

Productivity differences in variations of forest canopy

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Background

Forests play a vital role in removing carbon dioxide from the atmosphere as well as cycling water and nutrients. **Disturbances** can inhibit these processes and reduce productivity.

Defoliation from spongy moth herbivory has impacted forest productivity, though the effects are varied and inconsistent. Forest productivity can be estimated by measuring the **Leaf Area Index (LAI)**.

Disturbances such as fallen trees create canopy **gaps**, which may be less affected by spongy moths and therefore could serve as refugia of forest productivity during outbreaks.

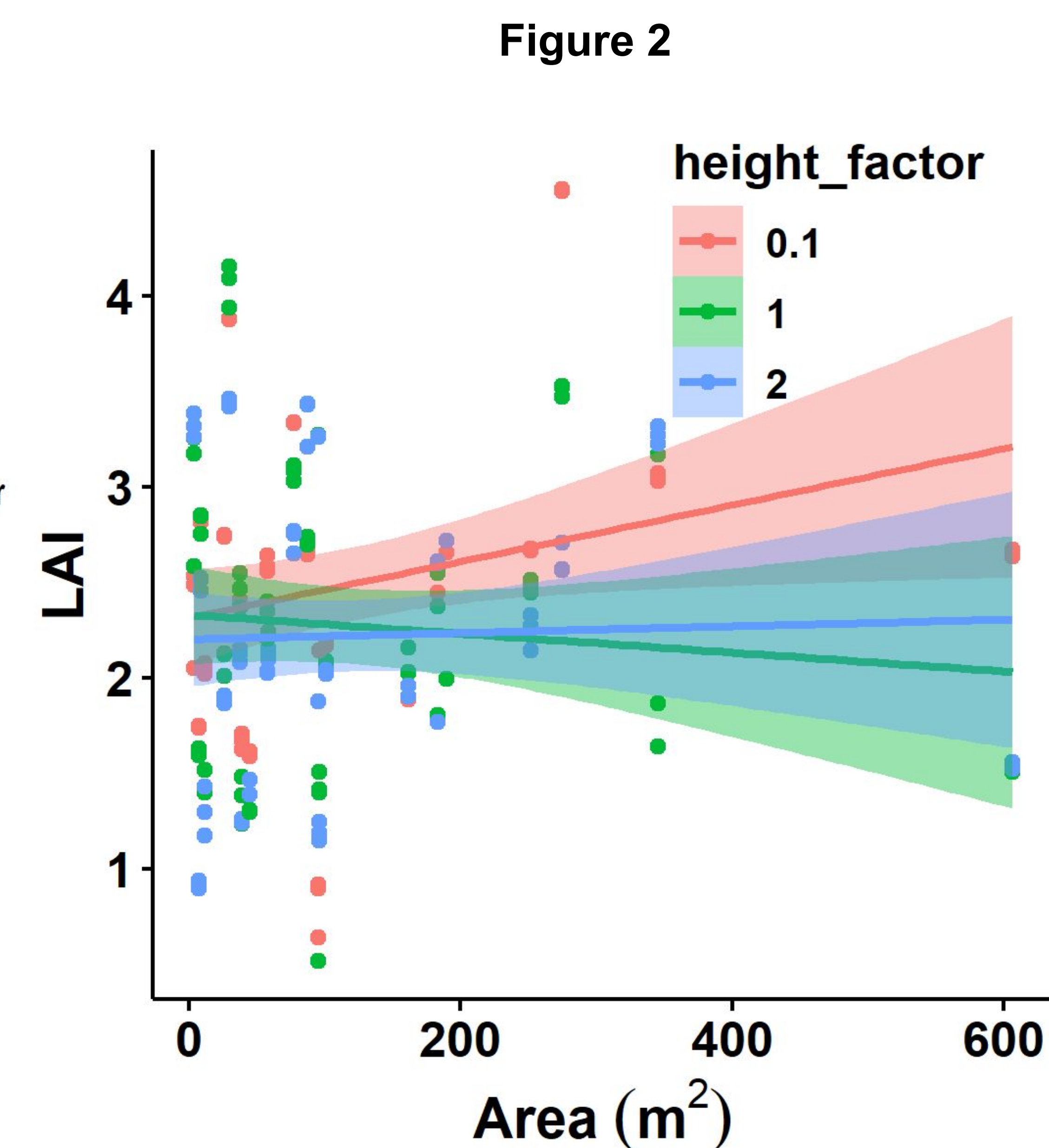
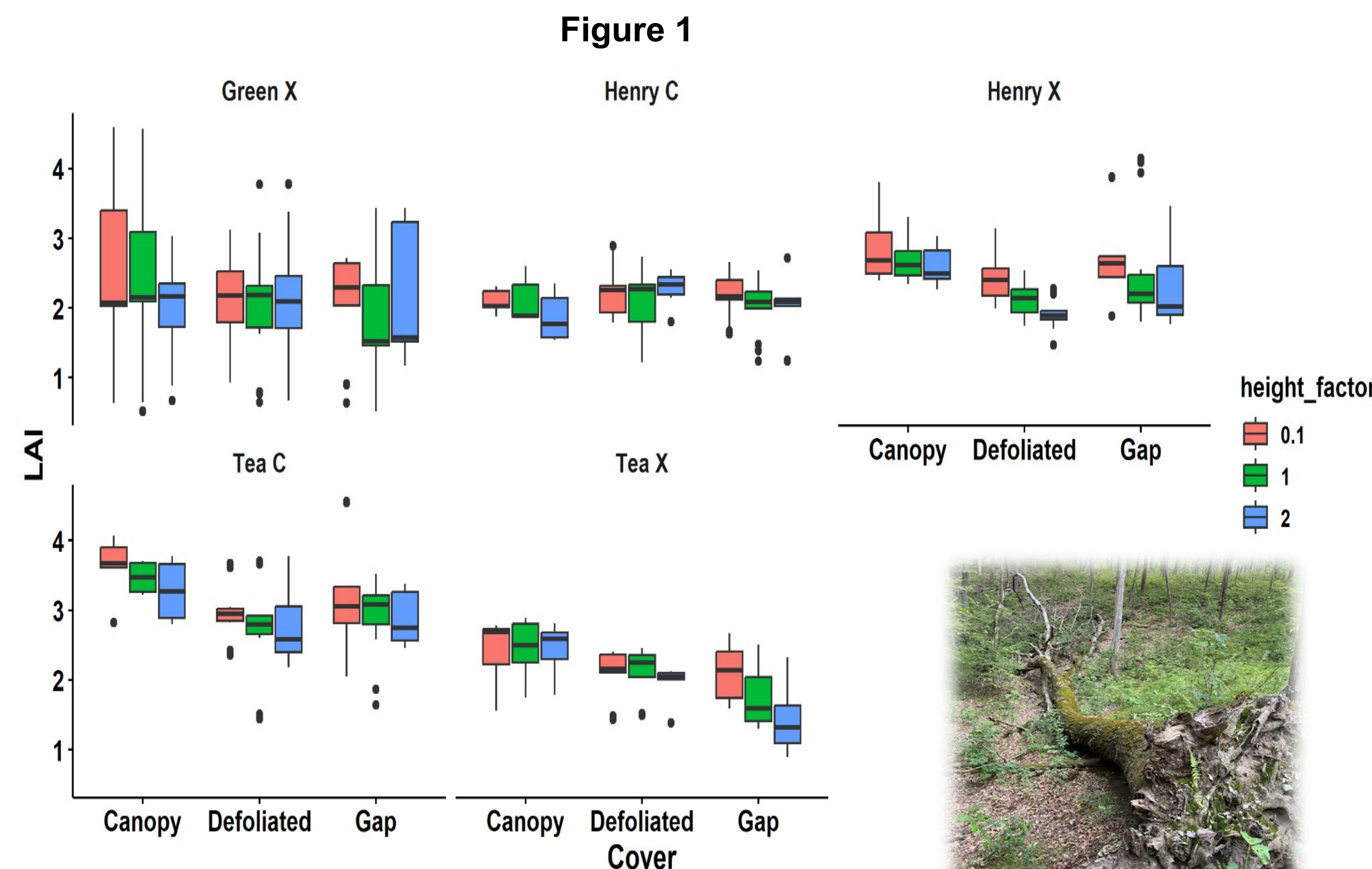
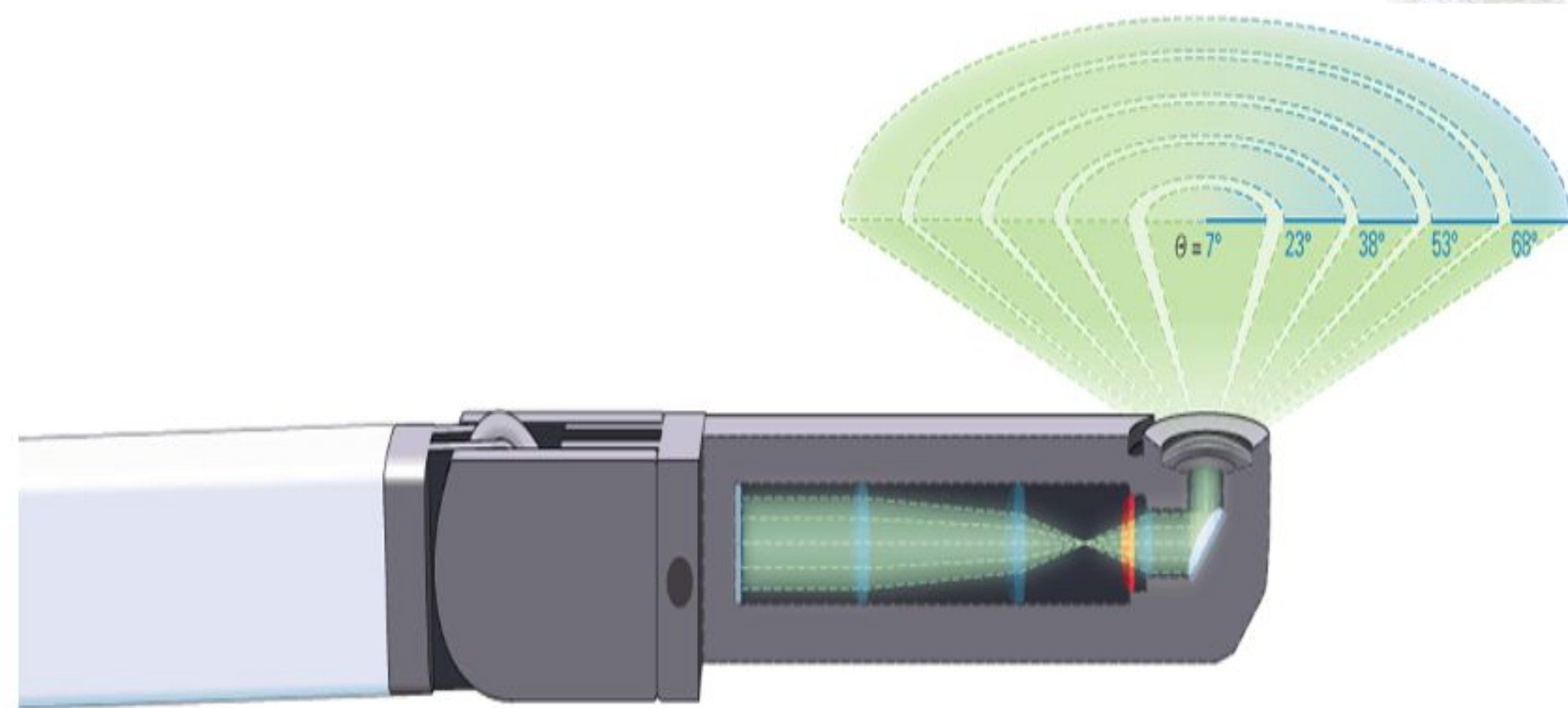
However, it is not known whether gaps serve as refugia, as the relationships between productivity in gaps of differing sizes and areas defoliated by spongy moths have not been quantified.

