Prairie Pod Transcript

Season 4, Episode 37: Climate Change Consequences: how the weather will determine how your prairie whethers

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Guest(s): DNR: Kenny Blumenfeld, Fred Harris; Marissa Ahlering (The Nature Conservancy)

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

Transcript:

((sounds of birds chirping and wind blowing))

Megan: Hey, we'll come back to the Prairie Pod, happy Prairie Tuesday everybody. I'm here with my trusty cohost Mike Worland.

Mike: Hey Megan. When you said trusty, you made me sound like a pocket knife.

Megan: I thought I was making it sound a little bit like, like Eeyore, you know, I don't know. I saw a dog yesterday dressed like Eeyore on the sidewalk and I don' t know, I was thinking of like trusty sidekick.

Mike: I appreciate you comparing me to, to Eeyore, thank you.

Megan: You're welcome, any time. So we're covering a really big topic today and it's something that Mike said that he's really excited that we're going to talk about on the podcast, we have sprinkled it into a lot of our other episodes, and so it certainly deserves an episode of its own. Right, Mike?

Mike: Yeah, well put. It covers the entire plant. It's that big.

Megan: It's that big. So what is, what is that big? Is it the brilliance of the tallgrass prairie and its historical range? Sort of. But it's climate change. That's what we're going to be talking about today. We're seeing evidence of it all around us, six-inch rain anyone? Six-inch rain. Seeing a lot of those and trying to figure out what on earth we're going to do with all that water. So we can't just talk about it as something that, you know, is going to

happen, it's happening right now. I gave a talk just the other day and I said it's here, it's happening, we're dealing with this every day on our prairies and with our management and we're going to need to figure out how to build better, more resilient, more diverse prairies in a hurry. So this topic for me is particularly challenging because I often find myself feeling really depressed when I talk about it and I get kind of hopeless, and so what we want to do today is not make you feel hopeless, we're going to talk about the reality and the stats and the science, but we're also going to give you some tools so that you feel hopeful, so that you feel like you can be part of the solution because you absolutely have the power to do that, and some of that power is in prairie. So I'm going to start us off with a quote from the one, the only Sir David Attenborough. I'm not going to do my David Attenborough voice because I, I wouldn't probably do it justice. Pip, pip, cheerio, Mike, here we go. We're now going to give a quote from a he has a new series, it's called A Perfect Planet. If you haven't seen it, go check it out. Episode 5 is called humans, and in addition to featuring my uncle Bob, it also has all of these messages of the critical fragility of nature, where we are at, like it's a great accounting of where we're at in a really accessible, informative way, like only Attenborough can do, right, but it also has so many messages of hope of people working every day to try to be part of the solution. So I want to give you start us off with this quote from him. For over 60 years, I've been privileged to witness the natural world in all its wonder, but the planet I saw as a young man has changed beyond recognition. Human activity is now so dominant, it's disrupting the forces of nature and the vital habitats that life needs to survive on earth. This is the most important story of our time. Sir David Attenborough.

Mike: You had to get the Uncle Bob plugin there, didn't you?

Megan: Yeah, he's amazing. He's definitely included.

Mike: He is literally your uncle and he was on his show.

Megan: Yes, he was on the show because he is a person who has spent his entire life working to save sea turtles, and they have basically built an entire recovery system out at Wellfleet Bay Mass Audubon where they have now the state-of-the-art nature center, they have hundreds of volunteers who walk the beaches, they take the turtles in, they put them in banana boxes that are donated by grocery stores, and then the turtles get shipped to the New England Aquarium where they go into recovery. Unfortunately, many of those turtles also die, and so the reason why they're on the beaches in the first place is because they're cold stunned because of the way the ocean is changing and the warming of the waters is changing, the water in the bay stays warm, and so they don't get the signal to migrate soon enough, and so then when they actually venture out into the Atlantic, it's very, very cold, and obviously we know that turtles are a reptile, and so they some tur- - some sea turtles can thermoregulate a little bit like the leatherback but most of them are just like other turtles and they don't really have that thermoregulation ability. So he's built this whole program to try to save turtles because they're a critical part of the ocean ecosystem that supports all of us because you might not have known this, we get a lot our oxygen from the ocean.

Mike: I didn't know you knew so much about sea turtles.

Megan: I know, it's like I should be a marine biologist. What am I doing on the prairie? I do, I, that was, those are my first jobs, Mike, out at Wellfleet Bay, so it was amazing, but not as amazing as working on the prairie, I don't know, or just as amazing as working on the prairie. All, all ecosystems are cool, how about that?

Mike: In their own way, well put.

Megan: But the prairie is my favorite, I want to say that. All right, we have to introduce our guest.

Mike: Yeah, I mean, the, the lineup today is impressive. We have prairie rock stars on our lineup today.

Megan: Prairie rock stars.

Mike: That wasn't a key to singing necessarily, Megan, just to be clear.

Megan: It was, that's their intro music. So we're going to start out with prairie rock star number one, Marissa, introduce yourself. Tell listeners who you are, what you do.

Marissa: Yeah, hi. I'm Marissa Ahlering, I'm the prairie ecologist for The Nature Conservancy. I don't know how to follow that Megan, if I'm supposed to be singing, singing my own introduction here. Yeah, it's funny. So yeah, I work for The Nature Conservancy in Minnesota, North Dakota, and South Dakota, but you said marine biology and that is how I came to prairies as well in a way. I wanted to be a marine biologist and then went to school in Nebraska, so that kind of - -

Megan: I love that Marissa.

Marissa: - - changed the trajectory, but yeah, so anyway. That's where I fell in love with the prairies and I guess the rest is history from there.

Mike: We discussed the parallels between the sea and prairie many times on this show and here's yet another one.

Marissa: It's true.

Megan: I know. I feel like we're soul sisters in this, Marissa, because I also started kind of in the oceans but then went to school in Indiana, so, you know. Not a lot of oceans there.

Marissa: When I went to do my undergrad, they're like yeah, you could be a marine biologist from studying, and I did take like marine ecology and, you know, freshwater ecology stuff in, in undergrad, but then, you know, did research on the prairie, and fell in love with the prairies.

Megan: Seas of grass, nothing like it. All right, our next prairie rock star is Kenny. Introduce yourself.

Kenny: My name is Kenny Blumenfeld, I'm a climatologist with the DNR, the Minnesota Department of Natural Resources. I help people understand what's going on with our climate and, you know, help distill the science, which is often at the national or global

level into something that's meaningful for people who work in managed resources right here in Minnesota.

Megan: Perfect, such a necessary and important job. Fred, you're our next prairie rock star. Introduce yourself.

Fred: Hi, I'm Fred Harris. I'm a plant ecologist with the Minnesota Biological Survey in the DNR, and I'm one of those people who would spend as much as possible of my free time wandering around in the natural world in the outdoors, and lo and behold I got a job that pays me to do that and find cool stuff.

