Genomics in Society
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# Clip #2 Transcript: About Dr. Singh's Two Main Projects & Some Findings

I'm working on two major projects—and they're both within the bigger CoAdapTree group which is understanding convergence and adaptation in conifers. My first project is looking at the DNA sequences of five different conifer species—so we've got two different kinds of pines [lodgepole pine, jack pine], we've got a larch [western larch], we've got a fir [Douglas-fir], we've got a spruce [interior spruce]—and we have sampled DNA from populations from the East to the West coast of Canada, within the bounds of what their [the tree species] **natural distribution** is like. And what we are trying to do is correlate DNA changes in these species to adaptation to the environment.

So we would take the DNA sequence, we would **cull** different **mutations** in the DNA and try to correlate those with variation in the environment, such as let's say if one region of the country was really cold and the other was warmer, if there was a lot of precipitation in one region and not the other, we would try to correlate these mutations essentially with these environments to see if there is a significant difference. And if yes, are these mutations in regions of the **genome** that are responsible for this adaptation to this climate.

We want **candidate regions** in the genome that may be responsible for adaptation to the environment because this could have huge implications for how they might respond to climate change in the future and how we could **selectively grow** trees that would be able to deal with climate change in the future.

So that's my first project, and the second project is more related to disease in these conifers. I'm working on how a disease called **Swiss Needle Cast** in Douglas-fir which causes them to turn that like reddish-brown colour and it's not autumn, it's just them being diseased, and these needles just fall off the trees and this is obviously not good for the tree. So what we are trying to understand is that there are certain populations of these trees that are actually **resistant** or they can **tolerate** this fungus on them and what we are trying to do is use the same sort of genetic approach to identify the regions in the genome that might help trees resist or tolerate these diseases.

And yet, again this is also linked not just to the trees and tree health, this is also linked to as the climate changes we know that there is a relationship between how bad the disease is; so, how much these fungi can affect these trees, and the environment. So, we know that when it's more humid or warmer, we know that the disease gets worse in certain situations. So that's my second project. I guess the overall theme is to understand how climate change might affect the conifers in Canada and their health.

Already what we've seen in the conifer species that we are working on is that we are indeed finding regions in the genome that are associated with, let's say especially cold-tolerance—that's a big one that pops out in terms of adaptation—that's a very strong one and that's more from the populations ranging north to south, and then we've also got species that range more from east to west and there we have more association with precipitation and evaporation related to climates. This is very cool because we would be able to predict which populations might survive if we know what the regions in the genome that are allowing these adaptions we could actually **genotype**, which means that we can check the DNA of a whole bunch of trees and say we know this tree has this particular mutation or this **allele** (which is different types of **polymorphisms**); we would be able to predict whether it would be able to survive or not if the climate changes in let's say in a warmer way or colder way.