Does disturbance facilitate the establishment of Chinese tallow in maritime forests?

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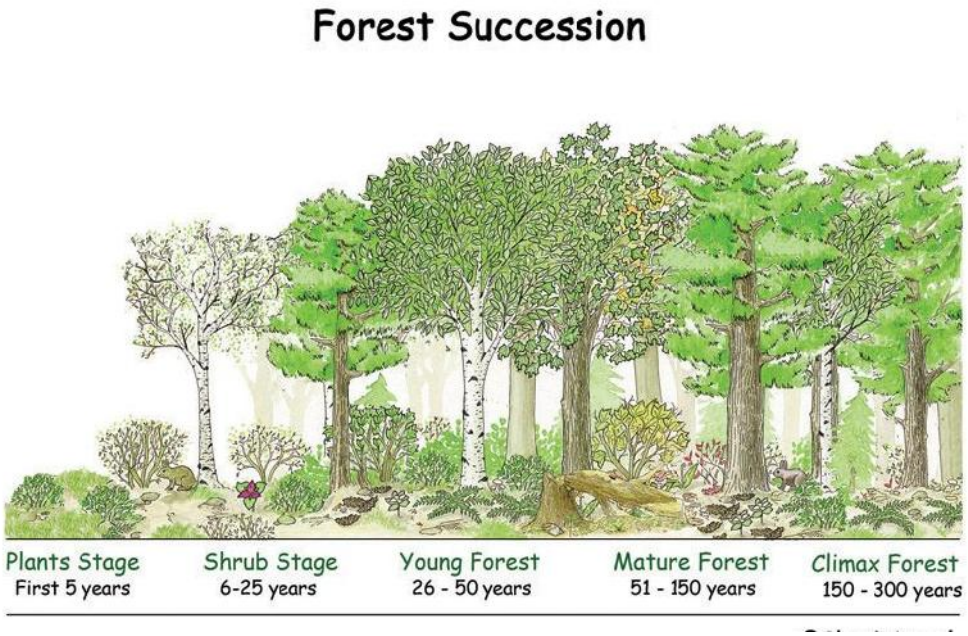
FORESTRY AND ENVIRONMENTAL CONSERVATION

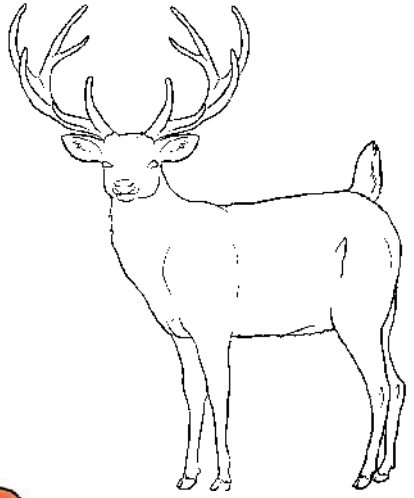
SEL

Disturbance can drive forest community change



Old field (secondary succession)

Fire



Fauna

Abandoned Agriculture

Severe Weather

Development

Resource Extraction

disturbance

Forest Invasion & Disturbance

Are invasive species the symptom or driver of ecological degradation?

Community Invasibility – How susceptible a community is to invasion…

- Species richness (either higher or lower has been documented)
- Changes in historic disturbance regime
- Combination of factors!

Novel disturbances can create empty niches – A "window of opportunity"

- Historical agriculture and its subsequent abandonment
- Modern forestry practices (thinning and prescribed fire)

Invader success (invasiveness of the species)

- Evolved for rapid resource acquisition
- High rates of reproduction
- Rapid growth rates

INVASIBILITY + INVASINESS = ECOLOGICAL DEGRADATION

disturbance

Why Study Tree Invasions?

