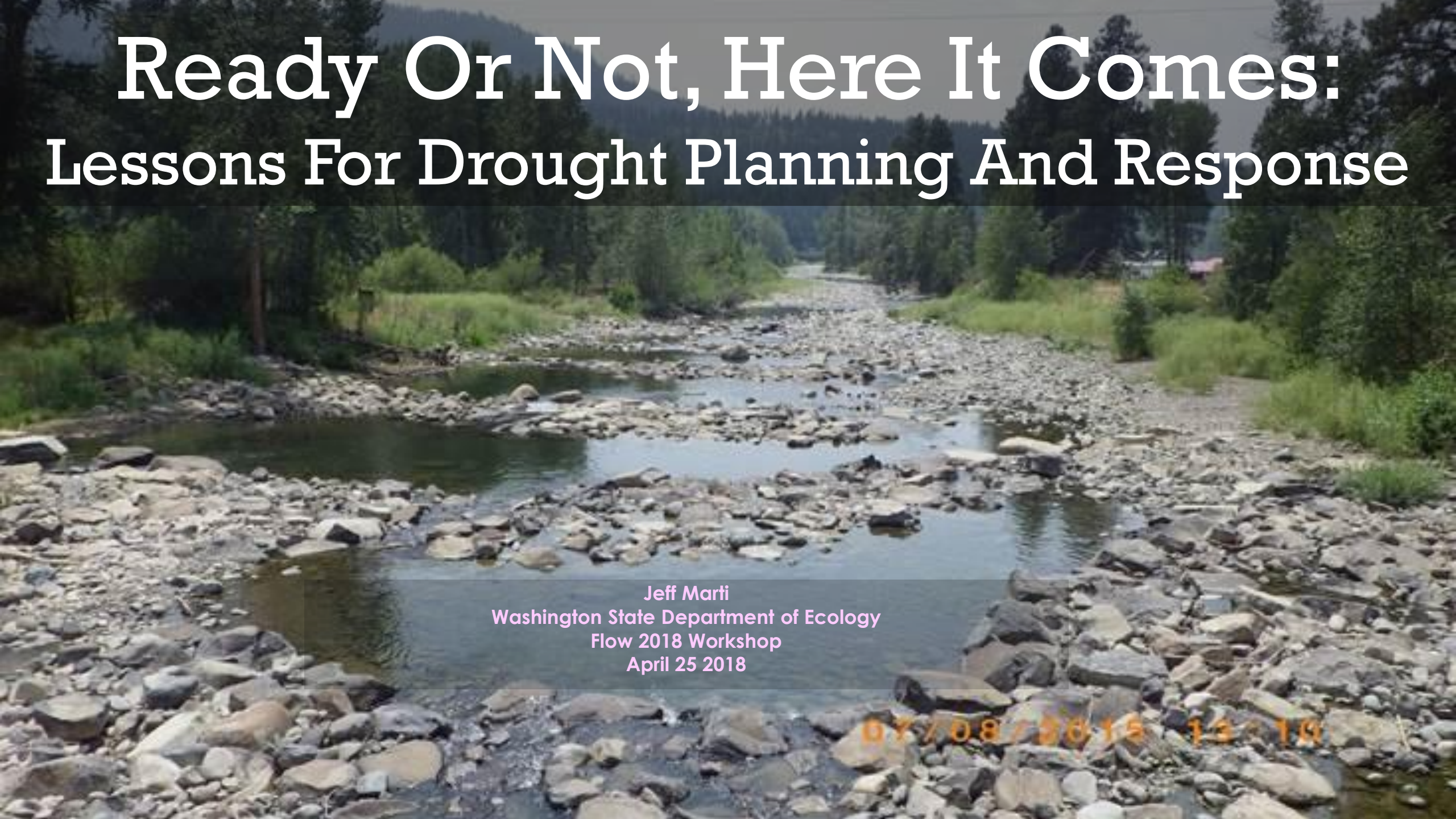
Ready Or Not, Here It Comes:
Lessons For Drought Planning And Response

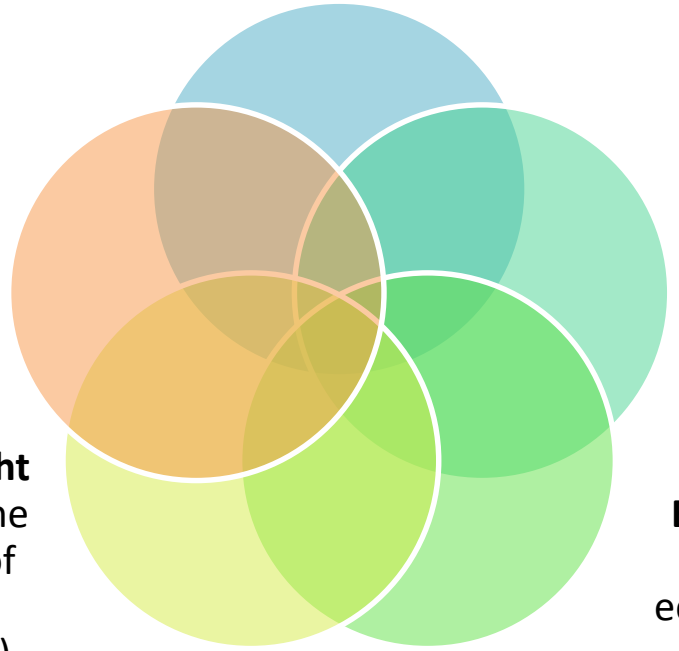


Jeff Marti
Washington State Department of Ecology
Flow 2018 Workshop
April 25 2018

Defining Drought

Meteorological Drought refers the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period.

Socioeconomic Drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought.



Agricultural Drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts.

