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TITLE: Fire and Carbon Cycling for the Yellowstone National Park Landscape

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Biogeosciences (B)

CURRENT SESSION: B05. Carbon Dynamics in Fire-Prone Forests

AUTHORS (FIRST NAME, LAST NAME): Michael G Ryan[1], Daniel M Kashian[2], William H Romme[3], Monica G Turner[4], Erica A H Smithwick[5], Daniel B Tinker[6]

INSTITUTIONS (ALL): 1. Rocky Mountain Research Station, USDA Forest Service, Fort Collins, CO, United States.
2. Department of Biological Sciences, Wayne State University, Detroit, MI, United States.
3. Dept artment of Forest, Rangeland, and Watershed Stewardship, Colorado State University, Fort Collins, CO, United States.
4. Department of Zoology, University of Wisconsin, Madison, WI, United States.
5. Department of Geography, The Pennsylvania State University, University Park, PA, United States.
6. Department of Botany, University of Wyoming, Laramie, WY, United States.

Title of Team:

ABSTRACT BODY: Understanding how stand-replacing fires control release of carbon from forests is critical for predicting changes in carbon storage across large areas, particularly if climate change alters disturbance frequency. We used three approaches to assess how fire changes carbon storage for a landscape. First, we measured carbon storage and carbon accumulation rates along a replicated lodgepole pine chronosequence to provide essential data for modeling and landscape scale assessment. Second, we modeled how a change in fire frequency from the current 200-300 year return interval to a 100 year return interval would change carbon stored on the landscape under equilibrium conditions. Finally, we modeled the recovery of carbon storage from the 1988 fires. The chronosequence data show that the aboveground live carbon recovers to pre-fire levels remarkably quickly (in 50-80 years) and total carbon stocks (including dead wood, forest floor and soil carbon) also stabilize in 80 years. The dead wood in the stands burned in 1988 was substantially lower than the total of the live+dead wood in stands 80-300 years old in our chronosequence, even accounting for combustion losses. Modeling the effects of changes in fire frequency on landscape carbon storage showed that the carbon storage is very resistant to large changes in fire frequency. This resistance occurs because lodgepole pine regenerates prolifically, and because carbon stocks stabilize after only 80 years. Either fire frequency would need to be < 50 years, or regeneration would need to fail frequently for changes in fire frequency to cause substantial losses of carbon from the Yellowstone landscape.

INDEX TERMS: [1631] GLOBAL CHANGE / Land/atmosphere interactions, [0414] BIOGEOSCIENCES / Biogeochemical cycles, processes, and modeling.