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

Project Description and Collaboration Opportunities

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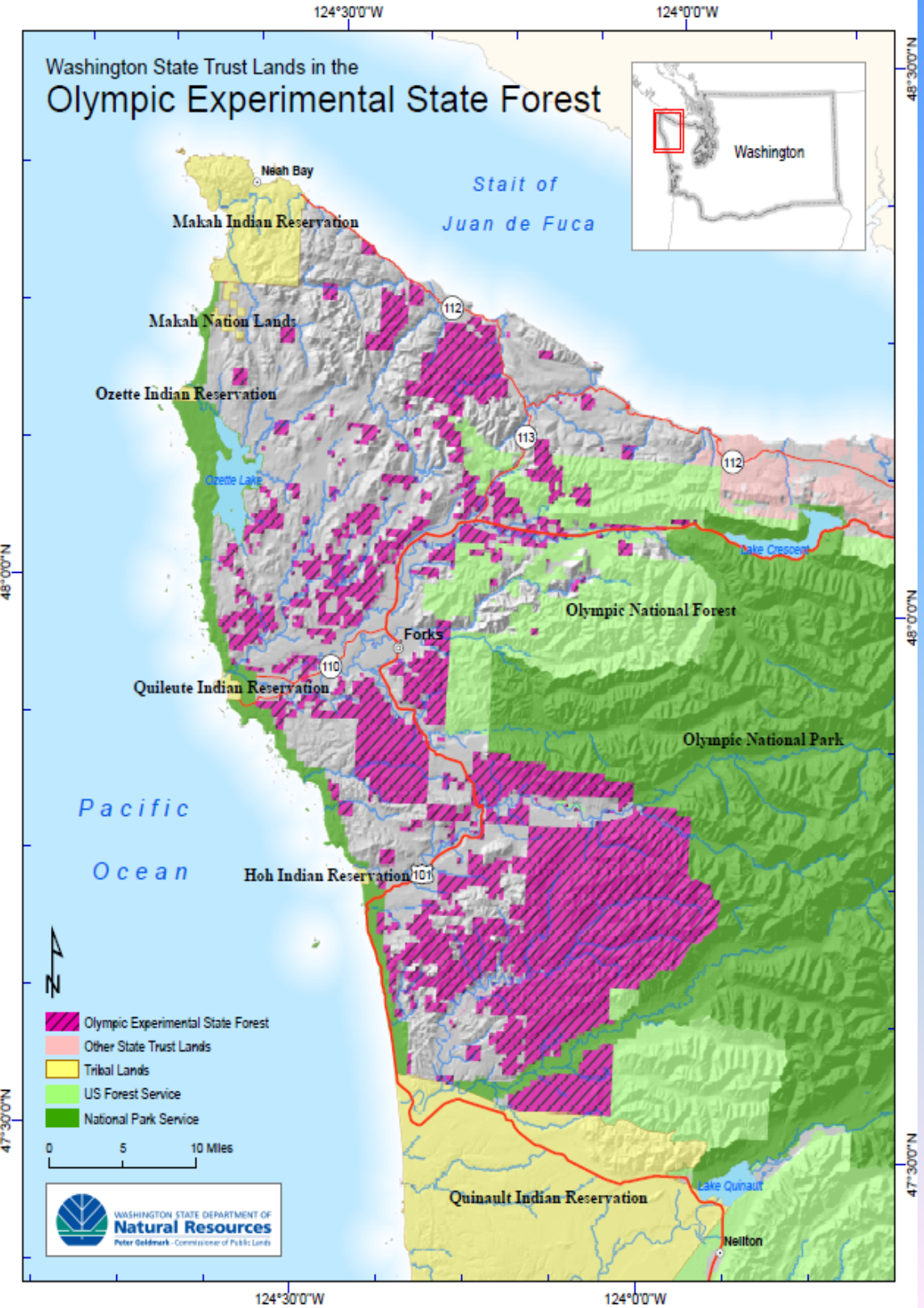
Presentation to WCSSP, March 24, 2015



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

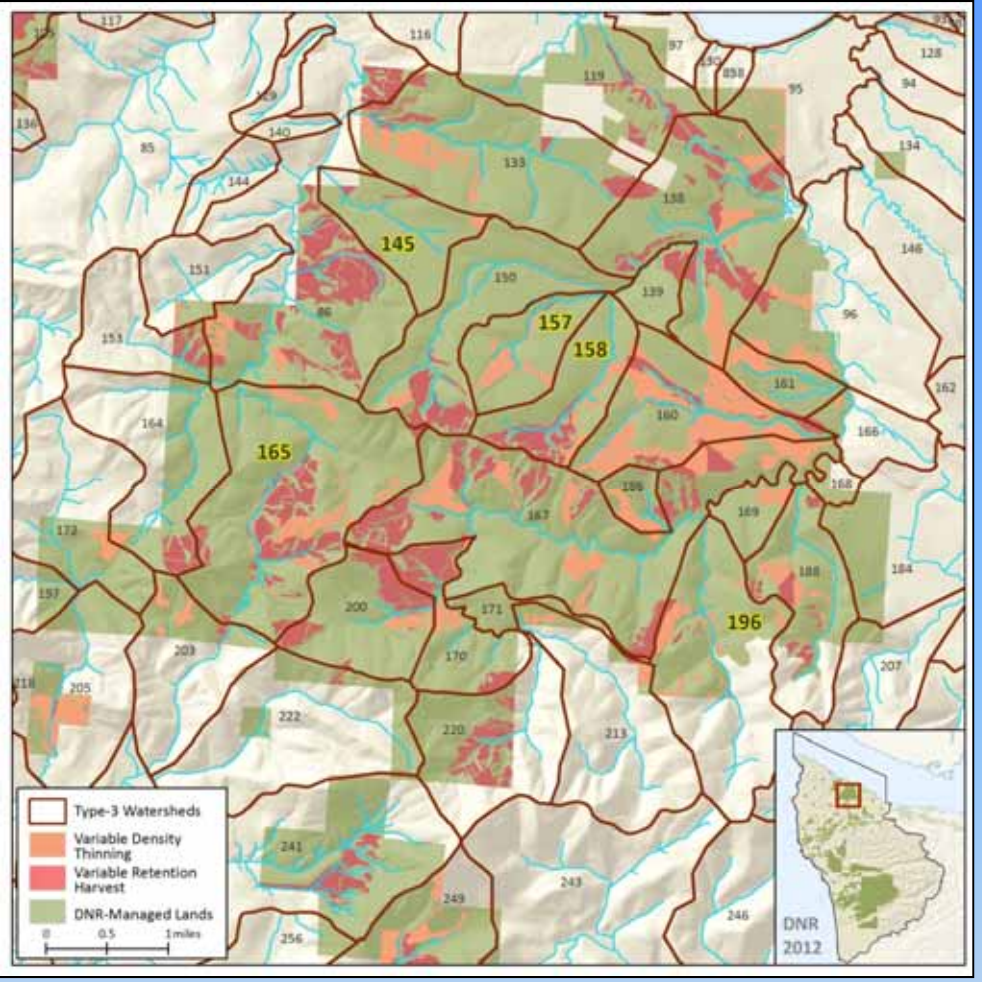
Habitat Conservation Plan signed in 1997

- 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

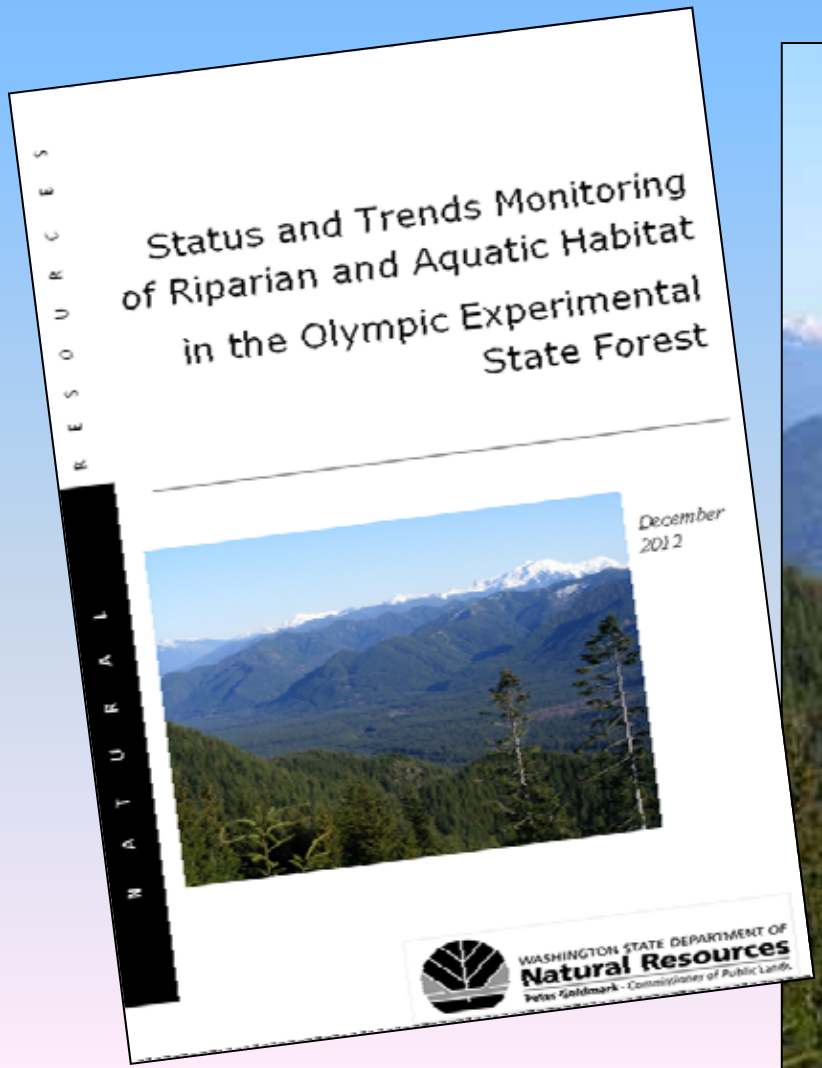
Environmental Impact Analysis (EIS) showed improved aquatic and riparian conditions

Uncertainties identified during the analyses:

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

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.

