Ep13_GradResearch

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SPEAKERS

Stever Bartlett, Stephen Peters-Collaer, Alison Adams, Kate Longfield, Cate Kreider

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A Alison Adams 00:08

Welcome to Restoration Roundup, a monthly podcast that explores recent research on, new and emerging best practices for, and stories about riparian forest restoration. I'm Alison Adams. I'm the watershed forestry coordinator with University of Vermont Extension and Lake Champlain Sea Grant, and I run the Watershed Forestry Partnership.

C Cate Kreider 00:26

I'm Cate Kreider, and I'm a senior environmental studies student with a minor in reporting and documentary storytelling in the College of Arts and Sciences.

A Alison Adams 00:44

This month we're speaking with three University of Vermont graduate students about their work related to riparian forests. Kate Longfield and Stever Bartlett are both Master's students in the Rubenstein School of Environment and Natural Resources working with Dr. Kris Stepenuck. Stephen Peters-Collaer is a PhD candidate in the Rubenstein school working with Dr. Bill Keeton. The work of these three students runs the gamut from natural science to social science and has the potential to inform the work of riparian forest restoration practitioners in the future. So we're really excited to speak with them and get the early scoop on what they're studying and what they're finding. We're going to speak with Kate first. Kate, can you tell us more about your research project?

K Kate Longfield 01:21

So my project is exploring Vermont farmers' trust in state and federal agricultural agencies. So the Farm Service Agency, Natural Resource Conservation Service, Agency of Agriculture... and comparing this trust to both their enrollment in and feelings towards government conservation programs, particularly those focused on forested riparian buffers. So to say that, again, more

simply in the form of a question, how does the level of trust that Vermont farmers have in government agencies influence their willingness to enroll in government conservation programs? So yeah, this is a qualitative study. Over the course of the coming winter, I will be conducting 20 semi-structured interviews with a random sample of dairy, livestock, crop, and diversified vegetable farmers. I'm intentionally excluding orchards, vineyards, apiaries, berry farms, tree farms and maple. Because I'm studying forested buffers, I wanted to focus on farms where trees aren't already part of the agricultural landscape, and where erosion and runoff might be more of a problem.

A Alison Adams 02:24

That sounds like a really cool topic. Can you tell us how you got interested in it?

K Kate Longfield 02:27

So my initial interest was in farmers' attitudes towards forested riparian buffers. That was sparked during my AmeriCorps service at the Vermont Land Trust (VLT). For context, VLT conservation easements require a 50 foot forested buffer along most already established rivers and streams. So I had the privilege of talking to a number of farmers who were interested in conserving their land and hearing their thoughts on having to implement or expand buffers. I found that there were so many different reasons why farmers were both interested in and opposed to the idea of reforesting buffer areas on their properties. These range from interest in preventing soil erosion, to family history and memory, to concerns about the economic loss associated with taking fertile land out of production.

A Alison Adams 03:16

Did trust come up with these farmers very often? Like how did you come upon that particular topic?

K Kate Longfield 03:21

I think basically, the trust that farmers have towards state and federal government agencies varies so much. For example, if a farmer has worked with a specific staff at the Natural Resource Conservation Service (NRCS) for years, they may be more trusting of them. They also might have grown up with someone who now works for NRCS, so they know they can sort of count on them. In that case, a farmer might be more willing to enroll in a conservation program and implement buffers, but some farmers are just naturally more like mistrusting of the government. And even in Vermont though, there are-- the percentage of farmers that are just totally not trusting of the government is actually pretty small. But it really ranges and the trust that farmers have towards working with government agencies really influences their willingness to enroll in these programs and implement buffers. So it really matters. Because when you're enrolled in a program, you're working with these agencies and their staff all the time.

C Cate Kreider 04:12

That's super interesting.

