Developing Silviculture Practices through Large-scale Studies: Some Perspective from the West-side

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Outline

- Definition of LSSEs
- Example findings from west-side LSSEs
- Factors that contribute to a collective value
- Potential linkages of LSSEs to monitoring

Silviculture in the Ecosystem Management Era

- Broadened ecological, social and economic objectives
- Alternatives to clearcutting
- Thinning for structural diversity
- Restoration management
- Intensive Silviculture

Small Plot Studies

- Experimental units selected for uniformity and comparability of initial conditions
- Precise implementation of treatments
- Results require scaling-up to reflect operational application
- Subject to fall-off in scaling results to larger and more heterogeneous areas and treatments
- Cannot be used to evaluate such things as wildlife, production and visual effects
- They may be relevant but commonly limited in scale of inference

Large-Scale Silviculture Experiments (LSSEs)

Photo: Doug Maguire, www.forestryimages.org

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Photo: USDA Forest Service, PNW Research Station

Large-scale Silviculture Experiments

- **Silviculture <u>experiments</u> conducted at operational scales**
  - Randomization
  - Replication
  - Unmanipulated references – “controls”

  → ***Statistical rigor***

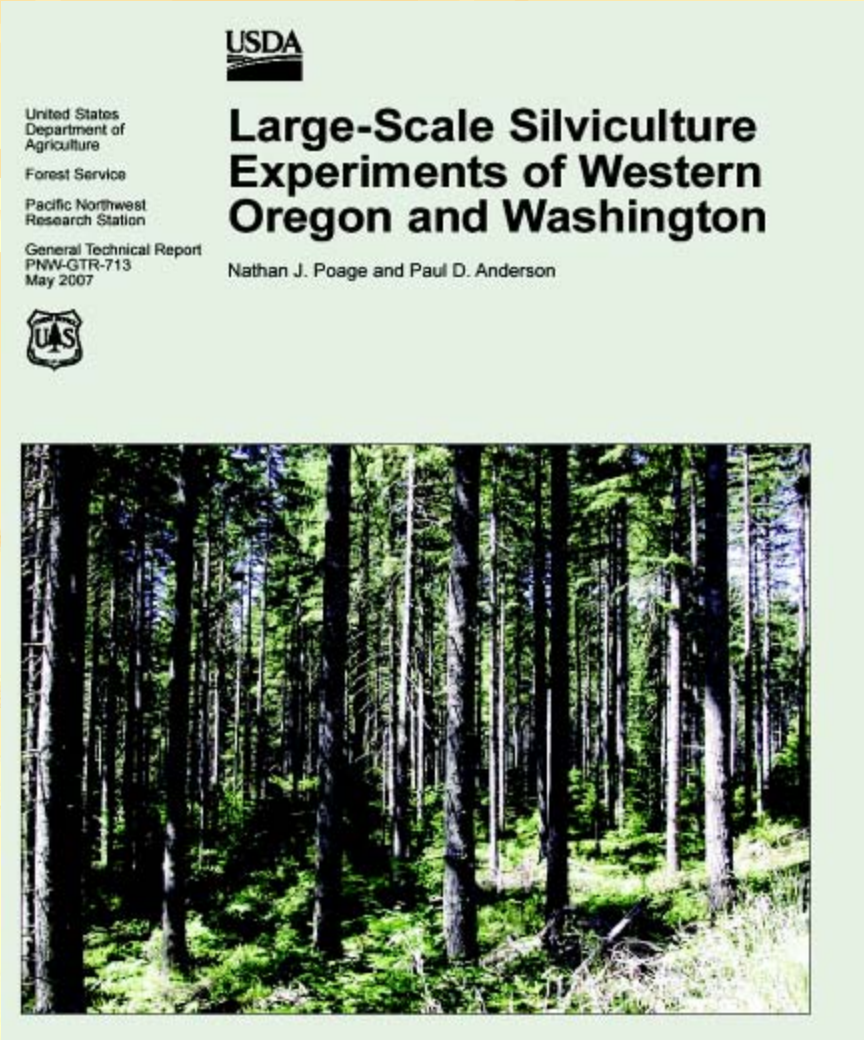
Large-scale Silviculture Experiments

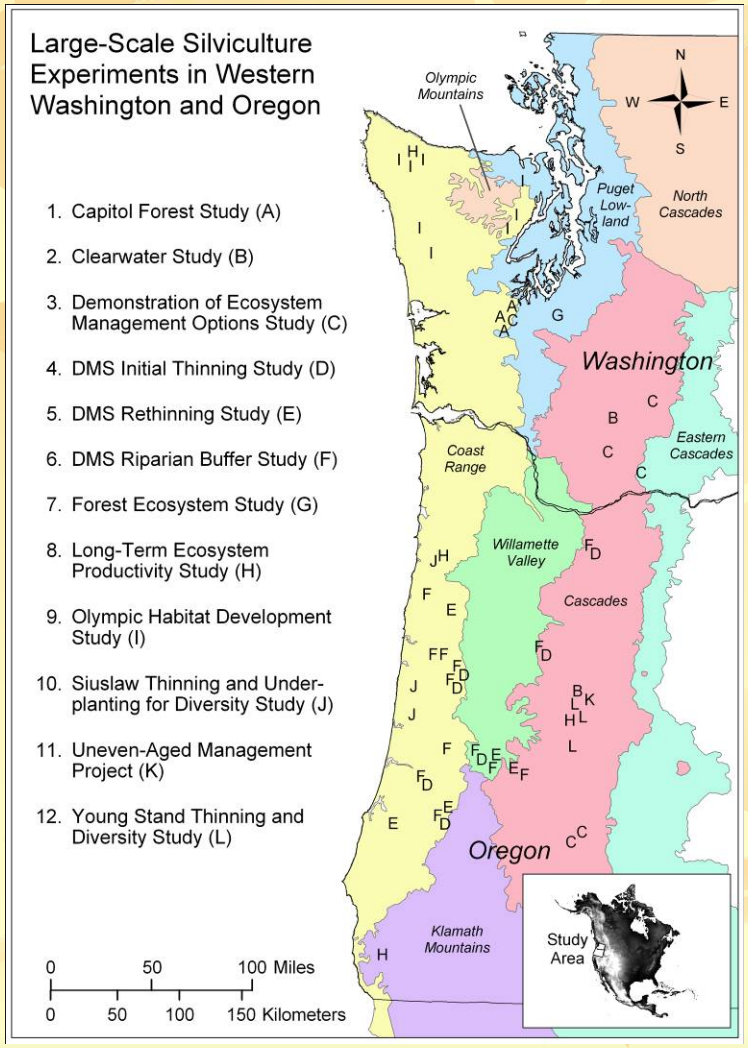
- **Silviculture experiments conducted at <u>operational scales</u>**
  - Experimental treatment units similar in size to typical management units – generally 10 to 100 ac
  - Long-term – generally greater than 20 years
  - Inferences directly applicable to operational management – minimize need to scale-up results