- Trees act as ecosystem engineers and regulate ecosystem function

- Non-native tree invasions can have profound impacts on ecosystem functions, including:
  - Changes (declines or initial inclines) in species diversity
  - Primary productivity
  - Biomass distribution
  - Litterfall and decomposition rates
  - Carbon storage

- Invasive tree species serve as a good model for invasion studies
  - Their longer generation times and lifespans can give insight into community response to disturbance and patterns of establishment

disturbance

Chinese tallow

High Reproductive Output

High Sprouting Ability

Shade tolerant

Ability to grow on a range of site conditions

Forms Monocultures

Impacts Wildlife

disturbance

The disturbance history of Parris Island

Located in Beaufort County, SC
608 ha are managed forests, 1,538 ha are salt water marsh and tidal streams, 1,111 ha are developed

time

European settlement as early as 1562 – but most of the island remained forested until the 1740s → established indigo

1775 plantation agriculture

1790 Sea Island Cotton is the primary agricultural species

1920 to 1945 Dairy farm on 200 hectares

1938 Marines expand operations to include entire island

Many of the agricultural lands were maintained as open fields until reforestation efforts of the 1970s – slash pine (primarily)

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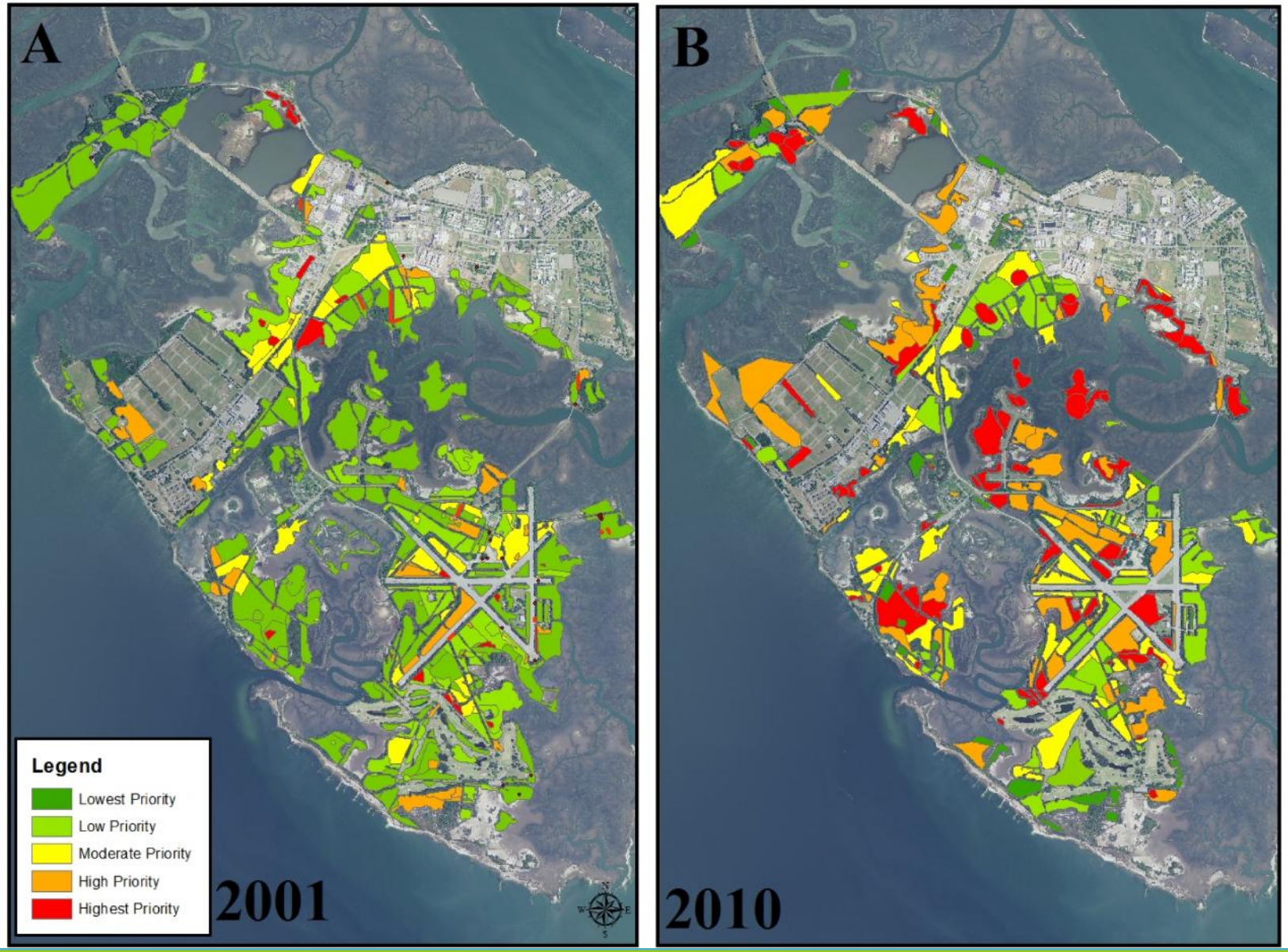
Chinese tallow & Parris Island



