

The impact of forest management on understory edge effects in roadside forests

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Objectives

- To understand the spatial extent and magnitude of edge influence on environmental conditions and understory communities in managed and un-managed roadside forest edges
 - Do environmental conditions, forest structure, and understory communities differ between managed and un-managed roadside edge forests?
 - Does roadside forest management affect the magnitude or depth of edge influence for plant communities or environmental conditions?

Hypotheses

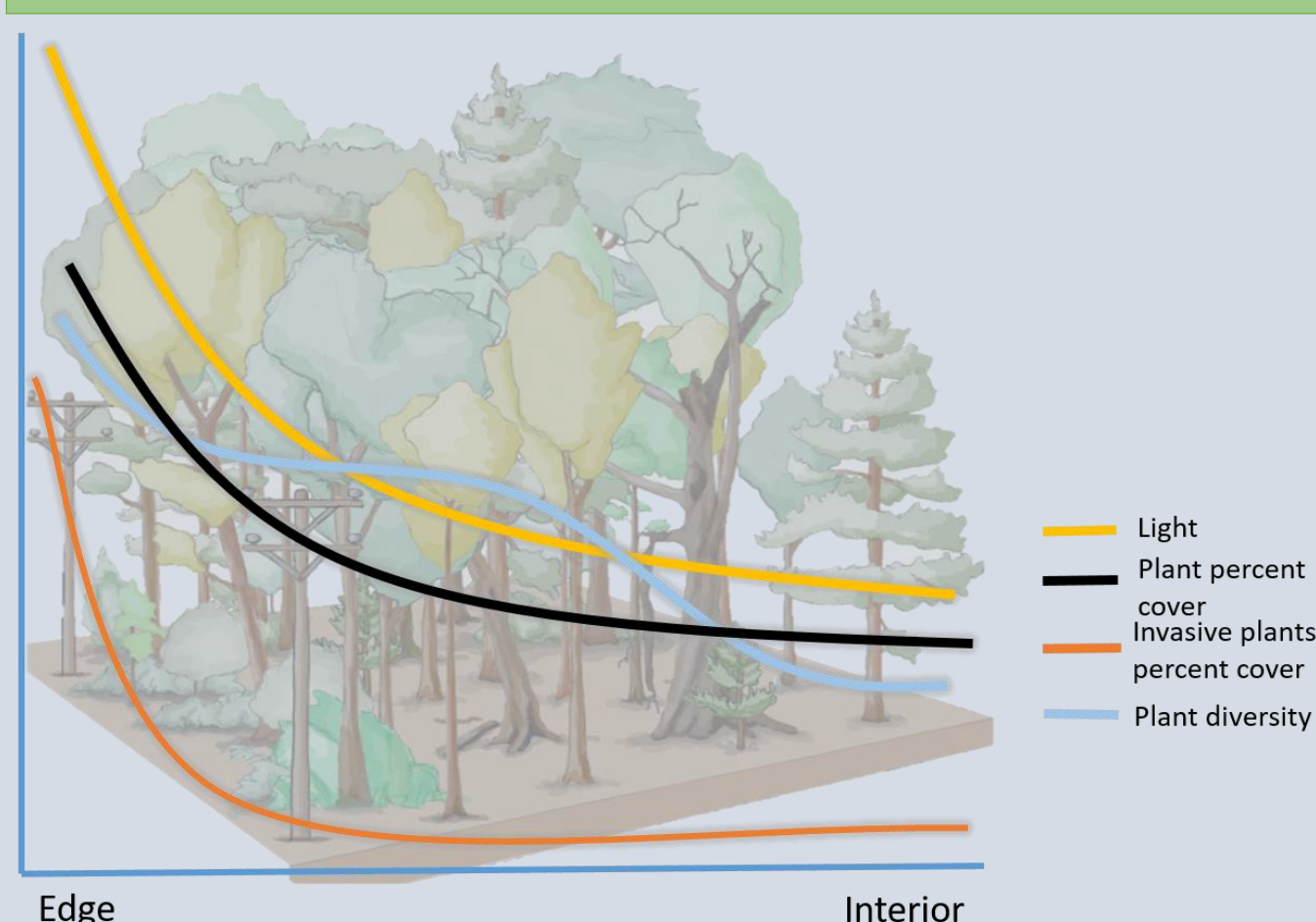


Figure 1. Predicted edge influence in an un-managed forest stand. Light and invasive species percent cover may be high near the edge but attenuate quickly, while plant (herbaceous or woody) percent cover and diversity may have a smaller gradient from edge to interior. (Flory and Clay 2006, Harper et al. 2005, 2015).

