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Ghost Forests: The Decline of the Whitebark Pine

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“Ghost Forests” Transcript

The world has lost 40% of its forests in the past three centuries as humans have expanded our cities and multiplied our carbon emissions.

But for many years, we seemingly spared one of the most remote trees in North America: the whitebark pine.

Jed Cochrane/Parks Canada forest ecologist: Whitebark pine is a super cool tree. Like, it is my favorite treat species by far.

Diana Six/Researcher: It's beautiful, it develops these incredible gnarly forms.

But now, after introducing an exotic disease, we've managed to put this ancient pine in peril.

Six: So in many places, whitebark pine is almost gone. And what's there are kind of their skeletons, and we call these “ghost forests.”

Projections show we stand to lose all but 2% of whitebark pine in the coming decades.

Cochrane: If we don't do something now, given how long it takes to make a difference with it, in our grandchildren's time, there won't be whitebark pine anymore.

Bob Keane/Forest ecologist: It would be almost inconceivable the value that we would lose from the high mountain landscapes.

And the loss of this single species would snowball, not just through the mountains, but to the rivers and valleys below.

Six: It could have significant impacts on agriculture, on our fisheries, recreation, a lot of economic impacts you would never expect from a tree that's up on top of a mountain.

Tony Incashola Jr./Forest manager: You know, the importance of a single tree species it's understanding that an environment's all connected.

Six: It may just be one species of tree, but it's just one of the first. I'm really hoping that that's not the legacy we leave is ghost forest after ghost forest after ghost forest.

You might call it the tree with the best view. Rooting into North America's highest elevations, the whitebark pine thrives where other trees can't survive.

Six: It's tough, and I think people appreciate anything that can live in a place like that and do what it does. But even if you don't know it's ecology and you go hang out with these trees, they grow on you really quick.

Rick Everett: I think it's gonna be a survivor, but we've still got to help.

Every year, the Whitebark Pine Ecosystem Foundation invites all who love the species to a conference, and the hike is the highlight. This year, they're headed to whitebark territory on Montana's Flathead Indian Reservation, home of the Confederated Salish and Kootenai tribes.

Incashola: Very high hopes for this area.

Forest manager Tony Incashola was born and raised here, and he says native tribes have a long relationship with the land and whitebark pine.

Incashola: It's a first food for our tribe. We've used trails going over high elevation for traveling for hunting purposes for cultural purposes, and part of those high elevation forests is whitebark pine, so there's always been a touch not just with that species with what all tree species on the reservation and understanding the value of everything.

The group's appreciation of the tree is grounded in the landscape that surrounds

ShiNaasha Pete: It's a very, very special tree. It's very, very special to be up this high.

Mike Durglo Jr: I mean, it's a special place. Period.

Whitebark pine provides more than just cover for high mountain creatures: its cones contain nutritious seeds that feed more than a hundred bird and animal species including grizzly bears.

Keane: And in fact, several of those animal and bird species are what we call obligate to whitebark pine in that whitebark pine provides the only food source for the species, and if whitebark pine is gone, so is the species.

But until the cones ripen, getting to the fatty morsels inside is a challenge for all but one of those species: the Clark's Nutcracker.

Cochrane: The cones are rock-hard. It's got this special beak, it opens up the cones and then it fills its sublingual pouch and underneath its beak with sixty to eighty of these seeds. That's quite a lot when you consider the size of these seeds; they're about the size of a pine nut that you'd use on your salad.

The Clark's nutcracker flies across the landscape – sometimes miles – to cash the seeds in clusters.

Keane: And of course they don't need all those seeds, but there is no way they can figure out that they've cashed too much, so they just keep on cashing until all seeds are gone.

Cochrane: And then it comes back later – months later – and it can remember where it's cached these seeds, and it then eats those seeds and that's what it lives off of.

Keane: The seeds that they either forget or the seeds that they never get to will become the whitebark pine forests of tomorrow.

Whitebark pine's range is limited to a narrow high elevation niche. It's sprinkled across the Crown of the Continent, the Canadian Rockies, the spine of the Cascade Range and the Sierra Nevadas, but its benefits trickle far beyond that.