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Study Objectives

1.) To compare the abundance of Chinese tallow in remnant forest stands and on sites that were cleared and used for agriculture at some point since 1939

2.) To determine relationships between Chinese tallow abundance and contemporary forest management practices (thinning and prescribed fire)

3.) To reconstruct the establishment patterns of Chinese tallow in relation to anthropogenic disturbance

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Study Hypotheses

1.) Chinese tallow will be more abundant on sites with agricultural history due to greater invasibility following disturbance

Further, higher levels of diversity and between-stand variability will support evidence of biotic simplification at the stand level on these formerly cleared lands

2.) Chinese tallow abundance will be positively, significantly related to the forest thinning and prescribed fire because these disturbances would provide establishment opportunities and increase resource availability

3.) There will be a significant relationship between the time of Chinese tallow invasion and forest management practices

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Chinese tallow & Parris Island

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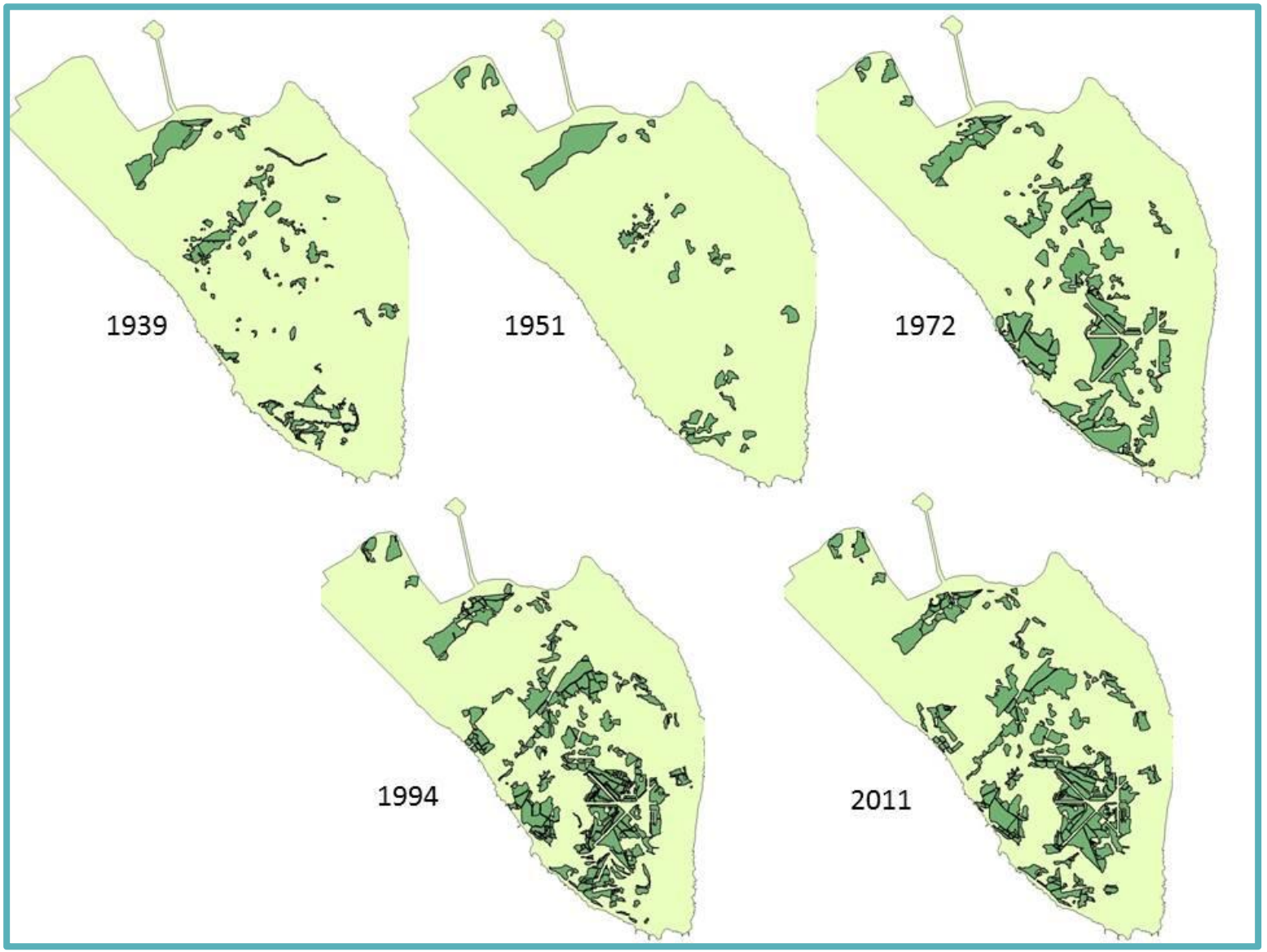
Methods – Forest Change

