CAN THINNING BE EFFECTIVE IN ALTERING OVERSTORY AND UNDERSTORY VEGETATION DYNAMICS AND ACCELERATE THE DEVELOPMENT OF LATE-SUCCESIONAL FEATURES IN TEMPERATE CONIFEROUS FORESTS?

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Poster presentation at the 13th World Forestry Congress, Buenos Aires, Argentina, October 18-23, 2009

INTRODUCTION

- Alternative silvicultural strategies applied to even-aged stands can enhance biodiversity, and accelerate the development of late-successional features and wildlife habitat.
- There are potential risks (e.g., promoting windthrow) and tradeoffs (e.g., excessively limiting canopy cover/wood production) involved in reducing stand densities below those commonly targeted in thinnings, albeit biodiversity and structural variability within stands could be increased.
- Disturbances caused by thinning affect understory species abundance and richness in a complex fashion because of subsequent shifts in resource availability and competitive interactions, and may contribute to developing multiple and diverse vegetation layers.
- Long-term field experiments such as the Young Stand Thinning and Diversity Management Study (YSTDS) let us to evaluate the response of forests to novel management approaches.

OBJECTIVES

- Determine changes in stand basal area and overstory cover in response to thinnings varying in intensity and pattern.
- Assess post-thinning shifts in cover and richness of understory plant vascular vegetation and ground-dwelling bryophytes (mosses and liverworts) and of invasive species.
- Evaluate persistence of understory species associated with old-growth forests such as *Goodyera oblongifolia* (rattlesnake plantain).

MATERIALS AND METHODS

RESEARCH SITES

- Four sites (92-164 ha of forested area in each site) in the Oregon Cascades, USA **(Fig. 1).**
- Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) dominated stands; age 33-43 years.
- Mean annual precipitation = 2300 mm.
- Elevation = 439-905 m; slope = 0-24%.

