Forested Wetlands Effectiveness Projects (FWEP): Chronosequence study design

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CMER Wetland Scientist
Northwest Indian Fisheries Commission

TFW Policy meeting
2 June 2022

Forested Wetland Effectiveness Projects: history and context

- Forested wetlands are one of three types of wetlands regulated under Forest Practices Rules:
  - Forested
  - Type A
  - Type B
- Under Forest Practices Rules, a *forested wetland* is defined as a "***wetland or portion thereof that has, or if the trees were mature would have, a crown closure of 30 percent or more.***" *WAC 222-16-035*

Photo credit: Leah Beckett

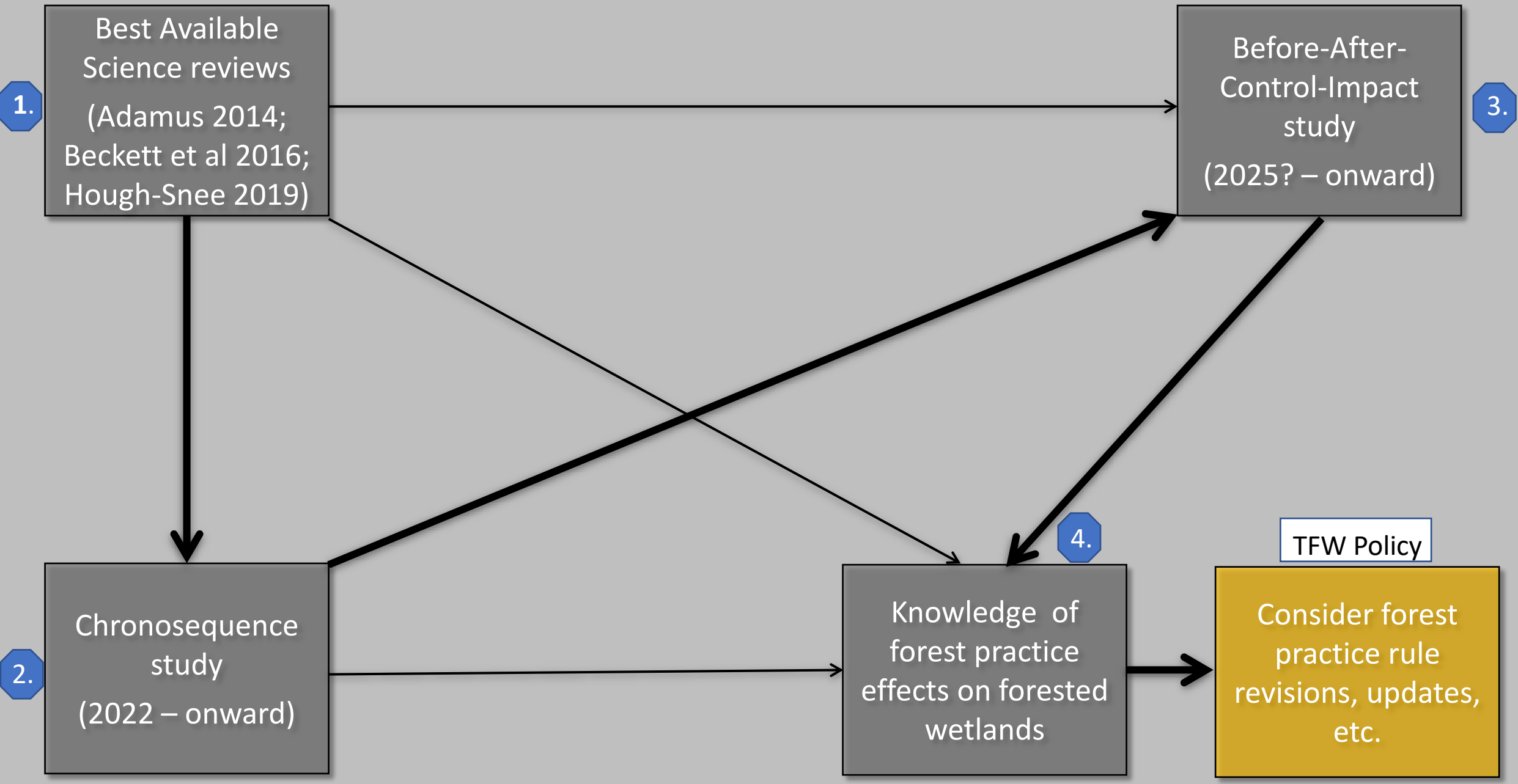
Forested Wetland Effectiveness Projects: history and context

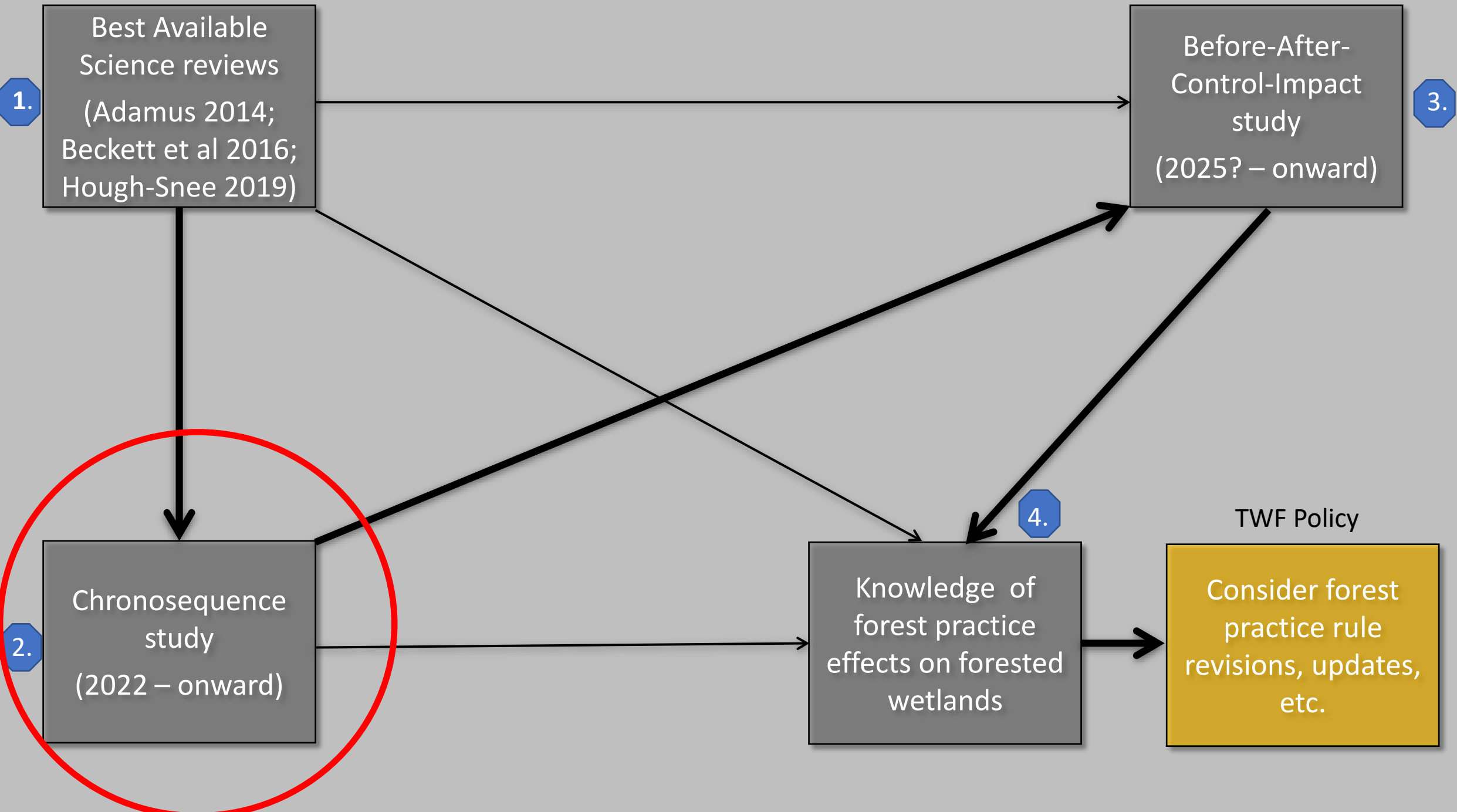
The FWEP…

"…will investigate if forest practice rules, as they apply to forested wetlands, are effective at:

1. maintaining and/or restoring key wetland ecosystem functions; and
2. meeting resource objectives and performance targets laid out in the Forest Practices Habitat Conservation Plan (FHCP), within one half of a timber rotation cycle (20-years, at minimum)."

Chronosequence study design; Hough-Snee et al. 2019


Best Available Science reviews
(Adamus 2014; Beckett et al 2016; Hough-Snee 2019)
1.
Before-After-Control-Impact study
(2025? – onward)
3.
Chronosequence study
(2022 – onward)
2.
4.
Knowledge of forest practice effects on forested wetlands
TFW Policy
Consider forest practice rule revisions, updates, etc.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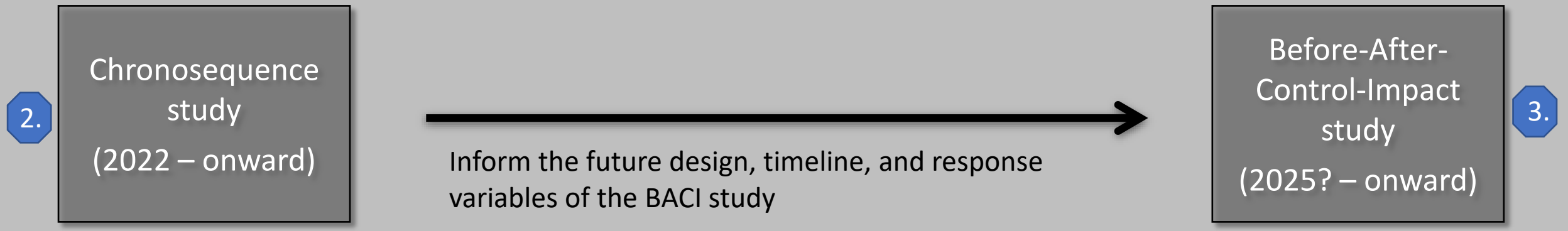
Role of the FWEP Chronosequence study

2. Chronosequence study (2022 – onward)

Role of the FWEP Chronosequence study



FWEP Chronosequence through the CMER process

Date	Action
2015	TWIG formed
December 2016	BAS (scoping) alternatives document presented to Policy
January 2017	Policy's selection of study design
June 2018	CMER Review and revisions
July 2018	CMER approval to send document to ISPR; Document sent to ISPR
December 2018	ISPR reviews returned with major revision designation
July 2019	Returned to ISPR for review
December 2019	Revised ISPR-approved study design returned to CMER
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*The confluence of budget / personnel cutbacks, COVID, and the hiring process delayed implementation until this year

FWEP Chronosequence:
Understanding forested wetland change over time

Time

FWEP Chronosequence critical questions

1. How does forested wetland hydrology change over time following post-harvest forest stand development? Specifically:

FWEP Chronosequence critical questions

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FWEP Chronosequence critical questions

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    - How does the hydrology of recently harvested forested wetlands compare to the hydrology of recently undisturbed second-growth forested wetlands?
    - How does the timing, duration, and magnitude of flow and material transport differ between recently harvested and recently undisturbed second-growth forested wetlands?

