

Rx-CADRE (PRESCRIBED FIRE COMBUSTION—ATMOSPHERIC DYNAMICS RESEARCH EXPERIMENTS) COLLABORATIVE RESEARCH IN THE CORE FIRE SCIENCES

D. Jimenez,^{1*} B. Butler,¹ K. Hiers,² R. Ottmar,³ M. Dickenson,⁴ R. Kremens,⁵ J. O'Brien,⁶ A. Hudak,⁷ and C. Clements⁷

¹ U.S. Forest Service, Missoula Fire Sciences Laboratory, 5775 Highway 10 W, Missoula, MT 59808, USA. *Corresponding author (djimenez@fs.fed.us)

² Jackson Guard, Eglin AFB Natural Resource Branch, 107 Highway 85 N, Niceville, FL 32578, USA

³ U.S. Forest Service, Pacific Wildland Fire Sciences Lab, 400 N. 34th Street, Suite 201, Seattle, WA 98103, USA

⁴ Rochester Institute of Technology, Center for Imaging Science, 54 Lomb Memorial Drive, Rochester, NY 14623, USA

⁵ U.S. Forest Service, Center for Forest Disturbance Science, 320 Green Street, Athens, GA 30602, USA

⁶ U.S. Forest Service, Moscow Forestry Sciences Lab, 1221 South Main Street, Moscow, ID 83843, USA

⁷ San Jose State University, Department of Meteorology, One Washington Square, San Jose, CA 95192, USA

ABSTRACT

Question: Describe the Rx-CADRE project.

Background: The Rx-CADRE project was the combination of local and national fire expertise in the field of core fire research. The project brought together approximately 30 fire scientists from six geographic regions and seven different agencies. The project objectives were to demonstrate the capacity for collaborative research by bringing together individuals and teams with a wide range of fire monitoring expertise and equipment from across the United States and Canada in order to instrument prescribed burns in the southeastern United States. A concurrent workshop was organized that brought fire and fire effects modelers into the mix, creating the linkage between data generation and data use for fire and fire effects model validation and development. The group documented fire-atmospheric dynamics on prescribed fires in southern pine (*Pinus palustris*) woodlands of varying size, ranging from 10 to 1,000 ha. Specifically, we 1) compared in situ and remote-sensed heat environments of prescribed burns, 2) documented coupled atmospheric interactions, 3) produced validation data sets for coupled fire-atmospheric dynamic models, and 4) related fire behavior to first-order fire effects. On the fully instrumented fires, the group collected data on pre-burn fuel loads, post-burn consumption, ambient weather, in situ convective dynamics, plume dynamics, radiant heat release (both from in situ and remote sensors), in situ fire behavior, and select fire effects.

Location: Florida panhandle and southwestern Georgia, USA.

Methods: Six prescribed burns were fully instrumented with in situ, remote sensed, and real-time weather observation equipment over a period of 6 days at Eglin Air Force Base outside of Pensacola, Florida, and the Jones Ecological Research Center in Ichauway, Georgia. The collaborative effort allowed for a detailed understanding of fire behavior with relation to fuels consumption and monitored fire effects. The Rx-CADRE experiments brought together diverse fire research backgrounds into a concentrated field effort. Research correlating fire behavior (both in situ and remotely sensed) with fire effects, fuels consumption, and emissions sampling were conducted seamlessly and repetitively on each of the burn units. Fire behavior collected data with multiple in situ fire behavior sensor packages, wireless trigger cameras. Infrared (IR) cameras were used to calibrate the in situ fire behavior data. Fuel plots were systematically located in a two-chain (132 feet) grid in each of the units. Plot centers were marked, flagged, and numbered. Organic material, including grass, downed woody material, and litter, was collected before and after the fire. Moisture samples were also collected before each burn. Post-fire effects quantified cover fractions of soil, ash, litter, and vegetation in twenty 1-m² plots arranged systematically within each prescribed burn block. These plots were co-located with the fuel consumption plots. Aerial IR sensing was used to characterize the time course of heat release over entire burn units. Ground-based IR sensors were used to calibrate the aerial imagery. Real-time atmospheric interactions were conducted by measuring the micrometeorology and turbulence of fire-induced circulations. Additionally, some air quality measures, including PM_{2.5} and CO₂ concentrations, were measured in the plumes.

Results and Conclusions: The Rx-CADRE experiments demonstrated the ability for collaborative and coordinated prescribed fire field research, which is a success in itself. The experiments were conducted repetitively and safely at each of the six individual burn units. The logistics associated with organizing experiments at this scale are monumental, and the success record is unsurpassed for field burns. A data collecting meeting is scheduled for fall 2008 and will also cover the preplanning process for subsequent follow-up burns in spring 2009.

keywords: fire behavior, fire effects, fire weather, Rx-CADRE.

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