Partnering with Planners to Develop Tools for Financial Analysis of Fuel Treatments

R. James Barbour and Roger D. Fight

ABSTRACT

The financial analysis component of the fuel synthesis project was guided by the general specifications of the broader project. The project was requested on behalf of specific users (fuel treatment planners), to address specific questions (how to design and implement fuel treatments), and with specific attributes (easily learned and used by people with little or no background in economics or financial analysis). The strategy for designing analysis and information to meet this need was to involve the target user group and managers in design, testing, and implementation of the tools. The result is a set of tools that appear to be being adopted more quickly and more widely than any previous financial analysis tools that the authors have developed.

Keywords: financial analysis, fuel treatment, planning, fire hazard

Federal and state natural resource managers who plan fire hazard reduction activities (fuel treatment planners) must consider factors such as human health and safety, wildlife habitat quality, aquatic conditions, future human use, behavior of posttreatment fires, and more, as they design treatment programs for a particular area. Treatment cost also is an important aspect of treatment design, but, often, it is overlooked in the early stages of planning. There probably are many reasons why this happens, but a simple absence of easy-to-use financial analysis tools is surely a major factor. Furthermore, the National Environmental Policy Act (NEPA) of 1969 does not require the use of financial information in designing proposed management activities. A more practical reason may be that planning for projects and programs is a major budget consideration, and adding additional staff to conduct financial analysis often is not an option.

Most federal decisionmakers who are responsible for these projects recognize that budget realities make thoughtful design of fuel treatment projects an important part of meeting management objectives. Fuel treatments that are not cost-effective result in treating fewer acres and underachieving management goals. These midlevel managers understand that failure to address costs could result in redirection of their treatment budgets to units with more successful records.

As we considered how to approach development of a tool that would fill the financial analysis needs of fuel treatment planners, we eventually settled on two key questions: (1) What basic financial information do fuel treatment planners need about the treatments they design so they can perform those treatments and still meet a variety of management objectives? (2) How can we package easy to obtain information and manipulate it to provide the understanding needed without requiring the involvement of experts in financial analysis methods? In answering these questions, we tried to design tools that are easily mastered by people with little or no technical background in economics or financial analysis methods but provide high-quality, reliable information. To do this, we engaged the types of people we expected to use the tools and included them in each step of the development process.

The purpose of this study is to introduce managers and planners to financial analysis tools that they can use to help them attain their management objectives when they implement fuel treatments. These tools were developed as part of the Fuels Synthesis Project, a project initiated at the request of and funded by Fire and Aviation Management in the Washington Office of the US Forest Service. The overall project consisted

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R. James Barbour (jbarbour01@fs.fed.us) is a research forest products technologist, US Forest Service Pacific Northwest Research Station, POB 3890, Portland, OR 07208. Roger D. Fight (rogerf2000@aol.com) is a research forester (retired), US Forest Service Pacific Northwest Research Station, Portland, OR 07208.

of four teams: Forest Structure and Fire Behavior, Environmental Consequences, Fuels Treatment Economics, and Social Science. These teams were made up of scientists from three US Forest Service research stations and numerous contributors from universities and other US Forest Service research stations. To keep the size of the project manageable, the geographic focus was limited to the dry forests of the western United States. These forests are, in most cases, dominated or potentially dominated by ponderosa pine (*Pinus ponderosa*) and/or Douglas-fir (*Pseudotsuga menziesii*) and occur throughout the western United States, southern Canada, and northern Mexico. McCaffrey and Graham (2007) provide additional information on the overall project.

Products Developed and Why

We developed a variety of products from computer models, to written documents, to data. The tools we developed were in large part adaptations and extensions of existing products rather than totally new ones. The primary products included

- A spreadsheet-based tool for conducting financial analysis of fuel treatments.
- A users guide for the financial analysis tool.
- A harvesting cost model that is incorporated into the financial analysis tool.
- Financial results and data for a set of prescriptions applied to a set of example stands.
- A document explaining financial analysis of fuel treatments.

Practitioners participated in the conception and design of each product. In some cases, they took an active role in specifying and testing content or functionality. In other cases, they played a more passive role, acting as reviewers of the documents we wrote. These documents were intended to address information needs identified by the practitioners we worked with as we developed our primary product, My Fuel Treatment Planner (MyFTP).

MyFTP

Our primary product was a spreadsheet-based financial analysis tool that we dubbed MyFTP (Biesecker and Fight 2006). The MyFTP application was designed to provide financial information alongside basic physical and biological indicators of treatment effects. The physical and biological indicators are to provide context that keys the financial information to detailed physical and biological information that is provided by other tools developed in the Fuels Synthesis Project. It also provides estimates of the economic impact of treatments in the geographic area (generally a group of counties) where the project is located.

