Prairie Pod Transcript

Season 3, Episode 2: Let's get our feet wet (Restoration Series: Prairie stream restoration)

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Guests: Luther Aadland, DNR River Ecologist and Brooke Hacker, DNR Clean Water Legacy Specialist

Podcast audio can be found online at mndnr.gov/prairiepod

Transcript:

((sounds of birds chirping and wind blowing))

Megan: Hey welcome back to the Prairie Pod Episode 2, Season 3. Mike, how are you today buddy?

Mike: Hey Megan, I'm doing wonderful how are you? It's a beautiful summer day out there you know.

((Laughing))

Megan: It's a beautiful day. We're in Minnesota, what day isn't it beautiful?

Mike: Well I agree, many people don't you know. Midwinter kind of weather, I don't know but anyway, I'm very happy to be here and very happy to be talking more about water today. It's kind of a new thing for me.

Megan: Well it's not new because we - - look, there's a plan going on here. So, we started with mussels and now we're going to talk about their streams that they live in, prairie streams.

Mike: Oh genius, did you come up with this plan?

Megan: Yeah, I'm a planner believe it or not, I have ideas for how things will work. ((Laughing))

Mike: Hmm.

Megan: So today's all about getting our feet wet - -

Mike: Well done.

Megan: - - which you know, it could be literally ‘cause it is beautiful outside, but we’re still infected with Mussel Mania from last episode, so we decided we’re going to learn a little bit more about where these little beasties live and we’re going to describe some pretty extreme restoration techniques and we’re with two fantastic people - -

Mike: I know.

Megan: - - in the state of Minnesota to talk about this. Do you guys want to introduce yourselves? Luther?

Luther: I’m Luther Aadland with the River Ecology Unit and my career has been studying rivers both in terms of the things that live there and physical processes that form them. Currently, I’m largely engaged in restoring rivers.

Mike: River Ecology Unit with the Department of Natural Resources. Right?

Luther: Correct.

Mike: Okay.

Megan: Yes and we had to reschedule this podcast because he’s in demand, like he’s so busy that we were like oh man, when are we even going to find him when he’s not in a river. So we’re really glad that you stepped out for a little bit to talk with us today. And, we also have Brooke. Do you want to introduce yourself?

Brooke: Hi, I’m Brooke Hacker, also with the DNR, Division of Ecological and Water Resources and I’m the southern region clean water legacy specialist. I work on just field aspects of monitoring assessment restoration projects here in the southern part of the state.

Megan: Nice, so you’re also always in the stream pretty much.

Brooke: Usually.

((Laughter))

Mike: So Brooke, your job is mainly, it mainly takes place within the prairie region of the state, right?

Brooke: Right.

Mike: Yeah. Luther is yours more statewide or?

Luther: Yeah, we work in every corner of the state, so.

Mike: Okay.

Luther: See quite a range of conditions.

Mike: Prairie and forest and everything in between?

Luther: Yeah.

Mike: Yep.

Megan: I like it. Let’s jump right in. I’m ready. We have a lot to unpack.

Mike: Jump right in was that a pun?

Megan: No, I wasn’t trying to do it, just go with the flow, Mike.

Mike: Oh my.

((Laughter))

Megan: Watch out for a riffle, no, it’s a run! Okay. ((Laughing)) Brooke, give us an overview of prairie streams in Minnesota. So we want to hear the good, the bad, the ugly here. What’s going on with them?

Brooke: So I’m part of a three person team. We work with the state's watershed approach to assess the health of prairie streams and rivers here in our area. And so as far as stream stability we find that many of our streams are incised, we've had a great deal of channelization that's happened over times.

Mike: Brooke, what's incised mean?

Brooke: Oh, sorry. Incised means that it's deep, it's down cut, and it's not able to access its flood plain - -

Mike: Got yeah.

Brooke: - - as often as it should during flood flows.

Megan: So it's like steep and narrow? Narrower than it should be?

Brooke: Yeah, it could even be too wide.

Megan: Oh.

Mike. Hmm.

Megan: Nice.

Brooke: But typically prairie streams they are more narrow and they're deep and they're very meandering or sinuous and they have access to their floodplain in that riparian zone. Very frequently.

Megan: Got it. Keep going.

Mike: I mean what's the overall trend with water quality in this state?

Brooke: Well, especially in this area, some areas of the state are doing quite well. But this area especially the Minnesota River Basin we have elevated levels of sediment, nutrients. We see more flashy flows. And we also have found that a lot of the sediment is actually coming from in the channel near channel sources as our streams are becoming more unstable. We have a lot more bank and bed erosion.

Megan: Oh, I don't like to hear that. Hopefully, there's going to be some things that we can do about that. So tell us, these are obviously, this is part of their condition, right? But it's also part of the challenge. So elaborate a little bit on what's kind of causing this.

Brooke: Well, streams go through this natural process and they strive for this equilibrium so they can move the sediment and water through the system. And so, you know, what's causing this is a combination of things. We've had land use changes in our watersheds. There are climate changes also that we can talk about too.

Mike: I'd be interested in that. So climate change, we're talking about changing flood patterns right? Or changing precipitating patterns? More frequent heavy precipitation events.

Brooke: Yeah, that's one component of it. The intensity of the storms. Also, you know, we have warmer winter nighttime temperatures too and we see more of that base flow in the winter than we used to. And we also have more drainage in our watersheds and some of those tile lines run much longer into the wintertime too.

Megan: So we've got a large volume of water that's moving when it didn't used to move.