FWEP – Chronosequence critical questions

2. How do forested wetland vegetation and canopy-mediated habitat conditions change over time following post-harvest forest stand development? Specifically:

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FWEP Chronosequence critical questions

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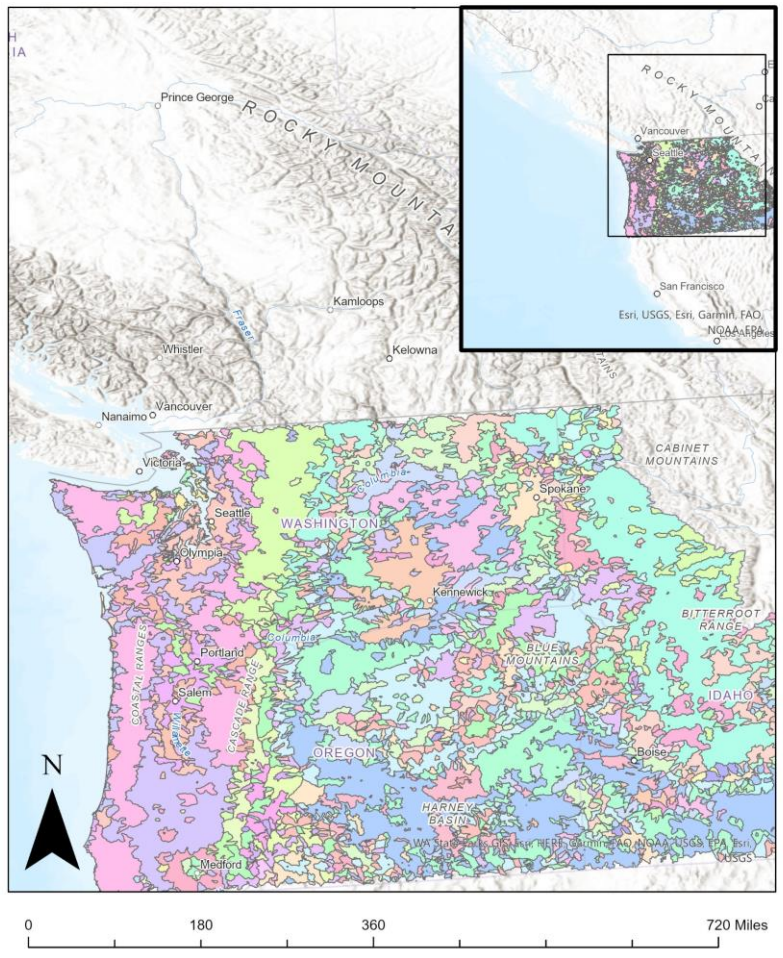
FWEP Chronosequence study design



Washington State is comprised of highly diverse hydrologic and climate contexts, as indicated on this map of hydrologic landscape classes (HLCs).

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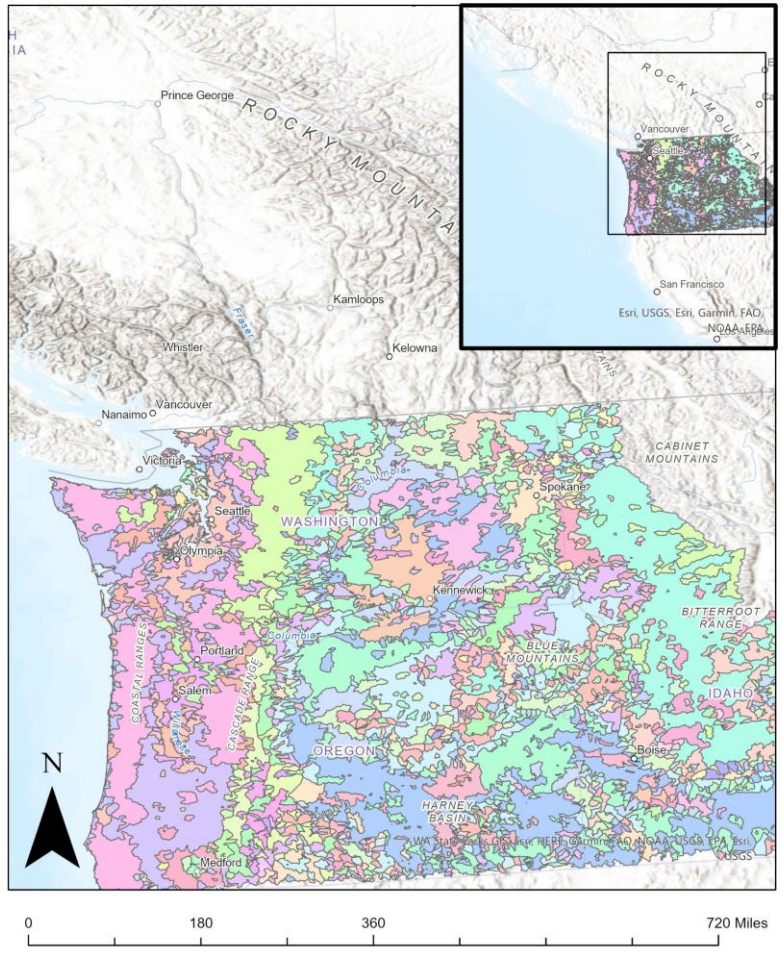
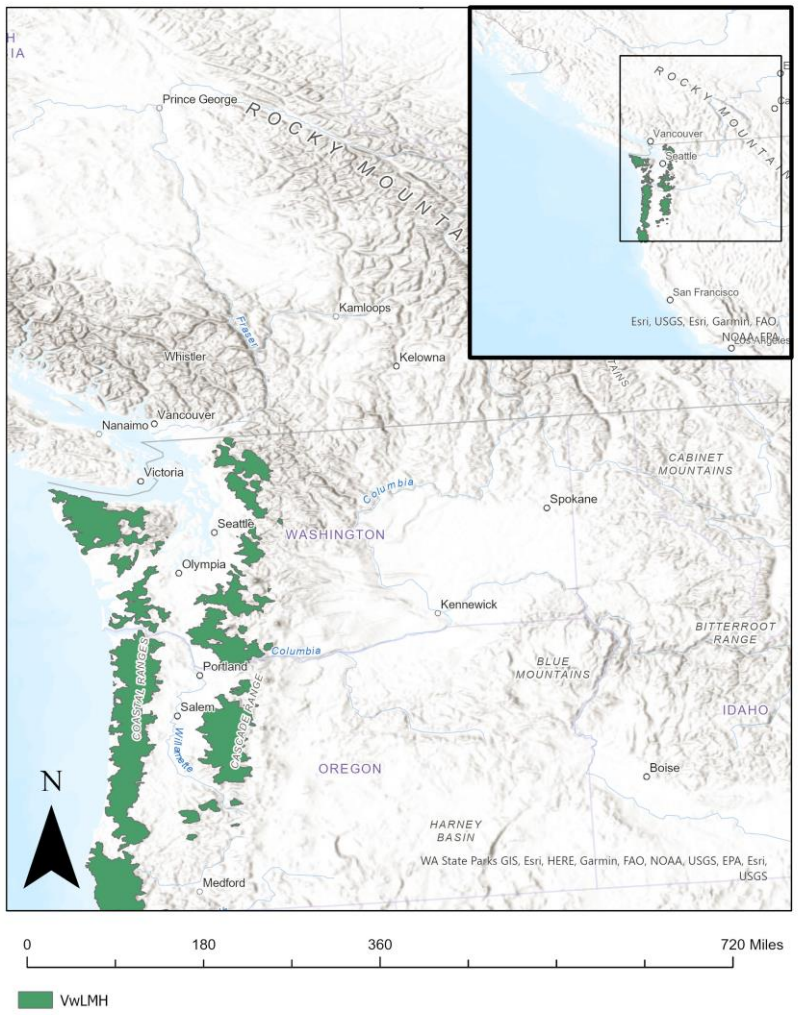


Washington State is comprised of highly diverse hydrologic and climate contexts, as indicated on this map of hydrologic landscape classes (HLCs).

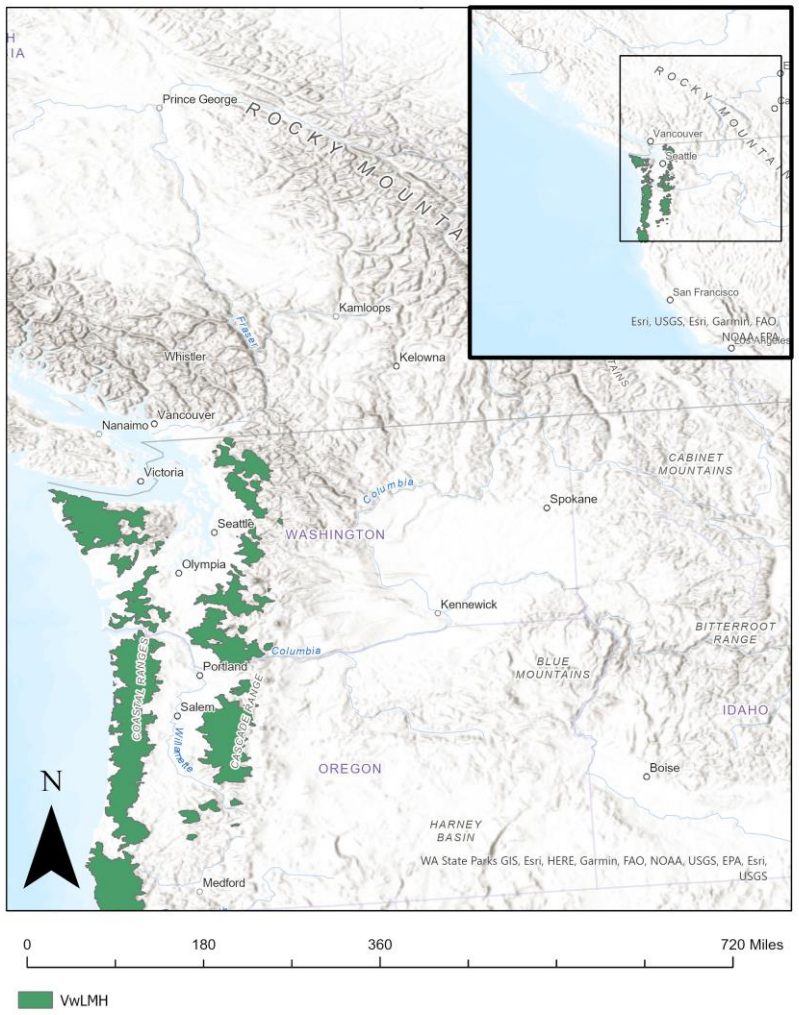
ISPR recommended focusing the Chronosequence study on a single, or similar, hydrologic landscape classes to reduce confounding issues of variable rainfall, climate, and substrate permeability.

