NWCG BRIEFING PAPER

A DECISION-SUPPORT APPLICATION FOR EVALUATION OF HAZARDOUS FUELS AND FUELS-TREATMENT PLANNING

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THE SYSTEM

Our application has been developed with the Ecosystem Management Decision-Support (EMDS) system, which is a corporate technology developed by the Pacific Northwest Research Station (USDA Forest Service), and funded and supported by the agency's Natural Resource Information System (NRIS). EMDS is a general, GIS-based decision-support framework, designed to provide a practical implementation of the adaptive management process. The system includes two major components that operate in tandem:

1. A logic component that interprets and synthesizes information about landscape condition.

2. A decision component that assists with setting priorities for management actions across landscape units in an assessment area.

EMDS is a general, logic-based solution framework that readily supports decisions on user-defined problems at any relevant geographic scale(s) and spatial extent(s), including support for integrated, multi-scale evaluation and planning.

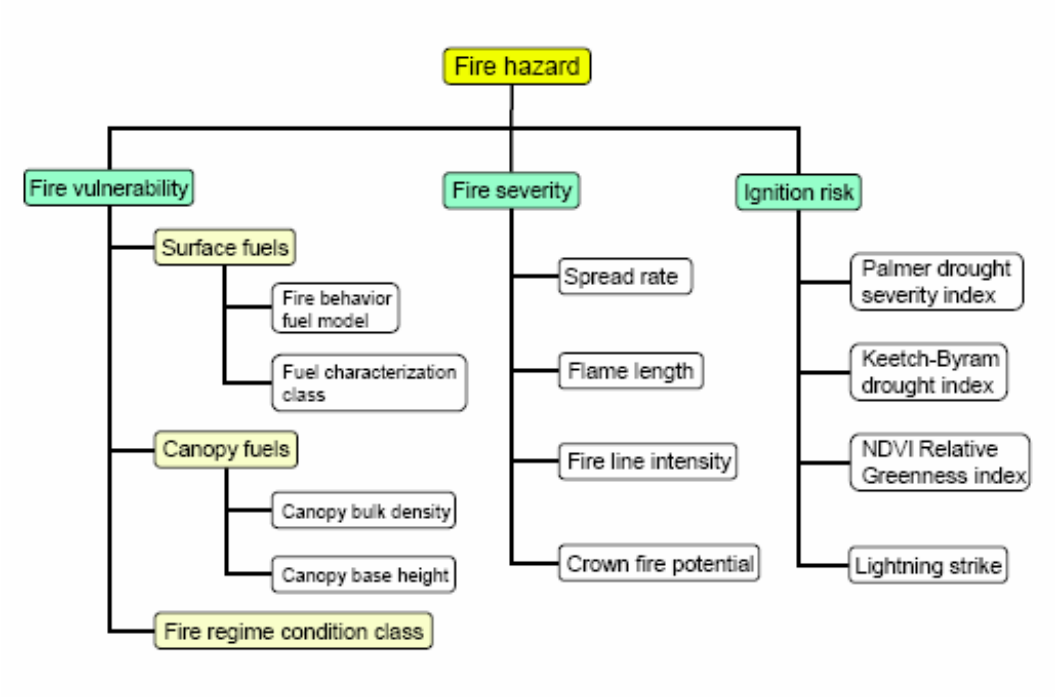

Figure 1. Outline of logic model for wildfire hazard. Details of the logic and math operations have been omitted. Lowest levels in the outline represent data inputs (see Data Sources section).

THE APPLICATION

As a proof of concept, we have developed a prototype application, providing decision support to 1) evaluate hazard from adverse wildfire conditions, and 2) prioritize subwatersheds (6th-code hydrologic units) for restoration and remedial action. We demonstrate use of the application with an example from the Rocky Mountain region in the State of Utah (USGS map zone 16), which represents a planning area of about 12 million acres, and encompasses 575 complete subwatersheds.

Hazard is evaluated, by a formal logic-based specification, as a function of three primary topics: fire vulnerability, wildfire severity, and risk of ignition. Each primary topic has secondary topics, and in some cases tertiary topics, under which data are evaluated (Figure 1). Results of the hazard evaluation are subsequently passed to the system component that handles decision modeling. Within this latter component, subwatersheds are prioritized for fuels treatment, based both on the intrinsic fire hazard in a subwatershed, and on additional logistical considerations that can have a bearing on issues such as the feasibility and efficacy of remediation measures (Figure 2). Our prototype uses a very simple example in which we include evaluation of the amount of wildland-urban interface in a subwatershed as an additional logistical consideration. However, many other factors could easily be accommodated in an operational version. For example, the decision model could include access to mills, opportunity to recover costs associated with treatment, etc.

