Ground Beetle Response to Conventional and Natural Disturbance-Based Silvicultural Practices in Western Quebec

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Context:

Forests that are structurally complex are thought to be more resilient to disturbances than simpler, homogenous forests. This has led to a shift away from intensive clearcutting to an expanded list of management options which may better reflect natural disturbance dynamics. In managed forest ecosystems, the practical application of ecosystem resilience into conservation and forest planning is impeded by a lack of long-term data on recovery of biodiversity. We will be using ground beetles to assess resilience of biodiversity as they are highly diverse and reflect shifts in species composition more rapidly than vertebrate and plant species. I predict that 16 years post-harvest species abundance will have recovered to pre-disturbance levels at all treatments, however the species composition within the clear-cuts will remain significantly different than the uncut controls.

Purpose and Location:

The Silviculture et aménagement forestiers écosystémique (SAFE) experiment is designed to empirically test the efficacy of natural disturbance-based forest management for maintaining biodiversity and is located at the Lac Duparquet Teaching and Research Forest (LDTRF).

Experimental Treatments:

Three main treatments at SAFE were conducted during the winter of 1998-1999 and corresponded to different degrees of canopy openness (0, 33, 66, and 100% of the basal area).

Forest Type:	Treatments:	Natural Disturbance Simulated:
Mature aspen dominated with sparse conifer understory	**1**: 1/3 partial cut, small stems	Small stem senescence (competition)
	2: 2/3 partial cut, large stems	Large stem senescence
	3: Clear-cut, slash retained	Fire
	3.1: Clear-cut, slash burned	
	3.3: Clear-cut, slash removed (Whole tree harvest)	
	4: Uncut Control	N/A

Table 1: Experimental treatments used to emulate natural disturbance

Site Map:

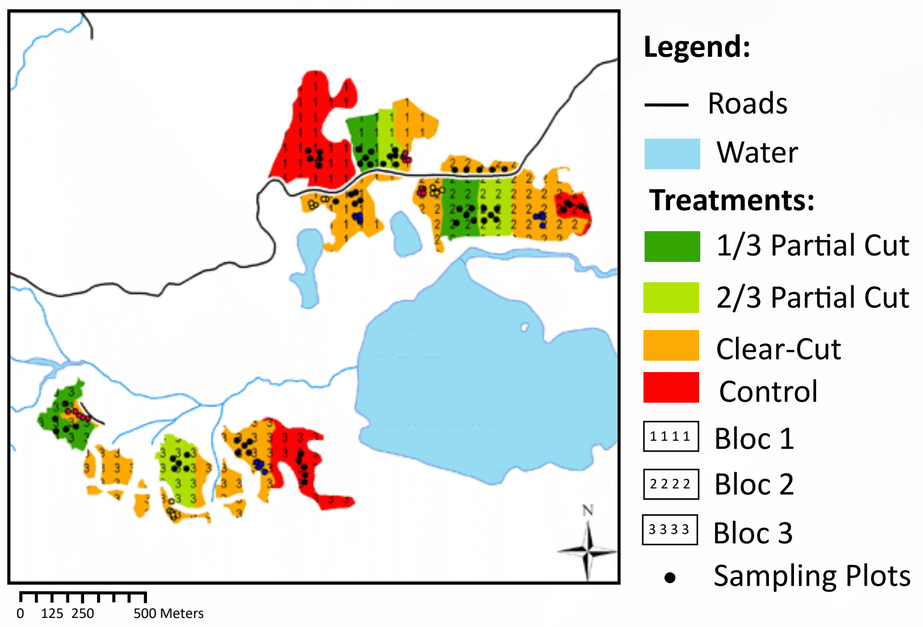

Figure 3: Overview of experimental design and plot locations at the LDTRF

Preliminary Results:

Initially following harvest, we observed a marked decline in closed-canopy and old-growth specialist species with concurrent increase in disturbance adapted species. This change in species assemblages was paired with an overall decrease in ground beetle abundance at all harvested treatments, especially significant at clear cut treatments. Over time, ground beetle abundance has increased at all treatments. At the 16 year re-measure abundance is has increased significantly within clear-cut treatments, possibly indicating an additional increase in disturbance adapted species in clear-cuts. Species identifications are ongoing, and will clarify species distribution within treatments.

Data Collection:

All ground beetles were collected using pitfall traps. A total of 180 pitfall traps were deployed for each collection at randomly selected permanent sampling plots. Samples were then sorted for ground beetles and abundance data recorded. Ground beetle specimens are undergoing ongoing identifications to species.