Megan: It's perfect.

Fred: So it's been really awesome. I've been with the Biological Survey for 27 years and a lot of it's been to try to document what's left of native habitats across in the areas that I work, and I work mostly in the prairie region in northwest, southwest, and southeast Minnesota, and so it's been a very gratifying experience.

Megan: Fred, I want to add to that. In addition to documenting what's happening in the prairie and where remnant prairie is, you also share that information with so many fellow scientists, land managers, landowners, and that's a really critically important part of your job and I can tell you there are many people who, who have Fred Harris hashtag goals that they're trying to meet when they're on the prairie. They want to know as much as you and they also want hats as cool as you, so I have many people come up to me in our plant ID training saying where can I get a hat as cool as Fred Harris' hat, so there's, you're, you're not just documenting the prairie, you're kind of a prairie idol out there.

Fred: You need a big hat when you're out in the sun all day at, at 70 degree dewpoint, that kind of stuff, but yeah. So one of the most gratifying things for me has been identifying and recommending natural areas for, for conservation, and some of them have actually made it to being SMAs or Nature Conservancy Preserves and things like that. Those are the pinnacle, the highlights of my career is, is being involved in that kind of stuff.

Kenny: Is it safe to say that as a prairie rock star, Fred has tassels on his microphone?

Megan: That is safe to say, yes. I think you all do, right, but they're in different colors.

Fred: I can't, I can't, I can't drop it, although I suppose I could drop my headset.

Megan: Drop the mic, nice. Well we're going to jump right in, we're going to start out with climate change trends and predictions for Minnesota specifically, so Kenny, we are going to flip it to you. So talk to us a little bit about some of the trends in temperature, precipitation, extreme weather events like droughts and flooding, talk, talk to us, talk us through what's happening in Minnesota.

Kenny: Yeah, sure. So, so Minnesota's climate, as everybody knows, it's always, it's always been pretty extreme. It ranges from, you know, you might be warm one year to cold the next year, so we are used to a lot of variability both within a given season or within a given year, but also from one season to the next or one year to the next, or even over multiyear periods. All that said, we also have these ongoing trends. So as a,

with a backdrop with all of that variability, we are also getting warmer and we're getting wetter, and really what's happened for the most part is we've seen much warmer winters, our nights have been getting warmer, and these have been driving up our annual average temperature. So parts of Min- - most of Minnesota has warmed by an average of about three degrees Fahrenheit since the turn or so of the 20th century. But if you break that warming down, you actually see it's warming much faster in the winter. We're seeing much less warming in the summer and what warming we have seen in the, in the summer has mostly been concentrated also at night, but wintertime warming is in many cases five to ten times faster than summertime warming. At the same time, the majority of the state has gotten much better and this is especially true in, in southern parts of Minnesota, so if you're talking about the prairies in particular, and those in southwestern Minnesota have been getting wetter much faster than northwestern Minnesota, and we're seeing increases not just in annual precipitation but in the number of days with heavy precipitation, heavy snowfall too, and we're also seeing some of those extremes be larger than we had ever recorded. Now, this, you have to keep all this in mind, though, that it's not like every year is warmer than the year before it or wetter than the year before it because we have those natural ups and downs that are part of our climate, so it's kind of a lot to keep in mind, and these kind of mind-blowing surprises can happen, so you can be in a really wet regime and still have a dry period kind of emerge from within that wet regime. This is something that happened a couple times during the 2010s. You could also go into, I mean, you know, just because we're getting warmer and wetter and, you know, if you focus on the part that we're getting wetter, that does not make us droughtproof, that does not mean that we won't have a drought, it just means that when we average it all up, we're, you know, a typical decade, you know, in the middle of the century is going to be wetter than a typical decade at the beginning of the century, but that does not mean that we're going to do this without ever having drought. We will have drought and one of the things that we see is even in a drought, you can get these big floods, you can get intense rain, so we always have to be ready for surprises. Now in terms of things that we haven't really observed yet, Minnesota has not seen increases in heat waves yet. This is something that's modeled to happen, in other words, the, the numerical simulations that tell us what the climate is going to be like, they suggest that by the middle of the century, we will start getting hotter, and that's really going to be concentrated in the prairie regions. And so we would be seeing more instances of daily extreme heat in the summertime, things that really haven't gotten, I'm going to use air quotes here but things that haven't gotten worse in quotes yet might start getting worse in the future. And similarly, drought, we haven't seen in recent decades because we've gotten so wet in Minnesota, including in the prairie regions, we have not seen an expansion or increase in the severity of drought beyond levels that we had ever recorded historically. However, as we get into even a wetter future with higher temperatures, instances of drought could very well be as severe or more severe than what we have observed historically because the heat stress, the stress on things that need water, including plants, could be much greater at that time. So that's kind of the, the big picture is that our two big changes are that we've gotten wetter and we've gotten warmer. We're getting wetter in kind of all the ways you would expect, more precipitation, more heavy precipitation, and, and great extremes

occasionally. As long as you keep in mind that these are, there's ups and downs that are superimposed over that trend.

Mike: Hey, this is Mike just breaking in with a quick note. We actually recorded this particular episode last February during a polar vortex cold snap, and Kenny is going to be talking about that for a little bit here, and so yeah, I just wanted to alleviate any confusion if you happen to be listening to this during a, a summer heat wave or something. Thanks.

Kenny: For temperature, it's been a little more counterintuitive because I think people would assume warmer conditions would also cenote hotter conditions, but really most of our warming so far, and it's been dramatic, but most of it has been concentrated in the wintertime and at nights, and so the way that that manifests is, you know, you don't have, this is going to be hard for people to, to swallow because we're recording this in the midst of a pretty good cold, you know, polar, polar vortex disruption and cold outbreak, but these instances of cold have actually become less common and also less severe and I'm happy to use the one that we're in the midst of right now as a case in point. It is one of the longer cold outbreaks on record, but when we compare it to other cold outbreaks of similar duration, we find that by and large, this one is 10 to 15 degrees warmer than the historical ones. So instead of, you know, we've, we've been here before with, with prolonged cold in Minnesota, but what we're finding with this particular event is temperatures have been bottoming out in the 10s and 20s below 0 Fahrenheit, maybe in some 30s below in northern Minnesota at times, but we go back historically and look at some of those and it was more like 30s and 40s below 0 across the state. So, so anyway, warmer, generally concentrated in winter, and wetter, and kind of all the ways you would expect it, and, you know, drought is going to be part of our climate but it has not worsened just yet.

Mike: Let's jump into what the consequences of this stuff mean. Fred, can you talk a little bit about what this, what these trends that, that Kenny was talking about, what they mean for prairie?

