Preliminary Research Assessment for EMC-2015-001

“Multiscale investigation of perennial flow and thermal influence of headwater streams into fish bearing systems”

AKA

“Class II-L Study”

FPC 2(b)

Acknowledgements

http://people.forestry.oregonstate.edu/catalina-segura/research/collaborators.html

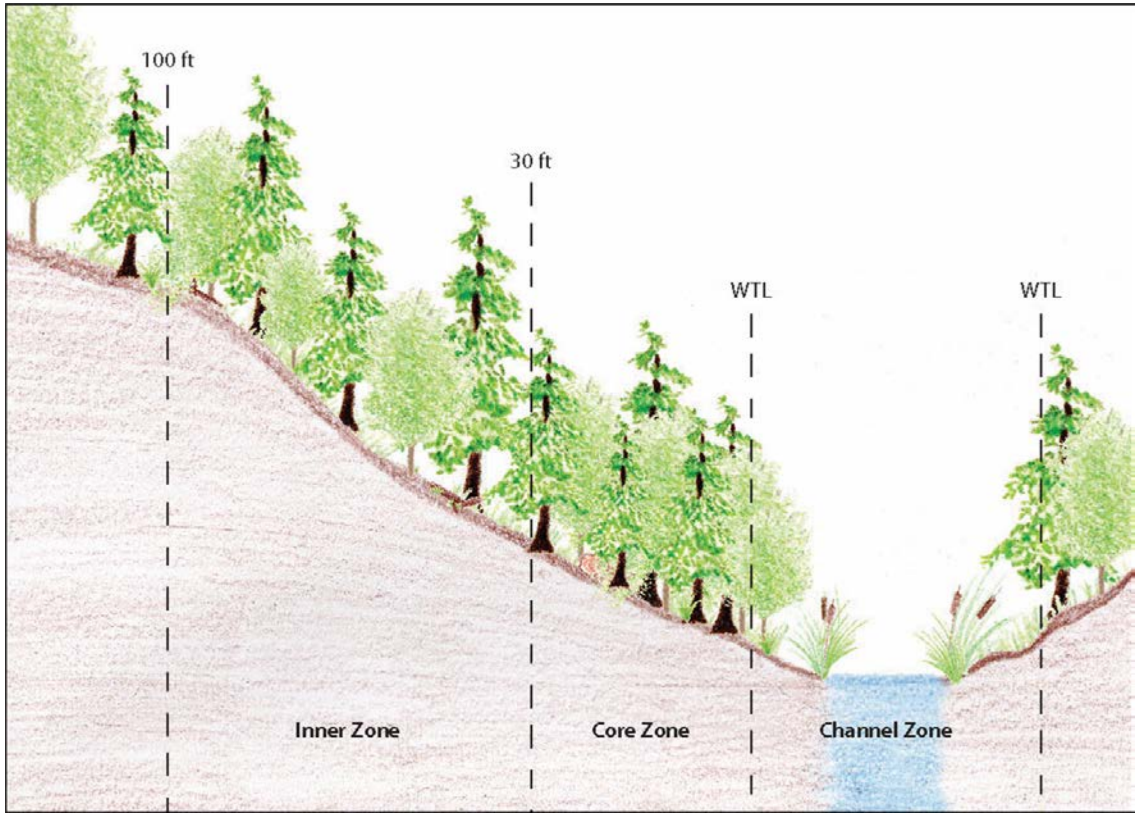
- Dr. Catalina Segura - Associate Professor –Oregon State University
- Dr. Kevin Bladon – Associate Professor – Oregon State University
- Adam Pate – Graduate Student – Oregon State University
- Austin Wissler – Graduate Student – Oregon State University

Anadromous Salmonid Protection Rules

916.9, 936.9, 956.9(c)(4) - Class II Large Watercourses (Class II-L): The primary objective is to maintain, protect or restore the values and functions of Class II-L type Watercourses described below. Class II-L Watercourses can have greater individual effects on receiving Class I Watercourse temperature, sediment, nutrient, and large wood loading than Class II standard (Class II-S) Watercourses due to larger channel size, greater magnitude and duration of flow, and overall increased transport capacity for watershed products ....

Class II-L protections are arguably the centerpiece of the Anadromous Salmonid Protection Rules

Class II-L Protection Measures:



In General Class II-Ls have:

- Wider buffers
- Wider “no-cut” (i.e., core zones)
- Higher canopy cover requirements
- More large tree retention
- More operational restrictions

Class II-Large Watercourse Identification Criteria
(ASP Rule Area)--January 1, 2014

- The contributing drainage area requirement for a Class II-L watercourse is **≥100 acres** in the Coast Forest District, or **≥150 acres** for the Northern and Southern Forest Districts, or

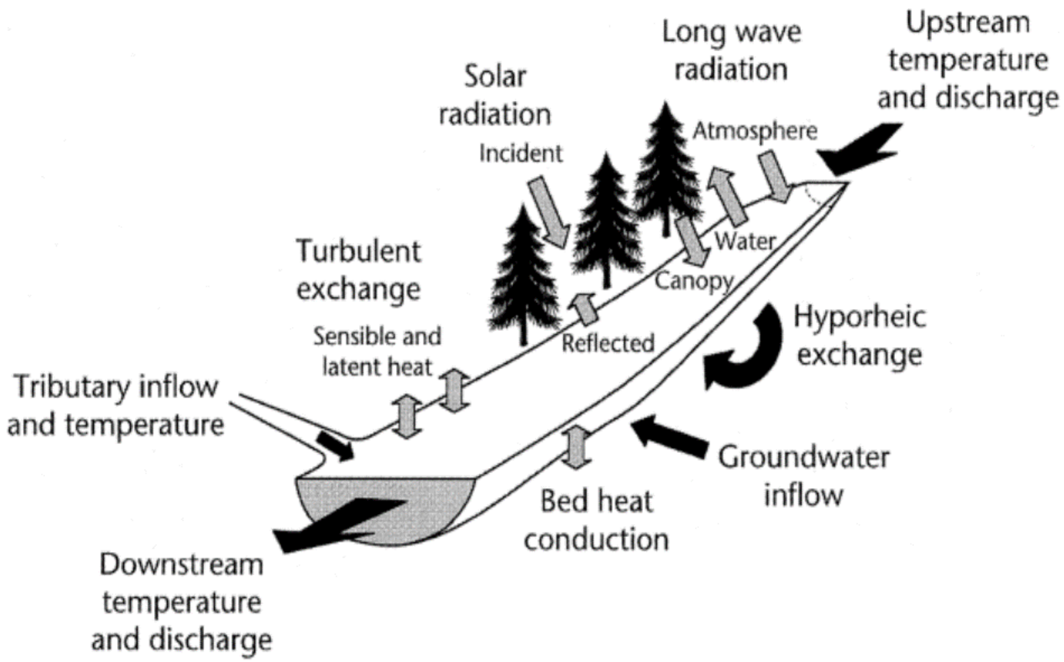
- The average active channel width must be **five (5) feet** or greater near the confluence with the receiving Class I watercourse.

Active channel width was defined with the new rule package

Reason for Presentation

- **14 CCR §§ 916.9 [936.9, 956.9] (g) (1) (C)** The above method for determination of Class II Watercourse type shall sunset on January 1, 2023 pending further evaluation of the efficacy of Class II WLPZ widths and operational requirements in relationship to Watercourse characteristics and achievement of the goals specified in 14 CCR § 916.9 [936.9, 956.9] subsection (a).

