

Mountain Views

Chronicles of the Consortium for Integrated
Climate Research in Western Mountains

CIRMOUNT



Informing the Mountain Research Community

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Participants in the Rocky Mountain Sustainability and Science Network Academy (see Halliwell and Bowser, page 4). Photo: Carrier Lederer.

Front Cover: Spring bloom of paintbrush, larkspur, and phlox. Three Sisters, Oregon. Photo: Jim Blanchard.

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Back Cover: Field Frames, Photo: Betsy Neely

Read about the contributing artists on page 74.

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QUESTION: Broadening the mix of heritages, legacies, cultures, and orientations that makes up our community of mountain science professionals has proven difficult despite efforts to increase diversity. From recruitment to retention, mentoring to modeling, there exist persistent challenges as well as ample opportunities. Have you observed or personally encountered barriers or behaviors that demonstrate intentional or unconscious bias? What recommendations and actions can you suggest that could help realize a future for our community that is truly inclusive?

Anna Sala, Lisa Cutting, Shakeeb Hamud, Jia Hu,
Daniel Ruiz Carrascal, Karen Pope, Nigel Golden ,
Kavya Pradhan, José Sánchez, Henry Diaz, Rene Henery,
and Sudeep Chandra

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Brian Scavone
Jim Blanchard
Wally Woolfenden
Carrie Lederer

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Brian Scavone, poem (*Myadestes townsendi*)
Wally Woolfenden, Frog Cartoon and Cactus Bunny

EDITOR'S WELCOME

Celebrating Diversity in our Science

This winter in California's Sierra Nevada we got used to shoveling—a lot of shoveling. Slowly the record snowpack is melting, transforming the vast white landscape into a kaleidoscope of spring wildflowers, and unveiling brilliantly colored slopes in the uphill march. In *Mountain Views* (MVC) we often focus on biodiversity in mountain environments, and so I felt it was natural and important that we celebrate diversity in our research community as well. Why now? No one with eyes open wouldn't observe that our clan of western North American mountain scientists is dominantly white, educated, and comfortable with outdoor work, reflecting a history of familiarity and ease in the mountains (an unconscious bias that several authors mention). A gentle but direct comment Meera Sethi made in her Autumn 2018 MVC summary of the *MtnClim 2018* meeting (read it also in her Guest Editorial, page 2) woke me to the decision to address the issue now.

In developing this topic for MVC, I talked with people more familiar than I am on how to address diversity. My main goal is to celebrate diversity in our science. I want to encourage more voices, more backgrounds, greater comfort in doing our science together. A better way to foster this than complaining or litanizing the wrongs done, I felt, was to feature a kaleidoscope of voices—colleagues celebrating their science, experiences, and art, sharing their opinions and recommendations, and offering hope.

I struggled with challenges, knowing that I would be criticized for any direction I took. The first challenge was the giant reality of individual diversity. Behind every face, no matter the color, age, or background, is a unique experience of life and the world. Why not just allow diversity to emerge from individual authors as usual in MVC and be done with it? Stick with the science. Trained as a geneticist, I get this, and rejoice. I also remember Sewall Wright (early 20th-century population geneticist) and his *F*-statistics. These mathematically decompose total diversity in a population into their various groups. For so many reasons groups develop, genetic or not. And for so many reasons, intentional or not, discriminations and biases develop among groups—of humans, at least. Thus while honoring the individual contribution each of us brings, there is no question that giant hurdles remain in dissolving boundaries related to such groups, whether they be of sexual orientation, race, cultural background, age, physical abilities...

One of the hardest challenges, then, became the issue of tokenism in regard to those I invited. How to bring important elements of diversity into the issue without insulting authors by implying they speak for a group, or worse, were invited only because they are a

token of the group? In the end, I decided there is no way around this offense (if taken) if I wanted to daylight certain elements of group diversity. So I invited selectively.

And who am I to tackle this topic? White, privileged, straight. I never missed a meal, had loving and supportive parents, hiked my way through college summers in the Cascades of Oregon (and got paid, thank you, USFS). I will share this one story that shaped, and continues to shape, my life. I met my future husband, Jeff, when we TA'ed a genetics course together as first-year PhD students at UC Berkeley. We married soon after, and our daughter was born seven years later. Partly because of the times, partly due to our trust, Jeff gradually realized something about himself: he is gay. Obviously this blew our world open, surprising us, shocking friends and family. Most relevant to the MVC topic, we made the decision to stay married. There was no question we were soulmates and wanted to spend our lives together. We also chose to have partners of our own. Those decisions made an already unconventional situation incomprehensible to many, and we lost friends and family as a result. Despite that we tried to explain how these decisions were based on the unwavering needle of our love, misunderstanding, disapproval, even shunning, remained.

As a result of this small venture into the world of bias, I know what a toll discrimination can take on the individual. I often felt diminished, insecure, anxious, and, among other things, my science productivity suffered. I can only imagine how it would be to deal with serious biases and discriminations every day of one's life.

I hope the articles in this issue provide insight for all readers, from the science to the personal content. I am elated because the authors share so many tangible recommendations and useful suggestions for action. I am deeply grateful to each author, especially when writing about personal experiences, for their honesty, transparency, and courage to speak. I believe it has been a bit of a journey for each, obviously a path that stretches out long in front of us.

If you would like to comment on this issue, please write me, and I will share selections in the next issue of MVC.

--Connie Millar

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GUEST EDITORIAL

Equity and Environmental Justice in Mountain Science

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It's kind of funny that I ended up becoming an ecologist who does field work above tree line on a mountain, since the highest natural point in Singapore, the tiny island-nation I grew up in, is a hill that rises only 178 meters (583 feet) above sea level. (We're quite proud of it.) Many of the Southeast Asian countries surrounding mine, however, including Myanmar, Indonesia, Malaysia, Vietnam, and the Philippines, are home to mountain ranges that host a stunning variety of flora and fauna and whose slopes are covered in lofty rainforests and the occasional equatorial glacier. Both my parents' families came to Singapore from mountainous regions further north in Asia—my paternal grandparents were born in Lahore, then part of India and now belonging to Pakistan, and my maternal grandparents in a small village near Guangzhou, China. They held this in common with over a billion other people across the world, since “20% of the world's human population lives either in mountains or at their edges” (Körner and Ohsawa 2005).

The communities of people who live in or near mountains are racially and ethnically diverse, but they have some things in common (the following points all are made by Chin and Dye 2016). They tend to be small and isolated, and therefore

frequently lacking in political power and social services. Their gorgeous landscapes attract affluent visitors whose relationships with the mountains are primarily recreational, and whose presence may be economically important but also the source of increased inequity. Mountain communities have long cultural histories of connection with their mountain environments—especially long when it comes to indigenous peoples. And yet the expertise that comes from their deep and intimate associations with the landscape and biota they live with is routinely devalued—including by scientists who study these things. On top of all this, we know that mountain landscapes are especially vulnerable to the effects of climate change (Pepin et al. 2015) and the people who live there face a greater risk of avalanches, flooding, wildfires, droughts, and other impacts that will remake their ways of life (Alfthan et al. 2018).

When Connie invited me to write a guest editorial for this issue of *Mountain Views Chronicle* focusing on diversity, it was largely because in my summary of the *MtnClim2018* conference I had noted that I was “one of the few brown faces in the room.” That wasn't an unusual experience for me or many other minoritized people in this country, especially in the sciences. We all recognize that the mountain science community is, like every other, subject to large systemic forces that are difficult to dismantle. (It's also fair to note that CIRMOUNT's stated scope of concern is “Western Mountains” and not, necessarily, all the mountains of the world—though the MtnClim meeting has a broader purview.) So there may be those who find this topic superficial, or better left to another forum. But if you feel like your passion for mountain landscapes and their ecosystems is part of your identity, consider how much our field would be enriched by the inclusion of everyone who shares that with you. I'm grateful to Connie for putting together this wonderful issue, and I'm excited by what we will gain from considering the ways in which equity and environmental justice matter to our field.

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Photo: Jim Blanchard

ARTICLES

A Diverse Sense of Place: Citizen Science as a Tool to Connect Underrepresented Students to Science and the National Parks

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All photos in this article show research projects of the Rocky Mountain Sustainability and Science Network and were contributed by Carrie Lederer (participants have granted permission for use of the photos).

Abstract

Citizen science represents an opportunity to invite, connect, and encourage broad participation within the scientific community. At the core the research strategy urges public participation to answer important research questions. Citizen science offers great potential to welcome diverse contributions to science on public lands while addressing relevant questions. This article explores this potential and highlights the Rocky Mountain Sustainability and Science Network as an organization that has capitalized on this research strategy to explore worthwhile social and environmental inquiry. Moreover, the organization has recognized and stressed the importance of leveraging a diverse cohort of graduate and undergraduate students to accomplish such work. This approach has resulted in students that express an enhanced, deeper appreciation for the parks, recognizing them as special places. The diverse social element of the experience appeared to be a key factor in the growing appreciation, value, and bonding with these public lands.

Keywords: citizen science, diversity, place attachment, stewardship, inclusive science

Introduction

Citizen science, an emerging research strategy employed on public lands, engages “non-professionals in scientific investigation” (Miller-Rushing, Primack, and Bonney 2012, p. 285). This research approach invites the general public to engage in valuable research efforts at various levels of involvement. Bonney et al. (2009) noted that certain projects may enlist volunteers only to collect data, while other projects ask volunteers to co-create research questions, participate in analysis, development of conclusions, and dissemination of results. Projects such as bio-blitzes as “...intensive public participation in scientific research” (Leong & Kyle 2014) can contribute to identifying as many species of organisms as possible within



a period of time (Sharkley 2001). While such approaches like bio-blitzes or citizen science research may not be appropriate for all research questions, when it is suitable it can offer benefits for both researchers and practitioners and can foster a sense of stewardship of a park or protected area (Leong & Kyle 2014).

Citizen science is often viewed as a win-win for all involved. Inviting the public to contribute toward a research project can generate data sets on understudied species, such as many invertebrates and also can allow for large scale efforts that span significant spatial and temporal scales (Schotens & Wagner 2007). While benefits, such as experiential education opportunities, are notable for those involved in citizen science or bio-blitzes there is further significance in bringing together a diverse cohort of individuals from different ethnic and racial backgrounds to explore research topics. Citizen science projects offer great potential to democratize science, allowing individuals from a variety of backgrounds to unite around a common objective of science and discovery (Baker, et al. 2014). This strategy integrates new and necessary perspectives into the scientific discussion, opens doors for underrepresented populations to contribute, and creates a platform where those involved can collaborate and be encouraged in their scientific pursuits, finding others that share similar scientific interests.

Citizen Science and Participant Diversity

Citizen science has the potential to invite a mix of participants of different gender, race, religion, age, education level, economic level, or geographic location. The diversity that such efforts can theoretically attract can add a level of richness and depth to a research effort. The strategy can blend a myriad of perspectives toward a singular scientific objective. While this diversity has yet to be fully recognized, the range of research topics suitable for the approach can be an asset in engaging broad participation. For example, a dragonfly mercury study is completed at over 100 public land locations. In addition, plant and animal phenology monitoring efforts track seasonal change across park landscapes (National Park Service n.d.-a). Other projects are unique and specific to individual parks or small number of parks. Examples of such projects include the common loon population study in Glacier National Park, and the Yellowstone National Park wolf photography study (National Park Service n.d.-b, Yellowstone Wolf Project n.d.).

Pandya (2012) pointed out that citizen science research in the US has not yet reached its full potential to integrate a diverse population into the scientific community. Specifically, it has done a poor job of engaging traditionally underrepresented populations including African Americans, Native Americans, and Hispanics (Pandya 2012). In addition, wealthier, white, and retired



Americans are more likely to participate in such efforts than those in lower income brackets (National Academies of Sciences, Engineering, and Medicine 2019). In short, citizen science volunteer demographics are highly skewed and representative of a very limited segment of the American public (Pandya 2012).

Providing some insight on the composition of citizen science efforts, the National Academies of Sciences, Engineering, and Medicine (NASEM 2019) completed an analysis of demographics within citizen science by considering various types of citizen science programs. SciStarter (2019), an online platform connecting potential participants with online and hands-on projects reported that females represented 64% of the SciStarter (2019) profiles. The median age of female participants was 41, whereas the median age for males was 47. NASEM (2019) also referenced the work of Theobald et al. (2015) and Burgess et al. (2017) who evaluated the demographic profiles of 125 hands-on, outdoor, biodiversity projects. They found that 88.6% of participants were Caucasian, 6.1% Hispanic, and 4.6% Asian or Asian American. African Americans, Native Americans, and Hawaiian/Pacific islanders were not represented in large percentages in any of the projects. Regarding education, 90.6% of projects noted that *some*, *most*, or *all* of participants were college graduates. Likewise, 79.5% of projects were comprised of *some*, *most*, or *all* retirees. Finally, these authors did not recognize a distinct difference in gender representation. NASEM (2019) summarized this demographic analysis by characterizing most citizen science participants in this study as “white, well-educated adults” (p. 160).

Lack of participation from certain groups may be due to a variety of issues. Evans et al. (2005) suggested that the reasons for such a participation gap could include lack of access to nature, unfamiliarity with nature, lack of an understanding for the scientific process, and difficulty balancing work and a citizen science project on constrained budgets (Evans et al. 2005).

While these obstacles likely exist, it is necessary to consider participation in a cultural context, noting that creating welcoming opportunities for anyone to contribute to science is imperative. Embracing projects where all individuals feel invited into the scientific setting is essential in overcoming participation barriers. Ensuring that underrepresented populations find scientific communities that they are able to identify with, value their contribution, and embrace their perspective is essential. In this regard, sharing the stories of the contributions that women and minority groups have made to science and the parks could serve as a bridge to welcome greater diversity into such experiences (Gretzel & Bowser 2013). Additionally, Gretzel & Bowser (2013) highlighted the importance of role models for fostering involvement in a variety of sectors. Citizen science projects, designed with such consideration, could be well suited to provide positive models for others to emulate. Such strategies in citizen science may serve to support greater diversity in the scientific community at large. Interestingly, Brouwer (2018) recommended a targeted invitation approach as opposed to open calls for volunteers as a strategy to further improve diversity. Ensuring that all cultures find inclusive scientific settings that they can connect with will be critical to encourage broad diversity in science. Addressing these participation gaps is an important area of opportunity for citizen science.

Rocky Mountain Sustainability and Science Network

One organization that has embraced both the potential that citizen science offers and the need for diverse representation in the sciences is the Rocky Mountain Sustainability and Science Network (RMSSN). RMSSN is a collaboratively funded organization that brings a diverse cohort of undergraduate and graduate students together to explore pertinent ecological and social topics. The program, founded in 2009 through a grant from the National Science Foundation (Bowser & Brown 2009), offers valuable leadership and research experience for participants while generating useful science. Historically approximately 70% of the students in the program are from traditionally underrepresented science demographics. Annually RMSSN has to turn away highly qualified minority candidates due to capacity limitations, highlighting the need for more science opportunities that intentionally and strategically welcome diverse representation. Bowser et al. (2014) explained that the organization is designed to “help train the next diverse generation of interdisciplinary leaders who are prepared to address issues related to global climate change, environmental sustainability, and the management of public lands and resources” (p. 692). RMSSN has displayed a commitment to embracing learning, promoting diversity, and encouraging a collaborative, connected environment in order to build sustainability leaders.



Approximately 25 students participate in a two-week research trip to Grand Teton and Yellowstone National Parks. Partnership and collaborative program grants and donations for all students cover the entire cost of housing, transportation, and meals thereby mitigating economic participation constraints. While all citizen science research is conducted in Grand Teton and Yellowstone National Parks, additional pre and post trip workshops are held at the Colorado State University Mountain Campus adjacent to Rocky Mountain National Park. The students undertake three parallel research efforts (3 teams of 5-8 students) supporting pollinator taxonomic surveys, pika presence or absence studies in various park locations, and cultural stories connecting to various ecological or geological aspects of the two parks.

RMSSN is composed of faculty from different institutions, practitioners, and professions interested in sustainability and education. Examples of diversity among faculty encompass gender, ethnicity, age, nationality, area of academic expertise, and industry. This blend of various backgrounds helps to create rich learning opportunities for a cohort of citizen scientists also exhibiting elements of diversity. Adding knowledgeable experts in the form of guides, park association personnel, or park rangers throughout the experience only serves to further enhance the learning opportunities. Such diversity should not be overlooked as it presents participants with individuals that they might be able better connect with and learn from.

The Social Component

Qualitative and quantitative assessment conducted on the 2018 RMSSN cohort considered how the experience, participating in citizen science research on public lands, impacted place attachment and stewardship motivations for students. Gathering a diverse group of students to do science on public lands not only yielded valuable science but cultivated a deeper sense of



attachment to these lands. The sense of belonging was expressed by all students including minorities (Walton & Cohen 2011). Moreover, students expressed greater motivations to take care of these public lands in the future (Halliwell 2019).

Findings of this assessment indicate that not only did the experience serve to cultivate bonds with the parks and encourage stewardship motivations but that the social facet of the experience was a critical element encouraging these shifts. One student expressed, *“Just being with everyone got me really excited about it (park stewardship). I definitely want to promote it to others.”* Another explained, *“It was amazing to be tied in with that community that I was able to make bonds with.”* The social experience left an impression on those involved and heightened connections individuals had with the parks. Sharing the experience with others was important, as one student commented, *“Obviously the most memorable part of it was the sense of community that you always had. There were all these people who came from so many different backgrounds that were learning about a lot of different things.”* This comment expressed the importance of community, but it also addressed the diversity of the community and the learning that was taking place (Halliwell, 2019).

Special Places

The experience of engaging with others in scientific pursuit appears to aid in cultivating a belief that parks are special places (Baker et al. 2014, Leong & Kyle 2014). As further evidence, all RMSSN participants, including those from underrepresented groups, acknowledged the parks to be special places following their research efforts in Yellowstone and Grand Teton, whereas only 45% of the same group felt this way prior to the experience (Halliwell 2019). The ability to connect with the parks in a deep manner enhanced this conviction.

This assessment was demonstrated in the comments that students made after reflecting on their research efforts during RMSSN.

For instance, one student noted, *“The land is so respected. It's more sacred to us, a thing to preserve. So that's what really led to a big connection for me. And that's what I'm always going to think of these places. It's very precious. You have to take care of them (parks).”* Others explained that the natural beauty of the environment played an instrumental role stating, *“the beauty of the place, just the very special environment, all the animals and the ecosystem.”* Still others furthered that thinking acknowledging the beauty of the place and recognizing the importance of stewarding such places for others to enjoy, *“you appreciate how beautiful it is and you'd want to be able to preserve that for future generations.”* (Halliwell 2019).

The RMSSN experience, like many citizen science programs, encouraged participants to explore, associate, and understand the parks in an interactive, sensory, and social manner. In so doing, deep bonds with the place seem to emerge. Participants connect with the parks as they explore them through a scientific medium. These bonds help provide participants a social sense of belonging to a group with a common purpose that involved science within the park (Davis et al. 2014) while also building on a sense of acknowledging the special essence of the place (Halliwell 2019).

Learning, exploring, and studying public lands in a citizen science forum has the potential to have a powerful impact on participants (Besissinger et al. 2017). Engaging people in parks is central to the original missions of the National Park Service and creating stewards of parks through the discovery of park resources was a core goal of the National Parks Bioblitzes that took place in many National Parks as part of the National Park Service Centennial in 2016 (Francis et al 2017). Sharing the experience with others and learning from the diversity that one another bring into the experience can be transformative and provide a social sense of belonging that appears to be critical for students from underrepresented groups (Walton & Cohen 2011). Bonds were formed as students learned and worked together. They overcame challenges and celebrated victories together. Being able to share the experience in nature with others added an



additional element to the citizen science effort. The combination of people and place brought deeper value to the experience. Although many citizen science projects are completed by individuals working alone, this project, with this group was enhanced because of the social element, bringing people to learn together, work together, and play together.

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Diversity in the Environmental Field: Lessons from a Desert Mountain Peak

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Sixteen students, two teaching assistants, and I peer up in the glowing light of the Mojave Desert morning at our goal for the day: Granite Peak, the highest peak in the Granite Mountains range. We can see our entire route ahead of us, with the mountain looming large over the sprawling desert bajada. Even from here we can see the prickly desert scrub change to pinyon-juniper forest, more typical of the Great Basin Desert, near the top of the peak 3,000 feet above us.

Some of the college students in this group from University of California Santa Cruz's Natural History Field Quarter class have never climbed a mountain, let alone visited the desert, or camped before. For them this 10-day immersion into natural history in the desert is a truly novel and often life-changing experience. I am particularly excited that one student, Esme, has chosen to accompany us on what I told her would be a challenging and long day. Esme is a latinx student who is quiet and sweet, and extremely quick and intelligent, but she seems perhaps a little unsure of her place in our larger group of 25 students. She hesitated as we briefed the night before, not sure if she could keep up with the rest of the group. I told her I had faith in her, and that I was sure she could do it, and she is here this morning, still a bit unsure, but determined to climb her first ever peak.

We trudge across the long, gently sloping bajada, stopping occasionally to appreciate the blooming *Phacelia* or listen to the song of the black-throated sparrows. For the most part, however, we speed up from the "natural history pace" we've maintained the last week, where we have collectively learned how to slow

down and observe nature at nature's pace—entering into the mindset of what the course has long called "mountain time." This is the 47th year of Natural History Field Quarter at UC Santa Cruz—a class that has changed many a life and jump-started many a career in the environmental field. We traverse California ecosystems throughout the entire spring and focus on fundamental skills of how to observe and inquire about nature—building a foundation of science, ecological literacy, and, I'll venture, love for the natural world.

As a college student I took the course and had the experience I've now seen in many students I've taught—the realization that the natural world is all around you, all the time, and is endlessly fascinating, if you only know how to "see" it. As a student in the class, I discovered that the world was full of birds, and fell in love with them, which launched me on my career as a conservation biologist, ornithologist, and teacher.

Eventually we reach the foot of the rocky mountain and start the long climb up, winding through cholla cactus and blackbush. We rest under the shade of a pinyon tree and the students pull out their Grinnell-style natural history journals and make entries. We munch on snacks and watch a spiny lizard do push-ups and try unsuccessfully to locate the singing black-chinned sparrow we hear nearby. Onward we push, as the going gets steeper and rockier.





About half way up the mountain, I check in with Esme, who has been near the back of the group. She says, “You shouldn’t have had faith in me!”

I say, “What do you mean?”

She says “I feel like I’m dying!” I just finished a Wilderness First Responder class, so of course I ask, “Hmm...can you tell me more about what that feels like?” She says “When we’re walking I’m breathing hard and my heart is beating fast, but when we’re stopped I feel fine.” I tell her that I feel exactly the same way and that’s what climbing a mountain feels like. Fun, right?

After a longer break in the shade, the group starts up again. I try my best to find the easiest route through the jumbled boulders, checking for rattlesnakes under each overhanging rock. Just like the trail-less route up the mountain, teaching a course like this for decades provides unexpected challenges, changes to the terrain you thought you knew, new perspectives each time you visit, a slightly different route than you anticipated.

Throughout the history of Natural History Field Quarter, which started in 1973, the class has changed and adapted to the times. Ken Norris, who founded the course, had a realization after many years of teaching that his students no longer thought it ethical to pin rattlesnakes to the ground to catch them, and stopped that practice. Times change, values change, students change. As with conservation and environmental science as a whole, a current challenge and realization for the course is the need to confront a historical and current lack of racial and economic diversity, update old-school approaches to thinking and teaching about humans’ relationships to nature, and acknowledge the violence and racism in the history of land in the U.S.

Today we have many more students joining the course who did not have the privileges of growing up with early exposure to nature or camping. In response, we have adjusted our application questions so we can hear more about the challenges that each student has overcome to get to where they are, rather than figuring that the privilege of previous outdoor experience is what makes a student qualified. We raised funds to create an endowed scholarship fund that pays for all or part of the course fee for students who need it the most, and have adjusted our curriculum to include more teaching about camping basics at the start.

We have realized that messaging and advertising can come off as inherently or subtly exclusive, such as photos of all-white former student groups, and adjusted our advertising and language to be explicit that we are welcoming toward diversity. A hard piece of self-reflection for the class is that the culture and traditions that create so much of the magic of the class are rooted in white 1970s “hippie” culture and may be less relevant or even alienating to non-white students or LGBTQ+ students. I practice playing pop songs and songs in Spanish on the guitar, not just bluegrass music or sing-alongs from white culture that used to seem entirely inclusive but may leave out people from non-white backgrounds. We don’t just assume everyone wants to jump in the swimming hole anymore, because not everyone knows how to swim.

We have also acknowledged that advertising simply based on the fun of studying outside may not appeal to students from lower income backgrounds who are focused on the need for economic success after college, and have worked to emphasize the many professional skills that are learned in the class. We invite our alumni who are working in urban environments and with environmental justice and social issues to come and speak

with the class. We have paid attention to how many of our guest speakers are white males and sought out a greater diversity of perspectives. In these and many other steps, my co-instructor, TAs, and I have taken tips and advice from forward-looking programs like the Doris Duke Conservation Scholars Program, which is centered on developing conservation leaders that will promote diversity in the environmental working world.

