USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Resiliency – Definitions and Application

Carlyn Perovich, GMUG NF

SBEADMR/Taylor Park Annual Stakeholder Meeting

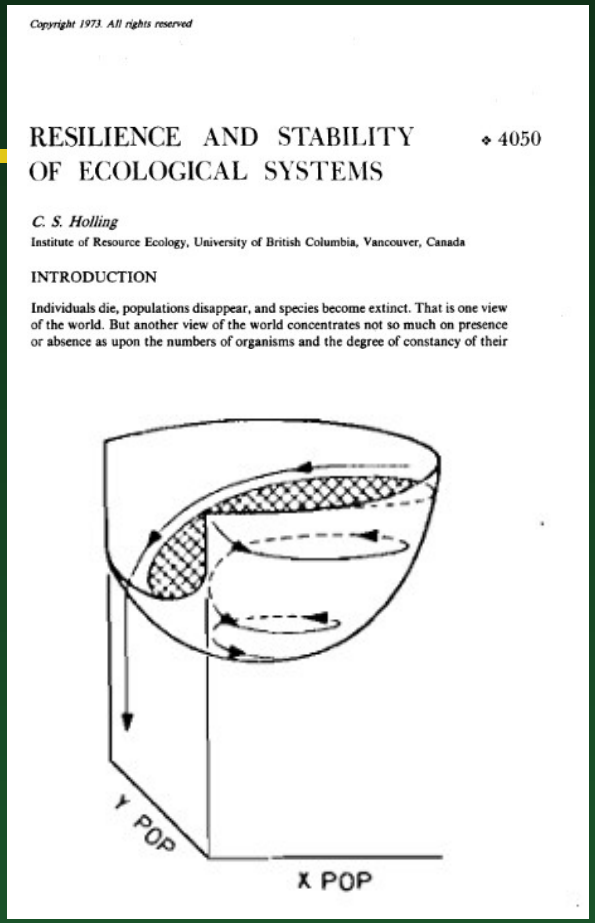
Resilience and SBEADMR

One of three primary goals:

1) Reduce threats of falling, dead trees (**SAFETY**)
2) **Improve the resiliency of stands at-risk to insects and disease (RESILIENCY)**
3) Treat affected stands via recovery of salvageable timber and re-establishment of desired forest conditions (**RECOVERY**)

Conceptual origin

- Introduced as an ecological concept by C.S. Holling (1973)
- Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist (i.e. not go extinct)
- In contrast to stability – the ability of a system to return to an equilibrium state after a temporary disturbance
- Ecosystem does not need to be stable to be resilient



RESILIENCE AND STABILITY OF ECOLOGICAL SYSTEMS ⋄ 4050

C. S. Holling
Institute of Resource Ecology, University of British Columbia, Vancouver, Canada

INTRODUCTION

Individuals die, populations disappear, and species become extinct. That is one view of the world. But another view of the world concentrates not so much on presence or absence as upon the numbers of organisms and the degree of constancy of their

