Living with Fire: Protecting Communities and Restoring Forests

Findings and Recommendations of the Front Range Fuels Treatment Partnership Roundtable

May 2006

Front Range
Fuels Treatment Partnership
Roundtable

This report is a product of the Front Range Fuels Treatment Partnership Roundtable, a coalition of individuals from state and federal agencies, local governments, environmental and conservation organizations, the academic and scientific communities, and industry and user groups—all with a commitment to forest health and fire risk mitigation along Colorado's Front Range.

Roundtable Member Organizations

Arapaho & Roosevelt National Forests and Pawnee National Grassland, USDA Forest Service
American Planning Association, Colorado Chapter
Bureau of Land Management
Coalition for the Upper South Platte
Center of the American West, University of Colorado
Colorado Air Pollution Control Division, Colorado Department of Health & Environment
Colorado Counties, Inc.
Colorado Department of Natural Resources
Colorado Division of Emergency Management
Colorado Geological Survey
County Sheriffs of Colorado, Inc.
Colorado Springs Utilities
Colorado State Forest Service
Colorado State Parks
Warner College of Natural Resources, Colorado State University
Denver Water Department
Florissant Fossil Beds National Monument, National Park Service
Grand County Board of Commissioners
Jefferson County Open Space
Jefferson Conservation District
Pike & San Isabel National Forests and Cimarron & Comanche National Grasslands, USDA Forest Service
Rocky Mountain National Park, National Park Service
Rocky Mountain Research Station, USDA Forest Service
Southern Rockies Conservation Alliance
The Nature Conservancy
The Wilderness Society
University of Colorado—Denver
United States Fish & Wildlife Service, Colorado Field Office
United States Geological Survey

Photo by Dave Steinke

Top row from left to right: *Tom Fry, The Wilderness Society; Greg Aplet, The Wilderness Society; Jim Bedwell, USDA Forest Service; Craig Jones, Governor's Office of Energy Management & Conservation; Merrill Kaufmann, Rocky Mountain Research Station; Jonathan Bruno, Coalition for the Upper South Platte; Bob Leaverton, USDA Forest Service; Chuck Dennis, Colorado State Forest Service; Jeff Jahnke, Colorado State Forest Service; Patricia Limerick, Center of the American West; Brian Muller, University of Colorado-Denver; Brian McPeek, The Nature Conservancy*
Middle row from left to right: *Timothy Brown, Center of the American West; Paige Lewis, Colorado State Forest Service; Leslie Ellwood, US Fish & Wildlife Service; Lisa Dale, Western Forestry Leadership Coalition; Peter Fogg, American Planning Association, Colorado Chapter; Randal Frank, Jefferson County Open Space; Vic Ecklund, Colorado Springs Utilities; Bob Sturtevant, Warner College of Natural Resources, Colorado State University; Liz Lile, United States Geological Survey; Dennis Zachman, Bureau of Land Management*
Front row from left to right: *Kathie Mattor, Roundtable Coordinator; Gali Beh, Beh Management Consulting, Inc.; Brian Kent, Rocky Mountain Research Station; Don Kennedy, Denver Water; Susan Linner, US Fish & Wildlife Service; Mike Foley, USDA Forest Service; Mary Mitsos, National Forest Foundation; David Hessel, Colorado State Forest Service; John Bustos, USDA Forest Service; Karen Berry, Jefferson Conservation District & Colorado Geological Survey; Marilyn Gally, Colorado Division of Emergency Management*
Note: *Not all Roundtable participants were present for the photo. See inside back cover for full acknowledgements.*

OVERVIEW

The Front Range Fuels Treatment Partnership Roundtable, a coalition of individuals, organizations and government agencies, has worked together since 2004 to develop a long-term vision and roadmap for protecting communities from the risks of wildfire and restoring forest health in 10 Colorado Front Range counties (Boulder, Clear Creek, Douglas, El Paso, Gilpin, Grand, Jefferson, Larimer, Park and Teller). The results of the Roundtable's work show that the challenges posed by Front Range forests are significant.

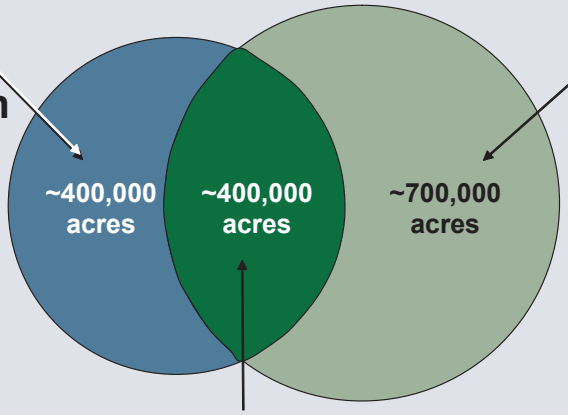
The Roundtable identified approximately 1.5 million forested acres along the Front Range that require treatment to protect communities or restore forest health, which the Roundtable refers to as fire risk mitigation and ecological restoration[1] (see exhibit below). At current treatment costs, achieving these goals could cost approximately $15 million annually over a 40-year period, a sum that vastly exceeds the approximately $6 million currently available each year for forest treatments. This challenge falls on individual landowners as well as governmental land managers because a significant portion of acres that need treatment are on private land.

While the challenge is daunting, the combined goals of reducing fire risk and restoring Front Range forests to good health are achievable. Success depends on leadership and action by federal, state, and local governments, as well as the proactive involvement of Front Range communities. The Roundtable has formulated a specific set of initiatives designed to provide additional resources for forest treatments, reduce treatment costs, drive local leadership

Dual Goals of Forest Treatments

Ecological Restoration

Restore an area's natural ecological structures and processes to within the historical range of variability (HRV)[1]



Fire Risk Mitigation

Protect human life, property and other values—such as watersheds, wildlife habitats, and community infrastructure including telephone and electricity poles and reservoirs—at risk from wildfire.[2]

1 HRV is the natural fluctuation in ecosystem structures or processes, and the spatial and temporal variations in these conditions, over time. Ecosystem structures include overstory and understory composition, expected biodiversity and patch sizes / diverse arrangement of patches of forest stands. Ecosystem processes include soil nutrient cycling, riparian sedimentation and the presence of recent wildfires. Because ecosystem structures and processes naturally change over time, areas should be restored so that combined they represent the natural range of ecological structures and processes—versus a one-time snapshot of conditions—for that ecosystem.

2 For the purpose of this report, the Roundtable primarily addressed protecting people and houses from wildland fire. Fire risk mitigation requires that buildings be protected with Firewise practices. Fire risk mitigation also requires assessing each of three types of fuels and then selectively reducing those that are especially dense and pose a wildfire risk. Surface fuels are grasses and leaves, needles, and branches that have fallen to the ground. When these fuels are ignited, a surface fire may result. Ladder fuels are branches, leaves, and needles protruding from the lower trunks of trees. Ladder fuels can ignite from burning surface fuels and carry the fire upward to the tree canopy, thus creating a crown fire. Canopy fuels are the majority of a tree's branches, leaves and needles. When these burn, a crown fire results. Reducing canopy density in a forest stand may slow the spread of a crown fire.

and planning, and establish common priorities for forest treatments. Roundtable members will continue to work with federal, state, and local decision-makers to advance these initiatives and help catalyze the changes needed to protect and restore Colorado's forests.

Above: Pikes Peak Watershed—The contrast is striking between the treated area on the left and the untreated area on the right.

Photo by Andy Schlosberg

Top left: Lower montane forest before treatment …
Bottom left: …after treatment.

Photos by Kristin Garrison

Firewise practices are critical to protecting structures from wildfire

- **Firewise practices include**:
  1. Creating a defensible space of at least 10 meters around all structures by:
     a. Properly thinning trees and brush within the defensible space.
     b. Removing trash and debris from the defensible space.
     c. Clearing leaves and other debris from roofs and gutters.
     d. Removing branches overhanging any roof and chimney.
     e. Stacking firewood uphill or on a contour away from house.
  2. Using fire-resistant construction such as noncombustible roof and deck materials, fire curtains, and chimney screens.
  3. Developing an emergency access and disaster plan in the event of a wildfire. This includes installing and testing smoke detectors; practicing family fire drills and evacuation plans; ensuring availability of outdoor water supply, fire tools, ladders, and fire extinguishers; posting address signs and load limits on bridges; and ensuring that driveways are wide enough for fire trucks and equipment.
- To be effective, Firewise practices require **comprehensive implementation** and **continual maintenance.**
- **Additional information** can be found at www.firewise.org.

BACKGROUND

In the summer of 2002—the driest year for Colorado on record—the Hayman Fire burned 140,000 acres, destroyed 133 homes and 466 outbuildings, and left parts of four counties vulnerable to flash floods and mudslides. The cost of fighting the fire and rehabilitating the burned area exceeded $80 million, excluding an estimated $160 million[2] in indirect economic losses and long-term rehabilitation. Although the Hayman Fire was the biggest wildfire in Colorado's recorded history, a number of other major fires also occurred over several severe fire seasons[3] associated with a multi-year drought. The same year as the Hayman Fire, more than 4,000 other wildfire events burned an additional 480,000 acres in Colorado.

And yet, losses throughout the state could have been much greater. By sheer chance, no major fire in the last few years has found its way into a large residential area. Colorado has, up to this point, "dodged a bullet" with regard to loss of life and property. The state's luck, however, will not last forever. With the memories of recent fire seasons still fresh in their minds and concerns about dry summers to come, Front Range residents understand more than ever the need to diminish the dangers posed by fire to life and property, to restore the ecological integrity of forests, to protect the watersheds that sustain the region's inhabitants and its agricultural lands, and to use economic incentives to drive this critical work.

Front Range Fuels Treatment Partnership

Colorado's Front Range Fuels Treatment Partnership (FRFTP) was created following the record fire season of 2002. Comprised of representatives from the Arapaho & Roosevelt National Forests, Pike National Forest, Colorado State Forest Service (CSFS), Rocky Mountain Research Station (RMRS), Rocky Mountain National Park, and Florissant Fossil Beds National

Top: The aftermath of the 2002 Hayman Fire in the Upper South Platte.
Bottom: The Hayman Fire severely impaired the Upper South Platte Watershed.
Photos by Katherine Timm

Monument, the interagency Partnership's goals are to reduce wildland fire risks through fuels treatment projects that are economically feasible, socially acceptable, and ecologically sustainable; to protect communities from wildland fires; and to restore fire-adapted ecosystems.[4]

The Roundtable

In 2004, the Partnership broadened its capacity and expertise with the creation of a roundtable comprised of representatives from state and federal agencies, local governments, environmental conservation organizations, academic and scientific communities, and industry and user groups. The FRFTP Roundtable was charged with the development of a long-term vision and roadmap for achieving comprehensive forest restoration and fire risk mitigation goals within Front Range forests and to engage local communities in the effort.[5] Building on the work of the FRFTP, the Roundtable convened leading local experts to examine ecological and fire risk mitigation needs, economic constraints and policy issues that must be addressed to reduce fire risk and restore Front Range forests.

The Roundtable's Shared Values

Respect for human safety

Respect for human safety and well-being requires that we recognize community protection from fire as a first priority. This means that we consider not only how best to thin overgrown forests where they abut residential areas, but also the best means for ensuring that future residential development avoids high-risk areas.

Healthy landscapes

Because a crucial aspect of human well-being rests on the right to reside in and visit healthy ecosystems characterized by resilience, integrity and biodiversity, an equal and connected priority is the maintenance of healthy and sustainable landscapes. In this semi-arid locale, the importance of forests as watersheds serving our population centers confirms that issues of fire management affect every resident, tying the state of the forests to the well-being of urban and suburban communities located well outside of the forest environment.

Collaborative strategies

The mixture of public and private land ownership along the Front Range demands collaborative strategies as a way of addressing and reducing the distrust and misunderstanding between and among citizens and governmental entities that has greatly complicated the implementation of comprehensive fire management. The FRFTP Roundtable's goal is to foster a sense of shared risk, as well as shared responsibility, for developing productive, practical and sustainable solutions.

Economic & policy factors

The Roundtable further recognizes that economic, social and ecological health are necessarily interdependent. Therefore the Roundtable has approached the problem of forest fire with a framework that reflects these three concerns: the ecology of the Front Range forests; economic challenges and opportunities for treatment of the forests; and policy and procedural realities at the federal, state and local levels.

Community engagement

The Roundtable understands, too, that the effectiveness of its work depends on its ability to engage with and be informed by local communities and interest groups, and therefore we have accordingly adopted community engagement as the fourth element of our work.

ROUNDTABLE FINDINGS

The Roundtable analyzed Front Range forests on public and private land to estimate the number of acres in need of treatment to protect communities and restore forests. The results are daunting. Approximately 1.5 million acres of forest may be in need of treatment, and approximately 60 percent of those acres are in private ownership. At an average cost of more than $400 per acre, treatment costs could exceed $15 million annually over a 40-year period.

Protecting Communities from the Risk of Severe Wildfires

The single greatest concern posed by wildfire is the enormous potential for the loss of life and property. However, it is difficult to estimate the full scope of this challenge, as there is not yet a standard method for defining where fire risk mitigation is needed. Communities may assess local risks through a Community Wildfire Protection Plan (CWPP), but only a few of these plans have been completed in Colorado. Despite this lack of standard methodology, the Roundtable estimates that more than 1 million acres may be in need of fire risk mitigation to achieve community protection goals,[6] and a significant portion of those forested acres are privately owned. (Note that approximately one-third of these forests also requires ecological restoration, and an additional half-million acres of forest may require ecological restoration alone, bringing the total acres requiring forest treatment to approximately 1.5 million.)

The threat to life and property will only increase with population growth along the Front Range in the coming years. Experts have projected that the Front Range wildland-urban interface (WUI)[7] may double over the next 20 years. While the desire to live close to nature often drives people to build homes next to and within the forest, this type of development complicates forest management and can negatively affect forest health. As Front Range communities grow, local leaders must consider how best to protect new development from wildfire while maintaining forest health.