After a long scramble we stop on an intermediate ridge and the students and I try to figure out which peak we are actually aiming for, now that the perspective has changed. I look over the long sweep of the creosote covered plain, and think about those that came before us on the land, and how easy it is in this context, teaching about the “wild” ecosystems of California, to forget about the land’s original stewards who shaped and in many ways created California ecosystems today. My personal perspective on this topic has been deepened and broadened greatly by tribal speakers who have visited the class in recent years. In addition to the short student-led presentations about indigenous people at each of the sites we visit on field trips, we now whenever possible invite members of the tribes from the areas we visit, including our home campus in Santa Cruz, to speak to us in person and share their perspectives. For many students, these are their first interactions with a Native American person, and the stories told are the first time they are directly exposed to the truth about the violent history of California and the U.S. that is so intertwined with how we perceive nature and land management today.

After another scramble up a boulder-strewn canyon and many a warning to the students to yell “rock” if one rolls below them, we survey our surroundings and see that we still have a long way to go. I feel the same way with our work to increase diversity in our class and in the environmental field. We have made great strides in awareness but there is still a long steep, beautiful climb ahead of us, full of learning and new perspectives. Just like climbing the mountain, there are unexpected detours, blind spots you didn’t see before you hit them, falling rocks when you least expect them. For example, in recent years of teaching I’ve noticed how uncomfortable many latinx students are with the way that some resource managers throw around words like “native” “non-native” and “invasive” when referring to introduced plants vs. California plants—the terms are just too close to the divisive language used in current issues like immigration. Terms like “invasive” are useful for talking about natural-resource management, but are undoubtedly alienating to major segments of the population. Are these terms helpful towards the urgent goal of diversifying perspectives in the environmental field? I seek new terms that convey the serious environmental problems of introduced species without alienating my human friends through language. I use “introduced” much more than “invasive” these days, and tend to say where it was introduced from. I say it “causes problems for California species” more than “this is invasive.”



We are near the top of the peak now, and getting short on time to get some of the students back to their duties to cook dinner for the whole group. We have hit a slow section full of giant granite boulders and are scrambling under the branches of pinyon trees, carefully testing for large loose rocks. I know some of my students are wondering “What have I gotten into!” Esme has skipped lunch and is low on energy. Emily, a teaching assistant on the course, insists she eat something and drink more water, and she does. After a brief check-in and rest, the students unanimously decide they want to make the peak and not stop where we are, even after I make a speech about how it’s all about the journey, not the destination. It turns out the last push is relatively easier and we soon top out on the peak with 360 degree views of the desert we have just explored for the last 10 days. We see the sand dunes we slid down together, the cinder cone where we learned about desert iguanas, the expanse of creosote on the bajada where we stopped and debated about the pros and cons of industrial solar power development in the Mojave.

The peak swirls with hill-topping butterflies as the students, elated, snap photos, and examine butterfly guides, and much to the instructors’ delight, all take out their journals and start making peak-top entries. I’ll learn some of their thoughts when I read their journals soon, but maybe I’ll never know the true impact on this day for some of them. I certainly still vividly remember making the top of Granite Peak as a student on the class 13 years ago. I never thought I’d be back as the instructor of the same course. I recall a conversation I recently had with a mentor of mine in thinking about diversity in teaching. I expressed reservation about continuing the tradition of white males being in the power positions in courses like these, along with just about everything else. She told me that being an aware person, seeking to learn and improve in relation to diversity, is critically important, and not to feel bad for who I am. These are hard conversations—is there anything wrong with our white male mentors from the past? No, they were wonderful people. And at the same time, systematic inequity meant that no one else

had these leadership opportunities. In my opinion this inequity is breaking down too slowly. I stood on this peak 13 years ago as a student; I hope in 13 years Esme might return here as the professor.

As happens at the top of peaks, the time to start down soon comes. We return back down the steep slopes, making our way through meadows of blooming flowers near the summit. After a long hike down the hill, three hours and many a cholla spine later we arrive back at our vans. I give Esme a high five. “I knew you could do it” I tell her. She smiles a tired smile. The group, exhausted but triumphant, delights in refilled water from a warm jug, which never tasted so good. I am proud of our accomplishment and that we got everyone up and down safely and had fun. I know that nature is the one who really did the work on our minds and souls over this last 10 days in the desert. Our job as instructors was simply to facilitate the meeting of these students with the natural world, and provide them with the tools to make their own connections.

A critical part of that facilitation is our work to acknowledge and embrace the need for diversity in our group and throughout the environmental field, and to create a safe space for students of all backgrounds. Much of that work is the hard and humbling task of listening and actively seeking out perspective on how to foster an experience that gives the gift of connection to nature while acknowledging and exploring the multitude of injustices and inequities that exist in our relationships to education, land, and knowledge. I hope the ripples of these experiences become waves of caring and passion for the natural and human world that are passed on and flow through many communities in ways perhaps unimaginable to this tired and happy group of newfound desert lovers.

MeadoWatch: A Case Study of the Challenges and Opportunities of Citizen Science in High Mountain Spaces

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High Mountain Ecosystems: A Conservation Challenge

A challenge to conserving high mountain ecosystems is a lack of awareness of the dramatic impacts climate change will have on these places. There is scientific consensus that ongoing climate change has caused glaciers to retreat (Field et al. 2014), treelines to advance (Harsch et al. 2009), and the timing of the alpine wildflower season to shift earlier (Parmesan 2006)—all with potentially large biological impacts on alpine ecosystems. Any efforts to slow future rates of climate change through emission reduction or to mitigate the negative impacts of climate change on high mountain biodiversity require the support of a sufficiently concerned and scientifically literate public that both cares about these systems and fully appreciates the impacts. Unfortunately, the politicization of climate change issues, the distance of an increasingly urban population from high mountain places, and variation in science education are potential barriers to gaining the support of the general public for conservation measures around climate change. Additionally, the historic exclusion of underrepresented minorities from both scientific fields and outdoor recreation is a particular challenge to engaging a diversity of viewpoints in the conservation of high mountain spaces.

MeadoWatch: A Citizen Science Program in Mt. Rainier National Park

Citizen science programs are one potential approach to increasing scientific literacy and an understanding of climate change impacts, because they have both a scientific as well as an outreach component (Theobald et al. 2015). Citizen science programs have a core scientific question that motivates data collection, but instead of scientists, members of the general public are involved in the collection and/or processing of the data needed to address this question. In the process, participants gain a greater understanding of the science underlying the topic being studied. Therefore, a citizen science program that addresses climate change impacts and involves data collection in the high mountains could simultaneously increase participants understanding of and concern for climate change impacts on high mountain places.

It was exactly this possibility that led us in 2013 to launch MeadoWatch (www.meadowatch.org), a citizen science program that takes place on the mountain traditionally known by native peoples as Tahoma, in Mount Rainier National Park, Washington (Wilson et al. 2017). Our scientific goal in setting up MeadoWatch was to better understand the relationship between snowmelt and alpine wildflower phenology (the timing of flowering and seed production). Although many other studies have demonstrated a strong link between climate and

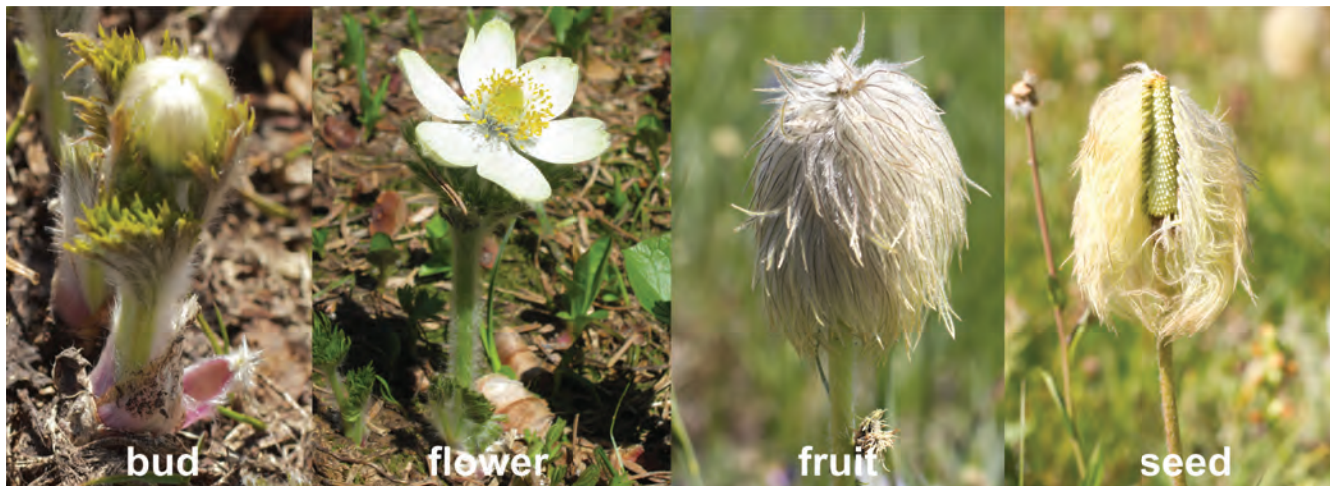


Figure 1. The four stages of wildflower phenology that MeadoWatch volunteers monitor for *Anemone occidentalis* (Western Anemone). Volunteers collect data on 16 focal wildflower species, noting whether these four phenological phases are present or absent at each plot in which these species occur. Photos: Natasha Lozanoff.

flowering phenology (Parmesan 2006), none that we were aware of focused on alpine wildflowers in the high mountains of the Cascades. At the same time, we wanted to engage a diversity of volunteers in the collection of scientific data relevant to one of the many potential impacts that climate change could have on the wildflower meadows of this iconic Washington mountain.

MeadoWatch volunteers collect data along two trails in the Park (Wilson et al. 2017), which cover a large elevational range and are located in climatically distinct portions of the park. Volunteers are required to attend a 3-hour orientation session prior to the summer season, and are provided with informational pamphlets to take in the field with them (with detailed information on how to locate plots and identify focal species). Volunteers hike along one of the ~7 mile trails one to three times each summer season, stopping at predetermined locations along the trail ('plots') to observe four wildflower phenology phases. Volunteers note the presence or absence of four phenological phases (budding, flowering, fruiting, and dispersing seed) of sixteen focal wildflower species (Fig. 1). We are fortunate that Mount Rainier National Park provides our volunteers free entry to the Park as well as up to two nights of free camping to facilitate their data collection efforts.

MeadoWatch Successes & Challenges

The MeadoWatch program has led to many insights that would not have been possible without the extensive data volunteers collect. For example, MeadoWatch data demonstrates that alpine wildflower phenology is strongly linked to the timing of snowmelt, with years and locations with earlier snowmelt leading to earlier emergence of buds, flowering, fruit maturation and seed dispersal (Fig. 2). We have also found that most focal

plant species need the entire snowfree growing season to go from flowering to seed dispersal, suggesting that the growing season constrains plant reproduction in these alpine ecosystems. An unusually warm year with record low snowpack in 2015 demonstrated that future warming could shift the wildflower bloom season into late May/early June (Fig. 2), fundamentally

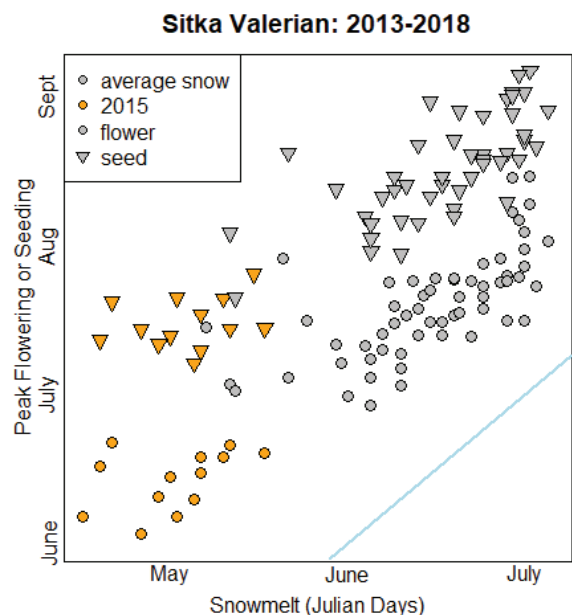


Figure 2. The relationship between snowmelt date and the timing of peak flowering (circles) and seeding (triangles) for *Valeriana sitchensis* (Sitka valerian) between 2013 and 2018. Each circle or triangle represents data collected from one plot in one year, with grey circles and triangles representing average snowmelt years and orange circles and triangles collected in 2015, a historically low snowmelt year. The blue line represents the date of snowmelt.

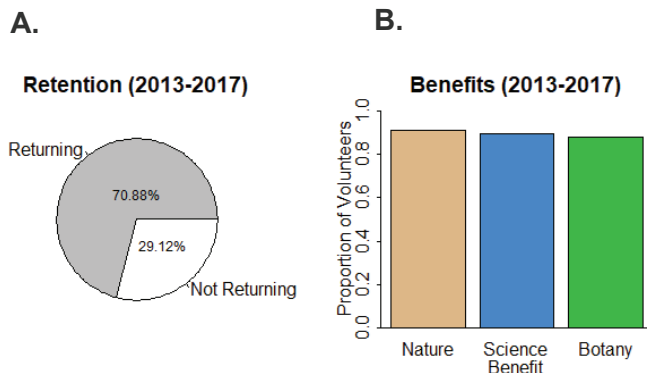


Figure 3. MeadoWatch retention of volunteers (A) and self-reported benefits gained from participating in MeadoWatch (B). For A, we used our own records to determine the proportion of volunteers (between 2013 and 2017) who returned for at least one additional year of volunteering. For B, we conducted an anonymous survey of MeadoWatch volunteers in 2017, where we asked volunteers to tell us what benefits they received from MeadoWatch (volunteers were allowed to select more than one benefit). Of the 64 volunteers who responded, nearly an equivalent number of volunteers indicated ‘Enjoying Nature’ (brown) as ‘Collecting Data for Scientific Research’ (blue) and / or ‘Learning about Botany / Plants’ as a benefit of the MeadoWatch program.

altering the ability of visitors to the park to access iconic wildflower blooms during the summer (Breckheimer et al. In press).

MeadoWatch has also been successful in its second goal of volunteer engagement. For example, since 2013, over 400 volunteers have collectively hiked more than 4,000 miles to collect > 47,000 observations of the presence or absence of flower buds, open flowers, maturing fruits, and dispersing seeds. The program has grown from 41 volunteers collecting data at 9 plots to over 130 volunteers (in 2018) who collected data along two trails and 28 plots. MeadoWatch has also reached non-scientific audiences by being featured in several news outlets (e.g. WTA magazine, High Country News), as well as being the subject of several popular science talks to interested Seattle groups (e.g. the Mountaineers, the Washington Native Plant Society). A mark of our success is that more than 70% of volunteers in any given year return to collect data for us again the following year (Fig. 3A). Additionally, our volunteers report that MeadoWatch has helped them learn more about scientific data collection and about plants (Fig 3B). Many MeadoWatchers also report a sense of motivation or pride at contributing scientific knowledge on the potential impacts of climate change to a place that they love.

MeadoWatch has undoubtedly been successful in generating high quality scientific data and engaging volunteers (Fig. 1, Fig. 2, Fig. 3). However, we have not entirely met our goal of engaging the broad and diverse populations that represent this country (Fig. 4). MeadoWatch volunteers tend to be older and a large proportion

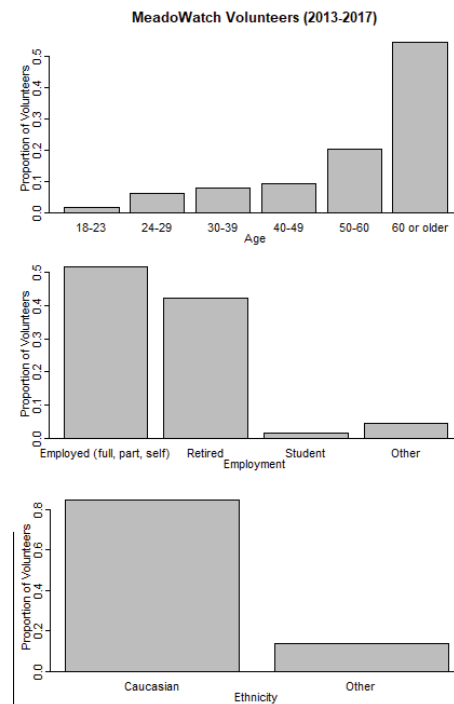


Figure 4. Demographic makeup of MeadoWatch in 2017 (of 64 survey respondents), according to self-reported age (A), employment (B), and ethnicity (C).

are retired, a likely reflection of the socio-economic barriers and a lack of leisure time that prevent some from participating in MeadoWatch, and more generally, from regularly visiting National Parks (Scott and Lee 2018). MeadoWatch volunteers are predominantly Caucasian, and 66% of our non-Caucasian MeadoWatch volunteers reported not feeling well represented in outdoor spaces. These latter patterns match those found in other National Parks (Root 2017), and reflect the difficulties many have faced in making environmentalism, conservation, mountain science, and outdoor recreation more inclusive (Root 2017). The causes, we believe, are at least partly rooted in an exclusionary past that arises from an often ignored and sometimes-uncomfortable history. We briefly highlight this history to spark a discussion on how to achieve transformative change.

Environmentalism and Outdoor Spaces: A History of Exclusion

“Everything in U.S. history is about the land—who oversaw and cultivated it, fished its waters, maintained its wildlife; who invaded and stole it; how it became a commodity broken into pieces to be bought and sold on the market.” (Dunbar-Ortiz 2014).

A parallel can be drawn to outdoor spaces by asking: who was at the forefront of the conservation and ownership of these

spaces? The original corps of conversation reformers and environmentalists in the United States include men like Theodore Roosevelt, Madison Grant, Gifford Pinchot, and John Muir. They bear much of the responsibility for the conservation of public lands and the creation of National Parks and National Forests. Despite their positive role in the creation of the systems of public land access that so many of us enjoy, these men also had a more troublesome influence on environmentalism, conservation, and public policy (Purdy 2015).

For example, Madison Grant, one of the creators of the Bronx Zoo, and founder of the first organizations dedicated to preserving American bison and the California redwoods, published the book titled “The Passing of the Great Race, or The Racial Basis of European History” in 1916. His work influenced the Immigration Act of 1924 (which restricted immigration from anywhere besides Nordic/Northwestern European countries; Purdy 2015). Similarly, when John Muir reported on a thousand-mile walk from Kentucky to the Gulf of Mexico he wrote: “the negroes are easy-going and merry, making a great deal of noise and doing little work. One energetic white man, working with a will, would easily pick as much cotton as half a dozen Sambos and Sallies” (Chopra 2017). In a similar vein, John Muir wrote in “Our National Parks,” a 1901 essay collection written to promote parks tourism, that: “As to Indians, most of them are dead or civilized into useless innocence” (Chopra 2017).

Some might argue that the beliefs held by these men were simply reflective of the times and thus should be taken with a grain of salt. While true, these views do not solely reside in the past. These attitudes are also evident in much more recent times. For example, when a Boston University professor named Harold DeWolf in 1960 asked an innkeeper at a Canadian National Park whether his two African American guests (a minister and his wife) would be welcomed, the innkeeper responded: “A great many [guests] are from the New England states, as well as those from farther South. For this reason we feel it would be better not to accommodate your friends.” As it turns out, Harold DeWolf’s friends were none other than Martin Luther King, Jr. and his wife Coretta Scott King (CBC News). This was likely not an isolated incident, as people of color were barred from many American National Parks until 1964 and the passage of Civil Rights Act.

Today, there are still many barriers for people of color in experiencing high mountain spaces. Socio-economic forces and a lack of leisure time (which often represent greater constraints for people of color) are important (Scott and Lee 2018), but a lack of representation, cultural factors, and discrimination also still play a role. A 2014 study found that less than 12% of leadership positions in environmental organizations are held by ethnic minorities (Taylor 2014). Advertisements and

promotional materials often strongly convey the message that outdoor spaces are exclusively for and primarily enjoyed by white people. Organizations like Outdoor Afro and Latino Outdoors are clear evidence that people of color have great interest in the outdoors and environmentalism. However, these intentional communities and organizations were created because many do not feel welcome or even safe within the mainstream environmental, conservation, and outdoor recreation structure. Many organizations like MeadoWatch and the National Park Service (Root 2017, Scotty and Lee 2018) are beginning to inspect themselves with the critical lenses of equity, diversity, and inclusion, and although progress has been made, there is much left to do.

Lessons for Diversity, Equity, and Inclusion in High Mountain Spaces

We believe that the success of MeadoWatch lies in that it challenges the notions of what a scientist looks like, what science is, and promotes a love of and concern for high mountain spaces. At the same time, our progress should not prevent us from acknowledging how a history of exclusion continues to create barriers; it should inspire us to dismantle them. For example, the following are efforts we in MeadoWatch are taking to make the enjoyment of high mountain spaces a benefit for all, and as a consequence, we hope a conservation priority for all as well.

- Removing socio-economic barriers to participating in outdoor activities (Scott and Lee 2018). MeadoWatch is able to provide free entrance and camping to Mt. Rainier National Park through our partnership with the National Park Service. We are exploring the possibility of setting up an online rideshare board to allow those without cars to participate in our program.
- Reminding those with power and privilege of how America’s history of exclusion prevent many people of color from enjoying outdoor spaces. For example, during orientations and on our website we acknowledge that Tahoma, which is today contained within the National Park our program works in, was home to many indigenous tribes prior to its designation as a protected area in 1895.
- Recruiting (and retaining) those with diverse backgrounds, ethnicities, and ages to science and outdoor programs in high mountain spaces. For example, MeadoWatch is now advertising its program to outdoor organizations like Outdoor Afro and Latino Outdoors. Similarly, we are exploring the possibility of working with the Education and Outreach Division of Mt. Rainier National Park to develop data collection activities appropriate to families with children visiting the park.

In the wise words of the late Kwame Nkrumah (first prime minister and president of Ghana) “Action without thought is empty. Thought without action is blind.” We take this to mean – that if we want to increase the human diversity within high mountain spaces we must think about our actions (past and present). At the same time, we also must act to increase human diversity within mountain spaces.

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GLORIA Great Basin: Monitoring Long-Term Alpine Plant Community Response to Global Change

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Montane systems are known heralds of shifting species distributions in response to changing climate, especially since warming has been especially pronounced at higher elevations (Bertrand et al. 2011, Körner 2012, Pepin et al. 2015). Alpine ecosystems share many key characteristics (cold temperatures, snow, and plant communities dominated by slow-growing, short-statured species) making comparisons possible among alpine regions worldwide (Körner 2003). Realizing the need and ability to assess long-term changes in mountaintop plant communities, in 2001 the Research and Technological Development Framework Programme of the European Union created an international collaboration and protocol. This group, called the Global Observation Research Initiative in Alpine Environments (GLORIA), provides a cost-effective, universal protocol and a unifying investigative community to examine how mountaintop plant communities and associated biota have changed through time and the spatial patterning in the rate and magnitude of that change at local, regional, and global scales (Grabherr et al. 2010). It is a tremendous effort with over 100 alpine areas in the global network, spanning every continent on earth but Antarctica. More information on the project overall can be found at <https://www.gloria.ac.at/>.

The non-profit organization GLORIA Great Basin (<https://www.gloriagreatbasin.org>) leads the effort at eight of these target regions in eastern California and Nevada with 3-4 peaks per target region. In collaboration with the National Park Service and the US Forest Service, GLORIA Great Basin coordinates the field survey work and data management in the Sierra Nevada

and Great Basin including sites in the Sweetwater Mountains, CA; Great Basin National Park, Snake Range, NV; Dunderberg Peak area, Sierra Nevada, CA; Langley Peak area, Sierra Nevada, CA; Death Valley National Park, Panamint Range, CA; the Carson Range, CA; and the White Mountains, CA (Fig. 1). GLORIA Great Basin monitors each of 29 peaks on a rotating basis every five years. With our first surveys starting in 2004, we are preparing for our 4th survey, spanning 15 years for some of the regions. In addition to these surveys, GLORIA Great Basin resurveys a series of downslope transects on five peaks in the CA White Mountains to examine larger-scale plant species dynamics. These transects allow us to examine what species may be moving onto the peaks in the future from lower elevations. Our first publication on this data will be coming out in 2019 and includes some interesting findings of how species turnover along an elevation gradient is scale-dependent and that warming-induced species range shifts are not likely to be moderated by small-scale habitat and microclimatic conditions.

