Jeff Marti: [SLIDE 1] Good morning everyone. Can everyone hear me clearly? Just once again, I'm Jeff Marti from the Washington State Department of Ecology, the water resources program. I just wanted to mention that we're a little different than other water agencies across the state. Typically, in the west, your water rights, water allocation agency, is a separate department, or a commission of some sort. And in Washington State, our water rights, water allocation program, we're actually tucked within a larger agency, the Department of Ecology. Which includes our water quality folks, our air quality folks, flood plain protection, more the whole suite of environmental regulation. So, I think I feel pretty lucky to have that structure because I think that helps us integrate a little better with some of these kinds of cross jurisdictional issues.

So, you're probably wondering why they would invite a guy from Washington State to talk about drought. Because we have this reputation as being the moss people. So, last night I just quickly looked up some precipitation figures comparing Olympia, Washington to Fort Collins. I thought it was interesting. Typically, from May 1st to September 30th, Olympia gets 7.37 inches of rain. Fort Collins gets 8.94 inches of rain. So, it's much wetter here in the summer. I don't know how people can stand to live here. I'm guessing that's why there's 25 micro-breweries, or something like that. So, do what you got to do to cope. All right. Come to Olympia, it's sunny, it's awesome. Okay.

I'm going to be talking about lessons for drought planning and response, drawing quite a bit on our lessons from the 2015 drought. Which was probably the worst drought on record for Washington State. A big snow pack drought. And some of the lessons in terms of the limitations, and the benefits of our emergency response model. But I also want to make it very meaningful for the west as a whole, and hopefully some of the other states as well. So, here goes.

[SLIDE 2] First we need some drought 101. There are, by some reports, more than 100 different definitions of drought. It's important to be clear when we're defining drought, because how we define drought defines how the triggers that we use to respond to drought, which then determines when actions are taken by a government, or a water management agency. Or whatever the case is in terms of responding to drought.

And so these are the five major definitions of drought that you see, or the more traditional meteorological precipitation deficit, more a hydrologic definition. A deficit in the volume of water in a river. And there's a new definition that perhaps some of you are familiar with, ecological drought, that's being discussed in the literature. And I see workshops happening in various places, where I think folks like you, more from the ecological side, are starting to kind of, "Well, what does the drought mean in terms of ecological impacts? And how do we best respond to that?" That hasn't quite filtered to the institutional setting, the administrative framework that I work in with yet. Maybe some elements of that. But I'll be interested to see what happens over time.

[SLIDE 3] And there's even new definitions of drought that are developing. Snow drought. And a lot of people scoff when people use the term snow drought. That's not a real drought. But now we even have new flavors of snow drought that are being discussed in the literature. A dry snow drought. That's a snow drought due to a lack of precipitation. Or a warm snow drought, which is a drought due to, essentially, lack of

cold temperature. Lack of snow pack. And that's what we had in 2015 in Washington, was a warm snow drought. And they both have implications for water managers, in terms of seasonal water well building. If had to choose which drought I'd want, I think I'd go for the warm snow drought, because at least you get some precipitation there, that you can manage if you have storage.

[SLIDE 4] Snow is a big deal in the western United States. This is a map that shows the percentage runoff that is attributed to snow. And these are for, I think, all the HUC eight basins across the United States. And you can see that there are some basins where snow constitutes up to close to 90% of the annual runoff. Some basins, not so much. The coastal area, some of those southwest basins. And the west as a whole, about 53% of the total runoff is attributed to snow melt. And in the mountainous areas, it's about 70%. So snow is a big driver of water supply in the west. And so, we have to pay attention, especially if we're in the business of responding to drought. How snow is forming over the winter. And it has some advantages in terms of forecasting, because snow is a big tell what's going to happen that summer.

We also have to be, I think, mindful that not all basins, even in the west, are dependent on snow for their water supply. They're dependent more on precipitation. And that presents some challenges in terms of forecasting. A little harder to forecast precipitation than it is to watch snow pack that forming over the winter season.

[SLIDE 5]This is a graph that tries to depict the challenge of timely drought response. And, essentially, it'd be nice at the beginning of every water year, that we knew what our budget of water was going to be for the coming year. You're going to have a hundred billion gallons, go work with that. Manage it carefully. But we don't know that, at all. And so, in the early part of the fall we have a very wide range of potential outcomes for what the water supply is going to be for the next coming water year. A lot of uncertainty. That's the wide range there.