FWEP Chronosequence study design



VwLMH: Very wet climate, winter seasonality, low aquifer permeability, mountainous terrain, high soil permeability.

FWEP Chronosequence study design



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Forested wetlands are more frequently reported on FPA documents in this area.

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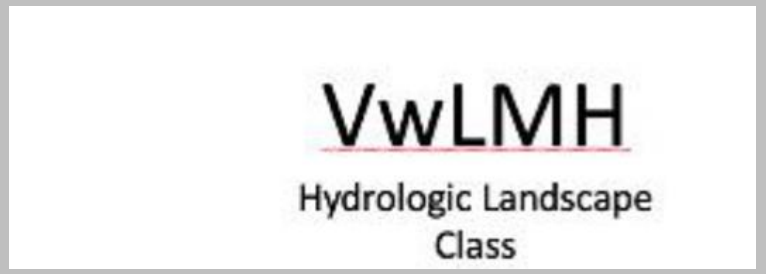


FWEP Chronosequence study design

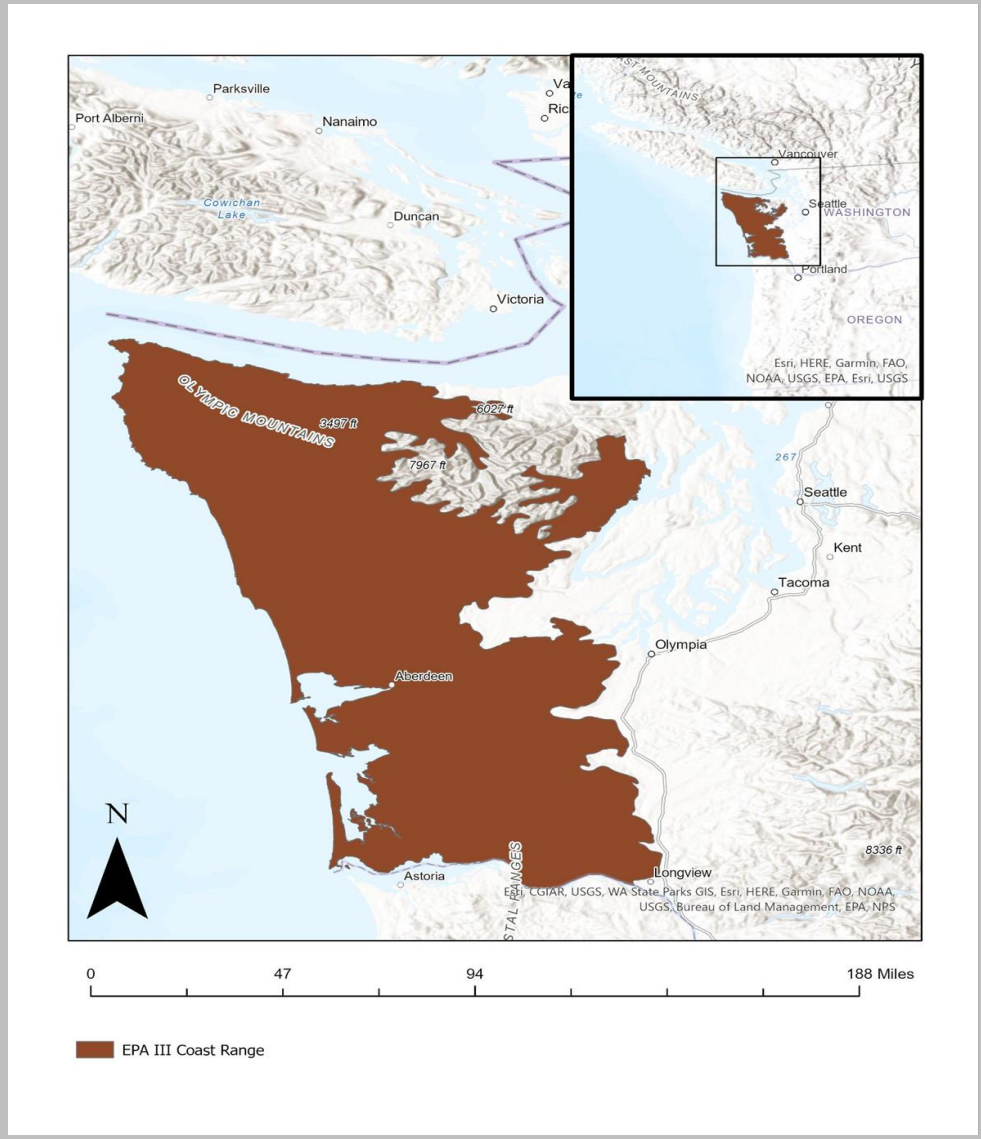
VwLMH

Hydrologic Landscape Class

↓

Coast Range L3 EcoRegion

Further restricted study area to the EPA L3 Coast Range EcoRegion.



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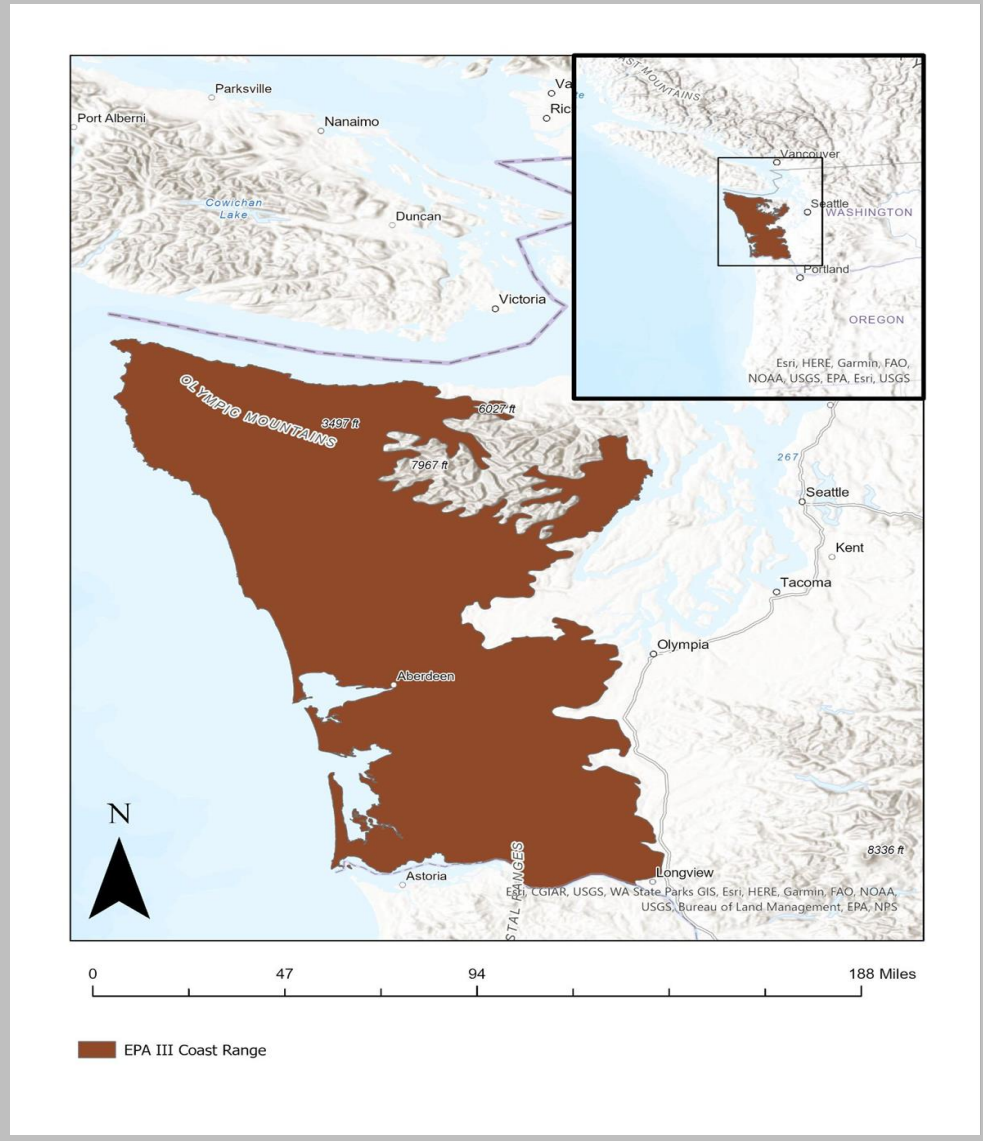
Olympic, Pacific Cascade, South Puget Sound DNR Regions