Six: So these trees grow up on the tops of mountains, and you know, unless you're a hiker and someone who spends time in the backcountry, the

chances are, you may never have seen one. Or, you know, if you saw it, you never really thought much. It's pine. But they are really important in our lives.

Whitebark pine has a key role in the water cycle, holding onto snowpack as seasons change.

Keane: Because the tree provides shade and shelter for the snowpack, it's able to deliver high-quality water at very low levels over the course of the summer, whereas if those species are gone, snowmelt happens so fast that we get low-quality water because of the high flows, and that happens over a very short season. It really is a to me a poster child of the very species that society should be restoring.

Cochrane: It's fundamental to the healthy functioning of these high-elevation ecosystems, and so when we see keystone species not doing well, it's an indication for us that the whole ecosystem itself maybe isn't as healthy as we'd want it to be.

Six: This is an opportunity to learn with this one that's in such bad trouble and then, maybe, have an idea how to deal with the others before they get this bad.

Society has been slow to recognize the seriousness of the whitebark pine's situation, let alone what's causing it.

Keane: They often think, "Well, it's a harsh ecosystem. It's cold. It's windy. It's snowy. Of course these trees are gonna die.

But those who study the hardy species know its resilience is one of the reasons it thrives in high elevations. In the 1980s, researchers discovered what was killing whitebark pine, and it was our fault.

Keane: The biggest factor was the fact that we had introduced, as a society, had introduced white pine blister rust into American ecosystems around 1910.

White pine blister rust, an exotic disease, travels through airborne spores to attack five-needle pines, including whitebark.

Keane: This is especially alarming because white pine blister rust is not native to our pines and none of them have really adapted to the disease, so this throws a wrench in the works if you want to restore the species because you can't just go out and plant it, because it'll eventually be killed by the rust.

But that's not the only enemy for whitebark pine. Rising temperatures have allowed native mountain pine beetle to propel into new territory previously too cold for them.

Six: Beetles are always out there, and they're just sort of present in low numbers, they can't really do much because there's not enough to kill trees. But if you get a warm period, that supports greater survival and reproduction and you get drought, which makes trees very stressed and that allows the beetles to kill them more easily, then they blow up.

Scientists estimate we've lost between 60 and 80% of all whitebark pine across its range and some areas, like Glacier National Park, have seen a 90% loss. Canada listed whitebark pine as endangered in 2010 while it remains a candidate for Endangered Species listing in the United States.

Six: There is a real sense of urgency to do something about the tree. I think the estimates are that just due to climate change, we could lose all but 2% of the range of the tree in the U.S. in just the next 20 years, and I don't know how we can work that fast.

Land managers across the West are going to great lengths to save whitebark pine. In the national parks that border British Columbia and Alberta, Parks Canada resource managers like Jed Cochrane recognize the effort required.

Cochrane: You know whitebark itself is challenging to get to, in that it's usually found way up high. For us in the national parks, there's no roads or locations that we can drive to that are close, so lots of our sites we end up hiking sometimes we'll hike two or three hours, you know, often up steep hills to get to the site.

And that's just part of the climb. Once the technicians reach the whitebark stands, they'll harness up and climb the trees to reach the cones that grow on top.

Laura Kroesen/Parks Canada: It's such a nice tree. I want to be really careful not to hurt it.

It's July, and the cones haven't matured yet, but the climbers need to get to them before the Clark's nutcrackers do.

Kroesen: OK, so this one has four.

Cochrane: So this is our version of a whitebark pine cage. It's made of window screen mesh that we just buy at the hardware store. We buy it in big rolls, and then the edges are taped with duct tape, that helps it from fraying.

Kroesen: Perfect! There's like so many on the top here.

Cochrane: We use colorful duct tape for us because it helps us find the trees again. And then, it's just stitched together with zap straps and then it sits on top of the branch and then the zap straps are tightened around the branch and that holds it in place. It needs to be held in place, we find, because if it's not held in place really tightly, the Clark's will go in there and they'll pull it off or squirrels will or even bears will come up there and pull the cages off, so it has to be snug right on the branch.