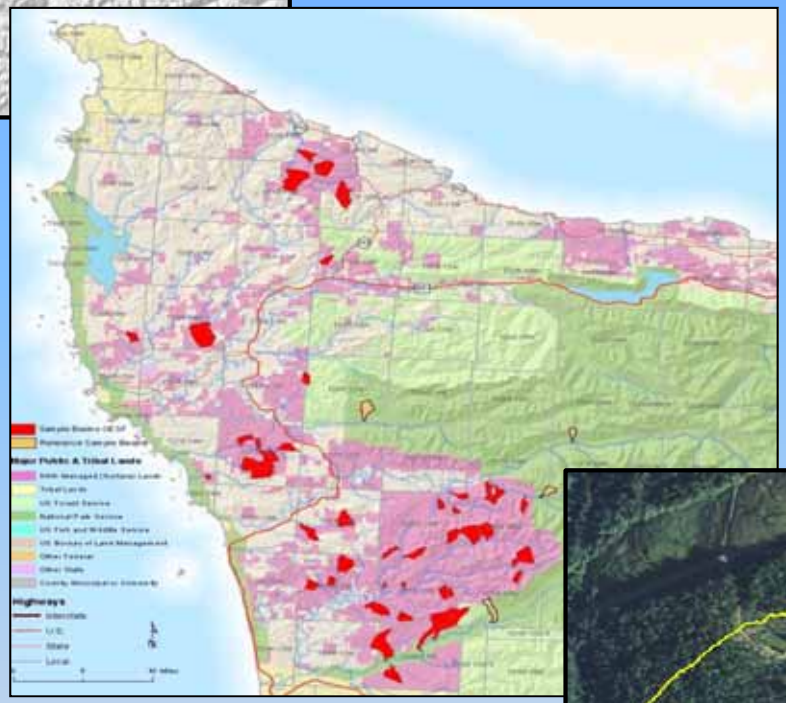
4. Supply information for HCP implementation, effectiveness, and validation monitoring.

5. Improve understanding of "habitat complexity afforded by natural disturbances".

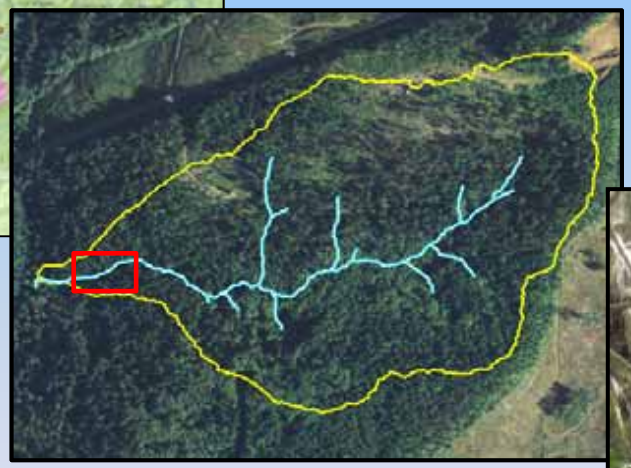
6. Establish critical baseline information for adaptive management.

Spatial Study Design

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

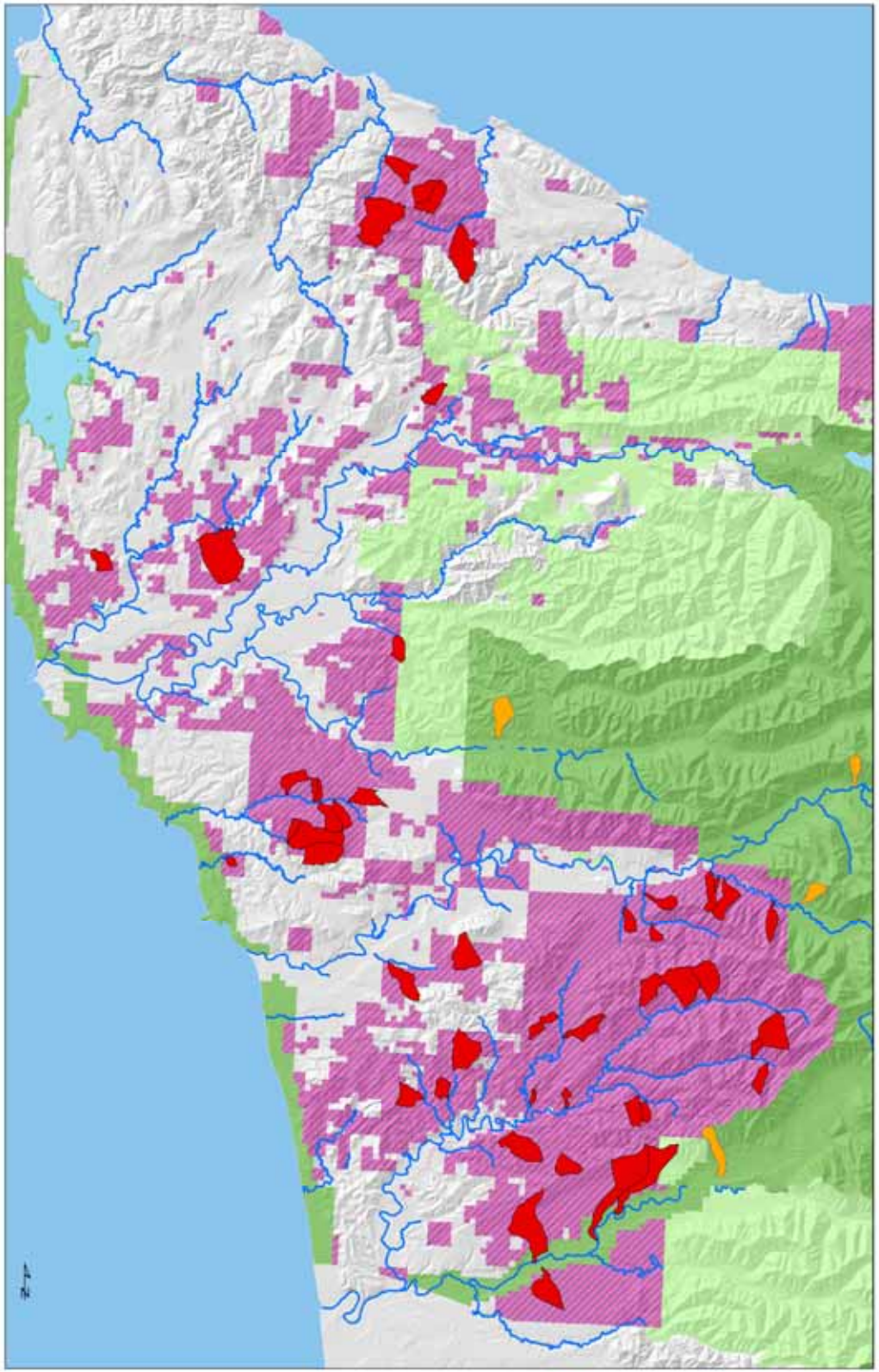


Sample: 50 OESF basins + 4 reference basins in the Olympic National Park



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

Monitoring indicators

Nine aquatic and riparian indicators sampled at reach level:

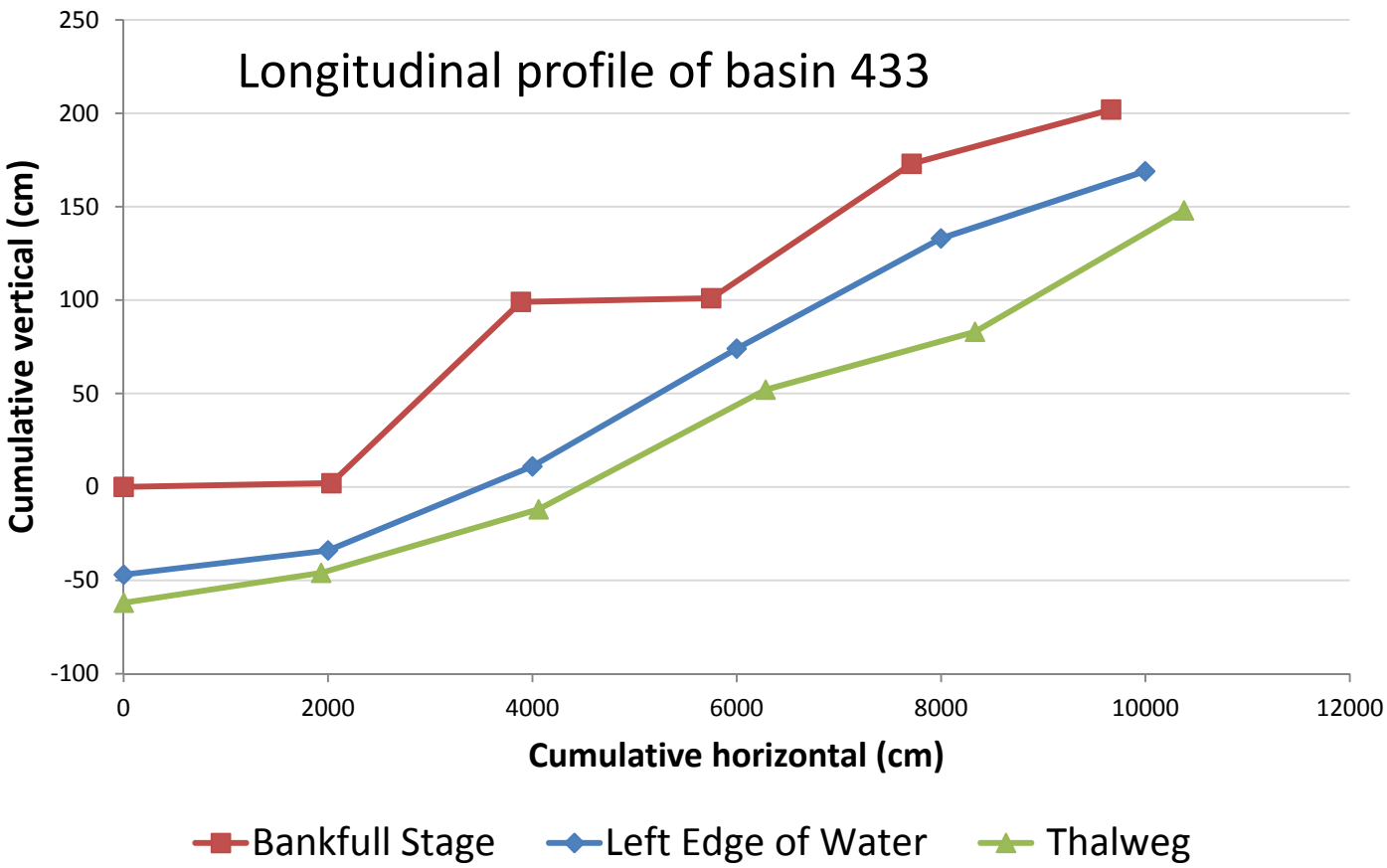
1) channel morphology (incl. gradient, confinement, depth, and width)
2) water temperature
3) channel substrate
4) stream discharge
5) in-channel large woody debris
6) habitat units (such as pools)
7) stream shade
8) riparian microclimate
9) riparian forest vegetation

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 33 basins



Cross-section Survey

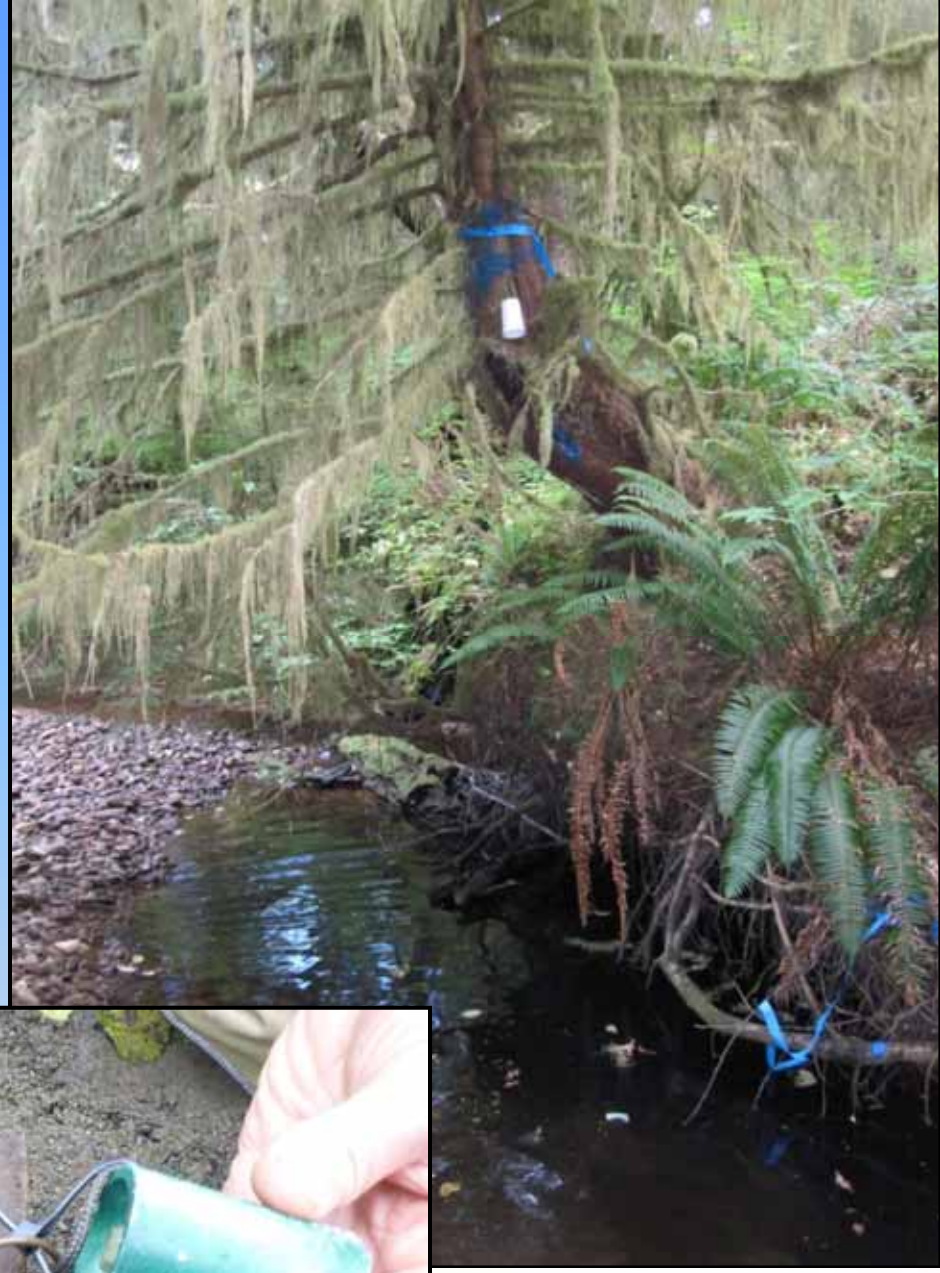
- channel width
- channel depth
- substrate size
- substrate embededness

Cross Section		Channel Substrate					
	station intervals (cm)	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