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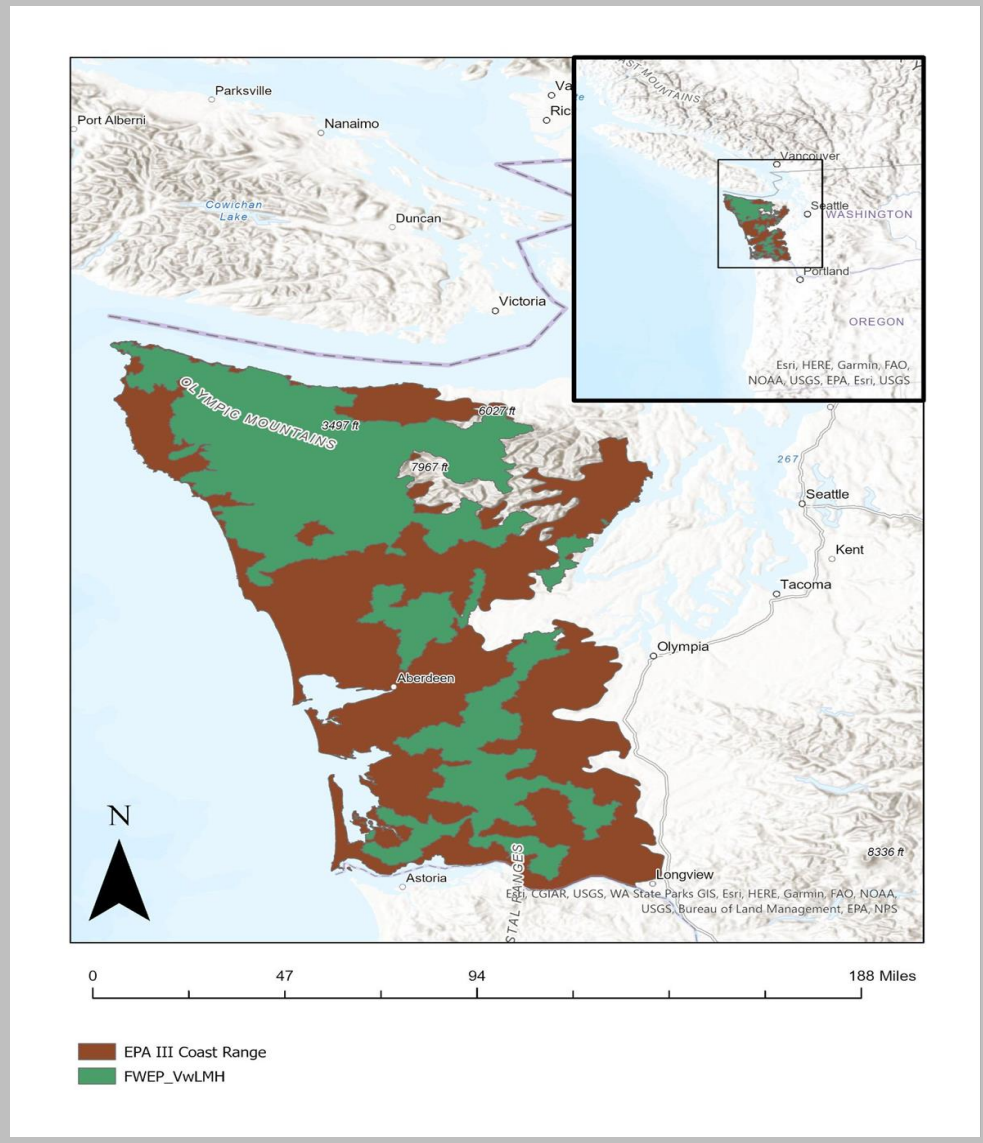

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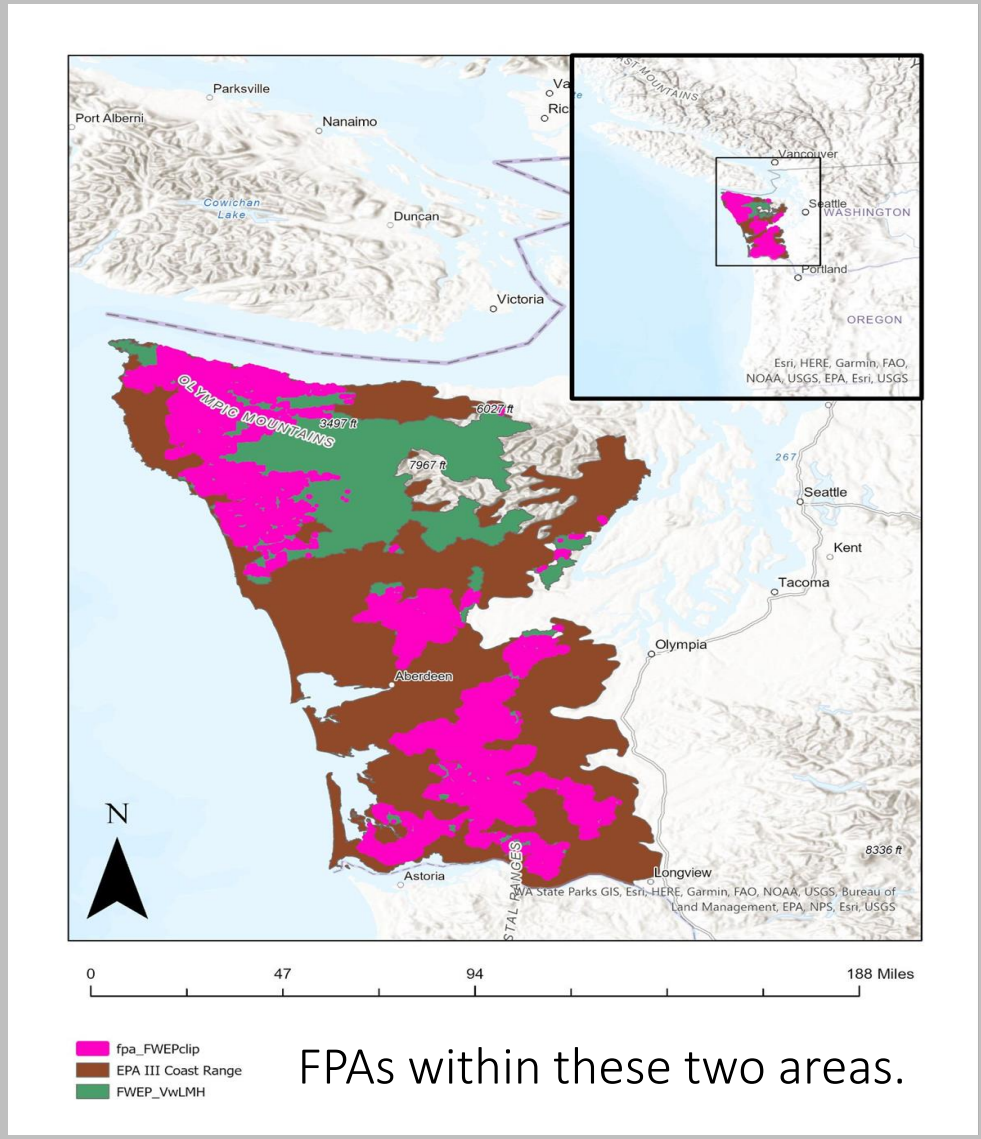
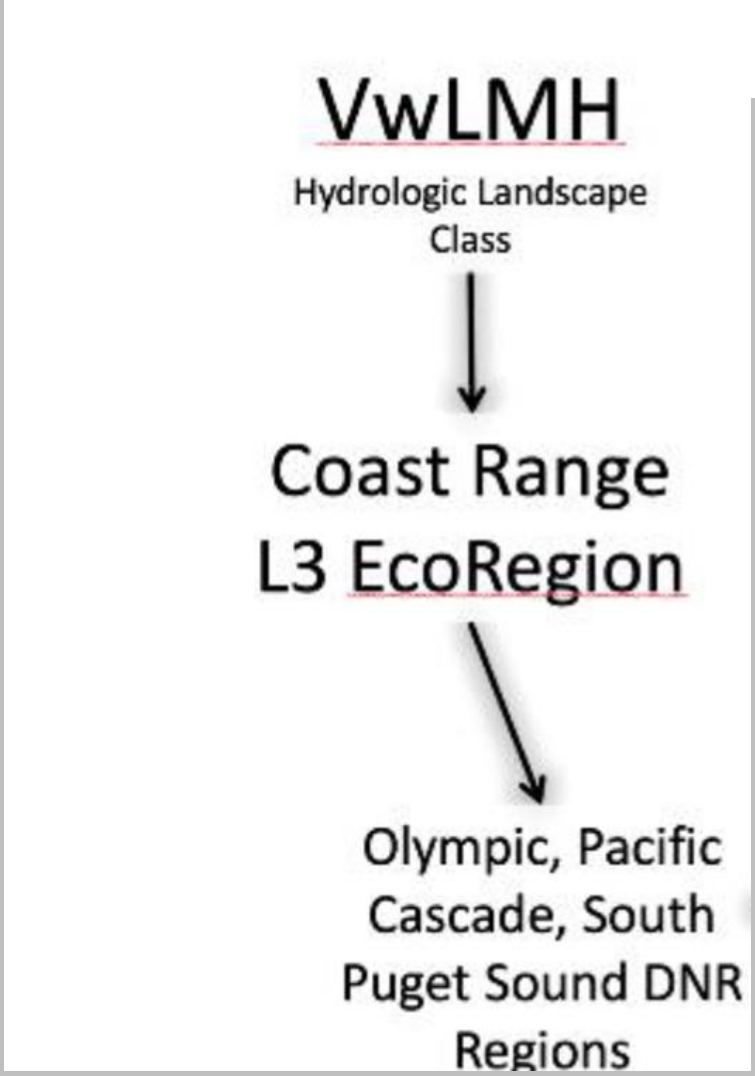


FPAs within these two areas.

FWEP Chronosequence study design



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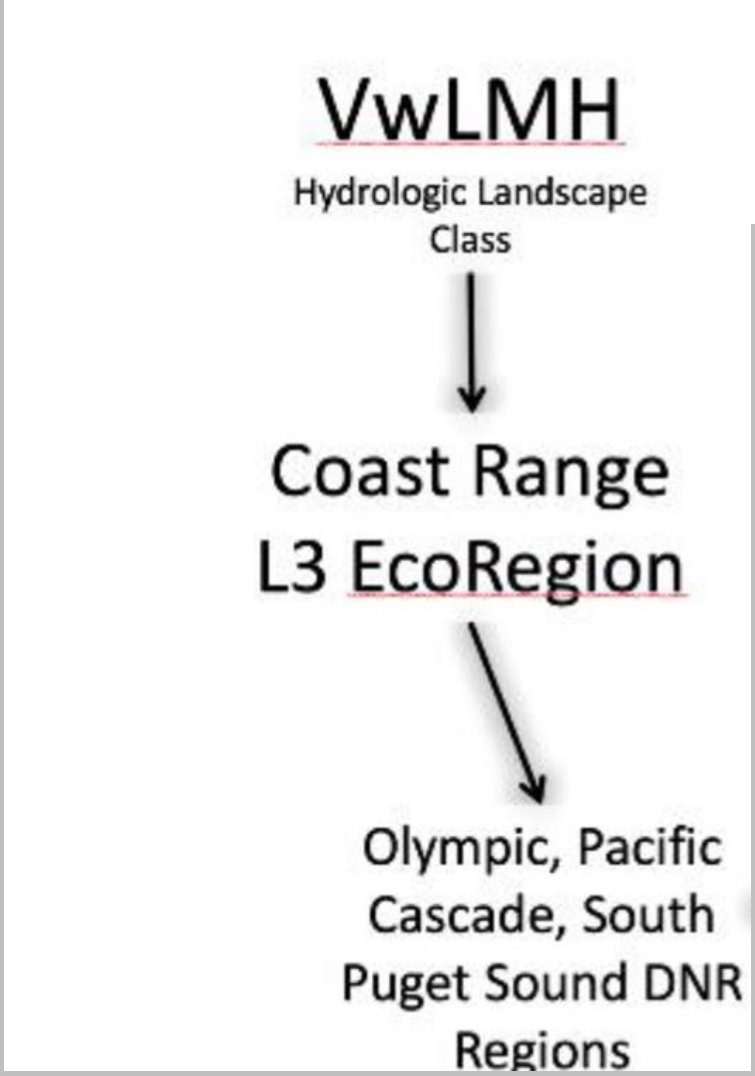

