Place matters:

Where conifers succeed on river flood plains of Olympic National Park

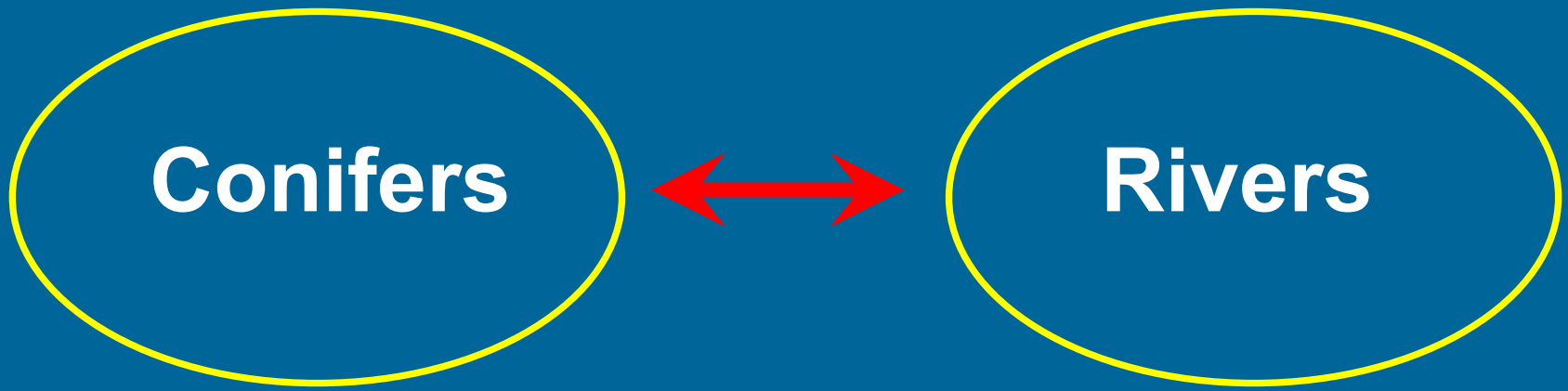
Scott Stolnack
School of Aquatic and Fishery Sciences / IPDES
University of Washington

I. Why do we care about conifers in riparian areas?

II. Field work in Olympic National Park

III. Connections to riparian restoration & management

Why do we care about conifers in riparian areas?


Conifers
Rivers

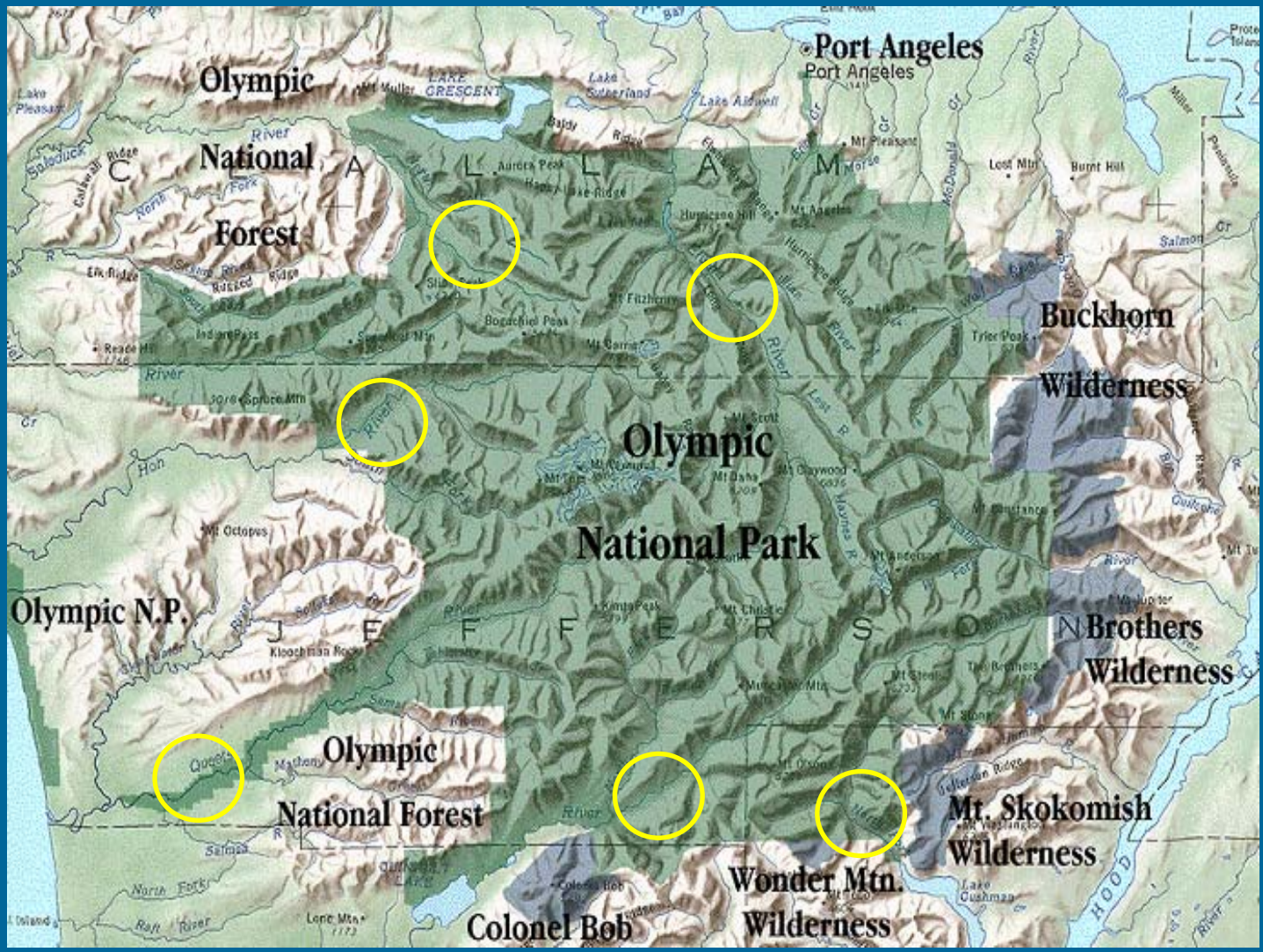
Main questions:

- Where do conifer trees survive on flood plains?
- What are the conditions under which they survive?
- Do growth rates in young (~10 to 40 year-old) conifer stands with and without hardwood competitors differ?

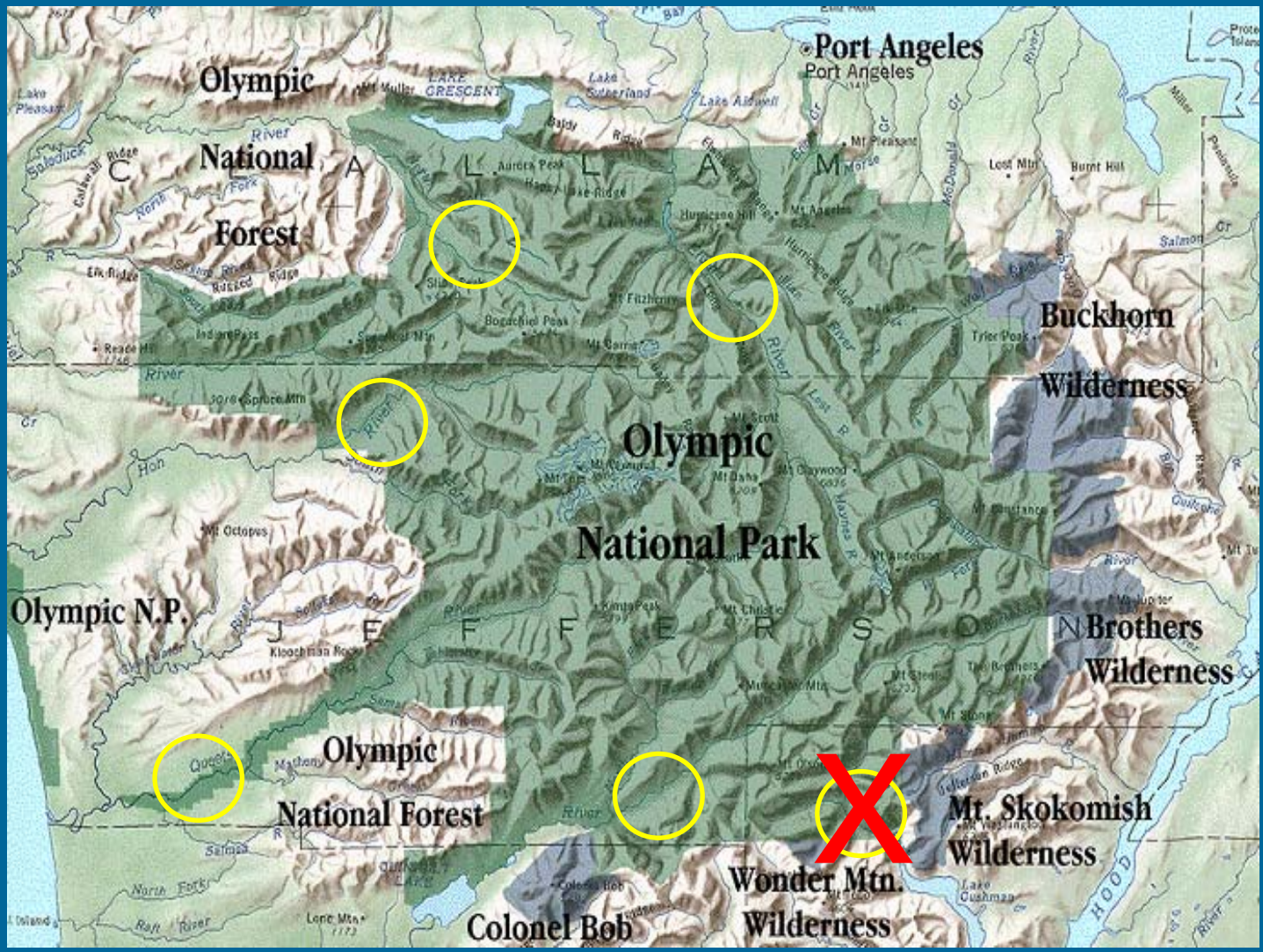
Main questions:

- Where do conifer trees survive on flood plains?
- What are the conditions under which they survive?
- Do growth rates in young (~10 to 40 year-old) conifer stands with and without hardwood competitors differ?