Restoring Front Range Forests to Good Health

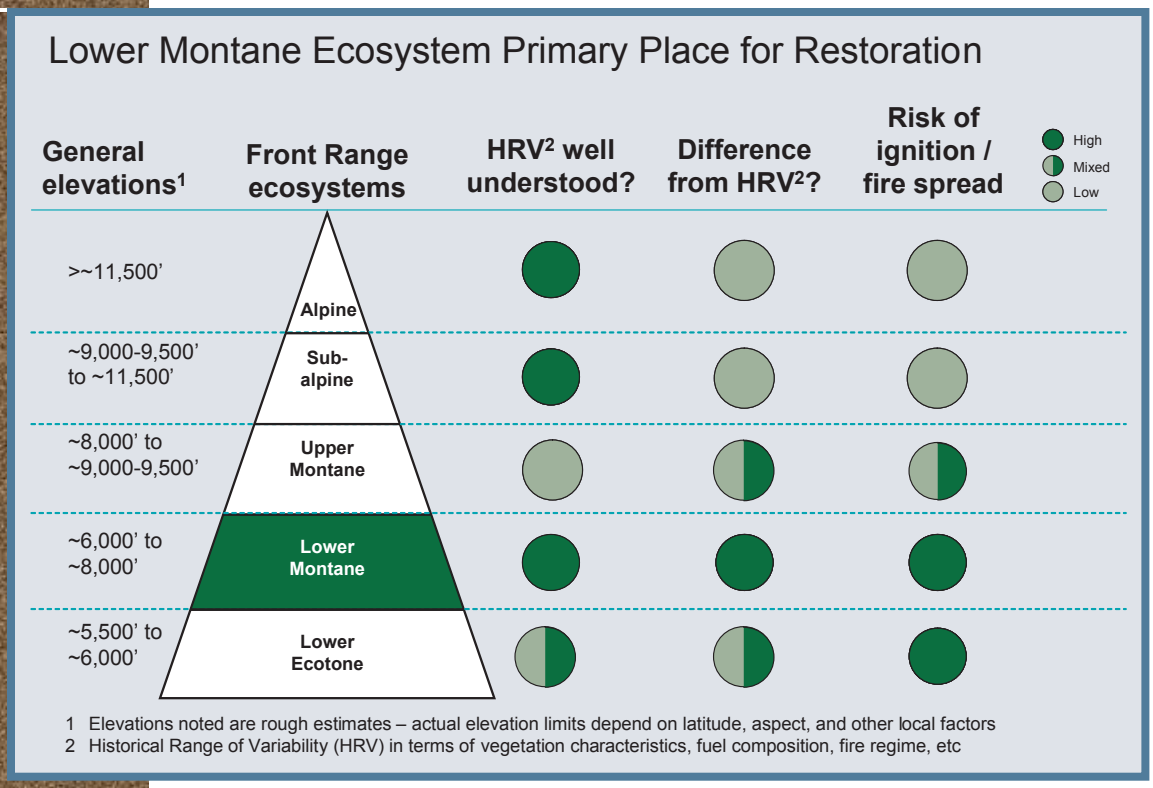
Scientists agree that most of the ponderosa pine forests located in the Front Range ecological zone[8] known as the lower montane[9] are unnaturally dense and in need of fuels reduction treatment. The lower montane life zone is currently far outside its historical range of variability. Evidence of pre-settlement conditions in these forests shows scattered open meadows and more large, old, fire-resistant ponderosa pines, spaced fairly far apart (with approximately 40 to 50 trees per acre) and with a rich understory. However, as a result of logging, fire suppression, livestock grazing and a wetter-than-average climate over the last 30 years, the lower montane forests are now extremely dense (with 200 to 400 trees per acre) and often lack understory and forest openings. While frequent surface fires used to be the norm for this life zone, dense ladder fuels are now capable of carrying fire up to the canopy and causing unnaturally severe crown fires. Hazardous fuels reduction through selective thinning of mostly smaller trees can effectively reduce the occurrence of extensive crown fires, and restore the historical surface fire regime as well as other ecological processes.

Front Range lower ecotone in Larimer County.
Photo by Laurie Stroh Huckaby

The lower montane forest at Cheesman Reservoir (color photos) after recent treatment resembles the forest of 100 years ago (black and white photo).
Color photos by Merrill Kaufmann
Historical photo courtesy of Denver Water

Above: A mixed conifer landscape in the upper montane of Larimer County.
Photo by Mitzy Forbes

Right: A subalpine stand in the Fraser Experimental Forest.
Photo by Laurie Stroh Huckaby

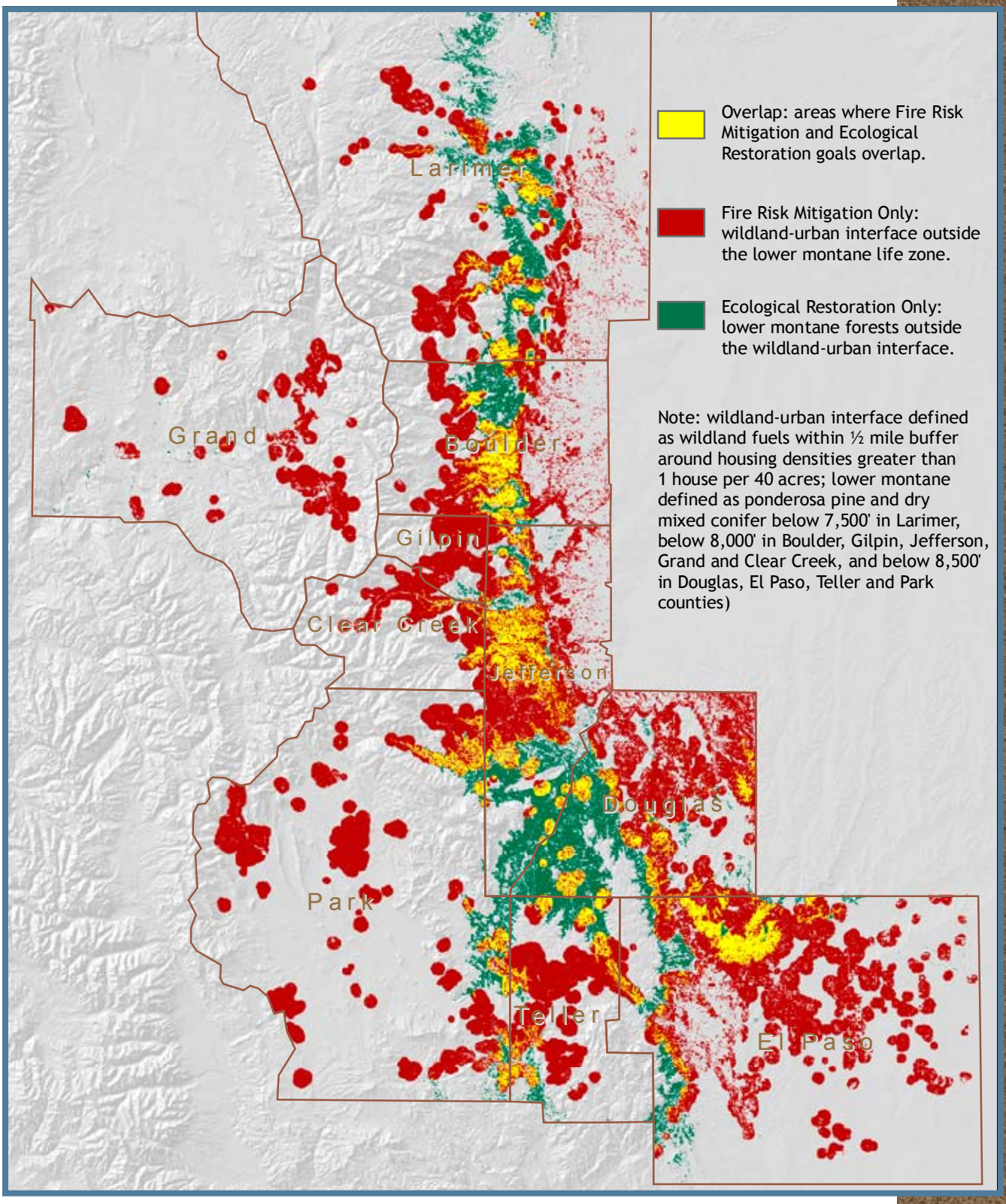


Front Range lower montane forests encompass approximately 700,000 acres[10] with more than 50 percent of the lower montane forests on private land. This is also where a significant portion of the wildland-urban interface exists. Because of this synergy between fire risk mitigation and ecological restoration goals, the overlap between the lower montane forests and the wildland-urban interface should be the top priority for forest treatments.

Front Range forests requiring forest treatment by county (acres)

	Restoration only	Fire risk mitigation only	Both restoration and fire risk mitigation	Total restoration and/or fire risk mitigation	Private land (percent of total)
Boulder	35,978	77,212	51,021	164,211	58%
Clear Creek	833	58,595	7,356	66,784	59%
Douglas	90,807	61,143	40,529	192,479	42%
El Paso	31,169	41,891	57,107	130,167	62%
Gilpin	2,177	42,365	472	45,014	63%
Grand	1,838	94,321	390	96,549	65%
Jefferson	71,157	92,971	88,094	252,222	73%
Larimer	98,856	130,956	42,350	272,162	60%
Park	27,463	122,808	31,377	181,648	57%
Teller	27,211	86,848	23,168	137,227	61%
Total Front Range	387,489	809,110	341,864	1,538,463	60%

Results of Roundtable Analysis: Front Range Forests Requiring Forest Treatment



The need for ecological restoration in forests immediately below[11] or above[12] the lower montane is less well understood. Research in this area is ongoing, however, scientists agree that the high mountain subalpine[13] forests of lodgepole pine and spruce/fir generally do not need ecological restoration. In these forests, tree densities and frequency of wildfire are within their historical ranges of variability. The Roundtable concluded, therefore, that fire risk mitigation treatments outside the lower montane should focus on site-scale applications. Given this, the Roundtable also recognizes that special circumstances may warrant landscape-scale projects outside the lower montane (for example, on stands of lodgepole pine killed by mountain pine beetle). In such cases, ecological restoration should not be the justification for forest treatments.

In all life zones, whether the treatment goal is to protect communities or restore forest health, the Roundtable strongly recommends that every effort be made to select treatment methods[14] that optimize ecological benefits. This means that wherever possible:

- Prescribed fire should be used to restore natural processes.[15]
- Extraction (removing trees and limbs from treated acres) should be favored over scattering biomass on the forest floor.
- Fuels reduction projects should avoid the creation of sterile, park-like forests that have evenly-spaced trees and no shrubs or downed logs. Instead, treatments should achieve a complex mosaic of forest structures with patches of variable tree densities and ages that favor retention of the older trees.
- Treatment plans should minimize any adverse impacts on the habitat requirements of species of concern (especially threatened and endangered species).[16]

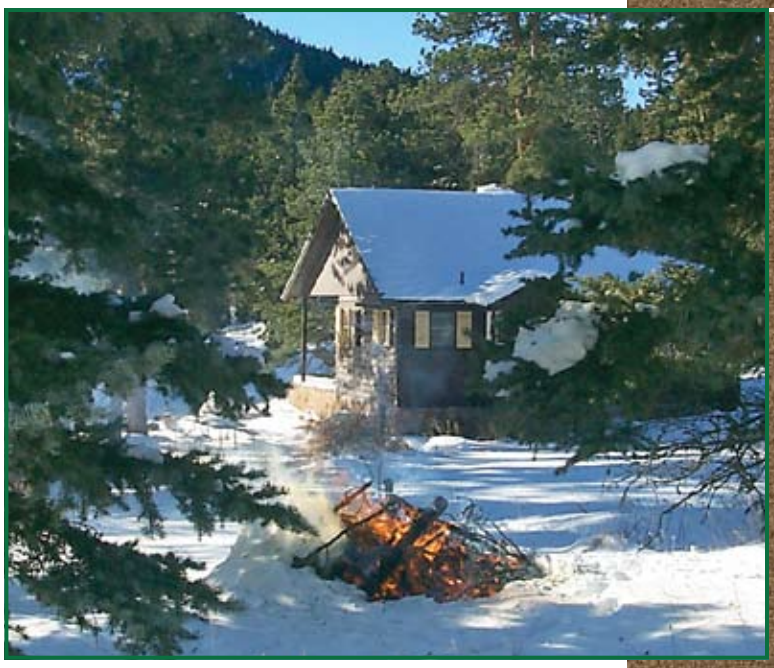
Prairie gayfeather, critical for the threatened Pawnee montane skipper butterfly, thrives after treatment on the Upper South Platte.
Photo by Paula Fornwalt

The populations of the Pawnee montane skipper butterfly, a federally listed threatened species, has increased 14-fold in a recently treated area near Deckers.
Photo by Mike Elson

Funding a Comprehensive Treatment Program

Funding is the primary constraint in achieving treatment goals. The Front Range Fuels Treatment Partnership developed its initial strategy after the 2002 Hayman Fire. This strategy aims to treat 510,000 wildland-urban interface acres (85 percent on public land) within 10 years. The Partnership identified a corresponding total funding need of approximately $24 million annually. This cost vastly exceeds currently available treatment funding, which totals about $6 million[17] per year.

Building on the initial work of the Partnership, the Roundtable extended its analysis to



Above: A masticator removes a tree on the Upper South Platte.

Photo by Kristin Garrison

Top right: Rocky Mountain National Park burns slash during the winter months.

Photo by Scott Sticha

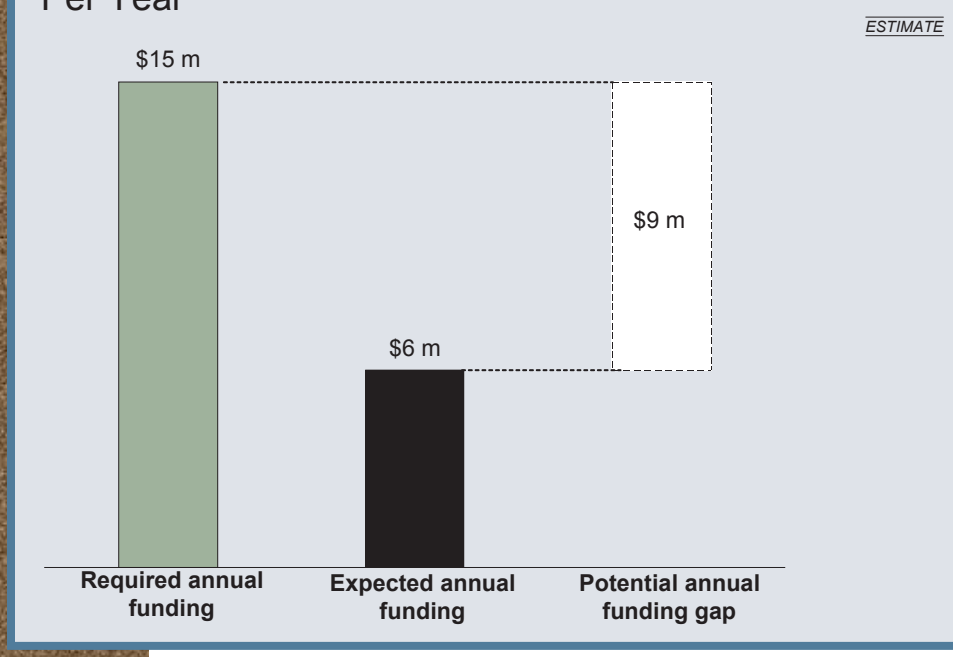
Middle right: A contractor lops branches off a tree during a thinning project in Boulder County.

Photo by Katherine Timm

Bottom right: A tree chipper in action in Boulder County.

