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**FORVAL-Online:
A Web-Based Forestry Investment Tool¹**
by
Clay B. Landrum and Steven H. Bullard²

Abstract

Over the past decade, timber values have risen considerably, and society is beginning to see timberland for what it is – a valuable capital asset that must be managed properly. Timberlands, however, cannot be subject to an “across the board” management regime. Different sites possess different productive constraints, and the same holds true for landowners and their management goals. Considering the diversity of managers’ and landowners’ analysis needs, the ability to obtain a customized forestry investment analysis is invaluable. “FORVAL-online: A Web-based Forestry Investment Tool” is a project to develop and make widely available an accurate and easy to use forestry investment analysis package for use by non-industrial private forest landowners and forestry professionals. FORVAL-online accepts user input and performs calculations in the following areas: financial criteria, monthly payments, annual payments, precommercial timber value and projected stumpage price.

INTRODUCTION

The internet is changing how business is conducted and information is presented. Less than five years ago, the World Wide Web was an emerging medium used to disseminate information. Recently, the World Wide Web has increasingly become an interactive information source. The introduction of client-side scripting languages such as JavaScript allows web pages to react to user actions and display user-specific content. In the field of forest economics, a useful attribute of JavaScript is the ability to quickly and accurately perform complex calculations without having to access a server-side computer program. The World Wide Web, coupled with the quantitative potential of JavaScript presents itself as an ideal medium for publicly available internet-based forestry investment analysis tools.

Statement of the Problem and Justification

Timberland investments are not limited to large corporations; nor are they limited to wealthy individuals. Everyone from industrial managers and executives to Wall Street investment bankers and private landowners have seen and experienced the benefits of investing in southern forestland (Donegan 1999). Over the past decade, timber values have experienced considerable appreciation (Stewart and Wikle 1996), and society is beginning to see timberland for what it is – a valuable capital asset that must be managed properly. Timberlands, however, cannot be subject to an “across the board” management regime. Different sites possess different productive constraints, and the same holds true for landowners and their management goals. In 1994, an

estimated 9.9 million private forestland ownership units included approximately 393 million acres of United States forestland. The southern United States alone included 4.9 million ownerships and 188 million acres of forestland. These non-industrial private forest (NIPF) landowners control nearly 70 percent of the South’s commercial timber resources (Birch 1996) and are, according to Rick Hamilton, Extension Forestry Specialist at North Carolina State University, “losing a tremendous opportunity to produce future timber income” through a lack of active reforestation. Many economists and investment experts state that reforestation is one of the best long-term investments available to landowners. While landowners frequently invest in other long-term investments, such as Individual Retirement Accounts (IRA’s), stocks and bonds, many of these landowners are likely to dismiss the opportunity to earn significant, if not greater, returns through timber production (Hamilton 1996).

To analyze the potential economic benefits of reforestation, the following pieces of information are necessary: the productive limits of the area to be planted; the costs associated with site preparation and reforestation; the amount and frequency of mid-rotation management activities required to protect and maintain stand vigor; and an estimate of the future value of harvested timber (Hamilton 1996). This information is usually determined by a professional forester; however, an educated landowner should be able to surmise a reasonable estimate of these values based on research and professional correspondence.

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Obtaining the cost and revenue information is only the beginning of financially evaluating a timberland investment. The information must be analyzed and interpreted. Financial calculators are sufficient for simple analyses, but natural resource investments have a tendency to be quite complex (Straka and Bullard 1994) and may require the use of a spreadsheet or a more task specific computer program. The advantages of using a computer program designed to perform specific tasks versus a spreadsheet range from steep learning curves and time constraints to the ease and familiarity of using a well designed user interface.

“FORVAL-online: A Web-based Forestry Investment Tool” is a project of research and application of research to help educate and interest non-industrial private forest landowners in reforestation and forestry investments through the use of internet technology. The project will also supply professional foresters with an accurate, easy to use, and readily available forestry investment analysis package.