Pitfall Trap Design:

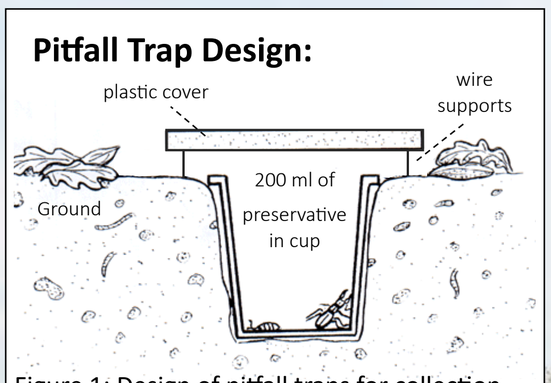

Figure 1: Design of pitfall traps for collection

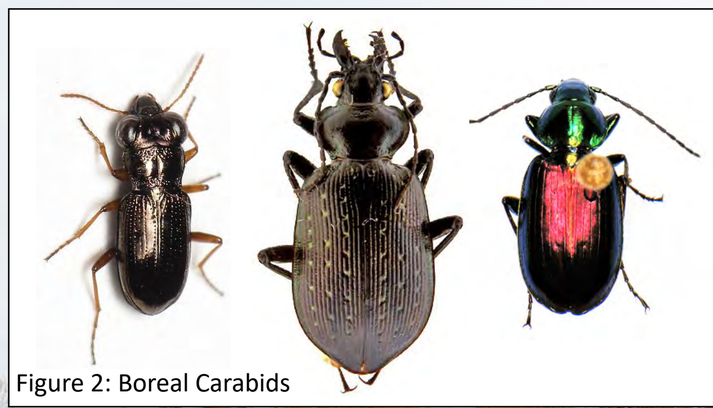

Figure 2: Boreal Carabids

Data Analysis:

- In all treatments overall ground beetle abundance is increasing with time
- Abundance is declining with time in 1/3 cuts when compared to the uncut controls
- Abundance is increasing with time in clear-cuts when compared to the uncut controls

Ground Beetle Abundance by Treatment:

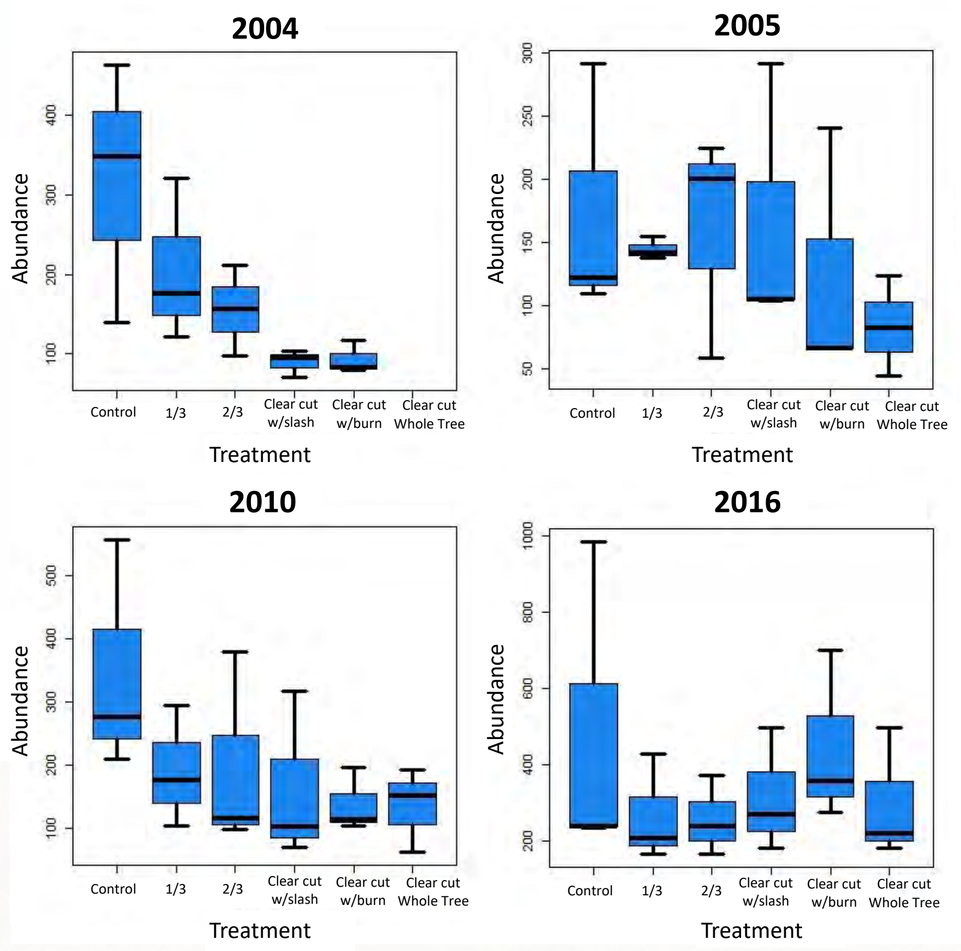

Figure 4: Ground beetle abundance compared by treatment