Congressional Research Service
Informing the legislative debate since 1914

Hazardous Fuels and Wildfire Mitigation: Background and Congressional Considerations

December 29, 2025

Congressional Research Service
https://crsreports.congress.gov
R48779

CRS REPORT
Prepared for Members and
Committees of Congress

Hazardous Fuels and Wildfire Mitigation: Background and Congressional Considerations

SUMMARY

R48779

December 29, 2025

Alicyn R. Gitlin
Analyst in Natural Resources Policy

Hazardous fuels are combustible vegetation that accumulates on the landscape, presenting a latent threat of starting and spreading wildfires that resist control. Land managers mitigate hazardous fuels for various reasons, including protecting human life and property; protecting desired uses or resources threatened by fire, known as *values at risk*; and promoting overall ecosystem health. Fire practitioners use specific terms and concepts, some of which are standardized, to discuss hazardous fuels.

Fire has performed a functional role across much of North America, determining vegetation structure and composition on forested and non-forested land. A composite of fire properties typical of a place is described as a *fire regime*; some attributes of fire regimes are standardized in scientific and policy documents or statute.

Fuel treatments are the means by which land managers alter hazardous fuels to influence potential fire behavior. The most prevalent approaches for reducing fuels are burning and mechanical treatments (involving tools or machinery). Other approaches include chemical (herbicide) and biological (i.e., grazing, insect) controls. Each approach has benefits and drawbacks.

Hazardous fuels and their associated wildfire threats cross land management and ownership boundaries. Five federal agencies across two departments manage hazardous fuels on federal lands: the Forest Service (FS), under the U.S. Department of Agriculture, and the Bureau of Land Management (BLM), the National Park Service (NPS), the Fish and Wildlife Service (FWS), and the Bureau of Indian Affairs (BIA), under the Department of the Interior.

Congress has, at times, provided specific authorities related to hazardous fuels management on federal lands. Prominent among these is the Healthy Forests Restoration Act (HFRA; 16 U.S.C. §§6501 et seq.), which pertains to the National Forest System, managed by the FS, and to the public lands managed by BLM. HFRA includes provisions related to planning, implementation, and administrative processes for specified projects, including hazardous fuel treatments. Congress also has enacted authorities to facilitate collaborative hazardous fuels mitigation across land ownerships. The federal government also helps nonfederal groups address hazardous fuels on nonfederal lands, generally by providing financial or technical assistance.

Congress regularly considers legislation related to hazardous fuels management on federal and nonfederal lands. Bills introduced in the 119th Congress would affect the planning, implementation, and oversight of fuels mitigation projects, as well as the workforce responsible for fuels management. Questions that Congress may consider regarding whether and how to address hazardous fuels include the following:

- Do existing authorities and programs adequately address hazardous fuels mitigation?
- What issues impact the pace and scale of project implementation?
- How do agencies track progress in a consistent manner that enables oversight while incentivizing effective fuel treatments where they are needed most?

Contents

Tables

Appendixes

Contacts

Overview

Congressional debates regarding hazardous fuels surround whether and how to manage hazardous fuels to promote resilient landscapes and community protection, as well as how to plan, report on, and measure the success of fuels mitigation projects. The 108th Congress passed legislation, the Healthy Forests Restoration Act (HFRA), to address "planning, prioritizing, and implementing hazardous fuel reduction projects."[1] Congress also faces decisions about the federal government's role in assisting nonfederal land owners with fuels mitigation projects.

Hazardous fuels are combustible vegetation that accumulates on the landscape, presenting a threat of starting and spreading wildfires that resist control. Hazardous fuels and their associated wildfire threats cross land management and ownership boundaries. Five wildland fire management agencies (WFMAs) across two departments are responsible for the majority of hazardous fuels mitigation on federal lands—the Forest Service (FS), under the U.S. Department of Agriculture (USDA), and the Bureau of Land Management (BLM), the National Park Service (NPS), the Fish and Wildlife Service (FWS), and the Bureau of Indian Affairs (BIA), under the Department of the Interior. The federal government also provides assistance to nonfederal groups to address hazardous fuels on nonfederal lands.

Federal and nonfederal land managers mitigate hazardous fuels (often called *hazardous fuel reduction* or *fuel treatments*) for various reasons. These reasons include altering fire behavior; protecting human life and property; protecting other desired uses or resources threatened by fire, known as *values at risk*; and promoting overall ecosystem health. Much of the debate surrounding hazardous fuels and wildfire mitigation focuses on how to protect life and property in the *wildland-urban interface* (WUI), where human development abuts undeveloped wildlands.

Fuel treatments are the means by which land managers alter hazardous fuels to influence potential fire behavior. The most prevalent approaches for reducing fuels are burning and *mechanical treatments* (involving tools or machinery). Other approaches include chemical (herbicide) and biological (e.g., grazing, insect) controls. Land managers choose mitigation approaches on the basis of various factors, such as cost, terrain, human safety, wildlife occupancy, public opinion, workforce, and local industries.

This report begins with an explanation of hazardous fuels mitigation terminology, concepts, and practice. Then it provides background on the role of the federal government and the principal laws and policies affecting the management of hazardous fuels on federal and nonfederal lands. The report concludes by discussing some issues Congress may consider that concern hazardous fuels mitigation. Finally, appendices discuss fire regime classifications and legislation introduced in the 119th Congress that could affect hazardous fuels mitigation policy or implementation.

Concepts and Terminology

Although the terms *fuels* and *hazardous fuels* are widely used in scientific, policy, and advocacy contexts, they and other synonymous terms have no formal, standardized definition.[2] For the

[1] Healthy Forests Restoration Act (HFRA; 16 U.S.C. §§6501 et seq.).

[2] Phrases such as *hazardous fuels*, *biomass fuels*, and *vegetative fuels* generally are interchangeable. In statute, *hazardous fuels* is commonly used. The term *biomass* is often applied when there is a potential economic value for combustible materials extracted from the landscape. For examples of uses of *hazardous fuels* in various contexts, see 16 U.S.C. §§6511 et seq., 16 U.S.C. §6704, and 43 U.S.C. §1748b, and of uses of *biomass* in various contexts, see 16 U.S.C. §7303, 16 U.S.C. §6592b, and 7 U.S.C. §8113. For an analysis of biomass definitions, see CRS Report R40529, *Biomass: Comparison of Definitions in Legislation*, by Kelsi Bracmort.

purposes of this report, *fuels* are defined as combustible vegetative material.[3] *Hazardous fuels* are defined as "a fuel complex defined by kind, arrangement, volume, condition, and location that presents a threat of ignition and resistance to control."[4] A *fuel complex* is an assemblage of fuels.[5] Each of the elements (fuel kind, fuel arrangement, fuel volume, and fuel condition) has a commonly understood definition (see **Table 1**).

No single statutory definition of *hazardous fuels* applies to all public lands.[6] Similarly, no broadly applicable definition appears in statute for *hazardous fuel reduction projects*. Existing definitions pertain to specific areas of federal land or other specific circumstances. In particular, statute defines certain activities on federal lands as "authorized hazardous fuel reduction project[s]" for the purpose of HFRA.[7] The definition generally does not apply beyond the specified areas and parameters defined in HFRA, discussed in the "The Healthy Forests Restoration Act" section of this report.

Table 1. Elements of Hazardous Fuels

Term	Definition
Fuel Kind or Fuel Type	"An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions." Fuel types include grass, grass/shrub, shrub, timber understory, timber litter, and *slash/blowdown* (debris from natural or human-caused events such as wind or logging).[a] Some additional fuel characteristics include the following: • *Heavy fuels*: "Fuels of large diameter such as snags, logs, large limbwood, which ignite and are consumed more slowly than flash fuels." • *Light (fine) fuels*: "Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter.... These fuels readily ignite and are rapidly consumed by fire when dry." • *Flash fuels*: "Highly combustible fine fuels such as grass, leaves, draped pine needles, fern, tree moss and some kinds of slash, which ignite readily and are consumed rapidly when dry." • *Live fuels*: "Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences." • *Dead fuels*: "Fuels with no living tissue in which moisture content is governed almost entirely by absorption or evaporation of atmospheric moisture (relative humidity and precipitation)."

[3] Many other types of fuels exist, including oil, natural gas, and nuclear, and some could be considered hazardous. This report does not address these other types of fuels.

[4] See National Wildfire Coordinating Group (NWCG), *Glossary of Wildland Fire*, PMS 205, https://www.nwcg.gov/publications/pms205/nwcg-glossary-of-wildland-fire-pms-205 (hereinafter NWCG Glossary). The NWCG is the federal interagency coordinating and standard-setting group for wildland fire, and the NWCG Glossary contains definitions for most terminology used by wildland fire management agencies in the U.S. Department of Agriculture (USDA) and the Department of the Interior (DOI). Other agencies may repeat this definition in their policies and guidance. For example, see Forest Service (FS), "Hazardous Fuels Management and Prescribed Fire," in *Forest Service Manual 5140*.

[5] Mark J. Schroeder and Charles C. Buck, "Weather and Fuel Moisture," in *A Guide for Application of Meteorological Information to Forest Fire Control Operations*, PMS 425-1, NWCG, May 1970, https://www.nwcg.gov/publications/pms425-1/11-weather-and-fuel-moisture (hereinafter NWCG, "Weather and Fuel Moisture").

[6] For examples of the use of *hazardous fuel(s)* in statute in various contexts, see 16 U.S.C. §§6511 et seq., 16 U.S.C. §6704, and 43 U.S.C. §1748b. Hazardous fuels are defined in regulation for the Colorado and Idaho Roadless Areas (36 C.F.R. §294.41 and 36 C.F.R. §294.21).

[7] 16 U.S.C. §6511(2), 16 U.S.C. §6512(a).

Fuel Arrangement	"A general term referring to the spatial distribution and orientation of fuel particles or pieces." • *Fuel continuity*: "The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread."
Fuel Loading or Fuel Volume	"The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area. This may be available fuel (consumable fuel) or total fuel and is usually dry weight."
Fuel Condition	"Relative flammability of fuel as determined by fuel type and environmental conditions."

Source: Definitions from National Wildfire Coordinating Group, *Glossary of Wildland Fire*, PMS 205, https://www.nwcg.gov/publications/pms205/nwcg-glossary-of-wildland-fire-pms-205.

a. Northwest Fire Science Consortium, "What Is Fuel?," https://www.nwfirescience.org/sites/default/files/publications/FIREFACTS_FUELS_0.pdf.

Hazardous Fuels and Fire Behavior

Three basic components necessary to start and sustain a fire are a heat source, oxygen, and fuel—a concept known as the *fire triangle*. Wildland fire practitioners refer to a wildland fire behavior triangle with three factors: weather, topography, and fuel.[8] Land managers mitigate fuels to influence fire behavior. Land managers and fire practitioners use specific terms and concepts to talk about hazardous fuels and wildland fire behavior, which are defined in **Table 1** and discussed below.

Wildland firefighters classify *fuel types* to predict a fire's heat output (*fire intensity*, sometimes indicated as *flame lengths*) and rate of spread.[9] Within each fuel type, fuel moisture, chemistry, and density all determine flammability, with moisture being the most important factor.[10] Dead fuels dry more quickly than live fuels.[11] The moisture content of live fuels varies seasonally, whereas the moisture in dead fuels depends on recent and ongoing weather.[12] Some species ignite more readily and burn hotter than others.[13] Fine, flash fuels—especially grasses—dry out quickly, ignite easily, and spread fire rapidly.[14] Large, heavy fuels with less surface area per volume take longer to absorb moisture, and to lose moisture, than fine fuels.

[8] National Park Service (NPS), "Wildland Fire Behavior," February 16, 2017, https://perma.cc/6PRC-VJ7G.

[9] Northwest Fire Science Consortium, "What Is Fuel?," https://www.nwfirescience.org/sites/default/files/publications/FIREFACTS_FUELS_0.pdf; NWCG, *NWCG Guide to Fire Behavior Assessment*, PMS 437-1, NFES 2636, December 2024, pp. 52-64, https://www.nwcg.gov/publications/pms437-1; Joe H. Scott and Robert E. Burgan, *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, General Technical Report RMRS-GTR-153, USDA, FS, Rocky Mountain Research Station (RMRS), June 2005, pp. 9-12, https://training.nwcg.gov/dl/s290/s-290-usfs-standard-fire-behavior-fuel-models.pdf.

[10] NPS, "Wildland Fire Behavior," February 16, 2017, https://perma.cc/6PRC-VJ7G.

[11] Ariel Cowan et al., *Prescribed Fire Basics: Fuels*, EM 9386, Oregon State University, April 2023, https://extension.oregonstate.edu/sites/extd8/files/documents/12581/osu-rx-modules-fuels-em9386.pdf (hereinafter Cowan et al., *Prescribed Fire Fuels*).

[12] NWCG, "Weather and Fuel Moisture"; NPS, "Understanding Fire Danger," April 15, 2025, https://www.nps.gov/articles/understanding-fire-danger.htm.

[13] Cowan et al., *Prescribed Fire Fuels*; Shusmita Saha and Jeanette Cobian-Iñiguez, "Effect of Fuel Structure and Species on Grassy Fuel Ignition: Insights from Bench Scale Experiments and Thermogravimetric Analysis," *Fire and Materials*, vol. 49, no. 5 (August 2025), pp. 623-641; Brad Smith, *Texas Wildland Fuel, Fuel Model Guide*, Texas A&M Forest Service, 2016 (hereinafter Texas A&M Forest Service, *Texas Fuel Model Guide*); NWCG, "Weather and Fuel Moisture."

[14] John Rizza et al., *Prescribed Fire Basics: Fire Behavior*, Oregon State University Extension Service, EM9341, (continued...)

Fuel arrangement, in particular *fuel continuity* (the extent that fuels are contiguous without gaps), affects a fire's ability to sustain combustion and spread.[15] Fuel continuity can be vertical or horizontal. Forest fuels are arranged on the ground (*surface fuels*), between the surface and the treetops (*ladder fuels*), and in the canopy (*crown fuels*). Ladder fuels create vertical continuity between the surface and crown fuels, lowering the amount of heat or wind required to bring fire from the surface into the crown.[16]

Ladder fuels are critical to determining how fires that burn during extreme weather conditions alter or disrupt forests (*fire severity*).[17] When ladder fuels conduct fire into the crown of an individual or small group of trees, it is called *torching*.[18] During high winds, a low-intensity *surface fire* can jump from the forest floor and move through the tree canopy, becoming a wind-driven, high-intensity *active crown fire* that advances through both the canopy and the surface fuels.[19] Active crown fires sustain greater rates of spread in forests than surface fires.[20] A *conflagration* is a rapidly moving, destructive fire.[21]

Fuel type and fuel arrangement affect the interaction of fire and wind. For example, grassland fires generally spread faster than forest fires.[22] This is partly because dense forests slow the wind speed.[23] Conflagrations are often spread by *spotting*, which occurs when burning trees and twigs

---

February 2022, https://extension.oregonstate.edu/sites/extd8/files/documents/12581/osu-rx-modules-fire-behavior-0423.pdf (hereinafter Rizza et al., *Fire Behavior*); Cowan et al., *Prescribed Fire Fuels*; Texas A&M Forest Service, *Texas Fuel Model Guide*.

