What does silviculture for resilient forests in a changing climate look like?

Klaus Puettmann
Edmund Hayes Professor in Silviculture Alternatives
• Assumptions
  – Global change leads to a variety of perturbations
  – No single/generic prescription
  – Providing multiple ecosystem services
  – Resistance, resilience, and adaptability are important

• Three Rules
  – Support/Explanation
The dog and the Frisbee

Complex problems = simple rules

Sensu A. Haldane
Command and Control and the Pathology of Natural Resource Management

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Conservation Biology 1996. 10: 328 - 337

Encourage bottom-up adaptation
Neighborhood $\xrightarrow{\text{Variability}}$ Stand $\xrightarrow{\text{Landscape}}$ Landscape

Variability $= \int_{\text{Neighborhood}}$
Opportunities for natural development
Simple Rule 1: Encourage bottom-up adaptation
Support for Rule 1:

Resilience, resilience, and adaptative capacity provided by:

Society → Ecosystem
Support for Rule 1:

Ecosystem services vs. Uncertainty and variability

- Traditional forestry
- Climate smart management
Support for Rule 1:

Preparing forests for “surprises” is like:

Raising Teenagers
Simple rule 2

Variability = \int \frac{\text{Landscape}}{\text{Neighborhood}}
Support for Rule 2:

- Crown length
- Tree size
- Canopy layers
- Bark, Crown shape
- Shrub cover
- Species composition
- Herb cover
- Exotic spp.
- Snags

“Old-growthsness” vs. Time

Silvicultural Treatment
Support for Rule 2:

- Seedling establishment
- Seedling/sapling growth
- Early successional vegetation
- Tree growth
- Mortality
- Large tree growth
  - Large crowns
Support for Rule 2:

(A) A point represents the center of a forest stand

Forest ownership

Possible plantation to be established

Stand/Forest estate to target in priority for silvicultural operations

Stand/Forest estate where targeted silvicultural operations were held

Functional link between two forest stands

Modified from Messier et al. 2018
Opportunities for natural development

Simple rule 3
Support for Rule 3

Drought in recently thinned stands
- lower growth reduction
- quicker recovery

Benefits are reduced
- over time
- after multiple thinnings
In fully stocked stands:

Species mixtures (alder/D-fir) did not differ from monoculture in terms of water use.

“Structural diversity had no influence on increment stability during the extreme summer drought.”

From Moore, G. 2003 PhD-thesis, OSU

Dănescu et al. in press ForEcolMan
Support for Rule 3:

Tree growth vs. Moisture stress graph:
- Fully stocked curve
- Understocked curve

The graph illustrates the relationship between tree growth and moisture stress, showing how tree growth decreases as moisture stress increases.
Support for Rule 3

Management Flexibility

Proportion of growing space used

Modified from Wilson and Baker 2001
Thanks for listening!

Questions and Comments?

Rules are mostly made to be broken and are too often used for the lazy to hide behind.

Gen. Douglas MacArthur

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