Title: Post Disturbance Canadian Boreal Forest Reestablishment Trends using Landsat Time Series

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Fire disturbances affect large areas of the Canadian boreal forest each year, with impacted areas expected to increase under future climatic conditions. Forest fire disturbances can be monitored on an annual basis for disturbances using remotely sensed data to provide seamless, consistent, and synoptic reporting across multiple jurisdictions. While not mapped, the return of vegetation towards forest re-establishment following harvest is typically captured via field visits as a component of sustainable forest management practices. In contrast to harvesting, other forest disturbances (e.g., fire) are not necessarily subject to the same practices, with the return of forest vegetation not systematically captured. As a result, there is an opportunity to use remote sensing to track the return of vegetation following disturbance and to further inform on forest re-establishment trends over time. Our objective is to demonstrate the diversity of spectral trajectories that represent forest regrowth after stand replacing fire disturbances, first spatially over the Canadian Boreal and Taiga Shield ecozones, and then temporally using time series techniques. Landsat data products were acquired from the National Terrestrial Ecosystem Monitoring System dataset, providing a continuous and gap free Landsat surface reflectance dataset covering the entirety of both ecozones and temporally between 1985 and 2012, with an additional disturbance classification data layer. The spectral data were restricted to fire disturbances and spectral trajectories were tracked for five years post disturbance, grouping each year’s post disturbance regrowth trajectories together for each year from 1985 through 2007. Thus a time series of initial regrowth trajectories was created and then used to calculate spectral trajectory metrics. Spectral trajectory metrics indicate that forests overwhelmingly show signals of regrowth after disturbance; however, post disturbance spectral trajectories vary spatially and temporally across the Boreal and Taiga Shield ecozones. Regrowth metric differences between each ecozone are greater than the differences that are observable over time in each ecozone, though several years show concurrent trends within multiple ecozones. These results confirm the applicability of Landsat data to monitor large areas with high levels of detail and the utility of long annual time series to generate meaningful and unique
information. The spatial variability of post disturbance spectral trajectories may reflect the broader inherent differences between ecozones. However the temporal differences within each ecozone show the effects of a variable site conditions on disturbance events, and in particular how single large fire disturbance events can drive post disturbance spectral trajectories for a number of years after the initial disturbance.