Large-scale Silviculture Experiments

- **Joint ventures between researchers and forest managers**
  - Knowledge and tool development
  - Demonstration
  - Learning experiences

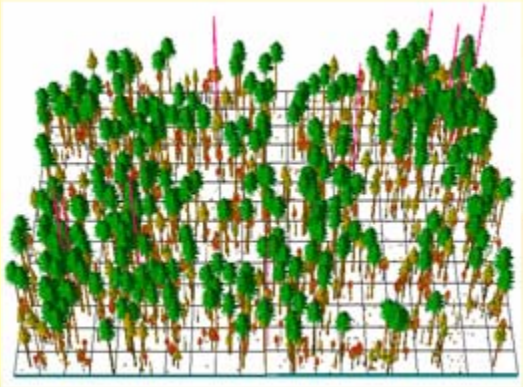
West-side LSSEs:





Examples of What Has Been Learned

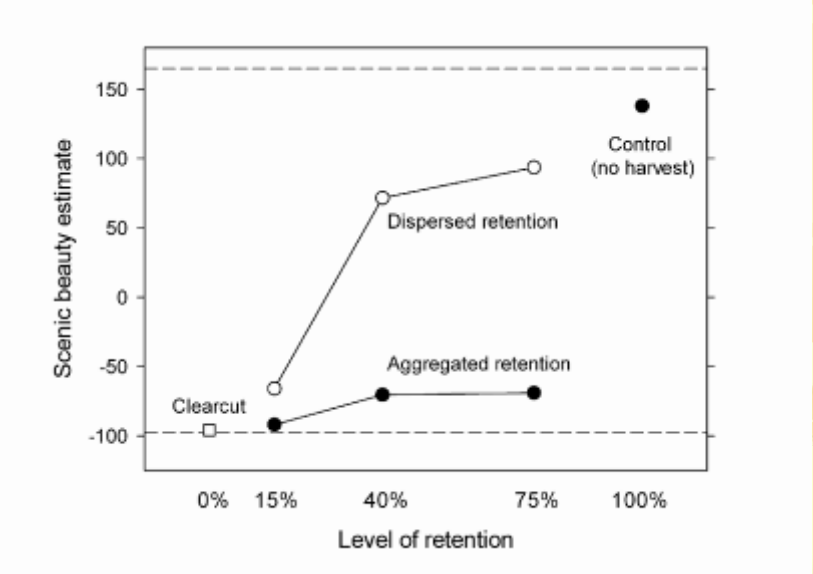
- We can increase stand heterogeneity through silviculture operations



Skips and Gaps

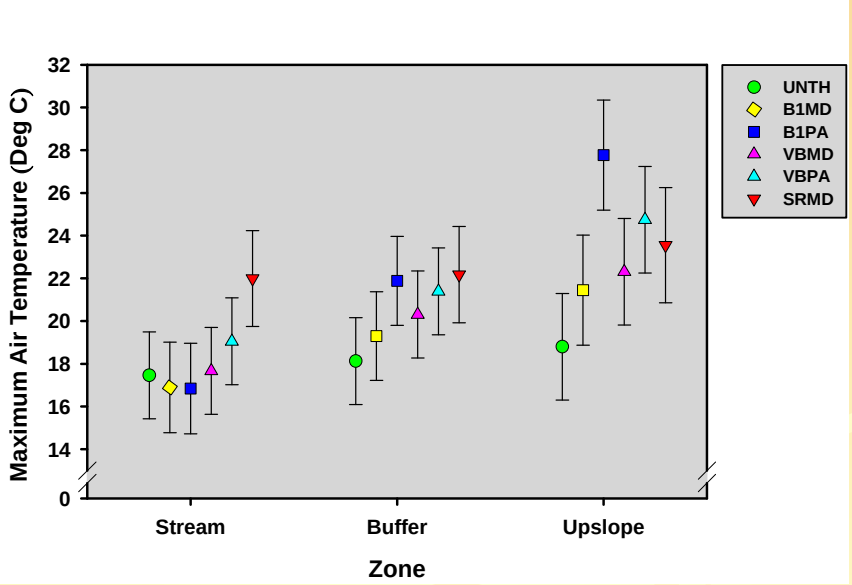
Examples of What Has Been Learned

- Green tree retention levels greater than 15% may be needed to protect residual trees, retain sensitive species, and gain public acceptance



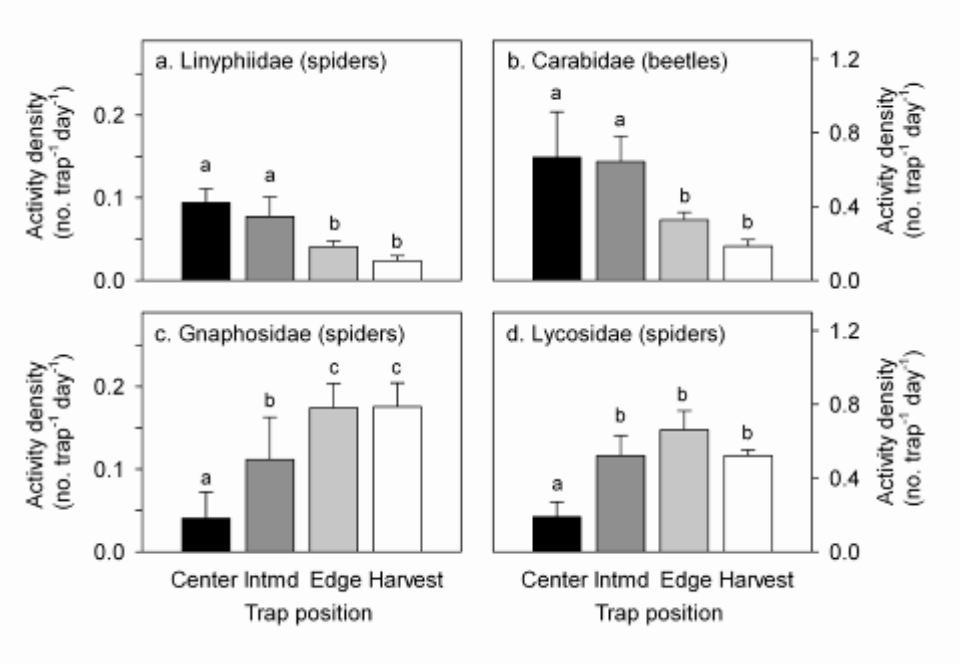
Examples of What Has Been Learned

- Buffers on headwater streams provide amphibian habitat, mitigate upslope harvest effects on microclimate, and provide connectivity across the landscape