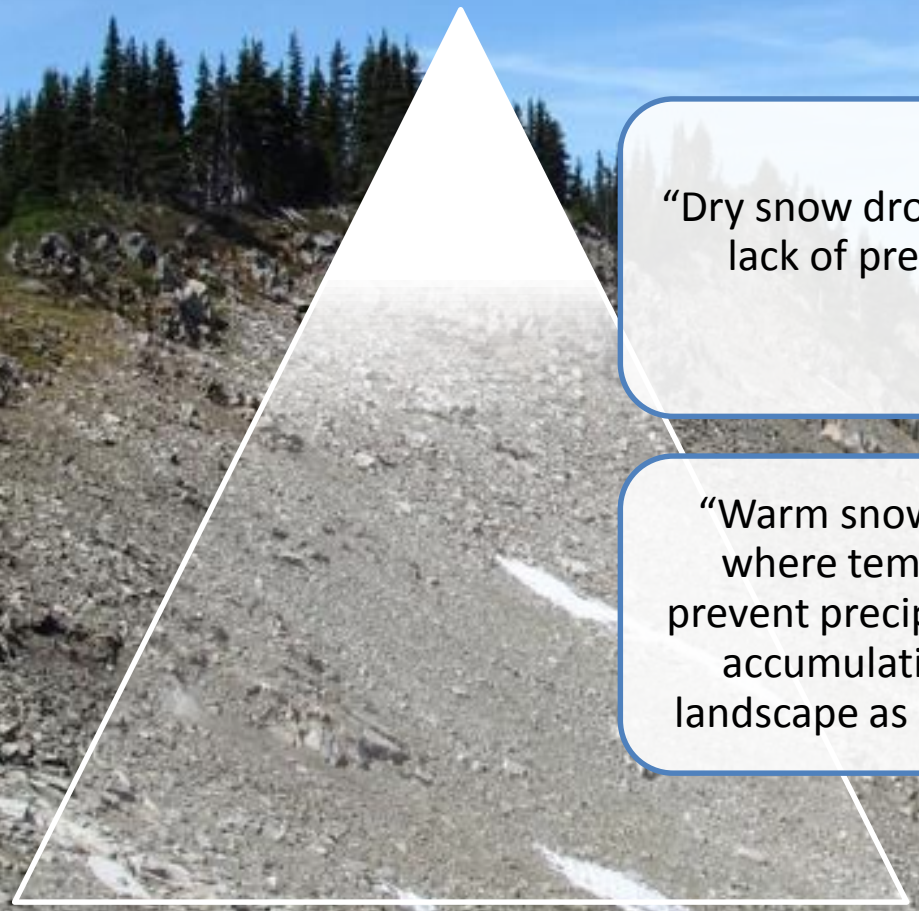
Hydrological Drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply

Ecological Drought incorporates the ecological impacts of drought and how those impacts affect human communities

NEW

http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx

Snow Drought



"Dry snow drought" due to lack of precipitation

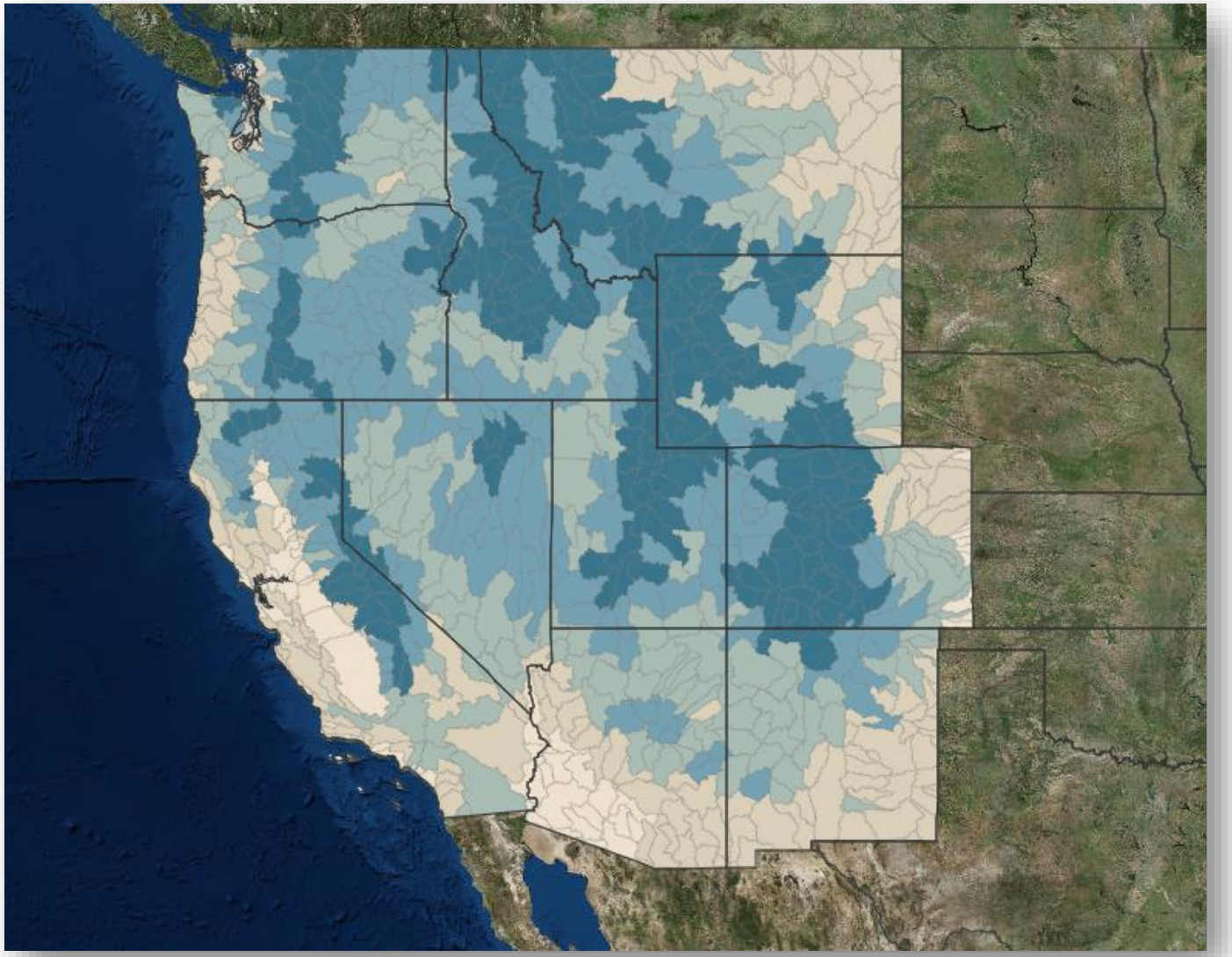
"Warm snow drought," where temperatures prevent precipitation from accumulating on the landscape as a snowpack.

