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Linking space and time: ecological legacies of land use and natural disturbances

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Abstract. The long-term ecological effects of natural disturbance and past human land use have become increasingly apparent in ecology. Natural disturbances can produce enduring legacies of physical and biological structure that influence ecosystem processes for decades or centuries. Similarly, patterns of historical land use can affect contemporary forest composition and ecosystem processes long after the land use has ceased. Understanding such legacies is an important line of inquiry in contemporary landscape ecology. In forests of the southern Appalachian Mountains, USA, agricultural land use in the early 1900s is associated with reduced herbaceous species richness and abundance, which is particularly pronounced for long-lived herbs with limited dispersal; altered patterns of biomass allocation in herbaceous plants; reduced fine-scale variation in soil nutrients and nitrogen availability; and changes in soil microbial communities. In floodplain forests along the Wisconsin River, USA, past land use still influences forest and bird community composition. In the coniferous forest landscape of Yellowstone National Park, Wyoming, USA, natural stand-replacing wildfires produce a heterogeneous mosaic of stand structure and function that may persist for nearly two centuries. Following the 1988 fires, post-fire stand density varied widely (from 0 to > 500,000 stems/ha) in response to variation in pre-fire serotiny, elevation, and fire severity. Spatial variation in stand structure and function was detectable for at least 175 years in a chronosequence of stands. The legacies of past land use and disturbance can be remarkably persistent, and understanding how the past affects the present has important implications for ecosystems and landscapes.