- How does the productivity of forest gaps compare to areas with intact canopy?
- Does the size of the gap make a difference in productivity?
- What impact does spongy moth defoliation have on vertical structure (leaf distribution) of the forest?

Questions

Methods

- LAI in m^2/m^2 (leaf area per ground area) was measured using LiCor 2200 plant canopy analyzer
- Vertical structure of leaf layering was measured at 0.1m, 1m, and 2m heights
- Located gaps, defoliated, and intact canopy areas at five forest sites on Cary institute property using LIDAR images



Results

Figure 1
Forest Productivity (LAI) was **greatest** in intact canopy, **lower** in defoliated, and **lowest** in gap areas. Individual plots **varied** in these productivity patterns.

There was a lack of variation in vertical structure within each forest plot.

Figure 2
Within gaps, gap size (area) was related to the LAI showing a shift in the **vertical structure** of leaf layers as the forest recovers from a disturbance. Ground level LAI **increased** with the size of the gap, but sapling-level productivity did not.

Take-home message

This study revealed that canopy gaps play a complex role in forest productivity and resilience. The generally lower LAI in gaps compared to defoliated areas indicates that, even though gaps may be less impacted by spongy moths than mature forests, they still don't match the productivity of defoliated forests. However, it's important to note that larger gaps might offer a boost in productivity, but additional data is needed to support this.

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