1951

disturbance

Methods – Forest Change



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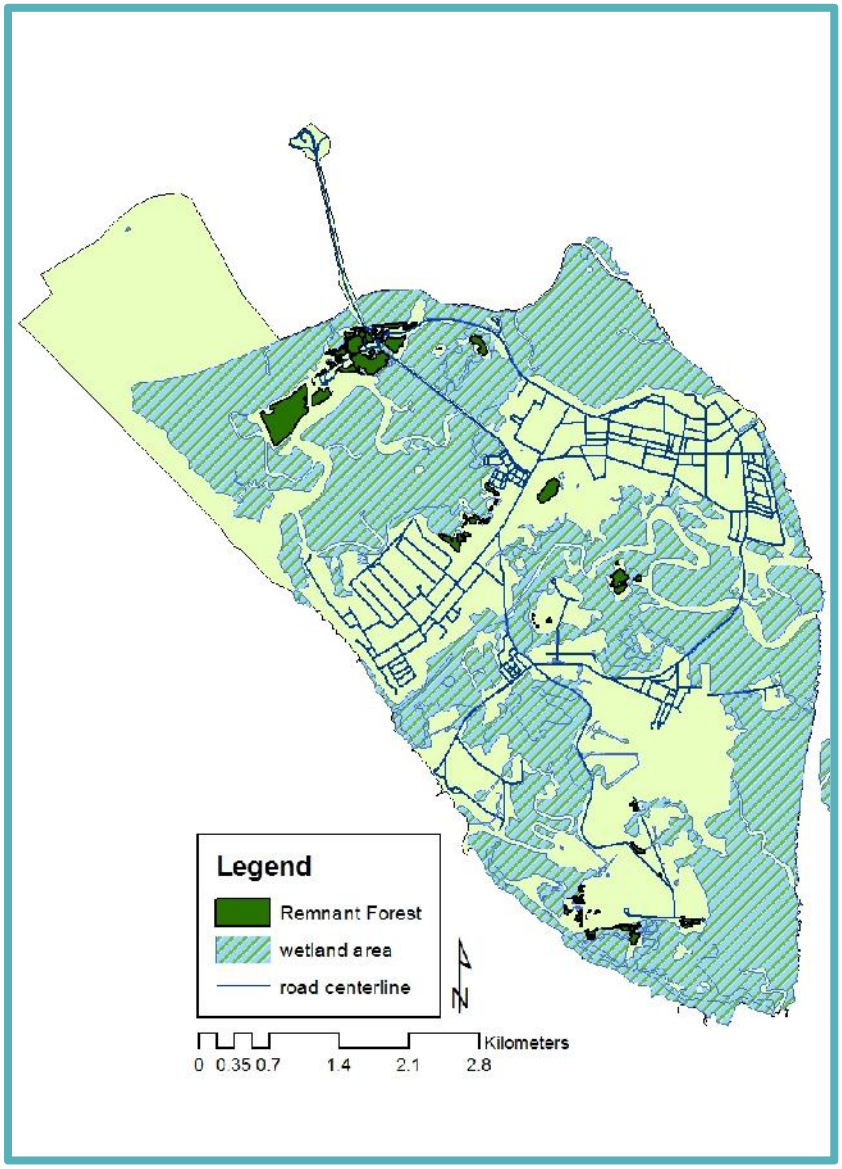
Methods – Forest Change