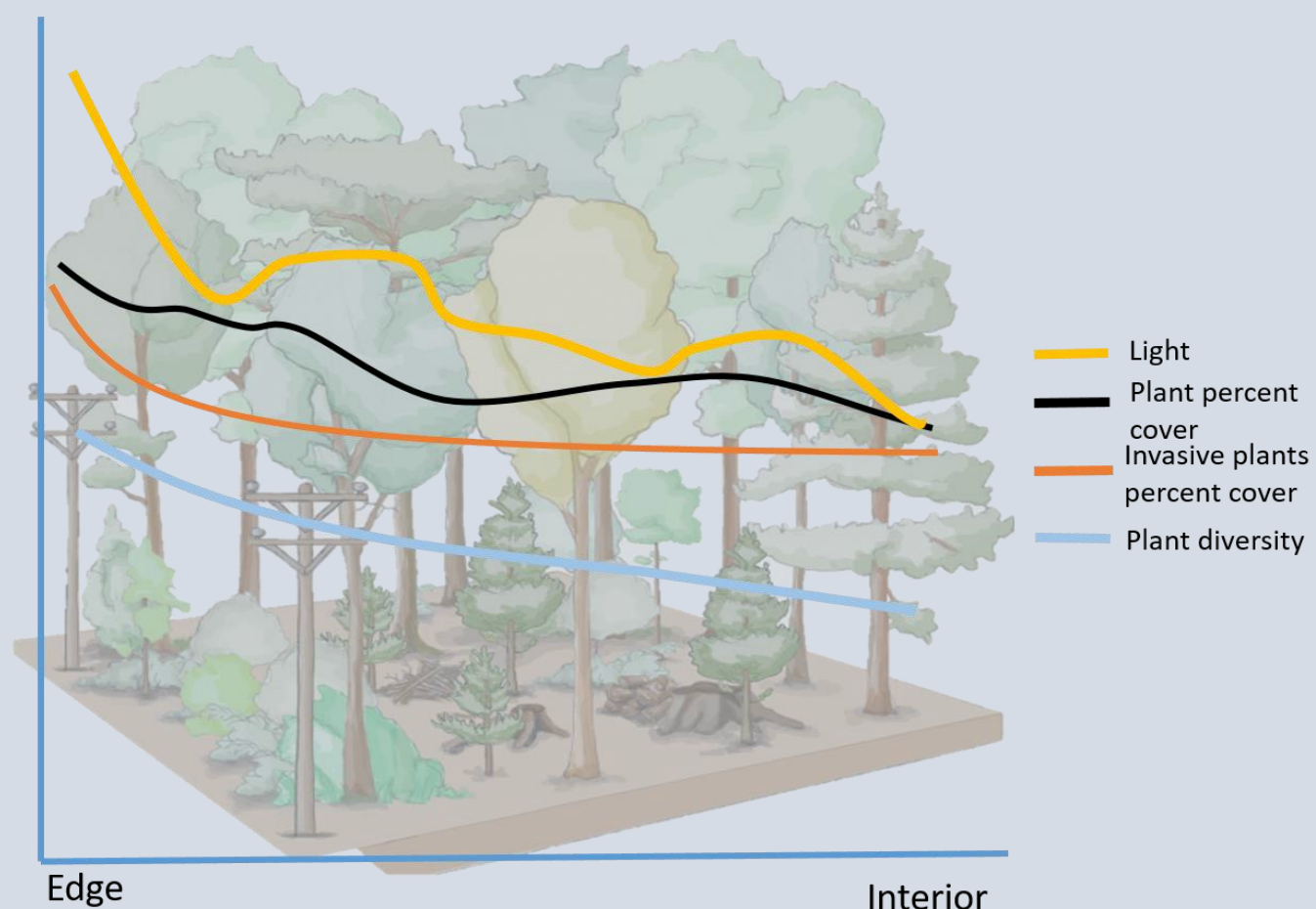


Figure 2. Predicted edge influence in a managed forest stand. All factors will be **more variable** and **greater** than in the un-managed stand. Most notably, we would expect to see **greater percent cover of invasive species** across the edge to interior forest gradient. All factors are expected to still be much higher near the edge than the interior. (Flory and Clay 2006, Harper et al. 2005, 2015).