Harpold, A. A., M. Dettinger, and S. Rajagopal (2017), Defining snow drought and why it matters, Eos, 98, https://doi.org/10.1029/2017EO068775. Published on 28 February 2017.

Snow as percentage of runoff, western United States

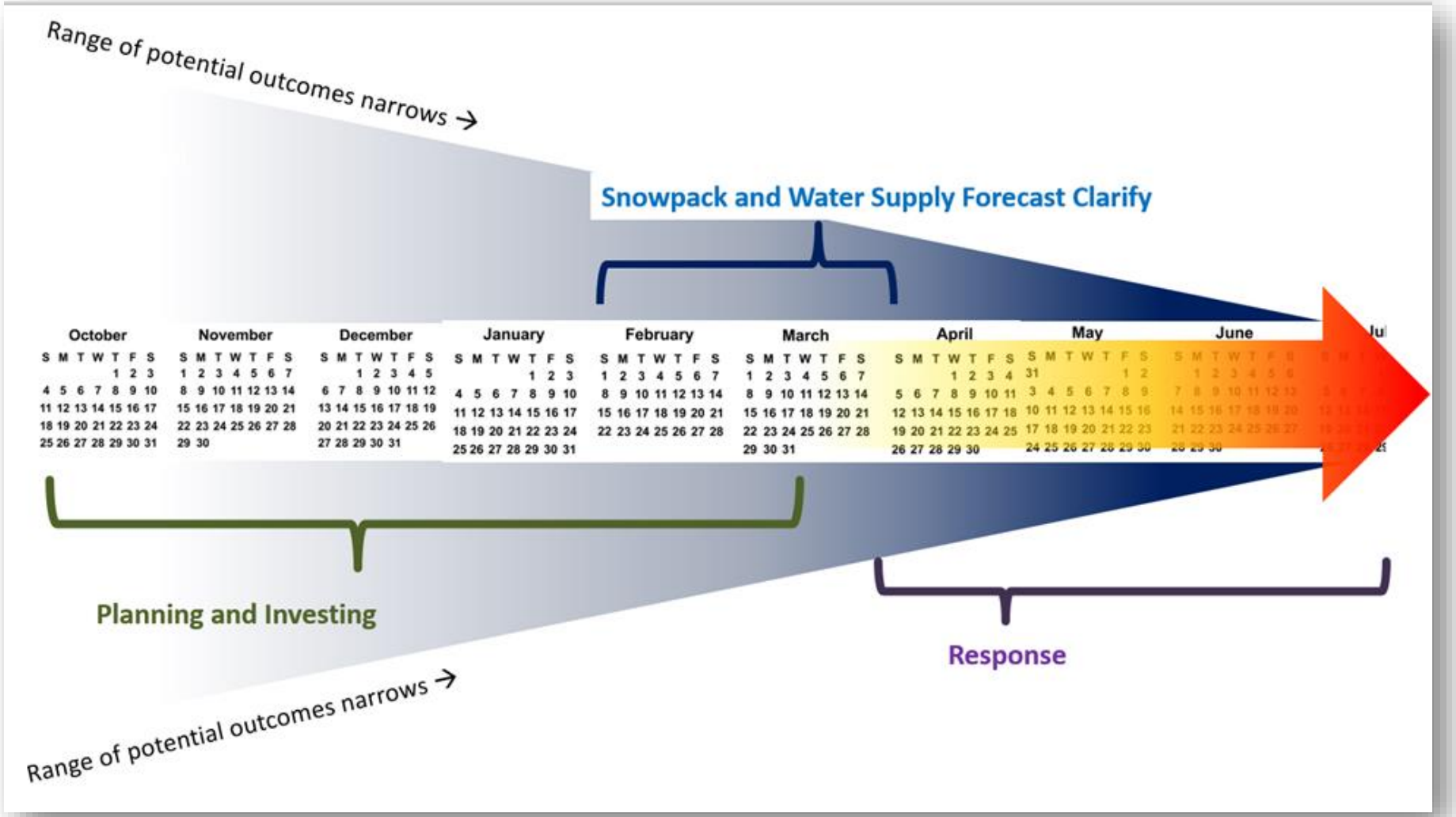
Percentage of runoff which originates as snow

- > 0.62 – 0.89
- > 0.397 – 0.62
- > 0.16 – 0.397
- > 0.007 – 0.16
- 0 – 0.007
- Other



Li, D., M. L. Wrzesien, M. Durand, J. Adam, and D. P. Lettenmaier (2017), How much runoff originates as snow in the western United States, and how will that change in the future?, Geophys. Res. Lett., 44, 6163–6172, doi:10.1002/2017GL073551.