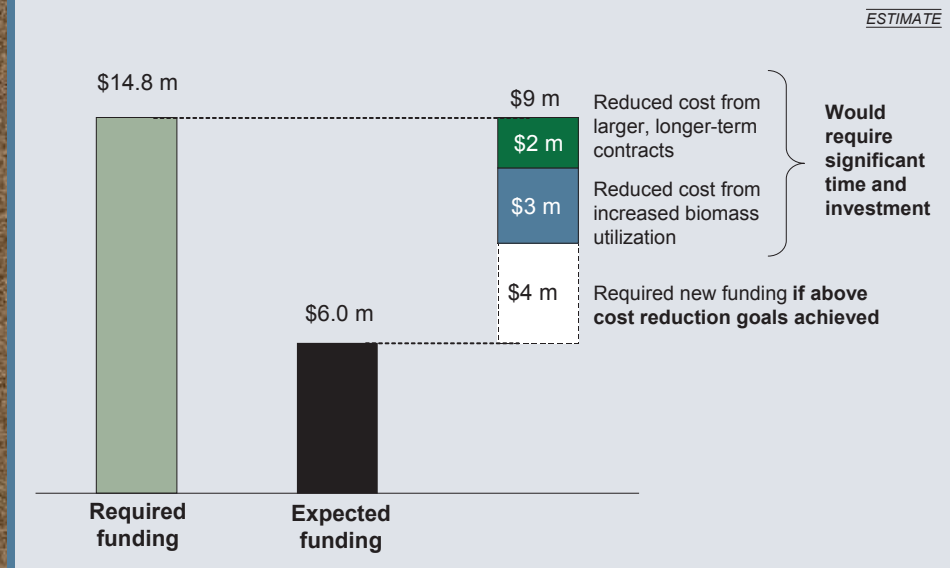
Photo by Katherine Timm

Current Treatment Funding Gap as High as $9 Million Per Year



include ecological restoration as well as fire risk mitigation on any forest that requires treatment regardless of ownership. The Roundtable examined the economic viability of several treatment scenarios,[18] varying by the scope of the challenge (how many acres to treat) and the timeframe to complete initial treatment. The Roundtable formulated a scenario that encompasses the dual goals of ecological restoration and fire risk mitigation on both public and private lands. This scenario presumes a timeframe for the completion of the work that spreads costs over a period sufficient to reduce the funding gap to a manageable size. This scenario shows that at current treatment costs,[19] approximately $15 million annually[20] is needed over a 40-year

Reducing Long-Term Funding Gap with Aggressive Cost Reduction Goals



period[21] to perform treatment on 1.5 million acres that require fire risk mitigation and/or ecological restoration (60 percent on private land).

The Roundtable explored several strategies for reducing treatment costs. These include increasing treatment contract sizes and durations,[22] reducing overhead and planning costs,[23] increasing the use of prescribed fire as a treatment method,[24] and finding commercial uses for the woody biomass that results from treatments. Several technologies exist for utilizing biomass.[25] The Roundtable concluded that wood-chip fired boilers in institutional buildings (also

Heating with woody biomass (i.e. bioheating): a "win-win-win" situation

- **Front Range forests win:**
  - Increasing woody biomass utilization from 0 percent to 50 percent could **subsidize an additional $210 per acre** of treatment costs, cutting treatment costs by more than 40 percent.
  - Unlike biofuels (bioethanol & biodiesel) and small-scale biopower, bioheating from woody biomass resulting from forest thinnings is a **proven technology** (e.g., >10 percent of Vermont students attend bioheated schools).
  - Public institutions such as schools typically require only ~300 tons of woody biomass per year. This represents a **sustainable, scaleable source of demand** for woody biomass. On the other hand, cost-efficient biopower or biofuels facilities may require hundreds of tons per day, requiring a level of forest treatment and transportation activity that would be neither sustainable nor desired.
  - **Demand for institutional bioheating along the Front Range could be significant**: in the 10 counties of the Front Range, almost 300 new public schools may be built and more than 500 existing schools will likely need to replace aging boilers over the next 25 years. If each of these approximately 800 schools converted to bioheating, treatments on ~17,000 acres per year could be subsidized by ~40 percent (the FRFTP treated just over 33,000 acres of forest in 2004).
- **Consumers win:**
  - The cost of heating buildings with woody biomass (~$2 per MMBTU) is lower than all other sources of energy (~$4 for coal, $6 for fuel oil, $7 for natural gas, and $18 for electric power). Two schools have reported first-year fuel cost **savings of 50-80 percent.**
  - Since public institutions (e.g., schools, government buildings, etc.) are almost as dispersed as Front Range forests, the **cost of transporting** woody biomass to bioheating users would on average be less than the cost of transporting it all to a central biopower or biofuels facility.
- **Communities win:**
  - A thriving bioheating industry along the Front Range will create **economic development opportunities** for woody biomass suppliers and distributors in mountain communities.
  - Suppliers of woody biomass can expect to earn a **higher price per ton** from bioheating users (~$30 per ton) than biofuels users (~$8 per ton) or biopower users (~$10 per ton).
  - **Reduced heating costs** for public institutions would ease pressure on public funding sources.

Wood chips from forest treatments heat the new Boulder County Open Space facilities in Longmont. The plant is designed to heat 120,000 square feet.

Top left photo by Randy Hunsberger.

Other photos by Dan Bihn.

known as bioheating) appear to offer the best opportunity[26] to connect woody biomass supply with near-term market demand, conveniently providing a source of funds to offset forest treatment costs.[27]

Even if potential cost savings are realized—an extremely challenging long-term task requiring significant investment—a large funding gap would remain, especially in funding for treatments on private land. More than 80 percent of the approximately $6 million in available federal funding is for treatment of public land only. Increased federal funding for forest treatments across ownership boundaries should be a priority. But because many of the acres needing treatment are on private land, the state and local communities must also find ways to contribute to treatment costs. In addition, new tools and landowner incentives are needed to catalyze treatments on private land (see exhibit).

Despite funding challenges, the Roundtable concluded that achieving community protection and forest restoration over the long term is possible. Success will require strong leadership from state and local governments, as well as their federal partners, and active involvement from local community leaders. In the near term, establishing a method of prioritizing treatment projects is unavoidable. As previously discussed, the Roundtable's diverse set of stakeholders identified one clear guideline for prioritization: namely, it makes sense to spend limited funds on areas where both fire risk mitigation and ecological restoration goals can be accomplished at the same time. Treatment programs designed according to this guideline likely will enjoy broad support. The Roundtable also recommends that Front Range stakeholders adopt 10 initiatives (see page 15) designed to increase funding for forest treatments, reduce the cost of treatments, ensure local leadership and planning, set clear priorities, and monitor progress toward common goals.

Private Landowner Incentives

Private participation is key

- **Approximately 60 percent** of Front Range forests requiring treatment are located on private land.
- Cost-sharing programs stretch public funding dollars by **catalyzing private investment**.
- Subsidizing private treatments **benefits the public** since wildfires, watersheds, habitats, and airsheds cross ownership boundaries.

Incentives work

- Full-service treatment programs: These programs provide treatment work to landowners free or at a significantly reduced rate. For instance, the Coalition for the Upper South Platte (CUSP) and the Pikes Peak Wildfire Prevention Partners (PPWPP) are two Front Range organizations that recently used grant money to conduct forest treatment work for private landowners.
- Partial-reimbursement programs: These programs subsidize the cost of treatment work for private landowners. For example, both Boulder and Douglas counties offer programs that will reimburse a group of private landowners for the treatment work they collectively have done on their properties (at reimbursement rates of 40 percent in Douglas, 50 percent in Boulder).
- Slash/mulch sites or hauling programs: These types of incentives provide landowners with a place to dump their biomass and/or offer hauling services to collect and dispose of the material. This saves landowners on transportation and/or dumping fees.
- Firewise education/assessments: visits by Colorado State Forest Service foresters to advise private landowners of steps they can take to protect their own homes.

Incentives need marketing

- Private landowner incentives such as the ones listed above exist in most, if not all, Front Range counties. Yet, it is often **difficult for residents to find out** what is offered in their local communities.
- **Centralized coordination and increased marketing** would help increase the utilization of private landowner incentives and increase the rate of private forest treatments.

ROUNDTABLE RECOMMENDATIONS

Based on its findings, the Roundtable formulated 10 recommended initiatives, each of which is accompanied by suggested actions for federal, state, and local stakeholders. Implementation of these measures will accelerate progress in reaching Front Range community protection and forest restoration goals. Some of these initiatives apply only to treatments on private land (#1 and #2) or public land (#6); the other seven initiatives apply to both public and private lands.

10 Initiatives to Increase Treatments

Increase funding for treatments	1. Identify new state and local funding sources for treatments on state and private land. 2. Increase treatment incentives for private landowners. 3. Advocate for additional federal funding for Front Range treatments.
Reduce the cost of treatments	4. Increase appropriate application of prescribed fire and wildland fire use as a management tool. 5. Increase utilization of woody biomass for facility heating. 6. Increase contract sizes and durations with stewardship contracts on federal land.
Ensure local leadership and planning	7. Limit the growth of fire risk in the wildland-urban interface. 8. Promote the development of Community Wildfire Protection Plans for Front Range Communities at Risk.
Set clear priorities and ensure progress toward common goals	9. Adopt a clear and common framework for prioritizing treatments. 10. Convene follow up Roundtable to ensure implementation of recommended initiatives.

Increase Funding for Treatments

1. **Identify new state and local funding sources that can contribute to treatment costs on state and private land.**
Federal funding through the USDA Forest Service is currently the primary source of funds for treatments on both federal and non-federal lands. While sustained federal funding is critical, these funds likely will not be sufficient to address long-term forest needs. The Roundtable's analysis shows that at least $4 million in additional funds are needed annually to meet comprehensive treatment goals. State and local funding must play a key role in filling this gap, particularly for treatments on state and private land.

Recommended Actions

Colorado General Assembly: Authorize and appropriate direct funding for fire risk mitigation on non-federal land.

Colorado State Forest Service: Identify and pursue opportunities for those dependent on good forest health to contribute to treatment costs (for example, municipal water consumers and suppliers, recreational users, and industries dependent on forest aesthetics).

County Commissioners: Create Forest Improvement Districts[28] (self-taxed) for the

purpose of funding and carrying out treatments in the wildland-urban interface.

2. **Increase treatment incentives for private landowners.**
The Roundtable's analysis shows that approximately 60 percent of acres in need of treatment are on private land. Greater incentives are needed to encourage private landowners to carry out treatments on their own lands because public subsidies catalyze private investments.

Recommended Actions

Colorado General Assembly:

- Enact a tax-credit program to encourage treatments on private lands.
- Revise the Forest Agriculture Tax Program to allow eligibility in the program if landowners reduce the risk of wildfire, even if the resulting products do not generate a profit.

Counties and Local Governments: Expand county and/or community-based cost-sharing programs and slash/mulch services.
Front Range Fuels Treatment Partnership: Create a centralized information resource for private landowners (for example, on the FRFTP website) to identify incentive and cost-share programs available in each Front Range county. Coordinate the expansion and increased marketing of private landowner incentives with all applicable agencies.

3. **Advocate for additional federal funding for Front Range treatments.**
Achieving Front Range community protection and forest restoration goals will require sustained or increased federal funding. Given federal budget realities and the competition for limited resources, sustaining long-term funding for Front Range treatment objectives requires a concerted effort by all affected stakeholders. Land managers should also seek to maximize efficiency by prioritizing projects that cross ownership boundaries.

Recommended Actions

Colorado Congressional delegation:

- Seek increased funding for the federal State Fire Assistance program[29] to assist communities and non-federal landowners.
- Seek additional federal funding through hazardous fuels reduction programs[30] such as the National Fire Plan, the Healthy Forest Restoration Act, and others.

Arapaho & Roosevelt and Pike National Forests, and other federal land management agencies: Accelerate opportunities to use the Wyden Amendment Authority[31] to extend federal land treatments onto adjacent non-federal land, when possible.

Tree slash, collected by homeowners in the Windcliff Estates subdivision in Larimer County, awaits chipping and scattering.
Photo by Katherine Timm

Colorado State Forest Service: Pursue opportunities to use the Good Neighbor Authority[32] to extend private land treatments and contracts onto federal land, when possible.

Reduce the Cost of Treatments

4. **Increase the appropriate application of prescribed fire and wildland-fire use[33] as a management tool.**
Careful application of prescribed fire and wildland-fire use offers a tremendous opportunity to achieve ecological goals and reduce treatment costs. Colorado's forests evolved with natural cycles of fire. These fires stimulated forest diversity, regeneration, and other key ecological processes. Prescribed fires also have a significantly lower average treatment cost of approximately $125 per acre compared to $400 to $800 per acre for mechanical treatments. However, the Roundtable also recognizes that the opportunities for prescribed fire and wildland-fire use currently are limited along much of the Front Range. This is largely due to dense forest conditions that require fuel loads be reduced mechanically before prescribed fire can be safely employed. The use of prescribed fire is also inhibited by public opposition to smoke pollution, despite the fact such small controlled burns prevent much larger air pollution problems produced by larger wildfires. Steps must be taken to reduce these barriers so that fire can be a primary tool in long-term forest management.

Recommended Actions

Colorado State Forest Service: Lead the formation of a statewide Prescribed Fire Council,[34] with active participation from appropriate state and federal agencies, non-governmental organizations (NGOs) and local community leaders, to promote the appropriate use of fire and reduce barriers to the application of prescribed fire and wildland-fire use.

Colorado General Assembly: Initiate and pass a resolution supporting the establish-

Top: A prescribed broadcast burn removes ground juniper and other fuels in Jefferson County.
Photo by Jen Chase

Middle: A prescribed broadcast burn in this mixed conifer forest has reduced surface and ladder fuels in Larimer County.
Photo by Laurie Stroh Huckaby

Bottom: Firefighters monitor a prescribed broadcast burn in Jefferson County, a much less dangerous task than fighting a wildfire.
Photo by Jen Chase

A skidsteer readies trees to be utilized as fencing at the Cal-Wood Education Center in Boulder County.
Photo by Katherine Timm

Woody biomass is ready for use to heat the Boulder County Open Space facilities in Longmont.
Photo by Dan Bihn

ment of a Prescribed Fire Council and the accomplishment of associated goals.

5. **Increase commercial utilization of woody biomass, especially as bioheating fuel for institutional buildings.**
One of the primary issues driving high treatment costs is the lack of commercial utilization for the woody biomass extracted during treatments. Although most of the higher-value sawlogs, posts, and poles produced during treatments currently are sold, little of the woody biomass—which makes up the bulk of material available after treatment—is utilized. Institutional bioheating, which uses wood chips to fire heating systems, appears to offer the best near-term opportunity to utilize this material. Bioheating has the potential to absorb a significant volume of available biomass and subsidize up to 40 percent of forest treatment costs. Bioheating also is the least expensive fuel available per unit of energy produced. Installing bioheating systems in new public facilities and replacing old boilers with them in existing public buildings would reduce energy costs while supporting fire risk mitigation and improved forest conditions along the Front Range.

Scattered biomass covers the forest floor in the Upper South Platte project area near Deckers. The Roundtable encourages commercial utilization of this biomass material.
Photo by Kristin Garrison

Recommended Actions

Colorado Congressional delegation:

- Seek funding for the Biomass Commercial Use Grants in the Energy Policy Act of 2005 to subsidize a facility's cost of purchasing biomass.
- Seek funding for the Improved Biomass Use Grants in the Energy Policy Act of 2005 to support development of woody biomass utilization opportunities.

Colorado General Assembly:

- Require the feasibility of bioheating to be explored for new public buildings on the Front Range.
- Provide subsidies for the conversion of heating units to bioheating in existing state buildings.
- Revise the state's renewable energy bill (Amendment 37) to include bioheating (for example, electric power made from biomass is currently included).
- Enact tax-credits to encourage businesses to serve bioheating consumers (for example, wood-chip suppliers and distributors).

Colorado Wood (Colorado State University): Act as a marketplace to bring together potential bioheating suppliers (such as private landowners and technology service providers) and consumers (such as public building planners).

Governor's Office of Energy Management and Conservation: Explore the development of bioenergy tax districts.