But at the same time, the other users of water, especially the agricultural industry, they're having to make decisions for, "What am I going to plant and grow next year? What am I going to invest in?" So, they're making decisions in spite of this uncertainty. As we go through the winter, the snowpack conditions emerge, and the water supply conditions gradually clarify. You see what kind of snow pack you have available. What your soil moisture is. It starts making itself visible within your models and your forecast. And that uncertainty gets reduced. But you really don't get good certainty, and good clarification until well into the spring. Maybe March and April. And by that time, your agricultural sector has already committed to what they're going to do for the coming season.

For the fishery folks, that might want to do something special, if it's a drought year, you're going to be trying to work with folks that have already committed one way or the other. And so the challenge is, how you create a structure where you can have a response that doesn't happen in the few weeks in the springtime, in that window, when everything's coming together. The water supply situation has clarified, but the famers are now in the fields, or real close to it. In 2015, in Washington, that was a very challenging situation for you to be in. To deploy that money quickly, to get the money

deployed quickly. And have a meaningful impact for people that are already committed to using water.

[SLIDE 6]This is kind of a real-life example of a forecast that we would look at. This is the Columbia River at the [Dalles 00:10:24]. I think the Dalles gauge is on the Oregon side, so it's a potential cross boundary conflict that we have to deal with. They're good neighbors though, for the most part. And you'll see that in the fall the range of potential forecast, we're looking at 41 million-acre feet. That's the beginning of October. And as we get through the season, those forecasts, these are daily forecasts, box and whisker plots. You'll see those gradually condense to ... Now we're in April, and that range is now 15 million acre feet. And this is for the volume of water that we expect to see between April and September.

My point being, we're going from a situation of wide uncertainty to less uncertainty. Happening over the winter. But not really getting that close, high level certainty until it's already well into the water use season.

[SLIDE 7] So how do different states define drought? This is from a paper, a couple of folks at University of Washington, and also someone from the National Drought Mitigation Center at Nebraska. You'll see that 8 of 19 western states have defined triggers, or what conditions are for when they initiate a drought response. That means that the other states have not done so. To me, that would be an area of concern, if you see your state up there, that doesn't have a defined trigger. What is your threshold? Other than a vague sense of dryness?

Of course, these other states do you indicators to tell when conditions are dry. But what precisely is the threshold that would cause them to act? You'll also notice that states use a mix of indicators embodying monitoring and forecasting approaches. And this is important to think about. So, in monitoring approach, you're looking at conditions that largely have transpired. So, you might not know that you're in a drought until you're actually in a drought. Some states look at more forecasting indicators, like a river forecast would be an example of a forecasting indicator. And maybe looking at the seasonal climate forecast as well. And those indicators, you can use, even though they have some uncertainty, as a way to get ahead of the game. And start mobilizing resources before the conditions actually transpire.

Some states also use multiple severity stages where, depending on their indicator, and the percentile of extreme-ness, you would move from like a level one to a level two stage of drought. And each of those stages might be associated with different response actions as conditions grow more severe. In any case, it's important to check your own state's plan to see what the indicators are. And I just have a quick question. How many here have actually read the drought plan for their respective states? Okay. That's good. I think we've got some work to do, though.

[SLIDE 8] And so the importance of these triggers are that they lead to actions. And here is a sampling of actions, looking across states. Emergency declarations where, say, a governor or water manager would issue a statement, and say a new set of rules apply.

The other triggers would be, okay, we're going to request federal aid and relief. Primarily agriculture, that's pretty common. We're going to up our communication game, talk to the public about the water supply conditions. We're going to work on coordination among agencies and response. We're going to have water use restrictions that might go beyond prior appropriations. For example, some states will ask municipalities to cut back their water use. California, I think I've seen the same thing, and some of the south east states as well. Massachusetts. We can't do that in Washington. Facilitating and expediting water transfers, that's a pretty common response in a state drought plan. Purchasing water to keep it in streams. That's something that's somewhat common, especially in the western states. And more rare, issuing grants and loans to water users for emergency infrastructure relief, or projects help agricultural and so forth.

[SLIDE 9] And so, those actions, however, don't happen unless those triggers are met. So that's really important to also pay attention to who pulls the trigger? And again, protocols vary by state. And a fairly common process is for a county to issue a declaration of some sort. And then perhaps use that declaration to petition the state, or the state to declare their county an emergency drought area. I call this kind of a bottom's up approach. Another approach is that ... And this is one that Washington has, it's more of a top down approach. Where the state itself is responsible for monitoring drought conditions, and making a call that a threshold is met, and that it anticipates that impacts are going to be severe enough that a declaration should be issued. This is more of a top down approach.