Brooke: Right, right. And it's just the cumulative effect and basically more water is going through our rivers now than what was historically occurring.

Megan: So it can't keep up. And then if it doesn't have a floodplain, it's natural - -

Brooke: It's evolving to these changes in that this happens. There's erosion and so on as the channel tries to find the new stable pattern and profile and dimensions.

Megan: That's interesting. I didn't know it was evolving and adapting with it. That's kind of cool to hear.

Brooke: But there's ways that we can help it too. Speaking of why we're here today to talk about stream restoration there's many opportunities to restore prairie streams. And then there's also ways that we can use more passive approaches too and, you know, give it appropriate buffer riparian zones and let the streams adjust where it can too.

Megan: And this is where I always like to mention deep roots. You know, I can't help myself, but if it's in some of those buffers.

Mike: You and those roots, Megan.

Megan: I know. I can't, I don't even want to go down a root tangent here, but if some of those buffers had deep, majestic prairie roots in them, you'd argue . . .

Mike: Majestic?

Megan: Majestic. We'd arguably be doing a better job of trapping sediment and nutrients because we're talking about roots that go down 13 feet in some cases. So that's going to be a lot more than some of our, you know, non-native cool season grasses that are more like sod and don't have a great depth to them. So, I'm a big fan of putting prairie roots all over the place.

Mike: I know you are.

Megan: I know.

Mike: You're convincing me.

Megan: ((Laughing)) You're coming around. I think Brooke likes prairie roots. I mean, she's smiling. She's down with it.

Brooke: Definitely. They're amazing.

Mike: Should we move on and start talking about restoration?

Megan: Yeah. Let's jump into that. So, okay, what are - - you touched on this a little bit with the condition, but sort of summarize for us what are the primary problems that make a stream unhealthy and therefore trigger us to know that we would need to restore it? Brooke, you tell us this.

Brooke: So the primary things we can talk about that unstable state where, you know, we have this excess sediment. We don't have the right channel shape and channel dimensions. Also, we lose that habitat, which is so important for aquatic species, riffle and pool sequence within that, that meander in the stream.

Megan: I've always wondered this, so I pretend that I know these things, but I deal on land so much that I don't necessarily know all the good definitions for this. Describe for me the difference between a riffle, a run, and a pool.

Brooke: So, the difference is that on the outside bend you're going to see this deeper pool and then you come around the bend and you're going to see this riffle, which is more of the cobble and the small gravel and so on. And you might not even really see it in prairie streams 'cause they're such low slope, but that's going to be a shallower part of the stream. It's more of the hydraulic control. And then the riffle's going to run into the pool and then it comes into a glide and back down through the riffle. So it's just this sequence in this undulating stream bottom. I wish I had a graphic right now.

Megan: So it's kind of like a speed bump in the stream 'cause it's trying to slow things down or give me an analogy here. So I know you're like, so you guys can't see Brooke, but she's gesturing with her hands and it's really good and she's painting the picture for us. We're just trying to paint the picture for you 'cause you can't see her hands. So we're trying to help you understand a little bit.

Brooke: Yeah. Could I defer to Luther?

Megan: Yeah. You can defer to Luther.

Luther: Well, yeah, you're right. Riffles are where you tend to see the rockier, yeah, so there's, it's more roughness on the bed of the stream that do, that cause some resistance. The pattern also slows that down. A more sinuous river has a lower slope than a straightened one so that's a big deal in terms of stability of the stream.

Megan: So a lower slope is good? It's a good thing.

Luther: Yeah. I mean the stream will reach its natural equilibrium over time by building those meanders and reaching that equilibrium and that connection to the floodplain. And then there's processes associated with that where the sediment deposited on these point bars at the bends are regrading the flood plain and reconnecting it to the flood plain. So those processes can’t be overlooked when we talk about restoration.

Mike: Tell us more about what objectives you're trying to achieve when you're restoring a prairie stream.

Luther: Well, one of the big, first steps is to identify the problem. And to do that, just like a doctor analyzing a patient you have to have some understanding of the system. So there's some groundwork and data collection that go into that. Sometimes the symptoms of a problem are real obvious where just extensive eroded banks or lacking fish diversity, lack in populations, those sorts of things that might make you think there's something wrong. But then we have to delve into well, how'd this get messed up. Brooke mentioned the landscape changes where we don't have as much prairie. We also have climate patterns that are trending wetter and so many of our prairie streams have more than doubled the channel forming discharge that they would normally have.

Mike: Really?

Luther: So when that happens the stream has to get bigger, the pattern has to get bigger and ultimately the belly has to even get bigger. The other big issue in streams is the lack of connectivity. Rivers are like highways for biodiversity. Not just fish and mussels, but a lot of the terrestrial species will use those same corridors to get from place to place. And they need to do that because while low-gradient streams have good pool habitat and that kind of thing, it may lack the spawning habitat that are associated with the steeper reaches of river. So, for instance, in the prairie region the prairie plateau is where we find some of those steeper river reaches and as the streams come down into the Minnesota Valley and those areas really need to be connected to these other reaches of river.

Megan: This may be a dumb question, how do they get disconnected?

Luther: Dam construction is one of the big ones because they block these migrations. And, you know, under sided culverts are another one where velocities can be too high for fish to get through. Just an example of that, here we're near the Cottonwood River and it's the watershed where I grew up and that entire watershed was lacking fish diversity because we had a dam right here in town, the Flandreau Dam that blocked that entire watershed.

Mike: So it was due to one dam?