Fred: Sure, yeah. So one of the questions we have had at the Biological Survey is are we seeing any changes in prairies yet that might be related to climate change. And we have a project where what we've done is we've gone back and resampled vegetation plots that were sampled 20 to 30, 30 or more years ago, vegetation plots are called relevés, and we, we've so far done this project in central and southeastern Minnesota on SNAs and state parks. We're in the process of writing up a report about it, so hopefully, that will be available soon, but a bunch of the sites that we resampled again recently were native prairie sites, and we're interested in trying to identify what kinds of changes we've seen in prairie in the composition of these prairies, and what we found so far is actually in a lot of the prairies' species composition, we don't see much change at all yet. Things like big bluestem and, and, you know, purple prairie clover and so on. What we are seeing is increases in cool season invasive grasses like smooth brome grass, which has increased a great deal, especially in the sites that we sampled but also anecdotally, we've seen that happen in southwestern Minnesota as well. And we're also seeing increases in woody shrubs and vines, things like Virginia creeper and wild grape, buckthorn, and poison ivy, and poison ivy is increasing in all the different systems that

we've sampled. In the forests, in prairies, different kinds of forest, so those are the main changes we've identified, and I think we can relate that the likelihood that these cool season invasive grasses like smooth brome are really stimulated by that increased rainfall that we're getting in the early part of this season. Really seems related to that. But there are a lot of other factors going on to make it hard to say specifically what the cause is. For example, aerial nitrogen deposition is also increasing. We're having nitrogen deposition into our soils, it's two to six times what was, what was there in preindustrial times, and the literature shows that increasing nitrogen also gives these cool season invasive plants like smooth brome a competitive advantage. So there are other factors involved. With the woody shrubs and vines and poison ivy, there's literature that says that predicts that these things are going to increase because of increasing ambient CO2 levels. And there are studies that, that experimental studies that really show especially poison ivy really benefits from increasing ambient CO2. It gets bigger, it has bigger leaves, and it makes a much more potent version of urushiol that makes it more toxic. So, so there are several factors that could be causing what we're seeing. But the good news is so far, we don't see that much change in the native plant community composition in prairies compared to 30 years ago in the ones that we've monitored.

Megan: Fred, I want to recap, I want to recap some of what you just said. I'm also making a horrified face as you talk about poison ivy. We should note that it is an excellent wildlife food for many wildlife that eat the leaves, they eat the berries, and they even eat the stems in the winter months. For Megan Benage in the prairie, it is a hazard, so I, I just, it doesn't, I don't even have to touch it, it just has to be existing there and I've got it, so that is a particularly horrifying thing that you just recounted. But so one of the things Kenny told us before we were recording was that there's a difference between what's happening in our far southern prairies versus what's happening in our northern prairies, so I want to recount some of that and then just check in with you here to see if when you talk about composition and change, if we're just seeing no differences across the board or if there are some subtle changes across kind of that spectrum. 'Cause what he was telling us earlier is that in our far southern prairies, they're getting wetter much faster than the far northern prairies, and then their summer days are showing notable, that these are his words, notable cooling, so gosh, I'm trying to read and talk, it's real quick, and that by contrast, the far northern prairies are getting wetter but at a substantially slower rate with average summer highs nudging upward ever so slightly. So if you're, it sounds sort of counterintuitive, right. So if you're in the far southern part of Minnesota in the prairie, it's getting wetter faster than the northern part, but it's also having cooler nights. Whereas if you're in northern Minnesota, our summer highs are edging upwards just a little bit. So it seems a little bit counterintuitive.

Kenny: Can, can I?

Megan: Yeah, go for it, Kenny.

Kenny: Can I, can I propose a really simple minded way of looking at this as a non-prairie expert? You know, when I would take physical geography courses, they would always tell us that the, the prairies essentially follow a, a neutral precipitation evaporation line, essentially, where basically prairies live on the dry side of that line and

then to the other side of the line you see other land cover types. That was the simple minded approach that, that I kind of followed. And when we look at what's happening in the, the different prairie regions in Minnesota, if the, the, the southwestern area is getting wetter very quickly and its temperature change is mostly being driven by those winter conditions, and it's not showing a lot of summertime, especially summertime extreme heat increases. So these, so you could further extrapolate that to mean that, that evaporation and evapotranspiration are actually not increasing necessarily in the southwestern prairie regions, whereas in the northwestern prairie regions where they're not getting wet as fast. In fact, they have pretty subtle precipitation increases, they are seeing more summertime heating and more increases in the summertime temperature. So my simple minded standpoint, I was really hoping that someone would help me understand what the modeling and what the, whether it's just a, a conceptual model or maybe actual land, land cover change modeling has shown because it would seem to me that the northwestern prairies would be coming, would be moving into a climate that's maybe more prairie-like, that's more supportive of aridity, and that the southwestern areas are, I mean, the increases in southwestern Minnesota are, are on the order of six inches of precipitation. That's, it's almost as if it shifted to a different region almost. Whereas in northwestern Minnesota, it's been pretty subtle increases more like on the order of, you know, an inch or so, and, and meanwhile getting warmer faster and more heat in the summertime. So that was kind of, so is there anything, is there anything to this, Fred or Marissa or Megan, since you guys know a ton of stuff that silly climatologists know nothing about?

Megan: You're not a silly climatologist, I would never describe you that way.

Kenny: Is there any sense that the, that the prairies are going to be kind of emboldened more in one part of the state?

Fred: We have in terms of our plot resampling, we haven't been doing that in northern, northwestern Minnesota or southwest Minnesota, so I can only speak sort of about my sort of anecdotal observations. But the places where we have really the big explosion of stuff like smooth brome is in the southern half of western Minnesota. I haven't seen quite that issue in northwestern Minnesota. Maybe that's because of what you're talking about, of greater rainfall in the south.

Marissa: I also think there could be an interaction there like with woody encroachment too. Right? And so, so what, I mean, when you talked about what creates prairie is that, that line of, you know, basically precipitation evaporation, I think that's, that's always been part of it. Right? But there's also the disturbance factors that have come into play, like historically fire and grazing and, and how those interact with that, that climate to create the systems in place. But certainly, as like large scale file, you know, with fragmentation has decreased and, you know, grazing obviously is, is patchy and hit and miss in mostly, you know, livestock now, so I do think that, I anecdotally, we are struggling more with woody encroachment in a lot of our, a lot of our prairies too, and not necessarily, I wouldn't say like trees but like increasing shrubby things like willow and sumac and places, so I don't know, Fred, if you've seen similar things, but.