GLORIA Great Basin is committed to continuing these resurveys into the future and to analyzing the resurvey data to understand how alpine plant community responses vary spatially and temporally. Recent studies, including those using data from the international GLORIA community, have found that species richness has increased with warming (Steinbauer et al. 2018). However, there is some evidence that this pattern may be muted or even reversed in water-limited alpine systems (Pauli et al. 2012), the kind of climate that make up many Great Basin mountain ranges. This increase in richness with warming has

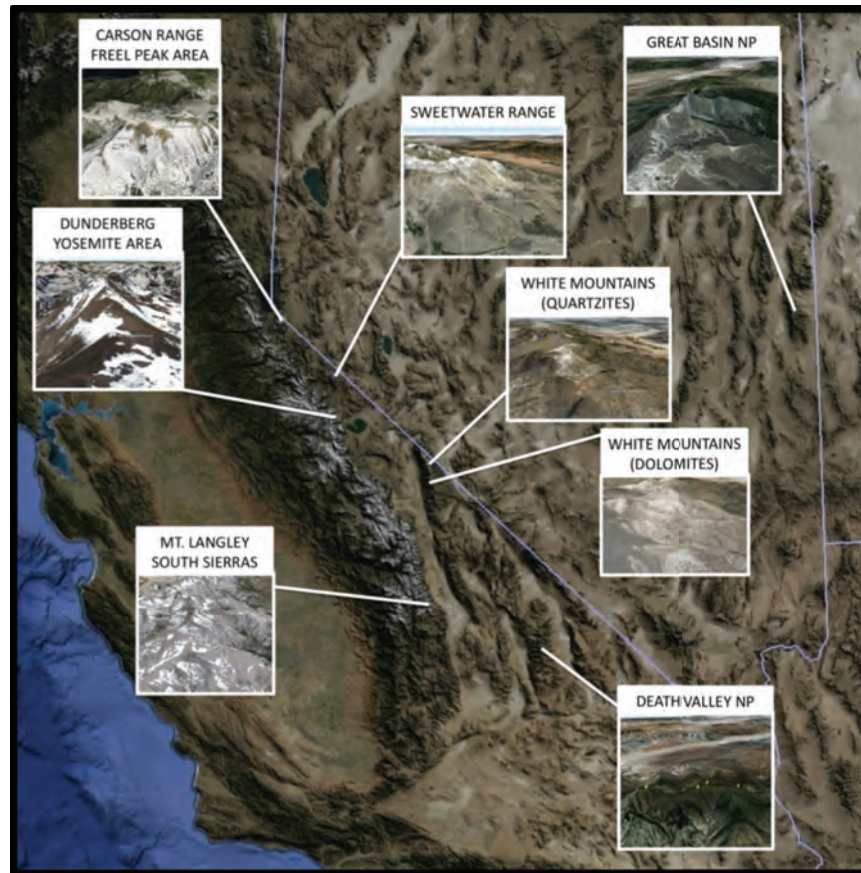


Figure 1. Map of study regions across the Great Basin region.

been hypothesized to be driven by more warm-adapted low elevation or sub-alpine species moving upslope, as well as a lag in the competitive exclusion of obligate alpine species (Lamprecht et al. 2018). Armed with 15 years of data, we are eagerly anticipating finally examining the temporal dynamics of our peaks.

While the international GLORIA protocol was developed with ecological study in the forefront, after 15 years in North America, there have been unexpected benefits that transcend the boundaries of a purely scientific endeavor. These benefits can largely be summed up by the word “community” that has developed over the years. GLORIA Great Basin is a shoestring operation that has only succeeded because of the herculean efforts of volunteers. While the earliest GLORIA volunteers included the current leadership stalwarts of Jim and Catie Bishop, Connie Millar, and Jan Nachlinger, the majority of GLORIA participants have been a rotating cast of agency personnel and citizen scientists. Our survey crews have included high school students to full professors and every kind of student in between. The diversity of education level, world-view, station in life, and experience, botanical, alpine, or otherwise, has been something of a marvel,

representing a rarity in our current age of polarization. We have participants who come once and have a great time contributing to this important data set, but mostly we have participants who become lifers and come back year after year.



Figure 2. GLORIA participants surveying Bald Mountain in Great Basin National Park in 2018.



Figure 3. *Eremogone congesta* var. *wheelerensis* on Wheeler Peak in Great Basin National Park.

Like any good ecological result, the GLORIA community also has scale-dependent features. The GLORIA target regions of North America are in the early stages of coordinating across North America to examine continental trends in GLORIA data including target regions from Alaska, British Columbia, Quebec, the Appalachians, and across the Intermountain West. This effort is bringing together researchers from all over North America in academia, government, NGOs, and citizen groups to look at how climate change is affecting our mountains' biota continent-wide. While parts of North America share some climatic similarities with European sites, some North American

target regions have unique climatic conditions that may show unique plant community responses to climate change. Such a continental examination is exciting in its ability to explore how our mountains are responding compared with the other GLORIA target regions globally.

This brings us to the final scale at which the GLORIA community operates. Since the GLORIA protocol is consistent and cost-effective, it is being used in scientifically underrepresented developing countries in ecology and in understudied regions such as Greenland, Nepal, Bhutan, Iran, Tajikistan, Chile, and all of the Andean countries in addition to its use in western Europe, North America, and China. The GLORIA international community is increasing ethnic and economic global diversity in ecological research, which is a stated, but often elusive, goal. The network of more than 100 global GLORIA sites that are run by local researchers are an opportunity for international collaboration among groups of scientists who rarely get this chance to interact in meaningful ways.

GLORIA Great Basin will be surveying in the California White Mountains and in the eastern Sierra this year. If you are interested in getting involved or contributing to this important work, please visit our website at <https://www.gloriagreatbasin.org> or contact us at: gloriagreatbasin@gmail.com.



Figure 4. GLORIA participants on White Mountain Peak in the California White Mountains in 2017.

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Figure 5. GLORIA participants in the California White Mountains in 2017.

I am re-posting this article from the Spring 2017 issue of Mountain Views Chronicles for its relevance to the current issue's theme of diversity. —Editor

Stupid Rock: Overcoming Obstacles to Women in Science

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Toni Lyn Morelli is a Research Ecologist with the USGS Northeast Climate Adaptation Science Center with interests in doing her small part to make the world a better place.

Monica recently defended her dissertation in the Department of Environmental Conservation at the University of Massachusetts, where I'm an Adjunct Assistant Professor. She told of her experience, typical of a graduate student in our field of science: long hours, lots of tedious work in unpleasant field conditions, failed methods, eventual victorious revelations. But this particular dissertation stood out in that it was efficient (she got her degree in less than 4 years), impactful (she was able to identify clear recommendations to deal with a tree pest), and scientifically noteworthy. In fact, she had an insect species named after her—not bad for a 20-something student. Monica shared the story of how eminent entomologists (yes, older males, at the risk of supporting your confirmation bias, URL-1; URLs are listed at the end of the article) repeatedly disregarded her assertion

that she had evidence of a new species. Instead of giving up, Monica redoubled her efforts until she had so much evidence—ecological, morphological, and genomic—that she could no longer be denied. And so, in the end, the species was named after her.

What I love about this story, aside from its victory for the scientific process, is how so many of the obstacles that are put between young women and long-term science careers were met, and conquered, by Monica. In the beginning of her life, and mine I guess, though I certainly have no memory of it, we were subtly steered away from math and science (not to mention tools and physical activities). Social science research from Nilanjana Dasgupta (URL-2) shows that girls are just as or even more likely to do well in math until puberty, when grades start to diverge. A large latitudinal study (URL-3) found that teachers consistently rate girls' mathematical proficiency lower than that of boys with similar achievement and learning behaviors. Once they get to college, the increasing lack of mentors and peers increasingly undermines confidence. How did a young woman like Monica have the gall to stand up against the scientific establishment,



The author, Toni Lyn Morelli.

Dr. Kay Holekamp (Michigan State University) leads one of the world's longest-running field behavioral research studies. The opportunity that Kay gave me as an undergraduate to study spotted hyenas in the Maasai Mara of Kenya changed the trajectory of my career.



Ph.D. advisor Patricia Wright (Stony Brook University) studies lemur behavior and conservation and helped establish one of Madagascar's first national parks.

against older male professionals, given all of the subtle, and not so subtle, cues she had undoubtedly picked up in her life? How did she even manage to make it to that stage in the first place?

I have to admit, I don't want the answer to be that Monica is remarkable. I hope the reason is that things are changing, that a woman coming up in science won't face the consistent bias that has kept our numbers so low for so long. Certainly the proportion of women in science at the undergraduate level is increasing and, in some fields, is outpacing men.

But I have a nagging worry. Because I look back at myself in my 20s and I was Monica. Well, perhaps not as brilliant, but certainly as driven, and totally unaware of breaking or beating convention by pursuing a graduate degree, and then a postdoctoral fellowship, in STEM. I look back and see that nearly all of my peers in the science college I attended at Michigan State University were male; that my most problematic supervisors were male. Part of that could be chalked up to my personality, since I tend to be fairly unaware of others' opinions. But we know from recent research (URL-4) that identical resumes will be considered less impressive just by replacing the name John with Jennifer (or John or Jamaal, for that matter; URL-5). And that women still get promoted less (URL-6). And none of this gets into the more serious threats that women face in the workplace, including sexual harassment (URL-7).

I'm the youngest of my parents' three kids, all daughters. My parents thought I was going to be a boy, and already had the name Tony picked out for me when, surprise, I wasn't. With 3 girls to deal with, my fairly traditional dad had no choice but to play sports with us, and I grew up chasing rabbits in the backyard instead of taking dance class. I also went to an all-girls high school, and I often wonder how that might have affected my trajectory; at that key developmental time, there were fewer opportunities for me to be told that boys were better in math and science. Perhaps most importantly, I had key female mentors all throughout my education, strong women who believed in me and showed me by example that women could accomplish great things as professionals in science, something that Dasgupta and others have shown is key to retention of women in science. I'd like to think that I would still be a scientist even if I had a brother. But I wonder...

The latest investigations into the "leaky pipeline" of female attrition out of the sciences, of which there are many (URL-8), indicate that something is happening between graduate school and tenure (or permanent research scientist positions). One of these things, for many of us, is motherhood. The unrelenting time pressures of professional science careers can be especially challenging for parents, and mothers in particular. Even beyond the time to get through potentially debilitating pregnancy and childbirth and time-consuming lactation (which for me involved pumping in a random unlockable conference room, hoping each time that students wouldn't burst through the door), women are often responsible for more of the work at home. In American households where both spouses work full time and have children



Toni Lyn's recent supervisor, USGS Biologist and Northeast Climate Science Center Director Mary Ratnaswamy, pictured here at Biosphere 2 at the base of the Santa Catalina Mountains in Arizona.

under age 18, women spend 46% more time with childcare, eldercare, and housework while men work 18% longer hours (according to 2011-2015 averaged data from the Bureau of Labor Statistics; URL-9). Studies show that married women with children are 35% less likely to enter tenure track positions after receiving a Ph.D. in science than men of the same circumstances (URL-10). Women with children are 27% less likely to achieve tenure than men with children. Moreover, women with children are 28% less likely to achieve tenure than women without children.

Personally, I was oblivious to the experience of most of these statistics in my 20s. But as I got farther along as a scientist, undergrad to grad school to postdoc to 2nd postdoc (2nd postdoc is the new PhD, ha ha!), more of my friends were dropping out. And most of my female friends did. One day I woke up and I had a 2-year-old and a great science career but nearly all of my career scientist peers were male. Even more striking is that among parents I know, with few exceptions, the dads are the tenure track professors and research scientists.

There are names for all of the terms that chip away at the proportion of women in STEM along the career path. Confirmation bias affects all minorities, causing us to include and exclude people based on stereotypes. Another is stereotype threat (URL-11)—the idea that if you are a rare “token” example of something you feel a lot of pressure to do things well. The feeling can be so overwhelming that it can cause a person not to even try. I heard a joke recently that perhaps we can all relate to on some level, but in this case I’ll relate it in terms of gender dynamics:

a man and a woman, sitting around bored, each throw a pebble into a can. The woman misses and is immediately embarrassed, thinking stupid her, what was she thinking, why even try, what will everyone think of her and, by extension, the throwing ability of every woman. Her male companion takes a shot at the can, and his pebble misses too. He just thinks, stupid rock.

Establishing a career in science is extremely difficult, and seems to be getting more competitive each year. It takes an incredible combination of motivation, intelligence, creativity, humility, and luck. On top of that, if we are causing certain groups of people—women, people of color, LGBTQ+ persons—to have to overcome extra obstacles, achieve more accomplishments, and surmount additional skepticism, we will continue to be less diverse in the sciences than in society, something research shows will hurt our productivity, outcomes, and achievements (URL 12). On top of that, many women in the critical point in their career have to fight societal expectations of how they should be choosing to spend more time as mothers than at work.

In the end, I circle back to Monica, her accomplishments, and her tenacity. I’m not sure if she is a sign of a better, more equal future on our horizon, or a shining exception to the rule. I just know we’ll all be better off with more scientists like her.

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4. <https://www.pnas.org/content/109/41/16474.abstract>
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Morelli and our very own Connie Millar in Washington D.C. Connie catalyzed my work on climate adaptation.

BREVIA

Considering Diverse Knowledge Systems in Forest Landscape Restoration

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Lake, F.K., Giardina, C., Parrotta, J.A., and Davidson-Hunt, I. 2018. *Considering diverse knowledge systems in forest landscape restoration-Chapter 3. In: Forest Landscape Restoration: Integrated Approaches to Support Effective Implementation. S. Mansourian and J. Parrotta (eds), Routledge Press:37-46, ISBN: 978-1-315-11187-2 (ebk).*

Abstract

Forest Landscape Restoration (FLR) is a planned process that aims to regain socio-cultural and ecological integrity to enhance human well-being and ecological processes in deforested or degraded landscapes. FLR demonstrates the value of an integrated and interdisciplinary approach to assist the recovery of landscapes and inclusive of socio-ecological systems. The consideration of diverse knowledge systems in FLR embraces many aspects of knowing the landscape, including Traditional or Indigenous Knowledge and Western or International Knowledge systems. Knowledge systems represent much more than repositories of timeless information useful to today's researchers, managers, and restorationists. These knowledge systems reflect relationships with ecological processes and landscapes that are intricately coupled human and natural systems, and, for indigenous peoples, that have evolved through intergenerational and community-based stewardship of natural resources. Effective and equitable strategies for integrating multiple knowledge systems in the context of FLR necessarily involve:

(i) respectful engagement of the holders of complementary but sometimes conflicting knowledge systems; (ii) identification of legacy drivers of degradation so as to be able to mitigate threats while decolonizing current approaches to FLR that can hinder effective communication and can prevent cross-sectoral policy coordination and governance; (iii) integrating the broadly collaborative processes that often define landscape management approaches within other knowledge or management systems; and so (iv) creating processes that facilitate opening up of western, agency-driven models of governance to allow more collaborative and community-based approaches for real engagement on landscapes.

Implications-Traditional Knowledge and its relationship to Western Knowledge

Long before the introduction of 'scientific' forest management (in Europe) in the early 19th century and its subsequent global expansion for timber resource management (and more generally to strengthen colonial government or state control over land resources), local, often indigenous communities throughout the world managed forested landscapes relying on complex, place-based and multi-generational knowledge systems with the goal of sustaining resident communities and future generations. The knowledge, innovations, and practices of these communities evolved through detailed scientific observations and cause-effect management experiences integrated across generations. On the scale of centuries, these community-based, intergenerational stewardship systems sought to create abundance in resources that were deemed critical to community survival and livelihoods, and that were resilient and adaptive to changing environmental, economic, political and social conditions. These include, for example, indigenous cultural fire regimes, agroforestry practices, traditional forms of watershed management, and stewardship of sacred or highly valued landscape areas. In altering the composition, structure, function, and dynamics of forests at

landscape scales these traditional systems purposely altered ecological processes, enhanced the abundance of desired higher valued species, as well as the loss or reduction of some species and the extent of different ecosystem types. If Forest Landscape Restoration aims towards living sustainably with landscapes and restoring degraded socio-ecological systems, then integrating lessons of Traditional and Western Knowledge systems can inform this effort (see Mansourian and Parrotta 2018).

The diverse knowledge systems that are embedded in the cultural traditions of regional, indigenous, or local communities are referred to using different terms, including Traditional Knowledge, Local Knowledge, Traditional Ecological Knowledge, Indigenous Knowledge, and Indigenous Science. Traditional Knowledge is defined by the Convention on Biological Diversity as: ... “the knowledge, innovations and practices of indigenous and local communities around the world, developed from experience gained over the centuries and adapted to the local culture and environment.” Traditional Knowledge is considered in relation to Western Knowledge (also called modern science, Western Science or international science), i.e., knowledge typically generated in universities, research institutions, and private firms following paradigms and methods associated with the ‘scientific method’ consolidated in Post-Renaissance Europe on the basis of wider and more ancient roots, usually transmitted through scientific journals, scholarly books, and now internet/web based platforms, with its central tenets being observer independence, replicable findings, systematic skepticism, and transparent research methodologies with standard units and categories.

Traditional Knowledge is transmitted through active mentorship of younger generations, and codified orally to facilitate transmission of knowledge and associated cultural practices between generations. This oral transmission of knowledge in the case of indigenous communities takes diverse forms including creation accounts, place names linked to socio-ecological grounded stories, traditional law teachings associated with subsistence and ceremonial activities, all of which would be transferred through direct training of youth by elders, or among resource practitioners. Such knowledge systems are strengthened by and embodied in local languages, cultural values, beliefs, rituals, stewardship practices, community laws, and governance systems. The resulting observational, place-based scientific knowledge underlies a diverse array of natural resource management and indigenous stewardship practices that sustain these communities’ food and water security, health, cultural traditions, and livelihoods. There are important challenges associated with, and requirements for, integration of Traditional and Western Knowledge systems. Western Knowledge systems often provide a more mechanistic and biophysically technical

form of knowledge, whereas Traditional Knowledge systems are more inclusive of holistic and metaphysical aspects. A challenge can arise when knowledge systems are pitted against each other as what is “the best science” versus being considered complementary to enriching the collective way of knowing the landscape, or reflecting different value systems across the landscape. While both Traditional Knowledge and Western Knowledge systems rely on science to understand and manage resources, they differ in philosophies, environmental, and stewardship approaches (Table 1).

These important differences between Traditional and Western Knowledge systems start with the underlying culturally-determined values, norms, and beliefs that influence people’s perceptions and the concepts shaping their worldviews and with their relationships to the land. Embodied in many indigenous teachings are lessons that guide humans on how to be able to “live with their relations,” of which include geological (soils/landscape), biological (fungi, plants and animals), and eco-hydrological elements or processes (i.e., fire, weather, flooding, earth quakes, etc.), inclusive of all the biophysical and spiritual features contained within a landscape of interest. Because Traditional Knowledge systems are often place-based, they display a high degree of variation across different landscapes and forest or mountain ecosystems. The content of such knowledge fundamentally reflects integration of locally observed and codified information on a place’s ecological condition and history, as well as the social, economic, and cultural characteristics of the communities that have accumulated this knowledge. These systems and associated social institutions are important components of the social capital of traditional societies with important implications for forest landscape restoration, including adaptation to environmental change and climatic disruptions.

Closing Thoughts

There is increasing recognition of the need to consider both social systems and ecological systems together, in what is termed “social-ecological systems.” In many mountainous regions, there is a need to integrate Traditional Knowledge and Western Knowledge in research, management, and for environmental conservation and restoration of landscapes. In practice, this means understanding the former legacy of, or current desires for, indigenous landscape forest management, while respectfully challenging current scientific methods, approaches, and beliefs about socio-economic institutions of forest or mountain dependent cultures. It requires adopting new understandings of the landscapes in question and its stakeholders, and adopting or designing new tools that can align application for both sets of knowledge systems.

	Element of Comparison:	Traditional Knowledge:	Western Knowledge:
Philosophy	Human & Resources environmental hierarchy	Kincentric: Humans and nature viewed as an extended family with shared ancestry and origins, often honored through ritual, and a central focus of management attention.	Anthropocentric: Humans considered above all resources, where living and non-living are largely viewed through a utilitarian lens, i.e., their capacity to provide ecosystem services.
Philosophy	Knowledge transfer: Teaching and gathering information	Transmitted across generations as oral traditions and cultural practices on landscape for specific habitats and resources.	Transmitted primarily through print and electronic media, in multi-disciplinary academic and professional settings.
Philosophy	Data and knowledge acquisition	Information used for cultural purposes to support community wellbeing and security, use value-based condition assessments.	Information used for natural capital management, resources studied/analyzed, data cataloged, fact-based to assess landscape and resource condition.
Environment	Environmental phenomena	Biophysical explanations are complemented by meta-physical explanations for observed phenomena to most and extreme events.	Biophysical explanations of environmental phenomenon. Natural range of variation concept applied as explanations to extreme or unusual events.
Environment	Resolution or accuracy of data	Quantitative and qualitative: Assessments determined by past and current cultural use to predict future conditions or amounts. Patterns are anticipated based on complex phenological indicators and past experiences. Local focus.	Quantitative and qualitative: Assessments by field data, modeling, analysis, and trends predicted. Patterns are anticipated based on complex data collecting methods and incorporation into simulation models. Local to global focus.
Environment	Use of reference ecosystems to guide FLR restoration and management actions.	Renewal: Human services to ecosystems. Past Social-Ecological Systems, where appropriate, guide current and future actions. Fewer technological fixes as solutions.	Recovery: Ecosystem services to humans. Past biophysical conditions or novel ecosystems. Reliance on technological solutions, regulatory compliance, to control environment and influence landscape processes.
Stewardship	Values or obligation to environment	Socio-cultural and spiritual responsibility to landscape. Management is self-regulated via cultural norms. Negative impacts to valued resources are avoided, adhering to beliefs and tenets.	Social and economic responsibility to private and public stakeholders. Negative impacts to valued resources are spatially and temporally mitigable through existing policies, governance institutions and management practices.
Stewardship	Environmental management	Ethic-based: Holistic stewardship a spiritual obligation and sacred responsibility for resource use. Humans necessary part of landscape.	Socioeconomic-based: driven by policies, markets, laws and/or regulations. Sustainability based on thresholds of resource use. Humans not necessarily an integral part of landscape.
Stewardship	Adaptive Learning/Principles	Learned from ancestral teachings (passed on knowledge), observation and direct experiences with landscapes, habitats and resources. Corrective actions to human uses to benefit resources.	Field observations, scientific literature inform conceptual theories and principles taught and applied to management of habitats and other biophysical resources. Corrective actions on resource use to benefit humans.

Table 1. Traditional and Western Knowledge approaches pertaining to forest landscape restoration.

For additional related work for this subject see: Lake, F.K., Parrotta, J.A., Giardina, C., Davidson-Hunt, I., and Upreti, Y. 2018. Integration of Traditional and Western Knowledge in forest landscape restoration-Chapter 12 In: Forest Landscape Restoration: Integrated Approaches to Support Effective Implementation. S. Mansourian and J. Parrotta (eds), Routledge Press:198-226, ISBN: 978-1-315-11187-2 (ebk).

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Forecasting Tree Mortality in California Forests

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Haiganoush Krikorian Preisler has been working as a statistical scientist with the US Forest Service, PSW Research Station, since her graduation from the Department of Statistics, UC Berkeley about 40 years ago. Her work focuses on the development of mechanistic statistical models for assessing and forecasting effects of anthropogenic and climatic factors on wildland forests and the surrounding urban interface.



Zachary Heath works with the US Forest Service as a GIS analyst. Formerly he was Program Manager for the Forest Health Aerial Survey Program, and has interests in landscape-scale forest health monitoring and assessment.



Nancy Grulke is Director of the Western Wildlands Environmental Threats Assessment Center, with research interests in abiotic and biotic stressors on pines and oaks.

Preisler, H. K., Grulke, N. E., Heath, Z., Smith, and Sheri L. 2017. Analysis and out-year forecast of beetle, borer, and drought-induced tree mortality in California. *Forest Ecology and Management* 399:166–178.

For the past three years we have been producing maps showing locations and amounts of tree mortality to be expected in California forests in an upcoming year due to bark beetle and wood borer outbreaks¹. Unique to these maps are measures of uncertainties that accompany each prediction (Fig. 1). Other forest risk assessment maps (e.g., Krist et al. 2010), while providing extremely useful information regarding locations of

trees at risk, are mostly qualitative² with no indication of the amounts of variability or the precisions of these risk forecasts.

Tree mortality in California has been of concern, in particular in the past decade where approximately 129 million trees have died from 2010–2017. This standing fuel (Fig. 2) is a fire risk that could threaten human lives, property, water supplies, wildlife habitat, and other forest resources.

Our yearly forecasts are anticipated to provide forest managers with an early warning of where and how much tree mortality to expect in the near future. Managers can then plan and prioritize

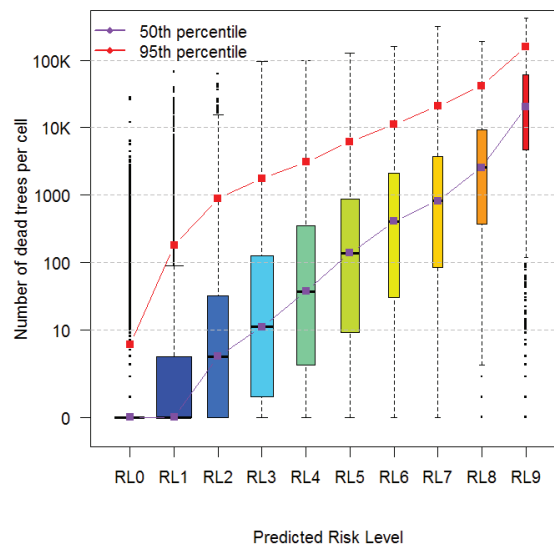
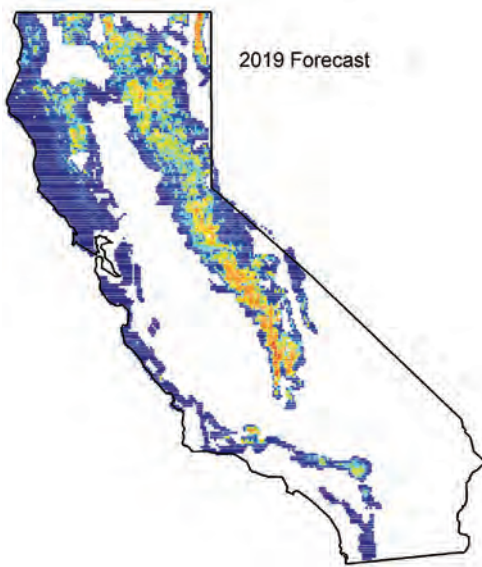


Figure 1. Map of tree mortality forecasts for 2019 with measures of uncertainties at each risk level as given by the parallel boxplots. The boxplots are based on 13 years (2005–2018) of observed mortality data per 2.5° (1800ha) cells of forested lands in California.