Statement of Project Objectives

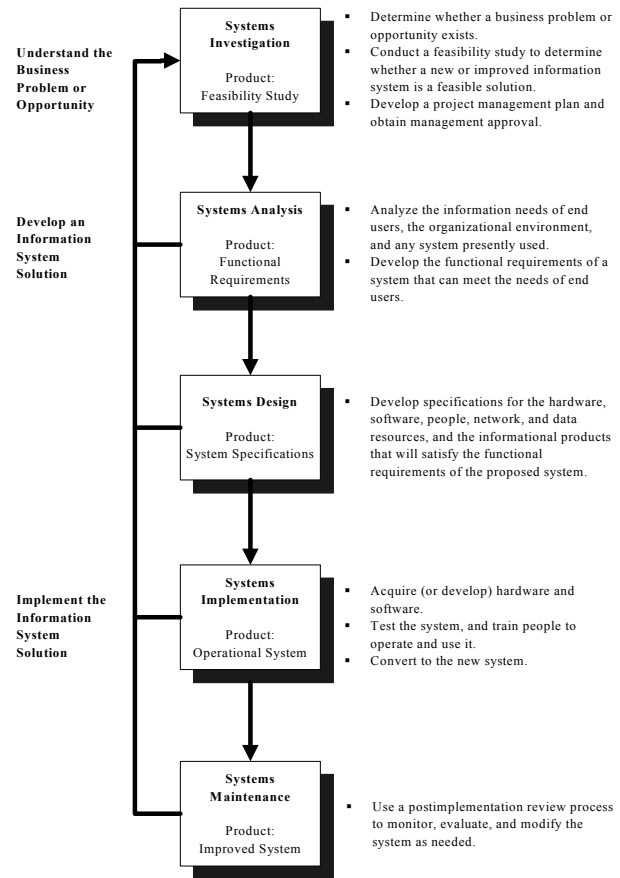
The overall objective of this research project is to develop and implement a series of HyperText Markup Language (HTML) documents that will function as a multi-platform natural resource investment analysis package accessible via the World Wide Web. Specifically, the HTML documents will accept user input and perform calculations in the following areas: financial criteria, monthly payments, annual payments, precommercial timber value and projected stumpage price.

SYSTEM DEVELOPMENT

Developing a computer-based information system is not a simple task. Information systems development or application development can be an ongoing process, even after the system is fully functional and in use. Before that time, however, computer-based information systems must be conceived, designed, and implemented using a logical and systematic development process. During this process, the programmer must communicate with potential end users to design the layout and content of the application based on an analysis of the information requirements of the end user. Often, this development process is referred to as the information systems development cycle or systems development life cycle (SDLC). Figure 1 shows what is involved in each of the following stages of the SDLC: investigation, analysis, design, implementation, and maintenance. Despite the rigid appearance of the SDLC, it is important to note that it only serves as a starting point for the systems development process.

Different steps in the process are highly related and interdependent. Thus, in actuality, multiple development activities can occur at the same time, and the likelihood of regressing to a previous step to change or improve the system in some way is high (O’Brien 1999).

Figure 1. The traditional information systems development cycle (O’Brien 1999).