Luther: Yeah, primarily. And there are 25 species of fish that were in the little segment downstream of Flandreau Dam, but didn't exist anywhere upstream.

Mike: Wow.

Luther: In 1995 we removed that dam and 23 of those 25 species came back very quickly to the watershed, dramatically increasing the biodiversity of that whole watershed. Literally 2000 miles of stream in the Cottonwood watershed. That increased their biodiversity by about 35% after that dam was removed.

Brooke: That's incredible.

Megan: And we know diversity makes the world go around. We talk about that all the time on the podcast.

Mike: Is that how you feel?

Megan: That's how I feel.

Mike: I've always been kind of confused about that.

Megan: Oh, Mike, get on the boat. This is how I feel. It's both true if you're a prairie, it's true if you're a stream, it's true if you're a person. Diversity makes the world go around. It makes the world more interesting.

Mike: I agree. I just like to give you a hard time about it.

Megan: It makes it healthier. Just, oh, man, I'm on the soapbox and I'm not going to get off of it for a long time if you do not accept what I'm saying.

Mike: Oh, please.

((Laughing))

Megan: Diversity is so important. You know it's funny that you mention that dam. I actually, this is a brief aside, last winter I was giving a snowshoe hike to our castle learning group, which is continued education for mostly retired folks. And one of the gentlemen there used to work for the DNR. He didn't identify himself that way, you know, and it was his first time ever snowshoeing. And then after we made him fall many times into the snow, he then told us that he was there when that dam was moved. He used to work at that park. And he talked about seeing the change and how incredible it was. And then we were like that's fascinating. Could we interview you about this? Could we talk to you a little bit more about this? He was like oh, sure, sure. And then we asked him the follow-up question, do you think you're ever going to come snowshoeing with us again and he just kind of did a real polite Minnesota slow head nod. We're like, no, probably not. ((Laughing)) But he did say he'd meet us for coffee, so, I mean, that was a win. But, anyway.

Mike: Luther, I'm glad made the connection to wildlife, in particular terrestrial wildlife because the connection with aquatic wildlife is fairly obvious. But these prairie or I'm sorry stream restorations are also important for the species that occur in the prairie that we care about, right?

Luther: Yeah, absolutely. And we've seen following restorations where we have a lot of wildlife that will just follow that corridor, 'cause you can have the semi-aquatic birds, the mammals.

Mike: Sure, all the reptiles and amphibians.

Luther: Yeah, that kind of thing. But the deer. The fawns will be often walk restored streams or where I look up and I see fawns popping out of every bend and they need that water supply too. And the wetlands that are tied to that and that kind of thing.

Mike. Sure.

Megan: Well, when we look at the Minnesota River as a whole and this is a big part of my job is looking at rare species, it's one of the, I call it the last frontiers in southern

Minnesota where it has an incredible amount of diversity that it still retains. And so it's an area that I look at when I see all the features that occur there still that I'm like okay we need to put some focus and energy into this. And there are a lot of people who are putting focus and energy into it, which you guys are as well.

Mike: I think it's well documented riparian corridors tend to be more diverse than anywhere else in the landscape.

Luther: Yeah. And rivers generally are some of the most diverse ecosystems on the planet even though they're a small percentage of the water area in the world. They're almost as many species in rivers and streams as there are in the ocean. And so - -

Megan: I didn't know that.

Luther: For the area that they comprise the diversity is much, much higher than the ocean is.

Mike. Sure. And the challenge of course is that there's - - the demand to use that ecosystem is also very high. It can be exploited in ways that may be a problem for some of the species that live there.

Luther: Yeah. And we haven't treated our streams very well. We've used them for sewers. We have channelized them. About half of our streams have been straightened in Minnesota and much higher in the prairie region. And we've built these barriers that have fragmented them so we eliminate those migrations that are key to a lot of wildlife and fish.

Megan: Alright. Tell us a little bit more about some of the like specific techniques that you would use if you're starting a stream restoration process?

Luther: Yeah, well, first of all, again, identifying the problem and then deciding well, how can we address this because it's a lot easier to mess something up than it is to correct it. So when we have these in size streams and disconnected flood plains part of it is getting the meander pattern back. But you also have this grade difference so that the rivers become in size, which means their floods are contained within the channel and a lot of energy is contained in the channel rather than dissipating into the flood plain where that water would be stored. So sometimes you have to bring the grade of the stream back up. Sometimes we can do that and reconnect the flood plain that way. The other way is to bring the flood plain down. That becomes very expensive because it's a lot of material.

Mike: We're talking about a lot of bulldozer working in the spring, yeah.

Luther: And in the long term having that pattern is what maintains a connection between the stream and flood plain because of this constant regrading as these meanders migrate down valley and in both erode and deposit of that eroded material on the flood plain.

Megan: Well, and I imagine too, I'm sort of connecting the dots here thinking the big picture, if you don't address the root cause you could spend a lot of time and energy into restoring the stream. But if you don't address the larger watershed problems whether it's

land use changes or other then, it's still going to go back to how it was. It's like a Band Aid on the system, right?

Luther: That's exactly right.

Brooke: That's where a lot of my work comes in too on the frontend as we work with partners on watershed assessment. It's really important since it's such a big undertaking. We're not just talking about hard armoring a bank. We're talking about bringing back those ecological functions and actually moving toward a stable stream. And so we go through a lot of assessment work and prioritization and then, you know, look at risk and cost benefit. Kind of quantify the ecological uplift and so on so that we can really justify and make a good decision on where it makes sense. And where we have the willing landowners and the partnerships that we need. It often takes a really - - I've learned that it takes a really diverse, large team to engage in these types of projects from engineers to ecologists and planners and so on.