Figure 2. Dead trees in Southern Sierra as seen from the air, September 2016.

hazard tree removal, pest suppression activities, infer location of funding needs and fuels reduction treatments as well as access for firefighting.

Producing quantitative probability risk maps required us to develop empirically based, site specific statistical models (Preisler et al. 2017) based on the past history, ~30 years, of tree mortality and weather (mostly precipitation levels).

The Data

Developing such statistical models has been possible because of the aerial surveys of forested lands that are compiled each year by the Forest Health Protection (FHP) aviation program of USFS, in cooperation with other state and federal agencies. Aerial Detection Survey data (ADS) in USDA Forest Service Region 5 (California) and other parts of the Western US have existed since the first flight in 1947 (Fig. 3).



Figure 3. Aerial personnel 1952 Blowdown and Bark Beetle Survey Photo, USDA Forest Service, Region 6, State and Private Forestry, Forest Health Protection. Collection: Region 6, Forest Health Protection, Aerial Survey Program slide collection.

Each year, Forest Health Protection conducts surveys of tree mortality by flying over much of forested lands in the Western US. Flights are typically conducted on five to six km-wide flight lines, and at 300–400 meters above ground level depending on the terrain (Fig. 4). While flying, surveyors mark locations with tree mortality on a map and collect information such as host and number of trees for each location. Paper maps were used early on, but since the early 2000's digital sketch-mapping systems were used (Fig. 5). Historic data on paper maps has since been digitized and compiled into one dataset. For this analysis, ADS data was queried for tree mortality attributed to conifer mortality from bark beetles, wood borers, drought, and unknown agents. Damage attributed primarily from fire and other abiotic causes, animals, and diseases was removed, as was mortality recorded to hardwoods.

The Model

Our statistical model utilizes observed history of tree mortality and precipitation in the previous four years, together with site characteristics, including availability of host and 30-year average precipitation, as drivers to arrive at tree mortality risk levels for each 2.5° (1800 hectare) grid cell for the upcoming year. We developed a set of rules based on the mortality drivers that assigns each data point to a mortality risk level. Machine learning methods, such as classification algorithms, may be used to accomplish this task. However, we found generalized additive regression modeling (GAM) techniques with spline functions more effective (Wood 2006). Classification methods did not seem to pick the relatively small, but important, effects of weather, and the rules produced were mainly based on the prior year amount of

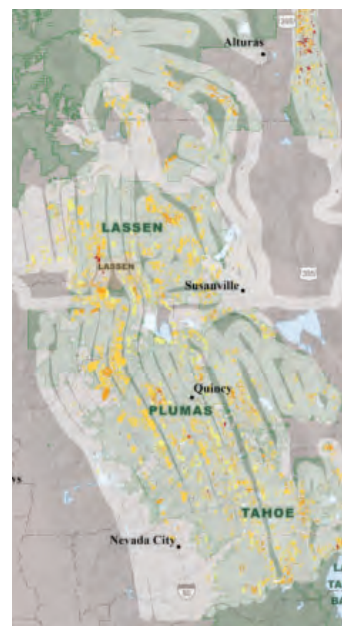


Figure 4. Map showing 5-6km wide flight routes (left panel) and aerial view from ~800 meters, eastern Oregon (right panel).





Figure 5. Left panel: USFS pilot Christina Colpitts and aerial observer Zack Heath with USFS Cessna 206 N166Z, September 30, 2015. Photo: Ben Smith, USDA Forest Service, Region 6, State and Private Forestry, Forest Health Protection. Right panel: Recording insect and disease damage using the new Digital Mobile Sketch Map (DMSM) system, June 26, 2018. Photo: Justin Hof, USDA Forest Service, Region 6, State and Private Forestry, Forest Health Protection. Aerial Survey Program collection.

mortality and host availability. GAM is a regression model with an advantage over linear regression routines in that no a-priori assumptions (e.g. linear or logarithmic) need to be made about the shape of relationships between mortality and the drivers. Additionally, GAM accommodates interaction terms by using 2-dimensional spline functions.

Another feature of our forecasting method was that uncertainty measures of our forecasts were not based on an assumption regarding the distribution of the variable of interest—in this case the number of dead trees per cell per year. Commonly used distributions for counts, such as Poisson, log-normal, negative binomial, or even over-dispersed or zero-inflated Poisson, all make strict assumptions about the measure of uncertainty. Rather than force a parametric distribution on the residuals of our models, we used the empirical distributions of the historic data to describe the variability expected at each risk level (parallel boxplots in Fig. 1).

Some Interesting Results

The empirical distributions at each forecasted risk level (Fig. 1) provide the amount of variability to be expected in the forecasts. For example, 50% of cells at the highest forecasted risk level, RL9, are expected to have 5K to 60K dead trees per cell with 5% having more than 160K dead trees. On the other hand, cells assigned to the lowest risk level, RL0, are expected to have zero mortality, with less than 5% having more than 10 tree killed in a given year. However, quite a few cells have been observed in this lowest risk level to have more than 1000 and some even more than 10K dead trees. Studying these outliers might be of some interest as we will see below.

Looking at total mortality levels per year (Fig. 6) we note a few things. First, mortality levels match well with our estimated weather suitability and beetle pressure metrics. Weather suitability, as estimated by the statistical model, is a combination of the prior four years of precipitation. Suitability metric was high when precipitation levels in the past three years were lower than average for that location and higher than average in the fourth prior year. The beetle pressure metric is based on the number of trees killed in the cell and surrounding cells in the past year. The total forecast for 2018 was within the projected

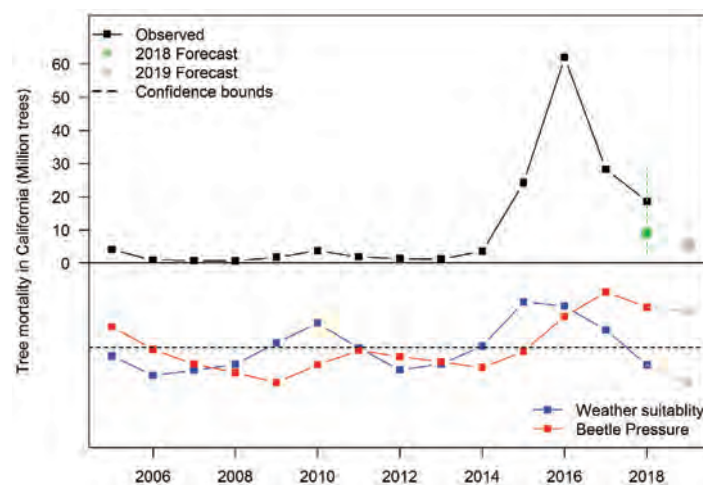


Figure 6. Total number of trees killed in forested lands in California between 2005-2018 together with the weather suitability and beetle pressure metrics and the forecasts for 2018 and 2019.

confidence bounds, albeit the observed total was higher than expected point estimate. Going back to the outliers we noted in Fig. 1, we plotted the locations of the outlier cells for 2018 (Fig. 7). We note a clustering of outliers in the northwestern region of California. While the number of outliers with >100 dead trees per cell was about 4% of the total cells in the lowest risk level, 50% of them are in the northwestern region. We propose two plausible explanations for these outliers. One reason may be associated with a Douglas fir-borer outbreak that may behave differently than bark beetles. northwestern California also experiences bear damage to Douglas-fir and other tree species, which would have a different relationship to tree mortality patterns than beetles. We speculate that some of the mortalities along the northwestern coastline was from bear damage being mistaken as beetle damage. Further study of outliers may increase our understanding of tree mortality drivers in forested lands.

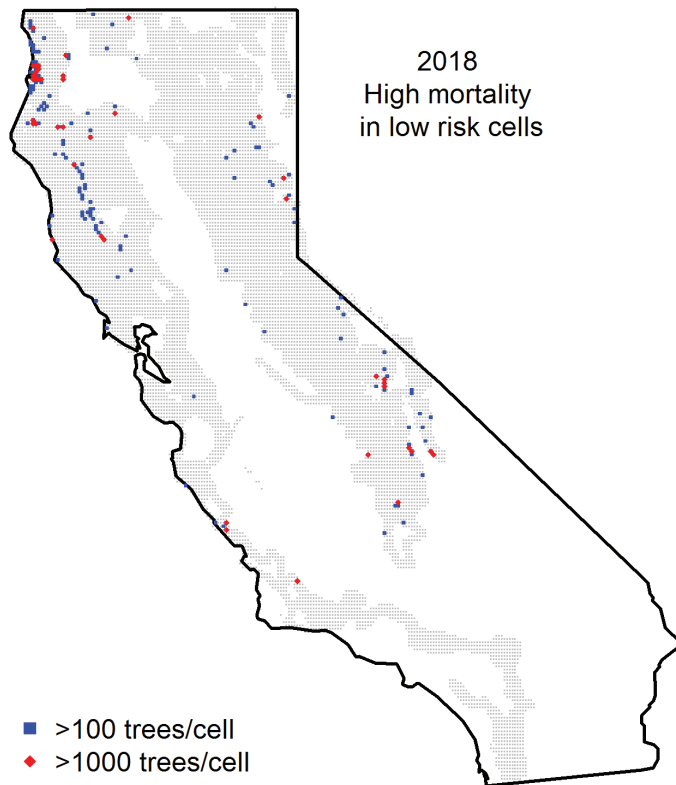


Figure 7. Locations forecasted to have very low risk of tree mortality (RL0) and yet were observed to have more than 100 or 1000 dead trees per 1800 ha cells.

Notes

¹https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd573081.html

²Risk or hazard is defined as ‘standing live basal area greater than one inch in diameter will die over a 15-year time frame (2013 to 2027) due to insects and diseases’ (Krist et al. 2010). <https://usfs.maps.arcgis.com/apps/webappviewer/index.html?id=52cb2bcc3c2b4868ac87b66f622062ab>

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For info on bear damage to trees, see: <https://www.fs.fed.us/t-d/pubs/pdfpubs/pdf03242832/pdf03242832dpi72.pdf>

Herbivory at High Elevations: Climate Change and a Montane Plant-Insect Interaction

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When I embarked on my first field research season in the summer of 2016, I inherited a great many useful items from Elli Theobald, a former graduate student in my lab who had just defended her dissertation that spring. Elli spent her Ph.D. studying the impacts of climate change on wildflower phenology and plant-pollinator interactions, and among the things she left behind for me were one scuffed and cranky Decagon ProCheck soil moisture meter, two books about plant physiology, a box and a half of extra-long landscape staples...and five drop-dead beautiful study sites located along an elevational transect on Mt. Rainier in the Cascade Mountain Range. When I explained to Elli that I planned to use her sites to look for climate-driven patterns in insect herbivory in subalpine meadows, she frowned, searching through

six seasons worth of memories of standing out there staring at plants. “Hmmm,” she said. “I don’t think there is much herbivory in the meadows. At least I’ve never noticed any, and definitely not from insects. I do see marmots chowing down on seed pods at the end of the summer, though,” she said brightly. To this day I don’t think Elli had any idea how much dread she struck into my heart, and the fear that I had accidentally chosen a nonexistent research subject rode around with me for weeks, until the snow finally melted and I hiked out into the field to look at my new study system with my own eyes (Fig.1).

Three years and tens of thousands of leaf surveys later, I can tell you that there is, in fact, insect herbivory taking place in Rainier’s subalpine meadows, and quite enough of it to be interesting. It’s true that on average (across nine species, 45 plots spanning 2,000 feet of elevation, and two sides of the mountain), herbivory rates are relatively low. An individual plant in the meadows is likely to lose about 4.8% of its total leaf area each growing season to chewing insects. But this figure hides a tremendous amount of variation among species and elevations. Some species, like Alpine Aster (*Aster alpigenus* var. *alpigenus*), experience almost



Figure 1. Evening on the mountain.

no herbivory wherever they grow. Others, like Subalpine Lupine (*Lupinus latifolius* var. *subalpinus*), are much more preferred hosts; some individuals of this species can experience losses of over 40% of their total leaf area to chewing insects each season (Fig.2).

Surprisingly, I found that chewing insect herbivory increases significantly with elevation despite a corresponding decrease in air temperature. This result suggests that mean ambient air temperature does not act as the major driver of insect herbivory in montane systems in the same way that we expect it to in lowland and agricultural ecosystems (Deutsch et al. 2018). Instead, vegetation structure, edaphic factors, and phenotypic differences among conspecific populations living at low vs. high elevations all contribute complexity to ecological dynamics. Here, elemental analysis of lupine leaves showed carbon-nitrogen ratios increase (and therefore nutritional quality decreases) with elevation, meaning compensatory feeding by high-elevation grasshoppers may play a role in this pattern. Experimental feeding trials with field-caught individuals of the dominant chewing insect herbivore in this system—the Cascade Timberline grasshopper (*Prumnacris rainierensis*)—provide additional insight. In lab trials, high-elevation grasshoppers showed higher feeding rates overall, and experienced a greater increase in feeding rates with temperature compared to low-elevation grasshoppers. This ability for time-

limited high-elevation grasshoppers to capitalize on spikes in temperature has been seen before (Buckley and Nufio 2014) and is likely facilitated by a significant decrease in canopy cover, and therefore increased sun exposure, at high elevations.

These findings highlight the complexity of predicting how species interactions will change with warming, as well as the importance of recognizing mountains as unique ecological systems with their own idiosyncrasies. Looking back at my pre-fieldwork fears, they are also a reminder to me that you never see what you are not looking for—a thought both encouraging and cautionary.

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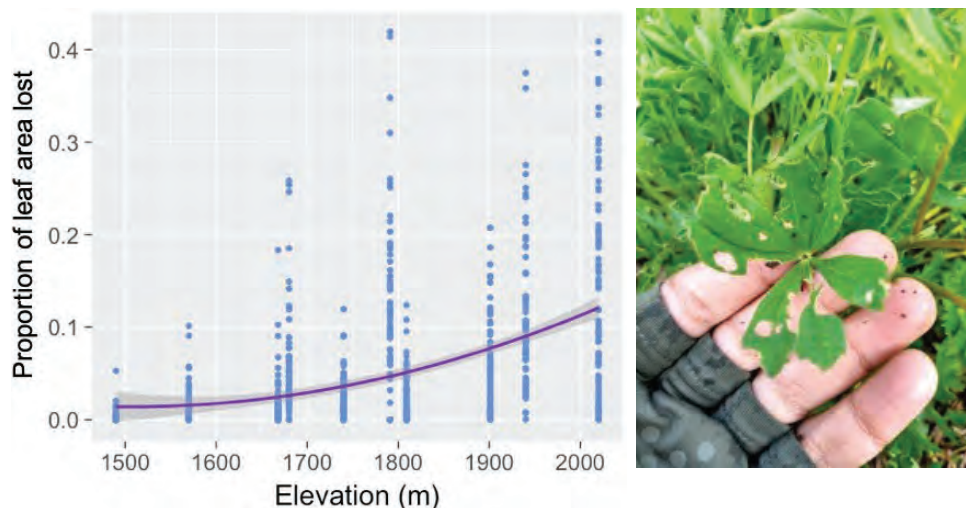


Figure 2. A) Herbivory increases with elevation for subalpine lupine. B) Damaged leaf.

Flash Droughts in the Mountain West: Emerging Risks under a Warmer Climate

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Mike Hobbins is a Research Scientist at the University of Colorado-Boulder and NOAA's Physical Sciences Division with interests in advancing drought and famine early warning by improved estimation and innovative exploitation of atmospheric evaporative demand.

McNeeley, S.M., Dewes, C.F., Stiles, C.J., Beeton, T.A., Rangwala, I., Hobbins, M.T., and Knutson, C.L. 2018. *Anatomy of an interrupted irrigation season: Micro-drought at the Wind River Indian Reservation. Climate Risk Management* 19:61-82.

Flash droughts have been much in the news recently. The flash drought event in the Northern Great Plains in 2017 received especially widespread news coverage due to its severe impacts on agriculture and livestock—the economic losses of which led NOAA to categorize it as a billion-dollar weather and climate disaster (NOAA Climate.gov 2018). Another billion-dollar disaster that year resulted from wildfires in the Mountain West, which we show here, were also driven by rapidly evolving dry conditions from anomalously wet antecedent conditions.

For climatologists, emergency managers, and natural resource decision-makers alike, such incidents raise many questions, including the following:

- a. Are we observing an increased risk of rapidly evolving extreme drought conditions under a warmer climate when we encounter dry spells that last for weeks to months?
- b. From a preparedness perspective, do these incidents catch us off guard, particularly when regions are experiencing anomalously wet conditions?
- c. Are there indicators of early warning of flash droughts that could help with preparedness?

Here we present some recent case studies from the US Mountain West to demonstrate occurrence of flash droughts that developed from normal to anomalously wet antecedent conditions and caused severe impacts (e.g., with respect to wildfire, agriculture, and ecosystem productivity), and likely caught managers unprepared. We also demonstrate here the application of a new indicator of drought and wildfire-risk, the Evaporative Demand Drought Index (EDDI; NOAA-EDDI 2019), to capture the signals of flash droughts during these specific incidents. EDDI solely represents atmospheric dryness, and its variability is driven by air temperature, relative humidity, radiation, and wind speed.

2015 “Micro Drought” in the Wind River Range, WY

A very short-lived (a few weeks in length) drought occurred in September, 2015 in the eastern foothills of the Wind River Range of central Wyoming, a region largely surrounded by the Wind River Indian Reservation (McNeeley et al. 2018). While this drought resulted in severe impacts to human and natural resources (Scientific American 2018), it is particularly significant for highlighting a transition from a record-wet to a record-dry condition in a period of few weeks (Fig. 1). At the end of May the region was experiencing record-wet conditions, as indicated by the 1-month EDDI ending in May, which was the lowest since 1980 (Fig. 2a). However, dry, windy, and clear-sky conditions ensued in early August, which resulted in rapid land-surface drying that subsequently led to large increases in temperature by September. All these factors contributed to a record atmospheric dryness for the region for the month of September (Fig. 2b).

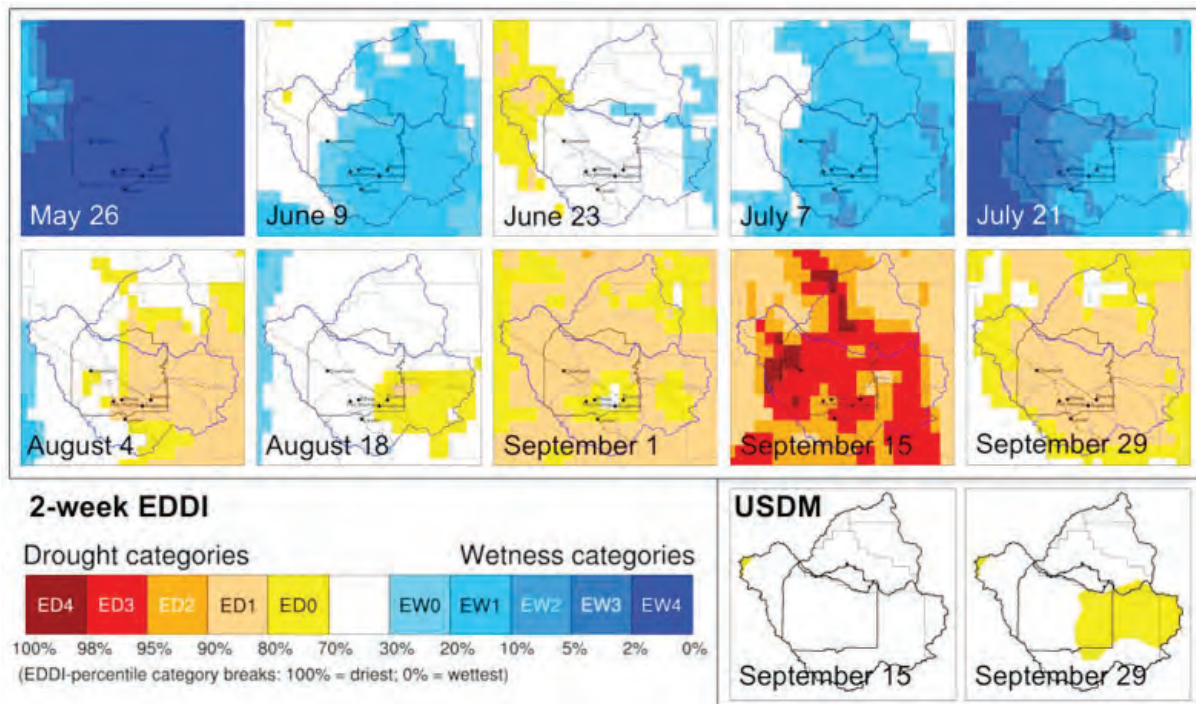


Figure 1. Flash drought development, as measured by the 2-week EDDI at 2-week intervals, in the Wind River Indian Reservation during the 2015 growing season after record wet conditions at the end of spring. The US Drought Monitor (bottom two plots) does not show significant drought conditions in September, when the region experienced record atmospheric dryness. Source: McNeeley et al. 2018.

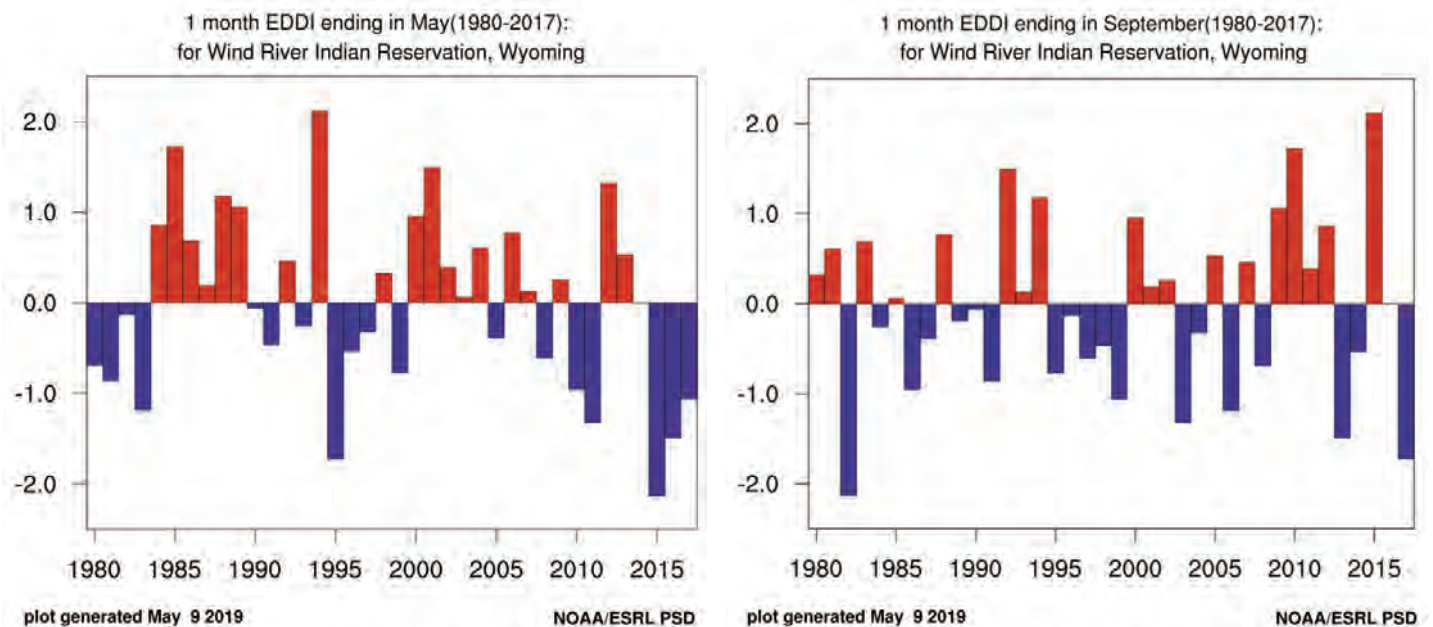


Figure 2. Time series of 1-month EDDI in May and September between 1980 and 2017 for the Wind River Indian Reservation. Source: <https://www.esrl.noaa.gov/psd/eddi/>.

