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Role of fire in biome-boundary shifts in Europe

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Recent studies have shown that climatic fire risk is projected to increase with future climate change due to increases in droughts and heat waves. In many fire regimes this trend translates into increasing area burnt, but recent analyses of fire statistics and other fire-related data have shown that climate fire risk is not always linearly related to area burnt or fire severity. This means that vegetation productivity, i.e. fuel production, or landscape fragmentation, e.g. through land-use and transportation routes, influence fire spread. Drier climate negatively impacts vegetation productivity, thus leading to less fuel load which further limits fire spread despite similar fire risk. The sensitivity of the affected vegetation also influences fire effects and post-fire mortality. Climate variability additionally contributes to the non-linearity of these processes, which is likely to change under future climate conditions. All these factors point to important feedbacks between vegetation and fire, which can be investigated using dynamic process-based vegetation-fire models such as LPJmL-SPITFIRE. We investigate the role of climate variability on European fire regimes, and if the interaction between climate variability and fire can be responsible for biome shifts under climate change conditions.

We apply LPJmL-SPITFIRE to future climate change scenario, 1) the WATCH-ERAI-REMO climate scenario which was run for the SRES A1B emission scenario to Europe and 2) the same climate scenario but with reduced climate variability. Here, we investigate the effects of climate variability and CO_2-fertilization on future fire regimes, vegetation dynamics and associated biome shifts. It is hypothesized that climate variability influences vegetation-fire interactions along biome borders, especially in Eastern Europe. Mediterranean countries are most likely to face fuel limitation, leading to a reduction in fire towards the end of the century. Transitions in vegetation composition leading to both types of trajectories will be examined.