FVS Lessons on the Web: A Resource for Users and Instructors

John D. Shaw
James N. Long

Abstract—A Web site (http://www.cnr.usu.edu/online/simulation) has been developed to provide users of the Forest Vegetation Simulator, Stand Visualization System, and Suppose an opportunity for self-instruction. Instructors may use the Web site as a source of lessons and data that can be used in a variety of classroom situations. Future expansion of the site includes a section highlighting cover types and silvicultural systems from across North America, and development of distance-delivered courses.

The Forest Vegetation Simulator (FVS), and the related programs Suppose and the Stand Visualization System (SVS), have been widely adopted as the standard programs for projecting forest growth on USDA Forest Service land. These programs have received relatively little attention as teaching tools in silviculture classes and other college courses in which growth projections are used. In this paper we describe our adoption of FVS, SVS, and Suppose as teaching tools, and announce the availability of Web-based resources available to users and instructors.

Using FVS in the Classroom

We started using FVS in the classroom in 1995 in a senior-level silviculture class (FR4250). Early in the semester, students collected stand inventory data during field trips to Utah State University's T.W. Daniel Experimental Forest. After a few weeks of class, the students were introduced to FVS during a laboratory session. Data collected in the field were pooled and used to create a tree list file for one Engelmann spruce-subalpine fir stand. This stand served as the example that was used to illustrate the effects of thinning, uneven-aged management, and other silvicultural practices.

The use of class time was not too efficient in the first 2 years, for several reasons. We could not expect all students in the class to be on par in computer skills. Few students were familiar with the concept of writing scripts or program code, so teaching them how to construct an FVS keyword file required more effort than merely familiarizing them with a text editor. A significant portion of the class time allotted to learning FVS was used getting the students' first simulations to run. However, students quickly learned to build subsequent keyword files on their first working version, and encountered fewer errors when adding new keywords to their simulations. Hardware and software architecture in the teaching laboratory was also problematic. Students did not have personal disk space on the system, so they were forced to direct FVS output to the floppy drive. This arrangement imposed limitations on output speed and volume. We also used the DOS version of SVS, which required command-line modification of the video mode on the computers. This, coupled with the need to run a conversion program to convert FVS output files to SVS input files, added more teaching overhead to the simulation lessons.

Despite the overhead time required to deal with technical issues (in other words, everything not related to silviculture), FVS and SVS proved to be effective tools in the effort to illustrate stand dynamics and the consequences (intended and unintended) of silvicultural manipulation. We found that, when given a verbal description of a silvicultural prescription later in the semester (table 1), students were generally able to deal with the technical issues effectively and concentrate on silviculture.

Encouraged by 2 years of success and refinement, in 1997 we allocated 2 weeks of lecture and lab time (12 instruction hours) to FVS, SVS, and the newly released Suppose interface. Our teaching lab had been upgraded with new computers and personal user space for each student, eliminating many technical obstacles. The goal was to increase the students' proficiency with the programs, and increase the number and complexity of silvicultural simulations to which they were exposed. Advances in development of the programs, including the advent of Suppose and the Windows version of SVS, not only required us to make changes in the lesson plan, but also reduced the overhead requirement. We were able to eliminate lecture time spent on all program control keywords (for example, STATS, TREEDATA, PROCESS) and some keywords associated with stand data (for example, STDINFO, DESIGN), although we continued to briefly describe how keyword files were generated by Suppose. Most of the time previously spent on technical issues was reallocated to learning the Suppose interface. With the elimination of the hardware and data conversion issues surrounding SVS, our time allocated to running SVS decreased dramatically. Because SVS has an easy-to-use interface and something of a gaming element (for example, perspective modification, tree design, timber marking), students need only a brief introduction and tend to explore the capabilities of the program on their own.

In early 2000, the Dean's Office of the College of Natural Resources released a request for proposals for development of "inquiry-based learning" projects. Although the

In: Crookston, Nicholas L.; Havis, Robert N., comps. 2002. Second Forest Vegetation Simulator Conference; 2002 February 12–14; Fort Collins, CO. Proc. RMRS-P-25. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

John D. Shaw is a Research Scientist and James N. Long is a Professor of Silviculture, Department of Forest, Range, and Wildlife Sciences, Utah State University, Logan, UT 84322–5230.

Table 1—Example of verbal silvicultural prescription converted into FVS simulation by students in a lab exercise.