[15] Stacy Drury, "Fuel Continuity," in *Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires*, ed. Samuel Manzello (Springer, 2019); NWCG Glossary.

[16] Miguel G. Cruz and Martin E. Alexander, "The Start, Propagation, and Spread Rate of Crown Fire," *Fire Management Today*, vol. 73, no. 4 (2014), p. 19 (hereinafter Cruz and Alexander, "Start and Spread of Crown Fire").

[17] Cruz and Alexander, "Start and Spread of Crown Fire"; Christopher R. Hakkenberg et al., "Ladder Fuels Rather Than Canopy Volumes Consistently Predict Wildfire Severity Even in Extreme Topographic-Weather Conditions," *Communications Earth & Environment*, vol. 5, no. 721 (November 20, 2024) (hereinafter Hakkenberg et al., "Ladder Fuels").

[18] Cruz and Alexander, "Start and Spread of Crown Fire"; Hakkenberg et al., "Ladder Fuels."

[19] NWCG, "Active Crown Fire Behavior," in *Fire Behavior Field Reference Guide*, PMS 437, April 1, 2025, https://www.nwcg.gov/publications/pms437/crown-fire/active-crown-fire-behavior.

[20] NWCG, "Weather: Estimating Winds for Fire Behavior," in *Fire Behavior Field Reference Guide*, PMS 437, April 1, 2025, https://www.nwcg.gov/publications/pms437/weather/estimating-winds-for-fire-behavior; NWCG, "Fuels: Canopy Fuel Characteristics," in *Fire Behavior Field Reference Guide*, PMS 437, April 1, 2025, https://www-nwcg-stg.fs2c.usda.gov/publications/pms437/fuels/canopy-fuel-characteristics; Wei-Ting Hung et al., "Evaluation of an In-Canopy Wind and Wind Adjustment Factor Model for Wildfire Spread Applications Across Scales," *Journal of Advances in Modeling Earth Systems*, vol. 16, no. 7 (July 2024) (hereinafter Hung et al., "In-Canopy Wind").

[21] NWCG Glossary.

[22] Martin E. Alexander and Miguel G. Cruz, "What Are the Safety Implications of Crown Fires?," in *Proceedings of 11th International Wildland Fire Safety Summit*, Missoula, MT, April 2011, pp. 6-7, https://www.iawfonline.org/wp-content/uploads/2021/04/2011-FSS-Proceedings.pdf; NWCG Glossary; Cruz and Alexander, "Start and Spread of Crown Fire"; Northwest Fire Science Consortium, "What Are Types of Fire?," https://www.nwfirescience.org/sites/default/files/publications/Types%20of%20Fire.pdf; Interagency Fuels Treatment Decision Support System (IFTDSS), IFTDSS Help Center, "Crown Fire Activity," June 25, 2025, https://iftdss.firenet.gov/firenetHelp/help/pageHelp/content/20-models/lfb/out/crownactivitylfb.htm.

[23] NWCG, "Weather: Estimating Winds for Fire Behavior," in *Fire Behavior Field Reference Guide*, PMS 437, April 1, 2025, https://www.nwcg.gov/publications/pms437/weather/estimating-winds-for-fire-behavior; NWCG, "Fuels: Canopy Fuel Characteristics," in *Fire Behavior Field Reference Guide*, PMS 437, April 1, 2025, https://www-nwcg-stg.fs2c.usda.gov/publications/pms437/fuels/canopy-fuel-characteristics; Hung et al., "In-Canopy Wind."

produce *firebrands*—flaming hot fuel particles carried by wind and convection currents—that cause new ignitions ahead of the fire's leading edge (*fire front*).[24]

Fuel loading (or *fuel load*) is the total amount of fuel available to burn. Fuel loading influences fire intensity and potential fire duration. Because the fuel loading consists of the entirety of fuels that can be consumed in a fire, it determines the potential amount of smoke emissions.[25] For these reasons, an estimate of fuel loading is essential to safely working with fire.[26]

The *fuel condition* is the result of recent and ongoing weather interacting with the fuel complex.[27] Several available indexes model fuel and weather conditions to estimate fire risk across large areas and aid in decisionmaking.[28]

The location of fuels adds to the wildfire hazard and vulnerability those fuels present.[29] Greater vulnerability to fire exists when fuels are in proximity to *values at risk*—things people care about, such as homes or sensitive wildlife habitats.[30] Hazardous fuels might be within (*intermix*) or adjacent to (*interface*) values at risk. Local factors such as topography, weather patterns, and recreational usage will influence where fires are likely to ignite, how they will spread, and their resistance to control.

Encroachment of human development on forest and grassland systems complicates wildfire response and increases the number of lives and structures at risk.[31] The area covered by the WUI, where land developed by humans and undeveloped wildlands intermix or interface in the United States, grew by one-third between 1990 and 2010.[32] According to some researchers, human

[24] Rizza et al., *Fire Behavior*; Samuel L. Manzello et al., "Role of Firebrand Combustion in Large Outdoor Fire Spread," *Progress in Energy and Combustion Science*, vol. 76 (January 2020); Samuel L. Manzello et al., "Firebrand Generation from Burning Vegetation," *International Journal of Wildland Fire*, vol. 16 (2007), pp. 458-462; Mohamad El Houssami et al., "Experimental Procedures Characterising Firebrand Generation in Wildland Fires," *Fire Technology*, vol. 52 (2016), pp. 731-751; NPS, "Wildland Fire Behavior," February 16, 2017, https://perma.cc/6PRC-VJ7G.

[25] Pamela G. Sikkink et al., *Field Guide for Identifying Fuel Loading Models*, USDA, FS, RMRS, RMRS-GTR-225, May 2009, https://www.fs.usda.gov/rm/pubs/rmrs_gtr225.pdf (hereinafter Sikkink et al., *Field Guide for Identifying Fuel Loading Models*); Northwest Fire Science Consortium, "What Is Fire Intensity?," https://www.nwfirescience.org/sites/default/files/publications/FIREFACTS_Intensity_0.pdf (hereinafter Northwest Fire Science Consortium, "What Is Fire Intensity?").

[26] Northwest Fire Science Consortium, "What Is Fire Intensity?"; Cowan et al., *Prescribed Fire Fuels*; Sikkink et al., *Field Guide for Identifying Fuel Loading Models*.

[27] NWCG, "Weather and Fuel Moisture."

[28] CRS In Focus IF12884, *Fire Weather: Background and Forecasting*, by Eva Lipiec; NPS, "Understanding Fire Danger," April 15, 2025, https://www.nps.gov/articles/understanding-fire-danger.htm; U.S. Geological Survey (USGS), "Fire Danger Forecast," accessed August 4, 2025, https://www.usgs.gov/fire-danger-forecast.

[29] Sara Brown et al., *Science You Can Use 101: Wildfire Risk*, USDA, FS, RMRS, 2024, https://www.fs.usda.gov/rm/pubs_journals/rmrs/sycu/2024/sycu101_2024_wildfire_risk.pdf (hereinafter Brown et al., *Wildfire Risk*).

[30] Brown et al., *Wildfire Risk*.

[31] James R. Karels and Monica Corbin, *Wildland Urban Interface: A Look at Issues and Resolutions: A Report of Recommendations for Elected Officials, Policymakers and All Levels of Government, Tribal and Response Agencie*s, Federal Emergency Management Agency (FEMA), U.S. Fire Administration (USFA), June 2022, https://www.usfa.fema.gov/downloads/pdf/publications/wui-issues-resolutions-report.pdf (hereinafter FEMA, USFA, *Wildland Urban Interface*).

[32] Between 1990 and 2010, the land area in the WUI grew by 33%, from 224,325 square miles to 297,298 square miles (581,000 square kilometers to 770,000 square kilometers), and the number of new houses in the WUI grew by 41% (30.8 million to 43.4 million). Volker C. Radeloff et al., "Rapid Growth of the U.S. Wildland-Urban Interface Raises Wildfire Risk," *Proceedings of the National Academy of Sciences, USA*, vol. 115, no. 13 (March 27, 2018), pp. 3314-3319; FEMA, USFA, *Wildland Urban Interface*.

activity and certain development patterns correlate with increasing wildfire ignitions.[33] Much of the debate surrounding hazardous fuels and wildfire mitigation centers on how to protect life and property in the WUI.

Fuel treatments incorporate the means by which land managers alter hazardous fuels to influence potential fire behavior—generally, to reduce the risk of ignitions, decrease fire intensity, and/or reduce fire spread. To do so, fuel treatments might seek to rearrange or resize fuels, reduce fuel loading, remove undesirable species, break up horizontal or vertical fuel continuity, or enact some combination of these approaches, in accordance with their goals. Many hazardous fuel reduction activities affect more than one element of fuels on the landscape and therefore may alter several different aspects of fire behavior.

Fire Regimes: Fire over Time and Space

A *fire regime* is a composite of fire properties "typical" of a place, including the behavior of individual fires (e.g., intensity, rate of spread) and the behavior of fire over time (e.g., frequency, seasonality). Fire has performed a functional role across North America, determining vegetation structure and composition in many ecosystems. Vegetation and wildlife that evolved with a particular fire regime will tend to thrive in—and even depend on—that overall regime. Atypical fire behavior (e.g., too frequent or too rare, too hot or not hot enough) might harm some species or affect ecosystem functioning.[34]

Fire Regime Condition Class (FRCC) is a tool for describing fire's historic role in an ecosystem (*historical fire regime*) and how current vegetation conditions differ from a reference period prior to Euro-American settlement (*condition class*).[35] FRCC definitions are based on a 2002 FS publication.[36]

The FS recognizes a total of five historical fire regimes that generally define natural fire frequency and severity, as well as whether fire typically would burn mostly on the ground at low temperature (*low-severity*), produce a mixture of effects on the landscape (*mixed-severity*), or clear areas entirely for new growth (*stand-replacement*).[37] The FS defines three condition classes, forming a continuum based on departure from historical fire regime, changes in vegetation attributes, and risk of losing key ecosystem components.[38] Condition class one represents the most similarity to the historical "norm" (i.e., prior to Euro-American settlement), whereas condition class three is most dissimilar to the historic norm.

---

[33] Alexandra D. Syphard et al., "Human Influence on California Fire Regimes," *Ecological Applications*, vol. 17, no. 5 (July 2007), pp. 1388-1402; Jennifer K. Balch et al., "Human-Started Wildfires Expand the Fire Niche Across the United States," *Proceedings of the National Academy of Sciences, USA*, vol. 114, no. 11 (March 14, 2017), pp. 2946-2951.

[34] Luke T. Kelly and Lluís Brotons, "Using Fire to Promote Biodiversity," *Science*, vol. 355, no. 6331 (March 24, 2017), pp. 1264-1265; Kendra K. McLauchlan et al., "Fire as a Fundamental Ecological Process: Research Advances and Frontiers," *Journal of Ecology*, vol. 108, no. 5 (September 2020), pp. 2047-2069 (hereinafter McLauchlan et al., "Fire as a Fundamental Process"); Thomas A. Spies et al., "Challenges and a Checklist for Biodiversity Conservation in Fire-Prone Forests: Perspectives from the Pacific Northwest of USA and Southeastern Australia," *Biological Conservation*, vol. 145, no. 1 (January 2012), pp. 5-14.

[35] Kirsten M. Schmidt et al., *Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management*, USDA, FS, RMRS, General Technical Report RMRS-GTR-87, April 2002, https://www.fs.usda.gov/rm/pubs/rmrs_gtr087.pdf (hereinafter Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*).

[36] Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*.

[37] Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*.

[38] Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*.

HFRA codified definitions for three fire regimes and two condition classes for purposes including prioritizing, authorizing, and assessing hazardous fuel reduction projects under the act.[39] (See **Table A-1** and **Table A-2**.) Specifically, HFRA provides certain tools for environmental compliance and project expediting in areas with designated fire regimes, when they fall into designated condition classes.[40] **Table A-1** and **Table A-2** provide the FS descriptions and statutory definitions for fire regimes and condition classes.

FRCC is one way to describe landscape conditions. FRCC is principally relevant for HFRA projects and projects that aim to restore patterns and processes to a *historic range of variability* or *historic range and variation* (HRV). Debate exists over whether restoration to HRV is desirable in places with significantly changed land uses, species compositions, or climatic conditions.[41]

Fire on Non-Forested Lands

Wildfire policy debates often focus on forests. However, several of the most destructive fires in recent years began on non-forested lands. Grass and shrub fires in the United States burned 64% of homes destroyed in wildfires between 1990 and 2020 (10,890 homes).[42] The 2025 Los Angeles County wildfires, the costliest wildfires in U.S. history, began in grass and shrub fuel types.[43]

Some features of grass and shrub fuel types create particular challenges. Low-elevation grasses and shrubs grow rapidly in response to moisture fluctuations—far more rapidly than timber fuels—meaning fuel loading in non-forested systems increases quickly after wet seasons. Fine fuels dry out quickly, becoming flash fuels with higher risk of ignition than heavy fuels.[44] The end result is ecosystems where fire risk may change rapidly over short periods of time and where conditions facilitate more frequent ignitions and rapid spread of fires.

Some invasive (i.e., nonnative) plants can change the fire regime, for example by increasing horizontal fuel continuity or changing the ratio of dead to live fuels, enabling fires to quickly spread.[45] When dead biomass dries out adjacent to ignition sources—such as highways—or

---

[39] 16 U.S.C. §6511(4-5); 16 U.S.C. §6511(8-10); 16 U.S.C. §6512.

[40] 16 U.S.C. §6512.

[41] Robert E. Keane et al., "The Use of Historical Range and Variability (HRV) in Landscape Management," *Forest Ecology and Management*, vol. 258 (2009), pp. 1025-1037; Robert E. Keane and Rachel A Loehman, "Historical Range and Variation (HRV)," in *Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires*, ed. Samuel L. Manzello (Springer, 2019).

[42] Volker C. Radeloff et al., "Rising Wildfire Risk to Houses in the United States, Especially in Grasslands and Shrublands," *Science*, vol. 382, no. 6671 (November 10, 2023), pp. 702-707 (hereinafter Radeloff et al., "Rising Wildfire Risk").

[43] Jean Eaglesham, "Los Angeles Fire Damage Likely to Be Costliest Blaze in U.S. History," *Wall Street Journal*, January 9, 2025; CRS In Focus IF12871, *January 2025 Los Angeles County Wildfires*, coordinated by Diane P. Horn and Alicyn R. Gitlin.

[44] Jon E. Keeley and Alexandra D. Syphard, "Different Fire-Climate Relationships on Forested and Non-Forested Landscapes in the Sierra Nevada Ecoregion," *International Journal of Wildland Fire*, vol. 24 (2015), pp. 27-36; Daniel L. Swain et al., "Hydroclimate Volatility on a Warming Earth," *Nature Reviews Earth & Environment*, vol. 6 (January 9, 2025), pp. 35-50; USDA, FS, RMRS, Fire Effects Information System (FEIS) "Fire Regimes of Plains Grassland and Prairie Ecosystems," accessed June 17, 2025, http://www.fs.usda.gov/database/feis/fire_regimes/PlainsGrass_Prairie/all.html; Zhengpeng Li et al., "Assessment of Fire Fuel Load Dynamics in Shrubland Ecosystems in the Western United States Using MODIS Products," *Remote Sensing*, vol. 12, no. 12 (2020).

