Modeling Biomass Consumption in Fires for Shrub and Forested Lands of the United States, Cerrado, and Tropical Forests of Brazil

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Summary

Objectives

- Develop new, modify and improve existing fuel consumption models for ecosystem types where there is:
  - Limited knowledge
  - Increased wildland fire expected
  - Emphasis on shrubs
- Incorporate new models in Consume 3.0, a software program to predict biomass consumption in prescribed and wildfires in forests, grasslands, and shrublands where fire is a critical component.
- Extend Consume algorithms for tropical ecosystems of Brazil (Cerrado and Amazon forest)

Results/Discussion

- Fuel consumption has the second largest error, after fuel loading, in estimating smoke emissions from biomass burning. It is the key to all effects from fire including smoke emissions.
- Predictive models derived from operational prescribed fires and wildfires are being developed to estimate woody fuel, shrub, grass, and forest floor reduction during wildland fire for natural fuels.

FERA and Brazilian collaborators have developed a standard set of field and laboratory sampling protocols to measure preburn biomass and fuel consumption in flaming and smoldering combustion throughout the United States and the Cerrado and Amazon forest in Brazil. These sampling techniques include:

- line intersect for dead biomass inventory
- clipping and weighing for grasses, herbs, and shrubs
- wiring logs for diameter reduction in natural fuels and slash
- metal nails to measure duff and moss reduction
- ocular and camera technology to determine smoldering consumption rate of stumps, logs, and forest floor.
- laboratory burns of instrumented logs to determine consumption rates by combustion phase

Biomass consumption findings include:

- woody fuel moisture and curing relates to woody fuel consumption for sound logs
- forest floor fuel moisture content relates to flammability of forest floor and large rotten logs
- live fuel moisture, wind speed, and temperature relates to flammability of shrubs.
- additional data collection and analysis is being conducted to improve robustness of equations for extremely wet or dry fuels.
- algorithms are being developed for Consume 3.0. They are being tested in the tropics.
- FERA holds an extensive data set that has been collected from a large number of operational and experimental prescribed and wildfires across the United States and Brazil

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