The common measure of financial cost or return from a project involving removal of trees is the net revenue generated by the project. To calculate net revenue, costs of conducting treatments are subtracted from revenues (if any) from logs or other products that are sold. Accounting for revenues is straightforward; volumes of delivered products are multiplied by delivered prices, taking into account any differences in quality that affect price. Subtractions include the cost of hauling products to the market, the cost of getting from a tree standing in the forest to a product (sawlogs, pulp chips, or dirty chips) loaded on a truck, and the cost of disposing of residues left on site (activity fuels) after the logging operation. The tool also allows for subtracting other costs such as planning and administering contracts and implementing projects relevant to the question being addressed.

The important cost components of fuel treatment projects are addressed in MyFTP by use of a series of linked cost estimators. The cost of felling, limbing, bucking, moving material to a landing, and loading it on a truck, i.e., the logging cost, is estimated by a logging cost simulator, STHarvest (Fight et al. 2003). This software was adapted to make it more applicable to the kinds of operations that are common in fuel treatment projects and incorporated in MyFTP. The logging cost simulator in MyFTP is called the Fuel Reduction Cost Simulator (FRCS) and is also available as a stand-alone model (Fight et al. 2006).

Hauling cost is estimated with a simple model that uses cost per day for a truck and driver, loads per day for the location in question, and volume per load to calculate the estimated cost per unit of volume. Costs of burning or mechanical operations (except mastication) that might be included in the treatment prescription are estimated by use of cost calculators that are adapted from work by Calkin and Gebert (2006). The cost of mastication is estimated with a very basic cost calculator provided by Rummer (Robert Rummer, pers. comm., USDA Forest Service, Southern Research Station, June 17, 2004.) Other costs can be added, but must be provided by the user.

FRCS

Mechanical operations that are designed to reduce fire hazard by cutting and removing trees from the stand range from commercial thinnings that generate net revenue to high-cost noncommercial operations that produce nothing of commercial value. The FRCS application was intended to allow consideration of a wide variety of silvicultural prescriptions because treatment cost is affected by the prescription. The FRCS application can be used to estimate costs for fuel reduction treatments involving removal of trees of mixed sizes in the form of whole trees, logs, or chips from a forest. Equipment production rates were developed from existing studies. Equipment operating cost rates are based on December 2002 prices for new equipment, and wage rates are for the Pacific Northwest. The user can modify these cost assumptions to suit local conditions and actual equipment costs. There are four ground-based systems, four cable systems, and two helicopter systems. Cost estimates are in US dollars per 100 ft^3 of product, per green ton of product, and per acre.

Example Stands, Prescriptions, and Financial Analyses

As part of the Fuels Synthesis Project a set of stands was selected that are typical of the types of stands that generally are regarded as having high fire hazard. A range of fuel treatments was simulated for each of those stands. The treatments included thinning from below to 300, 200, 100, and 50 residual trees per acre with either prescribed burning or mechanical treatment to clean up the activity fuels created by the thinning. Johnson et al. (2007) provide details on the origins of these stands and treatments. Financial analysis was conducted for all the combinations of stands and treatments that included some removal of merchantable material. Financial analysis was not done for other combinations because estimating the treatment cost alone is the financial analysis.

The purpose of presenting those analyses was to provide a starting point for discussion of fire hazard reduction treatments that meet the full range of management objectives, including budget priorities. Thoughtful design requires an understanding not only of the physical and biological outcomes but also of the costs and potential revenues of applying variations of fire hazard reduction treatments in a wide range of stand conditions. The analysis was done with MyFTP software and provided estimates of cost and net revenue from fire hazard reduction treatments in 18 dry forest stands from 9 national forests in the western United States.

The results of these analyses revealed few opportunities for commercial products to pay for the full treatment cost. They did show that in 12 of 18 cases, the removal down to 50 leave trees reduced the cost relative to 100 leave trees. It was, however, interesting that in one-third of the cases, removing more trees did not improve the financial situation. This happened because the value of the additional cut trees did not offset the cost of cutting and processing them. The prescriptions used in that analysis are a small part of the full set of prescriptions that have been proposed in various venues to respond to the issue of undesirable fire hazard. The output files also are available from this analysis to provide a starting point that fuel treatment planners can use for their own analyses to explore a wider range of conditions and treatments.

