

The Vandal Theory: Episode 1

How is climate change affecting Idaho's natural landscapes?

Leigh Cooper: Hello, everyone, and welcome to “The Vandal Theory,” a podcast about science and research from the University of Idaho in Moscow. My name is Leigh Cooper, and I’m a science writer here at U of I. Over the next year, I will be hosting a set of podcasts that investigate how climate change is affecting Idaho. Now, we know that the earth’s climate is warming, but the local effects of climate change vary from place to place. For example, Alaska has to deal with melting permafrost while coastal cities are keeping a close eye on rising sea levels. But what about Idaho? Idahoans don’t have to worry about disappearing beachfront property but what about changes to the amount of forest fire we’re seeing, the length of agricultural growing seasons, and our recreational opportunities? To answer these questions, I’ll be talking to researchers from U of I about how climate change is altering Idaho’s ecosystems and influencing our lives.

Today, we’re going to talk about how climate change affects Idaho’s natural landscapes. Idaho stretches across more than 80,000 square miles and hosts a diverse set of ecosystems ranging from the sagebrush steppe in the south to the forests of the north. These different ecosystems aren’t necessarily going to respond to climate change to the same extent or in the same way. To learn more about this, I’ve gathered four of U of I’s faculty members, all of whom are experts on climate change in Idaho, in a recording studio at U of I’s library. Can you all introduce yourselves?

John Abatzoglou: My name is John Abatzoglou. I’m an associate professor of climatology in the Department of Geography here at the University of Idaho.

Tim Link: This is Tim Link, a professor of hydrology in the Department of Forest, Rangeland and Fire Sciences.

Penny Morgan: Hello, I’m a fire ecologist. My name is Penny Morgan. I am in the Forest, Rangeland and Fire Sciences Department.

Ryan Long: I’m Ryan Long. I’m an assistant professor in the Department of Fish and Wildlife Sciences here at the University of Idaho.

Cooper: Excellent, well thank you all for being here today. Let’s dive right in, shall we? Temperature is one of the big indicators of climate change. John, can you talk us through whether our average temperatures are rising in Idaho?

Abatzoglou: Temperatures are changing here in Idaho. And since around 1900 or so temperatures statewide have warmed by about two to two and a half degrees Fahrenheit here, most of that warming over the past 50 years or so. So, the warming that we’re seeing in Idaho very much fits the pattern that we see globally, very much fits the pattern of a warming planet.

Cooper: Yeah, but our summer and winter temperatures vary a bunch, right? In the West, it's not uncommon to have a mild winter or hot summer, so how do you know that temperatures are rising overall?

Abatzoglou: We have good records of temperature. We have other proxy records, things that are not necessarily recorded in thermometers. Things involving the timing of when the flowers bloom. To the snow pack. To fish and wildlife migration. And they all paint the picture of a warming region. A few years ago, a couple of grad students here at the university put together a list of climate indicators for the state that sort of covered everything from thermometers to the timing of flower blooming. Temperature-sensitive flowers, so lilacs, that we typically point to as an indicator of spring, they have also been blooming about a week or two earlier. We've seen spring snowmelt happening earlier in the year as well. We've also seen the fire season lasting substantially longer.

Cooper: It seems like every other time I pick up the newspaper I'm reading about some sort of extreme temperature event. Should we expect to see an uptick in the number of really hot days or really cold days that Idaho experiences each year?

Abatzoglou: We have seen a significant decline in the frequency of extremely cold days here in Idaho and the broader Northwest. That sounds like a good thing, but extremely cold days end up having an effect on bark beetle populations. Basically, it reduces their overwinter survival rates. We've seen some increase in the warmest days of the year, heat waves and whatnot. Those aren't a huge deal in Idaho at least in terms of, you know, human mortality. They probably have some more profound impacts when it comes to the natural systems.

Cooper: So that's the temperature story, but what about precipitation? Tim, can you help me out here? Is precipitation going up, down, or staying the same?

