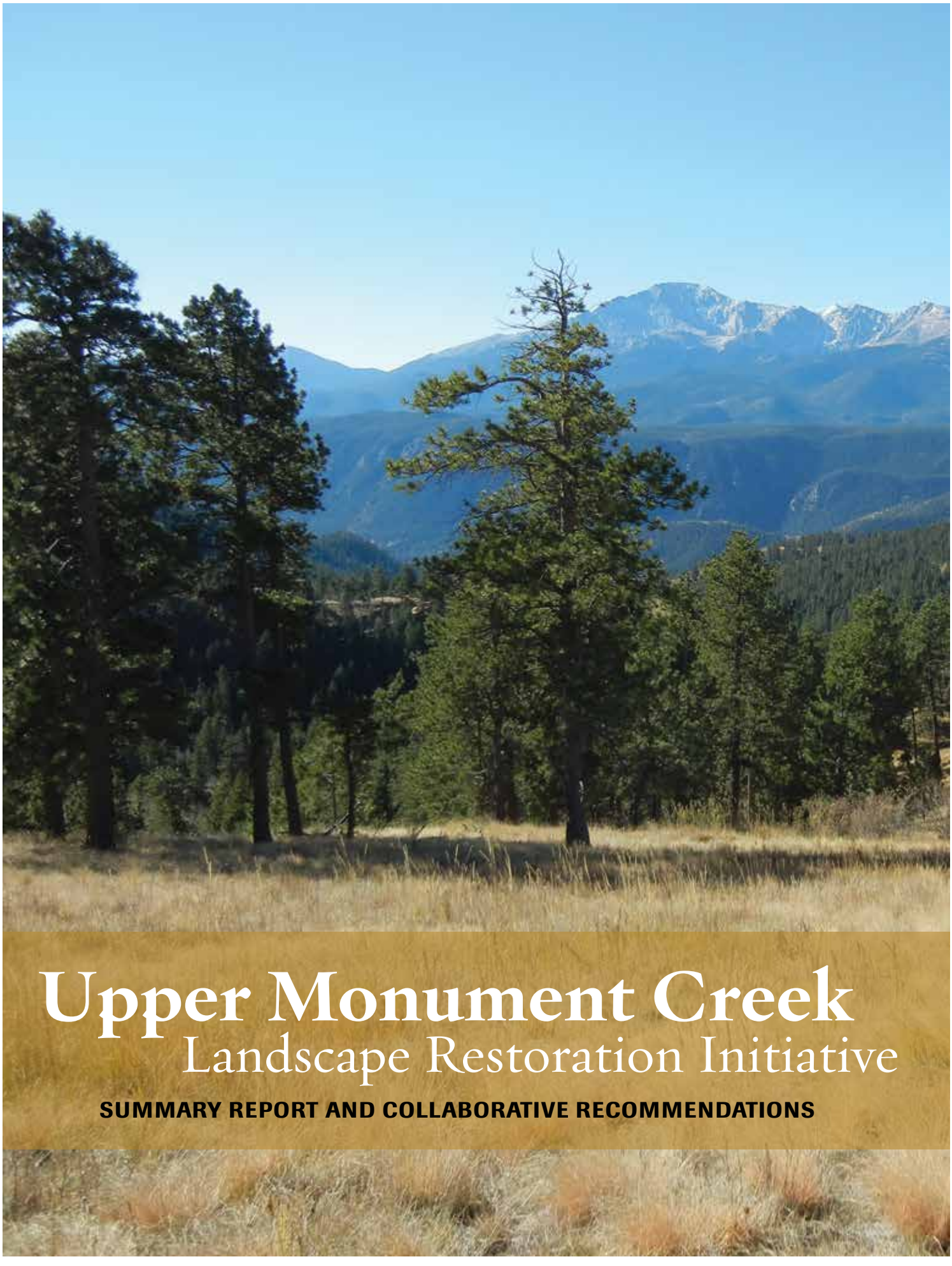

Upper Monument Creek
Landscape Restoration Initiative

SUMMARY REPORT AND COLLABORATIVE RECOMMENDATIONS

Acknowledgements

MANY people committed time, resources and expertise to make the Upper Monument Creek (UMC) Landscape Restoration Initiative a reality. A full list of participants is provided below. This effort would not have been possible without their dedication. Special thanks to The Nature Conservancy for convening and facilitating the UMC Collaborative. Thanks also to staff from the U.S. Forest Service's Pike's Peak Ranger District and Pike-San Isabel National Forest for providing valuable technical support to our deliberations and for taking us out in the field to experience the landscape first-hand. Thanks to the Colorado Forest Restoration Institute (CFRI) for their leadership of the Collaborative's Design Criteria Working Group and for valuable logistical support. Thank you to Julie Cornia with Black Dog Design for invaluable help with the final report. And finally, the UMC Collaborative wishes to acknowledge and thank Paige Lewis (The Nature Conservancy) and Rob Addington (Colorado Forest Restoration Institute) as the authors of this report.

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PHOTO:
Boulder resting near limber pine.

Executive Summary

THE Upper Monument Creek (UMC) landscape is located on Colorado's southern Front Range within a region that has experienced increasingly severe and costly impacts from wildfire, including the record-setting 2012 Waldo Canyon Fire that burned across the landscape's southern boundary. The UMC Landscape Restoration Initiative (the Initiative) was launched in 2012 in an effort to accelerate the pace of urgently needed forest restoration by forging collaborative agreement on science-based management recommendations for a high priority area on the United States Forest Service's (USFS) Pike National Forest.

The UMC Initiative builds on the work of the Front Range Roundtable, which has been working together since 2004 to dramatically increase forest management that reduces wildfire risks to communities and restores resilient ecological conditions in Front Range forests. The 67,000-acre UMC landscape is located within an area designated as a high priority for management by the Roundtable. Treatment within the landscape will be implemented under the auspices of the Front Range Collaborative Forest Landscape Restoration Project (CFLRP) and Long Term Stewardship Contract, both of which are Roundtable priorities.

As a framework for their deliberations, participants in the UMC Initiative developed a mission statement and goals that express their collective values regarding ecological resilience, community protection and ongoing collaboration. Of particular importance to these participants, collectively known as the UMC Collaborative, is the establishment of a forest structure that allows fire to play a more ecologically appropriate role on the landscape, posing less of a threat to people and the environment and fostering the sustainability of key forest values. Also important is the creation of a framework for ongoing stakeholder engagement, learning and adaptive management throughout the life of the project.

The UMC Collaborative used a series of workshops and field visits to identify effective strategies for restoring desired conditions to the UMC landscape. Using both spatial and non-spatial analyses, the Collaborative found that: three major forest types comprise 85% of the landscape; forests in older age classes are significantly underrepresented; and forest conditions are considerably more dense than they would have been historically, particularly in the drier ponderosa pine and mixed conifer systems. Analyses also revealed that these closed forest conditions place people, water and wildlife at significant risk from unnaturally large and damaging wildfires.

Based on these analyses, the UMC Collaborative recommends that, over the next 7-10 years, the USFS use a combination of mechanical, manual and prescribed fire treatments to manage conditions on approximately 18,000 acres within the UMC landscape. The Collaborative's detailed recommendations are captured in three overarching principles that suggest when, where and how these treatments should occur in order to realize the most beneficial, landscape-scale outcomes for both people and nature.

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PHOTOS:
Great horned owl fledglings
© Robert Granzow

First, treatments must be designed and implemented at a **meaningful scale**, ensuring that they are able to effect a landscape-scale change in conditions and processes. Second, treatments should be strategically scheduled and located so that they **maximize benefits** to both people and nature. Finally, treatments must be **carefully designed**, using the best available science for individual forest systems and ensuring that the purpose of treatments is clear.

The estimated ten-year budget needed to implement the above recommendations totals slightly over $10 million, or $1 million average cost per year. This estimate was developed by assigning costs to a variety of treatments that could be applied within the landscape and then using those costs to calculate the resources needed to implement the combination of treatments recommended by the UMC Collaborative. When compared with the $16.7 million spent over less than three weeks to suppress the Waldo Canyon Fire, the UMC Collaborative deemed this a reasonable investment.

The UMC Initiative was designed, in part, to launch a collaborative and adaptive management approach that will continue to engage stakeholders in the development, implementation and monitoring of treatments far into the future. To facilitate this ongoing engagement, the UMC Collaborative recommends that the USFS take an adaptive approach when developing and analyzing management alternatives for the UMC landscape and that adaptive management decisions be inextricably linked to a robust monitoring strategy that engages the Collaborative and other stakeholders, as well as agency personnel, in the gathering and assessment of treatment data.

Overall, the UMC Collaborative's recommendations represent broadly supported, science-based input to the USFS as it begins the formal planning and analysis for the UMC project area. The Collaborative looks forward to continuing their engagement as this next stage of the process begins.

The UMC Landscape Restoration Initiative was designed, in part, to launch a collaborative and adaptive management approach that will continue to engage stakeholders in the development, implementation and monitoring of treatments far into the future.

PHOTOS:
LEFT Webster Park © *Peter Brown*
RIGHT Front Range Roundtable members in the field. © *Peter Brown*

Background

THE Upper Monument Creek (UMC) Landscape Restoration Initiative was launched in 2012 to engage a diverse suite of agencies, organizations and individuals in the development of collaborative, science-based restoration and management recommendations for a 67,000-acre project area on the Pike's Peak Ranger District of the Pike National Forest. Participants in the Initiative also aimed to establish a framework for ongoing collaborative monitoring and adaptive management through which they and others could continue to engage and learn as the project is implemented over time.

The Pike National Forest identified the Upper Monument Creek landscape as its next area for analysis because of its location in a high fire risk area in close proximity to previously analyzed and treated project areas, including the Trout West and Catamount Projects. The UMC landscape offers a unique opportunity for collaborative engagement and learning because it is located in a high priority treatment area identified by the Front Range Roundtable[1] and because it will be implemented as part of the Front Range Collaborative Forest Landscape Restoration Project (CFLRP).[2]

The UMC Initiative also closely parallels a larger effort to define and publish a General Technical Report (GTR) outlining restoration guidelines for Front Range ponderosa pine and mixed conifer forests. The participants in the UMC Initiative hope that implementation in the UMC landscape can serve as one of several case studies for assessing the guidelines put forth in the GTR.

Because it is a relatively large project area, the UMC landscape also offered the opportunity for participants to test and evaluate two new tools developed for landscape-scale analysis. The first, *Landscape Conservation Forecasting*™, is a LANDFIRE-based process designed to aid managers in identifying the most ecologically beneficial and cost-effective strategies for landscape restoration at a meaningful scale (Low 2010).[3] The second tool is a new approach to Integrated Wildfire Risk Assessment being developed by the U.S. Forest Service (USFS). This tool is intended to improve managers' ability to identify the places within a landscape where fuels treatment and restoration will provide the greatest benefit to community safety, municipal water supply, wildlife habitat and other "highly valued resources and assets" (Calkin et al 2010).

The Pike National Forest identified the Upper Monument Creek landscape as its next area for analysis because of its location in a high fire risk area that is in proximity to previously analyzed and treated project areas, including the Trout West and Catamount Projects.

PHOTOS:
LEFT Columbine © Audrey Wolk
RIGHT Forest thinning.
© *Mike Babler*

1. *For more information on the Front Range Roundtable, see www.frontrangeroundtable.org.*

2. *For more information on the Collaborative Forest Landscape Restoration Program, see http://www.fs.fed.us/restoration/CFLRP/.*

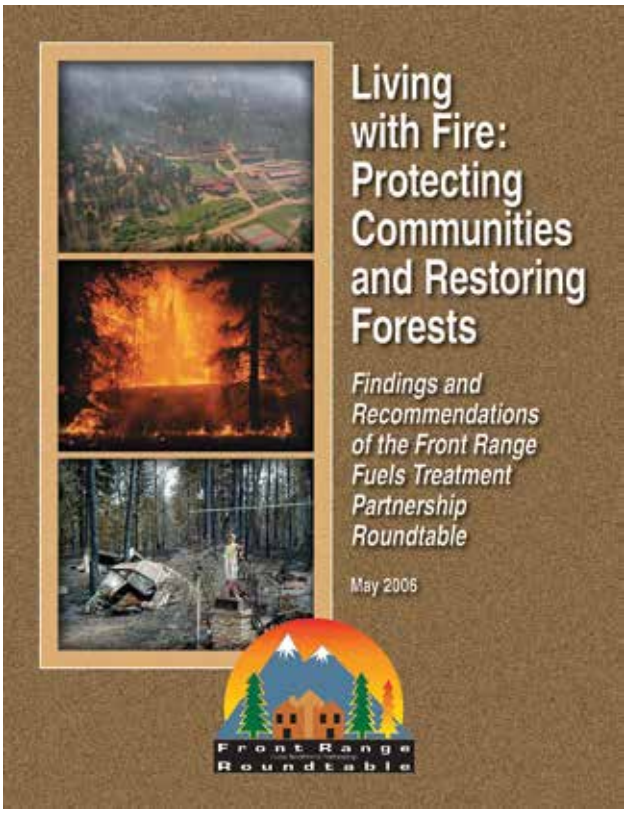
3. *More information and discussion on Landscape Conservation Forecasting™ is contained in subsequent sections of this report and in Appendix A.*

THE FRONT RANGE ROUNDTABLE AND CFLRP

The Front Range Roundtable (the Roundtable) is a regional collaborative that convened in the wake of the record-setting 2002 Hayman Fire. The Roundtable's mission is to identify and pursue strategies for increasing the pace and scale of community protection and ecological restoration in Colorado's Front Range forests, many of which are at extremely high risk to uncharacteristic and damaging wildfire. Participants include representatives from public land management agencies, forest industries, conservation organizations, forest-based businesses, public utilities, academic institutions, water providers, local governments and others.

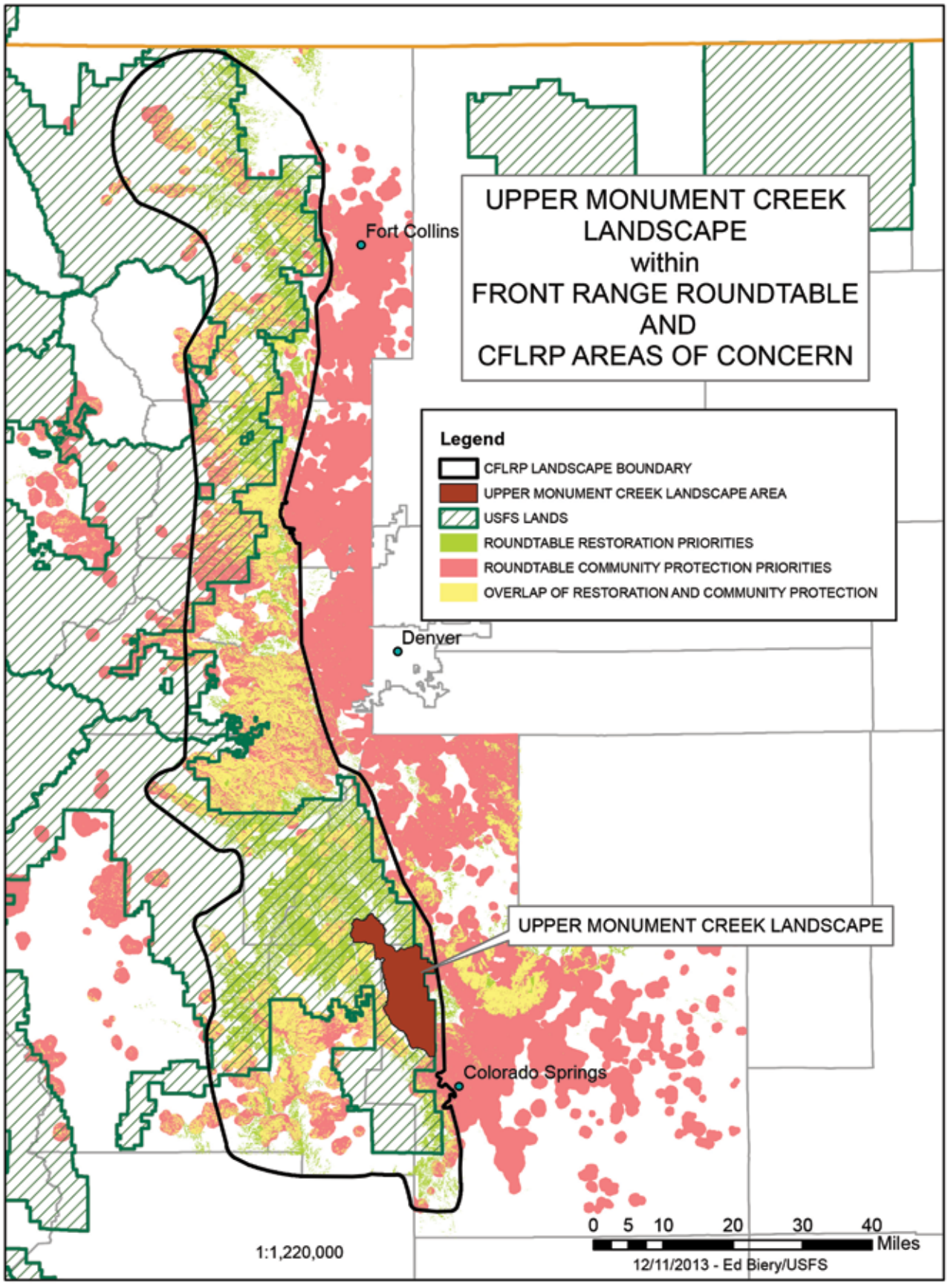
In 2006, the Roundtable released a report titled *Living with Fire* that identified 1.5 million acres in need of management to reduce wildfire risks to both people and nature and restore more resilient conditions for the future. In 2010, the Roundtable worked with the Pike-San Isabel and Arapaho-Roosevelt National Forests to successfully garner funding through the newly created CFLR Program, a USFS initiative focused specifically on collaborative, science-based restoration of large, high-priority forested landscapes.