A basic premise, underlying the two-step approach to decision support in EMDS, is that landscape elements in the worst condition are not necessarily the best candidates for management actions.

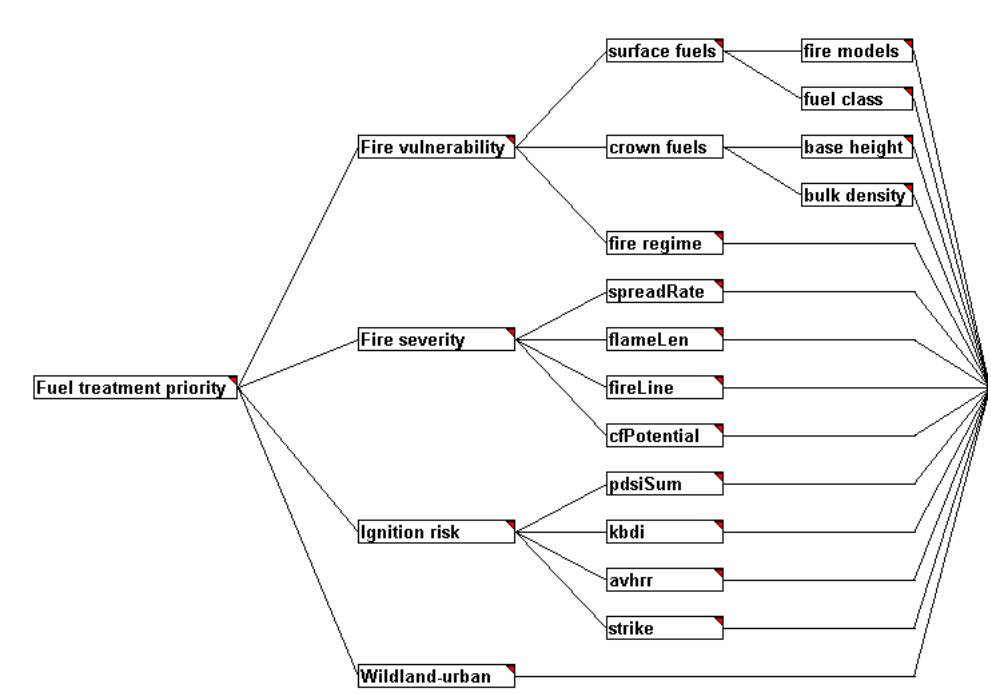

Figure 2. Decision model for determining priorities of subwatersheds for fuels treatment.

DATA SOURCES

The current prototype application draws upon three basic sources of data:

1. Vulnerability measures (Figure 1) are derived from the LANDFIRE data layers.

2. Severity measures are derived from various well-accepted fire models, which are managed by the FIREHARM system of Keane.

3. Most measures of ignition risk are derived from NOAA data.

SUPPORT FOR ADAPTIVE MANAGEMENT

Direction from the Executive Branch has mandated a shift from agency reporting based on outputs to reporting based on outcomes. One notable virtue of the logic-based approach to evaluation is that a logic model can report strength of evidence (the basic metric of a logic model) for outcomes. In the context of landscape assessment, this means that a basic product of an EMDS analysis can be the *distribution* of strength of evidence for outcomes. Furthermore, in the context of planning, distributions of outcomes from consecutive assessments can be evaluated very simply with standard statistical procedures to evaluate plan performance, thus making a rigorous implementation of the adaptive management process relatively straightforward and practical.

MULTIPLE SCALES AND SUPPORT FOR INTERAGENCY COLLABORATION

Our prototype uses subwatersheds as the basic unit of analysis. EMDS accommodates multiple user-specified spatial extents for assessment, so assessments of a single geodatabase, and based on a single logic model, can be designed to assess wildfire hazard over a range of scales, including for example, USGS map zones (as in our prototype), States, administrative areas such as Forest Service Regions, biogeographic provinces, etc. Use of a single model encourages application of a consistent methodology across geographic areas and across agencies. At the same time, for added flexibility, results of evaluations by the logic model can be combined with decision models adapted to scale-specific contexts. For example, decision criteria for prioritizing allocations to Forest Service Regions are likely to be different from those needed to address allocations to Forests within a Region. Finally, use of mid-scale features such as subwatersheds as the basic unit of analysis can facilitate collaborative analyses that cross agency boundaries.

FOR FURTHER INFORMATION

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