[45] Martin C. Holdrege et al., "Wildfire Probability Estimated from Recent Climate and Fine Fuels Across the Big Sagebrush Region," *Fire Ecology*, vol. 20, no. 22 (February 28, 2024); Bethany A. Bradley et al., "Cheatgrass (*Bromus tectorum*) Distribution in the Intermountain Western United States and Its Relationship to Fire Frequency, Seasonality, and Ignitions," *Biological Invasions*, vol. 20 (June 2018), pp. 1493-1506 (hereinafter Bradley et al., "Cheatgrass and Fire"); CRS In Focus IF11011, *Invasive Species: A Brief Overview*, by Pervaze A. Sheikh.

values at risk—such as homes—the overall wildfire risk increases, sometimes leading to disaster (as has occurred on the islands of Hawai'i).[46]

Fuels Mitigation Approaches

Land managers mitigate hazardous fuels for various reasons. Such reasons include protecting human life and property, protecting other values at risk, promoting ecosystem health, and achieving a combination of these aims. Land managers try to choose mitigation approaches, alone or in combination, that best achieve their goals under prevailing ecological, legal, logistical, and economic conditions. Various factors, such as cost, topography, human safety, wildlife occupancy, public perception, workforce availability, and nearby local industries, might affect project design. Managers also may choose project approaches that might generate co-benefits, such as choosing land management techniques that benefit fire-dependent species, protect water quality, improve wildlife habitat, or enhance other resources. The benefits and risks of various hazardous fuels mitigation approaches are sometimes debated, and some groups have published recommendations.[47] Two of the most prevalent approaches for reducing fuels are burning and mechanical treatments (or a combination of the two). Other approaches include chemical (herbicide) and biological (e.g., grazing, insect) controls. Each approach has various benefits, costs, risks, and limitations, as described below.

Fire as a Fuels Mitigation Approach

Prescribed Fires and Use of Wildland Fire

The use of fire to mitigate hazardous fuels and reduce the chances for future extreme or uncharacteristic fire behavior is an established, widely used practice. Burning to achieve resource benefits can occur as a *prescribed fire*, where the ignitions are planned, or as an *unplanned ignition* (i.e., lightning) allowed to burn under supervision. For the purposes of this report, the phrase *use of wildland fire* means applications of fire for resource benefits with either planned or unplanned ignitions (see text box below entitled, "The Overlapping Terms That Define Wildland Fire Response"). Land managers respond with *fire suppression* activities (efforts to extinguish a fire) when fires present an unacceptable level of threat according to predetermined criteria or as determined with the aid of a decision support system.[48]

---

[46] Cost of Government Commission, County of Maui, *Report on Wildfire Prevention and Cost Recovery on Maui*, July 2021; CRS Insight IN12218, *August 2023 Wildfires in Hawaii*, coordinated by Linda R. Rowan.

[47] The Wildland Fire Mitigation and Management Commission (hereinafter Wildland Fire Commission), authorized by the Infrastructure Investment and Jobs Act (IIJA; P.L. 117-58, §§70201 et seq.), made several recommendations about topics discussed in this report. See, for example, Wildland Fire Commission, *On Fire: The Report of the Wildland Fire Mitigation and Management Commission*, September 2023, https://www.usda.gov/sites/default/files/documents/wfmmc-final-report-09-2023.pdf (hereinafter Wildland Fire Commission, *On Fire*); relevant sections include "Enabling Beneficial Fire," "Use of Beneficial Fire," "Enabling Indigenous Stewardship," "Addressing Smoke Impacts," "Recruiting and Retaining the Workforce," and "Tribal Equity."

[48] USDA and DOI, *Guidance for Implementation of Federal Wildland Fire Management Policy*, February 13, 2009.

The Overlapping Terms That Define Wildland Fire Response

The terms that the federal wildland fire management agencies (WFMAs) and federal and nonfederal wildland firefighters, scientists, and policy professionals use to define wildland fires can lead to confusion. Many federal and nonfederal entities work together to plan for and respond to wildland fires. National offices such as the National Wildfire Coordinating Group (NWCG) and National Interagency Fire Center set standards and provide consistent information and terminology that is used by the WFMAs and the nonfederal entities that coordinate on wildland fire response. For the purpose of managing wildland fires under federal jurisdiction, the WFMAs distinguish between *prescribed fire*, meaning a planned ignition, and *wildfire*, meaning either an unplanned ignition or an *escaped prescribed fire* (a prescribed fire that exceeded, or is expected to exceed, its intended area). The WFMA definition of *wildland fire* includes both prescribed fires (within their prescribed parameters) and wildfires. The NWCG's *Glossary of Wildland Fire* defines the term *use of wildland fire* as "management of wildfire or prescribed fire to meet resource objectives specified in land/resource management plans."

The WFMAs manage all wildland fires under federal jurisdiction according to the same set of standardized decisionmaking policies, aiming to minimize risks and impacts while adhering to relevant planning documents. The federal decisionmaking framework allows wildland fires to be managed for one or more objectives that may change as the fire spreads or conditions evolve. However, the WFMAs manage the use of wildland fire according to the same overall decisionmaking framework, regardless of whether the ignition was planned or unplanned. These overlapping definitions, where all wildfires are wildland fires and not all wildland fires involve use of wildland fire, and where management decisions can change over time, may complicate communication about fire management. These overlapping terms also may cause confusion about fire's use in hazardous fuels reduction. Although a prescribed fire is always a planned ignition, *use of wildland fire* or similar terms can denote either a planned or an unplanned ignition source in scientific and policy documents.

Sources: U.S. Department of Agriculture (USDA) and Department of the Interior, *Guidance for Implementation of Federal Wildland Fire Management Policy*, February 13, 2009, pp. 11, 14, 16-17, 18, https://www.doi.gov/sites/doi.gov/files/uploads/2009-wfm-guidance-for-implementation.pdf; Interagency Standards for Fire and Fire Aviation Operations Group, National Interagency Fire (NIFC), *Interagency Standards for Fire and Fire Aviation Operations* ("*Red Book*"), January 2025, pp. 2-5, 148-159, https://www.nifc.gov/standards/guides/red-book; NWCG, *Glossary of Wildland Fire*, PMS 205, https://www.nwcg.gov/publications/pms205/nwcg-glossary-of-wildland-fire-pms-205; NIFC External Affairs, "Communicating Fire: Telling the Story Clearly, Consistently, and Professionally," https://www.nifc.gov/sites/default/files/document-media/CommunicatingFire-NIFC.pdf; Mary Taber et al., *Decision Making for Wildfires: A Guide for Applying a Risk Management Process at the Incident Level*, USDA, FS, Gen. Tech. Rep. RMRS-GTR-298WWW, June 2013, https://wfmrda.nwcg.gov/sites/default/files/docs/WFMRDA/Publications/Decision_Making_Wildfires_rmrs_gtr298.pdf. For additional information on terminology surrounding use of wildland fire, see Rachel Bean and Alexander Evans, *Managed Wildfire: A Research Synthesis and Overview*, Northern Arizona University Ecological Restoration Institute, 2023.

Qualified personnel or land owners might ignite prescribed fires in predetermined locations, under predetermined conditions, to meet desired resource objectives. To plan a prescribed fire, typically a specialist prepares a *burn plan* with criteria such as fuel moisture, wind speed, relative humidity, and smoke management that will determine the *burn window*, when a prescribed burn can occur.[49] These criteria in a burn plan are intended to maximize the likelihood of safely meeting objectives for the burn. In addition, prescribed burning generally is subject to various legal requirements, such as personnel qualifications, permitting, and liability considerations.

The costs of use of wildland fire are variable and, in some ways, unpredictable. Generally, researchers have found that use of wildland fire tends to be more cost-effective per acre than other fuels mitigation approaches.[50] However, ultimate costs for prescribed fires or use of

---

[49] NWCG, *NWCG Prescribed Fire Plan Template*, PMS 484-1, December 2021, https://www.nwcg.gov/publications/pms484-1; USDA, FS, Pacific Southwest Region, "Forest Service Professionals Prepare for a Prescribed Burn," April 4, 2023, https://www.fs.usda.gov/about-agency/features/professionals-prepare-for-prescribed-burn; Texas A&M Forest Service, "Writing a Burn Plan," accessed August 16, 2025, https://tfsweb.tamu.edu/forest-land/prescribed-fire/prescribed-burning-burn-managers/writing-a-burn-plan/.

[50] Timothy G. Holland et al., "The Management Costs of Alternative Forest Management Strategies in the Lake Tahoe (continued...)

wildland fires are difficult to predict for several reasons. For example, fires that escape containment are subject to suppression costs, leading to overall uncertainty regarding costs of use of wildland fire. Other considerations include the resource needs to monitor and contain the fire, the impact of burning on future wildfire risk, and the impact of the fire on long-term maintenance needs.[51]

A century of fire suppression in the United States has led to fuel buildup in many ecosystems. Many researchers assert that a policy of suppressing all fires will lead to less safe burn conditions in the long run, with larger and more severe fires.[52] Although all fire carries safety risks, fire often brings ecological benefits, such as restoring soil nutrients and supporting fire-adapted species.[53]

Cultural Burning

Cultural burning refers to the Indigenous practice of cultivating fire on the landscape and was a part of life for many Native Americans for millennia.[54] Cultural burning might be applied for fuels mitigation or other purposes. The reasons for cultural burns will vary between cultural affiliations. The Karuk Tribe, one Tribe that engages in cultural burning, offers this definition:

> Cultural burning is typically less formal [than prescribed burning], and is integrative of holistic knowledge of place to guide the timing and implementation of burning activities. Cultural burning implies the purposeful use of fire by a cultural group (e.g., family unit, Tribe, clan/moiety, society) for a variety of purposes and outcomes. The reasons for cultural burning can be quite extensive and range from maintenance of travel corridors,

Basin," *Ecology & Society*, vol. 27, no. 4 (2022) (hereinafter Holland et al., "Management Costs of Alternative Strategies"); Malcolm P. North et al., "Reform Forest Fire Management: Agency Incentives Undermine Policy Effectiveness," *Science*, vol. 349, no. 6254 (September 18, 2015), pp. 1280-1281 (hereinafter North et al., "Reform Forest Fire Management"); Alan A. Ager et al., "Tradeoffs Between U.S. National Forest Harvest Targets and Fuel Management to Reduce Wildfire Transmission to the Wildland Urban Interface," *Forest Ecology and Management*, vol. 434 (February 28, 2019), pp. 99-109 (hereinafter Ager et al., "Tradeoffs Between Targets and Fuel Management").

[51] Bruce R. Hartsough et al., "The Economics of Alternative Fuel Reduction Treatments in Western United States Dry Forests: Financial and Policy Implications from the National Fire and Fire Surrogate Study," *Forest Policy and Economics*, vol. 10, no. 6 (August 2008), pp. 344-354 (hereinafter Hartsough et al., "Economics of Fuel Reduction Treatments"); Hayley Hesseln, "The Economics of Prescribed Burning: A Research Review," *Forest Science*, vol. 46, no. 3 (2000), pp. 322-334; Holland et al., "Management Costs of Alternative Strategies"; James McIver et al., *Principal Short-Term Findings of the National Fire and Fire Surrogate Study*, USDA, FS, Pacific Northwest Research Station, General Technical Report PNW-GTR-860, 2012, https://www.fs.usda.gov/pnw/pubs/pnw_gtr860.pdf (hereinafter McIver et al., *National Fire and Fire Surrogate Study*); D. Evan Mercer et al., "Evaluating Alternative Prescribed Burning Policies to Reduce Net Economic Damages from Wildfire," *American Journal of Agricultural Economics*, vol. 89, no. 1 (2007); Michael H. Taylor et al., "The Economics of Fuel Management: Wildfire, Invasive Plants, and the Dynamics of Sagebrush Rangelands in the Western United States," *Journal of Environmental Management*, vol. 126 (2013), pp. 157-173; David Wear et al., *The Costs of Achieving Forest Resilience in California*, Resources for the Future, Working Paper 25-03, January 2025, pp. 16, 18, https://media.rff.org/documents/WP_25-03.pdf (hereinafter Wear et al., *Costs of Achieving Forest Resilience*).

[52] Mark R. Kreider et al., "Fire Suppression Makes Wildfires More Severe and Accentuates Impacts of Climate Change and Fuel Accumulation," *Nature Communications*, vol. 15, no. 2412 (March 25, 2024); North et al., "Reform Forest Fire Management"; Tony Schick and Jes Burns, "Efforts to Reduce Wildfire Risk Fall Short, Buck Science," *Oregon Public Broadcasting*, July 16, 2018.

[53] McLauchlan et al., "Fire as a Fundamental Process"; He et al., "Fire as a Key Driver of Earth's Biodiversity," *Biological Reviews*, vol. 94, no. 6 (December 2019), pp. 1983-2010 (hereinafter He et al., "Fire as a Key Driver of Earth's Biodiversity").

[54] See, for example, NPS, "Indigenous Fire Practices Shape Our Land," March 18, 2024, https://www.nps.gov/subjects/fire/indigenous-fire-practices-shape-our-land.htm.

> wildlife habitat improvement, attracting wildlife to a place, water stewardship, pest control, stewardship of cultural plants, conservation/protection, and even spiritual reasons.[55]

WFMAs might collaborate with *federally recognized Tribes* (hereinafter Tribes) or provide assistance for tribal members to enact cultural burns.[56] Some have recommended that federal agencies develop new procedures to proactively cooperate with cultural practitioners.[57] Cultural burning as historically practiced may be difficult to implement across some jurisdictions but may inform agency practices, or Tribes might be able to carry out burns with modifications in some cases.

Benefits and Risks of Use of Wildland Fire

Various reasons influence the choice to use fire as a fuels management technique. Some advantages of fire over other fuels management techniques include the following:

- Use of wildland fire tends to impede future fire progression or extent, and subsequent fires generally burn with reduced severity.[58]
- Fire may achieve certain ecological benefits or achieve them more easily than other means. For example, fire can affect soil properties, plant growth, and insect populations.[59] Some species rely on fire; hence management goals related to these species may not be achieved through non-fire means.[60]
- Under certain conditions, fire can reduce surface fuel loading and continuity across a large area, even in remote or difficult terrain.[61]

---

[55] Sara A. Clark et al., *Good Fire: Current Barriers to the Expansion of Cultural Burning and Prescribed Fire in California and Recommended Solutions*, Karuk Tribe, June 17, 2022, p. 3, https://karuktribeclimatechangeprojects.wordpress.com/wp-content/uploads/2022/06/karuk-prescribed-fire-rpt_2022_v2-1.pdf (hereinafter Clark et al., *Good Fire*).

