on a survey of adult residents from all five Boroughs. I sought to understand how neighborhoods were defined by looking for trends in how individuals possessing different demographic characteristics (e.g. age, gender, race, marriage status, income, employment status, educational attainment, length of residency) affected the area, perimeter and compactness of the region they perceived to be their neighborhood. For this research, I geocoded a dataset of over 1,000 perceived neighborhoods. Additionally, in order to examine the impact of past discriminatory lending on the dimensions of perceived neighborhoods, I incorporated historical redlining maps from 1936-1938 to determine which neighborhoods were most affected by redlining. In order to evaluate my hypothesis using the datasets I compiled, I used a combination of online mapping tools, GIS and R.

My results included relationships between the dimensions of perceived neighborhoods (area, perimeter and compactness) and demographic variables. For example, I found that an individual's gender, race, educational attainment, income and employment all significantly affected the dimensions of their perceived neighborhoods. Additionally, there is evidence that if an individual's perceived neighborhood did not lie in a region that was historically redlined, then that individual was more likely to have a higher income, and to identify as White. These findings indicate that, in New York City, social and/or cultural factors impacts how a person defines their neighborhood, and that the socioeconomic composition of present-day neighborhoods is related to historical redlining.

Earth Lab Launches New Professional Certificate in Earth Data Analytics

A new professional certificate in Earth Data Analytics - Foundations will launch at CU Boulder in August 2018. This certificate, launched by Earth Lab in collaboration with the Geography department, provides critical technical data skills for Earth system applications that are in high demand across many job markets. It is designed for students of various backgrounds and ability levels - from career changers with no programming experience to current Earth science professionals who are looking to boost their data-intensive skills.
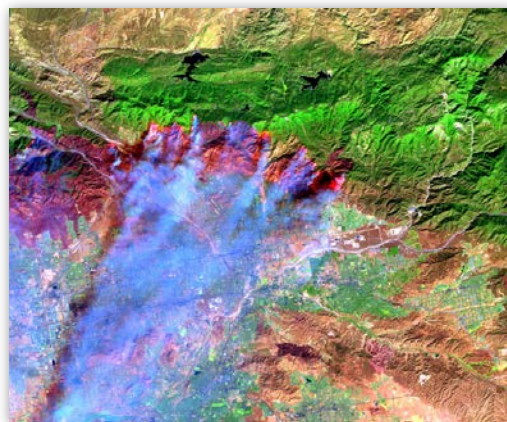
Through the Earth Data Analytics - Foundations Certificate, students will learn how to use scientific programming to automate workflows and gain facility with different types of data including spatial and remote sensing data, social media data, sensor network data and more. Students will also gain interdisciplinary communication and collaboration skills through hands-on projects with industry partners. Applications for the 2018 program year are being accepted now through July 1, 2018.

The Old and Grand Prix Fires that occurred in the San Bernardino Mountains in October 2003. This is the type of data Earth Data Analytics - Foundations certificate students will learn how to use.
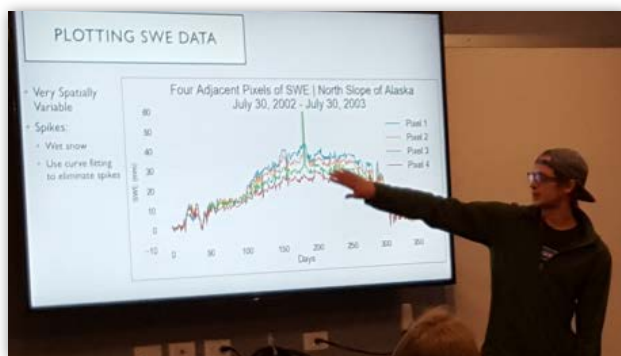
Certificate Structure and Audience

The Earth Data Analytics - Foundations certificate consists of three Geography courses that can be completed in as little as nine months (August 2018 to May 2019). The courses include:

1. a data science bootcamp,
2. a heterogenous data course which introduces spatial data, API's and automated workflows applied to science, and
3. an applications course where students work on an applied data intensive project in collaboration with industry and agency partners.

