

Patrick Shults (00:06):

Welcome to the Forest Over Story podcast. This podcast explores forest stewardship in the Pacific Northwest, helping landowners and professionals gain new insights and information in the field of forest management. The forest over story is a product of the Washington State University Extension Forestry Program and it's supported by the Washington Department of Natural Resources and the Society of American Foresters.

Kevin Zobrist (00:30):

Hello listeners. Welcome to the Forest Overstory podcast. We're glad to have you listening today. My name is Kevin Rist and I'm a professor and extension forester with Washington State University and I'll be your host for this episode. Today we have three guests with us from the Washington Working Group or Swiss Needle Cast, so we're going to be discussing an important disease of Douglas Fir. I'm going to turn things over to our three guests, Brett, Adam, and Bernard to introduce yourselves and we'll get going.

Brett Morrisette (01:03):

I'm Brett Morris with the Washington Swiss Needle Cast working group. Yeah, welcome.

Bernard Borman (01:10):

Hello, I'm Bernard Borman. I'm a professor at the University of Washington School of Environmental and Forest Science and I'm also the director of the Olympic Natural Resources Center in Forks, Washington.

Adam Carson (01:25):

I'm Adam Carson. I am the associate director of the Swiss Newcast Cooperative, which is based out of Oregon State University.

Kevin Zobrist (01:33):

Well, welcome to all of you. First of all, tell me a little bit about the Washington Working Group for Swiss Needle cast. Who's involved and what do you do?

Bernard Borman (01:44):

I'll take a crack at that. This is an effort that's been funded by the Washington legislature starting about four years ago, and it's a collaboration between the University of Washington and the Department of Natural Resources, Washington Department of National Resources, various elements including the forest resiliency division, forest pathologists, also the Olympic experimental state forest and various upland foresters from around the different DNR regions. We have a strong linkage to the Oregon State University needle cast cooperative effort through many of our members and we rely heavily on them for expertise and guidance. We seek membership in our working group from both federal and state foresters. Also private industry foresters and small woodland owners. We have something like 50 members and we tend to have a annual field trip and workshop of some sort. Let's just say Brett is our coordinator and perhaps he wants to add to my description.

Brett Morrisette (02:57):

Yeah, thank you Bernard. One of our goals is to get the word out about Swiss needle cast to the small forest landowners that may not even know it exists. They might just think, oh, I've got bad trees, cut 'em down, plant dug fur again, and then in 10 or 20 years they've got bad trees again. Let 'em know that this is a disease that's out on the landscape, it's native to North America, but has gotten causing more problems in the forestry sector since the early 1990s. Maybe Adam's got some stuff to add as well.

Adam Carson ([03:29](#)):

Well, in the working group particularly, I don't have a lot to add. I'm sort of associated by proxy. Most of the research that I do is in Oregon, but I do have some research plots in Washington as well.

Kevin Zobrist ([03:41](#)):

If it's native to North America, why do they call it Swiss needle cast?

Adam Carson ([03:47](#)):

It's named after its place of discovery this first reported in Switzerland in 1925, although it is as you mentioned, native to the Pacific Northwest.

Bernard Borman ([03:57](#)):

I think it's important to also begin by saying that this is a disease that only occurs in Douglas fir trees and it was Douglas fir trees that had been planted in Switzerland that showed the symptoms and where the organism was discovered. If I have that right Adam,

Adam Carson ([04:16](#)):

You do exactly. Yeah. It was moved there for lack of a better term. That's exactly correct, and then it did spread through Europe from about 1927 to 1939.

Kevin Zobrist ([04:26](#)):

So what is this organism? It's a fungus, right?

Adam Carson ([04:30](#)):

This is a fungus. This is an ASCO mce fungal pathogen. Its mouthful name as Ophail crasis gu, and it's actually considered an endophyte but it causes disease when it produces its rooting body, which are called pseudo theia that emerge the stoma, which are the gas exchange area on the bottom of the needles and this causes carbon starvation, basically prevents gas exchange, carbon starvation leading to needle loss and subsequent growth loss.