Fred: The reason it's hard to see changes in prairies is because prairies are really adapted to drought, have very deep root systems. The prairie climate typically has some

form of drought in the mid to late season. Prairies can handle that predominant and they're also dominated by long-lived plants for the most part that are able to survive those droughts. So it's, it's, and, and prairies have a lot of, of very diverse prairies have a lot of resilience built into them just because they have so many different species present, that sometimes the weather or the conditions in one year will favor a certain subset of, of plants that can handle the, the increased temperatures, other times different set of plants will be favored. But they have a lot of redundancy. It's what Chris Helzer calls good bench strength and so they're, that really adds a lot of resilience to prairies. And so I, I think that it's been really difficult to see any effects so far, especially we have this pattern of greater moisture coupled with drought, so I think the, one of the big questions is how, how are conditions going to change 20, 30 years from now and how is it going to be different. 'Cause at then at some point, we're going to have all of this increase in moisture from rainfall that's going to get overwhelmed by increases in evapotranspiration. The environment at some inflection point, which I think is about 20 years from now, things will really be getting hotter and dryer because increase in temperature will overwhelm the increases that we have in moisture.

Marissa: Yeah, it all builds on itself, so, right? So I don't think it's like change is just going to happen in 20 years. I think it's going to, it's going to build, and then maybe things get, get worse when changes get more dramatic, but yeah.

Megan: Well, and I, I want to take it back to a, to a hopeful point here because, because it might get worse, you know, but I want to add something helpful.

Marissa: Reduce the doom and gloom please, Megan.

Megan: Yeah, a little helpful and hopeful maybe for, for our folks listening, like as I'm hearing this, what I really honed in on is right away Fred talked about resilience and then he called out the diversity of prairies in and of themselves to be able to be resilient in the face of these extremes, and I think right away what that triggered in my mind is we just need to plant more prairies, and we need to save more remnant prairie because we all know it was built perfect the first time and we struggled to build it back when we're reconstructing. We're getting better, we're working at it, but let's be honest, it was built right the first time, and so we, we need to make those connection points in the landscape because that connectivity is a key part of that prairie being able to be resilient. So as I'm hearing you talk about it, Fred, I'm not just thinking about the plants. I'm thinking about all of the wildlife and all of the other organisms that are living in that prairie and living in the plant community, but it's the whole system of a prairie ecosystem and what we really need to be doing as a hopeful message is making sure that I, I guess what I'm hearing making those connections across the landscape are just as important now and they will become even more important in the future, so the work that you're doing to protect and build resilience into the landscape is critically, critically important. That's the hopeful part that I'm hearing. Don't, don't be overwhelmed like oh, great, now there's going to be even more woody invasives, now there's going to be even more brome, all the things I'm already struggling with, right? But there's also a chance for you to keep that resiliency going because the prairie inherently has this bench strength that Fred was talking about, so. Because we talked about wildlife, Mike, I'm going to pass it to you.

Mike: I love the sports analogies. I just want to say good job to Chris Helzer for the sports analogy. I could understand. You bet. Yeah, we should move on to, if we can touch quickly at least a little bit on wildlife, Marissa, do you, can you comment on, on how climate change is going to affect some of the wildlife species in prairie?

Marissa: That is a big question. There are a lot of wildlife species out there, Mike, but I can try. Yeah, it's a good question and it's one that actually, you know, in the wildlife field, people, we've been struggling with for a, quite a while now, you know, thinking about climate change and what is this going to mean and doing vulnerability assessments and, you know, species distribution modeling, and so I would say there's actually a fair amount of literature that's actually looked at, at a lot of this at this point, but, but it's, it's hard to draw like sweeping generalizations, but I'll, I'll give it my best shot here. I would say in general, what Megan said about building back prairie and connectivity is I think one of the most important things. Like that's by far connectivity is by far one of the most widely cited sort of climate adaptation strategies, and when you're talking about wildlife species, yeah, I mean, the reason for that is because either we want them to be able to shift their range, and so to do that, they have to be able to move, or we want to make sure that populations are connected and they're getting gene flow so that they can sustain their populations and be able to adapt. So I would say, you know, and, you know, in talking about like changes in the future and changes that are coming, but Kenny was talking about well, things that are already happening, and so we have, there actually has been a fair bit of work recently looking at like all right, climate change is here, it's happening, what are we seeing in terms of like how wildlife are responding and, and so there's been a number of like global meta analyses trying to look at like range shifts, and I wrote this down because I could never remember numbers off the top of my head, but there was a nice global sort of setting, looking at connectivity and of different settings that have looked at range shifts, and they found like globally, they've been finding that species are moving on an average 11 meters higher in elevation, which is maybe not super relevant to our prairies in Minnesota, 11 meter elevation would be like, I mean, it's a few places, right, but not, not many we're talking inches most of the time, but also 17 kilometers north per decade, so they're seeing species move globally and actually there was a paper out just a few years ago looking specifically at grassland birds, well birds in general I guess, but what they found was and, my bird bias, so I'm sorry, but that's my bird, bird brain for you. But they looked at like birds basically in the great plains, using the breeding birds survey data, and they found that specifically shrubland and scrubland birds, as well as grassland birds, had significantly moved northward, like their center of abundance, it's significantly moved northward about 40 miles actually, so between they looked at a period between like 1967 and like early '90s, and then, you know, late '90s to now, they found that birds have been moving, the evidence of birds have moved their range is 40 miles north already, right? So, so this just speaks to the importance that range shifts are happening for wildlife species, and we need that connectivity to make sure that if they are shifting their ranges, you know, they have places, places to go and have tattoos. We'll also say like, you know, in the bird world, there's been a lot of work like Audubon has some nice reports looking at evaluating where and predicting where species are going to potentially move to, using things like climate envelope models where they, they say all

right, well this is the climate where a species exists now and where is that climate going to exist in the future, and so then predicting range shifts that way, so.

Megan: Nice. That was a really good overview. I, I often think when people are talking about range shifts and they're talking about animals moving, I just, I know we talk about grassland birds, that is Mike's favorite obviously close to Marissa's heart too, but then I, I think about little tiny Dakota skippers and how they can't move that far, like inherently, they don't have the ability, and so I just think about how important it becomes to make sure that that connectivity extends so far because you're talking about birds moving this, you know, so many kilometers, it's like well that's dependent on them having that habitat there for them when they get there. It's not like they can just pack up and migrate and be like hello, we're now on the prairie with grassland birds, we are here. Like they're going to need some prairie there.

Marissa: Exactly, which is why sometimes the climate models seem a little funny, right. It's like all right, so the climate's going to be there but is the habitat going to be there? That's sometimes unclear.