Feasibility Study

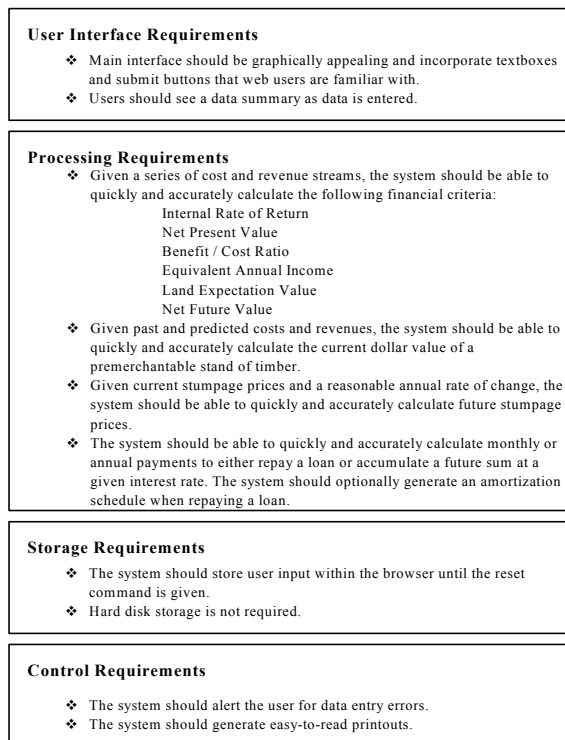
Several factors were considered prior to the construction of a completely Web-based forestry investment analysis calculator. First, the project as a whole was examined to determine if its development was feasible in the following areas: project timeframe, technology considerations, and required skills. A recent publication revealed efforts by Dr. Weihuan Xu, a forest resource economist with the Texas Forest Service, to design a set of on-line tools for use by non-industrial private forestland owners in timberland investment and management decisions (Anonymous 2000). The Timberland Decision Support System (TDSS) includes a timberland investment calculator that evaluates the returns on forestry investments, given cost and revenue

information. The idea of a self-contained, internet-accessible timberland investment calculator holds great promise; however, this particular attempt leaves much to be desired from the user. The primary weakness of the TDSS is its limitation of thirteen cost and revenue streams that can be included in a session. The program also denies the user the option to enter terminating annual, perpetual periodic, and perpetual annual cash flows. These types of cash flow series can have major implications in “real world” forestry investment analyses. FORVAL-online must establish initial credibility with users by providing a fast, versatile, easy to use and accurate forestry investment analysis calculator.

Systems Analysis

The proposed Web-based forestry investment analysis software package will be used by both non-industrial private forest landowners and forestry professionals. The system, therefore, should be easy to access and use, and it should provide useful information. To accomplish these goals, explicitly stating the system’s functional requirements is a necessity. System requirement categories include user interface requirements, processing requirements, storage requirements, and control requirements (Figure 2).

Figure 2. Functional requirements for Web-based forestry investment analysis software.



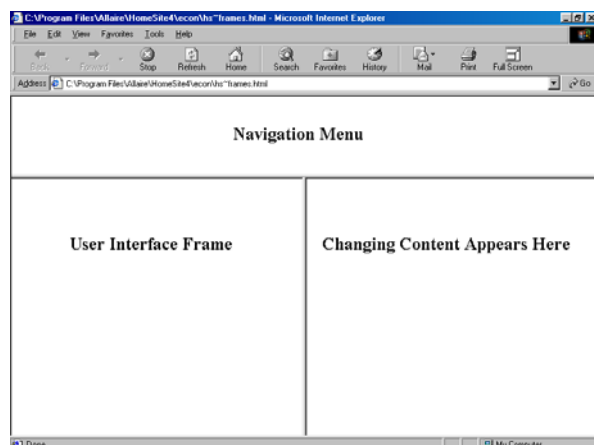
Systems Design

After a complete and realistic description of what the computer system should accomplish, the next step is to delineate how the system will accomplish the functional requirements laid out during the systems analysis stage of development. From a user’s standpoint, the most important aspect of a computer program is the graphical user interface (GUI). The GUI allows the user to communicate with the functions and procedures that perform the necessary calculations, given the users’ input. Considering that this forestry investment analysis calculator is being developed to run over the World Wide Web, several user interface problems present themselves. First, the use of standard HTML pages prevents the user from adding an undefined number of cost and revenue streams; this limitation was a problem in developing the Timberland Decision Support System described earlier. Second, the use of standard HTML pages makes it difficult for the user to know if the data entered has actually been recognized by the system. The logical solution to these problems is to incorporate frames into the HTML document.

The idea of frames was introduced by Netscape when it released Netscape Navigator 2.0. Upon the release of Navigator 2.0, Netscape proposed to the World Wide Web Consortium (W3C) that frames be included in the HTML 3.0 standard. Frames, however, were not made part of the standard until the release of HTML 4.0 specifications. Frames lend themselves quite well to applications where part of the displayed information is subject to change while other information must remain the same (Ladd et al. 1998). FORVAL-online, for example, will incorporate the use of three frames, one for navigation, one for a user interface, and one for results and other dynamic content. HTML code generates the layout seen in Figure 3 on which the entire Web-based application will be based.