Megan: Right. And then you have to have the buy in from the folks that live there too, right, to make the changes on farm or on their homes or wherever they need to do it to help slow the erosion instead of all these other things, right.

Brooke: Yep, exactly.

Luther: One of the other, a different kind of problem is the use of old dams where the reservoir is filled with sediment. And so in this case instead of in sizing we've graded the stream and buried it in sediment. So in some cases we have really deep sediments. An example of that was a recent project in Oronoco where we had 18 feet of accumulated sediment. So we had to bring the river, the Zumbro River back up to connect with the flood plain, which was now that new accumulated sediment. And we're able to do that by building rapids and riffles and stepping it up. A similar project we did in the southwest in Blue Mounds State Park where we had a reservoir full of sediment. The dam failed and we brought that river, that stream back up to connect to its flood plain and then remeandered it within those accumulated sediments to make a habitat similar to the more quality streams that Brooke would find in their surveys.

Brooke: Yeah, we try to work, these restorations are based off of what we call reference reach streams so kind of copying that, learning from nature and what's out there that's working well, what has these features, and then we can survey all those different parameters and then base our design off that based on the same stream type and valley type combination.

Megan. It's fascinating. It's the same thing we try to do with prairies so I would imagine if somebody asked me - - I got an email the other day and somebody said when do you think we'll have all the answers on how to do prairie restoration? And I said, well, you can ask the ecologists 10,000 years after me and they may still not know. ((Laughing)) And they just started laughing.

Brooke: I feel that way too.

Megan: Because it's so complicated. Like it's so complex and we - - I mean, here you guys are, like you're super smart, you're incredible, talented scientists and I know - - like

I don't know, I just think about myself. There's still so much I still don't know and I've been studying prairies for my entire career and hope to continue for the entire rest of my career and there's still so many connections and things that are going on that I don't fully understand. I just hope that I'm giving - - when I do prairie restoration I hope I'm making the right choices and I rely, like you guys said reference reach, I really like that. I rely on the native prairie to help me fill in the pieces of what's going on.

Luther: And when you speak of the prairie and the depth of roots that they have that's another key step in restoration obviously is getting that riparian zone reestablished. The trouble is prairie grasses and other vegetation take time to get that root mass down deep. The root volume ratios in the soil profile for a lot of these prairie plants will continue to increase over a period of 20 years where there's a tremendous length of root. I mean we're talking hundreds of kilometers of root in a meter wide profile of soil. So you can imagine how much or even carbon storage when you think about climate change can occur in a prairie.

Megan: You're leading us right into our - - we're going to do another - - the season, our last - - we're ending the season with our roots episode so you're just ahead of the times. You're ahead of the times.

Mike: It's Megan's favorite topic.

Megan: It is my favorite topic so I can't stop talking about that and bees and other things. Anyway.

Mike Can I just ask, I mean clarify. Avoiding Band Aid solutions and getting at solutions that solve the ultimate problems that we're facing with streams is one of them restoring prairie where at least maintaining grasslands in the corridors adjacent to streams, is it safe to say that's a key thing to do?

Brooke: Yeah, I think that's a key thing to do. We're looking at that bigger picture of bringing that resiliency and the health to the stream and the energies to the riparian corridor too.

Mike: We're constantly looking for management actions that have dual benefits or overlapping benefits so if we can do something that provides like habitat for grass and birds and then at the same time provide some stability for prairie streams. And also providing better water quality and water source and all these other things.

Megan: That's a valid point. And I want to say something that's real weird for me to say, it's going to freak you out a little bit Mike, I know. But I would also argue - - oh, gosh, it hurts to say it. It's more than just prairie because a lot of - - I know, this is weird where I'm going here. But we talk about prairies, I'm not talking about individual prairies, but we're also talking about the landscape as a whole. And the prairie landscape, I know, it has different ecosystems within it. There's certainly the prairie ecosystem that's a part of that is trees and forests and different things and wetlands. And so it's about making those bigger connections with all of those different ecological features on the land. So I know it's weird to hear me say it, but sometimes trees are important too. I said it here first.

Luther: Well, one aspect to that is trees on big rivers, the banks tend to get higher and the difference between prairie corridors and wooded corridors is that trees will have a deeper mass of roots, deeper in that soil profile. So on these bigger rivers trees tend to do better in holding the banks. And if you look at the original surveys of much of the prairie region many of the larger rivers have this wooded corridor that extended up into their prairie and provided a different kind of habitat along that stream.

Megan: Thank you. You said that much more succinctly. That was the point I was trying to make. There's multiple things going on in the landscape. It's not just all prairie all the time even though it is in my world.

Brooke: One other component too, we talk about recent restoration projects at Blue Mounds State Park so an oxbow, so those are kind of like part of the abandoned older channel, we have some rare species. The Topeka shiner, for example, that really rely on that habit.

Mike: Federally endangered fish, right?

Brooke: Yes. So we talk about the importance of being connected with the flood plain, having the wetlands, but then and also there's these oxbows that provide this unique habit for species.

Mike: At Blue Mounds you intentionally created these oxbows, so you intentionally created these little pools that basically simulate an oxbow.

Brooke: Yeah. It was a partnership with the Fish and Wildlife Service and there were seven of them created then with the larger restoration project.

Megan: And they provide habitat for the Topeka shiner?

Brooke: Yeah, in that off channel.

Megan: Nice.