2017 Wildfires in the Northern Rockies and Pacific Northwest

2017 was a historic wildfire season across many western and north-western states in the US, with about 10 million acres of forested land burned, and over 1 million acres in Montana alone. The end of spring saw anomalously wet conditions in the Northern Rockies and Pacific Northwest. However, episodic dry conditions emerged during summer, which were then followed by

extreme atmospheric dryness in the last week of August and first week of September, coinciding with the occurrence of many of these wildfires (Fig. 3).

2018 Camp Fire, California

The Camp Fire was the deadliest and most destructive fire in California's history, burning over 153,000 acres from November 8 and leading to upwards of 85 deaths, \$16.5 billion in damages, and the loss of 14,000 residences. Examination of the atmospheric dryness signal of this event provides a good example of the sort of interaction between EDDI and weather that can signal incipient fire conditions.

The long dry season in northern California normally ends with the onset of rains in October, which then last from late fall to early spring. In 2018, however, this rainy season did not get underway until November 21 (AccuWeather 2018), nearly two weeks after the outbreak of the Camp Fire. In this case, the failure of the onset of the rains may be indicative of a precipitation-forced flash drought. The effects of this anomalous weather are clear from Fig. 4a, which shows the 2-week running anomaly in atmospheric dryness and its decomposition into its drivers for the period from October 1 through November 9, 2018 (the day after the Camp Fire broke out). The atmospheric dryness had a positive anomaly throughout the period, with peaks in mid-October and then again at the fire onset (Fig. 4b). There appears to have been a turn-around in the weather on or about October 14, after which point, lower-than-normal humidity contributed significantly to this earlier peak, and above-normal and rising temperatures to the second. Throughout the period, solar radiation (associated with the clearer skies that bore no precipitation) also made significant contributions to the anomaly.

Emerging Risk of Flash Droughts

The enhanced warmth and dryness of the atmosphere because of climate change, particularly when a region is experiencing anti-cyclonic conditions (high pressure system), is expected to drive higher rates of moisture loss from the land surface, which may be experiencing normal to above-normal wetness (e.g., Wang et al. 2016). Such high rates of drying have the potential to set in amplifying feedbacks between the atmosphere and land surface causing increases in surface temperature and vapor pressure deficit, which in turn could severely affect ecosystem productivity and increase flammability of vegetation.

Atmospheric dryness at weather timescales (i.e., weeks) has the ability to indicate risk for wildfire and other ecosystem impacts. EDDI has shown promise as an early warning indicator of wildfire risk across California and Nevada (McEvoy et al. 2019).

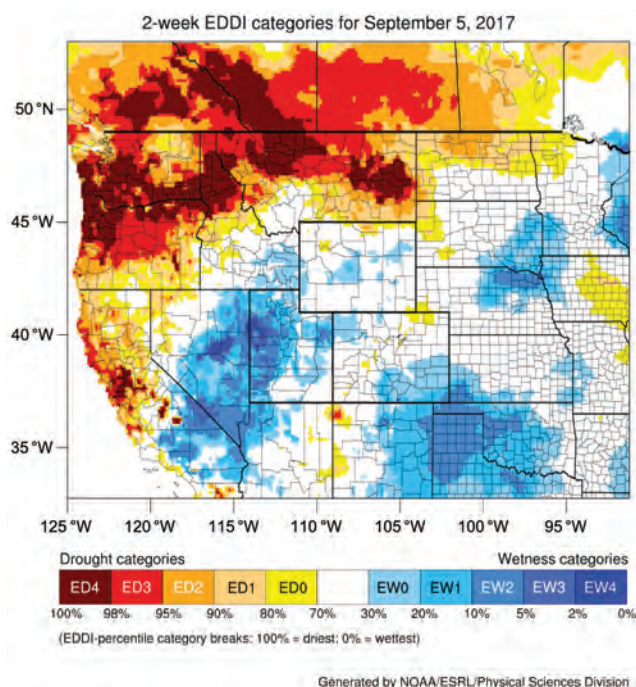
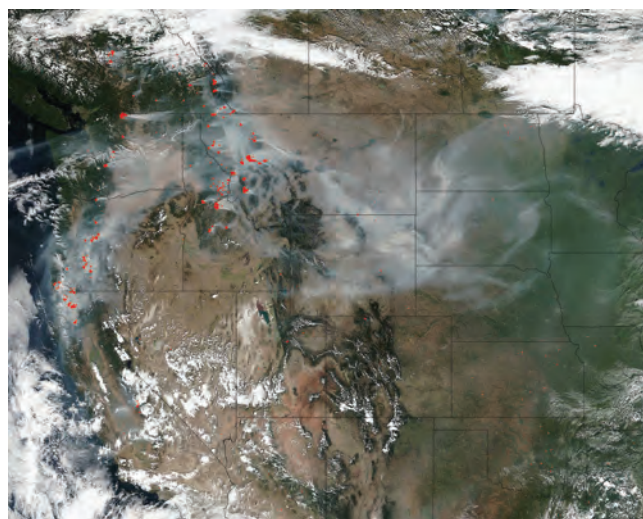


Figure 3. Top: Wildfires in the Northern Rockies and Pacific Northwest as observed by NASA's Suomi NPP using the VIIRS (Visible Infrared Imaging Radiometer Suite) instrument on September 4, 2017 Source: <https://www.nasa.gov/image-feature/goddard/2017/smoke-and-fires-light-up-pacific-northwest>. Bottom: 2-week EDDI on September 5, 2017.

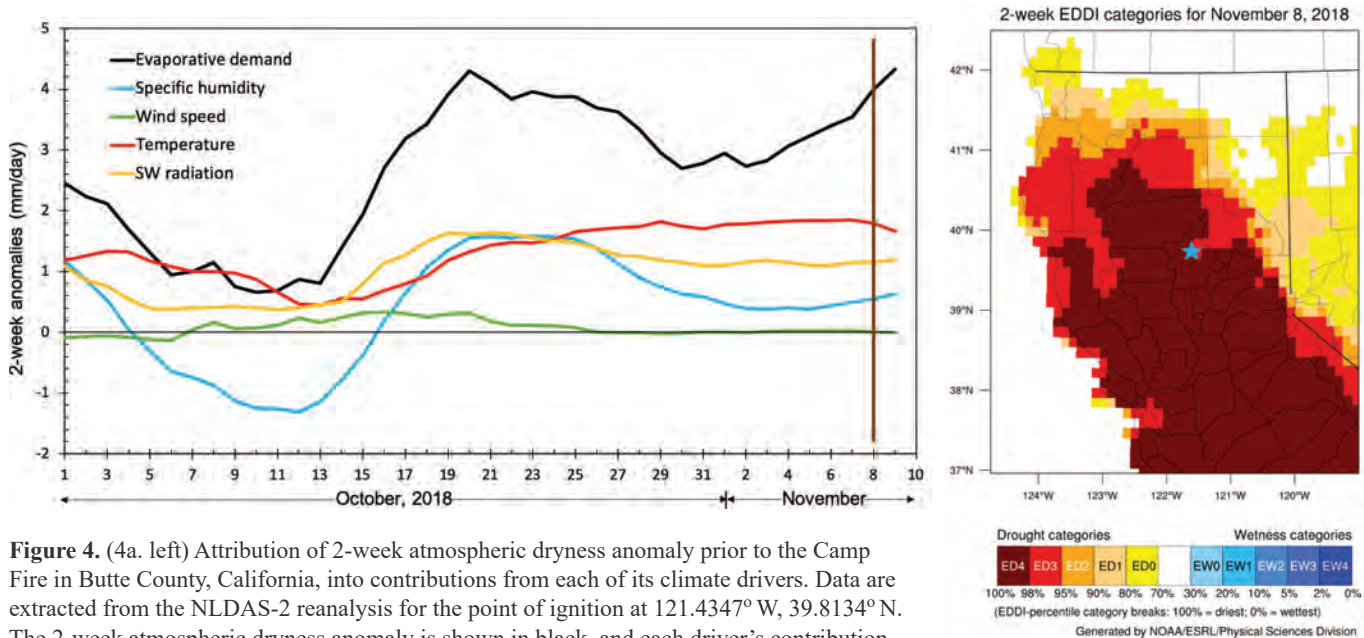


Figure 4. (4a. left) Attribution of 2-week atmospheric dryness anomaly prior to the Camp Fire in Butte County, California, into contributions from each of its climate drivers. Data are extracted from the NLDAS-2 reanalysis for the point of ignition at 121.4347° W, 39.8134° N. The 2-week atmospheric dryness anomaly is shown in black, and each driver's contribution is shown as a colored line. The ignition of the Camp Fire is shown as a vertical brown line on November 8. (4b. right) 2-week EDDI on November 8, 2018. The star indicates the location of the Camp Fire.

Relationships of atmospheric dryness to wildfire and drought impacts at the land surface operate at many timescales: the direct relationship between atmospheric dryness and plant physiology at the leaf scale leads to drought being reflected in plant-moisture stress and elevated live fuel loads at the forest scale.

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INTERVIEWS

Dr. Alexander Friend is Deputy Chief of Research and Development (R&D) for the USDA Forest Service. In this role, Alex directs, coordinates, and integrates Forest Service research across seven research stations in nearly 80 locations and an additional 81 experimental forests and ranges, which in total span all 50 States, U.S. territories, and commonwealths. Alex directs programs for about 500 Forest Service researchers, who work in a range of biological, physical, and social science fields to promote sustainable management of the Nation's forests and rangelands. Prior to his appointment as Deputy Chief, Alex served seven years as Station Director for the Pacific Southwest Research Station, headquartered in Albany, California, where I was fortunate to work under his leadership. Among his many contributions to our Station, Alex greatly advanced efforts in civil liberties. Through initiatives and personal examples, Alex modeled his dedication to improve diversity, promote respect, unveil implicit bias, and banish harassment in the workplace and our greater environment. I am deeply grateful to Alex for taking time for an interview with Mountain Views Chronicle, for sharing his experiences, and offering tangible recommendations. –Editor

ALEX FRIEND



Connie: During your tenure as Station Director of the PSW Research Station, you advocated consistently and effectively to improve diversity among our science ranks, to promote fairness and equity in opportunity, and to enforce zero tolerance for harassment of any kind. Can you point to any situations in your past or sources of inspiration that led to this commitment?

Alex: I was part of a Forest Service team during 2012-2013 that crafted the agency's Diversity and Inclusion Intention Statement. It was a transformative experience for me. It really opened my eyes about what can happen with diversity and inclusion within the agency, both good and bad, and motivated me to do as much as I could to help. When I was working on the team, it occurred to me that most of us have felt socially excluded at some point in our lives. As social animals, this puts us in an adrenaline mode. We have a visceral fear when we feel outcast from an important social group. During my life, I had exclusionary experiences that enhanced my sensitivity to this fear. When I was in grade school, my family moved several times. I lived in five different states during that period, so I was "the new kid" several times. It's a situation that makes you feel vulnerable, with a heightened sensitivity to any sense of exclusion. In my working life, I

have noticed that people can be excluded from others for many reasons: gender, appearance, sexual identity, ethnicity, race, poverty, disability, or even ideas that put someone in the minority within a particular setting, causing them to face added scrutiny and exclusion, even violence.

As a result of my work with the Diversity and Inclusion Team and my own experiences, I am deeply invested in our agency's commitment to make the work environment welcoming and inclusive for everyone. We don't always agree with each other, or even feel comfortable with each other at first, but it's not acceptable to exclude people based on differences or our own comfort. At the Pacific Southwest Station I set the tone for an environment that valued diversity and felt inclusive to everyone. It is a Forest Service core value. Supporting this value requires constant vigilance for major and minor behaviors and attitudes that are contrary to it. If we can address problems at the early stages when they take the form of micro-aggressions, unconscious bias, and subtle body language, we can often prevent them from growing into bigger problems that result in formal complaints and grievances.

Connie: As Deputy Chief for Research and Development of the Forest Service, you have an important leadership position within the agency. Do you see opportunities for new initiatives to promote diversity and equity in the R&D branch? Are there ongoing efforts that you are specifically supporting?

Alex: Yes, definitely. We must stay the course with our intention to "awaken and strengthen all people's connection to the land," and represent our value for diversity explicitly in our workplace. Within R&D, we have relatively good gender diversity but we need to take a careful look at all forms of diversity, and not only total numbers, but also representation in leadership positions and grade distribution.

Connie: In your experience, what are some of the most important barriers to a harassment-free science environment?

Alex: The most important barriers may be the more subtle and least obvious ones. It's easy to notice flagrant offenses like inappropriate pictures or jokes; however, subtle and insidious ones may be harder to correct. By that I mean habituation to the "old familiar." This type of comfort with the status quo can really impact a work environment. "It's the way we've always done things, so don't rock the boat." We need to be more open in R&D to questions and self-examination and ask ourselves: "It's the established practice, but is it the best way?" Inquiry-mode should not be uncomfortable for us, after all, it's what we do as scientists!

Connie: Can you offer any specific recommendations for us as a grass-roots science consortium to make our community increasingly more inclusive?

Alex: My advice is to include new or under-represented faces in decision making. Over the past 8 years as I have been in the position of connecting with land management, it has occurred to me that to connect with this group takes more than sending them stuff or asking them, "What do you need from Research?" It takes active inclusion in deciding what is needed and involvement as the science unfolds. This applies particularly to applied science. It also goes the other way. For Forest

Service Research and Development to be a good partner with land management, we need to be included in their deliberations. Honestly, all of this takes considerable effort. The norm is to hang out with folks like ourselves. However, with a little effort it makes our work both more enjoyable and impactful!

Connie: Is there anything else you'd like to talk about that we haven't yet covered?

Alex: All of us working in the natural resources need to be in tune with modern society. Sometimes we tend to think that everyone grew up thinking about conservation and hiking or fishing. That simply isn't true. Vast numbers of people are decoupled from the land and know very little about conservation, let alone sustainable resources management. To be effective in natural resources research, we need to meet people where they are and how they live. This is a matter of inclusion as well. We can't assume people everywhere share our values, especially in this digital age, when people spend a good portion of their time staring at a screen. People who live and work in Washington D.C., for instance, may not think much about national forests, but they may care deeply about their vegetable garden, and may love dogs and cats, and most people prefer to breathe clean air and drink sparkling pure water. So we can find a way to connect with them that opens the door to the bigger picture of what we do and why it's important.

***Jennifer Jones** is the Grants and Agreements Specialist for the USDA Forest Service, Pacific Southwest Research Station, based in Albany, California. For many years she has also been Chair of the Station's Community Enhancement and Diversity Team. I have had the fortune to work alongside Jennifer for several decades. For as many years I have been inspired by her dedication to fairness, equity, and sincere efforts to make our workplace a community where we enjoy meeting with co-workers as friends. In formal and informal ways, Jennifer is always on the lookout for opportunities to improve communications and streamline working relations. Having started with the research station before she was out of high school, Jennifer offers a longterm view of how diversity issues have evolved, with both advances made and challenges yet to address. Every time I talk with Jennifer I hear another learning story, and for this I am deeply grateful to her for making the effort to collect her thoughts and experiences to share with Mountain Views readers. –Editor*

JENNIFER JONES



Connie: Can you briefly describe your position at the Pacific Southwest Research Station (PSW) as Grants and Agreements (G&A) Specialist and also as head of the Community Enhancement and Diversity Team (CEDT)?

Jennifer: I'm a Grants Management Specialist responsible for administering incoming and outgoing funds to support research efforts at the PSW Station. I work closely with Station scientists to ensure their projects are set up correctly, adhering to the proper rules, regulations, and guidelines. The G&A staff works with many different partners such as universities, state departments, other federal agencies, and some international partners to accomplish a variety of research activities.

The Station's Community Enhancement and Diversity Team serves as a connection between Station employees and Leadership. We often receive concerns from employees and work to find a resolution at the lowest level possible. We have partnered with the Station's leadership team to support a variety of "Diversity and Inclusion" trainings across the Station, developed outreach materials, and are currently focusing on ways to improve the work environment. The Team has monthly conference calls and one in-person meeting per year. As the

Chair, I report to the Station Director on a quarterly basis or more often if necessary.

Connie: Would you share any tidbits of your personal history as to how you came to have a career with the Forest Service research station? Were there specific inspirations along the way?

Jennifer: Funny story: I actually ended up at PSW when I was a senior in high school and my mom took away my telephone and wouldn't return it until I got a job! I was 17 at the time and took business etiquette classes at school so when I looked at the job board in my counselor's office and saw a Clerk Typist position in Personnel, I applied immediately. I put on my best suit for the interview and landed the job; \$5.65 an hour with weekends off; I was so excited! A few months into working in Personnel at the Station, I discovered I really enjoyed the work and was good at it, and my career in Personnel officially started. Thanks to the Forest Service being an agency that accepted experience in lieu of education, I was able to work my way up to a Human Resources (HR) Specialist with the training I received and on-the-job experience. The longer I worked at PSW and the more I learned about the mission of the Station and Forest Service the more passionate I became about my role supporting research. In addition I learned that I loved helping people! Being in Human Resources I got to work with most people across the Station, which created a very diverse work environment that I thrived on. After 15 years in Personnel/Human Resources, the Forest Service decided to consolidate the Human Resources function, and unfortunately I was unable to make the move to Albuquerque, NM. However it was not the end for me at the PSW Research Station. I did a short stint as the Administrative Assistant to the Station Director before I competed for the opportunity to change my career from an HR Specialist to a Grants & Agreements Trainee, thanks to my long time mentor encouraging me to think outside of the box and my comfort zone. Twelve years later, I'm still in Grants & Agreements and love my job very much! I still get to help people and support the amazing research going on at the Station. I have always loved science and understood the importance of science and research. Being able to be a part of science that truly makes a difference in the world we live in is

one of the greatest joys of my work at PSW, and makes me proud to be a part of the Forest Service.

Connie: In your work with scientists have you had to confront conscious or unconscious biases or other barriers and how do you deal with those?

Jennifer: When I first started my career at PSW, I was very young and often encountered both conscious and unconscious bias due to my age and scientists not always trusting the information I was providing to them. I am also a woman with a very diverse ethnic background; the majority being African American and Hispanic, while the majority of scientists I work with are male and White. So there were times I was spoken to in a “different” tone of voice or not taken seriously. Early in my career I really didn’t know how to respond so I took no action for fear of retaliation if I spoke up. In instances where my word wasn’t taken, I would often refer the scientist to a higher-level employee or to my supervisor.

Later in my career when I was a supervisor in Human Resources, I was accused by a senior member of Leadership for “discriminating” against one of my employees who was Hispanic. I have always been proud of being multi-ethnic, and most everyone I worked with was aware of my diverse background

because I spoke about it regularly so I was very surprised by the accusation. When the leader confronted me with the accusation, I responded that I was surprised given I myself was half Hispanic. She was mortified because she had made an assumption about me based on my appearance and I called her out on it. That was the first time I felt confident enough to speak out.

In my current position I have been very fortunate and have very few experiences of conscious or unconscious bias. It is a subject that interests me very much, and as a result I have attended quite a few workshops and trainings in the past few years. What I have learned in my experience is that if you can create room for open and honest conversation that includes personal experiences, it creates awareness from people who may not have experienced such bias before. Most of my experiences of both conscious and unconscious bias have been in my personal life. Because the experiences have been outside of work doing ordinary things such as shopping in a department store, going to the doctor, or sitting on my own front porch, it has actually been very helpful in creating awareness surrounding bias to co-workers who know me and my family. I have made a personal pledge to myself that when/ if I encounter a situation where conscious or unconscious bias is apparent to try to make it a “teachable” moment and to speak up because most people are not even aware they are doing it.



Jennifer's extended family at the holidays.

Connie: Can you share a few successes of the station's CEDT?

Jennifer: The CEDT is proud to have implemented an annual Wellness Challenge that encourages employees to work together to improve their quality of life in all areas. Some examples of activities included in the Challenge are to eat healthier, more balanced meals, exercise, unplug from technology, and get the proper amount of sleep. The response to the Challenge has been very positive and employees look forward to the Challenge each year. In addition we are proud to have established a Thank You Board at each location across the Station as a way to show appreciation and gratitude to fellow co-workers throughout the year. The Team has received positive feedback from employees who have shared that when we clear the board at the end of the month it fills back up almost immediately as employees are excited to show their appreciation to one another consequently increasing morale.

Connie: Would you have recommendations for us as a consortium of environmental professionals for increasing our diversity and striving toward greater inclusivity?

Jennifer: My recommendation would be to increase outreach as much as possible to the younger generation. The earlier they are exposed to careers in science along with the opportunities for hands-on experience and avenues to achieve such a career the

more diversity will increase. I would also look to partner with organizations supporting underrepresented groups in STEM such as MANRRS (minorities in agriculture, natural resources and related sciences) <http://www.manrrs.org/> or NHEC (National Hispanic Environmental Council) <https://nheec1.org/> Both are national organizations and they can provide information on how and where to connect with underserved communities seeking exposure and opportunities in the science field.

Connie: How about any advice for young scientists from diverse backgrounds who might be contemplating a career in the environmental services (or with the US Forest Service)?

Jennifer: For young scientists from diverse backgrounds I would recommend seeking out and taking advantage of any opportunities in the science field to gain exposure to the variety of careers available and explore which career or discipline captures their interest. I also highly recommend having a mentor if one is available. Having someone in the field with prior experience and expertise is priceless. Networking is also important, making those connections during networking sessions can create all sorts of opportunities. Lastly I feel it is important to be open to new things and take a chance on something you are interested in especially if it is outside of your comfort zone, for that is where the most growth occurs.

Lief Gallagher is a Wildlife Biologist with the USDA Forest Service, Pacific Southwest Research Station, based in Davis, California. Lief has worked many years as part of a research team that studies California Spotted Owls, a keystone raptor that was petitioned in 2015 for listing under the federal Endangered Species Act. The team investigates population status and trends, demography and habitat relations, and responses to management practices in California's Sierra Nevada.

In a personal context, Lief recently shared news with his research colleagues that he has decided to move forward on a decision he forestalled in the late 1990s. Identifying then as now on the LGBTQ+ spectrum, in college he decided—as Claire Gallagher—to put his love of nature and science first. At that time, this meant prioritizing a career in wildlife biology rather than rectifying his personal identity; doing both was unimaginable then. Now, after more than 20 years of consideration, he decided it is time to transition. Legally changing his name from Claire to Lief begins the process of home-coming. Lief's words to his colleagues were open and generous, explaining that, "transitioning isn't about 'coming out' so much as inviting the world in, to become vulnerable and allow others to see me as I am."

I asked Lief to share thoughts on his science and his personal situation, with deep gratitude for the candor and humor with which he has invited us into his world. The beautiful California spotted owl photos here are his also. – Editor

LIEF GALLAGHER



Connie: You describe nature and science as one of your passions. What aspects of wildlife biology and research do you enjoy the most, and/or find most fascinating?

Lief: Like many people, I stumbled into ecology and research by chasing feelings of awe and wonder. Science allows me to pursue the question, how is this all possible? There are enough derivatives of this question to keep me busy for several lifetimes, I think, and then a few more.

It's tough to pick one aspect of wildlife biology that's most enjoyable, as it's neverendingly intriguing. I confess to a strong bird bias: my grandmother taught me birdwatching when I was a teenager, and I've been hooked ever since. I'm particularly interested in bird migration, population dynamics, vocalizations, and how birds adapt to changing landscapes. Of course, it's impossible to do field work and not fall in love with everything else; this has indeed happened, and my interests are quite broad.

Connie: Can you describe for those who know owl research as having to do with "hooting" a little more of what the field work entails?

Lief: Well, it certainly does involve hooting. We do much of our field work when the owls are active—that is, at night. The less obvious part of working in the forest at night is that it forces us humans to surrender one of our most treasured safety nets—our vision. At night, our sight is limited to the flashlight beam or the moonlit outlines of the forest. Most of the forest remains hidden to us. For many people, this means an amplification of fear. Our minds are very good at filling in the perceived voids of the nocturnal landscape, whether it be the silence or the lack of light—with imagined dangers or a neverending chatter of thoughts. Owl field work requires biologists to become fluent with trust, fear, and intuition (sixth sense).

Spotted owl field work is also incredibly rewarding—the owls are charismatic, intelligent, and have a knack for keeping us on our toes. The work takes us to some of the most beautiful forests in the Sierra Nevada, and being out in the woods at night is simply magical.

Connie: You mentioned that your team is moving into new research on bioacoustics. Can you explain about that work? You also told me, "Sound is one of my first loves." That fascinated me—could you unpack that a bit?