Examples of What Has Been Learned

- Legacy retention and recruitment of down wood in managed stands benefit ground dwelling organisms



Factors Contributing to Collective Value

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Overarching conceptual framework on which to align multidisciplinary studies

- Increasing structural heterogeneity in young, relatively uniform Douglas-fir forests will lead to increased biotic diversity and therefore greater ecological integrity
- These young forests can be actively managed to achieve some joint distribution of ecological, social and economic benefits

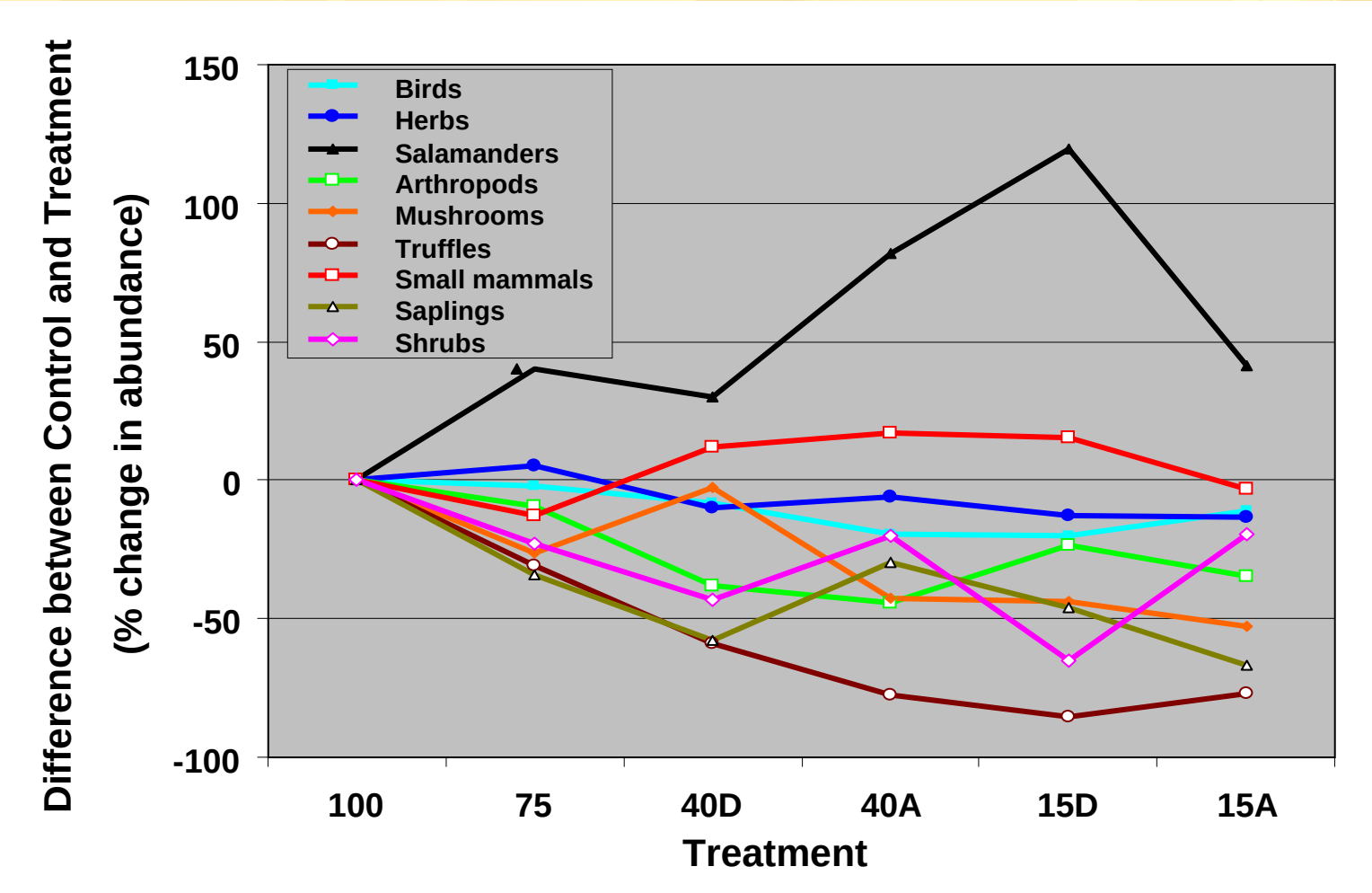
Factors Contributing to Collective Value

<u>Generally strong experimental design</u>

- Replication
- Randomization
- Untreated references – “Controls”