6. **Increase contract sizes and durations with stewardship contracts on federal lands.**

Treating large areas of land—more than 200 to 300 acres—at one time can result in cost savings at all stages of treatment, including planning, execution and monitoring. This scale of treatment can be accomplished on single ownership properties or by bundling together several smaller treatments crossing ownership boundaries. Stewardship contracts would also provide a long-term, consistent supply of biomass to increase commercial utilization of woody biomass, especially as bioheating fuel for institutional buildings (see Initiative #5).

The Windcliff subdivision in Larimer County received Firewise Communities/USA designation in December 2004. Firewise Communities/USA is a nationwide initiative that recognizes communities for taking action to protect people and properties from the risk of fire in the wildland-urban interface.

Photo by Scott Sticha

Recommended Actions

Arapaho & Roosevelt and Pike National Forests, and other federal land management agencies: Initiate long-term (for example, 10 year), landscape-scale stewardship contracts that reflect the priorities established by the Roundtable.

Colorado State Forest Service: Support stewardship contracts on federal land by identifying complementary projects on private and state lands.

Non-Governmental Organizations: Join multi-party monitoring groups to ensure stewardship contracts are implemented in accordance with Roundtable-identified priorities and sound ecological practices.

Ensure Local Leadership and Planning

7. **Limit the growth of fire risk in the wildland-urban interface (WUI).**
The proliferation of people, homes, and related infrastructure in the wildland-urban interface strains public resources and compromises firefighter safety. Growth projections for the Front Range suggest that the WUI could double over the next 20 years. Limiting future expansion of the WUI and/or ensuring that WUI development incorporates Firewise building materials, landscaping, and other practices should be a high priority for local communities.

Recommended Actions

County Commissioners:

- Include a wildfire component in comprehensive county land-use plans.
- Require Firewise compliance as part of the land development and building permit approval process.
- Require that fire risk information and Firewise educational materials be provided to applicants for new building construction.

Rocky Mountain Insurance Information Association: Work with insurance providers to ensure that policyholders living in forested areas follow Firewise practices. For example, State Farm's pilot program facilitates fire risk assessments and provides policyholders with recommended action plans to make Firewise improvements to their properties.

Colorado Real Estate Commission:

- Add fire risk disclosure to the Seller's Property Disclosure (as currently exists for flood risk).
- Require real estate brokers to provide educational materials on Firewise practices to buyers of forested properties.

8. **Promote the development of Community Wildfire Protection Plans (CWPPs) for Front Range Communities at Risk.**[35]
Treatment plans are best developed through a collaborative process at the local level

with active participation by communities. The Healthy Forest Restoration Act of 2003 prioritizes federal funding for treatments identified in CWPPs. Completing CWPPs for all Front Range communities should be a high priority for local community leaders.

Recommended Actions

Colorado Congressional delegation: Establish dedicated funding for the creation of CWPPs.

County Commissioners: Ensure that all Communities at Risk within the county have CWPPs in place within three years.

Local Governments, Fire Departments, and Fire Protection Districts: Complete CWPPs for all Communities at Risk within three years.

Colorado State Forest Service:

- Work with local planning teams to incorporate key findings of the Roundtable into CWPPs.
- Ensure continuity across CWPPs by providing state-level guidelines.

Arapaho & Roosevelt and Pike National Forests, and other federal land management agencies:

- Support development of CWPPs by providing specialized natural resource knowledge, technical expertise, and financial assistance.
- Prioritize federal projects in approved CWPPs.

Colorado Division of Emergency Management: Provide technical expertise in community-level hazard-response planning.

Non-Governmental Organizations (NGOs):

- Inform communities about the benefits of CWPPs.
- Encourage local participation and implementation of projects prioritized in CWPPs.

Set Clear Priorities and Ensure Progress Toward Common Goals

9. Adopt a clear and common framework for prioritizing treatments.

Even with implementation of recommended cost-reduction initiatives, the required funding to treat Front Range forests likely will exceed available funding for the foreseeable future. Therefore, the need to set and follow clear priorities is paramount.

Recommended Actions

All Front Range land managers: Prioritize treatments in accordance with the following consensus guidelines:

- Focus treatments in the lower montane life zone (ponderosa pine-dominated forests). This is where fire risk is unnaturally high, forest restoration and community protection goals overlap, and landscape-scale treatments are appropriate.
- Focus treatments in forest types above and below the lower montane on site-scale treatments to achieve community protection goals.
- Ensure that treatment programs are consistent with goals established through Community Wildfire Protection Plans (see Initiative #7).
- Support efforts of private landowners to comply with Firewise guidelines.

10. Convene follow-up Roundtable of forest stakeholders to ensure implementation of current recommendations and challenges.

Protecting communities from the risks of severe wildfires and restoring Front Range forests will require a sustained effort by all Front Range stakeholders over several decades. Formation of a collaborative group including senior representatives from state and federal agencies, the scientific community, conservation/environmental NGOs, industry and user groups, and local communities can help sustain comprehensive fire management.

Recommended Actions

Front Range Fuels Treatment Partnership: Convene follow-on Roundtable every six months to review implementation progress and provide support, guidance, and leadership where needed.

Colorado General Assembly: Adopt a resolution endorsing current Roundtable findings and recommendations and the formation of a follow-up Roundtable to monitor progress and address treatment challenges.

Conclusion

With the memories of recent fire seasons still fresh in their minds, Front Range residents understand more than ever the need to diminish the dangers posed by fire to life and property, to restore forests damaged by fire, to protect the watersheds that sustain the region's inhabitants and its agricultural lands, and to use economic incentives to spur the work of thinning our overgrown forests. There is broad agreement that these are the right goals; more difficult, however, is reaching consensus on how, in practical terms, to achieve them. Potential solutions must take into account that the problem of fire management extends indefinitely into the future and that our efforts must also be sustained indefinitely. The Roundtable recognizes that the complexity and scale of the challenge demand that federal and state agencies, local governments, the private sector, citizen groups, and individual homeowners all work together. No single entity has the expertise, resources, or authority to do it alone.

The Front Range Fuels Treatment Partnership Roundtable was formed to bring the interests and creative capacity of the community to bear on this broad set of issues. The Roundtable hopes that the findings contained in this document can be used by Front Range communities as they pursue amicable and collaborative approaches to fire management, fuels mitigation, and ecosystem sustainability in their own localities.

FOR ADDITIONAL RESOURCES

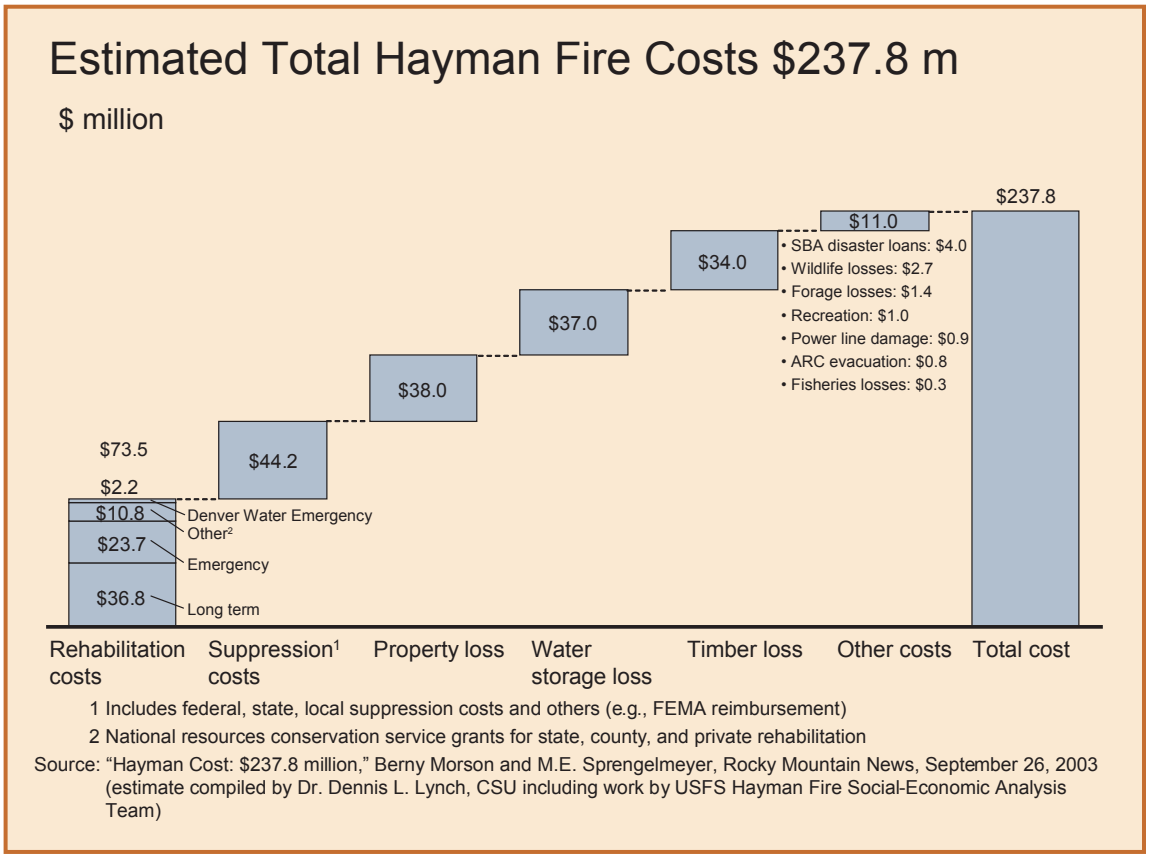
Please refer to the following websites:

1. Front Range Fuels Treatment Partnership: www.frftp.org
2. FRFTP Roundtable: www.frftp.org/roundtable
3. Roundtable report: www.frftp.org/roundtable/report.pdf
4. Recommended actions by organization: www.frftp.org/roundtable/actions.pdf
5. Ponderosa Pine ecology: www.frftp.org/roundtable/pipo.pdf
6. Action Advisory Toolkit (resources for private landowners): www.frftp.org/roundtable/toolkit.pdf
7. Community feedback on interim Roundtable findings (from August, 2005): www.frftp.org/roundtable/community.pdf
8. Economic model: www.frftp.org/roundtable/economics.xls
9. Roundtable contacts: www.frftp.org/roundtable/contacts.xls

ENDNOTES

[1] **Ecological Restoration definition:**
To include both structures and processes, ecological restoration must address the following:
(1) Overstory: tree density, distribution of tree size classes, distribution of tree age classes, and distribution of tree species (structure).
(2) Understory: whether shrubs, forbs, and grasses that typically coexist with a certain tree species are present, with a minimum of foreign weeds (exotics) (structure).
(3) Soil conditions: soil quality and the natural process of nitrogen and carbon cycling within the soil; porosity and natural water-holding capacity are also important, which can be compromised through soil compaction (structure and process).
(4) Water conditions/aquatic habitats: water quality, water flow, and the presence of aquatic habitats (structure and process).
(5) Biodiversity/threatened and endangered species: whether the floral and faunal species of an area (including the less common species such as federal and state-listed threatened and endangered species, and USFS sensitive species) are missing, threatened, or endangered (structure).
(6) Patch size/arrangement of patches: whether a diverse mosaic of forest patches exists, reflective of underlying biophysical diversity and characteristic disturbance history (structure).
(7) Presence of recent wildfire: whether fire plays its natural role in an ecosystem consistent with its historical range of variability (process).

[2] **Estimated direct and indirect costs of Hayman Fire** (note that calculation below excludes ecological benefits for the approximately 66,000 acres within the burn perimeter that either did not burn or burned with low severity thereby enhancing forest health):

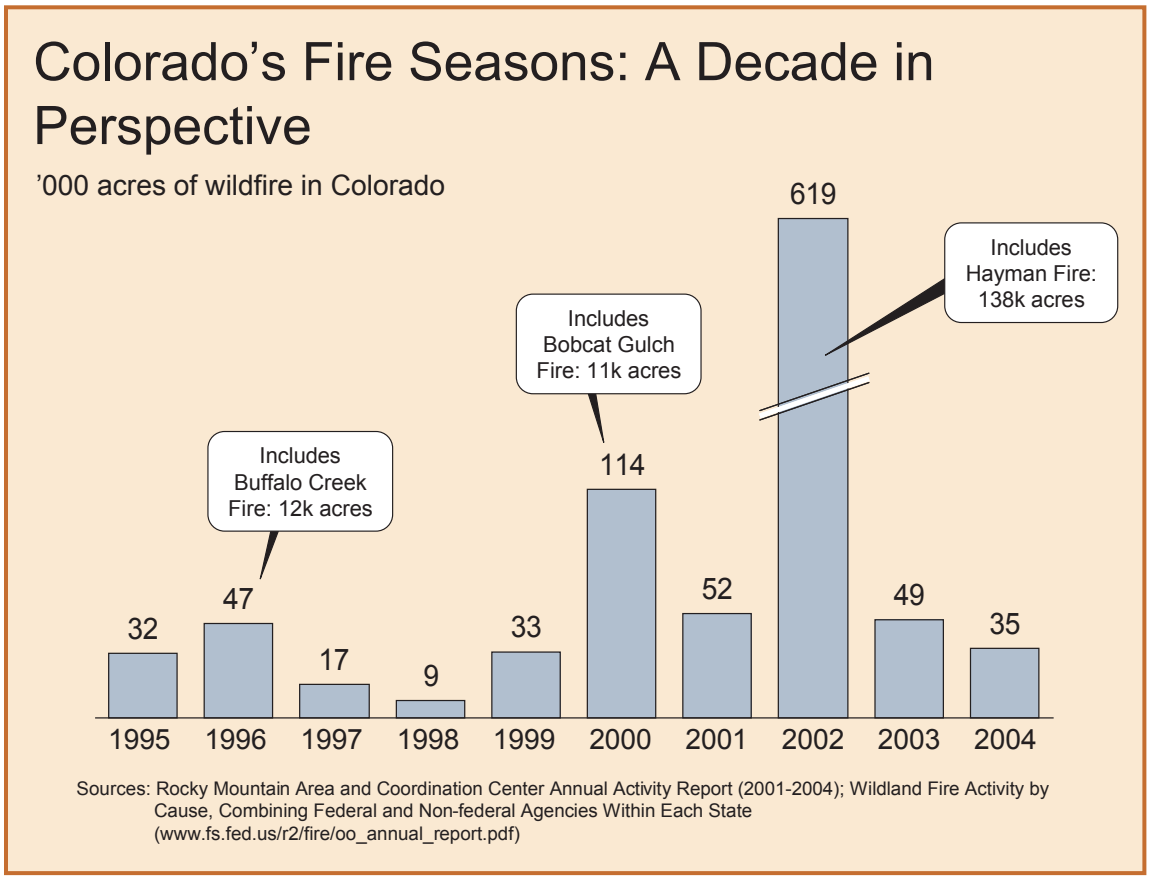


1 Includes federal, state, local suppression costs and others (e.g., FEMA reimbursement)

2 National resources conservation service grants for state, county, and private rehabilitation

Source: "Hayman Cost: $237.8 million," Berny Morson and M.E. Sprengelmeyer, Rocky Mountain News, September 26, 2003 (estimate compiled by Dr. Dennis L. Lynch, CSU including work by USFS Hayman Fire Social-Economic Analysis Team)

[3] **Recent history of Colorado wildfires:**



[4] **Goals of the Front Range Fuels Treatment Partnership (FRFTP):**
(1) Reduce wildland fire risks through fuels treatment projects that are economically feasible, socially acceptable, and ecologically sustainable
(2) Protect communities from wildland fires
(3) Restore fire-adapted ecosystems
Note: The FRFTP conducted a "rapid assessment" of acres requiring fire risk mitigation and identified 510,000 acres requiring treatment, mostly on federal land. The Roundtable analysis differs from the FRFTP analysis in that the Roundtable expanded the analysis to include private land and forests that require ecological restoration outside the wildland-urban interface. The analyses also differ by timeframe: the FRFTP's strategy is based on a 10-year timeframe for completion while the Roundtable analysis is based on a 40-year timeframe, which is more achievable given current economic constraints.