Megan: Right, yeah and so - -

Marissa: To the point about Dakota skippers, I would say that speaks to the fact that connectivity means different things at different scales for different species. Like for an insect, a pollinator, plants, that connectivity is going to have to be more contiguous, right? But for a migrating grassland bird or, you know, any sort of migrating bird, that connectivity can be much more of a patchwork. Like they can make hops and leaps and jumps or even like small mammals or larger mammals, it's the same way. So connectivity can exist in more of a fragmented patchwork for those species. And for smaller species like Dakota skippers, you need that more contiguous connectivity built in the landscape. And the other thing for a species like pollinators and invertebrates in general, that's a, a challenge with climate change is thinking about phenology and how tied they are to plant species. I mean, there's, it's an issue for birds too in terms of thinking about when they, when they arrive and if the insects have even emerged when they get there, but same between plants and invertebrates, right? So there's potentially the potential to have all these mismatches in phenology between species interactions that are important. And there's been some work along those lines but I think there's a lot we still don't understand about how important those are and how disruptive they may be already or how disruptive they might become in the future.

Megan: Absolutely, and you're, you're taking us right into our next section here, Marissa, on the where we want to chat with all of you a little bit about strategies for managers to build resilience, but because we're already mentioning connectivity and we've already mentioned resilience, I want to make sure to kind of just ensure that our listeners understand what we're talking about when we say prairies are inherently good at this, they wrote the book on being resilient just because of how they've, they've grown and adapted, right? So we often talk when we talk about climate change about reforestation. Right? We, when you're a kid in school, you learn right away that that tree is giving you valuable oxygen so that you can live in storing carbon, its roots are holding the soil in place, and I think particularly if you're a Minnesota kid in, in southwest northern Minnesota in the prairie parts of the state, you know, even extending into parts

of the southeast, we need to be talking about grass and prairies and we need to talking about them and what they're doing for us, so they are doing those same things, they are incredible sinks for carbon, they have an incredible root mass that is sinking that carbon right into the system, they're producing oxygen for you, that's why when Fred's on the prairie, he's, he's just breathing, you never hear him sneeze, he's just oh, big full breaths of air all the time on the prairie, he can, that's why he can run up those inch high hills so fast while he's teaching his plant classes. You know, they also have this because of that root system and because of the top growth, they have an incredible ability to intercept water to basically catch these six-inch rains and then filter them down into their roots, and so I want to make sure that people understand why prairies are resilient and it's literally because of how they're built into the system, and so yes, reforestation is very important, but reprairiestation is just as important, I really want to say like reprairieing the landscape is also going to be a critical part because trees don't go everywhere, and so we need to make sure that we're, we're accounting for, I don't know, just how great prairies are and all the things that they're doing, and so I wanted to make sure that resilience piece is clear, and now we're going to go right into our section of how, what can we tell managers, how can we build some of this resilience, and Fred, we're going to start with you.

Fred: One of, well we've been talking about defragmenting the landscape and that's one of the most important things, we've already mentioned that. One of the reasons for that is that especially if you can build in some topographic diversity to a site and increase its topographic diversity. You can add resilience. One of the ideas is that in the future what's going to happen is prairies are going to shift their position in the landscape. You have prairies that are more adapted to those dry hilltops, that's a dry prairie, prairie in the midslope and moisture soils and mesic prairie and wet prairie at the bottom, place like Hole in the Mountain Wildlife Management Area or Hole in the Mountain Preserve in Southwest Minnesota has huge topographic diversity. And over time, as conditions change, we might see shifts in some of those, those types of prairie in their position in the landscape, the, that mid slope area might look more like what used to be a dry prairie at the top of the hill, things like that. And so but the sites that are going to be the most threatened are those small fragments that don't have those, that kind of topographic diversity, especially if they're wetter, wetter sites, wet prairies. So small fragments of wet prairies. There's no place for those plants to shift to or no place adjacent, drier area adjacent to them for plants to shift into them, and, and maintain a native dominated prairie system, so right off the bat as, as you've already alluded to, one of the important things is to make, make existing remnants bigger, fill in those spaces between exist remnants with restorations, that kind of strategy, and look for ways to increase that topographic diversity in an area that's all dominated by prairie.

Mike: Got it, Fred. Thanks for that.

Fred: That's one of the first things that I think about.

Mike: Cool. Marissa, one thing, one strategy we need to, we should touch on, and I've heard, I've heard some, I think there's disagreements about this strategy and I'm thinking about restorations, and I guess there's just a lot of unknowns, a lot of questions

about seed mixes. Can you talk a little bit about restorations and seed mixes and, and if there's strategies we can do to build resilience in that way?

Marissa: Yeah, it's a good question. And there, yeah, there's a lot of controversy, there's a lot of debates, there's a lot of questions around, around these issues. And I would say, I mean, I want to echo Fred in saying that when you're building a seed mix, well, there's a number of things to consider when you're building, doing a restoration, one is where you put it. And if you can put it somewhere that's building back connectivity, making, you know, making an area bigger, building some stepping stones somewhere, that's, that's one thing that's just like where you put your restoration can be a climate adaptation strategy. And then there's right, the seed mix, of which you put on the ground, and there's two components to that. Right? There's the species that you put in it and the genetic diversity, so there's the species diversity and the genetic diversity of the seed mix. And I think where the biggest controversy comes is with the thinking about like genetic diversity in some ways. I don't think any of us are arguing about like species diversity and mix. We need that species diversity is the heart of our resilience, and that's what, that's why I don't think like in some ways, as a manager, you shouldn't be thinking of doom and gloom with management because anything you're doing to manage for species diversity, whether it's on a remnant or a restoration, is going to be fostering, you know, resilience and climate adaptation ability, so that's the first thing to keep in mind. Species diversity is key. But then, you know, there's some thinking that we might want to do about all right, I would just, I don't want to say species diversity is easy but I want to say it's a little easier than genetic diversity, 'cause we can see different species. You can go out to a prairie and you can say there are a lot of species here. You can't see what the genetic diversity of that prairie is, so it's hard to know do I have a lot of genetic diversity at this site, or not? And so, you know, we've been using in our restorations for a long time in Minnesota, you know, this idea about local adaptation, which absolutely truly exists, like local adaptation is a thing, but there are some, some things to consider when we're thinking about how that works in our restorations. And mainly, I think what we should be focused on is that adaptation piece and not so much local because that can mean a lot of different things to a lot of different people, it's hard to define what local is, and I think the most important thing is to think about like what should we put in, be putting into that mix to make sure we're getting a decent amount of genetic diversity. That genetic diversity is creates the variability, the natural selection needs to work in order to for things to adapt, right? So you need that genetic diversity for the species to be able to adapt. And maybe you can get that with just, you know, local sources or just onsite, if you've got a big enough site and it's not fragmented. The challenge is over time with fragmentation of our prairies, they're potentially losing some of that genetic diversity over time, and so if you only source from small fragmented sites, you could have reduced genetic diversity in your seed mix, and so you might want to be thinking about how to improve that genetic diversity by mixing different sources. And so there, there's a whole gradience of strategies here from, and so one of the papers I suggested when you get to the, the Let's Science, kind of goes through the pros and cons, because I think, you know, when we're very focused on local adaptation and just using one local source, that's great and that worked. I think if it was a large site and thinking about future conditions not being different. But we have to admit that, that there are actually some risks to that as well in this changing climate. So it's not like

