

[FOOTSTEPS]

HOST: That sound you're hearing right now is footsteps crunching on icy snow in the Chequamegon National Forest in northern Wisconsin. Today on the last episode of season 2 we're talking about climate change because climate change threatens to upend everything Western science understands about Native and invasive species. First, we join a team at the Great Lakes Indian Fish and Wildlife Commission that are carefully observing the relationships between the seasons and all other beings in the forest. Then we talk to the Tribal Climate Adaptation Menu team who are helping tribal nations find ways to assert their knowledge and adapt to climate change.

Finally, we step back 20,000 years to see what paleo ecology can teach us about how species move as the climate changes. But our first story takes place in the cold months of winter. Sidney I'll hand it over to you.

NARRATOR: Hannah Panci has been coming to this small lake nestled deep in the Chequamegon National Forest almost every week for the last five years. Sometimes in the spring and fall she's here even more often. During the winter though, her visits drop off. It's January. The forests are heaped with snow and the lake is covered in ice.

Sure. Definitely really connected to this place. And like each tree in particular, I've seen hundreds of times. So I feel like I got to know them each a little bit. Individually too.

I guess when you're out here by yourself you get a chance to listen more than talk. Listen to all the other animals and sounds outside.

Some of these interviews are a little bit hard to understand. We were outside masked up in the wind. So some of it's a little muffled

Hannah is a climate change scientist with the Great Lakes Indian Fish and Wildlife Commission. She keeps returning to the site to learn how it changes from season to season and from year to year. I was really lucky to join her and her colleague Rob Kroll on one of their winter surveys. The Great Lakes Indian Fish and Wildlife Commission which everyone just calls GLIFWC, represents 11 Ojibwe tribes from Minnesota, Wisconsin, and Michigan. Hannah and Rob aren't tribal members, but they've worked for GLIFWC for years.

SYDNEY The type of observation they're doing is called phenology.

WIDELL:

BONNIE Phenology, that is basically the study of seasons, like how plants and animals and other living beings would respond to seasonal change. Like the first leaves on the trees, or when the first blueberries get ripe, right?

WILLISON:

SYDNEY Right, or when ice forms on a lake, and how the ice develops over the course of a winter, which is actually what
WIDELL: Hannah and Rob came out to measure today. To answer those questions, Hannah and Rob have been visiting a few different lakes over the course of the winter, where they've been collecting information on the amount of ice and snow on those lakes.

ROB CROLL: The word for ice is mikwam.

HANNAH Oh, there's probably lots of different variations of that. There's so many words for snow and ice. But yeah.
PANCI:

SYDNEY For the Ojibwe people, Rob explains that mikwam is an animate being, just like trees, or animals, or humans.
WIDELL: Mikwam is one of several beings that Hannah and Rob are looking after in this project.

HANNAH So ice out, it's pretty variable in the spring, but-- and it can vary a lot even in different parts of the ceded
PANCI: territories we work in, but it's something we pay a lot of attention to because as soon as the ice goes out, tribal members are out there experiencing wildlife.

SYDNEY Basswood trees, wild leeks, white cedar, blueberries, raspberries, black ash, and paper birch are some of the
WIDELL: other beings included in this study. All of them are selected based on input from tribal elders and harvesters, and all have unique uses and cultural meaning. Hannah and Rob chose this place as a study site because most of the beings, like the cedar trees and the blueberries, they're all here, they're converging at this one place.

[PIANO MUSIC]

The lake is hard to access, especially in the winter. The lake was about a mile's walk down the snowmobile trail, and Hannah and Rob said that the fastest way to get there is usually to ski. But when we went back to do this survey, the snow was really thin, and there were rocks poking through, so we thought it would be a better idea to just walk instead.

Hannah pulled this purple plastic sled out of the truck and filled it up with all of the equipment they wanted to take back in. So I followed Hannah and Rob down this trail. And along the way, they told me a lot about the project and about what it's like to come back to this place season after season and see the way it's changing.