[5] **Roundtable Mission and Objectives:**
Mission: To serve as a focal point for diverse stakeholder input into the FRFTP's efforts to reduce wildland fire risks through sustained fuels treatment along the Colorado Front Range.
Objectives:
(1) To synthesize stakeholder input in order to ensure Partnership awareness of diverse impacts of fuels reduction work on public and private lands, including rural economies, community planning, risk reduction, homeowner protection, wildlife habitat, and ecosystem function in order to refine strategic treatments;
(2) To work with the leadership of the Partnership to facilitate consideration of forest restoration and risk reduction objectives in project planning and implementation strategies;
(3) To facilitate the inclusion of diverse viewpoints in fuels treatment project planning along the Front Range of Colorado;
(4) To ensure fuels reduction and forest restoration treatments are consistent with community-level priorities, and that those communities are included in appropriate dimensions of project planning and execution; and
(5) To assist in dispersing information and communicating the Roundtable's work to the public.

Strategies:

(1) Develop a "vision" document to facilitate the Partnership's processes for planning fuels treatment projects. Craft this vision with help from agency scientists, academic contributors, other experts, and interested stakeholders.

(2) During the production of the vision document, meet bi-monthly as a whole Roundtable group, and as needed in smaller committee-style "working groups."

(3) Work to ensure that planned and future projects are consistent with the vision.

(4) Encourage adoption of planning processes consistent with the landscape-scale vision by local governments in the course of non-federal fire management planning. Build support for the vision and the implementation of that vision (i.e. FRFTP projects).

(5) Work with the media to generate publicity and interest in the Roundtable's work, as well as to positively reinforce the Partnership's successes.

[6] **Methodology behind estimate of acres requiring fire risk mitigation:**

The Wilderness Society (TWS) led the Roundtable in determining where along the Front Range fire risk mitigation is required. The area requiring fire-risk mitigation is referred to as the Community Fire Protection Zone (CFPZ), which is made up of the wildland-urban interface (WUI) plus the buffer into the forest where treatments are required to protect the WUI from wildfire.

No standard operating definitions exist for the WUI or the CFPZ. For the purposes of this report, the interface communities component of the WUI (see Endnote #7) is defined as at least one structure per 10 acres and the intermix communities component is defined as less than one structure per 10 acres, but at least one structure per 40 acres. To determine the size of the total CFPZ, TWS considered five different scenarios for the size of the interface community and intermix community buffers, as shown in the table below. The economic analysis of Scenario 3, below, is included in this Roundtable report.

Community Fire Protection Zone: Scenarios Considered

	Scenario 1 (minimum)	Scenario 2	Scenario 3	Scenario 4	Scenario 5 (maximum)
Interface Community Buffer (assumption)	½ mile	½ mile	½ mile	2 miles	2 miles
Intermix Community Buffer (assumption)	10 meters*	100 meters	½ mile	100 meters	2 miles
Total area of woody fuels buffered WUI (millions of acres)	0.6	0.8	1.1	1.7	2.5

* Treatment performed on individual homes as recommended by the National Firewise Communities Program

[7] **Wildland-urban interface (WUI) definition:**

The WUI is an area where structures such as private homes or community infrastructure abut or are intermixed with trees and other vegetation. The WUI includes three types of communities:

(1) Interface Community: structures directly abut wildland fuels. A clear line of demarcation generally exists between the wildland fuels and residential, business, and public structures. Wildland fuels generally do not extend into the developed area. The Federal Register notice of January 4, 2001, allows the development density for an interface community to be defined in two ways: three structures per acre or 250 people per square mile (which translates to approximately one structure per six acres). The Roundtable prefers the definition of 250 people per square mile (or one structure per six acres) because areas with three structures per acre are much denser than many mountain communities of interest to the Roundtable. Although the Roundtable ideally would like to have used the one-structure-per-six-acres definition to measure the total number of acres within the Colorado Front Range made up of interface community land, the available data required defining an interface community as one structure per 10 acres.

(2) Intermix Community: structures are scattered throughout a wildland area with no clear demarcation between wildland fuels and residential, business, and public structures. Wildland fuels are continuous outside of and within the developed area. The Federal Register allows the development density for an intermix community to be defined in two ways: at least one structure per 40 acres or 28 to 50 people per square mile (which translates to approximately one structure per 64 acres). For the purpose of this analysis, the Roundtable used the definition of at least one structure per 40 acres (and less than one structure per 10 acres) to measure the total number of acres within the Colorado Front Range made up of intermix community land.

(3) Island Community: a forested area surrounded by urban density, such as Central Park in New York City. (Island communities are not found on Colorado's Front Range).

[8] **Working definitions of Front Range life zones:**

Front Range Life Zones

Front Range life zones	General elevations[1]	Example communities	Dominant overstory composition	Associated vegetation types
Alpine	>~11,500'	• None	• No trees	• Grassy slopes and boulder fields • Sedges, mat and cushion plants, dwarf willows
Sub-alpine	~9,000-9,500' to ~11,500'	• Winter Park • Ward	• Lodgepole Pine • Spruce/Fir	• Bogs, meadows, ponds, rich in wildflowers
Upper Montane	~8,000' to ~9,000-9,500'	• Estes Park • Granby	• Mesic Ponderosa Pine • Mesic Mixed Conifer[2]	• Some permanent meadows
Lower Montane	~6,000' to ~8,000'	• Evergreen • Monument	• Dry Ponderosa Pine • Dry Douglas-fir	• Mountain-mahogany • Scrub Oak
Lower Ecotone	~5,500' to ~6,000'	• Boulder • Golden	• Transition to Ponderosa Pine	• Grassland • Mountain-mahogany • Scrub Oak

1 Elevations noted are rough estimates – actual elevation limits depend on latitude, aspect, and other local factors; elevations generally are lower in northern Front Range and on north-facing slopes, higher in southern Front Range and on south-facing slopes (e.g., upper limit of lower montane ~7,500' in Larimer vs. ~8,500' in El Paso)

2 May include: ponderosa pine, Douglas-fir (up to ~8,000'), aspen, blue spruce, limber pine, Engelmann spruce, sub-alpine fir

Note: Riparian zones are included and considered in each life zone in which they are found

[9] **The need for ecological restoration in the lower montane life zone was evaluated by three criteria:**

(1) Is the historical range of variability (HRV) well understood?

The HRV for the lower montane life zone is well understood. From a historical fire regime perspective, this life zone normally would have a mixed severity fire regime that tends toward frequent, low-severity surface fires as often as every 30 to 70 years. Historically, the lower elevations of this life zone have been characterized by sparse, open tree stands created by frequent, low-severity fires that kill many of the younger, smaller trees while leaving the larger, older, more fire-resistant trees.

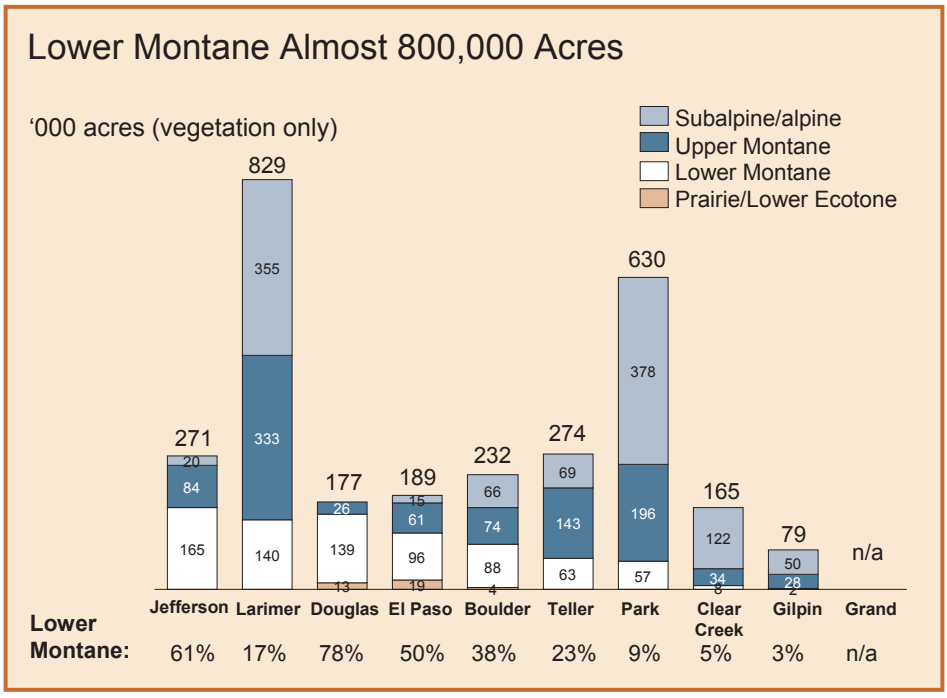
(2) Is this life zone outside its HRV?

The lower montane life zone is generally far outside its HRV. Evidence of pre-settlement conditions in these forests shows scattered open meadows and large, old, fire-resistant ponderosa pines, spaced fairly far apart (with approximately 40 to 50 trees per acre) and with a rich understory. However, as a result of logging, fire suppression, livestock grazing, and a wetter-than-average climate over the last 30 years, the forests of the lower montane are now extremely dense (with 200 to 400 trees per acre) and often lack understory and forest openings. While smaller, more frequent surface fires used to be the norm for this life zone, dense ladder fuels are now capable of carrying fire up to the canopy and causing unnaturally severe crown fires. Hazardous fuels reduction through selective thinning of mostly smaller trees can effectively reduce the occurrence of extensive crown fires and restore the historical surface fire regime.

(3) What is the risk of ignition and fire spread?

The risk of fire ignition and spread within the lower montane life zone is often high because several months of hot, dry weather occur almost annually within this life zone, leaving fuels sufficiently desiccated for extensive fires to occur almost annually.

[10] **Distribution of life zones by Front Range county (analysis by Rocky Mountain Research Station):**



[11] **The need for ecological restoration in the lower ecotone life zone was evaluated by three criteria:**

(1) Is the historical range of variability (HRV) well understood?

The historical range of variability (HRV) for the lower ecotone is not completely understood. Dominated by grassland and scrubland with trees spaced far apart, the lower ecotone has a mixed severity fire regime that tends toward frequent, low-severity surface fires. However, the mosaic of vegetation and moisture levels within the lower ecotone is complex. This results in a high variation in fire behavior in this life zone.

(2) Is this life zone outside its HRV?

Because this life zone's HRV is not completely understood, it is difficult to say whether the zone is outside its HRV. The settled and paved areas of the lower ecotone are obviously outside the HRV and well beyond ecological restoration. But some ranches and protected areas within the lower ecotone are not outside the HRV for this life zone. In addition, not enough is known about what restoration should look like for the lower ecotone. Given the high variability within this ecosystem, restoration goals vary by plant community.

(3) What is the risk of ignition and fire spread?

The risk of fire ignition and spread within the lower ecotone life zone is considered high because several months of hot, dry weather occur almost annually, leaving fuels sufficiently desiccated for extensive fires to occur almost annually.

[12] **The need for ecological restoration in the upper montane life zone was evaluated by three criteria:**

(1) Is the historical range of variability (HRV) well understood?

The HRV for the upper montane life zone is not well understood. The upper montane is an extremely complex ecosystem characterized by small patches of many different tree species and some permanent meadows. From an historical fire regime perspective, the fires in this life zone tend toward a mix of low-severity surface fires and infrequent, severe stand-replacing fires. The upper montane includes some stands of similarly aged trees that were created by stand-replacing crown fires as well as some stands of unevenly aged trees that were created by surface and mixed-severity fires.

(2) Is this life zone outside its HRV?

It is not currently known whether or how much the upper montane life zone is outside its HRV. Much more work is required to define criteria for ecological restoration for the upper montane.

(3) What is the risk of ignition and fire spread?

The risk of fire ignition and spread in the upper montane life zone is greater than in the lower montane because moisture is retained more on higher elevations than lower elevations.

[13] **The need for ecological restoration in the subalpine life zone was evaluated by three criteria:**

(1) Is the historical range of variability (HRV) well understood?

The HRV for the subalpine life zone is well understood. From a historical fire regime perspective, fires in this life zone occur as infrequently as every 200 to 400 years. When fires do occur, they tend to be high-severity, stand-replacing crown fires that result in the creation of temporary meadows and subsequent stands of trees of a similar age.

(2) Is this life zone outside its HRV?

The subalpine life zone probably is not outside its HRV because, with a fire-return interval of 200 to 400 years, it is unlikely that the relatively short period (50 to 100 years) of fire suppression that has occurred in this ecosystem has significantly altered forest structures or processes. Unlike in the lower montane, dense tree stands and abundant ladder fuels are natural in subalpine forests and do not represent abnormal fuel accumulations. Therefore, reductions in tree densities would not result in ecological restoration but would represent a departure from the natural range of variability in stand structure within the subalpine life zone.

(3) What is the risk of ignition and fire spread?

The risk of fire ignition and spread within the subalpine life zone is usually low because of the ecosystem's generally cool, moist climate. However, under suitably dry conditions (which occur infrequently), severe, stand-replacing fires could occur—but these would not be outside of the ecosystem's HRV. Dry fuel conditions necessary for fire spread may occur more frequently in areas of the subalpine dominated by lodgepole pine than in those areas dominated by spruce-fir (based on research in Rocky Mountain National Park by Sibold, J., T. Veblen, and M. Gonzales, "Subalpine forest fire regimes of the southern Rockies," *Journal of Biogeography*).