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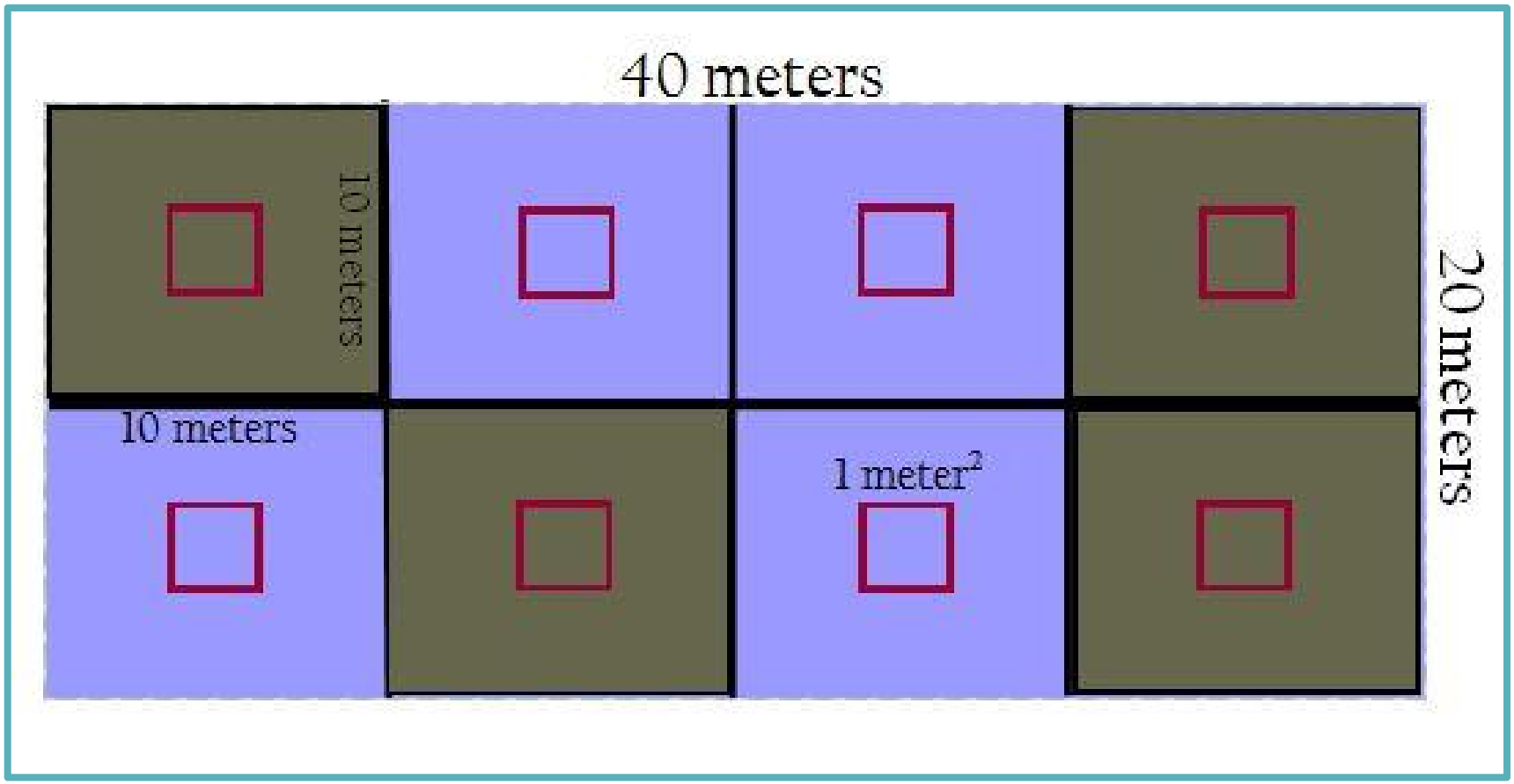
Methods – Forest Change



