Predicting Prescribed and Wildland Fire Smoke, Emissions, and Fire Characteristics in Deep Organic Soils

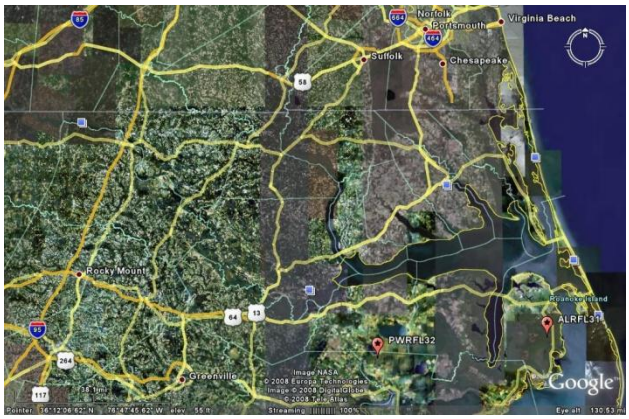
JFSP project—PI: Bob Mickler (Alion Science and Technology); Co-PIs: Miriam Rorig (USFS AirFire) and Chris Geron (EPA)

Project Summary

- The management of prescribed and wildland fire on federal, state, and private lands with deep organic soils pose critical challenges for ecosystem management, smoke dispersion, and the protection of private property and human life. We are characterizing fuel and fire effects in representative sites with deep organic soils in Virginia and North Carolina. The project objectives are to: (1) Determine the relationships between meteorology, soil characteristics, litter/duff moisture, micro-topography, and fire behavior in the ignition, flaming, smoldering, and extinction combustion stages; (2) Quantify pre- and post-burn below- and above-ground biomass to determine fuel characteristics and consumption for fine and coarse woody material, shrub, herbs, litter, and duff; (3) Characterize photochemically/radiatively important trace gases during combustion stages of prescribed and wildland fires; and (4) Provide land mangers with decision support tools for managing prescribed and wildland fire and assessing ground fire risk on deep organic soils.

Initial field work on the project during the past year resulted in a variety of data, including the response of the duff layers to changing weather parameters in several differing environmental regimes in North Carolina. These varying vegetative regimes included locations within the Alligator River National Wildland Refuge and the Pocosin Lakes National Wildland Refuge.

- Alligator River National Wildland Refuge (ARNWR)
  - This weather and duff moisture station was set up in the canopy across the drainage ditch, on Long Curve Road, south of Littlefield Road on the ARNWR.
    - Station location specifics: 35° 44.886’ N, 75° 47.720’ W; elevation 6 feet ASL
    - See http://www.fws.gov/southeast/pubs/All_river_tearsheet.pdf for a general map of the ARNWR; also view the Google map to the right which shows approximate locations for both stations in the lower right part of the map (ALRFL31 for the ARNWR site and



PWRFL32 for the PLNWR site)
        - Site pictures
    - Site data
        - Alligator River NWR data (mid-December 2008 through mid-May 2009)—Excel spreadsheet
    - Sample plotted data (**Note: all data times shown are EST**)
        - Alligator River soil moisture probes A, B and D located in the same soil pit at varying depths)
            - Hourly soil moisture probe A and Precipitation (probe A located at the top of the Oa horizon, just below the litter layer. The litter layer is about 2.5 inches deep, so the probe is about 2.5 inches from the surface)
            - Hourly soil moisture probe B and Precipitation (probe B located 8.5 inches from the surface (6 inches into the Oa horizon)
            - Hourly soil moisture probe C and Precipitation (probe C located in a separate location in a hummock next to a pond pine)
            - Hourly soil moisture probe D and Precipitation (probe D located 14.5 inches from the surface (12 inches into the Oa horizon)
            - Soil temperature A probe located 2.5 inches deep (top Oa horizon, next to SM-B) (Not plotted)
            - Soil temperature B probe located 8.5 inches deep (6 inches below top of Oa horizon, next to SM-A) (Not plotted)

- Pocosin Lakes National Wildland Refuge (PLNWR)
    - This weather and duff moisture station was set up in an open area within the burn unit (no trees, mainly shrubs) near the middle of the PLNWR (see map above).
        - Station location specifics: 35° 40.856' N 76° 31.806' W; elevation 10 feet ASL
        - See http://www.fws.gov/southeast/pubs/pscosin_map.pdf for a general map of the PLNWR
    - Site data
        - Pocosin Lakes NWR data (late October 2008 through early March 2009)—Excel spreadsheet
    - Sample plotted data
        - Pocosin Lakes soil moisture (SM) probes A, B and D located in the same soil pit at varying depths, with Soil temperature probe A (ST-A) located next to SM-A and ST-B adjacent to SM-B; SM-C was located in a hummock at the base of some small shrubs)

- Hourly soil moisture probe A, soil temperature A and precipitation (probe A located at the top of the Oa horizon, just below the litter layer. The litter layer is about 1 inch deep, so the probe is about 1 inch beneath the surface)
- Hourly soil moisture probe B and Precipitation (probe B located 7 inches from the surface (6 inches into the Oa horizon)
- Hourly soil moisture probe C, RH and Precipitation (probe C located in a separate location in a hummock next to some small shrubs; RH sensor located about 2m above ground)
- Hourly soil moisture probe D and Precipitation (probe D located 13 inches from the surface (12 inches into the Oa horizon)
- Hourly soil moisture probe A, fuel stick moisture and precipitation (10-hr fuel stick moisture located approximately 6 inches above ground)
- Hourly soil moisture probe C, soil temperature B and precipitation (Soil temperature B probe located next to SM-C in the "hummock")
- Hourly soil temperature A, air temperature, and precipitation (air temperature sensor located about 2m above ground; soil temperature A probe located 1 inch deep (top Oa horizon, next to SM-A)