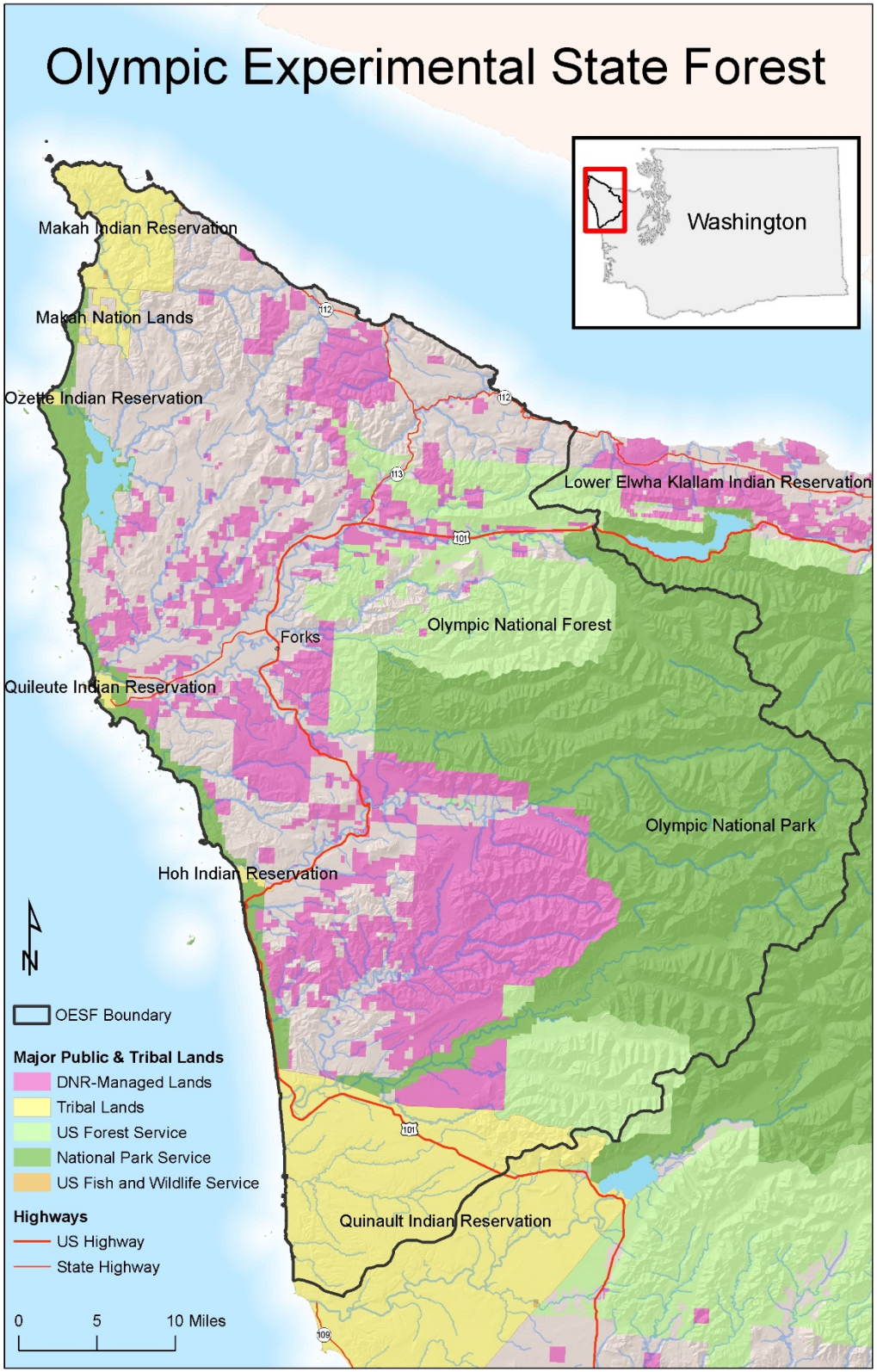
Monitoring of Riparian and Aquatic Habitat and Fish in the Olympic Experimental State Forest:

Project Description and Collaboration Opportunities

Teodora Minkova and Kyle Martens

Presentation to Quinault Indian Nation, October 22, 2015



270,000 ac forested lands

Steep erodible terrain

Ave. precipitation of 140"/year

Dense stream network

Temperate rain forest

Sitka Spruce and Western Hemlock vegetation zones

Some of the healthiest salmon populations in WA

Working forest - current harvest level of 576 mmbf / decade

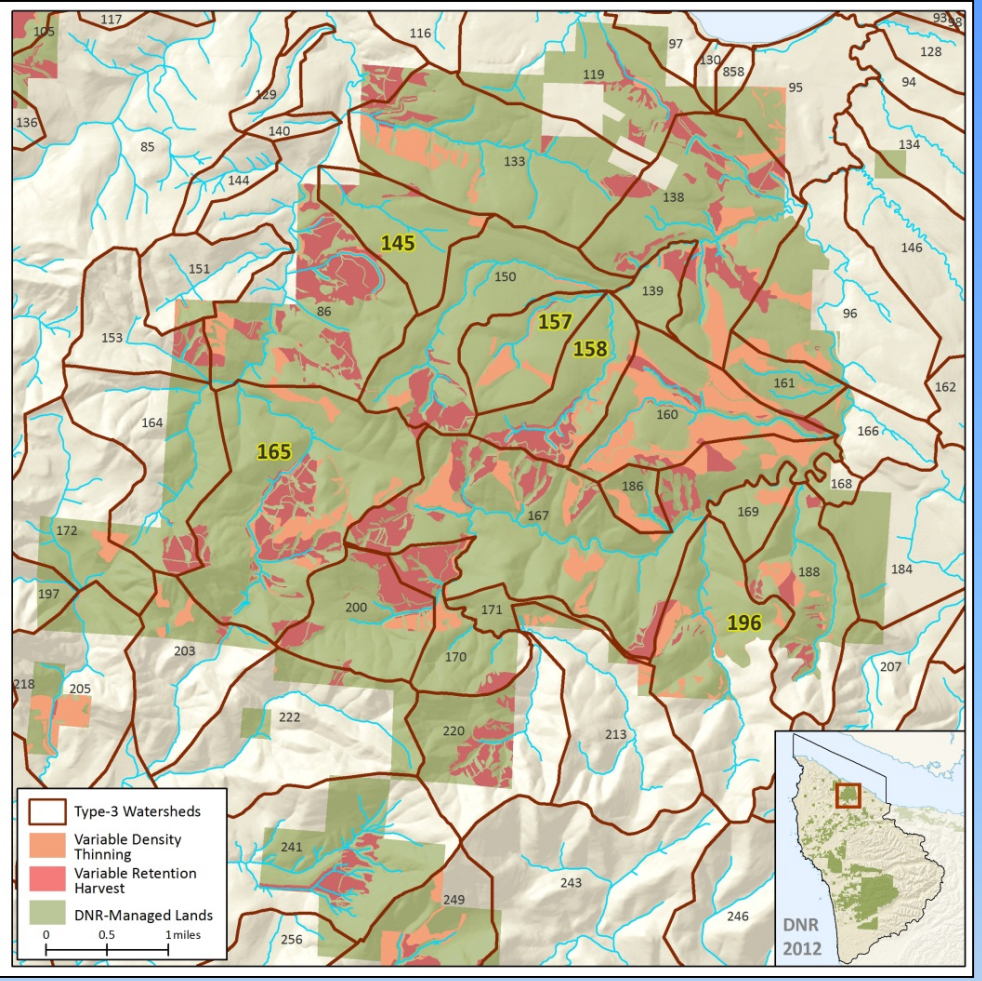
Habitat Conservation Plan signed in 1997

- Northern spotted owl
- Marbled murrelet
- Salmonids

Integrated forest management:

- limited fixed reserves for spotted owl conservation
- variable-width riparian buffers

A place for experimentation



Proposed harvest schedule

Clallam block, 1st decade, landscape alternative

OESF Forest Land Plan was developed to guide forest management

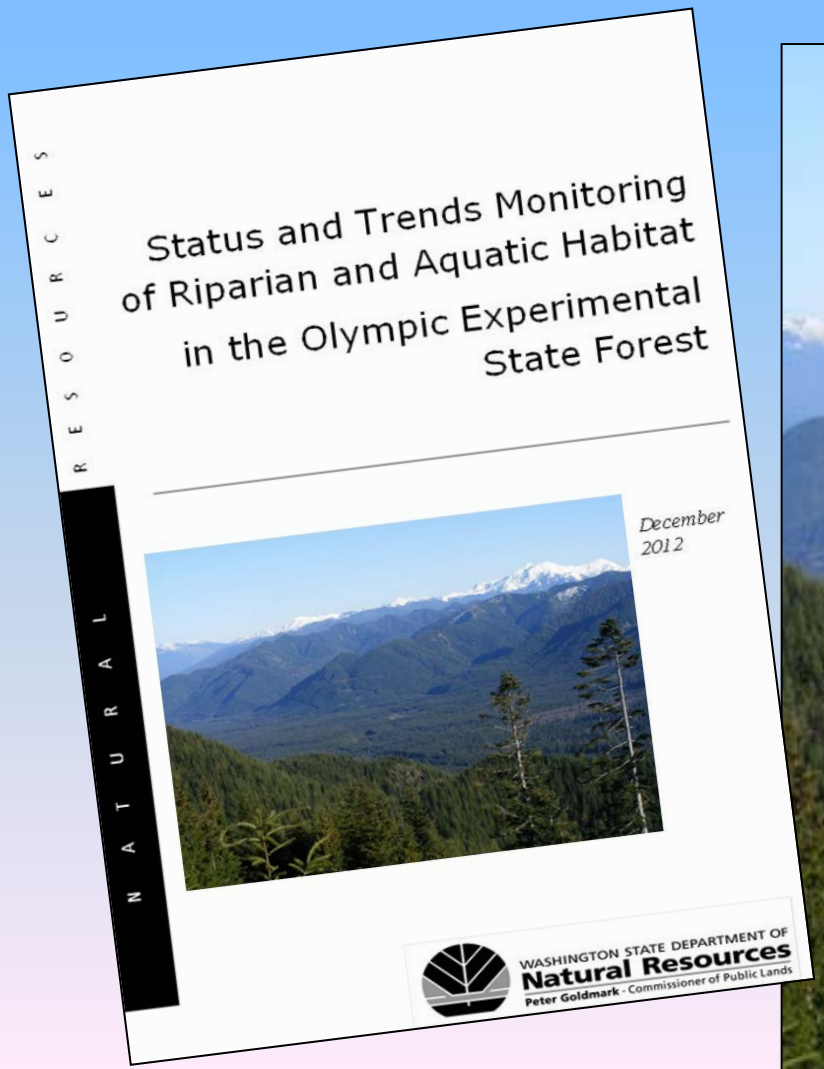
Environmental Impact Analysis (EIS) showed improved aquatic and riparian conditions

Uncertainties identified during the analyses:

- Resource inventory (streams, forest)
- Ecological relationships
- Management effects
- Effects of natural disturbances

Habitat Monitoring Goal

To characterize the recovery of riparian and aquatic habitat across the OESF as the forest land plan is implemented.



Objectives of the Study Plan

1. Document the status and trends in riparian and aquatic conditions.

2. Test presumed relationships between riparian, upland, and in-stream conditions.

3. Test the assumptions about habitat recovery and evaluate the EIS projections of riparian habitat conditions over time.

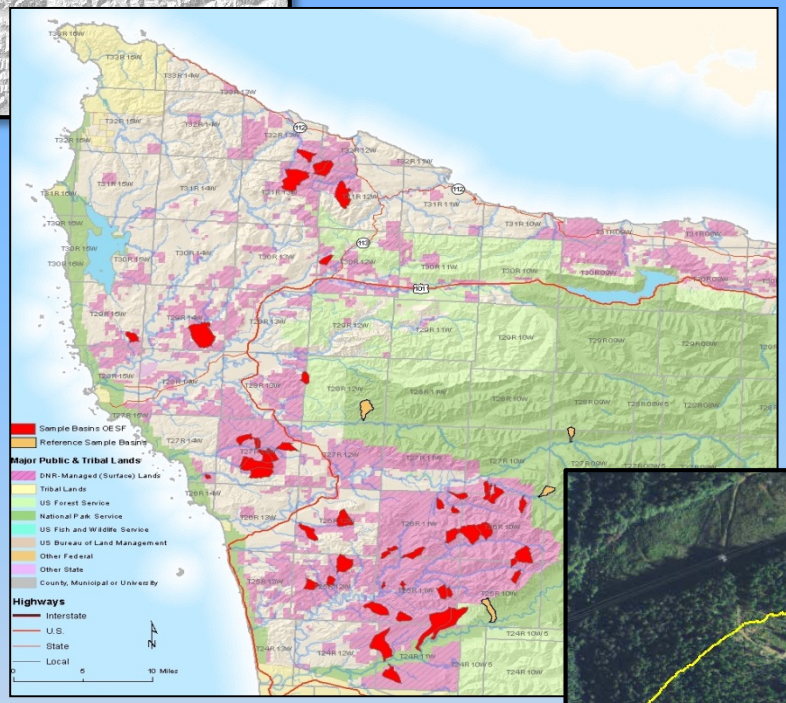
4. Supply information for HCP implementation, effectiveness, and validation monitoring.