All three courses are offered both in-person on the CU Boulder campus and online. Online offerings allow students to either participate real-time in the courses or watch video recordings of lectures at their own pace to accommodate even the busiest of schedules.

Student Will Norris presents his research on how remotely sensed data and machine learning are changing the way scientists analyze snowpack over large spatial extents.

Skills at the Intersection of Earth Science and Data Science

Providing skills at the intersection of Earth science and data science, the Earth Data Analytics Foundations certificate is one of just a few of its kind in the world. Earth Analytics certificate graduates will both gain an exceptional interdisciplinary skill set that is sought after by employers and become uniquely qualified to address pressing environmental problems in their careers. For example, in scientific efforts to better predict forest fires, understanding how to use
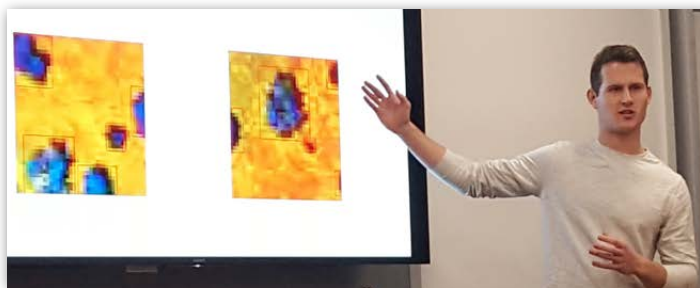
programming languages like R and Python to analyze different types of remote sensing data is just as important as scientific knowledge of Earth systems and landscape ecology.

Market Demand for Earth Data Analytics Skills

Experts contend that the U.S. is facing a shortage of hundreds of thousands of professionals trained in data science and analytics. The average wages for data scientists in the U.S. rose by about 16% per year from 2012 to 2014, compared to 2% across other occupations. To ensure that certificate graduates are marketable and can fill these gaps, the Earth Data Analytics program has been carefully designed following market research on what skills are in demand. It will prepare students to harness today's explosion of diverse data. It qualifies its recipients for job titles such as 'data analyst' and 'geospatial scientist'

for organizations such as Google, DigitalGlobe, the USGS, Lockheed Martin, and NOAA.

Please spread the word about this program! Applications to start in August 2018 will be accepted through July 2018. You can learn more about the program on the Earth Lab website or by emailing earth.lab@colorado.edu.

Zach Schira presents his research on teaching computers to recognize each individual tree in an aerial image of a forest.

Department News

Meredith DeBoom (PhD 2018) has accepted a tenure track position as an Assistant Professor of Geography at the University of South Carolina, starting in August 2018. Meredith was supervised by John O'Loughlin. Congratulations Meredith!

Joel Correia (PhD 2017) has accepted a tenure track Assistant Professor position in the Center for Latin American Studies at the University of Florida. Joel's faculty supervisor was Joe Bryan. Congratulations Joel!

Shae Frydenlund was awarded an NSF Doctoral Dissertation Research Improvement (DDRI) grant to support her dissertation research project titled "Rohingya Refugees, Translocality, and the Gendered Labor Geography of Urban Revitalization".

Dorje Tashi (**Duojie Zhaxi**) was awarded an NSF Doctoral Dissertation Research Improvement (DDRI) grant. The award will support his dissertation research project titled "Tibetan Farmers in Transition: Urbanization, Development, and Labor Migration in Amdo."

Shae Frydenlund

Monica Rother (PhD 2015) has accepted a tenure track assistant professor position in Environmental Sciences at the University of North Carolina Wilmington. Her faculty advisor was Tom Veblen. Congratulations Monica!

Dorje Tashi

Department News

Professor **Emily Yeh** received a Fulbright Fellowship to spend the next two semesters in China doing research. Her research project will focus on the political rationalities of various forms of transport infrastructures that are being built in Southwest China under the name of the Belt and Road Initiative, China's gargantuan and ambitious transnational infrastructure project. She plans to be based in Chengdu, the capital of Sichuan province and to explore how transport infrastructures rescale social relations and cultivate certain forms of "common sense" about development.