Advantages and disadvantages of forest treatment methods

	Ecological Restoration		Fire Risk Mitigation	
	Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Burned Biomass (broadcast burn or wildland fire use)	* Stimulates natural fire-driven processes (for example, riparian sedimentation, lodgepole pine seed dispersal, nutrient cycling)	* Risk of unintended consequences (for example, unexpected tree mortality, excessive erosion, negative effects on water quality, burn turning into uncontrolled wildfire)	* Prescribed burn may reduce risk of crown fire by reducing surface and ladder fuels	* Prescribed burn may not reduce crown density. Crown fires could still be severe * Not appropriate where excessive fuels might increase surface fire severity or risk of crown fire * Risk of excessive smoke pollution
Scattered Biomass	* Because this is a more precise treatment tool, it carries a reduced risk of unintended tree mortality, excessive erosion, and other unintended consequences possible from burned biomass * May reduce erosion * Post-fire rehabilitation: may inhibit growth of exotic species * Some light soil disturbance may be beneficial to seedling regeneration * Decomposition may help build soils	*Decomposition of biomass causes nitrogen depletion and possibly the production of toxic phenol * Chip layers may smother understory vegetation * Insulating quality of wood-chip layers could reduce soil temperatures and inhibit understory growth * If burned, fire might sterilize soil and damage tree roots with slow smoldering heat * Increased risk of soil damage / compaction from equipment may inhibit seedling regeneration	* May reduce risk of crown fire by reducing surface and ladder fuels (and by potentially reducing crown density if stand has mostly smaller, younger trees) * May prevent next seedling crop, thus reducing growth of new fuels * May reduce flammability if biomass deposit is compact enough	* If mastication equipment cannot handle trees larger than 9 inches in diameter, treatment may not reduce crown density and crown fires could still be severe * If biomass not compact, it may increase flammability due to kindling nature of material and redistribution of fuels * If burned, may increase severity of surface fire due to excessive surface fuels * Follow-up prescribed burn may require longer monitoring by fire crew due to slow, smoldering burn created by wood-chip layers. This would drive up costs, strain capacity, and increase smoke pollution
Extracted Biomass	* Because this is a more precise treatment tool, it carries a reduced risk of tree mortality, excessive erosion, and other unintended consequences possible from burned biomass * Equipment able to treat broad range of tree size classes in one process and meet restoration goals for canopy density and openings (unlike mastication equipment, which can generally handle only trees less than 9 inches in diameter)	* Compaction from ground-based equipment increases risk of soil damage * Slash treatments require either pile-burning or scattering, which have disadvantages noted under "burned" and "scattered" biomass. * Access roads required for extraction may disturb ecology * Increased risk of soil damage/ compaction from equipment may inhibit seedling regeneration	* May reduce risk and severity of surface fires and/or crown fires due to reduction in ladder fuels and canopy densities (as required to meet prescription) * Access roads may be used later in case of need for fire suppression	* Does not reduce surface fuels (for example, duff and litter) * If slash not treated, risk of severe surface fire or crown fire may increase * Access roads required for extraction may lead to more recreation and vehicle use, which may lead to ignition of more fires

[14] **Definitions, advantages, and disadvantages of main types of treatment practices:**

(1) **Burned biomass:** The result of these treatments is that biomass is consumed by burning. Types of burned biomass treatments include:

a. Broadcast burn: A prescribed burn without any pretreatments of the fuels.
b. Pile burn: Fuels—such as tree branches, needles and leaves—are piled together prior to ignition.
c. Wildland fire use: A naturally ignited wildfire that is managed for resource benefit, based on an approved Fire Management Plan.

(2) **Scattered biomass:** The biomass produced from these mechanical treatments is left on the forest floor in the form of wood chips or chunks. Scattered biomass treatments are believed to reduce the risk of wildfire by transforming ladder and canopy fuels into surface fuels, thus shifting the risk from a high-severity crown fire to a lower-severity surface fire. Types of scattered biomass:

a. Lop and scatter: Chain saws or other mechanical means are used to remove branches and cut trees into smaller pieces.
b. Mastication: Machines are used to chip, grind, or shred trees on site.

(3) **Extracted biomass:** The biomass from these mechanical treatments is hauled out of the forest to the roadside, where it is either trucked away or harvested. With extraction treatments, the tree is cut down and the tree tops and branches (also known as slash) are cut off prior to the removal of the trunk from the forest. Slash subsequently may be lopped and scattered, masticated, piled and burned, and/or broadcast burned.

[15] **The use of prescribed fire should be increased whenever possible:**
Prescribed fire restores important ecological systems and processes. For example, prescribed fire stimulates riparian sedimentation, lodgepole pine seed dispersal, and other natural fire-driven processes. However, because fuel loads in most lower montane Front Range forests are unnaturally dense, the Roundtable finds that initial treatments may first require mechanical thinning to reduce ladder and canopy fuels. Once these fuel loads have been reduced, a prescribed fire should follow within five years. Ecological restoration is not considered complete until mechanical thinning is followed by prescribed fire. After the initial period of fuels reduction with mechanical treatments (e.g., 40 years), the use of prescribed fire as the primary management tool for long-term maintenance should be increased.

[16] **Forest treatments should accommodate habitats, hibernation, and migration patterns of threatened and endangered species.** This can be accomplished by:
(1) Preserving some high-density areas for species adapted to that habitat.
(2) Retaining some dead, deformed, and diseased trees as well as some clumps of trees with interlocking crowns for nesting habitats.
(3) Leaving some areas untreated to serve as a refuge for wildlife during treatment phases and controls for research and monitoring. Untreated, dense timber stands should be located in areas where they were likely to have occurred historically, such as north facing slopes, small draws, and canyons. Dense areas can still exist if there are some horizontal and vertical breaks in the fuel conductivity of the landscape.
(4) Considering wildlife migration and hibernation patterns in the timing of treatments.
(5) Coordinating across ownership boundaries to ensure wildlife corridors remain protected.
(6) Minimizing mechanical disturbance of soil.
(7) Minimizing new road construction and ensuring post-treatment rehabilitation.
(8) Minimizing the introduction and spread of non-native plants.

Threatened and Endangered Species by County

(as of November 2005)

	Arkansas darter	Bald eagle	Black-footed ferret	Bonytail[1]	Canada lynx	Colorado butterfly plant	Colorado pikeminnow[1]	Greenback cutthroat trout	Humpback chub[1]	Least tern (interior population)[1]	Mexican spotted owl	North Park phacelia	Osterhout milkvetch	Pallid sturgeon[1]	Pawnee montane skipper	Penland alpine fen mustard	Penland beardtongue	Piping plover[1]	Preble's meadow jumping mouse	Razorback sucker[1]	Slender moonwort	Uncompahgre fritillary butterfly	Ute ladies'-tresses orchid	Whooping crane[1]	Yellow-billed cuckoo
Boulder		x			x	x		x		x	x			x				x	x		x		x	x	
Clear Creek		x			x			x		x	x			x				x			x			x	
Douglas		x	x			x		x		x	x			x	x			x	x				x	x	
El Paso	x	x	x					x		x	x			x				x	x		x		x	x	
Gilpin					x					x	x			x				x						x	
Grand		x		x	x		x		x				x				x			x	x				x
Jefferson		x			x	x				x	x			x	x			x	x				x	x	
Larimer		x	x		x	x		x		x	x	x		x				x	x				x	x	
Park		x			x			x		x	x			x	x	x		x				x		x	
Teller		x								x	x			x	x			x	x					x	

1 Water depletions in local rivers may affect the species and/or critical habitat in downstream reaches in other states; species does not necessarily exist in counties shown.
Source: US Fish & Wildlife Service

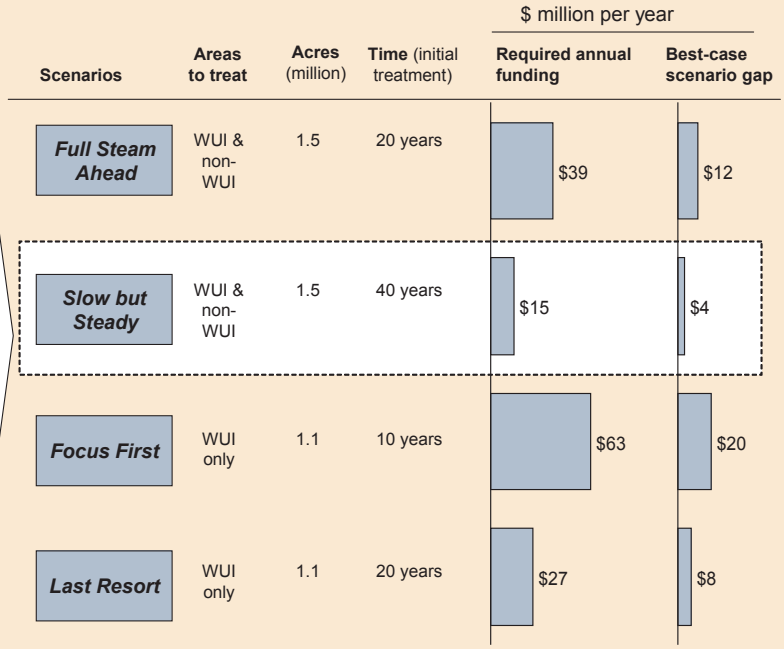
[17] **Expected funding of approximately $6 million:**
Federal funding for forest treatment implementation (excluding overhead and planning costs) for the 2006 fiscal year is estimated to total approximately $6 million. Of this money, $2.1 million will pay for treatments in the Pike National Forest, $2.9 million for treatments in the Arapaho & Roosevelt National Forests, $500,000 for treatments in Colorado State Forests, and $500,000 for treatments on private forest land (through authorities allowing federal funding to go to state and private lands). For the purpose of this analysis, the Roundtable assumed that funding for forest treatment implementation would continue to total approximately $6 million per year over the 40-year treatment period. However, National Fire Plan appropriations vary each year as other national priorities require funding.

[18] **Range of economic scenarios evaluated by the Roundtable:**

Required Funding Depends on Scope of Strategy and Desired Timeframe

Assumptions

- Required funding based on:
  - 25 percent broadcast burn (or wildland fire use) only
  - Scattered biomass limited by current capacity (13k acres per year)
  - Extraction with utilization limited by current demand (15k acres per year)
  - "Surplus" acres treated by extraction with dumping until new biomass demand created
- Best-case gap based on:
  - 20 percent cost savings on mechanical thinning on public land from larger and longer contracts
  - Increase in woody biomass utilization from 0 percent to 50 percent
  - Biomass markets found for acres treated by extraction with dumping (100 percent utilization of sawlogs, post, and poles, 50 percent utilization of woody biomass)

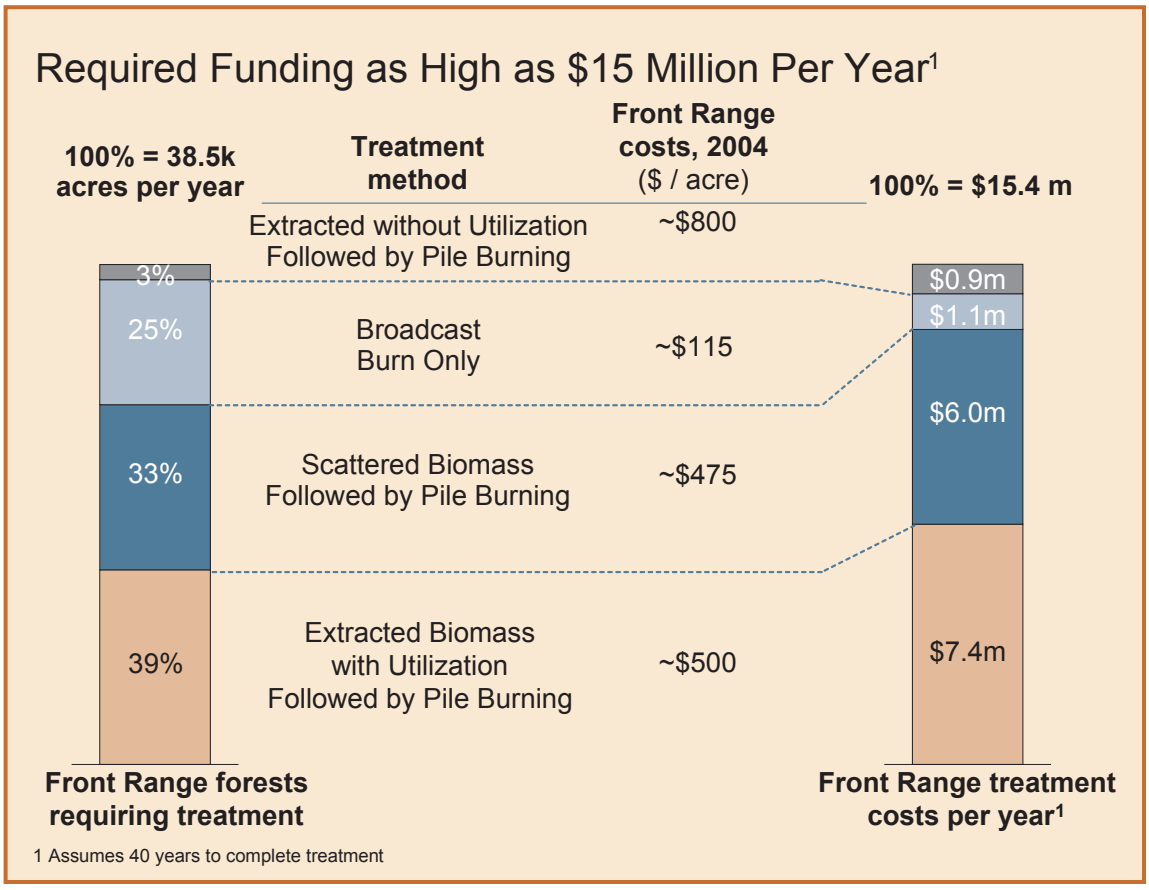


[19] **Forest treatment costs used in economic model:**

Treatment	Cost Per Acre	Source & Notes
Broadcast Burn	$114	Based on local 2004 USFS data.
Pile Burn	$132	Based on local 2004 USFS data. Pile burning is more expensive than broadcast burning because the trees, branches, and other forest materials are collected into piles prior to ignition.
Scattered Biomass	$341	Average mastication costs: Colorado State Forests $442 per acre; Pike National Forest $386 per acre; and Arapaho & Roosevelt National Forests $244 per acre. Based on land distribution, the weighted average cost of mastication was estimated at $341 per acre (20% x $442 + 40% x $386 + 40% x $244 = $341).
Extraction with Biomass Utilization at Current Levels	$364	Extraction with biomass utilization costs on average $457 per acre within the Arapaho & Roosevelt National Forests (data for Pike National Forest not available). The CSFS currently makes an average profit of $6 per acre through extraction with biomass utilization. Based on land distribution, the weighted average net cost of extraction at current utilization levels was estimated at $364 per acre.
Extraction without Biomass Utilization	$654	Extraction with utilization produces revenue through the sale of the extracted biomass. Extraction without utilization does not produce revenue and therefore costs significantly more. Extraction without utilization includes expenses associated with transporting biomass from the forest to a dumping station. For the purpose of this analysis, the Roundtable assumed an average transportation cost of 25 cents per ton per mile. It was also assumed that the biomass would be transported on average 50 miles. With 20 tons of biomass available per acre, the model assumes an average transportation cost of $250 per acre (20 tons per acre X $0.25 per ton per mile X 50 miles = $250). For this analysis, no dumping fee was assumed.

[20] **Assumptions behind estimated required annual funding:**

Treatment Type	Average Per-Acre Cost	Percentage of Overall Treatments	Number of Acres Treated Annually	Number of Acres Treated Over 40 Years	Annual Cost
Extracted without Utilization Followed by Pile Burning	$786 ($654 + $132)	3 percent (remainder)	1,096	43,847	$862,096
Broadcast Burn Only	$114	25 percent (2004 rate)	9,615	384,616	$1,096,155
Scattered Biomass Followed by Pile Burning	$473 ($341 + $132)	33 percent (2004 volume)	12,781	511,234	$6,040,053
Extracted Biomass with Utilization Followed by Pile Burning	$496 ($364 + $132)	39 percent (2004 volume)	14,969	582,766	$7,431,489
Total	$401	100 percent	38,462	1,538,463	$15,429,793



Rationales for treatment distributions used in economic model:

(1) Extracted without utilization followed by pile burning: Without the development of new markets for the biomass produced by extraction treatments, the Roundtable assumed that only approximately 15,000 acres could be treated annually using extraction with biomass utilization under current market conditions. Because the Roundtable does not recommend increasing the number of acres treated using scattered biomass each year and because prescribed fire probably cannot be used on more than 25 percent of treated acres within the initial 40-year treatment period, the surplus acres under the recommended scenario must be treated using extraction without utilization (with the biomass produced from these treatments transported to a dumping location and dumped at no cost). Extraction without utilization significantly increases costs because this treatment option does not benefit from the revenue produced through the sale of the extracted forest material but still incurs the cost of transporting the biomass from the forest to a dumping station.