Priority Areas of Uncertainty Regarding Class II-L Rules



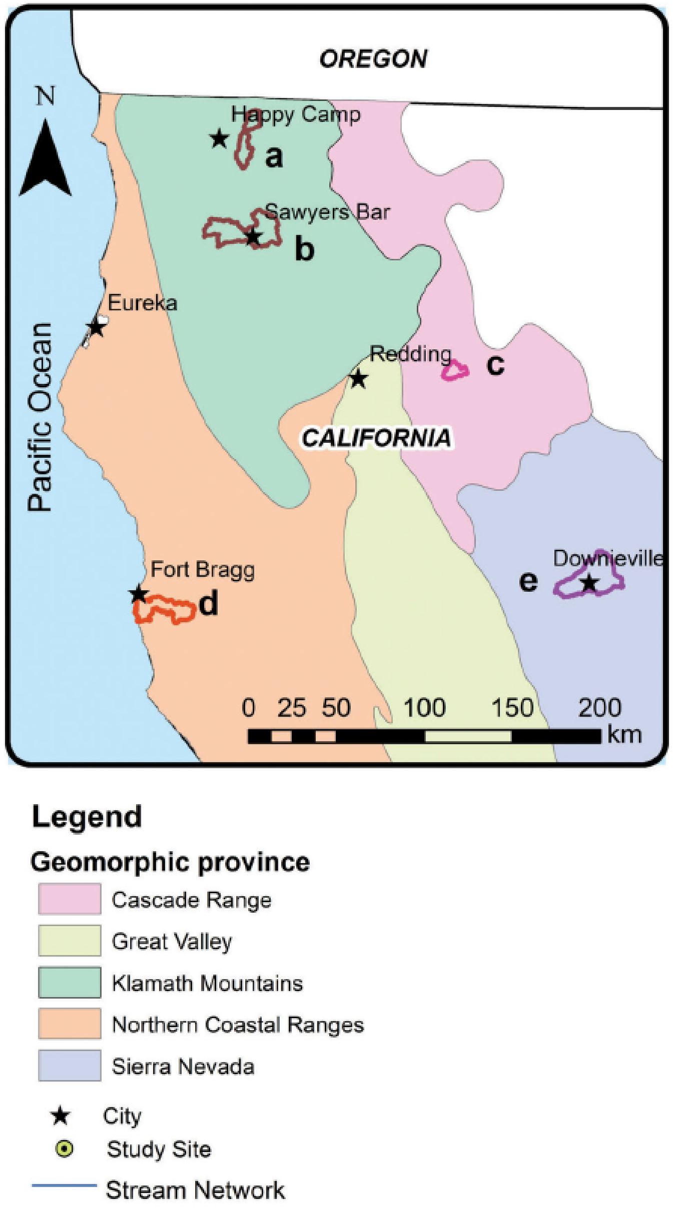
(Moore et al., 2005)

- Are the FPR Rule criteria effective in identifying Class II-L watercourses sensitive to thermal impacts?
- Thermal impacts largely driven by the presence of surface flow during warmer parts of year
- Need to determine what controls warm season stream flow presence in Class IIs
- Transport of nutrients, sediment, and LWD also a source of uncertainty, but more difficult to measure

EMC Worked with PIs from Oregon State University to Define Monitoring/Research Objectives:

a) Investigate the variability of the relationship between drainage area, active channel width, and perennial flow extent across the Anadromous Salmonid Protection (ASP) area (**Broad scale study on flow permanence and network connectivity**);
b) Compare the relationships derived in (a) to the rule criteria for Class II-L identification in terms of both drainage area and average active channel width (i.e., 14 CCR § 916.9 [936.9, 956.9] (g)(1)(a)(1 and 2)); determine if these criteria are effective in identifying perennial Class II-L watercourses in different lithologies, or if rule modifications are needed (**Broad scale study on flow permanence and network connectivity**); and
c) Conduct a pilot study to investigate the downstream propagation of water temperature from Class II-L systems in sites with contrasting lithology (**Longitudinal stream temperature study**).

FPC 2(b)



(Pate et al., 2020)

Broad Scale Study

- Assessed 101 stream reaches on Class II streams above Class I watercourses
  - 25 in northern Coast Range
  - 25 in Klamath Mountains
  - 26 in Southern Cascades
  - 25 in Sierra Nevada (not ASP)
- 10 cross-sections surveyed at each watercourse
  - Reach length = 20x channel width (~60 meters)
  - Flow condition characterized at each cross-section
  - Grain size distribution characterized along reach length

TABLE 2 Variables included as predictors in the random forest models

	Variable name	Description	Units	Resolution	Reference/source
Field variables	Bankfull width	Channel dimensions at bankfull stage	m	0.01 m	—
	Bankfull depth		m	0.01 m	—
	Grain size distribution (GSD; D_{16}, D_{50}, D_{84})	16th, 50th, and 84th percentiles of the GSD	m	—	—
	gradation coefficient	Spread of the GSD from percentiles	mm	—	Bunte & Abt (2001a, 2001b)
Geospatial variables	Channel slope	Mean channel slope	m/m	10 m	Benda et al. (2007)
	Catchment slope	Mean catchment slope	m/m	10 m	Archuleta et al. (2017)
	Drainage area	To the downstream end of the reach	km^2	10 m	
	Elevation	Mean catchment elevation	m	10 m	
	Aspect	Mean catchment azimuth	°	10 m	
	Topographic wetness index	Mean for the catchment	—	10 m	(Beven & Kirkby, 1979)
	Precipitation	30-yr normal[a]	mm	800 m	PRISM Climate Group (2004)
		Monthly 2018[a] water year		1,000 m	Thornton et al. (2018)
	Temperature	30-year normal	°C	800 m	PRISM Climate Group (2004)
		Monthly 2018 water year		1,000 m	Thornton et al. (2018)

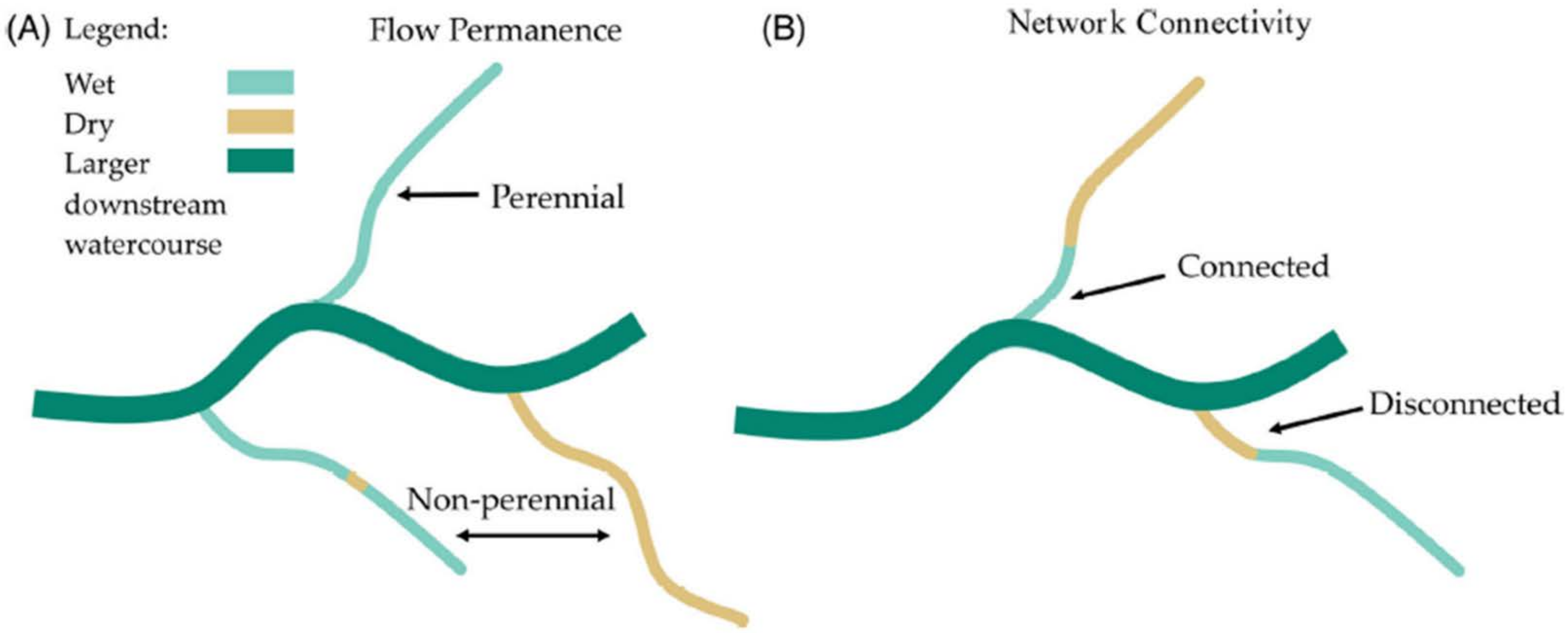
[a]We summarized precipitation inputs as relative winter (November–January) and relative spring (March–May) from the normal and 2018 monthly water year precipitation.