Associate Professor **Holly Barnard** is spending the year 2018 at the National Science Foundation in Washington D.C. as a Program Director for the Program in Hydrologic Sciences. Congratulations to Holly for being invited for this prestigious position.

Professor **John O'Loughlin** has been awarded a new grant from the NSF Geography/ Spatial Sciences and Political Science programs for $660,000 (matched by a $440,000 grant from the Research Council of United Kingdom to co-PI Kristin Bakke, University College London). The research will produce a detailed portrait of the geopolitical orientations of the populations in the countries across the post-Soviet regions of Europe, the Caucasus, and Central Asia through the implementation of a two wave panel set of public opinion surveys from 2018-2021.

Professor **Jennifer Fluri** has co-authored a new book, Feminist Spaces: Gender and Geography in Global Context. Jennifer also received a new NSF Grant. She is PI on the grant, "Security, Gender, Development," which will be used to study Afghan Women's political networks and influence at multiple scales of analysis. $475,000. Award #1759701, July 2018-June 2020.

Professor **Tim Oakes** was awarded a $390,000 Asia Responsive Grant from the Henry Luce Foundation for a collaborative project between the Center for Asian Studies, which he directs, and the Hong Kong Institute for Humanities and Social Sciences. The project team, which includes Professor Emily Yeh, will explore social, cultural, and political dimensions of China's infrastructural investments both within and beyond its borders.

Where is the water going in the Great Lakes?

NASA's earthdata.nasa.gov website featured an article by Agnieszka Gautier about Professor **Peter Blanken**'s research on the Great Lakes titled "To the Lighthouse — Where is the water going in the Great Lakes?" Here's an excerpt from this fascinating article:

> *Shortly after the boat set out onto Lake Huron, dense fog swelled. Unable to see beyond the bow, radar guided the researchers to Spectacle Reef Light, a lighthouse, 11 miles offshore. "We literally almost hit our heads on it," said Peter Blanken, a researcher from the University of Colorado Boulder. The team was checking on the instruments on top of the lighthouse, which was being used as a key research site.*
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> *The Great Lakes contain 20 percent of the world's surface fresh water and provide 35 million people with drinking water. "Surprisingly we know very little about them," Blanken said. "They're very poorly studied." Their immense size has led many to perceive them as unresponsive to climate change. From 1998 to 2014, water levels dropped in the Great Lakes to the longest low-level period in over 100 years. Then in 2016, water levels recovered in Lake Huron, jumping more than three feet after 12 days of rain.*
>
> *Precipitation is one driver of year-to-year fluctuations, but Blanken suspected another cause . . .*

Department News

Center for Water, Earth Science & Technology (CWEST), directed by **Noah Molotch**:

PhD student **Keith Jennings** received a CUAHSI Pathfinder Fellowship to work with the NASA Airborne Snow Observatory in California this spring. He also has a paper with Taylor Winchell, Ben Livneh, and Noah Molotch in press at Nature Communications. See the press release in CU Boulder Today and the video of interviews and the story which ran on 9News.