(2) Broadcast burn only: Based on discussions with staff from the USFS, CSFS, and others, the Roundtable estimated that broadcast burning alone currently makes up approximately 25 percent of annual forest treatments. While the Roundtable sees both ecological and economic benefits from the use of prescribed burning, most experts agree that current fuel loads in most Front Range forests are too high to allow an increased near-term use of prescribed burning. Therefore, for the purpose of this analysis, the Roundtable assumed that prescribed burning would continue to be used on only 25 percent of the total acres treated each year over the 40-year initial treatment period.

(3) Scattered biomass followed by pile burning: The Roundtable estimates that scattered biomass treatments were used for approximately 13,000 acres in Front Range forests in 2004 (out of a total of 37,000 acres treated). Because of the ecological concerns associated with scattered biomass treatment practices (and because of the relatively small cost savings of scattered biomass over extraction), the Roundtable does not recommend the increased use of scattered biomass treatments. However, forest treatment service providers already have invested in equipment to serve this market and the ecological risks are still unproven. Therefore, the Roundtable does not recommend reducing scattered biomass treatments at this time. It is assumed that each acre treated with scattered biomass would also receive a follow-up pile burn treatment because of the ecological benefits of combining these two treatments.

(4) Extracted biomass with utilization followed by pile burning: The Roundtable also estimated that land managers used extraction with utilization on approximately 15,000 acres (out of 37,000 acres treated) in 2004. It was also estimated that 100 percent of the sawlogs, posts, and poles produced from these treated acres was sold. For the purpose of this analysis, the Roundtable assumed that the number of acres treated using extraction with utilization in the future would at least be what it is today (however, little if any of the woody biomass produced from these mechanical treatments is utilized). It is assumed that each acre treated with extracted biomass would also receive a follow-up pile burn treatment because of the ecological benefits of combining these two treatments.

[21] **Rationale for using 40 years as the timeframe for completing initial phase of treatments:**
The lower montane has a fire-return interval of approximately 30 to 70 years. Therefore, applying follow-up treatment 40 years later would mimic the natural fire cycle. As shown in Endnote #18, the economic picture with the 40-year timeframe is challenging but achievable, whereas the shorter timeframe scenarios (even though with narrower treatment goals) result in best-case funding gaps of $8 million to $20 million per year.

[22] **Assumptions behind estimate of potential cost reduction from increased contract sizes and durations:**
Increasing contract sizes and durations is one of the best ways to reduce forest treatment costs. Economies of scale exist in all stages of forest treatments, including planning, implementation, and monitoring. Treating 200 to 300 acres under one forest treatment contract is believed to be the minimum efficient scale. However, many current treatment projects in Front Range forests are much smaller and, therefore, do not benefit from these potential efficiencies. Based on best practices within private industry, the Roundtable assumed that mechanical treatment contract prices could be reduced by approximately 20 percent if treatment units were bundled into larger, longer contracts. The greatest opportunities for increasing contract sizes are in the Arapaho & Roosevelt National Forests and on private lands. Using long-term stewardship contracts on USFS land would likely facilitate larger, longer term (up to 10 years) contracts and could drive down average costs. Increased use of Colorado's Good Neighbor Authority would similarly allow the CSFS to cross ownership boundaries and consolidate public and private lands under one contract.

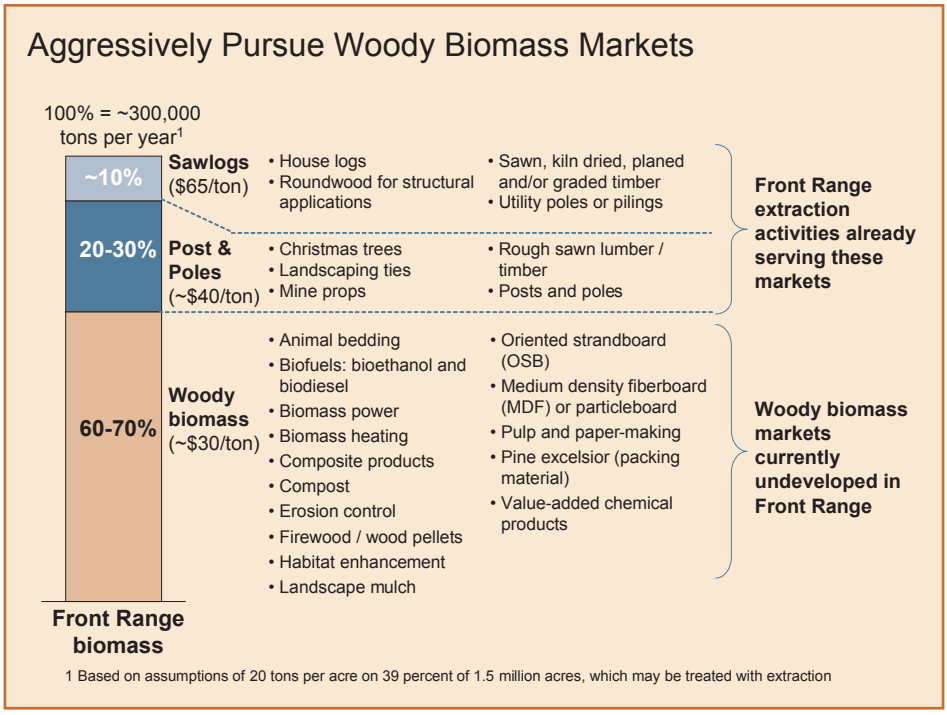
The greatest obstacle to increased contract sizes and durations is the lack of a comprehensive, long-term interagency vision for Front Range forest treatments. Communicating and focusing on the synergies that exist between fire risk mitigation and ecological restoration within the lower montane could help break down barriers to large contracts. In addition, reaching consensus among stakeholders on landscape-scale treatment priorities likely would reduce planning and litigation costs, and expedite implementation of larger contracts.

The Roundtable's analysis assumes that 11,538 acres of public forest will be treated mechanically each year. At a weighted average cost of $365 per acre (excluding follow up pile burn) and a potential volume savings of 20 percent, the resulting annual cost reduction could total almost $1.0 million in implementation costs alone. In addition, volume savings in overhead and planning costs are estimated separately below.

[23] **Assumptions behind estimate of potential cost reduction in overhead and planning costs:**
Only implementation costs were considered in the estimate of savings from larger contract sizes and durations. Reducing current planning and overhead costs by 20 percent could result in an additional annual savings of $1.2 million (the total estimated Front Range budget for planning and implementation is approximately $12 million with half of that going to contract implementation and the rest for overhead and planning). However, these potential cost reductions are likely to be a few years out because the USFS currently has 90,000 acres already planned for contracts through the National Environmental Policy Act (NEPA) process. In addition, increased USFS training in the streamlined NEPA process would likely be required to achieve these efficiencies. The Healthy Forest Restoration Act of 2003 allows agencies to use a streamlined NEPA process (one that needs to analyze the impacts of fewer alternatives to the proposed project) and is intended to accelerate treatments.

[24] **Assumptions behind estimate of potential cost reduction from increased use of prescribed fire:**
For every acre treated by prescribed fire instead of mechanical thinning, costs could be reduced by 75 percent. Unfortunately, most experts consulted consider the fuel loads in most Front Range forests to be sufficiently high as to prevent an increased near-term use of prescribed burning. Following initial treatment by mechanical thinning, however, most experts agree that long-term maintenance can be accomplished through the use of prescribed fire alone. Therefore, the Roundtable concludes that steps should be taken now to reduce barriers to a long-term increased use of prescribed burning by educating the public on the benefits of prescribed burning, increasing the number of trained staff who can conduct prescribed burns, and exploring revisions to the current Colorado permitting system for prescribed burns.

[25] **Products made from biomass:**
More than two dozen products can be produced from forest thinnings; however, 60 to 70 percent of the biomass produced along the Front Range likely will be woody biomass.

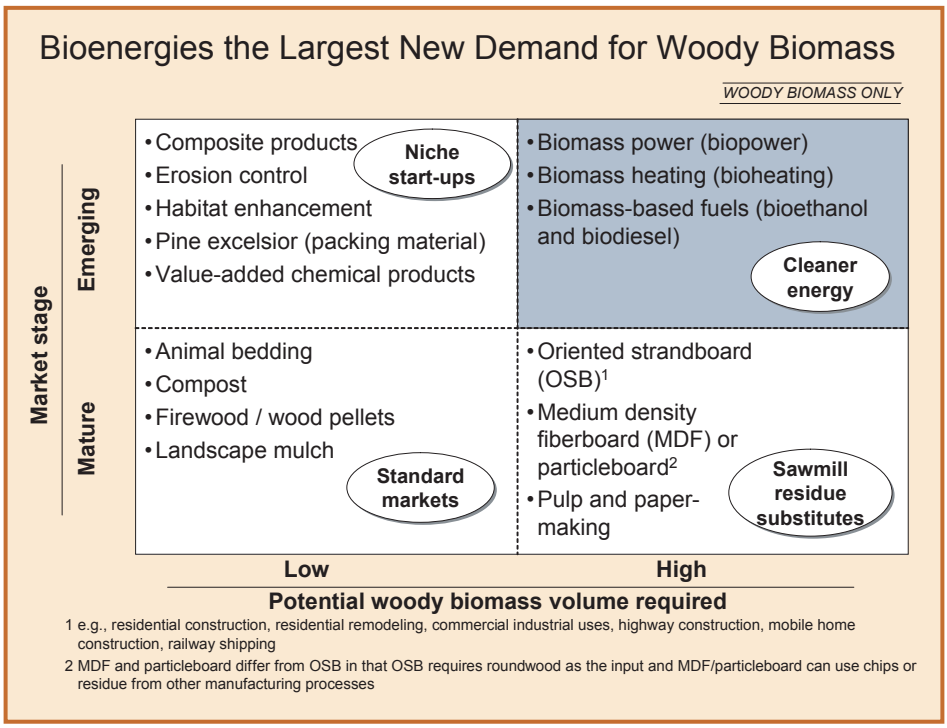


[26] **Bioheating is the best near-term option for woody biomass utilization:**
Woody biomass is significantly more abundant than sawlogs, posts, and/or poles and currently is not utilized. While biomass utilization for higher-value products should be exploited whenever possible, the Roundtable focused on products made from woody biomass as having the greatest potential for absorbing the bulk of expected biomass resulting from future forest treatment projects.

The Roundtable evaluated all known products made from woody biomass by two criteria:

(1) Which products require a large volume of woody biomass for their production?

(2) Which products are in emerging (growing) markets versus mature (stable) markets and would, thus, likely be able to absorb a large new supply of woody biomass?



The products evaluated were divided into four categories:

(1) Standard market products (e.g. compost, firewood and landscape mulch): The Roundtable concluded that the markets for the compost, firewood, and other standard market products were too mature to provide much potential for absorbing a large supply of new woody biomass.

(2) Sawmill residue substitutes (e.g. oriented strandboard or medium-density fiberboard or particle board): Competing with the OSB, particle board, and other sawmill residue products already on the market would be difficult because the companies that produce these products purchase sawmill residue at prices lower than it would cost to truck woody biomass from the forest to the manufacturing site.

(3) Niche products (composite products, erosion control products, habitat enhancement products): The markets for niche products are likely to be too small to absorb large volumes of new woody biomass.

(4) Bioenergy products (e.g. biopower, biofuels, and bioheating): Bioenergy products require large volumes of woody biomass for their production and are growth markets because of the rising costs of traditional fuels and continuously increasing demand.

Based on these evaluations, the Roundtable concluded that the various forms of bioenergy offer the highest potential uses of large volumes of woody biomass. From here, the Roundtable focused on five types of bioenergies in greater detail: large-scale biopower, small-scale biopower, biofuels (biodiesel and bioethanol), and bioheating. These bioenergies were evaluated based on the following criteria:

(1) Does the bioenergy product/technology produce secondary environmental benefits (for example, reduced pollution)?

(2) Is the technology proven?

(3) Is the cost structure competitive with substitutes?

(4) Is the market price high enough to sufficiently subsidize forest treatment costs?

(5) Does the distribution of woody biomass supply match geographic demand?

Based on its research, the Roundtable came to the following conclusions:

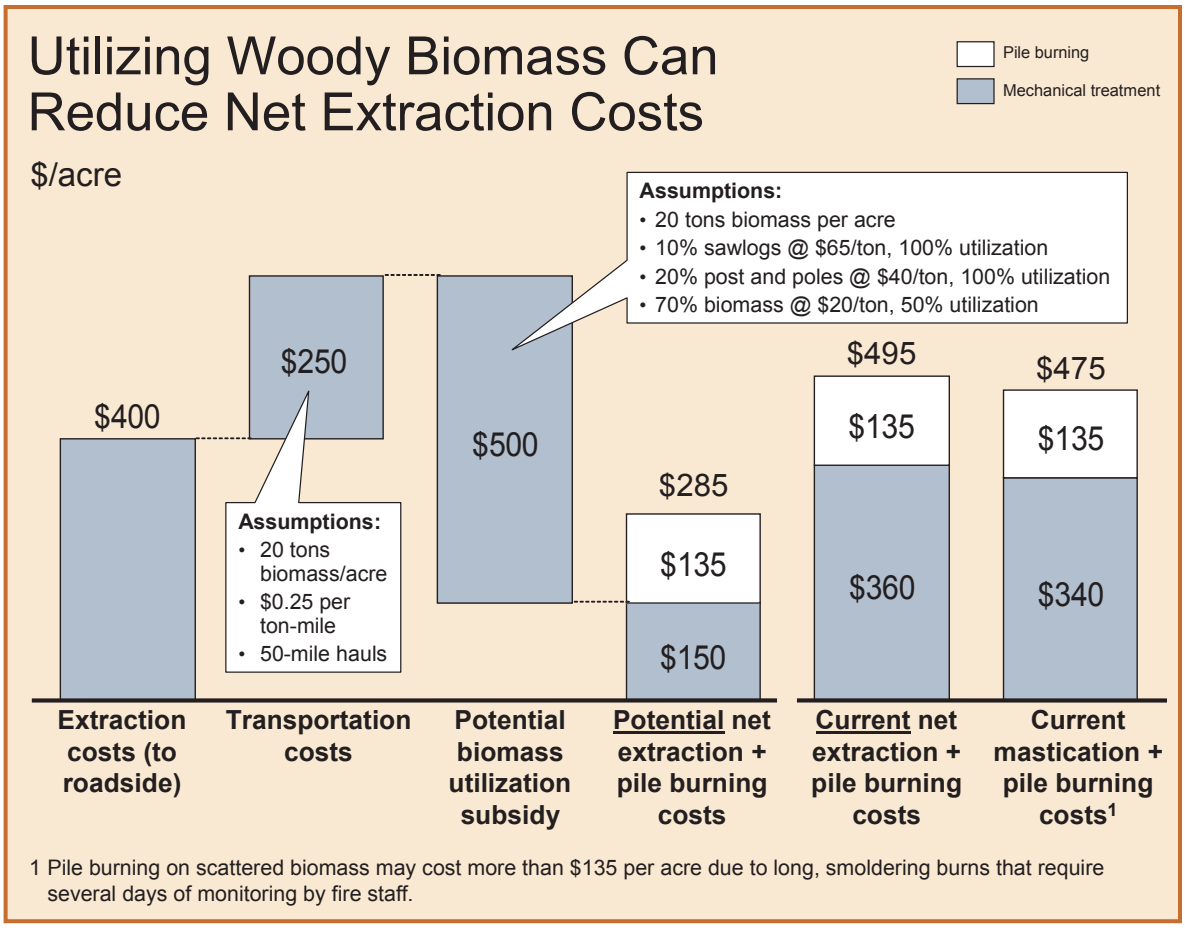
Large-Scale Biopower: Large-scale biopower is unlikely to provide a high-potential use for woody biomass. Large-scale biopower does offer secondary environmental benefits from reduced pollution and the technology is proven and in use in many wood and paper mills around the world. However, most large-scale biopower plants source their woody biomass supply from nearby sawmills. The cost structure of large-scale biopower is not competitive when the cost of woody biomass transportation from forests is included. Yet, the greatest barrier to using woody biomass for large-scale biopower is generating enough woody biomass supply to meet the fuel demands of a large-scale biopowered plant. Feasibility studies have demonstrated that a cost-effective plant could require up to 600 tons of woody biomass per day to meet its power needs. Meeting this need would require treating 32 acres of forest per day (assuming 200 days of operable weather per year), making 42 truck deliveries of woody biomass per day (or one truck delivery every 17 minutes through a 12 hour workday), and maintaining the storage space for 60,000 tons of woody biomass to supply the plant during the 100 days when forest treatment is not possible. Current supply streams do not come close to meeting this volume, and investors are unwilling to build the necessary infrastructure without a guaranteed supply.