N (disturbed stands) = 6

N (remnant stands) = 4

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Methods – Modern Forestry Practices

- Historical stand data on thinning and prescribed fire management activities

- Stem analysis to form a relationship between DBH and age

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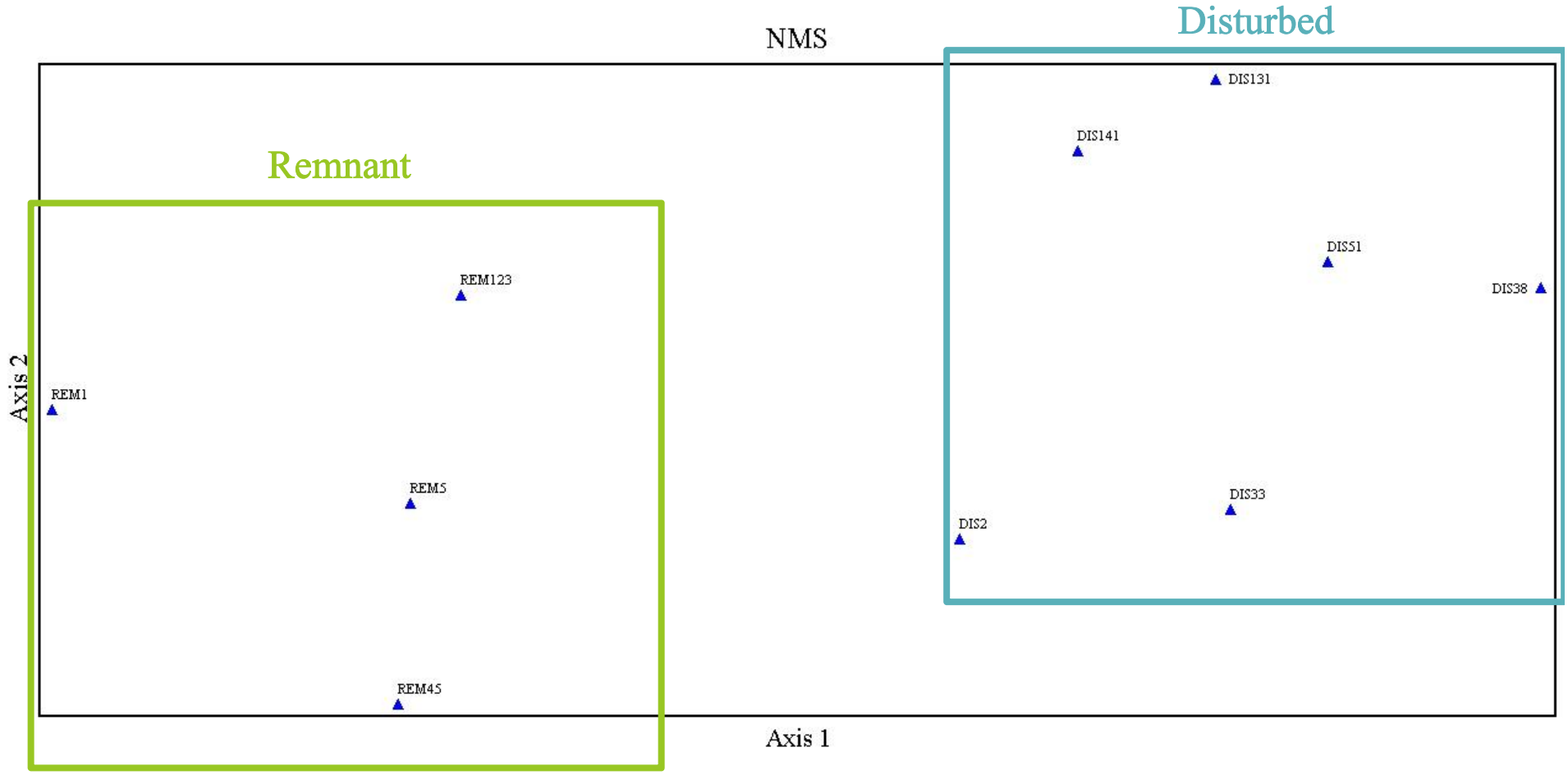
Results – Changes in Forest Composition and Structure