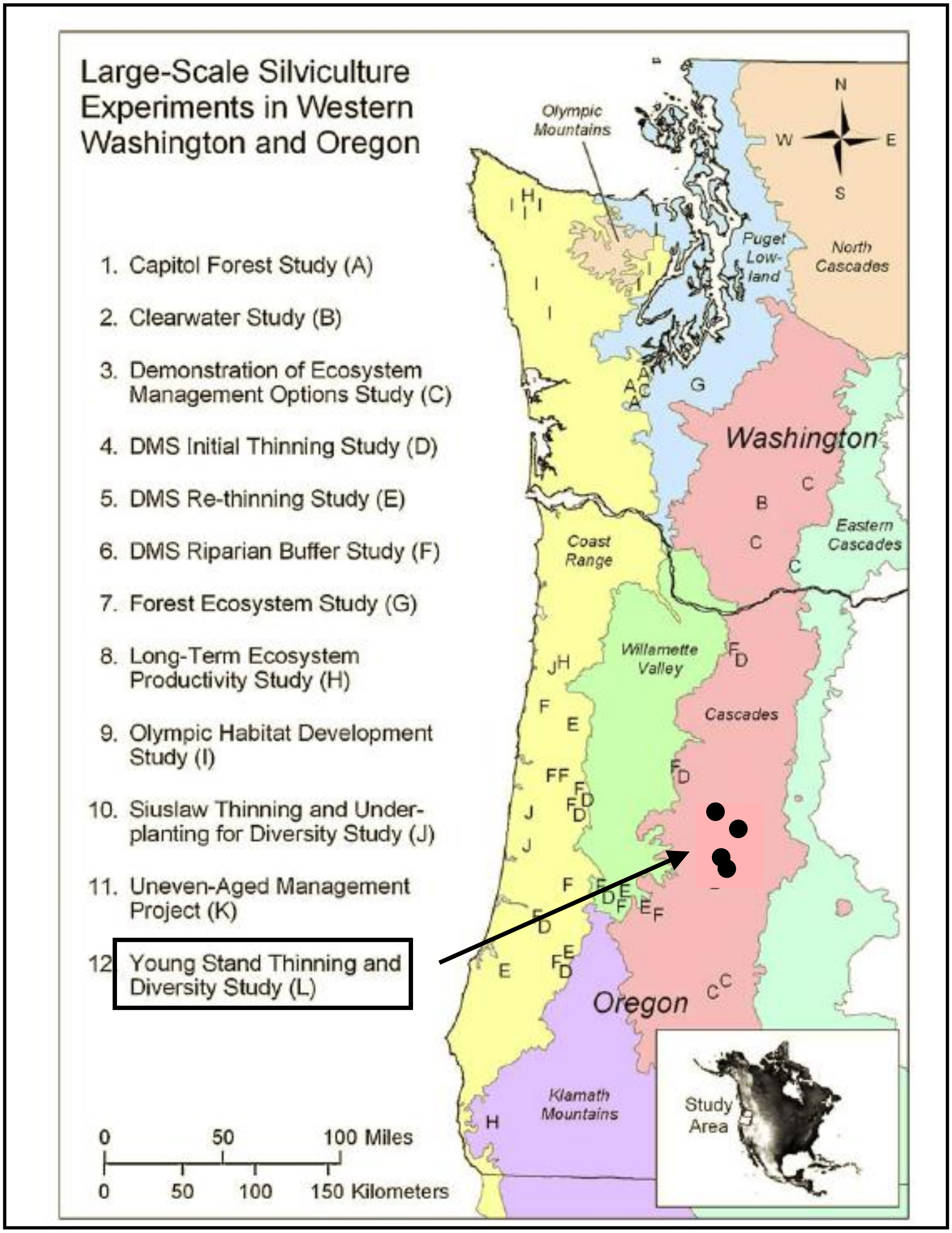

Fig. 1. Several large-scale silviculture experiments have been established in the PNW region of USA including the YSTDS.

STAND DENSITY TREATMENTS

- No thinning (about 650 tpha) **(CON)**
- Heavy thinning (125 tpha) **(HT)**
- Light thinning (250-300 tpha) **(LT)**
- Light thinning (250-300 tpha with evenly-dispersed 0.2-ha gaps on 20% of the area **(LG)**