[56] A *federally recognized Tribe* is an entity that is generally "eligible for the special programs and services provided by the United States to Indians because of their status as Indians" (25 C.F.R. §83.2).

[57] Clark et al., *Good Fire*.

[58] C. Alina Cansler et al., "Previous Wildfires and Management Treatments Moderate Subsequent Fire Severity," *Forest Ecology and Management*, vol. 504 (January 15, 2022); Theresa B. Jain et al., *Final Report: Effectiveness of Fuel Treatments at the Landscape Scale: State of Understanding and Key Research Gaps*, USDA, FS, RMRS, Joint Fire Sciences Program (JFSP) Project ID 19-S-01-2, December 2021 (hereinafter Jain et al., *Effectiveness of Fuel Treatments*); Sean A. Parks et al., "Wildland Fire as a Self-Regulating Mechanism: The Role of Previous Burns and Weather in Limiting Fire Progression," *Ecological Applications*, vol. 25, no. 6 (September 2015) (hereinafter Parks et al., "Fire as a Self-Regulating Mechanism"); Elizabeth L. Kalies and Larissa L. Yocom Kent, "Tamm Review: Are Fuel Treatments Effective at Achieving Ecological and Social Objectives? A Systemic Review," *Forest Ecology and Management*, vol. 375 (September 1, 2016), p. 7 (hereinafter Kalies and Yocom Kent, "Tamm Review: Fuel Treatments Objectives"); Rachel Bean and Alexander Evans, *Managed Wildfire: A Research Synthesis and Overview*, Northern Arizona University Ecological Restoration Institute, 2023 (hereinafter Bean and Evans, *Managed Wildfire Research Synthesis*); Kimberley T. Davis et al., "Tamm Review: A Meta-Analysis of Thinning, Prescribed Fire, and Wildfire Effects on Subsequent Wildfire Severity in Conifer Dominated Forests of the Western U.S.," *Forest Ecology and Management*, vol. 561 (April 2024) (hereinafter Davis et al., "Tamm Review: Effects on Wildfire Severity"); Susan J. Prichard et al., "Adapting Western North American Forests to Climate Change and Wildfires: 10 Common Questions," *Ecological Applications*, vol. 31, no. 8 (December 2021).

[59] McLauchlan et al., "Fire as a Fundamental Process"; He et al., "Fire as a Key Driver of Earth's Biodiversity"; McIver et al., *National Fire and Fire Surrogate Study*.

[60] McLauchlan et al., "Fire as a Fundamental Process"; He et al., "Fire as a Key Driver of Earth's Biodiversity."

[61] Eric E. Knapp et al., "Fuel Reduction and Coarse Woody Debris Dynamics with Early Season and Late Season Prescribed Fire in a Sierra Nevada Mixed Conifer Forest," *Forest Ecology and Management*, vol. 208 (2005), pp. 383-397.

- Fire reduces surface fuels without additional actions, and fire can reduce fuels remaining on the ground after mechanical or herbicide treatments.

Conversely, some disadvantages of fire as a hazardous fuels mitigation technique include the following:

- Fire presents a risk to life, property, and other resources and values if wildland fires escape containment.[62] Such fires are then *wildfires*, with all the costs and risks associated with fire suppression. Despite these risks and examples of when escaped fires have ended in tragedy, the FS points out that of approximately 4,500 prescribed fires per year, more than 99% go as planned.[63] However, the risk may affect public perception and lead to political and liability concerns, causing fire managers to refrain from using wildland fire.[64]
- The use of wildland fire is acceptable in only limited locations, times, and situations. Use of wildland fire depends on biophysical factors (e.g., weather), social factors (e.g., smoke impacts to communities), or a combination. These factors mean that some areas or some years may have very short burn windows when use of wildland fire is feasible.
- The use of wildland fire on federal lands is subject to the availability of qualified personnel and resources. In certain areas or at certain times (e.g., during wildfire season), this factor may limit use of wildland fire.[65]
- In addition to other considerations, smoke can be a significant health hazard during use of wildland fire. Research has associated wildfire smoke exposure with cardiovascular, respiratory, and brain diseases.[66] Several federal agencies

[62] For example, in 2022, two fires in New Mexico—Calf Canyon and Cerro Pelado—started when burned piles of slash remaining after mechanical treatments reignited months later. A third prescribed fire, Hermits Peak, escaped and merged with Calf Canyon. Altogether, the fires burned nearly 400,000 acres and several hundred homes, spurring the FS to temporarily pause all prescribed burns and review its national prescribed fire program. USDA, FS, *National Prescribed Fire Program Review*, September 2022, https://www.frames.gov/documents/usfs/USFS_20220908_National-Prescribed-Fire-Program-Review.pdf (hereinafter USDA, FS, *National Prescribed Fire Program Review*). In 2025, the Dragon Bravo fire in Arizona burned more than 145,500 acres and destroyed more than 113 structures, including the historic Grand Canyon Lodge, prompting closure of Grand Canyon National Park's North Rim. The fire was a natural ignition that the NPS initially managed for resource objectives, but the fire escaped containment. NIFC, "Incident Management Situation Report, Wednesday, August 20, 2025—0730 MDT," accessed August 20, 2025, https://www.nifc.gov/nicc-files/sitreprt.pdf; NPS, Grand Canyon National Park, "Grand Canyon National Park Temporarily Closes North Rim Due to White Sage Fire," July 10, 2025, https://perma.cc/9HJV-LNVP; NPS, Grand Canyon National Park, "Grand Canyon National Park Update on Dragon Bravo Fire," July 13, 2025, https://perma.cc/26L6-NNU4; Inciweb, "Dragon Bravo Fire Update - Last Update Unless Significant Activity Occurs 09-17-2025," https://inciweb.wildfire.gov/incident-publication/azgcp-dragon-bravo-fire/dragon-bravo-fire-update-last-update-unless-significant-activity-occurs-09-17-2025.

[63] USDA, FS, *National Prescribed Fire Program Review*, p. 3.

[64] Bean and Evans, *Managed Wildfire Research Synthesis*; USDA, FS, *Barriers to Prescribed Fire Implementation, Possible Solutions, and an Estimate of Fire Damage in Calendar Year 2021 That Could Potentially Have Been Avoided*, https://www.fs.usda.gov/sites/default/files/fy22-prescribed-burns-report.pdf (hereinafter USDA, FS, *Barriers to Prescribed Fire Implementation*). This report was produced by the FS in response to congressional direction in P.L. 117-103.

[65] For example, see USDA, FS, *Barriers to Prescribed Fire Implementation*. See also Wildland Fire Commission, *On Fire*, pp. 21-25, 162-191.

[66] Rosana Aguilera et al., "Wildfire Smoke Impacts Respiratory Health More Than Fine Particles from Other Sources: Observational Evidence from Southern California," *Nature Communications*, vol. 12, no. 1493 (March 5, 2021); Hao Chen et al., "Cardiovascular Health Impacts of Wildfire Smoke Exposure," *Particle and Fibre Toxicology*, vol. 18, no. 2 (January 7, 2021); Colleen E. Reid et al., "Critical Review of Health Impacts of Wildfire Smoke Exposure,"
(continued...)

provide information about wildfire smoke, including real-time maps, to assist with local outreach and mitigation.[67]

- Fire is an imprecise tool compared with some other techniques for reducing fuels. For example, fire managers cannot control fire's effects on postfire forest structure as accurately as they can control the effects of some mechanical or chemical approaches.[68]
- As with some other approaches, effects decrease with time after the treatment.[69]
- The ability of previous fires to impede future fire progression or extent decreases during extreme fire weather conditions.[70]

Mechanical Treatments

Mechanical treatments involve the manipulation, and may also include the removal, of hazardous fuels with tools and equipment, such as hand tools, chainsaws, and heavy machinery. Mechanical fuel treatments rearrange and resize fuels by cutting down biomass and redistributing it to the surface. The fuel loading is not decreased unless fuels crews remove the cut biomass after the treatment. Crews can remove fuels from the site, redistribute them on the surface, burn them, or some combination of these approaches.

Mechanical treatments can incorporate a variety of techniques, including the following:

- *Thinning* is the process of systematically removing part of a stand of trees to reduce stand density and break up horizontal continuity, among other goals. *Thinning from below* involves removing small trees and ladder fuels to break up vertical continuity.
- *Timber harvesting* is "the removal of trees for wood fiber use and other multiple-use purposes."[71] Managers can perform timber harvesting with a range of intensity, from a *clearcut* or *regeneration harvest* (removal of all trees) to *selective harvest* (removal of trees of a specific size, age, species, or condition or in different arrangements across the landscape). Timber harvesting can include *salvage:* harvest of dead, diseased, fallen, or damaged trees. Timber harvesting differs from thinning in that growth of new trees is a primary goal.
- *Mastication* involves using specialized equipment to grind trees or shrubs into small pieces to reduce fuel continuity and rearrange the fuel load, among other goals. It is sometimes used to remove specific species.[72]

Environmental Health Perspectives, vol. 124, no. 9 (April 15, 2016), pp. 1334-1343; Holly Elser et al., "Wildfire Smoke Exposure and Incident Dementia," *JAMA Neurology*, vol. 82, no. 1 (November 25, 2024); Wildland Fire Commission, "Protecting Public Health," in *On Fire*, pp. 83-105.

[67] AirNow, "Wildfires," https://www.airnow.gov/wildfires/, a centralized repository for data from the Environmental Protection Agency (EPA) and other federal, state, local, and international agencies.

[68] Bean and Evans, *Managed Wildfire Research Synthesis*.

[69] Davis et al., "Tamm Review: Effects on Wildfire Severity"; Jain et al., *Effectiveness of Fuel Treatments*, p. 15; Parks et al., "Fire as a Self-Regulating Mechanism."

[70] Jain et al., *Effectiveness of Fuel Treatments*, p. 22; Parks et al., "Fire as a Self-Regulating Mechanism."

[71] USDA, FS, "Silvicultural Practices," in *Forest Service Manual FSM 2400—Forest Management*, WO Amendment 2400-2014-1, March 6, 2014, pp. 10-18, https://www.fs.usda.gov/about-agency/regulations-policies/manual/2470-silvicultural-practices.

[72] Theresa Jain et al., *To Masticate or Not: Useful Tips for Treating Forest, Woodland, and Shrubland Vegetation*, USDA, FS, RMRS, RMRS-GTR-381, September 2018, https://doi.org/10.2737/RMRS-GTR-381.

- *Mowing* is reducing the height of surface vegetation with mechanized equipment. Mowing can rearrange flash fuel loads or reduce live fuels.[73]

Mechanical treatments produce debris (aka *slash*). Slash may be a by-product of the treatment (e.g., limbs and bark left over from timber harvesting), or it may be the primary result of the treatment (e.g., mastication). Slash is itself a wildfire fuel; thus, slash management is an important consideration in mechanical fuel treatments.[74] Options for slash management include redistributing by spreading or mulching or removing through burning or hauling.

Advantages and Disadvantages of Mechanical Treatments

Various factors influence the choice of whether and how to use mechanical treatments as a fuels mitigation technique. Some advantages of mechanical treatments over other fuels management techniques include the following:

- Some mechanical fuel treatments reduce future fire severity, within and beyond the actual areas treated.[75]
- Mechanical treatments allow precise manipulation of fuels in a defined area.
- Mechanical treatments may be used in situations where use of wildland fire is excluded or risky due to biophysical and social factors, such as weather, fuel conditions, or proximity to communities. Mechanical treatments sometimes prepare land for use of wildland fire.[76]
- In some cases, the costs of mechanical treatments can be offset with the sale of marketable forest products.[77] This may allow fuel treatments to be conducted that otherwise would be limited or forgone due to resource availability.

Conversely, some disadvantages of mechanical fuel treatments include the following:

---

[73] Jesse Kreye et al., *Mechanical Treatments in Pine Flatwoods: A Temporary Rearrangement of Fuel Structure*, Southern Fire Exchange, SFE Fact Sheet 2015-1, January 22, 2021, https://southernfireexchange.org/wp-content/uploads/2015-1.pdf; Lisa M. Ellsworth et al., “Fuel Reduction Treatments Reduce Modeled Fire Intensity in the Sagebrush Steppe,” *Ecosphere*, vol. 13, no. 5 (May 12, 2022) (hereinafter Ellsworth et al., “Fuel Treatments Reduce Modeled Intensity”).

[74] Valerie Rapp, *Tested by Fire: What Happens When Wildfires Meet Fuel Treatments?* USDA, FS, JFSP, JFSP Briefs no. 1, October 2007, https://digitalcommons.unl.edu/cgi/viewcontent.cgi? article=1052&context=jfspbriefs; Susan J. Prichard et al., “Fuel Treatments Reduce the Severity of Wildfire Effects in Dry Mixed Conifer Forest, Washington, USA,” *Canadian Journal of Forest Research*, vol. 40 (2010), pp. 1615-1626 (hereinafter Prichard et al., “Fuel Treatments Reduce Severity of Wildfire Effects”); Kalies and Yocom Kent, “Tamm Review: Fuel Treatments Objectives”; Ager et al., “Tradeoffs Between Targets and Fuel Management”; Emily Brodie et al., “Forest Thinning and Prescribed Burning Treatments Reduce Wildfire Severity and Buffer the Impacts of Severe Fire Weather,” *Fire Ecology*, vol. 20, no. 1 (February 2024); Jesse K. Kreye et al., “Fire Behavior in Masticated Fuels: A Review,” *Forest Ecology and Management*, vol. 314 (February 15, 2014), pp. 193-207; Brett H. Wolk et al., *Mulching: A Knowledge Summary and Guidelines for Best Practices on Colorado’s Front Range*, Colorado Forest Restoration Institute, CFRI-2001, January 2020, pp. 8-9, https://www.fs.usda.gov/rm/pubs_journals/2020/rmrs_2020_wolk_b001.pdf.

[75] Hugh D. Safford et al., “Effects of Fuel Treatments on Fire Severity in an Area of Wildland-Urban Interface, Angora Fire, Lake Tahoe Basin, California,” *Forest Ecology and Management*, vol. 258, no. 5 (August 20, 2009), pp. 773-787; Barbara A. Strom and Peter Z. Fule, “Pre-Wildfire Fuel Treatments Affect Long-Term Ponderosa Pine Forest Dynamics,” *International Journal of Wildland Fire*, vol. 16 (February 20, 2007), pp. 128-138; James D. Johnston et al., “Mechanical Thinning Without Prescribed Fire Moderates Wildfire Behavior in an Eastern Oregon, USA Ponderosa Pine Forest,” *Forest Ecology and Management*, vol. 501 (December 1, 2021).

[76] Davis et al., “Tamm Review: Effects on Wildfire Severity”; Kalies and Yocom Kent, “Tamm Review: Fuel Treatments Objectives.”

[77] Holland et al., “Management Costs of Alternative Strategies”; Hartsough et al., “Economics of Fuel Reduction Treatments”; Wildland Fire Commission, “Mitigation Through Mechanical Treatments,” in *On Fire*, pp. 63-68.