FPC 2(b)

(Pate et al., 2020)

Flow Characterization

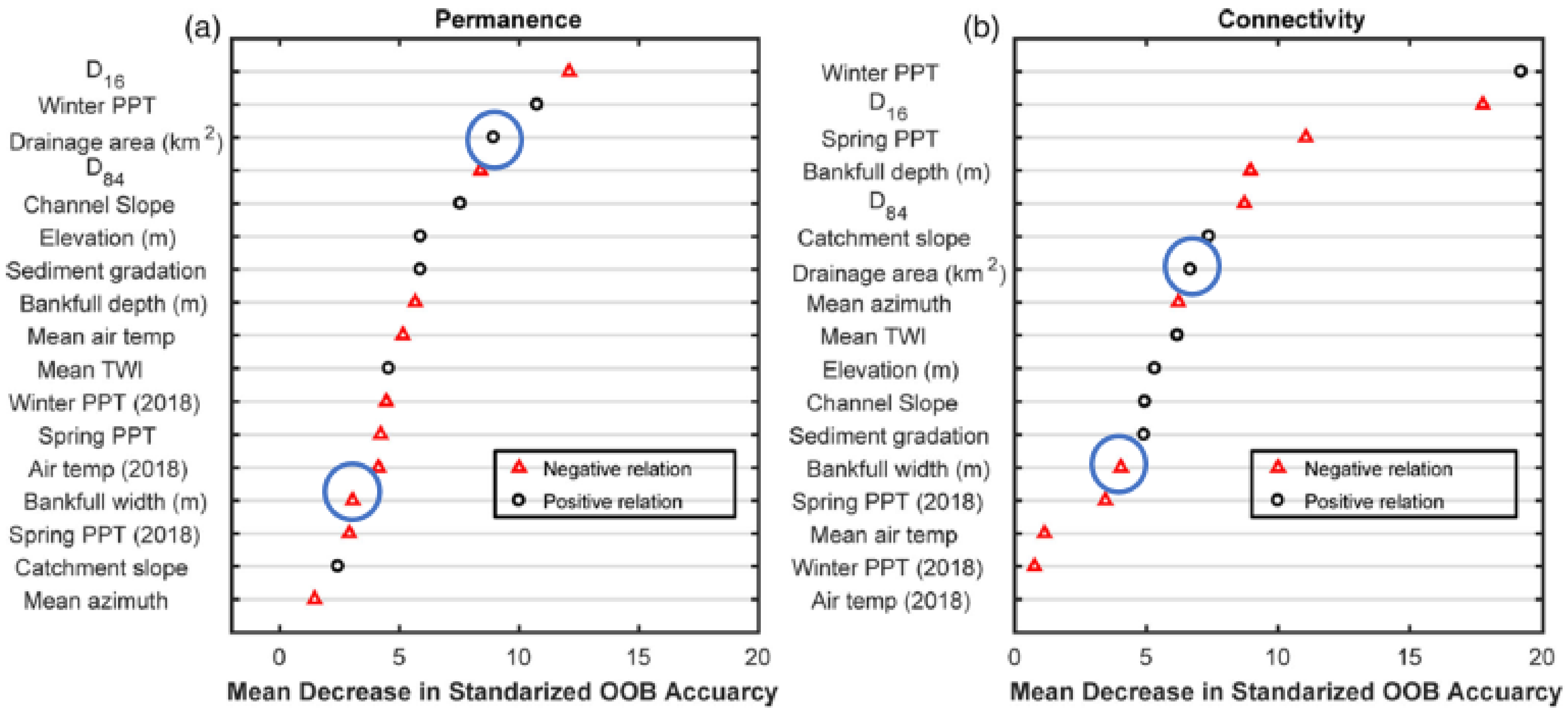
Flow permanence = All cross-sections flowing water
Network connectivity = Last downstream cross-section flowing water



FPC 2(b)

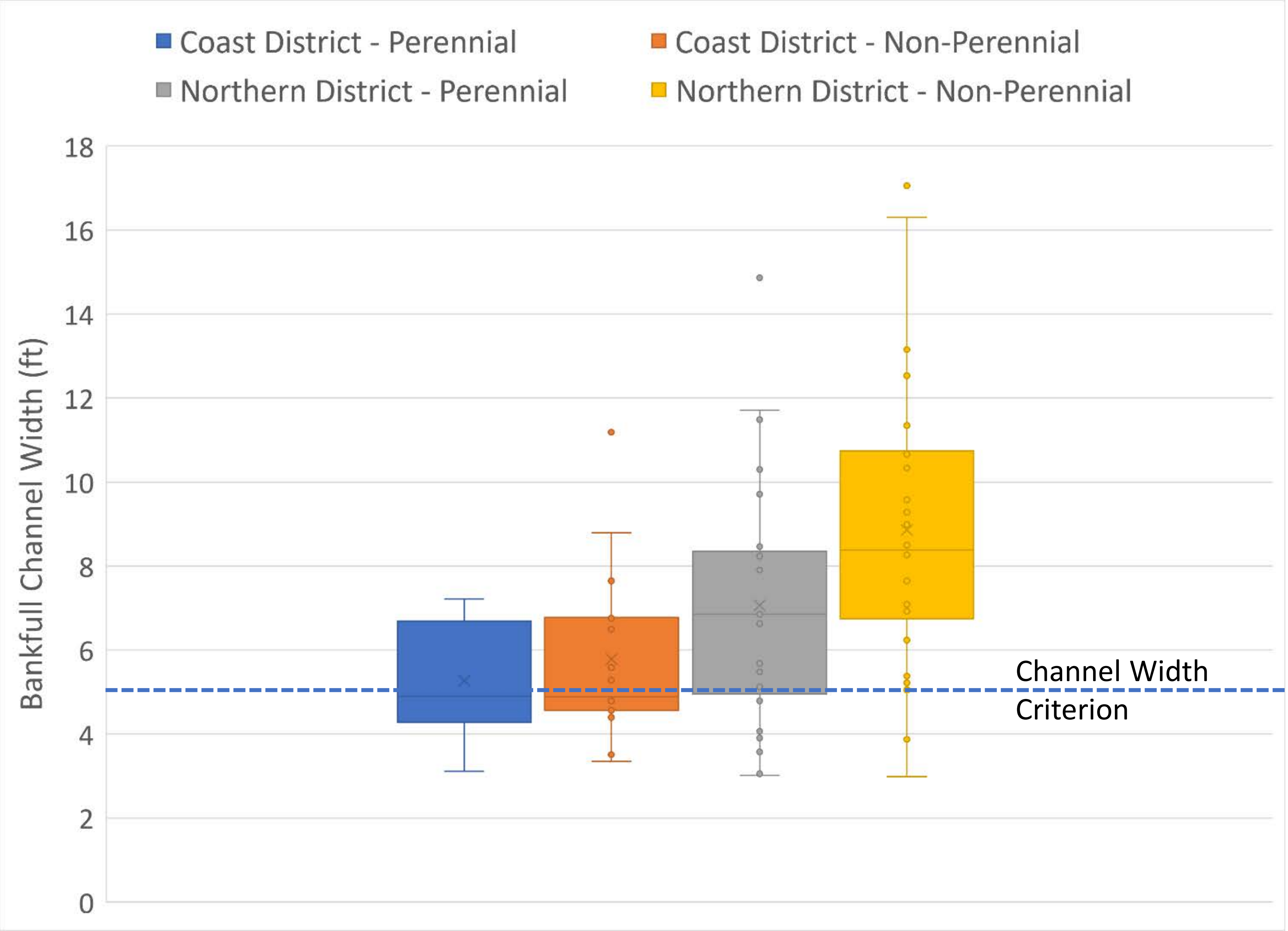
(Pate et al., 2020)

