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Non-objective observers: Untangling bias in science and conservation

A recent paper demonstrates why the way we do science is just as important as the research itself

Sarah Ruiz Science Writer

Ecological research seeks to describe the interactions between an environment and the species living there. But there's one important species most ecological work overlooks—us.

Human society, our histories, our economies, our politics, has played just as much hand in shaping ecology as the migration of animals or the shifting of continents has. The darker sides of human history—war, colonialism, racism—have had especially long-lasting effects. Yet ecological research seldom attempts to grapple with these forces. Ignoring the human element within the history of a landscape has led to research and conservation efforts that are at best, clumsy, and at worst, extractive and exploitative.

A recent paper, spearheaded by Yale Ph.D. student Gabriel Gadsden and Woodwell Climate postdoctoral researcher Dr. Nigel Golden, under the advisement of Yale University Professor, Dr. Nyeema Harris, has laid out a more interdisciplinary approach to conservation ecology, one that reckons with the negative histories affecting research sites and uses that knowledge to reduce bias within the scientific process. Failing to do so, the paper argues, perpetuates a societal “landscape of fear”—one that restricts the potential benefits of science for both wildlife and human communities.

Fear moves like a predator

In ecology, the term “landscape of fear” is used to describe animal behaviors as a product of perceived risk or fear, specifically of predation. For example, if you are an elephant, Dr. Golden suggests, one of the largest animals moving through the physical landscape, you have few predators; your risk of being hunted is low. The amount of time you can spend searching for



food isn't limited by fear. But if you are one of the Arctic ground squirrels that Dr. Golden conducted his graduate research on, everything from grizzly bears to golden eagles to foxes and weasels, is hunting you. The elephant's behavior is constrained by access to food and water and other resources, but the ground squirrel's behaviors are likely more motivated by fear. Animals perceive threats within a landscape and react accordingly.

But, as Gadsden points out, “Fear is an emotion that humans deal with, too.”

Fear moves like a predator on human landscapes, creating perceptions of places and people that may be incomplete or flat out inaccurate. When science is constrained by these perceptions, everything from the methods used, to the research questions being asked, is tainted with bias.

“If you fear a landscape, then you probably aren't going to go there to do your research,” Gadsden explains. “If you have this dominant idea about people that maybe isn't true, you're not going to seek collaborations with them. Or maybe you will do research in that area, but it won't be community-led and community-oriented. All of the unspoken restrictions that fear induces has implications on research outside of the significance of a result.”

Like a predator, these fears often target the most vulnerable groups. In urban environments, unequal distribution of greenspace has resulted in less wealthy, often minority, neighborhoods suffering much higher risks of extreme heat and consequent health impacts. This disparity has its origins in racist housing and development policies like redlining—which limited financial services available to people deemed



“hazardous to investment,” and reduced financial growth in their neighborhoods.

At a larger scale, these biases can be seen in the types of environments that are prioritized for conservation. There is a false notion that “pristine” wilderness holds more value than areas deemed degraded or developed, an idea that ignores the fact that many “pristine” wilderness spaces were shaped for centuries by Indigenous communities.

Do your research before you do your research

Acknowledging history, Gadsden and Dr. Golden say, is a critical first step in conducting science and conservation that doesn’t play into these unequal and unjust perceptions—causing more harm, even when the intention is to help.

In the case of the first U.S. National Parks, intended to protect the country’s natural landscapes from development, the removal of Indigenous peoples has left an indelible mark on the history and ecology of the American West. Not understanding that Native communities had been maintaining healthy and productive forests using controlled fire, U.S. Forest Service policies harshly suppressed fires for over a century which altered the ecological composition of the forest and allowed dry fuel to build up. This, coupled with a climate growing hotter and drier, created the conditions for the intense and out-of-control wildfires seen today.

Examples like this are common in the field of conservation wherever researchers enter a new landscape without knowledge of the site’s history.

“We know that our science is not just informed by the landscape

or the species,” says Dr. Golden. “It’s also informed by the social and political context around it.”

So Gadsden and Dr. Golden recommend scientists begin their research by asking the right questions.

“Okay, so this is your study site?” says Gadsden. Now ask, “How did your study site come to be?”