- The effectiveness of mechanical treatments depends on the ability to address certain fuel types (e.g., ladder fuels, surface fuels, slash). Studies indicate that mechanical fuel treatments alone are not effective unless accompanied by use of wildland fire or other removal of surface fuels.[78]
- Heavy equipment used in some mechanical treatments may have negative environmental impacts, such as contributing to erosion and soil compaction, disturbing wildlife and surface-level plants, or contributing to invasive species spread.
- Mechanical treatments require physical access to the entire area being treated, which may exclude or limit use in rugged, sensitive, or remote terrain.
- Fuel treatment costs are highly variable. Mechanical treatments tend to be more costly to conduct than prescribed fire, though in some cases the costs of mechanical treatments can be offset with the sale of harvested forest products.[79]
- Mechanical treatments do not replace all of fire's ecological roles in fire-adapted systems.[80]
- As with some other approaches, effects decrease with time.[81]

Biological and Chemical Approaches

Targeted Grazing

A commonly cited definition of *targeted grazing* comes from the American Sheep Industry Association: "the application of a particular kind of grazing animal at a specified season, duration, and intensity *to accomplish specific vegetation management goals*."[82] Targeted grazing differs from normal livestock grazing because the goal is vegetation management instead of animal production.[83] Concentrated livestock consume and trample fine fuels.[84] Targeted grazing is most commonly applied to create fuel breaks in grassland and shrubland systems (see "Fuel Breaks and Firebreaks"), though other applications include general fuel load reduction, reducing fire-adapted non-native species, and fuels mitigation in forested systems.[85]

---

[78] Davis et al., "Tamm Review: Effects on Wildfire Severity"; McIver et al., *National Fire and Fire Surrogate Study*; Prichard et al., "Fuel Treatments Reduce Severity of Wildfire Effects"; Kalies and Yocom Kent, "Tamm Review: Fuel Treatments Objectives."

[79] Wear et al., *Costs of Achieving Forest Resilience*; Holland et al., "Management Costs of Alternative Strategies"; Hartsough et al., "Economics of Fuel Reduction Treatments"; Wildland Fire Commission, "Mitigation Through Mechanical Treatments," in *On Fire,* pp. 63-68.

[80] McLauchlan et al., "Fire as a Fundamental Process"; He et al., "Fire as a Key Driver of Earth's Biodiversity."

[81] Davis et al., "Tamm Review: Effects on Wildfire Severity"; Parks et al., "Fire as a Self-Regulating Mechanism."

[82] Rachel Frost et al., "Targeted Grazing: Applying the Research to the Land," *Rangelands*, vol. 34, no. 1 (February 2012) (hereinafter Frost et al., "Targeted Grazing Research"), italics in original. See also Dan Macon, *Targeted Grazing: A Primer for Consumers*, University of California Agriculture and Natural Resources Cooperative Extension, Publication Number 31-1002, February 2018, https://ucanr.edu/sites/default/files/2018-05/279408.pdf (hereinafter Macon, *Targeted Grazing Primer*); Wildland Fire Commission, "Mitigation Through Grazing," in *On Fire,* pp. 69-71.

[83] Frost et al., "Targeted Grazing Research"; Macon, *Targeted Grazing Primer*.

[84] Derek W. Bailey et al., "Synthesis Paper: Targeted Livestock Grazing—Prescription for Healthy Rangelands," *Rangeland Ecology & Management*, vol. 72, no. 6 (November 2019) (hereinafter Bailey et al., "Synthesis Paper: Targeted Livestock Grazing").

[85] Charles A. Taylor Jr., "Targeted Grazing to Manage Fire Risk," in *Targeted Grazing: A Natural Approach to*
(continued...)

Targeted grazing has a different business model from traditional livestock production:[86] (1) the livestock operators' income is tied to providing a service;[87] (2) animals need to be concentrated at high enough levels to sufficiently reduce fuels and may not receive optimal nutrition;[88] (3) operators may need to provide additional feed;[89] (4) operators try to confine the animals with supplements or water sources but sometimes require more costly methods, such as temporary fencing or herding;[90] and (5) they remove the animals when fuels are depleted.

Some stakeholders propose a general increase in livestock grazing in fire-prone landscapes to reduce hazardous fuels instead of, or in addition to, targeted grazing.[91] A discussion of the potential positive and negative effects, including ecological effects, of broadly increasing livestock grazing in fire-prone landscapes is beyond the scope of this report.

Advantages of targeted grazing include the following:

- Targeted grazing can be applied to small parcels and within urban areas where use of wildland fire would be risky.[92]
- Targeted grazing can be cost effective and scalable.[93]
- Targeted grazing can be applied in steep and remote areas where mowing or chemical applications are impractical.[94]
- Properly applied, targeted grazing can reduce fine surface fuels and low ladder fuels, decreasing fire intensity.[95]

Vegetation Management and Landscape Enhancement, eds. Karen L. Launchbaugh et al. (American Sheep Industry Association, 2006) (hereinafter Taylor, "Targeted Grazing to Manage Fire Risk"); Patrick E. Clark et al., "Evaluating the Efficacy of Targeted Cattle Grazing for Fuel Break Creation and Maintenance," *Rangeland Ecology & Management*, vol. 89 (July 2023); Kirk W. Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing in Sagebrush Communities," *Ecosphere*, vol. 15, no. 5 (May 22, 2024) (hereinafter Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing"); Christopher L. Schachtschneider et al., "Targeted Cattle Grazing to Alter Fuels and Reduce Fire Behavior Metrics in Shrub-Grasslands," *Rangeland Ecology & Management*, vol. 96 (August 20, 2024), pp. 105-116 (hereinafter Schachtschneider et al., "Targeted Cattle Grazing to Reduce Fire Behavior").

[86] Macon, *Targeted Grazing Primer*; Frost et al., "Targeted Grazing Research."

[87] Macon, *Targeted Grazing Primer*; Frost et al., "Targeted Grazing Research."

[88] Bailey et al., "Synthesis Paper: Targeted Livestock Grazing."

[89] Frost et al., "Targeted Grazing Research."

[90] Bailey et al., "Synthesis Paper: Targeted Livestock Grazing"; Frost et al., "Targeted Grazing Research."

[91] For example, see Cattlemen's Foundation and California Cattle Council, "Cattle Grazing Is Key to Mitigating Wildfires," https://calcattlecouncil.org/wp-content/uploads/2024/01/Foundation-Wildfire-Factsheet-Final.pdf; Felix Ratcliff et al., "Cattle Grazing Reduces Fuel and Leads to More Manageable Fire Behavior," *California Agriculture*, vol. 76, no. 2-3 (April 2022); Genoa I. Starrs et al., "Quantifying Large-Scale Impacts of Cattle Grazing on Annual Burn Probability in Napa and Sonoma Counties, California," *Ecology and Society*, vol. 29, no. 3 (2024).

[92] Frost et al., "Targeted Grazing Research."

[93] Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing."

[94] Macon, *Targeted Grazing Primer*.

[95] Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing"; Schachtschneider et al., "Targeted Cattle Grazing to Reduce Fire Behavior"; Taylor, "Targeted Grazing to Manage Fire Risk."

- Targeted grazing can reduce undesirable species in the short term (one or two years).[96] A combination of fire and targeted grazing might control non-native annual grasses, some of which increase fire probability and frequency.[97]

Conversely, disadvantages of targeted grazing as a hazardous fuels mitigation technique include the following:

- Livestock foraging preferences could change species composition of the understory, sometimes in undesirable ways.[98]
- Timing is critical to success. There may be a short window of time when plant life cycles, palatability, weather, and other factors properly align.[99] Targeted grazing may take multiple years to have a measurable outcome.[100]
- Targeted grazing is not recommended in areas with woody stems and shrubs, because (1) cattle and goats do not remove woody stems and shrubs and (2) woody plants mixed with grasses burn at high intensity and spread fire quickly.[101] Improperly applied, targeted grazing could provide a competitive advantage to woody plants.[102]
- Livestock are unlikely to limit crown fires, especially during severe winds and low fuel moistures.[103]

---

[96] Katherine M. Marchetto et al., "The Effectiveness of Using Targeted Grazing for Vegetation Management: A Meta-Analysis," *Restoration Ecology*, vol. 29, no. 5 (July 2021), p. 8 (hereinafter Marchetto et al., "Effectiveness of Targeted Grazing for Vegetation Management").

[97] Hongwei Wan et al., "Selective Grazing and Seasonal Precipitation Play Key Roles in Shaping Plant Community Structure of Semi-Arid Grasslands," *Landscape Ecology*, vol. 30 (August 6, 2015); Joel M. Diamond et al., "Effects of Targeted Grazing and Prescribed Burning on Community and Seed Dynamics of a Downy Brome (Bromus tectorum)–Dominated Landscape," *Invasive Plant Science and Management*, vol. 5, no. 2 (January 20, 2017); Matthew L. Brooks et al., "Effects of Invasive Alien Plants on Fire Regimes," *BioScience*, vol. 54, no. 7 (July 2004) (hereinafter Brooks et al., "Effects of Alien Plants"); Bradley et al., "Cheatgrass and Fire."

[98] Mark Batcheler et al., "Assessing Silvopasture Management as a Strategy to Reduce Fuel Loads and Mitigate Wildfire Risk," *Scientific Reports*, vol. 14 (March 12, 2024); Gina R. Beebe et al., "Fire Versus Herbivory for Oak Woodland Restoration: Burning Achieves Short-Term Structural and Compositional Objectives Whereas Browsing Alone Fails to Reduce Stem Densities and Promote Ground Flora," *Fire Ecology*, vol. 20, no. 102 (November 20, 2024) (hereinafter Beebe et al., "Browsing Alone Fails to Reduce Stem Densities"); Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing."

[99] Bailey et al., "Synthesis Paper: Targeted Livestock Grazing"; Frost et al., "Targeted Grazing Research."

[100] Beebe et al., "Browsing Alone Fails to Reduce Stem Densities"; USDA Climate Hubs, "Targeted Grazing for Wildfire Fuel Breaks," accessed May 4, 2025, https://perma.cc/NJX4-PHV5; Devyn A. Orr et al., "Grazing Intensity Effects of Fire Ignition Risk and Spread in Sagebrush Steppe," *Rangeland Ecology & Management*, vol. 89 (July 2023); Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing"; Theresa B. Jain et al., "A Comprehensive Guide to Fuel Management Practices for Dry Mixed Conifer Forests in the Northwestern United States," USDA, FS, RMRS, Research Note RMRS-RN-61, 2014, p. 1, https://www.fs.usda.gov/rm/pubs/rmrs_rn061.pdf (hereinafter Jain et al., "Guide to Fuel Management Practices").

[101] Schachtschneider et al., "Targeted Cattle Grazing to Reduce Fire Behavior"; Taylor, "Targeted Grazing to Manage Fire Risk"; Beebe et al., "Browsing Alone Fails to Reduce Stem Densities"; Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing"; Victoria M. Donovan et al., "Targeted Grazing and Mechanical Thinning Enhance Forest Stand Resilience Under a Narrow Range of Wildfire Scenarios," *Ecosphere*, vol. 13, no. 5 (May 12, 2022) (hereinafter Donovan et al., "Targeted Grazing and Mechanical Thinning Enhance Resilience"); Casey Matzke, "Grazing Against the Flames: Using Targeted Grazing to Combat Wildfires," Texas A&M AgriLife Extension, West Texas Rangelands, April 9, 2025, https://agrilife.org/westtexasrangelands/grazing-against-the-flames-using-targeted-grazing-to-combat-wildfires/.

[102] Davies et al., "Ecological Benefits of Strategically Applied Livestock Grazing."

[103] Beebe et al., "Browsing Alone Fails to Reduce Stem Densities"; Schachtschneider et al., "Targeted Cattle Grazing to Reduce Fire Behavior"; Donovan et al., "Targeted Grazing and Mechanical Thinning Enhance Resilience."

- Targeted grazing may not provide long-term control for undesirable species, which recover one to two years after targeted grazing ends.[104]

Herbicide Application

Herbicide application is the controlled use of chemicals to kill or suppress unwanted vegetation. Some common uses for herbicides in hazardous fuels control include reducing the presence of specific undesirable species, clearing areas to bare soil, or creating fuel breaks (see "Fuel Breaks and Firebreaks"). Right-of-way (ROW) holders sometimes use herbicides to remove vegetation that could create an ignition risk within the ROW.[105] Herbicides can be applied manually, with vehicles, and aerially.

Personnel applying certain herbicides require licensing at the jurisdictional level where they make the herbicide applications. The Environmental Protection Agency ensures applicator certification programs meet minimum standards.[106]

Advantages of herbicide application include the following:

- When properly applied, herbicides allow precise targeting of individual species or locations. Herbicides can be applied to small parcels and within urban areas.
- Herbicides allow treatment with no ground disturbance.
- Herbicide application can be useful in combination with other methods, for example to prepare for prescribed fire or to suppress resprouting woody species after burning or thinning.[107]

Some disadvantages of herbicide use are as follows:

- Herbicides must be applied in a manner consistent with their label, during the correct phase of the plant lifecycle, and in specific weather conditions to maximize efficacy and limit nontarget exposure.[108]
- Herbicide application may take several years to reduce fuel loading, so additional actions may be required to change fire hazard in the near term.[109]

---

[104] Marchetto et al., "Effectiveness of Targeted Grazing for Vegetation Management."

[105] A *right-of way* (ROW) is a kind of easement, or non-possessory legal right to use or control land for a particular purpose. An ROW provides a right to the easement holder to pass through property owned by another. For example, see CRS In Focus IF12825, *Rights-of-Way for Access On or Through Tribal Lands*, by Mariel J. Murray and Benjamin M. Barczewski.

[106] EPA, Pesticide Worker Safety, "How to Get Certified as a Pesticide Applicator," September 26, 2024, https://www.epa.gov/pesticide-worker-safety/how-get-certified-pesticide-applicator.

[107] Colorado State Forest Service, Colorado State University, Grassland Fuels Management, "Wildfire Fuels Management Practices in Grass-Dominated Landscapes: An Overview of Fire Behavior, Management Practices and Treatment Methods in Mixed-Grass Landscapes," accessed May 4, 2025, https://csfs.colostate.edu/wildfire-mitigation/grasslands/fuels/ (hereinafter Colorado State Forest Service, Colorado State University, "Wildfire Fuels Management in Grass-Dominated Landscapes"; Douglas J. Marshall et al., *Synthesis of Knowledge of Hazardous Fuels Management in Loblolly Pine Forests*, USDA, FS, Southern Research Station, General Technical Report SRS–110, November 2008, pp. 9, 21-25, https://www.srs.fs.usda.gov/pubs/gtr/gtr_srs110.pdf.

[108] For example, Arizona Department of Transportation (ADOT), *ADOT Vegetation Management Guidelines—Herbicides*, pp. 23-24, https://azdot.gov/sites/default/files/2024-12/vegetation-management-guidelines-herbicides-chapter.pdf.

[109] Jain et al., "Guide to Fuel Management Practices"; Patrick Brose and Dale Wade, "Understory Herbicide as a Treatment for Reducing Hazardous Fuels and Extreme Fire Behavior in Slash Pine Plantations," in *Proceedings of the Eleventh Biennial Southern Silvicultural Research Conference*, 2002, pp. 109-113, https://perma.cc/LN4V-X982; (continued...)