A **Alison Adams** 04:13

Yeah, it's really interesting. And I think something that struck me about your answer to that is just that in Vermont, you probably are more likely to run into those kinds of situations where somebody grew up with someone who works for an agency or something like that, because it's such a small state, and we're so closely connected. So it strikes me that maybe your findings would be applicable to those kinds of contexts, more specifically, just the context where there's these smaller communities, people grew up in the state, continue to live in the state, staying in these kinds of industries for a long time. So that's super, super interesting.

C **Cate Kreider** 04:43

What is the most interesting thing you found or are finding?

K **Kate Longfield** 04:46

So I haven't started conducting my interviews yet, that will happen over the coming winter. So the timeline for my research looks a bit like interviewing farmers over the winter, analyzing my results in the spring, and then defending my thesis in late August of 2023. But I've been talking to a number of farmers, as I'm preparing for my research, and it connects to what we were talking about earlier with farmers' trust of government agencies and their staff ranging enormously. So I think that what I'm going to end up finding potentially is that if a farmer has an already established relationship with a agency staff member, or their family already had an established relationship, they might be more trusting of that agency and more willing to work with them and implement buffers and enroll in different conservation programs. And if a farm or a farm family doesn't have any relationships with agency staff, they might be less trusting. Or someone could be just generally, their personality, they might be less trusting of an agency, and they are uninterested in working even more with an agency.

A **Alison Adams** 06:00

That makes a lot of sense. Are there any challenges that you've run into so far in your work?

K **Kate Longfield** 06:05

One of the biggest challenges I'm currently facing is connected to the fact that I wanted a random sample of farms for my study. So the results can be generalized across the whole state, which will be helpful for the USDA and Vermont state agencies that are interested in the results. So in order to conduct a random sample of farms, I needed to build a database of all dairy, livestock, crop, and diversified farms in the Lake Champlain basin, just from publicly available information. So that has been a challenge! But the even-- the harder part for me has

been looking closely at the watershed boundary, which cuts through counties and towns and even farms. So it's been really tedious work, because the basin is enormous, and there are so many farms, and I'm trying to only get farms within the basin.

A Alison Adams 06:54

It's funny that you mentioned that because I run into that issue in all kinds of contexts, like trying-- when I need to do something specific to the watershed, you can't really get data for the watershed. It's all based on towns and counties, which the ecological boundaries just cut right through. So that is really, really challenging. Did you manage to build that database?

K Kate Longfield 07:11

Yes! So I currently have over 1100 farms in the database. And because I'm excluding maple, and orchards, and tree farms, and things like that, I'm actually pretty close to the number of actual farms that there are because again, I'm just looking at dairy, livestock, crop, and vegetable farms. So yeah, I have it, it's in an Excel spreadsheet, it's kind of fascinating, because my research is so specific, that database has never been created before. But I-- I definitely haven't found any publicly available list of farms in Lake Champlain basin. So it might be the first of its kind.

A Alison Adams 07:46

And that alone is a cool product. Like I could see so many uses for that-- I needed that information for a grant I wrote recently, so I'm really happy to hear that you have that that's really, really cool. And you shouldn't keep that a secret. Cuz I'm sure people-- I'm sure people are gonna want to know about your research results, and those are gonna be really awesome. But even just this intermediate product is gonna be useful to people.

K Kate Longfield 08:06

Yeah, and it was all just from the internet.

C Cate Kreider 08:09

So you've already got these cool resources and products coming from your project, what do you hope the impact of your work is going to be?

K Kate Longfield 08:17

My first broad goal that always comes to mind is to elevate the perspectives and lived experiences of Vermont farmers. That is sort of my driving focus. But I'm hoping to identify any issues with trust and communication between farmers and state and federal agencies and staff. So the goal would be to locate these different areas where USDA agencies and the Vermont

Agency of Agriculture can improve trust and strengthen relationships with farmers. In terms of impact, I'm hoping that the agency staff in Vermont will approach farmers exactly the way they want to be approached, which would improve trust and might make farmers more open to enrolling in conservation programs and implementing forested riparian buffers. So the goal is to improve trust.