5. Improve understanding of “habitat complexity afforded by natural disturbances”.

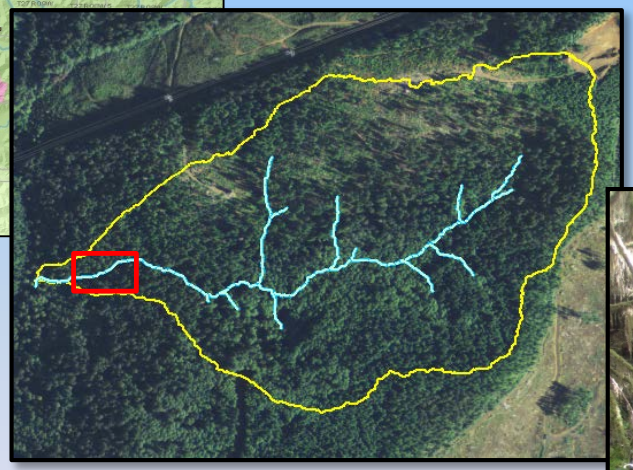
6. Establish critical baseline information for adaptive management.

Spatial Study Design

Target population: 601 basins (size 70 -1760 ac)

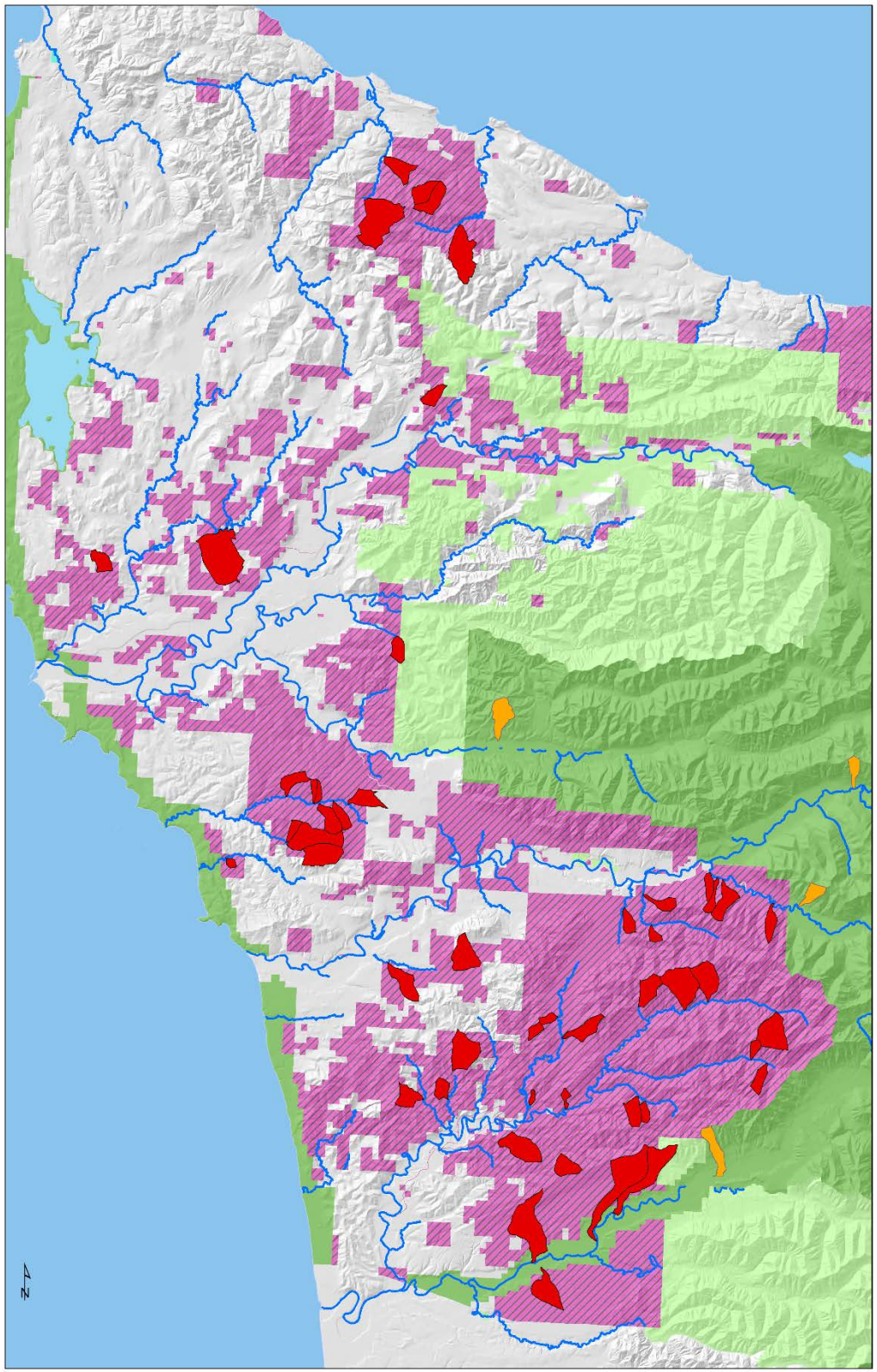


Sample: 50 OESF basins + 4 reference basins in the Olympic National Park



Field sampling at the basin's outlet

Sample reach: 100+ m of fish bearing stream and riparian area



Sites by watershed:

Hoko = 2

Clallam = 3

Sol Duc = 1

Dickey = 2

Callawah = 1

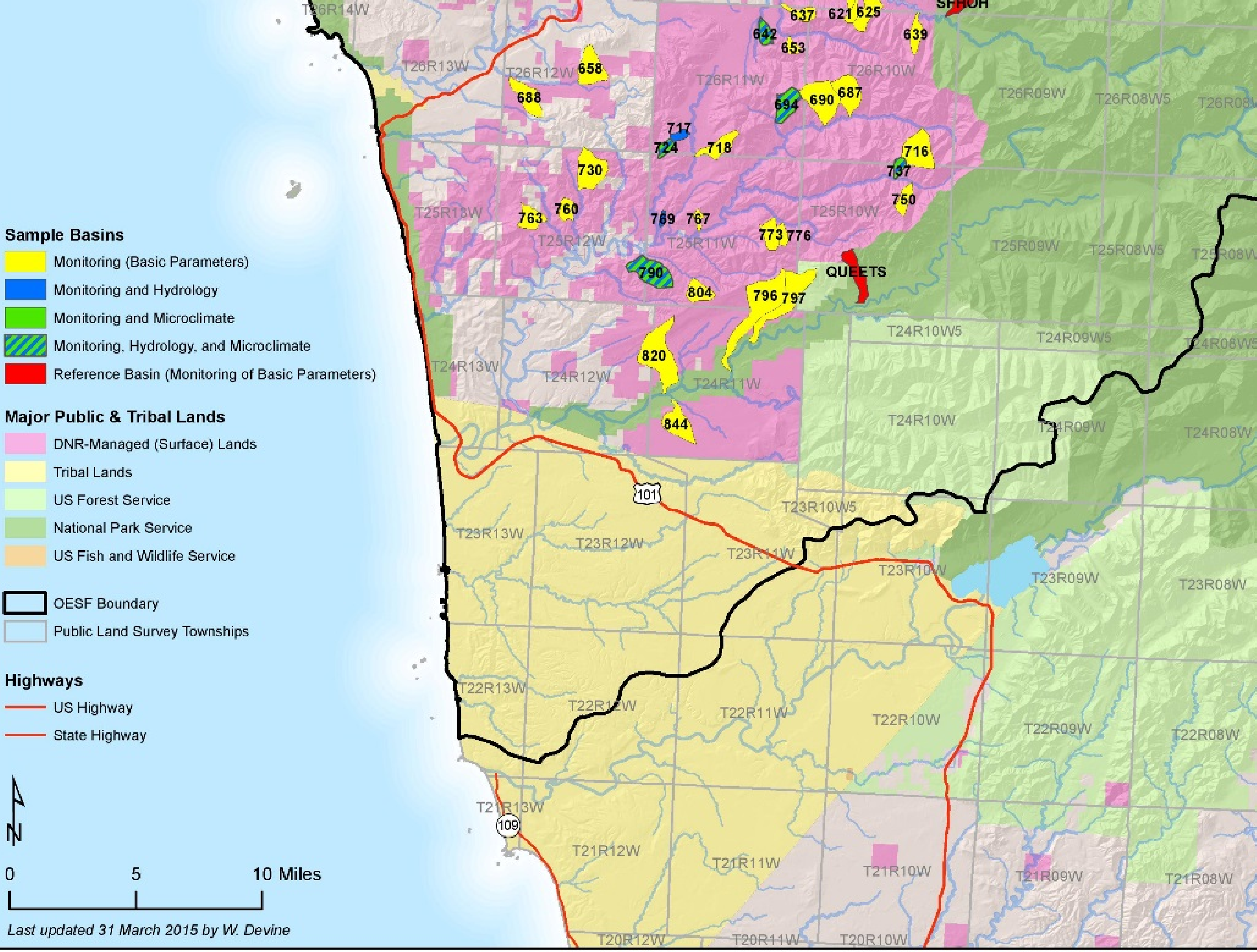
Goodman = 9

Mosquito = 1

Hoh = 9

Clearwater = 18

Queets = 4


Sample Basins
Monitoring (Basic Parameters)
Monitoring and Hydrology
Monitoring and Microclimate
Monitoring, Hydrology, and Microclimate
Reference Basin (Monitoring of Basic Parameters)
Major Public & Tribal Lands
DNR-Managed (Surface) Lands
Tribal Lands
US Forest Service
National Park Service
US Fish and Wildlife Service
OESF Boundary
Public Land Survey Townships
Highways
US Highway
State Highway
N
0
5
10 Miles
Last updated 31 March 2015 by W. Devine
QUEETS
637
621
625
642
653
639
658
688
690
687
694
717
724
718
716
737
730
750
763
760
789
767
773
776
790
804
796
797
820
844
101
109
T26R13W
T26R12W
T26R11W
T26R10W
T26R09W
T26R08W5
T25R13W
T25R12W
T25R11W
T25R10W
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T21R08W
T20R12W
T20R11W
T20R10W

Habitat Monitoring Indicators

Nine aquatic and riparian indicators sampled at reach level:

1) channel morphology (incl. gradient, confinement, depth, and width)
2) water temperature
3) channel substrate
4) stream discharge
5) in-channel large woody debris
6) habitat units (such as pools)
7) stream shade
8) riparian microclimate
9) riparian forest vegetation

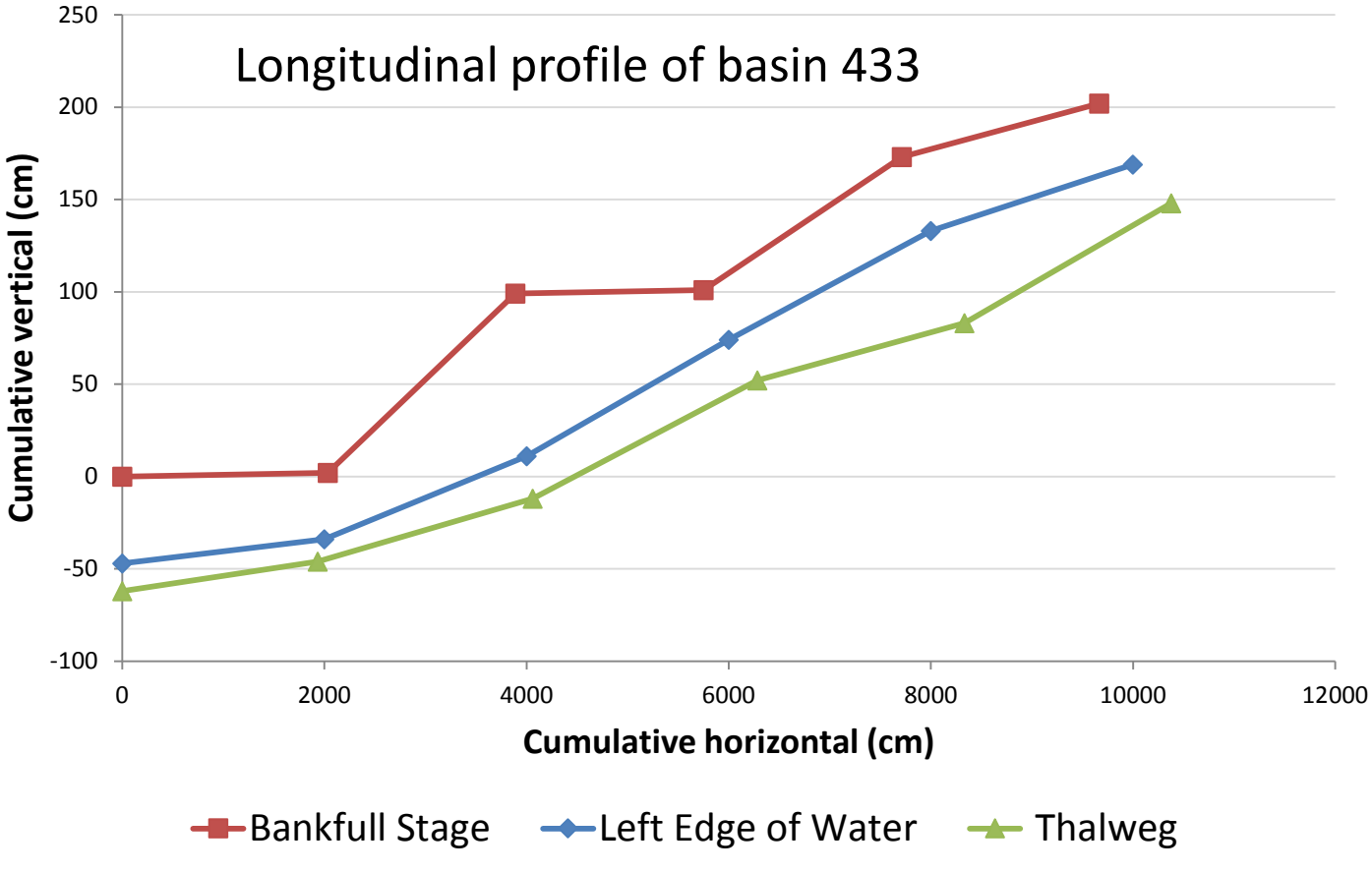
Watershed-level "stressors" were identified for monitoring in the 50 sample basins