Recognition of these histories could be as simple as a paragraph embedded in an article, or a land acknowledgement published alongside the research, but the paper outlines additional steps for researchers to take. Including local communities at the outset of a project, especially when developing conservation plans that will impact them, can further strip back biases and help scientists better understand local perspectives on the natural environment.

“One generally would not venture into the jungle without first building a relationship with a local guide,” the authors write in the paper, pointing out that it should be equally unadvisable to venture into a community without building connections with people who can guide you through it.

Building better science together

Their final recommendation involves collaboration across disciplines. The paper suggests that scientific research could benefit from “co-creating knowledge” with groups focused on sociological or environmental justice research to grapple with the ways societal and political forces have shaped ecology.

Dr. Golden has been applying these concepts to Woodwell Climate’s Polaris Project, which he coordinates. The project gives young scientists hands-on experience working in an Arctic environment.

“But it’s unethical for us to bring folks into Arctic science without having a clear understanding of the history of the Arctic and Arctic peoples, and how we’ve gotten to the problems that we are trying to solve today,” Dr. Golden explains. So the program is working on better understanding the history of their field site in Alaska. Polaris has partnered with the grassroots community leadership group Native Movement to conduct anti-colonial training for their participants.

“Knowing the history and context of the communities living in Alaska is one of the guidelines that we can use for co-creating knowledge with those communities,” says Dr. Golden.

These recommendations, Dr. Golden hopes, will provide a path forward for scientists looking to reduce bias in their research, and bring forward the voices of groups historically marginalized by biased science.

“If we focus on the most marginalized, we’re more likely to produce outcomes that are equitable for everyone,” Dr. Golden says.



Students take climate education into their own hands

Student-led education group partners with Woodwell to develop a brief on climate issues

Sarah Ruiz Science Writer

Switching light bulbs, recycling and composting, biking to school—to high school seniors Alice Fan, Amelia Kane, and Simone Colburn, these sorts of sustainability solutions being taught in their classes just didn't feel like enough.

"We were seeing a gap in climate education," says Fan. "We would learn about the greenhouse gas effect, and about the polar bears, but the curriculum wouldn't really touch on the human aspects of climate change, like environmental justice, redlining, and all the systemic issues that bring a different lens to climate change."

Fan, Colburn, Kane, and some of their fellow students had come to understand the true scope of the issue through their individual interests and participation in activist and environmental groups outside

of school. But the more involved they became, the wider the gap grew between them and their classmates. So they decided to take on the role of educators themselves, founding the Spring Forward Climate Education organization.

Spring Forward's mission is to bring those larger conversations about climate justice into elementary and middle school classrooms, after-school programs, and summer camps. The organization's high school members have developed lesson plans and activities that they lead for their younger peers. Mina Subramanian, Spring Forward's Partnerships Coordinator, says climate education taught by students can be more impactful than receiving information from adults.

"I joined a climate organization before Spring Forward, but it was mostly adults. I felt like in that space, I didn't have the voice that I wanted to," Subramanian says. "But at Spring Forward, being youth led, it is such a different environment. We're all on the same playing field and we all empower each other."

Spring Forward has also begun branching out from classroom education to develop additional materials that inform on broader climate topics. Collaborating with Woodwell, the team has created a policy brief around the issue of balancing solar panel installation with other land use considerations.

Solar panels require large clear tracts of land with good sun exposure. Some existing municipal development plans indicate their installation on land currently covered with forests or other vegetation. Forests are some of the best natural carbon sinks and sacrificing them in a rush to install renewable infrastructure is counterproductive. The Spring Forward team wanted to make the policy more accessible to the general public.

"We need both solar and forests working together—not in competition—if we are going to be successful in addressing the climate crisis," says Woodwell Carbon Program Director, Wayne Walker, who worked with the Spring Forward team on the brief. "Educating on these complex topics is so important, and the collaboration with Spring Forward offered me the unique opportunity not only to share some of my knowledge with the students, but also to play a small part in helping the students educate others."

As the group continues to grow and evolve with new members and partnerships, they hope to temper the sting of a sometimes scary topic by showing both kids and adults that they have a voice they can use to make a difference. Talking about the problem helps everyone develop a path forward.