A Alison Adams 09:02

I think that's really a cool project, and I'm really excited to see what comes out of it. And if the podcast is still running I hope maybe we can have you back when you have results. So to talk about what those are, maybe we can find another way to share those results out with all the folks who listen to this podcast. So thank you so much for being with us today Kate!

K Kate Longfield 09:16

Yeah, yeah. Thanks for having me.

C Cate Kreider 09:20

After speaking with Kate about farmers and governmental policies on riparian buffer health, we spoke with Stever Bartlett, a master's student working with Dr. Kris Stepenuck, about establishing restored riparian areas in places prone to aggressive invasive species. Stever, can you tell us a little bit about your project?

S Stever Bartlett 09:38

So the project-- its funding is actually through a pollution and habitat conservation grant through Lake Champlain Basin Program, and it's one of the first applied research projects through the Watershed Forestry Partnership, and the project itself is a two year-- basically a two year study in which we're looking at the effects of reed canary grass on the establishment of riparian plantings.

A Alison Adams 10:03

Steve, can you tell our audience what reed canary grass is and why this is something that you're exploring?

S Stever Bartlett 10:09

So read canary grass is is a grass species that is actually it is native to some parts of North America. And it is an invasive species because over the years in the 1800s, it was used as forage and pasture land for cattle. And it was also used for some erosion control properties. And a lot of the really fast growing and resilient parts of the species were kind of hybridized from some of the European species. And that is really what's kind of allowed reed canary grass

to be so invasive in some of these areas, it's really common to waterways, ditches, floodplains--that the seeds and the rhizomes can be transported pretty easily--and creates a monoculture that tends to shade out native species of grasses and/or trees. And it continues to grow and grow, and it can be up to six to seven feet tall in some areas with the right amount of moisture and soil and nutrients, which you can imagine if we're trying to plant three to four foot native tree stems, in areas with reed canary grass grows over that three foot four foot tree within one season, usually without any form of control. And it's-- the mortality rates are really high when you don't have any sort of interaction to prevent that growth.

A Alison Adams 11:28

I've been out on a few field sites that are really overrun with reed canary grass in like mid to late summer. And it is a brutal experience trying to get through those field sites. It's really thick, it's above my head. It's just a really intense experience. And there's absolutely no way that you could imagine a tree growing successfully-- a little tiny seedling growing successfully in that environment. Can you, Stever, tell us a little bit about how you came to this topic, how you got interested in this topic?

S Stever Bartlett 11:53

You know, ever since I was young, I've kind of had a passion for rivers. I think it started really through fishing when I was a kid and fly fishing as I got older. And then some involvement in conservation projects, you know, with local groups like the New Haven River Anglers, and Trout Unlimited things and you know, tree plantings and river cleanups and things and, and that that's kind of the passion that really directed me to several, several years after my undergraduate to decide to go back to school and get my graduate degree in watershed science and aquatic ecology. And as I've been going through my coursework and now my thesis research project, I've really grown to kind of love the idea of natural based solutions and process based restoration. And that's really how I kind of fell upon this area. The research itself, and the actual idea for my thesis--that came with a lot of conversations with practitioners and land managers that are trying to solve this reed canary grass, riparian buffer zone establishment problem, and Kris Stepenuck, who's my advisor, and I met and talked with a lot of the practitioners that are doing this work in the field and trying to solve these problems, and they identified this as a real issue. I think one of the issues that some of the landowners and practitioners were concerned about was the current use of glyphosate to control reed canary grass. And that was kind of a problem that came up over and over again is, you know, that's a current use and what are the alternatives to not using glyphosate for a landowner, or an area with sensitive species or an endangered species are a species of concern? Those areas cannot use the Roundup, the glyphosate or the Rodeo in those areas and how do you control the reed canary grass in those areas or with a landowner who just chooses that they don't want to use herbicide on their property? And so that question kept coming up again, and again. And a lot of the individuals we talked to just, you know, are trying to find answers and trying to find data, trying to find research to give the idea of like, what is the difference in mortality between using glyphosate and using mechanical methods such as tilling, or mowing? All of these questions surrounding this issue, you know, it's very complex. And that was one of the biggest challenges is to figure out what's our experimental design that makes sense? And then how does it make sense in terms of the scale of planting projects? And when you're planting 1000s of trees, over dozens of acres, how applicable are some of these management options that are non-herbicide

