Final Report, Joint Fire Sciences Program Project No. 01-1-3-22

Title: Optimizing landscape treatments for reducing wildfire risk and improving ecological sustainability of ponderosa pine forests with mixed severity fire regimes

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This report for JFSP Project 01-1-3-22 addresses the broader accomplishments that resulted from JFSP funding in support of research on landscape-scale treatments to reduce wildland fire risk and improve ecological conditions in the Colorado Front Range. The grant funds provided enormously valuable support for examining critical forest and fuel management issues in Front Range ponderosa pine/Douglas-fir forests. The accomplishments affected by this grant go well beyond the original intent of the project, partly the result of the 2002 Hayman fire in the project area and the dramatic increase in interest in forest and fuel management issues in the broader Front Range area that followed the Hayman fire.

An expedient way to characterize the original intent is to reproduce here the project abstract (first two paragraphs below), and a paragraph from the introductory section of the project narrative highlighting the overall objective. Project accomplishments are reported in the section below.

Project Abstract: "A mixed severity fire regime historically created complex landscape structures in ponderosa pine forests of the Colorado Front Range. Mitigating present wildfire risks and restoring these forests to ecologically sustainable conditions requires new guidelines for landscape treatment, because earlier guidelines developed for less complex forests with a historical low intensity surface fire regime are inappropriate. However, vast acreages need treatment while only limited resources are available. A landscape strategy is needed to provide the greatest ecological benefit and protection from severe wildfire over the largest area at the least cost.

"This proposal most closely aligns with Task 3 in the Joint Fire Science Program RFP, 2001-1. The proposal addresses a suite of values at risk in the landscape (forests at risk of high severity fire, erosion, habitat for species of concern, structures), and factors affecting forest treatment options (treatment effects on wildfire behavior, treatment cost, roads and access). A dual modeling approach will be used to identify and evaluate treatment strategies at the scale of 100,000-acre watersheds. Modeling will focus on simulating vegetation changes spatially in the presence and interaction of insects, disease, and wildland fire, and on optimal scheduling of treatments that effectively meet resource and management objectives. Models will compute trade-offs associated with those treatment choices and schedules. Spatially explicit treatment areas identified by these analyses will be used for fire behavior modeling to identify treatment combinations and spatial distribution that provide the greatest reduction in wildfire risk. This research will use historical characteristics of a landscape shaped by a historical mixed severity fire regime, obtained from research on an unlogged ponderosa pine/Douglas-fir landscape in the South Platte watershed southwest of Denver, CO."

From the introductory section on project justification and objectives: "Resources for treating large acreages are limited. Our premise in this proposal is that because only a fraction of the landscape will be treated in the near term, methods are needed to determine how to leverage treatments to maximize treatment benefits for the values at risk. Two contrasting but potentially complementary modeling approaches may be useful for identifying where treatments should be applied and what should be done to most effectively reduce the wildfire problem and produce the desired benefits. **The objective of this project is to evaluate and integrate spatially explicit modeling approaches for identifying forest treatments, their location in the landscape, and their effectiveness and efficiency for protecting the landscape from large-scale crown fires and restoring ecological sustainability.** This objective takes advantage of the fact that any treatments leading to reduced fire risk are also likely to be consistent with improved ecological condition in the landscape."

Project Accomplishments
        (Relevant website links provided in publication section)
Original project scope in the Upper South Platte watershed. Project research activities included modifying and parameterizing SIMPPLLE, a simulation model for projecting vegetation spatially in the presence and interaction of insects, disease, and wildland fire, for ponderosa pine/Douglas-fir forests in the Colorado Front Range. Research also resulted in parameterization of MAGIS, an optimization model for spatially scheduling treatments that effectively meet resource and management objectives and compute trade-offs associated with those treatment schedules, taking into account local treatment costs and revenue streams. These models were used for a 90,000-acre project area adjacent to the Hayman fire, but at a different location than originally proposed because of Hayman fire damage. A thesis written by Edward Butler (Missoula Forest Sciences Lab), entitled "Modeling Forest Planning Trade-offs on the Colorado Front Range, using MAGIS, an Optimization, Spatial Decision Support Tool," presents many of these findings. In addition, FARSITE modeling was conducted to characterize the effectiveness of partially treating a landscape to reduce the spread rate of crown fires. A workshop held for managers and researchers (more than 50 in attendance) was held in October, 2005, presenting findings of these modeling efforts.