Random Forest Modeling



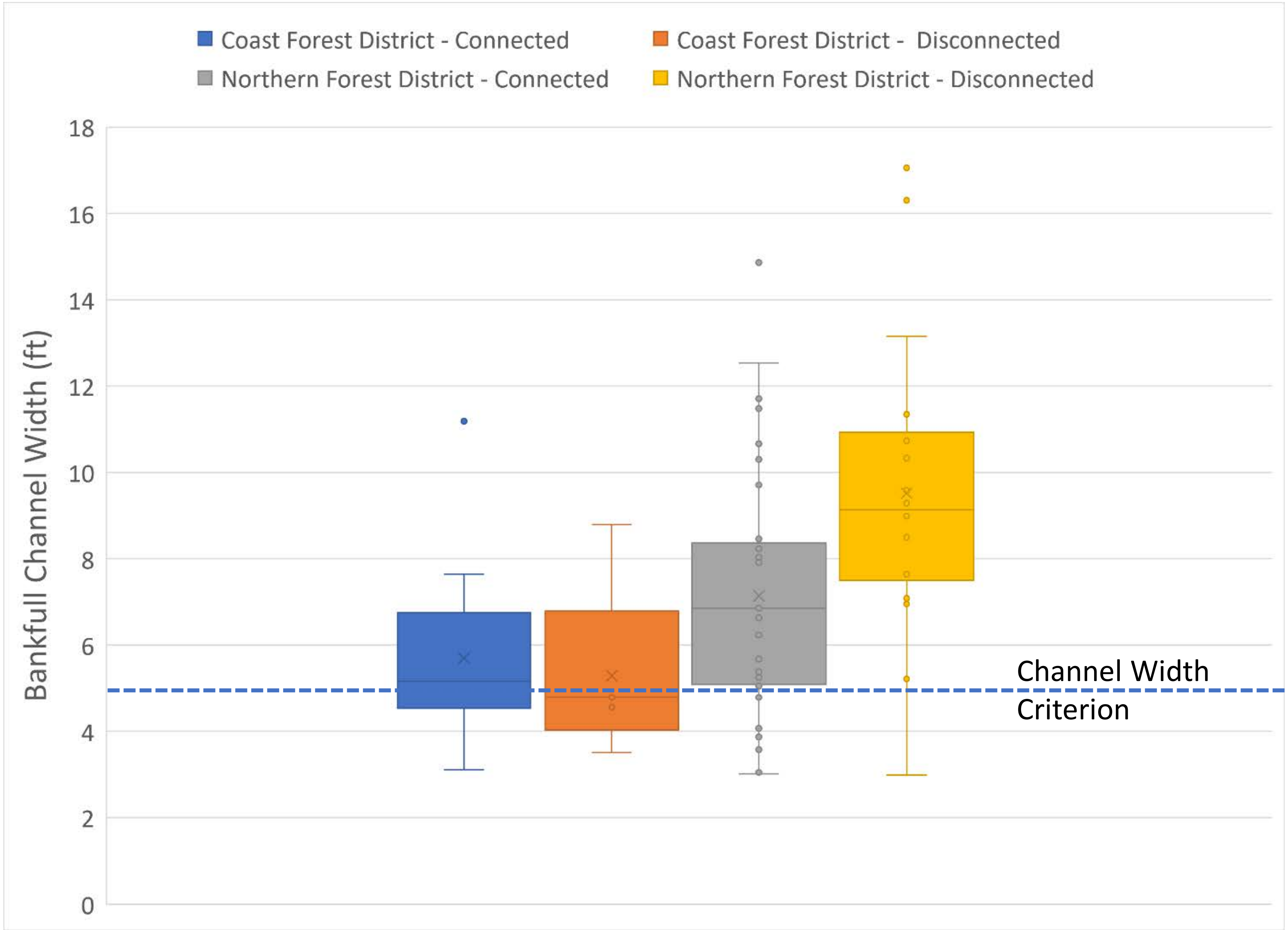
(Pate et al., 2020)

FPC 2(b)



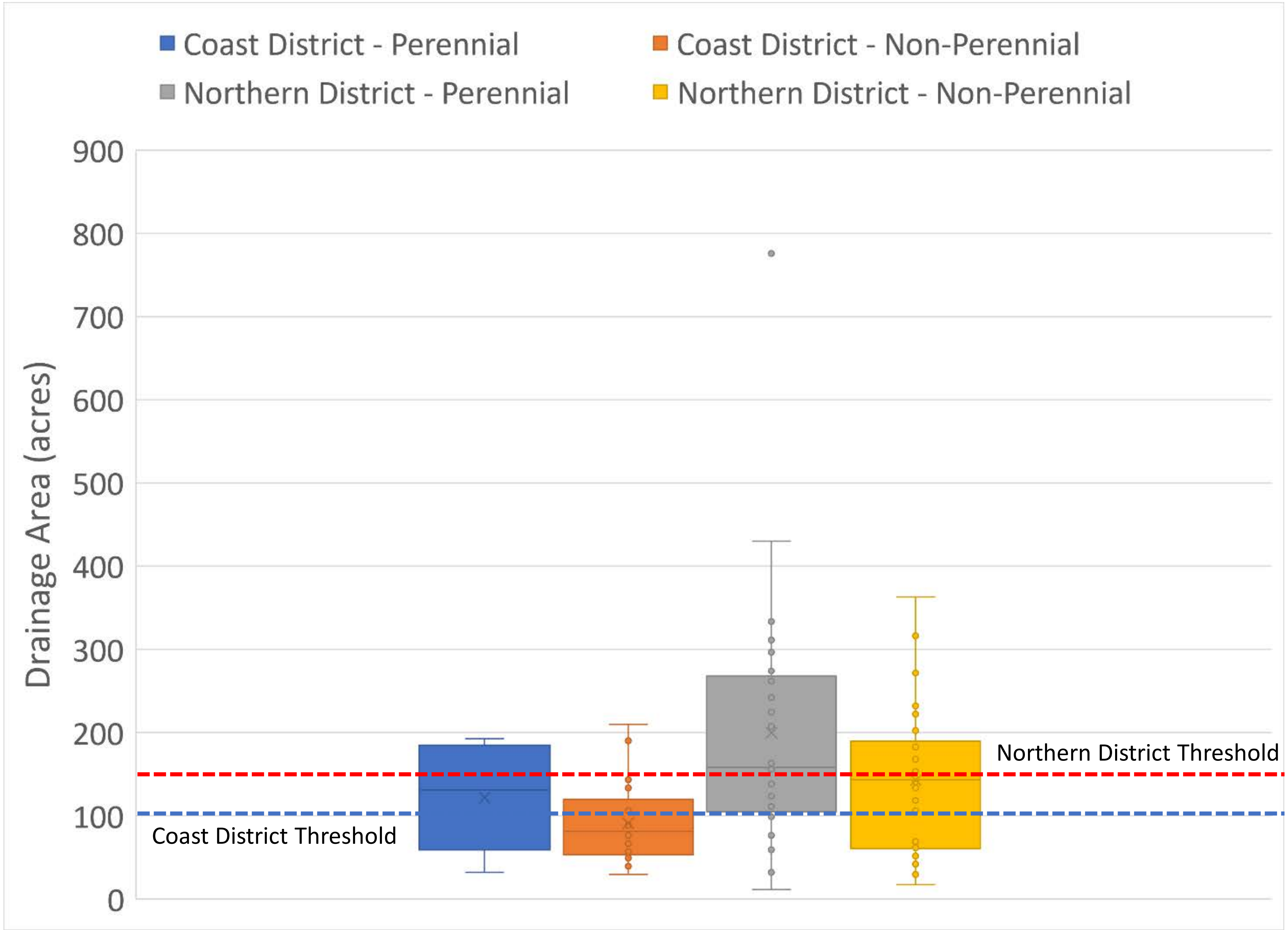
Coast District - Perennial
Coast District - Non-Perennial
Northern District - Perennial
Northern District - Non-Perennial
Bankfull Channel Width (ft)
0
2
4
6
8
10
12
14
16
18
Channel Width
Criterion