Lief: Bioacoustics is a new aspect of our work. Until recent technological advances in batteries, digital audio recording, and digital media, bioacoustics wasn't feasible as a research tool at larger spatial scales. Part of what makes this work exciting is that at large scales, it's still

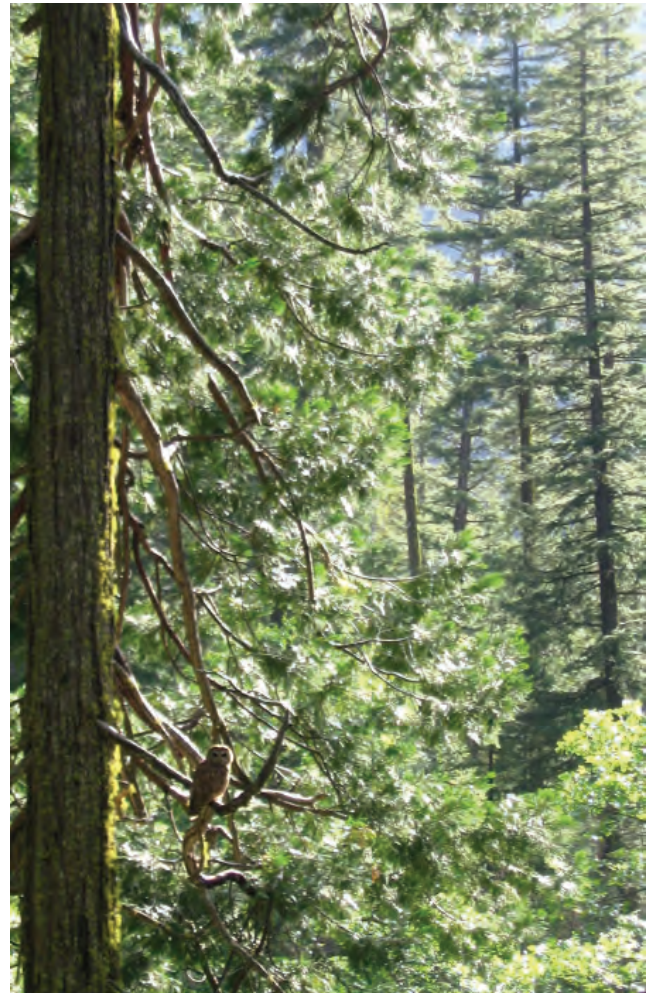
very new and we're discovering what can be done with it. A portion of our work here is exploratory. We're also evaluating bioacoustics as a monitoring method: traditional owl monitoring is intensive, extensive, and thus, expensive. Not to mention there are hazards inherently involved with nocturnal work, such as driving at night and hiking on steep slopes in the dark, that for the health of our crews we would like to reduce. Bioacoustics allows us to set up an array of recording units during the day, while the units record at night. Thus, the human component of the work is diurnal, and our electronic 'ears' are still active during the night hours. Part of our work this year is to see how well this all works in real life, at landscape scales. Can we still get the intensive data we need to robustly estimate population parameters? This is an open question.

Owls, more than any other bird species, have life strategies and anatomy that prioritize hearing over all other senses. With bioacoustics, we're also shifting our approach to enter the owls' world on the owls' terms; it is a fundamental perspective shift.

I've been in love with sound—music, bird song, natural sounds, rumbling trains, most anything that produces a sound—since childhood. I prefer to interact with the world more through sound and hearing, and bird-'watch' primarily by ear. If my parents hadn't exposed me to the Sierra Nevada as a kid, I probably would have ended up being a sound engineer who went outdoors every weekend.

Connie: In regard to your personal decision to transition, do you associate any specific situations at work or conversations with colleagues and supervisors over the years that supported your decision now? In other words, do you have advice for how we all can provide encouragement and assurance to friends and colleagues (or ourselves) to proceed with such important life decisions?

Lief: The moment I took a deep breath and announced my transition at work, I was prepared for a wide range of responses. A response that I wasn't expecting turned out to be a prevalent one—that colleagues would share stories and journeys from their own lives, with an astonishing degree of vulnerability. The topic was occasionally gender, but more often included universal themes of acceptance, connection, loss, change, identity, purpose, fear, power, and injustice. Some stories were so personal, I wasn't sure if they'd even shared it with a therapist. It was an honor, and a gift, to be a trusted listener for these conversations.



Story by story, a complicated and nuanced world revealed itself: that of hidden journeys and struggles. When people arrive at work, they don't sever vulnerable aspects of their lives; they censor them. There is so much going on in our colleagues' lives that we are unaware of, that is needing to be heard and supported, that can offer richness and depth to our community when shared. For this reason, I'd like to address your question more broadly: how do we support each other through deeply personal journeys that are hidden from view?

When we think about inclusive and supportive workplaces, we—myself included—often think about “do no harm”: refraining from ugly speech and behaviors that hurt others. This is a strong foundation, but falls short in the absence of conscious supportive language. Simply adhering to “do no harm” can have the unintended consequence of an absence of dialogue, and we need to fill the absence with something: with support and compassion.



For example, over a year before my transition began, I asked coworkers to begin calling me by “Lief”, which was a nickname at the time. Several colleagues, looking a) perplexed, b) suspicious, c) uncomfortable, or d) all of the above, awkwardly asked if there were any big life changes I needed to tell them about. At the time, I wasn’t planning on transitioning, so I said, very honestly, “no.” To which they invariably replied, “Ok. But you know it’d be ok if you did, right?” And there it was. Transgender issues hadn’t come up in our workplace—while there weren’t any hurtful words that I could recall ever hearing, there simply weren’t any positive opinions that I could recall hearing either. There was a vast silence, an absence of any opinion at all. And silence does not confer support, and it certainly doesn’t confer assurance. When I asked to be called Lief, my coworkers’ reactions were perfect: they stepped outside of their comfort zone, threw proper sentence structure to the wind, and were most concerned with connecting with me personally. The silence was replaced with acceptance, one small conversation at a time. Over a year later, looking back, their acceptances were the seeds of encouragement.

Colleagues sharing deeply personal aspects of their lives has fundamentally changed how I arrive at work. I find myself asking how I can be more supportive for the parts of

ourselves—in all of us—that are quarantined into the silent areas of the workplace. I’m still working out the answer to this question, but at the moment, it’s taking the shape of noticing the silences that surround topics of social stigma, and, as my coworkers did for me, lobbing statements of support into these silences. I’m still new at this, but learning that it doesn’t take much—a simple expression of genuine care, and listening, goes a long way.

What I didn’t understand before I came out was the importance of vulnerability in our conversations. Vulnerability creates the trust necessary to navigate difficult conversations together. Before transitioning, I had been offering a kind ear and support to colleagues, and to no one’s surprise, it always felt somewhat distant and formal. After transitioning, there is an ease, sincerity, and trust that has appeared in the same interactions. It turned out that what mattered was that I had been on a journey too, had experienced struggle, and was willing to listen without judgement. As for strength, we’d lean on each other and watch it appear in the fabric of community.

With Lief's note to colleagues, he also shared a set of FAQs he wrote. These were genuine and insightful, with practical information to dispel ignorance and address questions many might have. Lief generously allowed me to reproduce excerpts for MVC.

Lief's FAQ:

1. What if we're in a meeting and someone calls you "she/her"?

It's ok! Honest mistakes happen, and my gender will probably be outwardly ambiguous for a while. My preference is the next time that my gender is referred to, simply use masculine words to clarify (e.g. "his report"). If we're in a meeting together, I would like the focus to remain on accomplishing our collective mission and the work at hand, not on me.

2. How do I refer to you in the past—as "she/Claire" or "he/Lief"?

I'm thankful for the time we've spent time together and at the same time this creates the thorny issue of how to refer to me in the past tense. The best practice to refer to transgender people in the past is to use their preferred current name and pronouns. This is the general rule of thumb, and I'll use this convention. The reasons are 1) other people in the conversation may not know that I'm trans, and it's inconsiderate and sometimes dangerous to out a trans person without their consent. 2) My life is one unified life. It doesn't have two parts: before and after, Claire and Lief. I've always been who I am, I wasn't a different person before; I was the same person with a different name.

3. What changes are going to happen, and when?

Transitions, like puberty, are slow and take 4+ years. Transitions are as unique as the individual life they're a part of, and no two are the same. For me, my voice will slowly deepen and my body will very slowly become more masculine. Unfortunately I won't get any taller. My sense of humor will still be just as bad.

4. When did you first know you were transgender?

When I first learned the word 'trans' in 1996, I knew immediately that it described the way I had felt for as long as I could remember. If I were a kid in school now, my parents would've signed me up for gender therapy by age 5. Back then, in the early 80s, it wasn't part of the cultural conversation.

5. How do you identify?

My personal belief is that gender is a beautifully diverse spectrum, and I'm not a big fan of putting people in categories. That said, categories can have some practical uses. 'Non-binary transmasculine' is usually the closest category for me. And, frankly, has too many syllables. A shorthand of 'transman' or 'transguy' will do just fine. Non-binary alludes to my gender not being accurately described by traditional female or male categories. I'm equally uncomfortable at extremes of feminine and masculine; my gender is in the middle.

6. Do you regret not transitioning earlier?

No. Each part of the journey has been beautiful in its own way and I have no regrets.

***Deanna Dulen** has worked as a federal employee throughout her career, starting in 1978 as a US Forest Service firefighter. She worked at Grand Canyon, Yellowstone, Denali, and Death Valley National Parks as an interpretive ranger. Deanna also served with the USDA Forest Service as the first Director for the Visitor Center of the newly dedicated Mono Basin National Scenic Area in the eastern Sierra Nevada, California. In that capacity, Deanna developed conservation- and science-based interpretive programs on water issues, biodiversity, and management strategies to sustain Mono Lake and its ecosystems. She has been Superintendent for the National Park Service Devils Postpile National Monument (DEPO), located west of Mammoth Lakes, California in the Sierra Nevada, since 2000. I have been fortunate to work with Deanna since the early 1990s, when I was first setting roots in the western Great Basin and similarly fell in love with the Mono Lake region. As friends and colleagues, our careers have been interwoven with shared values and commitments—Deanna’s experience as a manager and Superintendent help me to understand the complex social context that decision-makers face in addition to the science we give them. Deanna is known by many CIRMOUNT scientists for her “science-friendly” attitude, for her spirited encouragement and welcome of scientists at DEPO. Recently, Deanna has taken a leadership role to develop management approaches for climate refugia as a climate adaptation strategy. In this interview she is speaking as a private citizen and not in an official capacity.*

—Editor

Photos here are from Deanna’s collection.

DEANNA DULEN



Connie: Would you share a bit about your background growing up and how you came to be the conservation leader that you are now?

Deanna: Born in Chicago, and later a suburban child, my father worked as a railroad engineer on the Santa Fe Railroad. When I was in 2nd grade, he took the family on a cross-country railroad trip. As the landscapes of the flat and dreary Midwest changed to the Rocky Mountains grandeur and on to the colors of Arizona and ultimately the Grand Canyon, my world view opened for the first time to the wonders of wild nature, grand landscapes, and open spaces. In my junior year of college I followed my connection to mountains and enrolled in a Comparative Education program in Salzburg Austria. Then I decided I could learn more from traveling, so I ventured off to explore Europe, Yugoslavia, Greece, Egypt, Jordan, and Israel. I did a lot of searching for ways to contribute to a better world. I realized that I drew my inspiration from nature, and that my calling was in paths

where I could directly contribute to ensuring that present and future generations will enjoy and be inspired by nature.

I began working seasonally as a Forest Service firefighter and later as an interpretive ranger at Grand Canyon National Park. I completed my degree at UC Santa Cruz in Environmental Studies, and wrote my thesis on “The Role of World Heritage Sites and Biosphere Reserves in Conserving Biological and Cultural Diversity.” I continued seasonal work as a national park interpretive ranger at Old Faithful during the Yellowstone fires, at Death Valley in winters, and Denali in the summers. When at Denali in 1989, I began exploring the science of climate change. I learned about the ice-free lands of Beringia that had served as paleoclimate refugia for large mammals during the Pleistocene ice ages. A seed of an important conservation concept was planted!

During these times, I often visited Mono Lake, and felt a riveting connection to the dying lake ecosystems, which was resulting from excessive water transport to distant urban centers. I knew part of my destiny was involved in the efforts to conserve Mono Lake and its associated ecosystems, and dreamed to become the first director of the new Visitor Center at the congressionally designated Mono Basin Scenic Area. In 1991, I was selected for this role, and planted my roots deep at the juncture of the Sierra Divide, Great Basin, and Mono Lake to fulfill what I felt was part of my destiny.

Connie: What are some (or the) key conservation goals you have for your park unit, Devils Postpile National Monument? Have you had challenges in achieving these goals that might relate to being a woman or to your background?



Sagarmarta National Park, Everest Trail with Namchee Bazaar in background.

Deanna: In 2000, when I began as Superintendent of Devils Postpile National Monument, I was enthusiastic and passionate about contributing to the mission of the Park Service, that is, to preserve the scenery and wildlife unimpaired for future generations, and to provide high-quality visitor services. I engaged in learning about the wildlife, birds, insects, meadows, forests, and river with the support of the emerging NPS Vital Signs program, which supported several scientific studies. Prior to 2008, I lived at DEPO in the summers, where I noticed how early to mid-mornings felt like I was in an icebox. During a workshop in 2008 to discuss climate adaptation at DEPO, I asked my scientific colleagues if this “icebox canyon” (DEPO is located at the bottom of a long, deep canyon) might contribute to buffering effects on global warming. Thus began a collaboration of federal and academic scientists to study the dynamics of cold air pools (CAPs). This has resulted in long-term study of CAP in the Middle Fork San Joaquin River canyon, where DEPO is situated. These studies will contribute best-available local science to inform managers about dynamics of this micro-climatic process, and hopefully add value to developing climate-adaptation strategies.

Concurrently, with my increasing understanding of the sciences related to climate refugia, I articulated this as a conservation and climate adaptation goal at DEPO and other park units. In 2015, I participated in an interagency and academic workshop at the University of California, Berkeley, which resulted in a publication outlining management actions for climate refugia

(Morelli et al. 2016). Soon thereafter, I joined colleagues from that effort to host a workshop at the 2016 IUCN Conference on “Implementing the 7-Step Climate Refugia Conservation Strategy.” In 2018, with the support of federal scientists and partnerships, a team came together to explore the physical and ecological characteristics of DEPO’s Soda Springs Meadow as a potential climate refugium, and to compile the information needed to develop an implementation plan for managing the meadow into the changing future.

When I first began researching conservation career opportunities early in college, it was in the day and age, where women “need not apply”. However, I explored opportunities at entry level jobs. Throughout my career, I was exposed to multiple levels of hostility, bullying, and attempts at intimidation. My passion for the mission of public lands and support from women friends who shared similar struggles contributed to my perseverance. I have seen women’s positions in upper management grow from just a few to approximately 30% of decision makers, along with an increased awareness of the challenges that women have struggled with in the workplace.

Connie: In addition to working in your home country you have passion for international landscape conservation and protection. You have described to me incidents with dignitaries in Asian countries where being a woman created certain challenges. Can you explain those and how you managed them?

Deanna: Some of my experiences exploring Asia for the first time in 2004 as an eco-tourist with a passion for parks were paradoxical. I joined two trips listed in the Sierra Club International Trips, “Discovering the Remote Wonders of Southern Thailand’s Wildlife Sanctuaries and Parks”, and “Tigers, Temples, and Treasures of India.” Thailand’s women have challenges personally and professionally. At a remote estuary near the Malaysian border, Thali Noi, I met one of the first women Superintendents in Thailand’s protected areas, who was leading the management of the Ramsar Site and Wetlands Reserve. She was in a challenging situation environmentally with wetlands being converted for tiger-shrimp farming for export to western consumers, and politically in an area where Malaysia border tensions around religion and culture were intensifying. Together these heightened her personal challenge as one of the first women reserve managers. Although we did not talk specifically of how she coped with these challenges, her presence spoke of her commitment and perseverance.

In 2012 I attended the National Parks International Institute and met a high-ranking woman in the Thailand National Parks system. She shared with me some of the dilemmas she faced, whereby woman were simultaneously expected to “do it all with a smile,” accommodating traditional female roles as well as masculine professional roles. At the same meeting, I met a high-ranking woman from Vietnam in a prominent role for protecting wetlands threatened by agriculture. She described how her success and challenges were based on her family history in farming wetlands, which gave her empathy for the people’s challenge to maintain a basic livelihood, while at the same time explaining more sustainable ways to farm and not destroy wetlands nearby. I was inspired by these female Asian colleagues for their passion and perseverance, and also concerned about the toll that being groundbreakers brought on their health and happiness. When I think of them, and the other courageous women, I send prayers for their success and happiness in their passion for conservation.

My experiences in India were more disturbing, especially concerning the safety of women. When I visited the tiger parks, all the staff were men. When I asked why women weren’t part of the park staff, they stated that the work was too dangerous for women. I asked: “Do the tigers prey on women more than men?” The reply was, “No, the men are the predators on women.” Our guides on this trip ensured that women participants were never separated from the group in these remote areas.

During this 2004 Asian trip, I met my future husband, who was the managing director of the Thailand based ecotourism trip I participated in. Wangdowa Sherpa is from a small, traditional, poor, agricultural Sherpa village in Nepal, and had inspired

and empowered himself to attain “his Everest”—a degree in Environmental Studies from California State Hayward. Our marriage led to a deeper connection to understanding conservation and gender issues in Nepal and parts of Asia.

During the 2012 National Parks Institute, sponsored by Yosemite National Park with 100 delegates from around the world, I connected with the Deputy Parks Director of Nepal. We were inspired to develop a Sister Parks Agreement with Yosemite National Park and three parks in Nepal, Sagarmarta, Chitwan, and Lang Tang, that was officially signed in 2016. During the evolution of this agreement, I met several Nepal Parks Directors and staff (all men). In Nepal I have received cordial reception, likely due in part to being a US Park Superintendent, and likely also that I am “married to Nepal” through my husband. That being said, there is within Nepal a gender inequality and an unofficial yet rigid caste system, where women have yet to become selected for managerial and professional positions in conservation.

In this way, my husband and I hope to complement our strengths in our work on conservation and poverty eradication coupled with education in the buffer zone around Sagarmarta National Park near his village of Phapre. We have a post-retirement dream of a Pikey-Pharpe Bio-Cultural Conservation area. We are building an education program for Sherpa youth, improving basic health needs, and hope to provide a vision of sustainable development and opportunity in conservation-based professions. After retirement, we hope to launch a science and conservation strategy for a bio-cultural conservation area to protect some of the last remaining old-growth rhododendron forests and habitat for rare threatened species such as Red Panda. My husband and



Man Bahadur Khadur, Director of Parks Nepal at Katmandu headquarters with Deanna and Wangdowa discussing Sister Parks Nepal and future opportunities.

I invite participation from scientists interested in contributing to this vision. I also hope that my presence provides inspiration to women for their potential and contributes to an evolving culture that values women's dignity and professional aspirations.

Connie: I would like to have interviewed your husband, Wangdowa Sherpa, for MVC, but I know he is unavailable now, working in the remote high Nepalese Himalaya's of his homeland. I would ask you this question instead: Have you observed unconscious or conscious bias in Wangdowa's experience as he interacted with the natural resource community in the eastern Sierra Nevada of his current home?

Deanna: Yes, my husband has had both negative and positive experiences in his applications for positions to work in the US natural-resource community. Our shared community of scientist friends has been interested in his traditional lifestyle, and the changes he is seeing in the Himalayan ecosystems due to climate change and rapid development. Several have contributed to events for Friends of Himalayan Sherpa People, 501c3, a non-profit organization we developed to raise funds for Nepalese youth education, improved health with outside venting smoke stoves, and earthquake relief. We hope someday that friends from the science community will join us in our efforts for conservation

and sustainable development through our dream for a Pikey-Phapre Bio-cultural Conservation Area, and other areas in need of problem-solving science.

Connie: Could you offer recommendations of how we might individually and collectively work to make our mountain science and resource community more inclusive?

Deanna: I hope I can provide a few humble insights from my personal and professional experiences. Over my career, I have focused on the faith that if I work locally, I will contribute globally. Recently, however, I have been wondering how to expand the scope of this to influence wider spheres of peoples and cultures directly during these challenging times. How I see expanding the range of inclusiveness is multi-faceted. First, engage with others who are not in the majority ethnicity and gender. Perhaps they may not be extroverts, or they might feel marginalized on the edges of the social circles of gatherings, such as workshops, meetings, conferences, and may be hoping for an invitation to engage. Diplomatically and respectfully ask them what their interests are in mountain climate and resources, and what are their hopes and obstacles for their work and/or their organization they represent. At the personal level, I have attempted to do more self-reflection, as to what might be



Deanna and her husband, Wangdowa Sherpa, at Thakla Pass, 4830 m (15,846 ft).

some of our culturally instilled biases and barriers to listening, understanding, and respecting those who are “different” from ourselves. Offer support and volunteer to help them bridge obstacles.

A few years ago, I participated in a multi-cultural workshop, “Engaging and Empowering the Heart to Heal the Earth.” This workshop included women of different ethnic, age, sexual identities, and class backgrounds. Over the course of the workshop, awareness and sensitivity grew to understand our individual and collective differences in how we approach the goal of healing the earth. We achieved this by sincerely wanting to understand and respect each other’s cultural differences. Each of us in our own way can expand our multicultural fluency by reaching out to others with respect, sensitivity, support, and appreciation for the contributions each person brings.

Collectively, the mountain science and resource community can become more inclusive in finding and distributing science-based solutions to offset declining biodiversity and life support systems, and expanding to contribute science-based solutions for nature conservation. These are ultimately our shared sources of life and inclusiveness. Individually and collectively, we need to become aware of the impacts of our choices of consumption and whether they are life-sustaining.

Collectively, the resource community has an opportunity to reach out to people and places in need of their expertise. There are many global organizations, such as the International Union for the Conservation of Nature, that bring people together for conferences with opportunities for engagement on multiple levels. There is a place for all resource professionals, whether we choose to work locally or globally, to contribute our scientific and social understanding toward creating a healthier, more sustainable global community.



Deanna and Minga Sherpa, manager of lodge in Tengboche, discussing the challenges of climate change to Sherpa culture and farming.

VOICES IN THE WIND

In this section, I queried members of the greater CIRMOUNT community for their perspectives on issues of diversity. — Editor

Question: Broadening the mix of heritages, legacies, cultures, and orientations that makes up our community of mountain science professionals has proven difficult despite efforts to increase diversity. From recruitment to retention, mentoring to modeling, there exist persistent challenges as well as ample opportunities. Have you observed or personally encountered barriers or behaviors that demonstrate intentional or unconscious bias? What recommendations and actions can you suggest that could help realize a future for our community that is truly inclusive?

Anna Sala is a Professor in the Organismal Biology, Ecology and Evolution graduate program in the Division of Biological Sciences at the University of Montana. She is originally from Barcelona, Spain, where she obtained her PhD.



Last fall, encouraged by the administration of my university, I attended an implicit bias workshop. My own reaction took me by surprise: by the end of the workshop I felt a powerful swell of anger. There are twenty of us fully active in my graduate program. Three of us are females. All of us are white. So, yes, the program is all white and male-dominated. But I have had and continue to have wonderful colleagues. I mean it. They respect me, they appreciate me and they have been there for me when I have needed it. What in the world was I reacting so strongly (and so unexpectedly) to? I was reacting to over twenty years of accumulated, occasional implicit bias. So implicit, so unconscious, and so unintentional that even I had not recognized it until it was explained to me. The most sobering lesson of that workshop, however, was that I, too, have been just as unconsciously biased towards others less familiar to me as I have felt those biases towards me. The fact is that implicit bias is in our human nature and it affects our decisions and actions, even against our values. The only way to prevent the damaging effects of our unconscious biases is by exercising empathy and awareness. And this requires practice. We need to talk about it openly, candidly, courteously and periodically. I shared my experience with my colleagues shortly after the workshop. Not surprisingly, they were receptive and grateful.

Lisa Cutting has been the Eastern Sierra Policy Director for the Mono Lake Committee for 20 years and a longtime member of the Mono Basin Regional Planning Advisory Committee in Lee Vining, CA.



As a gay woman growing up in the 70's, I have definitely experienced some exclusion in my life. Upon reflecting on this question, though, I realize that I have also internally created my own barriers to inclusion by not feeling “worthy enough” and therefore not participating. In my current work with policy issues and community leadership, I carry this awareness with me at all times and am constantly striving to include all the unique perspectives and opinions that make up our local community.

From my experiences I realize that it's not enough to just extend a blanket invitation and call it good. I need to look more closely and really identify what group isn't represented or whose voice isn't part of the collective dialogue. I also want people to feel safe to be involved, and of course welcomed by the rest of the group. Getting the unrepresented group there often takes extra effort and communication. Keeping the meeting environment safe and welcoming takes constant leadership. Both will likely be a lifelong process—but both are critical for diverse community representation and for my own ethical peace of mind. And I have learned that the more diverse voices we have the stronger the outcome, and for that our community benefits.

Shakeeb Hamud is a *Biological Science Technician with the USDA Forest Service PSW Research Station in Davis, CA, and has interests in forest insects and invasive species.*



Yes, I have experienced both conscious and unconscious bias as most of us have. Without getting into details, I can tell you that the moment you realize what transpired, you ask, why am I being treated this way, could these people be excluding/mistreating me for who or what I am? You feel the hurt and it plays in your head again and again until it destroys your self-esteem and triggers your insecurity.

Sometimes we are not able to speak up because of the power dynamic but, in other situations, if you have the confidence to voice your concern and let them hear you, it may be that it will be a lesson for all involved. This is what I believe but, quite honestly, I am not a confrontational person so, I ignore it most of the time and move on.

No matter how unbiased we think we are, we may have subconscious negative opinions about people who are outside our own group and my recommendation for how to extricate and fight unconscious bias is to have periodic trainings and follow up sessions for top-to-bottom level employees, and increase our diversity so that we are more exposed to other groups of people and to feel less likely to prejudice against them.