Challenge of Timely Drought Response

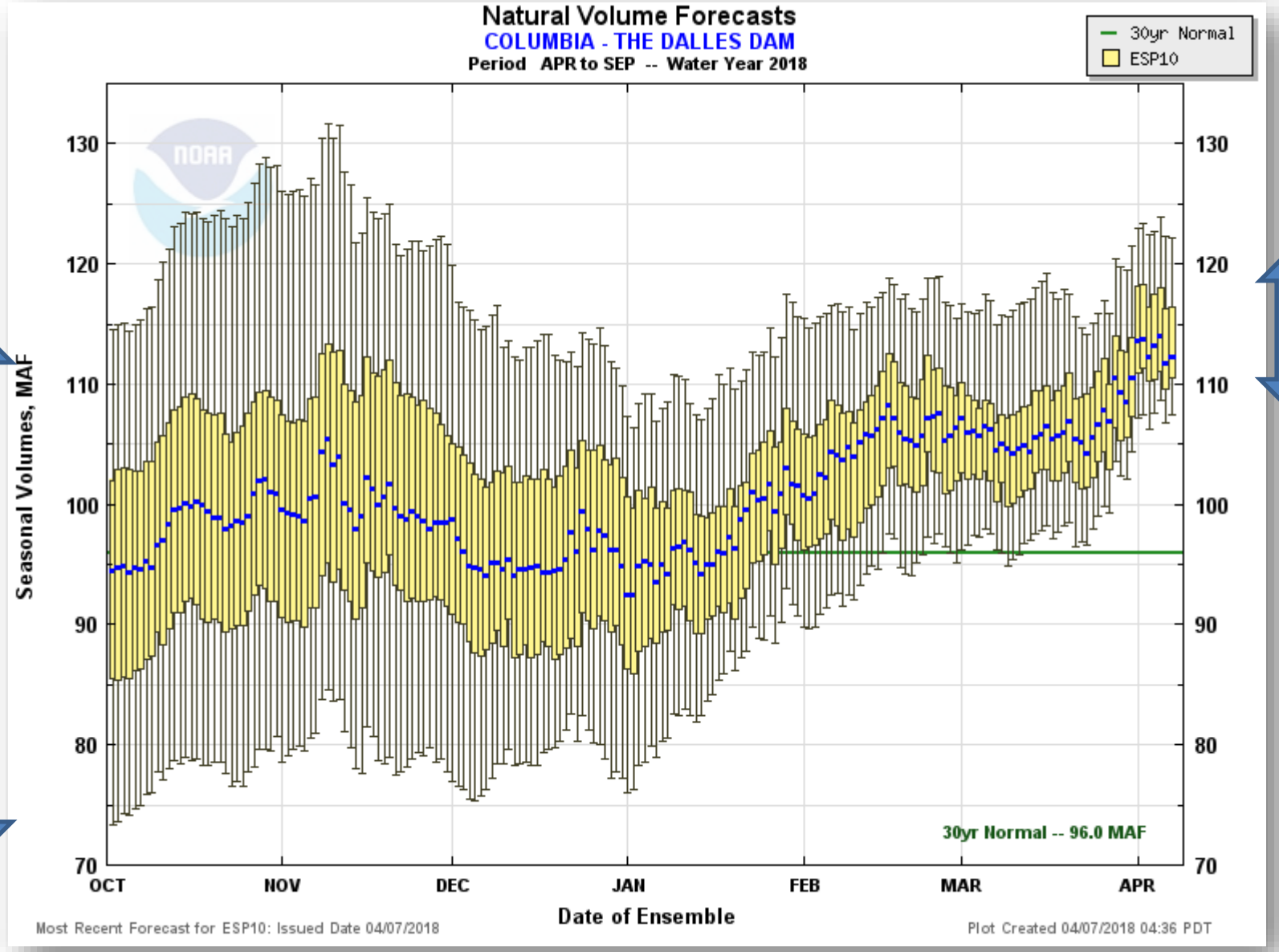


October 2 Ensemble

10% Forecast = 114 MAF (118 pct of normal)

Spread of about 41 MAF

90% Forecast = 73 MAF (76 pct of normal)



April 7 Ensemble

10% Forecast = 122 MAF

Spread of about 15 MAF

90% Forecast = 107 MAF

30 year normal: 96 MAF (1981-2010)

Table S-2. Drought Monitoring

State	Monitors Impacts	Monitors Hydrologic Indicators	Specialized Hydrologic Monitoring Tools	Defined Triggers	Trigger Flexibility	Defined Scale for Indicator Analysis	Primary Indicators
Alaska	x						
Arizona	x	x		x	x	Watersheds	SPI-6, SPI-12, and Streamflow
California	x	x				State Water Supply Projects	
Colorado	x	x		x	x		
Hawaii	x	x				County	
Idaho	x	x					
Kansas	x	x				River Basins	U.S. Drought Monitor
Montana	x	x	x[1]	x	x	County	
Nebraska	x	x					
Nevada	x	x		x	x	Watersheds	PDSI, SPI, and Reservoirs
New Mexico	x	x				Climate Division and Watersheds	
North Dakota	x	x					
Oklahoma	x	x	x[2]				KBDI
Oregon	x	x				14 River basins	SWSI
South Dakota	x						
Texas	x	x		x	x	Climate Division	
Utah	x	x		x	x[4]	County	SWSI
Washington	x	x		x	x		
Wyoming	x	x		x[3]	x		

How do states define drought?

8 out of 19 western states have defined triggers

Mix of Indicators embodying “Monitoring” and “Forecasting” Approaches

Multiple states use various severity “Stages”

Check your State’s Plan!

M. Fontaine, Matthew & Steinemann, Anne & Hayes, Michael. (2014). State Drought Programs and Plans: Survey of the Western United States. Natural Hazards Review. 15. 95-99. 10.1061/(ASCE)NH.1527-6996.0000094.

Triggers lead to actions (a sampling)

- Emergency Declarations
- State requests for federal aid and relief (Agricultural)
- Communication and Coordination
- Water Use Restrictions (Beyond Prior Appropriation)
- Facilitating Water Transfers (common)
- Purchasing water to keep it in streams
- Issuing grants and loans (Colorado, Oklahoma, Washington, California)

Who Pulls The Trigger?

