FORSight Resources, LLC

The FORSight Resource

Volume 3, Issue 1 February 1, 2006

Upcoming Events...

Managing Forestlands Sustainably - Workshops in Ecology
Feb 13-16, 2006
Ichauway, Ga
www.osiny.org.conservation forestry/home.htm

Forest Leadership Conference
Mar 1-2, 2006
Toronto, Ontario
www.forestleadership.com

WWPA Annual Meeting
Mar 11-14, 2006
Scottsdale, Az
http://www.wwpa.org/

Southern Forest Economic Workshop (SOFEW)
Mar 23-24
Knoxville, TN
http://sofew.cfr.msstate.edu/

Western Forest Economists Meeting
May 1-3
Welches, OR
http://ww.masonbruce.com/wfe/

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Inside this issue:

Portfolio Optimization Strategies

Describing timberland portfolio optimization strategy in a single newsletter article was a stretch, to be sure. Rather than generalize to the point that the information is of little value, this article will be an introduction to Modern Portfolio Theory. By presenting some key concepts and an overview of the optimization process, a clear understanding of the benefits of portfolio optimization will be shown. In the next newsletter, an example of incorporating timberland assets within a portfolio will be examined.

Efficient Frontier
Essentially, the efficient frontier is a collection of optimal portfolios. When displayed graphically (Figure 1), it is more easily understood.

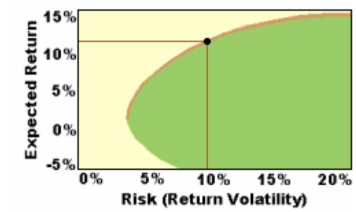

Figure 1.

The green region corresponds to the achievable risk-return space for a particular mix of assets. For every point in that region, there will be at least one portfolio that can be constructed and has the risk and return corresponding to that point. The efficient frontier is the brown curve that runs along the top of the achievable region. Portfolios on the efficient frontier are optimal in that they offer maximum expected return for some given level of risk and minimal risk for some given level of expected return.

The process of portfolio optimization involves constructing multiple portfolios varying the types and percentages of assets within. Each portfolio is then evaluated for risk and return and is represented by a single point on the graph (the green region). After the risk/return characteristics for many, many portfolios are graphed, the efficient frontier begins to materialize.

Now if we introduce an asset with a risk-free rate of return to the analysis we can construct a **Capital Market**

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Non-timber Values...Dollars and Sense

All forest land uses can be characterized in economic terms, but until recently there was no satisfactory way to compare the market and non-market benefits of alternative forest land use options. Recent developments in environmental and resource economics have produced new methods to estimate non-market forest benefits, making more comprehensive assessment of land use options possible.

Techniques for estimating non-market or non-timber forest values vary in their theoretical validity and acceptance among economists, their data requirements, ease of use, and the extent to which they have been applied. The following are different techniques that can be used to value non-market forest benefits but this article will focus on the surrogate market approach, specifically, the hedonic price model.

- ***market price*** valuation, including estimating the benefits of subsistence production and consumption;
- ***surrogate market*** approaches, including travel cost models, hedonic pricing and the substitute goods

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Non-timber Values...

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approach;

- ***production function*** approaches, which focus on bio-physical relationships between forest functions and market activities;
- ***stated preference*** approaches, mainly the contingent valuation method and variants; and
- ***cost-based*** approaches, including replacement cost and defensive expenditure.

The surrogate market approaches rely on the fact that certain non-market values may be reflected indirectly in consumer expenditures, in the prices of marketed goods and services, or in the level of productivity of certain market activities.

If robust data sets are available, the hedonic pricing model can be used to analysis higher and better use (HBU) components of timberlands currently on the market. This method attempts to isolate the specific influence of an environmental amenity or risk on the market price of a good or service. The most common application of this technique is the *property value* approach, which is used to value environmental amenities and dis-amenities. Hedonic pricing is based on the assumption that the market value of land is related to the stream of net benefits derived from it. This stream of net benefits includes a range of factors, including environmental amenities. Therefore, the value of the environmental amenity can be imputed from the observed land market.