- Perennial, non-fish-bearing stream adjacent forested wetlands
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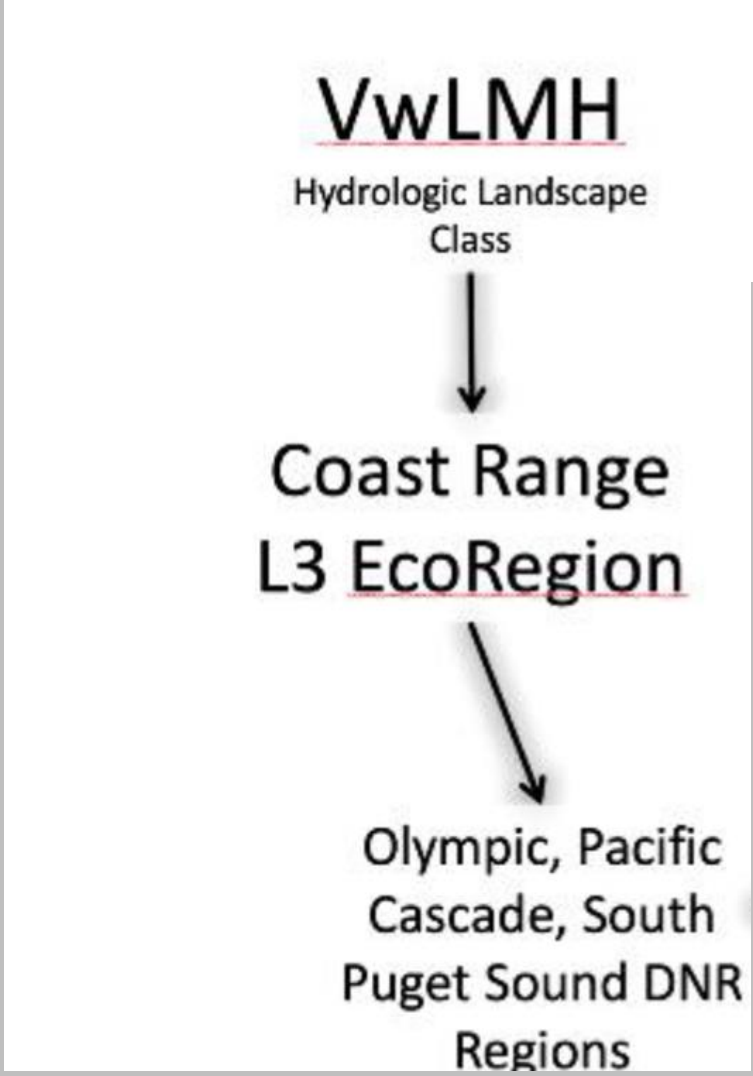

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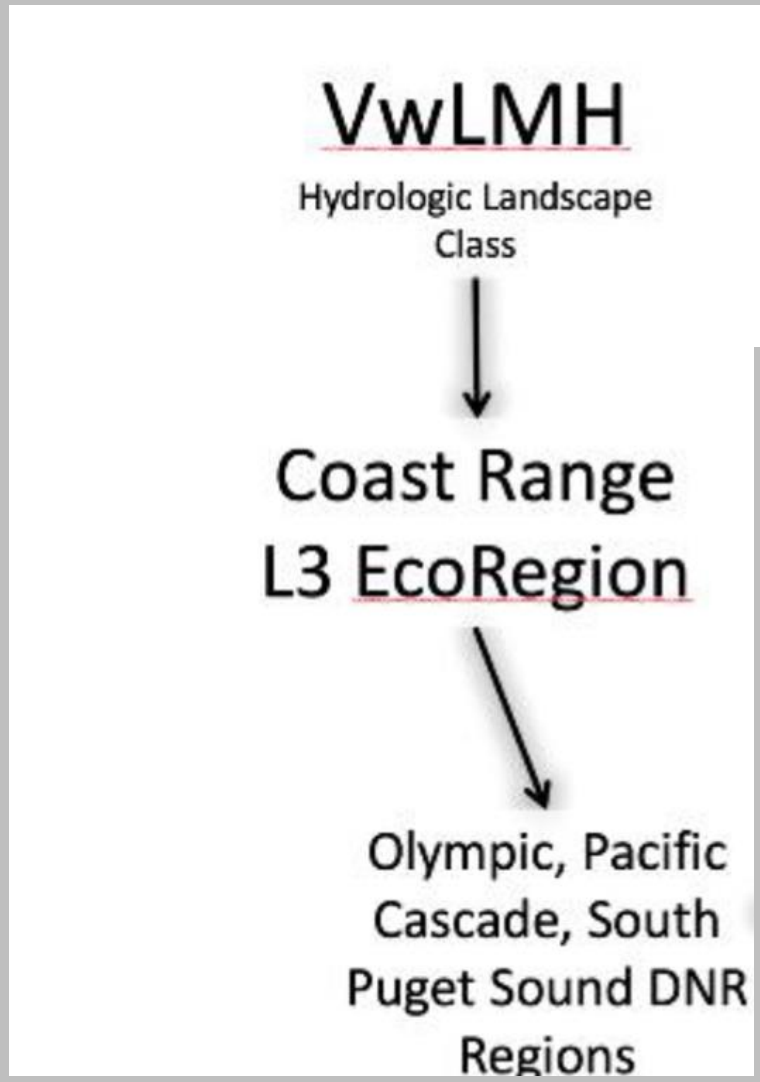

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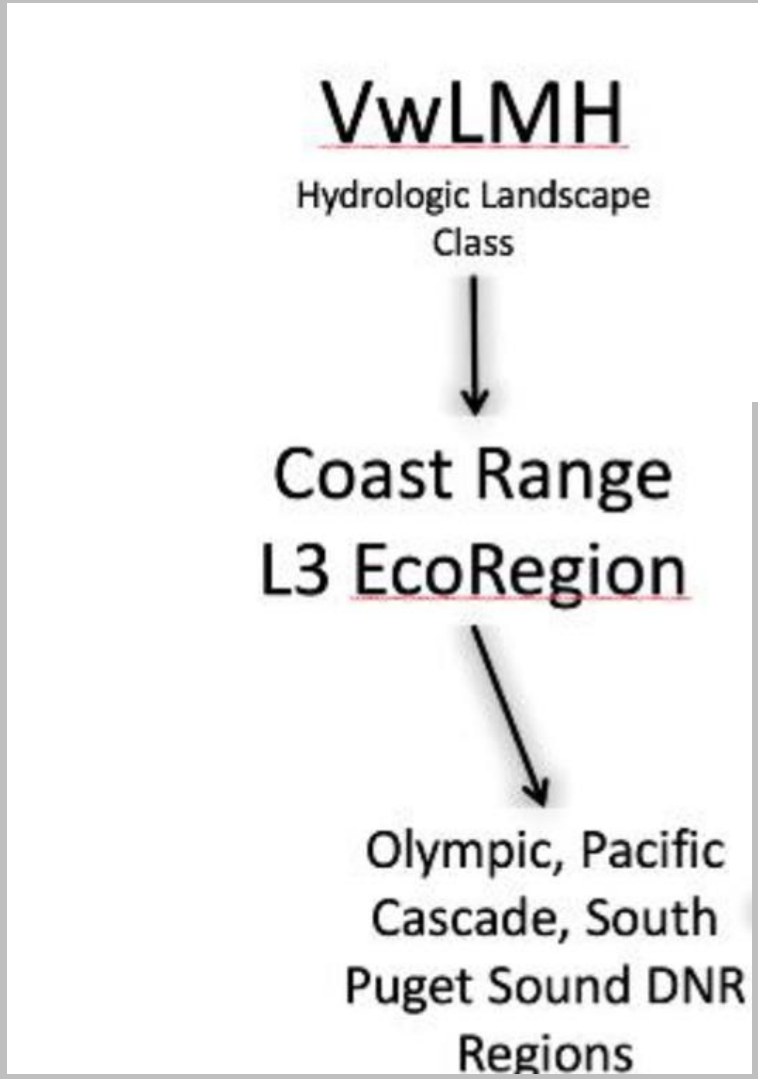

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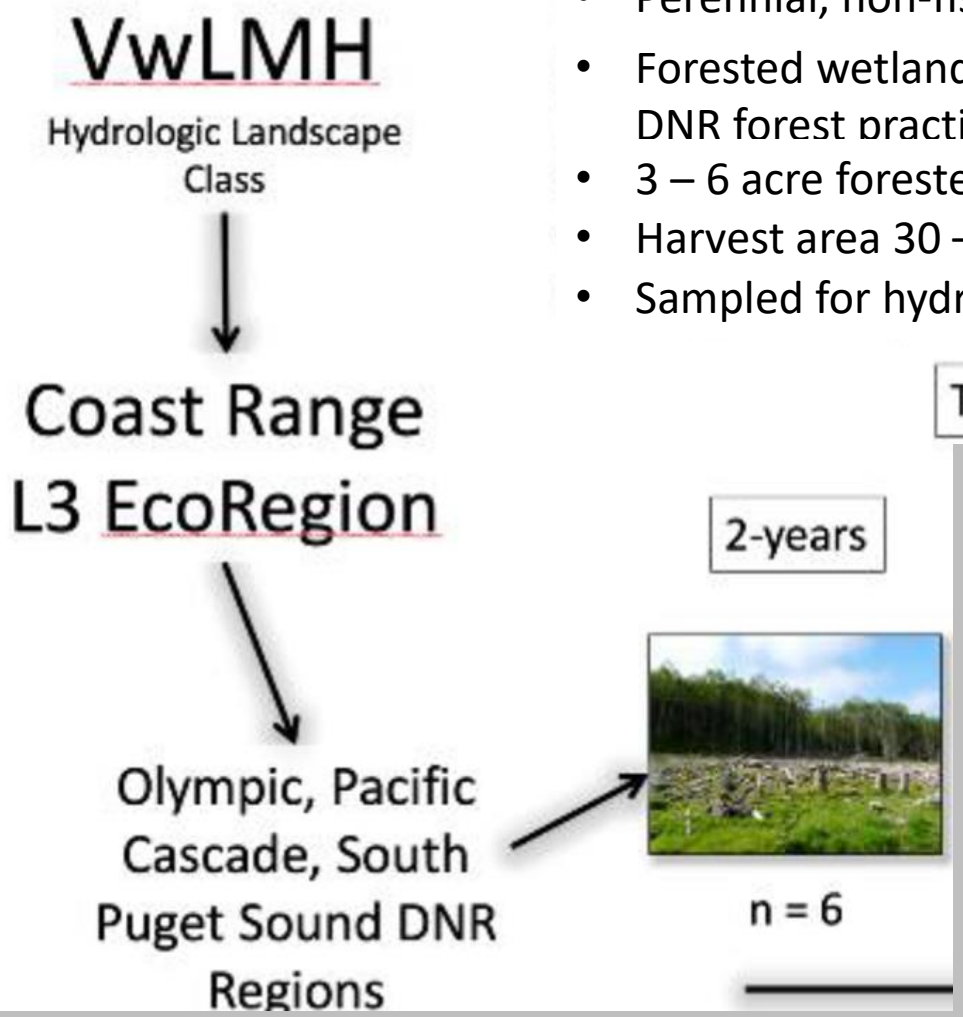

