Strategic Placement of Treatments (SPOTS): Maximizing the Effectiveness of Fuel and Vegetation Treatments on Problem Fire Behavior and Effects

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Abstract:

In 2005, eight US Forest Service and Bureau of Land Management interdisciplinary teams participated in a test of strategic placement of treatments (SPOTS) techniques to maximize the effectiveness of fuel treatments in reducing problem fire behavior, adverse fire effects, and suppression costs. This interagency approach to standardizing the assessment of risks and proposing strategically placed treatments to mitigate that risk uses an iterative, collaborative strategic approach to proposing landscape scale treatment patterns. The pilot teams used FARSITE and FlamMap, spatially explicit fire behavior prediction models, to evaluate the effectiveness of proposed treatments on fire behavior and effects at scales appropriate to address the expected problem fire event. A primary objective was to develop a consistent, systematic approach that integrates multiple land and resource management objectives when addressing and evaluating fuels risks. This paper discusses the accomplishments and challenges the pilot project teams faced as they tested strategic placement of treatments methods in different landscapes, vegetation, fire regimes, and ownerships.

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Introduction:

In 2005, the USFS in partnership with the Bureau of Land Management (BLM) tested the strategic placement of treatments concept using sophisticated spatial analysis tools in eight pilot areas across the country. This process is not just designed for fire and fuels planning, but as a holistic land management process. While problem fire is the filter through which potential treatment patterns are tested, the objectives for many of the treatments planned are related to timber management, silviculture, forest health, wildlife, and watershed issues, as well as protection of assets from unwanted wildland fire. The national objectives for the SPOTS pilots were to develop a consistent, interagency, systematic approach to evaluating and mitigating risks, test a variety of data sets, models and tools, and to identify barriers or restrictions to meaningful progress.

The SPOTS concept contributes to overall understanding of spatial dynamics of fuel and related fire behavior through use of a collaborative planning process and fire modeling tools that describe fire potential on a specific landscape. The placement of fuels treatments has shown promise in reducing the undesired effects of large fires and acres burned and in the modeling environment. (Finney 2005. Bahro 2006 in press. Stratton 2004). The Fireshed team in California has successfully implemented this concept since 2003. The California Fireshed team conducts integrated workshops to develop long-term strategic objectives and proposed treatment patterns as the basis for program of work planning required for United States Forest Service (USFS) compliance with the National Environmental Policy Act (NEPA).

The SPOTS process broadens fuels projects planning opportunities. Since fires do not stop at ownership boundaries, neither should our planning process. Planning should happen not only at the project level, but also the interagency broad scale fire planning level, where budgets are allocated. Integrating other resources upfront with fireshed-scale planning happening ahead of the NEPA process' "purpose and need" phase would reduce pressures on land managers and allow for a balanced, clear process.

These strategically placed fuels treatments are not intended to exclude fire from the landscape, but to change the character and ultimate effects of an unplanned fire. Treatments on a fraction of the landscape may or may not be sufficient to restore ecosystems, but may effectively disrupt or reduce large wildfire growth as well as being a step right direction toward the long-term goal of restoration of desired conditions at the large scale. Restoration is rarely fully realized in the first entry and may be achieved through multiple entries over many years. The initial strategic entry, if successful can reduce the probability of a large, uncharacteristically severe fire, and can serve to buy more time for mangers to continue working toward the long-term restoration goal.

Methods

A steering committee with members from USFS management and research and the Department of Interior was established to guide the pilot efforts, evaluate the proposals and participate in selection, interact with ongoing pilots, and ultimately develop a performance measure for 2006/2007. Eight pilot teams were selected. The projects represent a range of geographic areas, vegetative types, potential fire problems, data sources, and ownership mixes (Figure 1, Table 1).

The SPOTS pilot teams were required to attend training with the California Fireshed team and report on their lessons learned and current status. Each team was asked to define their specific problem fire scenario in an analysis area larger than the expected problem fire, prepare their data for integrated spatial analysis, and hold a workshop in which they designed potential treatment patterns in an iterative manner. The workshop was expected to feature testing the treatment scenarios with FARSITE or FlamMap fire behavior and spread models (Finney 1998; Finney et al 2004) and other spatial analysis tools to test effects on other resource objectives. An expected outcome of the workshops was a transparent spatial, tabular, or graphic display of the trade-offs made in the proposed action.