1) timber harvest activities
2) road management and use
3) natural disturbances (windthrow, landslides, floods and debris flows)

Stream Elevation Survey

Longitudinal profiles completed for

48 OESF basins and 2 ONP basins



Cross-section Survey

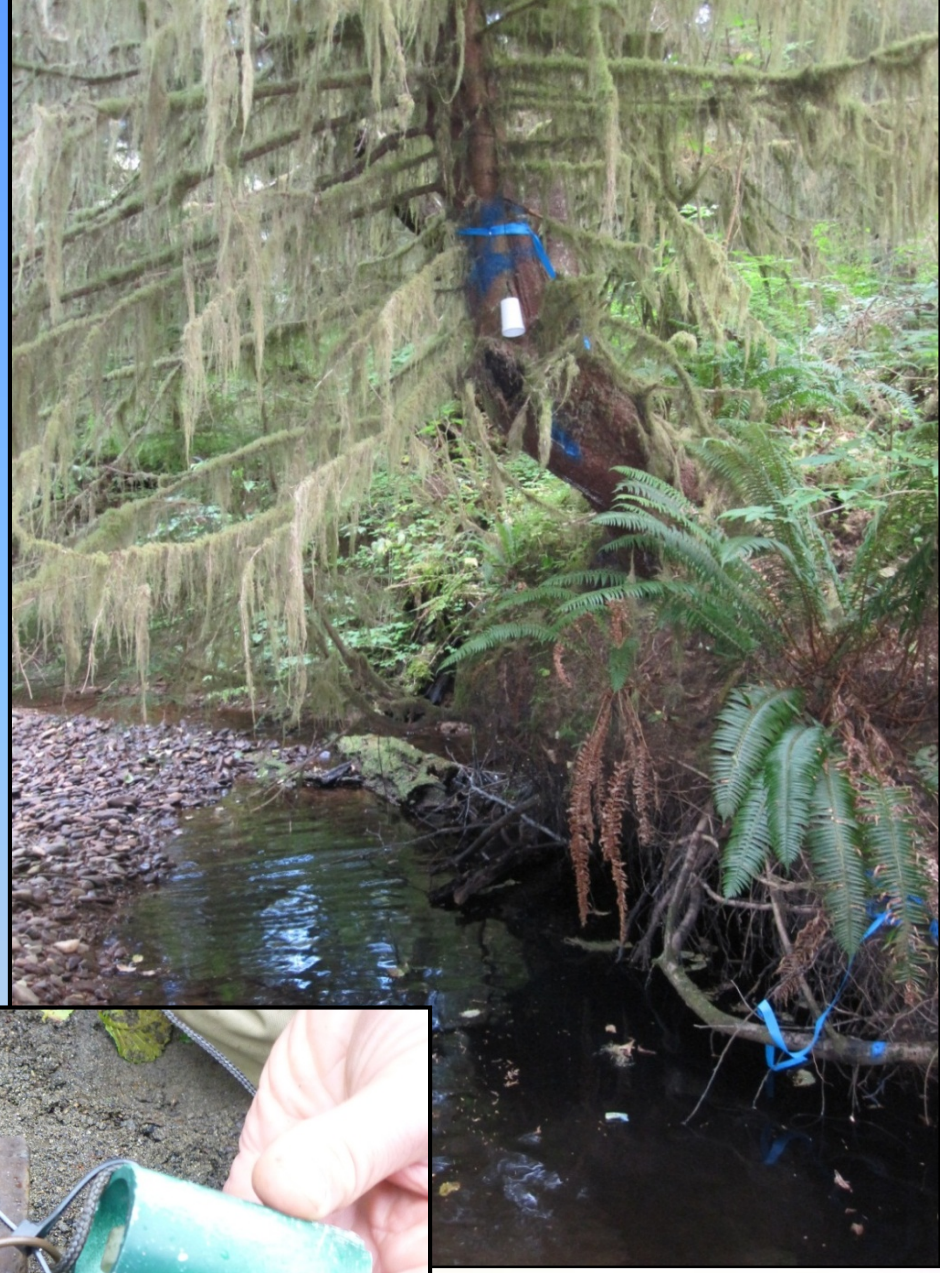
- channel width
- channel depth
- substrate size
- substrate embededness

Cross Section	station intervals (cm)	Channel Substrate					
		Particle #1			Particle #2		
		size (mm)	size class	embed. (%)	size (mm)	size class	embed. (%)
A	0	16	fine gravel	n/a	32	coarse gravel	n/a
A	80	22.6	coarse gravel	n/a	sand	sand	100
A	160	90	cobble	30	90	cobble	5
A	240	32	coarse gravel	n/a	180	cobble	50
A	320	180	cobble	20	90	cobble	15
A	400	8	fine gravel	n/a	90	cobble	40
A	480	16	fine gravel	n/a	32	coarse gravel	n/a
A	560	2	sand&silt	n/a	64	coarse gravel	0
A	640	16	fine gravel	n/a	32	coarse gravel	n/a
A	720	45	coarse gravel	10	64	coarse gravel	15
A	800	64	coarse gravel	n/a	64	coarse gravel	15

Protocols completed for 48 OESF basins and 2 ONP basins

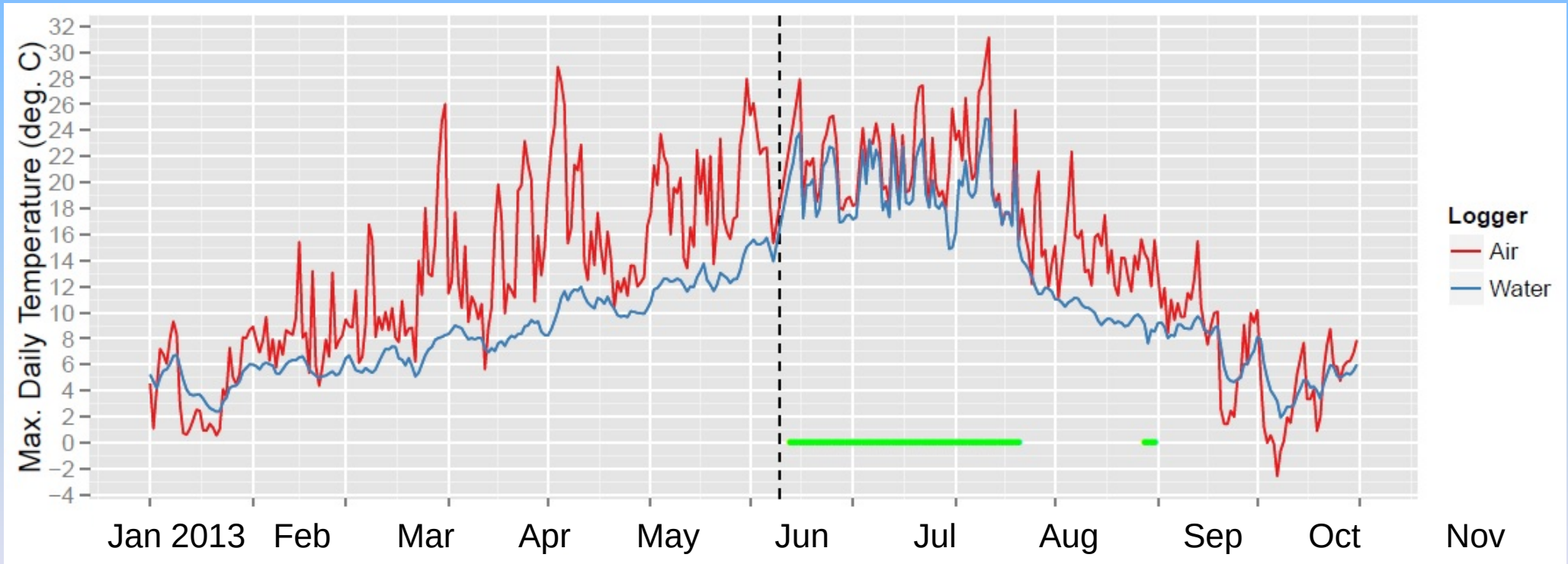
Stream Temperature

- Air and water temperature data loggers recording every 60 min year around
- Installed in all 54 basins
- Field protocol based on DOE procedures (Bilhimer et al. 2013)

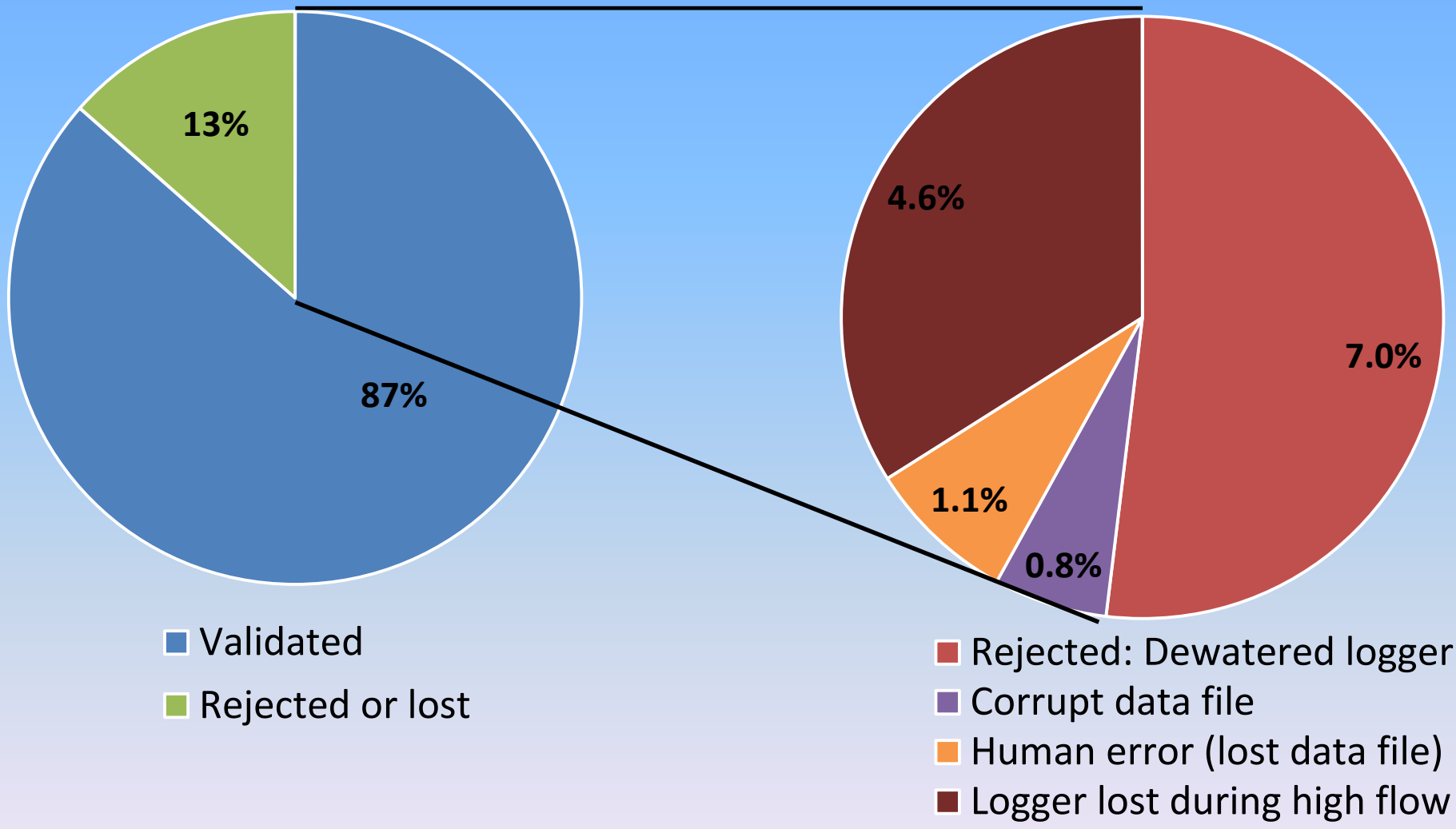


Stream Temperature Data Management

QC procedures following Sowder and Steel (2012)

