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Dynamics of fires, harvest and carbon stocks in U.S. forests 1926-2017

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Human-fire interactions have always played an important role in the United States of America. Important processes include land clearing with fires in the course of agricultural expansion and development of the West during the 19th century, large-scale fire suppression in the first half of the 20th century and recent “mega-fire” events in California. Strong regional divergences occurred: Fire regimes in the Eastern U.S. were significantly altered due to settlement and land-use changes over the past 100 years, resulting in reduced severity of fire events. In the West the area extent and severity of wildfires has increased, especially in recent decades, arguably due to more frequent climatic extreme events. Although the historical fire narrative in the U.S. has been studied in numerous publications, the links between these developments and changes in the socio-metabolic system i.e., changes in resource use, and consumption, are to our knowledge less well understood.

In this study we investigate the influence of anthropogenic alteration of fire regimes on forest biomass Carbon stocks in comparison to forest uses, i.e., the extraction of woody biomass and forest grazing on multiple spatial scales. We develop a long-term reconstruction of biomass burned in forests on the national, regional, and state level based on statistical and remote-sensing data. We describe and examine historical differences between fire regimes in the Eastern and Western United States in connection with human use of forest for the period 1940-2017. Using panel data analysis, we investigate the diverse connection between forest change, socio-metabolic processes, natural disturbances (i.e., wildfires), and associated human fire control on various spatial and temporal scales. With this study we aim to contribute to a better understanding of the underlying socio-metabolic drivers and accompanying processes of altered forest fire regimes.