So after a while, Hannah and Rob veered off the trail into the woods, just into this knee-deep snow. I was basically just plunging along after them. It was a while before we could see the lake through the trees, but Hannah and Rob seemed like they knew the way to this place by heart. Rob stopped occasionally to see-- to look for wolf tracks in the snow, because in the past, there have been wolves back here.

BONNIE Mm, did you see any?
WILLISON:

SYDNEY No, we didn't. But finally, you can see the lake through this gap in the trees. When we reached the shore of the
WIDELL: lake, Hannah and Rob paused for a minute under this fir tree. They took a few moments to acknowledge the other beings around them before they began their work. The lake was long and narrow. It's actually this beaver pond, so there's a dam on one side, and these huge hills rising up on both sides of us.

HANNAH Did you start a form for this?
PANCI:

ROB CROLL: I did not.

HANNAH Oh, OK. Perfect.
PANCI:

SYDNEY Hannah measured the snow depth in a few different places.
WIDELL:

HANNAH Mm, what did I say snow depth was? Seven?

PANCI:

ROB CROLL: Seven.

HANNAH [? Zero. ?]

PANCI:

SYDNEY At the first site, Hannah shovel the snow off a little region of the ice, and then she used a hand auger to drill
WIDELL: three closely-spaced holes.

[AUGER DRILLING]

BONNIE What's that sound?

WILLISON:

SYDNEY The ice auger. Then she unfolded this huge ice saw, like the type you see in pictures from the 1800s of people
WIDELL: harvesting ice off lakes, and she cut between the holes. And this little chunk of ice bobbed up into her hands. She measured the amount of compacted snow, like the snowy white ice on the top of the ice block compared to the amount of clear ice that was going down into the water. And when she holds the ice up to the light, you can see all the different layers.

BONNIE Did you get a sense for how many inches deep the ice was?

WILLISON:

SYDNEY Yeah, there was about a foot of ice.

WIDELL:

BONNIE OK.

WILLISON:

HANNAH So snow insulates the ice, so it-- the more snow there is, the harder it is for the cold air to get down to the ice and
PANCI: make it thicker. So if we have a lot of snow, probably less ice.

SYDNEY So at the next site, Hannah passed me the auger and she let me try. The texture of the ice changes as I turn the
WIDELL: auger, and I imagine that I'm cutting back through the winter, like the afternoon thaws on sunny days, or the longest nights of the year, the first November freezes. When we're done, Hannah fits the ice gently back in the hole. She stands a stick back upright so she can find the spot again in the future, and then she shovels the snow back into place like we were never even there.

[MUSIC PLAYING]

I'm Sydney.

BONNIE And I'm Bonnie.

WILLISON:

SYDNEY WIDELL: And this is *Introduced* from Wisconsin Sea Grant. Phenology looks at how seasonal changes evolve over time, and how different cycles are related to each other. For example, the ice coming off the lake is related to when walleye spawn.

BONNIE WILLISON: And as climate change intensifies, all of these cycles will be affected in ways that we can't even imagine yet.

SYDNEY WIDELL: Phenology also gives us this window into how beings are responding to climate change right now. Or at least it gives us this baseline of what places look like today so we can better understand how they might be changing in the future.

HANNAH PANCI: We're five years into this study. I would think, I don't know, maybe 10 years or so, we might be able to pick up if there's any kind of trend, and--

SYDNEY WIDELL: Like Hannah said, it's a little early to pick out any trends from this site in specific. Long-term rain records of a place are relatively rare in general, and usually, they don't go back very far. But the Ojibwe people have been living in these woods and along these lakes for centuries and centuries and centuries, passing down stories and traditions that are tied to the seasons and to the other beings that live there.