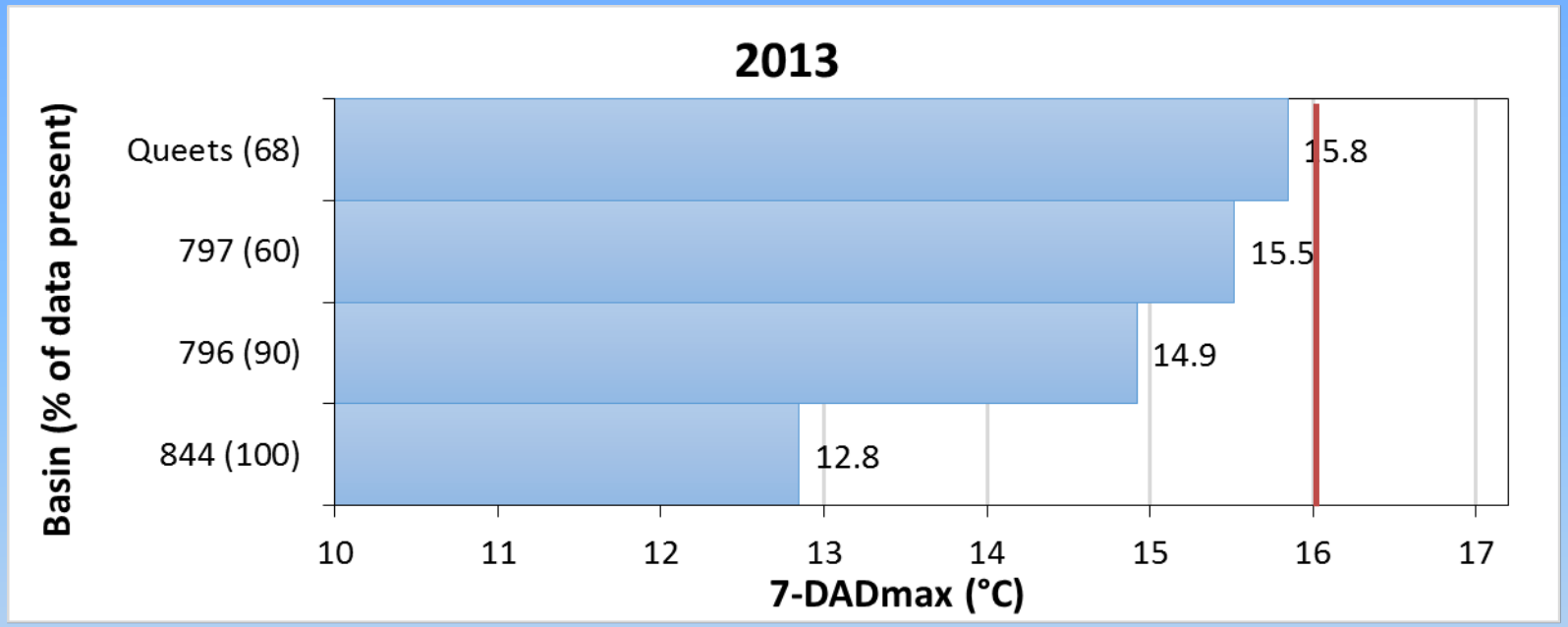


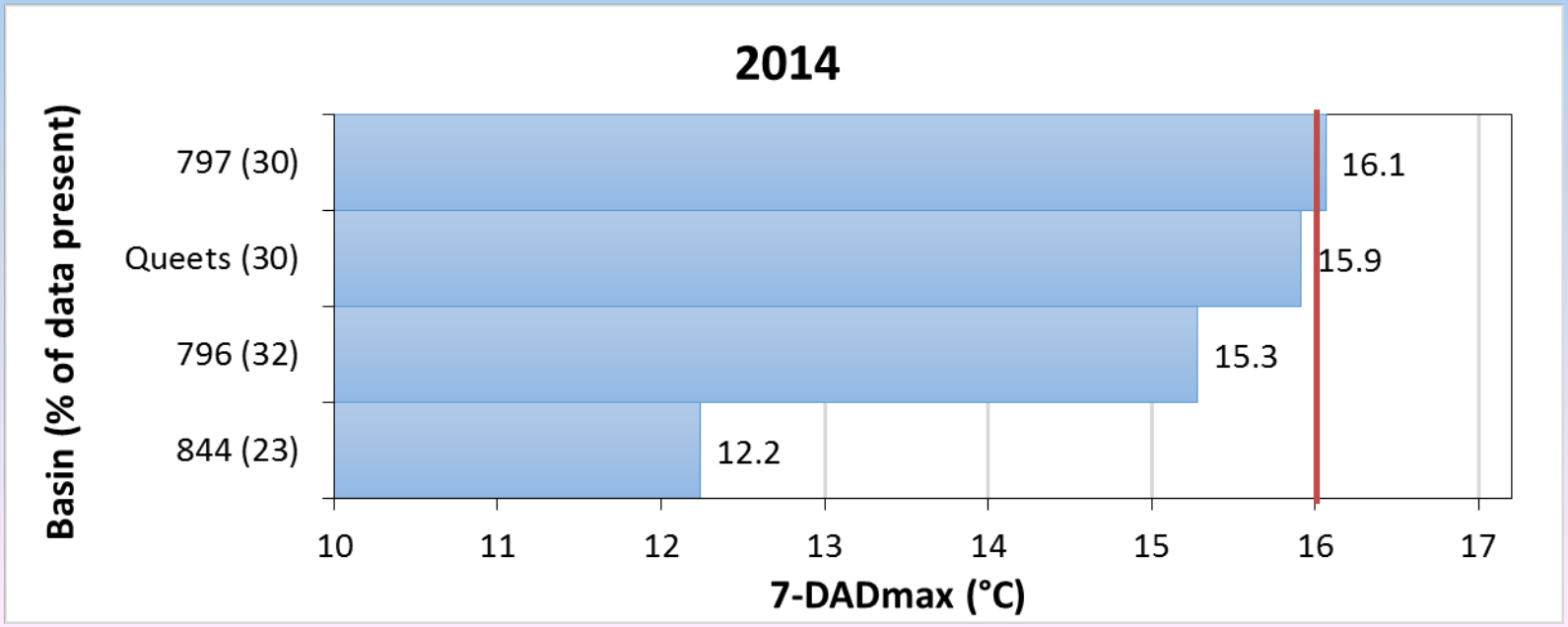
Stream Temperature Data 2012-2014



7-DADMax stream temperature for 2014 for basins with 16 °C core summer (15 June 15–15 September) habitat criterion

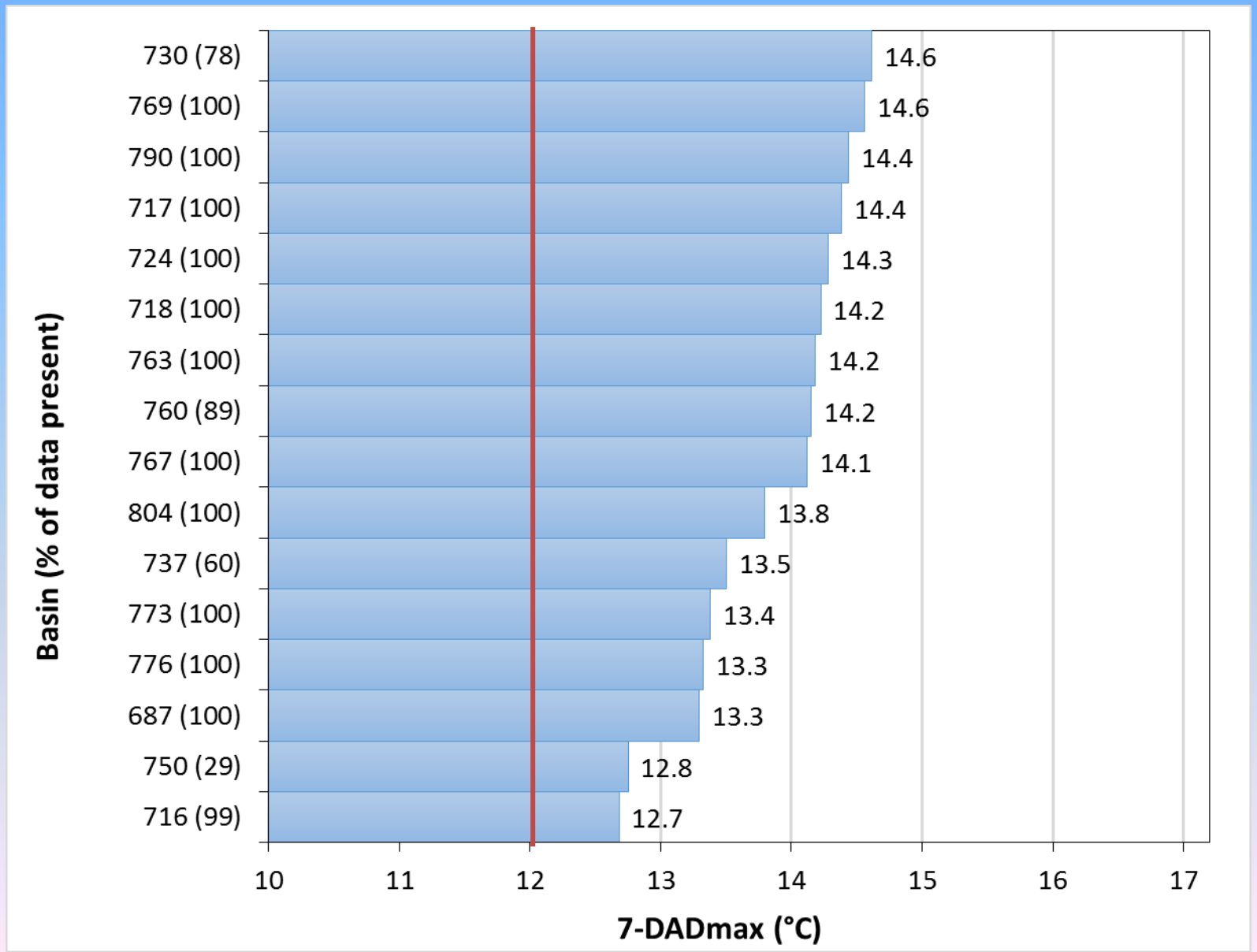
(WADOE 2006)





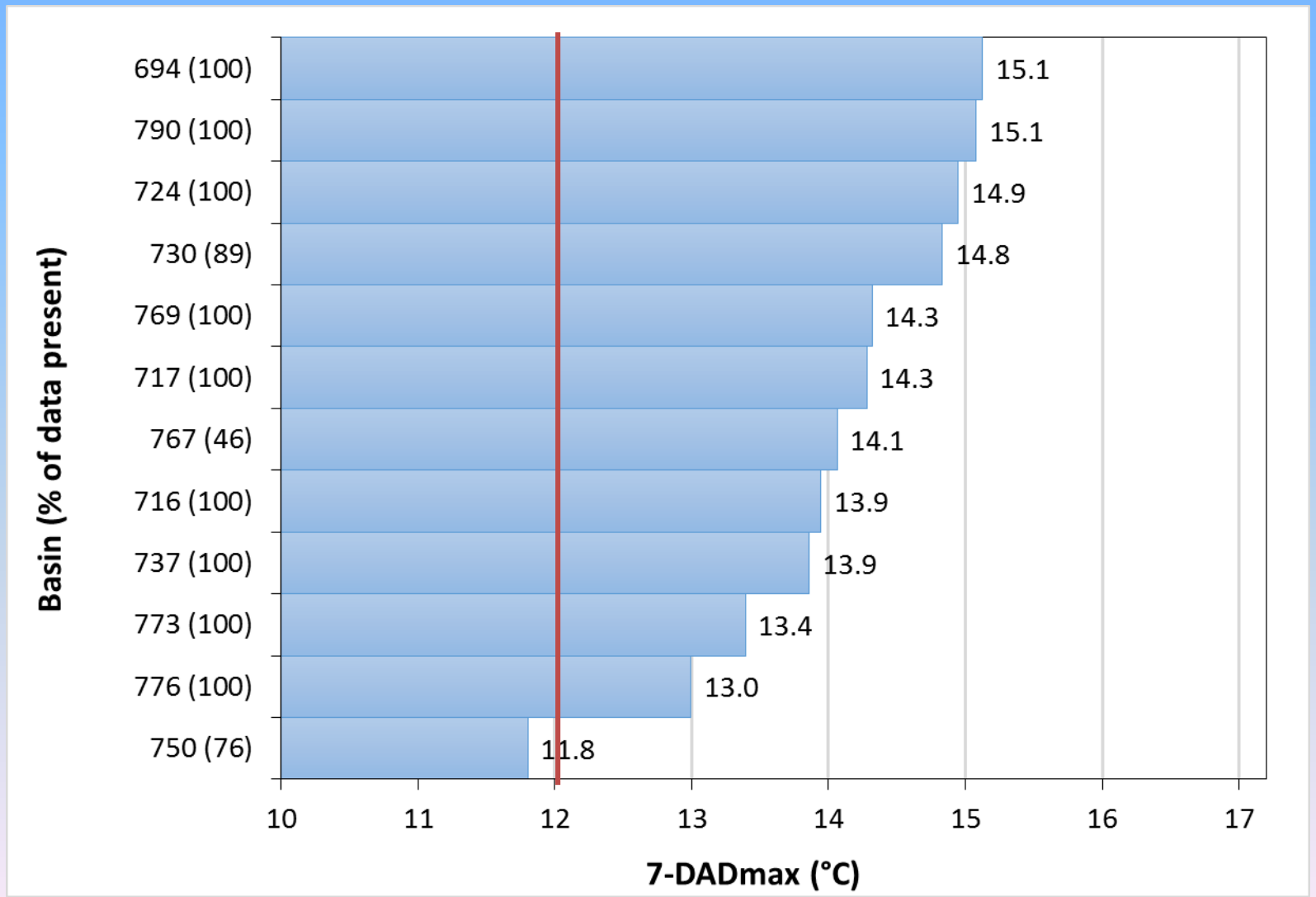
7-DADMax stream temperature for 2013 for basins with 12 °C core summer (15 June 15–15 September) and 12 °C (all-year) char spawning and rearing habitat criteria