based, like the mowing or the plowing or the tilling, even the sheltering of trees, you know, you have to have volunteers to go out and do all of that and the time and the money and that's probably one of the biggest things I was thinking about every time I was going out there when I was preparing the sites before we planted in the fall before like mowing and then tilling and mowing the sites over the last two summers worth, you know, and I was counting trees as well. So they were pretty big days of field work. As I was doing that work, I was like, how can we make this scalable when we're going to multiply this to really large areas? And so that is in a long explanation kind of how it got started and a little bit about some of the challenges of it.

A **Alison Adams** 15:17

That sort of ties back to one of our previous episodes where we talked to Katie Kain and Ethan Tapper about their use of herbicides and why they've both sort of decided to use that sort of in a variety of contexts and how that compares to the manual labor that's required to remove invasive species if you're not going to use herbicide, and that it's very, very, very hard to do that successfully. So I think it's really cool that you're looking into this, and thinking about those issues and how we might be able to do that in the scenarios where that's what's really needed or what the landowner really wants.

C **Cate Kreider** 15:47

So Stever, where are you in the timeline of the study?

S **Stever Bartlett** 15:51

We just finished our second summer of managing the sites and collecting the data. So my last data collection was in the first week of September. So we've counted trees live and dead and estimated the percent cover of reed canary grass in all of our sites for the last two summers. And our sites are located in eight different wildlife management areas around the Lake Champlain basin, mostly in Addison County area, as far south as Middlebury, Cornwall area, ranging all the way up to around Harrisburg, up in Little Otter Creek and [inaudible] Creek east and south are our northern most sites. The data is in, doing some of the analysis at this point to determine the relationship between our mechanical and the herbicide and try to do that work.

A **Alison Adams** 16:45

So it sounds like you're pretty far along. What is the most interesting thing that you found? I know you mentioned you're sort of in the process of writing this up.

S **Stever Bartlett** 16:52

So yeah, so it's a little early quite yet to put out any real conclusions. But you know, I can say that the survival for the first year, as expected, was was really high--it was about 95% survival for the stems, which and if you're controlling reed canary grass in the first year that-- I think that was pretty expected. The second year is looking at the data anecdotally it's, you know, it's

going to be significantly less, but yet, not at the rate of what it would be if we weren't managing at all. So you know, it gets to 60 to 80% survival after year two, compared to no control at all in sites, which can be 20, 30, 40% survival rate of stems. So I think we'll see more mortality for sure in year two. And then what's going to be interesting is comparing year one data with year two data for reed canary grass cover, right? Like the glyphosate, in year one, worked pretty well, right? In year two, it was barely recognizable. You could see a little bit of difference, but that's going to be really interesting to see how that plays out statistically--if there is significance or not. And then if that has an effect on mortality and itself between the treatment and the control, right? And then I would say the one thing that I thought was really interesting was in the first year, we started one site's been tilled and mowed, and that's the non herbicide side and the other side has been tilled and herbicide and the species that kind of moved in, instead of reed canary grass became really prolific and very strong. And they weren't species that really were kind of there prior. I mean, they were at some level, but like ragweed grew to be like five and a half feet tall on the control sites, but not on the treatment sites. So I'm like trying to weed ragweed that's like half inch to an inch thick, you know, just like, didn't expect ragweed to be one of the species that then occupied that bare ground. Birdsfoot trefoil, which is a species I wasn't familiar with it all, was really prolific in a number of the sites covering really dense ground cover, which reed canary grass did not grow in those areas. But we also had birdsfoot trefoil, which grew in that area. But that's a species that is pretty low to the ground. So it's just interesting, really, to see which species then took advantage of that that bare ground or the lack of reed canary grass.