Stormwise Forest Management

- A forest management strategy designed to reduce the risk of damage to utility infrastructure by tree failure
- Designed through collaboration among UConn, Eversource, and other stakeholders
- Selects for and promotes trees with symmetric crowns, reducing tree density and giving the remaining tree space to grow and resources to develop resistance to wind damage
- Removes trees with severe lean towards wire, or with defects that may increase risk of failure



An example view of an untreated control site (Litchfield, CT)

An example view of a Stormwise site (Litchfield, CT)

Methods

- At each site, one section of forest has received the Stormwise treatment, and a nearby section was not cut
- Within each treatment, we established 3 transects perpendicular to the road.
- Transects were **30m long, 30m from any edge**, at least 10m apart.

Parameters measured along transects:

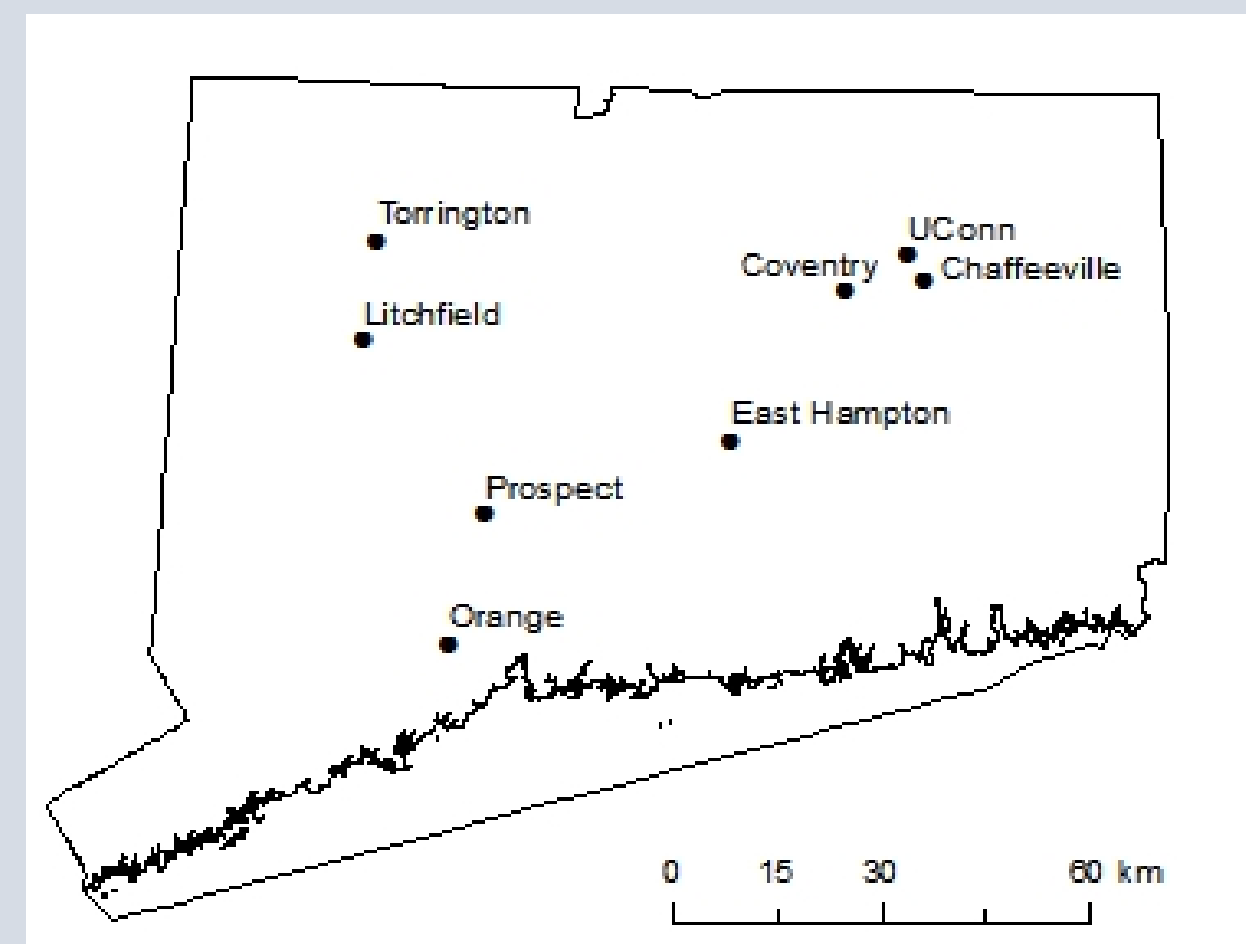


Figure 3. The 8 field sites across the state of Connecticut

Results

PAR At Increasing Distance from the Road

Edge influence only detected in the Stormwise sites

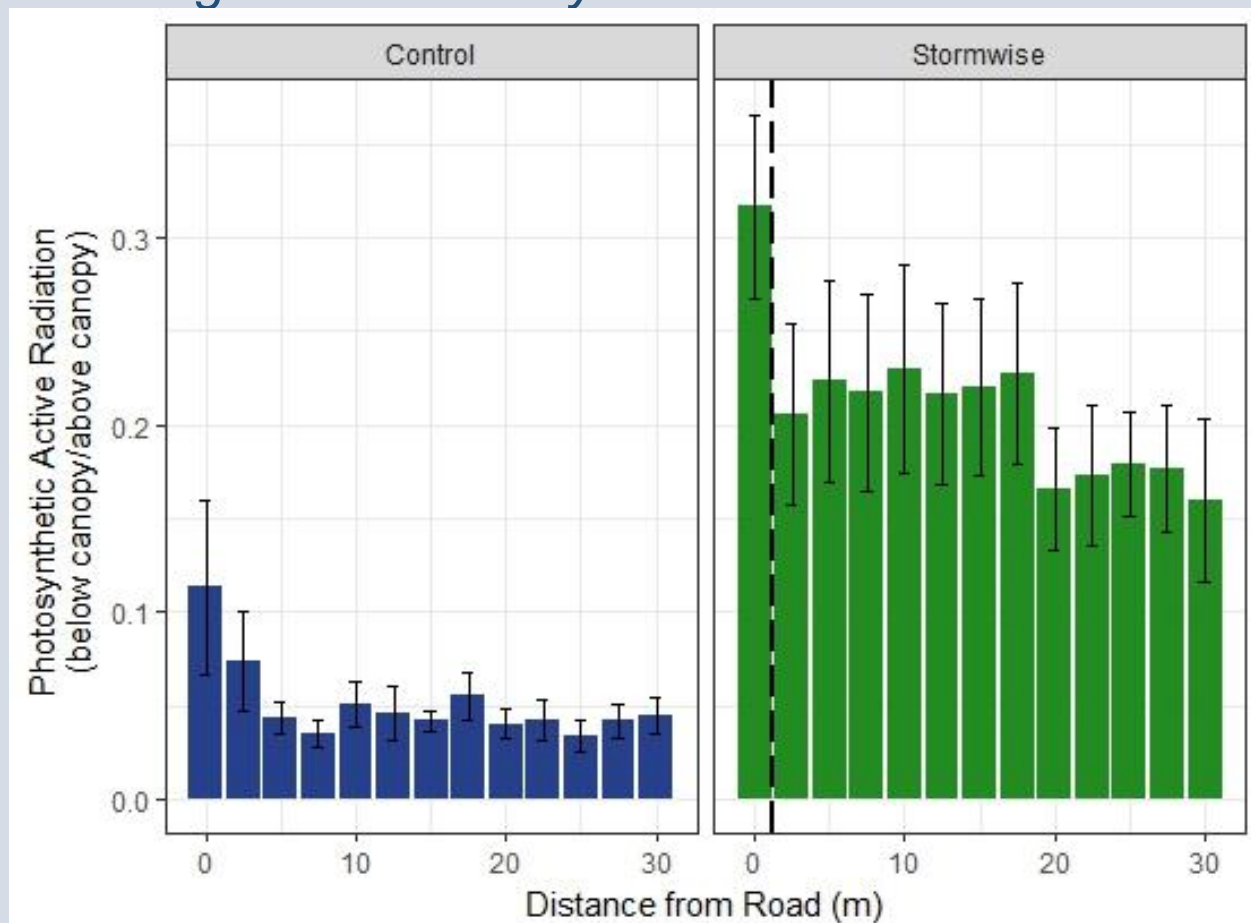


Figure 4. Photosynthetic active radiation in control and Stormwise sites at increasing distances from the road. Black dotted line indicates results from a depth of edge influence analysis (Harper and Macdonald (2011)). Edge influence was only detected within the Stormwise site.

Woody Plant Richness and Diversity

Edge influence only detected in the Stormwise sites and is greater than the edge effect for light