Factors Contributing to Collective Value

- Common currency response variables



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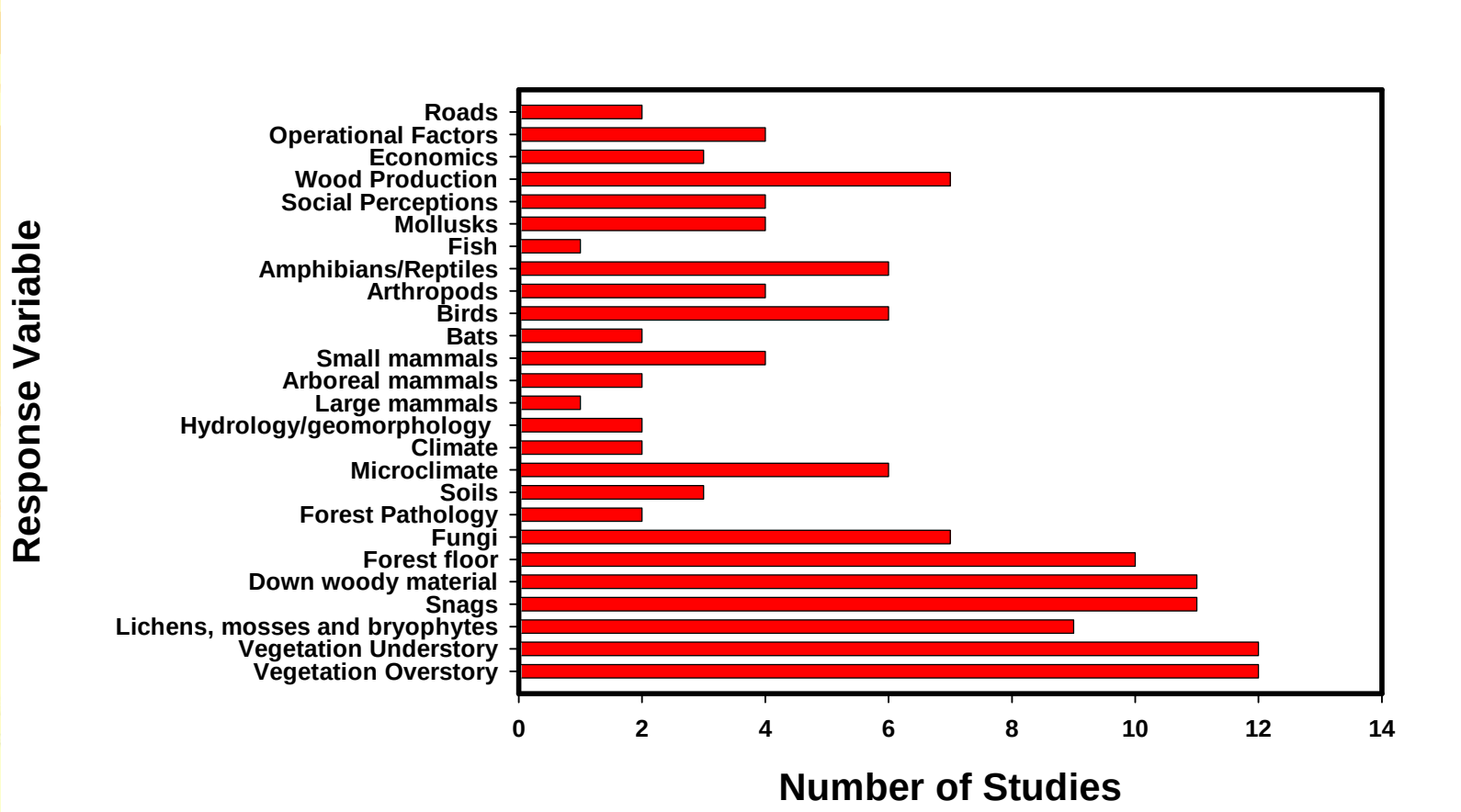
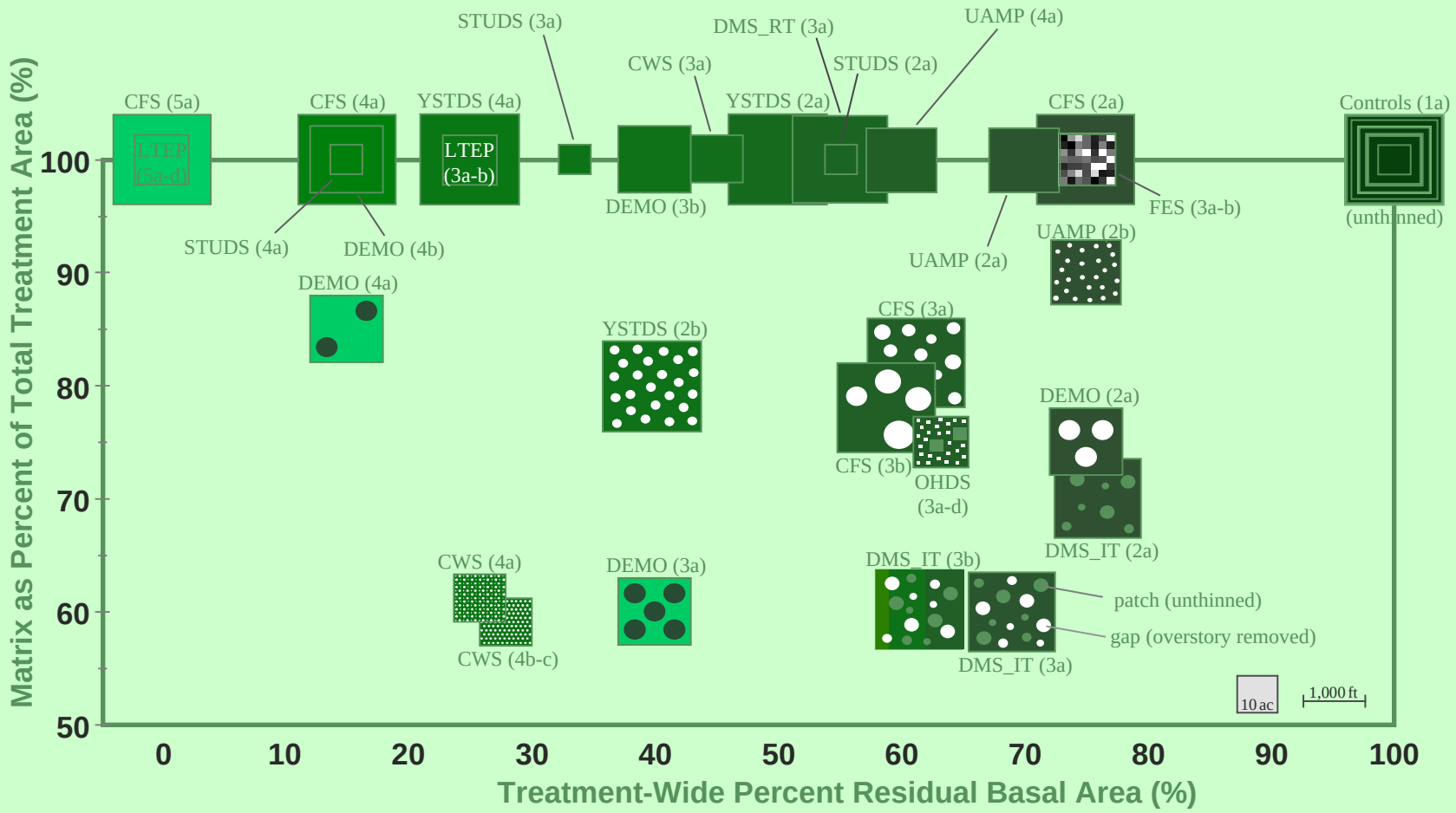