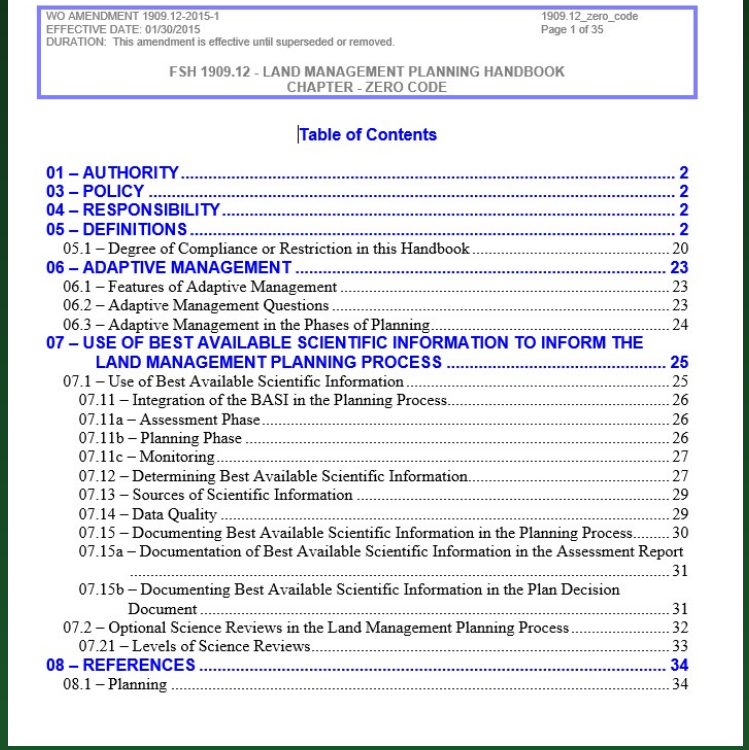
Resilience defined in SBEADMR

"Resilience is the capacity of a system to tolerate disturbance without shifting to a qualitatively different state that is controlled by a different set of processes (Resilience Alliance 2012); i.e., the ability of a system to retain its function, structure, identity and feedbacks in the face of disturbance and environmental change (Walker et al. 2004)."

SBEADMR FEIS (p 49)

Resilience in the USFS 2012 Planning Rule Directives

Resilience: The ability of an ecosystem and its component parts to absorb, or recover from the effects of disturbances through preservation, restoration, or improvement of its essential structures and functions and redundancy of ecological patterns across the landscape.



WO AMENDMENT 1909.12-2015-1 1909.12_zero_code
EFFECTIVE DATE: 01/30/2015 Page 1 of 35
DURATION: This amendment is effective until superseded or removed.

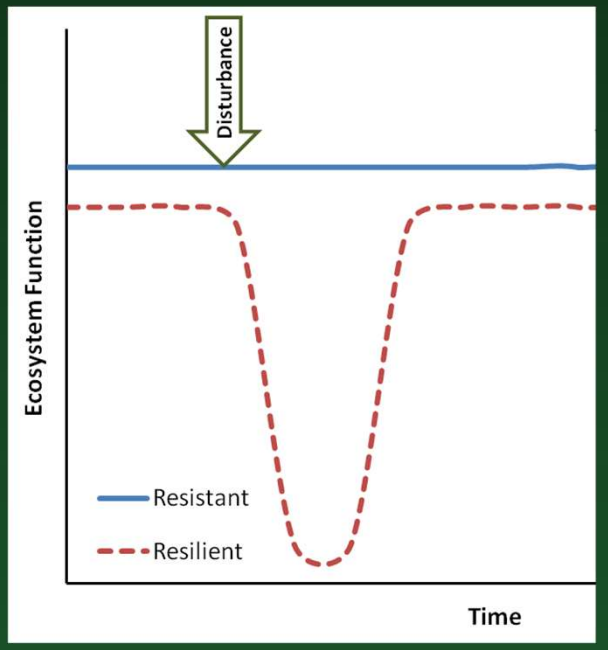
FSH 1909.12 - LAND MANAGEMENT PLANNING HANDBOOK
CHAPTER - ZERO CODE

Table of Contents

Resilience vs. Resistance

Resistance: Capacity of an ecosystem to *retain* its fundamental structure, processes and functioning (or remain largely unchanged) despite stresses, disturbances, or invasive species (Folke et al., 2004).

Resilience: Capacity of an ecosystem to *regain* its fundamental structure, processes, and functioning despite stresses, disturbances, or invasive species (e.g., Hirota et al., 2011; Chambers et al., 2014a; Pope et al., 2014; Seidl et al., 2016).



Resilience & Management in SBEADMR

Resilience is the capacity of a system to tolerate disturbance without shifting to a qualitatively different state that is controlled by a different set of processes (Resilience Alliance 2012); i.e., the ability of a system to retain its function, structure, identity and feedbacks in the face of disturbance and environmental change (Walker et al. 2004).

A resilient forest ecosystem is a forest that contains the diversity of composition, size, density and pattern that enables it to cope with changing disturbance processes. *Such an ecosystem is capable of providing various ecosystem services such as wildlife and aquatic habitat for a variety of species, clean water, recreation, and carbon sequestration in the short and long term.*

SBEADMR FEIS (p 49)

Resilience & Management in SBEADMR

"Resiliency

1. Increase the forest's ability to respond to multiple and interacting stresses, including climate change, insect attack, drought or disease.

    a. In healthier spruce-fir stands, promote **regeneration** and create multiple age classes of trees.