Keith Jennings

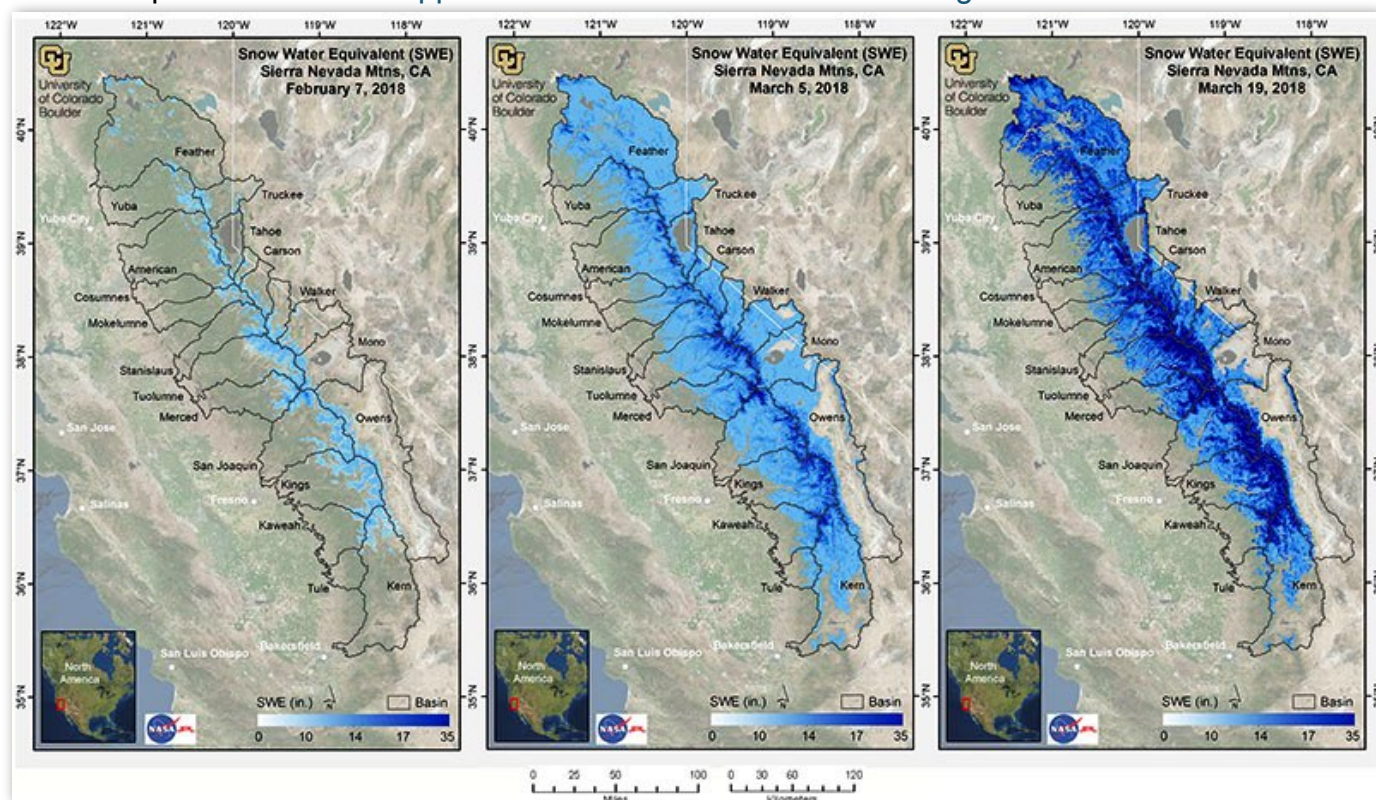CWEST continues to galvanize CU's water research community and bridge opportunities to collaborate with the U.S. Geological Survey. In our most recent initiative, CWEST established its Graduate Research Fellowships to directly foster CU-USGS research collaborations. We are pleased to announce that two CU graduate students, Anna Hermes (INSTAAR/ENVS) and Isaac Bukoski (INSTAAR/Geography), were awarded funds for their collaborative research proposals. The next Graduate Research Fellowship application round will open at the end of the Spring 2018 semester. For more information, please visit CWEST's Student Funding Opportunities webpage or contact CWEST's program manager at c-west@colorado.edu.

Noah Molotch

CWEST's NASA Water Resources Project

California water managers and stakeholders are excited about our new near real-time snow water equivalent (SWE) reports. We are actively engaged with the CA Dept of Water Resources to add our data to their operations. The figure below is from the latest report. This is part of the NASA Applied Sciences Water Resources Program.

Thank You! The Department of Geography is grateful to its alumni and friends for their financial support over the years. Our donors have had a big impact, making a difference not only to the Department as a whole, but to the lives of many individual students. There is always a real need for funds to support academic departments. As we strive for higher standards and more and better opportunities for our students, we depend on the caring and generous nature of alumni and friends like you to meet these ever increasing financial needs. Your gift to the Department of Geography can take many different shapes. The information below may help you find the type of gift that best meets your needs, the impact you want, and the way you want to give. The CU Foundation can also assist you with your needs, be they for targeted or unrestricted programs.

