
WASHINGTON
DEPARTMENT OF NATURAL RESOURCES

Forest Resilience Metric in the Eastern Washington Sustainable Harvest Calculation

A Presentation to the Board of Natural Resources

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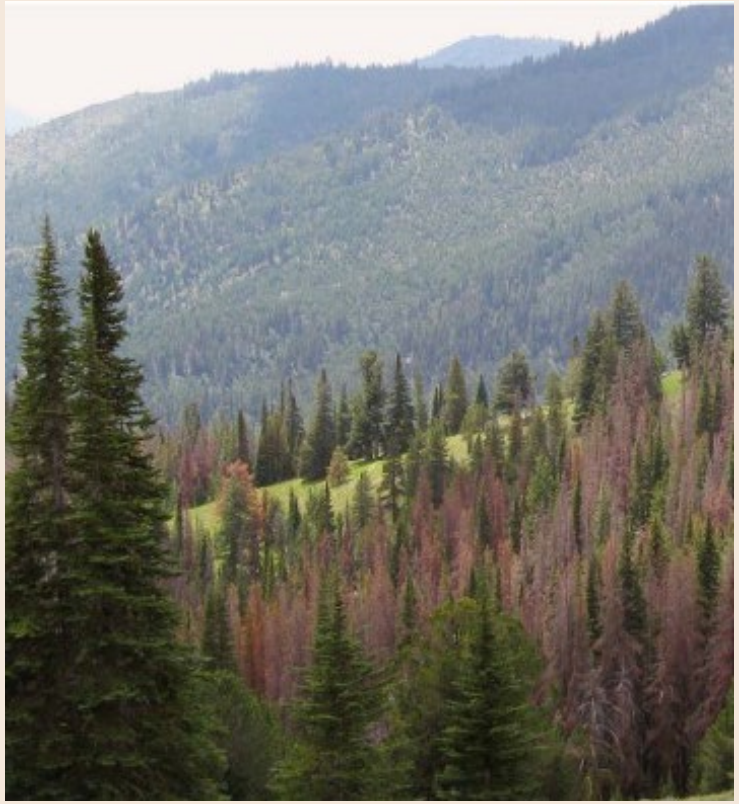
Review of Staff Recommendations

- Future harvest and silviculture informed **by ecotypes shifts.** New strategy for explicitly incorporating climate change impacts in the model.
- Use a **forest resilience metric** to track forest health and resiliency over time. Could be used to drive harvest activities.
- **Forest health prioritization** framework could drive where forest health treatments should be conducted.

Ecological Forest Resilience

The ability of a system to persist through and recover from disturbance

- Ability to adapt to a warming, drying climate and increases in wildfire by shifting to more drought and fire-tolerant tree species, fuel structures, and landscape patterns.
- Resistant to large-scale, high severity fires and drought-induced tree mortality that can lead to rapid destabilization

