FIRESCOPE Predictive Services Committee
Decision Support Systems
Selection Best Practices

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I. Introduction

Advances in scientific understanding are expanding at an unprecedented pace. Aptly, the expectation for public safety providers is that contemporary technology will be integrated into existing practice. As wildfire activity increasingly captures the public consciousness, the technical disciplines of *Fire Weather, Fire Danger,* and *Fire Behavior* are now regularly being utilized outside of traditional audiences. Overall comfort and trust in technology will only amplify the demand for timely, accurate intelligence as we move forward. Nevertheless, the ongoing challenge for FIRESCOPE member agencies remains consistent; a commitment to evaluate, validate and champion best practices; all at a tempo which matches the pace of evolving understanding.

II. Intent

Within the wildland fire management community, the analysis and interpretation of *Fire Weather, Fire Danger,* and *Fire Behavior* are universally acknowledged as specialties. Standardized training and qualification, obtained through recognized sources, is an appropriately arduous course of study; creating a limited number of advanced practitioners within these same fields. Simultaneously, enhanced technology has decreased the overall technical proficiency required to produce fire weather, fire danger, and fire behavior outputs and conclusions. If properly applied from a validated source, technology can assist in bridging the gap between an incomplete understanding of the wildland fire environment and desired actionable intelligence. Frequently, innovation precedes oversight. Consequently, insufficient experience, training and/or qualification has not deterred entry into the *Fire Weather, Fire Danger,* and *Fire Behavior* disciplines. The intent of this document is to provide a fundamental understanding of *Fire Weather, Fire Danger,* and *Fire Behavior* decision support methodologies; as well as a straightforward process on how FIRESCOPE member agencies can choose a "Decision Support" system to best serve their individual needs. To reiterate, the purpose of this best practices document is narrowly focused on the subject of "how to select" and explicitly avoids the "who to select".

III. Principles of Decision Support

Quality decision support is founded in several basic doctrines. Foremost amongst these tenets is that models only represent reality; they are not reality. It is critical to never surrender your judgement to a model or device; no matter how "smart". All models possess assumptions and limitations based on the intellectual design bias inherent in the product. Properly applied, models are useful in confirming or refuting conclusions that are already established through education, training and experience. Like any model, *Fire Weather, Fire Danger,* and *Fire Behavior* models are designed to support decisions, not make them.

Fire Weather, Fire Danger and Fire Behavior "decision support" use a common framework to answer valid questions. Typically, public, private and academic interests want to know the following:

1. How ***fast*** is the fire advancing? (Rate of Spread- Function of Time and Distance)
2. How ***intense*** is the fire going to be? (Flame Length- Function of Energy Release)

Understanding the answers to these questions allows for the following:

1. Accurate evacuation and/or protect in place strategies (Rate of Spread based).
2. Effective suppression capabilities (Flame Length based).
3. Efficient point protection and/or perimeter control strategies (Rate of Spread and Flame Length based).

Scientifically derived modeling is the primary tool utilized to provide the requested speed and intensity values. Traditionally, modeling products are segregated into the following:

1. Deterministic- "Where and when will the fire likely advance?" (Perimeter and/or Paths of Spread)
2. Probabilistic- "How likely is it that the fire will advance to a specific point?" (Percentage Based Probability Zones)

The quality of actionable intelligence derived from modeling is only as good as the quality of the modeling inputs. The standard practice for quality modeling inputs is as follows:

1. Acquire quality datasets from recognized sources.
2. Critique the datasets for accuracy and completeness.
3. Edit the datasets to create meaningful inputs.

IV. Recommendations

Members of the FIRESCOPE Predictive Services Committee possess the requisite qualification-based experience to participate in nationally accepted, operational decision support structures; and are correctly recognized as subject matter experts in their respective fields. Collectively, the group has extensive understanding of the needs of the end user and insight into best practices relating to existing platforms, emerging technologies and formalized training. The following section represents recommendations for FIRESCOPE member organizations when considering their decision support system needs.

1. **To choose the correct decision support tool, you need to clearly understand your decision support needs.** Only when you fully comprehend your decision support problem, can you accurately identify your decision support answer. Defining the exact question you want answered is the first step in selecting a decision support tool or system, and will allow you to customize the most appropriate product to meet your needs. If there are questions regarding the applicability of potential deliverables, reach out to known subject matter experts in your area, specifically your local Geographic Area Coordination Center (GACC) and members of the FIRESCOPE Predictive Services Committee. These valuable resources can assist you in framing the right question, to secure the right answer. In doing so, you can avoid the pitfall of placing "blind trust" in flawed outputs; simply due to a lack of familiarity with the principles of decision support modeling.

2. **To choose the correct decision support modeling tool, the assumptions and limitations of the model need to be clearly articulated.** Every model has assumptions and limitations built into their resultant "representation of reality". Having a basic understanding of these design concepts is critical since they impact the precision of subsequent deliverables. Assumptions and limitations not clearly articulated, commonly lead to false conclusions by the end user. If your potential supplier of a decision support suite is unwilling, or unable, to explain the strengths and weaknesses of their model, an informed decision cannot be harvested from their tool. Remember, modeling technology only supports decisions. It doesn't make them.

3. **To choose the correct decision support modeling tool, you need to know the quality and completeness of the input data.** All decision support models and systems are dependent on the quality and completeness of their input data. Any potential supplier of a decision support suite should have a strong working knowledge of how their input data is acquired, critiqued, and edited. These are mandatory steps before data is ingested into any tool. It is also important to identify the location where your data is captured from. Knowing the reliability of your input data source beforehand will help you choose a decision support system which is responsive and resilient when you need it most. Again, if the potential supplier of a decision support suite is unwilling, or unable, to explain the resolution, extent, and sources of their input data, an informed decision cannot be garnered from their tool. Remember, "Garbage in, Garbage out."