"In our lessons we try to give information even if it's scary, but then say 'okay, well what can you do about it?'" says Colburn. "And one of our big beliefs is that if kids are getting weighed down by information, knowing that they can have power and that they can be influential is really helpful."

READ

Find the co-written policy brief at: woodwellclimate.org/spring-forward-climate

Colorado River water crisis a symptom of greater climate crisis

Two degrees of warming could mean dry reservoirs, year-round extreme drought

Sarah Ruiz Science Writer



Drought in the Western U.S. has plunged the largest reservoir in the country into alarming shortage conditions that have rippling impacts for the region. Lake Mead, formed by the construction of the Hoover Dam on the Colorado River, delivers water and hydroelectric power to 25 million residents in the Southwest. But its viability has been pushed to the brink by intensifying drought, exacerbated by climate change, triggering emergency measures to conserve water in the basin.

The region has been in a “megadrought” since 2000, but recently, Lake Mead’s water levels have been breaking ever lower lows, unearthing old shipwrecks and other long-forgotten debris and leaving a “bathtub ring” around the reservoir’s edges. The drought signals a larger trend of dwindling snowfall and longer summers brought on by the growing climate crisis.

New water scarcity measures enacted

Water usage on the Colorado River operates on a tier system. When water levels in a reservoir drop below a certain point, usage by neighboring states is restricted. Lake Mead hit Tier 1 in August 2021 after the elevation of the reservoir dipped below 1,075 feet, leading to a reduction in water supplies that largely impacted agricultural users across counties.

This was the first time a shortage condition has been implemented on Lake Mead. The Tier 2 decision was announced in August of 2022—stating that the water level would fall below 1,050 by the end of the year, triggering a more intense shortage.

This emergency declaration for Lake Mead is part of a plan to increase the

water levels in Lake Powell—an upstream reservoir and the second largest in the United States behind Mead. Dealing with shortages in the Colorado River Basin has required officials to weigh the needs of one region over another. The Bureau of Reclamation has indicated that at present, keeping water levels up in Lake Powell supersedes the requirements of Lake Mead. The generators at Powell have a total capacity of 1,320 megawatts and the reservoir is considered a ‘bank account’ for the region to draw on in times of drought—which are anticipated to worsen with climate change.

According to the US Drought Monitor, extreme droughts were rare in the historical climate—a 5.5% likelihood. In 2022 however, nearly all of the watersheds in the Colorado River experienced extreme drought. In a world warmed by 2° C, the likelihood of 12 or

more months of extreme drought in the Colorado River Basin becomes as high as 40%.

Meeting water needs in dry times

But Lake Mead also serves a massive population in the lower basin, and filling demand for water even during shortages means some major cities have to turn to reservoirs on other river systems. Arizona, suffering some of the steepest cuts in their allotment of Colorado River water (21%) , will draw from the Salt and Verde rivers. Other strategies include pumping groundwater and implementing more aggressive conservation and re-use strategies, which have so-far helped to spare Las Vegas from the worst effects of the shortage.