Luther: But another part of that was that we put a very sinuous pattern back into the streams so that over time those oxbows will naturally form and those meanders cut off as they naturally do in meandering streams.

Megan: Very cool.

Brooke: Because one of the challenges, we talked about some of the water quality concerns at the beginning so we have a little more sediment access, sediment moving through the system and we have a flood plain, which is great because that can deposit the sediment and nutrients. But then these oxbows are filling in faster than we think they did in the past.

Megan: Right. And part of - - so, just taking it to, thinking about economics here for a minute. This might be a tangent, but it just - - I'm looking at a picture of a person paddling and so it seems appropriate that we bring this in.

Mike: Sure.

Megan: When you restore the stream and you get back to this kind of meandering pattern, now only is it healthier in theory, hopefully, that's the goal, right? But wouldn't it also be a little bit more interesting because it's more natural and you're sort of going - - I don't know - -

Mike: Better for recreation.

Megan: Recreation, yeah, because, I mean, let's be honest if you're just in a channel and you're just going straight that is just not as much fun.

Luther: Not a big - - a lot of canoeists target ditches.

Megan: Yeah, right. I don't often see people in the ditch with a canoe.

Luther: They don't find it that interesting. But the other part of that too that's brought is the water quality benefits of that. We've actually measured the turbidity of these prairie streams that have agricultural watersheds. They have a high suspended sediment load and they're very turbid. As they go through these prairie grasses the particles actually adhere to the grasses and in this one case within a few 100 yards this went turbidity impaired to crystal clear water.

Megan: Oh, my gosh.

Luther: As it moved into a big wetland basin and eventually back into the stream. And as it came back into the stream, we measured turbidity. It was the full tube transparency. In other words, you could see a meter down; whereas, in the upper part you could see about two centimeters.

Mike: Just to clarify, turbidity means the amount of sediment that's settled in the water basically, how dirty the water is?

Luther: Turbidity would be the opposite of clarity. If it's turbid, you can't see through it.

Megan: Yeah. And the tube you guys use to assess that are really fun. I've gotten to use it a couple times and they make sense, right? You look down into it and you're like I can't see. Or you look down in there and you're like I can see. It's pretty common sense.

Luther: The other part of that is the nutrient loading that comes with fertilizer and other types of runoff, sewage and that kind of thing. And as that water flows through the prairie those plants will take up those nutrients and its measurable affects on water quality. Whereas, in a ditch those nutrients are confined. They're moving very quickly into the bigger river and those nutrients will make it clear to the Gulf of Mexico where we have a dead zone of anoxic ocean.

Megan: Right.

Luther: Largely nutrients that are applied in the Midwest.

Mike: Gotcha.

Megan: Well, while you're talking about this a cord that strikes the most sense in my mind at least is you're talking about how important it is to make sure that the river itself is connected. But part of that connectivity is also making sure that the landscape around

it is connected so that you have - - as you're describing this and I'm thinking about okay, so just a little bit down the stream it gets clear if you have the prairie grasses around the edge, it's really about making those connections with what habitat we put adjacent to the stream and then also how it's connected on the land as a whole. The land and water's a whole system together. You just can't look at one individually. You have to look at the whole system, the watershed and so.

Luther: Absolutely. One of the ironic things about the channel straightening of rivers. A lot of it was done for flood control. So you move the water off rather quickly.

Megan: And it does the opposite is what you say.

Luther: Well, if you live downstream that's not a good thing. And that's a big reason why their floods are bigger as well. The conveyance of the land, you know, and the water that moves much more quickly so for these downstream communities they get flooded worse and worse even though you may have, you know, moved the water out more quickly in the headwaters. It's impacting municipalities downstream.

Megan: As they say, it all flows downstream.

Mike: Indeed.

Megan: And you know what I mean there, Mike. Okay. So this is complex stuff, it's complicated.

Mike: Yeah, I know. It's stimulating though.

Megan: Mike's stimulated. Okay, tell me ideal, like what is the end look that we're going for. And I know you sort of mentioned some of the parts and pieces, but, so, if I were to go out and say this stream is healthy, this stream is not healthy what are the key things that I'm looking for to make that determination?

Luther: Well, one thing, I like to fish and for a lot of these watersheds that are fragmented in size the diversity is lower but also the game fish don't tend to be there. So that's one of those obvious things that you'll see when you go there. Another is in a connected system where we have that flood plain connectivity you won't tend to see the rapid erosion rates because a lot of the energy is held in the flood plain. So you see a better water quality, more diverse biota, not only the fish and muscles, but the - -

Mike: Turtles.

Luther: Terrestrial. Yeah. Turtles are an interesting one because they lay their eggs in eroded riverbanks.

Mike: There you go.

Luther: So if we just do a Band Aid approach where we're saying, oh, my God, there's an eroded riverbank, we've got to armor that we're actually impeding the process that the river needs to go through to get more stable. So we don't want to be just doing Band Aids that are symptomatic. We want to get to the underlying root causes of the problem.

Mike: I think about Kingfishers, thousand of Kingfishers nesting in the riverbanks. And there's lots of other species that - -

Megan: This is the second time this week you've talked about Kingfishers.

Mike: I know. I just love them. Megan, I like Kingfishers.

Megan: That's fine. I'm surprised you're not wearing a Kingfisher shirt today. (Laughing)

Mike: Kind of loud and obnoxious.

((Laughing))

Megan: That must be why we're friends. (Laughing) It's all making sense to me now.

Luther: One of my coolest photos is of a Kingfisher on a prairie stream that we restored. It had a legal ditch and I was able to zoom in close enough to identify the fish species that was in the Kingfisher's mouth.