Across the continent, assimilation projects carried out by colonial governments mean that a great deal of this knowledge is lost. But in the upper Great Lakes, some of this wisdom remains safe with knowledge holders and elders. Hannah and Rob are gathering those stories too-- stories from elders who have lived in this place for a long time and have witnessed it changing.

HANNAH PANCI: And there's a lot of connections between phenology of certain species, like when the frogs start singing, it's time to go spearing for walleye. Stuff like that. So there's a lot of those indicators that-- those will be affected by climate change too. Those things that might not always happen at the same anymore, but that's-- those are the cues that native people have been using for years and years and years to know when to harvest.

SYDNEY WIDELL: Hannah and Rob hope that, together, the science and the stories will expand their understanding of what's at stake and how these lands are changing.

HANNAH PANCI: One thing that we're interested in is comparing it to historical records, and we've been doing a lot of interviews with tribal members about changes they've seen in their lifetime and their family's lifetime. So monitoring phenology now, we'll be able to compare a little bit to observations they've made over the past decade.

SYDNEY WIDELL: What Hannah and Rob are learning will help the tribes of the upper Great Lakes make preparations for the future.

[MUSIC PLAYING]

JERRY JONDREAU: Historically, we were a very mobile people. As we saw change, and as we saw something declining, for example, we could pick our stuff up and go somewhere, go somewhere else. If we couldn't actually help out at that moment, we could pick our stuff up and move our community somewhere else, and move our family somewhere else. And we don't have that luxury anymore, because as tribal people, we are stuck on our reservation.

And so as these changes are happening and occurring, we can't take our reservation and pick it up and move it north to Canada and plop it down and say, OK, now, the Keeweenaw Bay reservation's up here in Canada, y'all. We're moving with the sugar maple trees. We can't do that anymore. We are bound by the legal boundaries of our reservations now. And so it's even more important that we get back to the land, we participate in the land again, and we participate in our ceremonies again, and we witness those changes as they're occurring.

BONNIE That's Jerry Jondreau.

WILLISON:

JERRY [SPEAKING OJIBWE]

JONDREAU:

My name's Jerry Jondreau. I'm from the Keeweenaw Bay Indian community.

BONNIE Jerry and his partner Katy Bressette own and operate Dynamite Hill Farms in the Keeweenaw Bay Indian
WILLISON: community, which is close to Lake Superior in what we now know as the upper peninsula of Michigan.

JERRY Fighting fires in the summer, wildland firefighter in the summertime, and rice during the fall, and a sugarmaker in
JONDREAU: the spring, and a dad to a lot of kids.

BONNIE Jerry studied forestry at Michigan Tech, and then he established the first Keeweenaw Bay Indian community
WILLISON: tribal forestry department.

JERRY As a forester for our tribe, we oftentimes dealt with the US Forest Service or the state DNR programs, and it
JONDREAU: became obvious that those agencies had very little understanding of those indigenous perspectives on the land. And so any time that we tried to start a project where there were multiple agencies involved, which was pretty much every single time, we had to educate them before we could even begin moving the project forward.

And so it felt like we had to take several steps backwards before we could even start moving forward with anything that we did, and it just became more of a burden than anything. And it was a necessary burden, but at times, it felt like, why is this responsibility always falling onto my shoulders? I mean, I know about their agencies. I know who they are. I know what their directives are. But they don't know anything about me or my community, even though we have rights that are guaranteed by the Constitution that protect our treaty rights. So it seemed extremely imbalanced.

BONNIE Jerry was observing that there wasn't a clear way that he could see for tribal nations to advocate for different
WILLISON: ways of, quote, unquote, managing the land. There were stories and ceremonies, languages, thousands of years of observation, but Western scientists like documents.

JERRY I felt proposing different ways of doing things was challenging, because people in the scientific community
JONDREAU: always wanted some sort of paper that backed what you were proposing, and it just didn't exist.