A Alison Adams 19:18

Are those species that are compatible with the restoration of those sites to forest ecosystems, or are they just going to pose a new challenge?

S Stever Bartlett 19:28

Good question, actually, you know, like, I don't know the answer to that, to be honest with you. That's a great question to ask. And I would say one more thing that was interesting visiting the sites throughout the summer I visited each site basically four times each summer to do management and collect data and count live and dead trees... in the sites that had extremely high densities of reed canary grass, as opposed the other sites that were just really pretty prolific in it, those sites the rhizomes really were were creeping in from the outside rapidly, and it was much more visible reed canary growth in those sites that were like super, super dense, six feet tall stands of reed canary grass. So that was something really visible that I was recording and observing. And as I kind of did my comprehensive exams, one of my committee members kind of asked like, hey, what do you recommend based on what you found, and I was like, the only thing I can think of to recommend is, if you want to have greater success, find areas that have less dense stands of reed canary grass. The ones that are super dense, super tall, those are really challenging to control probably in any manner, and like trying to find upstream areas that maybe have less dense reed canary grass--focusing planning efforts in those areas, because you could see it coming in from the outsides, especially in year two.

C Cate Kreider 20:53

You've mentioned this a few times, but could you go over some of the challenges you faced

over the course of this project?

S Stever Bartlett 21:00

Yeah, I think the time commitment, part of managing reed canary grass is a major challenge. In my research, it was a challenge, because we were weed eating around trees with weed eater by hand for the study itself. But as I mentioned, for trying to extrapolate that into the scale of acres and acres and 1000s of trees, that time commitment is probably the biggest challenge. Each site was at least two hours of work between counting trees and weed eating around the trees, and these were not big sites, these are a quarter acre sites, you know, so small sites--16th of an acre on either side, control and treatment. So this wasn't a large area. And so that, that time commitment is, is interesting. And then also in any planting situation, like the the amount of time that it took to plant and to do it well, and the environmental conditions that exist to make the planting challenging, anything from drought after your plant needing to water to-- we had a couple of sites that were under a foot and a half of water for two weeks longer than-- Alison was there for one of them planting with us I think maybe.

A Alison Adams 22:13

I was-- I was there. Yep.

S Stever Bartlett 22:15

And thank you for that! But yeah, we had a few sites that were underwater for so long that we couldn't plant them, you know. So that's another challenge, the environmental challenges of planting and managing the sites.

A Alison Adams 22:28

As you're sort of thinking about what the findings are that are kind of coming out of this, the patterns that you've noticed--what do you hope the impact of your work might be?

S Stever Bartlett 22:37

I mean, I hope that this work kind of provides science and research based information for landowners and practitioners to kind of help them with a decision of should I use herbicides, or should I use mechanical methods? Hopefully providing information that allows them to make a better decision based on what we find and give some of that information to landowners and to wildlife managers and practitioners and nonprofits that are trying to figure out how to grow trees in riparian buffer areas along waterways to improve water quality and to have a mature forest that then drops large woody debris in there and increases the biodiversity and the richness and all of that. I'm just hoping that we can provide some data and information that's based on a study because there are definitely a lot of studies in the Midwest and a lot of studies and other places, but not as much in the Northeast.

A Alison Adams 23:31

That does sort of mirror what I've heard, which is that, you know, yeah, we have research from other areas, but here, we're largely relying on on very knowledgeable and very experienced practitioners and what their experiences have been of either trying to manually control reed canary grass or trying to bring in herbicide and see how that does. And I'm sure they would appreciate having some some research behind it, and I know that there are a lot of folks who are going to appreciate having this information. So thank you so much for joining us Stever and telling us about your study, and I'm really looking forward to seeing it when it's all written up and everything's all finalized.

S Stever Bartlett 24:04

Great, well, thanks. I'm excited to have been able to be on your podcast. I love it. I listen to every episode. It's really cool. Thank you.