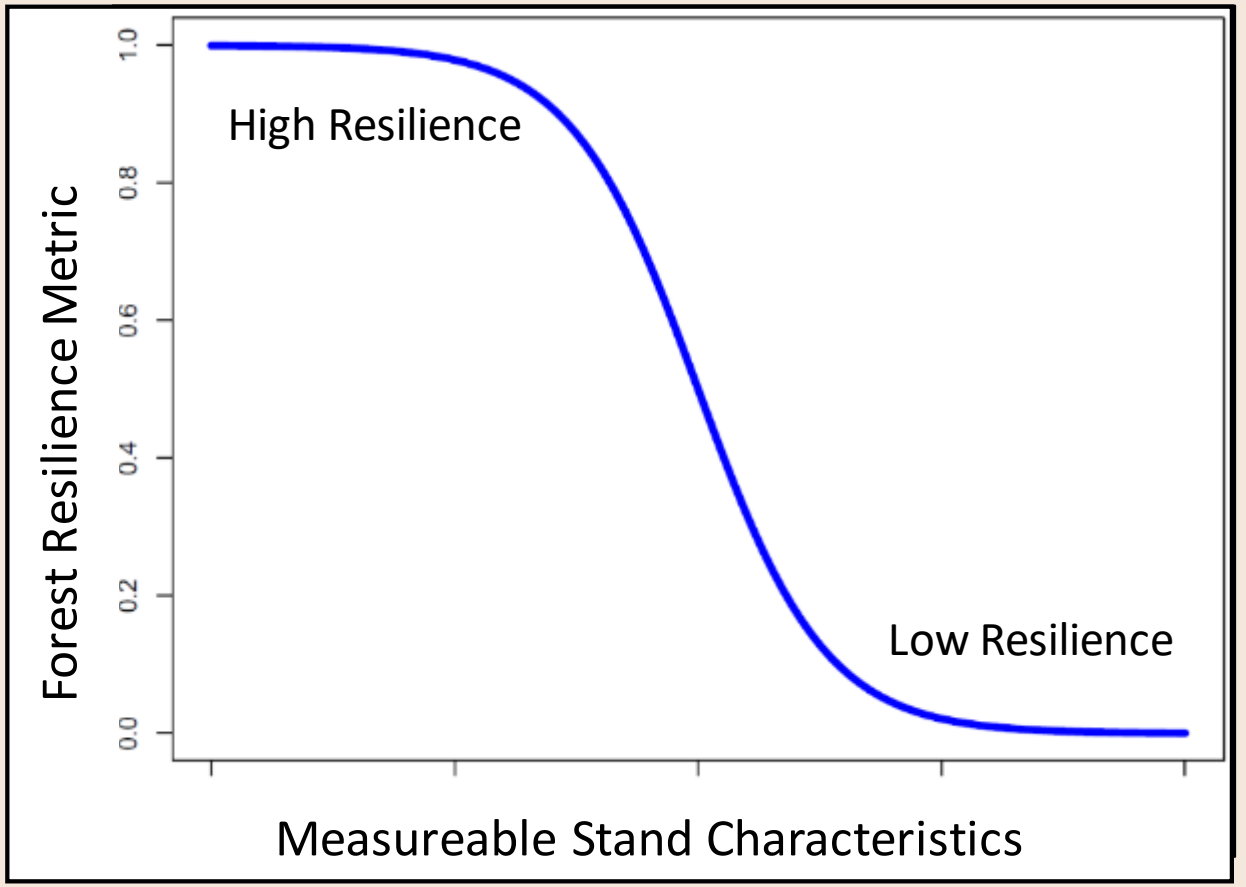


Ecological Forest Resilience

Forest health in RCW 76.06:

> "The condition of a forest being sound in ecological function, sustainable, resilient, and resistant to insects, diseases, fire and other disturbances, and having the capacity to meet landowner objectives"

