

Plant community responses to silvicultural opening size across and between gaps in Wisconsin northern hardwood forests

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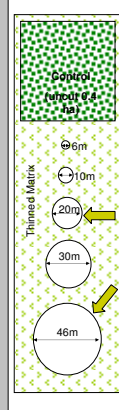
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Abstract

Within northern hardwood forests, gap-creating disturbances alter the resources available to understory vegetation. Levels of diversity following disturbance are expected to vary based on the size of the created gap. One mechanism of understanding this overall diversity is the Gap Partitioning Hypothesis (GPH), which proposes that a variation in resource availability allows for species specialization. My hypothesis is that as gap size increases, diversity levels should parallel this increase until the full gap heterogeneity has been attenuated. However, other biotic factors may decouple this hypothesis, such as the presence of clonally reproducing shrubs, (example *Rubus strigosus*). Therefore, while diversity levels may initially rise with increasing gap size, they may eventually decrease as other factors have increasing impacts. This theory was tested in medium-sized (20-meter diameter) and large-sized (46-meter diameter) gaps in a northern hardwood forest of northern Wisconsin. Understory competition and abundance was assessed in the summer of 2008 in this forest in 1-m² plots that were previously established within gaps created between 1995 and 1996. Analyses show that overall, intermediate gap sizes tended to be more diverse than the larger gap sizes. Diversity levels tended to be lower than predicted due to the dense population of *Rubus strigosus* in the larger, and to an extent, the medium-sized, gaps.

Methods

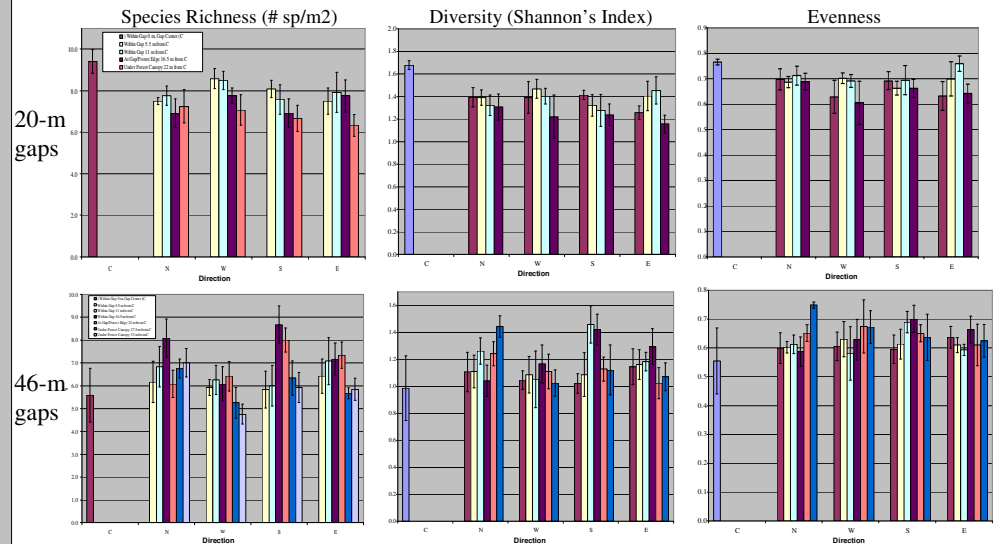
The **study site** is located on the Chequamegon-Nicolet National Forest in northeastern Wisconsin. It is an even-aged mixed hardwood forest that developed after early 1930s intensive logging. Forest habitat occupying the area is ATD, Acer-Tsuga/Dryopteris (Kotar et al., 1988). Management activities between 1995 and 1996 established a **randomized complete block** design with six treatments (right), replicated three times in four blocks. The 20-m and 46-m diameter gaps were used in this study (see arrows in study design to the right). **Permanent plots** were set up in cardinal directions from treatment center through gap edge into adjacent forest. 20-m gaps have 17 plots each and 46-m gaps have 25 plots each. Understory vegetation was sampled by species cover class in midsummer 2008; diversity analyses included richness, Shannon's Index and evenness.



Results & Discussion

Mean gap-level (table) and plot-level (figures) results of medium- and large-gap richness, total cover, Shannon's Index and evenness for understory vegetation, Divide Canopy Gap Study, northeastern WI.

	Average Gap Richness	Average Gap Total Cover	Average Gap Shannon's Index	Average Gap Evenness
20-m diameter gap	7.618±.567	66.396	1.359±.0387	0.684±.0112
46-m diameter gap	6.457±1.174	77.593	1.152±.2389	0.631±.114



- The results did not support the GPH at the gap level; contrary to the GPH, 20-m gaps were more diverse than 46-m gaps. Shrub competition and presence in large gaps likely decoupled the GPH and decreased diversity.
- Within gaps, the GPH was partially supported at edges where diversity measures changed across the gap to forest gradient. Edges represent sharp changes in environmental conditions that support a variety of species.

Future Directions

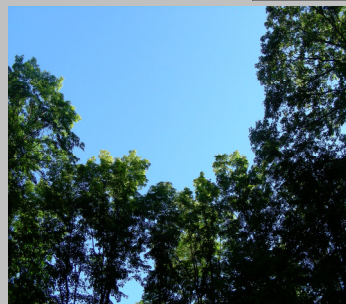
- Gap size is important to floristic diversity, but decoupling factors such as shrub presence may play just as significant a role. Additional studies at this site should consider simultaneous sampling of decoupling factors, such as shrub competition.
- Gap edges provide unique conditions that could aid in meeting understory diversity goals.
- Managers cannot assume that larger canopy gaps increase understory diversity; other factors need to be considered when selecting a gap size for management prescriptions.



Raspberry (*Rubus strigosus*) presence in a 46-m gap



Understory vegetation in a forested plot



Looking north above the canopy of a gap, from gap center