Using FIA Data and FVS to Develop Yield Streams and State-and-Transition Models for National Forest Planning

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Overview:

- Decision support systems (DSS) and optimization models have been part of the National Forest planning process for several decades, and the amount of data and analytical complexity has grown with advances in tools and computational power.
- Current planning projects, such as the Lolo National Forest plan revision, are using the PRISM DSS in conjunction with state-and-transition models to evaluate a wide variety of management scenarios and their outcomes as they relate to a wide variety of forest management objectives (figs. 1, 2).
- The primary goal of this project is to develop a process and information to inform landscape-scale vegetation models with stand-level vegetation change projections under different management regimes. This process has been done in different ways for various forest plans, but it has not been documented to the extent that it is reproducible, and previous efforts did not use the currently available data and tools. As a result, the secondary goal is to document the process in sufficient detail such that the important elements that are likely to be common in other forest plans can be replicated. This should make for efficient completion of this component of forest planning.

Summary:

DSSs have become an essential part of forest planning. FORPLAN was the primary analysis tool for Forest Service land management planning starting in 1980. Although it was cutting edge at the time, there were many criticisms, including it not being user friendly, being difficult for analysts, managers, and the public to understand models and explain results, and expensive to run in terms of computer resources. Computing power has grown independently, and FORPLAN has been succeeded by a long line of alternatives, including SPECTRUM, SIMPPLLE, VDDT, and LANDIS. In most cases, this has resulted in “starting over” with respect to the user experience with scenario setup and analysis, including the preparation of large amounts of input data for the models. As a result, carry-over of methods from forest plan to forest plan is minimal.

The forest plan revision for the Lolo National Forest represents the current step in the evolution of this process, with the PRISM model (Nguyen et al 2022) being used for scenario evaluation and optimization, ST-Sim providing state-and-transition data (Daniel et al. 2016) for use in PRISM, and FVS providing yield stream data for PRISM and state-and-transition input data for ST-Sim. Potential source data include the Forest Inventory and Analysis database

(FIADB) and the Field Sampled Vegetation database (FSVeg). The use of FVS to produce yield stream data as optimization model input has a relatively long history of use in forest planning, but documentation of methods is sparse and sometimes specific to particular forest plans. As a result, there is a documentation need.

Because all of the necessary modeling and evaluation steps would have to be done in support of the Lolo plan revision, the opportunity was used to explore a range of methodological approaches. During the evolution of the process many alternatives were either tried and rejected or implemented and possibly improved upon in later parts of the process. Although there are many parts to the process, documentation of the explored and adopted alternatives is focused on the use of FVS as a primary source of input data for the other models.

Key Concepts for FVS Users:

- Data acquisition was the first step. We considered FIADB and FSVeg as the primary data source candidates. FSVeg can include FIA data, but inclusion at the National Forest level is "on demand" at the request of the Forest. Early in the process we rejected FSVeg in favor of FIADB, partly due to a technical issue with FSVeg Spatial, which has since been resolved, and some other limitations. However, lessons learned from the use of FIA data might be useful for a future re-evaluation of FSVeg as a primary data source.
- We used a number of techniques to expand the dataset and streamline simulation runs. For example, there are fewer than 400 FIA plots on the Lolo, so the number of plots included in the simulation dataset was expanded by using plots from surrounding forests with PV_Codes (habitat types) common with those found on the Lolo. Another method involved "replicating" plots in the input database, which was accomplished by appending Stand_CNs and Stand_IDs with a suffix corresponding to silvicultural scenarios that would be applied in the simulations. This approach replaced the need to select groups of stands and apply keywords; KCP files were simply added to the AddFiles column in the StandInit tables according to the prescription applied to each replicate. As a result, replicates of each stand were easily identifiable in output and output tables.

Management Applications/Future Directions:

The timing of this project coincided with the beginning of implementation of Forest Service Planning Service Centers, which are intended to streamline many aspects of forest planning and plan revision. Although the results of our process could be applied by other individual National Forests with plan revisions scheduled for the near future, we recognized that the successful implementation of Planning Service Centers could especially benefit from a well-documented process. Among the potential benefits would be higher consistency of the yield steam components among new forest plans, and Planning Service Centers serving as "institutional repositories" for the methods and documentation we developed. The potential for institutionalization of the process is especially attractive because we found that the sparse amount of existing documentation also came from disparate sources, and frequently left open questions that required follow-up investigations.