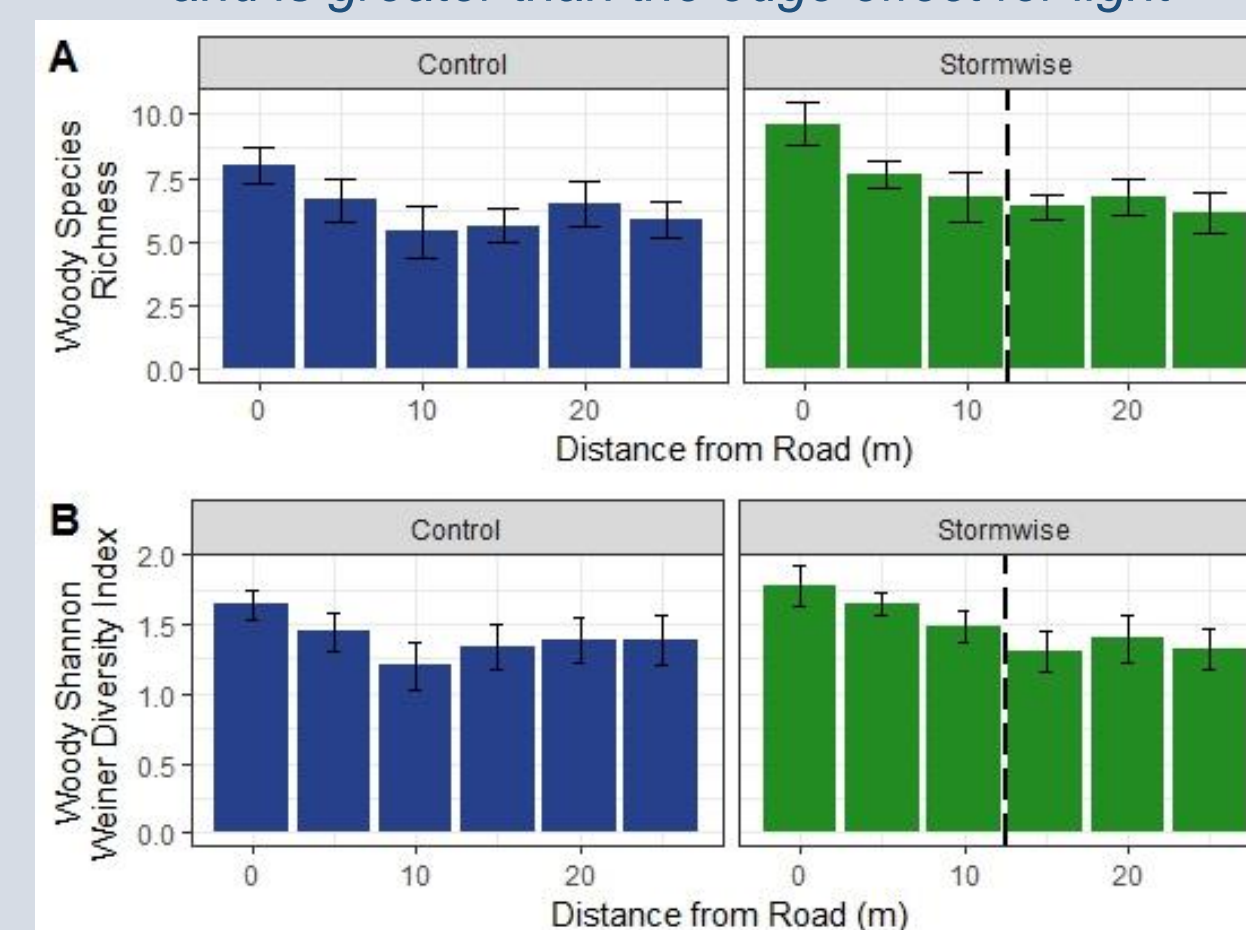


Figure 5. (A) Woody species richness and (B) woody Shannon Weiner Diversity Index in control and Stormwise sites. Black dotted lines indicates the depth of edge influence, in this case up to 15m in Stormwise sites. There was no edge influence in control sites.

Total Percent Cover of Native and Non-Native Invasive Plants

Lower than expected percent cover of invasive plant species. Edge influence was only detected in the Stormwise sites, and the edge effect is greater in invasive species than native species.

