

Erin Larson:

You are listening to Making Waves. Fresh ideas in fresh water science. Making Waves is a bimonthly podcast where we discuss new ideas in freshwater science and why they matter to you. Making waves is brought to you with support from the Society for Freshwater Science, Arizona State University School of Life Sciences, the University of Washington School of the Aquatic and Fishery Sciences and Cornell University's Ecology and Evolutionary Biology Department. I'm your host, Erin Larson. I'm here to today with Elizabeth Anderson, who's at Florida International University where she's the Co-Director for the Tropical Conservation Institute and housed in the Department of Earth and Environment. Thank you for joining me today, Elizabeth.

Elizabeth Anderson:

Thank you so much, Erin, for having me.

Erin Larson:

I was wondering if you could talk to our listeners a little bit, give us a 30 second overview of your research for those who haven't heard about what you work on before.

Elizabeth Anderson:

Sure, so my research explores the ecology and natural history of tropical rivers. And the two main geographic areas where I work are the Andean Amazon region of Columbia, Ecuador, Peru and Bolivia. And then tropical East Africa, mostly Tanzania. And I would say most of the research questions I ask relate to kind of pressing conservation issues or management needs. One example would be environmental flow assessments. And so, kind of what's happening on those landscapes with rivers really informs a lot of my research.

Erin Larson:

Awesome. And so in light of that research topic, how do you think about balancing ecological and social needs in freshwater conservation?

Elizabeth Anderson:

Good question. So, that's sort of like a million dollar question in just river conservation. And I would say my academic background was in a pretty solid ecology department where there was, I feel like I have really good training in sort of understanding ecological aspects of rivers within a little bit of social science or just general kind of including people into the equation at that point. But, as I've progressed in my research and in my career, I have really grown to have a huge appreciation for the role that social science can play in helping to identify conservation questions that are realistic and that are opportune. And then also, any kind of recommendations that an ecologists like myself might make about management or conservation of rivers, making sure that those are on trend or on point or actually relevant to people who are doing the hard work of management or conservation.

Elizabeth Anderson:

So for example, in some of our work in East Africa, we have worked very closely with the Tanzanian Ministry of Water on environmental flow assessments. So figuring out how much water ecosystems need and at what time of year and of what quality. And the first few years of that work were more

ecologically focused. I guess you could say we had an interdisciplinary team that had ecologist, hydrologists, geomorphologists, hydraulic engineers and one kind of token social scientists at that point.

Elizabeth Anderson:

But, what we've found is that while we might make recommendations, getting them to implementation or getting folks who are in these basins to support those recommendations or want to help in making sure that they're implemented, those kinds of things can be really strengthened if you use more social science approaches as part of your research. So another example from that work is that we now have been working with some human geographers to try to understand the strengths and assets of local human communities.

Elizabeth Anderson:

So, riparian human populations in particular. That can be put to work for river conservation or for, in this case, implementation of environmental flow recommendations or flow management strategies. So what do I mean by strengths and assets? Strengths and assets would be something like a community that has many sacred areas that happen to also be wetlands or lagoons or certain stretches of the river that they recognize as having a special importance to their culture in general or to their community, or even ... it's really common that people recognize that certain areas are really critical to conserve because that's where water sources are. And so what we've found is that you can kind of already work within those frameworks and use that to kind of support river conservation programs. Another example of a strength and asset would be strong kinship networks.

Elizabeth Anderson:

So if you're working in a river basin and you find in different villages that you come across, Erin, and then two villages down, you're meeting her twin sister, and then a few villages over, you meet her parents and then her uncle. And what you realize is that Erin and her family are talking regularly, maybe mostly about family stuff, but if you are hoping to build more awareness of let's say a particular species of fish and its needs for conservation or the importance of not dumping wastewater garbage in a river.

Elizabeth Anderson:

Those are already communication networks that are in place that you can kind of help to use. So if you can convince Erin that this is important, Erin can probably convince many of her family members too. Or reciprocity networks too, is something that we see a lot, particularly in rural areas where somebody might have a farm and they depend on their friends and neighbors to help them with their harvest, and they don't pay them.