Once the individual frames have been defined, JavaScript can be used to access and manipulate each frame. It is important to note that in JavaScript, each frame is a separate Window object. The Window object is the global object for client-side JavaScript code, and the window serves as the execution context for all JavaScript code it contains (Flanagan 1998). Considering that each frame is a separate Window object, each frame is capable of independent JavaScript execution. Within these independent JavaScript executions, each frame has its own namespace and its own set of global variables that can be written to other frames within the same “top” Window object. This unique property allows FORVAL-online to accept an undefined number of data entries and display those entries in a separate frame as they are entered.

Figure 3. The <FRAMESET> tag creates the screen layout that will be used throughout FORVAL-Online.



FORVAL-online's graphical user interface is extremely simple and to the point. There are no complex explanations of how to use the program; it is assumed that the user has some knowledge of forest valuation concepts. The intuitive design of the program and its user interfaces are sufficient for typical operation. References will be available to users seeking more information on forest economics concepts and examples.

The data entered into the program via the user interface will be used immediately for computation or stored within the JavaScript application until the data set is complete. The financial criteria and precommercial timber value sections of the program will place the data into arrays as they are entered. Eight different arrays will be used. Four will be used for cost data, and four will be used for revenue data. For both cost and revenue data, the following data will be stored in the aforementioned arrays: cost or revenue type, cost or revenue amount, the year when the cost or revenue either occurs or begins, and the year the cost or revenue ends if the cost or revenue type is a terminating annual series. Once the data set is completely entered, the program will iterate through each array to perform the necessary computations on the data. Cost and revenue information is assumed to occur at the end of the year.

Once the program makes the necessary computations, the results will be displayed in the frame labeled for changing content. An optional printable version of the results will be made available to the user. The financial criteria, precommercial timber value, and projected timber price sections of the program will use a JavaScript "cookie" to pass the results into a new browser window making the information available for printing. A cookie is a "small amount of named data stored by the web

browser and associated with a particular Web page or Web site" (Flanagan 1998). Cookies give the web browser memory, allowing data to be passed from window to window. The amount of information that can be stored in a cookie is limited to four kilobytes or approximately four-thousand characters. While this amount of storage space is sufficient for most cash-flow series, even a short amortization schedule, an optional computation in the monthly or annual payment section of the program, may well exceed this limitation. To solve this problem, a server-side scripting language must be used. The server-side script must first write the information that needs to be printable to a text file. Next, the script must open a new browser window with its contents being read dynamically from the aforementioned text file. Because FORVAL-online will be housed on a Windows NT server, Microsoft's Active Server Pages will be used as the server-side scripting language.

Systems Implementation

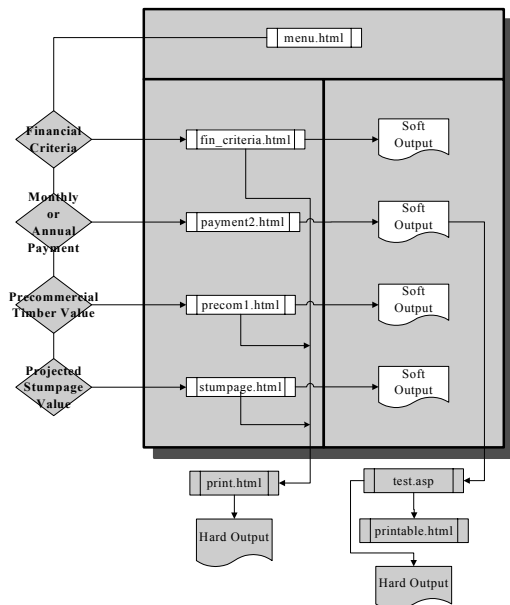
The next stage in the development of FORVAL-online is the systems implementation phase. The bulk of the work involved in this phase revolves around the actual software development and coding process. The remainder of the work involves formal testing of programs and procedures. First, however, it is important to lay out the entire program on paper and label the function and frame/window location of each file used in the program. A graphical representation of this can be seen in Figure 4.