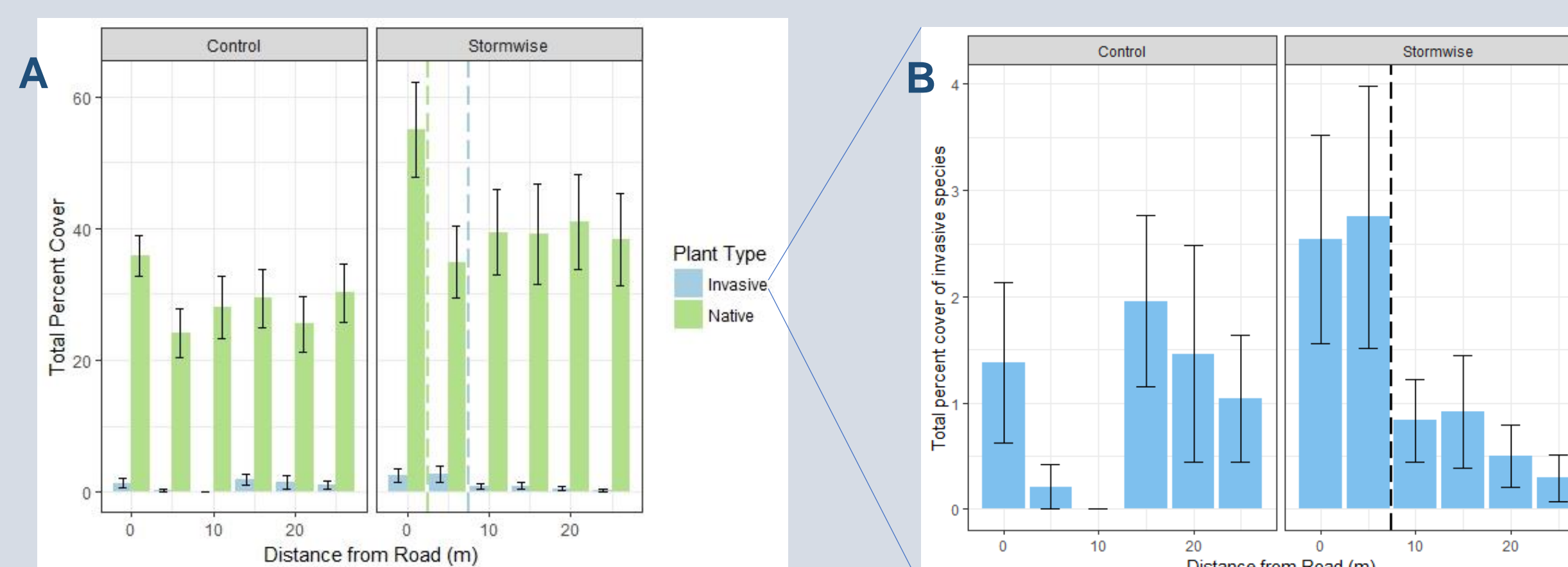


Figure 6. (A) The total percent cover of native and invasive plant species at increasing distance from the roads. The green dotted line indicates the depth of edge influence for native plants (0-5m), and the blue dotted line indicates the depth of edge influence for invasive plants (0-10m) in Stormwise sites. There was no edge influence in the control sites. (B) The total percent cover of invasive plant species. Note the greatest average percent cover is less than 3%.