(WADOE 2006)



7-DADMax stream temperature for 2014 for basins with 12 °C core summer (15 June 15–15 September) and 12 °C (all-year) char spawning and rearing habitat criteria

(WADOE 2006)

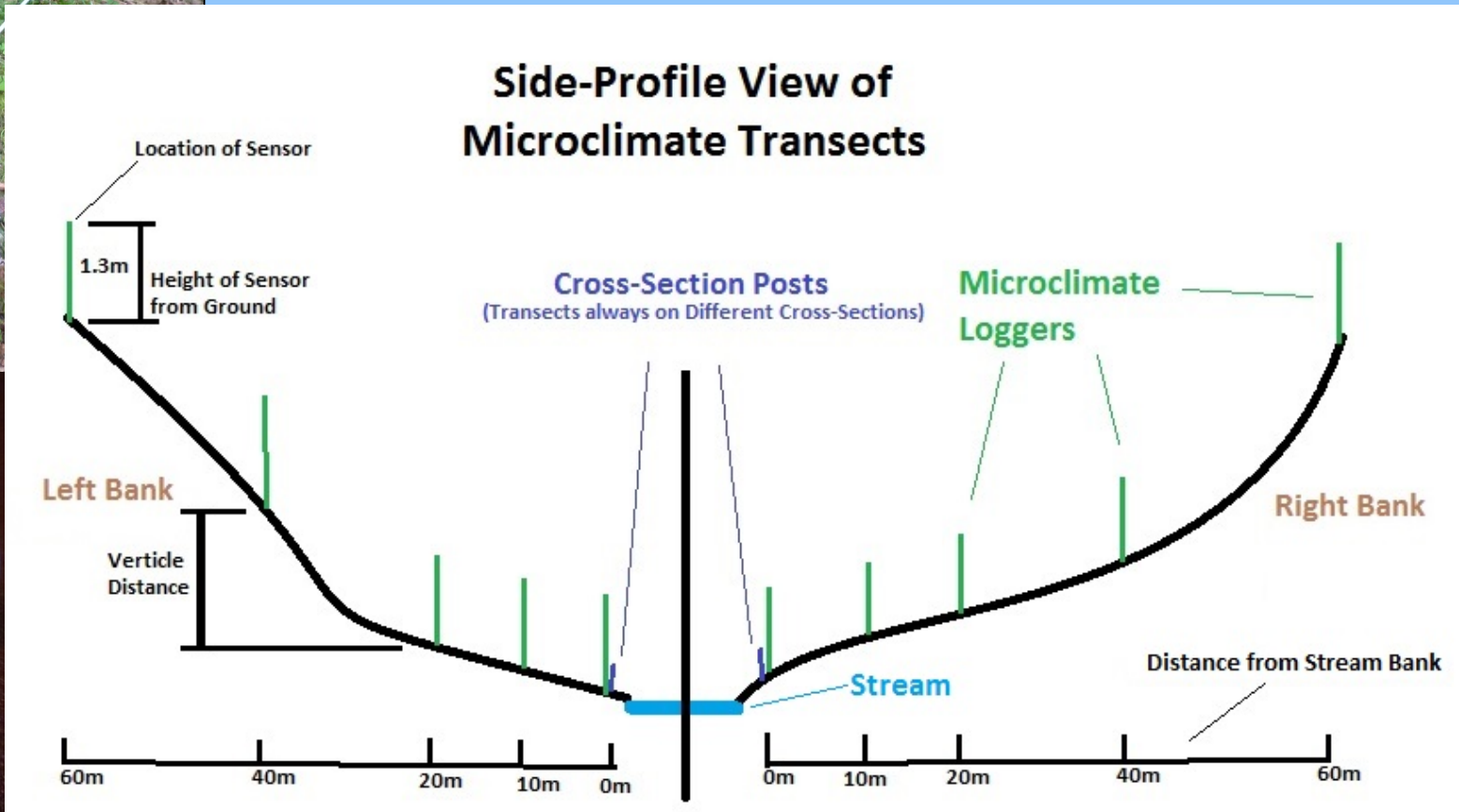


Stream Shade

- Sampling through hemispherical photography
- Analyses of images with Hemispher (Schleppi 2011) and Sidelook (Nobis 2005)

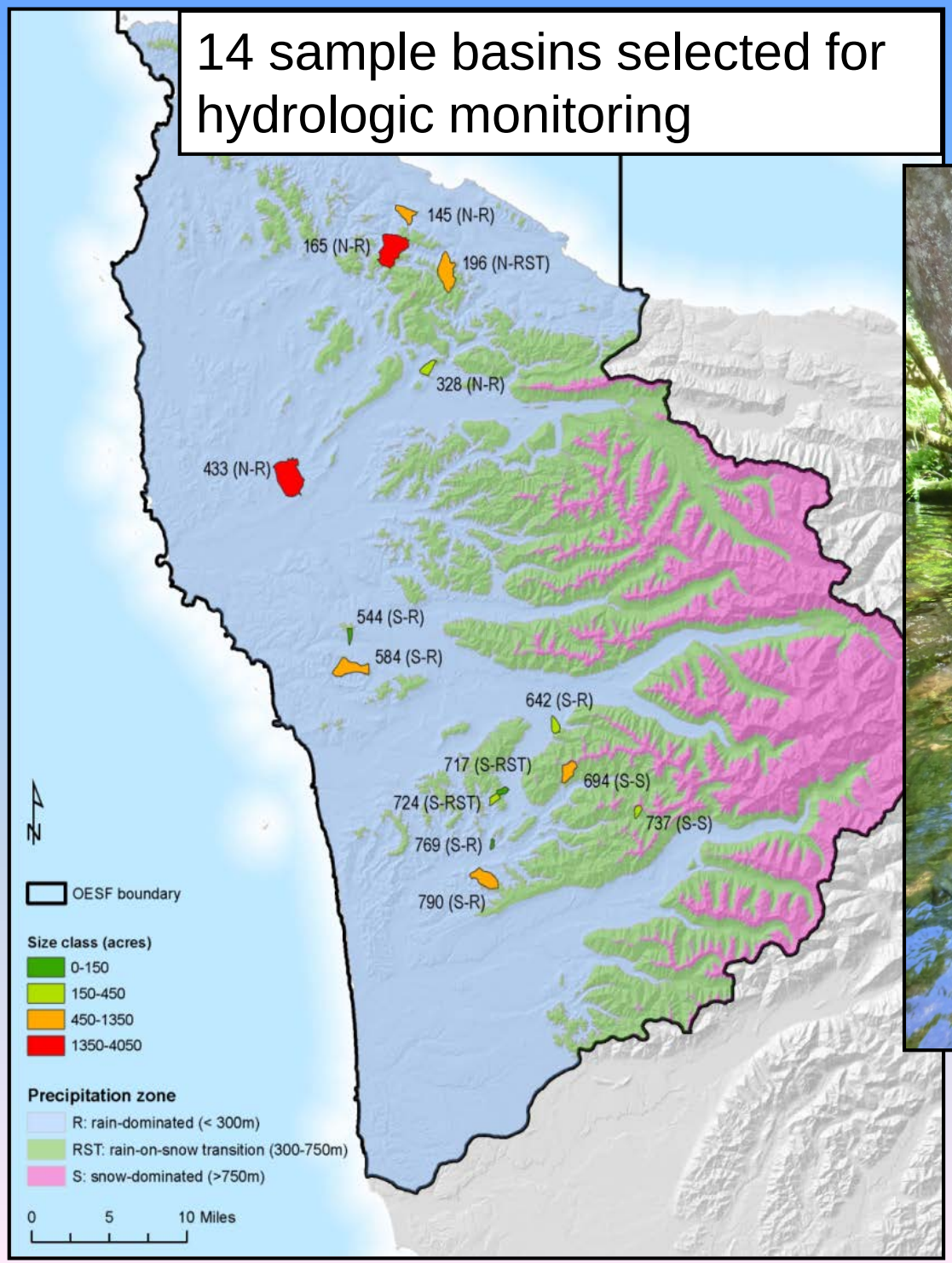
Microclimate

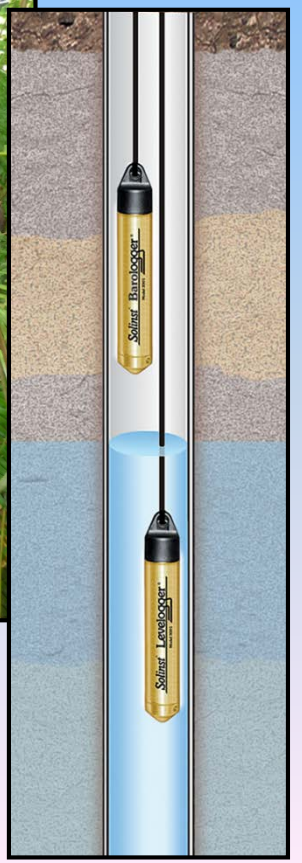
- Loggers measure air temperature and humidity every 2 hours year around
- Installed in 10 basins



Hydrologic Monitoring

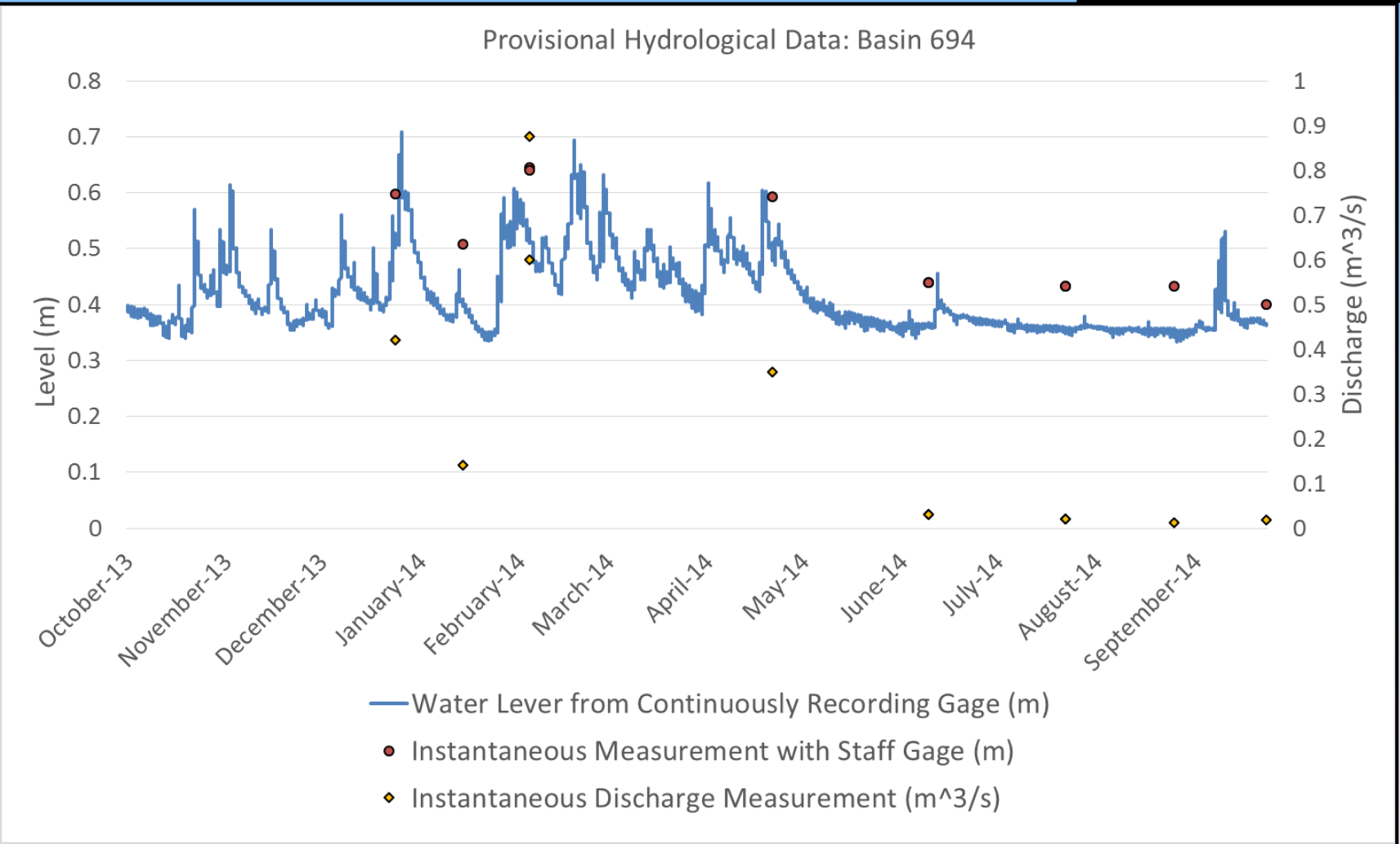
14 sample basins selected for hydrologic monitoring



