Fire Research in the New Jersey Pine Barrens

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I. Introduction

A multi-disciplinary research program to enhance fire research in New Jersey and the East has been re-established at the Silas Little Experimental Forest, New Lisbon, NJ. The mission is to provide better tools for predicting fire danger, fuel loading and air quality to fire managers at multiple scales.

Twenty-two percent of New Jersey's land area (1.1 million acres, Fig. 1) is occupied by the pine barrens, a volatile combination of pitch pine and scrub oak vegetation that historically burned every 25 years, with large (100,000+ acre) fires common prior to fire suppression practices.

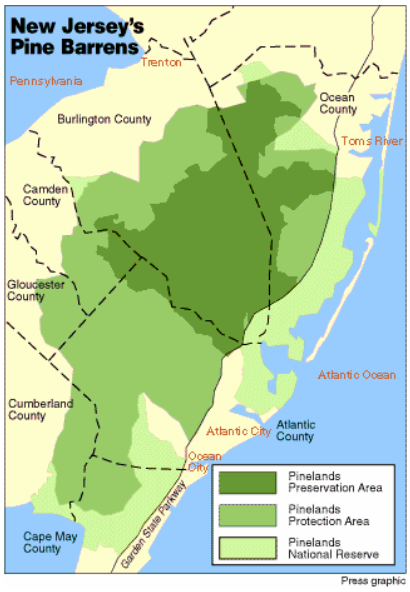

Fig. 1. New Jersey Pine Barrens

As part of the USDA Forest Service research efforts in New Jersey, we developed an integrated regional network of ground plots, meteorological stations, above-canopy atmospheric sampling towers(Fig. 2), SODAR towers, remote sensing data layers, and validated weather and forest ecosystem models. This provides the basis for a "model forest" system with the infrastructure and tools to address fire management issues at multiple scales. This framework has been extended to parallel studies in eastern coniferous forests for central Florida, Long Island, North Carolina and Wisconsin.

This paper provides the background and an overview of the interdisciplinary studies and monitoring started in 2002 to support National Fire Plan (NFP) research in the East. Research products and applications are described, including: real time fire weather indices, mesoscale fire weather modeling, vegetation mapping efforts and annual productivity estimates. This program incorporates the latest science-based knowledge into decision support tools at the local to regional scales.

Fig. 2. Above canopy flux towers in the NJ pine barrens used for monitoring fire weather, and CO_2, H_2O, energy budgets

2. Regional fire weather and climate modeling

Fire managers have identified the need for a reliable fire danger rating system for the Eastern coastal plain. The National Fire Danger Rating System (NFDRS) does not meet the needs of the wildfire managers in this region of the eastern U.S. As part of the National Fire Plan (NFP), we established a network of six canopy-level and understory meteorological towers for improved fire weather monitoring in the New Jersey Pine Barrens. Meteorological data from these towers are sent by wireless modems to the New Jersey State Climatologist Office, for posting on their website making this information accessible to fire managers and researchers in real time. (http://climate.rutgers.edu/stateclim/

Prediction of fire weather indices, using high resolution MM5 modeled forecasts, are available on an operational basis for this region through the Eastern Area Modeling Consortium (http://www.fs.fed.us/fcamms , Heilman, et. al, 2005). Case studies like the 2002 Jake's Branch Fire showed the ability of these regional MM5 to predict potential fire weather (48 hrs, Fig.3).

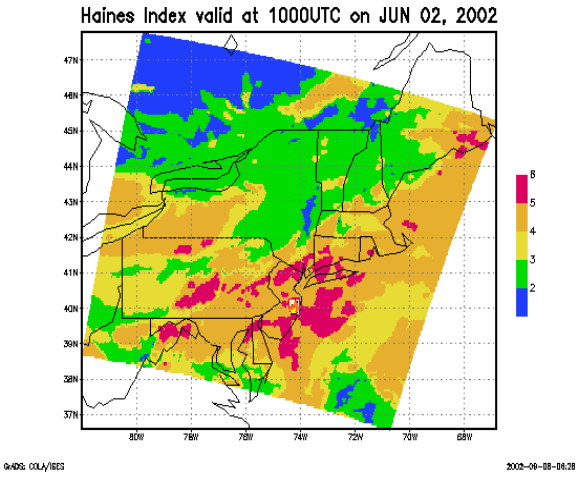

Fig 3. Haines Index during the period of the Jake's Branch Fire. It is an example of one index fire managers use to assess potential fire behavior.