If fully funded, the Front Range CFLRP will provide $37 million over ten years for treatment of 32,000 acres in high priority areas on both national forests. This treatment is expected to leverage treatment on up to 100,000 additional federal and non-federal acres. The Roundtable engages in an ongoing basis in the collaborative design and monitoring of forest management projects implemented through the CFLRP and seeks to improve the ecological, social and economic effectiveness of these treatments over time.



In 2006, the Roundtable released a report titled Living with Fire that identified 1.5 million acres in need of management to reduce wildfire risks to both people and nature and restore more resilient conditions for the future.

MAP 1. UPPER MONUMENT CREEK LANDSCAPE FRONT RANGE ROUNDTABLE AREAS OF CONCERN



MAP: E.H. Biery

THE UPPER MONUMENT CREEK PROJECT

In 2012, the Pike-San Isabel National Forest identified the UMC landscape as a future project area as part of the Front Range CFLRP. Members of the Roundtable felt that the designation of this new project landscape offered a unique opportunity for collaborative partners to engage in a dialogue about forest restoration strategies focused on a specific landscape rather than the entire Front Range. Through this dialogue they hoped to increase their level of agreement on management, restoration and monitoring issues of relevance across the region.

In July 2012, The Nature Conservancy convened a Steering Team to develop a plan for engaging Roundtable members and other local stakeholders in a collaborative conversation about forest restoration in the UMC landscape. In October 2012, the UMC Landscape Restoration Initiative was launched with a kick-off workshop and field trip.

Over the course of nearly 12 months, participants in the UMC Initiative developed the information and recommendations contained in this report. This document is intended to capture broadly supported, community-based input for consideration by the USFS, along with other analyses and public comments, as the USFS develops a Proposed Action for the UMC project area.

The UMC Initiative is envisioned as an ongoing effort with these initial recommendations serving as a starting point for future engagement, learning and adaptation over time. In the short term, UMC stakeholders will continue to engage with the USFS, local communities and a wide range of interested partners as this project moves into the formal public land planning process.

This document is intended to capture broadly supported, community-based input for consideration by the USFS, along with other analyses and public comments, as the USFS develops a Proposed Action for the UMC project area.

PHOTOS:
LEFT Mesic mixed conifer
© Carrie Segil
RIGHT Pike National Forest
© Paige Lewis

The Upper Monument Creek Landscape

THE Upper Monument Creek (UMC) landscape consists of 66,881 acres of primarily National Forest land on Colorado's southern Front Range in El Paso and Douglas Counties. The landscape is within the Rampart Range and sits between two other landscapes previously analyzed for management by the USFS.[4] It is bounded by the Pike National Forest to the east.

The landscape is highly urbanized with the Colorado Springs metropolitan area dominating on the southeast border and the community of Woodland Park on the southwest. Two smaller communities, Monument and Palmer Lake, border the landscape to the northeast. The U.S. Air Force Academy (USAFA) is a significant presence on the landscape's eastern boundary. The USAFA also maintains the private 655-acre Farish Recreation Area as an inholding within the landscape itself. The northern portion of the UMC landscape includes approximately one-quarter (4,407 acres) of the U.S. Forest Service's Manitou Experimental Forest and 3,409 acres of designated Colorado Roadless Area. The 2012 Waldo Canyon Fire burned across approximately 11,000 acres at the landscape's southern tip.

TOPOGRAPHY, SOILS AND CLIMATE

The Rampart Range is not as tall as many mountain ranges in Colorado (max. elev. 9748'), but it is still a significant landscape feature. The steep eastern face of the range rises sharply from the adjacent plains, while the top of the range resembles a broad dissected plateau. The UMC landscape is nearly completely underlain by the Pikes Peak Batholith, a massive granite block of 1.4 billion year old rock. The soils that developed from this granite are generally shallow, well-drained and poor in organic matter, except where they are alluvial in nature. Due to their coarse condition, these soils are not easily compacted except during road or trail construction and use. They are, however, highly erodible due to their lack of cohesion, a trait that makes them highly prone to post-fire erosion and debris flows. The UMC landscape also contains a few pockets of sandstone and limestone, and the associated soils derived from them. The average annual precipitation for the Upper Monument Creek area is 22 to 25 inches, with the majority falling during April through August. Average annual snowfall ranges from 111 to 115 inches, with the majority falling between October and April.

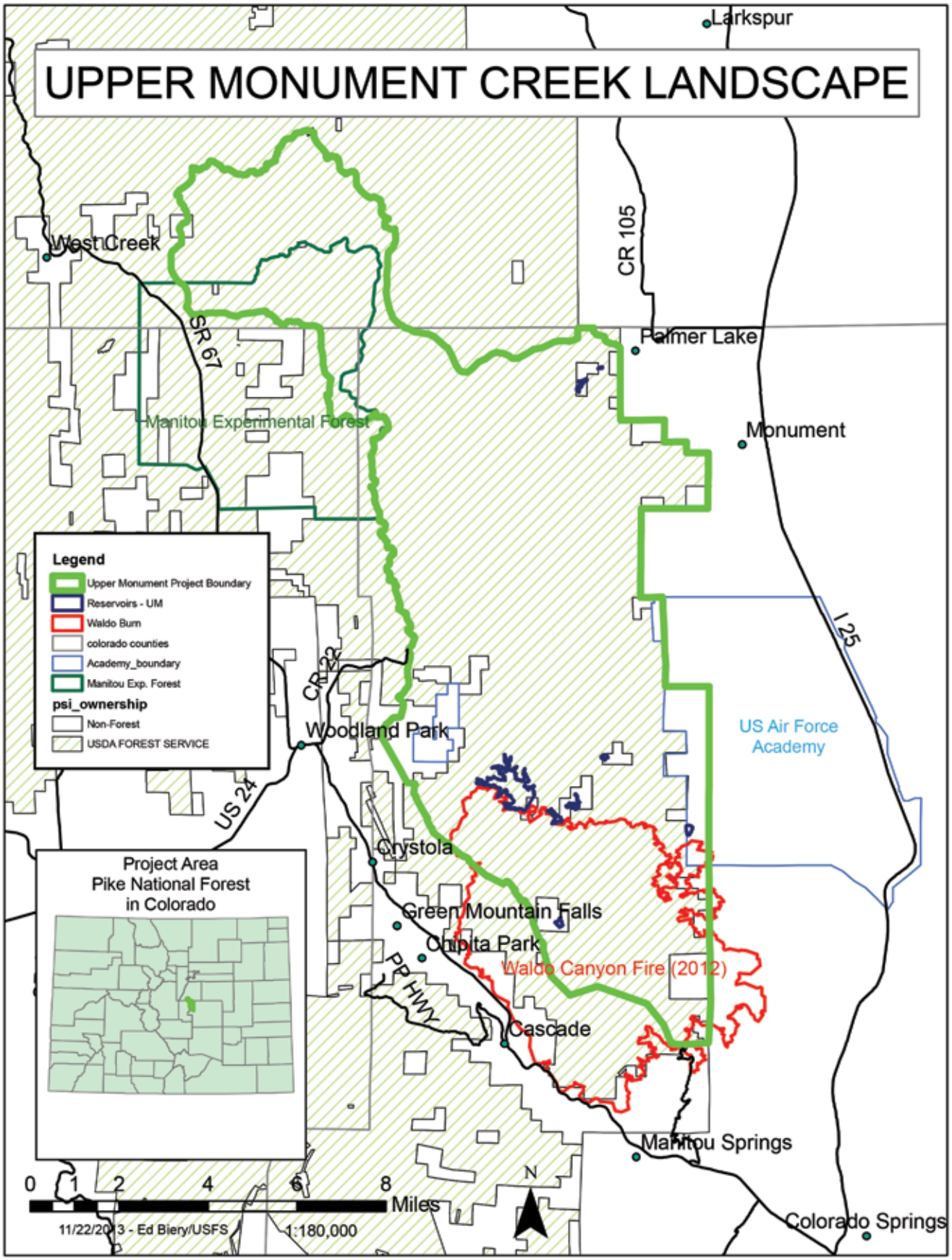
The landscape is highly urbanized with the Colorado Springs metropolitan area dominating on the southeast border and the community of Woodland Park on the southwest.

The U.S. Air Force Academy (USAFA) campus is also a significant presence on the landscape's eastern boundary.

PHOTOS:
LEFT Rampart Range in Colorado
© *Istockphoto.com*
RIGHT U.S. Air Force Academy, Colorado Springs, CO
© *Istockphoto.com*

4. *Previously analyzed projects were the 2010 Catamount Forest Health and Hazardous Fuels Reduction Project and the 2001Trout-West Fuels Reduction Project.*

MAP 2. UPPER MONUMENT CREEK LANDSCAPE BOUNDARY AND VICINITY.



MAP: E.H. Biery

WATERSHEDS

The UMC landscape includes all or part of nine 6th level watersheds. Three of these are tributary to the South Platte River and six drain into Fountain Creek and subsequently to the Arkansas River. Nearly all of these watersheds are designated in the Colorado Statewide Forest Resource Assessment as a high priority for drinking water and also as watersheds at high risk for post-fire soil erosion.[5]

The Upper Monument Creek watershed and the West Monument Creek watershed are of particular importance for municipal water supplies. In the Upper Monument Creek watershed, major streams include Upper Monument Creek and Limbaugh Canyon, both of which provide drinking water to residents of Palmer Lake. In the West Monument Creek watershed, decreed water rights on Rainbow Gulch, Wildcat Gulch and West Monument Creek provide drinking water to Colorado Springs.

The West Monument Creek drainage is a critical element of Colorado Springs Utilities drinking water collection system as trans-basin water supplies are diverted and piped from along the Continental Divide into Rampart Reservoir. Stored water from Rampart Reservoir is treated at the Pine Valley and McCullough water treatment plants, which at times provide up to 80% of Colorado Springs' drinking water supply.

VEGETATION

The UMC landscape supports a diversity of ecosystems and associated vegetation types consistent with the Montane Zone of the southern Front Range. The landscape is generally conifer-dominated with approximately 85% of the area characterized by three primary systems: Ponderosa Pine-Douglas Fir Woodland, Dry-Mesic Montane Mixed Conifer Forest and Woodland (dry mixed-conifer forest), and Mesic Montane Mixed Conifer Forest and Woodland (mesic mixed-conifer forest). These three systems are distributed across the UMC area and are often found commingled, with location and patch size based on aspect, elevation, soils and other factors. Dominant conifer species throughout the landscape are ponderosa pine, Douglas-fir, and limber pine, with Colorado blue spruce, Englemann spruce, pinyon pine, Rocky Mountain juniper, lodgepole pine, and white fir also occurring. Aspen is also common to dominant in much of the landscape, particularly in the dry and mesic mixed-conifer forests. Notably, this landscape contains one of the northernmost stands of native pinyon pine and white fir in the Front Range of Colorado.

Table 1. Primary ecological systems of the Upper Monument Creek project area.

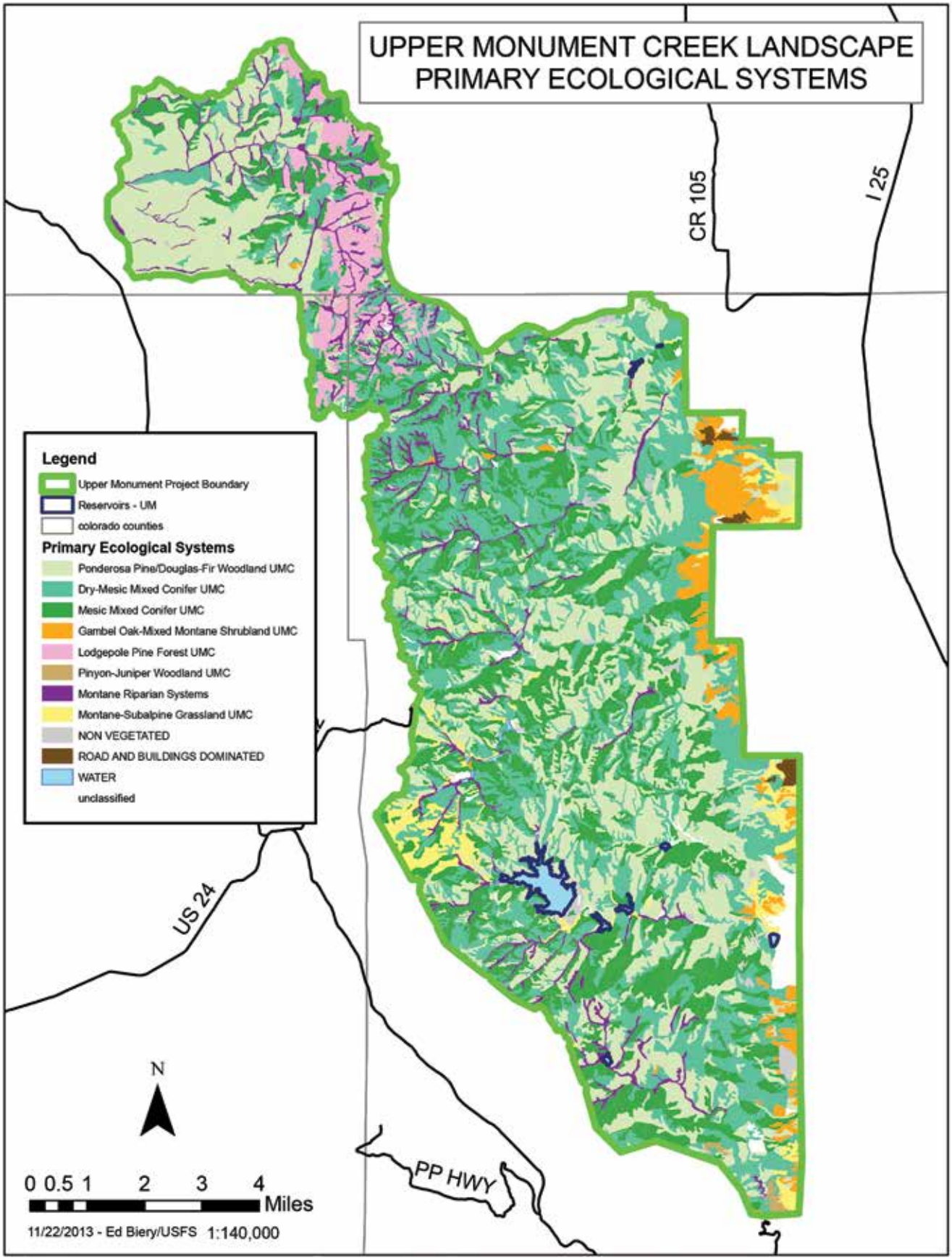
Ecological System	Acres	% of Area
Ponderosa Pine/Douglas-Fir Woodland	20,470	32%
Dry-Mesic Montane Mixed Conifer Forest and Woodland	18,680	29%
Mesic Montane Mixed Conifer Forest and Woodland	15,660	24%
Montane Riparian Systems	2,970	5%
Lodgepole Pine Forest	2,360	4%
Gambel Oak-Mixed Montane Shrubland	2,140	3%
Montane-Subalpine Grassland	1,890	3%
Pinyon-Juniper Woodland	110	0%

The West Monument Creek drainage is a critical element of Colorado Springs Utilities drinking water collection system as trans-basin water supplies are diverted and piped from along the Continental Divide over into Rampart Reservoir.

PHOTO:
Girl enjoying a cool drink.
© Istockphoto.com

5. *The Colorado Statewide Forest Resource Assessment and accompanying Forest Action Plan can be found on the Colorado State Forest Service website at http://csfs.colostate.edu/pages/statewide-forest-assessment.html.*

MAP 3. PRIMARY ECOLOGICAL SYSTEMS OF THE UPPER MONUMENT CREEK LANDSCAPE.



MAP: E.H. Biery

As with other areas of the Front Range, vegetation patterns in the UMC landscape closely follow moisture gradients, with distinct changes in species composition and structure accompanying changes in elevation and aspect. On the east side of the landscape, lower elevations are characterized by Gambel oak shrublands that begin to incorporate ponderosa pine and/or mixed conifer species as they rise to approximately 8300'. At higher elevations, most stands are dominated by mixed conifer and aspen. There is a small area of pinyon-juniper forest in the southeast portion of the landscape.

On the western flank of the landscape, ponderosa pine dominates with a grass or grass-shrub understory. As one climbs eastward, the Douglas-fir component increases, and then the other conifer species become more common. Above 9000' limber pine becomes a 3rd co-dominant tree species (at times replacing ponderosa pine) and spruce (both Englemann spruce and Colorado blue spruce) are common to co-dominant in wetter and cooler sites.

There is a large area dominated by lodgepole pine centered on the main ridge of the Rampart Range (app. 7,500 acres), of which approximately 1/3 is in the UMC landscape. This isolated stand of lodgepole pine has not yet experienced the kind of epidemic mountain pine beetle activity that has affected other areas of the state over the last decade.

Ponderosa Pine Douglas-fir Woodland © *Paige Lewis*

Lodgepole Pine © *Paige Lewis*

Dry Mixed Conifer © *Paige Lewis*

Mesic Mixed Conifer © *Paige Lewis*

As with other areas of the Front Range, vegetation patterns in the UMC landscape closely follow moisture gradients, with distinct changes in species composition and structure accompanying changes in elevation and aspect.