Forest Structure:

Control sites have more homogenous canopy cover than Stormwise sites. Stormwise sites display vegetative clumping, deep gaps, and overall heterogeneity in canopy cover and therefore light availability.

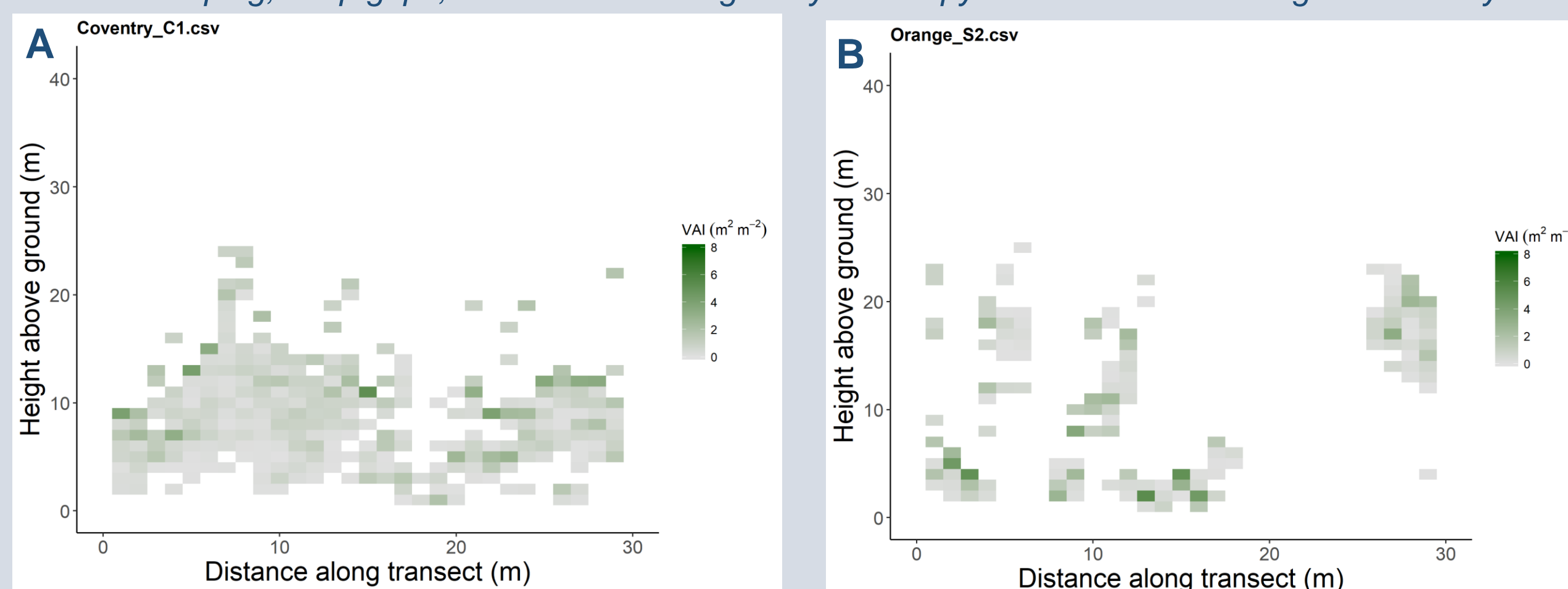


Figure 7. Examples of the results from the portable canopy Lidar in a control site (A) and a Stormwise site (B). Individual boxes represent the vegetation area index along the transect at the various heights of the vegetation.

Conclusions

- Stormwise sites have greater forest structure variability, and therefore greater light heterogeneity in the understory.
- Stormwise treatments resulted in edge influence, while un-managed stands had no edge influence
- The edge influence displayed in Stormwise sites suggests that the disturbance (or management) increases edge permeability.
- We did not find a larger percent cover of invasive species in Stormwise sites as we hypothesized.
- Next step: a common garden experiment to measure photosynthesis and carbon gain in native and invasive plants in these managed and un-managed roadside environments.



Example transect in untreated control forest in Mansfield, CT

Example transect in Stormwise forest in East Hampton, CT

References

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