Wood Production in Structurally Complex Black Hills Ponderosa Pine Stands

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Roadmap

- Stand structures and functions
- Study sites
- Analytical methods
- Results
  - Small trees in uneven-aged stands are inefficient wood producers
  - Uneven-aged stands are as efficient as even-aged stands
- Conclusions

Stand structure comparison

Even-aged

Uneven-aged

Even-aged stands

Structure

- 1 story
- 1 age class

Major characteristics

- 1 regeneration event
- Efficient timber operations
- Habitat value and aesthetics change over time

Even-aged stands

Structure

- 1 story
- 1 age class

Major characteristics

- **1 regeneration event**
- Efficient timber operations
- Habitat value and aesthetics change over time

Uneven-aged stands

Structure

- >1 story
- >1 age class

Major characteristics

- Continuous or episodic regeneration
- Aesthetics and habitat
- Less efficient timber operations
- Inefficient wood production?

Uneven-aged stands

Structure

- >1 story
- >1 age class

Major characteristics

- **Continuous or episodic regeneration**
- Aesthetics and habitat
- Less efficient timber operations
- Inefficient wood production?

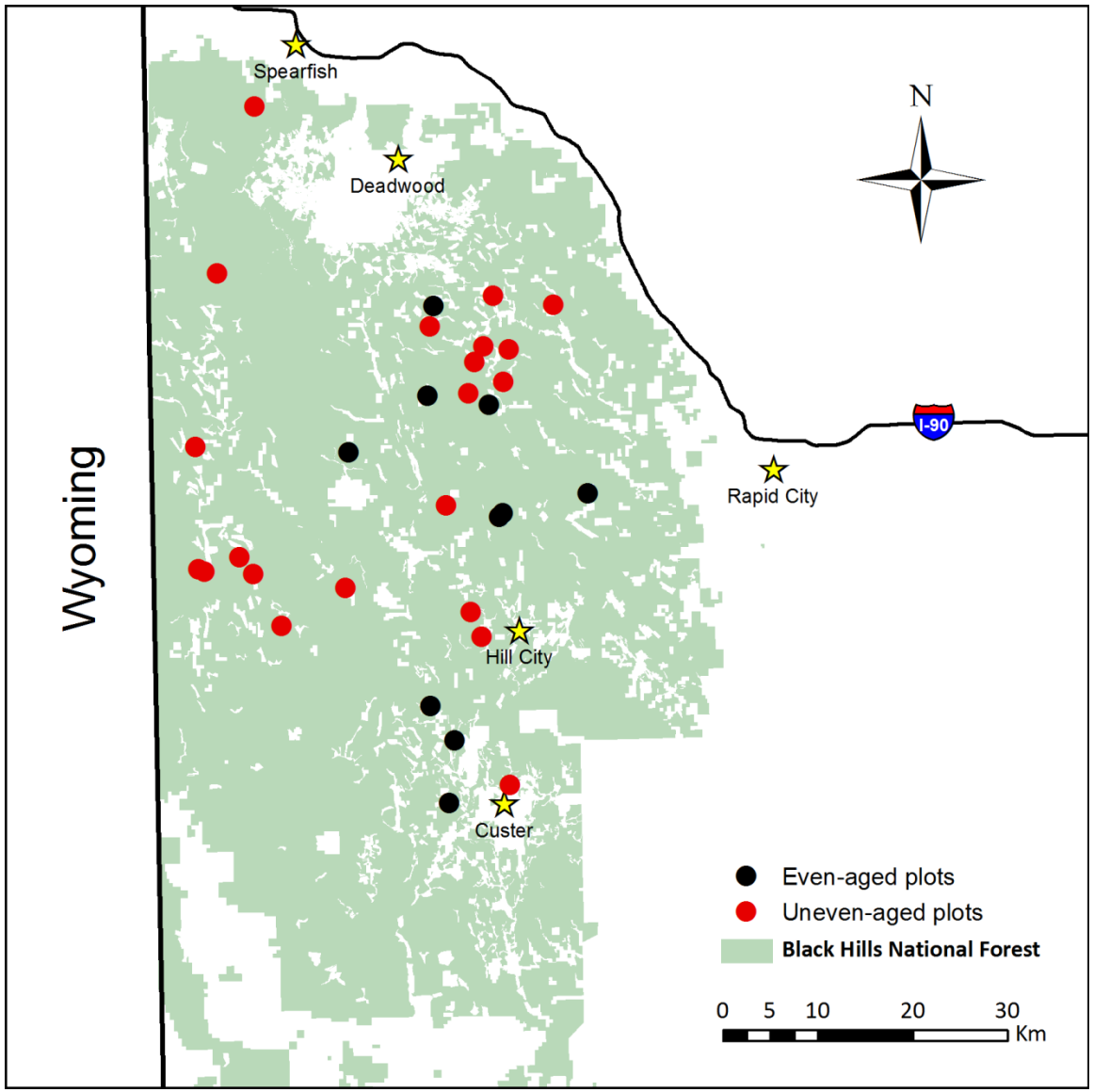
Uneven-aged stands

Structure

- >1 story
- >1 age class

Major characteristics

- Continuous or episodic regeneration
- Aesthetics and habitat
- Less efficient timber operations
- **Inefficient wood production?**


Spearfish
Deadwood
N
I-90
Rapid City
Wyoming
Hill City
Custer
Even-aged plots
Uneven-aged plots
Black Hills National Forest
0 5 10 20 30
Km

Analytical approach

Production efficiency analysis

- Stemwood production per unit foliage area
- Foliage area approximates light capture and indexes site occupancy

Production efficiency comparisons

- Size classes in uneven-aged stands
- Uneven-aged stands to even-aged chronosequence

Foliage area estimator

Dataset

- 68 destructively-sampled ponderosa pine trees
  - Total foliage weight
  - Specific foliage area
  - Breast height sapwood area (SA)

Local estimator

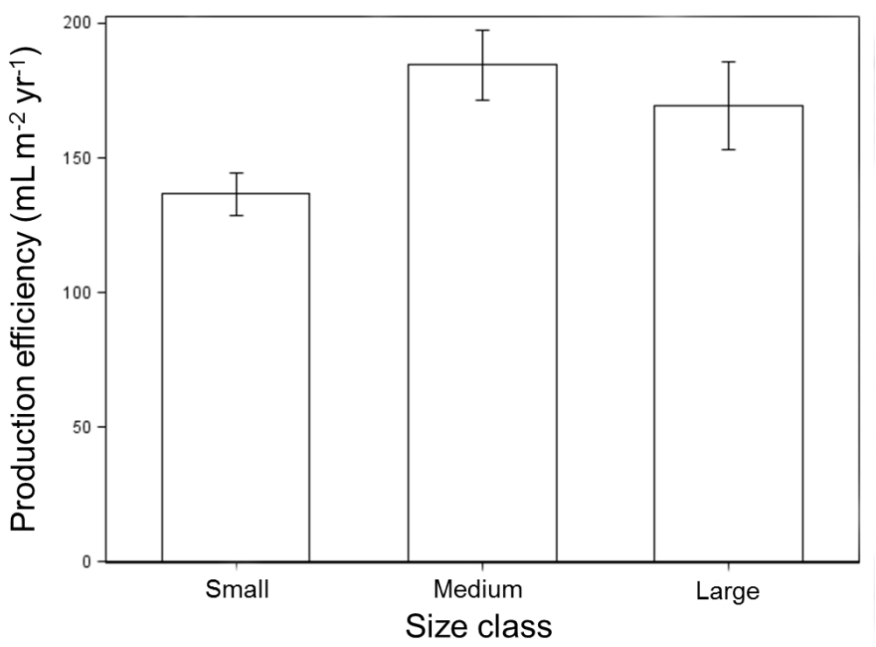
- Foliage area = $0.1748\ (SA^{1.2152})(D^{-0.6642})$
  - D = distance from breast height to middle of live crown
  - $R^2 = 0.9787$, df = 65
  - Unbiased by tree size