Concept for Forest Resilience Metric

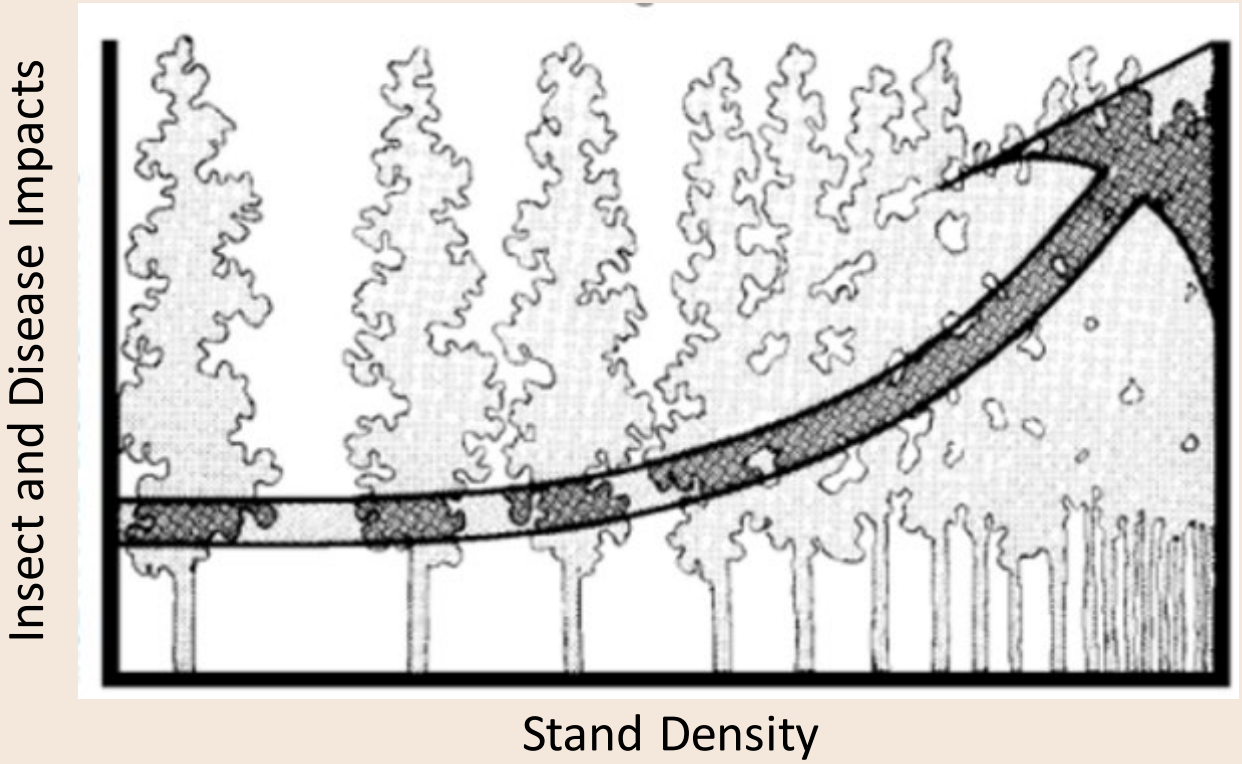


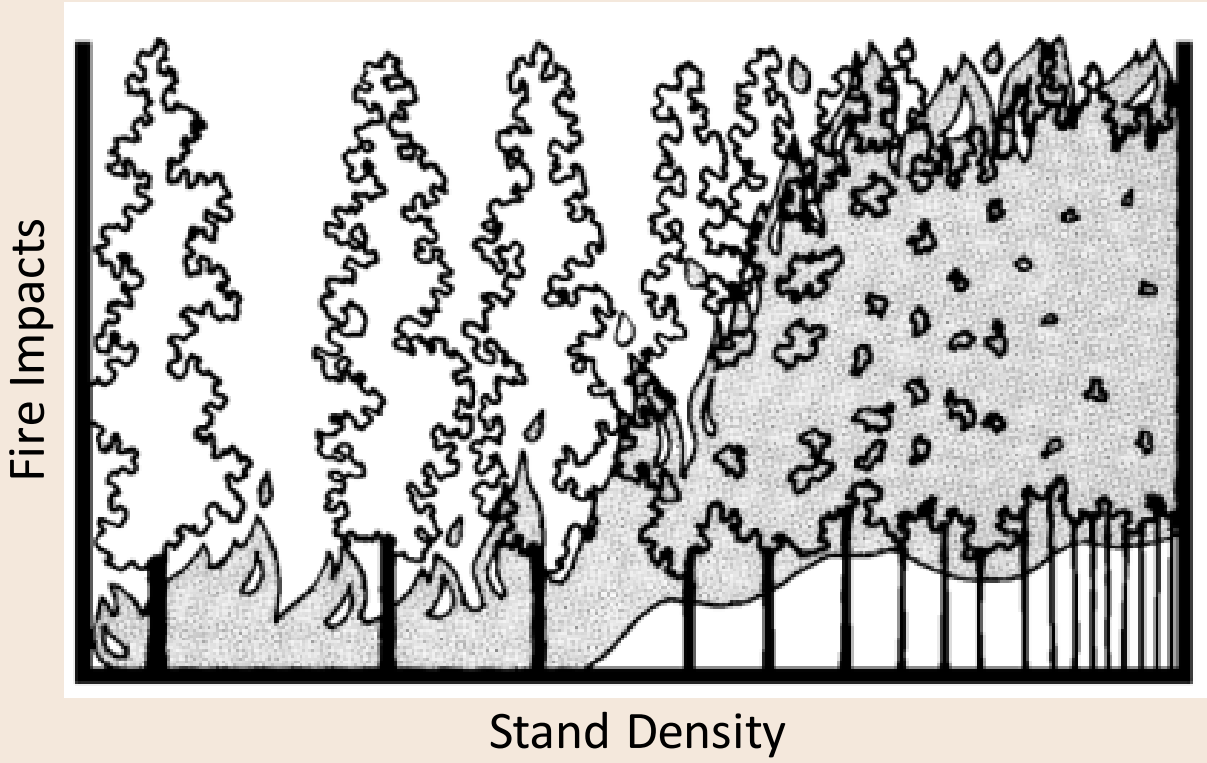
Goals of a Forest Resilience Metric

- Identify relevant components of forest resilience, especially those affected by management decisions
- Develop a single, quantitative stand-level forest resilience metric
- Track changes in forest resilience over time and under different management regimes

Components of the Forest Resilience Metric

As stand density increases the risk of insect, disease and fire impacts increases