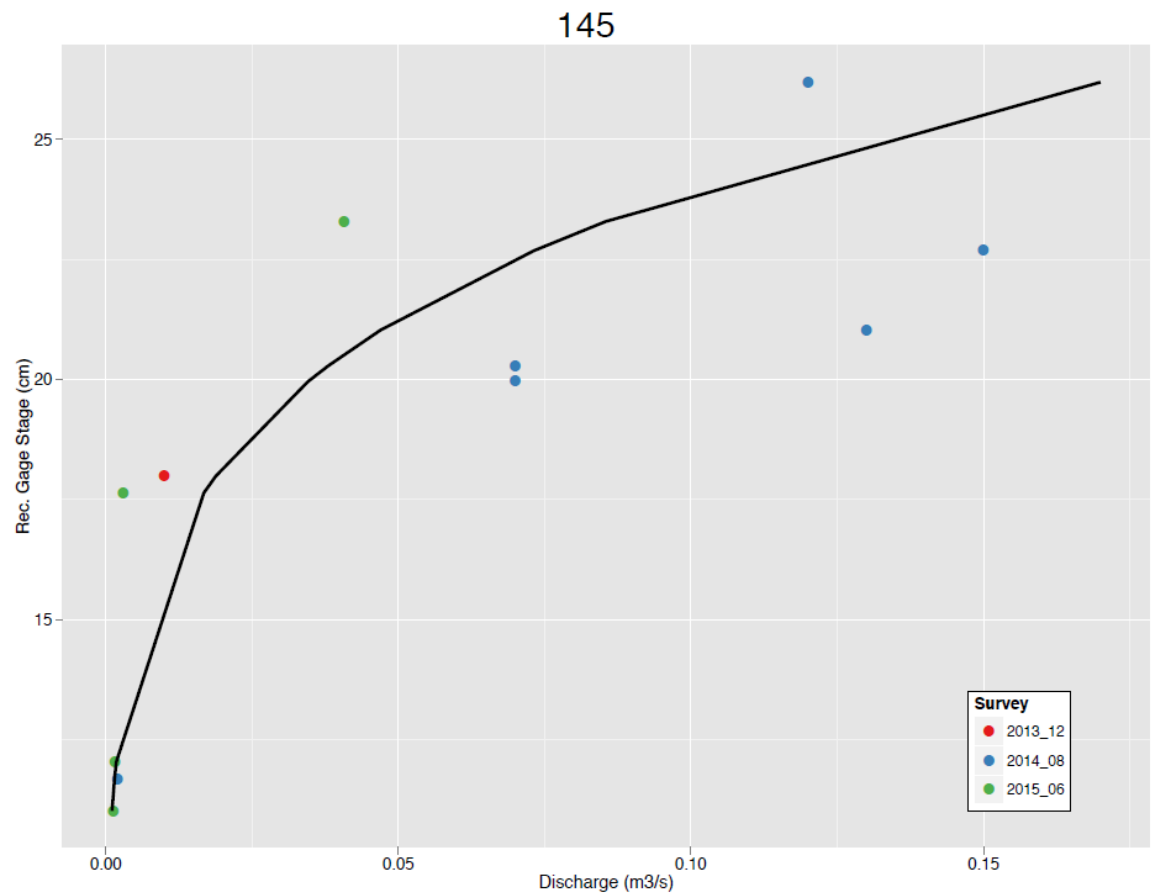


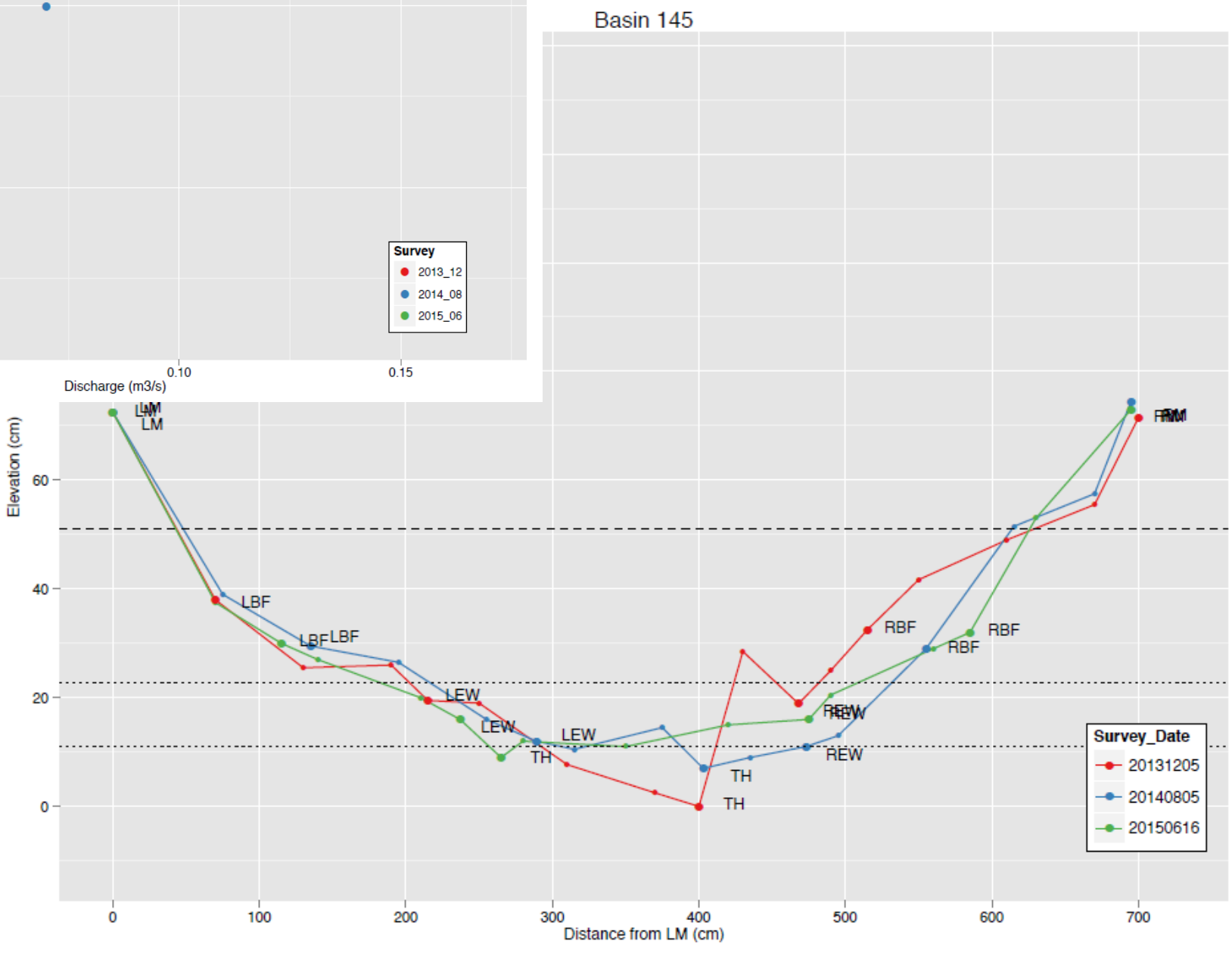
Hydrologic Monitoring

- Discharge measured 10 times first year following USGS protocol
- X-section stability surveys, 1-2 times/year
- Data management in house using relational Access database



Preliminary Hydrology Analyses



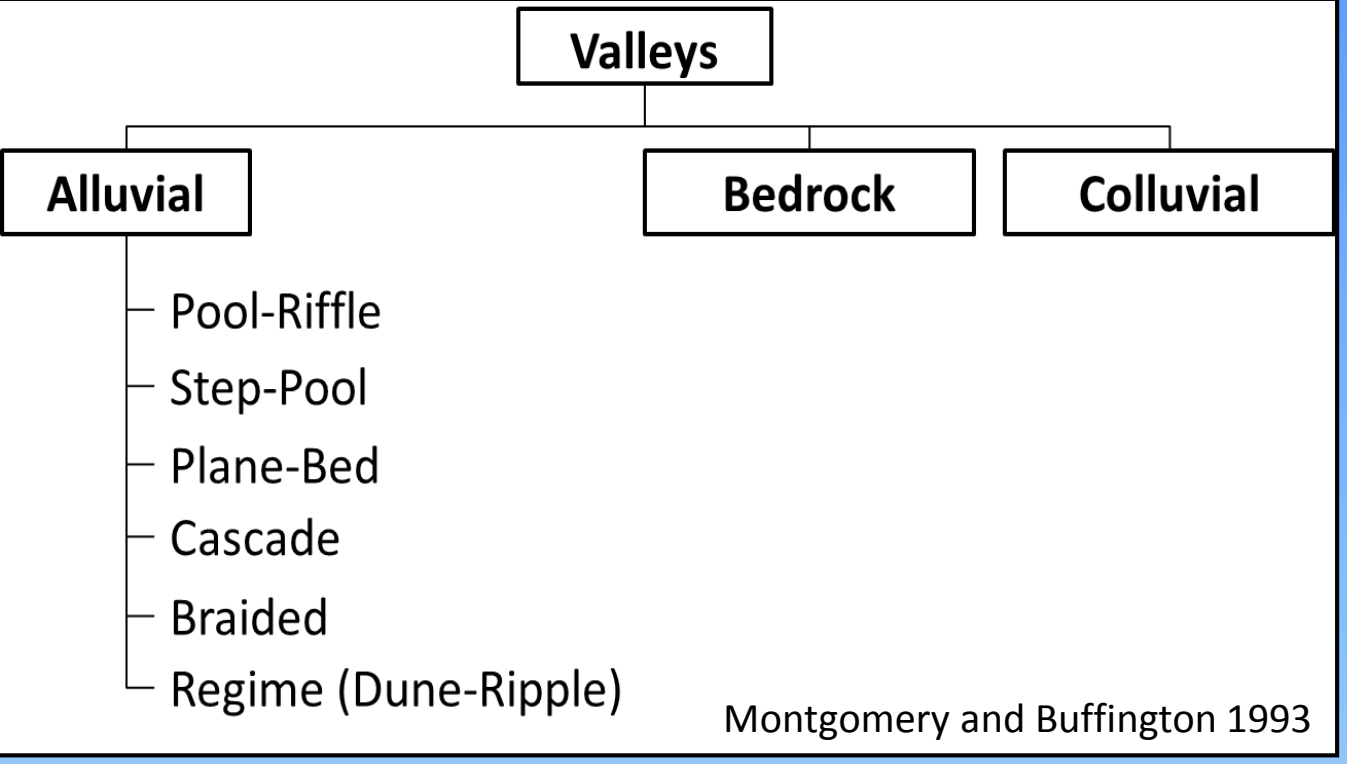


Large Wood

Field protocol modified from Schuett-Hames et all. (1999)

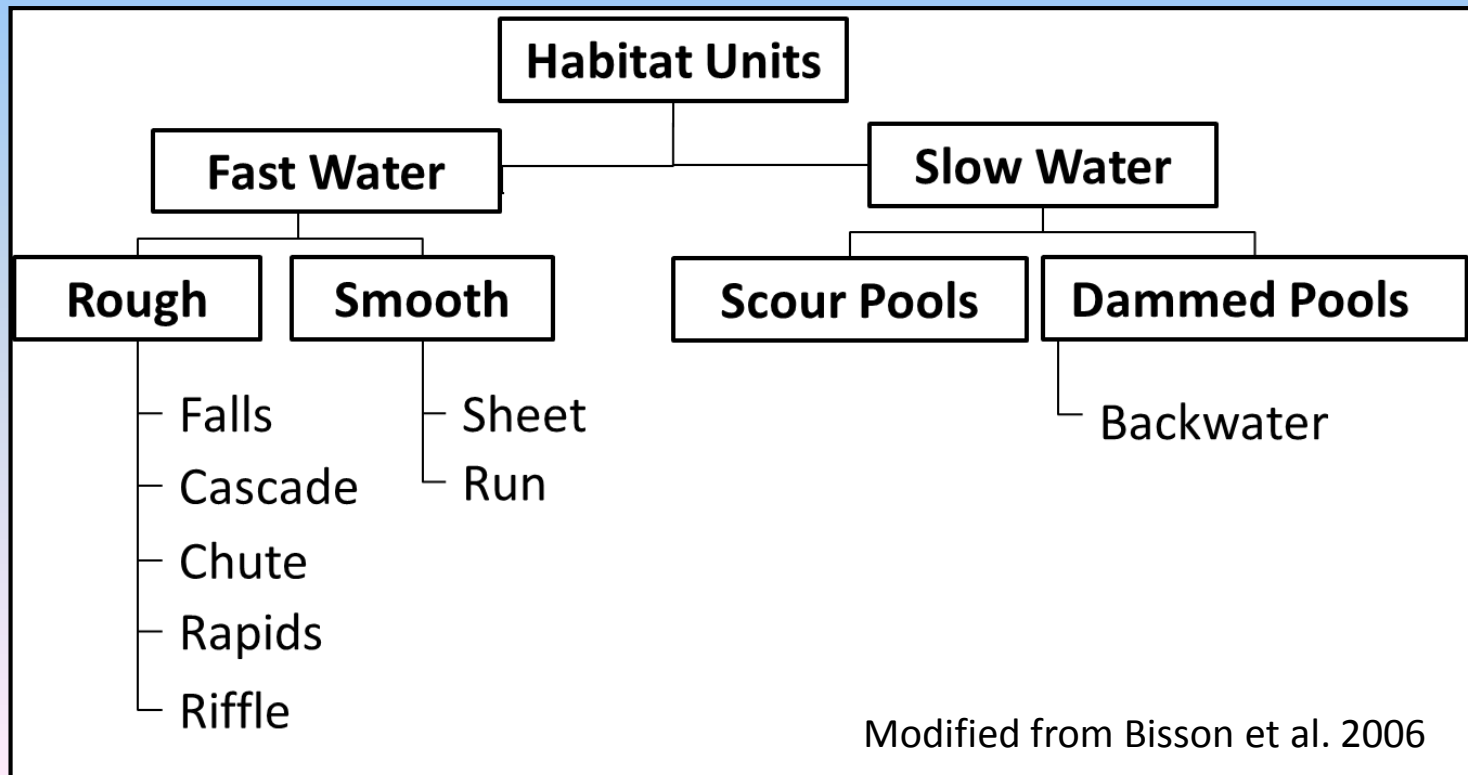
Sampling completed in 48 OESF basins and 2 ONP basins