BONNIE So Jerry and the Tribal Climate Adaptation Menu team set out to create that paper. So they got a team together
WILLISON: to create the Tribal Climate Adaptation Menu. They got together tribal representatives, people from local governments, researchers from places that we now know as Minnesota, Wisconsin, and Michigan. And this group started meeting every other month. They had to figure out, how do our Ojibwe and Menominee cultures want to adapt to climate change, and how do we put that down on paper?

SARA SMITH: [NON-ENGLISH SPEECH]. My name is Sara Smith. I'm from the Oneida Nation in Wisconsin. When we were doing these working sessions, we tried as best we could to all be in person. But I think being in person for those meetings was really important, because stories came out-- we had kids in the room constantly reminding us why we're doing this.

BONNIE WILLISON: Sara Smith joined the team as a liaison for the College of Menominee Nation, which is where she works.

SARA SMITH: And it was a really great process because it actually brought us closer as a group, so we weren't just colleagues, we were more like a family.

BONNIE WILLISON: The idea was to take an already-existing climate adaptation menu as a sort of framework. And they started editing it, like going through line by line, doing a lot of wordsmithing.

SARA SMITH: Everything that we put into the document was all based on consensus, so that's why we had a lot of wordsmithing. I mean, there was one term we spent an entire day talking about.

BONNIE WILLISON: Can you guess what that word was?

SYDNEY WIDELL: I think I have some suspicions. [CHUCKLES]

BONNIE WILLISON: That term was "invasive species."

SARA SMITH: Yeah, so when it came to talking about invasive species, these beings are going according to their original instructions, they're just in a different place. They don't have the same checks and balances the other beings around them. And so that's why we had a lot of discussion about invasive species, is because they're not the enemy. 'Cause there's a lot of talk about, oh, we need to eradicate them, we need to just get rid of them, right? But they're only doing what they were told to do.

BONNIE WILLISON: Another term that they spent a long time talking about was climate change. Here's Rob Croll. In addition to being part of the phenology project, he was an editor of the Tribal Adaptation Menu.

ROB CROLL: I mean, the way it was explained to me anyway, there really isn't a term in Ojibwemowin that would translate to climate change, because over thousands of years, things are constantly changing, and people and other beings had to learn how to adapt to it and change what they were doing.

SARA SMITH: Yeah, and coming up with the title for the menu was also a big project to do as well, just because Climate Adaptation Menu doesn't translate from any of the languages.

BONNIE WILLISON: Each chapter in the Tribal Climate Adaptation Menu is a strategy to adapt to a changing climate. So for example, woven into these strategies about cultural practices, connections with the landscape, and spiritual guidance, and very careful observation is, for example, strategy 5, which is reduce the impact of biological and anthropogenic stressors. And then they list ways to do this. So for example, maintain or improve the ability of communities to balance the effects of non-local beings.

So this whole process of writing the menu took two years. And now the menu is in high demand. It's based on Ojibwe and Menominee perspectives and values, but it's designed to be customized by other tribes, and now it's being used all over, from Oklahoma to Alaska to Canada. It's usually used in workshops put on for tribal nations.

JERRY JONDREAU: I would like to see this menu used as an educational tool for state agencies and federal agencies that are around, and internationally too, because this could also be used over in Canada with their departments and their agencies as well. As Anishinaabe people, as people of this land, and as people that have usufructuary rights to this land protected by a treaty with the United States, it's imperative that these other agencies have a better understanding of who we are as indigenous people, and understanding of what our values are, and what are the things that we need to ensure that our rights to hunt, fish, and gather on these lands are protected and enhanced.

BONNIE WILLISON: One really important thing that is in the menu that is inherent in all the different strategies is getting people out on the land to observe.

JERRY JONDREAU: I think one of the things that, through a lot of our conversations that we came to was this point again about relationships and the fact that our people, through colonization and through assimilation and stuff like that-- our relationship with the land has been broken. And we don't spend as much time on the land like we used to. If you look at the way we set up that menu too, there was a lot of emphasis on getting people back onto the landscape, participating in culture again, and bringing the people to the table that still have those relationships.