Kevin Zobrist ([04:59](#)):

What happened in the 1990s that brought this to the forefront?

Adam Carson ([05:04](#)):

I think that they started seeing this needle loss in Oregon in the 1980s and sort of raised the red flag on what's going on and this was happening in Douglas fir plantations and that led to a whole bunch of research and much of it was done at Oregon State University to figure out what was causing this disease even though they knew it was Swiss needle ca had been discovered in the area already confirming that that was the cause of the needle loss led to a lot of research projects

Bernard Borman ([05:31](#)):

Being the oldest here, I can add a little bit. I moved to Corvallis, Oregon in 1989 from Alaska and I remember when I first arrived there was a big uproar. People driving over the coast were seeing these areas of red needles and needle loss and people were flying small planes around and it was considered a huge crisis, which I think then perhaps a few years before that had facilitated or Oregon State University decided to form this cooperative research group to address this question and they quickly jumped on it

and have very meticulously tracked the changes in the distribution of the infected trees largely along the Oregon coast, but extending into Washington for some years as well and have been able to look at the changes over time, which is extremely valuable. I think just to reiterate, this organism has probably been with Douglas Fir for many, many thousands of years and has certainly affected Douglas fir from time to time. There's some good work done by Henry Lee and others reconstructing growth of Douglas Fir and comparing it to growth of hemlock and they do see incidences of needle cast that extend 50 years ago and longer, but this really major landscape appearance was quite shocking in the beginning and it's still pretty dramatic in a lot of places.

Kevin Zobrist ([07:11](#)):

It sounds like this is primarily a coastal issue, is that correct?

Adam Carson ([07:16](#)):

Yes. Coastal proximity is strongly correlated with disease pressure and symptoms and within 25 miles or so, it's generally considered kind of assisting the past BeltLine. It is found in the valley and in the foothills of the cascades, but the disease seems to be not as significant. Foliage retention is greater. So I guess I should back up and say that's one way that we assess disease with this patho system is foliage retention. As I mentioned, the pseudo theia occlude the stoma and that causes the tree to respond by drop in the needle. So one metric of assessing disease is foliage retention, and then another way is pseudo these occlusion, so literally occurrence of pseudo and then percent of occlusion. So anyway, it is found in the foothills and in the valley, like I was saying, some more inland areas, but the disease seems to be quite a bit less and that we believe is pretty strongly correlated with environmental condition.

Bernard Borman ([08:13](#)):

I think we could also add that needle is I think most prominent in the northern Oregon coast into the southwest Washington coast. It's less of an issue as I understand it, moving south into California and it extends, it's now known to extend well into British Columbia, so it has quite a range and we're seeing some needle retention issues in trees near Bellingham, which is close to the water but not the ocean. So we're not really sure being close to the water. It probably suggests a climatic element, the extent to which the fungi can grow, particularly in the summer months. Perhaps it's simply growing too much and clogging these spores in the needles. I also think that we definitely should mention that it attacks the oldest needles first. It rarely has any effect on the current year needles, and for those of you who are not familiar, most conifers carry many years of needles on their tree and it could be six, seven even more in some conifers, and when needle cast is affecting a Douglas fir tree, those older needle classes start dropping off and if you get down to having only one or two years of needles, that's when the growth of the tree starts to decline fairly sharply.

([09:43](#)):

And it's the simple story, as Adam said, carbon starvation, the photosynthesis goes down because there's less leaf area, less ability to capture the incoming solar radiation.

Kevin Zobrist ([09:57](#)):

But that's a great segue into signs and symptoms of this disease in addition to loss of the older needles, which are the inner needles. What else should landowners look for?

Adam Carson ([10:11](#)):

It is a good segue. I want to add to what Bernard was saying in that yes, you won't see symptoms in this current year's needles and that's because just a little background on what's going on. The pathogen releases its spores in the springtime, which land on the current year foliage and germinate, and over the

course of the next year the mycelium, the pha colonize the intercellular tissue of the needles and then in the following spring we'll produce the pseudo theia. So only in the second year and older needles will you see symptoms, but in addition to needle loss, the needles will become chlorosis, you will have thin crowns. Mortality is pretty uncommon. It can happen, but it's pretty uncommon. But really the characteristic signs is a kind of chlorotic yellow browning foliage and loss of needles leading to thin crowns.