Megan: That's so cool.

Mike: It wasn't a - -

Luther: A juvenile white sucker.

Mike: Okay, was clearly endangered, well that's good.

Megan: Yeah. ((Laughing))

Luther: But that's part of it too.

Megan: It is part of it. It's a circle. The circle of life. Okay. I cut you off. So, Brooke, make sure I get this right. So we're looking for habitat. We're looking for fish diversity. We're probably looking for buffers that the stream has some vegetation next to it, right? A meander not in sized. That would be good. Water quality. What am I missing?

Brooke: Well, just to add to that if the stream is in more of an equilibrium with the right channel dimensions and shape and pattern then you won't see as much erosion. And also we are getting, we talked about the more intense rain events and more flooding and so on. And so these channels are more stable or more in this dynamic equilibrium are better these bigger events. You don't just see it just so blown out after the close go down because they're healthier. They have more resiliency, better stability, yes.

Mike: They can handle some of these big precipitation events better I guess.

Brooke: Yes.

Megan: Which is going to be hugely important because like Luther mentioned the predictions for Minnesota are that we're going to get wetter. And so that's not good news for some folks if they're trying to figure out - - if they're already struggling with some of these climate issues that we're seeing so we're going to have to get, I don't know, work smarter to figure all this out so that we can deal with that. Because I don't think the answer is that we'll just keep shoving the water downstream. We're going to have to figure out a way to solve all these hard problems.

Luther: And another related problem is that these unstable streams cost us money because they blow out roads. People's houses will fall in the stream because this is so out of whack. And so that's a human cost. Just an example of that. In western Iowa where 80% of the streams have been altered by channelization, they have massive incision of their streams and this is in the '90s when they estimated those damages just in western Iowa, just to infrastructure like roads and crossings at over a billion dollars. Just because of unstable streams.

Megan: Well, even think last year across southern Minnesota how we had the late snow, you know, and then we had just, it just never stopped raining and so our farmers couldn't get in the field and we had all, you know, these fallow fields that were open to more erosion. And we had all kinds of issues going on. And I just remember all the pictures that kept coming through of people that they thought that they might have been outside of the flood plain of the Minnesota River, but clearly in it or at least in the new flood plain. Because their shed is fully underwater. All you can see is like the little weather vane at the top. And so that you know that there's actually a building there, I mean, which is devastating for people who live there. But also like you said, there's a long term problem then if you're going to continue to be in the flood plain and we're going to continue to have these rains. It's just going to be a systemic problem that keeps going. Negative feedback we want free.

Brooke: We're fortunate now with the Clean Water, Land and Legacy Amendment though. There's a lot more collaborative watershed planning going on and they're using watershed science to help us target and prioritize. And then, you know, working in the headwaters and working throughout the watershed because we talk about how it's all connected so we can slow the flow, hold more, you know, hold some of this runoff back and just try to improve the overall health of the watershed.

Mike: Yeah, good point.

Megan: That's good. We do have a lot of good people working on these things. Tell us pretty quickly. We'll ask this question of both of you. So, think about some key things that you learned. It could be from a project that you've worked on. It can just be through your career up to this point. So these are like the golden tidbits that you would impart to somebody else. Golden tidbits. Like an Indian grass seed head blowing in the wind. Okay. Anyway. That you think that you've learned that can be applied to other projects. Like what are some things that you would tell folks that are starting out and trying to figure these things out. I know, like to do it succinctly would be hard, but try. Luther, you go first.

Luther: Well, as a kid I grew up on the creek, Dutch Charley Creek in the Cottonwood Watershed.

Mike: What was the name of it?

Luther: Dutch Charley. It was named after a trapper that lived there, but what I like to do is talk to the old timers and they talked about these huge runs of fish of all different species coming up that stream and taking wagon loads. Some of these old timers were born in the 1800s and trapped in the late 1890s and I spent all my time on that same

creek. I didn't see those big runs of fish. Later I learned that with the removal of Flandreau Dam that, that same stream increased its diversity and started to get those big runs of fish back. So that was something that actually took me awhile to fully understand. I remember standing below box culverts on the creek and seeing these fish trying to get over the perch culvert in the creek and I could actually catch minnows by the handful below that barrier because they're all concentrated there trying to get past it. So when we moved that and removing now dams around the state and we're seeing on average so at these barriers we'll see about a 40% loss of the number of species in that watershed, about 43%. After we remove that barrier, we'll see about 70% of those missing species return fairly rapidly. So it's very gratifying to see that ecosystem regain its biota.

Megan: That's incredible.We learned a lot about that last episode too. Well, I shouldn't say a lot. We learned a little bit about it with the discovery, the spectacle case.

Mike: I learned a lot.

Megan: Ok. We did learn a lot. I mean we learned a little bit about the barriers, that's what I mean. We learned a little bit about where they were solving the mystery of the spectaclecase mussel and what host fish that it needs. So, and we learned how, you know, there was a fish species above the dam, but not below it. Am I saying this wrong? Or was it below the dam, not above it? I can't, now I can't remember.

Luther: Below the dam and not above it.

Megan: There we go. I knew you'd help me out Luther, thank you. And then they solved that mystery of oh well, it's got to be, you know, this one because this is where its host fish is.

