FLORIDA'S FIRE MANAGEMENT INFORMATION SYSTEM

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EXTENDED ABSTRACT

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INTRODUCTION

The Florida Fire Management Information System (FMIS) is a tightly integrated set of applications that handle the data input, processing and reporting needs of work undertaken by the Florida Division of Forestry (DOF), including:

- Open Burning Authorizations
- Responding to wildland fires and other incidents
- Recording law enforcement actions taken by DOF personnel

By integrating these functions into a single system and storing the data in a single relational database, the DOF has eliminated duplicate data entry and reduced paperwork, while at the same time increasing the amount and quality of information being recorded and reported about incidents, open burning authorizations, law enforcement actions, fire danger and many of the day-to-day operations of the DOF.

Every incident, regardless of type is recorded by the application as they occur. The types of incidents the Florida Division of Forestry responds to include such things as wildfires, open burning/smoke complaints, on site inspections, and illegal burns as well as others. These incidents are recorded as they occur, which allows for unprecedented access to all of this information as it happens at the local and statewide levels. This has required the agency to modify some of its business rules and their application to our day-to-day work.

FMIS MOTIVATION AND HOW IT IS USED

The population of the state of Florida is one of the fastest growing in the US. This is taking place in a region that has had a long connection with fire in its wildlands. Published observations showing the necessity of fire are abundant. Early accounts include one by Mrs. Ellen Call Long of Tallahassee Florida who described her observations regarding southern forests in 1889 stating:

> The annual burning of the wooded regions of the South is the prime cause and preserver of the grand forests of *Pinus Palustris* [longleaf pine] to be found there; but for the effects of these burnings . . . the maritime pine belt would soon disappear and give place to a jungle of hardwood and deciduous trees. . . The statute books of almost every southern state contain enactments prohibitory of setting fires to the woods, and severe penalties are attached to violation of the law. There may be sound reason for such legislation, since great loss of property often results from burning fences and buildings. But viewed from a forestry standpoint we believe that total abolition of forest fire in the South would mean the annihilation of her grand lumbering pineries. (Biswell 1989, p.82)

The Florida Division of Forestry (DOF) has the responsibility to walk this fine line of fire management in a time when the application of fire and the resulting smoke can, if not properly handled, have a negative impact that can threaten public health and safety. In this circumstance, if the state is to protect the public, it is necessary to have the most accurate information available. FMIS allows our dispatch centers to quickly assess a request to burn, determine what infrastructure points might be threatened by a reported wildfire and select the closest appropriate equipment, and then follow up on any action taken by the DOF on these incidents so that Florida's public receives the type of service that manages our wildlands while protecting public safety.

Not all of the information supplied to the FMIS database comes through the communication centers. Some of the data is supplied by personnel that were on scene during wildfire. In addition to data entry, FMIS also has a reporting system that are both tabular and GIS based. The application in the communication's centers resides locally (desk-top) and is updated each time the users access the central database in Tallahassee. The field application and the reporting system is web based and is accessed either by a local area network or through a dial-up connection. All incidents are initiated through the desk-top application, this includes the issuance of authorizations to burn. Most authorizations to burn are requested over the phone or the radio, however authorizations for burning sugarcane are placed via the Internet, and then approved by the communication center in Ft. Lauderdale. Once the request has been received, the authorization approval process is the same statewide.

SMOKE MODELING IN FMIS

Smoke screening should be an integral part of the planning process for all prescribed burns. Smoke from prescribed fires has caused serious accidents resulting in fatalities and significant property damage; resulting in rather poor public relations for prescribed fire. FMIS seeks to implement a baseline level of smoke screening for every prescribed burn conducted within the state to help minimize threats to life and property.

FMIS provides a smoke screening component for all burn authorizations to assess potential visibility hazards resulting from the smoke from prescribed burns. An additional component is designed to track the potential impact of nuisance ash from the burning of sugar cane fields in the southern part of the state. While FMIS does provide a baseline screening tool that emphasizes hazards due to reduced visibility, there are other aspects of smoke screening that are left to the burner (screening for health and/or air quality concerns.

In the original FMIS prototype system all smoke screening was handled by VSmoke (Lavdas, 1996) and sugar cane ash was handled by AshFall (Achtemeier, 1998). Using hourly weather data from the MM5 weather forecast model, hourly plumes (isopleths of surface visibility) were constructed by VSmoke that were then intersected with a GIS layer of smoke sensitive features (i.e. roads, airports, hospitals, schools). If a plume intersected a smoke sensitive feature, supervisor approval was required to approve an authorization. The AshFall model, a lagrangian particle model representing the trajectory of ash particles from sugar cane burns, was never integrated into the prototype due to source code incompatibilities.