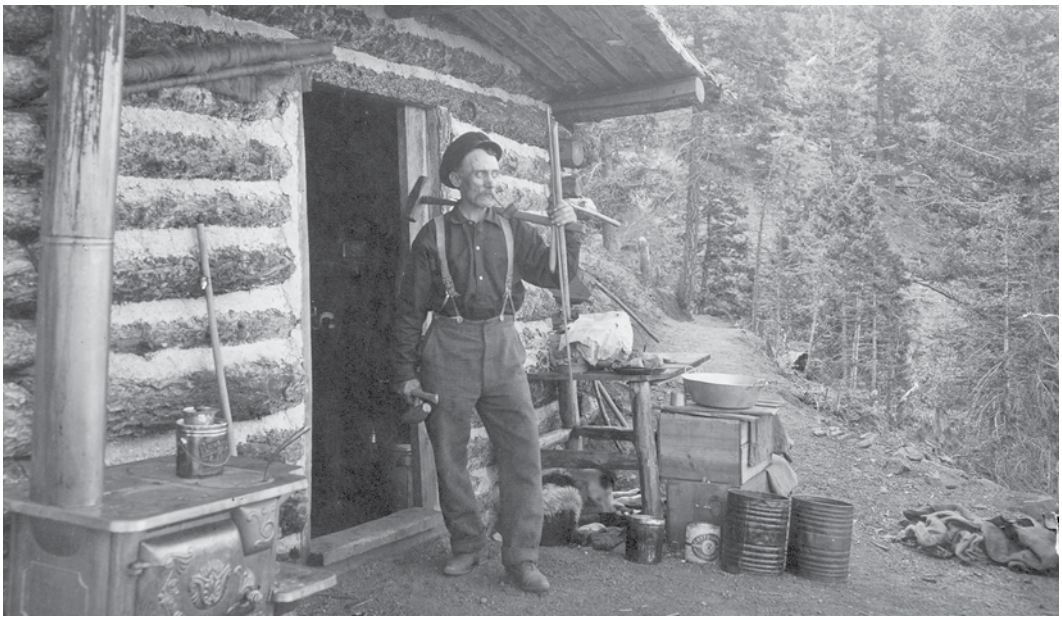
PHOTOS:
Mesic mixed conifer.
© *Carrie Segil*

HUMAN USE, DEVELOPMENT AND MANAGEMENT

Although the UMC landscape was used seasonally by several indigenous groups, human settlement in the area did not begin in earnest until approximately 1860.[6] Early settlers established and expanded timber operations in conjunction with mining activity. By 1867, several large-scale saw mills were operating in the area in response to the rapid pace of development. General William Jackson Palmer, anticipating railroad-driven economic growth, initiated development of the Colorado Springs area in 1871. A full-scale timber boom ensued as harvesters raced to meet the needs of the rapidly growing community and associated mining and railroad industries.

By the 1890s, much of the UMC landscape and surrounding area had been extensively logged and badly burned by both human and naturally ignited wildfires. A 1900 report by U.S. Geological Survey employee John G. Jack noted that at least 75% of the forests around Pike's Peak had been logged, burned or both.[7] While regular cycles of natural fire had occurred in lower-elevation forests for centuries, the increase in human activity led to larger, more severe and more frequent fires in all forest types.

In his report, Jack described these forests as among the most damaged of any he had seen in the nation. A map accompanying the Jack report shows much of the UMC landscape occurring in areas designated as "badly burned" or "much burned over." Concern about the condition of the forests and the potential negative impacts on water supply led President Benjamin Harrison to designate the Pikes Peak and Plum Creek Timberland Reserves in 1892. These reserves were consolidated, along with the South Platte Reserve, in 1907 to form the Pike National Forest, one of the first two National Forests in Colorado.



General William Jackson Palmer, anticipating railroad-driven economic growth, initiated development of the Colorado Springs area in 1871. A full-scale timber boom ensued as harvesters raced to meet the needs of the rapidly growing community and associated mining and railroad industries.

PHOTOS:
LEFT A Pike's Peak Prospector
© Denver Public Library, Western History Collection
RIGHT Portrait of a family who settled in Colorado
© istockphoto.com

6. *The Colorado Natural Heritage Program's 2002 "Monument Creek Watershed Landscape Assessment", prepared by John Armstrong and Joe Stevens, contains a wealth of information about the larger Monument Creek area, of which the Upper Monument Creek landscape is a part. Another good resource is Harry Galbreath's 1942 "History of the Pike National Forest", produced as part of the Works Projects Administration Writers Program and available through the Pikes Peak Library District.*

7. *John G. Jack's survey of the Pike's Peak and other early forest reserves is an invaluable resource on post-settlement conditions in and around the Pike National Forest.*

The federal government launched an aggressive reforestation initiative throughout the Pike National Forest shortly after its establishment.[8] As a result, more than 2 million trees were planted in the area between 1912 and the early 1920s. The most significant planting in the UMC landscape occurred from 1924-1932 when the U.S. Forest Service's now-defunct Monument Nursery oversaw the planting of seedlings across more than 7,000 acres. Current conditions in the UMC landscape reveal the lasting impact of these ambitious planters.

The turn of the twentieth century also brought a new federal policy mandating aggressive prevention and suppression of fire. This new policy led to the further disruption of natural fire cycles and promoted the growth of dense, even-aged forests that became stressed by competition for resources and vulnerable to unnaturally large-scale wildfires and insect and disease outbreaks.

No significant fires occurred in the UMC landscape between approximately 1916 and 1989, when the Berry Fire (aka Mount Herman Fire) burned 850 acres in proximity to the USFS's Monument Fire Center. In 2002, the Hayman Fire burned approximately 137,000 acres in an adjacent landscape, spreading 19 miles and growing by 62,000 acres in one day. In 2012, the Waldo Canyon Fire burned 18,247 acres northwest of Colorado Springs, destroying 346 homes and forcing 32,000 residents to evacuate

After a brief increase in logging during the 1950s, very little systematic timber harvest has occurred in the area surrounding the UMC landscape apart from smaller scale thinning and fuels reduction projects. Current forest management projects are complicated by the difficulty of operating in a largely urbanized environment, the relatively low value of products to be removed and the high cost of transportation due to a lack of local wood processing facilities.

Concern about the condition of the forests and the potential negative impacts on water supply led President Benjamin Harrison to designate the Pikes Peak and Plum Creek Timberland Reserves in 1892.

PHOTOS:
LEFT Camp scene in the Pike National Forest © *Denver Public Library, Western History Collection*
RIGHT Vista from road to Devil's Head © *Denver Public Library, Western History Collection*

8. *A helpful resource on the history of this and other National Forest reforestation efforts is contained in C.G. Bates 1923 article for the Scientific Monthly titled "Planting in the National Forests."*

Rapid population growth and development in Colorado Springs, Woodland Park and surrounding communities has been a significant driver of conditions in the UMC landscape and, in fact, the entire Pike National Forest. The UMC landscape includes portions of El Paso and Douglas counties, two of Colorado's fasting growing municipalities. The economic base of the area has shifted from one driven by resource extraction to one dominated by high tech businesses, higher education and the federal government. As a result, the UMC landscape is now highly valued for aesthetics and as a recreational outlet for urban dwellers.

Hikers, cyclists, equestrians, hunters and anglers, wildlife enthusiasts and off-road vehicles all frequent these forests, placing increasing pressure and stress on the natural systems. Of particular concern are illegal shooting ranges, refuse dumping, and illegal creation of roads and trails. The USFS monitors these uses and periodically restricts access to the most heavily impacted areas to allow for revegetation and repair. Human use is particularly high on and around the Rampart Range Road and Mt. Herman Road. Unfortunately, due to staffing and resource constraints, resource degradation from illegal recreation use is not adequately addressed in some areas.

Of related concern is the expansion of homes, business and related infrastructure into previously wildland areas, a zone also known as the *wildland-urban interface* (WUI). The presence of people and homes in the forest contributes to fragmentation of the landscape, dramatically increases the values at risk from wildfire, and adds to the difficulty and cost of wildfire risk reduction and other management efforts.

Hikers, cyclists, equestrians, hunters and anglers, wildlife enthusiasts and off-road vehicles all frequent these forests, placing increasing pressure and stress on the natural systems.

PHOTOS:
LEFT Fire rages above Colorado Springs © *istockphoto.com*
RIGHT Bikers enjoying a mountain trail. © *istockphoto.com*

Collaborative Values and Operating Principles

MEANINGFUL collaborative engagement in public land management is at the heart of the Upper Monument Creek Landscape Restoration Initiative. Early in the process, the Colorado Forest Restoration Institute (CFRI) led the UMC Collaborative to develop a mission statement and goals, which documented how participants wanted to work together and their vision for the future of the landscape. These "operating principles," included below, served as a guidepost for subsequent collaborative dialogue and recommendations.

PREAMBLE

Resilience is defined as the ability of a living system to absorb shocks without changing its structure and function. Every living system possesses attributes that allow it to respond to and recover from a disturbance. Front Range forest landscapes have evolved with the ability to absorb wildfires and other natural disturbances, making them "fire-adapted" ecosystems. Many of those attributes have been lost or compromised in the past 150 years. The Upper Monument Creek Landscape Initiative aims to restore the ecological attributes, and promote the social attributes, that will allow the people and environment of the Upper Monument Creek landscape to be resilient into the future.

MISSION STATEMENT

We will demonstrate a collaborative, adaptive management process to restore and sustain forest structures across land ownerships in the Upper Monument Creek landscape through the strategic placement of treatments that: reduce the risk of uncharacteristically large, severe fires; result in increased community and watershed protection; and are resilient in the face of anticipated climate changes.

Resilience is defined as the ability of a living system to absorb shocks without changing its structure and function. Every living system possesses attributes that allow it to respond to and recover from a disturbance.

PHOTOS:
LEFT Roundtable's CFLR field trip. © *Peter Brown*
RIGHT Pasque flower. © *Paige Lewis*

GOALS

Over the next ten years, we will:

1. *Continuously collaborate and adapt.* This Initiative seeks to bring together individuals with different perspectives, experiences and expertise to develop, implement, monitor, and continually adjust a range of goals and management practices to accomplish the Mission.

2. *Create and sustain vegetation conditions so that fire can be allowed to function across the landscape.* Disturbances are essential and necessary for forests to sustain important ecological and social values. However, the current structure and composition of many ponderosa pine and warm-dry mixed-conifer forest areas on Colorado's Front Range may be outside their natural range of variability (NRV), making them vulnerable to high-severity, stand-replacing fires and compromising ecological and social values. In particular, the communities and watersheds in and around the Upper Monument Creek landscape are vulnerable to negative effects from wildfires – loss of life, destroyed homes and infrastructure, economic disruptions, loss of scenic quality, and post-fire flooding and landslides. A primary goal is to establish forest structure where the outcomes of fire are socially acceptable and would be less destructive to people and the environment.

3. *Contribute to Firefighter Safety, Community Safety and Economic Sustainability.* With its proximity to the Colorado Springs and Denver metropolitan areas, as well as communities along highways 24 and 67, the Upper Monument Creek landscape encompasses a broad range of goods, services and values to local communities. Forest restoration can reduce risks to firefighter and community safety in the event of a wildfire, and reduce the vulnerability of forest-dependent economic investments, such as water supplies, transportation networks, recreational facilities and tourism businesses. Additionally, the economic sustainability of forest restoration is enhanced by engaging forest-based enterprises to commercially use woody biomass from restoration treatments.

Forest restoration can reduce risks to firefighter and community safety in the event of a wildfire, and reduce the vulnerability of forest-dependent economic investments, such as water supplies, transportation networks, recreational facilities and tourism businesses.

PHOTOS:
LEFT Monitoring a prescribed burn. © *Jeff Crandall*
RIGHT Forest management. © *Charles Sweet*

Desired Future Conditions and Purpose and Need for Management

THE establishment of desired future conditions for a landscape enables both land managers and diverse stakeholders to agree on a common vision of success. Once identified, these desired landscape conditions can be compared with current conditions to determine the purpose and need for management action. Desired conditions also serve as an important benchmark to measure effective management and determine necessary changes.

Desired conditions are frequently used to define the target range of variability in forest attributes such as vegetative structure and composition. They are often based on historical information or data gathered from reference sites where disturbance processes such as fire are intact and functioning. These baseline conditions are often referred to as the *historical range of variability* (HRV), meaning the range of conditions that likely existed prior to Euro-American settlement.

Desired conditions do not describe a static reference condition. Rather, they highlight how scientists believe a given ecosystem functions, including the dynamics and disturbance regimes that interact to sustain desired conditions over time. Well-developed desired conditions should also be forward-looking in the context of global change and should use information from the past as a guide to anticipate likely system responses to future climate and disturbance scenarios.

In identifying desired future conditions for the UMC landscape, Initiative participants built on previous collaboratively developed visions for Front Range forests. In its 2006 report, the Front Range Roundtable described their goal as a complex mosaic of forest structures, with patches of variable tree densities and ages that favor retention of the older trees. Roundtable members added greater detail to this vision in 2011 when they developed a proposal and subsequent ecological monitoring plan for treatments implemented through the Front Range Collaborative Forest Landscape Restoration Project (CFLRP).

As described below, the UMC Collaborative's desired future conditions for the UMC landscape emphasize the need for a more natural range of forest diversity, heterogeneity and complexity. In contrast, many areas of the UMC landscape currently contain forests that are much denser than would have been seen prior to Euro-American settlement and lack the kind of age and structural diversity needed to promote resilience. As a result, these forests are extremely vulnerable to unnaturally large and damaging wildfires. This situation places both people and key forest values at risk and creates an imperative for action.

Desired conditions do not describe a static reference condition. Rather, they highlight how scientists believe a given ecosystem functions, including the dynamics and disturbance regimes that interact to sustain desired conditions over time.

PHOTO:
Forested landscape after treatment. © *Paige Lewis*

Although initial treatment in the UMC landscape will likely have a ten-year life span, the Collaborative's desired future conditions for the landscape look much further into the future. Achieving the conditions described below will likely require sustained action over several decades. The current UMC project is only the beginning of this process.

Phantom Creek project area before treatment. © *Jeff Underhill*

Phantom Creek project area after treatment. © *Jeff Underhill*

It is also important to note that even though the conditions outlined below focus primarily on the ecological aspects of the landscape, it is the Collaborative's intention that by promoting greater overall resilience to the forest, land managers will also be reducing risks to human lives, community infrastructure and the many natural benefits that people obtain from the forest.

The Collaborative recognizes that priorities such as community and watershed protection will sometimes dictate a different treatment regime.

PHOTO:
Site near North Catamount Reservoir © *Paige Lewis*

DESIRED FUTURE CONDITIONS FOR THE UPPER MONUMENT CREEK LANDSCAPE

The desired future condition for the UMC landscape is one where the forest structure is such that the outcomes of fire are ecologically appropriate and socially acceptable, posing less of a threat to people and the environment and fostering the sustainability of key forest values. The Collaborative anticipates that this forest structure is one that closely approximates the natural range of variability whenever possible, but the Collaborative also recognizes that priorities such as community and watershed protection will sometimes dictate a different treatment regime.

Specific desired conditions include:

A diverse landscape mosaic with forest composition and structure that reflects variation in topography and underlying moisture gradients.

- Open ponderosa pine – Douglas-fir woodlands occur in lower elevation settings and dry, south-facing slopes and grade into dry mixed-conifer forests with increasing moisture availability; mesic settings such as north-facing slopes and upper elevations support mesic mixed-conifer forests and more closed forest conditions.
- A range of forest structural and developmental conditions is present across forest types, reflecting various degrees of recovery from natural or restoration-based disturbances; early, mid, and late-seral conditions are all present, as are uneven- and even-aged stand structures, and both open and closed canopy structure.
- Old-growth stands are present throughout the landscape across forest types.
- Large openings and early-seral conditions are present across the landscape, in some cases on dry, south-facing slopes where growing conditions are harsh and in other cases in more productive settings such as north-facing slopes representing recovery from high-severity disturbance events; opening size, shape and arrangement are highly variable.

Landscape diversity provides for natural disturbance regimes that are within the natural range of variability and are socially acceptable.

- Low-severity fire occurs in lower elevation settings primarily as surface fire that can be safely prescribed or managed as wildfire use.
- Pockets of moderate- to high-severity fire occur occasionally in more productive settings but are generally small in extent.
- Insect and disease-caused mortality occurs at the individual tree to small tree-group scale.
- Landscape heterogeneity provides natural barriers to the spread of high-severity disturbance events over large scales.

PHOTOS:
TOP Prescribed burn in ponderosa pine forest. © *Jeff Crandall*
BOTTOM Ponderosa pine-Douglas fir woodland. © *Paige Lewis*

Forest stands exhibit fine-scale heterogeneity in structure and tree spatial patterns.

- Concurrent with the increase in overall forest density, species such as Douglas-fir have increased. The growth form of more shade-tolerant species such as Douglas-fir (long crowns with branches spreading to the ground) increases the potential for fire to spread into the tree canopy.
- Fine-scale mortality and regeneration processes are present.
- Old trees, snags and coarse woody debris are all present to provide wildlife benefit and structural complexity and richness.
- Even-aged, dense patches are present in fire shadows or moist areas.

Landscape and stand-scale heterogeneity provide diverse habitats for wildlife.

- A wide range of desired species are present at viable population levels.
- Rare and endemic species are not vulnerable to extirpation.
- Habitat connectivity exists for species movements and to facilitate species migrations along elevation or latitudinal gradients that may accompany climate change.

Watersheds are stable and hydrologic processes are intact.