Protocols Vary by State

- County Declarations
- Counties Petition the State (Bottoms Up)
- State Makes the Call (Top Down)
- States Wait for the USDA to designate a county

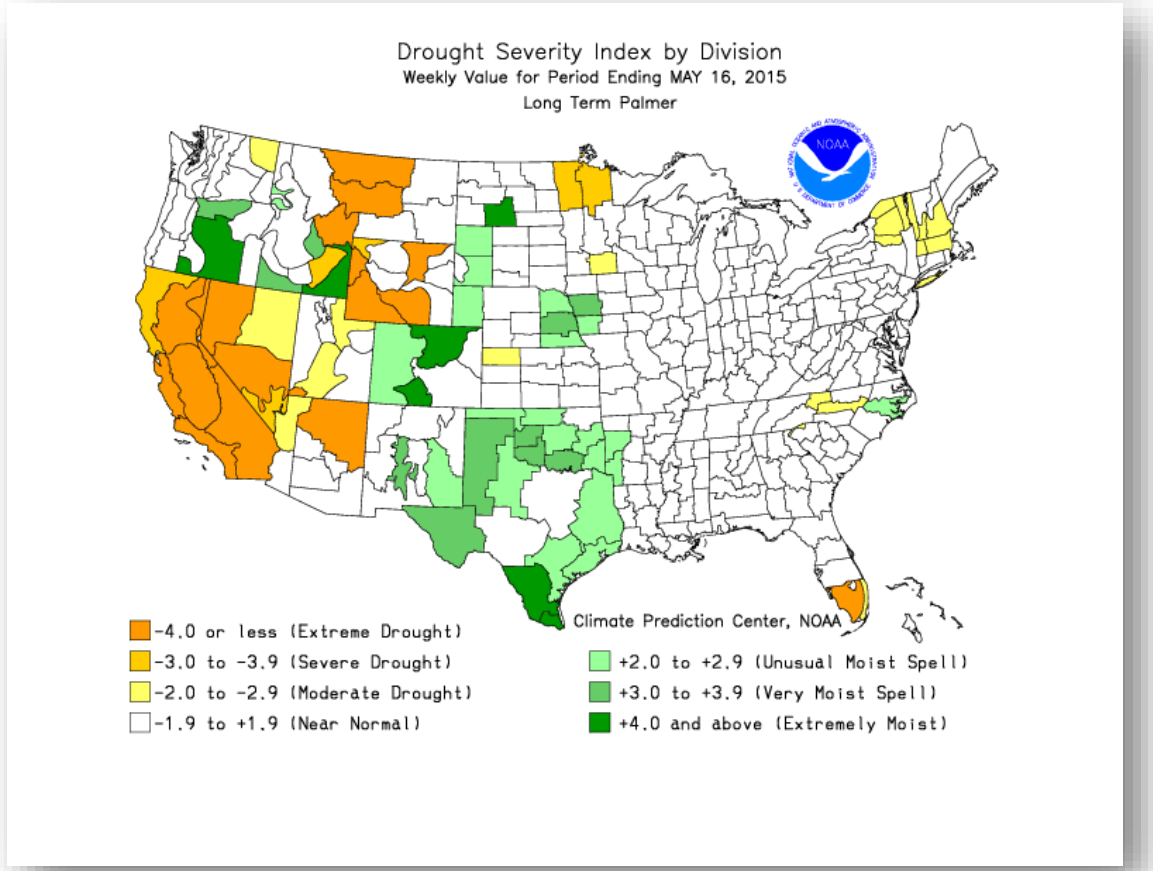
You should pay attention to triggers

Triggers **define what's important** (e.g., long term evapotranspiration vs forecasted river flows)

Triggers affect **timing** (e.g., preventive action vs insurance)

Triggers can **determine the geographic area** of concern (county level or watershed)

Two Views of Drought Conditions, May 2015

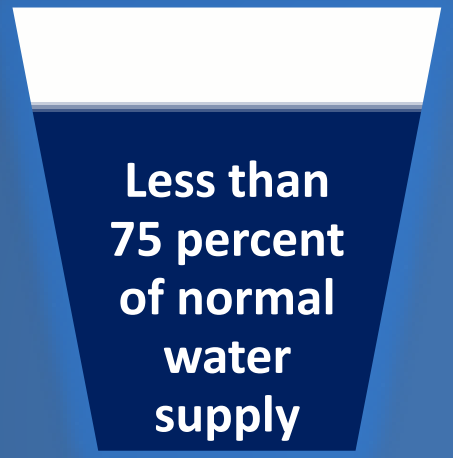


Siebert Creek nr Sequim, WA, Olympic Peninsula

Washington State's Drought Response Model

- Defined by Statute (RCW 43.83B) and Rule (WAC 173-166)
- Targets Water Supply Emergencies
- Emphasizes response over prevention

Washington State's Drought Trigger



+

Hardship

→

Drought

RCW 43.83B.400

DEPARTMENT OF
ECOLOGY
State of Washington

Ecology Drought Response 2015

Leasing of Water Rights in Yakima and Dungeness Basins to boost stream flows

Authorization of Emergency Wells in Yakima Basin

Approving Emergency Water Right Transfers
(e.g., Skagit Basin, Yakima Basin)

Emergency Drought Funding (grant and non-grant) to irrigation districts, cities and Tribes

Curtailment Orders issued for almost 900 water rights statewide to protect senior water rights

Funding Emergency Fish Passage and Hatchery Projects

Limitations of Emergency Response Model

Long term resolution of water supply imbalances often requires long term investment of resources, dialogue and partnerships.

Many projects simply can’t be completed within the time scope of an emergency.

Lack of in-place drought contingency funding can delay response.

Expedited decision-making may not assure most strategic investments.

Emergency Water Right Leasing

Mixed success in Yakima Basin (4.7 cfs)

- Only 10 bids, of which Ecology accepted 6
- Farmers already had made plans (reverse action in April)
- Cost of water was high (twice that of 2005)
- Competition from other buyers

Better Success in Dungeness Basin (5.6 cfs)

- 13 participants
- Split Season Lease period running from Aug 15 – Sept 15 gave farmers more time to decide

DEPARTMENT OF ECOLOGY
State of Washington

- Interagency Agreements
- Contracts
- Work Assignments
- Plans



Washington Department of FISH and WILDLIFE

WSDA

Washington State Department of Health

Washington State Conservation Commission

OWSC

Plan Recommendations

- Move to a two-stage drought response system
  - Advisory
  - Emergency
- Use pre-staging of agreements and contracts to streamline and expedite deployment of resources
- Importance of drought contingency funding
- Apply advances in forecasting as they become available