Kevin Zobrist ([11:05](#)):

Are there other agents or conditions that produce similar symptoms?

Adam Carson ([11:10](#)):

This might be a good time to mention the Swiss cast cos website because we have a whole page on signs and symptoms and that's at s ncc dot forestry dot Oregon state.edu and there's a whole page on identifying it and the other pathogens that are what we might call lookalikes. So there is one called rab decline, which sort of looks similar but it's more of a dramatic oranges sort of color. And if you look at the images on the webpage, you can see the differences between that and Swiss needle cast. The other one that comes to mind is called red needle cast, which is caused by a water mold called oph that tends to have sort of more of a flare up sort of situation where a lot of needles will drop, but then the trees will bounce back and it seems to be in isolated pockets, whereas Swiss needle casts, if you have Swiss needle casts in a stand or in a general area, you're likely to have it on all of the dug fur trees.

Kevin Zobrist ([12:12](#)):

So with Swiss needle cast, my understanding is that on the undersides of affected needles, there'll be kind of a soy looking appearance, is that correct?

Adam Carson ([12:22](#)):

You might be referring to the actual pseudo theia and they can be seen with the naked eye, but often they're very difficult to see with the naked eye. If the disease is really significant, you might be able to see 'em. They look like little black dots like little pepper, but really a hand lens is the best way to check the underside of the needles to see if you have pseudo. I should also mention that you are really only going to see those in the spring and in the summer if there's some precipitation but won't see pseudo or really theosis in the fall or the winter. Really, it's really a springtime summer event

Brett Morrisette ([12:58](#)):

And I'll mention that there's also pictures of the pseudo on the co-op website as well.

Kevin Zobrist ([13:05](#)):

In terms of impacts, I've heard you talk about growth loss but maybe not mortality. I can see this would have a big impact on timber production for landowners growing timber for harvest. What should small forest landowners be concerned about?

Bernard Borman ([13:22](#)):

I think it's important to learn more about where your land is, how close is it through the ocean, what's the potential for there to be a problem with growing Douglas fir in that location you have the option of planting other species such as hemlock or alder or cedar, which are completely unaffected by this disease, so that's an option to consider. You're right that economically, if Doug fur can only carry a couple years of needles, your growth rate will be substantially lower than it would've been if there was no needle cast

effect and over a rotation that may either extend your rotation or reduce the growth, the volume when you go to harvest it, there's some thoughts that it may even affect wood quality. So those are very real economic consequences, especially when you think of a whole region. It adds up to millions and millions of dollars.

Adam Carson ([14:20](#)):

If I can add a couple things, just a little background on this because obviously when this started to happen, this was a big concern. In the late mid 1990s, one of the first things was done was by McGuire and sips. Another research co-op at Oregon State University in association with the Swiss Newcast coop was to set up a network of plots to assess growth loss and they found this was in northwest Oregon, but they found that growth loss was reaching up to 50% in some of the stands that were most severely impacted. However, since then, the Swiss Noodle cast Cooperative has installed a larger, much larger permanent research plot network and that extends all the way down to the border of California up into Washington. We have eight plots in Washington. We found that the highest gross losses were maxing out at about 35% in heavily infected stands. I think that's partly because we're including some of those areas that are further south, as Bernard was mentioning, where the disease tends to be a little less, whereas that first flat network that was installed in the nineties was really concentrated in northwest Oregon where the disease is pretty prominent year after year. But either way, the mean from the last five year measurement of our plot network was around 30%, which is pretty significant in terms of timber production.

Kevin Zobrist ([15:38](#)):

I'm sure that at this point our listeners are wondering, what do I do about this? Is there a treatment? Should I spray fungicide? Talk a little bit about response.