Document on Financial Analysis of Fuel Treatments

Our charge was to design tools that are readily understood and used by people with little or no background in economics or financial analysis. Based on conversations with and suggestions from the practitioners we worked with in developing MyFTP, we felt there was a need to provide an explanation of financial analysis related specifically to designing and decisionmaking related to fuel treatments. The article on financial analysis of fuel treatments (Fight and Barbour 2005) used data, software, and analysis conducted under the Fuels Synthesis Project to illustrate and explain issues involved in design of fuel treatments. As with the example analysis, this document was seen as one more way a fuel treatment planner could use MyFTP to follow the calculations made in the article to gain experience with the tool.

The following conclusions come from the document on financial analysis. Financial analysis does not address the tradeoffs between costs and benefits of large fuel treatment programs over the long-term because it does not estimate and incorporate those benefits. It is the appropriate tool, however, to address many issues once a decision to implement a program of fuel treatment has been made. Financial analysis can be used to explore the cost of doing treatments under different conditions and different treatment designs. This information is useful in budget development and in the allocation of funds, given a budget. Financial analysis can help determine whether the most appropriate arrangement to accomplish projects in different circumstances is a standard contract (all cost and no revenue), a timber sale (substantial net revenue), or a stewardship contract (a combination of units, some with positive and some with negative net revenue). Where environmental documents require an estimate of the economic impacts of a project, financial analysis provides the information needed to make that estimate.

Quality Assurance Procedures and Accessibility

Involvement of Practitioners in Design. We approached development of financial analysis tools for fuel treatment planners with the belief that involvement of technology and information users at all stages was important if the products were going to find wide acceptance. Accordingly, we actively sought advice and opinions from people who represented the groups we were trying to serve as we decided what types of products to develop and how to configure those products. Once development began, we engaged people who we expected to actually use the products to get their opinions on how well the tools worked and how useful written information was in explaining how the tools work or why different types of analyses are conducted.

The primary products, MyFTP, and the logging cost model incorporated in MyFTP, were the subject of our main efforts to assure quality and accessibility to the target user. Many of the ideas for our written products also came from these interactions. To ensure that these products would be perceived as useful to fuel treatment planners, we contacted regional fuel treatment specialists in the western regions of the US Forest Service and US Department of the Interior (USDI) Bureau of Land Management (BLM). Our initial discussions included regional office representatives from two western regions of the US Forest Service and staff specialists from national forests or BLM field offices. We talked with the regional fuel specialists from each region, a regional NEPA coordinator, and a regional economist. We also included a fire management officer from a national forest, a timber staff officer from a different national forest, and a silviculturist from a BLM field office. We developed the general specifications for the tools through interactions with this group. We held a series of conference calls with the whole group and face-to-face meetings with several of the members of the group. As development proceeded, we periodically interacted with one or more members of this group to get their opinions on various aspects of the project such as the look and functionality of the tools.

Involvement of Practitioners in Evaluation. *My Fuel Treatment Beta-Test.* Following initial design of MyFTP we held a beta-test evaluation in which we involved five fuel treatment planners from the US Forest Service regional office level down to the national forest ranger district level. Participants worked through a 2-day hands-on test of the model. We collected both verbal feedback and written evaluations during the beta-test. The evaluations generally were supportive of the approach we were taking, but they yielded some suggestions that led to important changes and resulted in a network of highly motivated potential users with which we could have ongoing discussions about the evolution of the model.

A fortuitous spinoff of the network we created was a move to have MyFTP incorporated into a process conducted by the US Forest Service's Pacific Southwest Region known as Fireshed Analysis. A national test of the Fireshed process was implemented shortly after the first MyFTP beta-test, and MyFTP and other tools from the Fuels Synthesis Project were offered to the national forests and ranger districts where the pilot projects for this test were located. See the following section on applications.

Another fortuitous spinoff of this networking was that MyFTP was incorporated into a mechanical fuels treatment course before the full set of fuels tools (tools from all the components of the Fuels Synthesis Project) was ready for beta-testing. This course is sponsored by an interagency fire training group and is taken by fuels planners from throughout the West who come from both the US Forest Service and the USDI agencies. This course reaches 50–100 fuels treatment planners each year, and the tools and information (users guide and financial analysis primer) are included in the curriculum.

The participants in our first beta-test suggested that we link MyFTP to the Forest Vegetation Simulator (FVS; Dixon 2004) so that FVS, a tool they are familiar with, could be used to generate the cut tree lists (the set of trees removed during a simulated thinning) and transferred electronically into MyFTP. We worked with the staff of the Forest Management Service Center in Fort Collins, Colorado, to develop this link, and as a result, the service center has begun to offer technical support for MyFTP. Important details remain to be worked out about if and how this service will continue in the future, but for the time being, users can get assistance through the Forest Management Service Center. This was an important development because in our experience, tools that are developed by researchers do not gain broad acceptance from managers unless there is a readily accessible source of information about and help in using the tool. Researchers generally can not provide this level of support.