- Herbicides leave dead fuels on the surface that may need removal to reduce overall fuel loading.
- Herbicide application may be controversial due to real or perceived dangers to human and environmental health.[110] Herbicides can harm some nontarget species through spray drift, water contamination, direct toxicity to organisms, or habitat removal.[111]
- Herbicide application may cause a change in species composition, potentially allowing undesirable frequent-fire species to establish.[112]

Fuel Breaks and Firebreaks

Fuel breaks are "a natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled."[113] Fuel breaks can reduce ignition potential, fire intensity, and rate of spread.[114] Fuel breaks are often strategically located to create places for firefighters to operate and protect values at risk. *Shaded fuel breaks* are a type of fuel break that is "thinned and pruned to reduce the fire potential yet retain enough crown canopy to make a less favorable microclimate for surface fires."[115]

Firebreaks are "a natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work."[116] Firebreaks tend to be areas where fuels are completely removed down to the bare soil or a road and often are used in combination with fuel

Ellsworth et al., "Fuel Treatments Reduce Modeled Intensity"; Colorado State Forest Service, Colorado State University, "Wildfire Fuels Management in Grass-Dominated Landscapes."

[110] Nicholas E. Korres, "Herbicide Effects on Humans: Exposure, Short and Long-Term Effects and Occupational Hygiene," in *Weed Control: Sustainability, Hazards, and Risks in Cropping Systems Worldwide*, eds. Nicholas E. Korres et al. (CRC Press, 2018), pp. 14-31.

[111] EPA, Causal Analysis/Diagnosis Decision Information System (CADDIS), "Herbicides," February 7, 2025, https://perma.cc/5AVN-6MW7; EPA, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention, *Herbicide Strategy to Reduce Exposure of Federally Listed Endangered and Threatened Species and Designated Critical Habitats from the Use of Conventional Agricultural Herbicides*, EPA-HQ-OPP-2023-0365-1137, August 2024, https://perma.cc/TUB4-3KS2.

[112] Thomas W. McGinnis et al., "Fuel Buildup and Potential Fire Behavior After Stand-Replacing Fires, Logging Fire-Killed Trees and Herbicide Shrub Removal in Sierra Nevada Forests," *Forest Ecology and Management*, vol. 260, no. 1 (June 2010); Brooks et al., "Effects of Alien Plants."

[113] NWCG Glossary. *Fuel breaks* are statutorily defined for the purpose of HFRA (16 U.S.C. §§6501 et seq.; 16 U.S.C. §6511(2)(B)(i)). The definition in HFRA is not broadly applicable.

[114] Benjamin Gannon et al., "A Quantitative Analysis of Fuel Break Effectiveness Drivers in Southern California National Forests," *Fire*, vol. 6, no. 3 (March 7, 2023) (hereinafter Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness"); Macarena Ortega et al., "Modeling Fuel Break Effectiveness in Southern Spain Wildfires," *Fire Ecology*, vol. 20 (April 23, 2024) (hereinafter Ortega et al., "Modeling Fuel Break Effectiveness"); Janine A. Baijnath-Rodino et al., "Quantifying the Effectiveness of Shaded Fuel Breaks from Ground-Based, Aerial, and Spaceborne Observations," *Forest Ecology and Management*, vol. 543 (September 2023) (hereinafter Baijnath-Rodino et al., "Effectiveness of Shaded Fuel Breaks"); Alexandra D. Syphard et al., "Comparing the Role of Fuel Breaks Across Southern California National Forests," *Forest Ecology and Management*, vol. 261, no. 11 (June 2011) (hereinafter Syphard et al., "Comparing the Role of Fuel Breaks"); Cali L. Weise et al., "A Retrospective Assessment of Fuel Break Effectiveness for Containing Rangeland Wildfires in the Sagebrush Biome," *Journal of Environmental Management*, vol. 341 (September 1, 2023) (hereinafter Weise et al., "Fuel Break Effectiveness in Sagebrush").

[115] NWCG Glossary.

[116] NWCG Glossary. *Firebreaks* are statutorily defined for the purpose of HFRA (16 U.S.C. §6511(2)(B)(ii)). The definition in HFRA is not broadly applicable.

breaks.[117] Firebreaks may be created as a precautionary measure before a fire starts or may be created during firefighting operations.

Fuel breaks and firebreaks are most effective when fire suppression includes both aerial and ground resources.[118] These approaches will not stop fire spread without concomitant ground operations.[119] Fuel breaks function best within landscape-level treatments, especially prescribed fire.[120] They can be created and maintained with mechanical (e.g., mowing), biological (i.e., targeted grazing), and/or chemical methods.[121]

Potential advantages to creating fuel breaks include the following:

- Strategically locating fuel breaks near WUI is likely to facilitate firefighting and increase human safety.[122]
- Fuel breaks can incorporate existing features, such as powerlines and roads.[123]
- When fuel breaks are created with mechanical methods, the costs might be offset with the sale of harvested forest products.[124]
- Fuel breaks colocated with roads enable firefighter access and maintenance of the fuel break.[125]

Potential disadvantages of fuel breaks include the following:

- To serve as fire control lines, fuel breaks must provide firefighter access; therefore, they may not function well in remote locations.[126]
- Ecological degradation, including invasion by non-native species that increase fire hazard, may occur when vegetation is completely or substantially removed to create fuel breaks.[127]
- Fuel breaks, similar to firebreaks, lose effectiveness in extreme weather.[128] Firebrands may jump fuel breaks, spreading fires downwind.[129]

---

[117] Ortega et al., "Modeling Fuel Break Effectiveness"; Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness."

[118] Pedro Belavenutti et al., "Multi-Objective Scheduling of Fuel Treatments to Implement a Linear Fuel Break Network," *Fire*, vol. 6, no. 1 (December 20, 2022) (hereinafter Belavenutti et al., "Multi-Objective Scheduling of Fuel Treatments"); Ortega et al., "Modeling Fuel Break Effectiveness"; Baijnath-Rodino et al., "Effectiveness of Shaded Fuel Breaks."

[119] Ortega et al., "Modeling Fuel Break Effectiveness"; Baijnath-Rodino et al., "Effectiveness of Shaded Fuel Breaks."

[120] Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness."

[121] Bailey et al., "Synthesis Paper: Targeted Livestock Grazing."

[122] Syphard et al., "Comparing the Role of Fuel Breaks," p. 2047.

[123] Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness."

[124] Belavenutti et al., "Multi-Objective Scheduling of Fuel Treatments."

[125] Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness."

[126] Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness"; Syphard et al., "Comparing the Role of Fuel Breaks"; Weise et al., "Fuel Break Effectiveness in Sagebrush."

[127] Syphard et al., "Comparing the Role of Fuel Breaks," p. 2047; Weise et al., "Fuel Break Effectiveness in Sagebrush."

[128] Gannon et al., "Quantitative Analysis of Fuel Break Effectiveness"; Syphard et al., "Comparing the Role of Fuel Breaks," p. 2047; Weise et al., "Fuel Break Effectiveness in Sagebrush."

[129] Eunmo Koo et al., "Firebrands and Spotting Ignition in Large-Scale Fires," *International Journal of Wildland Fire*, vol. 19, no. 7 (November 5, 2010), pp. 818-843.

- The sale of forest products may not significantly offset costs of fuel breaks in all cases, because the locations that maximize wildfire protection may provide lower potential revenues, or the materials that need to be removed may have low value (e.g., small trees and branches that compose ladder fuels).[130]

Maintenance

Some lands may benefit from multiple hazardous fuel treatments to maintain fire risk reduction, especially to compensate for ongoing plant growth. Generally, treatments may reduce wildfire severity in most forests for 10-20 years posttreatment and then must be repeated.[131] Site-specific conditions help determine the necessary maintenance intervals to protect homes in the WUI and other values at risk in non-forested lands, such as grasslands and chaparral.[132] Successful maintenance of fuels mitigation measures may depend on whether and, if so, how well activities are tracked and the extent to which resources are available to plan and perform regular maintenance.

Federal Role and National Policies

Federal Role in Hazardous Fuels Mitigation

Hazardous fuels generally are managed by the landowner of the underlying land. Thus, the federal role in hazardous fuels management varies in accordance with the underlying land ownership. The federal government has a direct role in the management of forests in federal ownership. The federal government's role in managing nonfederal forests is indirect and generally consists of providing financial, technical, or other assistance. In many situations, various groups may collaborate to manage hazardous fuels in an area, particularly where land ownership is commingled or adjacent. In such situations, authorities for collaboration, along with authorities related to the underlying lands, become relevant.

Much of Congress's legislative activity has focused on authorizing federal lands to be managed and used for specific purposes. No federal law explicitly requires hazardous fuels mitigation from a broad perspective. Instead, various statutes implicitly authorize the FS, BLM, NPS, and FWS to mitigate hazardous fuels as part of their mandates to manage and protect the lands and resources under their jurisdiction.[133] Specific authorities also may direct, facilitate, or condition hazardous fuels mitigation in certain circumstances; for example, the BIA can carry out "forest land

[130] Belavenutti et al., "Multi-Objective Scheduling of Fuel Treatments."

[131] Davis et al., "Tamm Review: Effects on Wildfire Severity."

[132] Edith B. Allen et al., "Chaparral Restoration," in *Valuing Chaparral: Ecological, Socio-Economic, and Management Perspectives*, eds. Emma C. Underwood et al. (Springer, 2018); Radeloff et al., "Rising Wildfire Risk"; Colorado State Forest Service, Colorado State University, "Wildfire Fuels Management in Grass-Dominated Landscapes"; Weise et al., "Fuel Break Effectiveness in Sagebrush."

[133] For example, the FS is directed to "make provisions for the protection against destruction by fire" (16 U.S.C. §551); the NPS's purpose includes conservation of "the scenery, natural and historic objects, and wild life in the System units" (54 U.S.C. §100101); the Federal Land Policy and Management Act (43 U.S.C. §§1701 et seq.) directs the Bureau of Land Management to manage public lands "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" (43 U.S.C. §1701(a)(8)); and the Fish and Wildlife Service is directed to administer the National Wildlife Refuge System to "ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans (16 U.S.C. §668dd(a)(4)(B)).

management activities" on Indian forest lands. These activities may include hazardous fuels mitigation and actions to protect forest health.[134]

The Healthy Forests Restoration Act

Congress also has, at times, provided specific authorities related to hazardous fuels management on federal lands. Prominent among these is HFRA, which pertains to the public lands managed by BLM and to the National Forest System (NFS), managed by the FS.[135] The pace and scale of hazardous fuels management on these lands—the largest systems of federal forest land—have been perennial congressional concerns. HFRA's primary purpose is "to reduce wildfire risk ... through a collaborative process of planning, prioritizing, and implementing hazardous fuel reduction projects."[136] Thus, HFRA contains various provisions related to planning, implementation, and administrative processes for specified land management projects on NFS and BLM land, including hazardous fuel reduction projects. HFRA also includes various provisions regarding grant programs, cross-boundary collaboration, and other items, some of which are discussed in other sections of this report.

Under HFRA, authorized hazardous fuel reduction projects (as defined for the purposes of HFRA) can be developed and implemented under a potentially expedited process in specified areas of NFS and BLM land.[137] These areas include NFS and BLM lands within the WUI; federal lands in specified ecological conditions that are important for maintaining municipal water supplies; and other federal lands in specified ecological conditions, such as departure from historical fire regimes, where forest health is declining, or where fire could affect threatened and endangered species survival.[138] HFRA also specifies limitations on authorized projects, for example, excluding projects within certain land designations and requiring particular ecological considerations.[139] HFRA includes various administrative provisions to potentially expedite such projects, for example, project prioritization in specified areas and a pre-decisional administrative review process intended to reduce litigation.[140] HFRA also set forth requirements for judicial review for HFRA projects.[141]

---

[134] 25 U.S.C. §3103(4)(D); 25 U.S.C. §3104(a).

[135] HFRA (16 U.S.C. §§6501 et seq.).

[136] 16 U.S.C. §6501(1).

[137] 16 U.S.C. §6511(2); 16 U.S.C. §§6512 et seq.; 16 U.S.C. §§6591 et seq.

[138] For the purposes of HFRA, *wildland-urban interface* (WUI) is defined as an area within or adjacent to an *at-risk community* and identified within a plan called a *community wildfire protection plan*, or, for at-risk communities without community wildfire protection plans, the WUI includes adjacent lands within specified distances or that meet specified conditions (16 U.S.C. §6511(16)). HFRA defines *at-risk community* (16 U.S.C. §6511(1)) as an area composed of either (1) "an interface community," as defined in federal regulation (see USDA and DOI, "Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk from Wildfire," 66 *Federal Register* 753, January 4, 2001), or (2) "a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land"; additionally, an at-risk community has conditions "conducive to a large-scale wildland fire disturbance" and "a significant threat to human life or property" from wildland fire. As defined in USDA and DOI's 2001 regulation, an *interface community* has "a clear line of demarcation" between the built environment and wildland fuels, "where structures directly abut wildland fuels." Other definitions of the WUI may be used in scientific contexts or may apply to other federal statutes, policies, or programs. WUI is discussed in this report in "Hazardous Fuels and Fire Behavior." An explanation of fire regimes is in the section, "Fire Regimes: Fire over Time and Space."

[139] 16 U.S.C. §6512.

[140] For example, 16 U.S.C. §6513, 16 U.S.C. §6515, 16 U.S.C. §6543.

[141] 16 U.S.C. §6516.

In addition, HFRA includes statutory *categorical exclusions* (CEs), categories of federal actions that are excluded from the requirement to prepare an environmental impact statement or environmental assessment under the National Environmental Policy Act (NEPA).[142] Several HFRA CEs are unique to authorized hazardous fuel reduction projects, and others may encompass a broader suite of hazardous fuel reduction activities.[143] HFRA CEs are subject to various constraints, including project size, and most are available only in specified areas (e.g., designated areas, areas with specified characteristics).[144] Some legislative action in the 119th Congress seeks to expand the applicability of many HFRA CEs. For example, provisions of the Fix Our Forests Act (H.R. 471/S. 1462) would expand the applicability of many HFRA CEs.

Collaboration with Nonfederal Groups

Hazardous fuels, and hazardous fuels management issues, cross land ownership and jurisdictional boundaries. Therefore, managing hazardous fuels often requires collaboration between groups. To facilitate collaboration across land ownerships, Congress has enacted numerous authorities, most of which pertain to the FS and BLM. Most such efforts include hazardous fuels management as one possible application among many. For example, the Collaborative Forest Landscape Restoration Program and the Joint Chiefs Landscape Restoration Partnership Program provide dedicated funding for multigroup, cross-boundary landscape management projects for specified purposes, including hazardous fuel reduction.[145] Other authorities facilitate contracting for large-scale, long-term projects on federal land or authorize nonfederal partners to conduct work on federal lands under specified parameters.[146] Lastly, some authorities pertain to specific partner groups; the Tribal Forest Protection Act allows the federal government to enter into agreements or contracts with Tribes to perform work on certain FS or BLM lands.[147]

Federal Support for Hazardous Fuels Management on Nonfederal Lands

The federal role in nonfederal hazardous fuels management generally consists of providing assistance to various nonfederal groups, such as Tribes, states, localities, and private entities, sometimes operating as collaborative groups. Assistance may consist of financial or technical support. Federal assistance programs may provide specific project support or overall programmatic or capacity support (e.g., to ensure baseline levels of capacity or provide broad

[142] National Environmental Policy Act (NEPA; 42 U.S.C. §§4321 et seq.). See CRS In Focus IF12560, *National Environmental Policy Act: An Overview*, by Kristen Hite and Heather McPherron; and CRS Report R48595, *Legislative Categorical Exclusions Under the National Environmental Policy Act*, by Heather McPherron.