Bernard Borman ([15:49](#)):

There have been trials of using fungicides and as I understand it, they're quite effective in reducing the amount of the disease, but economically speaking and ecologically speaking, widespread use of fungicide does not seem to be remotely feasible for most landowners. So that option does not appear to be available. The best option it would seem to me is just choosing your species correctly. Are you planting Douglas fir in a place where it's at risk to not grow well? And at a minimum, if you really want to plant Douglas F, you might want to enter plant with other species just in case the Douglas F is greatly affected.

Brett Morrisette ([16:38](#)):

There are also some groups looking at some Douglas F families that are growing in conjunction with other Douglas Spur or one of the families is doing better than the other. So you might have an option talking to some larger landowners, see if they're having any luck with family trials and see if you might be able to get some of that stock as a small landowner be part of their study.

Kevin Zobrist ([17:04](#)):

For landowners who already have their Douglas planted and discover Swiss needle cast, do you have a recommended option if they're growing for harvest, should they just wait it out the rotation age? If they're not growing for harvest, should they take 'em out right away and replace with other species or just let it go and do its thing? What are some good options?

Adam Carson ([17:26](#)):

It might be a good time for me to mention that on the Swiss needle cast cooperatives website, there is a Swiss needle casts cultural decision guide, which goes through some of the things we're talking about, fungicides, pre-commercial thinning, which by the way has not been shown to be effective for controlling

or reducing sustainable cast a alternative species, which Bernard touched on, which is a huge one and it's one that we really encourage and that really, again, to your point, goes to replanting really. But in terms of thinning and pre-commercial thinning and when to scrap your losses, the decision guide does go into that and I think the answer has to do with how bad the disease is on your property in terms of what can you do. And I do agree with Bernard about the fungicide. It can control the disease, but it's very expensive and it's been shown to be not effective as soon as you stop treating. So as soon as you stop the fungicides, the disease pressure comes right back.

Bernard Borman ([18:21](#)):

I was just going to add that the Washington work group has been working on an economic calculator where a landowner can enter information about their stand and information about the disease and it can help them run scenarios to help them make decisions about what to do. I also want to add that I think one of the bigger problems we have is that we've gotten used to focusing so much on Douglas throughout the whole region, that there's so many resources to landowners to learn how to grow Douglas fir, where to buy Douglas fir seedlings and all of that. And there's far less information about growing alders or hemlock. It's harder to get the seedlings to do that as well. And so I think a lot of the decision making by many small woodland owners is driven by lack of information and lack of being connected to resources such as those that Washington State University provides, and I think those are a valuable place to look for that kind of information and take a risk by growing some alternative species or species mixtures.

Brett Morrisette ([19:31](#)):

And lemme follow up with if the small landowner does find that they have Douglas or Swiss needle cast issues, they should start looking at nurseries and putting in an order for a non Douglas seedling stock so that if they are going to decide to slash the stand, they have something other than the default Douglas fir for the area to go to the nursery and get.

Bernard Borman ([19:56](#)):

We should also mention the Oregon State University Hardwood Silva Culture co-op, which focuses on a lot of hardwoods, but especially alder, they have wealth of information as well.

Kevin Zobrist ([20:08](#)):

So it sounds like for small forest landowners, number one thing is to get educated about the disease, but then it sounds like the two most viable options are either tolerate it, live with it or switch to a non Douglas first species. So what does the future hold for Swiss needle cast and for your working group wondering is there new research on the horizon that might provide some additional insights or treatment options or do you have any expectations maybe about how the disease process will change with climate change and things getting

Adam Carson ([20:48](#)):

All great questions. I'll take a stab at a couple of 'em, but Brett Bernard, please jump in. I will mention something about the lifecycle of the pathogen and we think that an important part of what causes more disease is more mild winter temperatures, which is allowing more heel growth inside the needle and so that in mind, I think it's pretty easy to postulate or reasonable to postulate that climate change and global temperatures and increasing warmer temperatures could lead to more disease in the landscape and more disease at higher latitudes. I know that some of the things we're interested in looking at, and this is also Bernard was touching on this too, is what to do and you have it and there's a lot of resources on how to purchase seed stock and things like that, but one thing I know that's been talked about at least in our co-op

and well with the advisory board is pre-commercial thinning regimens under varying disease, Swiss no cast pressure in mixed ends.