Geography Department Fund

This fund is for academic support in the broad sense. If giving online and you want your gift to go to a specific scholarship, please provide scholarship name in the "Comments" section.
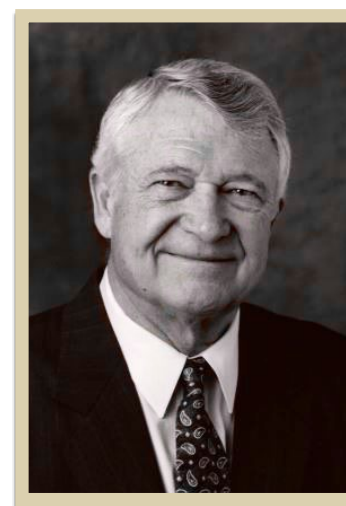
GIVE NOW Go online to: giving.cu.edu/fund/geography-department

Undergraduate Scholarship Programs

A. David Hill Scholarship Fund

Established by Richard L. Knowlton, Professor Hill's former teammate and friend, and recently endowed by Myhra and Graham Hill, his wife and son. Applicant must be a Geography major, and have a minimum GPA of 3.0 in Geography, with a preference for those with interests in the environment-society relationship. Award is based on merit and demonstrated financial eligibility.

A. David Hill

GIVE NOW Go online to: giving.cu.edu/fund/david-hill-endowed-scholarship-fund

Albert W. Smith Geography Scholarship

Established in 1983 to honor Professor Smith at his retirement from the Geography Department faculty after thirty-one years of service to the University. Applicant must be a full-time senior majoring in Geography. Award is based on academic performance.

GIVE NOW Go online to: giving.cu.edu/fund/albert-w-smith-geography-scholarship-fund

Karl and Barbara von Dreden Stacey Scholarship

Established by Katherine and Frank Baxter in honor of Katherine's parents, Barbara von Dreden (CU class of 1940) and Karl Stacey (CU class of 1936). This scholarship supports undergraduate students to engage in summer research with faculty. Preference given to applicants who are juniors or seniors majoring in Geography, and graduates from Colorado high schools. Award is based on academic performance.

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Theodore C. Myers Memorial Scholarship

Named in honor of long-time geography instructor Ted Myers. Scholarship is awarded to the undergraduate student with the most exceptional honors thesis.

GIVE NOW Go online to: giving.cu.edu/fund/theodore-c-myers-memorial-fund

Mable B. Duncan Scholarship Fund

To support scholarships for Geography majors at the University of Colorado Boulder, based on financial need.

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Graduate Scholarship Programs

Gary L. Gaile DART Graduate Fellowship in Geography

This fund, in memory of Professor Gary Gaile, provides a fellowship/scholarship for Geography MA and PhD students doing field research addressing social and environmental concerns in developing areas.

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James A. and Jeanne B. DeSana Graduate Research Scholarship Fund

This fund provides invaluable support for graduate student research.

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Gilbert F. White Dissertation Fellowship

Named in honor of Professor Emeritus Gilbert F. White, this fellowship provides funding to outstanding PhD. students in the final year of dissertation preparation. Students are nominated by their academic advisors. Award is based on merit and financial eligibility.

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Geography Graduate Student Support Fund

To provide support for graduate students in the Department of Geography at the University of Colorado Boulder. Support may include research support and equipment purchases. Gifts to this fund can be made in memory of (IMO) **Jennifer Dinaburg**. Jennifer, a vibrant, active doctoral candidate in the Geography department, passed away on April 26, 2012 at the age of 31. In her memory, the department has established a small, named fellowship for doctoral field research.

Jenn was passionate about geography in many forms: through the environment, the outdoors, and through learning about China. After studying Chinese language and literature at Connecticut College, she traveled and worked extensively on the Tibetan Plateau. After a degree in environmental studies at Prescott College, her journey brought her to the Geography PhD. program in 2008 to study the commercialization of Tibetan medicinal plants in China's northwest Yunnan province. Jenn brought a love of mountains, travel, and unconventional learning to the department, where she was well loved for her sense of humor, wit and spirit.

Jennifer Dinaburg

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Please specify "In Memory of Jennifer Dinaburg" in the Comments field.

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