Elizabeth Anderson:

But then there's the expectation that when those friends and neighbors need help, they will be there to also work with them. And so, you can think about in the case of a river, it's just that people are already used to lending a hand for kind of a greater communal good. And you can use those ... you can tap into those kind of strengths and assets and put them to use for conservation. So I would say where 10 or 15 years ago with my research, when I was thinking of projects or when I would work on things that had kind of conservation recommendations as an outcome, I would write those in my papers or maybe even make a policy brief or some sort of ... maybe a simpler explanation of those recommendations.

Elizabeth Anderson:

But, at no point was I actually thinking on how they could be streamlined or interwoven into what people were already working on. Nor did I typically go and talk to riparian human communities before I started my projects. And so, now I'm seeing that they can really help to inform research questions in a way that makes them ... whatever kind of conservation recommendations you have later on might have more of a chance of being implemented or accepted if you're working really closely with people.

Erin Larson:

Yeah. So would you say that in terms of thinking about best practices for working with large groups of these types of diverse stakeholders, that getting people involved at sort of the beginning of the process is a really important thing to consider for scientists?

Elizabeth Anderson:

Absolutely. Absolutely. And another example from Tanzania is when I was a postdoc, I got this invitation to go and be kind of like a technical advisor to the Ministry of Water for putting together some environmental flow assessment studies for certain rivers. And actually I shouldn't say it like that. I got an invitation to help with some environmental flow assessment studies for a couple of rivers. And I could've just gone and done that on my own and collected some data or talked to other people and gotten data and then come back to U.S. and made my model, and come up with my recommendations, and then send them back to that country.

Elizabeth Anderson:

But, when I went there and I first met with the Tanzanian Ministry of Water, who has sort of the legal authority and the responsibility for this kind of work, they asked me very clearly like, "Well, thank you for coming to our country," and they were very polite and very welcoming, "But we're puzzled by why you're trying to do our job for us." And then someone, they asked me very earnestly, "Is somebody paying you to do our job? Because they're paying us too." And so, I mean for me that was one of these moments that I was talking about it 10 years later. It was very formative, where I thought, wow, there's a huge opportunity that we're wasting to actually ... for myself as a professional, but also just in general for doing more environmental flow assessment for Tanzanian rivers if we don't try to work together on this.

Elizabeth Anderson:

Because if whatever recommendations I come up with, even if they're scientifically super cutting edge, they're only as good for the rivers actually being managed sustainably as they are implemented. And so, what I realized was that there was a lot of local interests from the Tanzanian Ministry of Water to build capacity in country on environmental flow assessments, on just river science in general. There were already many scientists that were working on this, on kind of aspects that were related to environmental flow assessment, but not in a coordinated way. So there was a chance to use this initiative to bring people together in kind of what we would call research coordination networks here, to do something like that there.

Elizabeth Anderson:

And now we've had this, let's say eight or nine years of implementation on one particular river, and seeing many iterations as well where we've gone back and revised our initial estimates based on additional data. But, just seeing how that process now has some sustainability and they've used the recommendations to make decisions about water allocation for irrigated biofuels plantations with

sugarcane and decided like, okay, this isn't a wise ... this would compromise the ecosystem needs for water based on this assessment. So we need to consider that in the permitting process.

Elizabeth Anderson:

And I don't think that that would've happened if I had just done this study kind of without the strong collaboration of the Tanzanian Ministry of Water.

Erin Larson:

Yeah. It seems like collaborations are a really important theme here.

Elizabeth Anderson:

Yeah, I think it is. I think it is too. And so, then the other thing that's happened now is that ... there's momentum in Tanzania for just increasing the amount of data that's available and just general scientific understanding of rivers. And now there's a community of local scientists and now there's students and those students are finishing their doctorates. And their students all kind of making a critical mass of people that are working on rivers in a way that 10 years ago, wasn't there. And so I find that really exciting.

Erin Larson:

Yeah, I think that's awesome.

Elizabeth Anderson:

And I think it's a good way, I think just part of it is that there's lots of enthusiasm in Tanzania and recognition of the importance of river ecosystems and the need to kind of manage them well. But, also it's just like the way that small collaborations can start to build and turn, and sort of snowball into these really big networks around particular topics.

Erin Larson:

Yeah. And that seems like a really powerful way to think about researching and tackling complex problems like flow ecology relationships and subsequent river management in these types of data scarce regions. And so how do you think about, when you're thinking about how to prioritize research needs in data scarce regions, what do you think about being really high priority types of projects and types of data to collect, versus working with some existing data when it does exist? And I know that's a hard question.