Factors Contributing to Collective Value

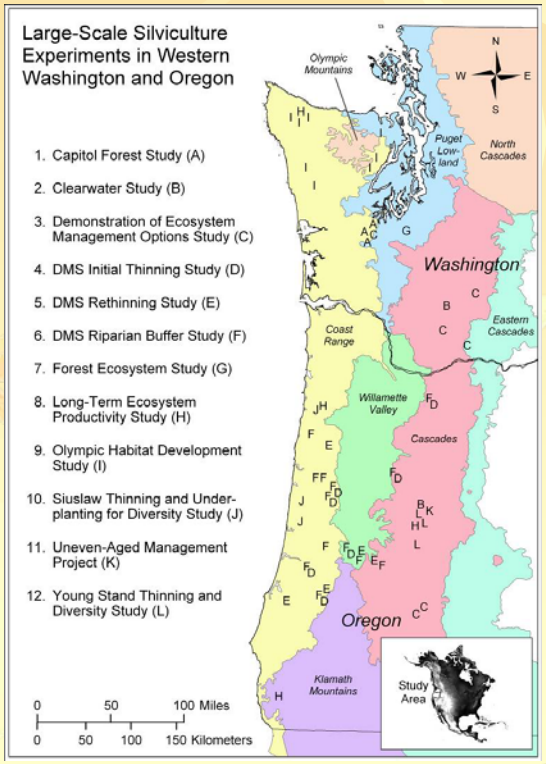
- Broad range of experimental treatments

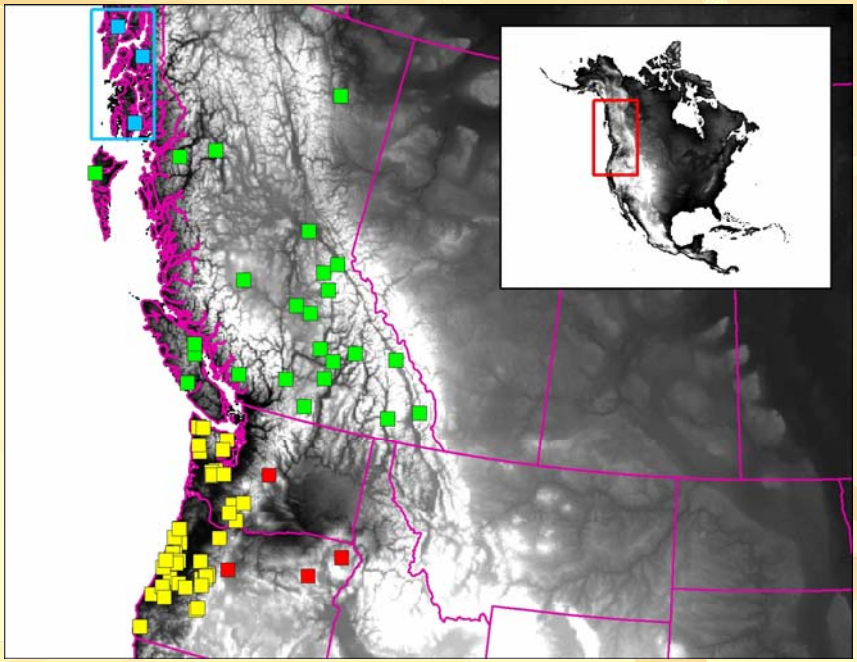


Poage and Anderson (2007)

Factors Contributing to Collective Value

- Broad composite geographic distribution

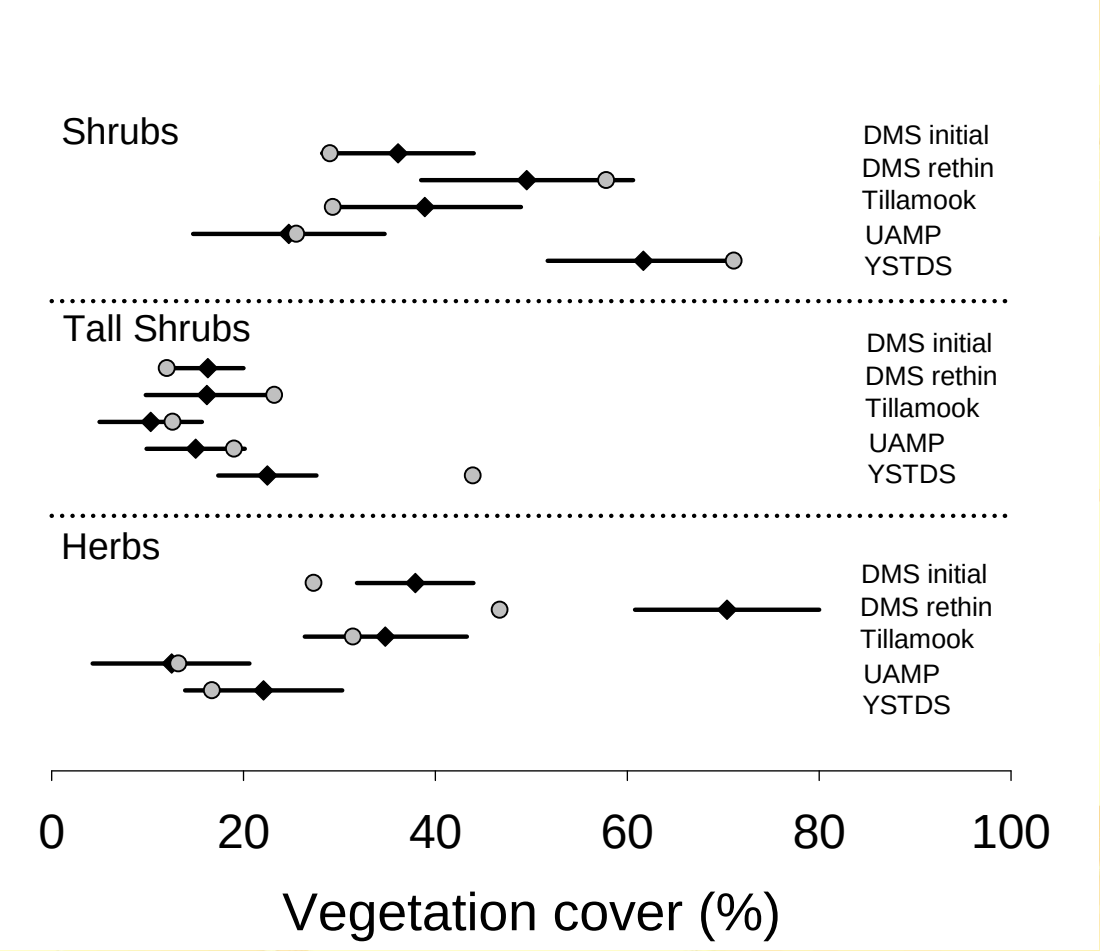




Realizing the Collective Value of LSSEs:

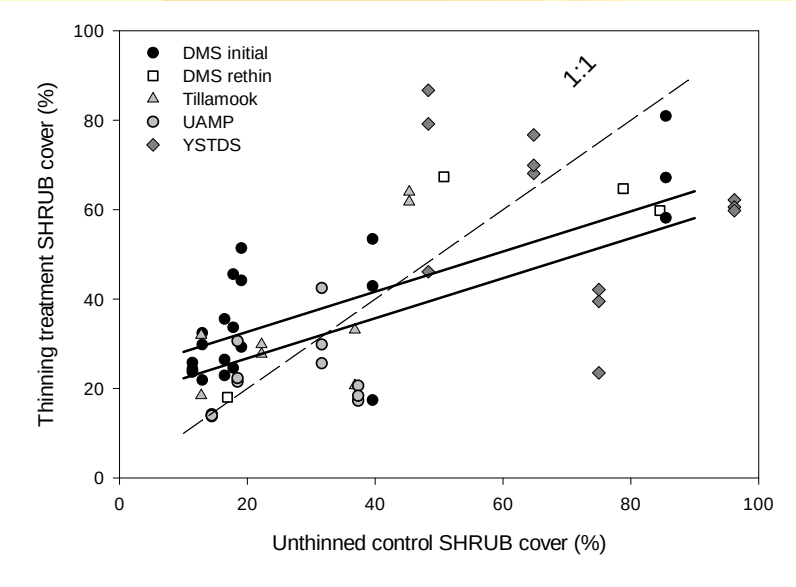
- Information Synthesis
  - Analytical compilation of published findings
  - Meta-analysis of published findings
  - Joint analysis of primary data
  - Bayesian belief networks

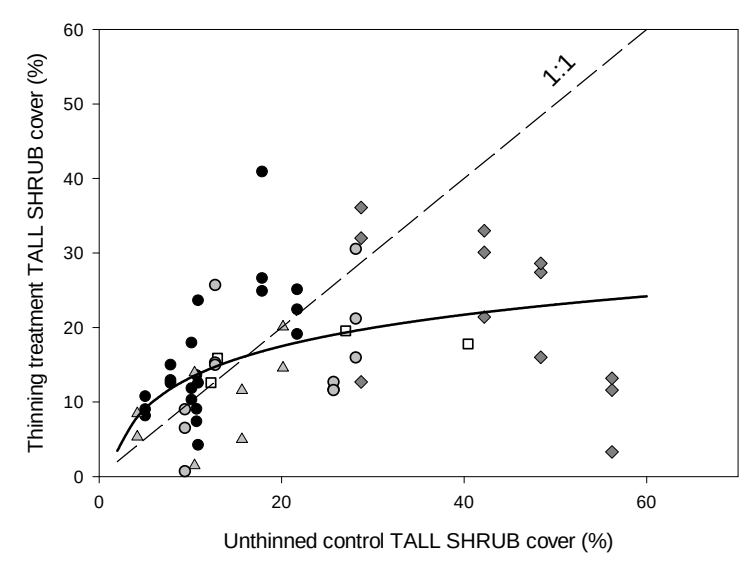
Example Synthesis: Vegetation Response to Thinning

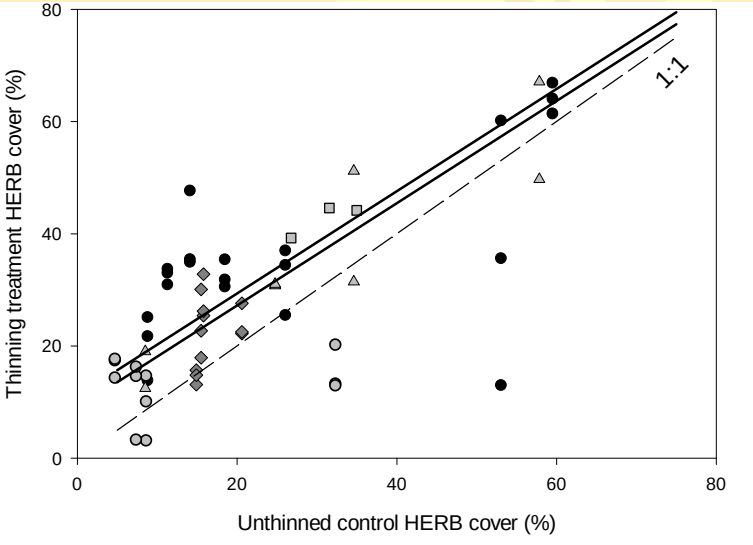


Wilson, Anderson, Puettmann (In Press)

Example Synthesis: Vegetation Response to Thinning







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Can Research Studies Contribute to Monitoring?

NFMA Requirements…

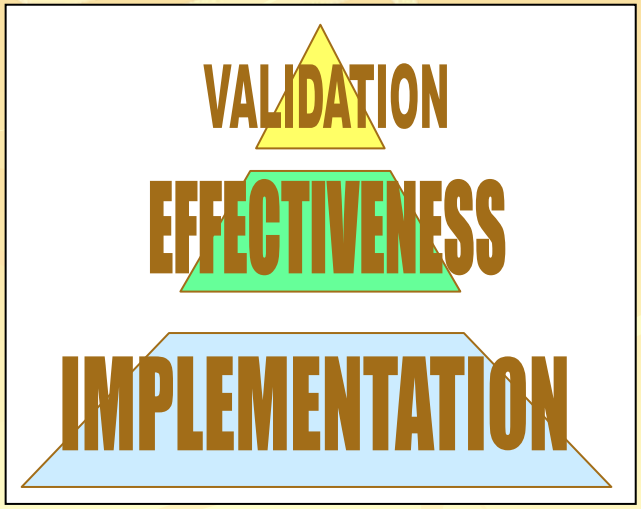
36.CFR 219.12(k)(1): Quantitative comparison of planned, versus actual, outputs and services

36.CFR 219.12(k)(2): Documentation of the effectiveness of measures and prescriptions

36.CFR 219.12(k)(4): Identifying what should be measured, the frequency of measurement, the precision of measurements, and the time frame for reporting results

36.CFR 219.19(a)(6): Determine population trends of management indicator species in terms of habitat changes.