C Cate Kreider 24:11

With all this information about the obstacles facing brand new plantings of forest, we next met with Stephen Peters-Collaer, a PhD candidate working with Dr. Bill Keeton. We talked about forest structure, particularly how the age of a forest changes its structure and function, and the value of downed wood in streams for carbon storage. Steven, tell us about your research project.

S Stephen Peters-Collaer 24:34

Yeah, absolutely. I'm a third year PhD student at UVM working with Dr. Bill Keeton in the Carbon Dynamics Lab, and I joined onto a project that's taking place at the Hubbard Brook Experimental Forest in New Hampshire. And this is a forest in the White Mountains pretty similar to most of the ones you find in the Greens and the project is focused on forest interactions with streams basically, and looking at how the interactions between these two will change as forests develop and as they age. Within that broad topic, my focus is really on the impact of what we call forest structure, which is basically the spatial arrangement of the forest. So that includes things like the size of trees, does the forest have a lot of small trees? Or does it have some big trees? Medium trees? How densely packed is it? Are there a lot of other openings? Is it evenly spaced? Things like logs and deadwood on the ground... I'm interested in that because it has a lot of connections to what is going on in the streams. And two of the big ways that it impacts streams is through light in the streams. We're working in some pretty small headwater streams, which are really cool environments to work in, because what happens in these streams impacts what happens downstream in the bigger streams. And even though the streams are really small, they actually make up I think, more than 70% of the total miles of streams in the world. They're small, but they're important. Since they are so narrow, they're often completely covered by forest canopy, and when something happens in the forest canopy that impacts how much light gets down into the streams, which impacts algae and the bottom of the food web. And so if there's enough light that can impact photosynthesis, which can have impacts on that food chain. And then forest structure can also impact these streams

by impacting wood: a tree dies and falls, it goes into the stream. Wood in streams is actually really cool, I know you did an episode on it a couple of weeks back with Gus and Shayne at the Nature Conservancy. And they talked a lot about the importance of it, but in these small streams it can impact basically the speed of the water in the stream, the ways in which the river flows, it might pool up behind a river. These logs can be important for carbon storage, for fish habitat, for bugs, for a whole host of things. And so essentially what I'm interested in is how that--the structure of the riparian forest changes--and then what that means for what's happening in the stream, mostly as it pertains to wood and light.

A Alison Adams 27:15

That's really cool. I know that this is a topic that comes up a lot with the practitioners that I work with through the Watershed Forestry Partnership. A lot of them talk about what they call lollipop forests, that kind of result from even the best technology that we have right now for restoring riparian forests. And there isn't that kind of really diverse structure, oftentimes in those forests, and a lot of the restored riparian forests that we have are quite young, and so they haven't had time to develop that kind of older structure that you would see and that's really important for the stream house. So really, really cool and relevant topic, thank you so much for being here to talk about it. How did you end up interested in this topic?

S Stephen Peters-Collaer 27:52

It's sort of a roundabout journey that brought me here. I've been interested in forests for a while. I had a field job out in Utah where I was working in the sagebrush, but I found myself every time we drive through forests to get to a site, I would always pick our field crew leader's brain about what was going on in the forests. And so I kind of knew I wanted to do forest work. And as I decided to look into grad school, I reached out to Bill, my advisor, and he described this work to me and I was really drawn to it because it feels like a great combination of a lot of different things. It's an opportunity to think about forest, which I love, but to think also a little bit more broadly than forests: how does what's happening in the forest impact streams, aquatic systems, and allows for an ability to kind of work across disciplines within ecology, and approach these questions from a lot of different angles, which is usually the best way to go about answering anything.

A Alison Adams 28:49

So is this your first foray into aquatic systems at all?

S Stephen Peters-Collaer 28:53

Yeah, formally, this is my first work in aquatic systems.

A Alison Adams 28:56

Very cool. This job is my first foray into freshwater aquatic systems, so I'm with you on that.

C Cate Kreider 29:02

So we're talking about forest growth and new growth and old growth--what is the timeline for your study when you're working in this long-term environment?