The broader Front Range area. The 2002 Hayman fire changed everyone's scope of interest and level of concern. Shortly after the fire, the Front Range Fuels Treatment Partnership was formed to address fuel management and forest restoration needs in the whole Colorado Front Range area. Kaufmann, the PI for this JFSP project, was on the steering group for this partnership (and remains active in his Emeritus status). Intense partnership activity continues, with a major focus on ramping up fuel treatment activities to protect human and natural resource values at risk. Less than two years into this flurry of activity, a new effort emerged – the Front Range Roundtable.

The Front Range Roundtable is an on-going effort begun in early 2004, addressing the broad questions of treatment needs for community protection and forest restoration in a 10-county area, nine of which include the critical ponderosa pine/Douglas-fir zone. The counties extend from the Pikes Peak region at the south end of the Front Range north to the Colorado-Wyoming state line. They have experienced a series of large fires, most of which threatened extensive wildland/urban interface areas. The nine counties, an area of nearly 7 million acres, include El

Paso, Teller, Park, Douglas, Jefferson, Clear Creek, Gilpin, Boulder, and Larimer. Grand County was included in some of the Roundtable discussions because of its role in supplying water from the western side of the Front Range to eastern Colorado.

The first phase of this roundtable process lasted about two years and involved roughly 10,000 hours of effort by many individuals contributing to roundtable and breakout workgroup activities. In a parallel supporting effort, several researchers (Kaufmann, Veblen, and Romme) convened to address specific points of agreement on fire ecology of ponderosa pine and related forests in the Front Range. This effort further solidified the scientific underpinnings for Roundtable activities. The initial Roundtable phase examined ecological conditions and restoration needs, community protection needs, and economics for treatments to address the ecological and community protection issues. The Roundtable developed an overall strategy and ten specific initiatives to achieve Roundtable recommendations. Roundtable findings were made public at a large gathering (~300 attendees) in May, 2006, which included opening remarks by the Governor of Colorado. Kaufmann (PI for this project) was one of two presenters of the Roundtable findings. A second phase of the Roundtable is addressing the implementation of Phase 1 recommendations.

Many of the ecological and forest treatment issues addressed by the JFSP project being summarized in this report were considered in lengthy discussions that were part of the Roundtable process. With extensive research insight developed from project and related studies, the ecology workgroup of the Roundtable was able to determine that the highest restoration and fuel treatment priority in the Colorado Front Range was the lower montane life zone, dominated by ponderosa pine/Douglas-fir forests. The ecology of these forests was based largely on JFSP project and related research done in the Upper South Platte watershed. The ecology workgroup identified specific acreages in this life zone warranting treatment to restore sustainable ecological conditions (nearly 800,000 acres). The workgroup also identified about 1,100,000 acres needing fuel treatment to protect communities. Of these two acreage estimates, about 400,000 acres overlapped, having both restoration and community protection needs. Overall treatment needs for the entire Front Range amount to 1.5 million acres.

Roundtable activities are continuing on two fronts. First, more specific details of treatment needs are being examined. One topic of discussion is the use of local wind patterns estimated with analytic tools such as computational fluid dynamics. These analytic efforts are being undertaken to refine community wildfire protection zones, to replace circular buffer zones around communities with more refined treatment zones reflecting local vegetation, topography, and fire spread patterns anticipated during strong, wind-driven fire events. Second, a statewide roundtable is being planned, following approaches found useful in the Front Range Roundtable effort.

The continuing saga of JFSP Project No. 01-1-3-22: It is clear that the long-term impacts of research embodied in this project are still unfolding. The primary thesis of this project was to find optimal ways to address fuel management and restoration needs. The JFSP project provided vital funding and scientific footing to help get the ecology right while protecting human values at risk. The model of using scientific knowledge to guide managers and decision-makers is highly regarded and well-received in the Colorado Front Range (and elsewhere of course), and it is

anticipated that this approach can be successfully extended to Colorado forests more broadly. Science is important, and collaboration is crucial to its use. The roundtable approach holds great promise as an outstanding way to utilize science. Watch for future results from the Front Range Roundtable and the new statewide roundtable, and from a Colorado Forest Restoration Workshop on the role of collaborative processes in achieving science-based ecological restoration and community protection results (planned for February 2007).