Application of the hedonic pricing approach to property values involves observing systematic differences in the value of properties between locations and isolating the effect of environmental quality on these values. The market value of a residential property, for example, is affected by many variables including its size, location, construction materials, and also the quality of the surrounding environment. With sufficient data on property values and characteristics it may be possible to control for size, location, construction materials and other factors, such that any residual price differential may be imputed to differences in environmental quality.

The hedonic pricing method requires large data sets, in order to account for and eliminate the influence of all other variables which affect market prices. The approach also assumes that markets for land are competitive, and that both buyers and sellers are fully informed of any environmental amenities or dis-amenities. Hedonic pricing has been used in developed countries to estimate the negative impact of air and noise pollution, or the presence of waste disposal facilities, on the market prices of residential property and, conversely, the positive impact of proximity to water or public green space.

In developing countries this pricing model has seen limited use for the assessment of environmental amenity values of forests. One constraint on use of the technique in developing countries is that private property markets are often thin, uncompetitive and poorly documented. This is a particular problem at the frontier of forested areas, where formal title to land may be missing and where land is often essentially an open access resource.

This situation will probably change as incomes grow and land markets in developing countries become more efficient and discriminating (and as land transactions are better documented). It may already be possible to apply the hedonic pricing method to residential property markets in and around high-growth cities in developing countries, especially where new residential housing developments provide home buyers with the opportunity to reside in greener, forested areas, away from metropolitan centers.

The good news is that non-timber values are finding their way into the market and increasing timberland asset values. The use of the hedonic pricing model can help investors determine to what extent non-timber values will ultimately affect land values. ■

New Forest Planning Rule Examined

The USDA Forest Service released its final rule that provides the framework for individual forest management plans governing the 155 national forests and 20 grasslands in January of 2005. The two major changes arising from the rule are 1) an Environmental Management System (EMS) will be established on each Forest to facilitate implementation and monitoring of forest management activities that are called for in the Forest Plan, and 2) Forest Plans themselves are no longer subject to the NEPA review process. According to the Forest Service, the rule establishes a dynamic process to account for changing forest conditions, emphasizing science and public involvement.

A key feature of the EMS is the requirement for independent audits of the Forest Service's work. This new review and oversight of agency performance should help the Forest Service more fully account for its management of more than 192 million acres of public land. In order to have independent third party audit, some forest certification scheme (SFI, FSC, etc.) will need to be adopted first. The Forest Service is currently evaluating forest certification standards as part of its move to ISO 14001.

The new rule proposes to make forest planning more timely and cost effective. Currently, the forest planning process generally takes 5-7 years to revise a 15-

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"Good luck...is the result of good planning"

Ancient FORSight Proverb

Growth Model Review - FVS

	PARTICULARS
Author	USDA Forest Service
Species	Most major forest tree species in the forested regions of the U.S.
Region	All forested regions of the U.S. Some recalibration has been done for parts of Canada.
Silviculture	Establishment, Intermediate & Final Harvest Options
Model Type	Individual Tree - Distance Independent
Add'l Info	http://www.fs.fed.us/fmsc/fvs/index.shtml

The Forest Vegetation Simulator (FVS) is an individual-tree, distance-independent growth and yield model. It has been calibrated for specific geographic areas (variants) of the United States (Figure 1). FVS can simulate a wide range of silvicultural treatments for most major forest tree species, forest types, and stand conditions.

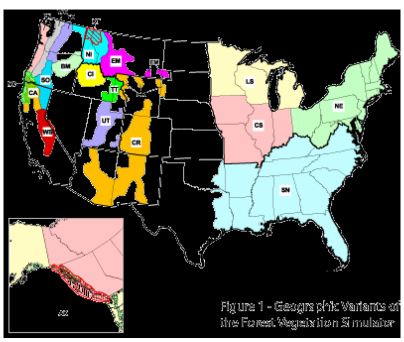


Figure 1. Geographic coverage for all FVS variants.

