Faculty Mentoring Committee

Matthew Ross

13 November, 2019

Drs. Kampf, Fassnacht, and Wohl,

Thank you again for being on my mentoring committee. After my first full year as a faculty member (I started Aug, 2018), I have learned a lot about the incredibly diverse pressures of this job and it has been a period of immense growth in my capacities as a researcher and teacher. I've attached my updated CV, in addition to this letter, but I will briefly lay out my successes and failures for this year and discuss how I will continue to build my research and teaching programs.

Research

My research program currently falls into three distinct goals: First, I am using large public datasets, remote sensing, and machine learning to interrogate continental scale changes in water quality in rivers and lakes. Second, I am building an active research program in the Cache La Poudre river, working with the city of Fort Collins to better understand both short- and long-term changes in water quality. This research is based on using live-streaming sensors to better understand how the myriad land-use changes in the Poudre watershed (fire, agriculture, urbanization) interact to control the chemistry and biology of the river. Finally, I am working on a recently funded NSF project to integrate all watershed-ecosystem study datasets across the various networks that have funded long-term watershed research (Forest Service, National Ecological Observation Network, Critical Zone Observatories, Long-Term Ecological Research stations, Department of Energy research watersheds). The core research goal for bringing these data is to bring the historically parochial watershed-ecosystem approach to the continental scale, so that we can better understand how large-scale environmental change (like climate change or changing acid deposition) alter ecosystem and hydrological properties of watersheds.

2019 Summary

Funding

In 2019, I dedicated the majority of my research time to writing proposals. I submitted 12 proposals as a CSU lead PI or CO-PI to a range of local and federal agencies. Three of these proposals were funded, with the most important being a $1 million NSF Macrosystems grant to study continental scale changes in watershed ecosystems ($420,000 to my lab). I also received (with Ed Hall) a Colorado Water Institute grant to study algae blooms in Colorado reservoirs (~$50,000), which is the project my first master's student is now working on. Finally, I am a co-pi on a USDA grant to fund 4 master's students and 1 PhD student to better integrate data science techniques into how agricultural and watershed graduate students are trained.

I also have partnered with the city of Fort Collins and the sensor manufacturer In-Situ to install 8 live-streaming water quality Sondes in the Poudre River. Many of these sensors were either donated for free or purchased by the city, allowing for me to get a large research project started with little contribution from my startup ($85,000 in in-kind contributions).

Publications

In terms of publishing, this year was admittedly a bit slow, due to my focus on grants. However, I had one major paper accepted in Water Resources Research. In this paper, we built the largest remote sensing training dataset ever. We are actively using this data to make predictions of water quality at unprecedented scales (over 20,000 lakes and 10,000s of kilometers of rivers). I also am second author on a paper by Alex Brooks from our time at Duke. Alex shows large nitrate increases downstream of mountaintop mining increases, decades after mining has ceases.

Moving forward

Over the next 4 years I plan on adjusting my approach a little. These adjustments include:

- Focusing on fewer, but higher quality proposals more central to my research goals (closer to 5-8 per year).
- Focusing on publications, I anticipate that over the next few years, including papers for which I am co-author or adviser I will publish closer to 5-10 papers per year. I currently have 9 fully drafted papers that will be submitted over the next year.
- Continuing to grow my collaborative research program by partnering with more cities (including Loveland and Denver) and companies (like In-Situ and Hach). This work allows me to do excellent research while also connecting to the community.

Teaching

In the ideal form, my classes will include a deep integration of data analysis, content mastery, and creative demonstration of these skills. This approach would be tightly integrated with my mentoring approach, where students that I work with develop research- and work-relevant skillsets and then share those skills with others. I am currently teaching 9 credits (this academic year) and will teach 6 next year. I like this teaching schedule.

2019 Summary

In my first semester teaching Water Quality (WR 418) and Water Quality Lab (WR 419), I saw glimpses of this ideal integration of skills and content, but mostly I struggled to simultaneously generate both analytical and content knowledge. As a result, I changed the way I am teaching Data Issues in Hydrology (WR 674). In this class, I have completely flipped the class. Students watch videos of lecture before class, read relevant readings, and in class we focus entirely on homeworks. It has been a revelation and a much better class where I can much more obviously see progress in my students. Admittedly, it's a graduate class, so they are more motivated, but I plan on using this flipped approach more in my undergraduate courses.

While my undergraduate courses need work, I had more success mentoring the undergrads who contacted me for research, mentoring 5 last year with 3 continuing to do theses with me. At the same time, I have started mentoring my graduate students (2) who have just joined the lab. Since they just started, there is not much to report yet on the grad mentoring front, though I am also on 7 grad committees.

Moving forward

To improve my teaching and mentoring practice I plan on working on a few critical issues over the next 4 years:

- I will work to flip my undergraduate courses, which will have the simultaneous benefit of making them ready for online versions.
- Related to the above, I also plan on more deeply integrating coding in R not only in my classes, but in our watershed curriculum. I am actively working on grants and inter-departmental support to start an intro-R course taught by stats and offered by the university.
- I plan on building a tiered mentoring approach, where my graduate students closely advise undergraduate honors theses, with an eye towards undergraduate publishing.
- Finally, I plan on developing a generic mentoring plan for my mentees and specific plans for each student.

Service

- Chair of the NREL education committee
- Member of the Warner College IT committee

- Member of R-User Group
- Member of 7 graduate committees
- Reviewed 5 papers this year