

GLOBE North America Phenology Campaign:

Dr. Steven Running Q&A Transcript

Dr. Steven Running: My name's Steven Running. I'm an Emeritus Regents professor at the University of Montana.

U.S. GLOBE: What kind of research do you do?

Steven: My specialty was tree physiology and particularly the carbon cycle of plants, and one of the sidelights of understanding the carbon cycle is understanding the seasonality particularly in higher colder latitudes.

My personal research was writing algorithms for the NASA Earth Systems satellites, and so this dormancy in phenology in a way was kind of a sidelight. What we always wanted to understand was, what triggers the spring growing season and in a way, it seems kind of self-evident but it's, to get it measured precisely is trickier than people think. And then to quantify the growing season and then the dormancy and senescence of ecosystems in the fall and how they go into their deep winter dormancy.

U.S. GLOBE: When did you know you wanted to be a scientist?

Steven: I think when I was an undergraduate and I met a guy in a tennis class that was a graduate student in forest ecology. He ended up hiring me for to just be his summer field assistant and that's what got me into seeing I guess forest science in a hands-on way.

U.S. GLOBE: What is the research question you've tried to answer?

Steven: Probably the most important research question I tried in my career to answer, our lab did produce this calculation of daily photosynthesis of the entire world, which is an interesting theoretical concept but it's kind of hard to get your head around. But that is what is the basis for us asking, how strong is the global land carbon sink. In other words how much CO₂ can our forests pull out of the atmosphere to slow down global warming. So when I started climate change wasn't really an active topic yet but understanding the carbon cycle at both a local scale and then ultimately a global scale was coming into vogue. This was early 1980s.

My real effort was, first how do we measure CO₂ uptake from first a plant canopy and ultimately extrapolating globally, and then how do we put this calculation into the context of understanding how much of our CO₂ emissions that land ecosystems actually take back out of the air on our behalf. And that's of course a question that's still ongoing and is still calculated every year.

Part of understanding that carbon sink is in our higher latitudes, it's very seasonal and so that research took me into was understanding that transition from the winter dormant season, we clearly can see the snow melt but then when do the trees bud out. And then of course in the fall when do the senescence start and they go into dormancy. So that was all details of understanding that carbon sink throughout the whole season.

And trying to contrast that with tropical ecosystems. They have almost no seasonal change in temperature, almost no seasonal change in day length. And so you're saying, well is there any seasonal phenology there? Well it turns out down there, it's all about the wet season and dry season. The monsoon rains pick up their photosynthesis rates and then their dry season slows it down. And so in trying to get a global understanding of these carbon sources and sinks, you have to end up working in all these little details on the side, you might say.

U.S. GLOBE: Why is studying phenology important?

Steven: Phenology, and what I'm really referring to more specifically is the budburst and the fall leaf transition, doesn't have quite as clear of a labeling. But we wanted to understand how the climate triggers that and it became clear in physiology a good while ago that two things control the timing of budburst in these temperate plants. And the first is daylength, as the days get shorter and shorter it tells the trees to get ready to drop their leaves, that's exactly where we're at right now here on October 9th. And then the second thing of course is cooler and cooler temperatures with the particular significance of frost. And so when the first frost hits, I think any gardener has seen your tomato plants croak, your grape leaves, your squash leaves, the big leaves full of water that, all that water crystallizes, shatters the cells and those leaves are dead the very next morning. The minute you talk about that you recognize, well in a changing climate is that timing of the first frost and the fall changing.

And of course we looked at that too, so here in Missoula, Montana, date of first frost has become almost a month later. It used to be in mid-September when I first started here 40 years ago. Well it's now October 9th, we have not had a frost yet. And so this then illustrates that the minute you start talking about climate change and planned ecosystems, this seasonal timing phenology turns out to be a real focal point in where the changing climate has very immediate impacts.

We see the same situation in the spring that we used to have our last spring frost something like May 20th. Well now it's May 1st and so the frost-free season is starting earlier. For gardeners with their annual gardens it's great because they can get gardens going earlier. But with native plants that are timed by genetically, they sit around being dormant when the seasonal weather is already woken up.

And so it starts this mismatch between the genetically timed seasonality of budburst and the actual current conditions that we're seeing around the world of warmer springs and earlier dates of the last frost. The native plants that of necessity were pretty conservative about their growth timing, particularly springtime seasonal growth, when those new cells break bud and they're all just full of water, that's what helps them expand and grow, they're exceedingly sensitive to a freezing temperature because they're just full of water. It's like a water balloon.

And so if a native forest that, you know, had lived here for eons has gotten to where their genetics make them very careful and not breaking bud too early, now as the temperatures get warmer quicker other plants from other areas that do have earlier budburst genetics can definitely come in and out compete the natives.

U.S. GLOBE: What equipment or technology do you use in your research?

Steven: Basically all you really need is regular observation, which nowadays they have these automated cameras, Pheno cams, that can take a picture once a day and you don't have to be out there. And then you just need a local weather station so you know absolutely in that vicinity when freezing conditions occurred.

U.S. GLOBE: What is your favorite fall activity?

Steven: [laughing] Well when I'm in town I ride my bike but I'm within minutes of heading to Yellowstone Park because right about now it is absolutely premium. It's about 65 degrees outside, we're just almost at the park getting to where it frosts at night, and I'm hoping it isn't going to be a big crowd. And so I'm going to go through the park with and have lots of room and take my little camper and do a fall campout.