36.CFR 219.28(a): Identifying research needs



Research Studies and Monitoring

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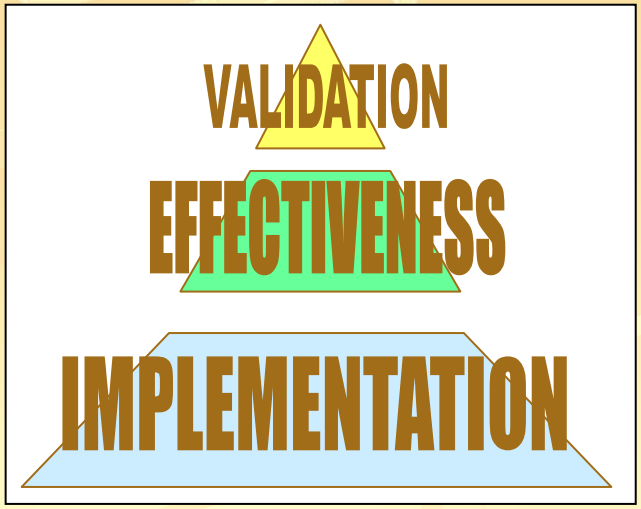
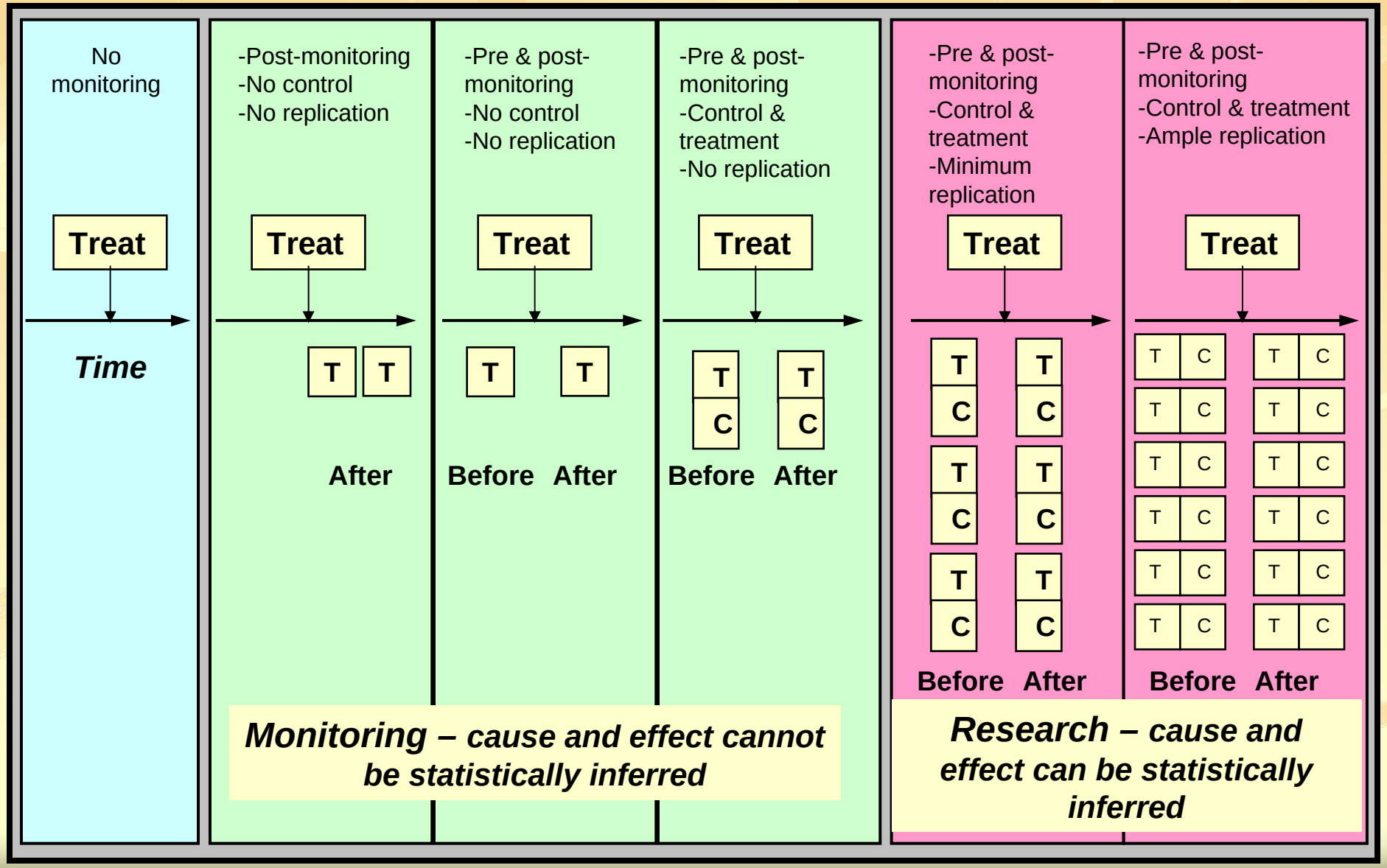
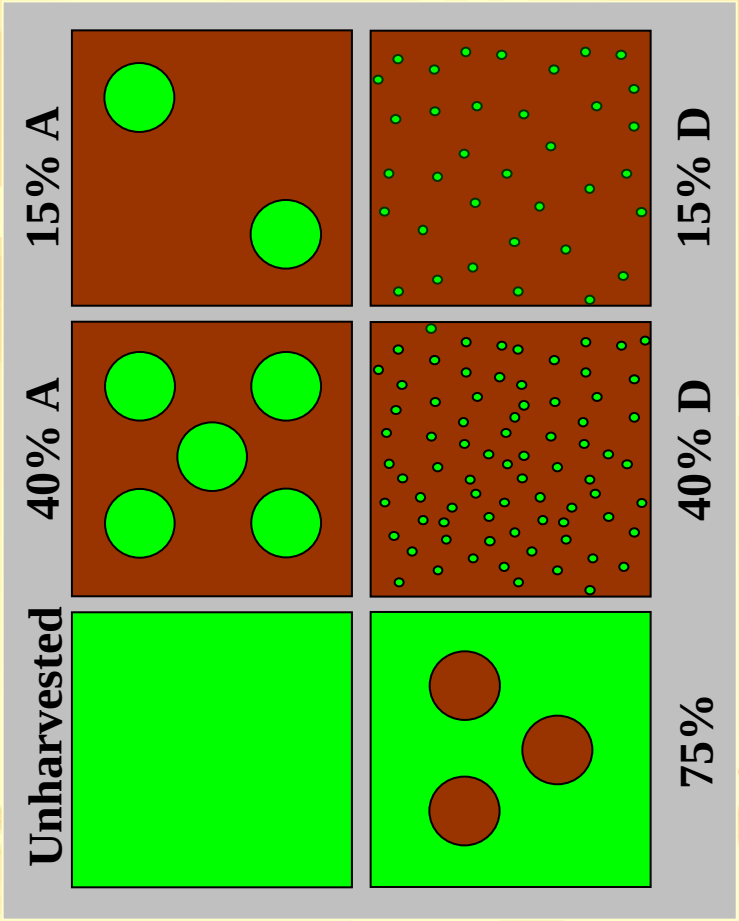


