Disturbance Interactions in the Greater Yellowstone Ecosystem: Time-series Analyses of Aerial Photography and Landsat Satellite Imagery

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Forest structure and composition are governed by dynamic processes, including disturbance events like bark beetle outbreaks and fire. In turn, forest disturbance and regrowth strongly influence terrestrial carbon flux. Quantifying the spatial and temporal variability of forest dynamics, disturbance, and carbon flux, and elucidating the factors that shape the patterns and trends we see across our landscapes remains a major challenge for science and land management alike. We hypothesize that historical land management practices, including fire suppression and grazing, have contributed to widespread conifer encroachment in parts of the Greater Yellowstone Ecosystem, which in turn has created favorable conditions, along with changing climate, for bark beetle outbreaks and high severity fire. However, the degree of interaction among forest dynamics and disturbance processes remains untested at broad spatial and temporal scales and is likely to vary considerably by forest type, disturbance regime, and biophysical setting. Therefore, we propose a synoptic and spatially expansive analysis that will leverage long term datasets (aerial photographs and satellite imagery). Coupled with recent innovations in remote sensing time-series analysis that improve our ability to map the timing and location of abrupt (e.g. fire, harvest) and chronic (e.g. insects, conifer encroachment) forest dynamics and disturbance events, these analyses will significantly advance understanding of interactions among forest dynamics and disturbance processes, with follow-on implications for the carbon cycle and the climate system.

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