Small-Scale Biopower: Small-scale biopower technology, such as the BioMax 15 produced by Colorado's Community Power Corporation, provides a more promising future use of woody biomass than large-scale biopower. This technology is installed in at least 11 locations around the world, and the cost of generating power from this biopower technology is less than for wind or photovoltaic power. Additionally, this biopower technology only demands approximately 30 to 50 tons of woody biomass per year. However, the feedstock price for this technology is only about $10 per ton, while the average cost of extracting woody biomass is about $60 per ton. Furthermore, the cost of using this biopower technology is still relatively high compared to most other fuel sources. Therefore, the Roundtable views small-scale biopower as potentially promising as a longer-term option if costs come down.

Biofuels (Biodiesel and Bioethanol): Biofuels, including biodiesel and bioethanol, offer promising future uses of woody biomass, particularly given their significant potential secondary environmental benefits from reduced emissions from fossil fuels. However, the technology to produce these fuels from woody biomass rather than corn is not yet proven or successfully commercialized. In addition, feedstock prices for substitute inputs (for example, corn or vegetable fat) cost only about $8 per ton. Still, the Roundtable believes that if the technology for biofuels improves dramatically while the price of traditional fuels increases, biofuels could become an important part of the long-term biomass utilization solution, especially if portable biofuel production equipment becomes available. In the future, forest treatment equipment may run on biofuel produced directly in the forests, but this rosy picture is still a long way off.

Bioheating: Bioheating offers the most promising near-term use of woody biomass. Bioheating is a proven, age-old technology that is successfully installed in more than 30 public institutions around the country. In fact, more than 10 percent of Vermont's students are educated in bioheated schools. On a dollar-per-unit-of-energy basis, biomass has a significantly lower fuel cost than coal, fuel oil, gas, and electricity. As a result, institutions that have converted from other fuel sources to bioheating have realized significant savings in fuel costs. For example, two schools have reported immediate heating cost savings of 50 to 80 percent. Because of bioheating's competitive cost structure, the biomass feedstock price for institutional heating is the highest of all the bioenergies, at around $30 per ton. Selling the woody biomass generated through forest treatments for institutional bioheating at this price would subsidize up to 40 percent of the cost of forest treatments on a per-acre basis.

[27] **Economics of woody biomass utilization:**



[28] **A forest improvement district** could be made up of private forests with improvements funded by assessing costs on the properties that benefit from the improvements.

[29] **The State Fire Assistance Program** is a federal funding program that provides state forestry agencies with assistance in hazard assessments, fuels treatment projects, and public education efforts (as well as traditional fire suppression training and preparation). Funds travel from the Washington office of the USDA Forest Service to individual Forest Service Regions where it is then allocated to individual States. State forestry offices then distribute this money, much of it in the form of competitive cost-share grants, to communities and private entities.

[30] **The Hazardous Fuels Reduction Program** is a line item of the National Fire Plan. This federal program was developed in August 2000, following a landmark wildfire season, with the intent of actively responding to severe wildfires and their impacts to communities while ensuring sufficient firefighting capacity for the future. The NFP addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.

[31] **The Wyden Amendment Authority** allows federal agencies to expend funds on adjacent state and private lands for forest treatment projects if qualifying criteria are met.

[32] **The Good Neighbor Authority** allows the Colorado State Forest Service to include adjacent federal land in forest treatment projects.

[33] **There are three main categories of prescribed burning:**
(1) Broadcast burn: A prescribed burn without any pretreatment of fuels.
(2) Pile burn: Fuels—such as tree branches, needles, and leaves—are piled together prior to ignition to make burning safer and more controlled.
(3) Wildland fire use: A naturally ignited wildfire that is managed for resource benefit, based on an approved Fire Management Plan.

[34] **Communities at Risk**

A community is considered at risk from wildfire if it lies within the wildland-urban interface as defined in the federal register (FR Vol. 66, No. 3, Pages 751-754, January 4, 2001). A recommended approach for identifying and prioritizing Communities at Risk (from *Field Guidance: Identifying and Prioritizing Communities at Risk*, National Association of State Foresters, June 27, 2003) is to evaluate communities based on the following factors:

(1) Fire Occurrence: Using historic fire occurrence records and other factors, assess the anticipated probability of a wildfire ignition in the vicinity of each community.

(2) Hazard: Assess the fuel conditions surrounding the community using a GIS mid-level mapping tool.

(3) Values Protected: Evaluate the human and economic values associated with the community, such as homes, businesses, community infrastructure (e.g., water systems, utilities, transportation systems, critical care facilities, schools, manufacturing and industrial sites, etc.) as well as high value commercial timber lands, municipal watersheds and areas of high historical, cultural, and spiritual significance.

(4) Protection Capabilities: Assess the wildland fire protection capabilities, including the capacity and resources to undertake fire prevention measures, of all agencies or organizations with federal, state, tribal, and local jurisdictions.

[35] **Colorado Prescribed Fire Council**

Proposed objectives for the Colorado Prescribed Fire Council could be to assemble land managers and others concerned about prescribed fire into an organization to increase the appropriate use of prescribed fire by:

(1) Analyzing barriers to the increased use of prescribed fire and suggesting courses of action

(2) Advocating for the development and use of prescribed fire practices consistent with ecological restoration

(3) Disseminating technical information to prescribed fire practitioners

(4) Educating the general public on the ecological and economic benefits of prescribed fire and wildland fire use

(5) Providing a centralized forum for prescribed fire practitioners and other concerned parties to resolve issues and communicate recommendations

(6) Demonstrating results by measuring and communicating prescribed fire accomplishment and issues resolved on an annual basis through the *Annual Colorado State Forest Service Forest Health Report*.

Issues that the Colorado Prescribed Fire Council could address in reducing barriers to the increased use of prescribed fire:

(1) Does the statewide capacity of prescribed fire resources need to be increased?
   a. Is the rate of retirement of prescribed fire practitioners greater than the rate of new recruitment?
   b. What are barriers to getting new practitioners engaged (e.g., training opportunities, compensation)? How can these barriers be reduced?
   c. What role should Non-Governmental Organizations and private consultants play in increasing capacity of prescribed fire practitioners?

(2) Would an interagency agreement to share prescribed staff resources and coordinate in project planning and implementation help to reduce barriers?
   a. Do current interagency fire management agreements include and/or optimize opportunities for interagency participation in prescribed fire planning and implementation?
   b. If not, what are the required modifications? What would be the process for implementing required modifications?
   c. Are processes in place for funds transfers between agencies (or between agencies and non-agencies), in order to allow organizations to recoup costs?

(3) Can changes be made to the Colorado prescribed fire permitting system to reduce barriers?
   a. Are the costs of permits prohibitive? Are Colorado prescribed fire permit costs (per ton of particulate of pollution produced) in line with other states?
   b. When permits go unused due to poor weather, is the renewal process cost prohibitive? Private landowners pay about $100 per permit. Do they need to repay for renewals?
   c. Is there unnecessary redundancy in the federal air quality review process when federal agencies go through NEPA as well as the state permitting process? If so, what changes are required to eliminate the redundancies?

(4) Do prescribed fire liability laws need modification in order to reduce barriers?
   a. What are the current liability laws for private landowners?
   b. If interagency agreements exist, what are the liability laws for the federal government helping perform prescribed fire on state or private lands?
   c. How would such laws need to be modified?

(5) What are other potential barriers to the increased use of prescribed fire, aside from excessive fuel loading? How might these barriers be reduced?

Acknowledgements

The FRFTP Roundtable would like to thank the following individuals for their participation in and/or support of the Roundtable's findings and recommendations.

Greg Aplet, *The Wilderness Society*
Mike Babler, *The Nature Conservancy*
Jim Bedwell, *Arapaho & Roosevelt National Forests and Pawnee National Grassland, USDA Forest Service*
Gali Beh, *Beh Management Consulting, Inc.*
Ember Brignull, *Jefferson County Open Space*
Joyce Berry, *Warner College of Natural Resources, Colorado State University*
Karen Berry, *Jefferson Conservation District and Colorado Geological Survey*
Timothy Brown, *Center of the American West, University of Colorado*
Jonathan Bruno, *Coalition for the Upper South Platte*
John Bustos, *Arapaho & Roosevelt National Forests and Pawnee National Grassland, USDA Forest Service*
Coleen Campbell, *Colorado Air Pollution Control Division, Colorado Department of Health & Environment*
Gary Cure, *County Sheriffs of Colorado, Inc.*
Duane Daily, *Grand County Board of Commissioners*
Lisa Dale, *Western Forestry Leadership Coalition*
Chuck Dennis, *Colorado State Forest Service*
Vic Ecklund, *Colorado Springs Utilities*
Carol Ekarius, *Coalition for the Upper South Platte*
Leslie Ellwood, *U.S.Fish & Wildlife Service, Colorado Field Office*
Mike Foley, *Arapaho & Roosevelt National Forests and Pawnee National Grassland, USDA Forest Service*
Peter Fogg, *American Planning Association, Colorado Chapter*
Mitzy Forbes, *Colorado State Forest Service*
Randal S. Frank, *Jefferson County Open Space*
Tom Fry, *Southern Rockies Conservation Alliance and The Wilderness Society*
Marilyn Gally, *Colorado Division of Emergency Management*
Russell George, *Colorado Department of Natural Resources*
Dave Hessel, *Colorado State Forest Service*
Jeff Jahnke, *Colorado State Forest Service*
Nan Johnson, *Colorado State Forest Service*
Craig Jones, *Governor's Office of Energy Management & Conservation*
Andy Karsian, *Colorado Counties, Inc.*
Merrill Kaufmann, *Rocky Mountain Research Station, USDA Forest Service*
Don Kennedy, *Denver Water*
Brian Kent, *Rocky Mountain Research Station, USDA Forest Service*
Lisa Kraft, *Colorado State Parks*
Brian Kurzel, *Colorado State Parks*
Lyle Laverty, *Colorado State Parks*
Bob Leaverton, *Pike & San Isabel National Forests and Cimarron & Comanche National Grasslands, USDA Forest Service*
Paige Lewis, *Colorado State Forest Service*
Patricia Limerick, *Center of the American West, University of Colorado*
Susan Linner, *US Fish & Wildlife Service, Colorado Field Office*
Liz Lile, *United States Geological Survey*
Carlotta Mast, *Writer*
Kathie Mattor, *Roundtable Coordinator*
Brian McPeek, *The Nature Conservancy*
Brian Muller, *University of Colorado—Denver*
Laura Nay, *Colorado Division of Emergency Management*
Tom Owens, *United States Geological Survey*
Jackie Parks, *Arapaho & Roosevelt National Forests and Pawnee National Grassland, USDA Forest Service*
Margie Perkins, *Colorado Air Pollution Control Division, Colorado Department of Health & Environment*
Gini Pingenot, *Colorado Counties, Inc.*
Chuck Romaniello, *Bureau of Land Management*
Tania Schoennagel, *Department of Geography, University of Colorado*
Scott Sticha, *Rocky Mountain National Park, National Park Service*
Bob Sturtevant, *Warner College of Natural Resources, Colorado State University*
Katherine Timm, *Colorado State Forest Service*
Carmen Velasquez, *Colorado Division of Emergency Management*
Dick Vnuk, *Colorado Division of Emergency Management*
Carole Walker, *Rocky Mountain Insurance Information Association*
Sarah Warner, *Editor*
Rick Wilson, *Florissant Fossil Beds National Monument, National Park Service*
Dennis Zachman, *Bureau of Land Management*

Roundtable Facilitator:

Mary Mitsos, *National Forest Foundation*

On the cover:
Top: Smoke from the 2002 Hayman Fire shrouds the Lost Valley Ranch near Sedalia.
Photo by Tim Sexton

Middle: On June 14, 2002, the Hayman Fire exhibited intense fire behavior.
Photo by Doug Cupp and Doug McGraw

Bottom: This is all that remains of a house in the Painted Rock subdivision near Woodland Park after the Hayman Fire.
Photo by Kelly Close

THIS REPORT IS ENDORSED BY THE FOLLOWING ORGANIZATIONS:

Center of the American West
University of Colorado at Boulder

APA COLORADO

Colorado Department of Public Health and Environment

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

Colorado Division of Emergency Management
Preparedness Mitigation Response Recovery

BEH Management Consulting

Colorado State Forest Service

Colorado Governor's Office of Energy Management and Conservation

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Colorado Springs Utilities
It's how we're all connected

CCI
Colorado Counties, Inc.

COUNTY SHERIFFS OF COLORADO

NATIONAL PARK SERVICE

Coalition for the Upper South Platte

Colorado State Parks

DENVER WATER

JEFFERSON COUNTY OPEN SPACE

COLORADO
DEPARTMENT OF NATURAL RESOURCES

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

WARNER COLLEGE OF NATURAL RESOURCES

Colorado State University
Knowledge to Go Places

NATIONAL FOREST FOUNDATION

SRCA
Southern Rockies Conservation Alliance

Rocky Mountain Research Station

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

ROCKY MOUNTAIN INSURANCE INFORMATION ASSOCIATION
RMIIA

THE WILDERNESS SOCIETY