Timber harvest affects mushroom fruiting and community structure in a northern hardwood ecosystem

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BACKGROUND

Study Question

Does fruiting of ectomycorrhizal, parasitic, and saprobic mushrooms increase or decrease following timber harvest?

Why does fungal fruiting matter?

Fruiting responses of fungi to forest disturbance may indirectly impact nutrient cycling and forest structure:

- **Ectomycorrhizal** fungi exchange nutrients with trees (Fig. 4A)
- **Parasitic** fungi facilitate forest structural heterogeneity by killing trees (Fig. 4B)
- **Saprobic** fungi cycle nutrients via decomposition (Fig. 4C)

Why New Hampshire?

- Timber harvest is a common disturbance in New Hampshire, and fungal fruiting may impact nutrient cycling and forest recovery
- Most previous research has occurred in northern Europe or western North America and often in boreal systems

FIELD METHODS

- Mushrooms were surveyed in summer 2019 at Dartmouth Second College Grant, NH
- Surveys conducted via belt transect in ten 0.4ha patch cuts and surrounding forest (Fig. 1)
  - Patch cuts were approximately 18 months old
  - Surveyed 240m^2 per patch cut
- Mushrooms counted, identified to genus, location recorded, and representative specimens collected and weighed

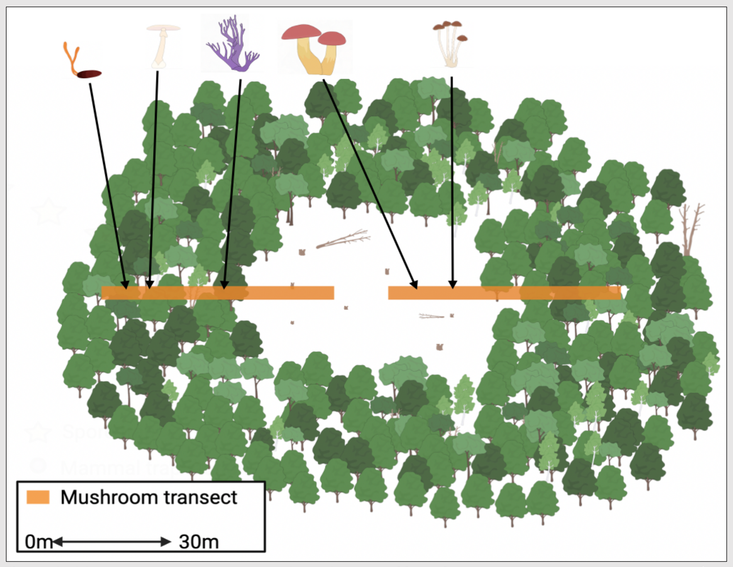

Figure 1. Mushroom surveys were conducted on two 60m x 2m belt transects at each patch cut (and surrounding forest).

DATA ANALYSIS

- Effect of timber harvest on **overall community composition** tested with PERMANOVA, visualized using non-metric multidimensional scaling (NMDS, Fig. 2)
- Tested **differences between forests and patch cuts** using Wilcoxon's signed rank test for the following metrics (Fig. 3):
  - Genus richness
  - Shannon-Weiner diversity index
  - Dry biomass

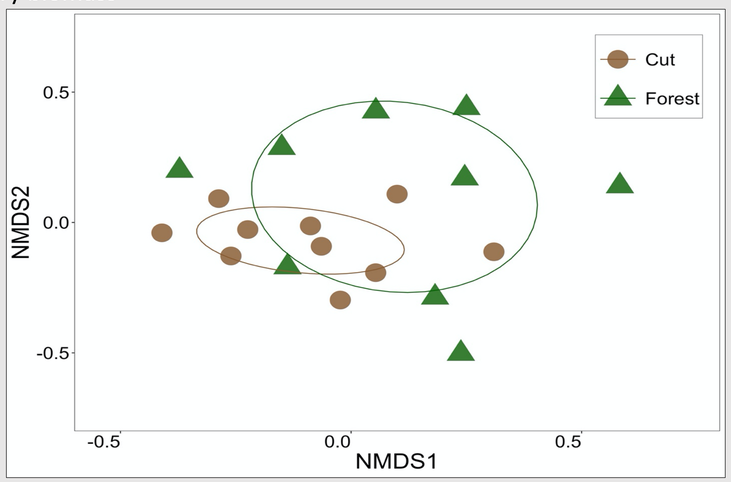

Figure 2. NMDS ordination (final stress = 0.15) of mushroom communities in patch cuts (circles, *n* = 10) and forests (triangles, *n* = 9). Greater pairwise distance between markers indicates decreased similarity in community composition.