All in all, it takes a village, a community, leadership, and hard work to fight unconscious bias.

Jia Hu is an Assistant Professor in the School of Natural Resources and Environment at the University of Arizona. She studies water, carbon, and nutrient cycling in terrestrial ecosystems around the world.



In my experience, any bias that may have occurred has been quite unintentional and often occurs under the guise of social activities. Most people who work in mountain science probably enjoy outdoor activities to some degree, but everyone differs in their physical ability

to participate. People who work together also like to socialize together, and this often results in people meeting outside of work to do outdoor activities, such as skiing, rafting, hiking, hunting, mountain biking, etc. Friendships with colleagues often strengthen during these activities, and these close relationships can lead to future collaborations. In this scenario, there is the possibility that if people are not physically able to participate to the same degree as others, then some people miss out an opportunity to build these relationships.

For some under-represented groups of people, who grew up without opportunities to be outdoors for extended periods of time, not being exposed to the natural world at a young age can be a big hindrance to entering jobs related to mountain science. If someone does not have the proper gear to do multiple days of field work (and needs a tent, sleeping bag, sleeping pad, hiking boots, etc.), how could they participate? Outdoor gear can be cost prohibitive for a lot of people and money itself is probably another giant barrier.

With regard to the first issue, there isn't one solution to address this because we can't fault people with similar interests to naturally gravitate to one another. If a group of people enjoys back-country skiing together and enjoys working with one another, that's actually a great example of a positive work environment. I think the important thing is to be aware that we may unconsciously bias people by not including them in the same activities we may enjoy. Might there be other inclusive activities to consider as well?

With regard to the second issue, I think there are two solutions. The first is already in effect in many programs that try to encourage under-represented students to become involved in outdoor activities when they are young, such as in middle school. The programs that I am familiar with are also focused on including girls in outdoor leadership programs. These programs include The Cairn Project (<https://www.cairnproject.org/>) and GALS (<https://sciencegals.org/> and <https://gals.arizona.edu/>). Encouraging students at a young age to be familiar with the outdoor world is the first step to having a more representative group of mountain scientists. The second solution is to try to include basic outdoor gear in research grants so that those who may not have the proper equipment, but want to participate, can. This should be prominently advertised in the job description too.

The biggest problem right now is recruitment—if we have better gender and ethnic representation in mountain sciences, we will have more people to become mentors for future generations. I think that addressing retention and mentoring is important, but if we lack representation at the undergraduate level (i.e. can't get students in the door), there won't be many to retain or mentor.

Students are often malleable and excited to try new things. I started as an undergraduate at UC Berkeley determined to go medical school, but in my senior year, I took three ecology classes that completely changed my trajectory. I also had a chance to spend a summer working as a research technician in Tibet and then I took a semester field course in French Polynesia. These two outdoor research experiences cemented my love for working in the field. I'm sure there are many students out there just like me who are ready to be (easily) swayed to work in mountain science research, and it's our job to recruit them!

Daniel Ruiz Carrascal is an adjunct researcher at the International Research Institute for Climate and Society, Columbia University, New York City, USA and associate professor at the Department of Environmental Engineering, Colombia, with interests in climate variability and environmental change in high-mountain watersheds.



I have worked hard to join the CIRMOUNT collaborative consortium since the very first time I learned about the ambitious initiative in the mid-2000s. I started by sharing my own experience and efforts in the Colombian Andean Mountains with colleagues in the US. I celebrated the day when CIRMOUNT became one of the pilot regional projects of the international Mountain Research Initiative. I have to admit that at the beginning I got trapped by the motto 'Anticipating challenges to western mountain ecosystems and resources' but then I realized that CIRMOUNT was (perhaps entirely) devoted to improving our scientific understanding of the western North American mountains. It was too late to step back. I have participated in this effort actively over the past ten years, not as periodically as I would desire, but in several key academic events. In the process, I have encountered a few, but very limiting, barriers that demonstrate unconscious bias. What strikes me most is the fact that there are enormous differences in the scale at which we all run our research projects. Every time I defend my initiative in CIRMOUNT scientific events, I feel a big gap between how we all instrument our experimental sites, run our field campaigns, and communicate our findings to broad audiences, and how many scientific questions are addressed in our projects. Also, our own expertise biases our interests and, in some cases, drives us away from the ones of our colleagues. We normally find ourselves in a scenario in which there are significant differences between the interests of decision makers, stakeholders and researchers in our place, and these differences get even bigger when small-scale

initiatives like ours are compared with many of the CIRMOUNT projects. A truly inclusive future for our community of mountain scientists and professionals could be possible if we all foster further collaboration among researchers not only from many scientific disciplines, but also from many different global programs and assessments.

Karen Pope is a wildlife biologist with the USDA Forest Service, Pacific Southwest Research Station, with research interests in stream and meadow restoration and conservation of mountain amphibians.



I am a white woman who comes from a privileged background. Maybe this is why it took me so long to realize I was gay; I believe it was my own personal biases that held me back. Of course these biases were learned from broader cultural biases as I grew up. Once I was "out" fully, it was quite freeing and empowering. Learning to be true to myself regardless of (mis)perceptions has greatly influenced who I am and how I relate to people from diverse backgrounds and experiences. I feel extremely lucky to be part of a minority and to experience just a few of the challenges of being different.

These experiences have helped me to reflect on my recruitment practices and how they may create barriers to people from different backgrounds. For example, I used to require backpacking experience to get a summer backcountry field job. Now I only require the enthusiasm for working in remote settings. I figure it is part of my job to provide the backpacking experience and to teach the necessary skills to succeed and, more importantly, enjoy the mountains. This small change has increased the diversity of my crews dramatically. The second conscious decision I made was to minimize my volunteer workforce and provide a salary for all positions, if possible. I used to include a fairly significant volunteer work force, but realized that only those with family support could take these positions. The final action I have taken is to partner with the local Boys and Girls Club to provide access to summer science camps for disadvantaged children in our area. We take the kids into the forest and show them the fun and interesting work that we do. We encourage them to study science and return as scientists one day soon. While just the tip of the iceberg, I am enthusiastic about actively increasing diversity in our mountain science community.

Nigel Golden is a PhD candidate at the University of Massachusetts in Environmental Conservation and his research focuses on arctic ecology and conservation management.

A Better World is Possible....

Let me start off by stating that I am grateful that *Mountain View Chronicles* is creating space in this “Voices in the Wind” section that seeks, learns, shares, and affirms the distinct histories and perspectives of Queer, Trans, Black, and Indigenous People of Color (QTBIPOC). It’s a life-affirming paradigm to create and hold space for the minoritized amongst us. It is natural to hold a multitude of perspectives the same way that ecosystems hold and support a multitude of species. Originally, I began this reply much the same way I do for my colleagues when I discuss what it means to be black and queer in conservation—unpacking the traumatizing experiences that stretch across generations of my ancestors. Have I experienced acts of marginalization? Yes, I have. That’s how *institutionalized oppression* works (this is a great term to Google). I don’t want to use this opportunity however to engage in a deficit model of storytelling—I’m not always interested in viewing my blackness and queerness through a lens of oppression. I AM however, interested in viewing it through a lens of resilience—this is what nature provides for me. Unfortunately, I don’t have the space here to delve deeper into that topic but I would love to write an article about it in the future.

The question of what actions and recommendations I have to realize an inclusive community in the future brings us to a necessary discussion: the need for culturally competent leadership in the conservation discipline. Now more than ever, conservation needs champions who are engaged in the protection and upkeep of nature, and undeniably, Queer, Trans and Black and Indigenous People of Color (QTBIPOC) have a role (as they always have) in that process. The only way to move forwards is by addressing the internal relatedness of systems of hatred and issues of equal access to the environment, activities in or around nature, and environmental issues. Lastly, each of us individually needs to embody the values of diversity—i.e. actions speak louder than words. This means having very difficult conversations with ourselves (being uncomfortable), and listening to those who have been trail-blazing the work of inclusivity.



Kavya Pradhan is a PhD student in the Department of Biology, University of Washington in Seattle, with interests in plant community responses to climate change and the connections between species, traits, and productivity.

There have been many instances where I have felt like an outsider trying to find my way into this field. Personally, the biggest hurdle for me was at the point of entry mainly because I had very little prior experience in conducting ecological research, especially field research. However, thanks to the support and guidance that I have received from my mentors, I have found a way in and am excited to be a part of this community.

The biggest step we could take to make progress towards a more inclusive community is to recognize that love for the mountains does not necessarily mean opportunities to interact with them. I grew up in Nepal surrounded by mountains, yet I had little to no opportunity to think about and interact with them the way I do now. Removing barriers to entering this field by introducing mountain research to a wider audience from different backgrounds and identities through outreach would increase interest in mountain research. Coupling this with increased exposure to mountain science through opportunities in research either at the undergraduate or the postgraduate level for people with varying levels of experience would make this research more available to a wider group of recruits. For example, it is extremely difficult to get positions in field biology without prior experience, yet obtaining your first position is the hardest of them all, especially if you have other responsibilities that keep you from taking part in field experiences early on in your career. Diminishing this barrier by introducing opportunities targeted specifically at folks with less experience but a lot of interest would be especially beneficial. In addition to this, increasing representation of scientists from a variety of identities and cultures is extremely important because then this career path does not seem like such a strange one to follow!



José Sánchez is a Research Economist with the USDA Forest Service, PSW Research Station, focusing on the valuation—or determining a quantifiable value—that people place on intangible forest resources (commonly referred to as “ecosystem services”), such as recreating in a forest or having clean water.



I grew-up in the inner city and didn't have many opportunities to visit the forests or go up the mountains. Actually, I did not know much about the mission of the Forest Service or any other natural resource agencies, other than seeing billboards and commercials on Smokey Bear and how “you can prevent wildfires.” Based on my personal experience, the lack of information for disadvantage communities on the Forest Service and other natural resource agencies mission and career opportunities has led to an underrepresentation of people of color in these agencies, especially as environmental scientists and professionals. Therefore, this limits recruitment of highly talented minority students as they are unaware of professional careers available with Forest Service and other natural resource agencies. In addition, the current low number of minority scientists make it difficult for outreach and to mentor potential candidates. One recommendation is focus on students from disadvantaged communities by increasing the number of internships opportunities (i.e., Pathways Internship Program) with conversion possibilities. If possible, matching the student with a minority scientist will be ideal to increase retention. Another suggestion is to have outreach activities in high schools and universities with large numbers of minority students to increase awareness of potential internships and career opportunities available with the Forest Service and other natural resource agencies.

Henry Diaz is a research meteorologist, retired from 33 years with NOAA. Currently Adjunct Professor at the University of Hawaii, he continues to pursue problems in climate impacts and has logged more than 200 miles walking Maui beaches since retirement.



An African proverb that has been mentioned recently in some political circles affirms that, “It takes a village to raise a child.”

As early as in classical Greece, the significance of mentoring was recognized for its importance¹. The Merriam-Webster Online Dictionary defines a mentor as “a trusted counselor or guide.” Serving as a mentor brings many challenges and rewards, with the best mentors “working to shape their mentees into leaders, rather than just good followers. If done well, the long-term impact of mentoring can offer life- and career-changing benefits to both parties. A mentoring relationship is a win-win for all parties.”²

For most, if not all of us, there were places and times when someone's guidance, advice, or assistance became an important catalyst in that person's future pathway. It turns out that evolution has endowed most humans with greater feelings of satisfaction when giving to others than they normally feel when receiving from others³. I can attest to that and to the fact that both mentors and mentees in my own experience have been both friends and colleagues. I have always considered it a privilege of my profession to have been in the company of exceptionally smart and creative people.

By the Year 2045, the generation being born today will be turning 25 years of age. The detrimental effects of climate change on the environment and society will already be evident, as well as the even more dire future prospects of their unborn children 25 years hence. It is not a euphemism to state that our house is on fire—the times call for all hands on deck.

Notes

1. A character in Homer's epic poem "The Odyssey" could be called the original mentor. When Odysseus, King of Ithaca went to fight in the Trojan War, he entrusted the care of his kingdom to Mentor, who served as the teacher and overseer of Odysseus' son, Telemachus. From A Guide to Understanding the Role of a Mentor, <https://www.thebalancecareers.com/a-guide-to-understanding-the-role-of-a-mentor-2275318>
2. <https://www.thebalancecareers.com/a-guide-to-understanding-the-role-of-a-mentor-2275318>
3. Giving really is better than receiving. Psychology Today. <https://www.psychologytoday.com/us/blog/the-social-self/201012/giving-really-is-better-receiving>

Rene Henery is an Ecologist and Eco-geographer who holds a joint position as California Science Director for Trout Unlimited and part time Research Faculty with the University of Nevada, Reno, Global Water Center. His work embraces water, diversity, connectivity and equity as pathways to resilient ecosystems and communities.



Disclaimer: I want to acknowledge that diversity is an inherently challenging topic for me to engage. To discuss it feels vulnerable, in the painful memories that it evokes, the personal trigger points it touches on, and in the way that it exposes my sensitivity to dynamics around it and in that my "difference." Woven through my life experience as a person of color has been the complex dilemma of having to choose whether to be vulnerable, share, and expose myself in doing so, or to take on some mask or pretense in an effort to hide my difference, not disturb the dominant culture around me, and deny the self-awareness and insecurity that constantly comes up as a function of my experience not fitting in with what is "normal." Because, in my life and work I am fundamentally interested in making and repairing connection among living things, in healthy living systems and communities, in resilience born of diversity, I do my best to share, and to grow and heal. What I share, however, carries all of the above complexity and sometimes artifacts of my struggles and challenges. I offer it only as what I perceive from my vantage; as a window into my experience.

Unpacking the challenge of cultivating diversity in the related fields of science and conservation is both a journey into our collective baggage, and a window into the possibilities for growth, adaptation, and change before humanity. At the core of this challenge, I would suggest, are two fundamental misunderstandings: 1) a misunderstanding of the nature and opportunity of diversity, and 2) a misunderstanding of the nature and opportunity of science.

Over the last decade I have been struck by a growth in the popularity of (and to a lesser extent actual attention to) diversity, equity, and inclusivity in a range of popular-cultural and professional earth science and conservation contexts. As an expression of this, I have been invited to and participated in several structured forums, conferences, and workgroups all in some way focused around the intention of bringing more diversity to the earth sciences and conservation. In almost all cases, what was meant by this was increasing the number of

people, like myself, identifiable by the organizer as belonging to a demographic perceived as underrepresented in science and conservation as they exist currently. To generalize, the desired outcome from my participation was essentially the same culture and system, working towards the same outcome, but with the addition of my more colorful face. What this approach to diversity misses is that different faces often come with different backgrounds, stories, experiences, and values which, if incorporated into the system, may fundamentally change how the system operates. For example, several of the forums I participated in I would characterize as attempting to increase diversity by training people on some facet of the culture existing in conservation and earth sciences today, be it related to leadership, organization and management, or messaging and engagement with the media and public. From my vantage, however, **that normative impulse: to include by acculturating, fundamentally undermines the diversity it is nominally in pursuit of.**

I am the son of a South American father with heritage extending to four continents and a Euro-American mother. The racial, ethnic, and cultural facets of my personal and familial history, however, I experience more as parts of the palette that I create with than colors with which I singularly identify. I tend to see all people in this way: life expressing itself through a unique collection of contexts, experiences, genetics, love and wounding, separation and connection. Every person, (in a sense every living thing) from this vantage is a collection of culminating moments in a long and unique thread of life through time. From this place, the opportunity of a diverse system really becomes about all of those unique expressions becoming fully realized together. That realization, however, is unlikely to occur in contexts where those diverse expressions must first pass through a normative filter, woven of the same colonial, patriarchal, white supremacist, or other oppressive and value-effacing threads that (often intentionally, at least at the outset) created the contextual homogeneity in the first place. In short, in my experience, diversifying earth science and conservation cannot occur through diverse people adopting the normative cultures of those fields and spaces as they exist now, it can only occur through those fields and spaces reforming to incorporate, support, and reflect the plurality of experiences, perspectives, and expressions of diverse people.

The idea that deconstructing normative culture and replacing it with an emergent expression of difference bound by belonging is central to supporting diversity, highlights a second misunderstanding: that of the role and opportunity of science. At its core, science is a collection of individual, subjective experiences conveyed in a language and suite of methodologies that seek to be transparent and replicable. In part, as an

expression of its history and application not only for knowledge but for oppression and control, science often is misperceived as providing universal truth. The notion that something can provide a truth that applies across people, independent of the differences in their histories, experiences, and values, fails to recognize the extent to which truths are personal and a function of perception. The application of science in pursuit of universal truths is thus inherently normative and counter to diverse expression. From my vantage, that pretense in and around science is, understandably, at the core of the frustration and anti-scientific sentiment increasingly bubbling up in the US and elsewhere. But this misunderstanding does not mean that the field of earth science cannot become more diverse or that science does not have a critical role to play in the pursuit of more diverse modes of being. The vast differences in some facets of people's experiences can make connection and communication challenging. Science offers a common language through which we can share our experiences with others and explore and learn from theirs. Critical to science supporting diversity in this way, however, is that the goal of its application be understanding and connection. Through greater respect for other experiences and transparency around our own, we can discover individually and collectively, with help from science, the ways we differ, the ways we don't and ultimately that we are all connected as parts of something greater.

In my own work to support and deepen diversity in science, conservation, and elsewhere, I often find that understanding the concepts laid out above does not necessarily reveal how to apply them in practice. Over the years a few general principles have emerged as helpful in guiding me in this work. I offer three of them below in the hopes they can help concretize some of this for others as well:

1. Don't act on your own—Diversity begets diversity: When developing a program, initiative, or even a simple dialogue around diversity, it can be tempting to take our own ideas about how it could look or function and implement them—resist this temptation. Instead, reach-out to a diverse suite of people, engage them, interview them, invite them to become our wise counsel and to guide us. Ideally this engagement begins by allowing them to frame their own understanding of the topic so that even our core questions may shift and change as the dialogue moves from one constrained by our own perspective to one emergent from many perspectives. Within an organization, this may take the form of beginning with a group of diverse people who are empowered to guide change, but who then reach outside the organization to engage other perspectives, experiences and skillsets to broaden the dialogue even further.

2. Embrace change, communicate, be vulnerable, and trust—Increasing diversity in an organization, a community, a field, a discipline, or any context will invariably change that context in ways that are unexpected and can be scary. Throughout the process, it's important that we work to be open to the change. This is not easy, but some of the friction of change can be abated if we become vulnerable and communicate our fears as they arise. Even then, operating in a diverse system with new unfamiliar parts requires a great deal of trust. Rather than feeling comfortable because the system is fully known and gives us a sense of control, we must trust, relinquishing control of a known outcome for the possibility of a greater outcome beyond any one individual expression, achievable only via diversity.

3. The container matters—Diverse communications, interactions, and spaces while often inherently deeper and richer can also be more vulnerable, exposing, triggering, and at times uncomfortable. Navigating them effectively takes time, practice, and often some fundamental changes and increased attention to the “container” (i.e. the intention, style, format, and venue) through which we engage. Some of the things that can be helpful in creating a strong and effective container include: a) neutral facilitation with expertise in diverse engagement, b) attention to and valuation of the emotional understorey of the engagement and experience of the participants, c) inspiring, grounding contexts (i.e. natural or informal settings) that support participants feeling more relaxed and less pressure, and d) a structure for the discussion and dialogue that gives everyone equal space and time to share, to be seen, and to be heard without pressuring them to do so.

Sudeep Chandra is an Associate Professor of Limnology and Director of the Global Water Center at the University of Nevada Reno. He is a lover of mountains, their ecology, and the communities that live in them.



In these writings, I reflect on my early life experiences that helped elevate me to find my love for the mountains and its ecology.

While I have not encountered intentional behaviors that would lead to bias, in developing a more diverse racial culture I am reminded through my high school and college experiences that connections to nature and mountain environments are not well-developed for some first-generation Americans whose families

focus on other aspects of life productivity. As a result there is a lingering self-imposed bias during one's early life that results in a lack of exposure to new disciplines, places, and activities. These lack of exposures and mentor-guided career experiences by one's upbringing can be overcome with specialized and targeted programs that attract new diverse cultures into a field. Such targeted programs allowed me to examine a new sense of place and in my case, select a career in this place we call the mountains.

Born and raised in Oklahoma and a handful of summers in India with my extended family, I am first generation Indian-American whose family didn't have vacations in nature like other non-first-generation families. As such, I had little formal contact with nature during my youth, other than mowing lawns (so connecting with "human-created" nature) or walking along the modified creek behind my house with friends. After my senior year, I had an opportunity to participate in a high school diversity internship with the Oklahoma Biological Survey's Natural Heritage Inventory. Little did I know at the time, this few months' work experience would introduce me to the beautiful plants of the playas and prairies of Oklahoma. The directed mentorship of individuals would begin my interest in exploring the natural world.

During college at UC Davis, I explored internship opportunities in traditional fields that a first generation Indian-American might consider as career path (e.g. medicine, engineering). Studying overfed rats for medical nutrition studies (summer after my freshman year), however, did not resonate with my heart although it did connect me with living things, at least in cages. This innate connection, through biophilia, as EO Wilson coined, was my first realization that I am deeply connected to the living animals around me. During my sophomore and junior summer holidays I engaged in a series of opportunities that would create a deep connection with mountain environments and the living creatures within them. By serendipity I learned about and signed up for a summer field studies class through UC Santa Cruz's Sierra Institute. Backpacking and camping for 2 months in the Sierra Nevada, I learned how to navigate through the wilderness with

map and compass (there was no GPS then), exercised my natural history observation skills, learned about medicinal plants and ethnobotany, and how to go to the bathroom in the woods! To a first-generation kid from Oklahoma, this was a mind-opening experience. My class mates were mostly seasoned campers and only two of the dozen or so students and instructors were non-white. In some way, I was in conflict with the experiences from my culture and childhood but in another way I found a sense of place in the mountains. The following summer, I applied for a US Department of Agriculture's Rocky Mountain Experiment Station minority internship. This paid internship (including travel) to work in the Magdalena mountains of New Mexico to mark and track bats using radio tags connected my love for biology with the natural connections I was developing in the mountains. In short, the internship experiences that targeted minorities or classes that were more directed in learning gave me the opportunity to explore nature (and my inner-self) in fundamentally different way than would be afforded otherwise.

This reflection is a story of how I developed my mountain connections at an important stage in my life-development path. I clearly benefited from targeted and funded programs that improve diversity in the sciences, ecology and management of public lands, or through hands-on learning experiences that allowed me to discover my sense of place. It is important for our institutions (e.g. government, nonprofit, academic) to promote discourse related to diversity in the mountains, what hinders this diversity, and how we can improve it. Targeted programs and directed mentorship are one tool to improve this discourse and provide experiences for those who would not otherwise experience the mountains at an early age. There is a falsehood in many recently immigrated cultures that one cannot have a viable, financially successful career in the environmental sciences. Funding programs that target minority cultures that promote work-based experiences demonstrate the potential viability of environmental sciences as a career path. Recruiting from these programs for permanent positions in government and academia can generationally move our society towards not having to ask the questions or address this issue of diversity in the future.

NEWS and EVENTS

Mountain Ecosystem Conference: MtnClim's Sister Conference in Mexico

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The Mountain Climate Conferences (*MtnClim*) have been a great success, 16 years, eight meetings, great science communicated, and networks and careers strengthened. What would you say if you found out there is a parallel conference in Mexico, the Mountain Ecosystem Conference? The 7th Symposium on Mountain Ecosystems of Mexico occurred in the state of Mexico in October of 2018. The meeting is organized every 2 years at different places around the country. It is entirely volunteer driven, and represents a grassroots effort by Mexican scientists to promote and develop mountain ecology for Mexico.

The theme for 2018 was “Ecology, Management and Conservation.” The event comprised 79 oral presentations and posters, six plenary sessions and multiple social gatherings. It was hosted at the Center for Interdisciplinary Research in Regional Integrated Development (CIIDIR), a graduate research university located in Oaxaca City that is part of the National Polytechnic Institute, the largest public university system in the country. Local graduate and undergraduate students were able to attend the multi-day symposium, as well as several busloads of graduate students from the prestigious National Autonomous University in Mexico City (UNAM). Researchers from other parts of the country also came, with an approximately equal mix between university and agency scientists.

Funding is much more restricted in Mexico, and by necessity registration costs are lower than for the *MtnClim* conferences. Additionally, some researchers had to drive along roads that are not secure in order to attend. We heard a story from one of the keynote speakers whose car was chased by men in a different car seeking to rob them, and likely would have done so had they not fortuitously driven by local law enforcement who came to their aid. Nonetheless, the speaker made it to the conference, and the appreciation and enthusiasm he received from the group was palpable.

While some of the science themes were similar to *MtnClim*, the Symposio has some differences. It is organized around host locations that have an academic tie, and there is an active attempt to involve the local community, including outreach to local students. In this dimension, the Symposio serves more as an external communication endeavor than *MtnClim*, which has some element of an internal communication tool. For example, the local government officials of Xoxocotlán, the host town where CIIDIR is located, were part of the opening convocation. They also helped organize the school marching bands that performed during breaks between speaker sessions and during a small artisanal market that was held on the campus and where local artisans had crafts and food for sale to conference attendees.



Local government officials and conference organizers prepare to open the Symposio.