Because she is telling us everything that we need to know. But if we're not out there listening, then we won't know. Change has been happening forever. Nothing is ever really static, especially in nature.

[MUSIC PLAYING]

SYDNEY WIDELL: After the break, I wanted to learn more about the long-term changes Jerry was talking about, and how they can complicate our idea of what is native and what isn't.

WOMAN: There once was a resident of Wisconsin who was unable to locate a trash bin. The unwanted items found their way to the ground, and from there the impending disasters compound. The spring snowmelt and summer rains wash the refuse down storm drains, 'cross the land and other locations unplanned.

The wastewater treatment plant did its best to filter and settle, but microplastic waste was just too small to wrestle within the existing technology and cost parameters constraining the work of pollution control managers. Other problems ensued as organisms inadvertently ingested the waste that humanity manufactures with unabating haste.

Want to learn more about the impacts of waste on our waters? The Trash Trunk lessons and tools will allow you to consider and measure how to rethink, refuse, reduce, refurbish, repair, repurpose, recycle, and treasure the resources we steward on behalf of one another.

SYDNEY WIDELL: If you're among the many who are looking for online learning materials for use at home, check out the Trash Trunk. Its free lessons are great for learners anywhere from levels kindergarten through adult. Click on the link in the description and visit the Wisconsin Sea Grant website for more details.

[MUSIC PLAYING]

This idea that change has been happening forever, I wanted to learn more, so I talked to Jack Williams. He's a paleo ecologist and a geography professor at UW Madison, and he spends a lot of time thinking about how ecosystems have responded to climate change in the past. Jack takes a long view on invasive species.

JACK WILLIAMS: Inherently, to call something a native species implies that you have some moment in time where that species was present. You're indicating that is historic range, or its native range. And most of the time in the US, we would say that is-- say, 1700 AD. We have to be really careful about this stuff, because we know that climate changes all the time and species move around because of that. Humans have been in the Americas for the last 15,000 years, and they have altered the ecosystems in various ways. And so from a paleo ecologist perspective, to call something a native species or non-native is a little arbitrary a lot of times.

SYDNEY WIDELL: On a global climate timescale, the lakes we love, they are new. The plants and animals that live here, those are even newer. Like Bonnie, picture yourself standing on Picnic Point looking out over Lake Mendota.

BONNIE WILLISON: OK. So yeah, Picnic Point is really close to Sea Grant headquarters at UW Madison. I like to go there. It's a popular hiking spot with a network of trails. I would see some tall oak trees, some prairie grasses on the lake in front of me.

SYDNEY WIDELL: If you were there 20,000 years ago, your view would be a lot different.

JACK WILLIAMS: 20,000 years ago, there wouldn't have been a Picnic Point, right? There would have been an ice sheet here. And we always say a mile high, a kilometer high. It was probably several kilometers high, this big dome of ice centered over Canada all the way down here. And so Picnic Point, and Lake Mendota, and Lake Monona, all those came into being maybe about 15,000 years ago or so.

SYDNEY WIDELL: The lakes formed were stagnant blocks of melting ice left behind these-- they're called kettle holes.

JACK WILLIAMS: Then what we see is a whole series of ecosystem changes, where, first what we have around here are spruce trees, and bogs, and wetlands, and mastodons, these kind of glacial forests and glacial landscapes.

SYDNEY WIDELL: I like how he's just like, these trees, these trees, and then mastodons! Like, whoa! I can't imagine that!

[CHUCKLES]

So yeah, the temp keeps rising, though, and the spruce trees around here die out, and mastodons go extinct.

JACK WILLIAMS: Pine species move into the area. And then, maybe around 10,000 years ago, if you're here on Picnic Point watching time and ecosystems flow by you, you would see oak savannahs starting to establish, and elm forests starting to move into the area.