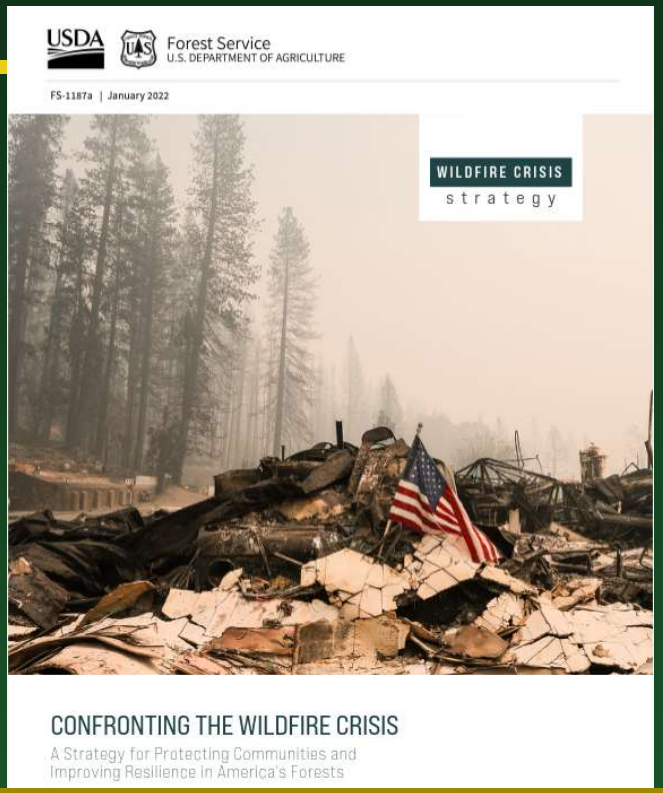
    b. Where the beetle population is endemic, minimize spread of bark beetle from infected stands to neighboring healthy stands.

    c. Promote aspen **regeneration** via active treatments in live stands, with emphasis on those affected by Sudden Aspen Decline."

SBEADMR FEIS p. 20

Challenges in Managing for Resilience

- Resilience to what? (fire, insect, disease, climate change)
- Diversity is good – but at what scale?
- It's complicated



"A Strategy for Protecting Communities and Improving Resilience in America's Forests"

SBEADMR Science Team Monitoring

Did unmanaged and previously managed stands respond differently to the spruce beetle epidemic?

Spruce stands

- Mortality from SB similar between the previously managed and unmanaged stands
- Previously managed stands have significantly more seedlings (<dbh) than the unmanaged stands.

Spruce-aspen stands

- Mortality from SB similar between the previously managed and unmanaged stands
- Previously managed stands have twice as many live trees per acre than unmanaged stands (1104 vs 517)
- No difference in the amount of seedling regeneration (<dbh); 3106 to 3627 per acre

SBEADMR Science Team Monitoring

Terror Creek Aspen

How has harvest impacted aspen regeneration density and height in SAD affected stands? (12 years post-treatment)

Rainbow and Bald TS

How do modified shelterwood cuts and group selection cuts influence successful regeneration and growth in spruce dominated forests?

Taylor Park Science Team & ASCC

- Development and long term monitoring of resistance, **resilience** and transition silvicultural strategies

The resilience treatment at Taylor Park will aim to increase species, structural diversity, & spatial heterogeneity. Photo Credit: Kirsten Martin, Colorado State University

Thank you!