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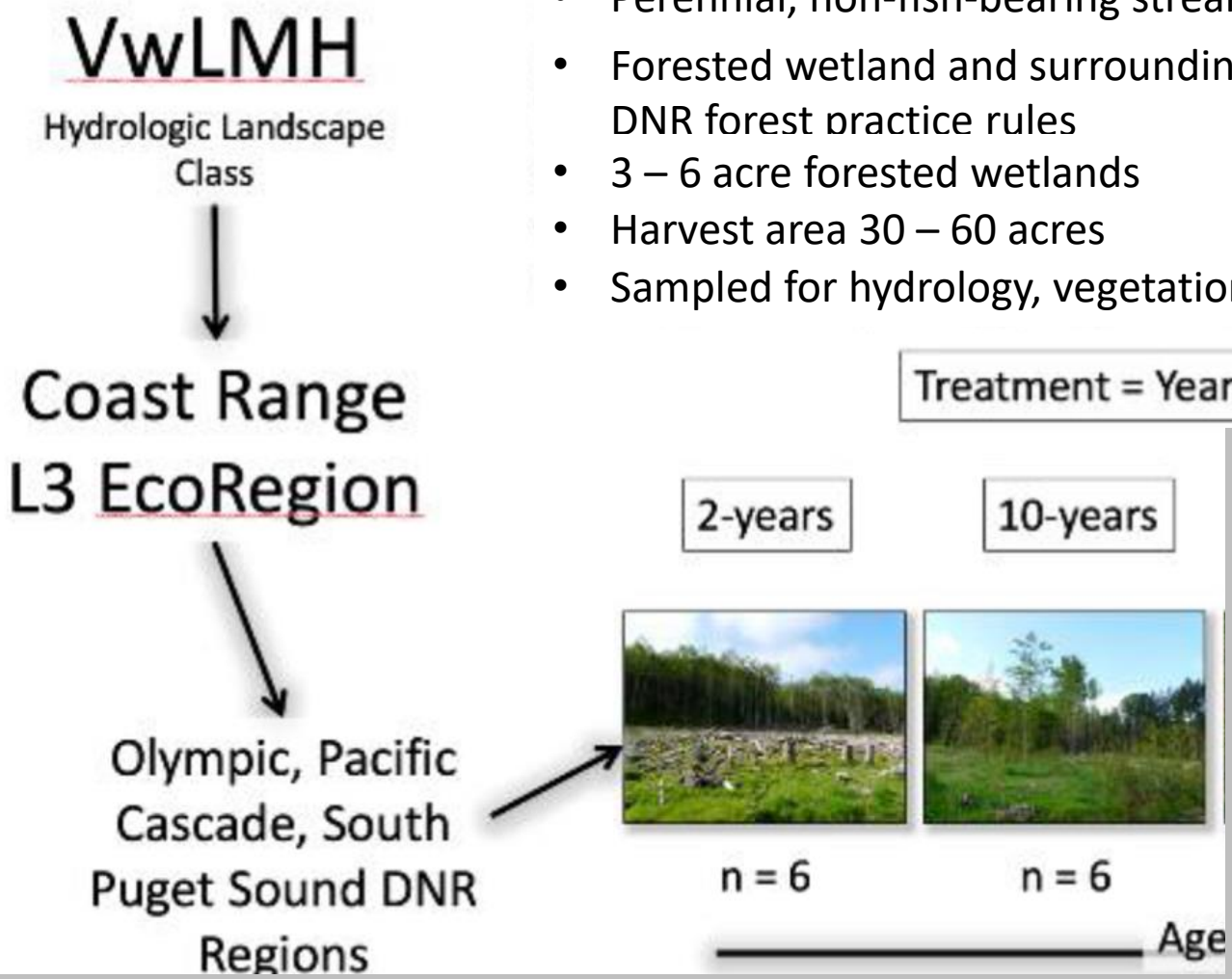

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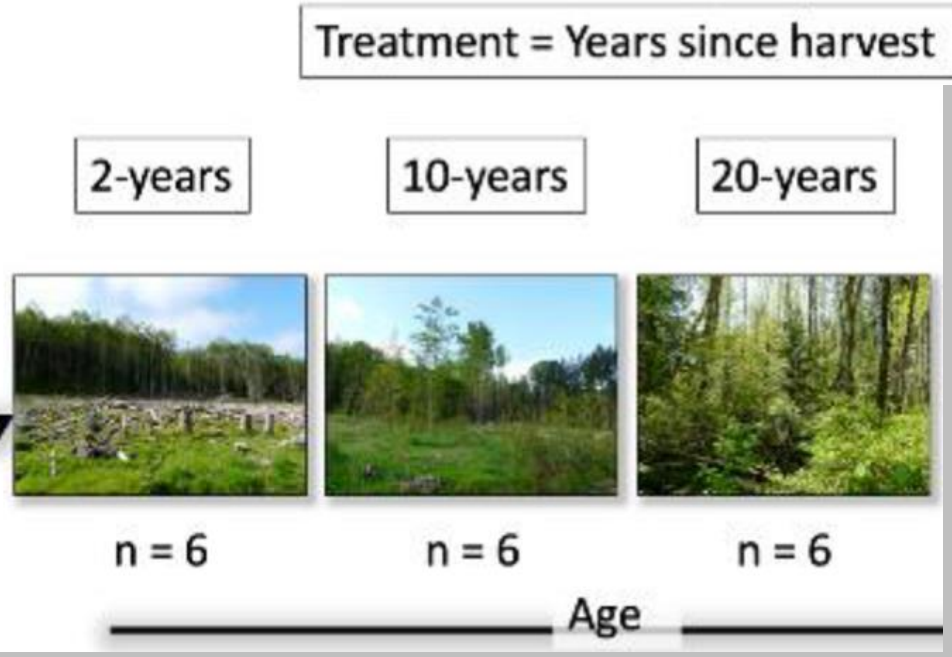

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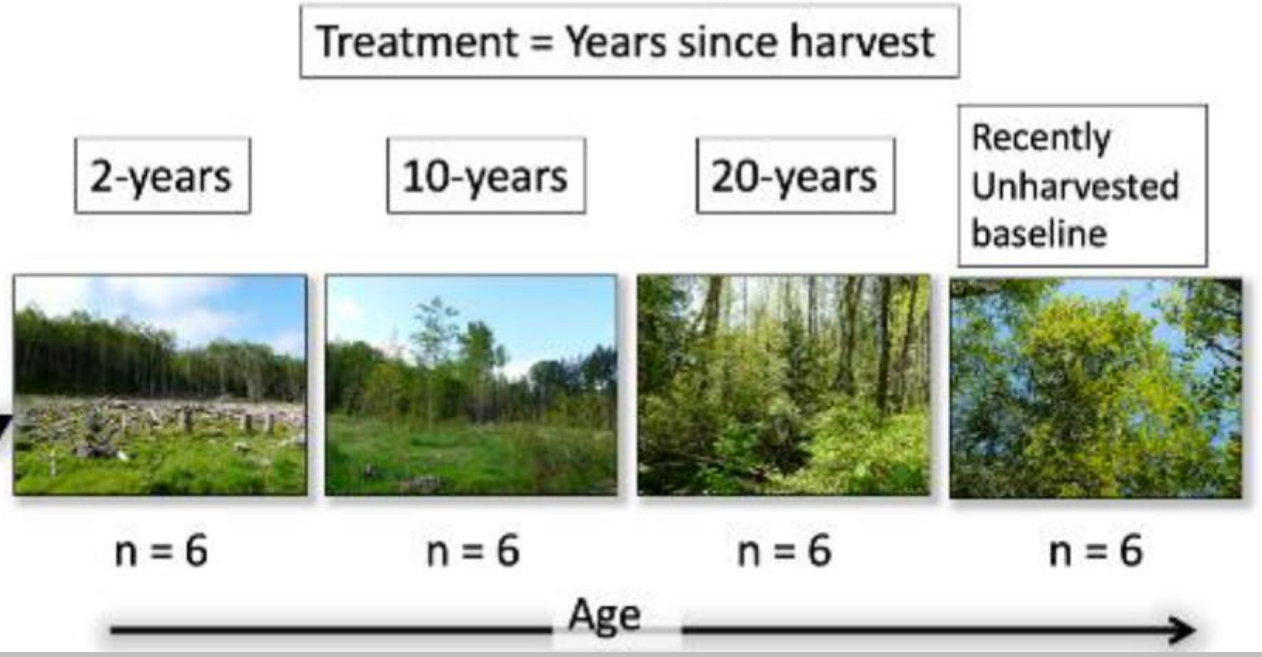
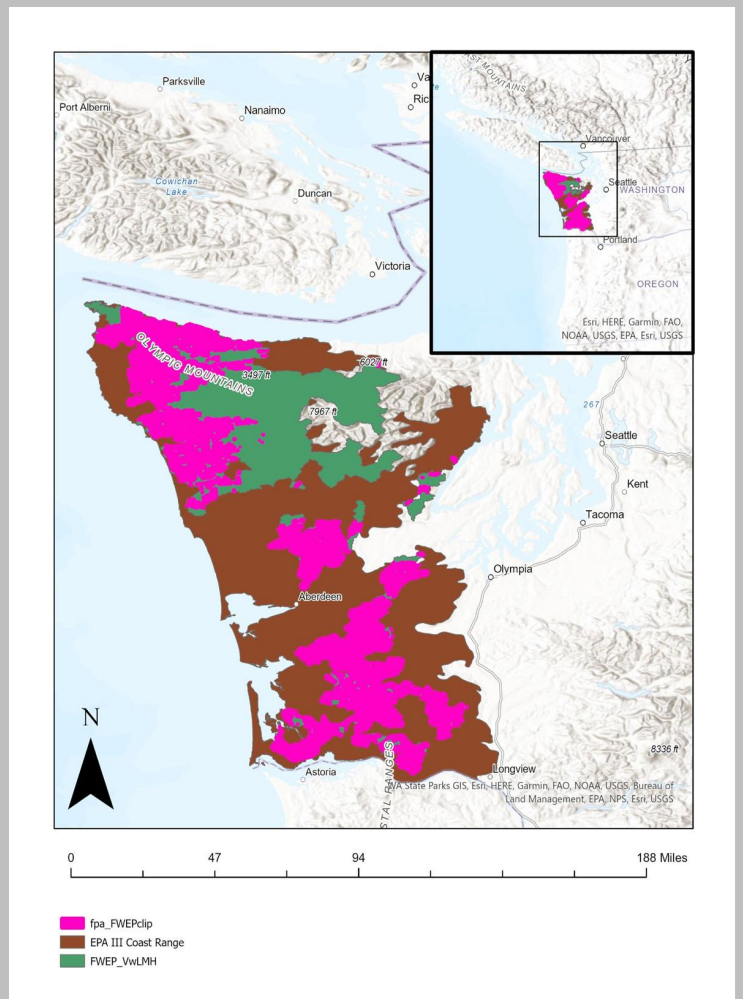