S Stephen Peters-Collaer 29:12

So one of the cool things about where we're working, the Hubbard Brook Experimental Forest, is this has been a research forest for decades. And they have some of the best long term data in the Northeast, both when it comes to forests and streams. And they're part of this great network called the Long Term Ecological Research Network, which has sites all across the country that prioritize long term studies. And so in theory, being a part of this forest, there are opportunities to continue monitoring these sites and working there sort of for as long as we want to. In terms of my specific research, I'm limited by the grad school timeline. And there are a couple of ways around that and one of them is using modeling software. And so we're using this really interesting program called Island, which it comes from Germany, and it allows you to sort of create a forest within the model, create a landscape, and then based on ecological processes--so you input all of the information about tree species and soil and climate--you can basically model into the future. And you can look at climate change and disturbance and tree growth and all that kind of stuff. So that's one way that I'm kind of looking to get around that within the timeframe of graduate work. And then the other way is by looking at old growth forests as comparison. My advisor has done a lot of work with old growth forests and has lots of data on streams and old growth forests. And so I look at what I'm finding in Hubbard Brook, which is not an old growth forest--it was partially logged 100 years ago or so--and sort of compare that to old growth forests to see how things might shift as forests age and develop.

A Alison Adams 30:56

And so where are you--you mentioned you're a third year graduate student... I'm a PhD student, so I have a sense of what that means about where you might be in your work, but our listeners might not--can you share kind of where you're at in terms of the study progression? Do you have results yet? Where are you?

S Stephen Peters-Collaer 31:10

Yeah, I'm kind of right at the point where I'm about to do what's called proposing my research. So I've had the opportunity to go out and collect data, and I do have some preliminary results. But I'm sort of in the point where I know what I exactly what I'm going to do, and how I'm going to do it, and I'm you know, I need to basically propose that to my committee of professors, and then if they approve of it, then I get the approval to go forwards with the plan. I have had the opportunity to have two years of data collection, so I have some data, and I have some older data that was collected in the lab as well and I've been able to get some results from that. Which is exciting! It's always exciting to have some results to look at and try to sort through and see what you're finding. But even though I am in the third year, it's still early on in the process or halfway through.

A Alison Adams 32:03

Yeah, definitely. I don't know if there's like a typical PhD path at this point. You mentioned that you have some preliminary results, and I don't want to make you go on the record about preliminary result, but also we're dying to know: what are you finding so far? What's something interesting that you've noticed in the data you have?

S Stephen Peters-Collaer 32:19

The preliminary results are related to this question about how much carbon is stored in the logs that are in streams. There's been a lot of really good research looking at what wood in streams does, but there's been really little that's actually looked at, oh, how much carbon is stored there? And as conservationists and researchers are thinking about climate change, what we call natural climate solutions become really important to that, and that's basically storing carbon in trees and forests, soils. In forests, there's a lot of work on how much carbon is stored in logs, but no one has really looked at how much is stored in the logs in the streams. And that's the research that I'm farthest along in. And one of the interesting preliminary findings is that there seems to be a connection between the amount of wood in these streams and basically the density of big trees in the riparian forest. So when you have more large trees in the forest next to streams, you tend to have more wood in the streams. And that makes sense intuitively, for two reasons: One, when you have bigger trees, that wood will take longer to decompose. But then also, many of these big trees are what we call legacy trees. And they're remnants from before land use history or disturbance. And so since these sites were logged, often these big trees were trees that were never cut and having more trees leftover means there's more opportunities for trees to fall into the stream and add more wood to streams. Whereas if you had a clear cut that came in and took all the trees out, there'd be nothing to fall in, and it would reduce the amount of wood in there. So it's an important finding when thinking about retaining trees when in these areas when doing logging or management practices and trying to protect those old trees.

A Alison Adams 34:08

If you're looking at the carbon stored in wood that's in streams, what sort of the long term life of that carbon? Like, what happens to that wood? How long can we expect it to stay in trees? Is it getting replaced? What happens when the wood degrades?