Field work in Olympic National Park



Field work in Olympic National Park



Study Design

- 22 plots per river (4 on Soleduck)
- 11 plots with conifers, 11 without (paired design) on each river (2 each on Soleduck)
- Will complete field work on Skokomish R. in summer 2007

Study Design

- All sites between 10-40 years old
- Counted all stems 2 m and taller

Results

- Species composition and stem density
- Conifers and wood
- Environmental variables and conifers
- Predicting Douglas-fir presence

Species composition (% of **stems**)

	Elwha	Hoh	Queets	Quinault	Soleduck
Alder	36.5	51.8	52.2	79.2	89.7
Willow	44.5	42.9	39.7	1.3	2.6
Sitka Spruce	--	5.3	7.0	15.4	3.3
Douglas-Fir	14.6	--	0.1	3.0	3.1
Grand Fir	2.1	--	--	--	--
Cottonwood	1.3	--	--	0.2	--
W. Hemlock	0.1	--	1.0	0.3	--
Big-L. Maple	0.9	--	--	0.2	--
W. Redcedar	0.1	--	--	--	--
Other	0.1	0.1	0.1	0.5	1.3

All sites between 10-40 yrs

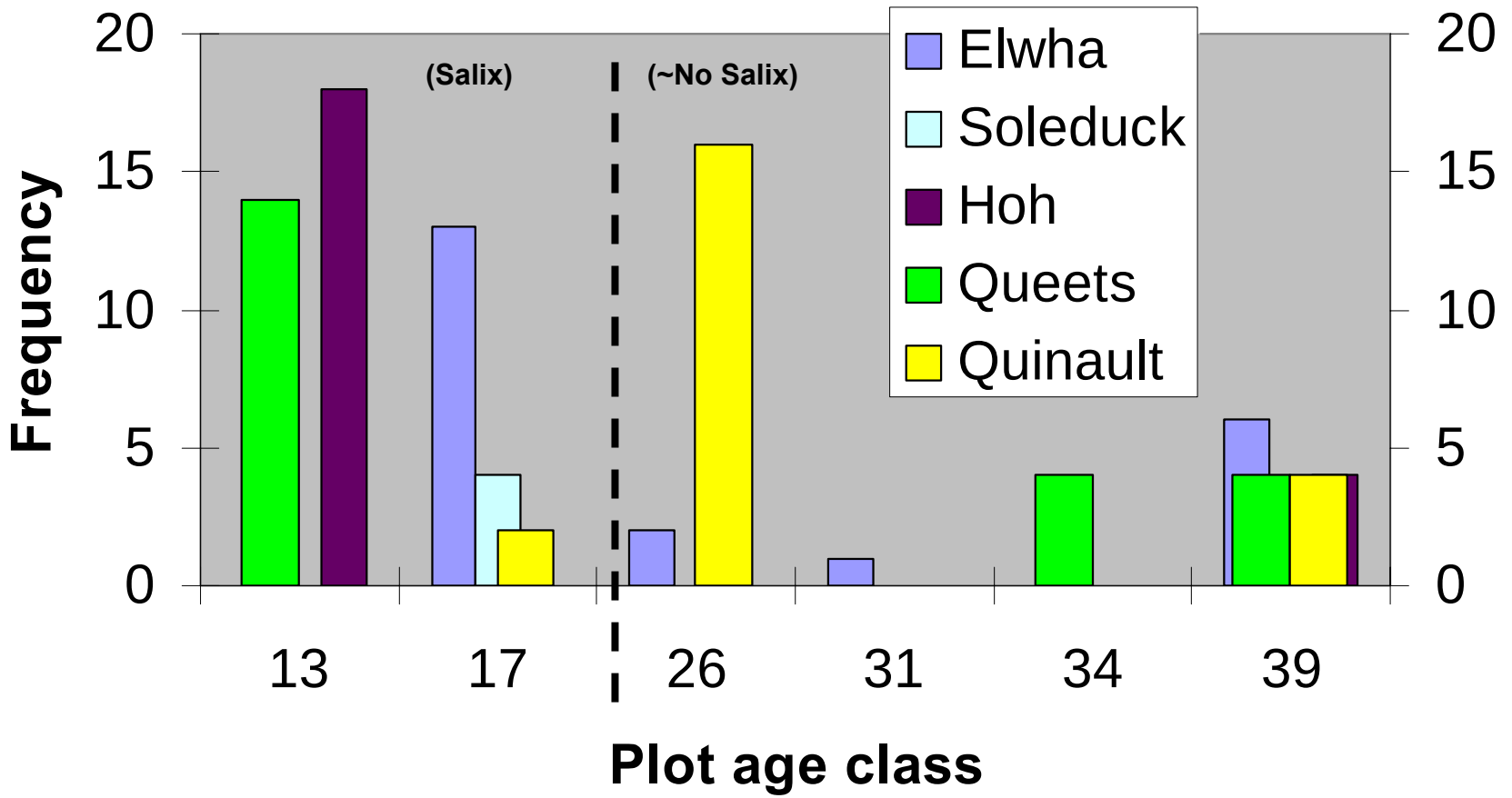
Few willows on Quinault R. sites

Species composition (% of stems)

	Elwha	Hoh	Queets	Quinault	Soleduck
Alder	36.5	51.8	52.2	79.2	89.7
Willow	44.5	42.9	39.7	1.3	2.6
Sitka Spruce	--	5.3	7.0	15.4	3.3
Douglas-Fir	14.6	--	0.1	3.0	3.1
Grand Fir	2.1	--	--	--	--
Cottonwood	1.3	--	--	0.2	--
W. Hemlock	0.1	--	1.0	0.3	--
Big-L. Maple	0.9	--	--	0.2	--
W. Redcedar	0.1	--	--	--	--
Other	0.1	0.1	0.1	0.5	1.3

All sites between 10-40 yrs

Age distributions of study plots



Majority of Douglas-fir were on Elwha R.