Classification of Channel Types and Habitat Units

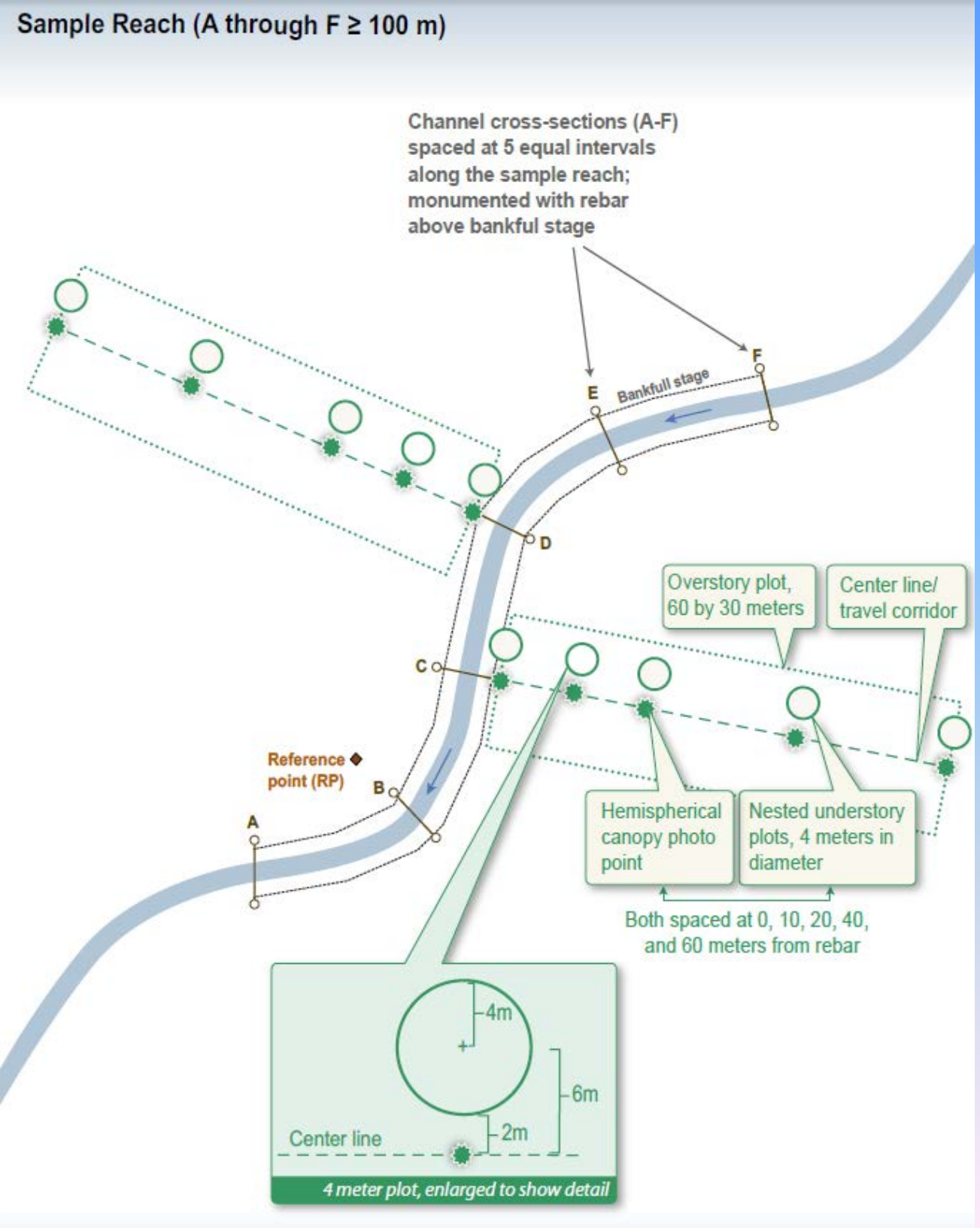


Montgomery and Buffington 1993

Habitat unit measurements completed in 48 OESF basins and 2 ONP basins

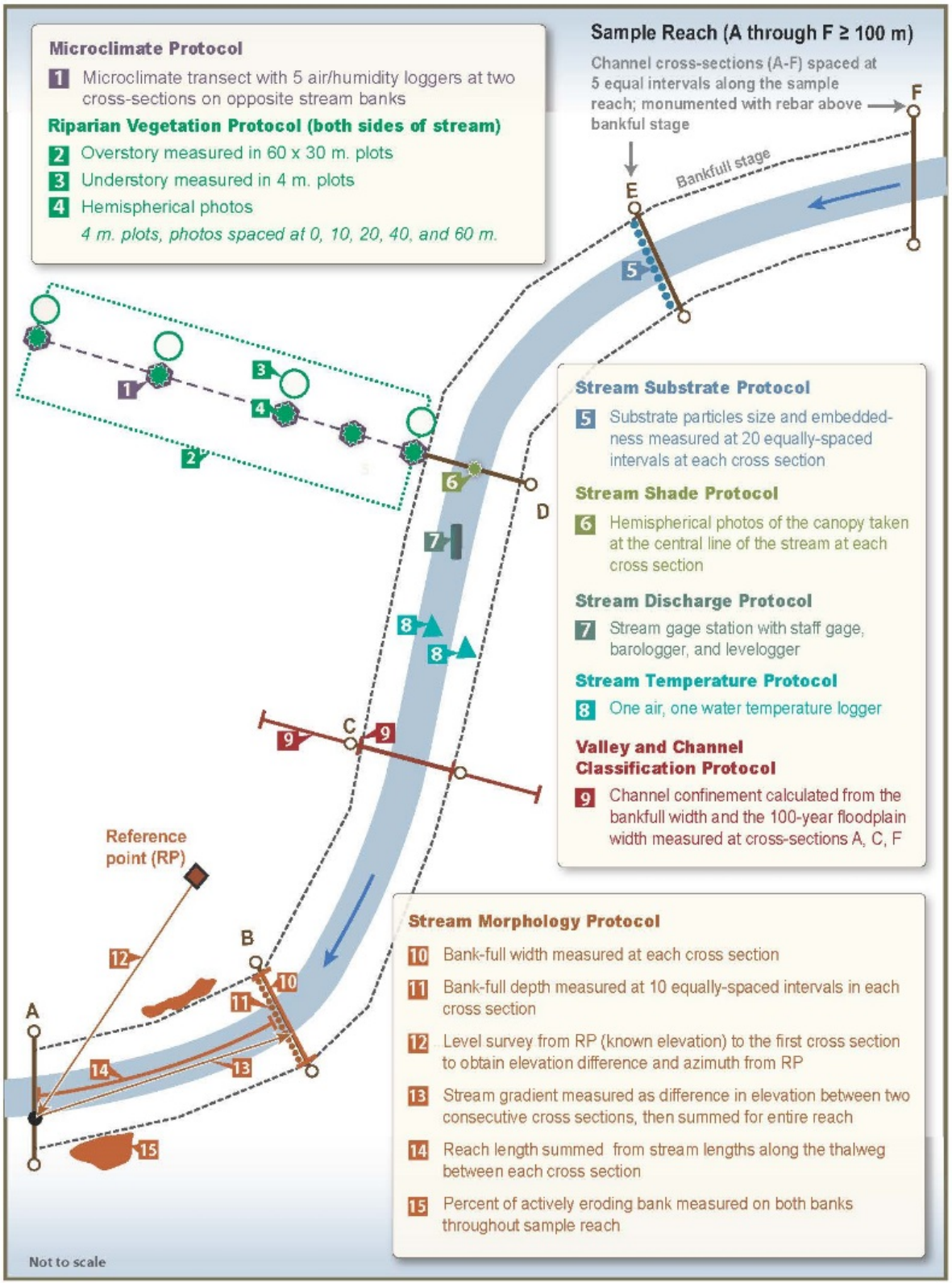


Modified from Bisson et al. 2006



Riparian Vegetation Sampling plots

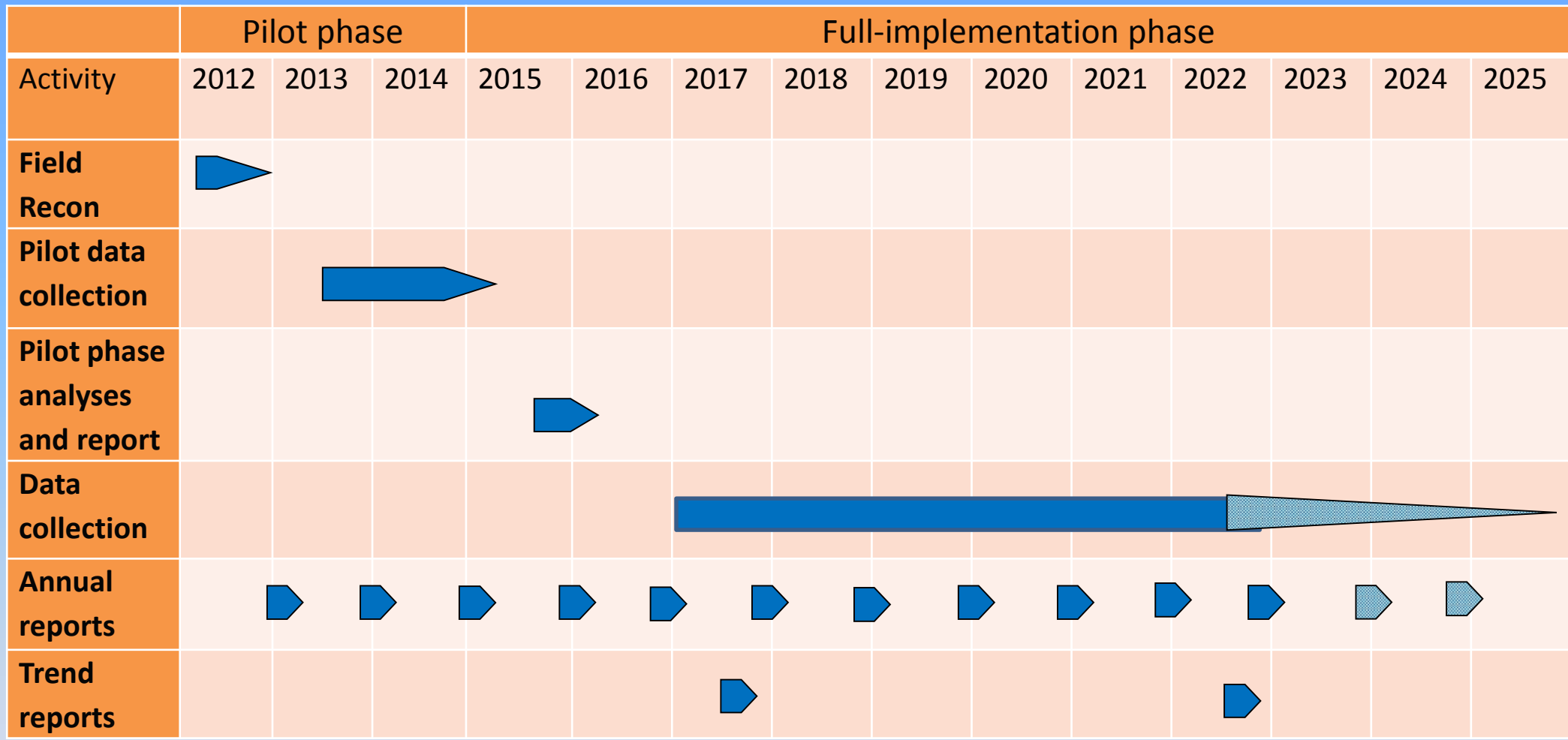
Protocols completed in 41 OESF basins



Monitoring protocols not depicted:

- In-stream large wood
- Habitat units

Project Implementation Schedule



Funding provided by DNR

Conducted in cooperation with FS Pacific Northwest Research Station

Salmonid monitoring

Objective: To develop a salmonid validation monitoring program for the OESF as part of the DNR's riparian conservation commitment to the HCP.

"Validation monitoring, used to evaluate **cause-and-effect relationships** between **habitat conditions** resulting from implementation of **conservation strategies** and the **salmonid** and northern spotted owl **populations** these strategies are intended to **benefit**."