Shelterwood and Retention System Project	
Objectives:	
	1. Additional experience with practical applications of FVS, SVS, and Suppose.
	2. Development of a "base case" shelterwood system for ponderosa pine on the Black Hills National Forest
	3. Explore implications of reserves
2000	Seedcut – thin from below; 4 to 999 inches; leave 20 TPA
	Regeneration – natural regen; PP 700 TPA, 70% survival after 10 years
2030	Final removal – thin from above, 999 to 3 inches, leave 0 TPA
	PCT – thin from below, 0 to 10 inches, leave 300 TPA
2120	CT – thin from below when SDI approx. 270, leave 130 TPA, i.e., SDI ca. 125 if Dq ca. 10 inches)
2160	End of Rotation
	Report: 1. yield table 2. SVS images for: a) current stand, b) 2040 (i.e., 10-yrs after removal), c) EOR
	Extra credit: Modify the removal to leave different numbers of reserves: a) 0 TPA (you have already done this), b) 5 TPA, c) 10 TPA, d) 20 TPA
	What are the implications of the reserves in terms of: 1. total yield of next rotation (i.e., must subtract out initial volume of reserves)? 2. yield of "understory"? 3. growth and yield "costs" of reserves (if any)?

concept of inquiry-based learning appeared to be broadly defined (similar to ecosystem management in its formative years), most of the existing examples involved the independent exploration of topics on the worldwide Web as a complement to some in-class exercise. We felt that the FVS module in FR4250 was an ideal candidate for adaptation to this learning process, so we proposed and were awarded start-up funds for Web-authoring software and development time.

We deployed the Web site (fig. 1; http://www.cnr.usu.edu/online/simulation) in fall of 2000 for use in FR4250. We assigned introductory modules on each of the three programs as a pre-lab reading assignment, and students were given a take-home quiz with a few questions on each module. In addition, students were instructed to read about, and attempt to create on their own user accounts, the Suppose directory structure and Windows desktop shortcuts to Suppose and SVS. By this time, a required course on computer applications in natural resources had been added to the undergraduate curriculum, so we expected that the students would have a higher computer aptitude and better capacity for self-instruction.

Use of Web-based lessons had a substantial effect on the progress made during the 2-week simulation module in FR4250. Most students met our expectations of coming to

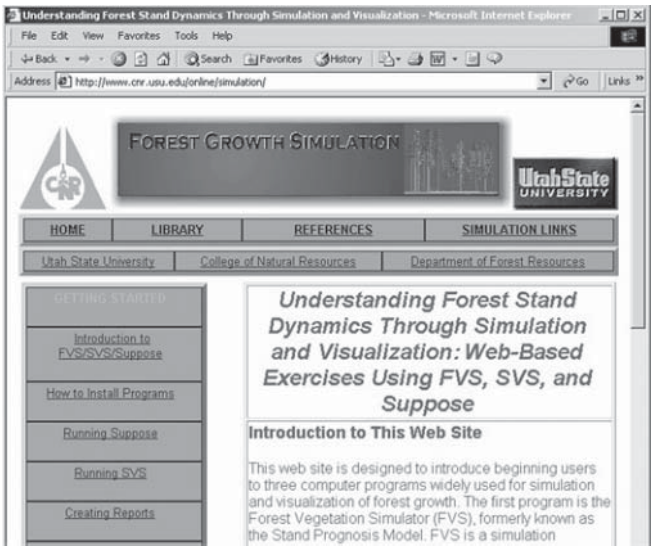

Figure 1—Simulation and visualization home page.

the first class of the module with a basic understanding of the programs and their user accounts prepared for use. The students who did not complete all the tasks required relatively little coaching, from us or their classmates, to catch up with the rest of the class on the first day. The cumulative effect of having students with better computer aptitude and self-instruction modules available was being able to cover the same amount of material in 1 or 2 fewer days. To date, we have used the extra time for review, discussion of advanced topics, and completion of a trial (that is, no-grade) assignment similar to the ones they are assigned during the remainder of the semester.

Following the initial deployment of the Web site, we considered possible additions to the site that would improve its utility in other courses and for FVS users in general. We considered two types of additions: those involving adaptation of existing materials, and those involving development of new material. In both cases we would have the opportunity to take advantages of the unique qualities of the Web.

Expanding the Web Presence

During development of the silviculture module, it became apparent that Web-based modules could be useful in other classes or for any FVS users. We focused the next phase of development on modules with general applicability. The obvious candidate for inclusion was the FVS keyword reference manual.

We obtained the most current revision of the keyword reference manual (Van Dyck 2000) from the Forest Management Service Center, converted the text to Web pages, and added extensive hyperlinks throughout (fig. 2). The online manual is more convenient to use than the hard copy version, because users can quickly navigate among keyword entries and create bookmarks using their Web browser. In the future, the keyword manual may be integrated into the Suppose interface.

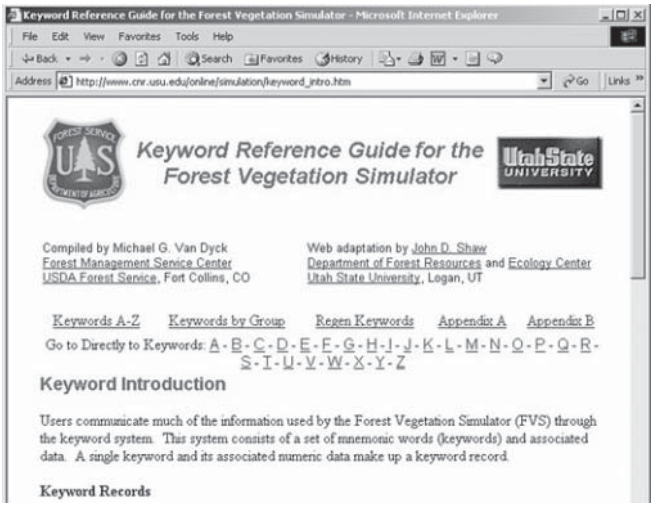

Figure 2—Introduction to FVS keyword reference guide.