using local adaptation is risk-free. I mean, not local adaptation, using only like one small local source is, has its own risks. Like there could be some, some loss of genetic diversity at that site. But as you go down the list of like these different strategies, so using one local source to mixing local sources to moving further out and mixing sources to, you know, climate matching kind of at that opposite of extreme where people say all right, well I'm going to, if we're predicting that the climate for this area 50 years from now is going to be currently exists in Nebraska, then we should bring seeds from Nebraska to this site. Well there's problems with that too, right? Because for one, you're assuming that like, that, well, the main problem is that if the, the conditions don't currently exist at that site, then you might not have much establishment, right? So 'cause it's not, it's adapted to some future thing that doesn't exist. Plus there's other concerns about things like outbreeding depression and things that, and maladaptation, so knowing that once you get further away, it may not be very well adapted to that site. And so I think what we need to think about is finding the balance between these things, and so, you know, think about all right, yes, local adaptation is important to consider, but maybe we want to be drawing from multiple local sources so that we can mix that seed in a local area to increase the genetic diversity that goes into that site. So I mean, there's a lot to weigh and you have to think about your context, you have to think about your situation, you have to think about what seed sources are even available to you, and so, you know, the paper that I shared goes through those different strategies and kind of outlines what are the risks, what are the advantages of the different ones, so you can think about, you know, in your situation what makes the most sense. But you're right, it does, it does raise a lot of hackle sometimes, this conversation. But what, what I think the key, though, is that like what we're talk, what I'm talking about here actually is, is sort of what we call, you might call assisted gene flow or kind of facilitated gene flow locally, making sure that genes are, are flowing here, and not assisted migration of species, which is a whole separate thing to consider, so even in this context, I'm just talking about species within their range.

Megan: Right.

Marissa: What even gets a little more controversial is like well, should we be moving species? Because they can't, there's no connectivity and that's a whole other, a whole different topic. So, I mean, making the distinction between those two things I think is also important.

Megan: Agree 100%.

Fred: What I would add to that is, is that there are a lot of questions that we still need more information on and there's some research already going on in Minnesota related to some of these questions and we need a lot more of it. Questions like what is the adaptive capacity of native prairie plants in Minnesota, what restoration practices are working and how well our seeds sourced from farther away actually doing in comparison to local seed. We need, we need more studies of those kinds of things to help inform our practices. At the same time, we want to be careful around some of our best native prairie remnants because we, we want to be able to study those and see how they're changing over time and adapting over time without being altered, you know, genetically

by gene flow from, from seed from somewhere else that's been planted next, next to them, things like that, so.

Megan: Or do we want that gene flow? Well it's a whole, it's a whole debate because if, if we were talking about a, a prairie landscape that still had the majority of it on the land. The reality is we're talking about a tallgrass prairie system that has less than 2% left in Minnesota, and so I completely understand your point, Fred, there's utility and understanding the remnants that we have left, but there's also danger in them in and of themselves now being isolated at their detriment with their lack of genetic diversity, which we just don't know without studying it and learning more but, but that could be happening too, and so we don't want, it's like we want to follow the medical doctor's advice of first do no harm, but we also want to recognize that the system isn't the same as it was and there might already be inbreeding depression and genetic fitness issues, and we're going to have to sort all this stuff out, so that's why it just becomes even more important to plant more prairie and get that connectivity in there and make sure that we're following good diversity and good resilient standards.

Marissa: Yeah, there's a lot we don't know about what genetic diversity is harbored in our prairies and what that, what that means and what that represents, like what adaptive potential exists, like you said, and I think there's a lot of need for, for understanding that. And so actually I've been working with collaborators. We have a project that we, we implemented, mixing multiple sources of seed, and we set up experimental plots to actually do some of this to say all right, if you have single sources versus multiple sources, how's that going to work? What, what's going to advantage of that over time? And we collected the, the material to do the genetics, but we can't seem to find anybody to fund that at the moment, but we have it sitting in a lab waiting to figure out what is the genetic diversity of these prairies. So anyway, to be determined there. But the other thing that makes it hard from a manager perspective with the genetic diversity is like, like I said, you can't see it, you don't know. We're making an assumption that by mixing sources, you're mixing genetic diversity, which I think is a reasonable assumption. But then there's the added layer of like it's hard enough to find the number of species you want to go in your mix, much less now you want three sources of that species. I can only imagine a manager being like what are you telling me. So we've also developed a tool to try to get at this and make it a little easier. So in Minnesota with this project, we had a bunch of crews out kind of mapping locations of lots of the common prairie plants with the idea that this could be used to say all right, I want to put, you know, purple prairie clover in my restoration and I want three sources and you could use this tool to say where could I find three sources in where, you know, around my preserve. So we're continuing to add to that and it's a tool that's shareable to others, and I can share the, the web links and stuff to that, that you guys could put on the, on the podcast site 'cause that's helpful.

Megan: Yes, it is helpful and we will do that, and while we're making managers' lives complicated, I also want to give a shoutout to our native seed industry in Minnesota and just mention them briefly that when they are collecting seed, they are trying to do some of that local mixing, right? They're going across a site, they're going up and down a hill slope, they're making sure that if they're, that they're not just getting it from one small localized patch. So some of that mixing is already happening inherently and just how we

collect seed, and that's part of our good standard practice and guidance when we tell people how to collect seed is that we don't want them to just collect it from one small localized patch, we want them to try to build in some of that mixing in like you said, Marissa, in the hopes that we're capturing more of the genetic diversity from that site that we hope, even though we can't see it, does exist there. So I just want to give that plug.

Marissa: Yeah, and I would say on those lines, you know, so the tool that I talked about is like if you're going to be doing harvesting or hand collecting for your restorations, if you want but for vendor purchasing, like if you're buying seeds from our vendors in Minnesota, like we've actually, you know, said hey, would it be possible to get three different sources of these species? And they've actually been like yeah, here, we can give you three sources from this species and two from this species and tell you where they came from, so if you're doing, working with vendors, it's not, you know, it can't hurt to ask as well. And if more people ask, they might, you know, this might become more sort of consumer demand driving the process, so.

Fred: It's really important to monitor the outcomes and determine how successful those mixes are compared to other options. And so I'm really excited to hear about your project, Marissa, and I'd love to hear the results.

Marissa: Yeah, we planted it last year as you know with restorations to be, it'll be a couple of years before we, we have any results but yeah.

Fred: We also have an effort here called the Prairie Restoration Initiative, right, Megan?