- Aquatic environments are healthy and support a wide array of aquatic species and rich fisheries.
- Soil erosion and sedimentation are within acceptable limits and do not compromise water quality or create hazardous runoff or flood events.
- Riparian vegetation is intact and provides cover for wildlife, buffer from upslope soil movement and shade to in-stream environments.
- Water quality and quantity sustainably support human uses.

In total, the landscape is functional, resilient to disturbance and climate change, and provides in perpetuity important forest functions and ecosystem services to support wildlife and human populations.

CURRENT CONDITIONS

As a first step in the *Landscape Conservation Forecasting*™ (LCF) analysis for the UMC landscape, Initiative participants assessed the "ecological departure" of the three focal forest systems that make up 85% of the project area.[9] The ecological departure metric (aka fire regime condition class) was originally developed by the interagency LANDFIRE program as a broad-scale measure of ecosystem health.[10] Ecological departure assesses the degree to which current ecosystem conditions are different or departed from the historical range of variability. Ecological departure is an integrated measure of composition, structure and disturbance regime, and is a key metric to assess current and long-term future conditions.

As a first step in the Landscape Conservation Forecasting™ (LCF) analysis for the UMC landscape, Initiative participants assessed the "ecological departure" of the three focal forest systems that make up 85% of the project area.

PHOTO:
UMC participants at lunch .
© *Carrie Segil*

9. *A complete report on the Landscape Conservation Forecasting analysis for the Upper Monument Creek landscape is provided in Appendix A. See pages 22-24 of Appendix A for a discussion of some of the benefits and limitations of this tool.*

10. *More information on the LANDFIRE program and the ecological departure metric can be found at www.landfire.gov.*

The initial LCF ecological analysis of the UMC landscape revealed the landscape's three focal forest systems to be moderately departed from their HRV due to an overabundance of closed canopy forests and a significant lack of older age classes. Overall, approximately 63% of the forest in these three systems is in a closed canopy or dense condition, about twice as much as occurred historically. This leaves an approximately 15,000-acre shortfall in the more open canopy forest classes across the landscape. Moreover, because of historical logging, forests representing age classes above 150 years in age are significantly under-represented.

Table 2. Ecological departure of the UMC ecological systems. The measure of ecological departure is scored on a scale of 0% to 100% departure from HRV: 0% represents HRV while 100% represents total departure. Departure was not calculated for the five smaller systems.

Ecological System	% Departutre	Acres (rounded to next 100)
Ponderosa Pine/Douglas-Fir Woodland	41	20,500
Dry-Mesic Montane Mixed Conifer Forest and Woodland	52	18,700
Mesic Montane Mixed Conifer Forest and Woodland	42	15,700

Further analysis of current conditions revealed that today's UMC forests lack a number of the ecological attributes, such as spatial heterogeneity and significant representation in older age classes, which were once common and contributed to the resilience of pre-settlement forest landscapes. These conditions are described in further detail below. Without strategic and timely management, these forest conditions will continue to worsen, resulting in increasingly undesirable outcomes.

- **High forest density** characterizes much of the current UMC landscape as a result of fire exclusion combined with wet climatic conditions and favorable regeneration conditions that occurred in the late 19th and early 20th centuries. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions were highlighted as primary concerns by the LCF process. Overly high forest density creates continuous, fairly uniform canopy conditions that allow for the unimpeded spread of high-severity disturbances such crown fire.

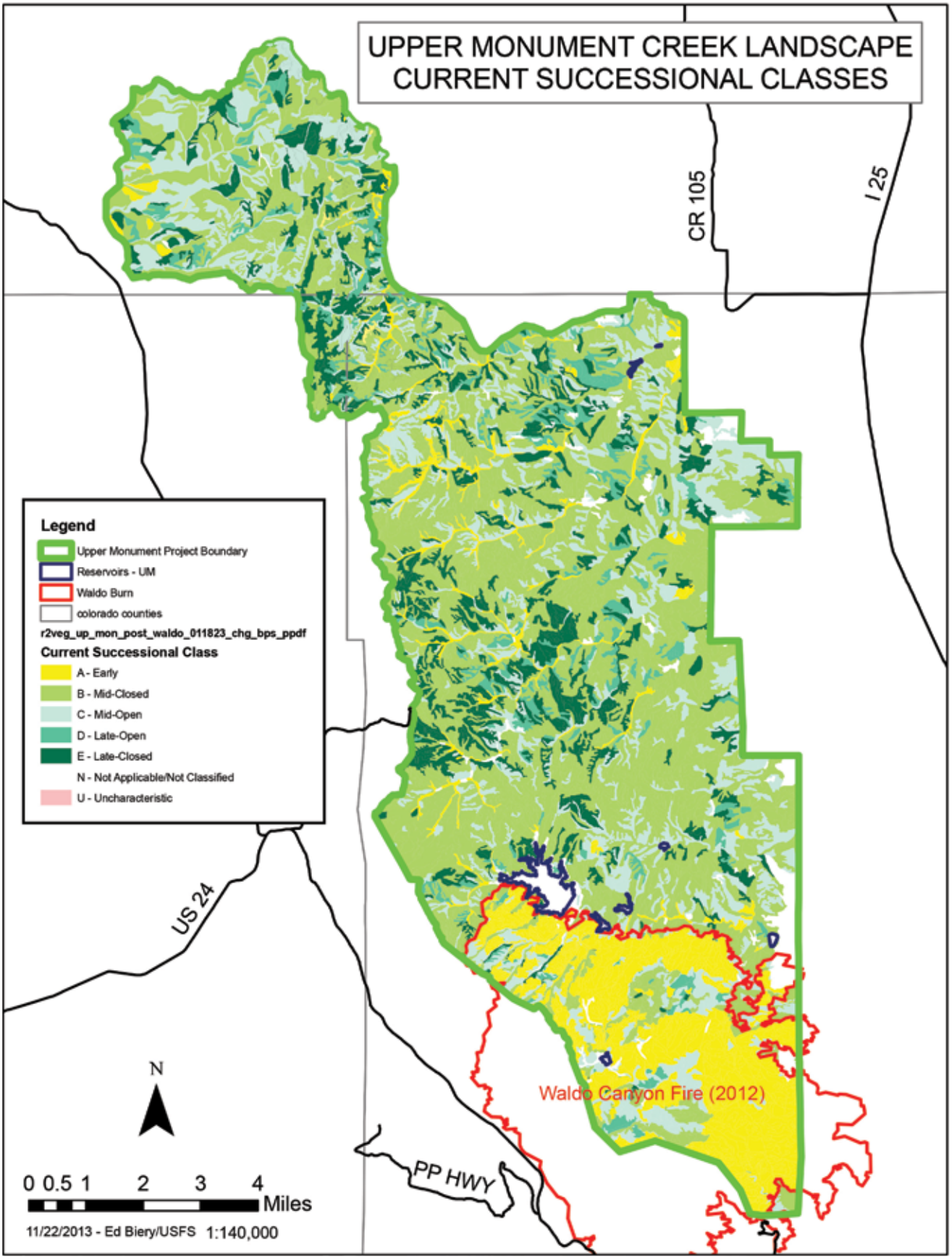
- **Loss of spatial heterogeneity** has also occurred as the forest has filled in with younger trees. The "groupy-clumpy" stand structure where trees occur in groups separated by openings is characteristic of forests that burn frequently and at low intensity, but is often not apparent in the current Upper Monument Creek forest. This structure is important for some wildlife, fine-scale ecological processes such as tree mortality and regeneration, and for facilitating low-severity disturbances.

- **Loss of openings** has occurred as a result of fire exclusion that enabled the forest to fill in with trees. Openings provide many important ecosystem functions, including understory herbaceous vegetation and shrub community development and habitat and foraging opportunity for wildlife. Openings also contribute to overall landscape heterogeneity and provide natural barriers to the wide-scale spread of high-severity disturbances.

The initial LCF ecological analysis of the UMC landscape revealed the landscape's three focal forest systems to be moderately departed from their NRV due to an overabundance of closed canopy forests and a significant lack of older age classes.

PHOTO:
Dense forest conditions.
© *Paige Lewis*

MAP 4. CURRENT SUCCESSIONAL CLASSES IN PRIMARY FOREST SYSTEMS OF THE UMC LANDSCAPE



MAP: E.H. Biery

- **Early-seral forest structures are less common and less dispersed** currently than they likely were historically. The Waldo Canyon fire has created one large patch of primarily early-seral forest within the UMC landscape, whereas historically early-successional forests were likely smaller in scale and spatially distributed throughout the landscape.

- **The mid-seral forest classes, which are somewhat even-aged due to century-old logging, are overabundant** in the current forest.

- **Old trees and old-growth stand structures are much less common currently than they were historically** due to logging and forest clearing that occurred with Euro-American settlement. The LCF analysis pointed to a deficiency in old-growth, late-seral stand conditions within the UMC landscape. Old trees and old-growth stands provide landscape structural complexity and important ecosystem functions, especially for wildlife.

- Concurrent with the increase in overall forest density, **species such as Douglas-fir have increased**. The growth form of more shade-tolerant species such as Douglas-fir (long crowns with branches spreading to the ground) increases the potential for fire to spread into the tree canopy.

- **Frequent, low-severity surface fire is absent in the UMC landscape**. The low-severity fire regime that historically characterized low-elevation ponderosa pine and drymixed-conifer forests has largely been replaced by high-severity active crown fire. Loss of surface fire represents loss of a keystone ecological process.

PHOTOS:
LEFT
Forested landscape after mechanical treatment. © *Paige Lewis*

RIGHT TOP TO BOTTOM
Fire scarred stump. © *Paige Lewis*
Lodgepole pine. © *Mike Babler*
Mesic mixed conifer forest. © *Mike Babler*

THE NEED FOR ACTION

The size, severity and behavior of recent fires on the Pike National Forest and across the Front Range have vividly demonstrated the risks posed by current forest conditions, particularly in areas where homes and communities are intermixed with wildlands. The record-setting 2002 Hayman Fire and 2012 Waldo Canyon Fire, the latter of which occurred within the UMC landscape, book-end a decade that saw significant increases in the human and environmental costs of wildfire across the region. As detailed above, the conditions that drove these fires are also found throughout the UMC landscape, suggesting that without strategic intervention these forests – and surrounding communities – are vulnerable to similarly unnatural and devastating events.

The complete LCF analysis, discussed in greater detail below and in Appendix A, included an examination of management alternatives ranging from "no action" to a variety of active management scenarios. The no-action alternative would essentially perpetuate the current condition over the next ten years, an option that quickly becomes undesirable when considered in the context of recent fires. Recent fire risk analyses conducted by the USFS Rocky Mountain Region underscored this fact when they found the Pike National Forest and the Pike's Peak Ranger District, in particular, to be among the Region's highest risk jurisdictions in terms of potential for negative wildfire impacts to people, water and wildlife (Langowski 2012).

Alternatively, the "feasible treatment" scenario recommended by the UMC Collaborative, also detailed below, proved likely to significantly improve the condition of the landscape through the treatment of approximately 18,000 acres. The ten-year budget for this combination of mechanical thinning and prescribed fire totals slightly more than $10 million, or $1 million average cost per year. This estimate was developed by assigning costs to a variety of treatments that could be applied within the landscape and then using those costs to calculate the resources needed to implement the combination of treatments recommended by the UMC Collaborative.[11] When compared with the $16.7 million spent over less than three weeks to suppress the Waldo Canyon Fire, the Collaborative deemed this a very reasonable investment.

The size, severity and behavior of recent fires on the Pike National Forest and across the Front Range have vividly demonstrated the risks posed by current forest conditions, particularly in areas where homes and communities are intermixed with wildlands.

11. *Please see Appendix D of the report contained in Appendix A for a full display of the management treatments and associated costs that were considered as part this analysis.*

PHOTO:
Wildfire smoke trails over a Front Range community. © *Chris Pague*

Management Recommendations

THE recommendations outlined below were developed through a year-long collaborative process that included several in-person workshops, field visits, and the application of current science and technology to our landscape analysis. These recommendations are aimed at restoring more resilient ecological conditions to the entire landscape, thereby reducing the risk of wildfire to both people and nature and contributing to the long-term sustainability of a full range of forest values. They are designed to inform project implementation over a ten-year period, but are also intended to set the stage for complementary management that will extend the benefits of these treatments over the next 50 years.

The UMC Collaborative's detailed recommendations are captured in three overarching principles that they believe will result in a management approach that is effective at both the large landscape and more specific treatment scales. First, treatments must be designed and implemented at a **meaningful scale**, ensuring that treatments are able to truly effect a landscape-scale change in conditions and processes. Second, treatments should be strategically scheduled and located so that they **maximize benefits** to both people and nature. Finally, treatments must be **carefully designed**, using the best available science for individual forest systems and ensuring that the purpose of treatments is clear.

PHOTOS:
TOP Igniting a prescribed fire. © *Charles Sweet*
BOTTOM Night watch on a wildland fire. © *Jeff Crandall*

RECOMMENDATION: Design and Implement Treatments at a Meaningful Scale

SUMMARY

- Implementing strategically placed treatments on approximately 18,000 acres across the landscape will produce significant improvement in ecological conditions across the entire UMC landscape.
- The greatest benefit will be accrued through a combination of mechanical thinning, manual hand thinning and prescribed fire. Each individual tool produces benefits, but a combined treatment approach is most effective.
- Based on feasibility and related analyses, the Collaborative anticipates that over the next ten years these treatments will consist of approximately 6,000 acres in mechanical thinning, 6,000 acres in manual hand thinning, 3,000 acres of site preparation and 3,000 acres of prescribed fire.
- The majority of treatments should be focused in the UMC landscape's three primary forest systems: ponderosa pine, dry mixed-conifer and mesic mixed-conifer.
- Treatments should emphasize the creation of more open canopy conditions in the significantly overrepresented mid-closed and late-closed successional classes within the primary forest systems and on retaining and fostering the underrepresented older age classes.

- The ponderosa pine-Douglas fir system should receive the most thinning treatment, followed by the dry mixed-conifer system with recommended thinning treatment at approximately 5,900 and 4,300 acres respectively. Acres requiring prescribed fire are distributed across the three major forest systems.

- Although they were not analyzed through the LCF process, the Collaborative anticipates that treatment will also be warranted in the smaller lodgepole pine and Gambel oak systems, primarily for the purposes of wildfire risk reduction and/or preparation for prescribed fire in adjacent ponderosa pine-Douglas fir or dry mixed conifer systems.

- Based on the LCF analysis, the Collaborative anticipates that the total cost of treatment for the proposed management scenario will be approximately $10 million over the next ten years.

DISCUSSION

The UMC Collaborative placed a priority on identifying how much and what types of management action would be needed to meaningfully effect a landscape-scale change within the project timeframe and budget. To help answer this question, the Collaborative used the Landscape Conservation Forecasting™ (LCF) process to explore the potential benefits and costs of a variety of landscape-scale treatment scenarios. The Collaborative then compared the results of this process to a treatment feasibility analysis. The Collaborative characterized their final recommendations as a "Feasible Treatment" scenario.

The LCF tool has been used in multiple landscapes across the United States to assess current ecological conditions, develop management strategies that achieve meaningful and measureable ecological benefits, and forecast future conditions under alternative management scenarios, including benefits and costs. The LCF concept was developed by Greg Low of Applied Conservation LLC, along with Dr. Louis Provencher (Director of Science at The Nature Conservancy in Nevada), and Susan Abele (currently US Fish & Wildlife Service in Nevada), building upon methods developed under the national interagency LANDFIRE program. The LCF name is trademarked by The Nature Conservancy in Nevada.

Within the LCF framework, the UMC Collaborative used predictive models to forecast anticipated future conditions under alternative management scenarios, including the "Feasible Treatment" scenario. The analysis focused on the three focal forest systems that dominate the UMC Landscape. Five other ecological systems within the landscape were not analyzed using LCF because of their small overall acreage within the project area. Potential management scenarios were compared based on the level to which they could positively impact both ecological departure and open canopy departure. [12]

The UMC Collaborative placed a priority on identifying how much and what types of management action would be needed to meaningfully effect a landscape-scale change within the project timeframe and budget.

PHOTO:
Ponderosa pine forest after prescribed fire. © *Paige Lewis*

12. Within the LCF framework, *ecological departure* is defined as the level (1-100) to which current conditions are departed or different from reference conditions or the *natural range of variability* (NRV). Ecological departure is an integrated measure of composition, structure and disturbance regime, and is a key metric to assess current and long term future condition. For the UMC analysis, forest conditions were also assessed using an *open canopy departure* metric. This second metric proved valuable for showing the short-term impact of treatment scenarios because positive results can be quickly realized and do not depend on trees growing older. For more information on both of these metrics, please see Appendix B.