Now think about who at those levels is making the call that the drought is a problem and needs to be responded to. At the county level, you might have county commissioners, probably, I would imagine being very responsive to the agricultural sector in their area. That may or may not include a state fish biologist, or a federal fish biologist. Other fish biologists in the area. And so, they're going to be representing maybe the agriculture concerns primarily at that county level. And at the state level, Washington as an example, in our committees we include the Department of Fish and Wildlife. So, we get that input from the Fish and Wildlife sector, that they expect impacts to be severe. And that they are also a reason that an emergency declaration should be issued.

And then some states just wait for the feds to issue a drought disaster declaration for a county. And that's based upon, is the federal drought monitor at a certain level for a D2 level? Kind of a moderate drought for, I think, eight consecutive weeks.

[SLIDE 10] So, okay. Now, triggers define what's important. For example, long term evapotranspiration vs. forecasted river flows. You know, depending on what you're paying attention to, is going to affect when you think a problem is developing, or has

developed. They affect the timing of your action. For example, preventive action, in that river forecast, you can get ahead of the game. Vs. say an after-the-fact type action, like crop insurance, where a federal drought declaration might happen. But that's just to go kind of clean up and make people whole after the damage has already occurred.

For a fisheries biologist, I would recommend that you would want to look more at the triggers that would help you support more of the preventive actions, and getting ahead of the game. The triggers can also determine the geographic area of concern. So, it could be at a county level, which makes sense in one sense for administrating a response. But we're environmental resource people, and we manage a lot by watersheds. So maybe that's more our area of concern. How do you respond to drought in a river that crosses multiple counties if only one county has declared a drought? So that's another difference among states worth paying attention to. And reading your state drought plan and seeing what the case is for your particular area.

[SLIDE 11] So here's kind of two views of drought conditions. This is from Washington State in May 2015. And on the left we have a national map. But I want you to kind of hone in on Washington State, if you could. And this is the Palmer Drought Severity Index, long term. And this is for May 18th, 2015. And you'll see that Washington State, by and large, is regarded as having a normal condition. No apparent outbreak of drought conditions there in Washington State. However, we had just gone through probably the worse snow pack season of our recent history. And in May, we were already having some fisheries issues appear. And so you'll see on the right, this is Siebert Creek, near [Sequim 00:20:24], Washington, Olympic peninsula.

This is a stream that empties onto saltwater. And there, the flows had gotten so low that they no longer could flow over the berm. They could no longer get over the berm to the saltwater so fish and salmon couldn't get up ... Saltwater to fresh water, move back and forth. And so, what you see here are employees of the Jamestown S'Klallam tribe, out there with picks and shovels, actually clearing a way for fish to get up and down. I'm not sure whether they actually requested our state department Fish and Wildlife for a HPA permit, but they got the job done, so ...

[SLIDE 12] So in Washington State, we define drought by statute, as part of our law. We're required to monitor drought. And when conditions are present, respond to it.

The statute defines what kind of actions we can take. We also have an administrative rule that further defines what we can take. That kind of lays out the requirements for expedited water right permitting, protection of in stream flows, how people can, if they want to, we can let people petition for drought as well. That's all a matter of law and rule which makes our process, I think, transparent so people can see, are we executing in accordance with the directions that we're supposed to. Our process does target water supply emergencies. And it emphasizes response over prevention.

[SLIDE 13] Real quickly, here's our drought trigger. And so, we have a very defined threshold where if an area's going to receive less than 75% of normal water supply. So, think of normal as median. So, 75% of median. That'd be about 37, 38th percentile. And if we think that hardship is going to occur in relation to that deficit in water shortage,

then we can declare drought. Now, this hardship criteria that does include considerations of severe environmental impact, in effects to fisheries populations and survival. As well as social and economic considerations as well. And the committee that makes that hardship call is composed of, largely, state agency directors or their deputies from agriculture, fish and wildlife, commerce, ecology, conservation commission, and so forth. So, a broad representation of all the sectors that kind of have skin in the game when it comes to water shortages.

[SLIDE 14] This is, real briefly, some of the actions we took in ecology drought response. I'll be talking a little bit about leasing. And I just kind of wanted to focus on the item here that says "Curtailment orders." Where we issued curtailment orders for almost 900 water rights statewide to protect senior water rights. And in Washington State, we do have in stream flow rules for many of our basins. They are water rights held by the state. They have a priority date. So they're junior to everyone who came ahead of them, which is most people. And then, senior to appropriations that came after. And so, you'll look at 900 water rights statewide, and to put that number of water rights in perspective, statewide Washington has approximately 230,000 outstanding water rights. And that includes claims certificates permits. So, it's a very small portion of the number of overall water rights that actually get regulated. And so, keep that in mind in terms of the effect that an in stream flow rule can have in times of drought.