We have completed construction of a SODAR (acoustic radar) tower to support the validation of the fire weather predictions from the EAMC MM5 mesoscale modeling (Charney, et. al, 2005).

We have developed a new fuel moisture model based on stand structure, fuel loading, and energy balance that is driven using data from the meteorological network. This is being tested at five Ameriflux tower sites in the East (Clark, et. al., 2005)

3. Forest productivity, biomass and fuel mapping

The Eastern LANDFIRE Prototype was initiated in 2004 to enhance the National LANDFIRE effort by developing fire regime maps that accurately characterize historical frequency, severity, and pattern of fire at multiple scales in the East. This effort complements the ongoing efforts of LANDFIRE-US , to provide a cohesive and consistent national fire management strategy for the conterminous United States (Ryan, et. al., 2005). The Eastern Prototype region utilizes 3.6 million ha that includes the contiguous region made up of the Delaware River Basin Watershed (DRB) in the states of PA, NJ, DE and NY, and the New Jersey Pine Barrens Management Area.

Biometric measurements from field plots and use of LIDAR for biomass and fuel structure will validate LANDFIRE models and products for the region. We compared forest productivity estimates at different scales with MODIS satellite estimates of net primary productivity (NPP), with predictions with our forest ecosystem models, eddy flux estimates of NPP, and forest inventory data (FIA). It was determined that MODIS (MOD17) overestimated NPP in the conifers and underestimated NPP in the deciduous hardwoods for the eastern prototype region. We were able to correct the overestimates in conifers, but the deciduous forests in the model may need to be re-parameterized for the East (Pan, et. al., 2005).

LIDAR was flown over 500,000 acres on 1 km flight lines, to look at fuel structure and standing biomass. We are currently validating the LIDAR estimates of standing aboveground fuel structure and biomass against FIA survey data for the region (Skowronski, et. al., 2005).

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4. Air quality

The current network of towers monitoring climate, carbon, water and energy flux, can be used to monitor smoke emissions and carbon flux from wildfires and prescribed burns, to determine the best management practices for reducing hazardous fuels, maintain cleaner air, and increase carbon sequestration following fire disturbance.

The NJ Department of Environmental Protection and the Rutgers Coastal Ocean Research Lab, are conducting pollen and the sea breeze effect on human health at the NJ shore. Pollen and PM2.5 samplers will be placed on existing fixed towers and a mobile SODAR unit with crank up met tower on trailer has been equipped and tested to provide more extensive regional sampling.

In support of our efforts to determine the source area that influences our eddy flux tower measurements, the DOE Brookhaven National Labs will be conducting PFT tracer studies at our sites. These tracers can also be used to validate smoke emissions transport models, and changes in turbulence from burned and disturbed sites.

5. Conclusions

A multi-disciplinary research program to enhance fire research in New Jersey and the East has been re-established at the Silas Little Experimental Forest. With NFP support starting in 2002, we have been able to provide better tools for predicting fire danger in NJ and East**,** map fire regimes and fuels for management, and monitor air quality in this problematic part of the country. We wish to develop and strengthen research partnerships with fire and air quality cooperators and customers across the region.

6. References

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7. Biography

Dr. Hom is the Deputy Program Manager with the USDA FS Northern Global Change Research Program. He is the PI for the National Fire Plan fire danger rating research in the Pinelands of New Jersey and for the NFP Eastern LANDFIRE Prototype fire mapping effort. He is conducting research on forest productivity and remote sensing in the Delaware River Basin for NASA, carbon uptake in suburban regions with the Baltimore LTER “urban” flux tower, and respiration under the interactive effects of elevated CO and ozone at the Aspen FACE site. Prior to the Forest Service, he did research on soil warming in permafrost ecosystems in Alaska and developing a biomass energy program using chaparral in California.