The initial scenarios tested included the following:[13]

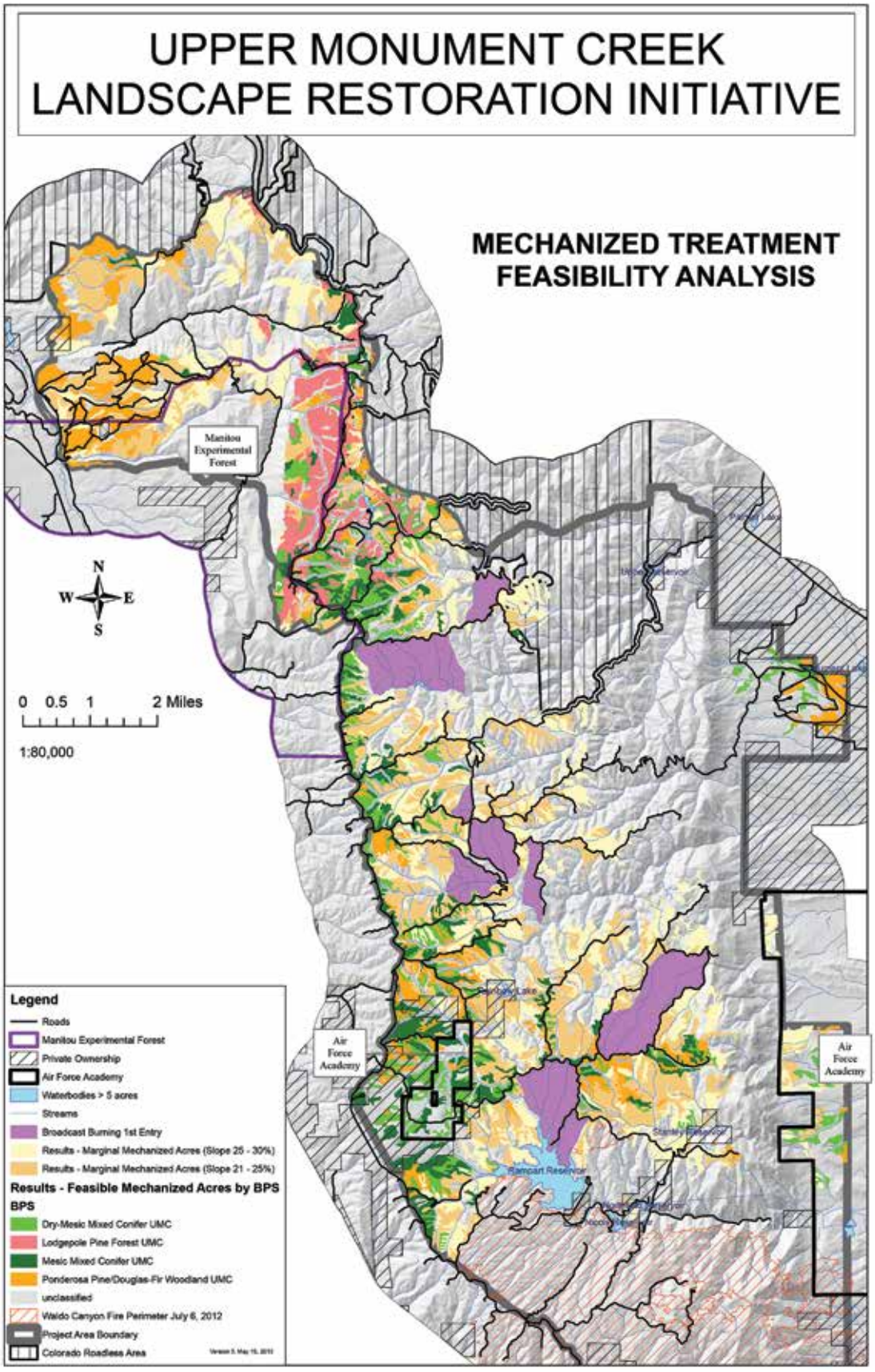
1. **No management** – no management actions except continuation of current fire suppression.
2. **Mechanical treatments only** – mechanical thinning of closed canopy vegetation, including varying levels of openings creation, to create more open canopy conditions and/or to reduce ladder fuels beneath overstory trees.
3. **Prescribed fire only** – broadcast burning (after site preparation treatments) to create more open canopy conditions.
4. **Combined** mechanical treatment and prescribed fire, including the possibility of conducting one large prescribed burn.
5. **"Zero canopy departure"** – management treatments geared to restore open canopy conditions to the greatest possible degree, regardless of budget or feasibility constraints.

A return-on-investment (ROI) calculation[14] was done for all scenarios, to compare ecological benefits against costs, both *within* and *across* the three ecological systems. If ROI values differ substantially between management scenarios, this analysis can be a useful tool to assist land managers in allocating scarce management resources. For the UMC landscape, the ROI analysis showed roughly equivalent results across all management scenarios and ecological systems, with only a few small variations. On an area-weighted, inter-system basis, the highest overall ecological benefits per dollar invested accrued in the ponderosa pine/Douglas-fir woodland (largely due to a higher level of manual thinning) with the lowest return in mesic mixed conifer.

PHOTOS:
LEFT Fire management planning. © *Tim Borgman*
RIGHT TOP TO BOTTOM Ponderosa pine landscape. © *Paige Lewis;* Dry mixed conifer forest. © *Mike Babler*

13. See Appendix A, pages 31-34 for a more detailed description of the scenarios analyzed and results produced.
14. See Appendix A, pages 22 and 35-36 for further discussion on the Return on Investment (ROI) methods.

MAP 5. ACRES WITHIN THE UMC LANDSCAPE DEEMED FEASIBLE FOR MECHANICAL TREATMENT.



MAP: J. Underhill

After the initial scenario run, the Collaborative asked USFS staff to analyze where mechanical treatments would be most feasible based primarily on slope, access and an assessment of the likely success rate based on previous experience implementing treatments in the Front Range Long-Term Stewardship Contract. The Collaborative solicited this input as a "reality check," but not necessarily a limitation, on their deliberations. The resulting analysis showed approximately 7,600 acres in four forest systems that would be feasible for mechanical treatment.[15] The majority of these stands are concentrated in the west and northwest portions of the project area. More than half of these acres are in ponderosa-pine-Douglas fir and/or dry mixed conifer forests.

After reviewing the feasibility analysis, the UMC Collaborative developed and assessed a sixth "Feasible Treatment" scenario as follows:

6. **"Feasible treatment"** – combined mechanical treatment with the addition of manual hand thinning – both at levels deemed feasible based upon the USFS's GIS analysis of potential and marginal treatment areas (e.g., slope, accessibility and other variables), as well as a conservative USFS estimate of the amount of feasible, prescribed broadcast burning (following site preparation).[16]

All treatment scenarios involving management produced positive results. However, when compared to using mechanical thinning or prescribed fire alone, the "Feasible Treatment" scenario produced significantly more open canopy conditions across the landscape, set the forests on a trajectory toward greater dominance by older age classes and achieved management objectives while staying within the acreage and financial targets that the Collaborative deemed reasonable given physical, political and financial constraints.

Table 3. Ecological and open canopy departure scores based on ten years of treatment under all scenarios. Departure color gradient from Green (low departure) to Yellow/Orange (moderate) to Red (high).

Management Scenario	Ponderosa Pine-Douglas Fir Woodland		Dry-Mesic Montane Mixed Conifer Forest		Mesic Montane Mixed Conifer Forest	
	Ecological Departure	Open Forest Departure	Ecological Departure	Open Forest Departure	Ecological Departure	Open Forest Departure
Current Condition	40	43	52	43	42	57
No Management - 10 Years	39	44	49	43	36	56
Mechanical Only (20% Regen)	36	16	47	19	31	44
Prescribed Burn Only	38	39	49	36	33	49
Mechanical + Rx Burning	37	11	47	10	29	38
Mechanical + Large Rx Burn	35	1	47	3	26	27
10 Year Zero Departure Open Range	36	0	47	0	25	0
Feasible Treatments - 10 Years	37	14	48	19	31	42

An associated cost analysis estimated that the ten-year budget for the feasible treatment scenario would be approximately $10 million, with funding requirements being slightly higher during the initial seven years when the majority of mechanical treatment would occur (Appendix A). Overall, approximately $6 million would be spent on mechanical thinning, $2.25 million on prescribed burning, and the remaining $1.75 million on site preparation and manual thinning.

15. See Appendix B for a summary of the feasibility analysis results.

16. See Appendix A, page 21 for a detailed description of the Feasible Treatment Scenario.

Table 4. Summary of ten-year benefits, cost & ROI across systems – Feasible Treatment Scenario

Ecological System	Acres	Ecological Departure		Open Canopy Departure		10 Year Total Cost	ROI (area-weighted)
		No Mgmt	Feasible Treatment	No Mgmt	Feasible Treatment		
Ponderosa Pine-Douglas Fir Woodland	20,500	39	37	44	14	$3,754,800	0.9
Dry-Mesic Montane Mixed Conifer Forest	18,700	49	48	43	19	$3,618,000	0.7
Mesic Montane Mixed Conifer Forest	15,700	36	31	56	42	$2,985,100	0.5

Additional model runs were conducted for the Feasible Treatment scenario to assess whether or not the prescribed treatments would produce a lasting positive effect. The overall trajectory over 20 and 50 years proved to be very good for all three systems under the Feasible Treatment scenario. Ecological Departure scores improve for all three systems as the forests mature. However, Open Forest Departure scores get slightly worse over time, as the forest canopy slowly becomes more closed in the absence of management treatments in future years. All three systems fared noticeably better in one or both metrics than they would have fared with no management over 20 and 50 years.

Table 5. Ecological and open canopy departure scores in 10, 20 and 50 years under Feasible Treatment Scenario. Departure color gradient: Green (low), Yellow/Orange (moderate), Red (high).

Management Scenario	Ponderosa Pine-Douglas Fir Woodland		Dry-Mesic Montane Mixed Conifer Forest		Mesic Montane Mixed Conifer Forest	
	Ecological Departure	Open Forest Departure	Ecological Departure	Open Forest Departure	Ecological Departure	Open Forest Departure
Current Condition	40	43	52	43	42	57
No Management - 10 Years	39	44	49	43	36	56
Feasible Treatment - 10 Years	37	14	48	19	31	42
Feasible Treatment - 20 Years	32	16	46	20	28	44
Feasible Treatment - 30 Years	23	21	36	24	22	49

RECOMMENDATION: Strategically Schedule and Locate Treatments to Maximize Benefits

SUMMARY

- Due to the high overall potential for negative impacts from wildfire, the Upper Monument Creek, Beaver Creek and West Monument Creek watersheds should be considered priorities for early action.
- Treatments on the eastern portion of the project area should be designed to reduce wildfire risks to adjacent communities as well as to water and power infrastructure that lies within the landscape.
- Because of the steep slopes and difficult access that characterize the eastern portion of the landscape, mechanical and manual treatments should be concentrated in the lower and higher elevations so that fire in the more challenging middle elevations will be more manageable and pose less of a risk for negative consequences.
- Treatments intended to reduce risks to communities must be paired with complimentary action by those communities to be effective. A priority should be placed on implementing federal land treatment in areas where communities have taken or are in the process of taking action to reduce risks on non-federal land. This will likely require proactive community outreach and engagement.

- Treatments on the more accessible, less populated west side of the project area should be prioritized to maximize large-scale ecological restoration benefits that increase overall resilience and modify the potential size, severity and behavior of wildfires. This prioritization should not exclude the need for strategic community protection in this portion of the project.

- Mechanical treatments in accessible areas throughout the landscape should be designed so as to facilitate the use of both prescribed fire and naturally ignited wildland fire in less accessible and/or more sensitive portions of the landscape.

- Opportunities should be sought to use fire as a management tool in areas that analyses show as having the potential to benefit from a natural range of fire behavior.

- Maintain desirable forest conditions within the Waldo Canyon Fire burn site and seek opportunities to use the burn's footprint as an anchor for the use of fire as a management tool in other areas of the landscape.

- Balance the annual distribution of treatments between the western and eastern portions of the landscape to facilitate cost-effective on-the-ground implementation and ensure maximum treatment flexibility.

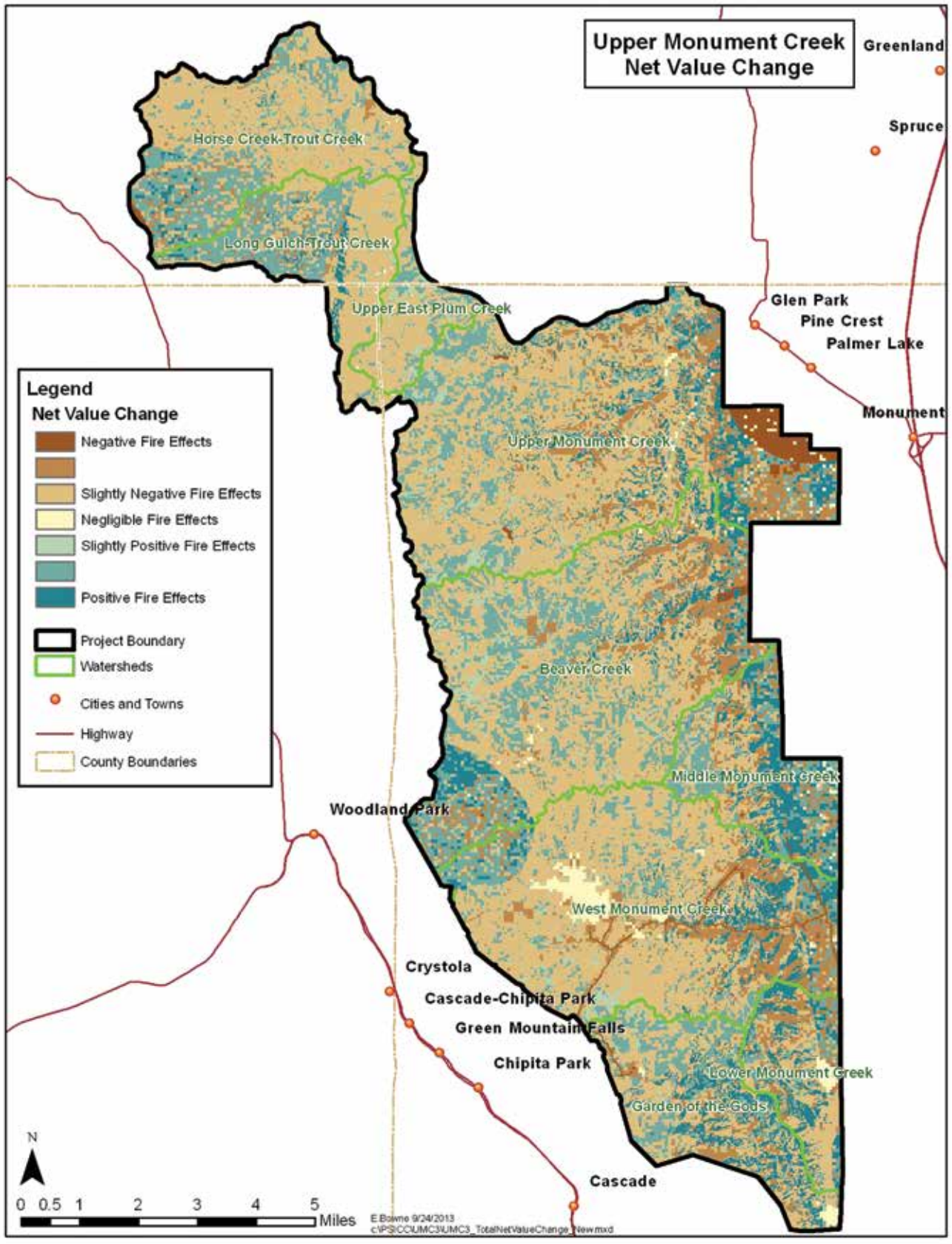
DISCUSSION

Central to the UMC Initiative are the intertwined goals of increasing firefighter and community safety while also enabling fire to play a more natural, restorative role in the landscape. The realization of these goals will require that forest treatments be designed and implemented in a way that maximizes potential benefits, including protection of communities, infrastructure and water supply; protection and enhancement of wildlife habitat; and restoration of more resilient forest structure and function.

Central to the UMC Initiative are the intertwined goals of increasing firefighter and community safety while also enabling fire to play a more natural, restorative role in the landscape.

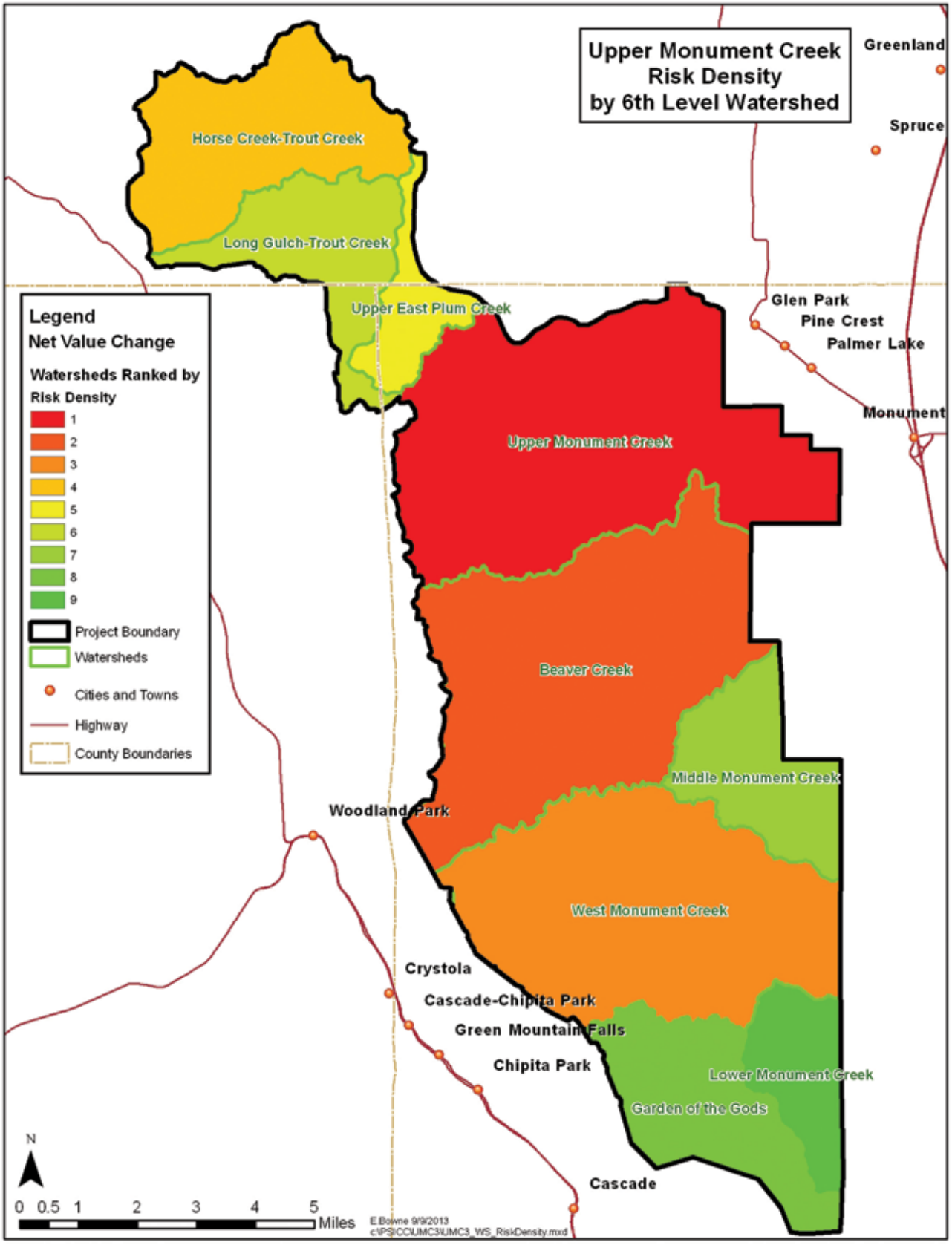
PHOTOS:
LEFT Elk amid blackened tree trunks © *istockphoto.com*
RIGHT TOP TO BOTTOM
Smoke pours from a burning log cabin © *istockphoto.com;* Monitoring a prescribed fire. © *TNC*

MAP 6. UPPER MONUMENT CREEK NET VALUE CHANGE



MAP: E. Bowne

MAP 7. UPPER MONUMENT CREEK RISK DENSITY



MAP: E. Bowne

As a resource in the landscape analysis, the UMC Collaborative engaged fuels and fire specialists from the USFS's Rocky Mountain Region and Missoula Fire Sciences Laboratory to apply a new Integrated Fire Risk Assessment (IFRA) framework to the UMC project area (Calkin 2010). Through this analysis, the Collaborative hoped to learn more about where wildfire posed the greatest threat to "highly valued resources and assets" (HVRAs) as well as where fire might produce a benefit to those same values.