FPC 2(b)

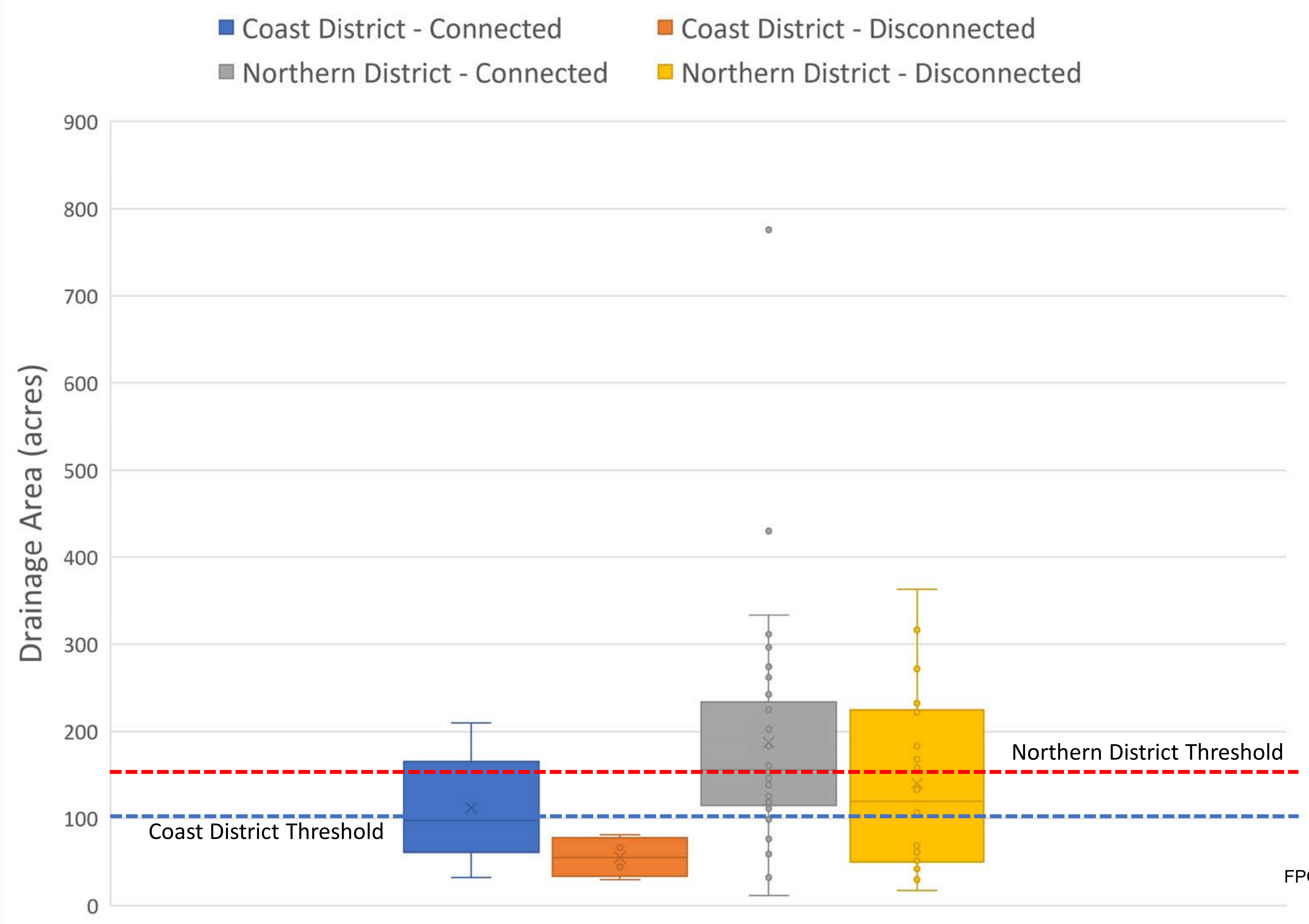


Coast Forest District - Connected
Coast Forest District - Disconnected
Northern Forest District - Connected
Northern Forest District - Disconnected
18
16
14
12
10
8
6
4
2
0
Bankfull Channel Width (ft)
Channel Width Criterion

FPC 2(b)


Coast District - Perennial
Coast District - Non-Perennial
Northern District - Perennial
Northern District - Non-Perennial
Drainage Area (acres)
900
800
700
600
500
400
300
200
100
0
Northern District Threshold
Coast District Threshold

FPC 2(b)



Coast District - Connected
Coast District - Disconnected
Northern District - Connected
Northern District - Disconnected
Drainage Area (acres)
900
800
700
600
500
400
300
200
100
0
Northern District Threshold
Coast District Threshold

FPC 2(b)

Drainage Area Statistics

		Drainage Area (acres)			
District	Flow Condition	FPR Criteria	Median	Mean	Geometric Mean
Coast	Perennial	≥100	131	122	103
Coast	Non-perennial	<100	82	91	79
Northern	Perennial	≥150	158	200	150
Northern	Non-perennial	<150	143	143	112
Coast	Connected	≥100	98	112	97
Coast	Disconnected	<100	59	56	53
Northern	Connected	≥150	156	188	148
Northern	Disconnected	<150	120	140	102

Broad Scale Study Preliminary Findings

(Pate, 2019)

