Genomics in Society
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Dr. Yeaman Clip #3: Novelty and Climate Change

These species [lodgepole pine, interior spruce, jack pine, Douglas-fir, and western larch] were chosen for a number of reasons; they're species of great economic importance—interior spruce and lodgepole pine are the most planted species for forestry uses in Western Canada. They're also just tremendously important for **ecosystem values** and for recreation—I mean these are the forests that we all live and work around and so they have tremendous value for people on many different fronts. And likewise, western larch and Douglas-fir and jack pine are also really dominant trees, these are some of the most common trees making up our montane and boreal forests in Canada. For anybody that appreciates forests as being part of their life, these trees are really cornerstones of those forests.

One thing that was really neat about what we did was starting to take this comparison. People had often studied within a single species patterns of adaptation to environment. And I think what was kind of novel or interesting about what we've started to do was taking this more comparative approach and seeing do we see the same patterns in different species and what does that mean? If we don't see the same patterns, it's almost like there's lots of recipes in Mother Nature's cookbook to do things lots of different ways, each species figures it out on their own. Whereas if we see the same thing in every species we look at, that implies that evolution is actually quite constrained and there's not very many different ways to solve the same problem. That's a really fundamentally interesting question about how evolution works and how nature works, and we actually don't know the answer yet. So, it's really fun to be pushing up against those frontiers of knowledge and trying to figure out, you know, is evolution fundamentally a very flexible process? Or is it a process that tends to follow the same kinds of channels at the genomic level over and over again?

A lot of the work that myself and my colleagues have been working on and collaborators is pushing the bounds of that understanding and trying to really answer those kinds of fundamental questions. We're certainly not the only ones, but it's been really fun to be exploring that frontier.

The main ones [**adaptive traits**] we really study mechanistically right now are cold and heat and then drought. But there definitely are people in other labs that look at things like serpentine soils—so soils that have very extreme characteristics and heavy metals or strange balances in the minerals that aren't usually found and so only particular kinds of plants can thrive on those kinds of soils. So you can see people using genomics to understand adaptation to those kinds of soils as well.

So, almost really, if you can think about something that causes a stress for life to deal with, you can use genomics to figure out how things are dealing with that stress. Sometimes there's not going to be a genetic basis to that response, sometimes there won't actually be adaptation, but you can look for it. Foresters are currently planting western larch further north than it used to be, and that's just because they're seeing that it's really productive given the change in climate and it makes sense to kind of have these **mixed plantings** and keep western larch in that.

So we're already seeing the forestry community adjusting its practices to accommodate climate change, and certainly almost anywhere you look, people have actually noticed that you can find detectable changes in, say, flowering time or in the way that different plants and animals are adjusting to climate change—people are studying this and finding evidence of this all over the place. So, it's happening right now and we're detecting changes of this nature as we speak.

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