The IFRA framework was developed at the national level to assist federal agencies in better prioritizing and allocating limited fuels reduction dollars. The foundational components of the framework are: (1) spatial characterization of fire likelihood and intensity, (2) spatial identification of highly valued resources and assets, and (3) quantitative representation of likely fire effects to HVRAs. Key to this analysis is the emphasis on the "likelihood" of fire impacts versus just looking at predicted fire behavior or the presence / absence of an important value. Using this framework, managers are better able to evaluate both the risk and the potential benefits of various mitigation opportunities.

The IFRA framework is consistent with the scientific basis for the National Cohesive Wildland Fire Strategy[17] and has now been pilot-tested at several planning scales. The UMC analysis represents one of the first project-level applications. When the USFS Rocky Mountain Region applied this framework to the National Forests within their boundaries, they found that the Pike-San Isabel and Arapaho-Roosevelt National Forests along Colorado's Front Range were among the top five for risk of negative wildfire impacts to people, water and infrastructure. A subsequent analysis of the Pike-San Isabel National Forest and Comanche and Cimarron National Grasslands (PSICC) identified the Pike's Peak Ranger District, within which the UMC landscape resides, as the Forest's second highest District in terms of potential risks from wildfire to the identified HVRAs (Langowski 2012).

Using the IFRA framework, the UMC Collaborative identified and assigned relative importance to the following HVRAs:

- Forest Condition by System (vegetation)
- Water Supply
- Wildland Urban Interface
- Water and Power Infrastructure
- Habitat for Threatened and Endangered Species
- Habitat for Other Important Wildlife and Plant Species

A team of resource experts associated with the UMC Initiative then met to determine the range of both positive and negative effects that various levels of fire behavior could produce for each HVRA. The USFS then took all of these inputs and ran a final IFRA analysis for the UMC landscape, with the outputs summarized by 6th level watershed.[18]

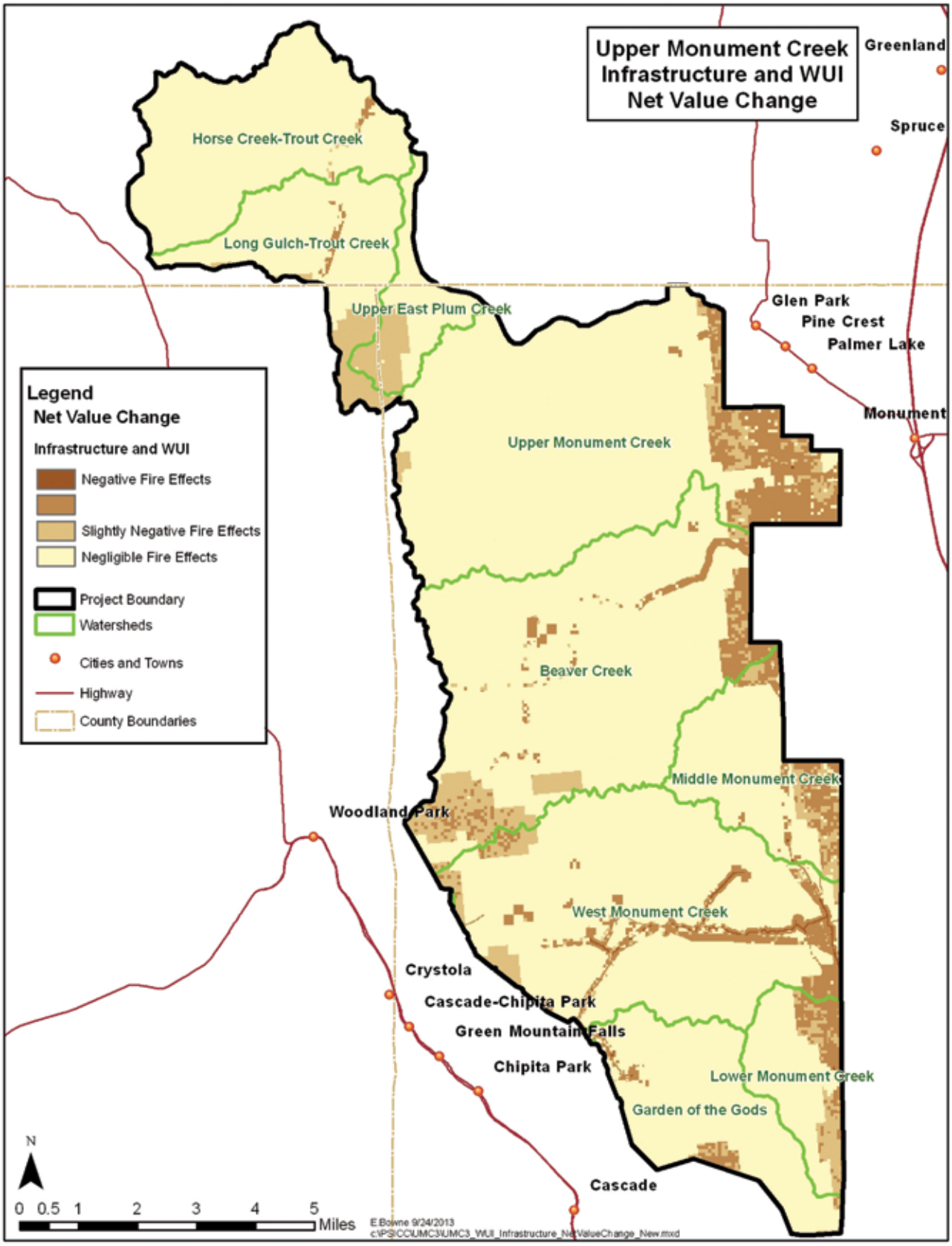
The IFRA framework was developed at the national level to assist federal agencies in better prioritizing and allocating limited fuels reduction dollars.

PHOTO:
Porter's feathergrass Lost Park. © *Steve Olsen USFS*

17. For more information, please see http://www.forestsandrangelands.gov/strategy/.

18. See Appendix C for a summary of the Integrated Fire Risk Assessment as it was applied to the UMC landscape.

MAP 8. UPPER MONUMENT CREEK INFRASTRUCTURE AND WUI



MAP: E. Bowne

The results of the IFRA analysis clearly highlighted the tremendous risk that wildfire poses to people, municipal water supplies and water and power infrastructure on the UMC landscape's eastern boundary. The results also highlighted the potential for significant benefits from fire to important wildlife habitat and overall vegetative structure in some forest systems.

Overall, the Upper Monument Creek, Beaver Creek and West Monument Creek watersheds, located in the center of the project area, showed the greatest potential for negative impacts to HVRAs from fire. Ponderosa pine-Douglas fir woodlands and dry mixed conifer forests showed the greatest potential for positive benefits from fire.

After reviewing the IFRA results, the Collaborative's discussion on how to spatially maximize treatment benefits honed in on the following concepts: 1) tiered implementation of management tools (e.g. mechanical treatment followed by prescribed fire); 2) emphasis on complementary federal and community action to reduce wildfire risks; and 3) attention to increasing the feasibility and use of fire as a management tool. These concepts are further detailed in the bullets above.

The Collaborative recognized from the outset that the IFRA assessment, although spatially relevant, would not be at a scale appropriate to inform fine-scale treatment planning. The Collaborative recommends that the IFRA analysis be paired with additional modeling and analysis tools that can provide more precise guidance on where and how to place individual treatments to achieve maximum beneficial effect.

The results of the IFRA analysis clearly highlighted the tremendous risk that wildfire poses to people, municipal water supplies and water and power infrastructure on the UMC landscape's eastern boundary.

PHOTO:
LEFT Ponderosa pine. © *Mike Babler*
RIGHT Forest treatment in progress © *Mike Babler*

RECOMMENDATION: Carefully Design Treatments, Accounting for Ecology of System and Purpose of Management

SUMMARY

- Clearly define management goals and intent when designing treatments. Both ecological restoration and fuels reduction are included in the Collaborative's recommendations. Sometimes a single management approach can be used for both purposes, but often different approaches are needed. In some cases, one kind of treatment (e.g. fuels reduction) can set the stage for the other (e.g. prescribed fire).

- Base treatment design on the natural variation in ecosystem structure and composition that occurs with topography and landform variation, as well as natural disturbance processes and how they shape ecosystem structure and composition.

- Design treatments to facilitate the restoration of important ecological processes such as fire. Identify areas where prescribed fire and/or managed wildland fire may be used for management and anchor treatments in and around these areas.

- Restore key structural and compositional elements across ecological systems and across the landscape, including:

  Openings – Look for opportunities to enhance existing openings by reducing tree encroachment along opening peripheries. Also look for opportunities to create new openings. Consider the spatial pattern, size, shape and rationale for placement of openings.

  Density – Vary residual density and basal area among and within treatment areas based on environmental and topographic gradients. For example, low-density structures are appropriate along ridges and south-facing slopes and should grade downslope into higher density areas. Avoid uniform densities both within and between treatment areas.

  Spatial structure – Enhance the characteristic "groupy-clumpy" structure of dry forest types such as ponderosa pine and dry mixed-conifer where possible. Group size, number of trees in groups, number of groups per unit area and distances between groups are all important considerations.

  Old trees and old-growth stands – Retain old trees (i.e. trees > 200 years old) of all species and protect and enhance old-growth stands. Remove small-diameter material and ladder fuels in the vicinity of old trees in order to decrease competition and reduce the potential for crown fire. Inventory and map old-growth stands and consider fuels reduction treatments in adjacent stands in order to protect the high ecological value associated with old-growth on the landscape.

Age and size distribution – Remove overrepresented age classes (typically trees 50-120 years old) and size classes (typically smaller diameter trees) to promote more balanced age and size class distributions. Residual age and size class distributions should be multi-modal as opposed to steep/reverse-J distributions.

Species preferences – Preferentially retain ponderosa pine over other conifer species. Douglas-fir should be targeted for removal where it competes with ponderosa pine. Retain and enhance aspen; consider "day-lighting" remnant aspen patches by clearing around them to increase vigor and abundance.

Snags and coarse woody debris – Retain snags and coarse woody debris where possible to provide structural complexity and important wildlife functions. Not every acre has to contain snags and coarse woody debris, but retain these structures where they are locally deficient and where they do not represent hazards or heavy fuel loads.

Wildlife structures – In addition to snags and logs, retain other structures important for wildlife such as turkey roosts and Abert's squirrel nest trees. Leave small pockets of high tree densities and shrub thickets where appropriate to provide wildlife cover. Follow habitat management guidelines for rare species where they occur in the project area.

Understory vegetation – Minimize damage to the understory vegetation layer by using silvicultural approaches that are as low impact as possible. Apply prescribed fire where possible following mechanical treatments to hasten the recovery of understory vegetation and to enhance the response of herbaceous vegetation in particular. Be aware of noxious weeds and take measures to prevent their spread should they become established.

Riparian areas – Implement Best Management Practices as well as Forest Plan standards and guidelines for riparian areas within treatment units to maintain riparian buffers and to protect aquatic environments. Prescribed fire can also be managed to carry over from adjoining forest systems to benefit riparian systems as well.

- While following broad design principles across ecological systems, be aware of important characteristics and distinctions associated with individual ecological systems. For example, dry forest types such as ponderosa pine – Douglas fir and dry mixed-conifer are where low density, "groupy-clumpy" forest structures and large openings are most appropriate, whereas higher density structures should be allowed for more wet forest types such as mesic mixed-conifer forests.

- Employ a range of silvicultural approaches to enhance heterogeneity in residual forest structure. Uneven-aged approaches such as single-tree and group-selection may be appropriate in dry forest types, whereas patch clearcuts that simulate small-scale blow-outs that occur with mixed-severity fire may be appropriate in more mesic forest settings. Regeneration harvests may be applied for creating low-density forest structures and openings.

PHOTOS:
TOP TO BOTTOM
Prescribed fire to rejuvenate grasses *© Jen Chase / Colorado State Forest Service;*
Forest thinning. *© Sue Sitko*

- Consider treatment efficacy and longer-term maintenance requirements. Have a plan for dealing with residual biomass and slash to ensure that the "finishing work" of treatments is completed. Also, anticipate treatment responses such as regeneration. Consider taking steps to discourage regeneration in situations where the likelihood of follow-up treatment is low.

- Acknowledge uncertainty and the need for experimentation, especially in ecological systems for which management information is limited. Monitoring and adaptive management become increasingly important as the level of uncertainty regarding treatment response increases.

DISCUSSION

The UMC Collaborative recognizes the importance of carefully designing treatments based on ecological dynamics and clearly defined management goals. A sub team of the Collaborative formed to have more detailed discussions about treatment design specifications, with the intent of providing guidance about what treatments should look like *on the ground*, as well as describing constraints or sideboards for management by specifying undesirable conditions and actions to avoid.[19]

The sub team considered desired conditions, management goals and output from the LCF and IFRA processes, which helped to determine the restoration need and prioritization. Several members of the sub team are also part of a concurrent effort aimed at developing general principles and implementation guidance for Front Range forest restoration, to be published as a general technical report. This concurrent effort helped to inform the design criteria for the UMC landscape.

The design criteria sub team began by evaluating management goals based on restoration needs highlighted by the LCF process. As noted previously, the LCF process identified a nearly 15,000-acre shortfall of open canopy conditions and a lack of late-seral, old-growth conditions across ecological systems within the UMC landscape. These findings led the Collaborative to set management goals aimed at creating more open forest conditions and enhancing structural heterogeneity and old-growth features.

While the overall focus of the UMC Initiative is landscape restoration, it is important to recognize that not all management goals will be focused solely on restoration. Management approaches that emphasize fuels reduction are also very important for enhancing community safety; these treatments may also contribute to restoration goals by facilitating the reintroduction of fire elsewhere in the landscape.

Where restoration of ecological resilience is the primary management goal, treatment designs should be informed by ecological dynamics and natural patterns of forest structure and composition that result from interactions among environmental gradients and disturbance regimes. Treatments should attempt to mimic patterns of tree mortality that would be created by natural disturbance regimes. Historically, low elevation ponderosa pine and dry mixed-conifer forests were shaped by low- to mixed-severity, frequent fire,

PHOTOS:
TOP TO BOTTOM
Big horn sheep © *Brian Dreher*
Fire scarred stump. © *Mike Babler*

19. See Appendix D for a complete summary of the Design Criteria Sub-Team's analysis and detailed recommendations, which were adopted by the larger UMC collaborative.

which maintained open stand structures with variably spaced individual trees, groups of trees, and openings. Low-severity fires would result in very little overstory mortality, most often at the individual tree to small tree-group scale. This disturbance dynamic allowed for the development of uneven-aged, complex stand structures containing a wide range of age classes, including old-growth.

Variation in stand densities and spatial structure occurred with environmental factors such as moisture, with higher density structures being more likely to develop on wetter, more productive sites. Increases in density and changes in species composition signal the transition from dry forest types to mesic mixed-conifer forests, most often on north-facing slopes and at higher elevations. The fire regime tends to be driven more by climatic conditions in these settings and more prone to extremes. Under mild conditions, mesic mixed-conifer forests may not burn at all whereas during drought they may burn with high severity. This dynamic would tend to create more of an even-aged, patch-structured system as opposed to the uneven-aged, complex matrix characteristic of drier settings. A range of structural stages would have characterized the mesic forest systems across the landscape, representing varying degrees of recovery following stand-replacing fire. Fine-scale disturbances such as insects or root disease may be important here as well in creating gaps for regeneration and enabling the development of uneven-aged stand structures over time.