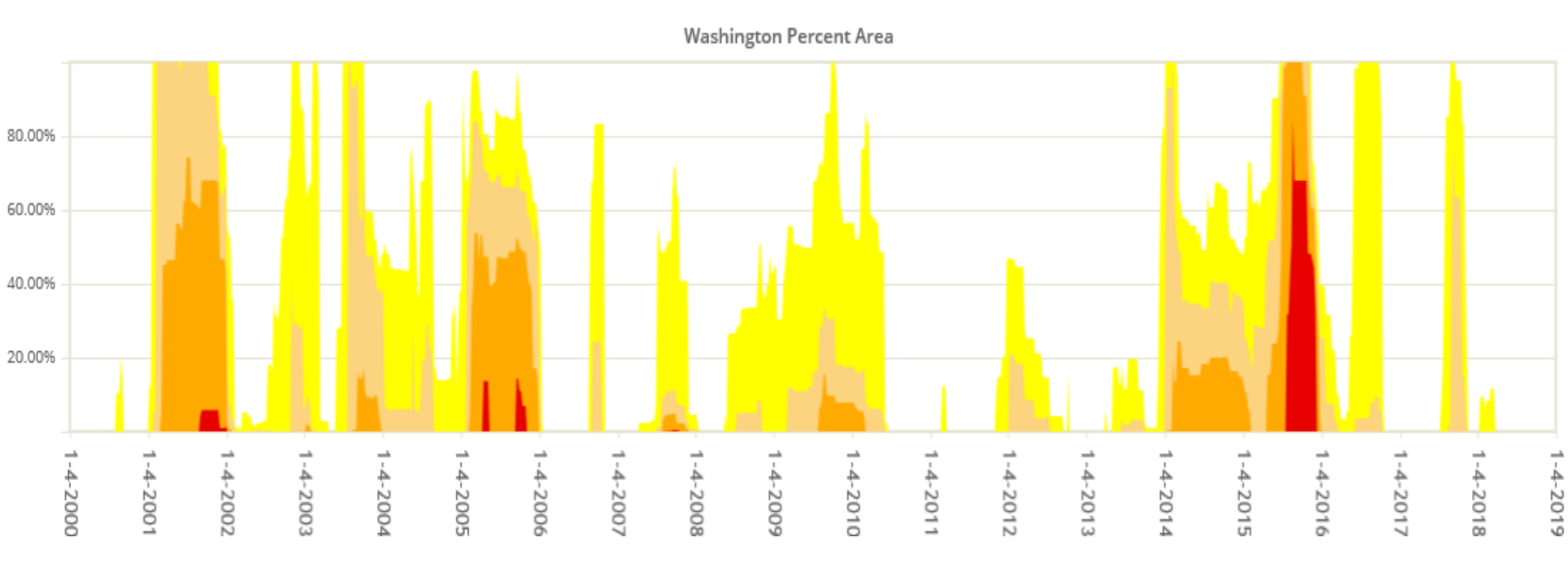
Don't put all your eggs in the drought response basket

- Work with water managers to develop "dry year" protocols
- Establish rights for instream flow purposes
- Acquire water for instream flow purposes
- Establish dry year lease options for water
- Long term habitat protection measures

Post Drought Impact Assessments

- Documenting impacts helps us understand vulnerabilities to experienced conditions
- Tracking impacts over time helps us understand whether we are adapting, or conditions are worsening
- Documenting impacts can help you make the case next time that resources are needed.

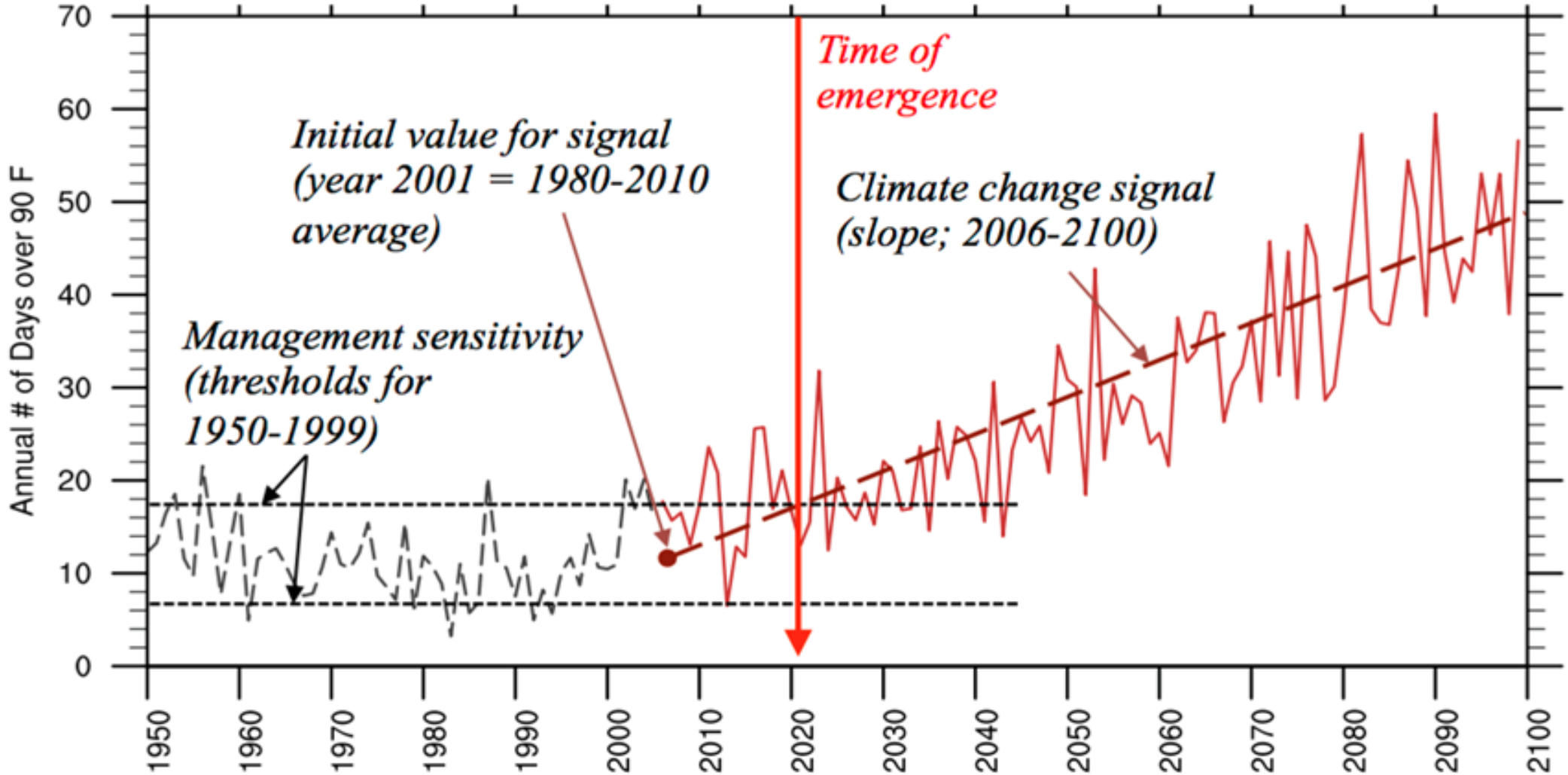
A final thought!