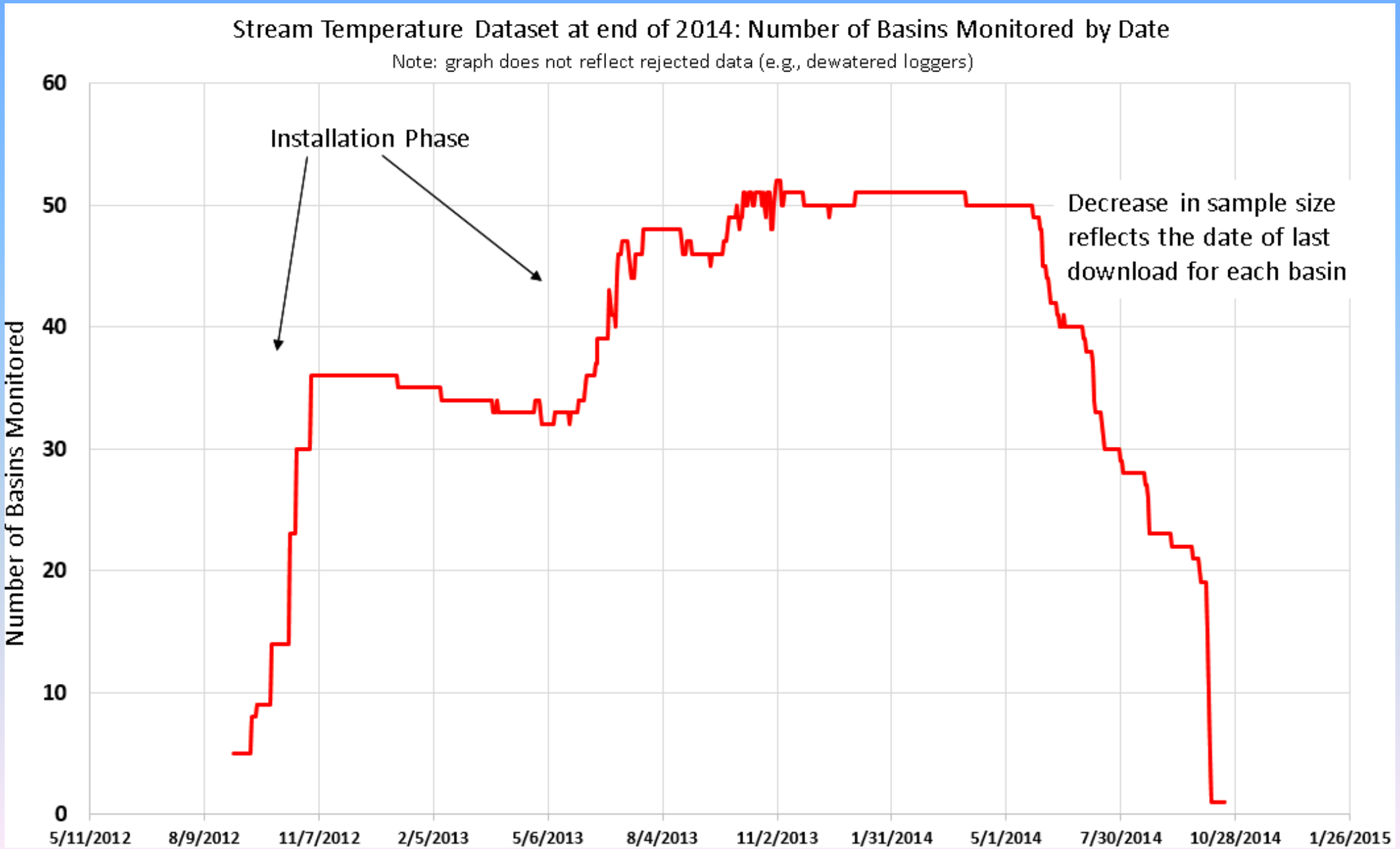
Protocols completed for 33 basins

Stream Temperature

- Continuously recording air and water temperature data loggers
- Installed in all 54 basins
- Field protocol based on DOE procedures (Bilhimer et al. 2013)

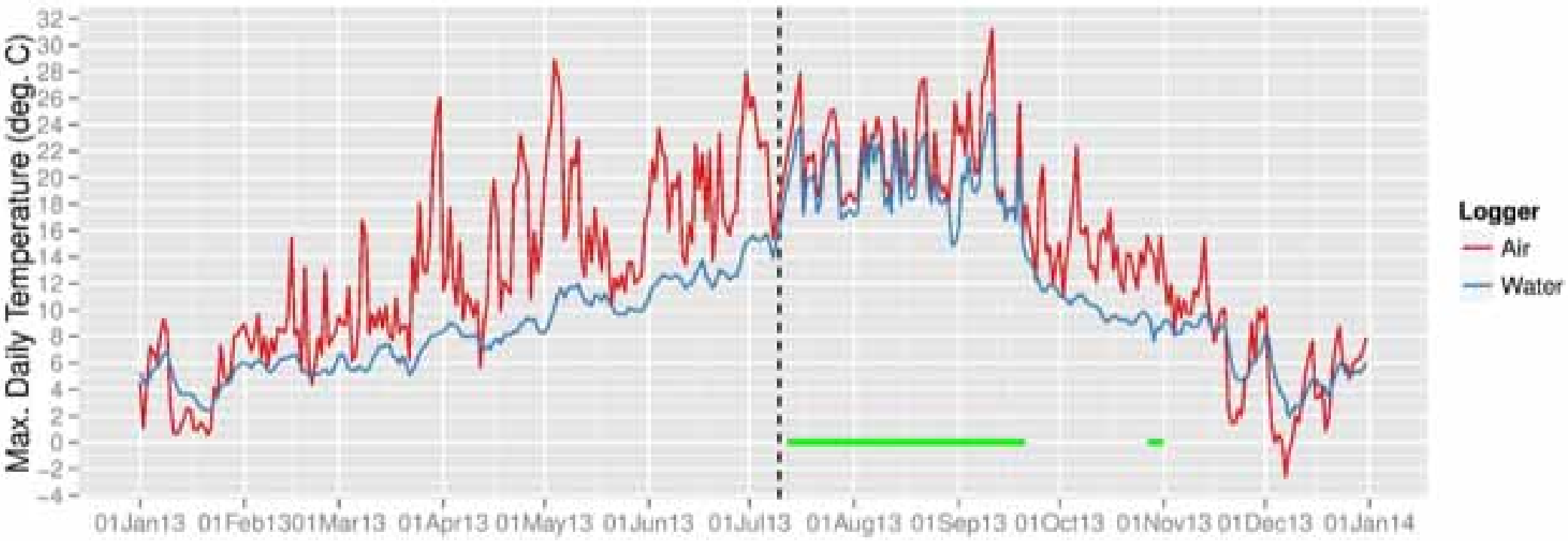


Stream Temperature Data Management



Stream Temperature Data Management

QC procedures following Sowder and Steel (2012)



Commonly observed problems:

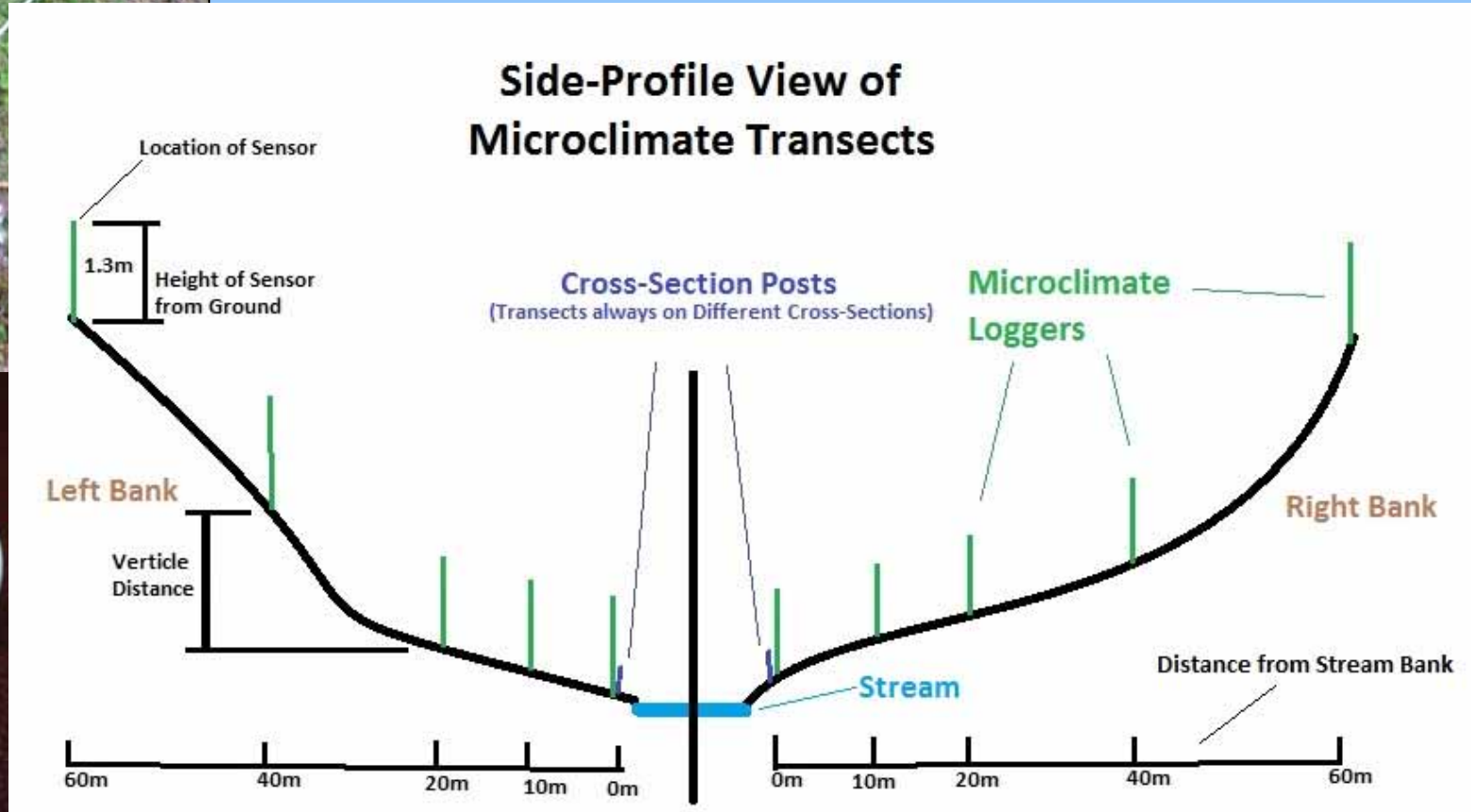
- Dewatered loggers
- Buried loggers

Stream Shade

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

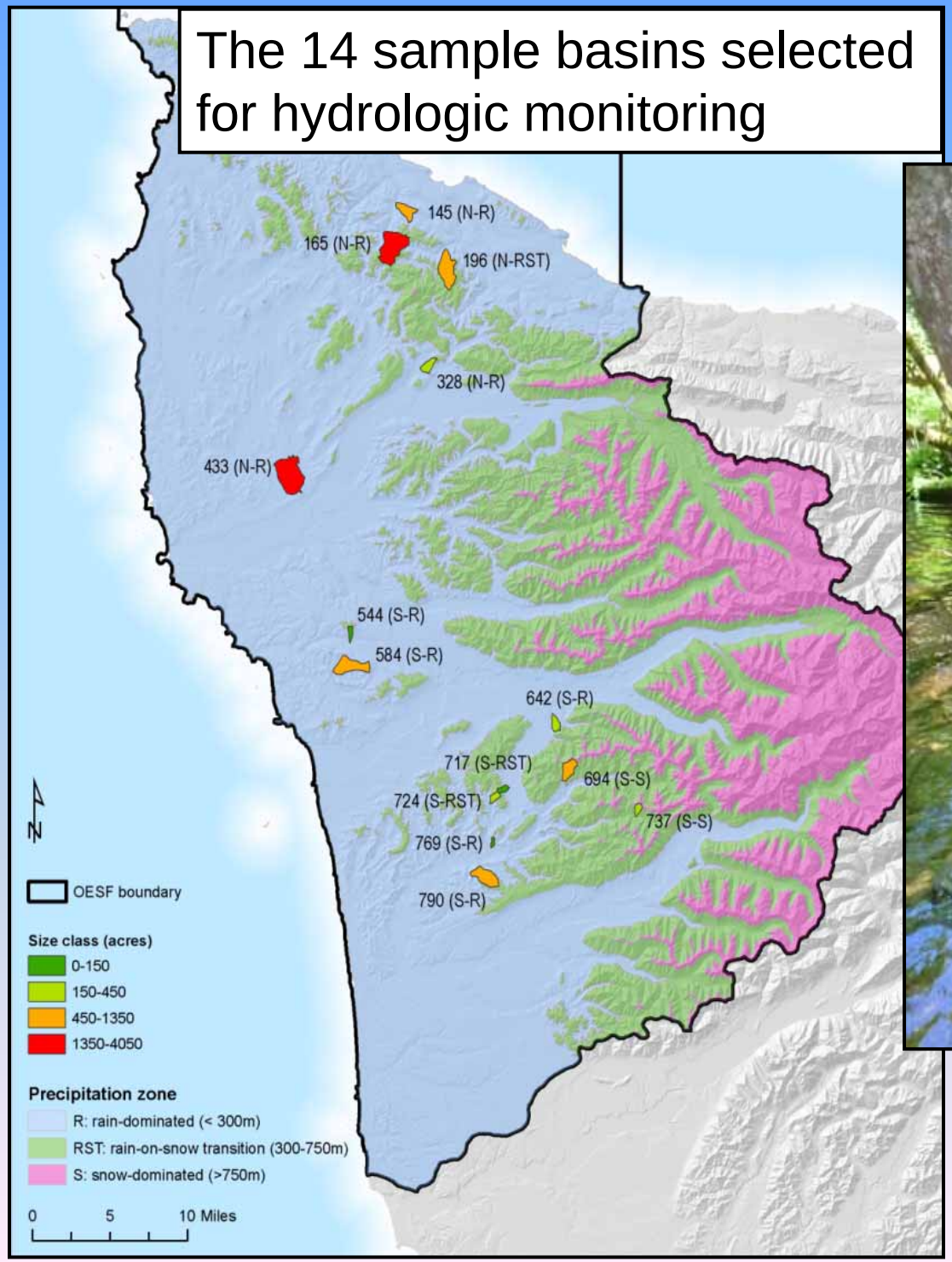
Microclimate

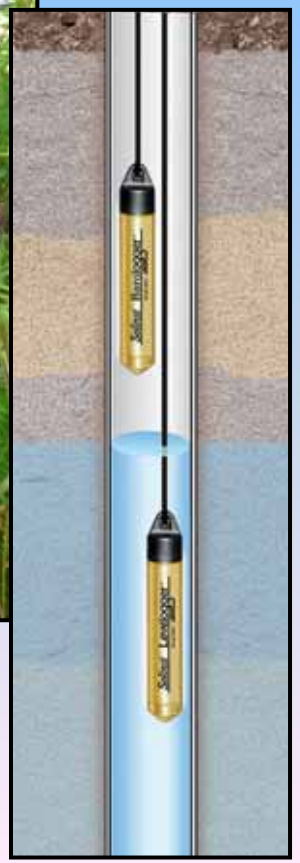
- Continuously recording loggers measuring air temperature and humidity
- Installed in 10 basins



Hydrologic Monitoring

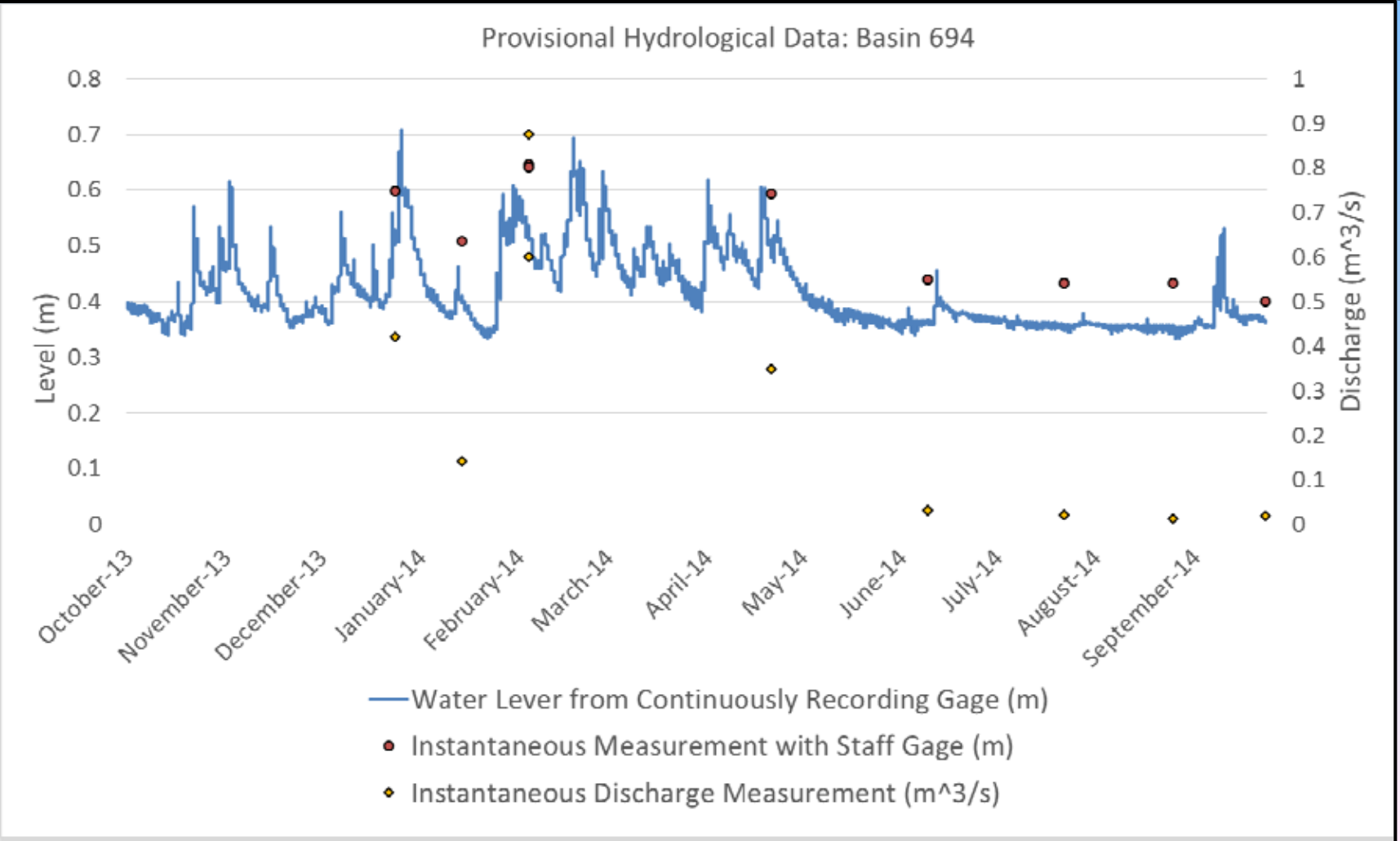
The 14 sample basins selected for hydrologic monitoring





Hydrologic Monitoring

- Discharge measured 10-12 times first year to build a rating curve; following USGS protocol
- Cross-section surveys, 1-2 times/year
- Data management in house using relational Access database