In the context of management goals and ecological dynamics, the design criteria sub team considered design principles that apply across ecological systems within the UMC landscape. These broad design criteria are summarized in bullet form above and include recommendations such as maintaining old-growth stands. Old-growth conditions provide tremendous ecological value that should be protected and enhanced wherever they occur. Additionally, the team recognized the need for more detailed design criteria for individual ecological systems, with emphasis on the dry forest types since these forest types represent the majority of the acres to be treated. More detailed information for individual ecological systems is provided in Appendix E and is summarized on page 45.

Historically, low elevation ponderosa pine and dry mixed-conifer forests were shaped by low- to mixed-severity, frequent fire, which maintained open stand structures with variably spaced individual trees, groups of trees, and openings.

PHOTOS:
LEFT Inter-tree space in UMC landscape. © *Peter Brown*

RIGHT Material removed through forest thinning. © *Mike Babler*

In ***ponderosa pine – Douglas-fir woodlands***, treatments should focus on reducing stand densities and restoring spatial structure by enhancing tree groups, scattered individual trees and openings. A more open stand condition that supports low-severity fire is the desired condition for this ecological system. Residual basal areas should be highly variable at fine scales based on variation in environment. For example, within a given stand, residual basal area may range from 0 ft^2 per acre in openings up to 80 ft^2 per acre or higher in areas of high productivity. Ponderosa pine should be the dominant species, but Douglas-fir should be present in areas with higher moisture availability and productivity. In all cases, aspen should be retained and enhanced. Retaining old trees, snags and coarse woody debris is important as well. These structures provide wildlife benefit and structural complexity. Not every acre has to be treated. In fact, leaving small, untreated pockets or "skips" is important for providing landscape heterogeneity and wildlife cover.

The treatment approach in ***dry mixed-conifer forests*** is similar to that in ponderosa pine – Douglas-fir woodlands, though higher overall densities and a higher proportion of Douglas fir and other conifers such as limber pine should be present. Greater variability in tree group composition may be present as well. Groups may contain single species or multiple species and may be single-aged or multi-aged. Old trees, snags and coarse woody debris are important structural components here as well.

Treatments in ***mesic mixed-conifer forests*** should reduce densities of older stands to maintain and/or accelerate the development of structural complexity and old-growth features. Focus on removal of small-diameter trees and ladder and surface fuels. Treatments should enhance structural and age-class diversity between stands (e.g. young stands adjacent to older stands) by creating openings in early- and mid-seral stands that mimic blowouts associated with mixed-severity fire. Openings as large as 20 acres are acceptable. Avoid uniform shapes and spacing for openings and place them only in areas considered to have moderate to low risk of wind throw. Decisions on whether or not to treat in mesic mixed-conifer forests should be based on the local context and the presence of values at risk. For example, a high-density patch of mesic mixed-conifer adjacent to an old-growth stand of ponderosa pine may be a candidate for treatment in order to reduce the potential for crown fire and protect the old-growth conditions.

Lodgepole pine forests within the UMC landscape are relatively small in area and appear healthy and somewhat diverse in seral stage distribution. Thus, ecological restoration may not be as high a priority for lodgepole pine forests as it is for other systems within the UMC landscape. The location of the lodgepole pine forests relative to other high priority ecological systems, however, may warrant a fuels-based treatment approach. Fuels reduction would increase the likelihood of being able to use prescribed fire in downslope ponderosa pine – Douglas fir woodlands and dry mixed conifer forests and thus would advance larger landscape restoration goals. Such treatment would also serve to protect late-seral lodgepole pine stands that have been identified as unique within the landscape.

Overall, these treatments should reduce surface and aerial fuel loads, disrupt canopy continuity and increase structural diversity and resilience to fire and mountain pine beetle. Openings should be created to slow the rate of spread and break the direction of an active crown fire and treatments should be implemented at a level that would negate the need for creation of standard fuel breaks (such as clearcut strips or Finney bricks). Treatments should avoid creating homogenous patterns such as evenly spaced openings of the same size and even-spacing of trees. Wind throw is a concern here as well. Treatments should be placed in areas with low risk of wind throw. Thinning between openings in mature lodgepole stands is discouraged due to potential wind throw.

Though less is known about the ecological dynamics of ***Gambel oak – mixed montane shrublands*** compared to other ecological systems, current conditions are fairly uniform and represent a fire hazard to adjacent communities. Treatments in this ecological system should be focused on reducing fuels, increasing structural diversity, and breaking canopy continuity where uniform canopy cover exists. Remnant patches of ponderosa pine should be protected through removal of Gambel oak, other brush and smaller trees that can serve as ladder fuels that channel a fire to the main pine canopy. Pine regeneration should be encouraged by removing Gambel oak in the vicinity of ponderosa pine seed trees. Large, old oak trees should be maintained and managed for variation in oak growth forms, sizes, age-classes and densities. Treatment prescriptions should incorporate wildlife objectives where possible. Priority should be given to treatments along roadsides and private land interfaces, especially where opportunity exists for complementing defensible space activities implemented by surrounding homeowners.

The design criteria sub team recognized that choosing a management approach in some of the ecological systems within the UMC landscape will involve a varying degree of uncertainty. Significantly more scientific literature is available to inform management for ponderosa pine – Douglas-fir woodlands than for other systems, such as Gambel oak – mixed montane shrublands. Ecological monitoring and adaptive management become increasingly important as the level of uncertainty increases regarding treatment outcomes. Monitoring and adaptive management, discussed in more detail in a subsequent section are critical to the UMC Collaborative's recommended restoration approach and should be implemented as a framework for addressing uncertainty and for incorporating knowledge gained into future treatment designs.

PHOTO:
Forest treatment in progress. © *Mike Babler.*

Other Management Concerns

IN addition to the management recommendations detailed in the previous section, the UMC Collaborative identified four other areas of management concern that they wanted to address in their recommendations to the USFS. First, the Collaborative views **coordination with local communities** as essential in prioritizing and implementing wildfire risk reduction treatments on USFS land. In order to maximize effectiveness, wildfire risk reduction measures must be implemented on both federal and adjacent non-federal lands. Without this complementary action, neither treatment will be as effective as it could be in reducing the risks of wildfire to people, infrastructure and the environment. Second, the Collaborative feels it is imperative that the USFS consider the likely impacts of **climate change** on the UMC landscape when developing treatment priorities and prescriptions. Management activities should aim to increase the landscape's ability to adapt and be resilient in the face of large-scale change. Third, the Collaborative recommends that the USFS give particular attention to the **needs of wildlife** as they develop treatment prescriptions. And fourth, the Collaborative asks that the USFS give consideration to the **economic sustainability** of forest-based businesses that will be engaged in implementing treatments on the ground, either through the Front Range Ten Year Stewardship Contract or through other contracts and mechanisms. Additional information on each of these management concerns in provided below.

In order to maximize effectiveness, wildfire risk reduction measures must be implemented on both federal and adjacent non-federal lands.

COMMUNITY WILDFIRE PREPAREDNESS AND PROTECTION

Wildfire does not recognize ownership and jurisdictional boundaries. In order to be effective, wildfire risk reduction measures must cross boundaries as well. The UMC Collaborative envisions a future where communities and fire can more safely co-exist within the UMC landscape. To realize this vision, individuals, communities and public land managers must address community wildfire protection in a coordinated manner that maximizes the potential benefits of mitigation actions.

There are four primary communities located in or near the Upper Monument Creek Project Area: Palmer Lake, Monument, the Air Force Academy and Woodland Park. Each of these communities has taken steps to prepare themselves for fire. Woodland Park is part of an extensive Community Wildfire Protection Plan (CWPP)[20]. Likewise, Palmer Lake has created a CWPP for its community. Monument is an unincorporated township, and therefore is included in the El Paso County CWPP.

Though these CWPPs vary widely in scope and depth, there are some commonalities. All of the CWPPs highlight the risks of wildfire to residential structures as a foremost concern. In addition, all of the communities identify infrastructure and lifelines, such as drinking water and evacuation routes, as areas of critical importance. The most often recommended actions in the applicable CWPPs are: 1) creating defensible space around

PHOTOS:
Homes burning during Front Range wildfire. © *Jay Stalnacker*

20. Community Wildfire Protection Plans (CWPP) are authorized and defined in Title I of the Healthy Forests Restoration Act (HFRA) passed by Congress and signed into law in 2003. As described in the Act, CWPPs bring together diverse local interests to discuss and establish an action plan to address their mutual concerns for public safety, community sustainability and natural resources. For more information see http://www.stateforesters.org/files/cwpphandbook.pdf.

residential structures to the extent possible, and 2) establishing buffer zones around critical infrastructure and evacuation routes. In addition, the communities' CWPPs call for more aggressive fuels treatment on public land to prevent spread of fires from the forest into the residential communities.

Community Wildfire Protection Plans only apply to non-federal land; therefore the Air Force Academy does not have a CWPP. However, the Air Force Academy does have a comprehensive forest management strategy that incorporates both prescribed burning and mechanical fuels reduction to improve wildlife habitat, reduce vegetative fuel loads, and reduce risks to people and infrastructure.

The UMC Collaborative recommends that the USFS work closely with these and other surrounding communities, including the city of Colorado Springs and El Paso and Teller Counties, to solicit input on treatment priorities and to encourage pro-active risk mitigation measures on non-federal lands. Within the UMC landscape, priority should be placed on federal land treatments that are complemented by fuels reduction and other mitigation measures undertaken by communities.

CLIMATE AWARENESS AND ADAPTATION

The UMC Collaborative's Mission Statement highlights the group's emphasis on the need for forests that "are resilient in the face of anticipated climate changes." In light of this goal, the UMC Collaborative believes that restoration efforts within the UMC landscape should consider and plan for the potential effects of climate change. Changes in temperature, precipitation patterns, disturbance regimes, and vegetation distribution are all predicted to accompany changes in climate, and implications and consequences for future forest function need to be considered in forest planning and restoration work.

The UMC Collaborative recommends that the USFS work closely with these and other surrounding communities, including the city of Colorado Springs and El Paso and Teller Counties, to solicit input on treatment priorities and to encourage pro-active risk mitigation measures on non-federal lands

PHOTOS:
LEFT UMC Collaborative in the field. © *Carrie Segil*
RIGHT UMC Collaborative considering management options. © *Carrie Segil*

Climate change projections for Western forests include generally hotter conditions with less snow and snowpack (especially at lower elevations), earlier spring snowmelt, and more extreme climatic events. These conditions will only exacerbate existing forest management challenges such as larger, more intense and more frequent wildfires and insect and disease outbreaks. Other potential climate induced changes include:

- Longer fire seasons; occurrence of "off-season" fire such as fires during winter.
- More land area burned.
- Increased incidence of Sudden Aspen Decline (SAD) particularly at lower elevations and other moisture-limited areas.
- Shifts in species composition toward drought- and fire-tolerant species; loss of drought- and fire-sensitive species.
- Changes in species geographic distributions along elevational and latitudinal gradients; movement of drought-tolerant species such as ponderosa pine upslope; conversion to grasslands or shrublands at low elevations.
- Reductions in forest cover on moisture-limited sites.
- Increased opportunity for invasive species establishment and spread; cheatgrass is of particular concern in the western U.S.
- Increase in stream temperatures; negative effects on cold water fisheries and species.

While scientific consensus regarding general consequences of climate change has largely been reached, uncertainty exists regarding suitable management strategies and what can be done on the ground to increase landscape resilience. Adaptive management provides an appropriate framework for restoration actions taken in the context of climate change by explicitly acknowledging uncertainty and encouraging a "learn as you go" approach.

Adopting management practices that are sound regardless of climate change but that will also likely provide benefit under climate change is a logical first step. Such practices should:

- Enhance heterogeneity across ecological systems and spatial scales to increase options for adaptations under future climate and disturbance regimes.
- Reduce forest densities where possible, especially on drought-prone sites, to reduce competition, site moisture stress, and enhance individual tree health and vigor.
- Favor drought- and fire-tolerant species such as ponderosa pine.
- Enhance aspen populations, particularly at higher elevations.
- Maintain or enhance habitat connectivity to facilitate species migrations; minimize barriers to migration; consider assisted migration strategies where barriers exist.
- Reduce stress caused by other factors to lessen the likelihood of compounded stress or "stress complexes" that may accompany climate change.
- Identify and develop specific plans for rare or specialist species with limited geographic ranges as well as species that may be particularly vulnerable to climate-induced changes in habitat.

While scientific consensus regarding general consequences of climate change has largely been reached, uncertainty exists regarding suitable management strategies and what can be done on the ground to increase landscape resilience.

Adaptive management provides an appropriate framework for restoration actions taken in the context of climate change

PHOTO:
Evening sets on a Front Range wildland fire. © *TNC*

- Protect and enhance riparian cover in order to maintain shade, reduce exposure, and decrease the potential for rising stream temperatures.
- Maintain rigorous ecological monitoring programs; rapid detection of invasive species is particularly important.
- Conduct informational outreach to educate Forest Service staff, stakeholders, and the general public about climate change impacts.
- Promote and reward the development of innovative strategies for addressing climate change impacts; encourage experimentation and research.

It is also important to recognize the role of forested landscapes such as Upper Monument Creek in mitigating greenhouse gas emissions that contribute to climate change. Restoration treatments may enhance the carbon sequestration potential of forests by promoting forest health, vigor, and carbon uptake capacity, and by maintaining carbon stores in large, old trees. Prescribed fire may reduce the potential for uncharacteristically severe wildfire, thereby reducing emission pulses that typically accompany large, high-severity wildfire events. Use of forest materials such as biofuels can also replace fossil fuel use for energy production where opportunity exists.

The UMC Collaborative recommends that the USFS consider and incorporate climate adaptation strategies when developing both their treatment and monitoring plans for the UMC landscape. The adaptive management cycle should specifically identify climate impacts and climate adaptation as items to be regularly assessed and reviewed through a collaborative monitoring process.

HABITAT FOR PLANTS AND WILDLIFE

The UMC landscape provides habitat for a wide variety of animal and plant species, including some that are designated as endangered, threatened or otherwise imperiled. These species contribute significantly to the overall biodiversity, function and value of the UMC landscape and warrant particular consideration during the design and implementation of forest management treatments. The paragraphs below provide information on a small number of species that occur within the UMC landscape and that were identified as a priority by the UMC Collaborative. The Front Range Roundtable's Landscape Restoration Working Group is in the process of developing a wildlife monitoring protocol that will provide more comprehensive guidance for considering wildlife as part of forest restoration treatments in the UMC project area and across the Front Range.

The UMC landscape provides habitat for a wide variety of animal and plant species, including some that are designated as endangered, threatened or otherwise imperiled.

PHOTOS:
LEFT Mule deer © *Scott Copeland*
RIGHT Northern Goshawk © *Bruce Taubert*

Federally Threatened Species

- *Mexican Spotted Owl* – Mexican Spotted Owl (MSO) is federally listed as threatened under the Endangered Species Act (ESA) and is state threatened in Colorado. MSO habitat is generally described as dense, uneven aged, mixed coniferous forest. Nesting areas are described as steep sloped, old-growth mixed coniferous forest or steep-walled, rocky canyons. Occupied MSO habitats are designated as Protected Activity Centers (PAC). The nearest active PAC to the UMC landscape is Red Creek on the boundary of El Paso County and Fremont County. Established PACs also occur on National Forest System land north and northwest of the UMC project area.

  Critical habitat is designated for this species but does not occur in the UMC area. USFS habitat suitability modeling identified potential nesting habitat throughout the northwestern and eastern portions of the UMC project area..

- *Preble's Meadow Jumping Mouse* – Preble's Meadow Jumping Mouse (PMJM) is federally listed as threatened under the ESA and is state threatened in Colorado. PMJM is a riparian specialist; its habitat is generally described as riparian areas and adjacent uplands with a large portion of existing floodplain dominated by willows and cottonwood trees up to 7,600 feet in elevation. Occupied PMJM habitat occurs on the northwestern and eastern portions of the UMC project area.

  Critical habitat is designated for this species and does occur in the UMC project area – specifically, the lower elevation riparian areas and adjacent uplands along Trout Creek and South Beaver Creek. West Monument Creek and North Monument Creek and associated tributaries are considered occupied PMJM but are not designated as critical habitat.

Sensitive, Imperiled or Unique Species

- *Northern Goshawk* – Northern goshawk is considered a Sensitive Species for Region 2 of the USFS. Other conservation organizations rank it as very rare and local throughout it range or found locally in restricted range. Northern goshawks use a variety of different forest structures to complete their life cycle requirements. In the UMC project area, goshawks use mesic mixed-conifer, dry mixed conifer, ponderosa pine, lodgepole and riparian forests, which represent the majority of the project area.

- *Flammulated Owl* – The flammulated owl is considered a Sensitive Species for Region 2 of the USFS. Other conservation organizations rank it as secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Flammulated owl habitat in the UMC project area is represented largely by open canopy cover with large trees in the ponderosa pine and dry mixed conifer forest types.

PHOTOS:
TOP TO BOTTOM
Mexican spotted owl.
© *The Kaufmann Group*
Prebles meadow jumping mouse © *Michael Rieger*

- *Forest Birds* – Williamson's sapsucker, mountain bluebird, golden-crowned kinglet, olive-sided flycatcher and pygmy nuthatch are listed by the USFS as Sensitive Species for Region 2. Other conservation organizations have them listed as species of concern or apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. All species occur within the UMC project area and use a variety of forest habitats, including ponderosa pine, mesic mix conifer, dry mixed conifer and lodgepole pine.