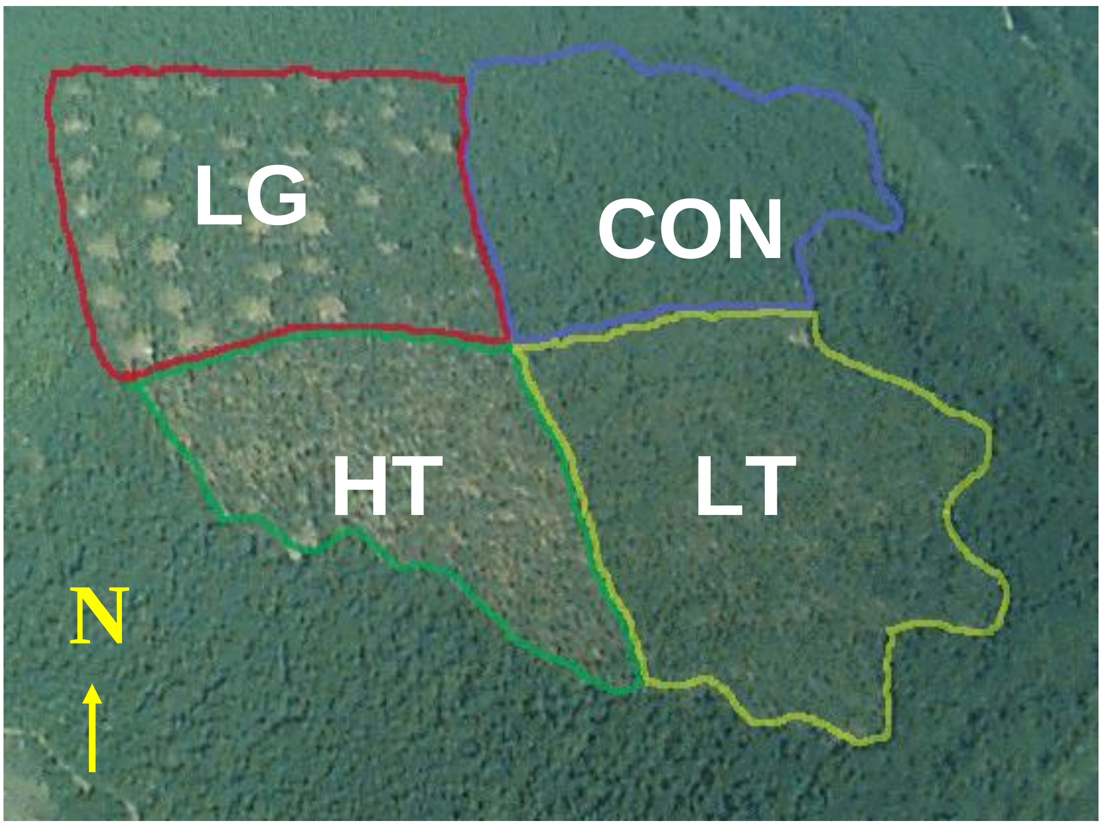

Fig. 2. View of treatments at the Christy Flat site

RESULTS

- Stand basal area and overstory cover were still greater in the control than in the thinning treatments 10 years after harvest **(Fig. 3)**.
- For both basal area and cover, the light-thinning treatment with gaps had, in general, intermediate levels between the heavy and light thins **(Fig. 3)**.
- Differences in the herb layer (i.e., higher cover in heavy and light thinned with gaps stands than in the control at year 3) became less apparent with time **(Fig. 4).**
- Cover of low shrubs (≤ 2 m in height) in all thinning treatments was lower than in the control at year 1 but substantially greater at year 10 (**Fig. 4**).

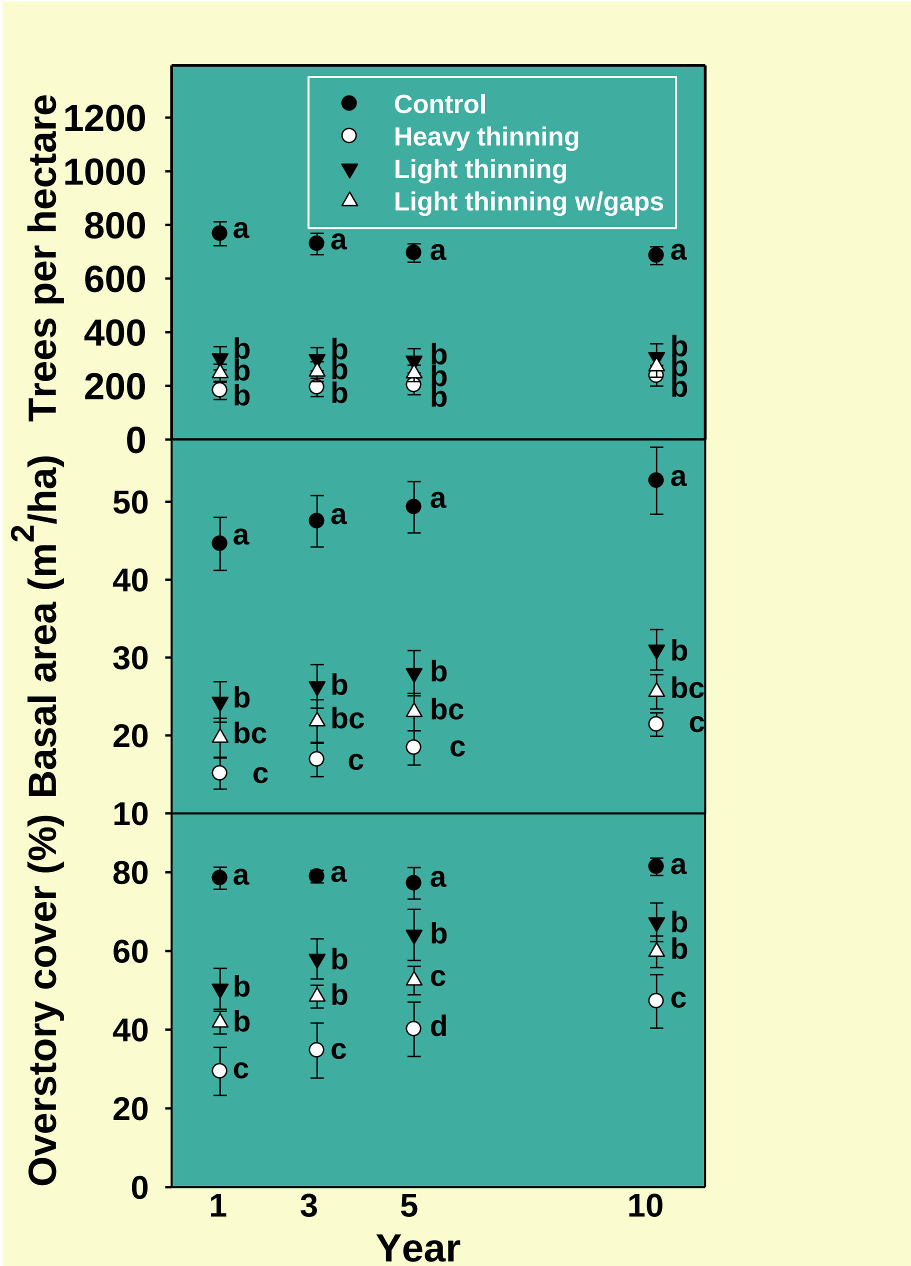

Fig. 3. Changes in overstory characteristics with thinning in the YSTDS.