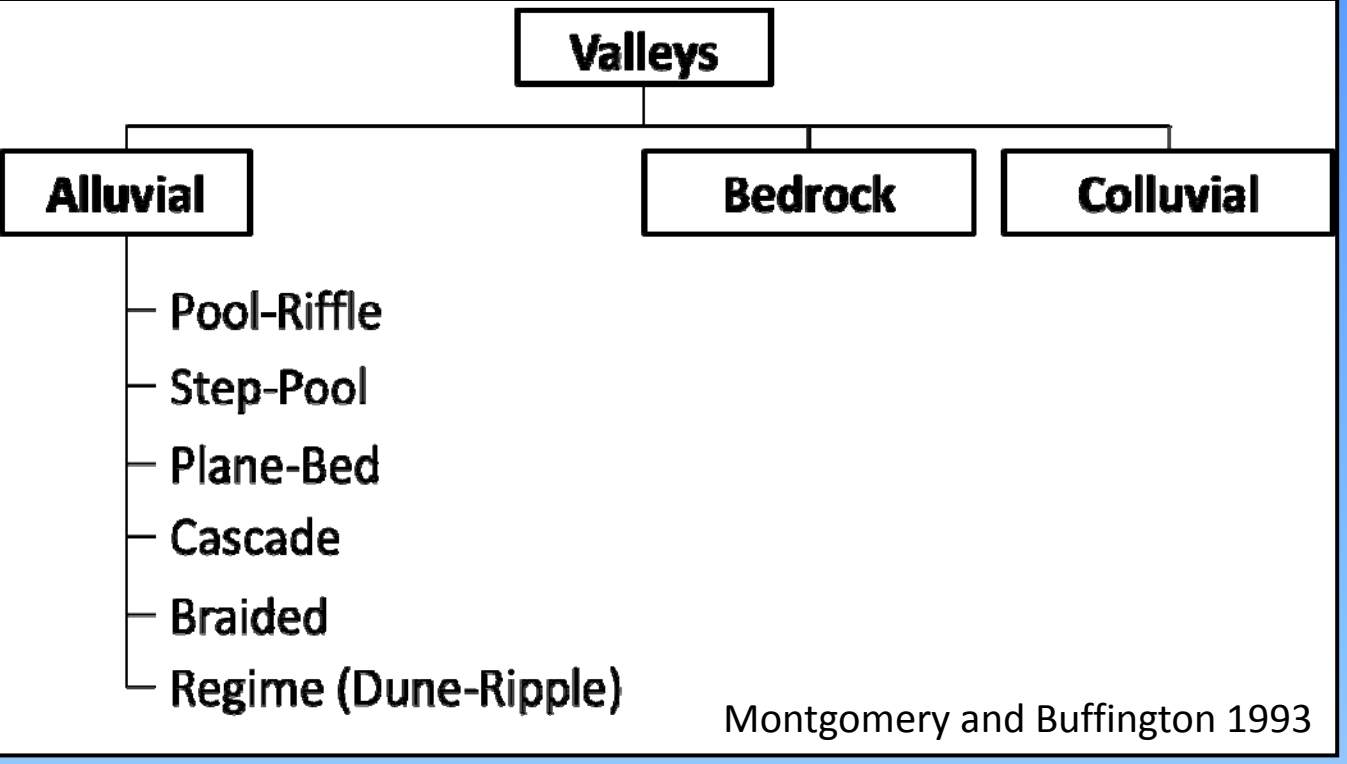


Large Wood

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

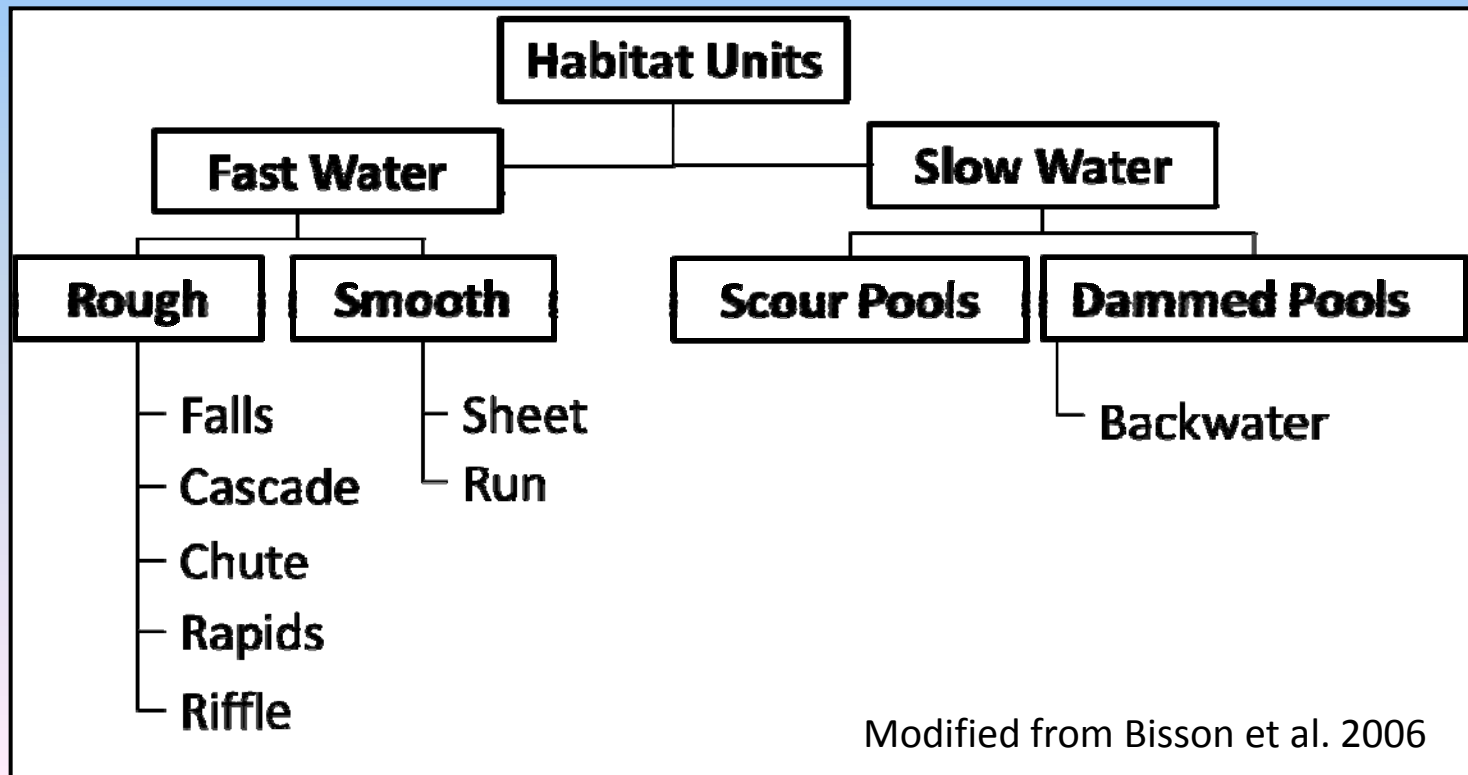
Sampling completed in 33 basins

Classification of Channel Types and Habitat Units



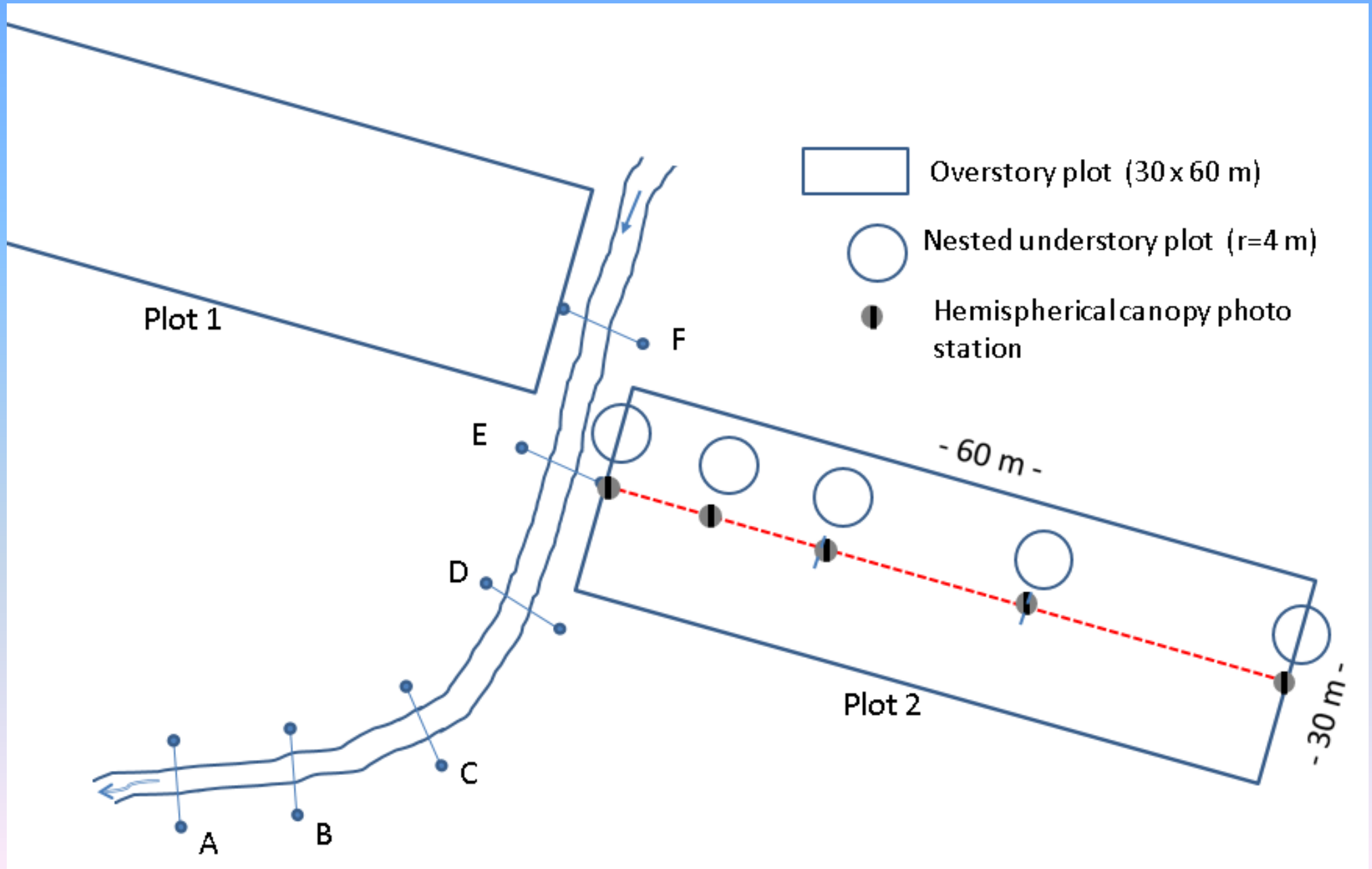
Montgomery and Buffington 1993