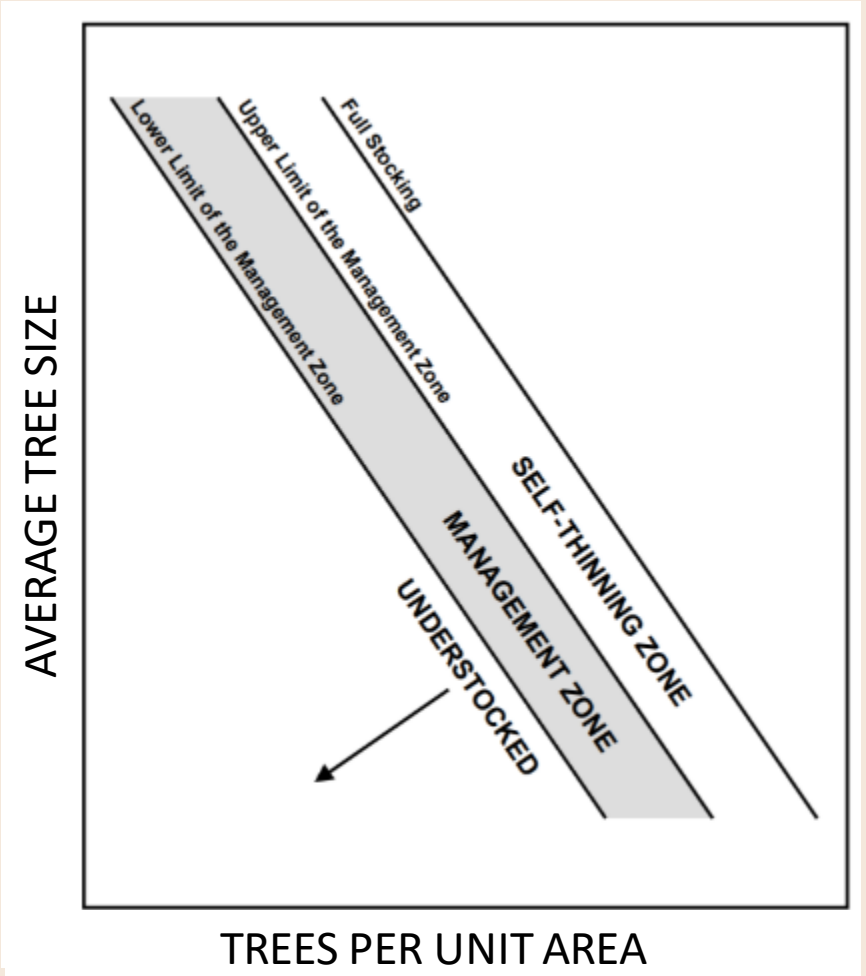




Powell DC. 1999. Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest. USDA Forest Service Technical Publication F14-SO-TP-03-99.

Density Management for Resilience

- Stand density index (SDI) is based on the relationship between tree size and the number of trees per acre
- Healthy forests generally fall within the ‘management zone’
- As trees occupy more growing space, mortality occurs in the ‘self-thinning zone’
- The full or maximum stocking is the SDI Max



