

Fire-Climate Adaptation Strategies and Approaches

Strategy 1: Sustain fire as a fundamental ecological process

Approach 1.1. Restore or maintain fire in fire-adapted ecosystems

Examples of adaptation tactics include:

- *Use prescribed fire and mechanical treatments to manipulate structure and fuels*
- *Promote fire- and drought-adapted species and communities*
- *Increase intentional use of wildfires whenever possible*

Approach 1.2. Develop fire use strategies in altered or novel ecosystems where fire can play a beneficial role

Examples of adaptation tactics include:

- *Manage forest restoration for future range of variability*
- *Consider using more prescribed fire where supported by scientific evidence*
- *Consider using prescribed fire in non-traditional ways (e.g. low-intensity controlled burning in mesic mixed conifer to reduce fuels and risk of high-severity fire)*

Approach 1.3. Protect fire-sensitive ecosystems from fire

Examples of adaptation tactics include:

- *Reduce ignitions in areas sensitive to fire*
- *Control nonnative invasive species*
- *Implement and maintain fuel breaks in strategic locations*
- *Encourage acceptable fire in buffers surrounding fire-sensitive areas*



Strategy 2: Reduce the effects of biotic and abiotic stressors on fire regimes

Approach 2.1. Prevent the establishment and spread of nonnative invasive species, and remove existing populations

Examples of adaptation tactics include:

- *Increase inventory and monitoring of nonnative invasive species*
- *Use mechanical or chemical means to eradicate high priority populations of nonnative invasive species*
- *Create and enforce regulations for internal staff, contractors, and the public to prevent accidental introduction of nonnative invasive plant material*

Approach 2.2. Maintain or improve the ability of forests to resist pests and pathogens

Examples of adaptation tactics include:

- *Increase inventory and monitoring of pests and pathogens, focusing on high priority areas*
- *Anticipate the arrival of pests and pathogens and prioritize management actions*
- *Promote species, age class, and stand structure diversity to reduce density of a host species*
- *Use chemical control in heavily infested areas*
- *Promote pest- and pathogen-resistant species or genotypes during thinning and planting*
- *Restrict harvest and transportation of logs in or near stands with known infestations*

Approach 2.3. Limit and selectively apply land uses that alter or degrade ecosystem structure and/or function

Examples of adaptation tactics include:

- *Consider and actively manage fire risk in areas of heavy recreational use*
- *Limit increased WUI area resulting from development and urban expansion*

Strategy 3: Reduce the risk of unacceptably severe fire

Approach 3.1. Alter forest structure and/or composition to reduce the risk of unacceptably severe wildfire

Examples of adaptation tactics include:

- *Implement strategic fuel treatments/fuel breaks to reduce fire behavior*
- *Reduce tree density within stands (thinning, Rx burning) considering historic ranges of variation and anticipated future conditions*
- *Reduce ladder fuels and increase crown base height using mechanical or Rx burn treatments*
- *Suppress wildfires that threaten to burn at unacceptably high severities*

Approach 3.2. Establish fuel breaks to stop the spread of unacceptable wildfire

Examples of adaptation tactics include:

- *Create fuel breaks in strategic locations preventatively*
- *Create fuel breaks to protect infrastructure (WUI) and other non-negotiable resources*
- *Prevent ignitions and suppress wildfires in non-fire-adapted systems*

Strategy 4: Promote post-fire recovery

Approach 4.1. Maintain or create refugia

Examples of adaptation tactics include:

- *Identify processes and conditions that create fire refugia*
- *Inventory and document existing refugia that have survived previous fires*
- *Add refugia to maps/lists of resources requiring special protection during fire suppression/management, communicate this information to fire managers*
- *Identify and protect focal areas for regeneration and recovery following a disturbance*
- *Prioritize and maintain unique sites and sensitive or at-risk ecological communities*

Approach 4.2 Facilitate post-fire ecosystem recovery to reduce the long-term effects of unacceptable wildfire

Examples of adaptation tactics include:

- *Contour felling, wood mulching, and other slope stabilization techniques to reduce soil loss and post-fire flooding*
- *Create suitable physical conditions for natural regeneration through site preparation after a burn to promote seed establishment*
- *Plant native species expected with an emphasis on those adapted to future conditions*
- *Experiment with planting native species to compete with invasives expected to colonize after fire*

Approach 4.3. Promote habitat connectivity and increase ecosystem redundancy at the landscape scale

Examples of adaptation tactics include:

- *Locate and map habitat types, corridors, and patches at a landscape scale, identify priorities for protection and/or restoration*
- *Restore native species and vegetation structure in areas of low connectivity*
- *Restore or increase a community type across a range of topographic positions and elevations*
- *Work with partners to achieve connectivity goals at the landscape level*

Strategy 5: Maintain and enhance structural, species, and community diversity

Approach 5.1 Promote diversity within and among communities

Examples of adaptation tactics include:

- *Promote age class and structural diversity through regeneration harvest, thinning, prescribed fire, and managed wildfire*
- *Identify keystone species and roles in fire adapted systems, maintain or restore where possible*
- *Retain patches of existing vegetation to the greatest extent possible*

Approach 5.2 Maintain or increase structural diversity at the landscape scale

Examples of adaptation tactics include:

- *Employ techniques such as variable-density treatments or irregular fire return intervals in order to encourage the development of multiple age cohorts*
- *Implement a variety of management activities or silvicultural prescriptions across multiple stands or areas with similar starting conditions in order to diversify forest conditions and evaluate different management approaches*
- *Use prescribed burning to create openings or early successional habitat*

Approach 5.3 Maintain or restore diversity of native tree and understory plant species

Examples of adaptation tactics include:

- *Maintain up-to-date inventory of native plant species in management area, monitor health of populations*
- *Use silvicultural treatments to promote and enhance diverse regeneration of native species*
- *Plant desired native species in areas otherwise expected to regenerate naturally*

Strategy 6: Maintain and enhance genetic diversity to promote fire resilient genotypes

Approach 6.1. Use seeds, germplasm, and other genetic material from across a greater geographic range

Examples of adaptation tactics include:

- *Use mapping programs to match seeds collected from a known origin to planting sites based on climatic information*
- *Plant seedlings germinated from seeds collected from various locations throughout a species native range*

Approach 6.2. Favor existing genotypes that are better adapted to future conditions

Examples of adaptation tactics include:

- *Plant stock from seeds collected from local trees that have survived past fire and other disturbances*
- *Plant stock from seeds collected from healthy trees in warmer and drier locations in the region*
- *Monitor areas of natural regeneration to identify well-adapted phenotypes*

Approach 6.3 Increase seed banking efforts to preserve genetic diversity

Examples of adaptation tactics include:

- Preserve specimens from a diverse array of genotypes
- Focus on endemic species or species with narrow geographic ranges
- Focus on genotypes proven to be resistant to stressors, particularly vigorous, or adapted to past disturbance

Strategy 7: Facilitate ecosystem adaptation to expected future climate and fire regimes

Approach 7.1. Promote native species that are expected to be resilient to future climate and fire regimes and disfavor species that are distinctly maladapted

Examples of adaptation tactics include:

- *Plant, and protect existing, species resilient to fire and other disturbances*
- *Promote species with shorter times to sexual maturity*
- *Promote species with wider ecological amplitude*
- *Remove unhealthy individuals of a declining species in order to promote other species known or expected to be better adapted*
- *Do not continue to promote species that are known or expected to maladapted to future fire regimes*

Approach 7.2. Facilitate the movement of species that are expected to be adapted to future conditions and fire regimes

Examples of adaptation tactics include:

- *Plant disturbance and fire-adapted species on sites within the current range that have not been historically occupied by those species*
- *Consider planting species native to lower elevations, drier, and/or warmer geographic areas nearby, or areas with more frequent fire, based on projected range expansion*

Approach 7.3. Consider using fire as a tool to align existing vegetation communities with changing climate regimes

Examples of adaptation tactics include:

- *Shift prescribed burn seasons to align with project climatic changes*
- *Consider using managed and/or prescribed fire to facilitate transition to new fire regimes*
- *Consider increasing acreage treated with prescribed fire in the short term in areas where current regeneration responses are desirable (and future regeneration trends are uncertain)*

Strategy 8: Use fire events as opportunities for ecosystem realignment

Approach 8.1. Revegetate burned areas using fire-tolerant and drought-adapted species and genotypes

Examples of adaptation tactics include:

- *Integrate climate-sensitive revegetation planning into the Burned Area Emergency Response (BAER) and other post-fire activities*
- *Consider specific experiments such as common gardens to test performance of different species or genetically different populations*
- *Monitor and control invasive species*

Approach 8.2. Allow for areas of natural regeneration to test for future-adapted species

Examples of adaptation tactics include:

- *Increase post-fire monitoring to collect information on mortality and regeneration at the species level*
- *Incorporate areas of natural regeneration or 'passive realignment' into BAER and other post-fire management and monitor outcomes*
- *Consider traits such as drought-tolerance, shade tolerance, and C3/C4 pathways in monitoring efforts*

Approach 8.3. Realign ecosystems that have undergone post-fire vegetation type conversion to meet expected future conditions

Examples of adaptation tactics include:

- *Consider future range of variability in post-fire management*
- *Plant species expected to be better adapted to future conditions, especially where natural regeneration is slow or absent*
- *Create novel communities where the level of disturbance necessitates intensive remediation efforts to recover desired ecosystem services or characteristics (e.g. tree cover)*
- *Reduce or remove focus on eradication of nonnative or aggressive native species where they may form part of a novel community that is preferable to a lack of vegetation*

Strategy 9: Promote organizational and operational flexibility

Approach 9.1. Develop adaptive staffing and budgeting strategies

Examples of adaptation tactics include:

- *Cross train staff to prepare for short time frame/ high effort projects*
- *Implement new agreements with partners to increase implementation capacity*
- *Consider establishing a dedicated staff person to navigate partnerships and agreements*
- *Strategically use single-year funds*

Approach 9.2. Explicitly consider future and changing ecological conditions during the planning process and adaptive management cycle

Examples of adaptation tactics include:

- *Devise flexible management protocols to avoid rigid requirements to restore historic conditions*
- *Explicitly consider opportunities created by a longer prescribed burning season*
- *Build 'if/then' statements before fire or other disturbance events to plan and prepare for multiple future management scenarios*

Approach 9.3 Facilitate and streamline information management and sharing

Examples of adaptation tactics include:

- *Digitize documents that only exist in hard copy*
- *Promote file-sharing technology*
- *Create new opportunities to formally share success stories or outcomes of pilot projects*
- *Develop systems for effective communication within and between agencies and organizations*

Strategy 10: Promote fire-adapted human communities

Approach 10.1 Increase fuel reduction treatments in the wildland-urban interface

Examples of adaptation tactics include:

- *Implement mechanical thinning in areas adjacent to developed areas and structures*
- *Develop spatial priorities for implementation of thinning or other fire mitigation efforts*

Approach 10.2. Actively promote broad social awareness and Increase education and about anticipated effects of climate change on local fire regimes at all scales

Examples of adaptation tactics include:

- *Share climate adaptation plans and examples of implementation with the public*
- *Explicitly address climate adaptation in agency planning documents made available to the public*
- *Communicate example of climate adaptation efforts that have social benefits to stakeholders and the public (e.g. increased opportunities for products like fuelwood)*