S Stephen Peters-Collaer 34:22

That is part of the question. And I don't have a great answer on how long an individual log might stay. But one of the ways we've been trying to look at the long-term storage is by looking at old growth forests, because in forests that were logged there's a lot less wood in the streams. It wasn't left to go to the streams. And in old growth forests while a lot of trees die, that all falls in place and stays over time. And what we're finding preliminarily is that in second growth forests typical of the region, by the time it gets to an old growth forest, we might be

able to expect the amount of carbon stored there to double or triple in size. And that doesn't necessarily answer how long one log might stick around for, but over time, this pool will grow and expand, and especially as trees get bigger--

C Cate Kreider 35:12

Looking through this project, what kind of challenges have you run into?

S Stephen Peters-Collaer 35:16

Well, there's been all the challenges of being a PhD student, but outside of that, I think one of the bigger challenges has been actually finding appropriate sites to do our field research. The sites at Hubbard Brook are great, and we have five sites there. But ideally, we'd have a lot more sites so that way we can draw conclusions from having more replicates and from a broader geographic range. And last summer, so 2021, we went out with our field crew to southern Vermont, and tried to scout for more sites, and we went out every day looking at multiple sites, and we found one that fit our criteria. And our criteria aren't really that picky.

A Alison Adams 35:54

What are they?

S Stephen Peters-Collaer 35:56

Streams, probably, maybe 10 feet wide at the max, has water all year round, you know, maple trees, birch trees, beech, and it's not crazy steep, not super flat. So you'd kind of think, oh, there's a lot of these streams around but finding the right ones turns out to be trickier than expected.

A Alison Adams 36:18

That sounds challenging. Did you add that one site to your sample?

S Stephen Peters-Collaer 36:23

We haven't. We want to have multiple streams in the same region. So that it's-- we have some kind of comparisons there. Maybe in the future, we can find some more, but for now, still looking.

A Alison Adams 36:36

Yep, that makes sense. So what do you--sort of looking ahead to that future--what do you hope the impact of your work might be in sort of the longer term?

S Stephen Peters-Collaer 36:45

We think a lot about the interactions of climate change, and disturbance and forest aging. And when we throw a lot of factors, and you look into the future, and you say, okay, I want to manage a forest to be resilient, and I want to manage a stream to be resilient and manage for flood control, and fish habitat and all of these things, you end up with a lot of unknowns. And so sometimes it can be tricky to figure out exactly what the best path forward is. And I think my hope is that by focusing on forest structure, going back to what I was talking about, and thinking about the role that plays in streams and forests that will hopefully provide managers with just a little more information on what we have right now, what the current forest structure is like, what current carbon storage is like, and then maybe what expectations are for the future. And so that by providing just a little more clarity, hopefully it's helpful for managers, conservation organizations, landowners to kind of think about what they want out of their-- their land and kind of where it might be headed now, and how they might want to shift where it's going.

A Alison Adams 37:54

Awesome. That sounds like a really good potential impact and really appreciate you doing this work Stephen. I know that a lot of our listeners will probably be excited to hear a little bit more about carbon storage and rivers and how riparian ecosystems you know if we can get them to develop into sort of these old growth formats, how they might contribute to that in the longer term. So really appreciate you joining us today and sharing information about your research and we'll have to follow up with you and when it's further along down the line. Good luck!

S Stephen Peters-Collaer 38:22

Yeah, thank you so much!

C Cate Kreider 38:33

Today's episode featured the call of the bobolink. It was recorded by Phil Brown in Hamilton, Massachusetts on May 21st 2018. We downloaded the songs from xeno-canto.org.

A Alison Adams 38:44

For more information about today's topic and other topics related to riparian forest restoration, visit the restoration roundup podcast tab of Lake Champlain Sea Grant's Watershed Forestry Partnership website. This project has been funded wholly or in part by the United States Environmental Protection Agency under an assistance agreement to NEIWPCC in partnership with the Lake Champlain Basin Program.