SYDNEY WIDELL: So at this point, all of the ice is gone. We've entered this period of relative warmth called the Holocene. And this is about when the first people begin to live on the shores of Lake Mendota. This huge change, going from glaciers to Lake Mendota, that was caused by around 10 degrees Fahrenheit in warming.

And those changes happen because of very minor shifts in the Earth's rotation and warming feedbacks that were set off by these melting ice caps. And it ushered in this ongoing migration of living beings into the state. Trees grow, they drop their seeds, and those seeds are most likely to grow along the edge of that tree range where conditions are most favorable. This type of movement takes centuries to play out, and scientists like Jack look to lakes for records of these changes.

JACK WILLIAMS: Because as it turns out, lakes aren't just beautiful for recreation and have all of these species and food webs going on in them. They're also natural collectors of everything in the lake and around the lake.

SYDNEY WIDELL: Sediment washes in, it carries pollen from everything going around the lake. And Jack says understanding how something responds to change in the past can help us predict how it will respond to change in the future.

JACK WILLIAMS: These climate changes aren't just gradual and linear. There's some pretty abrupt changes along the way. What I'm interested about as an ecologist is how do plant species and other species handle abrupt climate change? How quickly do species respond? How quickly can species adapt or migrate? How do we manage forests today, or aquatic ecosystems, or how should we help species adapt to the changing environments around us right now?

SYDNEY WIDELL: When climate starts to change, Jack says a species has a few options. First it can adapt, which basically means it evolves to be successful under new conditions. Second, it can persist. Basically, it stays in place, kind of hunkers down. It's probably more limited. It can move-- and for this, I want you to picture those large-scale range shifts Jack was talking about earlier, like spruce moving from here up into Canada. And finally, it could die.

Take hemlock, for example. Pollen records show that hemlock got to Wisconsin through the upper peninsula of Michigan around 5,000 years ago. Geologically, and even compared to a lot of the other trees here today, that's kind of recent. One explanation could be that climate was slowly warming, but it took hemlock a way longer time to track its ideal habitat toward northern Wisconsin.

JACK WILLIAMS: If that's the truth, that's important, because that says that if we want to help species adapt to current climate change, we need to assist them. They can't move very fast on their own, and so we might really need to plant hemlock seedlings. I do think that one of our greatest challenges facing us when we think about climate change is imagining the worlds of the future. We are moving to a state of the climate system that we have not seen in our lifetimes, and arguably, our species has not seen in its evolutionary lifetime.

SYDNEY WIDELL: The expectation is that species will move north. Jack said these changes are playing out around us already, and it has pretty profound implications for how we decide what is native here and what isn't. Like, what belongs and what doesn't.

JACK WILLIAMS: And I do think that what's most useful about paleo ecology is that kind of opening of vision, and that recognition that the way things are now, that we might not have to be the way things always were. And that helps broaden our imagining about the way things could be. So if we can start to understand how species have changed, which species are most sensitive to climate change, what species have the highest rate of response and able to quickly adapt or move on their own, versus which ones might need a helping hand. So those are the kinds of lessons that I try to help communicate and share with current ecologists and land managers.

SYDNEY WIDELL: Jack has argued that we need to shift from thinking about states to thinking about rates.

JACK
WILLIAMS: We're kind of used to this framework in which you try to manage systems to be in a certain state. We want to keep things the way they are in some certain condition. I would now argue that we are living in a world that is going to be changing around us for at least the next several decades because of rising temperatures and so forth. And given that, it's not usually a realistic goal to hold things to a certain way of being. And so what becomes more important is think about rates of change, and which rates of change do you want to accelerate, if you're trying to help accelerate species' migrations or other kinds of adaptations to changing climates, and which ones do you want to maybe limit, if you're worried about an invasive species that's causing damage to your lake or other ecosystem.