Link: The expectation is that the northern part of the states and into southern Canada may actually see an increase in precipitation. And the southern part of the state may remain drier. But, in general, we're not actually observing total precipitation declining.

Cooper: Well, even though the amount of precipitation in Idaho isn't changing, I'm guessing that doesn't mean that our water resources are in the clear.

Link: Not exactly. What is happening is that we're seeing an increased fraction of rain relative to snow. Snow actually is a natural reservoir that stores a lot of water and then gradually modulates the release of it. And a lot of times people refer to mountains as the water towers of the world, and that's actually a pretty good analogy, because again they just naturally store water and then release it during the dry season when we actually need it the most.

Morgan: It seems like the shoulder seasons are getting more affected than the middle of the winter.

Link: Yeah, exactly. That's what's actually happening with our snowpack. We're getting less snow and more rain occurring in those shoulder seasons.

Cooper: It sounds like anything that results in more of our precipitation falling as rain in the winter means that we're going to have less water come summer.

Abatzoglou: One thing we can add to that is that across much of Idaho we receive the bulk of our precipitation in our cool season which is super important. And our summers are relatively dry. And we expect actually under climate change to see slightly wetter winters and slightly drier summers. So that actually puts even more of an onus on our snowpack to store water because that dry season there is pretty important and that infiltrates down to water resources for humans, water resources for fish and wildlife, and water resources for our ecology.

Cooper: So, summer water is important, but I'm also a cross-country skier. In general, what's happening to my ski season?

Link: What's happening is that basically snow packs are developing later in the year. They're developing to a lesser depth and then likewise the timing that snow melts is occurring earlier. The other thing though that makes it a little bit more complicated in terms of winter recreation is also the quality of the snow pack. As you get warmer conditions you get more freeze-thaw cycles which leads to icier conditions and less of that really light fluffy powder that skiers really appreciate.

Cooper: I had one last question concerning water. Since the mountains are running out of snowpack earlier in the year, what's happens to rivers?

Link: When you get into the drier months, such as July and August, the low flows—and this has actually been demonstrated in the scientific literature—is that the low flows are actually declining. And it turns out that the low flows are actually declining more in some of the driest years. That is one particular concern both for water-based recreation and for fish that depend on those late season flows to survive and be healthy.

Cooper: So, let's move out of the water and onto dry land. Penny, how are our forests responding to changing patterns of precipitation and warming temperatures?

Morgan: Well, first, I want to talk a little bit about fires. People are really concerned about what the future of wildfires will be. Dry and thirsty forests are more vulnerable to bark beetles and to fires, and what we're seeing, especially with the warmer springs that John mentioned, is that the fire season in Idaho, one of our students showed that it's thirty-two days longer since 1984. And that helps to exemplify why we're seeing so many large fires.

Abatzoglou: In 2015, here across the northwest and in Idaho, we had pretty normal precipitation, but snow pack was abysmal. The water that did fall ran off pretty early in the year. And then that was followed by a wicked hot and dry summer. And that set the stage for a pretty nasty fire season. And those sorts of combinations, we expect to see more often under climate change. A group of us did a study looking at how often years like that might occur in the future for Washington State, and we found that many of those conditions that occurred in 2015. They're

pretty unusual in the context of the historical record, but they'll be basically like a one-out-of-every-two-year type of deal by the middle portion of the 21st century.

Cooper: So, climate change is dehydrating our trees and making them more vulnerable to fire and beetles. What else is going on in our forests?

Morgan: There are direct effects as well. If trees post-fire are trying to establish in a dryer summer, they are less likely to grow successfully. We're seeing less and less successful tree regeneration after these large fires. If the fire created really large patches and killed most of the trees within those large patches, then the seed source is not there, and it's gonna be very difficult for the trees to regenerate on their own.

Cooper: But we've always had fire in the West. In fact, quite a few species of animals and plants rely on fire for survival. So, how big of a deal are these fires to the landscape?

