

DECISION SUPPORT SYSTEMS FOR THE USE OF PRESCRIBED FIRE TO MAINTAIN AND/OR RESTORE TALLGRASS PRAIRIE, SAVANNA, RED OAK AND WHITE PINE ECOSYSTEMS

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Abstract

Many ecosystems in Ontario are fire-dependant. These include tallgrass prairie, savanna, red oak and white pine ecosystems. Prescribed burning is a tool that can be used to maintain and/or restore these ecosystems. Three prescribed burn decision support systems have been developed by the Ontario Ministry of Natural Resources. These decision support systems use site and fire management characteristics, as well as specific weather conditions in the case of red oak and white pine, to provide qualified recommendations for the use of prescribed fire on a specific site. The systems do this by integrating a large body of data and knowledge that was previously dispersed among various publications and experts. The decision support systems can be used as: training tools for land managers interested in the use of prescribed fire; communication tools between prescribed fire practitioners and land managers; decision making tools to determine whether a site is suitable for the use of prescribed fire to meet specific management goals; and, tools to identify areas where information is lacking and future work is required.

Introduction

The objective of the prescribed burn decision support systems is to assist resource managers with the assessment of potential sites for the use of prescribed fire. The systems use both site and fire management characteristics to provide a qualified recommendation. They do this by integrating a large body of data and knowledge from Ontario and neighboring jurisdictions that was previously dispersed among various publications.

Operational experience in the use of prescribed burning in white pine, red oak and tall grass prairie and savanna ecosystems in Canada is limited. Only a few areas across Ontario have conducted these types of burns. These tools also integrate the practical experience of people who have planned, carried out and evaluated specialized prescribed fires, and they actually serve as a means to preserve and distribute their rare expertise.

The development of decision support systems requires the coding of knowledge and the process of making decisions. This coding allows users to follow the decision making process in selecting sites and developing prescriptions for specialized prescribed burns. The decision support systems can be used as:

- training tools for land managers interested in the use of prescribed fire;
- communication tools between prescribed fire practitioners and land managers;

- decision making tools to determine whether a site is suitable for the use of prescribed fire to meet specific management goals; and,
- tools to identify areas where information is lacking and future work is required.

Three prescribed burn decision support systems have been developed by the Ontario Ministry of Natural Resources since 1998:

- *Understory Prescribed burn Expert System for Ontario White Pine (UPBX98)* (OMNR, 1998);
- *Tallgrass Prairie and Savanna Prescribed Fire Decision Support System* (OMNR, 2001); and,
- *Red Oak Prescribed Burn Expert System* (OMNR, 2002).

Understory Prescribed Burn Expert System for Ontario White Pine

The expert system for understory prescribed burning in white pine (*Pinus strobus*) stands was developed in 1998 for white pine stands in central Ontario. It attempted to answer two questions:

- Is a specific site suitable for an understory prescribed burn to regenerate white pine?
- Is the current forest condition, fuel and weather conditions appropriate for an immediate burn?

To answer these questions, the user is presented with a series of windows designed to look like pages in a book. Each page has a group of user input controls where the user must describe the situation on the proposed prescribed burn site. The inputs are grouped into forest stand descriptions (overstory and understory), fire weather descriptions, and other site-related and fire-related considerations.

Once the user finishes entering the data, the program computes a site suitability index and a burning-condition index. These indices represent the appropriateness of the site for a burn and whether or not the current fuel and weather conditions are acceptable. To effectively use the system, the user must have some technical knowledge of forest and fire management.

Tallgrass Prairie and Savanna Prescribed Fire Decision Support System

The purpose of the Tallgrass Prairie and Savanna Prescribed Fire Decision Support System is to assist land managers with the assessment of potential candidate sites for prescribed burning in tallgrass prairie and savanna ecosystems. The system uses both site and fire management characteristics and considerations to provide a qualified recommendation involving the application of prescribed fire. It is a tool to assist in planning and conducting tallgrass prairie and savanna prescribed burns and integrates a large body of data and knowledge. This tool captures the knowledge and experience of the people who have

planned, carried out and evaluated these fires and serves as a means to preserve and distribute rare expertise.

The development of the system requires the codification of present knowledge and decision-making. This codification will permit the automation of the decision making process in selection of and prescription setting for tallgrass prairie and savanna prescribed burn sites.

Before using the *Tallgrass Prairie and Savanna Prescribed Fire Decision Support System*, the user should have selected and visited potential sites. The user can browse through the input screens to determine the type of information that is needed (site description, prescribed burn objectives, etc.). Once the information is entered, the decision support system will provide detailed outputs based on the information provided.

Red Oak Prescribed Burn Expert System

This system was developed using the same platform as the white pine system. It also attempts to answer the two questions:

- Is a specific site suitable for an understory prescribed burn to regenerate red oak?
- Is the current forest condition, fuel and weather conditions appropriate for an immediate burn?

Once again, the user is presented with a series of windows designed to look like pages in a book. Each page has a group of user input controls that include:

- site related factors such as the status of red oak regeneration, competing understory vegetation, overstory description, ecosystem classification, and terrain considerations to assist in deciding whether a specific site is an appropriate candidate for a prescribed fire; and,
- fire related factors such as fuel descriptions, fire weather inputs, anticipated fire control problems, smoke management considerations and values in the area to assist in predicting fire behavior and fire effects.

Once all inputs are entered, the program computes a site suitability index and a burning-condition index. These indices represent the appropriateness of the site for a burn and whether or not the current fuel and weather conditions are acceptable. This program has an explanation component that describes the process used to arrive at the indices, thus giving the user an opportunity to change some of the site or fire weather related conditions to increase the appropriateness of using a prescribed burn on the site.

Linked to the program is a large Microsoft-format help file/field guide. It describes with text, charts and photos the current state of knowledge related to red oak site requirements, regeneration techniques and silviculture requirements. It also contains information that assists the user in running the program. To effectively use the system, the user must have

some technical knowledge of forest and fire management.

Conclusion

These expert systems have already served an important role by integrating a large body of data and knowledge from Ontario and neighboring jurisdictions previously dispersed among various publications. They have also preserved and allowed for the distribution of the expertise of people who have planned, carried out and evaluated specialized prescribed fires. And finally, they have identified areas where information is lacking and future work is required. However, they are still in a state of development. As more information becomes available through operational experience and research, new data will be added to improve their applicability and usefulness.

References

- OMNR (Ontario Ministry of Natural Resources). 1998. *Understory Prescribed burn Expert System for Ontario White Pine*. CD-ROM. AFFM. Publication No. 310. Queen's Printer for Ontario: Toronto, ON.
- OMNR (Ontario Ministry of Natural Resources). 2001. *Tallgrass Prairie and Savanna Prescribed Fire Decision Support System*. CD-ROM. AFFMB Publication No. 381. Queen's Printer for Ontario: Toronto, ON.
- OMNR (Ontario Ministry of Natural Resources). 2002. *Red Oak Prescribed Burn Expert System*. CD-ROM. AFFMB Publication No. 384. Queen's Printer for Ontario, Toronto: ON.