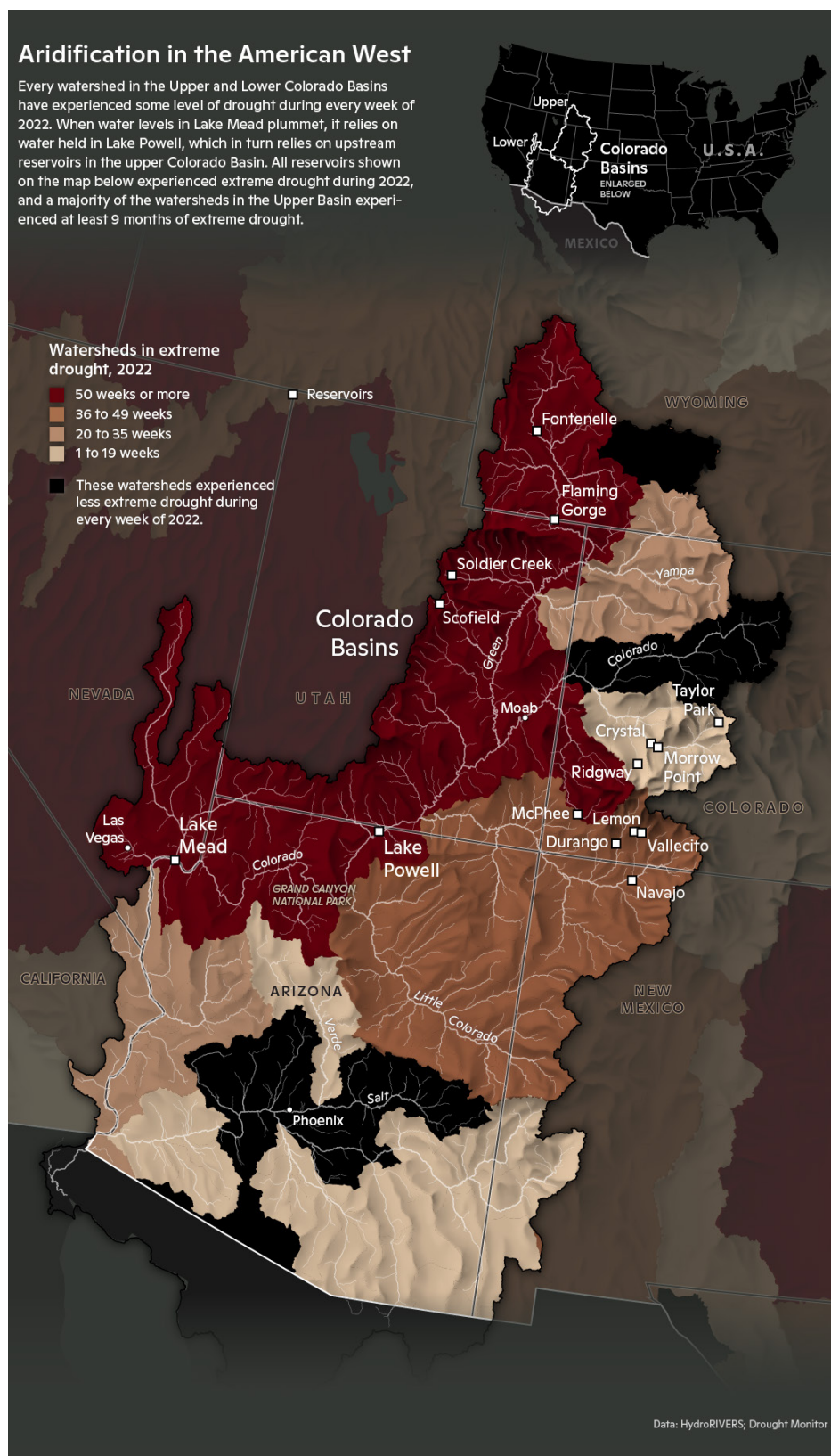
The Southern Nevada Water Authority also began using its low lake level intake in 2022, which allows the state to draw water even when the elevation of the lake falls below “dead pool” status— the point at which downstream water releases are no longer possible. But this is only a temporary solution, as the water in the reservoir keeps falling.

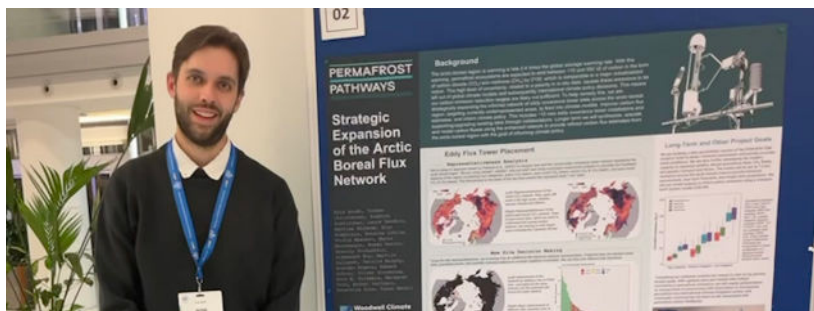
The next significant threshold for Lake Mead would be a drop to Tier 3 (1,025 feet) which some experts say could come as soon as 2024. At 950 feet, the reservoir would be considered an “inactive pool”, meaning the dam’s generators can no longer run. Energy shortages could kick off a vicious cycle, requiring backfilling with fossil fuels that would exacerbate the climate crisis and warming-driven drought conditions.