- *Rare Plants* – The broad expanse of grassland in the Air Force Academy's Farish Recreation Area within the UMC landscape provides habitat for several globally rare plants and natural communities. The only known population of Porter's feathergrassc from El Paso County is found in the Recreation Area. Other significant species known from this area include: a dryland sedge and a globally significant montane grassland - Parry's oatgrass grassland.

Game Species

- *Abert's Squirrel* – Abert's squirrel is considered a game species for the state of Colorado and is designated as a Management Indicator Species (MIS) for the Pike-San Isabel National Forest. Abert's squirrel is closely associated with open, pure ponderosa pine and ponderosa pine/ Gambel oak forest on the Front Range of Colorado. A mosaic of big trees in open, groupy clumps of ponderosa pine with some denser stands of younger trees is considered high quality habitat.

- *Rocky Mountain Bighorn Sheep* – Bighorn sheep are a Sensitive Species for Region 2 of the USFS and are considered a management indicator species for several National Forests in Colorado. This species occurs in isolated patches throughout Colorado. Habitat is generally described as steep, rocky terrain with more open vegetation structure. Some managers believe that forest and tree encroachment in these steep, rocky areas has led to overall habitat decline. In the UMC project area, the Rampart Range herd uses a limited amount of the southeastern side of the project area. However, steep rocky terrain occurs along the entire eastern boundary of the project.

- *Mule Deer and Elk* – Mule deer and elk are considered management indicator species for several National Forests in Colorado. These species occur throughout Colorado as well as throughout the UMC project area. Both species are habitat generalists that use a variety of forest, shrubland and grassland habitats. One of the limiting factors of both species is the quality and quantity of winter range. Winter range is generally described as areas in which the animal spends 90% of time during the average five winters out of ten winters. In the UMC project area, winter range occurs along the eastern front of the Rampart Range at lower elevations. Typically winter range is associated with southern and eastern aspects.

PHOTOS:
TOP TO BOTTOM
Porter's Feathergrass.
© Steve Olsen
Abert's squirrel in ponderosa pine.
© Chad Loberger Game & Fish
Big horn sheep
© Brian Dreher

PARTNERING WITH LOCAL FOREST BUSINESSES

The UMC Collaborative recognizes that a vibrant and sustainable local forest industry is essential to accomplishing many of the management goals outlined in this document. A skilled and reliable workforce is needed to implement mechanical and manual harvesting treatments. Processing and utilization facilities are needed to maximize the productive uses for the woody biomass that results from treatments. And markets are needed in order to realize some profit from those materials, thereby reducing the overall treatment costs. By contributing to each of these business sectors, the implementation of forest treatments can in turn produce a wide range of jobs and other economic and social benefits to local communities.

Much of the work in the UMC landscape will be implemented through the existing Front Range Long-Term Stewardship Contract (LTSC). Stewardship contracting allows the USFS to exchange the value of forest products, or goods, for services such as forest restoration, watershed protection and wildlife conservation activities. A smaller number of vegetation management projects within the UMC landscape will likely be implemented by other harvesting contractors, identified through a competitive bid process, particularly when the project is not likely to result in product removal.

The Front Range LTSC was established in 2009 as a tool for accelerating the pace and scale of hazardous fuels reduction and forest restoration on the Pike-San Isabel and Arapaho Roosevelt National Forests. It was awarded to Hotchkiss, CO-based West Range Reclamation, *LLC*. The LTSC assures a ten-year commitment of treatment acres that provides West Range with the stability needed to identify and maximize utilization opportunities for the material removed. This utilization generates additional funds that can further offset treatment costs, resulting in more work accomplished and a stronger forest industry in the region.

A skilled and reliable workforce is needed to implement mechanical and manual harvesting treatments.

PHOTOS:
LEFT Processing small diameter trees from a forest thinning. © *Sue Sitko*
RIGHT Forest thinning project © *Sue Sitko*

The UMC Collaborative recommends that, when possible based on restoration goals, the USFS design and implement treatments in a way that sustains local forest businesses and facilitates effective utilization of woody biomass removed from the landscape. Some specific considerations for the LTSC include:[21]

- Design restoration activities in a manner that results in marketable products.
- Endeavor to maintain a balanced annual program of work, taking into consideration product utilization opportunities as well as product value and marketability.
- Consider the balance of species to be treated each year.
- When feasible, offer increased flexibility on operating parameters for high priority fuels mitigation and restoration projects.
- When treatments are designed and laid out, consider opportunities for utilization of biomass in the forest.

PHOTOS:

LEFT

Two girls rest from their hike. © *Photographer unknown*

RIGHT TOP TO BOTTOM

UMC Collaborative participants © *Paige Lewis;* UMC Collaborative participants. © *Peter Brown*

21. Please see Appendix E for more detailed recommendations on FRLTSC implementation provided by West Range Reclamation, LLC.

Adaptive Management and Monitoring

THE Upper Monument Creek Landscape Restoration Initiative was designed, in part, to launch a collaborative and adaptive management approach that will continue to engage stakeholders in the development, implementation and monitoring of treatments far into the future. Central to this design is the creation of an adaptive management process that includes meaningful implementation and effectiveness monitoring and clear opportunities for stakeholder engagement throughout the management cycle.

The UMC Collaborative believes that an adaptive management framework will enable land managers and interested stakeholders to work together to effectively address areas of uncertainty, take advantage of new science, technology or areas of agreement, and ensure that management treatments continue to move the landscape toward desired conditions.

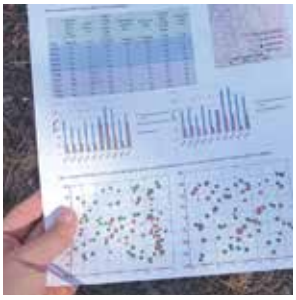
Through adaptive management and monitoring, the Collaborative expects to achieve the following objectives:

- Learning as a group.
- Testing assumptions and reducing uncertainties.
- Informing and cultivating social acceptance for management.
- Ongoing education and outreach.
- Incorporating science as the basis of treatment design and adaptation.
- Continuously improving the design of management approaches to achieve desired conditions.

BACKGROUND

Monitoring and adaptive management in the UMC landscape should be seen as a geographically specific endeavor, but also as an extension of the existing Front Range CFLRP monitoring strategy and the larger-scale adaptive management model currently being developed by the Front Range Roundtable (the Roundtable).[22] In this model, the Roundtable adopts a definition of adaptive management put forth by the National Research Council (2004):

> Adaptive management promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a "trial and error" process, but rather emphasizes learning while doing...Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders.



Adaptive management promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood.

PHOTO:
Analysis of monitoring plot.
© *Carrie Segil*

22. The current draft of this document may be obtained upon request from the Front Range Roundtable

The UMC Collaborative feels that, because there are unverified assumptions and a level of uncertainty in how best to achieve the large-scale restoration goals set out in this document, this active "learning by doing" approach will be particularly important in moving forward with the design and implementation of treatments in the UMC landscape.

The Roundtable's draft adaptive management model also provides helpful information on the roles that different levels of monitoring should play in guiding meaningful adaptive management. *Implementation monitoring* is the most basic level of monitoring and asks primarily whether or not a management action was performed as designed. Implementation monitoring can also play a critical role in informing the need for modification of restoration practices within the scope of the original project plan. *Effectiveness monitoring* asks questions that address longer-term, landscape-scale goals and looks more broadly at whether an action has achieved its intended result. *Adaptive monitoring* is focused on the monitoring plan itself and helps to inform whether or not a change in monitoring protocols and/or approach is needed.

In recent years, there has been increasing interest from both land managers and stakeholders in taking an "adaptive" approach to the development and analysis of management alternatives as outlined in the National Environmental Policy Act (NEPA), particularly for large-scale restoration projects.[23] While there are a number of ways to design this adaptive approach, sometimes referred to as a "rolling alternative," the basic concept is to develop an environmental analysis and decision-document that acknowledge uncertainty, identify and analyze a reasonable range of alternative management scenarios, and set up a monitoring and adaptive management process that enables land managers to adjust their management approach if monitoring shows it to be ineffective or leading to undesired outcomes. Should any outcome trigger a change based on monitoring, the Forest Service could change prescriptions – but the proposed action as a whole would be the same.

23. See https://www.fedcenter.gov/programs/nepa/ for a Council on Environmental Quality (CEQ) memo on Procedures for Implementing Adaptive NEPA Practices.

Effectiveness monitoring asks questions that address longer-term, landscape-scale goals and looks more broadly at whether an action has achieved its intended result.

PHOTOS:
LEFT Monitoring team in the field.
© Rob Addington
RIGHT Counting tree rings.
© Carrie Segil

Under this scenario, the decision-document would also identify triggers for when the needed change exceeds the scope of the current decision and indicates the need for a new plan and analysis under NEPA. The Roundtable's approved adaptive management model provides useful guidance about how the adaptive NEPA approach could be applied under their recommended monitoring and management framework.

RECOMMENDATIONS

The UMC Collaborative recommends the USFS take an adaptive NEPA approach when developing and analyzing alternatives for the UMC landscape. In doing so, the agency should analyze the possible effects of all management scenarios that could be implemented under the project plan and indicate, when possible, what would trigger a management change within the plan as well as what would trigger the need for an entirely new plan and NEPA analysis. The Collaborative further recommends that implementation and effectiveness monitoring be inextricably tied to project implementation such that further treatments under the NEPA document cannot move forward without monitoring and evaluation of previous treatments through a multi-stakeholder process. It is through this process that the need for a management change should be determined.

The Collaborative has identified a number of recommendations (described below) that they would like the USFS to consider as the agency moves through the project development, analysis and public engagement processes. The Collaborative expects to continue working with the USFS, through appropriate avenues, as the questions of monitoring and adaptive management are addressed.

Adaptive Management and NEPA

- Use the NEPA process to identify and analyze the full range of treatment options that might be considered for use in the UMC landscape so that the resulting decision document will provide the flexibility needed for adaptive management based on monitoring results as well as new science, information and technology and/ or new levels of collaborative agreement.
- In order to maximize social acceptance for treatment, the Collaborative recommends that the USFS analyze the maximum level of treatment that might occur but take a conservative approach to initial on-the-ground implementation, using monitoring and collaboration to guide changes in management.
- The Collaborative recommends that, where possible, the USFS work with the public and subject matter specialists to identify management outcomes that would indicate the need to alter a treatment approach within the scope of the final decision document. These outcome-based "trigger points" will likely include undesirable short-term outcomes such as an unexpected increase in invasive weeds post treatment. The appearance of this condition would indicate, or "trigger," the need to consider an alternate management approach. Trigger points might also be tied to longer-term desired outcomes such as reduced susceptibility to unnatural crown fire. Post-treatment modeling could be used to determine whether the implemented treatment was actually enough to alter expected fire behavior at the desired scale. Trigger points should also be developed to indicate when an entirely new analysis and decision document are needed.

The UMC Collaborative recommends that the USFS take an adaptive NEPA approach when developing and analyzing alternatives for the UMC landscape.

PHOTO:
Lodgepole pine forest.
© *Mike Babler*

- The identification of trigger points will provide transparency regarding the conditions under which a treatment approach might be determined undesirable, ineffective or otherwise in need of change. Trigger points should be tied to results revealed through monitoring, and changes should not occur without monitoring. The Collaborative recognizes that not all reasons for change can be anticipated and does not expect that these initial trigger points will provide for all possible scenarios.
- The adaptive NEPA document should capture the benefits in terms of time and cost savings that can be achieved by taking an adaptive management approach.

Monitoring

- The UMC Collaborative believes that the success of the recommended adaptive management approach hinges on the design, implementation and funding of a robust monitoring program. Without a meaningful and transparent monitoring program, neither land managers nor stakeholders will have the information and the confidence needed to support management changes.
- Monitoring must be integral to the adaptive management process established in the project's final decision document. Meaningful monitoring must not be optional.
- Both implementation and effectiveness monitoring must be included in the final plan and should be assessed at both the treatment and landscape scales.
- The Front Range CFLRP monitoring plan and protocol, and any collaboratively developed addendums, should serve as a foundation for monitoring in the UMC landscape. Additional monitoring elements should be identified to help address specific areas of management uncertainty.
- Monitoring should be robust but realistic. Monitoring protocol should be directly tied to questions that will reveal whether or not treatments are moving the landscape toward desired conditions.
- The Collaborative and other stakeholders should be engaged in both implementation and effectiveness monitoring to the greatest extent possible. Monitoring should not be a function of the USFS alone.
- Monitoring data should be collected, analyzed and made available to stakeholders on a regular schedule that allows for effective input into all phases of the management process.
- The Collaborative strongly encourages the use of aerial/satellite photography, remote sensing, modeling and other technologies that facilitate effectiveness monitoring of both risk reduction and forest restoration goals at the landscape-scale.
    - Particular attention should be paid to tracking whether or not treatments are being designed and implemented at a scale that results in desired changes in fire behavior.
    - Periodic analysis of the landscape's ecological departure should also be considered as a way of tracking whether or not treatments are producing the desired changes in canopy closure and age distribution in ecosystems across the landscape.
    - Ongoing refinement and use of computer models should be considered to re-simulate future outcomes as management treatments and landscape conditions change over time.
- Areas of uncertainty that cannot adequately be addressed through monitoring should be captured and used to inform a complementary research agenda.

The UMC Collaborative believes that the success of the recommended adaptive management approach hinges on the design, implementation and funding of a robust monitoring program.

PHOTO:
Field monitoring.
© Rob Addington

Undesirable Conditions

- Monitoring should be closely tied to explicitly defined "undesirable conditions." The emergence and/or acceleration of these conditions should be considered an indication that management is not functioning as expected.
- The Collaborative developed the following preliminary list of undesirable conditions for consideration as planning for the UMC landscape goes forward:
  - Noxious weeds – Introduction of new noxious weeds and/or the spread of existing weed species into new areas.
  - Impacts to water quality and quantity – Degraded water quality as a result of management; degraded stream channels; and/or non-functioning riparian habitat.
  - Excessive soil loss and / or decline in soil quality.
  - Unexpected decline or negative impacts to wildlife – Includes loss or decline of wildlife character trees.
  - Unexpected decline or negative impacts to threatened and endangered species habitat and/or sensitive plants.
  - Lack of expected understory regeneration.
  - Treatments that are inadequate to influence or modify desired/characteristic fire behavior.
  - Treatments that result in undesirable/uncharacteristic fire behavior.
  - Treatments that result in undesirable species conversion and/or unexpected species regeneration.
  - Deterioration of aesthetic quality.
  - Unwanted increase in unmanaged recreation.

Ongoing Collaboration:

- The UMC Collaborative envisions the UMC Initiative as an ongoing opportunity for a wide variety of stakeholders to actively engage in the development, implementation and monitoring of forest restoration treatments.
- The Collaborative requests that the USFS continue to engage Initiative participants in deliberations regarding the UMC landscape, but recommends that the USFS also reach out to members of the Front Range Roundtable and other organizations and individuals that represent a broader range of interests. Stakeholder engagement in the UMC landscape should be open to all those interested in participating.
- In order to facilitate effective stakeholder input, the USFS should establish a regular schedule for collaborative engagement in the design, implementation, monitoring and evaluation of management treatments. This schedule should ensure that meaningful opportunities for input into the decision-making process are provided.
  - The UMC Collaborative recommends that stakeholders gather for at least two in-person meetings per year: One in the winter to discuss monitoring data and future treatment plans and one in the summer to visit and assess treatment sites in the field.
  - Additional regular information updates regarding management progress will help to keep stakeholders up to date in between meetings.
- Multi-party monitoring should also be considered as a vehicle for collaboration, including programs that engage local students and other citizens in monitoring.

PHOTOS:
TOP TO BOTTOM
Musk thistle © *Edward Orth;*
Protecting areas for rehabilitation.
© *Audrey Wolk*

Conclusion

THE recommendations outlined in this report represent a science-based, broadly supported and economically feasible strategy for moving the UMC landscape toward a more resilient and sustainable future. By strategically applying the recommended forest treatments, the USFS can reduce wildfire risks to people, water and wildlife while also restoring a more natural range of ecological conditions across the landscape. If these efforts are coordinated with complimentary actions on adjacent private and other non-federal lands, the scale of both the treatments and the benefits could be significantly increased. Both recent experience and predictive models suggest that without this action, the UMC landscape will become increasingly vulnerable to unnaturally large, damaging and costly wildfires – a reality that is even more difficult to accept when a reasonable alternative is available.

Of equal importance are the UMC Collaborative's recommendations regarding adaptive management and ongoing collaborative engagement in implementation and monitoring. The Collaborative recognizes that there is a level of uncertainty inherent in the goal of restoring resilience to a diverse and multi-faceted forest landscape. An adaptive approach will give the USFS the flexibility they need to address this uncertainty and adjust treatment strategies over time so that the resulting management is as effective as possible. Robust monitoring and meaningful collaborative engagement will provide the USFS will the ground-based evidence and stakeholder support they need to make this adaptive approach succeed.

The UMC Landscape Restoration Initiative is an ambitious and hopeful endeavor. It reflects the Collaborative's belief that it is possible to change the trajectory of our high-risk forest landscapes – resulting in a brighter future for both people and nature. The development of these recommendations is a first step in that direction.

By strategically applying the recommended forest treatments, the USFS can reduce wildfire risks to people, water and wildlife while also restoring a more natural range of ecological conditions across the landscape.

PHOTOS:
LEFT UMC wet mixed conifer forest. © *Mike Babler*
RIGT Young hikers enjoy a forest trail. © *Chris Helzer*

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Appendices

A: Landscape Conservation Forecasting Report

B: UMC Feasibility Analysis

C: Fire Risk Analysis Report

D: Design Criteria Report / Appendices

E: Recommendations from West Range Reclamation, LLC