Megan: We sure do. So the Prairie Reconstruction Initiative group is that what you're thinking of, Fred? Those, those folks, yeah, sorry, not to, you're right, we do. So the prairie and Marissa's part of the Prairie Reconstruction Initiative and I am also, and so that is as group that is multi-state and basically what they're trying to do is just what all these things that we're talking about, we're getting really excited about because we're science nerds, we're prairie nerds, we want to figure this stuff out, we want to solve all the mysteries that the prairie offers us. That group is trying to collectively figure out how we can do a better job of tracking what we're doing when we build prairie on the landscape, what we're doing with our reconstructions, and what's working and what isn't, and so part of that is they built this awesome database where you can enter in your seed mix, all of the site prep that you did, any management that you did, and then they're hoping to use that to then evaluate what's actually happening on the land so that we can collectively get better at this instead of it being like well, Megan Benage is now 102 years old and she really understands a lot about how to do this right and she's about to die. Like we want to try to learn from each other faster. I mean, I just can't think of any, that's what science is. Right? Look at how fast we can do things when we put our collective heads together and that's what the Prairie Reconstruction Initiative is all about. It's this multistate effort to try to figure out how we put our heads together at a practitioner level, at a landowner level, and on a researcher level to get better at this, and we're trying to do it in a hurry because we know climate change is here. So Kenny, take us home here for a second, help us like we're talking about a lot of climate change stuff, it's a lot of big picture stuff, it can be very overwhelming. What are, is one piece of advice that you would give to land managers and folks struggling with this. What should

they be thinking about as they're trying to plan for climate change integrated into their work?

Kenny: You know, that's a, I was listening to Marissa and Fred give really practical advice and we climatologists just, you know, kind of point at the future and say well, it's, it's going to change but it's hard to get specific. But the one thing that I would say is even though there are going to be those year-to-year variations, we know it's going to keep getting warmer until something levels out with greenhouse gas emissions. So whether you're on the wet side or the dry side of that, it's going to get warmer, so you should be prepared for I would say warmer conditions, almost no matter what. But then you should also keep in mind it is still Minnesota and, and so, you know, we're not saying goodbye to winter, we're not, we're not going to have 94 degree days in February, that's not what we're going. We're still going to be importing airmasses from the north for six months out of the year, so, so keep in mind that even as you contemplate these changes, the Minnesota you have always known, the one that goes back and forth between hot and cold and wet and dry regimes, that's always going to be there too. So however you can infuse what Fred and Marissa were saying with that knowledge that it's still going to be wildly variable, but that would be the advice I would give.

Megan: Well that's a perfect way to round us out and just head right into our next section.

LET'S SCIENCE: TO THE LITERATURE!

SCIENCE!

Megan: This is the part of the podcast where we recommended a book, a blog, or a paper or a whole compilation of science, so let's go through our picks. Kenny, we'll start with you.

Kenny: Yeah. I think the, you know, since I do so much kind of basic outreach and just getting people on the same page, and I think the best way to understand what's happening in, say, your region and in Minnesota is to read the national assessments. So I recommend that folks read the 2014 and 2017, 2018 Midwest Chapters of the National Climate Assessment. This is the foundational science, it summarizes things, it's written in plain language for policymakers, so it's quite accessible, and it really does summarize the, the relevant science. So you can look at the Midwest region, you could also look at the northern Great Plains region. And either one of those would really help you I think understand the gist of what's going on here in our region in terms of the latest understanding of climate change and science.

Megan: All right, Marissa.

Marissa: Yeah, well I mentioned the paper that I suggested as my choice earlier when I was talking about seed mixes, but it's a paper by I think it's Kari Havens and a bunch of colleagues called Seed Sourcing for Restoration in an Era of Climate Change. And I, it's just a really nice overview, like I said, of the various different types of seed sourcing strategies that have been suggested in the literature and kind of a summary of like the pros and cons, disadvantages, definition of why they work, why are they good, what are

the challenges, and the context for which you might want to use them, so it's a nice, they have a nice table in there that kind of lays it all out.

Mike: Fred, how about your pick?

Fred: So I recommended a paper by two professors at the University of Minnesota and a postdoc, Sue Galatowitsch, Lee Fralich, and Laura Phillips-Mao and the paper is entitled Regional Climate Change Adaptation Strategies for Biodiversity Conservation in a Midcontinental Region of North America, which is Minnesota, and it's very specific about Minnesota and it really covers a broad range of issues, it hones on specific regions of Minnesota and talks about what, what the predictions are for changes and what the implications are of predicted climate changes on different regions in Minnesota, and goes into a lot of discussion of different kinds of strategies that could be employed to help mitigate or mitigate those effects or increase resistance, resilience, things like that, and I think it's a pretty accessible paper, it's very specific to Minnesota, so it's one I keep going back to.

Marissa: They do some cool, like I said earlier, climate envelope modeling in that paper too, kind of showing where like future climates corollaries of where the future climates exist now, so you can kind of imagine the future.

Mike: Sounds very useful.

Fred: And imagine being in eastern Kansas in 50 years.

Mike: Hey Megan.

Megan: Yeah Mike.

Mike: Take a hike.

Megan: I would love to take a hike and I, what I took away from this whole episode is that the prairies that we know and love are a critical component of the future of Minnesota looking like what it does now. So the Minnesota that as Kenny said, the Minnesota that we know, we want that to stay and persist, it's going to have that other P in it, prairie, so we're going to be taking a hike on some beautiful prairies today. Marissa, why don't you just, where are we hiking?

Marissa: So I, I struggle with this question because there are so many places to go and so many prairies to see, but, you know, since we're talking about climate change and we were talking about resilience and diversity, and connectivity, I actually a tiny little prairie fragment came to mind that's kind of the opposite of connectivity, but it's, it harbors some amazing diversity, so it's Olson Waterfall Production Area in Clay County just east of Hawley, and just a little bit south of Highway 10. It's super tiny, it's actually mostly a lake wetland, but there's this hill and it's one big hill in like a wetland essentially, but it's got incredible biodiversity on that hill and some really cool plants that I just don't see in many, in other places. And so if you got out there in July and August, it has amazing blooms. I guess it's not much of a hike. You can hike to the top of the hill, it's a really small place, but it, and you get a decent view, and I think also some decent perspective of why connectivity is important, because this is like a little hill that's kind of stuck where it is when you look all around it and you see all of the, the ag of the

Red River Valley, so anyway, but it's a beautiful spot if you're ever driving by in July or August, any time of year, but that time of year.

Mike: Sounds like a nice little hidden gem.

Marissa: Mm-hmm.

Mike: Fred, how about your pick?