Morgan: Fires are often a catalysis for change. One of the things that we've found by going out and sampling on 52 large fires across Idaho and part of Montana and Northwestern Wyoming is that 30 to 50 percent of the driest forests are not coming back after fire. They will switch from forest to non-forests.

Cooper: And what about Idaho's rangelands?

Morgan: I'm glad you brought up rangelands. So, the shrub lands, the grasslands, and the woodlands cover more than half of Idaho. Many of the rangelands are changing. Some of them are changing because of fires. And let me just give you what I call a Goldilocks example. In sagebrush, we're seeing some areas that have too much fire and others that have not enough. The ones that have too much fire, we often have invasive annual grasses like cheatgrass. They grow so quickly that they can outcompete the native grasses and provide lots of fuel for the next fire, and fuel fires so frequency that the sagebrush and the many sagebrush-obligate birds like sage grouse can't get what they need. Just go up a little bit higher in elevation, there is too little fire. We have lots of places where trees are encroaching into sagebrush habitats. And that, with less fire, we're having less and less sagebrush. We don't have many places where it's just right.

Cooper: And, of course, fire affects humans as well as the plants and wildfire in Idaho.

Morgan: Fire presents a lot of challenges to us. And as we think about the future, we are going to have to adapt to both more fires, especially more large fires, and to smoke as climate changes. The annual area burned is projected to increase by two to five times by the middle of this century and that will affect us in Idaho. Smoke is a significant health hazard to everybody when it's breathed deep into our lungs, and one in four people are sensitive to smoke.

Cooper: So far, we haven't talked much about Idaho wildlife, but I'd expect that any changes to Idaho's climate and ecosystems would influence Idaho's animals. Can you weigh in on that, Ryan?

Long: So, I think it's useful to think of the effects of climate change or climate in general on wildlife in the same couple of broad categories that Penny talked about with forests. There's direct effects, where changes in temperature or precipitation can directly influence the survival or reproductive success of a wildlife species. And then there's indirect effects, where climate change causes changes in the distribution or the abundance or maybe the quality of forage resources or things along those lines. And then those changes in vegetation in turn are what affect survival and reproductive successes of wildlife. Thinking about direct effects of climate on wildlife, animals that are sensitive to heat are going to be in a position where they might have to spend more of their time in the shade. They might have to limit their distributions to where they have access to water resources that are harder to come by.

Cooper: Are there any species of animals in Idaho that are struggling with climate change? Or, I guess, for that matter benefiting from climate change?

Long: If you've got species like a mule deer, for example, that's relatively small-bodied, doesn't really deal so well with cold temperatures, doesn't really deal so well with deep snow packs. Not this past winter but the one before, we had incredible snowpack throughout a lot of different areas in the west and as a result of that some mule deer populations took a huge hit. So, places like Wyoming, parts of southeastern Idaho, 40, 50 percent of some of those mule deer populations died over winter. So that's a species that's likely to have some potential benefit from a situation where you have warmer winters, less snowpack. But think about a species like moose. So, a moose is really large-bodied animal. Large-body size translates into dealing with cold temperatures really well, but not so good with dealing with warmer temperatures. They have thick fur, long legs to deal with deep snowpack. Warmer winters can actually be pretty problematic for a species like moose. And there's evidence that here in Idaho and other places that are close to the southern extent of the range, is that we are seeing some of those kind of negative direct effects of warmer winters in particular on moose populations.

Cooper: Earlier you mentioned that there were indirect effects of climate change like food availability. Do you have any examples along those lines?

Long: If you're a deer or if you're an elk or a moose or anything along those lines, you want to give birth at a time of year when there's a lot of forage around. So, breeding seasons are timed in such a way that when those offspring are born in the spring, those resources are available. The thing that is interesting to consider though is that the cue that animals tune into in the fall, which is when most of the breeding seasons are—it's day length. Day length is not changing with climate change, obviously. And, so, if animals are still using that cue to time their breeding seasons, but we're having earlier spring green up, then you start to see this sort of mismatch between when offspring are born in the spring and when the peak in resource availability for supporting those offspring are.