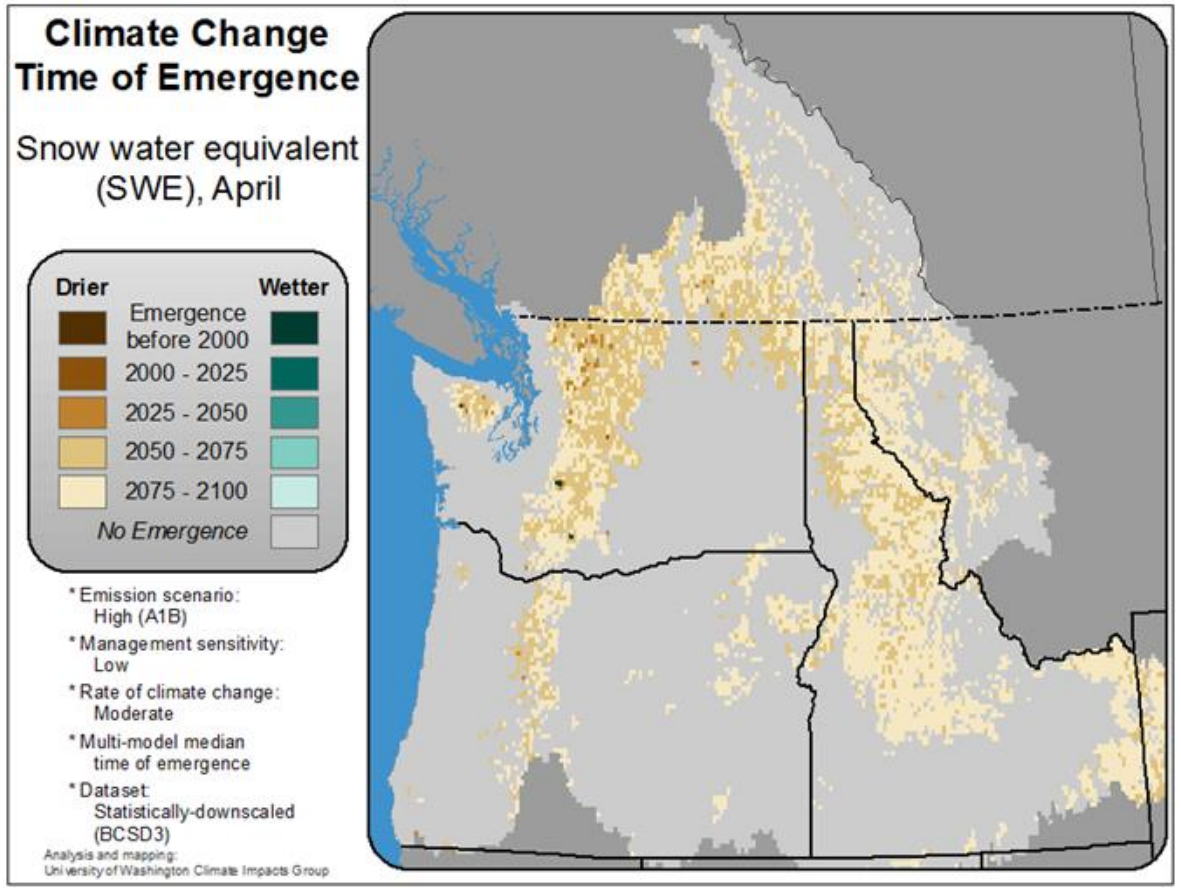
Category	Description
D0	Abnormally Dry
D1	Moderate Drought
D2	Severe Drought
D3	Extreme Drought
D4	Exceptional Drought