Model Structure

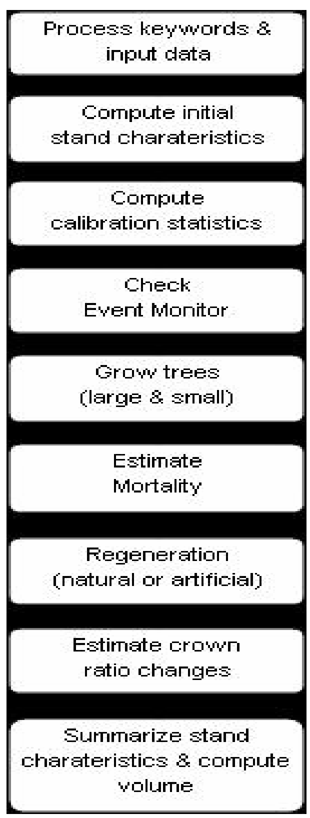
The FVS model has several components that work together to simulate forest growth and management actions. There are three main growth components of FVS:

- Large-tree model
- Small-tree model
- Establishment model

The stand is the population unit used to model individual tree interactions. Forest inventories or stand examination data can be used to describe the initial stand conditions. Input files include "keywords" the user can manipulate to simulate different management scenarios. There are extensions to FVS variants that simulate the influence of other agents upon tree growth, such as insects and disease. Post-processors are other programs that use FVS output for further reporting, display, or analysis.

Model Execution

While specific details will vary for each variant, the following steps are generally performed during model execution.



Model Cautions

FVS is a very powerful tool, consequently, users must have significant experience before experimenting beyond the default settings. Due to the exactness of the formatting requirements and the way pieces interact, we strongly recommend reading the Essential FVS User's Guide, Keyword Reference Guide, and User's Guide to the Event Monitor (all available at www.fs.fed.us/fmsc/fvs/documents/gtrs) prior to running a simulation.

Keywords – Specifications for each keyword should be understood particularly when two or more are used simultaneously to simulate management. It is also important to note that keyword parameters may have different meanings depending on the variant being used.

Event Monitor – Conditional scheduling of events often allows more accurate simulation of certain management regimes. Simulating test stands is a means to ensure events are occurring when and how they were intended. FVS has several pre-defined variables to facilitate this.

Maximum Density Limits – Care should be exercised when changes are made to maximum density limits (stand basal area and stand density index). These limits affect the maximum densities that stands may achieve, thereby affecting all other model predictions. While the default values for these keywords may be unsatisfactory, altering their values has been shown to drastically change model predictions at the tree and stand levels.

Growing Cycle Length – Growth in most of the FVS variants is based on either a five or ten-year cycle length. Specifying other cycle lengths will result in some bias, with the bias being larger for cycle lengths longer than the model default (12 years compared to 10) than for cycle lengths shorter than the default (8 years compared to 10).

Model Multipliers – FVS gives the option to change growth multipliers

FVS...

(Continued from page 3)

such as basal area increment and height growth. The default values are calibrated from regional growth data. Changing the multipliers may have unintended consequences as all parts of the model affected by a multiplier may not be obvious or even intuitive.

The FVS model and its variants are complex programs. As such, bugs are sometimes reported. Bulletins are used to notify users of program updates, model problems, and other information related to the FVS model and its related programs, and are available on the FVS website. ■

Courtesy of John McColgan, Fire Behavior Analyst. Photo was taken on August 6, 2000 in the Bitterroot National Forest outside of Sula, MT.

New Forest Planning Rule...

(Continued from page 2)

year management plan. Under the new rule, forest plan revisions are expected to take approximately 2-3 years and result in significant cost savings.

We at FORSight Resources are cautiously optimistic about the new planning rule. Nothing in past planning efforts precluded the use of collaborative planning methods, but the requirement to develop Plan Alternatives (at great expense of time and money) that focus on widely divergent management objectives was probably more conducive to contention and strife than to collaboration. The new planning rule emphasizes the development of a single Forest Plan alternative that incorporates the goals of various cooperators, non-governmental organizations and interested stakeholders throughout the process, without the need to publicly scrutinize thousands of pages of EIS documents outlining effects of management alternatives that few, if any, would credibly consider implementing.