Fred: So the first place I think of is Prairie Coteau Scientific and Natural Area, which is in Pipestone County, it's in the northeast corner of Pipestone County near the town of Holland that's along Highway 23 that runs from Marshall Down to Pipestone. And like I said, the main entrance is right along the Highway 23, if you're hiking from there. There's a lot of road noise along that highway, and so my insider tip is just try to drive around this site, it's a really big preserve, drive around and go in from the west side, which is the opposite side from the main entrance, but there's a gate there that you can go into, and over there you don't get all that highway noise and the train noise and stuff like that. You can hike in and you have this huge valley that's all native prairie kind of extending from you off this hillside that you can, that's a wonderful place to take a hike or to hang out, just contemplate the prairie and it's a great place to see that topographic diversity from the high hillsides down to this intact wet meadows in the valley bottoms, and so it's just a great place to get a sense of what the, what the larger landscape probably kind of felt like at least a little glimpse of it, so.

Mike: That's a great insider tip for access from the west, I'll remember that.

Fred: You have to get roadmap to figure that out.

Mike: Okay, okay. I like to give a quick anecdote if that's okay about, about Prairie Coteau SNA, it's very relevant for today's talk. So back in 2018, I think it was a record flood year to the southwest, so just what Kenny was talking about, that it was super wet, and we're trying to do bird surveys for a project down there. Many of our areas were completely flooded. I could do a bird survey, you would be wading through waist deep water. And so I had to do a, a survey at Prairie Coteau and I was concerned there's a little that valley you were talking about, Fred, there's a little prairie stream that goes through there, it's, you know, it's basically a bunch of connected wetlands. I was concerned like am I, do I need a canoe to get across this thing? And I went in there and guess what, that stream looked no different than it had any other year. That, that prairie had I guess stored water, Megan, how do you describe it? What does it do?

Megan: Prairie, that stored water. It had an excellent infiltration, Mike. It captured the raindrops and then it infiltrated it down into its roots, interception and infiltration.

Mike: We're talking about like a record flood year in the southwest and Prairie Coteau, this big prairie looked no different than it had any other year.

Megan: I feel like I should have put that in sports terms for you, Mike. Like the prairie intercepted the rain, oh, my gosh, then it's, it's going down nine feet, now 10, now 11, the water is almost into the groundwater, holy cow. Like if I had done that, that would have been, you really would have gotten it.

Mike: It would have added some drama, thank you.

Megan: Kenny, let's hear from you. What's your pick?

Kenny: Well we're just going to go out to Carver Park. It is, you know, I, I feel really intimidated talking about prairies with a bunch of prairie experts because my experience on them is not as great as, as what you all possess, but I can tell you that when I get out to Carver Park Reserve, you know, just from the city, that's, you see an openness that you don't really see in other areas. There's some nice hiking paths, there's some of those paved paths too, I don't know what prairie purists think about that, but it's, you know what, it's usable, it's fairly close to the metropolitan area, it's, it's, you know, half an hour or 45-minute drive from most parts of the Twin Cities area, and I don't think it's as pristine as some of the areas that you all will talk about, but it is, you know, it can kind of give you a sense, and I know there's been some prairie restoration work that's been done by Three Rivers Park over the past couple decades, so it's a nice example of what that kind of landscape system looks like in Minnesota without getting too far afield.

Megan: I love it. I think it's a nice example of connectivity and resilience, which is what we're talking about on here today. They've got some remnant pieces and then they've got the restorations built in.

Kenny: I love that you made it sound so much smarter, so I really appreciate that. That's, this is, yeah, like it's open, and then you've got a oh, yeah, no, connectivity, stick with the theme Blumenfeld, stick with the theme!

Megan: Kenny, I don't think, I don't think anybody's ever said that to me before.

Kenny: - - stick with the theme, yeah, no, I, I appreciate the save. Thank you. Thanks Megan.

Megan: Man, you can come back every week. Didn't you hear him? He said I sounded smarter. Well, let's just, and the next week we'll be joined by Kenny Blumenfeld climatologist on the podcast. Well this has been.

Mike: It's a great pick, Kenny. Just all the more important because of how many people, how accessible it is by that huge number of people, so all the more important for that reason.

Megan: Absolutely. Oh, my gosh. We could just, climate change, if you guys haven't figured this out in this episode, it's a, such a big topic and so we're going to.

Mike: We can have a whole conference about it actually, you know.

Megan: We could. We would have multiple conferences about it and so I want to boil it down if I can into five words for you, okay? Five words. Are you ready for this, Mike?

Mike: Mm-hmm.

Megan: Diversity, connection, resilience, balance, and prairie. That is how we're going to get there, folks. And so if we can combine all of those philosophies, ideologies, guiding principals into our work, that is going to serve us very well. Don't get overwhelmed by all of this, just go out and plant some more prairie, people. All right, so.

Mike: Five words, well done.

Megan: Thank you. Five words, that's right. You're welcome. So catch us next Tuesday on the Prairie Pod. We have been reminded this season so many times that there is wisdom in the land itself. It is telling us things if we are just willing to listen. The lesson of diversity there is ever present, it's such a great word, it's not only a backbone of everything that Mike and I do for our jobs, building connections across the prairie landscape, so it can persist, sustaining us just as it has sustained native people and settlers through time. We already said this, it's the guiding principal for what makes our world work in terms of our jobs and our connection to nature, but it also makes the world work just in terms of people, diverse ideas, approaches, values, make this big, wide world interesting, fun, and arguably so much better. So just as diversity serves the prairie and allows it to thrive, there's a lesson there for us, it allows us to thrive as people when we learn to embrace it. And so next week, Mike and I are super excited to take a page out of the prairie book, we're going to connect with the DNR's Diversity Program Coordinator Rowzat Shipchandler, and Urban Roots, Conservation Program Coordinator May Vang to chat about expanding diversity, equity, and inclusion in the work of prairie conservationists, because we do not have all of the answers if you have not learned this already. It is going to take a giant collective of minds, not just Mike and I talking to each other in a vacuum, we are going to need a lot of perspectives and it certainly needs to include all of the cultural and other identities that we define ourselves as, as people so that we can come together just as the parts and pieces of the prairie serve it. We're going to need that to figure this landscape out and make sure that we're building it right. So it's going to be a really fun episode, we're excited for our guests, and we hope you join us next week. Yeah.

As always, you can find all the links and resources that we talked about on the podcast today on our website at mndnr.gov/prairiepod. This episode was produced by the Minnesota Department of Natural Resources Southern Region under the Minnesota Prairie Conservation Partnership. It's you, it's me, it's Fred, it's Marissa, it's Kenny, it's all of us together working to save prairie. It was edited by Dan Ruiter and engineered by Jed Becher. Gosh, this has been so much fun chatting with all of you guys. This is incredible information. I just want to say thank you to everybody.

Mike: Yeah, that was awesome. Thanks, guys.

Marissa: Thank you.

Kenny: Thanks for having us on.

Marissa: Thanks for having us, Megan and Mike.

((sounds of birds chirping and wind blowing))