Deliverables

Proposed	Delivered	Status
Parameterize SIMPPLLE for Colorado Front Range	Model parameterized by Jimmie Chew and lab	Completed
Parameterize MAGIS for Colorado Front Range	Model parameterized by Edward Butler/Greg Jones	Completed, with MS thesis, additional articles pending
Publication series	See attached Publication List and Website Links	Completed, though related publications and documents will continue to be developed and published
Presentations	Literally dozens of presentations on research findings and implementation	Continuing as needed

Publications and Links

Fornwalt, P. J., M. R. Kaufmann, L. S. Huckaby and J. M. Stoker. 2002. Using the Forest Vegetation Simulator to reconstruct historical stand conditions in the Colorado Front Range. In N. L. Crookston and R. N. Havis, eds. Second Forest Vegetation Simulator Conference, Fort Collins, CO, USDA Forest Service, Rocky Mountain Research Station. Proceedings RMRS-P-25, pp. 108-115.

Fornwalt, P. J., M. R. Kaufmann, L. S. Huckaby, J. M. Stoker and T. J. Stohlgren. 2003. Non-native plant invasions in managed and protected ponderosa pine/ Douglas-fir forests of the Colorado Front Range. Forest Ecology and Management 177: 515-527.

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Huckaby, L. S., M. R. Kaufmann, P. J. Fornwalt, J. M. Stoker and C. Dennis. 2003. Identification and ecology of old ponderosa pine trees in the Colorado Front Range. Fort Collins, CO, US Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-110. 47 p.

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of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-109. 43 p.

Kaufmann, M**,** A. Shlisky, and B. Kent. 2003. Integrating scientific knowledge into social and economic decisions for ecologically sound fire and restoration management. Proc. 3rd International Wildland Fire Conference, Sydney, Australia, October 2003. http://www.fs.fed.us/rm/analytics/staff/pubs/Sydney%20PDF%20Kaufmann%20Shlisky%20Kent.pdf.

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Hall, S. A., I. C. Burke, D. O. Box, M. R. Kaufmann, and J. M. Stoker. 2005. Estimating stand structure using discrete-return Lidar: an example from low density, fire prone ponderosa pine forest systems. Forest Ecol. and Management 208: 189-209.

Lewis, P., M. R. Kaufmann, D. Leatherman, and L. S. Huckaby. 2005. Report on the Health of Colorado's Forests 2004 -- Special Issue on Ponderosa Pine Forests. Colorado State Forest Service, Colorado State University. 36 pp. http://www.fs.fed.us/rm/analytics/staff/pubs/2004_Forest_Health_Report.pdf

Kaufmann, M. R., A. Shlisky, and P. Marchand. 2005. Good fire, bad fire: how to think about forest land management and ecological processes. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p. http://www.fs.fed.us/rm/analytics/staff/pubs/Good_Fire_Bad_Fire.pdf

Butler, E. B. Jr. 2005. Modeling Forest Planning Trade-offs on the Colorado Front Range, using MAGIS, an Optimization, Spatial Decision Support Tool. M.S. Thesis, University of Montana. 132 p.

Front Range Fuels Treatment Partnership. 2005. 2004 Annual Report. http://frftp.org/docs/about_frftp/frftp04anrpt.pdf

Front Range Fuels Treatment Partnership. 2006. 2005 Annual Report. http://frftp.org/docs/about_frftp/frftp05anrpt.pdf

Kaufmann, M. R., T. T. Veblen, and W. H. Romme. 2006. Historical fire regimes in ponderosa pine forests of the Colorado Front Range, and recommendations for ecological restoration and fuels management. Front Range Fuels Treatment Partnership Roundtable, findings of the Ecology Workgroup. www.frftp.org/roundtable/pipo.pdf.

Front Range Roundtable. 2006. Living with fire: protecting communities and restoring forests, findings and recommendations of the Front Range Fuels Treatment Partnership Roundtable. Printed by Colorado State Forest Service. http://frftp.org/roundtable/report.pdf