(21:45):

So if you have dug fur and you have hemlock or cedar, at what point do you decide to keep your dug fur and scrap your alternate species or the other way around if your disease pressure is really bad and your dug fur look miserable, when do you scrap your dog fur and keep your alternate species? That's one project that's been kicked around and I think that's worth looking at. There's also talk about doing spore trapping to look at where the disease is found in the landscape and how the inoculum load is moving and then correlating that with weather conditions to see how the environment is driving the reproduction of the pathogen.

Bernard Borman (22:23):

I completely agree with what Adam said about mixed stands in particular. I think in this region we've tended to grow pure species stands and in this time of climate change and other uncertainties, there's some reduction in the risk if you move to a mixture because you may not know which species will do the best, and so if you have two species and you can wait and see which one is doing better, you're in a far better place than taking a risk of planting only a single species. I'm personally interested in the role of fog. It seems when you look at the maps of needle cast effect, it's common to see more of an effect on hillsides that face out particularly towards the Pacific Ocean and around the backside of some hills. Sometimes there's less. I don't know if anyone's done a really good geographic analysis of that, but that at least it comes across to me and what I have done some research in the past on rainwater and fog water chemistry, we studied this up and down the west coast and the conclusion was really quite interesting are adapted to fog in that as a fog is moving through the air and if you have say a beard, you'll notice at times your beard can get wet without anything else getting wet.

(23:42):

And it's because the fog is cloud of small droplets in that certain size of the droplet and the size of your beard or the needle, there's more cloud water droplets that impact on these linear features. Trees can get a lot of water through that fog. What we studied was chemistry, and it turns out that fog coming off the Pacific Ocean drives from wave action. Every time you see a white cap, there's a water being turned over and little droplets are coming out into the air and those collect together to create sea fog. Most of the rain that we see tends to come from evaporation, whether it's the evaporation from a tree or evaporation from a snowbank. What we found was the fog water had three times the nutrient load of rainwater, and so really makes a difference over year and the amount of nutrients that are coming into forests that are affected by fog. And I'm wondering if those nutrients are somehow maybe causing the fungi to grow too fast or grow out of balance perhaps.

Adam Carson (24:49):

Well, Bernard, it's a fun hypothesis and I guess since you brought it up, I'll just mention a couple things. I don't know about the nutrients, but I do know that Skylon who is at Oregon State University, she has a project right now where she's looking at Swiss needle cast within the fog belt and outside of the fog belt, and her preliminary results are already showing that that's much more Swiss needle cast within the fog belt. Then I also mentioned that I've had discussions with a couple people about trying to capture Swiss needle cast or NOFA fail crispus spores from fog to see if fog is acting as a dispersal unit, but it's pretty tricky thing to do as it turns out.

Kevin Zobrist (25:28):

Well, it sounds like we still have many things to learn about this disease and maybe some exciting new discoveries on the horizon. Any final thoughts before we wrap up here?

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Adam Carson ([25:40](#)):

I want to mention something because I think it's relevant to anyone, but I just want to point out that both Oregon and Washington conduct biannual area detection surveys for Swiss needle cast and produce a digital map of these symptomatic areas. And these are available on the internet. And if you're a small landowner, one thing you could do is look at some of these aerial detection surveys and just see if your property is within one of these symptomatic areas.

Bernard Borman ([26:06](#)):

I was going to mention that the Olympic Natural Resources Center webpage also has some needle cast information.

Kevin Zobrist ([26:14](#)):

Lots of good resources out there. All right, well thank you gentlemen. This has been very interesting and educational. I have learned quite a bit here about Swiss needle cast and listeners, thank you for tuning in for this episode and we look forward to having you again on the next episode of the Forest Overstory podcast.