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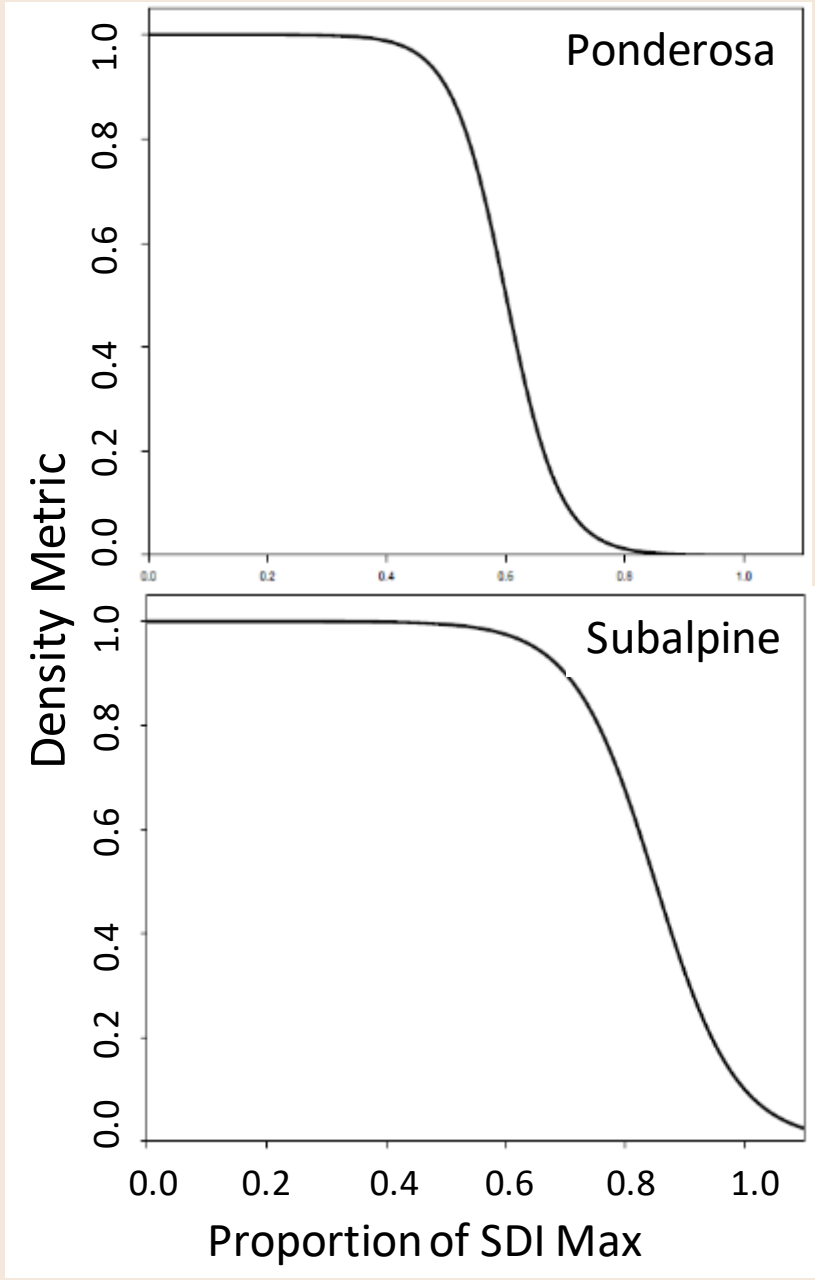
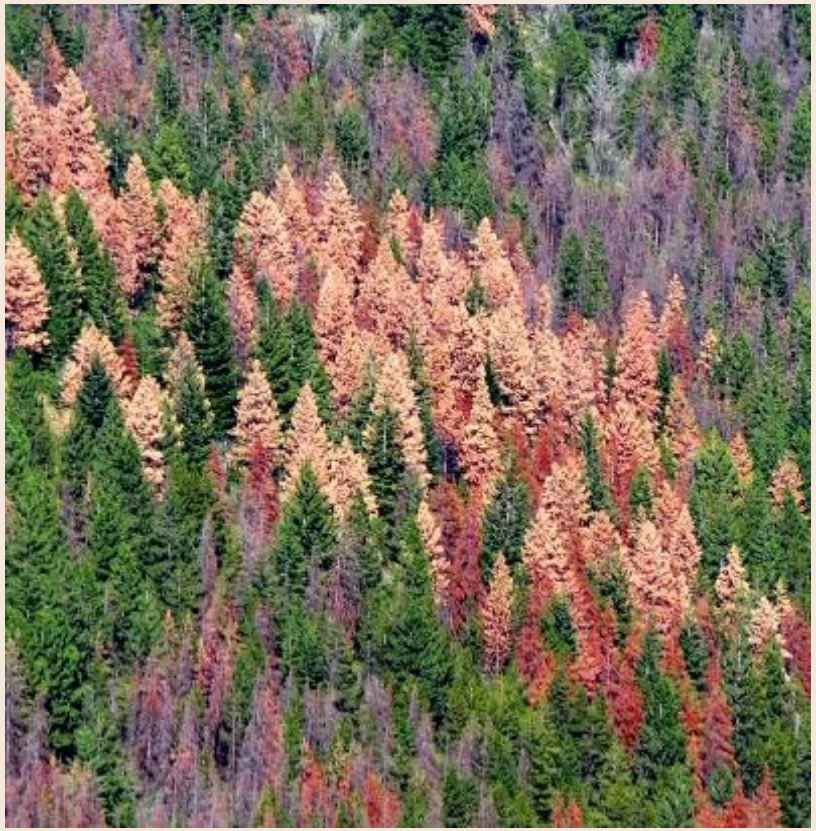
Density Metric

- Density metric quantifies the relationship between SDI and the maximum stocking or SDI Max
- SDI Max varies by vegetation ecotype
- The slope and shape of the curve varies by ecotype



Insect and Disease Metric

- Determines a severity score of pathogen and insect infestation based on tree species and diameter size of individuals
- Determines likelihood score of impact by each pathogen and insect infestation by vegetation ecotype
- Scores generated through a collaborative effort between experts in DNR's Forest Resources and Forest Resiliency Divisions



Insect and Disease: Individual-Tree Severity Scores

- List of potential threats generated for each tree species
- Severity of mortality is scored for each threat by diameter size class and tree species

Example Subset

Species	Diameter size classes			Insect/Pathogen Name
	Small <10”	Medium 10”-20”	Large 20”+	
Douglas fir	1	3	3	Douglas fir beetle
Lodgepole Pine	3	5	5	Mountain pine beetle
Western redcedar	2	2	2	Armillaria root disease