Luther: The other part of that that we're discovering now is that these fish will migrate extreme distances. Now that we have more tagged fish, but every - - one of the mussel examples was when Lock and Dam 19 was built clear down in the southern end of Iowa into Illinois, it eliminated the skipjack herring, which is the sole host of two mussel species. But the skipjack herring went clear up to Big Stone Lake historically and were virtually eliminated from the whole Mississippi basin upstream of Lock and Dam 19 in Keokuk, Iowa. And so it has a dramatic effect on just broad spatial scales in terms of river miles.

Megan: That's crazy.

Mike: Brooke, what is your golden tidbit. Do you have one?

Brooke: I feel like I'm still learning. So ask me in 20 years or something. But, you know, I think our overall goal is restoring the process and the form and the habitat. The whole big picture of everything. And so there's always constraints and challenges and you have to make adjustment, but, I think we've been really lucky through partnerships and through just like Luther's group and mentorships and trainings that we've been allowed to participate in. I think that's just a big deal, just the collaborative effort that's needed to carry out these projects.

Mike: Do you guys work together on projects? Did you work together on Blue Mounds?

Brooke: Yes, we did.

Luther: Yes, we did.

Mike: Yes, that was my first exposure really to a larger level of stream restoration and it kind of blows my mind what you guys did there.

Megan: Yeah, mine too. And it blows my mind how many different disciplines and scientists and expertise were needed to make that project successful. It shouldn't blow my mind, but it was just an incredible partnership that went on there. I mean Luther was there, Brooke was there, but then there was also the nongame folks were there.

Mike: Lisa Gelvin-Innvaer was there dealing with snakes.

Megan: Parks and Trails. Molly Tranel Nelson was there. They were trying to figure out oh, no, the dam was the hibernacula for these snakes so now we've got to move the snakes so the snakes don't die.

Mike: That's a cool project.

Megan: There is a super neat video that I'll see if we can share where Lisa and Molly are trying to keep these snakes warm and try to figure out how to create a right, new, hibernacula for them. They're looking at plans and do you construct this and everything. And then they've got their hands filled with snakes. I know, it weirds me out too. And they're just putting them in the holes so that they don't freeze.

Mike: It didn't weird me out.

Megan: Yeah, it doesn't weird you out, but oh, gosh, bless them because - -

Mike: And now the prairie restoration that's occurring in that area, the park is - -

Megan: It's a huge partnership.

Mike: We're going to be monitoring the pollinator and grassland bird's response in that prairie restoration.

Megan: Yeah.

Luther: That part is really a fun part of it working with people. And sometimes the partners are different than you might think. We're getting more projects proposed and implemented by drainage authorities. The ones that are responsible for the ditch network and we just have a watershed district in the northwest that's restoring 26 miles of a channelized stream, prairie stream. It'll benefit the local farmers as well as the biodiversity and water quality of the stream.

Mike: Cool.

Megan: Great because we all live here. I like it.

Luther: Absolutely.

Megan: You talked about the economics of that too earlier. Okay. We have to move on to our next section. We got to throw some good science at people, right, Mike.

Mike: I like throwing science at people, you bet. I mean that in a non-aggressive way.

Pre-recorded Jessica, Megan and Mike: LET'S SCIENCE TO THE LITERATURE! SCIENCE!

Megan: Okay. This is the part of the podcast where we recommend a book, a blog or a paper and we're super lucky today because we're with two incredible, amazing people that they are going to share some of their very own research and their own talks that they just help spread the science. Luther, take it away.

Luther: Well, we've got a few more recent books that are coming out. One is through the University of Iowa Press and with the University of Minnesota on the ecosystem. Well, Ecological Restoration in the Midwest. And we get into some of the prairie stream restoration, the dam removal and that kind of thing in a chapter in that book. Another one is one we did a few years ago on reconnecting streams, dam removal and fish passage in these sorts of streams. We'll have a book coming out shortly, The Red River Valley and Aspen Parklands that will get into just the biodiversity of that system. And we have a chapter in there on rivers and streams and the biodiversity in these systems. There's others that you can access online. One is the Superior Effects paper that we've done together statewide on barrier effects. Streams and then effects of removing those barriers on those watershed.

Mike: So links to all these books will be on our website right?

Megan: Yes. Yes, they'll definitely be on our website. Brooke, tell us about some of the things that you use in your work.

Brooke: Yeah, I don't have specific research or talks of my own to share, but I have a couple others that I just want to point out. I've been gathering some training and reading and more interested in the stream quantification tool. It was developed by Will Harmon with Stream Mechanics. He's from Colorado and it's used in a variety of different states, but now we have a manual for bringing it to Minnesota. And the Corps of Engineers is one that took a lead in bringing it and have been offering some trainings. So there is a mitigation piece that goes along with it, but this stream quantification tool is important because it helps to document the ecological uplift and so you can compare different sites. You can before and after a stream restoration.

Mike: What does ecological uplift mean?

Brooke: So the benefits, right that you're going to see after a stream restoration versus what you're going to see in a degraded stream.

Mike: So it kind of helps you prioritize where to work?

Brooke: Yeah. So you look at the geomorphology. You look at the hydrology, the biology. The connectivity can also be a factor too. All the components that would play into a healthy stream system.

Mike: Is it like, is it a computer program where you plug in parameters?

Brooke: Yeah. It takes some training to go through it and there's an Excel sheet and there's a manual that goes along with it. But you'll go out and you'll collect your field data and then you'll come up with a scoring system once you fill out the worksheets.

Megan: Well, that's great that they're adapting it to Minnesota.

Mike: Very useful.

Megan: Models are only as useful as the data that goes into them. So it's important to have that Minnesota data in there. Okay. Here's two others, or one other.