[MUSIC PLAYING]

SYDNEY
WIDELL: Managing invasive species is all about limiting how fast and how widely a species can spread. But Jack says we're heading toward a future where we may have to actually advance the rate certain species can spread. And that just flies in the face of everything we're taught about invasive species. This question-- should we encourage species to move, and maybe should we even be the ones moving them-- is kind of divisive.

JACK
WILLIAMS: Traditional restoration ecology would say you don't do that. You try to restore things to the way they were, and protect that. But there is another emerging community that says, it is our obligation to help species migrate.

SYDNEY
WIDELL: Of course, the most important thing we can do is limit our carbon emissions. But after that, what species do you move? Where do you move them? Who gets to decide? Do we have an obligation to be doing that, and do we have a right to do that?

JACK
WILLIAMS: I tend to be in the camp of those who think that, when climates change, species move, and we should help species move. And if we are holding to these somewhat arbitrary time-limited perspectives about what is a natural ecosystem, we are limiting ourselves and limiting the species that we're trying to protect.

SYDNEY
WIDELL: Of course, Jack is cautious about recommending this type of assisted migration. For example, he says no moving species across continents. But he is open to moving species within continents.

JACK
WILLIAMS: One classic narrative is that things were good in the past. We have wrecked lots of things, and now we need to restore back to that Edenic prior. I think that is a mindset that we need to move away from. And so just knowing that there's been this ongoing sweep of species moving back and forth across the continents, and species mixtures, and communities reshuffling and remixing over time-- that, to some degree, says that what we're just seeing around us right now is change.

And it's changing from one set of species around us to another set of species around us. And so to accept and sometimes facilitate change, while at the same time really trying to prevent things that cause irrevocable extinction of species or loss of key ecosystem services that we really value and protect--

HANNAH
PANCI: That's definitely walleye--

SYDNEY
WIDELL: Back in the Chequamegon forest, Rob and Hannah are trudging through the snow on their way back from their last phenology site, where they're keeping watch for signs of change in the woods and on the lakes.

HANNAH In general, I think it's really important to do the stuff we're doing and be out there on the landscape. There's a lot of people that can tell you a lot from looking at computer models and stuff, but is it actually what we're seeing out there? That's still important.

PANCI:

ROB CROLL: Being out in it is absolutely necessary. You can't understand it if you're not.

HANNAH Yeah.

PANCI:

SYDNEY For the communities Hannah and Rob serve, the beings they are looking out for are connected to their traditions and culture in profound ways.

WIDELL:

ROB CROLL: You know, I think for us, trying to maintain those beings is probably-- we have to do that, and keep them here as long as we possibly can. Because they're completely integrated with the culture. And what happens when the old stories don't apply anymore? What happens when you talk about wild rice and nobody's seen wild rice for a generation, or two generations?

SYDNEY Increasing habitat connectivity to create ecologic quarters and maintain diversity is a key strategy in the Tribal Climate Adaptation Menu. When it comes to actively moving species, though, Hannah and Rob are way more wary.

WIDELL:

ROB CROLL: Yeah. It's like, every single one of these trees has checks and balances on it from the other things in its community. And if you bring something new and you don't know what was in its community, and whether the other beings here are going to be a part of that community or whether it's going to cause problems. So people look at that, and it's a real concern, that they don't want to lose their relationships they've had with some of the beings that we know are very vulnerable to climate change. And they're also afraid of what could happen if somebody new comes in. The records for that really aren't that good.

SYDNEY Hannah points out that this perspective might not be shared by all the native people that GLIFWC serves, and she and Rob certainly don't intend to speak for everyone.

WIDELL:

ROB CROLL: The whole mindset of control and management, we have that. We're managers. We want to do things. We want to fix stuff. We want to make it better. And maybe we need to sit back and see what it's going to do by itself.

HANNAH Yeah, managing does imply that we're in charge, and we decide what to do, and those other ones out in the forest don't have any say in it. We use caring sometimes, or taking care of those who take care of us.

