

# Resilience of Insect Communities

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## Introduction

Resilience is the ability of an ecosystem to return to a previous state following disturbance. Disturbance may reduce ecosystem function but increase biodiversity, a phenomenon known as the disturbance paradox. We used the response of forest beetle communities to different timber harvest treatments in a long-term research study, The Hardwood Ecosystem Experiment, to test predictions of ecosystem resilience.

Predictions:

- (1) communities would change,
- (2) they would show community trajectories back to pre-harvest communities,
- (3) greater disturbance would cause lower community resilience, and
- (4) community change would be attributed to an increase in pest species.

## Methods

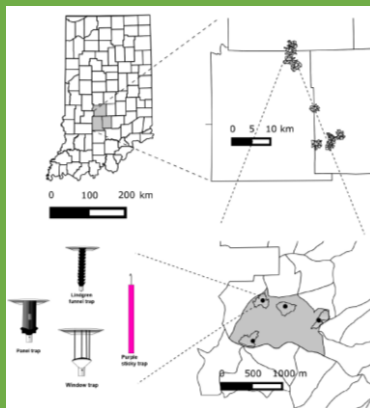
Nine management units (lower right) each had 4 areas subjected to one of 4 different treatments:

- Control – no harvest
- Even-aged – clear cut
- Even-aged – shelter wood cut
- Uneven-aged – patch cut

Beetles were trapped in an array of 4 types of traps in each of the 9 x 4 = 36 replicates.

This study uses data from 9 years with two years of pre-harvest data.

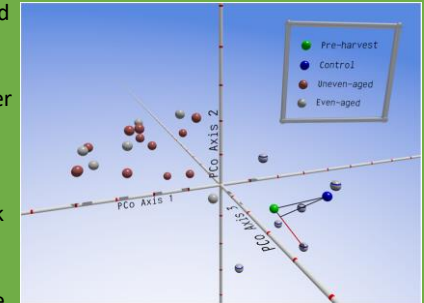
Beetle communities were ordinated in species-space and resilience was quantified as the trajectory and rate of return to the preharvest conditions. Control sites corrected for annual variation.



Populations of insects that provide ecosystem services and that are pests are determined by filters of landscape connectivity and local management and habitat.

## Results

- (1) Communities did change, but shelterwood but little.
- (2) Resilient trajectories back to pre-harvest communities did occur within 8 years after harvest.
- (3) The patch cut and clear cut sites were displaced the same distance but in different directions and they tracked back to pre-harvest communities at the same rate.
- (4) Live-tree attacking pests were responsible for most of the community change.



## Discussion

Quite unexpected that the two 'more intensive' treatments moved communities on different trajectories but that they tracked back at the same rate.

Did find evidence of the disturbance paradox in that species richness was greatly increased following harvest disturbance but there was a decrease in beneficial species and an increase in 'pest' species.

Likely that the solution to the disturbance paradox lies in the cross-scale phenomena determining the species present. Services versus pest losses are determined locally but these species flow from the larger landscape. While this study focused on the effect of management at the local scale (center image, middle), the species able to flow to the sites are determined by the larger landscape context (center image, top).

## Acknowledgements

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