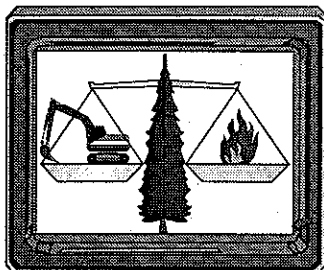


## RESEARCH SUMMARY

Nov. 1992 R 006

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- Evaluates growth-limiting factors
- Allows "management gaming" of site preparation treatment options



**SYTEPREP**  
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# forest sciences

## NELSON FOREST REGION

### Overview of the SYTEPREP Computer-Based System (System To Evaluate Prescription Effects on potential Productivity)

*M.P. Curran and M.M. Johnston\**

#### INTRODUCTION

Proper reforestation of a harvested site often requires a site preparation treatment (mechanical, burning, or chemical). These treatments may critically affect long-term site productivity if improperly planned or executed. Many economic, operational, and other resource value considerations go into a site preparation prescription; however, from a long-term productivity perspective the most crucial consideration is the "biological appropriateness" of a given treatment.

The objective of SYTEPREP is to predict the ecological effects of various site preparation treatments and thereby assist users in selecting a "biologically appropriate" treatment. Presently, the system has been developed as a prototype for use in the Nelson Forest Region of the British Columbia Forest Service and prototypes have been distributed to over 100 potential users.

#### PROJECT DESCRIPTION

This project commenced as a Masters thesis project (Johnston 1989) to develop a fire effects system under the direction of Dr. Yair Wand, Associate Professor, University of British Columbia Faculty of Commerce, in cooperation with the Protection Branch of the B.C. Forest Service. The project has continued with the support of the Silviculture and Protection Branches and the B.C. Science Council.

In June 1990, prototype versions of the FIREFFEC system were released for field testing, with version 1.2 being widely released in May 1991. As of March 1992, systems for fire (FIREFFEC),

mechanical (MSPEFFEC) and chemical (CHEMEFFEC) treatments are in various stages of development and implementation. The SYTEPREP shell system will integrate all three systems. A prototype, including FIREFFEC and MSPEFFEC, was released in December 1991 (CHEMEFFEC will be added shortly). A total of about 20 user-training workshops have been held over the last three years and more are planned.

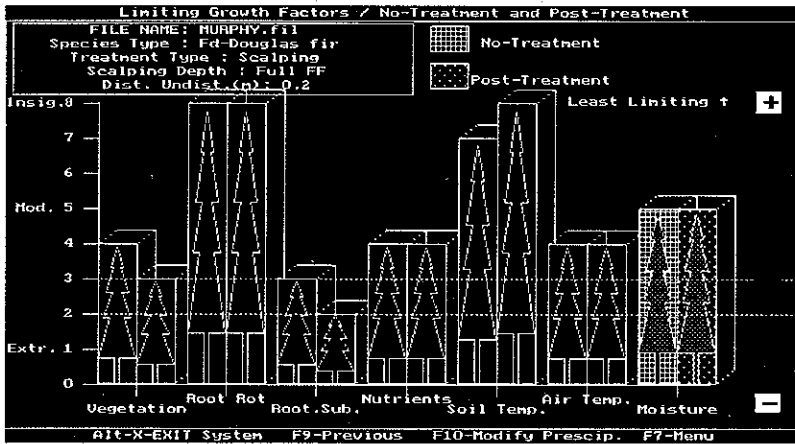
SYTEPREP can be categorized as an expert system in that it draws upon the reasoning and experience of specialists. The development process involves constructing a conceptual model of the problem and acquiring the knowledge from specialists. Specialists and prospective users periodically evaluate the design of the system by testing the results against field experience. The system is then modified in an attempt to better reflect "reality".

Many specialists in the fields of ecology, vegetation management, fire behaviour, silviculture, and pedology have been involved in the development of the systems. They are acknowledged on the system's screens. Some of this knowledge was obtained from partially overlapping disciplines which required a central specialist (Curran) to resolve conflicts and formulate the conceptual framework for the system.

The limiting factor concept was adopted as the conceptual framework for the system. This concept states that the growth rate of a plant will be determined by the level of the factor that is the most limiting (least optimum). It is acknowledged that the limiting factor concept is a simplification of ecosystem processes (i.e., some factors compensate for others), and attempts have been made to reduce over-simplification by applying the main effects (e.g., moisture-limited nutrient

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## OVERVIEW OF THE SYTEPREP COMPUTER-BASED SYSTEM



### COMPARISON OF NO-TREATMENT AND POST-TREATMENT LIMITING

uptake) to the factor which is most responsible (e.g., moisture).

The system is based on relative differences, using first principles, literature, field research sites and field experience in developing the ratings. The biogeoclimatic classification system (Braumandl and Curran, 1992) and soil sensitivity ratings (Curran et al. 1990) provide some basic structure and finer details for further ranking.

### RESULTING SYSTEM

SYTEPREP uses the limiting factor concept to compare effects of a proposed treatment on various direct and indirect growth factors. Each growth factor (vegetation, root rot, rooting substrate, soil nutrients, soil temperature, air temperature/frost, and soil moisture) is rated on a relative 1 - 8 scale for both the No-Treatment and Post-Treatment cases. Similar factor rankings indicate comparable limitations. The SYTEPREP system also provides explanatory text concerning the justification for the limiting level ranking. The underlying objective is to determine whether the proposed treatment is expected to have a net negative or net positive overall effect when compared to the No-Treatment option. The time frame that the system currently models is the "seedling establishment" phase. Some factors clearly vary in the length of time that they will affect the performance of the crop trees, and the user must decide which treatment optimizes short- and long-term tradeoffs.

### TESTING OF THE SYSTEM

Both the conceptual model, and the specific rules are currently being tested at three levels: 1) Academic scientists, 2) Local field scientists and research data, and 3) Field practitioners and operational sites. As well, test cases (both research sites and operational field experience) are used to compare the system outputs with solutions proposed by specialists.

### INTENDED USE AND LIMITATIONS

The system is designed to be used for operational development and review of site preparation prescriptions and as a focus for discussions such as in training workshops. It is not intended to be used on all sites but the users may prefer to do this until they become familiar with an area. It is currently recommended in the Nelson Forest Region for use on sites with a High Forest Floor Displacement Hazard (Curran et al., 1990). **Users are cautioned that the SYTEPREP decision aid is not designed to replace common sense, and local experience, but rather to help encourage critical thinking and discussion during development or review of a proposed prescription.** The comparison of trade offs between possible treatments helps encourage discussion and facilitates extension of research results and local experience to staff who develop site prescriptions.

### FUTURE PLANS

The SYTEPREP decision aid is not intended as an end in itself; it is being developed as one type of tool to assist operational decision-making. Immediate plans are to complete testing and ensure a robust system is available for operational use and to finalize the knowledge base in the overall SYTEPREP system. In addition some preliminary work has been done to extend it to include equipment selection, short-term economics comparisons, and a planting stock type selection. Possible future system platforms include a Windows version and a DOS-Extended version. Continued support from the Regional Silviculture section and Silviculture and Protection Branches are key to the success of this project.

### LITERATURE CITED

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