[SLIDE 15] Okay, so some limitations of the emergency response model. And one is that the long term resolution of some of these water supply imbalances really requires longer term effort. You know, think watershed planning, where you're bringing together everyone who's affected in a basin, the water users, the people that water in stream and out of stream. And sitting down and kind of doing the hard work, and working out the solutions that work for everybody.

And then, we've found that in an emergency response, you simply can't complete these within the scope of an emergency year. One thing to issue someone a grant, but for them to plan, design, and construct their project, and have it actually be meaningful within the scope of that current drought emergency, very difficult. And part of our funding criteria is we only funded projects that could have an impact in that current drought emergency. And so, we actually only approved about 14 out of 40 applications that came to us in 2015. And some of those are good projects for long term resiliency. But since we have this emergency response model, we're prevented from supporting them. So, at the state level, we want to start taking action to better support longer term projects that can be approved and go forward outside the context of an emergency.

[SLIDE 16] So we did do some emergency water right leasing. And we had mixed success in the Yakima Basin. And part of our challenge there was we went out in April looking for water. By that time, farmers had already made their commitments. And because it was a drought year, the cost of water was high. It was twice of what we had paid for in 2005, which was our previous statewide drought emergency. And so, there was a lot of competition. You've got irrigation districts, especially those that are junior in relation to other users in the basin that are also out in the basin looking for water. So, you're competing, you're out there when water is at a premium. And so, we didn't get a lot of successful bids in the Yakima Basin. We had better success in the Dungeness Basin.

Those are split season leases, where the lease didn't take effect until later summer, where they would forego a third or second cutting of hay. The farmers had more time to kind of evaluate their lease option and sign on in that case, so we're pretty happy with what happened in the Dungeness Basin. Okay. I wanted to skip ahead [inaudible 00:27:55]. My time's over?

SKIP SLIDES 17,18,19

Jeff Marti: [SLIDE 20] Okay. All right. So, one thing we have found is it's really important after these drought emergencies to do a post-drought impact assessment. And what we found, and going into the 2015 drought, it had been 10 years since the state had had a drought emergency, was that the existing drought plan really wasn't that useful. And what was really useful was looking at the impact assessments and reports that actually described what happened in those previous drought emergencies. Those impact assessments, what actions did the agencies take? What did we spend money on? Where did we lease water? Those sorts of things. And I think it's very important for the fisheries managers, documenting your impacts, because it helps us understand the vulnerabilities to the conditions that occurred.

And that information becomes very important as you move into future drought conditions. And being able to make your argument that this is important. And that the state should deploy resources in this direction. And tracking impacts also lets us know, are things getting worse? Or are we adapting, making progress? Are we kind of holding it together? Don't know that if you don't have data.

[SLIDE 21] Okay. Final thought. So, drought is kind of regarded as an ephemeral thing. It happens once in a while. It's temporary departure from normal. You have this anomaly of conditions. And then we get back to normal. And this here is a drought monitor time series for the state of Washington.

And this kind of fits with the thinking, I think, behind Washington's emergency drought response. That drought is something we'll have to deal with once in a while. We'll take care of it. We'll go back to normal.

[SLIDE 22] As we move into the future, however, what we're facing here is a time when what is now kind of these period anomalies can become more chronic conditions. This graph here, this illustrates the time of emergence concept. And this is something that the University of Washington climate impacts group produced. And the idea is with drought and, really, current ... Or just climatology, there's natural variability. Okay?

And it's natural to have drought. It's natural to have extreme years. Everything needs a tail end. An outlier. But as we move through time, the frequency of those events is going to ramp up to where what we thought was natural variability kind of is now a new regime. And what this is often referred to is when this climate change signal starts to emerge from the noise of variability. And so, what does this mean for drought planning emergency response? It means that those conditions that we previously considered once in a while extreme conditions are now more persistent conditions.

And so, given that, what is the optimum strategy at this point in time to prepare for those conditions? And I think we would probably all agree, it's time to start making those long term investments in resiliency. And for our state, it's like moving away from emergency leasing, and starting to maybe secure some long term leases that can go into effect 5, 10, 15 years from now. And kind of ramp up to those new sets of conditions. So, I'm at zero.

[SLIDE 23] And one final slide on this time of emergences. I think it's going to be very challenging for us as water managers because the emergence of conditions is going to vary according to, one, how sensitive we are to the new conditions. And that's going to vary according to sector. Maybe species. Geographic area. And also in time.

Some of these conditions are going to emerge 10, 20 years from now. Some will be 30, 40 years ago. So, it's a very long game. Which is both, I think, good and bad. Good in that it gives us time to plan. Bad in that maintaining the sense of urgency, I think, will be a challenge, so ... All right. So, with that, I'm getting the shepherd's crook here. Thank you very much.