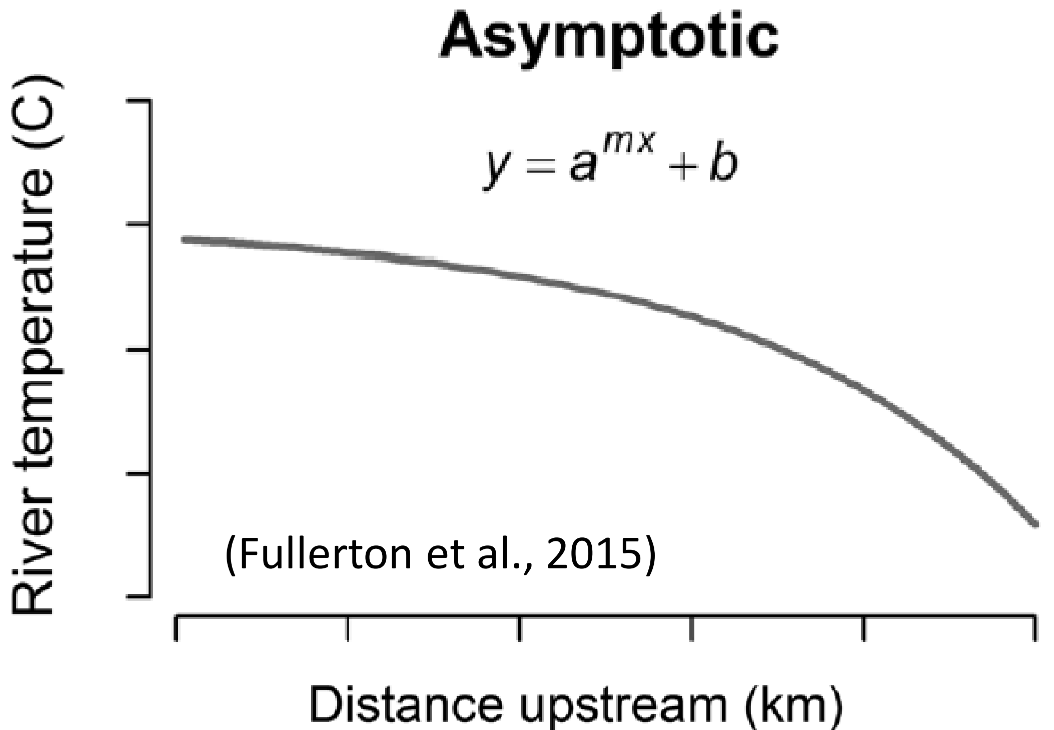
- Flow permanence and connectivity are multi-factored
  - Winter precipitation and grain size (D_{16}) more important than drainage area
- Drainage area is more important than channel width
  - Wider streams in Northern District less perennial or connected than narrower streams
- Geometric mean and/or median drainage areas for Coast and Northern District close to matching FPR criteria for drainage area
  - Validates FPR drainage criteria

Longitudinal Stream Temperature Study

FPC 2(b)

ASP Rule Assumptions - **916.9, 936.9, 956.9 (c)(4)**

(4) Class II Large Watercourses (Class II-L): The primary objective is to maintain, protect or restore the values and functions of Class II-L type Watercourses described below. Class II-L Watercourses can have greater individual effects on receiving Class I Watercourse temperature, sediment, nutrient, and large wood loading than Class II standard (Class II-S) Watercourses due to larger channel size, greater magnitude and duration of flow, and overall increased transport capacity for watershed products. Other objectives stated in 14 CCR § 916.9 [936.9, 956.9] subsections (c)(1) and (2) above for the Core Zone and Inner Zone are also desired objectives for Class II-L type Watercourses.

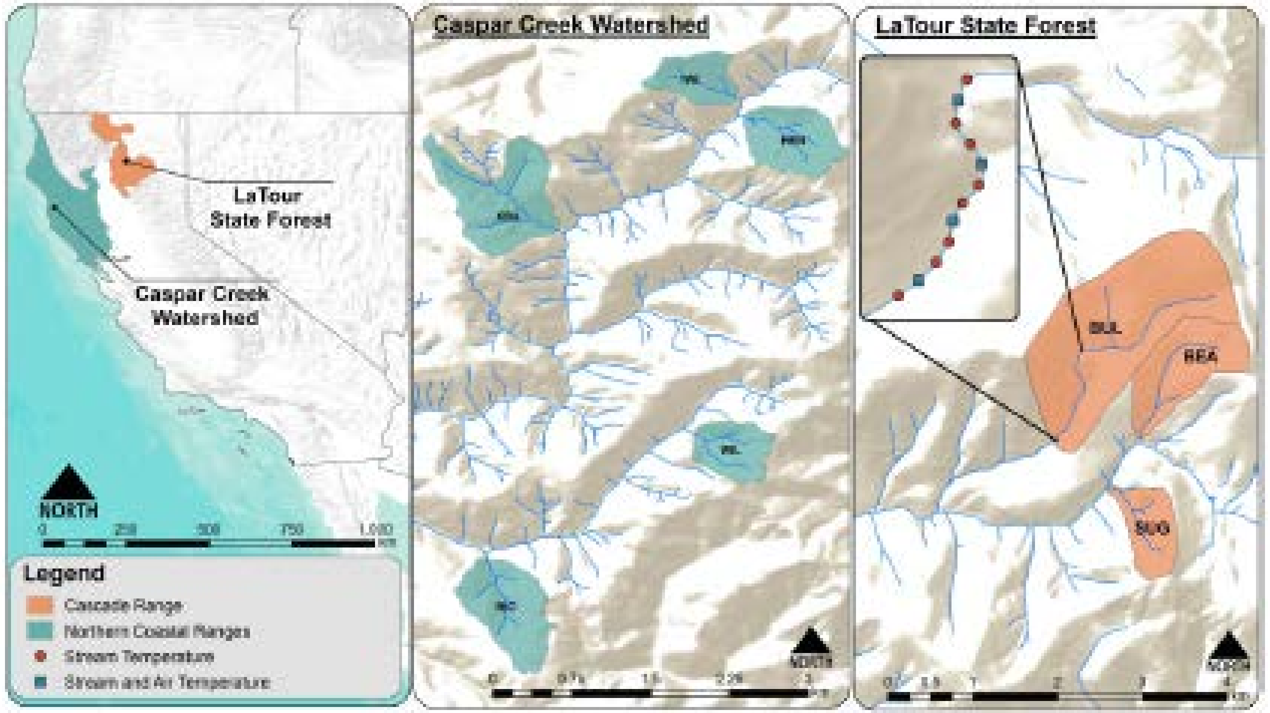


(Fullerton et al., 2015)

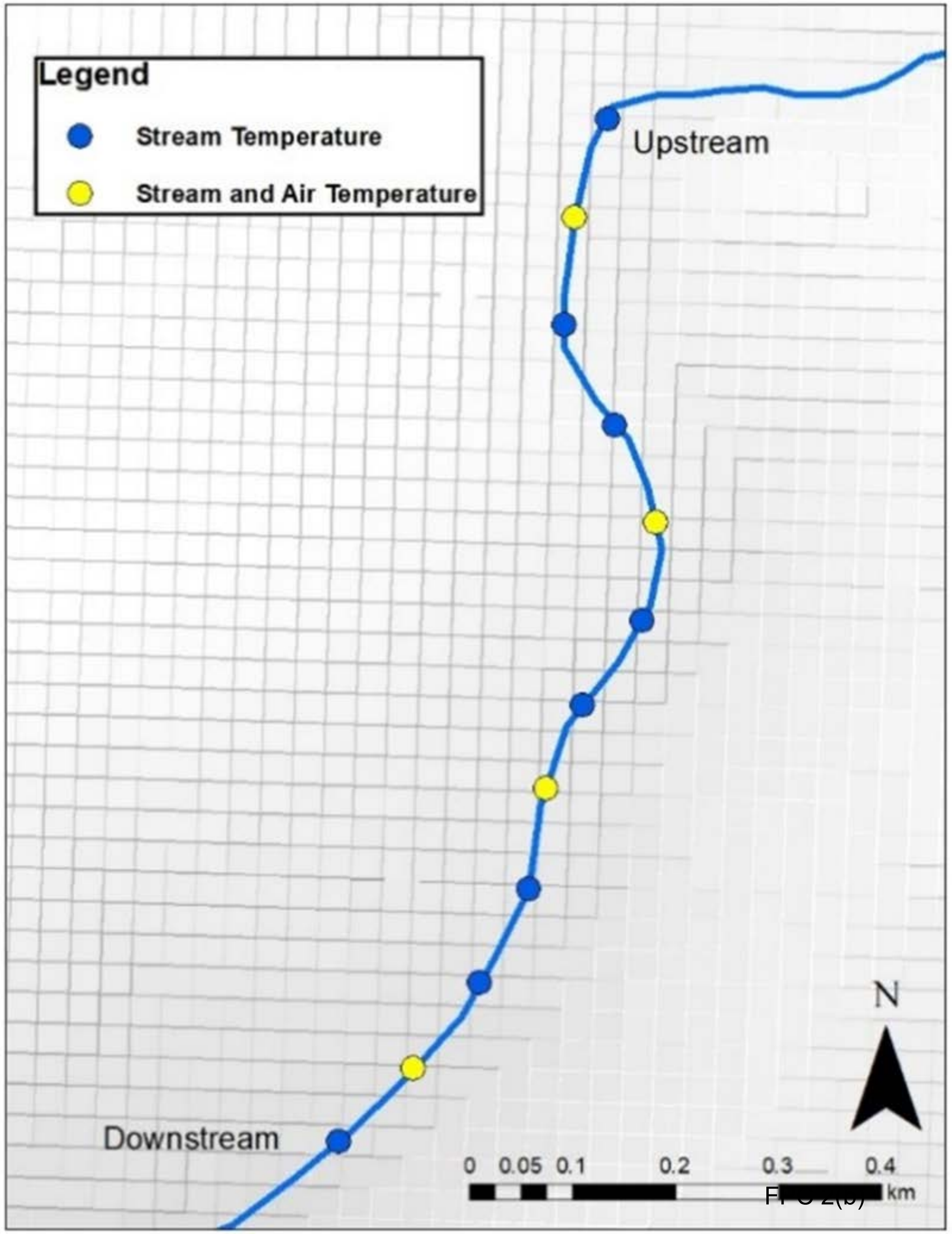
- Assumes that Class II-L have more of an influence transmitting temperature increases to Class I watercourses
- Consistent with the dominant paradigm of asymptotic warming where stream temperature reaches equilibrium with meteorological conditions