Mortality Severity Score
1 = minor
2 = associated w/ other stressors
3 = moderate
4 = significant
5 = imminent

Insect and Disease: Likelihood Scores by Vegetation Ecotype

- Likelihood of occurrence over a large scale, such as a watershed
- Threats from root disease and mistletoe are likely to be exacerbated by a changing climate

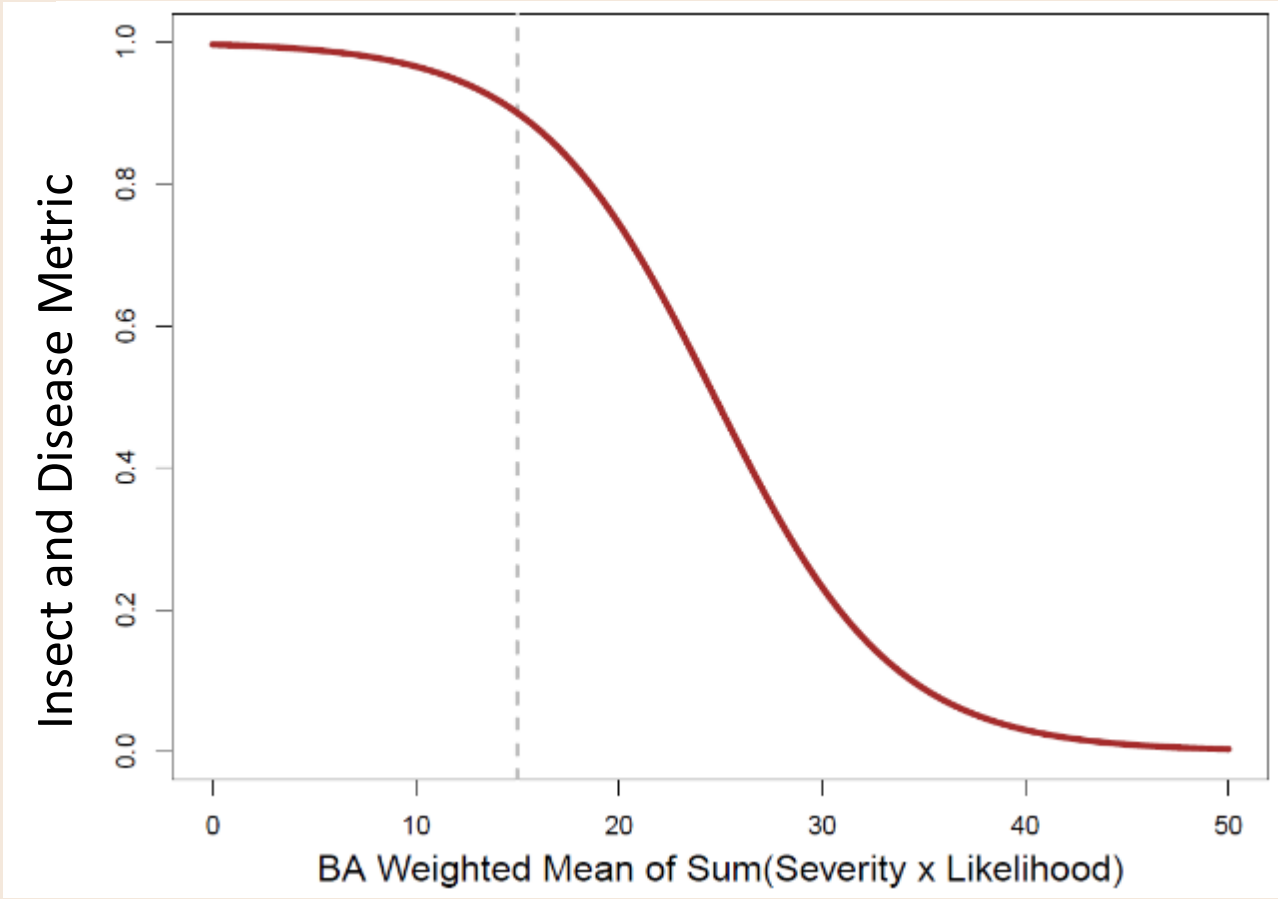
1 = rare occurrence
2 = likely to occur over a decade
3 = frequent/chronic

Example Subset

		Diameter Size Class			
Vegetation Ecotype	Species	Small <10”	Medium 10”-20”	Large 20”+	Insect/Pathogen Name
All Ecotypes	Douglas-fir	1	2	2	Douglas fir beetle
Cool ecotypes	Lodgepole Pine	1	3	3	Mountain pine beetle
Warm and drier ecotypes	Lodgepole Pine	1	2	2	Mountain pine beetle
All Ecotypes	Western redcedar	3	3	3	Armillaria root disease