Elizabeth Anderson:

That's a really hard question. You can probably tell looking at my face. I think it really depends on the region and on what you want to know. So if you're just going for a basic ecological science or understanding of rivers, I think that there's lots of things that you can do as a scientist or to encourage other scientists to kind of just generate new baseline information about rivers. And I think that that's great. If you're looking at a region, which is the case in a lot of the tropics, that is let's say, could become a new protected area, and there's never been collections of fishes or aquatic biodiversity surveys or anything in there. Then that might be a moment to do kind of like a rapid inventory, not try to make an exhaustive list of all the species, but look for things that make that area unique. What are the endemic species? What are the rare species? How is it different from other protected areas in that same region?

Elizabeth Anderson:

So that would give ... those things can all kind of, that would be more of a conservation question, right? Or conservation motivation. What would make that area different from other places? And therefore, really important for some kind of protected status. So you're getting basic information again in an area that is very data scarce, but you're doing it in a way that tries to kind of create a case that's really strong for its conservation. In places where I'm doing a lot of work in the Andean Amazon region right now, and that's a region that's being rapidly transformed in many ways. And one of those ways is with new infrastructure development, particularly dams. And so that's also a region that people say there's a lot still left to learn. There's new species of fish being described every week.

Erin Larson:

Yeah. What's the number for that right now? It's something like the number of fish species in the Neotropics has just skyrocketed.

Elizabeth Anderson:

Yeah, the number of fish species in the Neotropics, we're close to 6,000 species that have been described now, which is 40% of the global total of freshwater fish species. And we haven't reached an asymptote. So in the past 10 years, we've described around 1,000 species.

Erin Larson:

That's amazing.

Elizabeth Anderson:

In my lifetime, we've described half of what we know in the Neotropics in terms of freshwater fishes, which is pretty exciting.

Erin Larson:

Yeah.

Elizabeth Anderson:

I'm not that old. I would say that's a real kind of exciting frontier for basic ecological research. But the other thing is that many of these new studies are being done by South American scientists.

Erin Larson:

That's amazing. That's awesome.

Elizabeth Anderson:

Yeah. And I think that is something that sometimes there is a whole list of journals out of many South American countries that are in Portuguese or in Spanish and have really high quality information and really done by wonderful scientists. But, that doesn't always make it into kind of the literature that we're used to seeing here in the United States or in Europe. And so one of the ... I guess going back to what we talked about originally with trying to kind of understand what some of the implications of rapid hydropower development are in that region. Right now, there's obviously a lot of interest in doing primary data collection, but there's a lot of information that's already out there that could be synthesized or analyzed in new ways to say something about regional patterns of distribution of

different fish species, or patterns of fish species distribution along elevational gradients and thinking about those on an individual gradient basin basis or on a regional scale.

Elizabeth Anderson:

And you find kind of different things when you look at those data in different ways. And in a situation where you have rapid transformation, I would say getting information that's already available and consolidating it or synthesizing it and then asking questions with that existing data is a good way to kind of build awareness quickly of the conservation importance or the biodiversity importance of many of these rivers. So in that particular case, I think it's like a two pronged approach.

Erin Larson:

Yeah. To sort of make the case this place should be preserved. And then given sort of this rapid biodiversity assessment that's been done in historically or some sort of preexisting data. And then to have the opportunity once that has some sort of conserve status to then go more in depth and study it potentially.

Elizabeth Anderson:

Yeah. And also, the value of including students and others in that research ... just right now there's a lot of momentum. People are excited about rivers and for reasons that relate to just their biodiversity, but also just their potential for development in the region. And so, while many people are talking about this proliferation of hydropower dams in the Andean Amazon region as something very scary for rivers and that could have major implications, I try to look at the positive of it is that three, four years ago, five years ago, it was tough to get people excited about rivers in that region. And I would give talks about our work and people would say, "Oh, that's really great. What's it like to travel?" And now that this has been identified as one of the top 15 global conservation concerns, everybody wants to talk about the Andean and Amazon rivers.