Cooper: Penny mentioned that, as fires become more frequent, cheatgrass is doing really, really well in sagebrush country. But are we seeing any animals invading due to climate change?

Long: In general, larger-bodied species tend to do better in colder environments. In contrast to that though it's the smaller-bodied species that often have a greater ability to ramp up their

population production really quick. So they have high reproductive rates that do a better job of taking advantage of changes in their environments. Now a lot of invasive species in the wildlife world are smaller-bodied species, rodents and things of that nature. As you're starting to see the climate warm and put pressure on larger-bodied species that have slow lifecycles, they only give birth to one or two offspring every year, it takes them a long time to adapt to those sorts of things. Smaller-bodied species can do really well, and when those smaller-bodied species are invasive that can pose some real problems.

Cooper: Alright, to start to sum things up, I want to ask you one big take-home question. If you grew up in Idaho, should you expect the landscape of your childhood to look different in the future?

Morgan: The forests of Idaho, many of them will still be forests. It depends on fires and insects, and those are going to both be indirect effects of climate. We'll lose forests in some locations, especially those that are already pretty hot and dry where even a small change could make it difficult for trees to establish. It's possible we're going to see different species move as they find the environments in which they can grow successfully. And for some, it may be that they'll go up in elevation. And there are lots of foresters and other managers talking about how do we help those species adapt.

Long: So I think one of the take-home messages with respect to Idaho's wildlife populations is that there are going to be winners and losers. Species that have greater ability to adapt, to change their behavior for example, are likely to manage relatively well. Species that are less behaviorally flexible, are likely to suffer greater consequences as a result of the changes in climate that we're experiencing. You're favorite hunting hot spot or your favorite trout stream from your childhood, 20 years from now may not support the kind of fishery or hunting opportunity that it did when you were a kid. Or it may be better. The most important thing is to just be prepared for those kind of changes.

Cooper: It seems like I need to start mentally prepping for climate change.

Link: It is just something that we are going to have to really accept and deal with. Although we've talked a little bit about snow pack declining and conditions maybe not being as good, there still will be, of course, those wonderful days that are out there and there still will be really good years. And I think, that's something that people need to realize of course and not really view this with a big kind of gloom-and-doom scenario but to realize that people can adapt their behavior to basically maximize and optimize the time that they do have outside.

Morgan: What we do as people can change the outcome of changing climate. Active management of forests either through thinning or prescribed burning can often help protect communities from what we think will be more large fires in the future. Certainly, thinking that we will have fires and planning accordingly is a big part of adapting to more large fires and more smoke as climate changes. And what's been really exciting to me is how many people in rural communities have come together and said, "How are we gonna be a safe as a community?" And so, I think there's a lot of reason for hope as we move forward with a changing climate.

Abatzoglou: Climate change is going to continue. The question is how do we better prepare ourselves as a state, as a community. Here at the University of Idaho and other universities across the region, when we're working on climate change research, we're trying to help the broader community to understand what sort of impacts might occur and what opportunities there may be to adapt and cope with the future. The research that we're doing is to ensure that we go forward as a state, as citizens of the state and continue to enjoy living here.

Cooper: Well, I want to thank you all for being here today. I think you gave our listeners a really good introduction to climate change in Idaho.

Long: Well, thanks for the opportunity, Leigh.

Link: Happy to chat anytime.

Abatzoglou: Thanks for having us.

Morgan: It's really exciting to talk about the science and the data that really matters to the people of our state.

Cooper: I know we talked a lot about science today, but we have barely touched on how climate change affects people's lives in Idaho. For our next podcast, I'll talk with researchers about how climate change influences how we manage Idaho's landscapes. Check back throughout the year to learn more about climate change in Idaho. And if you want to learn more about Idaho's premiere research university, check out our website at uidaho.edu. I'm Leigh Cooper, U of I science writer, and thanks for joining us.

Music: "Young Republicans" by [Steve Combs](#) via freemusicarchive.org ([License](#)).