The prototype system using these two models suffered from two primary limitations. First, time varying meteorology was not handled well by either model as each hour of the simulation had to be considered as an independent model run, increasing computational overhead. Second, incompatibilities in the source code of each model and the FMIS application rendered the code difficult to manage, making the simplest changes to the FMIS application difficult to code and test.

A new smoke modeling component for FMIS was designed to address these limitations. This new system would be designed to work seamlessly with varying weather conditions and would present a consistent interface to the core FMIS application for both smoke plumes and ash plumes. This new smoke screening component would be implemented as a web service, allowing the core functionality to be used in FMIS as well as in other future applications.

The primary component of the new smoke modeling component is the trajectory component of HySplit (HYbrid Single-Particle Lagrangian Integrated Trajectory) first described by Draxler (1992) which has been used successfully in studies of volcanic ash plumes (Heffter and Stunder, 1993) and forest fires (Sapkota et al 2005). Trajectories are created every hour starting at 3 levels above the burn site: surface, half of the mixed layer depth and at the top of the mixed layer. Along each trajectory the perpendicular spreading of the plume is determined using a gaussian distribution following the methodology of VSmoke (Lavdas, 1996) with initial emissions calculated using CONSUME (Ottmar et al., 1993). A polygon representing the 300 $\mu g\ m^{-3}$ ground level concentration of PM2.5 is constructed and returned to FMIS for intersection with layers containing smoke sensitive features. The choice of a PM2.5 concentration of 300 $\mu g\ m^{-3}$ was chosen to provide some level of buffer around a concentration associated with visibility reductions of approximately three quarters of a mile, 500 $\mu g\ m^{-3}$ (Therriault and Smith, 2001).

Sugar cane ash is also handled by HySplit in much the same manner as smoke. The primary change is in the size and fall speeds of the particles used. Following the work of Achtemeier (1998) initial vertical velocities and terminal velocities are assigned for a representative particle, this particle is then transported in a 2-dimensional (height-distance) plane using the forecast weather information to determine how far along the HySplit trajectories ash is likely to travel. The motivation for this approach over calculating an isopleth revolves around the lack of any definable ash concentration for use in defining an ash nuisance.

The smoke modeling component of FMIS supplies the Florida Division of Forestry personnel with a quick way to determine potential hazards from prescribed fires as an integrated part of their authorization process. The modular nature of the system allows the same modeling component to be used by prescribed burners through an internet-based screening tool provided by the Division of Forestry at their web site (http://www.fl-dof.com).

THE FUTURE

Florida's ability to maintain and improve fire protection services to meet public demand requires the integration of ecosystem management and fire protection into a comprehensive approach to fire management. The interaction between population density, ownership, and vegetation creates a vast array of fire management environments, each of which requires a customized fire management strategy comprised of prescribed fire, wildfire suppression, and post-fire management options. The successful implementation of these strategies depends upon active participation by citizens, local government, and the private sector, with an obvious increased emphasis on prescribed fire management.

Managed fire in our wildlands tends to polarize our population. Many of those that find themselves on the side of managed fire, sometimes tend to go too far, supporting the idea that ALL fire is good. While those on the other say that ALL fire is bad. The bottom line in this argument is that both are wrong, fire is not good or bad, it simply is, and most probably will be, so we must find ways to manage it responsibly.

Florida's Fire Management Information System is an important tool in maintaining this delicate balance. We do not maintain that FMIS is perfect, after all FMIS depends on mathematical models to produce the displayed outputs. As with all such tools it is critical that the persons on the receiving end understand the power and the limitations of this tool and act accordingly. At this time this system presents the best solution to assisting the state of Florida and the land management community in their decision making process. However, even armed with this new technology defining responsibilities and

procedures, prescribed burners should remember the old saying, “Fire and smoke are the responsibility of the burner — no matter where they go.”

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Bio-Sketch Jim Brenner

Graduate of the Pennsylvania State University in 1974, post-graduate work done at the University of Warsaw and Leningrad between 1976 and 1981. Started work with the Division of Forestry in 1981 as a ranger in the Bunnell District. Promoted in 1982 to the Palm Beach County Forester position. Promoted in 1984 to the Division of Forestry Planner position located in Tallahassee. Promoted in 1985 to the Law Enforcement and Fire Prevention Coordinator in the Forest Protection Bureau. Reassigned to the Fire Management Administrator Position in 1988 where I have served to this date. Major accomplishments include writing the Florida Prescribed Fire Act FS 590.125(3), development of the fire season severity forecast based on the El Nino Southern Oscillation, development of the Inter-Agency Basic Prescribed Fire Course and currently working on the new GIS based Fire Management Information System for the state of Florida and the Florida Risk Assessment Analysis. Surviving four hurricanes in one year.