Insect and Disease Metric

- Insect and Disease metric combines the severity and likelihood scores
- Scores are calculated from the yields
  - Changes reflected due to growth and changes in species composition post harvest



Fire Metric

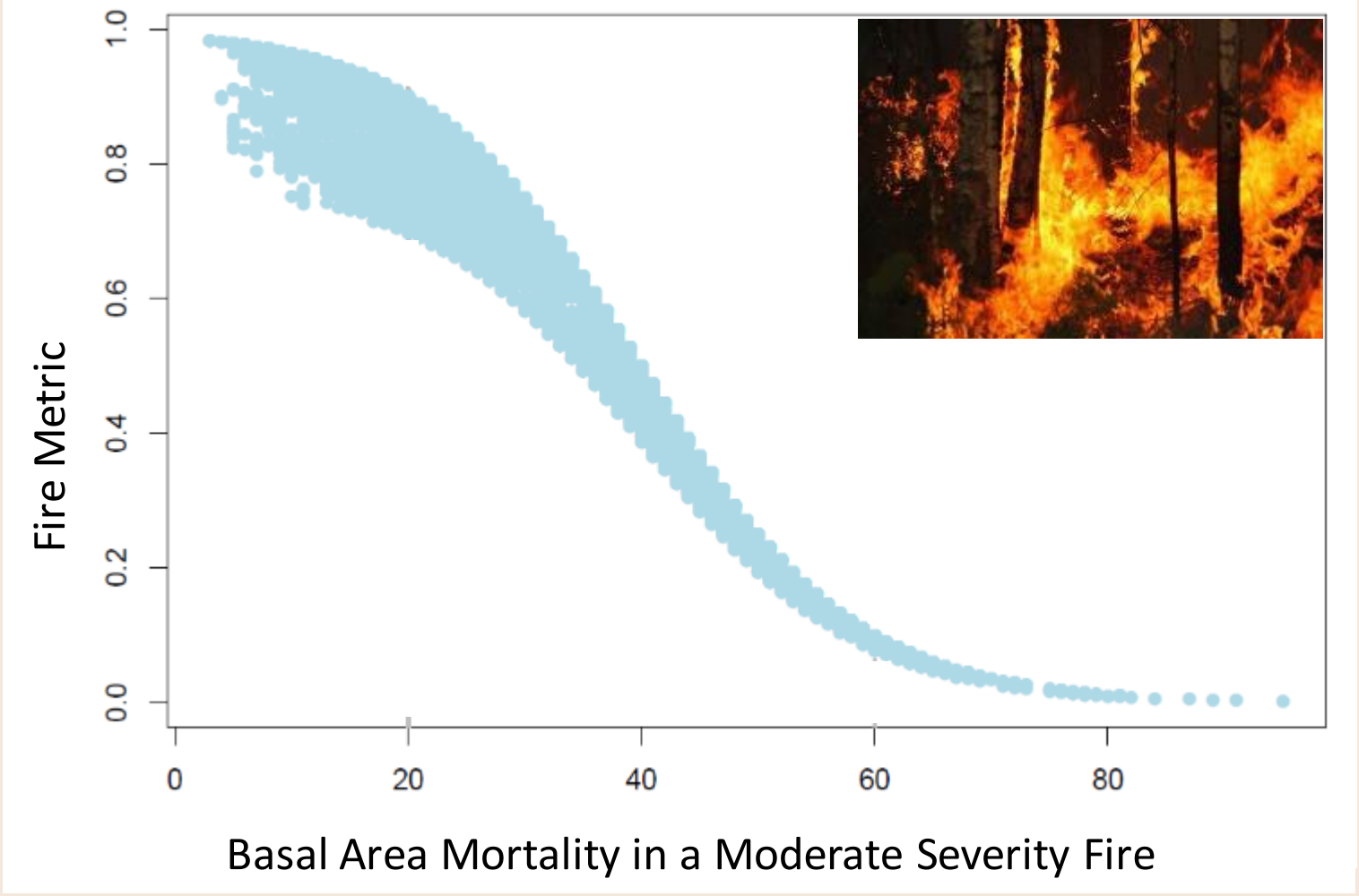
Components

- Bark Thickness
- Species
- Diameter
- Total length of the crown in feet

USFS Forest Vegetation Simulator (FVS) Fire and Fuel Extension

- In a moderate severity fire, calculates the percent of the crown volume scorched and the mortality of basal area