Species composition (% of stems)

	Elwha	Hoh	Queets	Quinault	Soleduck
Alder	36.5	51.8	52.2	79.2	89.7
Willow	44.5	42.9	39.7	1.3	2.6
Sitka Spruce	--	5.3	7.0	15.4	3.3
Douglas-Fir	14.6	--	0.1	3.0	3.1
Grand Fir	2.1	--	--	--	--
Cottonwood	1.3	--	--	0.2	--
W. Hemlock	0.1	--	1.0	0.3	--
Big-L. Maple	0.9	--	--	0.2	--
W. Redcedar	0.1	--	--	--	--
Other	0.1	0.1	0.1	0.5	1.3

All sites between 10-40 yrs

Few hemlock or cedar on any site

Species composition (% of stems)

	Elwha	Hoh	Queets	Quinault	Soleduck
Alder	36.5	51.8	52.2	79.2	89.7
Willow	44.5	42.9	39.7	1.3	2.6
Sitka Spruce	--	5.3	7.0	15.4	3.3
Douglas-Fir	14.6	--	0.1	3.0	3.1
Grand Fir	2.1	--	--	--	--
Cottonwood	1.3	--	--	0.2	--
W. Hemlock	0.1	--	1.0	0.3	--
Big-L. Maple	0.9	--	--	0.2	--
W. Redcedar	0.1	--	--	--	--
Other	0.1	0.1	0.1	0.5	1.3

All sites between 10-40 yrs

Few young cottonwood

Species composition (% of stems)

	Elwha	Hoh	Queets	Quinault	Soleduck
Alder	36.5	51.8	52.2	79.2	89.7
Willow	44.5	42.9	39.7	1.3	2.6
Sitka Spruce	--	5.3	7.0	15.4	3.3
Douglas-Fir	14.6	--	0.1	3.0	3.1
Grand Fir	2.1	--	--	--	--
Cottonwood	1.3	--	--	0.2	--
W. Hemlock	0.1	--	1.0	0.3	--
Big-L. Maple	0.9	--	--	0.2	--
W. Redcedar	0.1	--	--	--	--
Other	0.1	0.1	0.1	0.5	1.3

All sites between 10-40 yrs

Conifers and wood

	Elwha	Hoh	Queets	Quinault	Soleduck
Total conifers	**243**	**95**	**125**	**114**	**25**
Sitka Spruce	--	95(5)	109(25)	94(54)	13(5)
Douglas-Fir	211(0)	--	1(0)	18(0)	12(0)
Grand Fir	30(0)	--	--	--	--
W. Hemlock	1(0)	--	15(12)	2(1)	--
W. Redcedar	1(0)	--	--	--	--

Numbers in parentheses denote number of conifers clearly growing from wood substrate.

Conifers and wood

	Elwha	Hoh	Queets	Quinault	Soleduck
Total conifers	**243**	**95**	**125**	**114**	**25**
Sitka Spruce	--	95(5)	109(25)	94(54)	13(5)
Douglas-Fir	211(0)	--	1(0)	18(0)	12(0)
Grand Fir	30(0)	--	--	--	--
W. Hemlock	1(0)	--	15(12)	2(1)	--
W. Redcedar	1(0)	--	--	--	--

Numbers in parentheses denote number of conifers clearly growing from wood substrate.

Relationship varies from river to river

	Elwha	Hoh	Queets	Quinault	Soleduck
Total conifers	**243**	**95**	**125**	**114**	**25**
Sitka Spruce	--	95(5)	109(25)	94(54)	13(5)
Douglas-Fir	211(0)	--	1(0)	18(0)	12(0)
Grand Fir	30(0)	--	--	--	--
W. Hemlock	1(0)	--	15(12)	2(1)	--
W. Redcedar	1(0)	--	--	--	--

Numbers in parentheses denote number of conifers clearly growing from wood substrate.

Western hemlock + wood = survival chance ↑

	Elwha	Hoh	Queets	Quinault	Soleduck
Total conifers	**243**	**95**	**125**	**114**	**25**
Sitka Spruce	--	95(5)	109(25)	94(54)	13(5)
Douglas-Fir	211(0)	--	1(0)	18(0)	12(0)
Grand Fir	30(0)		--	--	--
W. Hemlock	1(0)	--	15(12)	2(1)	--
W. Redcedar	1(0)	--	--	--	--

Numbers in parentheses denote number of conifers clearly growing from wood substrate.