Monitoring vs. Research



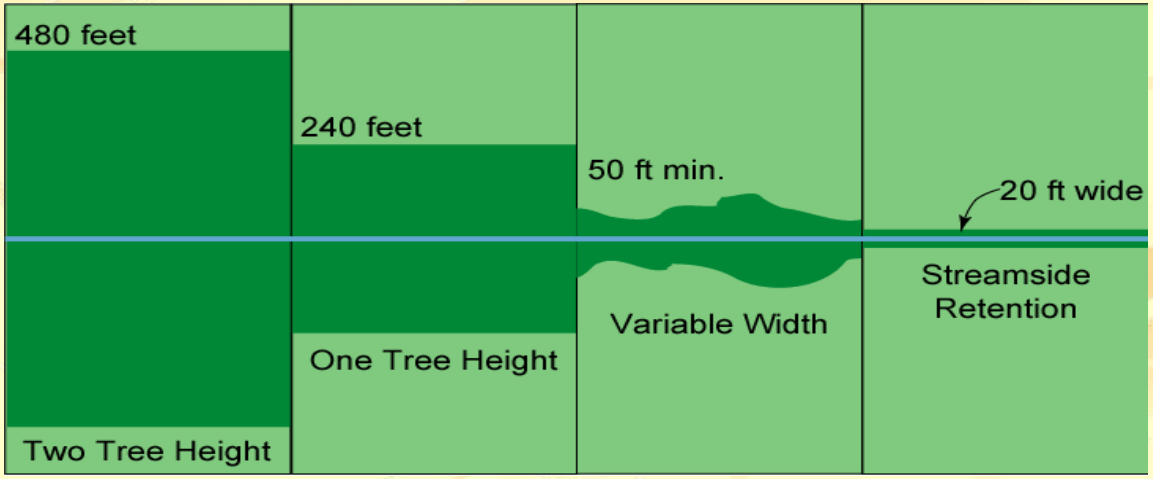
Research Treatments Linked to Standards and Guidelines: DEMO

- **Green-tree Retention under the NWFP**
  - Retain at least 15 pct of the harvested area as green trees
    - Retain 70 pct of those green trees in aggregates 0.2-1.0 ha in size
    - Retain the remainder as dispersed structures, either as individual trees or aggregates <0.2 ha in size
  - Aggregates and dispersed retention should include the largest, oldest live trees, decadent or leaning trees, and hard snags in the unit
  - Patches should be retained indefinitely



Research Treatments Linked to Standards and Guidelines: Density Management Study

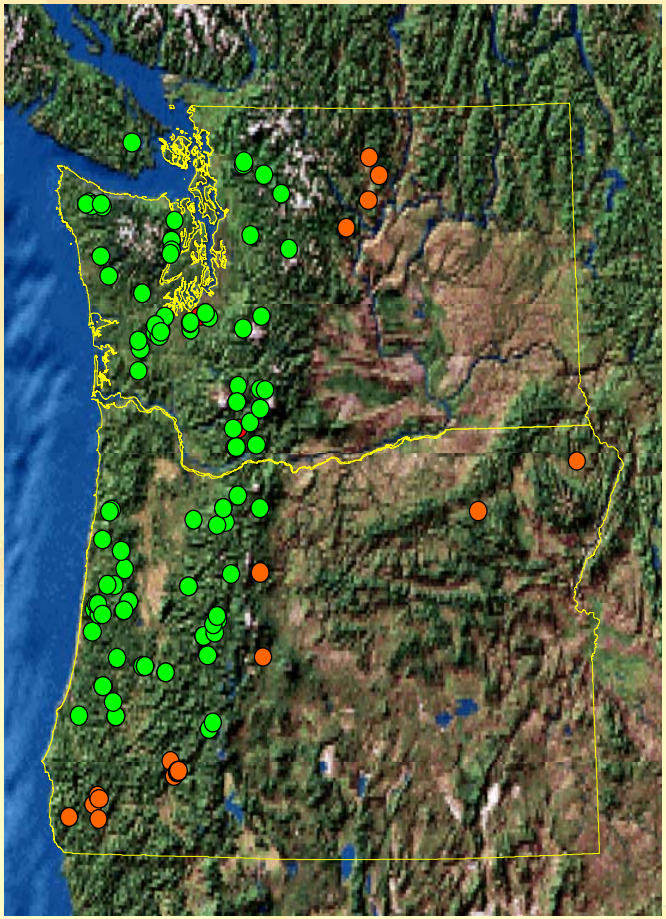
- **Riparian Buffers under the NWFP**
  - Buffers a minimum of 2 Site Potential Tree Heights on fishbearing streams
  - Buffers a minimum of 1 Site Potential Tree Height on non-fishbearing streams



Linking Research and Monitoring

- Frame research hypotheses to provide proof of concept
- Incorporate standards and guidelines into array of experimental treatments
- Enhance local inference through site-level replication
- Address relevant geographic and temporal scales
- Assess attributes, and using metrics, that correspond to regional monitoring guidelines and protocols

Ongoing and Recent Silviculture Studies in Dry Forests of Oregon and Washington



- Relatively few
- Span small plot to landscape scales
- Expanded List of Response Variables
  - Tree damage agents
  - Deer and elk habitat quality and habitat use
  - Ground-water hydrology
  - Slope stability
  - Nutrient cycling
  - Fuels loads
  - Potential fire behavior

Conclusions

- LSSEs have yielded substantial information regarding early responses to silvicultural practices such as green-tree retention and variable density thinning
- The collective value of LSSEs can be increased through syntheses, but the opportunities to do so vary with respect to specific management issues or ecological and social values of interest
- Operational-scale research studies may serve in monitoring if they incorporate relevant metrics and scope of inference, and are sustained over appropriate timeframes.