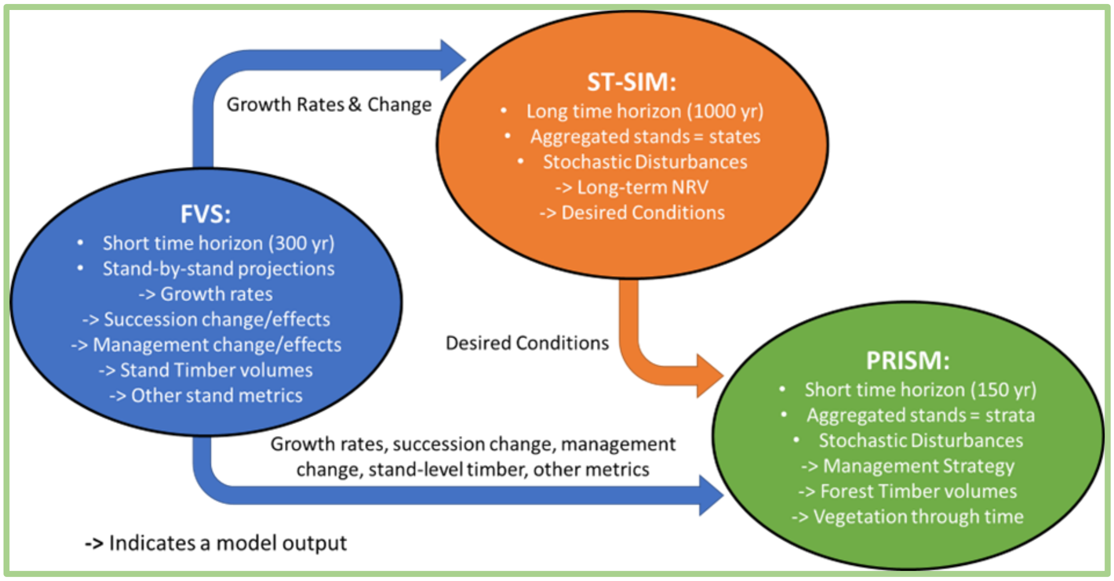

Figure 1—General framework for running alternative scenarios through FVS to produce state-and-transition and yield stream data.

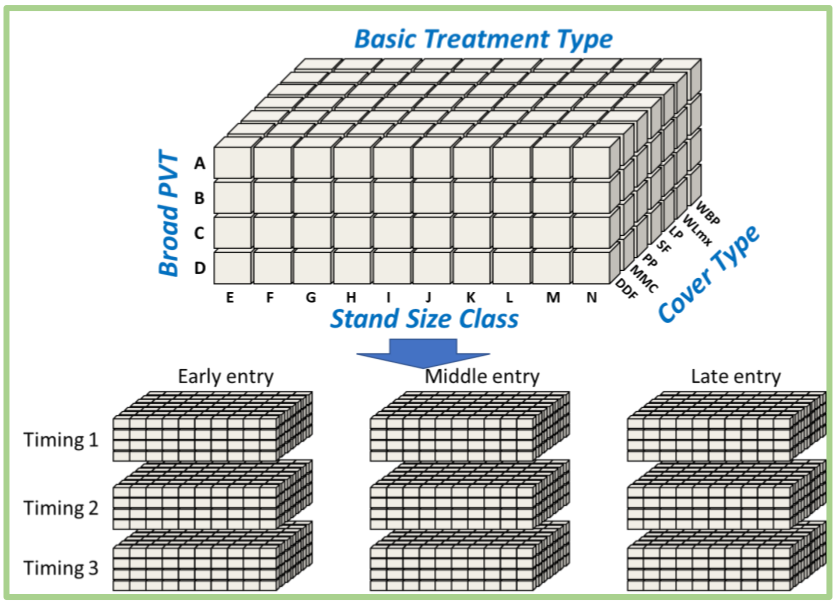

Figure 2—Graphic illustration of how a basic silvicultural treatment type expands into a potentially large number of treatment options when different combinations of entry timings (e.g., precommercial thinning, commercial thinning, final harvest) are needed to supply alternative yield stream data to optimization programs such as PRISM.

References:

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