FWEP Chronosequence study design

Evaluate potential sites using FPA data, and…



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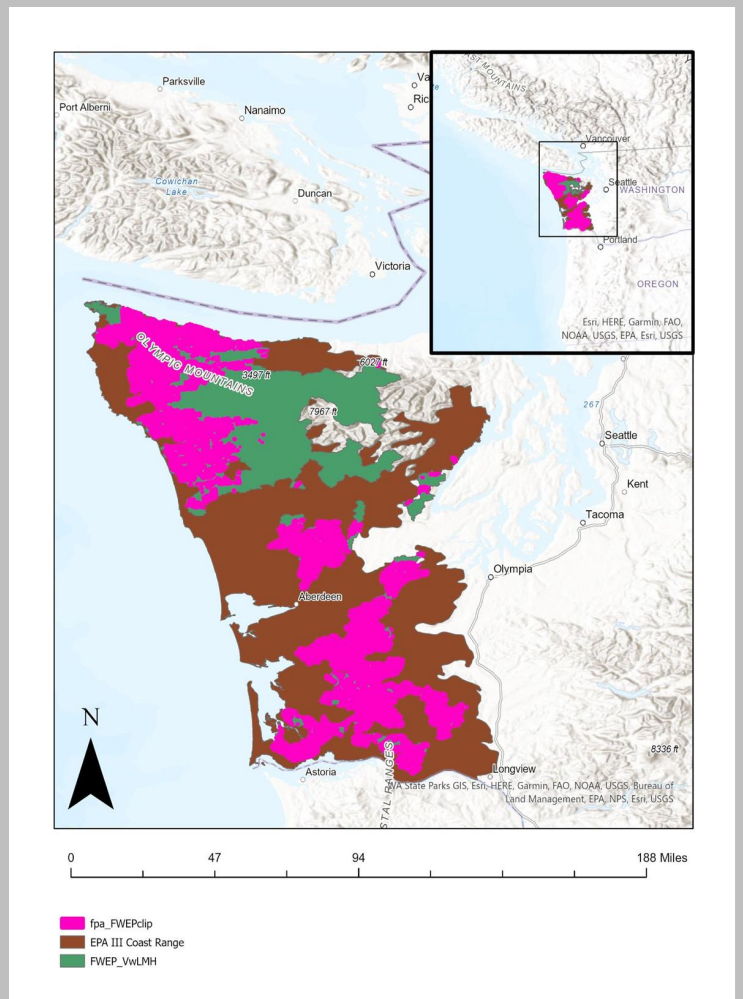
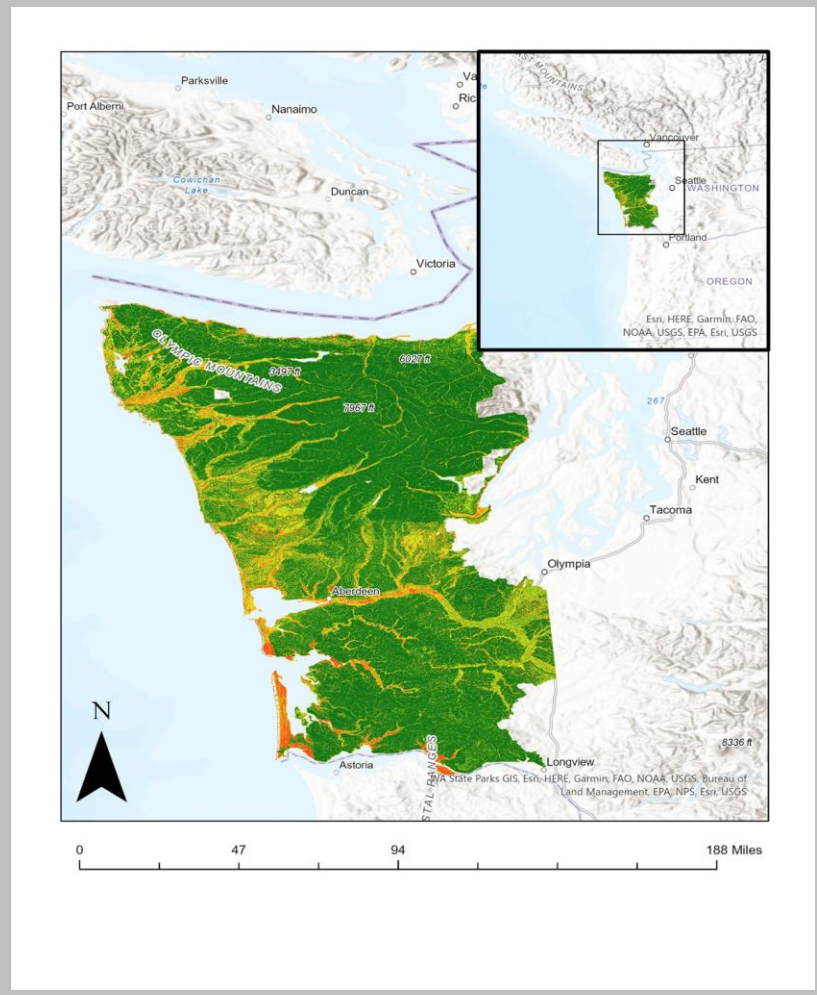


Wetland Intrinsic Potential (WIP) tool.