Results

Pilot project teams reported the results of their efforts in October of 2005 (Table 2). All eight teams were able to describe the problem fire scenario, including probable weather, fire behavior, and undesired effects. Seven out of eight project teams calibrated the FARSITE landscape by validating outputs against known fire behavior or a recorded fire event. Seven of eight teams identified an analysis area of appropriate size, sufficiently large to contain the expected fire event. Five of the eight pilot projects completed some sort of collaborative workshop or public meeting. Of the five teams that had a workshop, only two teams used FARSITE in an iterative way at the workshop so the participants could test various treatment patterns. Two additional teams used FARSITE outside of the workshop environment, modeling and displaying results from ideas provided by workshop attendees at a later date. One team simply used FARSITE to test their existing program against the no action alternative, but chose not to evaluate alternative treatment patterns. Five teams created an estimate of how proposed treatments changed the fire size or behavior using screenshots, graphs, or tables. A single team shared maps of different ultimate fire sizes in different treatment scenarios.

Pilot teams used several models, but did not even begin to explore the dozens of tools available. FARSITE and FlamMap fire behavior and spread models were the common tools used to evaluate treatment patterns. Though FARSITE has been taught for a decade, it has been used primarily for incident support and has yet to be embraced by the planning community. The projects universally recognized the utility of the FARSITE model for fuels planning purposes. These fire modeling programs should become the centerpiece of a suite of interconnecting software programs that are designed to evaluate treatment patterns.

Four overall national objectives were identified at the start of the 2005 Pilot Projects. The following is a summation of results concerning those national objectives:

1. **Develop a consistent, systematic approach for evaluating and addressing landscape-level risks in an integrated and collaborative way.**

This objective was fully met. The seven-step framework outlined in the discussion section of this paper was developed as a direct result of lessons learned from the national SPOTS pilots.

2. **Test a variety of available data sets, models, and tools in partnership with researchers to determine applicability of some of the many tools available.**

A total of eleven tools and data sets were tested by the various pilot projects. Two teams tested prototype LANDFIRE data.

3. **Identify barriers or restrictions to implementing the selected pattern, intensity or timing of fuel treatments that may be imposed by existing Land and Resource Management Plans.**

The most common barriers reported by the pilot project teams were:

- Analyst skills are universally in short supply.
- The complexity and effort required to generate data layers was extraordinary.

4. **Devise an appropriate measure of success to describe accomplishments developed and implemented using the *landscape-scale effectiveness* approach.**

A performance measure will not be built for SPOTS at this time. The Forest Service will collect data in the next two years on the use of the seven step framework and begin to document cases where strategic treatment patterns are tested by wildland fire.

Discussion

At the October 2005 SPOTS pilot project meeting, teams identified barriers and successes concerning their efforts. Key themes in this discussion included the time and labor-intensive nature of planning and data preparation and calibration, the lack of skilled personnel to complete the preparation and analysis, and the overall success of the process as a communication tool. Where pilots failed to move forward in the process, lack of line officer support was most often the cause.

The collaborative workshop is perhaps the most critical step in the process, because the participants can actively test their ideas about treatments, and see the results almost immediately. This is the step that allows for transparency regarding the trade-offs for the decision maker. The best possible fire solution may not be desired because of impacts to wildlife, watersheds, or scenic quality objectives. The best solution for timber management may not meet the fire objectives. The workshop displays the outcomes of those choices on expected fire behavior as well as the implications for other resources.

The most successful workshops used fire behavior models to inform and support the process. Models increased understanding of fuels and fire spread on the landscape, helping to define the problem and align participants towards a common goal. Fire models run on properly calibrated landscapes were very successful in demonstrating how well treatments worked to interrupt theoretical large fire spread on the landscape. Seven out of eight project teams calibrated the FARSITE landscape by validating outputs against known fire behavior or a recorded fire event. Model calibration gives confidence in model output and contributes to overall participant support. The models were most useful where live modeling was available within the workshop and multiple treatment scenarios could be compared in an iterative manner.

The pilot teams acknowledged the need to identify problem fire behavior within the context of the workshop. This aim establishes modeling parameters, facilitates the discussion of treatment intensities, and helps to create “buy in” regarding the final outputs. Many of the pilot areas identified multiple fires of concern. Developing a shared understanding of the problem fire can be challenging. The members must understand that the task is not to describe everything that could happen under a variety of different conditions, but to discuss the worst case scenario with as defined by the known local fire history or recorded weather conditions.

A change in the planning culture emphasizing partnership and shared decision-making was recognized as a key success by all of the pilot project teams. Communities and collaborators appreciated inclusion in the process, increasing perceived “buy-in” to decisions and decreasing the perceived likelihood of litigation. Internal cooperation was also a success in many areas, when multiple resource disciplines were able to use the tools and collaborative process to understand overall fire risk and achieve hazardous fuels project planning and multiple resource benefits.

Multiple barriers to the process were identified including: perceived conflicts between fuels treatments and the protection of threatened and endangered species habitat, smoke issues, limited budgets for project implementation, and the tendency for large chunks of these budgets to be spent in the planning process. Traditionally, fuels treatments may be constrained by cost-per-acre, with acres accomplished taking precedence over higher dollar wildland urban interface or remote area treatments. Litigation or the potential for litigation was also perceived as a planning constraint.

