A brief description of MFPS:

A multipurpose forest projection system

by

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INTRODUCTION

MFPS is a forest projection system applicable to a wide range of inventory, management, and research needs. It provides a basic program framework and tree accounting system for a distance independent, individual tree based, stand growth projection.[2] Other models of this type are listed in a bibliography by Dudek and Ek (1980) and reviewed by Ek and Monserud (1975). MFPS is intended to provide clarity of interpretation in both programming and usage and the speed appropriate for the analysis of economic and silvicultural alternatives and the study of response of stands to treatment. In particular it was designed as a projection model for simulation and optimization methodology geared to optimizing management practices over large areas. It is written in a structured, disciplined style of FORTRAN that is easy to understand and modify.

MODEL STRUCTURE

The basic model provides for the input of a list of trees and their projection in terms of diameter growth, present and future height estimation, individual tree mortality, thinning options, clearcut harvest, and regeneration following harvest. The input list may be drawn from a single plot or it may be constructed to represent an average stand condition.

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2 A distance independent individual tree based stand growth model was defined by Munro (1974) as one not requiring inter-tree distance information.

The basic version of MFPS incorporates submodels and coefficients for diameter growth, height, and mortality from the tree growth projection system developed by the U.S.D.A. Forest Service North Central Forest Experiment Station under the program heading FREP (Forest Resources Evaluation Program). Modifications from the FREP software of interest to potential users are:

1. A simplified regeneration routine following clearcut. Regeneration is implemented by inserting an appropriate tree list (size class distribution by species) at some date following harvest. Such distributions can be derived rather simply from forest survey or permanent plot records.
2. Flexible tree product expressions have been developed to allow estimation of a number of products from each tree such as sawtimber, bolt, and pulpwood size materials to whole tree biomass.
3. Simplified thinning and harvest options.
4. Succinct coding in ANSI FORTRAN that permits compilation and execution with only 40-60 K memory.

The major component routines for MFPS are described briefly below:

1. MFPS main program of the system provides overall control
2. INITLZ reads model parameters and run specific options for run initialization
3. RDPLT reads the basic input data, i.e., stand data and tree list for each plot
4. SETSI determines the site index of the various species on the plot from the site index given for the major species

5. DETCT provides optional cover type classification for use by MANAGE subprogram

6. UPDATE processes the tree list to consider survivor growth, mortality, and regeneration

7. MANAGE implements thinnings and clearcut by cover type

8. REGEN provides for the insertion of an after-harvest species-size class distribution for regeneration

9. VOLUME provides multiproduct tree volume estimates

10. REPORT provides an optional output report

11. WRITFIL writes an updated output plot and tree list file for optional later processing

12. VALUE1 a real function which provides the tree growth, probability of mortality, height and biomass values

13. DEBUG provides optional output for testing program modifications

The MFPS package also includes SUMARY, a separately executable program for summarizing WRITFIL output for selected projection dates across cover types and geographical areas of interest.

MFPS is capable of rapid stand growth projections. The output mimics stochastic behavior but is deterministic through the use of swindle techniques. A thirty-year projection of a list of 50 trees (one plot) currently requires about .3 seconds on a CDC Cyber 172 computer. This is frequently sufficient operational speed for the projection program to interact with various optimization or other simulation packages for management analysis.

Because of its structured code, MFPS is also easily modified to other situations or regions. First of all, component models for diameter growth, height, etc., are easily modified by changing appropriate model form and/or

the model coefficients. The latter reside in the coefficient data file which is read upon initialization.[3] Users may add algorithms to consider accelerated responses due to thinning, fertilization, or insect and disease problems. Users may also easily substitute tree volume equations for products of local interest. The addition of a tree location array, for example, would also allow users to convert MFPS to a distance dependent model, although such conversion would likely be of interest only for research applications. A location dependent competition measure could then replace the use of basal area as the competition measure in the current model.

That MFPS is a flexible program for a wide range of conditions should be evident from the fact that it currently handles pure or mixed species stands for some 31 species in the Lake States. It also handles clearcut harvest, thinning from below, thinning from above, mechanical thinning, diameter limit harvest, and selection by species. Program modifications are facilitated by the fact that none of the current operating modules (subprograms) involve more than 60 executable statements.

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[3] The data base for coefficient development and potential diameter growth and mortality models are described by the USDA Forest Service (1979).

ACCESS

The MFPS package was designed and written by the authors. The package (programs, coefficient file, and sample run data) is available in card or tape form along with the copyright publication describing it. More details are available upon request to:

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