“The Fog and the Redwood” Excerpt Transcript

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IRA FLATOW	This is Science Friday. I'm Ira Flatow. The redwood trees of California-- you know, they are iconic symbols of the Golden State. And if you've stood at the base of one of these ancient giants and you've looked straight up into the canopy, you know the experience can be transformative. But there's one feature that might be just as thought provoking as the Redwood tree in California. Any guess? I'm talking about the fog, hey? If you drive along Route 1, you're bound to be fog bound toward dusk, somewhere along the day. And you may not realize it, but these two famous features of the California coast-- the redwoods and the fog-- are linked together. My next guest has studied their relationship and is here to reveal how the drought and climate change are affecting these towering trees. Todd Dawson is a professor of integrative biology and environmental science policy at the University of California Berkeley. Welcome to Science Friday.
TODD DAWSON	Thank you, happy to be here.
FLATOW	Nice to have you. Tell us, how is rain-- yeah, we know about fog and rain. Is fog different than rain, how they both affect the redwood tree?
DAWSON	Yeah, it really is. I mean, the fog, of course, comes in off of the ocean in a horizontal way. And it's kind of pulled on to shore each night. As the Central Valley of California heats up, the air rises. And when that air rises, of course, it draws the fog banks in where rainfall, of course, comes out of the Gulf of Alaska here in California. And it, of course, falls directly vertically out of the sky. So one form of water is coming down vertically, and the other one's coming in during the summer months horizontally.
FLATOW	But, you know, we kind of think of water as water, you know? Does it affect the tree? Is there something different in one kind of water in the water itself?
DAWSON	Well, you know, the important things about the fog bank are kind of two-fold. A, they come during the summer months when we don't have any rainfall here in California during our Mediterranean climate. And not only do they bring water when they come in off the ocean, they also bring other nutrients that are kind of dissolved in the fog-- things like nitrogen. And we know all plants really require quite a bit of nitrogen to grow. And so they're getting both water and nutrients from the fog mix.

FLATOW	Gosh, I didn't think-- so the fog is sort of fertilizing the plant?
DAWSON	Indeed it is, yeah.
FLATOW	Wow. Does it help the trees grow, if it's sort of a natural fertilizer with the nitrogen in it?
DAWSON	It definitely does. We've published some work where we've shown that this fog that comes in, as I said, you know, it provides both a subsidy of nutrients and a subsidy of water. And it comes during a very, very important time in the year for that tree, during the long summer months when the temperatures are warm. And the growing seasons are long, so these resources are really important for redwood trees.
FLATOW	Now, I read that you conducted a study where you can actually see when the tree was fed by fog or rain. And you do that through the tree rings.
DAWSON	Absolutely. Yeah, it was one of the coolest things. We didn't know if it was going to work. But when we got some great cores out of these trees and we analyzed, actually, different parts of a single year's worth of growth, we could see in the cellulose that's being made by that tree a signature of either winter rainfall at one part of the year or summer fog during the other time of the year.
FLATOW	What's different about the cellulose from one to the other?
DAWSON	Well, the main thing is that cellulose, as we all know, is composed of a bunch of different elements. And some of those elements are carbon, some are hydrogen, and some are oxygen. And the hydrogen and the oxygen in the cellulose come from the water. And we know that, by analyzing sort of the chemical composition of winter rainfall versus summer fog, they carry sort of different fingerprints. And because of that, that gets also locked into the cellulose that's made in that tree ring.
FLATOW	Does the stuff that might come up through the roots have a different composition than what's coming up in the fog?
DAWSON	It can at certain times of the year. Say, for example, if the fog drips into the soil and is being taken up by the roots, then some of that will come in directly up through the root system itself. But one of the other things that we discovered about fog during the summer months is not only can it be taken up by plant root systems, but it can also be directly absorbed through the leaves directly into the canopies.
FLATOW	And I know that California is in its fifth year of a drought. But the coastal redwoods are actually growing at a faster rate. Does that have to do with the fog? Or what was happening there?

DAWSON	Well, we think that in some of the places where coastal redwoods grow-- and that's mostly in the northern part of their range-- they do seem to show an increase in growth. We don't know exactly why that's happening. But one of the hypotheses that's out there that needs to be further tested is that, as the fog has actually declined over the last 60-70 years, the light has actually increased. And it may be that these trees are growing more because there's actually more light for them to grow on because that's what photosynthesis actually requires. But we don't see that growth spurt all places throughout the redwood range. If you go down to the southern part of the redwoods, we see that the growth actually hasn't increased. And it might be because, in that part of the range, it's already a lot warmer. There's less rain input. And there's also less fog input. So it's not universally true that all redwoods are growing better along the coast.
FLATOW	So you're actually seeing the effects of the drought, then, in the southern part of the state?
DAWSON	We see more so in the southern part of the state, and we certainly see it in other parts of the state. So of course you know that there's two redwood trees here in California-- one that grows along the coast and one that grows up in the Sierra Nevada mountains. And the ones in the Sierra Nevada, along with all the other trees that live up there, are the ones that are really feeling the drought. And that's actually where we see not only decreases in tree growth but increases in tree mortality.
FLATOW	Well, we thank you for taking your time to share your knowledge. And good luck in the next 25 years.
DAWSON	All right. Thanks very much, Ira. Pleasure to talk with you.
FLATOW	Thank you very much. Todd Dawson is a professor of integrative biology and environmental science policy at UC Berkeley.