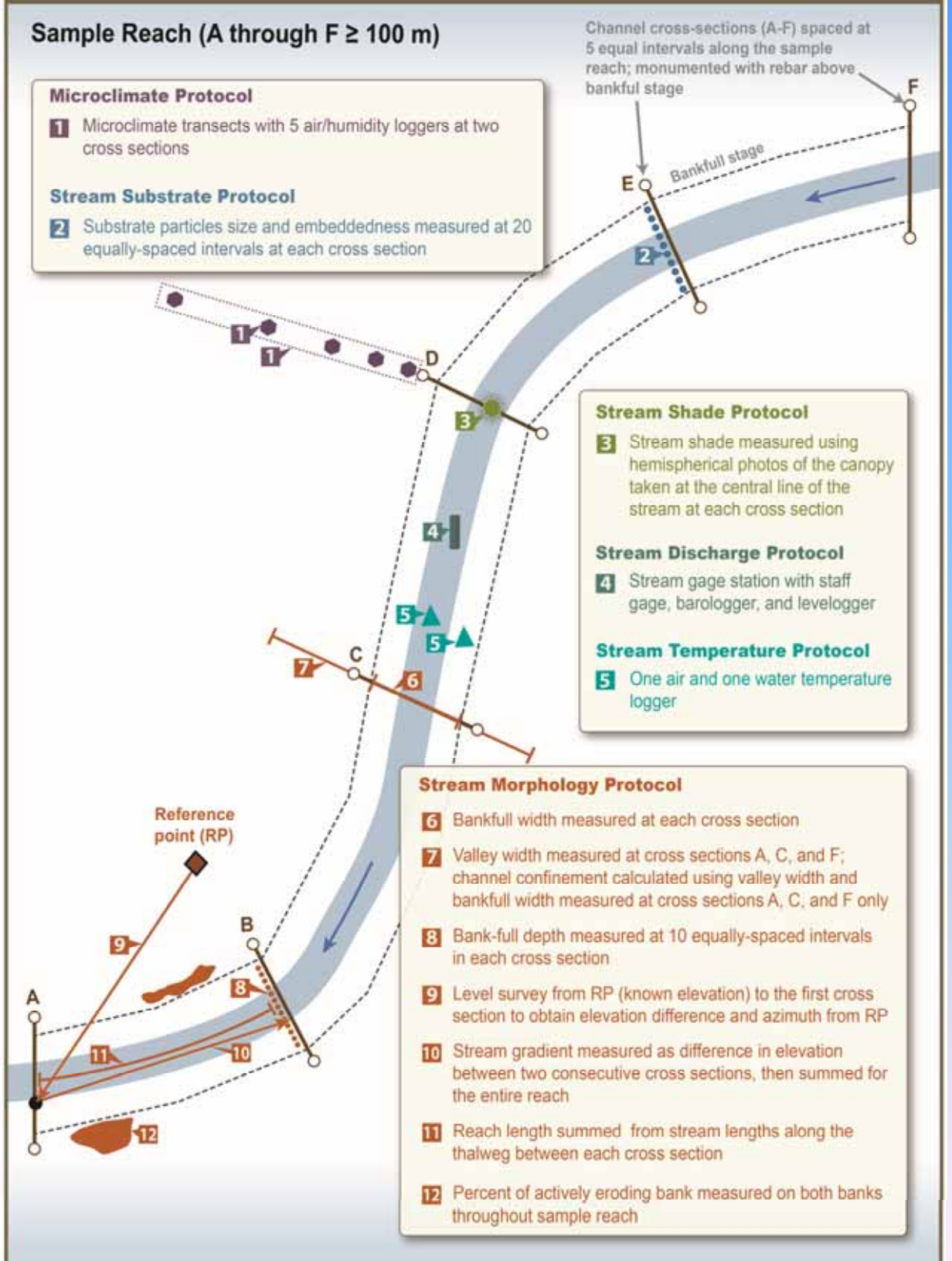
Habitat unit measurements completed in 33 basins



Modified from Bisson et al. 2006

Riparian Vegetation

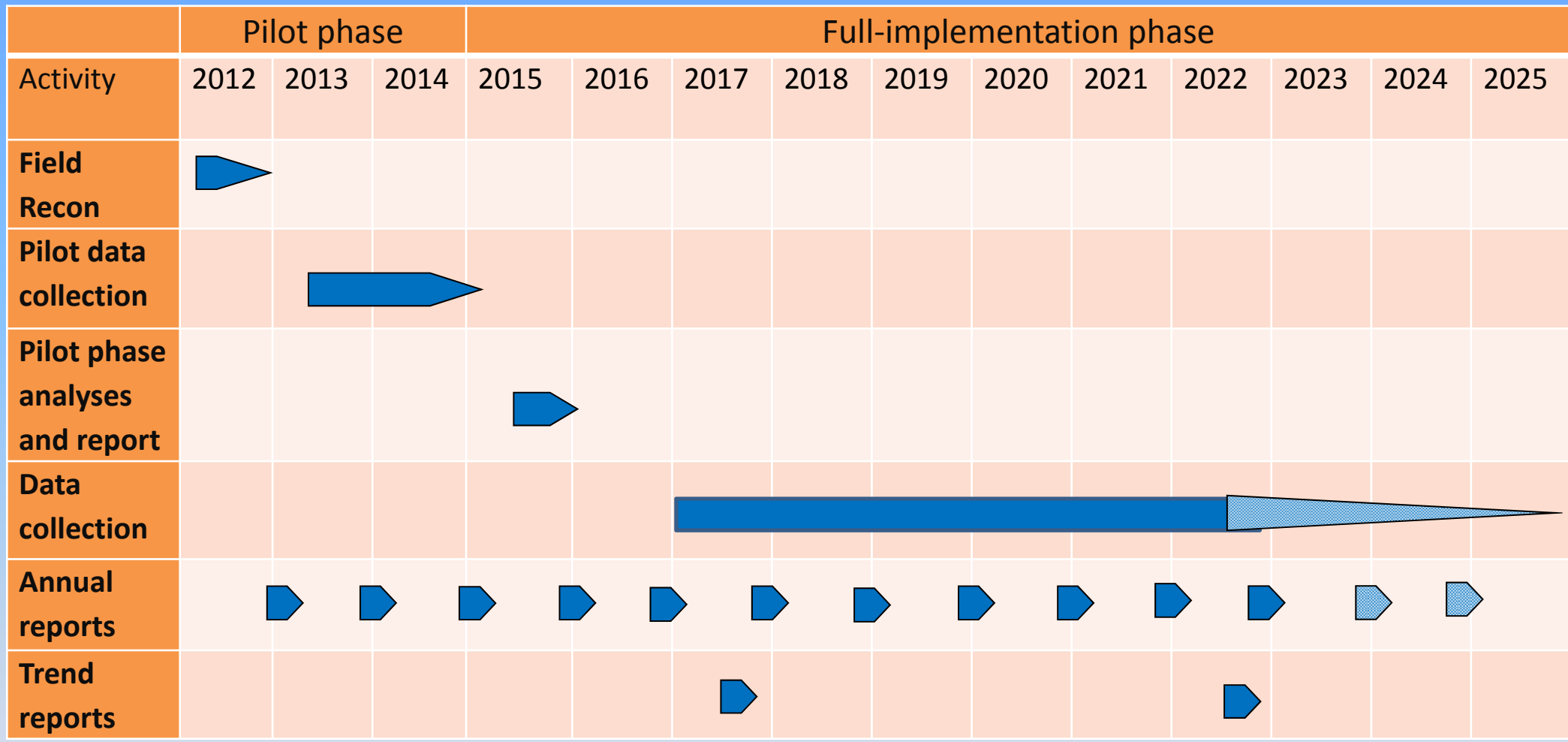




Monitoring protocols not depicted:

- In-stream large wood
- Habitat units
- Riparian vegetation

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.