Environmental variables and conifers

- Soil depth (cm)
- Soil moisture (% water)
- Height above river level (m)
- Canopy cover (% cover)

West-side rivers (Sitka spruce patches)

-- no clear patterns emerge

Parameter	
Soil depth (cm)	No statistical differences on any river
Soil moisture (%)	No statistical differences on any river
Height above river (m)	Conifer plots higher on Hoh and Queets*
Canopy cover (%)	Conifer plots had less cover on Queets only*

*(P < 0.05)

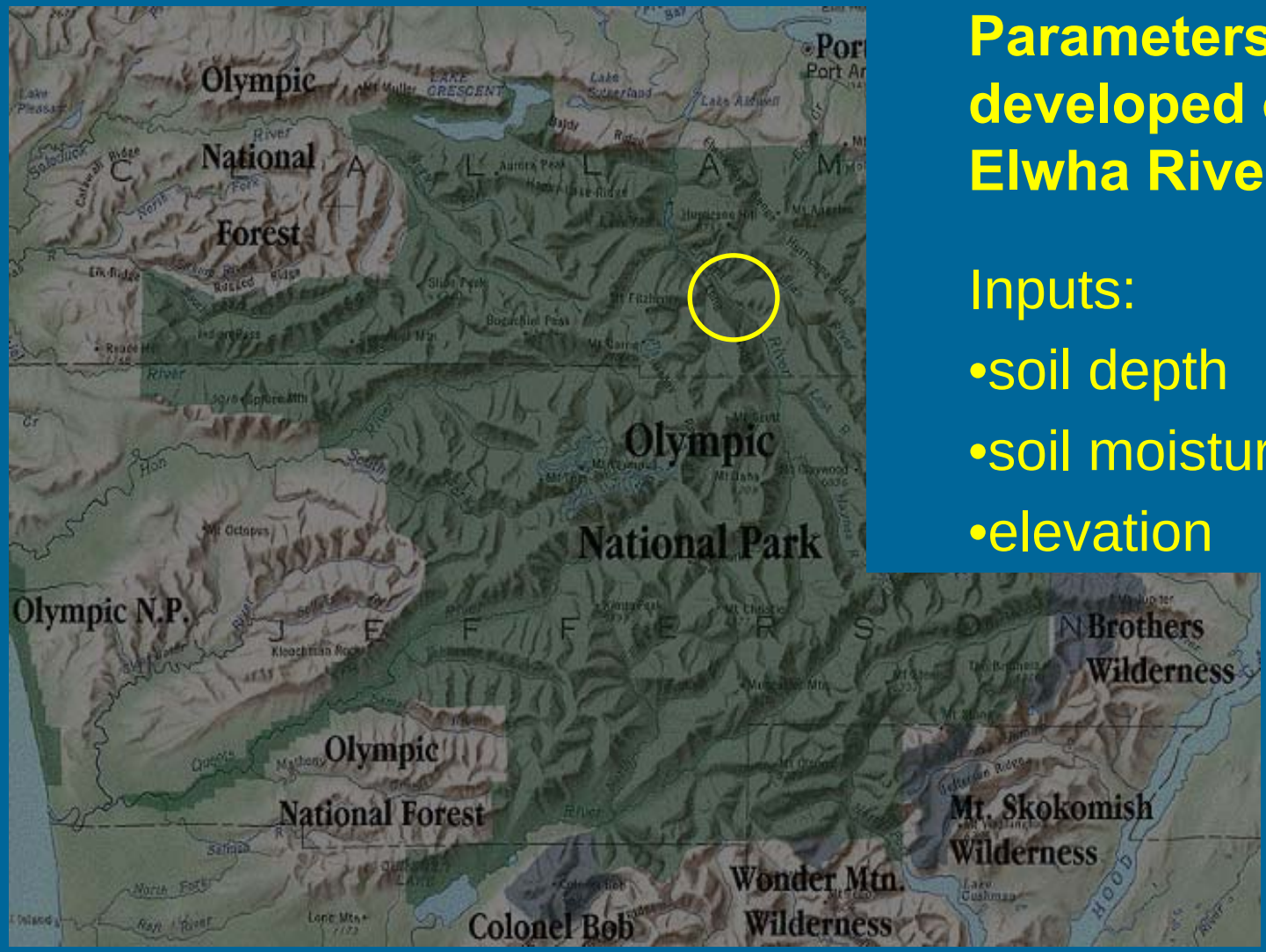
Elwha River (Douglas-fir patches)

Parameter	Conifer plots	Non-conifer plots
Soil depth (cm)	16.9**	34.9
Soil moisture (%)	9.0	10.4
Height above river (m)	1.4*	0.3
Canopy cover (%)	55.9*	80.9

**(P < 0.01)

*(P < 0.05)