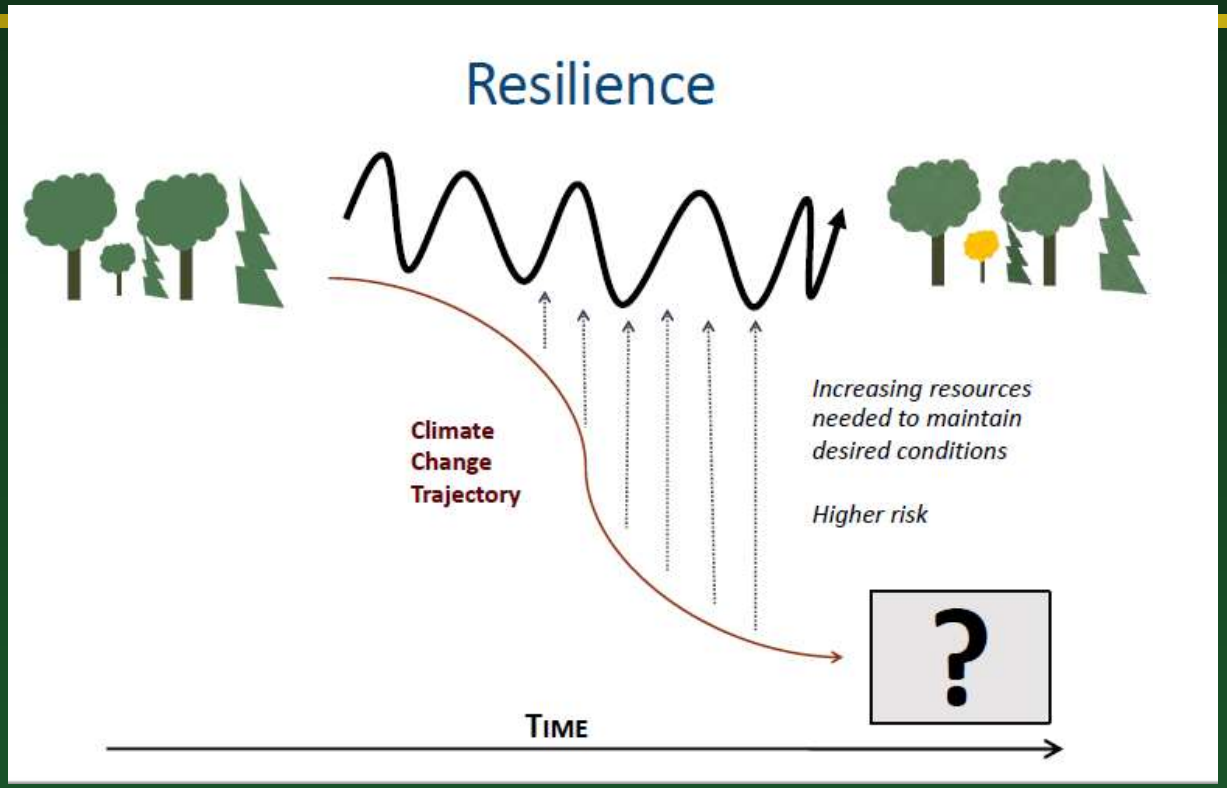
Spruce Resiliency

Resiliency goals in spruce stands would be met by removal of single trees or group selections of trees where bark beetle impacts are light or in areas yet unaffected by beetles. Resiliency treatments are designed to mimic natural gap dynamics that maintain or encourage multi-storied attributes, with the same considerations for retention of advanced regeneration as noted above. These treatments would be completed in accordance with the Southern Rockies Lynx Amendment, and they are considered a conservation measure for lynx (USDA Forest Service 2008, SRLA). Cuts typically cover only 20-40% of a given treatment unit.

Aspen Resiliency

Aspen and aspen-spruce treatments would consist of coppice cutting, mastication, prescribed fire or removal of single spruce or groups of spruce within a stand dominated by aspen. ***The treatment goal is to regenerate or maintain aspen; site disturbance through treatment activities and removal of aspen canopies typically stimulates regeneration of aspen from the existing root system.*** Efforts would be made to prioritize treatments based upon likelihood of aspen persistence, given climate projections and current modeled future distribution by elevation (Rehfeldt et al. 2015).

Resilience and Climate Change



Accommodate some degree of change or disruption, but be able to return to a similar condition after disturbance.

Millar et al. 2007, Swanston et al. 2016, and Nagel et al. 2017

Resilience and Taylor Park EA

“The primary purpose of this proposal is to increase the forest’s ability to respond to multiple and interactive forest stressors including climate change, drought, insect attack, or disease ...”

“This project intends to continue to increase landscape tree-age and tree-size diversity for increased ***resilience*** *to stressors such as bark beetle, mistletoe, and climate change.”*

Taylor Park EA p16, p 59