Reversing the drought in the Colorado River Basin will ultimately depend on snowfall in the Rocky Mountains, which will ultimately depend on getting the climate crisis under control. Experts estimate there would have to be several consecutive heavy snow years in the mountains to make back the current deficits further downriver. 2023 is currently experiencing above average snowpack, but if temperatures keep

rising, that will be a less likely annual occurrence. Water rights and resource usage will have to adapt rapidly to support residents as reservoir levels

continue to drop, but pulling out of emergency scarcity measures for good will require curbing the greater impacts of global climate change.





Drs. Jennifer Watts and Kyle Arndt recently attended the WMO International Greenhouse Gas Monitoring Symposium in Geneva, Switzerland. Dr. Watts chaired a session on “Observations, data exchange and data management” and presented on the state of knowledge in greenhouse gas fluxes in Arctic-boreal ecosystems. Dr. Arndt presented a poster on the flux network and greenhouse gas monitoring network as part of the Permafrost Pathways project. Both participated in larger conversations at the symposium to guide considerations for international greenhouse gas monitoring.

In the news: highlights

Dr. Jen Francis was quoted in *Newsweek* explaining why Arctic thunderstorms are getting longer. She also described how the jet stream is bringing milder air to the Eastern US in an article syndicated to many outlets this week, including *SFGate*, *The News & Observer*, and *Financial Post*.

The Environmental Monitor featured Dr. Marcia Macedo and her work in Brazil monitoring riparian zones in the Amazon.

Dr. Ludmila Rattis was featured in articles from *Folha da Manhã* and *Observo* covering the recent Woodwell Climate risk report prepared for the Canastra Region (Portuguese).

Yale Daily News quoted Dr. Marcia Macedo about work with the Yale School of Environment modeling the effects of climate change on global tropical forest loss. The article also mentioned Drs. Paulo Brando and Mike Coe.

Press releases from Oregon State University were published in *EurekAlert* and *SciTechDaily*, describing research in collaboration with Dr. Sue Natali and past Woodwell Climate president Dr. Phil Duffy on climate feedback loops that aren't being fully accounted for.

Dr. Sue Natali was mentioned in a Portland Press Herald article whose author is calling for a “Pearl Harbor moment” for climate change.

Inside Philanthropy mentioned Woodwell Climate's research in an article naming key funders of sustainable agriculture.

MBL mentioned their salt marsh work with Woodwell Climate in an article recognizing World Wetlands Day.

Dr. Alex Naegele was interviewed by KBBI about Woodwell Climate's risk assessment produced for Homer and Seldovia, AK.

Dr. Max Holmes was featured on a *Nonprofit Report* webinar about climate change and the role of humanity.

Drs. Paulo Brando and Mike Coe were quoted in a story from *Carbon Brief* covering their recent publication about how the loss of humid areas in tropical forests could cause a substantial loss of carbon. Yale School of the Environment also published a press release on the study, and it was covered by *Rinnovabili* as well (Italian).

Dr. Jen Francis was quoted in a *CNN* article on extreme cold snaps, as well as an article from *The Boston Globe* calling unusual weather “global weirding.” She was also one of the accessible experts listed on *SciLine's* “Cold snaps and climate change” fact sheet for reporters.

Dr. Paulo Moutinho was quoted in a *Yahoo* article about the importance of Indigenous land rights in combating deforestation.

Dr. Taniya RoyChowdhury was quoted in an article from *Popular Science* on a new soil-themed board game.

An interview with Dr. Jen Francis about how climate change is affecting US winter storms was published on UCS' blog *The Equation*.

An article from *Mongabay* on carbon storage in mature US forests discussed two publications to which Woodwell Climate scientists contributed.

Woodwell Climate was mentioned in a *Bangkok Post* article announcing a new Sustainability Partnership Agreement between Wellington and BBL Asset Management.

An article from IPAM mentioning the CONSERV program was picked up by *eCycle* (Portuguese).

The most recent episode of podcast *Hooked in New England* featured Joe Mangiafico, who talked about his work with Science on the Fly, as well as his knifemaking.

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