What is the commitment?

"For salmonids, validation monitoring will employ surveys to detect changes in the productivity of spawning adults and salmon habitat relationships." HCP 1997

"This will involve estimating numbers of spawning adults and numbers of recruits (i.e., out migrating smolts or rearing juveniles), and surveying different stream habitat types and conditions to determine fish numbers, species composition, and densities." HCP 1997

Photo from pacificrivers.org

Picture from gopixpic.com

Photo from http://quizlet.com

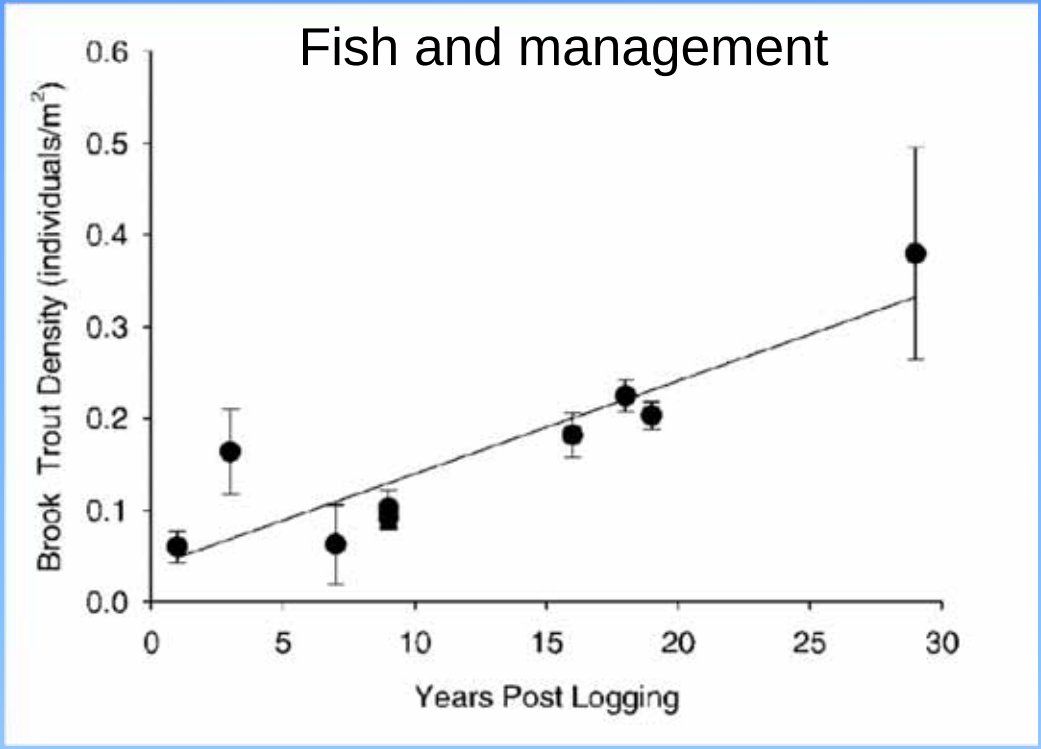
Field work planned for 2015

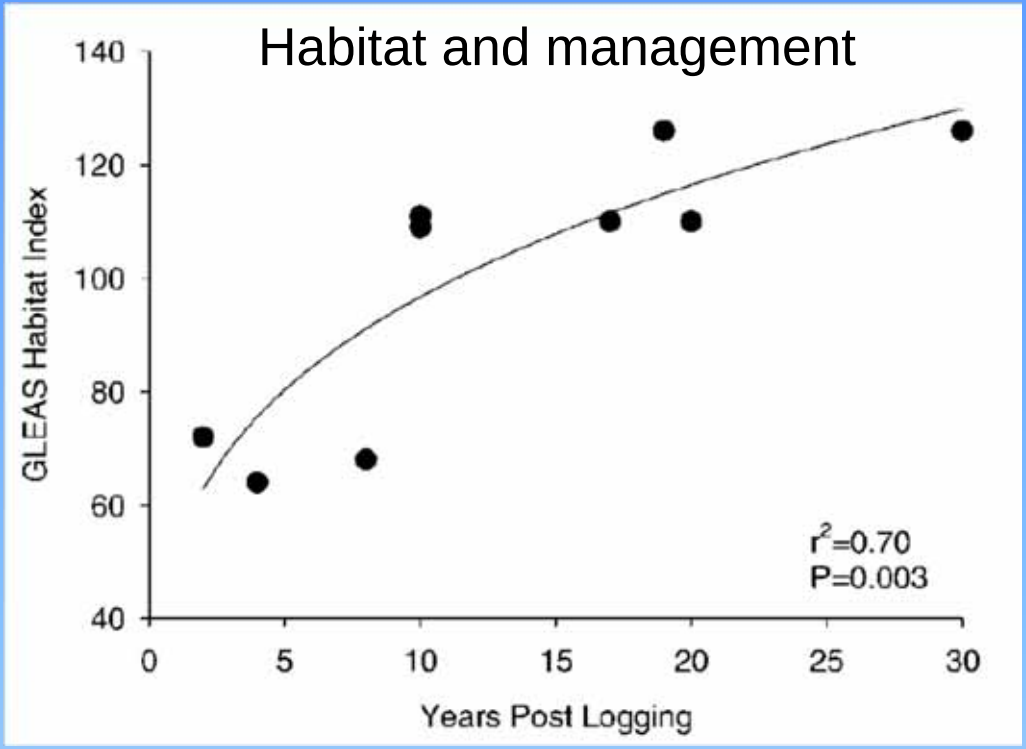
Non-population fish sampling at the 50 habitat sites
(Fish were observed in 32 sites and 1 site was found to have a fish barrier)

- Identify species composition and presence/absence at sites
- Confirm timing of sampling based on fish size
- 2-3 person crew
- 2-3 sites per day (17-25 days)

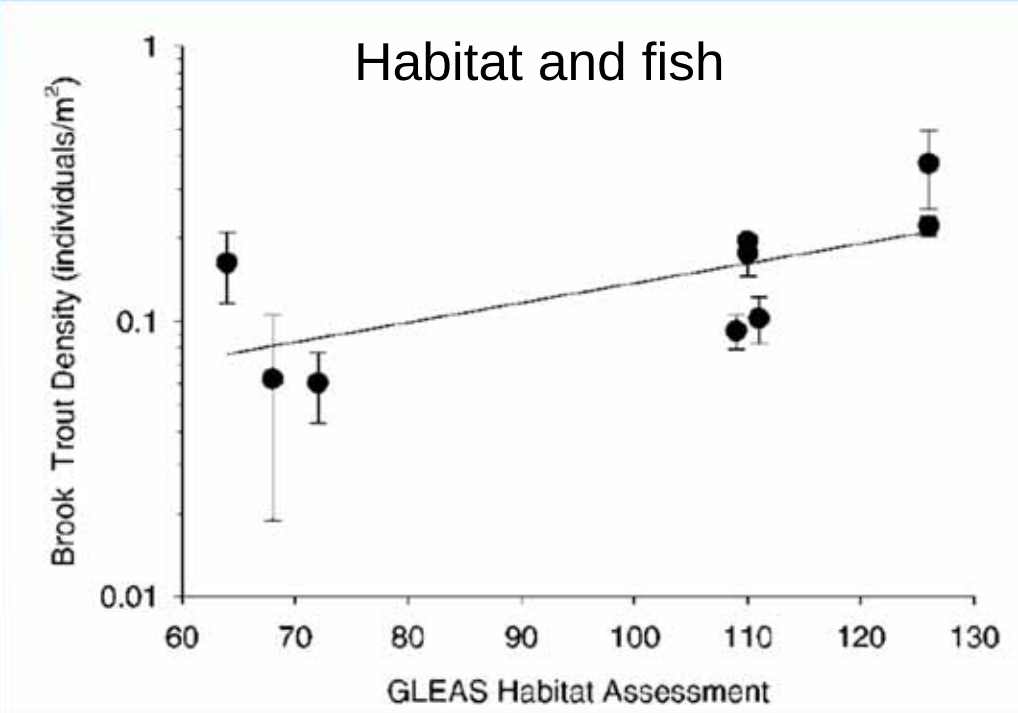
Initial ideas for a sampling plan (starting in 2016)

- 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 (?)





Relationships between habitat, fish, and management activities



Examples of correlation graphs (Van Dusen et al. 2005)

Acknowledgements

Field crew:

Jessica Hanawalt

Mitchell Vorwerk

Ellis Cropper

Rachel LovellFord

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

PNW

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?