Elizabeth Anderson:

And so when I talk about fish diversity, there's a lot more interest because of what's happening and that people are more aware of it. So in the same sense that this is ... these infrastructure development could transform a lot of these rivers, it's also started a dialogue that has opened a much larger space for talking about rivers and river biodiversity than I've seen in my career previously for this region.

Erin Larson:

Yeah, that's so exciting. As someone who's also working in that region, that makes me really happy.

Elizabeth Anderson:

And you can see that it's really positive in that sense, in that it's like a catalyst for more scientific research.

Erin Larson:

Yeah. That's awesome.

Elizabeth Anderson:

So, I guess one other thing just when we were talking about strengths and assets and understanding my riparian human communities and their strengths and assets for conservation. That's the way that, at least my approach in more social science aspects of my research has been with that in mind. I'm not discounting the importance of understanding threats, but I think that sometimes we get bogged down in just trying to understand all of the levels of threat of a particular situation and we miss the sort of positive opportunities for conservation that already exist. And this whole idea of understanding and mapping out strengths and assets is kind of an approach of optimism and just thinking like, okay, what's the opportunity here for conservation? Yes, these threats exist. But, there are also these great opportunities and things that people are already doing that can be put to work for conservation.

Erin Larson:

I like that. The sunny side of conservation.

Elizabeth Anderson:

The sunny side. Yes.

Erin Larson:

One thing I was wondering if we could talk a little bit about before we wrap up, you've written a bit about water security as a management tool and freshwater systems. That might not be something, that's not something that I know I'm not super familiar with and some of our listeners might not be super familiar with, so I was wondering if we could talk a little bit about what that is, what it entails, what it looks like when it's implemented?

Elizabeth Anderson:

Sure, sure. Actually, it's interesting that you say that water security isn't a topic you're familiar with because if we had been having this conversation two years ago, I would also have said that. So water security is actually a concept that's used in a lot of different disciplines now. I came across it in information that's put together by the United Nations and more of the kind of global development groups where they're thinking about water security as a concept that relates to people having enough water now and into the future to satisfy their basic needs, to satisfy their agricultural needs, if that's the case, or just for their kind of general wellbeing. But they also recognize the importance of water security for ecosystem. So ecosystems also having enough water for just general ecosystem health if you want to use a kind of basic term.

Elizabeth Anderson:

But just recognizing that that key piece too. Others will also say that water security means that people in ecosystems have the access to sufficient quality and quantity of water at the right time, in a climate of peace and stability. And so that's also another component that goes into that definition. If you look on the United Nations, in their information online, you can find their official definition. And so, when I read this, I started thinking about like, this is actually kind of an interesting concept that encompasses social and ecological and political and even economic dimensions of water in a concise way.

Elizabeth Anderson:

And then I have a colleague that I'm working with now who is trained as a geographer, a human geographer. And that's a concept that they talk about a lot. And so for her, the concept of water security was mostly focused on people having access to water in a climate of peace and stability. But also with

just healthy ecosystems and not having access to water doesn't mean living alongside a super contaminated river. And so I've learned a lot from that world too about this concept and the way you would apply it.

Elizabeth Anderson:

I would say that the other thing I find is that the topic or this term makes sense to people in other disciplines as well. When I talk about the ecological flow needs, that for me as an ecologist, I understand exactly what I mean. But, someone from political science might not totally get that, but when I say, well, water security for ecosystems, it's like I'm seeing it as a bridging concept between a lot of disciplines as well.

Erin Larson:

Yeah, that's cool to think about having those types. It's just funny how it seems like semantics, but it actually is facilitating conversations around different types of disciplines, which is really cool.

Elizabeth Anderson:

And so at my university, Florida International University, we have a lot of people that work on water issues and I mean we're right next to the Everglades and certainly water issues and water management is really important in that landscape. And we have folks that are ... we've got a forum for discussion on this topic of water security and what it means to me as an ecologist, to someone who's a geographer, to a political scientist, to an economist. And it's been a really rich discussion that I would say that each one of us has walked away from those with kind of new perspectives on our own work from that kind of sharing.

Erin Larson:

That's awesome.

Elizabeth Anderson:

Yeah, that's been cool.

Erin Larson:

Yeah. Well, thank you so much for taking the time to meet with us today, Elizabeth.

Elizabeth Anderson:

My pleasure. My pleasure. Thanks again.

Erin Larson:

Yeah, no problem.

Erin Larson:

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