Forest Management Strategies to Rehabilitate a Coastal Red Spruce Forest in Maine

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Introduction

Background:

- Major portions of Maine's historically iconic coastal red spruce (*Picea rubens*) forests are in a degraded state [1]
- A lack of awareness and funding to support sustainable management practices has limited active rehabilitation [2]
- This project uses a 28-acre woodlot in coastal Maine with the goal to increase awareness of management options for spruce rehabilitation

Objectives:

- To demonstrate forest management strategies that can increase red spruce composition as well as diversify forest structure and age

Figure 1. *A photo of the property in coastal Maine.*

Methods

Property Information:

- Historically likely a large proportion of red spruce
- Likely heavily logged upon settlement
- White pine (weevil), red maple (stump sprouts), balsam fir (balsam woolly adelgid)

Inventory:

- Inventoried in October 2025
- 16 plots across 4 stands
- Sampled overstory trees, saplings, seedlings
- Data shown is limited to the two largest stands (20 acres total, 70% of property)

Current Conditions

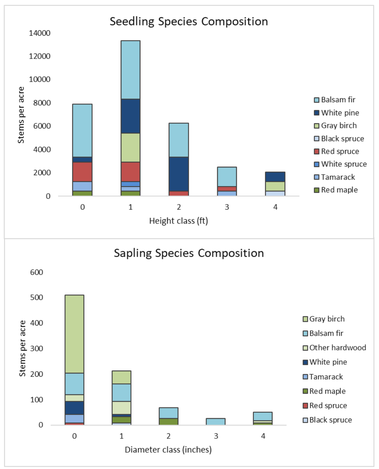


Figure 2. *Species composition of seedlings ≤4.5 ft tall by stems per acre (top) and saplings >4.5 ft tall and <4.5 in. DBH (bottom).*

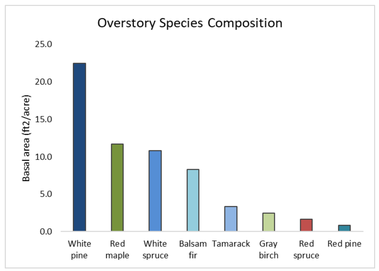


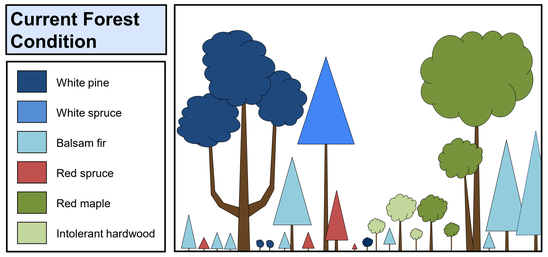
Figure 3. *Species composition of overstory trees ≥4.5 in. DBH by basal area per acre.*

Seedlings: 13% red spruce

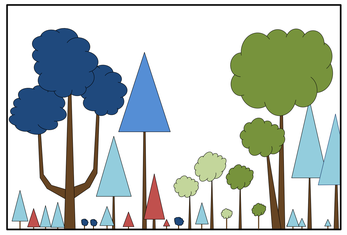
Saplings: 1% red spruce

Overstory: 3% red spruce

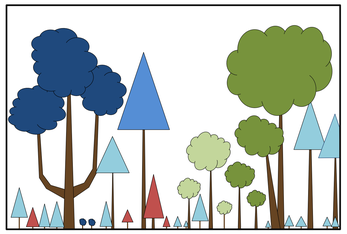
Possible Future Conditions



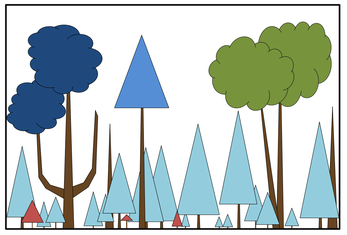
Passive Management



Year 1: Regeneration dominated by balsam fir, intolerant hardwoods in gaps.

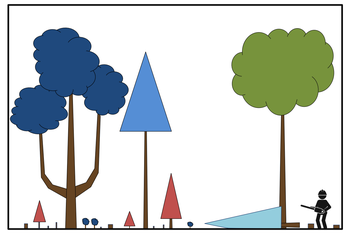


Year 2: Balsam fir stressed by woolly adelgid as it matures, crown mortality continues.

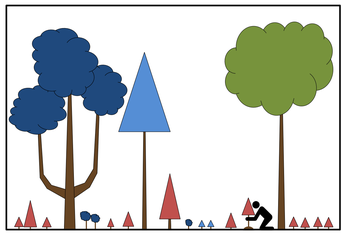


Year 50: Intolerant hardwoods die out. Woolly adelgid kills mature balsam fir. Advance regeneration of fir succeeds.

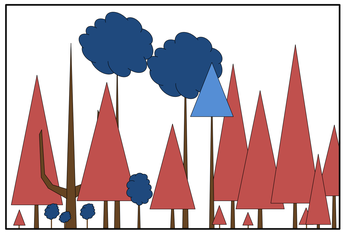
Active Management



Year 1: Balsam fir removed in cleaning treatment, red maple clumps reduced to one stem.



Year 2: Enrichment planting of red spruce where species isn't present, white spruce in open gaps.



Year 50: Red spruce forest with white pine and white spruce components. Advance regeneration of red spruce, white pine in gaps.

Pros and Cons

	Passive Management	Active Management
Pros	➢ Low to no cost ➢ Preserves "natural" processes ➢ Avoids soil disturbance	➢ Promotes historical structure and composition ➢ Improves forest health and timber value ➢ Mimics natural processes ➢ Supports forest resilience
Cons	➢ Forest health concerns ➢ Low timber value threatens forestland retention ➢ Preservation of "natural" processes ignores historical impacts to forest	➢ Initial cost without immediate return ➢ Short-term aesthetic impact ➢ Requires expertise

Implications

- Cleaning treatments and enrichment planting may effectively improve forest health and promote advance regeneration of red spruce
- Despite initial cost without return, active management may improve timber value
- An increase in timber value supports light-touch management to achieve rehabilitation objectives
- Future management mimicking normal wind disturbances may allow established red spruce regeneration to succeed in gaps [3]
- Overall, **long-term benefits of active management may outweigh initial costs**

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References

1. Thompson, J. et al. 2013. Four Centuries of Change in Northeastern Forests. PLoS ONE 8, 9.
2. Gellman, R. et al. 2025. Coastal Spruce Forests: A Guide to Ecological Management. University of Maine, School of Forest Resources.
3. Seirup, C. 2024. Sixty Years of Change in Picea rubens (red spruce) Forests of Coastal Maine, U.S.A. *Electronic Theses and Dissertations,* 3928.