The process begins with the file labeled "menu.html"; the user then makes a decision whether to enter the financial criteria, monthly or annual payment, precommercial timber value, or projected stumpage value section of the program. The appropriate file is then loaded into the frame labeled for the Graphical User Interface. This file then generates soft output and accesses the file(s) needed to generate hard output. The HTML and JavaScript code comprising these files is available upon request.

To insure the accuracy of FORVAL-online, comprehensive examples will be evaluated and checked against forest economics problems published by Duerr (1993), Klemperer (1996), Gunter and Haney (1984), and Bullard and Straka (1998). Formal testing will be done in the following areas: internal rate of return, net present value, equivalent annual income, benefit/cost ratio, land expectation value, precommercial timber value, loan repayment in monthly payments, loan repayment in annual payments, future sum accumulation in monthly payments, future sum accumulation in annual payments, and projected stumpage price.

Figure 4. Frame/window location and flow of files

used within FORVAL-online.



Once FORVAL-online has proven to be accurate in each of the preceding areas, the program will be housed on Mississippi State University's College of Forest Resources' server. The program will then be available world-wide at the following url: <http://www.cfr.msstate.edu/forval>.

SUMMARY AND CONCLUSIONS

The purpose of "FORVAL-online: A Web-based Forestry Investment Tool" was to develop and implement a series of HTML documents to function as a multi-platform natural resource investment analysis package accessible via the World Wide Web. This objective has been met. FORVAL-online uses JavaScript and Microsoft's Active Server Pages to accept user input, make necessary computations, display results, and make these results available in a printable format. The World Wide Web is a perfect medium for such an application. Internet availability eliminates the need of a software distributor; this advantage saves time by allowing users to have access, on demand, to a forestry investment analysis calculator. Although FORVAL-online is an internet application, the actual processing takes place within the user's browser; this permits users to load sections of the program into their browser and continue using the program without being connected to the internet. FORVAL-online provides an extraordinary forestry investment analysis calculator to landowners and forestry professionals. Entering accurate cost and revenue information is crucial when evaluating a forestry investment. Site variety, coupled with the diversity of timberland managers and landowners, makes forestry investments extremely difficult to

generalize. When a user enters cost and revenue information into FORVAL-online, taxes, inflation, risk, and discount rate must be considered and incorporated into the cost and revenue information. Failure to address consistency in these external calculations can drastically affect the outcome and accuracy of an investment analysis.

Over the past decade, timber values have experienced "unprecedented price appreciation" (Stewart and Wikle 1996), and society is beginning to see timberland for what it is – a valuable capital asset that must be managed properly. Timberlands, however, cannot be subject to an "across the board" management regime. Different sites possess different productive constraints, and the same holds true for landowners and their management goals. Considering the diversity of managers' and landowners' analysis needs, FORVAL-online allows users to consider their own unique situations when entering cost and revenue information.

While having numerous benefits and potential applications as a stand-alone forestry investment analysis calculator, "FORVAL-online: A Web-based Forestry Investment Tool" is an ideal project for future research. Future projects to improve the usefulness of FORVAL-online include the incorporation of a growth and yield section into the program and using database technology to store and retrieve cost and revenue data.

The World Wide Web is definitely changing the ways people obtain information. An easily accessible, graphic-oriented network of computers linked together to provide users with virtually any type of desired information is an increasingly powerful information tool. It is extremely important that the forestry industry does not fall behind in this arena. Web-based forestry applications such as FORVAL-online serve as an important step in keeping forest landowners and investors abreast of newly developing internet technologies. Applications of these technologies are crucial to business development and are destined to reshape any industry that chooses to take advantage of their potential. The Internet, according to Michael E. Porter of the Harvard Business School, is "an enabling technology – a powerful set of tools that can be used, wisely or unwisely, in almost any industry as part of almost any strategy" (Porter 2001).

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