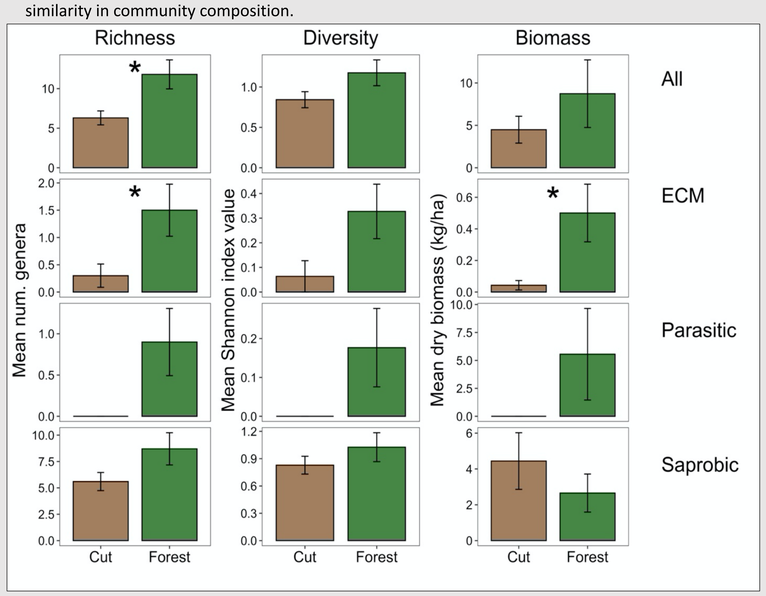

Figure 3. Values (means ± standard error of the mean) for genus richness, Shannon-Weiner diversity index (also at the genus level), and dry biomass of fruiting bodies per survey for all functional groups combined and for ectomycorrhizal (ECM), parasitic, and saprobic groups individually. Asterisks indicate significance ($p < 0.05$). Note that y-axes are scaled independently.

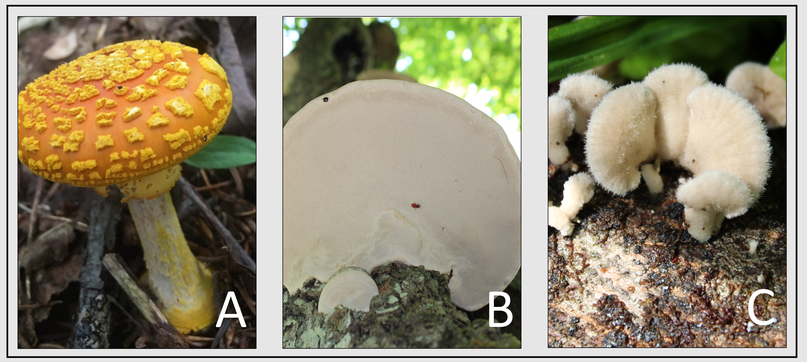

Figure 4. Commonly encountered genera from each of the three functional classes. From left to right: *Amanita* (ectomycorrhizal), *Ganoderma* (parasitic), and *Schizophyllum* (saprobic).

RESULTS

- We detected over **3,000 fruiting bodies** belonging to **63 genera**
- Community composition differed significantly between forest and patch cuts (PERMANOVA, $F_{1,19} = 1.65$, adj. $p = 0.042$)
- NMDS ordination indicated tighter community clustering in patch cuts than in forests (Fig. 2)
- **Richness was greater in forests** than in patch cuts for all functional groups combined and for **ectomycorrhizal** taxa only (Fig. 3)
- **Biomass was greater in forests** than in patch cuts for **ectomycorrhizal** taxa only (Fig. 3)

DISCUSSION

- Timber harvest affects overall fungal fruiting community composition
- **Unharvested forest** holds more **diverse** fruiting communities
- **Ectomycorrhizal** fruiting was decreased by timber harvest
- Harvest strategies that prioritize **maintenance of mature forest conditions**, such as retention of live trees and large-diameter coarse woody material, may minimize impacts on fungal fruiting

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