PANCI:

BONNIE There are lots of ideas about how we can manage through climate change and adapt to climate change. And one group trying to figure out the climate adaptation problem is the Tribal Climate Adaptation Menu team that we talked to before. After two years of work, they finally went public with the menu in 2019. But that's not to say the menu won't grow and change in the future. It's really a living document. One interesting thing that's come about is it was created with natural resources projects in mind, but people have been eager to use it for other topics as well, like education projects, and even things related to mental health and physical health.

WILLISON:

JERRY Everything's related, right? And so it's very difficult to try and take topics such as forestry, for example, and cut out all of these other ties in connection to it, and just focus on a single tree species or something like that.

JONDREAU:

BONNIE WILLISON: Nothing is certain except for change. Climate change is happening. Species are being forced to move. People are being forced to move. There are many different ways to respond to this challenge, and probably all of them are going to be needed.

JERRY JONDREAU: We're in changing times, and in an era where there's a whole lot of uncertainty that's out there. Well, if you ask me, I think it's the indigenous people that are best suited to lead the charge during those times, because our culture is adaptable. We've been adapting this entire time. We've been adapting even while we were assimilated. And so as this change continues to happen, I think it's important that both agencies, both federal, state, NGOs, whatever, really start uplifting the indigenous communities around them and start giving us more authority on these decisions.

And if you think about what tribes want, and you think about treaty rights, hunting and fishing and gathering, and if you upheld those rights across Anishinaabewakiing, Minnesota, Wisconsin, Michigan, if our water was clean enough to have healthy fish populations, the non-native community would benefit. If our wildlife populations were healthy enough to support a healthy harvest, the non-native community will benefit. If the medicines and the plants are healthy, and they're able to share their gifts with us through harvesting, I guarantee you that that landscape will be healthy and be beneficial to non-tribal people too. And I think the tribes are ready to do that. And I think we're ready to take that position. And I think it's time.

BONNIE WILLISON: Climate change threatens to upend everything Western science understands about native and invasive species. And it's scary. Like, if humans decide to move species in order to help them adapt, we don't know how they're going to react to species in the new areas. If we open up corridors and take down dams, there's always a possibility that other nuisance species could migrate up and change the ecosystems. And that could change our waters like now, in the very short term.

And there are people who their whole job is to stop the spread of aquatic invasive species in order to protect the environment. And they would say, we need to be very careful and understand the risks of what we do. But there are also risks in not taking action, like pushing off decisions for future generations.

It's scary to think that the places we know and love could change. That the species that we know, like walleye, wild rice, beech trees, they potentially won't be able to survive here anymore. We've got a lot of work to do before we can adapt to climate change in a respectful and beneficial way.

And one thing we need to do before we make decisions is listen, like the Tribal Adaptation Menu team listening to their communities to create their framework. Like Rob and Hannah, that are closely listening to all of the beings in the forest to see how they live season to season, year to year. Thankfully, these people and a host of others are thinking about climate adaptation and planning for the future.

SYDNEY WIDELL: I want to read you what the Tribal Climate Adaptation Menu suggests. It says that communities should favor or restore native beings that are expected to do well under future conditions and that can help meet future needs. It says that communities should establish or encourage new mixes of local beings expected to do well under future conditions to meet future needs. And that communities should seek out and share traditional and cultural knowledge of potential new beings from tribal communities where these beings are native. What that comes down to is-- and I'm quoting-- "encourage community adjustments and transition while maintaining reciprocity and balance."

[MUSIC PLAYING]

**BONNIE
WILLISON:**

You can find a link to the Tribal Climate Adaptation Menu in the description below. For non-native listeners, the first eight pages of the menu are about guiding principles for interacting with tribes, and this is a great place to start.

**SYDNEY
WIDELL:**

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[MUSIC PLAYING]