Grade school marching band musicians perform during a break in the presentations. For sale were guides to local flora and fauna, food, mexcal, woven baskets, and fabrics.

Since 2014, John has been working as a professor at CIIDIR. He organized a session and invited me (Jim) down to report on a study we jointly conducted with seed funding from UC Mexus, a program that seeks to foster collaborations between the University of California and Mexican researchers. We presented two papers on climate risks to the state of Oaxaca and for the country, which the National Forestry agency CONAFOR is actively interested in. I stayed in a comfortable and clean hotel on the edge of town. The conference occurred during the Dia De Los Muertos festivities, which coincide with Halloween and showcase the artistic, cultural, and culinary splendors of Oaxaca, as well as the unique way that Mexicans remember and celebrate their ancestors. Oaxaca is definitely one of the cultural and arts centers of Mexico, and the parades and evening bacchanals were outstanding! Conference organizers brought a face painter to one of the poster sessions and encouraged conferees to get painted. I had the pleasure of getting ‘done’ and then presenting a talk

in full fiesta mode. That evening a large group of us went to the local cemetery where hundreds of people were sitting with their relatives—candles and marigolds on graves, costumes, music, mescal, picnics, dancing, singing. The festivities were still going strong when we returned around 2am in the morning.

I tried to identify who was the lead organizer, but the Simposio has a much more grassroots approach, and no one was directly willing to own up to that role. Graciela González from CIIDIR, however, was one of the organizers for the 2018 simposio and would probably be a good person with whom *MtnClim* could establish initial contact. There is also potential for mutual support for future meetings in the US and Mexico. The Mexicans, for example, have already selected Guanajuato as the location of the next symposium in 2020. It may not be possible to hold a joint meeting in 2020, but it would be worth looking into. Alternatively, perhaps *MtnClim* could offer to bring a few of



One of the poster sessions.



Professor John Williams in formal Dia de los Muertos face paint.

the Mexicans to the next convening, and perhaps a few of the *MtnClim* researchers would be willing to go to the next Simposio. The topics of the 2018 Simposio covered a wide range of ecological and land use studies, with emerging interest in ecological forecasting and impact assessment of climate change.

The Simposio schedule is posted at <https://intranet.ciidiroaxaca.ipn.mx/simposiomontana/>. We can also post it to box.net if people want a copy.

We hope that the two conferences will be able to support each other in the future. In the meantime, it is heartening to learn of a sister conference emerging in its own right in the beautiful country of Mexico.

For more information, contact Graciela Eugenia González, gracielaeu@gmail.com, or Dr. Lázaro Sánchez Velázquez, lasanchez@uv.mx



From the Xoxocotlán cemetery.

29th PACLIM Workshop Report - PACLIM 2019

Michelle Goman¹ and Scott Mensing²

¹*Geography, Environment and Planning, Sonoma State University, Rohnert Park, California*

²*Department of Geography, University of Nevada Reno, Nevada*

The 2019 PACLIM workshop was held at the Asilomar Conference Center in Pacific Grove, California, February 17-20. The theme of this year's meeting was "Extreme Events," inspired by the recent fires and floods in the West that followed an extended drought period. We were fortunate this year to host nine keynote speakers, providing us with a full day of talks with a range of perspectives on fire, flooding, drought, and snow extremes. Our keynotes used tree-rings, marine sediments, historical documents, remote sensing, and future modelling to bring insights into the changing patterns of climate extremes through time. Sunday evening, Daniel Cayan of Scripps Institute of Oceanography and UC San Diego, opened the meeting by giving the inaugural Kelly Redmond Keynote Address. In honor of Kelly's long presence at PACLIM, and keen interest in the complexities of mountain climate patterns, he gave an insightful lecture describing the complexities of cold air pooling in mountain valleys, and the potential significance of such thermal dynamics considering potentially warming future climates.

This year we had 90 registrants to the PACLIM conference, with 24 submitted oral presentations and 46 posters. Alex Rose, of the Long Now Foundation gave an evening lecture on *Designing for Longevity*, a discussion of how one can design for structures that last thousands of years. It was a well-travelled group, with participants from Kentucky, Maine, Arkansas, South Carolina, North Carolina, Tennessee, Georgia, Indiana, New York, New Jersey, Massachusetts, Michigan, Washington, Utah, Colorado, Arizona, Nevada New Mexico, and of course a large contingent from California.

Each evening we had a two-hour poster-session/social that as usual was very well attended, sparking many conversations and allowing students to meet many of the researchers whose work they were building upon. Students commented that the meeting was incredibly important for networking and talking with USGS personnel and academic faculty, for making potential graduate school connections, and getting suggestions and feedback on their research from highly regarded professionals in their field.

One student said, *"The feedback that I received will aid in taking my thesis work to the next level, and I left with questions to address that I had not previously thought about. Seasoned researchers who have long worked on similar problems as I were more than willing to network and offer a helping hand."*

Another noted, *"I appreciated the opportunity to meet and hear takes from people whose research has informed my own. As an example, in my poster, I cited a number of authors who were either present at the meeting, or whose students were. When I had the opportunity to speak with these individuals, we were already starting out from a similar level of familiarity with the topic and region. As such, these interactions often led to recommendations and ideas for how to further pursue answers to my research questions. It was also exciting to listen to talks from some of the "big names" in the field and think about how their work could be relevant to my own."*

A third student wrote, *"I found attending and presenting at PACLIM to be a valuable experience. Being a small specialized conference was an advantage, because I was able to have more personal interactions and almost all the research presented was relevant to my interests. At larger conferences I generally only interact with people I already know, but at PACLIM I was able to meet new people during meal times and poster sessions. I also received feedback on my own research during the poster sessions. The talks were high quality and I often took notes on presenter's research and looked up their publications later. Larger conferences can easily become overwhelming and I tend to not take in as much information and often need to find somewhere quiet mid-way through the day. PACLIM was designed to be manageable, in both the number of talks and the number of people in the presentation hall, as such I learned more than I otherwise would have."*

Many of the senior researchers at the meeting had attended PACLIM as graduate students, demonstrating the long legacy or participation in the workshop.

We are working on a volume of paper contributions once again as a special volume in *Quaternary International*, and edited by Ingrid Hendy.

PACLIM 2021 Early Announcement

Hold the date for PACLIM 2021
Feb 7-10, 2021 at Asilomar Conference Grounds, Pacific Grove, California

For information contact Michelle Goman (SSU, goman@sonoma.edu)
or Scott Mensing (UNR, smensing@unr.edu)



Photo: Scotty Strachan

***MtnClim 2020* Early Announcement**

Hold the date for *MtnClim 2020*

September 14-18, 2020 at the Rocky Mountain Biological Lab, Gothic, Colorado

The MtnClim research conferences are sponsored by the Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT) and dedicated to mountain climate sciences and effects of climate variability on ecosystems, natural resources, and conservation in western North American mountains. MtnClim conferences feature invited and contributed talks, poster sessions, field trips, and working-group sessions. Post-conference workshops address topics of interest for further discussion. Mtnclim conferences convene every two years. *MtnClim 2020* will be held September 14-18, 2020 at the Rocky Mountain Biological Lab in Gothic, Colorado.

Contact Andy Bunn (WWU, bunna@wwu.edu) or
Scotty Strachan (UNR, strachan@unr.edu) for more information.



Photo: Jeff Wyneken

Eighth Annual High Sierra Natural History Celebration

Yosemite National Park, California
July 26-28, 2019

This Celebration—a gathering of local and visiting naturalists—will take place in Yosemite National Park's beautiful Tuolumne Meadows. This weekend gathering is hosted by the Tuolumne Meadows Interpretive Staff in partnership with the Natural History Institute and includes natural history activities along with some special offerings and opportunities for exploration and interaction with a diverse and inspired group of naturalists. All are welcome. See our Facebook page for more information.

Brian Scavone, Yosemite National Park, California
felis.concolor@gmail.com



Tuolumne Meadows. Photo: Ryan Alonzo

24-26 June 2019,
Bern, Switzerland.



GEO GNOME WORKSHOP: ESSENTIAL CLIMATE VARIABLES FOR OBSERVATIONS IN MOUNTAINS

Identifying and selecting essential variables required in high elevation contexts for the monitoring of mountain-specific processes of change.



WWW.MOUNTAINRESEARCHINITIATIVE.ORG/EVENTS

International Mountain Conference 2019

September 8-12, 2019

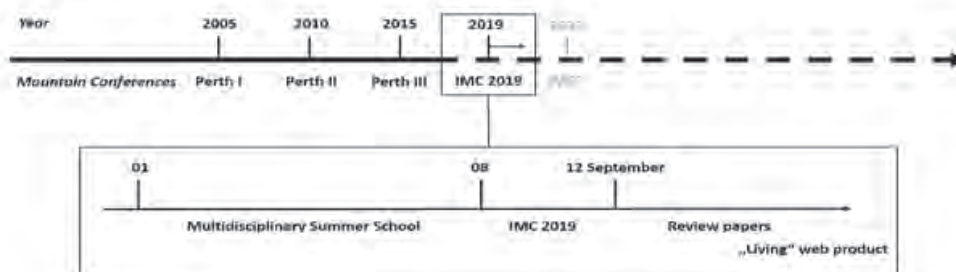
University of Innsbruck, Innsbruck, Austria

About the Conference

Evaluating the responses of mountains to climate and other changes, and their resilience as social-ecological systems, requires the consideration of multiple and mutually interacting stressors. The IMC 2019 aims to encourage in-depth cross-disciplinary discussions towards a new understanding of mountain systems, their responses and resiliencies.

The IMC 2019 will take place 08 - 12 September 2019 in Innsbruck, Austria. It aims to build upon the three previous mountain conferences that took place in Perth, Scotland, continuing this special scientific conference series with a focus on mountain-specific topics. Hosted in the Alps, the IMC 2019 will provide an excellent opportunity for experts from different disciplines to come together and discuss mountain-related issues.

Timeline



For Conference Information:
www.uibk.ac.at/congress/imc2019/about/

International Mountain Conference, Innsbruck, 08–12 September 2019



IMC 2019 – International Mountain
Conference 2019

FIELD NOTES

What do Contact Lenses and Dataloggers Have in Common? Solutions Inside the Box

Connie Millar
USDA Forest Service, Pacific Southwest Research Station
Albany, California

*Dedicated to Jessica Lundquist, in her unwavering quest to innovate simple,
inexpensive field methods to address sophisticated science questions*

Ever since I learned about the availability of small, inexpensive temperature dataloggers (Fig. 1), I have been sprinkling environments of the Great Basin with these devices. From rock glaciers to pika habitats, mountaintops to cold-air-pooled ravines, I have become an iButton addict, desperate to learn the thermal regime of just one more place. After losing units to woodrats, we learned to outsmart them with wire mesh and tethers; after overheating units due to direct sunlight we fashioned pseudo-radiation shields from PVC tubes. One thing continued to stymie



Figure 1. Temperature dataloggers (Maxim iButtons).

simple solution: how to keep the units dry when submerged in water. Being both a miser and determined to find a simple way (thanks, Jessica) to waterproof the units, we tried tying the units in condoms, engulfing them in shrink wrap, and sealing the seams with silicone gel. These worked to some degree but all led to unit failures that we attributed to water leakage. I finally caved and bought a handful of company-offered cases made for the purpose of water-proofing, but it irked me to pay as much for a case as for a datalogger itself. And by now I have hundreds of iButtons and need dozens of waterproof cases to satisfy my curiosity about wet places.

This winter a cheap alternative surfaced: Anyone who wears contact lenses knows that when you buy lens solution, each box also contains a new plastic lens case (Fig. 2). As these accumulate, I seek to put the extras to new uses, such as to store

ear plugs, as pill containers, salt, pepper and spice containers for camping, and earring containers for traveling. Eventually I run out of ideas and recycle the extra containers. Last year, a citizen scientist, Steve Stampfli, contacted me. Steve participates in the Cascades Pika Watch and had gotten interested in an ice-cored talus in the Columbia Gorge of Oregon. We discussed using iButtons to investigate the talus thermal regime, and I sent him a few units with our standard gear (PVC, wire, etc.) to get started. The Gorge being a wet place, I suggested that he seal the units with silicone. Many months later, Steve casually mentioned that maybe contact lens cases would work as waterproof iButton cases. Brilliant!



Figure 2. Typical contact lens case.



Figures 3. I used a hack saw to cut each lens case into two iButton containers.



Figure 4. Here I put my programmed iButton in its new water-tight container.

I immediately put the cases to the test, running parallel sets in buckets of water, with bare iButtons, units in company-made cases, and in contact lens cases. I moved the sets from fridge to freezer to outside dry air. After three weeks, I downloaded the data. Several of the bare units had failed whereas all units in company or lens cases were still functioning, and temperatures were similar. Granted this was hardly a statistical test, but at least I could see that the units stayed dry in the lens cases, and reached the same minimum and maximum temperatures of the other units.

You can see in the accompanying figures how I plan to deploy iButtons in their contact lens cases. In all situations, of course, the cases should be placed in a location that is protected from direct and ground-radiated sun.

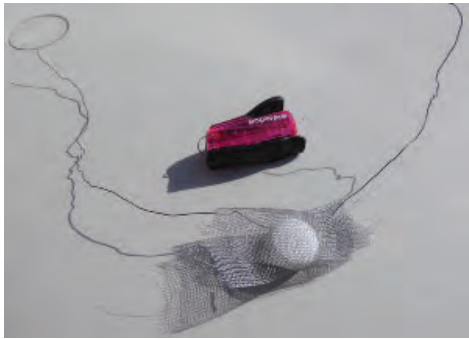


Figure 5. To protect and secure the iButton container, I use wire mesh and staple the container into a package that also includes a piece of wire, which can be used as a tether.

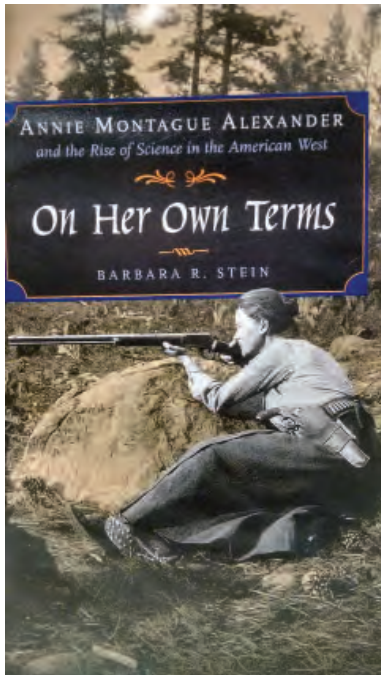


Figure 6. Use the wire to secure the package in wet places. In a) I've tethered it to a tree near snow (=wet). Here the case is unprotected from direct sunlight, but they should always be in a shaded location or in a radiation shield of some kind. In b) I'm showing the case in a stream, but again it should be protected from direct sunlight (e.g., under a rock).



Nunatak Tarn, Sierra Nevada, CA; a nice place to monitor water temperature. Photo: Jeff Wyneken

BOOK REVIEW



Stein, B. R. 2001. *On Her Own Terms: Annie Montague Alexander and the Rise of Science in the American West*, University Of California Press, Berkeley, 380 Pp. ISBN 0-520-22726-3

I only recently learned of and read Stein's book, On Her Own Terms: Annie Montague Alexander and the Rise of Science in the American West, which chronicles the life and work of Annie Montague Alexander (1867–1950). Among many other accomplishments, Alexander was a brilliant paleontologist, mammalogist, and, later in life, botanist, to say nothing of explorer and adventurer. At her initiative, as well as financial support and ongoing guidance, Alexander founded the now-internationally prominent Museum of Vertebrate Zoology (MVZ) of the University of California, Berkeley. Critical to that was her association with George Grinnell, the first Director of the Museum, whom Alexander hired and worked closely with for many years. The collections and documentation of Grinnell and his team are the basis for the current Grinnell Resurvey Project, which many in the CIRMOUNT community know well, contribute to, and use. Working in the early 1900s as Alexander did, in uncharted backcountry with her life partner, Louise Kellogg, as her sole companion, she invited challenging adventures that few women would have dreamed of at the time. Alexander was



Campsite in Saline Valley, CA, late December 1936. Collection of the University of California, Museum of Vertebrate Zoology, Berkeley, CA.

equally at ease in remote Africa or the mountains of Nevada as she was stumping for the MVZ with the University president or lobbying for support to expand MVZ and continue annual collecting expeditions. I was deeply moved and inspired by Alexander's spirit and highly recommend this wonderful book. I am pleased to share Felisa Smith's 2002 review. –Editor

Reprinted by permission of Oxford University Press and consent of the author: Smith, F.A. 2002. *On Her Own Terms: Annie Montague Alexander and the Rise of Science in the American West* by B. R. Stein. *Journal of Mammalogy* 83:626-627.

“...I do not want to be selfish yet it seems to me we [women] have the right to a considerable extent of disposing of our lives as we think fit.” (A. M. Alexander to her friend M. Beckwith, February 1901).

Over the past few decades historians, scientists, and the like have become interested in the role played by women in the development of various scientific disciplines during the early 1900s (Abir-Am and Outram 1989; Bailey 1994; Bonta 1991; Ogilvie 1986; Rossiter 1982). In an era when few worked outside the home, professional scientific careers for women were unheard of, and educational opportunities were limited, some women still managed to become involved in scientific endeavors. *On her own terms* is the biography of one such remarkable woman, Annie Montague Alexander. Not only was Alexander an intrepid explorer with an insatiable appetite for adventure, but she was also a highly skilled amateur naturalist. Over her lifetime she collected more than 22,000 mammal, 17,000 botanical, and 1,500 fossil specimens, including a number of previously undescribed species. Arguably more important, however, was Alexander's



Annie Alexander. Date and location unknown. Collection of the University Of California, Museum Of Paleontology, Berkeley, CA.

pivotal role as the founder and patron of both the Museum of Paleontology and the Museum of Vertebrate Zoology at the University of California at Berkeley (MVZ).

This book is more than just a biography. Drawing on correspondence, diaries, personal interviews, and other archival material, the author Barbara Stein has written an engrossing account of how science in the early 1900s was influenced by Annie M. Alexander. This occurred not only through the scientific and political impact of the 2 museums Alexander founded and continued to fund throughout her life but through her role as the patron, advisor, and colleague of men who went on to become highly influential and respected scientists. Readers will find her relationship with Joseph Grinnell particularly intriguing, especially in the light of his well-known prejudices against female scientists. The author is not shy about this apparent paradox: “Grinnell’s willingness to take direction from Alexander and be accountable to her in almost all aspects is an astonishing and key factor in the success of their venture [the establishment of the MVZ] ... Such deferential expressions were counter to the manner in which Grinnell treated all other women (with the possible exception of his wife) and many of his colleagues...” (p. 91). Throughout his tenure as director (1908–1939), Grinnell did not permit women to participate in museum-sponsored field expeditions, and they were denied entry into the graduate program until the 1930s. Despite this, it is apparent that Grinnell

held Alexander in high regard both as a field biologist and as a fellow visionary: “This is your enterprise. You have sacrificed a very great deal to bring it to its present estate. The Museum’s assets in the way of scientific materials are enormously valuable ... I want you to know that I am not unmindful of my debt to you for the opportunities I have had here to work in exactly the field I have always preferred to any other. In other words your getting me here meant the realization of my dreams. I am keenly grateful.” (p. 95). This esteem was clearly mutual; although Grinnell was still 5 years from attaining his Ph.D. and had not as yet achieved the reputation he enjoyed later, Alexander made his appointment as director an inflexible condition for her willingness to establish the MVZ. Upon his sudden death in 1939, she wrote: “We have been so closely united in our ambition to make the Museum a center for the study of vertebrate zoology with a reputation for high quality output that his sudden death leaves me stranded...” (p. 253).

The book is arranged in roughly chronological order, with each of the 29 chapters devoted to a different topic, event, or time period. The 1st chapter deals with Alexander’s father, Samuel, and his business partner, Henry Baldwin, who together established a Hawaiian sugar empire that was an immense financial success. The wealth provided by this venture opened countless opportunities and provided considerable autonomy for Alexander. There is little doubt, for example, that her underwriting of field expeditions was the original reason she was allowed to participate in them—opportunities that at that time were largely unavailable to other women.

The 2nd chapter deals with the family’s move from Hawaii to Oakland, California, and Annie’s late childhood. It is unfortunate that few details were available about Annie Alexander’s early life (although this is touched upon again in chapter 25, “Hawaii—my only real home”). I found myself curious about the early experiences that might have contributed to Alexander’s inquisitive and adventuresome spirit. And where did her unwavering commitment to fieldwork and science (despite the prevailing social culture) come from? Her father appears to have been a formative influence in the development of her ideas, but this is difficult to assess given that so little of their correspondence was available. The author appears to share this frustration; she comments that few details were available about this period of Alexander’s life. Given the extensive research that clearly went into this book (evidenced by the exhaustive footnotes and the wide variety of source material), this is undoubtedly the case. These background chapters of *On her own terms* are followed by a number of chapters that vividly illustrate Alexander’s increasing interest in and passion for science and detail her early field expeditions (i.e., “A passion for paleontology,” “Meeting C. Hart Merriam,” “Alaska, 1906,” “Founding a museum of vertebrate zoology”).

Later chapters deal with a variety of issues, ranging from her relationship with Grinnell (“An unusual collaboration”) and her partner Louise Kellogg (“The team of Alexander and Kellogg”), her loathing of publicity or recognition (“From ‘a friend of the university’”), and her establishment of a 2nd museum at the Berkeley campus (“Founding a museum of paleontology”) to her continued presence in the field until after her 80th birthday (“Fieldwork—the later years” and “The switch to botany”). Although largely chronological, the temporal scaling is uneven. Consequently, upon reading the book the 1st time, I found the narrative somewhat jarring. Certain chapters, for example, summarize events over many decades, whereas others deal with only a single year. Moreover, there is a great deal of temporal backtracking that occurs between chapters. Chapter 17 (“Founding a museum of paleontology”), for example, covers the period from about 1910 to 1948, whereas chapter 18 (“A restless decade”) deals with events from 1917 to 1923. Nonetheless, once I became accustomed to this, I found that aggregation by topic rather than strict chronological order provided a much more comprehensive and cohesive understanding of the events and issues.

The book includes 32 black and white plates, an appendix listing the taxa named in honor of Annie Alexander and Louise Kellogg (a list that would have been considerably longer had Alexander not circumvented every attempt of which she had foreknowledge), and comprehensive documentation of each footnote. Throughout, Stein has made liberal and particularly effective use of quotations to illustrate her points. In the process, she has animated the central figures very effectively. Barbara Stein has written a vivid and captivating account of how an intelligent and independent woman circumvented the strict social expectations of her day and realized her ambitions. What set Alexander apart from other wealthy women interested

in science is that she did not become involved in science vicariously. Instead, she used her considerable fortune as a vehicle to become an active participant in scientific endeavors. In the process of satisfying her own intellectual yearnings, Annie Alexander profoundly affected the trajectory of natural science in the American West. Because of Alexander's distaste for publicity, her remarkable role as explorer, naturalist, benefactor, and patron of 2 prominent museums has been largely unappreciated until recently (Bonta 1991; Williams 1994). This engrossing book should be required reading for any student of mammalogy or paleontology at the museums Alexander founded, and I believe it will be of general interest for anyone interested in the history of science.

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CONTRIBUTING ARTISTS



Brian Scavone works as a naturalist, educator, and park ranger with a wide curiosity for the American West and all its varied landscapes, creatures, and lifeways. His interests include long walks, gatherings of friends, night skies, music, and books.

Jim Blanchard is an avid photographer, hiker, skier, and kayaker, now retired after several decades as Director of the Outdoor Pursuits Program at the University of Oregon, Eugene, Oregon.



Carrie Lederer is a veteran nonfiction do-it-all filmmaker who's made it her mission to deliver stories from the world over. You can find more of her work at: <http://www.carrierpigeonproductions.com/>

Wally Woolfenden's career as paleoclimatologist and US Forest Service heritage resource manager continues in retirement as a wild-eyed search for Secrets of the Past and expression of the world through the arts and cartoons.



MOUNTAIN VISIONS



Myadestes townsendi

I sit tonight as if
in the sky,
where summer meadow gives to pine forest
gives to ice cast stone,
daylight to starlight to moonlight.

As I sit,
one solitaire sings one solitary
ballad—
I thought you were a red finch once,
but look at your buff gold wing-bars,
that eye-ring!

Your song continuous disjointed
low husky whistles
as if a finch was a warbler
interspersed,
with no pattern.

I thought all treetop songs
were finches once,
I thought all short-eared owls
were short-eared owls once
too.

Myadestes townsendi
“Fly-eater where the town ends”,
meadow to forest to ice-glinted stone,
now I know.

—Brian Scavone

With close attention and an open mind, brilliant variation emerges from the ordinary...
From the imagination of Wally Woolfenden



FIELD FRAMES



Photo: Betsy Neely

I am with the members of Gunnison Climate Working Group (GCWG) engaged in the restoration of wet meadows in the sagebrush ecosystem in Colorado's Gunnison Basin. I have worked with GCWG since 2013 to understand impacts of climate change in the Basin.



Imtiaz Rangwala (back row, fourth from right)
North Central Climate Adaptation Science Center
University of Colorado, Boulder