Kroesen: Yeah, that's good.

Cochrane: But if someone ever invented a cage that you could put on with one hand and tighten with one hand, it would save us because we're often up in the tree, you know, we're harnessed in, we're leaning out. If you could just drop it on with one hand and tighten it with one hand, you know, that would be an amazing invention. But there'd be a handful of whitebark pine scientists that would pay for it, and that's about it.

But they don't choose just any tree to climb, because white pine blister rust has already attacked most of them. Instead they look for trees that have managed to escape infection.

Cochrane: What we think or hope is that there are trees out there that have a certain level of, kind of, natural genetic resistance to the rust, and so the trick to finding those resistant trees is to go into stands where there's lots of infection and mortality from rust, and then we look for the healthy ones.

Some of the earliest signs of white pine blister rust are red needles known as "flagging." Eventually, blisters form on the bark and once that happens, the tree is on its way to dying.

There's some real active rust cankers happening on the stem of this Tree, so you know this tree is not long for this world. Once it gets it on the stem, it pretty quickly will impact that cambium and girdle the tree, and if the rust doesn't do it, then often what'll happen is that other animals like squirrels will come along and gnaw on that – it's kind of rich in carbohydrates and so they'll gnaw on that and then that'll contribute to the death of the tree.

In an effort to reach as many trees as possible, a team of four Parks Canada whitebark pine specialists are gearing up to survey a remote site they've recently noticed from the air. The easiest way to access it is by helicopter.

Even though they saved hours of hiking time, they don't waste a minute to start surveying the stand. In this case, they want to see a high ratio of blister rust.

Cochrane: And if we have enough of that impact, infection and mortality then then we know that we're probably in a site where the trees have been exposed to Rust, and so any that are healthy, we're hoping are healthy because they are showing signs of resistance as opposed to being healthy because they haven't been exposed to the rust.

After inspecting a hundred trees for infection, they determine only a small percentage of them aren't showing signs of rust. To ensure the survivors they cage are not too closely related, they choose trees at least 100 meters apart, and oftentimes, those aren't the easiest trees to climb.

After a full day of work, the team caged about 100 cones across four pines. In a couple months, they'll return to this site and collect the mature cones from their cages, then they'll send the seeds to a nearby nursery where the

seeds take two years to sprout into seedlings technicians hope are genetically resistant to the rust.

Cochrane: We think – we don't know a whole lot about it yet -- but we think it's a combination of genes, and so some trees show varying levels of resistance. So, just like, you know, you and I and someone else might get a cold: Someone might get really sick, some might get a little sick and some might not get sick at all. The trees are like that, and so, we don't want the person that gets really sick or the tree that gets really sick, but we might take the person – the tree -- that gets a little bit sick, fights off the cold, and then is able to kind of do well after that.

Scientists estimate just one in 100 trees are resistant. Even if the climbers correctly identify one, its seeds face their own odds: Only half will germinate into a seedling, and once planted on the landscape, only half will survive the first couple of years. It usually takes whitebark 30 to 50 years to produce its first cones.

Cochrane: Not only does it take a lot of work, it takes time, and there's lots of mortality along the way, there's a tremendous amount of effort. You're covered in sap and bleeding usually by the end of the day, so it's, you know, it's a lot of work, but it's fun. Yeah.

Six: Hello, is there a bat?

But trees resistant to white pine blister rust may still fall victim to mountain pine beetle.

Six: It's like a book to read.

University of Montana researcher Diana Six has spent two decades studying the beetle and its rise to destruction in western forests.

Six: You can even see some dead beetle parts. This outbreak is so far outside the norm. It's something like 10 times bigger than any we've ever seen, more severe, greater extent, the beetles moved into new places, so it's been a pretty remarkable thing to study. But now that the population has collapsed, I find that some of the most interesting questions are things that we can answer now and

that's because these forests still have trees left and I think we can learn a lot from the trees that remain.

In southwest Montana, Six watched mountain pine beetles chew through this forest in four years. But as she kept returning to the site, something didn't add up. The beetles had missed some obvious targets.