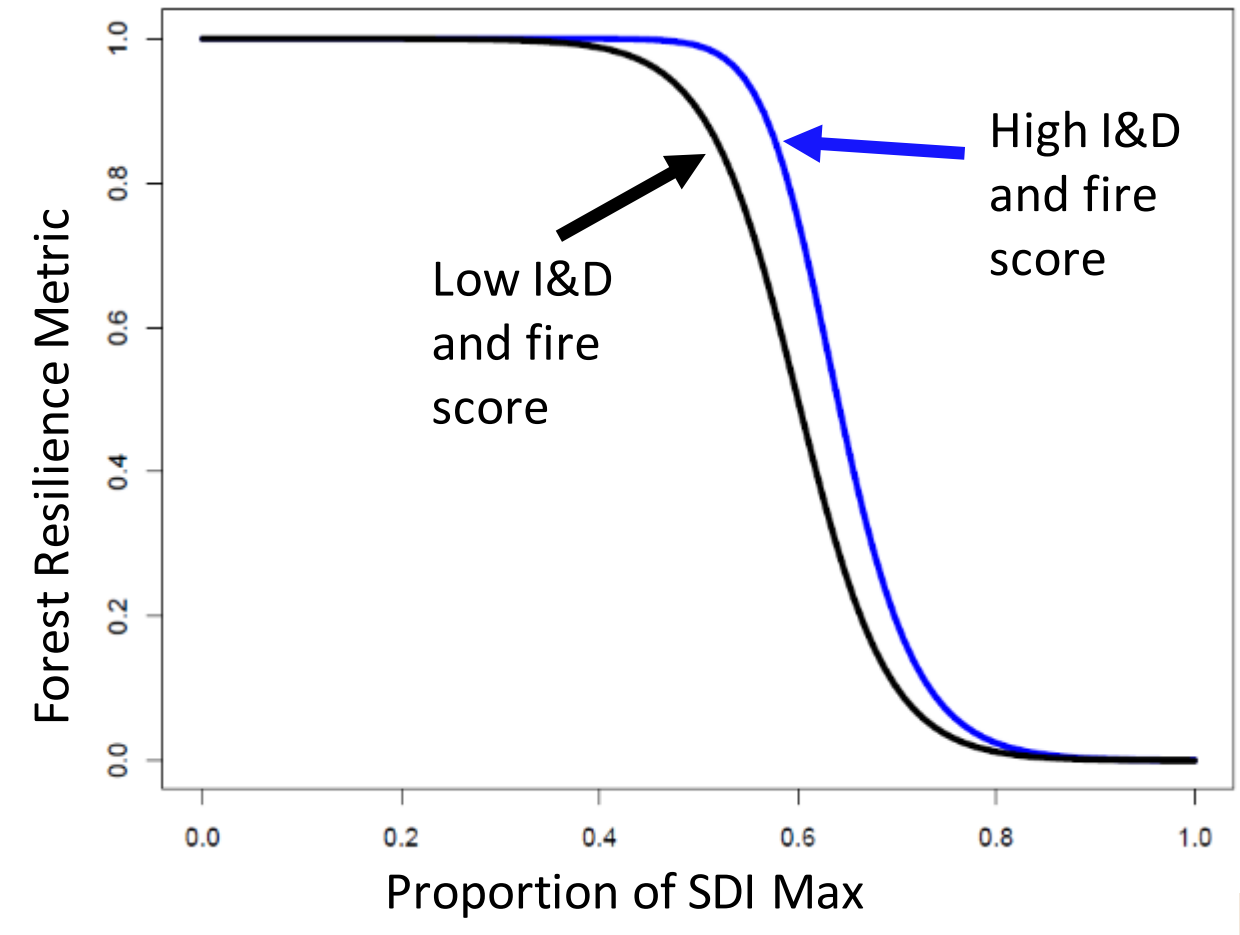
Fire metric has a high score if a modeled fire results in low mortality



Integrating Metrics

Forest Resilience Metric

- Density score is the primary component
- Threshold for resilience is extended to denser conditions if the insect and disease and fire scores are high (=good)



Resilience Example

Low Resilience

High Resilience

Resilience Example

High Resilience

Low Resilience

Forest Resilience in the SHC

Forest resilience metric calculated from the yields

- Metric calculated for each decade modeled
  - FVS Treelists and FVS Fuel and Fire Extension outputs
- Tracked within stand-level and for stratified yield groupings

Use in the Forest Estate model for the SHC

- Summarized at various scales (vegetation ecotypes, SHUs, strata)
- Potential component of an action in the model
  - Proactive management vs reactive
- Future ecotypes impact future forest resilience scores (must explore iteratively)
- Integrate into policy direction

Questions?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