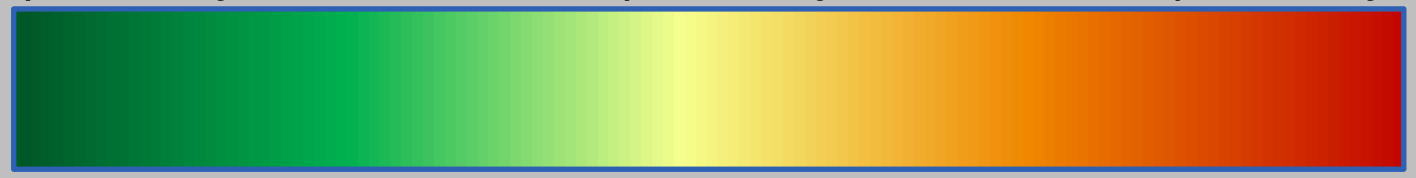


The WIP tool generates a probabilty raster of wetland potential

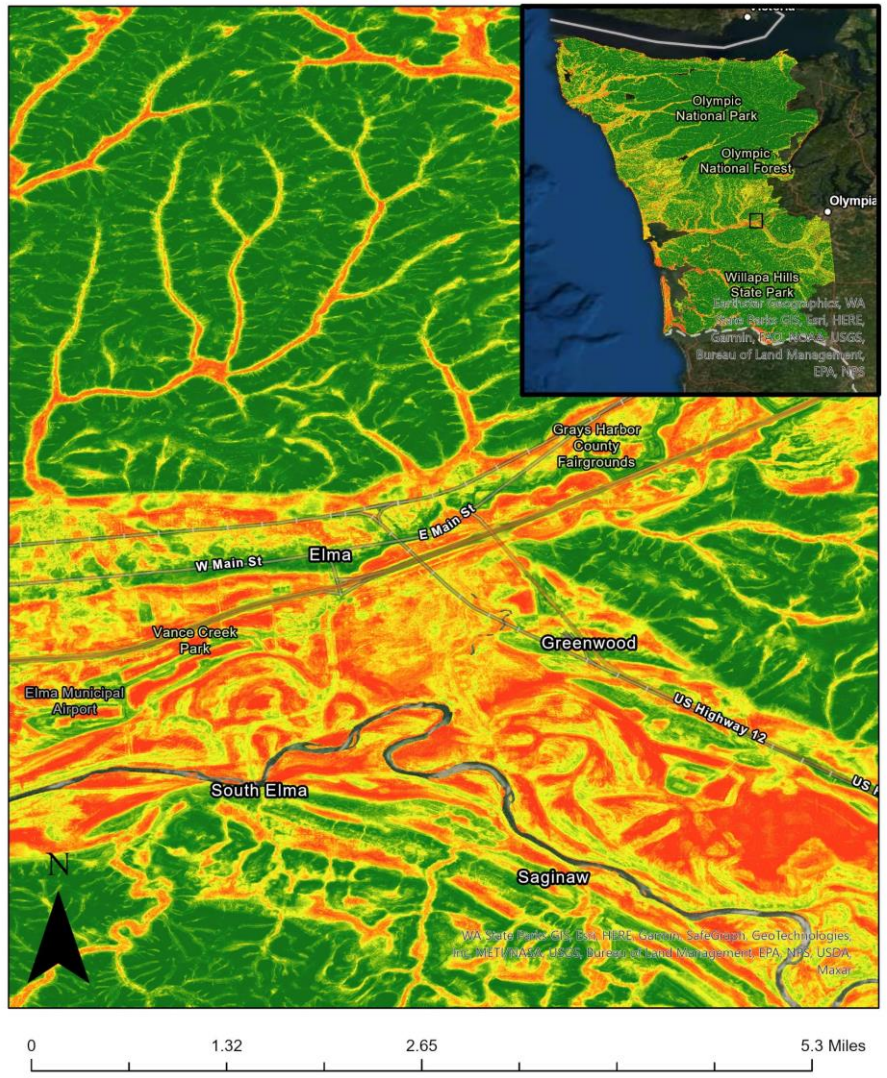
Low probability

Moderate probability

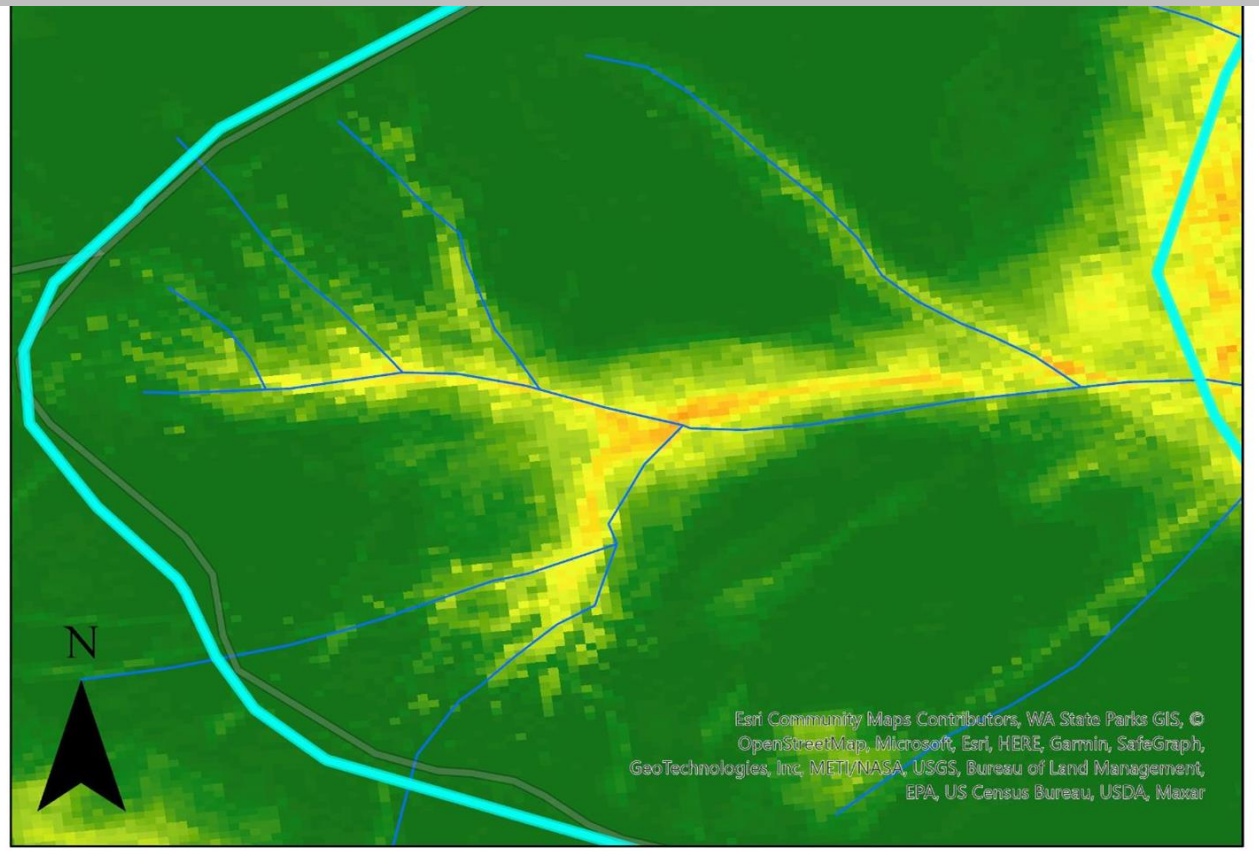
High probability



For example, the Chehalis River near Elma, WA.



Evaluate FPA units and discard those that don't meet the study design criteria



The WIP model does a seemingly good job at identifying stream networks

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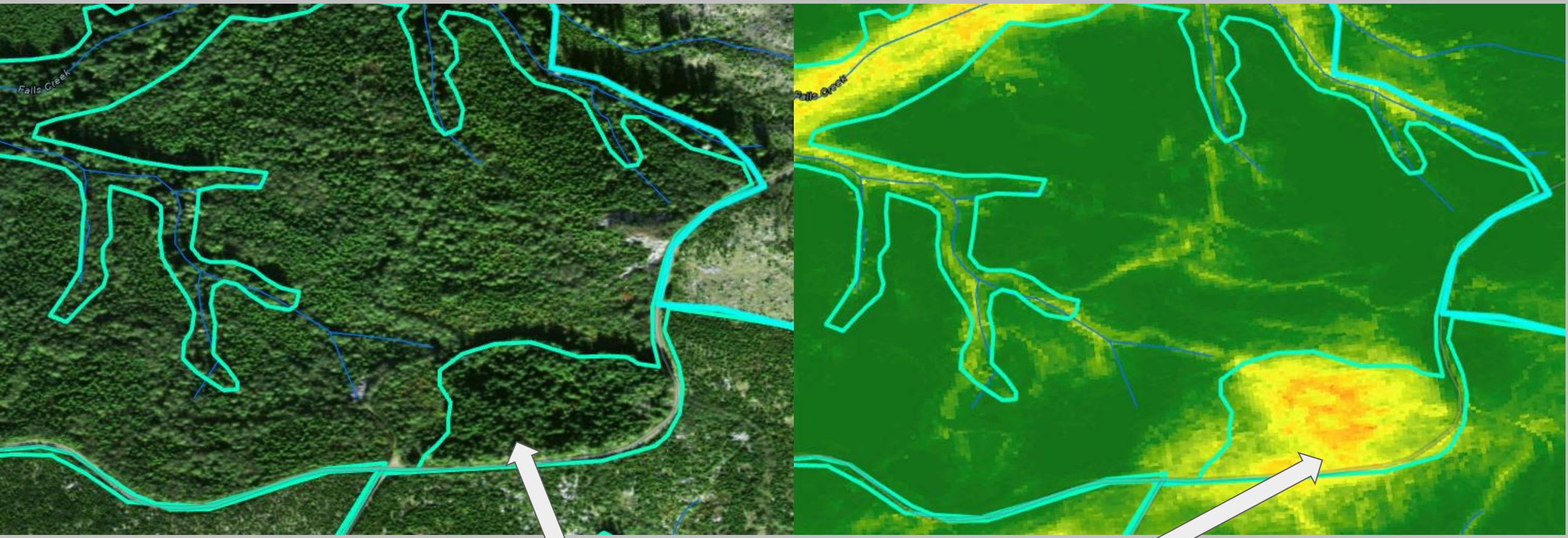
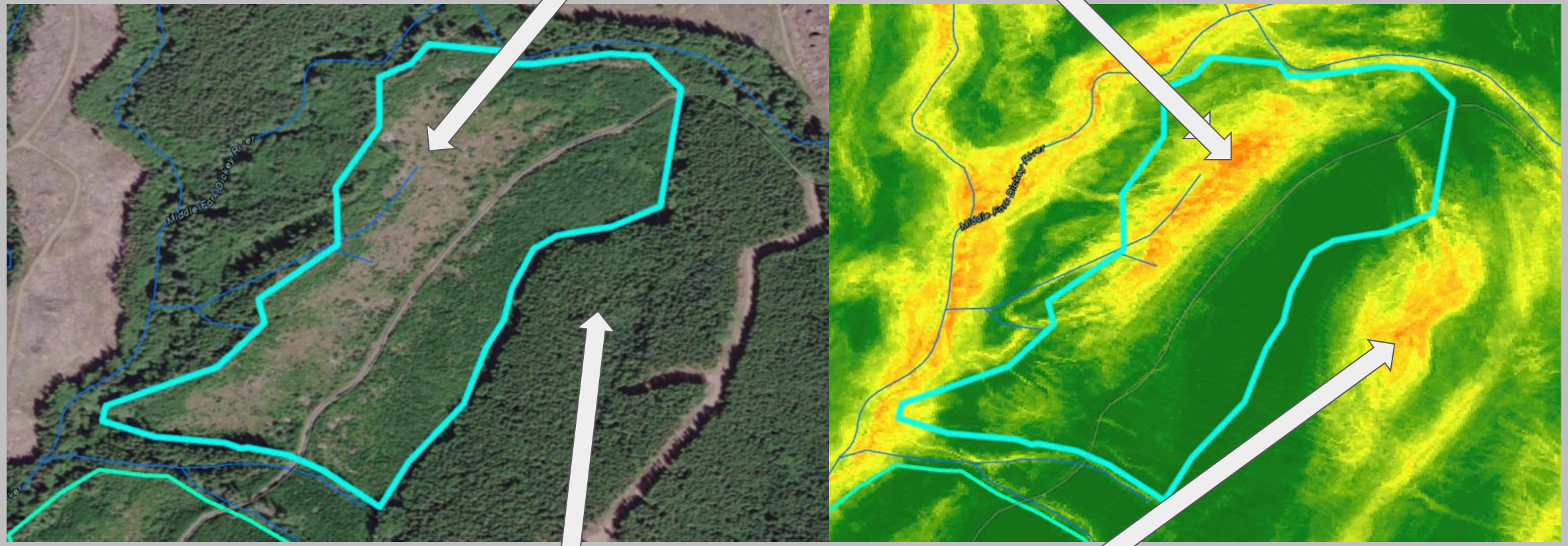


Area left unharvested

Harvested in 2012



Last harvested pre-1985

FWEP chronosequence response variables

Independent Variable Category	Response variable	Measurement timeframe
Hydrology	Streamflow	Continuous – hourly
	Wetland water table depth	Continuous – hourly
	Surface water occurrence (hydroperiod)	Continuous – daily
	Stream – wetland surface connectivity	Continuous – daily
Vegetation	Tree basal area by species	Single visit
	Understory species composition	Seasonal (2x per year)
	Stand age structure	Single visit
	Leaf area index	Annual measurement visit
Habitat parameters	Sediment concentration and turbidity	Continuous - hourly
	Wetland canopy and effective shade	Annual measurement visit
	Nitrogen, phosphorus, and dissolved organic carbon concentration	Annual measurement visit
	Soil temperature and moisture	Continuous – hourly
	Stream temperature	Continuous – hourly

Additional landscape covariates

Independent Variable Category	Independent Variable	Methods
Watershed	Catchment area	GIS - during site selection
	Slope of harvest unit	GIS - during site selection
	Aspect of harvest unit	GIS - during site selection
	Harvest unit area	GIS - during site selection
	Hydrologic Landscape Units	**GIS – Primary site selection variable**
Forest vegetation	Conifer vs deciduous forest cover	GIS - during site selection; Field validated
	Stand-level dominant species in the watershed	GIS - during site selection; Field validated
	Stand age prior to harvest	GIS - during site selection
Site	Site productivity (site class)	GIS - during site selection
	Soil types	GIS - during site selection
	Wetland type - Cowardin or HGM class	GIS - during site selection; Field validated

Data analysis - Chronosequence

- Compare means for hydrological and ecological metrics between age treatments
  - ANOVA, means and confidence intervals
  - For each treatment n = 6
- Plot each matched group of sites as a time series
- Multivariate vegetation and hydrologic comparisons
  - Clustering
  - Ordination
  - PERMANOVA

Year - 2

Year - 10

Year - 20

Recently unharvested baseline

How the Chronosequence informs the future BACI

- Identify critical response variables for the BACI
- Identifying the relevant timeline needed for study
- Learning how Forest Practice Rules are implemented with regard to forested wetlands (Chronosequence site selection process will be valuable in informing this)
- Unanticipated knowledge

Year - 2

Year - 10

Year - 20

Recently unharvested baseline

Current efforts and next steps…

- Landowner outreach is ongoing
- Finalize access permission / agreements
- Complete initial site evaluation for inclusion in the Chronosequence study
- Select final sites from list of evaluated potential sites
- Confirm landowner commitment to the 2-year Chronosequence study (does not imply participation in the following BACI study)