Photo from pacificrivers.org


Picture from gopixpic.com

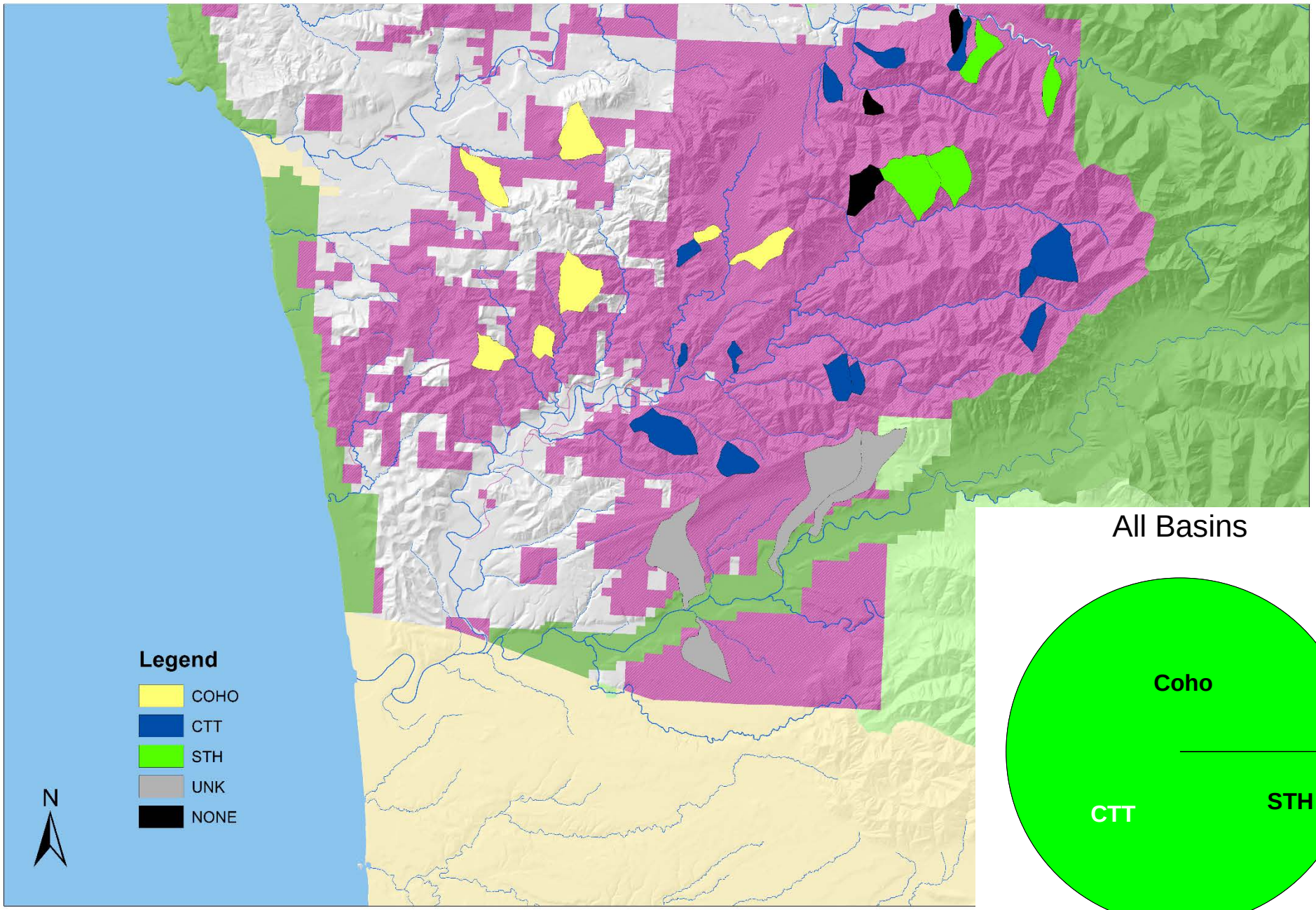

Photo from http://quizlet.com

2015 Field work

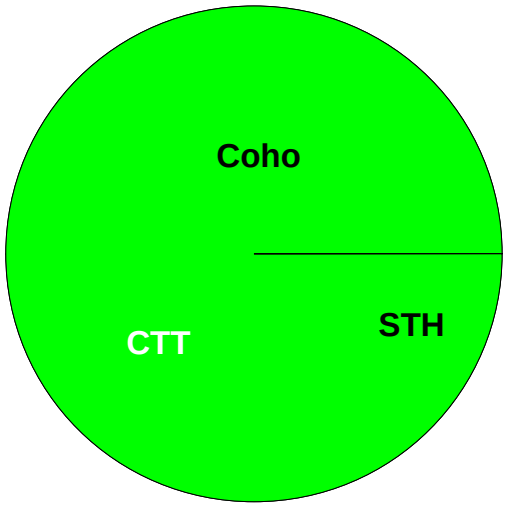
Non-population fish sampling at the 50 habitat sites

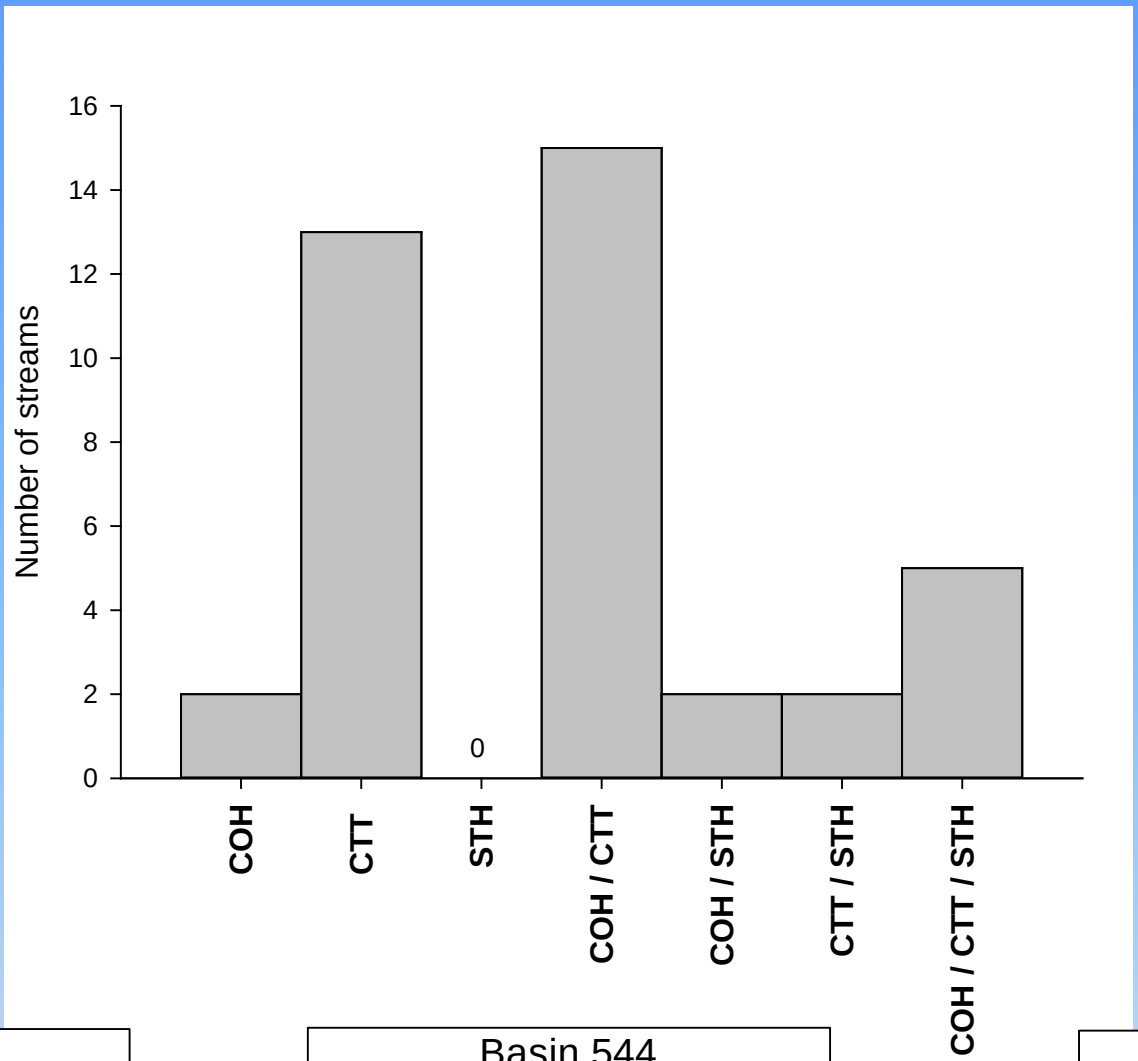
- Identify species composition and presence/absence at sites
- Confirm timing of sampling based on fish size
- 2-3 person crew
- 3-5 sites per day

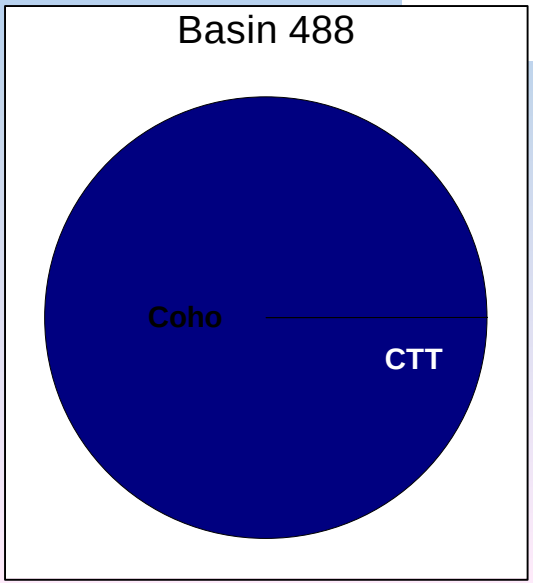
Dominant Fish Species

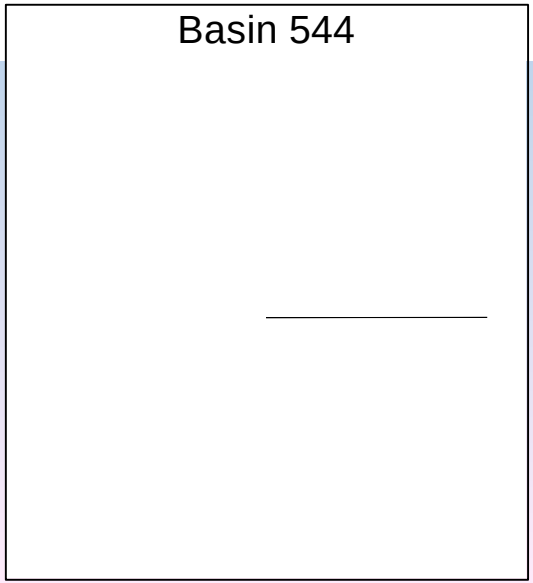


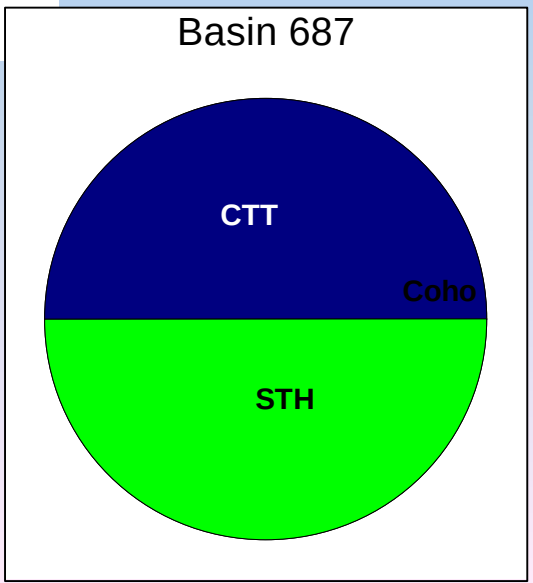
All Basins




Number of streams
16
14
12
10
8
6
4
2
0
0
COH
CTT
STH
COH / CTT
COH / STH
CTT / STH
COH / CTT / STH


Basin 488
Coho
CTT


Basin 544


Basin 687
CTT
Coho
STH

Initial ideas for a sampling plan (starting in 2016)

- 50 existing habitat sites (20 annual and 30 rotating sites)
  - Summer sampling 30 or 35 sites a year (2 or 3 year rotating panel)
  - Coho redd surveys (fall/winter)
  - Winter sampling on 20 annual sites
- Electrofishing using multiple-pass removal
- PIT tagging in 20 annual sites (2,000-3,000 fish per year)
- Indicators: fish abundance, growth, species richness, survival/fall migration (?), and smolt abundance index (?)

Acknowledgements

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Megan McCormick

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Michele Boderck
Julian Sammons
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Photo: WADNR/Teodora Minkova

Collaboration opportunities: sharing data

- Stream temperature data
- Stream flow data
- Remote sensing data (e.g. LiDAR)
- Salmon habitat data
- Redd surveys
- Juvenile production estimates
- PIT tag recapture data

Collaboration opportunities: sharing scientific expertise

- Hydrology analyses
- Remote sensing analyses
- Data management
- Analyses of forest and road management effects on aquatic and riparian habitat
- PIT Tag Technology

Collaboration opportunities: joint grant applications

- Restoration projects
- Monitoring projects
- Research projects
- Education / citizen science projects


Questions?