[143] For a description of legislative categorical exclusions (CEs) in HFRA, see CRS Report R48595, *Legislative Categorical Exclusions Under the National Environmental Policy Act*, by Heather McPherron; and CRS Report R43872, *National Forest System Management: Overview and Issues for Congress*, by Anne A. Riddle.

[144] More information on HFRA and NEPA can be found in CRS Report R43872, *National Forest System Management: Overview and Issues for Congress*, by Anne A. Riddle; and CRS In Focus IF12560, *National Environmental Policy Act: An Overview*, by Kristen Hite.

[145] Collaborative Forest Landscape Restoration Program: 16 U.S.C. §7303; Joint Chiefs Landscape Restoration Program: 16 U.S.C. §6592d.

[146] For more information on assistance programs, the Good Neighbor Authority, and Stewardship End Result Contracting, see CRS Report R45219, *Forest Service Assistance Programs*, by Anne A. Riddle; CRS In Focus IF11658, *The Good Neighbor Authority on Federal Lands*, by Anne A. Riddle; and CRS In Focus IF11179, *Stewardship End Result Contracting: Forest Service and Bureau of Land Management*, by Anne A. Riddle.

[147] Tribal Forest Protection Act (25 U.S.C. §§3115a et seq.); FS, "Proposal Evaluation and Determination Factors Under TFPA," in *Forest Service Handbook 2409.19*, p. 37, https://www.fs.usda.gov/about-agency/regulations-policies/handbook/240919-60-stewardship-contracts-and-agreements. See also CRS Report R48256, *Tribal Self-Determination Authorities: Overview and Issues for Congress*, coordinated by Mariel J. Murray; and CRS Report R47563, *Tribal Co-management of Federal Lands: Overview and Selected Issues for Congress*, by Mariel J. Murray.

program support to a state land management agency). Programs can provide financial assistance through competitive grants, formula grants, or other instruments. No federal program is specific to hazardous fuel reduction assistance. Such activities may occur through programs related to broader issues (e.g., forest health, wildfire preparedness, hazard reduction to communities).

Assistance programs reside in various agencies. As examples, several FS assistance programs provide grants to state governments to promote baseline levels of capacity in areas related to forest health and wildfire preparedness and response. Other FS grants provide competitive grants to various groups to manage landscapes at scale, or they provide for community wildfire defense.[148] The Federal Emergency Management Agency (FEMA) provides financial assistance in certain circumstances for hazardous fuels mitigation near homes and structures.[149]

Issues for Congress

Authorizations and Programs

Congress debates whether—and, if so, to what extent—to support hazardous fuels mitigation programs on federal and nonfederal lands. Congress may determine that programs it previously established are adequate to achieve desired hazardous fuels management goals. Alternatively, Congress may decide to refine or augment existing or new efforts. For federal lands, this may involve establishing new authorities or expanding existing authorities. For nonfederal lands, this may include establishing or modifying assistance programs or supports for nongovernmental entities that perform work on both federal and nonfederal lands. Congress may choose to establish programs for specific hazardous fuels mitigation approaches, locations, or situations, or may set broader goals that allow for substantial local discretion. For a list of legislation introduced in the 119th Congress that could affect hazardous fuels mitigation policy or implementation, see **Appendix B**.

Pace and Scale of Implementation

An issue facing Congress is the pace and scale at which hazardous fuels mitigation occurs. Congress frequently considers bills that attempt to accelerate the timeline from project conception to implementation. Associated questions concern how to conduct hazardous fuels mitigation to protect values at risk from wildfire: whether an adequate number of projects are initiated, at a suitable size to be effective, in the right locations, using the most appropriate techniques. Two areas often highlighted in the project context are the availability of qualified personnel and the effects of environmental and administrative requirements.

Multiple groups have identified shortfalls in the number of qualified personnel available for planning and conducting hazardous fuels mitigation. The federally mandated Wildland Fire Mitigation and Management Commission (Wildland Fire Commission) found that "hiring, recruitment, and retention of the workforce are some of the most significant gaps within the existing wildfire mitigation and management system."[150] The FS points to investments in workforce capacity and collaborative partnerships as necessary to achieving the required scale of

---

148 For more information on FS assistance programs, see CRS Report R45219, *Forest Service Assistance Programs*, by Anne A. Riddle.

149 42 U.S.C. §5170c. For more information on FEMA funding for disaster mitigation, see CRS Insight IN11187, *Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance*, by Diane P. Horn; and CRS In Focus IF12833, *Post-Disaster and Pre-Disaster Hazard Mitigation Assistance*, by Diane P. Horn.

150 Wildland Fire Commission, "Building a Comprehensive Workforce," in *On Fire*, p. 161.

hazardous fuels mitigation work.[151] The Nature Conservancy, a nongovernmental advocacy organization performing fuel treatments with the agency, points to a lack of trained crews as one of the top reasons that prescribed burns are not being executed during the short windows of time when weather is favorable.[152]

Legislative approaches to workforce shortages may include reforms to federal employment practices; programs to promote training, workforce development, and housing opportunities; or authorities to leverage resources across groups by promoting collaboration or easing cross-jurisdictional work.[153] For example, the National Prescribed Fire Act of 2025 (S. 2015/H.R. 3889) includes provisions for increased pay for federal employees conducting specified prescribed fire work. It also would allow specified hazardous fuels appropriations to be used to train federal and nonfederal groups for prescribed fire, among other purposes. As another example, in May 2025, the House Committee on Natural Resources held a hearing on a draft bill titled "Fostering Opportunities to Restore Ecosystems Through Strong Tribal Stewardship Act (FORESTS Act)," which would expand authority for Tribes to manage specified federal lands, including, but not limited to, managing hazardous fuels.

The role of environmental and administrative requirements is another common source of debate when discussing timelines for hazardous fuel reduction on federal lands. Similar to other federal land management projects, hazardous fuels mitigation projects typically require the agency to undertake several statutory processes to comply with environmental and administrative requirements. For example, NEPA delineates the procedure to identify a project's resource objectives and analyze effects.[154] The National Historic Preservation Act (NHPA) and the Endangered Species Act (ESA) define additional site-specific analyses and potential consultation requirements to protect cultural and biological resources.[155]

Legislative approaches to the role of environmental compliance may include addressing compliance requirements or litigation under the statute. The Fix Our Forests Act (S. 1462/ H.R. 471) would extend the applicability or acreage of several statutory CEs and reform litigation related to NEPA for specified projects. The Fix Our Forests Act would authorize the use of emergency procedures for compliance under NEPA, ESA, and NHPA for projects in certain areas.

Tracking and Accountability

Agency tracking of hazardous fuel reduction accomplishments can sometimes complicate congressional oversight. For example, the USDA Office of Inspector General (OIG) reported in

[151] USDA, FS, *Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests*, FS-1187a, January 2022, pp. 4, 10, 31-35, https://www.fs.usda.gov/sites/default/files/Confronting-Wildfire-Crisis.pdf; USDA, FS, *National Active Forest Management Strategy*, FS-1268a, May 2025, pp. 3, 6, 10, https://www.usda.gov/sites/default/files/documents/national-active-forest-management-strategy.pdf; USDA, FS, *National Prescribed Fire Review*, September 2022, pp. 16-17, https://www.frames.gov/documents/usfs/USFS_20220908_National-Prescribed-Fire-Program-Review.pdf.

[152] Adiel Kaplan and Monica Hersher, "The Forest Service Is Overstating Its Wildfire Prevention Progress to Congress Despite Decades of Warnings Not To," *NBC News*, August 9, 2022 (hereinafter Kaplan and Hersher, "Forest Service Overstating Wildfire Prevention Progress"); The Nature Conservancy, https://www.nature.org/en-us/.

[153] The Wildland Fire Commission provided legislative recommendations on this topic in the sections "Permitting and Project Planning" and "Building a Comprehensive Workforce" in *On Fire*, pp. 78-82, 157-191.

[154] 42 U.S.C. §§4321 et seq.

[155] National Historic Preservation Act (NHPA; 54 U.S.C. §§300101 et seq.), Endangered Species Act (ESA; 16 U.S.C. §§1531 et seq.). For information on consultation requirements of NHPA and ESA, see CRS Report R47543, *Historic Properties and Federal Responsibilities: An Introduction to Section 106 Reviews*, by Mark K. DeSantis; and CRS In Focus IF12423, *Endangered Species Act (ESA) Section 7 Consultation*, by Erin H. Ward and Pervaze A. Sheikh.

2016 that (1) the FS was overstating its accomplishments and (2) the FS had difficulty determining what it spent on hazardous fuel reduction.[156] In 2024, OIG reported that the FS tracked multiple Infrastructure Investment and Jobs Act (IIJA) provisions in a single budget line item, so hazardous fuels spending was not available independently of other IIJA provisions.[157] The total impact of increased funding from the IIJA on project implementation is therefore unclear.

Inconsistent agency tracking makes it difficult to determine treatment effects and to compare different approaches. For example, the FS tracks acres treated for hazardous fuels in its Forest Service Activity Tracking System (FACTS) database, and the Department of the Interior tracks hazardous fuels treated in its Interior Fuels and Post-Fire Reporting System (IFPRS).[158] When wildfires burn treated areas, both departments document the interactions between wildfire and hazardous fuel treatments in the Fuel Treatment Effectiveness Monitoring (FTEM) application.[159] If these data were consistently collected and reported, Congress might be able to compare fuel treatment approaches, to understand cost effectiveness and performance.[160]

The commonly used *acres treated* metric to report work completed also might disincentivize efficient spending on hazardous fuels operations. For example, agencies wishing to show a high number of acres treated could prioritize projects that cost less per acre, even if the projects are not located in a strategic area or do not employ the most effective methods.[161] The metric is also hard to interpret, because multiple treatments on the same part of the landscape—which sometimes are required to measurably decrease fire hazard—may be counted multiple times.[162] A related question is whether agencies should aim for greater risk reduction in smaller areas or a smaller risk reduction per acre across larger areas.

---

[156] USDA, Office of Inspector General (OIG), *Forest Service Wildland Fire Activities: Hazardous Fuels Reduction*, 08601-0004-41, July 2016, pp. 13-20, https://www.documentcloud.org/documents/22120891-usda-oig-2016-forest-service-wildland-fire-activities-hazardous-fuels-reduction-08601-0004-41/.

[157] USDA, OIG, *IIJA: Hazardous Fuels Management*, Inspection Report 08801-0001-21, September 2024, pp. 3-4, https://usdaoig.oversight.gov/sites/default/files/reports/2024-09/08801-0001-21FR508FOIAsigned.pdf.

[158] Interagency Standards for Fire and Fire Aviation Operations Group, National Interagency Fire (NIFC), *Interagency Standards for Fire and Fire Aviation Operations* ("*Red Book*"), January 2025, p. 219, https://www.nifc.gov/standards/guides/red-book (hereinafter NIFC, *Red Book*). The FS also displays annual acres treated on the U.S. Forest Service Hazardous Fuels Treatments dashboard, with the caveat, "Accomplishments are defined as treatments that are planned or contracted to occur. They are not necessarily completed on the ground." USDA, FS, "U.S. Forest Service Hazardous Fuels Treatments 2025," accessed May 10, 2025, https://www.arcgis.com/apps/dashboards/95470eec0ef1424eb1e74369b3519677.

[159] NIFC, *Red Book*, pp. 219-220; DOI and USDA, IFTDSS, "About FTEM," accessed May 8, 2025, https://iftdss.firenet.gov/firenetHelp/help/pageHelp/content/10-ftem/ftemabout.htm?tocpath=FTEM%7C_____1.

[160] Government Accountability Office (GAO), *Wildland Fire Management: Better Information and a Systematic Process Could Improve Agencies' Approach to Allocating Fuel Reduction Funds and Selecting Projects*, GAO-07-1168, September 28, 2007, pp. 44, 57-60, 64-66, https://www.gao.gov/products/gao-07-1168.

[161] GAO, *Wildland Fire: Federal Agencies' Efforts to Reduce Wildland Fuels and Lower Risk to Communities and Ecosystems*, GAO-20-52, December 19, 2019, pp. 35-36, https://www.gao.gov/products/gao-20-52; USDA, FS, *Fiscal Year 2025 Budget Justification*, March 2024, p. 29a-93, https://www.fs.usda.gov/sites/default/files/fs-fy25-congressional-budget-justification.pdf; USDA, FS, *Toward Shared Stewardship Across Landscapes: An Outcome-Based Investment Strategy*, FS-1118, August 2018, p. 18, https://perma.cc/KJ2Z-CYJ9; Wildland Fire Commission, *On Fire*, pp. 17, 252-253; GAO, *Forest Service: Fully Following Leading Practices for Agency Reforms Would Strengthen Prescribed Fire Program*, GAO-24-106239, June 2024, pp. 33-34, https://www.gao.gov/assets/gao-24-106239.pdf (hereinafter GAO, *Reforms Would Strengthen Prescribed Fire Program*, GAO-24-106239); Scott Rodd, "Stalled U.S. Forest Service Project Could Have Protected California Town from Caldor Fire Destruction," *CAPRadio*, August 16, 2022.

[162] Kaplan and Hersher, "Forest Service Overstating Wildfire Prevention Progress"; George LeVines and Emily Zentner, "How We Measured U.S. Forest Service Wildfire Prevention Work," *CAPRadio*, August 16, 2022.

The FS, Government Accountability Office, and the Wildland Fire Commission all recommend improving performance metrics for hazardous fuels mitigation, including prescribed fire.[163] Bills in the 119th Congress, including the ACRES Act (H.R. 204) and the Fix Our Forests Act, include reporting requirements such as accurate size of area treated, treatment costs, location with regard to WUI and wildfire risk, and type of treatment activity (see **Table B-1**).[164]

[163] GAO, *Reforms Would Strengthen Prescribed Fire Program*, GAO-24-106239, pp. 33-34; USDA, FS, *National Prescribed Fire Program Review*, pp. 9, 12, and Appendix A p. 23; The Wildland Fire Commission's recommendations regarding performance measures include Recommendations 13, 32, and 123, as well as the section entitled, "Accountability"; see Wildland Fire Commission, *On Fire*, pp. 17, 60-61, 80-81, 220-221, 252-254.

[164] Fix Our Forests Act (S. 1462, §302; H.R. 471, §302); ACRES Act (H.R. 204).