- Cover of tall shrubs was consistently lower after thinning until year 5 (due to harvest damage) **(Fig. 4)**.
- Bryophyte cover showed a dynamic pattern; after an initial reduction in thinned stands, it recovered to control levels by year 5 **(Fig. 4)**.
- Cover and richness of early seral species were greater in the thinning treatments 10 years after thinning with no differences for late seral species **(Table 1)**.

- Understory homogenization by introduced or native recalcitrant species did not occur **(data not shown)**.
- Frequency of *Goodyera oblongifolia* tended to increase in thinning treatments 10 years after harvest **(Fig. 4)**.

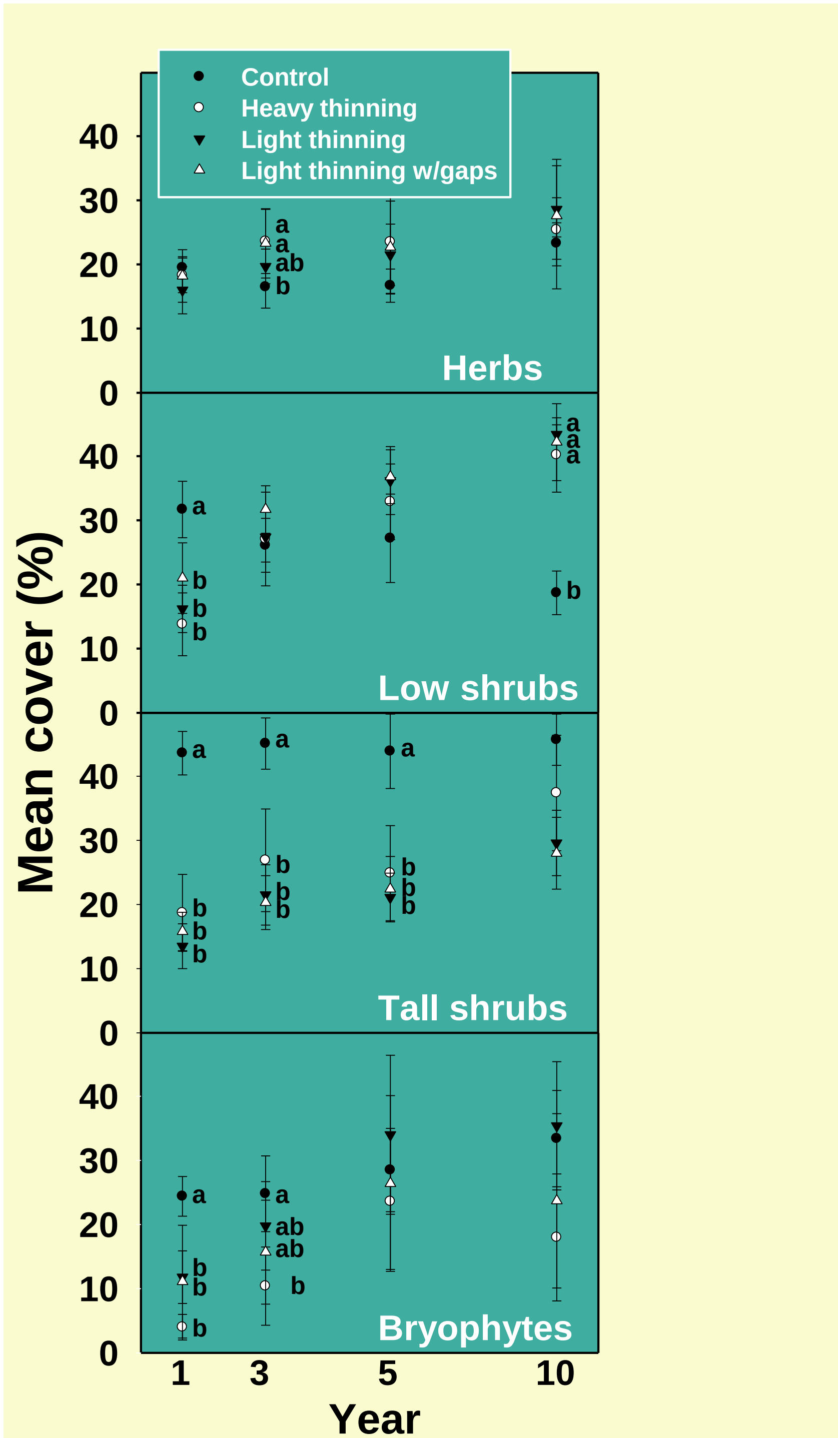

Fig. 4. Changes in cover of vascular plant groups with thinning in the YSTDS.

Table 1. Average absolute cover and richness of all, early (ES) and late seral (LS) understory species 10 years after thinning at YSTDS (Total species = 150)

Treatment	**Cover (%)**		**Richness (species per plot)**		
	ES	**LS**	**ALL**	**ES**	**LS**