Conclusion

A framework was developed, based on the experiences of the eight SPOTS pilot project teams, giving general guidelines to follow when attempting to implement fireshed-level fuels treatment planning on individual landscapes. While strategic approaches will vary throughout the country to account for different fuels, topography, weather, and social factors, all spatial modeling approaches targeting undesired fire behavior should feature:

1. Explicitly defining an analysis area
2. Identifying assets and protection targets
3. Defining the “problem fire”
4. Designing treatment patterns
5. Testing multiple treatment patterns with a spatial fire behavior model
6. Clearly displaying the trade-offs
7. Monitoring and adaptive management

This framework is discussed in depth at www.nifc.gov/spots . The framework meets the need, described by the United States General Accounting Office (2000, 2003, 2004, 2005), to establish a consistent way to define risk and test potential solutions. The framework can be used collaboratively across agency boundaries and would be useful even lacking complex modeling software or data. Critical innovations provided by this framework are tying the size of the analysis area directly to the ‘problem fire’, the development of a treatment pattern specifically designed to impede fire spread and severity, and the iterative testing that allows team members to have immediate feedback on their ideas.

Challenges to the wide spread adoption of SPOTS seven step approach remain. The lack of analyst skills is a critical need that must be filled with training and employee development. The Fire Modeling Institute at the Fire Sciences Lab in Missoula is beginning to supplying skilled analysts who may be available to teams that are trying to develop a skills base locally. A great deal of work remains to select and integrate models that would form a unified national corporate software package. Teams using a SPOTS approach will be the early customers of the national LANDFIRE data set. SPOTS analysis approaches should dovetail with Fire Program Analysis (FPA) System, and could be critical in supporting land and resource management planning.

The seven-step framework for SPOTS is an excellent way to aid in collaboration with a variety of partners and supports policy directives like the National Fire Plan and Healthy Forests Initiative. Fire modeling shows that a deliberate pattern of slower burning fuels can lead to fires that are smaller and less intense. Fuel treatments and vegetation management efforts can change the outcome of the problem fire consequently reducing suppression costs. SPOTS approaches encourage a landscape-level, cohesive fuels treatment strategy that may provide biomass and encourage the development of businesses that can use our hazardous fuels to bring value added products to market or increase our capability to generate energy.

SPOTS approaches may not be meaningful on all lands, for all problems. In an environment where the land management agencies currently only fund treatments on about 1% of their lands per year, planning to treat 20% of the entire landscape seems unrealistic. The strategic placement of fuel treatments should be used in high profile, high priority areas to increase the likelihood of success and secure future treatment opportunities. SPOTS treatment patterns may allow managers time to implement long-term management strategies to restore ecosystems. The enhanced understanding of wildland fire potential gained by participants of the SPOTS approach as well as the distribution of treated acres with lower fire severity potential across the landscape may provide some comfort to local decision makers considering the highly effective fuels treatment option provided by broad-scale Wildland Fire Use.

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Figure 1: Location of the final 8 pilot projects selected across the country