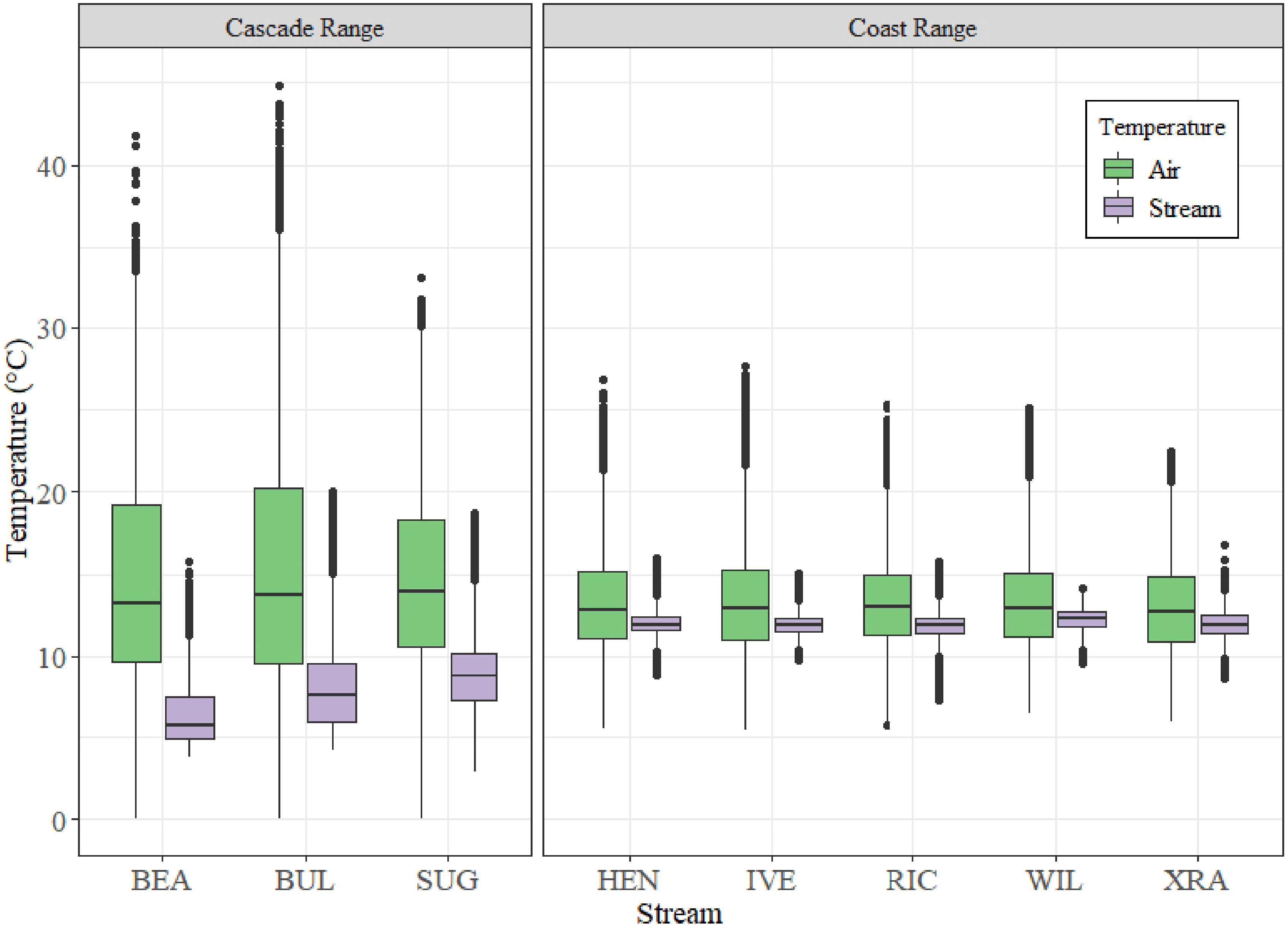
FPC 2(b)

- 5 streams in Jackson Demonstration SF (57-153 acres)
- 3 streams in LaTour Demonstration SF (143-773 acres)
- Contrasting lithology (Sedimentary vs Volcanic)
- 12 stream temperature sensors and 4 air temperature sensors from start of Class III down to higher order watercourse
- Measured Oct 2017 to September 2018