Logistic regression model

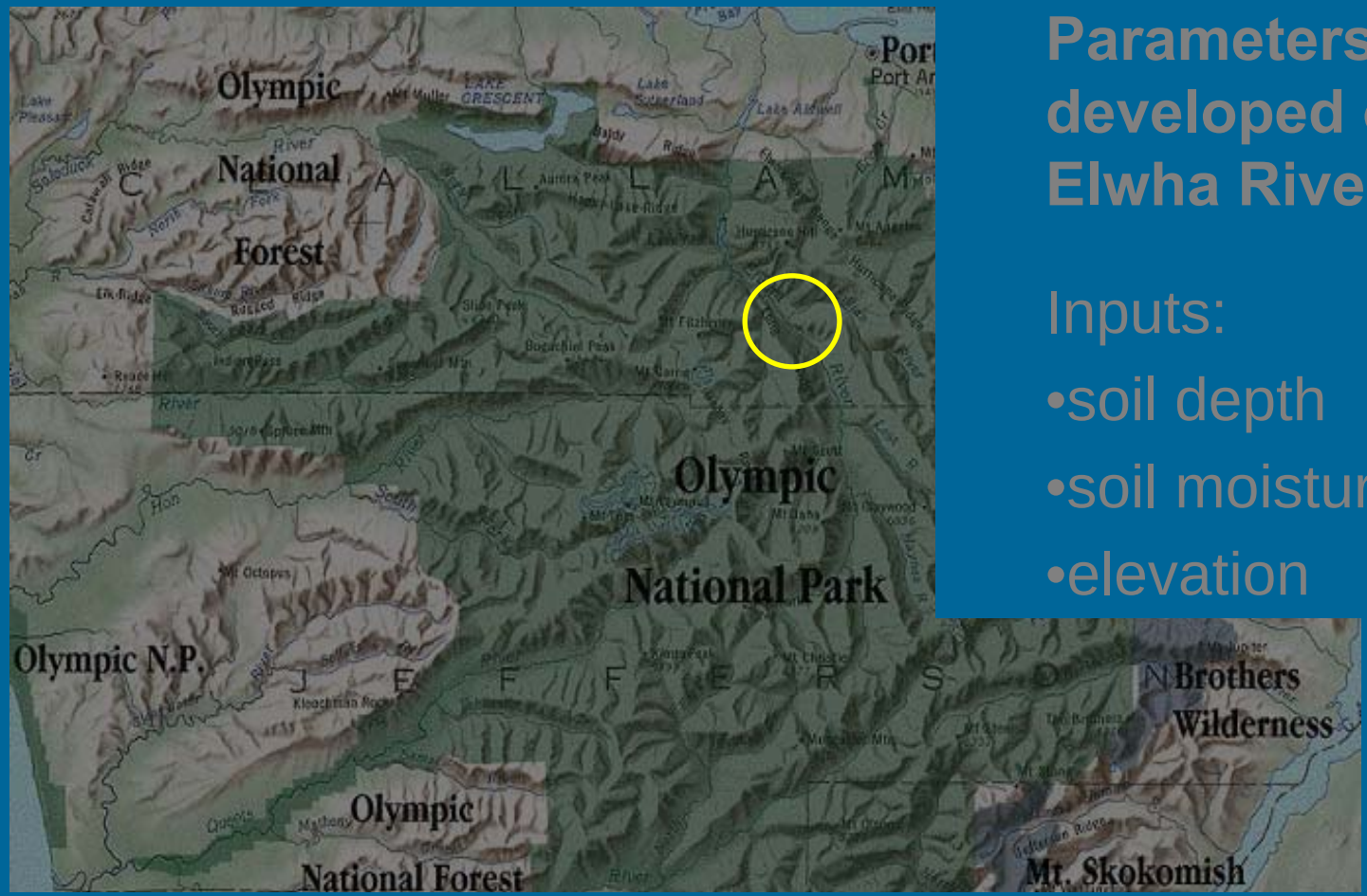


Parameters developed on Elwha River…

Inputs:

- soil depth
- soil moisture
- elevation

Logistic regression model



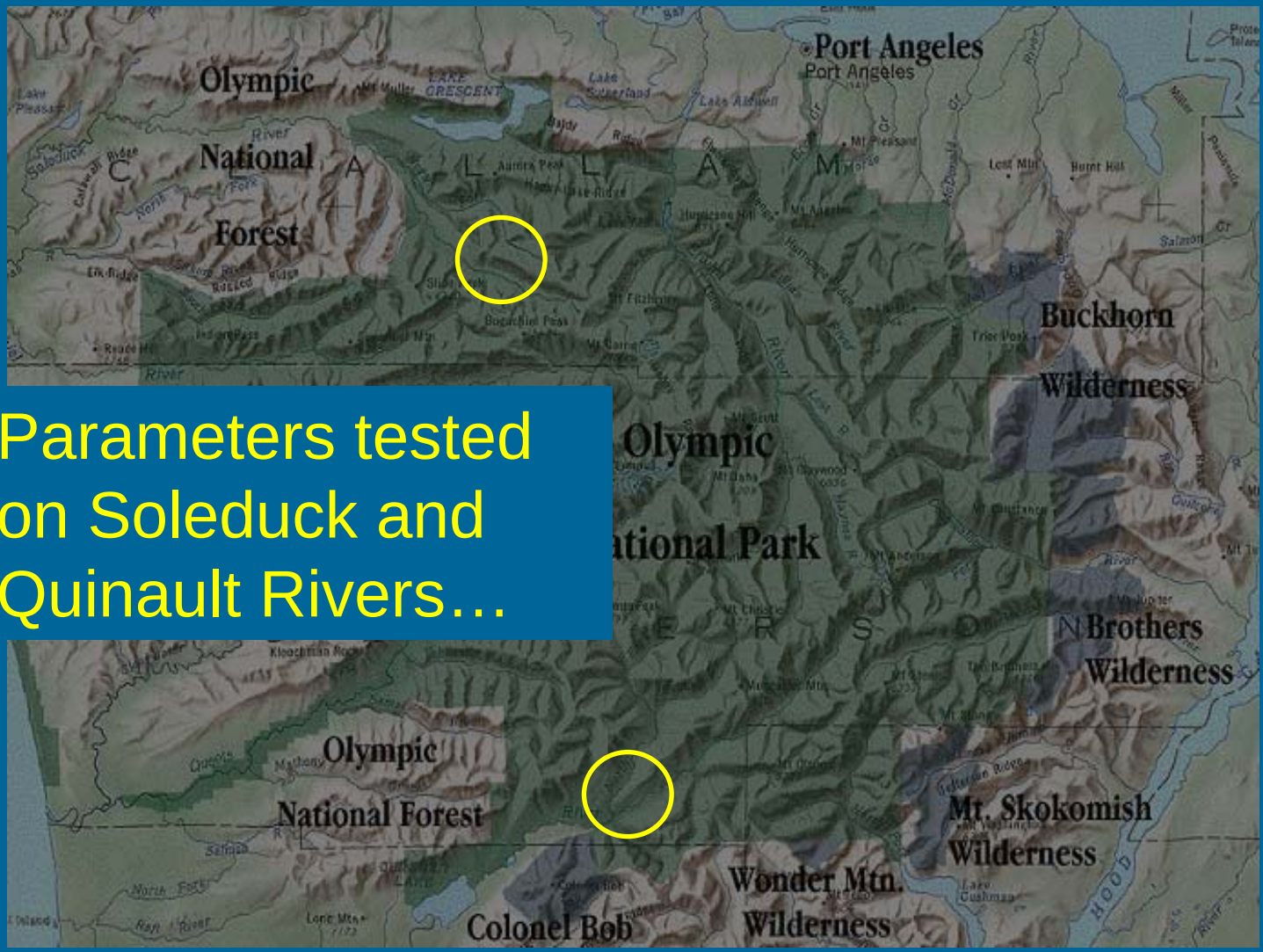
Parameters developed on Elwha River…

Inputs:

- soil depth
- soil moisture
- elevation

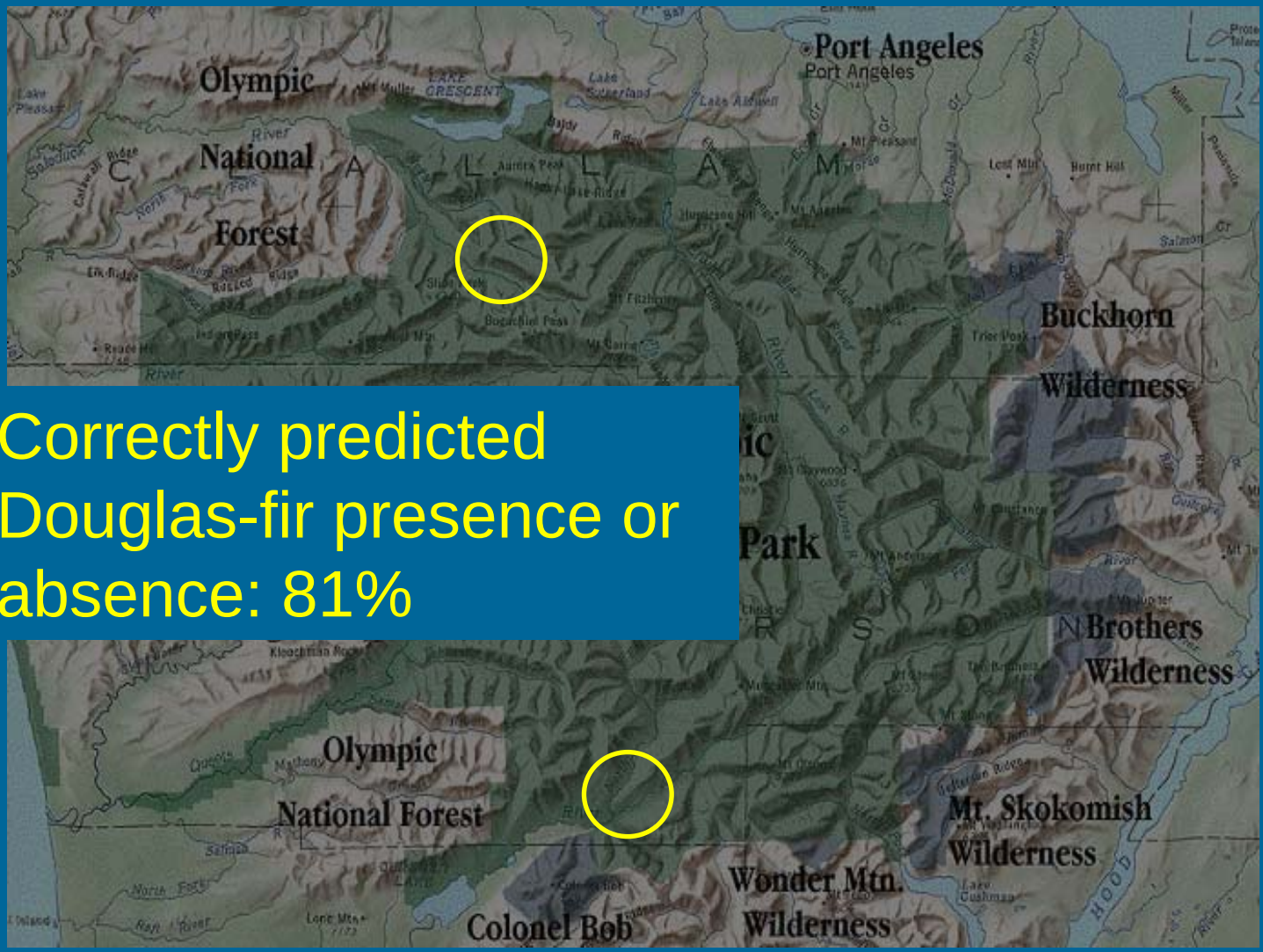
Plots correctly classified: 82%

Logistic regression model



Parameters tested on Soleduck and Quinault Rivers…

Logistic regression model

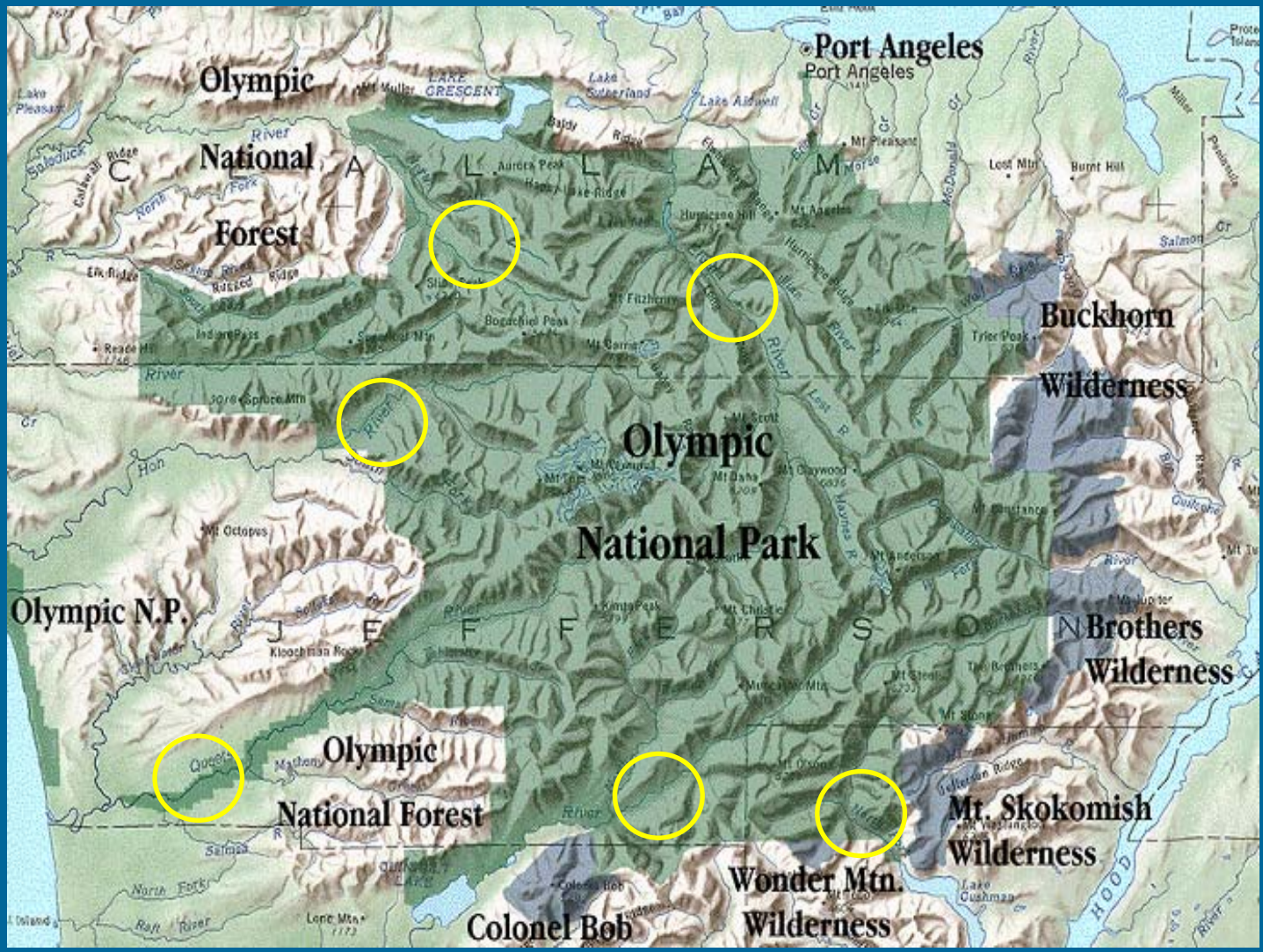


Correctly predicted Douglas-fir presence or absence: 81%

Logistic regression model

- Inputs: soil depth, soil moisture, elevation
  - Plots correctly classified: 82%
- Tested model on Quinault and Soleduck data
  - Correctly predicted Douglas-fir presence or absence: 81%

Wrapping it all up…



Connections to riparian restoration & management

…Place matters!

- Conifer species composition varies from river to river
  - Some common conifer species may naturally establish early, but others may not

Connections to riparian restoration & management

- Douglas-fir favors shallow soils where other species struggle
  - Often found on higher, open flood plain surfaces

Connections to riparian restoration & management

- Associations between conifers and wood vary from site to site
  - Wood has a number of important roles in floodplain areas

…Place matters!

- Conifer species composition varies from river to river
- Douglas-fir favors shallow soils where other species struggle
- Associations between conifers and wood vary from site to site


Thank you!

Thank you!

River Lab:

Josh Latterell

Deanne Drake

Bob Van Pelt

Scott Bechtold

Liz Perkin

Field help:

Cameron Chapman

Tobin Youngs

Liz Perkin

Corrina Chase

Michael Kroeger

Gary Yetter

Funding support:

Andrew W. Mellon Foundation; Egvedt Charitable Trust;
UW School of Aquatic and Fishery Sciences