Appendix A. Fire Regime Classifications

The following tables provide Forest Service (FS) descriptions and definitions codified in the Healthy Forests Restoration Act (HFRA) for fire regimes (**Table A-1**) and condition classes (**Table A-2**).[165] The FS described five "historical natural fire regimes" and three "fire regime current condition classes." HFRA codified three of the five fire regimes and two of the three condition classes for the purposes of the act. The statutory definitions are not broadly applicable.

Table A-1 and **Table A-2** provide the FS descriptions and statutory definitions for fire regimes and condition classes.

Table A-1. Fire Regime Classifications

Forest Service: "Historical Natural Fire Regimes"		
Code	**Description**	**Statutory Definitions**
I	"0–35-year frequency,[a] low severity[b]"	**Fire Regime I** The term "fire regime I" means an area- (A) in which historically there have been low-severity fires with a frequency of 0 through 35 years; and (B) that is located primarily in low elevation forests of pine, oak, or pinyon juniper.
II	"0–35-year frequency, stand-replacement severity"	**Fire Regime II** The term "fire regime II" means an area- (A) in which historically there are stand replacement severity fires with a frequency of 0 through 35 years; and (B) that is located primarily in low- to mid-elevation rangeland, grassland, or shrubland.
III	"35–100+ year frequency, mixed severity"	**Fire Regime III** The term "fire regime III" means an area- (A) in which historically there are mixed severity fires with a frequency of 35 through 100 years; and (B) that is located primarily in forests of mixed conifer, dry Douglas fir, or wet Ponderosa pine.
IV	"35–100+ year frequency, stand-replacement severity"	Not defined in statute.
V	"200+ year frequency, stand-replacement severity"	Not defined in statute.

Sources: Forest Service descriptions are taken from Table 1 in Kirsten M. Schmidt et al., *Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management*, U.S. Department of Agriculture, Forest Service, RMRS-GTR-87, p. 5, https://www.fs.usda.gov/rm/pubs/rmrs_gtr087.pdf (hereinafter Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*). Statutory definitions are taken from 16 U.S.C. §6511 (8-10).

Notes:

a. *Fire frequency* is defined in Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*, and also commonly understood as "the average number of years between fires."

[165] HFRA (16 U.S.C. §§6501 et seq.).

b. *Severity* is defined in Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*, as "the effect of the fire on the dominant overstory vegetation." This FS definition of severity differs from the definition of severity used elsewhere in this report, which includes a broader suite of potential effects (e.g., to soils).

Table A-2. Fire Regime Condition Class

Forest Service: "Fire Regime Current Condition Class[a]"			
Condition Class	**Fire Regime**	**Example Management Options**	**Statutory Definitions**
1	"Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range."	"Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use."	Not defined in statute.
2	"Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range."	"Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime."	**Condition Class 2** The term "condition class 2", with respect to an area of Federal land, means the condition class description developed by the Forest Service Rocky Mountain Research Station in the general technical report entitled "Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management" (RMRS–87), dated April 2000 (including any subsequent revision to the report), under which— (A) fire regimes on the land have been moderately altered from historical ranges; (B) there exists a moderate risk of losing key ecosystem components from fire; (C) fire frequencies have increased or decreased from historical frequencies by 1 or more return intervals, resulting in moderate changes to- (i) the size, frequency, intensity, or severity of fires; or (ii) landscape patterns; and (D) vegetation attributes have been moderately altered from the historical range of the attributes. (16 U.S.C. §6511(4))
3	"Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is	"Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to	**Condition Class 3** The term "condition class 3", with respect to an area of Federal land, means the condition class description developed by the Rocky

Forest Service: "Fire Regime Current Condition Class[a]"

Condition Class	Fire Regime	Example Management Options	Statutory Definitions
	high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range."	restore the historical fire regime."	Mountain Research Station in the general technical report referred to in paragraph (4) (including any subsequent revision to the report), under which— (A) fire regimes on land have been significantly altered from historical ranges; (B) there exists a high risk of losing key ecosystem components from fire; (C) fire frequencies have departed from historical frequencies by multiple return intervals, resulting in dramatic changes to- (i) the size, frequency, intensity, or severity of fires; or (ii) landscape patterns; and (D) vegetation attributes have been significantly altered from the historical range of the attributes. (16 U.S.C. §6511(5))

Sources: Forest Service (FS) descriptions are taken from Table 2 in Kirsten M. Schmidt et al., *Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management*, U.S. Department of Agriculture, Forest Service, RMRS-GTR-87, p. 8, https://www.fs.usda.gov/rm/pubs/rmrs_gtr087.pdf (hereinafter Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*). Statutory definitions are taken from 16 U.S.C. §6511(4-5).

Notes:

a. *Fire regime current condition classes* are defined in Schmidt et al., *Coarse-Scale Spatial Data for Fuel Management*, as "a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, introduced insects or disease, or other management activities."

Appendix B. Hazardous Fuels Mitigation Introduced Legislation in the 119th Congress

Table B-1 lists legislation introduced in the 119th Congress that may affect hazardous fuels mitigation policy or implementation. Entries are current as of September 2, 2025.

Table B-1. Hazardous Fuels Mitigation Bills in the 119th Congress

Bill Number	Title	Description
S. 91	Western Wildfire Support Act of 2025	To improve federal activities relating to wildfires, and for other purposes.
S. 135	Wildland Firefighter Paycheck Protection Act of 2025	A bill to amend Title 5, *United States Code*, to provide for special base rates of pay for wildland firefighters, and for other purposes.
S. 140	Wildfire Prevention Act of 2025	To address the forest health crisis on the National Forest System and public lands, and for other purposes.
S. 279	Tim Hart Wildland Firefighter Classification and Pay Parity Act (Tim's Act)	A bill to reform and enhance the pay and benefits of federal wildland firefighters, and for other purposes.
S. 349	Fire-Safe Electrical Corridors Act of 2025	To authorize the Secretary of Agriculture to permit removal of trees around electrical lines on National Forest System land without conducting a timber sale, and for other purposes.
S. 350	Wildfire Emergency Act of 2025	To direct the Secretary of Agriculture to select and implement landscape-scale forest restoration projects to assist communities in increasing their resilience to wildfire, and for other purposes.
S. 395	Emergency Fuel Reduction Act of 2025	To amend the Healthy Forests Restoration Act of 2003 to expedite wildfire prevention projects to reduce the risk of wildfire on certain high-risk federal land, and for other purposes.
S. 449	Expediting Forest Restoration and Recovery Act of 2025	To amend the Healthy Forests Restoration Act of 2003 to require the Secretary of Agriculture to expedite hazardous fuel or insect and disease risk reduction projects on certain National Forest System land, and for other purposes.
S. 453	Wildfire Intelligence Collaboration and Coordination Act of 2025	To establish a Wildfire Intelligence Center, and for other purposes.
S. 602	Wildfire Resilience Through Grazing Research Act	To amend the Food, Agriculture, Conservation, and Trade Act of 1990 to support research and development of ungulate grazing land management techniques for purposes of wildfire mitigation, fuel reduction, and postfire recovery.
S. 647	Regional Leadership in Wildland Fire Research Act of 2025	To require the Secretary of Commerce to create regional wildland fire research centers, and for other purposes.
S. 670	Protect the West Act of 2025	To establish an Outdoor Restoration Fund for restoration and resilience projects, and for other purposes.
S. 1323	The Facilitating Increased Resilience, Environmental Weatherization and Lowered Liability (FIREWALL) Act	To amend the Internal Revenue Code of 1986 to provide a refundable credit against tax for disaster mitigation expenditures.

Bill Number	Title	Description
S. 1462	Fix Our Forests Act	To improve forest management activities on National Forest System land, public land under the jurisdiction of the Bureau of Land Management, and tribal land to return resilience to overgrown, fire-prone forested land, and for other purposes.
S. 1842	Wildfire Reduction and Carbon Removal Act of 2025	To amend the Internal Revenue Code of 1986 to create a credit for carbon removal and storage for forest residues from wildfire management.
S. 2015	National Prescribed Fire Act of 2025	To direct the Secretary of the Interior and the Secretary of Agriculture to encourage and expand the use of prescribed fire on land managed by the Department of the Interior or the Forest Service, with an emphasis on units of the National Forest System in the western and southeastern United States, to acknowledge and support the long-standing use of cultural burning by Indian Tribes and Indigenous practitioners, and for other purposes.
S. 2038	Wildfire Coordination Act	To direct the Secretary of the Interior to establish the Wildfire Science and Technology Advisory Board.
S. 2208	Wildfire Resilient Communities Act	To provide mandatory funding for hazardous fuels reduction projects on certain federal land, and for other purposes.
S. 2431	Department of the Interior, Environment, and Related Agencies Appropriations Act, 2026	Making appropriations for the Department of the Interior, environment, and related agencies for the fiscal year ending September 30, 2026, and for other purposes.
H.R. 168	TORCH Act	To improve the ability of the Secretary of Agriculture and the Secretary of the Interior to carry out forest management activities that reduce the risk of catastrophic wildfires, and for other purposes.
H.R. 178	To require the Secretary of Agriculture to Carry Out Activities to Suppress Wildfires, and for Other Purposes	To require the Secretary of Agriculture to carry out activities to suppress wildfires, and for other purposes.
H.R. 179	Proven Forest Management Act of 2025	To direct the Secretary concerned to coordinate with impacted parties when conducting a forest management activity, and for other purposes.
H.R. 184	Action Versus No Action Act	To require that only two alternatives be considered with respect to certain proposed collaborative forest management activities, and for other purposes.
H.R. 191	Inflation Reduction Act of 2025	To repeal the Inflation Reduction Act of 2022.
H.R. 204	ACRES Act	To require that the Secretary of Agriculture and the Secretary of the Interior submit accurate reports regarding hazardous fuels reduction activities, and for other purposes.
H.R. 471	Fix Our Forests Act	To expedite under the National Environmental Policy Act of 1969 and improve forest management activities on National Forest System lands, on public lands under the jurisdiction of the Bureau of Land Management, and on tribal lands to return resilience to overgrown, fire-prone forested lands, and for other purposes.

Bill Number	Title	Description
H.R. 527	Strengthening Wildfire Resiliency Through Satellites Act of 2025	To direct the Secretary of the Interior, acting through the Director of the United States Geological Survey, to establish a grant program for monitoring wildfires by satellite.
H.R. 582	Community Protection and Wildfire Resilience Act	To establish a community protection and wildfire resilience grant program, and for other purposes.
H.R. 731	Green Tape Elimination Act of 2025	To exempt hazardous fuel reduction activities from certain environmental requirements for a 10-year period.
H.R. 743	Tim Hart Wildland Firefighter Classification and Pay Parity Act (Tim's Act)	To reform and enhance the pay and benefits of federal wildland firefighters, and for other purposes.
H.R. 948	Safe HOME Act	To amend the Internal Revenue Code of 1986 to provide a refundable credit against tax for wildfire mitigation expenditures.
H.R. 1105	Disaster Resiliency and Coverage Act of 2025	To amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act to require the President to establish an individual household disaster mitigation program, and for other purposes.
H.R. 1110	Grazing for Wildfire Risk Reduction Act	To require the Secretary of Agriculture to develop and implement a strategy to increase opportunities to utilize livestock grazing as a means of wildfire risk reduction.
H.R. 1393	Wildfire Response Improvement Act	To direct the Administrator of the Federal Emergency Management Agency to conduct a review of the criteria for evaluating the cost-effectiveness of certain mitigation projects, and for other purposes.
H.R. 1459	Protect the West Act of 2025	To establish an Outdoor Restoration Fund for restoration and resilience projects, and for other purposes.
H.R. 1820	FLASH Act	To address the public safety issues and environmental destruction currently impacting federal lands along the southern border, enhance border security through the construction of navigable roads on federal lands along the southern border, provide U.S. Customs and Border Protection access to federal lands to improve the safety and effectiveness of enforcement activities, allow states to place temporary barriers on federal land to secure the southern border, reduce the massive trash accumulations and environmental degradation along the southern border, reduce the cultivation of illegal cannabis on federal lands, mitigate wildland fires caused by illegal immigration, and prohibit migrant housing on federal lands.
H.R. 1923	Modernizing Wildfire Safety and Prevention Act of 2024	To provide for the implementation of certain recommendations from the *Report of the Wildland Fire Mitigation and Management Commission*.
H.R. 2026	Ending Major Borderland Environmental Ruin from Wildfires (EMBER) Act	To mitigate environmental degradation and wildland fires caused by illegal immigration along the southern border of the United States, and for other purposes.
H.R. 2492	Fire Safe Electrical Corridors Act of 2025	To authorize the Secretary of Agriculture and the Secretary of the Interior to permit removal of trees around electrical lines on National Forest System lands and Bureau

Bill Number	Title	Description
		of Land Management lands, respectively, without conducting a timber sale, and for other purposes.
H.R. 2709	Save Our Sequoias Act	To improve the health and resiliency of giant sequoias, and for other purposes.
H.R. 3553	BRUSH Fires Act	To direct the Secretary of Agriculture to carry out a study with respect to the effectiveness of available wildfire mitigation methods in reducing the risk of wildfire and the severity of damages from wildfire in communities within or adjacent to shrubland ecosystems, and for other purposes.
H.R. 3637	Locally Led Restoration Act of 2025	To amend the Healthy Forests Restoration Act of 2003 with respect to third-party contracts for wildfire hazard fuel removal, to amend the National Forest Management Act with respect to the threshold for advertised timber sales, and for other purposes.
H.R. 3889	National Prescribed Fire Act of 2025	To direct the Secretary of the Interior and the Secretary of Agriculture to encourage and expand the use of prescribed fire on land managed by the Department of the Interior or the Forest Service, with an emphasis on units of the National Forest System in the western and southeastern United States, to acknowledge and support the long-standing use of cultural burning by Indian Tribes and Indigenous practitioners, and for other purposes.
H.R. 3923	Wildfire Coordination Act	To direct the Secretary of the Interior to establish the Wildfire Science and Technology Advisory Board, and for other purposes.
H.R. 4075	Fire Weather Development Act of 2025	To direct the Administrator of the National Oceanic and Atmospheric [Administration] to improve fire weather and fire environment forecasting, detection, and local collaboration, and for other purposes.
H.R. 4181	WILTR Act of 2025, Wildfire Infrastructure and Landowner Tax Relief Act of 2025	To amend the Internal Revenue Code of 1986 to provide incentives for wildfire prevention.
H.R. 4218	CLEAR Act (Clean Air and Economic Advancement Reform Act)	To amend the Clean Air Act to facilitate state implementation of national ambient air quality standards, and for other purposes.
H.R. 4295	Wildfire Resilient Communities Act	To provide mandatory funding for hazardous fuels reduction projects on certain federal land, and for other purposes.
H.R. 4754	Department of the Interior, Environment, and Related Agencies Appropriations Act, 2026	Making appropriations for the Department of the Interior, environment, and related agencies for the fiscal year ending September 30, 2026, and for other purposes.

Sources: Bill titles and descriptions at Congress.gov, https://www.congress.gov/.

Author Information

Alicyn R. Gitlin
Analyst in Natural Resources Policy

Disclaimer