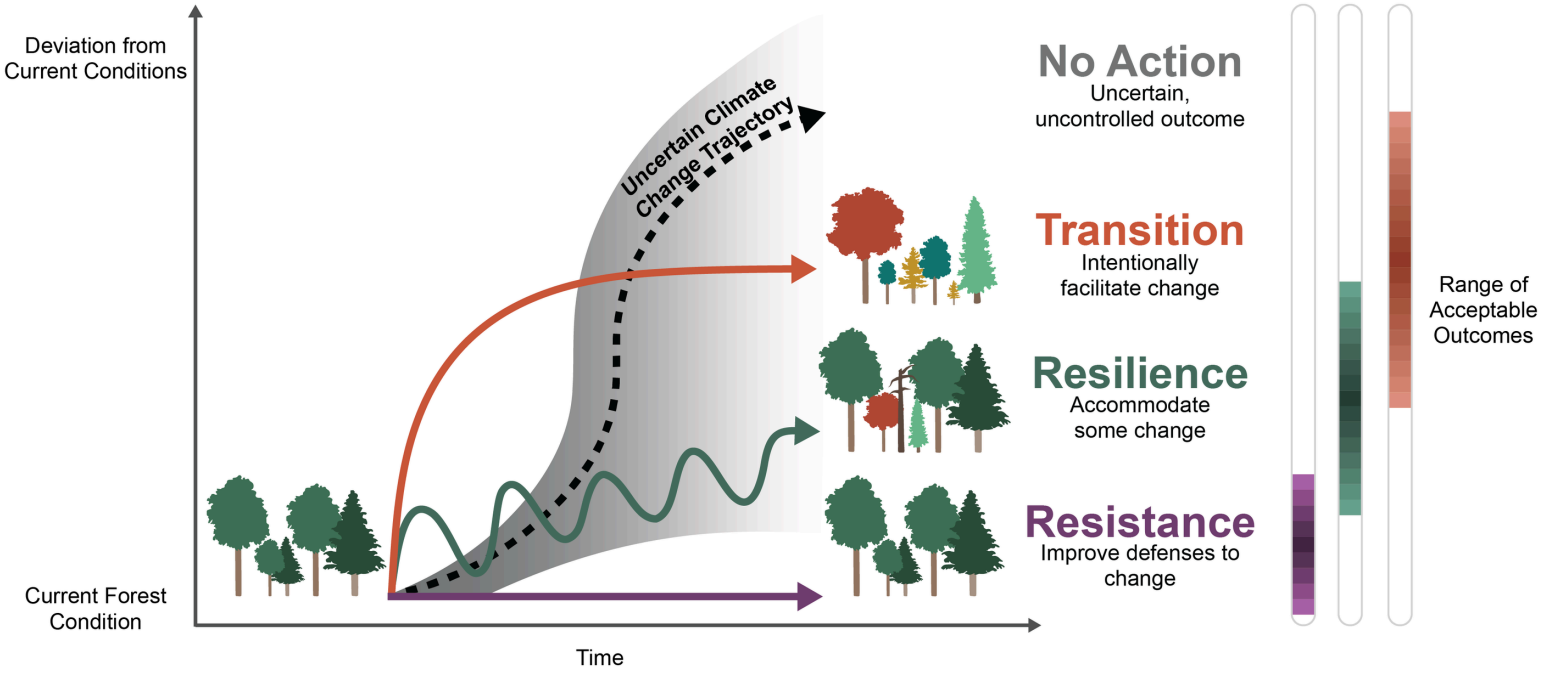
Resistance, Resilience, & Transition (RRT)

A Spectrum of Adaptation Options for Responding to Climate Change

	Adaptation Option Definition	Adaptation Option Goal
Resistance	Actions that improve the defenses of the forest against anticipated change or **directly defend the forest against disturbance** to **maintain relatively unchanged conditions**.	Maintain relatively unchanged conditions over time.
Resilience	Actions that accommodate some degree of change, but **encourage a return to a prior condition or desired reference conditions after disturbance.**	Allow some change in current conditions, but encourage an eventual return to reference conditions.
Transition	Actions that intentionally accommodate change and enable ecosystems to **adaptively respond to changing and new conditions.**	Actively facilitate change to encourage adaptive responses.
No Action	Given that climate change impacts all forests globally, under the "no action" approach forests are allowed to respond to climate change in the **absence of direct silvicultural intervention** as an appropriate baseline.	Allow forests to respond to climate change without direct management intervention.

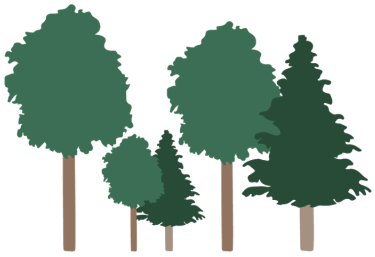


Advances in application of the different adaptation options

Resistance	Resilience	Transition	No Action
Designed to respond to specific climate impacts Desired condition may become more vulnerable over time Assumes greater risk of not meeting desired future conditions with altered climate conditions	Supports inherent ability of the ecosystem to change and reorganize within a defined range of reference conditions May be informed by natural or historical range of variation Provides a widening range of options to reduce risk compared to resistance	Enhances capacity of the ecosystem to change to a new state Actively facilitates change, often transforming to a novel system Assumes greater risk in the near term to reduce long-term risk May be most relevant to highly vulnerable systems already transforming	Ecosystem is allowed to respond passively to climate change without direct silvicultural intervention Risk is a function of climate and environmental changes

Trends of adaptation actions across RRT

RESISTANCE



- More uniform application of intermediate treatments or regeneration methods focused on increasing tree vigor and maintaining current compositional conditions
- Density management (semi-arid) or regeneration harvests (humid) to resist impacts of disturbances

RESILIENCE

- Treatments increase ecosystem complexity
- Multi-cohort silvicultural methods that create diverse resource environments, spatially complex distributions of mature trees, and a range of size and age classes

TRANSITION

- Treatments intentionally facilitate change to a novel system
- Increasing focus on regeneration of future-adapted species through large canopy gaps or stand-wide harvests of most mature trees

Reduce impacts/ maintain current conditions ⟷ **Forward-looking/ promote change**

Text and figures: Linda M Nagel, Maria K Janowiak, Peter W Clark, Courtney L Peterson, Maria R Vicini, Brian J Palik, Anthony W D'Amato, Mike A Battaglia, Christopher W Swanston, Ten Years of Adaptive Silviculture for Climate Change: An Applied, Coproduced Experimental Framework, BioScience, Volume 76, Issue 2, February 2026.