Production efficiency analysis

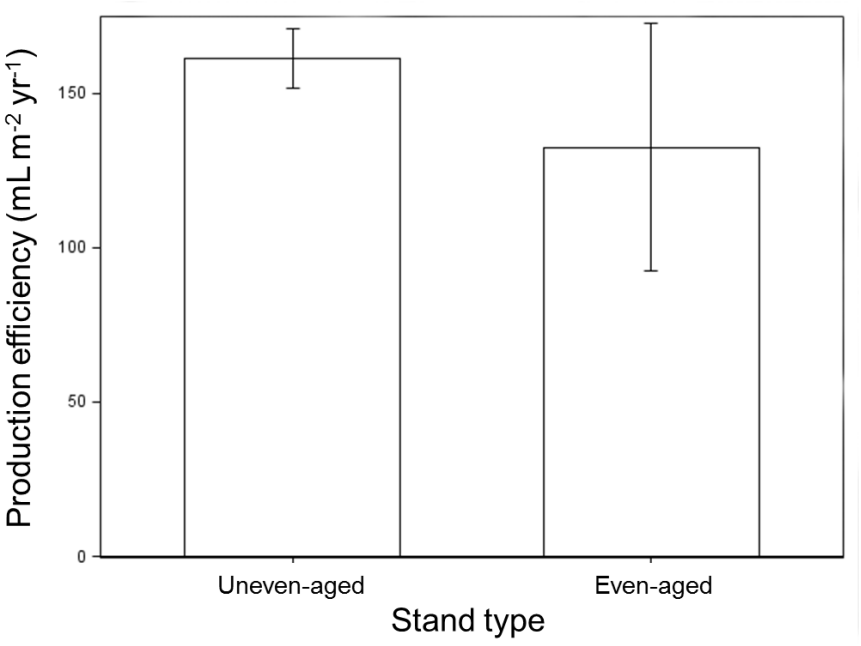
Dataset

- 31 fully stocked, pure ponderosa pine stands
- 21 uneven-aged stands
  - 3 storied stands
  - 1,487 increment cores
- 10 even-aged stands
  - Chronosequence: stands of varying age and average tree size
  - 329 increment cores

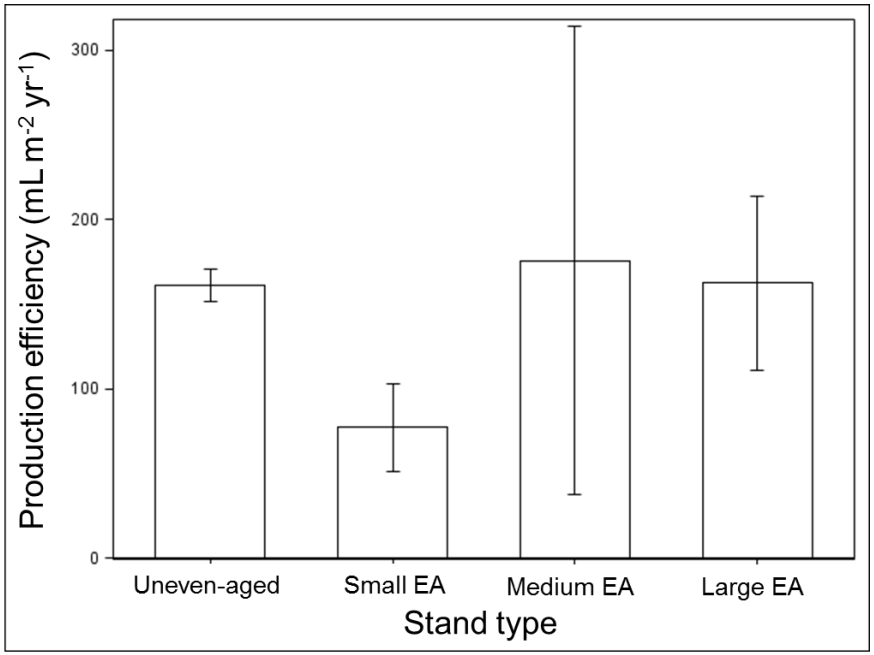
Efficiency in uneven-aged stands



Even- versus uneven-aged stands



Even- versus uneven-aged stands



Conclusions

Small trees in uneven-aged stands are inefficient wood producers

- Probably shaded by neighbors
- Silvicultural tactics can maximize productivity

Conclusions

Uneven-aged stands produce wood as efficiently as even-aged stands

- Variable even-aged efficiency
- Uneven-aged methods a viable option in the Black Hills

Want to know more?

Production efficiency in uneven-aged stands:

Ex, S.A. and F.W. Smith. In review. Wood production efficiency and growth dominance in multi-aged ponderosa pine stands. *Forest Science.*

Application of uneven-aged silviculture:

Ex, S.A. and F.W. Smith. In review. SDI estimates LAI in uneven aged ponderosa pine stands. *Western Journal of Applied Forestry.*

Acknowledgements

This work was funded by the McIntire-Stennis program and the Black Hills National Forest. Blaine Cook was instrumental in data collection and analysis. Tara Keyser generously shared data. Dan Binkley and David Steingraeber provided insightful comments on analysis and interpretation. Many thanks to our fabulous 2010 field crew, and to Lindsay Ex for endless support and patience as well as occasional help in the field.