Brooke: I guess one other thing too is my assessment work that we do. There's this textbook called Stream and Watershed Restoration, The Guide To Restoring A River and Processing Habitat. And so that's Roni and Beechy and it just applies a lot to the type of assessment work that we are doing, geomorphic assessment work and then helping us to prioritize where it makes sense to do stream restoration work.

Megan: I like it.

Mike: Cool.

Megan: So we can be more effective overall. That's good. I feel like I'm going to have a lot of reading to do tonight.

Mike. Yeah, absolutely. Not Harry Potter tonight, but stream restoration. Hey Megan?

Megan: Yeah, Mike?

Mike: I wish you would take a hike.

Megan: I think I will take a hike and I might take a swim because we're talking about streams.

Mike: Maybe do some fishing, you know?

Megan: Maybe do some fishing. I know. We could do some river recreation this podcast. So we're going to continue on this water theme. So, like always we are going to introduce you to some very incredible public lands because you're a public landowner in the state of Minnesota because we have public lands. See how that works? Okay. So Luther's going to start. We made our guests do all the work and they're going to tell us some places where we can hike or swim or fish in this case.

Luther: Well, one of my favorites is a stream that I've worked on for a couple decades and that's in the Rothsay Wildlife Management Area. That management area is one of the bigger tracks of prairie and it's positioned along the Beach Ridge of Glacial Lake Agassiz. And part of the reason it's still native prairie is it's very wet. A lot of springs coming out of that area. A lot of natural wetlands and wetlands that were difficult to drain because there's ground water constantly pumping up there. But at the headwaters of Londale Creek, there's this pool. It looks like a geyser. It's crystal clear water. It's about the size of a large living room and you'll see the ground water pumping out of the bottom of the pool. And that feeds a cold water stream that's a very diverse stream. It has brook trout in it and a few miles downstream of that spring it becomes a ditch and a

length of that in the Atherton Wildlife Management Area we restored about three miles of that ditch working with the ditch authority and diverting that stream into a remeandered channel that we excavated. But it's a real unique spot.

Mike: It sounds cool.

Megan: It does sound cool. Also I love that you tied it into your work so it's like directly related as it all is. As we say all the time, conservation's not just a career, it's a lifestyle. Okay, Brooke, give us your place where we're hiking or swimming or fishing or wading.

Brooke: Well, I'm really amazed by the upper part of the Minnesota River Basin. There's so many intact natural areas, beautiful prairies, these wide, confined valleys where we have these streams that are very sinuous and Luther would call them super meanders because it's just these big meanders and small meanders within and I'm thinking of it's Lac qui Parle WMA Emily Creek before it goes to the Minnesota River. It's a nice, intact stream and it would be a good hike. And the other one I'd have to throw in too is just upstream of in Blue Mounds State Park the Sioux Quartzite Outcrops and the upstream from where we did the restoration project near the walk-in campsites. My kids love to just on big rocks across the stream and it's fun. It's more of that riffle system with the rock rapid kind of environment. And the Minnesota River has so many amazing waterfalls too. It's steep when you come into the valley and, you know, we've got Minneopa we've got county parks and there was a Gustavus professor that wrote a book about waterfall hikes that you can take in the Minnesota River Valley so that would be one more thing I would recommend.

Megan: I love it. Okay, a brief nother side story because Mike has never heard this story. When I first came and started working at the DNR, my supervisor asked me if I had ever done any waterfall hunting. And I just kind of looked at him and I was like waterfall hunting? Is that a thing that people do here? I mean is it like a life list for birds? Do you write them down? Like I got Minneopa, I got this county park. I did all of them. I was thinking in my head like I don't understand but I like it. I like that people do this here. And then I'm just looking at him confused and I'm like oh, that sounds cool. I mean those are pretty. I mean there's a lot of water there. And he's looking at me a totally confused look on his face where I can tell we're clearly having a miscommunication. And he just points to a goose on the way and he says water fowl hunting. I go, oh, water fowl, yes. Enunciation is more important. I had a little bit of an accent curve there. I wasn't thinking that.

Mike: That's hilarious. But to be clear there are waterfall hunters.

Megan: Yeah. Well, see, and I didn't know on either count, but it was clear as I was describing this to him that what I was saying when I was like yeah, they're beautiful, there's lots of water and he's like (laughing…)

Mike: Well, they are made mostly with water.

((Laughing))

Megan: He's like umm, no. Anyway, okay. Oh, my gosh. I have so enjoyed this time.

Mike: I really enjoyed this.

Megan: This is a topic I don't know a lot about so I feel like every part of it I was learning.

Mike: Me too.

Megan: It was so nice.

Mike: Yeah, well done you two.

Megan: A really, really nice job. As always you're going to find all the resources that we talked about today in our Lab Science and our take hikes on our website mndnr.gov\prairiepod. This episode was produced by the Minnesota Department of Natural Resources, Southern Region under the Minnesota Prairie Conservation Partnership. It was edited by Dan Ruiter and engineered by Jed Becher. I don't know what we should do. I wish we had some thought to like put some water in here so we could like splash as our send off or something.

Mike: Oh, why didn't you think of that, Megan?

Megan: See. I know. When we did the mussel one they like, we signed off with clam fam. What should we do for your guys? I don't know, stream team? Dream stream team.

Mike: Did you just come up with that?

Megan: Stream dream team. No, I think that's what they call themselves. The stream dream team. You guys ready? On three? Should we do it? One, two, three. Stream dream team!

((Laughing)

((sounds of birds chirping and wind blowing))