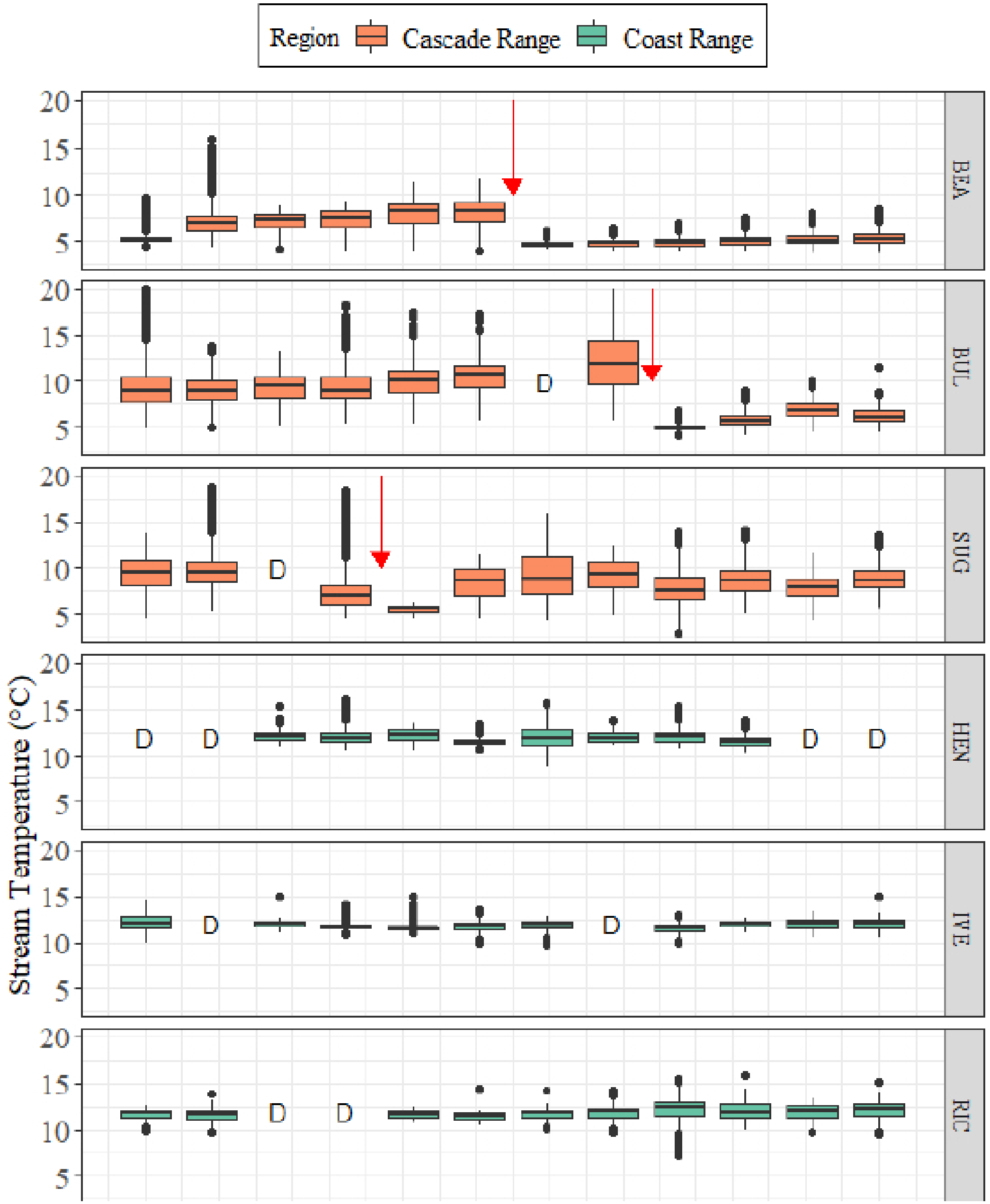
(Wissler et al., in prep)





(Wissler et al., in prep)

Cascade streams more decoupled from atmospheric controls than Coast Range streams



(Wissler et al., in prep)

- 3 Cascade streams cooled in the downstream direction
  - Primary due to cold water spring inputs
- 4 of 5 Coastal streams warmed in the downstream direction
- Thermal sensitivities were lower in Cascades versus Coast
  - Thermal sensitivity is the slope term of the regression between water temperature and air temperature
  - Median thermal sensitivity is 43% more in Coast as compared to Cascades

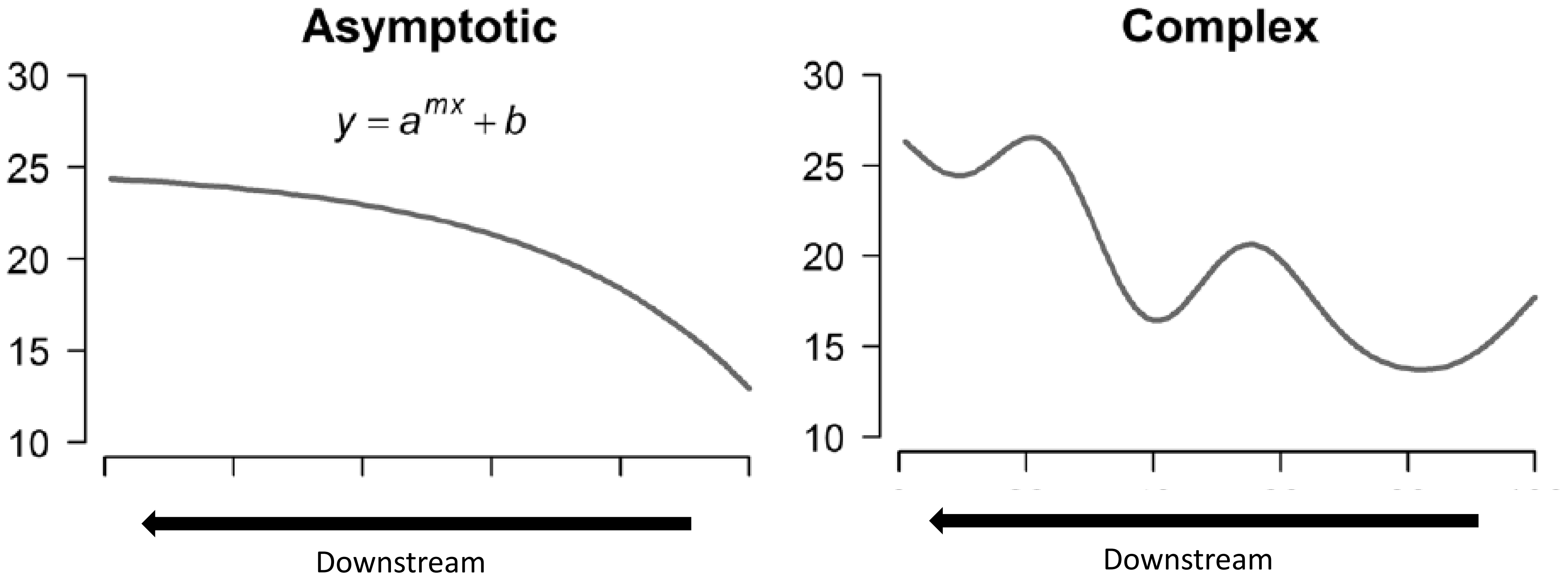
Study Validates Concepts in 14 CCR § 916.9 [936.9, 956.9] (v)

(v) Site-specific measures or nonstandard operational provisions

(1) In consideration of the spatial variability of the forest landscape, the RPF may propose site-specific measures or nonstandard operational provisions in place of any of the provisions contained in this section. Site specific plans may be submitted when, in the judgment of the RPF, such measures or provisions offer a more effective or more feasible way of achieving the goals and objectives set forth in 14 CCR § 916.9 [936.9, 956.9], subsections (a) and (c), and would result in effects to the beneficial functions of the Riparian zone equal to or more favorable than those expected to result from the application of the operational provisions required under 14 CCR § 916.9 [936.9, 956.9].

“Section V” is not widely used despite Guidance Document Being Available

What Should Our Assumptions for Class IIs be in ASP?



(Fullerton et al, 2015)

EMC-2015-001 Limitations

- Mitigation of Thermal Impacts is Only One Aspect of the ASP Rules
  - EMC-2018-006 is testing Class II-L riparian prescription effectiveness on GDRC lands for preventing thermal impacts and changes to primary productivity
- The Broad Scale Study May Not Adequately Characterize Spatial Variability Across the Range of the ASP Rules
- The Broad Scale Study May Not Adequately Characterize Temporal Variability Across the Range of the ASP Rules
- The Longitudinal Study is a Case Study and May Not Reflect Downstream Temperature Dynamics Across the Entire Range of ASP

EMC-2015-001 Potential Implications

- Potential for simplifying Class II-L FPRs by removing channel width criterion
  - Broad scale study shows drainage area more important than channel width
  - Drainage area criteria is more objective than channel width
  - Coefficient of variation for channel width is 25-40%
  - Likely smaller total length of streams will receive Class II-L protection
- Potential for using “Section V” in instances where thermal sensitivity is lower (e.g., younger volcanics; other lithologies?)
  - Why is “Option V” not utilized commonly?