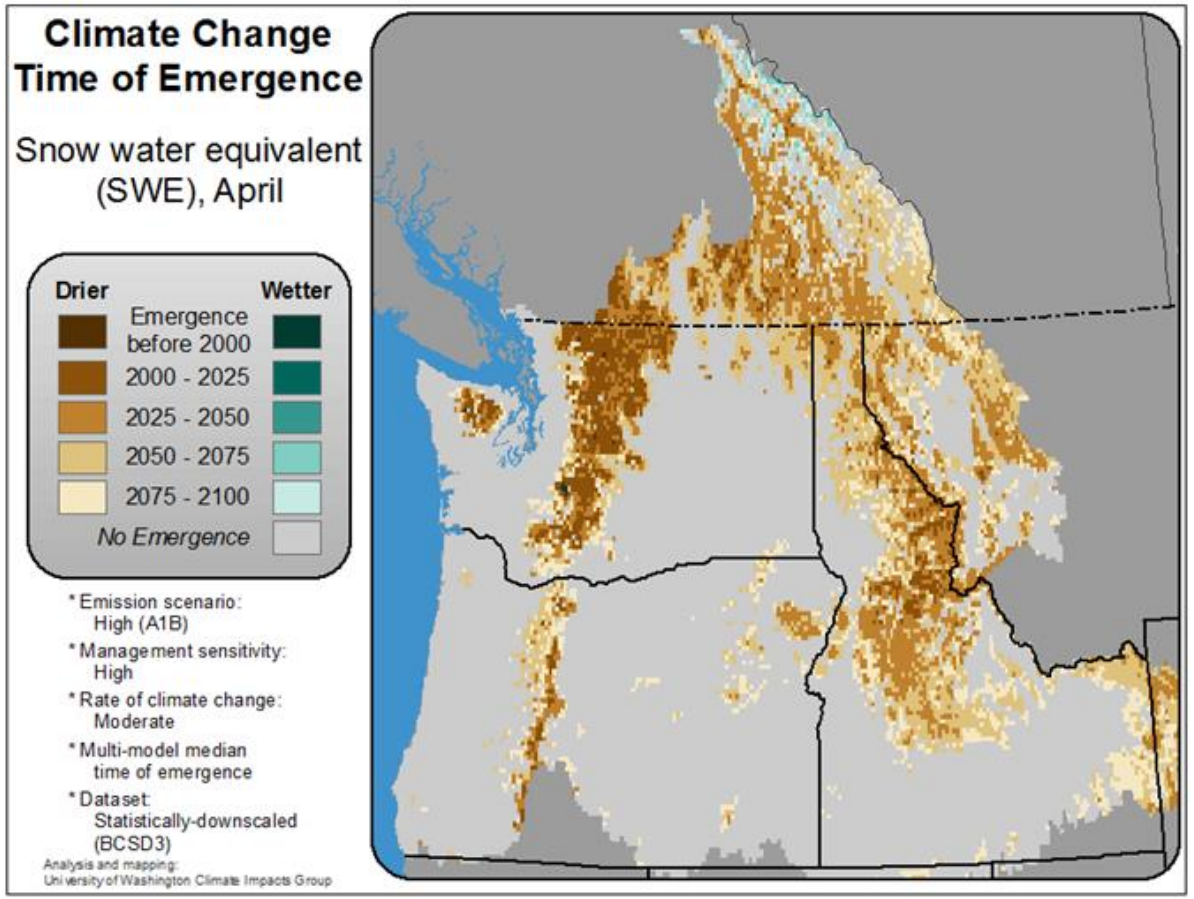
TIME OF EMERGENCE

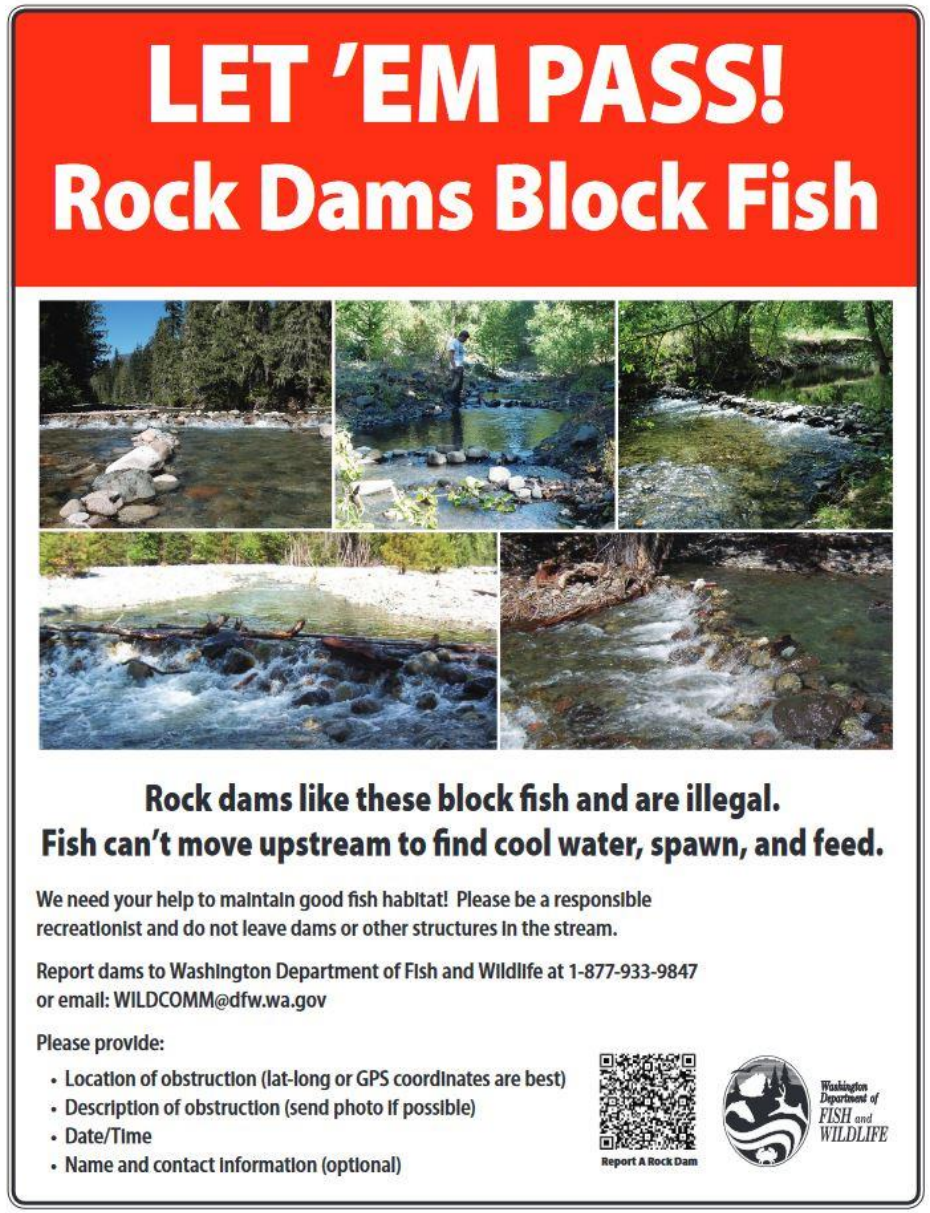
The time when conditions are projected to distinctively differ from the past due to climate change. In other words, it is when the effects of human-induced climate change become apparent.



Time of Emergence: Snow Water Equivalent for Low and High Management Sensitivities







Thank you

Jeff Marti
360.407.6627
Jeff.marti@ecy.wa.gov
Department of Ecology