The Forest Management Service Center also maintains a training guide (Van Dyck 2001) that covers a wide range of FVS keywords and operations in Suppose. Although our classroom modules do not require the depth provided by the training guide, we anticipated that we or other instructors might require some of the lessons in the future. We converted the training guide to a hyper-linked document, similar in format to the keyword manual.

Integrating the keyword and training manuals into the Web site provided two important benefits: we saved time on lesson development, and we were able to hyperlink our existing Web pages to relevant entries in the two manuals. Although a significant number of labor hours were required to convert the manuals to a format consistent with the rest of the Web site, we anticipate that future updates of the documents will require relatively little effort.

One important distinction between the Forest Service exercise guide and the modules we developed for class is that the Forest Service manual focuses primarily on developing technical competence with the software (that is, it is a "how-to" manual), whereas we focus more on teaching silvicultural methods and only include the technical understanding of the software that is necessary to accomplish the lesson. As a result, the lessons we develop and the ones in the Forest Service exercise guide are complementary.

The third area of expansion, which may prove to be of most interest to instructors in general, is a section on cover types from across North America (those areas covered by FVS variants). This section was inspired by an article in the November 2000 issue of the Journal of Forestry (McNab and Ritter 2000) describing the 100–year history of the Old Orchard plantation on the Biltmore Estate in North Carolina. We obtained data on the Old Orchard plots from the authors and created two sets of FVS tree files. The first set includes data from the 100–year inventory of the plots done in 1999. We constructed the second data set using the site data from the plots and descriptions of the stand when it was planted in 1899. We also provide the user with a table of treatments applied to the stands over the past 100 years. The user has the opportunity to manage the 1899 stand for 100 years using FVS and compare results to inventory conditions. We provide several questions that the user may use as starting points for exploring the stands, but there are many other approaches that instructors might use.

We hope to build the cover types section into a resource that can be used by instructors everywhere. We hope to obtain a wide range of data from local sources for inclusion. We will not only provide data, but we will also provide some background information about the stand or a detailed history such as the one that has been recorded for the Old Orchard plantation. To date we have compiled data for several cover types, including aspen, Douglas-fir, lodgepole pine, longleaf pine, Engelmann spruce-subalpine fir, and red spruce-eastern white pine. Visitors to the Web site who wish to contribute data may contact the senior author.

Conclusion

We have developed a Web resource that can be used by instructors wishing to incorporate FVS into their lesson plan, or by other FVS users who want to improve their expertise or have easy access to reference material. The evolution of the Web site will be based on instructors' current and future needs, and future development of FVS, SVS, and Suppose. We anticipate that we will use the Web site as a component of distance-delivery courses in the near future. We hope to continue development as FVS becomes a more popular management tool and demand for education in its use increases.

Acknowledgments

We thank the Dean's Office of the Utah State University College of Natural Resources for providing the incentive to develop the simulation Web site. We also thank M. Van Dyck, USDA Forest Service, Forest Management Service Center, for providing the source documents for the FVS keyword and exercise manuals, and W.H. McNab, B.A. Ritter, and R. Seymour for providing data for the cover type examples section.

References

Crookston, N.L. 1997. Suppose: an interface to the Forest Vegetation Simulator. In: Teck, Richard, Moeur, Melinda; Adams, Judy, comps. Proceedings: Forest Vegetation Simulator conference, February 3–7, 1997; Fort Collins, CO. Gen. Tech. Rep. INT–GTR–373. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Johnson, R.R. 1997. A historical perspective of the Forest Vegetation Simulator. In: Teck, Richard, Moeur, Melinda; Adams, Judy, comps. Proceedings: Forest Vegetation Simulator conference, February 3–7, 1997; Fort Collins, CO. Gen. Tech. Rep. INT–GTR–373. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

McGaughey, R.J. 1998. Techniques for visualizing the appearance of forestry operations. Journal of Forestry 96:9–14.

McNab, W.H. and B.A. Ritter. 2000. The Old Orchard white pine plantation at Biltmore. Journal of Forestry 98:18–23.

Van Dyck, M.G. 2000. Keyword reference guide for the Forest Vegetation Simulator Forest Management Service Center, Fort Collins, CO.

Van Dyck, M.G. 2001. Forest vegetation simulator: FY2001 class exercises, Region 4. Forest Management Service Center, Fort Collins, CO.