While some have expressed the opinion that the use of strategic forest modeling and operations research tools will be greatly de-emphasized under the new planning rule, we see no lessening of rigor in relation to determining bounds on desired future conditions or other outcomes. Some form of benchmarking will still be a necessary preamble to the setting of goals if there is to be any credible plan. Desired future conditions or output levels that are biologically incompatible with other outcomes need to be explored to determine joint production relationships. We believe the best path for collaborative planning is to use smaller, transparent models that show important effects or tradeoffs in real time while all the stakeholders are present. A single forest model that incorporates all the known relationships of the proposed Forest Plan and corroborates the expectations of stakeholders provides a firm foundation for Plan implementation and facilitates monitoring and feedback down the road.

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Portfolio Optimization...

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Line. This is a line drawn from the risk-free return rate tangent to the efficient frontier (Figure 2.). The point of tangency corresponds to a portfolio on the efficient frontier called the **super-efficient portfolio.** By combining a risk-free asset with the super-efficient portfolio, it is possible to achieve the same risk-return profile as the super-efficient portfolio. The resulting portfolios have risk-reward profiles which all fall on the capital market line. Accordingly, portfolios which combine the risk free asset with the super-efficient portfolio are superior from a risk-reward standpoint to the portfolios on the efficient frontier. Long-term government securities (T-bonds, T-bills) are often used in such analyses to represent the risk-free asset.

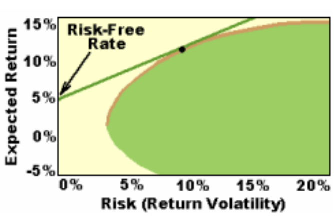

Figure 2.

In the next article we will examine three different asset mixes; one containing 100% equity investments, a second containing a composite timberland asset and a third containing regionally specific timberland assets (Pacific Northwest, Southeast and Northeast). The achievable risk-return space for each mix of assets will be different and each have their own efficient frontier. The goal will be to find the capital market line with the highest slope (Sharpe ratio). This will identify the portfolio with the highest return at the lowest possible risk.

To perform portfolio optimization, sophisticated models capable of processing large amounts of data through hundreds or thousands of iterations are required. The number of assets or asset classes in a portfolio adds complexity to the analysis in exponential fashion. While the software is necessary, a thorough understanding of the process, inputs & assumptions, and correct interpretation of the results are essential and cannot be overstated. ■

Planning Rule...

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It is worth noting that spatial restrictions can have a very large impact on desired future conditions. If a Plan calls for a certain level of vegetation management through harvesting and silviculture but that level of harvesting cannot be achieved without violating spatial restrictions, the assumptions and expected outcomes from a Plan become immediately suspect. Knowing the potential impacts of these restrictions BEFORE Plan approval is a wise course of action and should be part of strategic planning through integration of strategic and tactical spatial allocation tools. The new planning rule has the potential to create a less contentious, and more transparent planning process for public lands, which we view as a very positive step.■

FORSight Resources provides world-class expertise to companies and agencies facing critical natural resource decisions. The company's offerings include forest planning, acquisition due diligence, forest inventory & biometrics, GIS & data services, custom system/application development and hardware/software sales.

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Forest Management Plan Implementation: The Economic Implications of Straying from the Optimal Strategy

ABSTRACT

Increasingly investors are using sophisticated computer modeling techniques to formulate forest management plans. Optimization modeling techniques are gaining in popularity because they allow the exploration of management alternatives and provide an optimal solution. As investor sophistication grows models incorporate more and more detailed geographic information system (GIS) data, inventory data, and biometric assumptions. Biometric models, that provide growth and yield assumptions for optimization models, now include treatment responses allowing the ability to model intensive silviculture directly represented by data rather than simple multipliers (as was common in the past). The goal of these sophisticated models is to improve financial returns for investors. Improved financial returns, however, may be compromised if an optimal plan is not implemented.

To examine the sensitivity of financial returns, three common forest management plan implementation methods were investigated. Impacts on financial returns were calculated using 1) 'rules of thumb' to guide implementation, 2) current harvesting practices even while silviculture intensity is increasing, and 3) implementation rules addressing only the broadest intent of a plan. It is shown that varying from the optimal plan can have significant consequences in future volumes, revenues and net present value.

For a copy of this paper, please contact us at:
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"In a knowledge economy information is capital, but wisdom is gold."

Richard Thieme

In the Next Issue...

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Cartography, Art or Science?

Growth Model Review - NATLOB

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Letter from the Editor

FORSight Client Profile