4. **To choose the correct decision support modeling tool, you need to know the specific, relevant qualifications and experience of the modeler.** To skillfully perform *Fire Weather, Fire Danger,* and *Fire Behavior* decision support, an adept practitioner successfully balances the concepts of modeling with the context gained from practical field experience. In contrast, inexperienced and/or untrained modelers often mistake luck for skill. Unfortunately, technology can be used to hide limited training and experience. Knowing these truths, it is imperative that the end user of any decision support product authenticate the qualifications of the producers of these products. Credentials are suspect if they are not in alignment with the accepted NWCG/CICCS standards for *Fire Weather, Fire Danger,* and *Fire Behavior* education, training and experience. Understand that well intentioned "Technicians" and/or "Specialists" can lack either the aforementioned conceptual or contextual background to provide intelligence that is safe and/or actionable and often cannot establish a satisfactory confidence scale when explaining their modeling results. Known subject matter experts in your area, specifically your local Geographic Area Coordination Center (GACC) and members of the FIRESCOPE Predictive Services Committee, can help expand your understanding of the strengths of a potential decision support providers' stated qualification. It is always prudent to consult in-house legal guidance on the consequence of utilizing any non-validated decision support system; whether research based, experimental or anecdotal.

5. **To choose the correct decision support modeling tool, you must ensure technical support is available, and meets your needs.** Prompt**,** available technical support is a key component to a robust decision support system. By defining your individual technical support needs early in the selection process, you will quickly narrow the field of potential decision support suppliers. It is also important to understand where your support is physically located. Knowing whether that site is staffed locally with the physical hardware, or running remotely, will provide additional guidance for your choice. Similarly, investigate if the levels and methods of support you desire are available. Will support be automated or in person? Will support be available by phone or online? Is there redundancy in the technical support operation during times of increased activity? Is support available 24 hours a day, 7 days a week? These factors will commonly solidify a choice in providers.

6. **To procure the correct decision support modeling tool, identify and mitigate any potential conflicts of interest.** Providing *Fire Weather, Fire Danger,* and *Fire Behavior* decision support has quickly matured into a multimillion-dollar business venture. Financial conflicts of interest, or the appearance of, are required to be disclosed to meet the mandates contained in the California *State Leadership Accountability Act (SLAA)*. Government Code sections 13400 through 13407 were enacted to reduce the waste of resources and strengthen internal control. SLAA requires each state agency to maintain effective systems of internal control, to evaluate and monitor the effectiveness of these controls on an ongoing basis, and to biennially report on the adequacy of the agency's systems of internal control. Transparency during the selection process will assist in ensuring compliance.

VI. Conclusions

Technology can be a "force multiplier"; bridging timely information and correct action. By applying sound principles in *Fire Weather, Fire Danger,* and *Fire Behavior* decision support through fact-based risk management; limited training and experience can be overcome; ultimately supporting safe and efficient operations. Always "ground truth" any technology before assimilating research into policy; and policy into subsequent practice. For questions regarding the recommendations contained in this document, reach out to the highly qualified, multi-disciplinary subject matter experts on the FIRESCOPE Predictive Services Committee and your local GACC.

Appendix

Fire Weather, Fire Danger, and *Fire Behavior*

Decision Support Systems- Selection Checklist

Agency Specific Considerations

- ⎦ Accurate Evacuation and/or Protect in Place Strategies
- ⎦ Effective Suppression Capability Thresholds
- ⎦ Efficient Point Protection and/or Perimeter Control Strategies
- ⎦ Fire Danger Decision Thresholds
- ⎦ Fire Weather Decision Thresholds

Products Desired

- ⎦ Fire Perimeters (Temporal/Spatial)
- ⎦ Fire Flow Paths (Temporal/Spatial)
- ⎦ Fire Behavior Characteristics
  - ✓ Flame Length
  - ✓ Rate of Spread
  - ✓ Crown Fire Potential
- ⎦ Fire Impact Probability
- ⎦ Fire Danger Adjective Ratings
- ⎦ Fire Weather Warnings

Modeling Program Characteristics

- Assumptions of Model
- Limitations of Model
- Data
  - ✓ Acquisition Method
  - ✓ Critique Method
  - ✓ Editing Method

Relevant Qualifications

- Education
  - ✓ Fire Weather-Meteorology Degree
  - ✓ Fire Danger- S491, S491(Advanced)
  - ✓ Fire Behavior-S290, S390, S490, S490, S495, S590
- Training
  - ✓ Fire Weather- Peer Reviewed
  - ✓ Fire Danger- Peer Reviewed
  - ✓ Fire Behavior- Peer Reviewed
- Experience
  - ✓ Fire Weather-NWS, GACC, Operational Forecasting
  - ✓ Fire Danger- GACC, Fire Danger Operating Plan (Production/ Implementation)
  - ✓ Fire Behavior-Wildland Fire Suppression, IMT, Operational Forecasting
- NWCG/CICCS Qualification
  - ✓ FBAN (Fire Behavior Analyst)
  - ✓ LTAN (Long Term Analyst)
  - ✓ IMET (Incident Meteorologist)
  - ✓ SITL (Situation Unit Leader)
  - ✓ IRIN (Infrared Interpreter)
- Fireline Qualified

Technical Support

- Location
  - ✓ Onsite
  - ✓ Local
  - ✓ Remote
- Method
  - ✓ Automated
  - ✓ Phone
  - ✓ Online
- Availability
  - ✓ Times
  - ✓ Days
  - ✓ Surge Capacity