Fuel Tools Beta-Tests. When most of the tools from related components of the Fuels Synthesis Project were ready for beta-test, there was a series of beta-test meetings with interdisciplinary teams that were the target audience for the full set of tools. These tests were led by Dr. Anne Black from the US Forest Service, Rocky Mountain Research Station (Black and Perin 2007).

Getting Detailed Technical Review of MyFTP. A users guide was prepared for MyFTP and published by the Pacific Northwest Research Station (Biesecker and Fight 2006). That process required a formal technical review, but there was no formal requirement for a technical review of the software. It is our belief that technical review of the software is critical because if software errors (which are unavoidable in something so complex) are left to be found by users after the software is released, the credibility of the software is put in jeopardy. When users are left to debug software, they quickly lose faith in the software and are likely to stop using it. Errors found after release also may require, depending on their severity, announcements to stop using the software until upgrades are readied and released, which also may result in users abandoning the tool. We obtained technical review of the software from five people experienced in software development under the lead of Dr. Jim McCarter at the University of Washington. Interacting with a group of people with expertise in different aspects of software development was a valuable aid in gaining feedback on a wide range of potential problems.

Use of MyFTP in Fuels Planning and Examples

The first independent application of MyFTP was by the US Forest Service's Pacific Southwest Region as part of their process known as Fireshed Analysis. This is a planning process for developing fire hazard reduction programs for national forests and ranger districts. It uses an interactive process to help both federal employees and the public discuss acceptable levels of management, and then to quickly (generally within hours) view the results of those management actions as projected by a set of models. By iterating this process, groups often are able to find a set of management activities that are acceptable to the group and accomplish management goals. The MyFTP application was built into this process to provide financial information.

An important aspect of the Fireshed cadre's decision to incorporate MyFTP was their decision to modify the program slightly to suit their needs. As Rogers (2003) pointed out, the process of adaptation and reinvention is important in the adoption of new ideas or processes. When people take a tool and come up with new ways to use it, they are more likely to accept it and continue to use it. Acceptance by one group often will lead to use by other groups who are familiar with and respect the first group.

Development Challenges

User Participation in Model Development. Engagement of people who are the target users and people who manage and train the target users is a key to developing tools that are readily accepted and adopted. We knew that the regional fuels treatment specialists who we sought to involve were busy people. We were fortunate in that the people we were able to engage were devoted, helpful, and influential in the federal agencies so they could not only provide good feedback, but also assist with timely implementation. The fact that the Fuels Synthesis Project was requested by the US Forest Service's Fire and Aviation Management staff and was intended to be an integrated product that would bring all the relevant science to bear on the processes required to do fuel treatment planning was certainly important in getting such a high level of cooperation.

Computer Platform for Model. Selecting a platform for computer tools requires balancing technical, practical, and bureaucratic considerations. From a technical standpoint, an application programmed in a language that is computationally efficient would be an advantage. From a bureaucratic standpoint, choosing a platform, such as Microsoft Excel (Microsoft Corp., Redmond, WA), that is already installed on all US Forest Service computers facilitated its acceptance by the computer gatekeepers in the federal agencies and simplified the process for getting approvals for software development. That became an important practical consideration in deciding to go with Excel as the platform. Other practical considerations include the familiarity of the target users with the look and feel of software developed on that platform and the mechanisms for input and output of data.

Insightful Validation by User Community. Acceptance from a technical standpoint is necessary, but not all that is needed for a successful model adoption. Adoption requires that the target users find that the software meets a requirement or need better or easier than alternative approaches. That idea was the essence of the mandate given to the Fuels Synthesis Project. We were charged to develop tools that would meet the minimum requirements for fuel treatment planning in an integrated way. In meeting this requirement, we relied heavily on input from the user community. We believe that the acceptance of MyFTP to date is a validation by the user community that we have been successful in that regard.

Summary

The financial analysis tools and information developed for this project seem to be on a path to widespread adoption by the target user group. The harvesting cost component also is receiving wide use by other researchers who are doing analysis of fuel treatments or designing tools to do similar kinds of analyses. Although the process leading to these outcomes has not been scientifically studied, it is reasonable to assume that having this project initiated by managers, to address specific questions, with a specific target user, and with specific design criteria related to ease of use and level of background required of users was important in getting to these outcomes.

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