CON	3.7 b	37.4	0.3	2.2 b	6.5
HT	25.4 a	42.1	1.8	4.9 a	7.1
LT	19.1 a	46.9	1.7	5.0 a	6.9
LTG	28.3 a	45.0	1.4	5.3 a	6.8

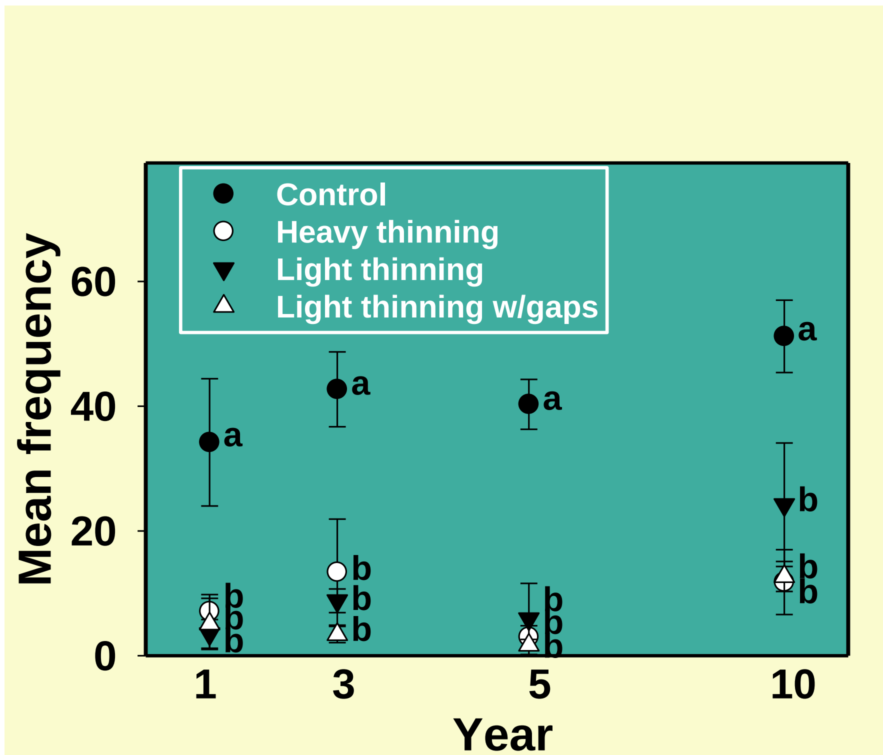

Fig. 5. Changes in frequency of *Goodyera oblongifolia* with thinnning in the YSTDS.

CONCLUSIONS

- Acceleration of late successional habitat may not be a simple function of thinning as direction and speed of recovery will differ with plant groups of different growth form and successional status.
- Cover of low (mainly clonal) and tall shrub recovers gradually after thinning to reach levels comparable to those in old-growth forests.
- Bryophytes exhibited resilience to disturbance possibly in parallel to changes in forest microclimate conditions.

- Potential negative effects after drastic stand density reductions such as invasion/encroachment of introduced or native species were not evident in this study.

ACKNOWLEDGMENTS

USDA Forest Service Pacific Northwest Research Station, Oregon State University, field crews and data management personnel.