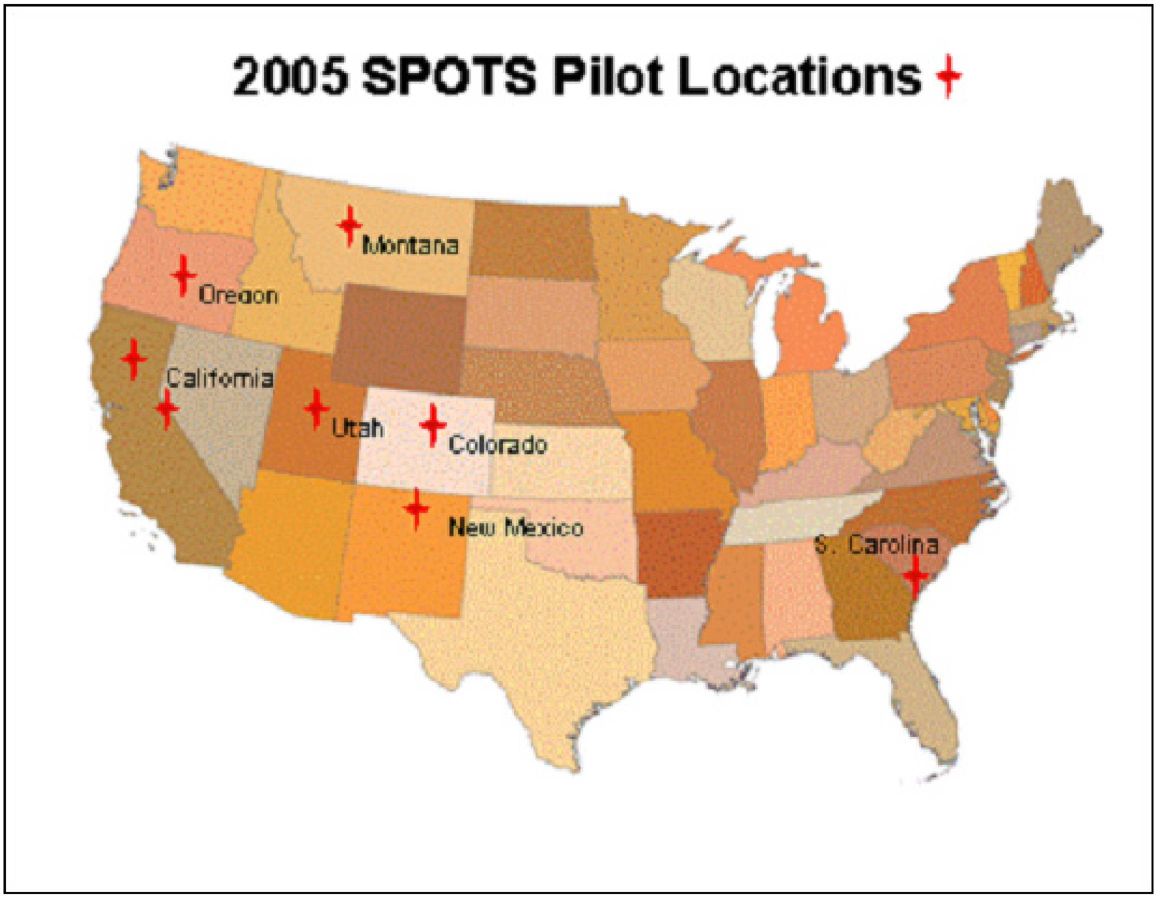

Table 1: Participating pilot projects are identified by project name, management unit, location, and a brief study area description

USFS Region	**Project Name**	**Unit**	**State**	**Study Area Size and Vegetation**
1	Butte North	Beaverhead-Deerlodge NF	MT	45,000 acres mixed lodgepole pine forest
2	Yankee Hill	Arapahoe Roosevelt NF	CO	35,600 acres high elevation Rocky Mtn mixed conifer and lodgepole
3	La Jara	Carson NF	NM	6,000 acres within the 42,000 acres Taos Canyon, fuels range from low pinyon/juniper to ponderosa to high elevation conifer
4	Upper Provo	Wasatch-Cache NF	UT	90,000 acres, 7-12,000 ft elevation; aspen, lodgepole, spruce-fir, mixed conifer, and mountain-shrub/ oakbrush
5	Alder Springs	Mendocino NF	CA	31,000 acres; Sierra conifer and chaparal
5	Sagehen	Tahoe NF	CA	8,000 acres; mixed conifer, red fir, eastside pine, and pine plantation
6	Cascade Front	Deschutes NF & Prineville BLM	OR	150,000 acres. BLM and FS. Five Buttes/LaPine interface Pondo/mixed conifer, lodgepole
8	ION/Wando	Francis Marion NF	SC	1,030 acres: Longleaf pine, loblolly regeneration, pocosin, hurricane blowdown

Table 2: Summary of results from the 2005 SPOTS pilot projects

Project Area	Defined problem fire	Collected historic weather and wind data and evaluated for PF	Identified Analysis Area Appropriate to the problem fire size	Created FARSITE landscape from vegetation and other data	Calibrated the model by validating outputs against known fire event or behavior	Completed an iterative process to answer strategic placement of treatments "So What?"	Created an estimate of how proposed treatments changed the problem fire outcome (screenshots, graphs or tables)	Workshop and duration	Categories of persons attended
North Butte, MT	X	X	X	X	X			Plan to	Public, city government, local fire departments
Yankee Hill, CO	X	X	X	X		X	X	Yes: 2 days	Public, state FS, environmental groups
La Jara, NM	X	X		X	X		Yes = Informs burn severity maps for before and after treatment	Yes: 1 day	Public, inter-agency partners and the Taos Pueblo Tribal Council
Upper Provo, UT	X	X	X	X	X	X	Yes = FARSITE and FlamMap screenshots for 2 treatment options	Yes: 3 days	FS ID team, summer homeowners and 1 county commissioner
Alder Springs, Mendocino, CA	X	X	X	X	X	X	Yes = FARSITE and FlamMap screenshots for multiple treatments and fire scenarios	Yes: 2 days	FS ID team, representatives from the timber and energy industries, county and local government representatives, the public, and environmental groups
Sagehen, Tahoe, CA			X	X	X	Plan to		Plan to	
Cascade Front, OR	X	X	X	X	X	Plan to		Plan to	TNC, BLM, USFS, public
ION/Wando, SC	X	X	X	X	X		Yes = FARSITE screenshot	Yes: 1day	USFS, public, collaborators