Gen. Tech. Rep. PSW-101 Berkeley, CA. Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 1987.

Fire Occurrence and Behavior Analysis: Report of Futuring Group 8[1]

Futuring Group 8 represented a combination of two original topics--Fire Behavior/Fuel and Fire Danger Rating--which was subsequently renamed by its members. For purposes of clarification, some simple definitions of terms, as taken from Merrill and Alexander (In press) are deemed in order:

Fire occurrence - The number of fires started in a given area over a given period of time.

fire behavior - The manner in which fuel ignites, flame develops, and fire spreads and exhibits other related phenomena as determined by the interaction of fuels, weather, and topography.

The term "fire danger rating" is used as a management system to evaluate the various factors influencing fire potential, chiefly for the purposes of determining fire protection needs.

IDENTIFIED TRENDS

1. Continuing need for better and better "fire intelligence systems" (Barrows 1969) in fire suppression and fire use programs.

2. Adoption and increasing use of Geographic Information Systems (GIS) in fire management (e.g., Kessell and others 1984).

3. Steadily increasing demand for three-dimensional fire growth modeling (e.g., Kourtz 1984) for use in presuppression planning, including training, and daily operations.

4. More and greater expectations of fire managers due to external and internal pressures (e.g., cost-effectiveness, urban/wildland interface problems).

5. Increased weather data gathering activity (e.g., remote automatic weather station or RAWS networks, lightning locator systems, precipitation radar, satellite imagery).

6. Greater demands on the existing systems used to evaluate fire danger and predict fire occurrence/behavior (i.e., they are being applied to fire problems/opportunities which exceed their original purpose or capability or both).

7. Significant improvements in electronic communications.

8. Gradual acceptance of centralized fire control centers.

9. Skill level of some fire management personnel being surpassed by the state of knowledge and new technology.

10. Widespread misunderstanding of the proper application(s) of the present analytical systems available for fire occurrence and behavior.

11. Growing interest in more robust schemes for predicting human-caused and lightning-caused fire loads.

12. Tendency towards greater international cooperation in fire research (e.g., Albini and Stocks 1986).

13. Necessity for designing systems to address all levels of fire management activities (Rothermel In press).

14. Continuing demand for "longer-range" weather forecasts.

[1]Prepared at the Symposium on Wildland Fire 2000, April 27-30. 1987, South Lake Tahoe, California.

15. Increased interest by fire-prone countries in the use of the various other national systems of fire danger rating developed in Canada, Australia, and the United States (e.g., Valentine 1978, Peet 1980, Van Wilgen 1984).

KEY VISIONS AND ASSOCIATED STRATEGIES

Basic Models of Physical Fire Phenomena

Comprehensive fire occurrence and behavior models would take into account nonuniformities in fuels, topography, and weather.

Strategies

- Conduct problem analyses to identify knowledge gaps.
- Fund basic fire research and model development to address the needs identified above.

Practical Application of Models in Fire Management

An internationally accepted family of fire occurrence and behavior systems would be available to serve the needs of fire management at all levels within the organization, from planning to operations for both wildfire and prescribed fire.

Strategies

- Form an international working group to coordinate system development.
- Determine the needs of fire management with respect to wildfire and prescribed fire applications.
- Design a family of systems for predicting fire occurrence and behavior.
- Build and test these systems.

Centralized Fire Control Operations

Centralized fire command centers would use data from satellite transmissions, advanced weather gathering systems, and other state-of-the-art technology. Integrated systems would display last known fire perimeter and intensity as well as predicted fire growth on a near real-time basis.

Strategies

- Conduct an in-depth feasibility study with respect to engineering and development requirements, options/alternatives, etc.
- Follow the course of action recommended above.

Role of Geographic Information Systems (GIS)

A computerized data base on fuels, terrain, etc., would be available for use with weather models (e.g.. wind flow over complex terrain) and forecasts for predicting the occurrence and behavior of potential or going fire situations. The predictions would include not only the probabilistic (rather than deterministic) outcomes of conventional parameters (e.g., probability of ignition, rate of spread, intensity) but other important considerations (e.g., likely location and timing of fire whirl development, blowup potential). Predictions from fire growth models can be updated using near real-time surveillance of actual fire perimeter.

Strategies

- Survey the construction, content, and use of GIS.
- Explore the feasibility of using GIS in a fire intelligence system.
- Supply fire research input to GIS plans.
- Incorporate GIS into fire intelligence systems.

Training of Fire Management Personnel

Fire managers would understand and use the appropriate analytical systems for predicting fire occurrence and behavior through training courses and field application, interpretation, and evaluation of results.

Strategies

- Determine the specific training needs of fire managers.
- Develop and conduct a series of mododularized training courses.

- Ensure that quality control for monitoring user's performance in using the systems takes place and is maintained.

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