Six: The way I look at a forest like this is there are green trees, and there's dead trees. And the green trees, some of those just escaped because of their size – they're just too small for the beetles to use. But the big trees that are green, those are the ones that intrigued me, because when these beetle populations were really high, those beetles were getting desperate for somewhere to go. They were running out of food; almost everything was dead. But, instead of going into these trees, they basically, just collapsed. Their population disappeared, so that that told me right there was something really different – probably genetic about these trees that allowed them to be survivors.

The surviving trees showed no signs of the beetles even attempting to get inside.

Six: We don't know what kind of behaviors the beetles have around these survivors. We don't know if they even land on them. One thing we do know, is we can't find any unsuccessful or accidental attacks. These trees don't – they're virtually untouched. To us, they look like perfect beetle food but to beetles they don't look like beetle food.

If any of the whitebark pine trees contain resistance to both mountain pine beetle and blister rust, they're few and far between.

Six: Yeah, that's a pretty one up there, but it's got a big red blister rust flag on it. That's a bummer. Even though they have what it takes to get past the beetle, they're not gonna make it because of the disease.

Blister rust has moved in on many of the trees that survived pine beetle at Diana's study sites.

Six: They're actually ones we included in the study, but they have blister rust, so they don't get attacked by beetles, but the disease is there.

Specialists caging cones for blister rust resistance do attach pheromone packets to the trees that they cage to signal to the beetles that the tree is already taken, but most restoration methods across whitebark pine's range have prioritized producing seedlings with blister rust resistance.

Six: If you replant stands that have these survivors, the likelihood is whatever genes those trees possess will swamp out any of this beetle resistance that exists or really dilute it. And so I can see where there might be conflict between groups that are trying to all save the tree but maybe have a very different perspective on what needs to be done.

While land managers agree that genetics are the key to restoring the species, there still isn't a tool they can use in the field to tell them whether or not a tree is resistant.

Cochrane: There's a tremendous amount we still don't know about whitebark. You know, like, we have trouble even knowing exactly where it is on a landscape, let alone knowing kind of genetically exactly what's key for it. If there was a handheld device that you could just poke into the tree and told you whether or not the tree was resistant, that would be a dream, 'cause right now from what time we take the cones and then grow them into seedlings, we're still looking at almost five years before we get an answer as to whether or not a tree is resistant.

Six: A few years ago, I was really feeling pretty hopeless about whitebark pine and I was really thinking of moving on because I didn't think there was much of a chance for the tree, but this the results of this study have really given me a lot of hope. We can now probably develop probes that could be used at the management level, and so it really, this is coming at the right time, just as technology is developing to the point we can apply it in management. Trees aren't clones, they're incredibly diverse, and we need to start taking advantage of the genetic differences because that is what's going to allow them to be able to live in a different future.

Back on the Flathead Indian Reservation, the hike culminates at a sacred site at the top of a mountain and the base of an ancient whitebark pine the tribes have called “allowyah” which means my great-great grandparent.

Pete: All of our knowledge here together, you know, these trees have more and more knowledge than any of us and this tree has seen more than what we can like see in our lives. Coming up here and then getting to come up here with all of the scientists, it's very, very significant.

Incashola: The species doesn't stop at our reservation border, it crosses boundaries. It's a community and neighbor and efforts to restore the species it's not just us, it's not just them. We're doing what we're doing, you're doing what you're doing. No. It's all of us doing something to help the species.

Keane: The restoration will not take years, it will not take decades, it will take centuries in order for us to restore this valuable species. So we're in it for the long haul.

Cochrane: We're not going to see the results from the work we're doing Ourselves. And, you know, to be doing nothing would be would be giving up without trying. We owe it to our grandkids to make sure we're doing something.

Whitebark pine is teaching us something that could change the outlook for other species.

Six: I think this tree really does have some potential to move into a very different future, but we've got to keep our other forests from turning into ghosts forests as well.

This one tree on top of a mountain is giving us a view of the challenges that will echo across ecosystems. And also, some of the solutions.