disturbance

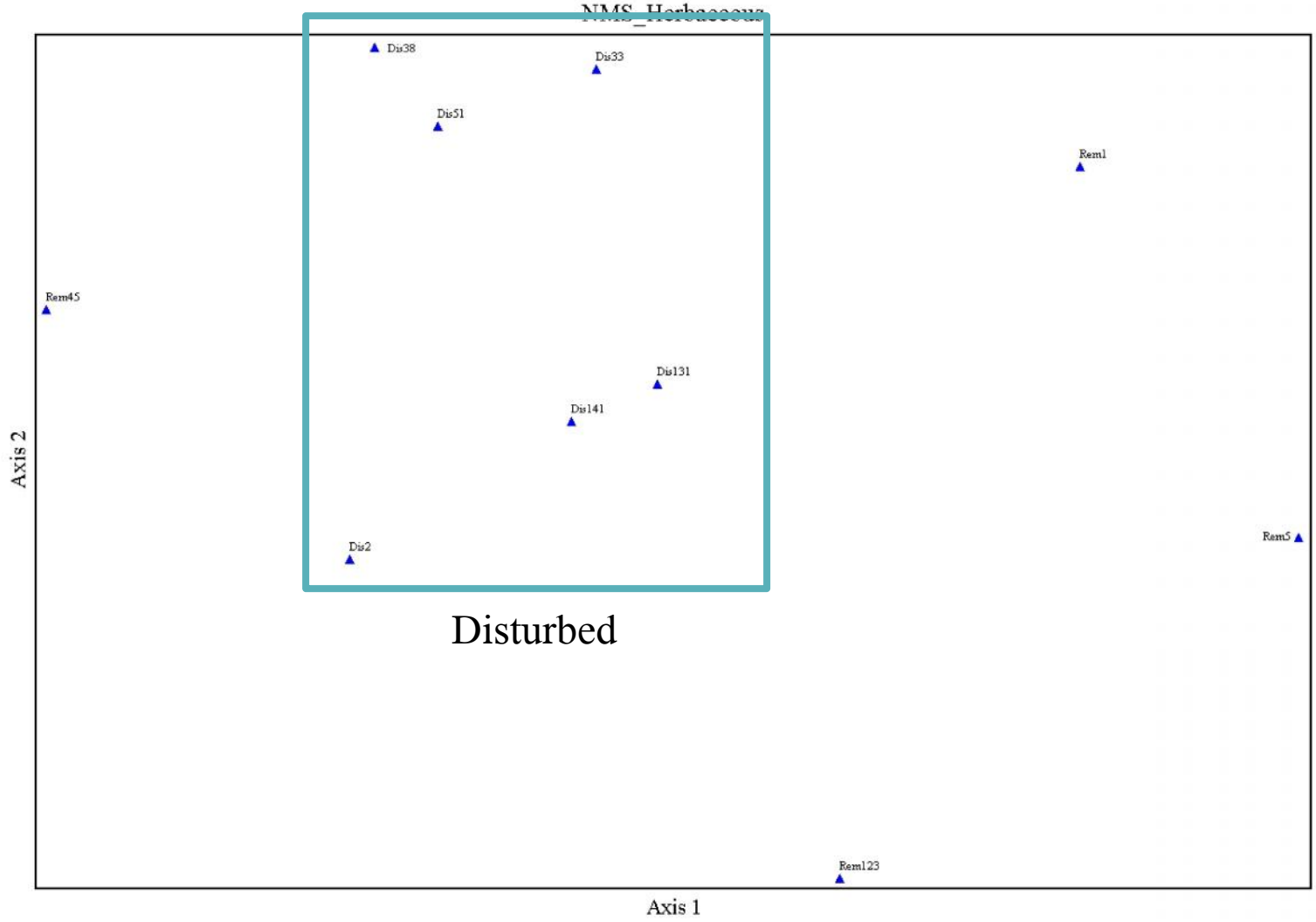
Differences in Compositional Complexity



Woody Species

disturbance

Differences in Compositional Complexity



Disturbed

Herbaceous Species

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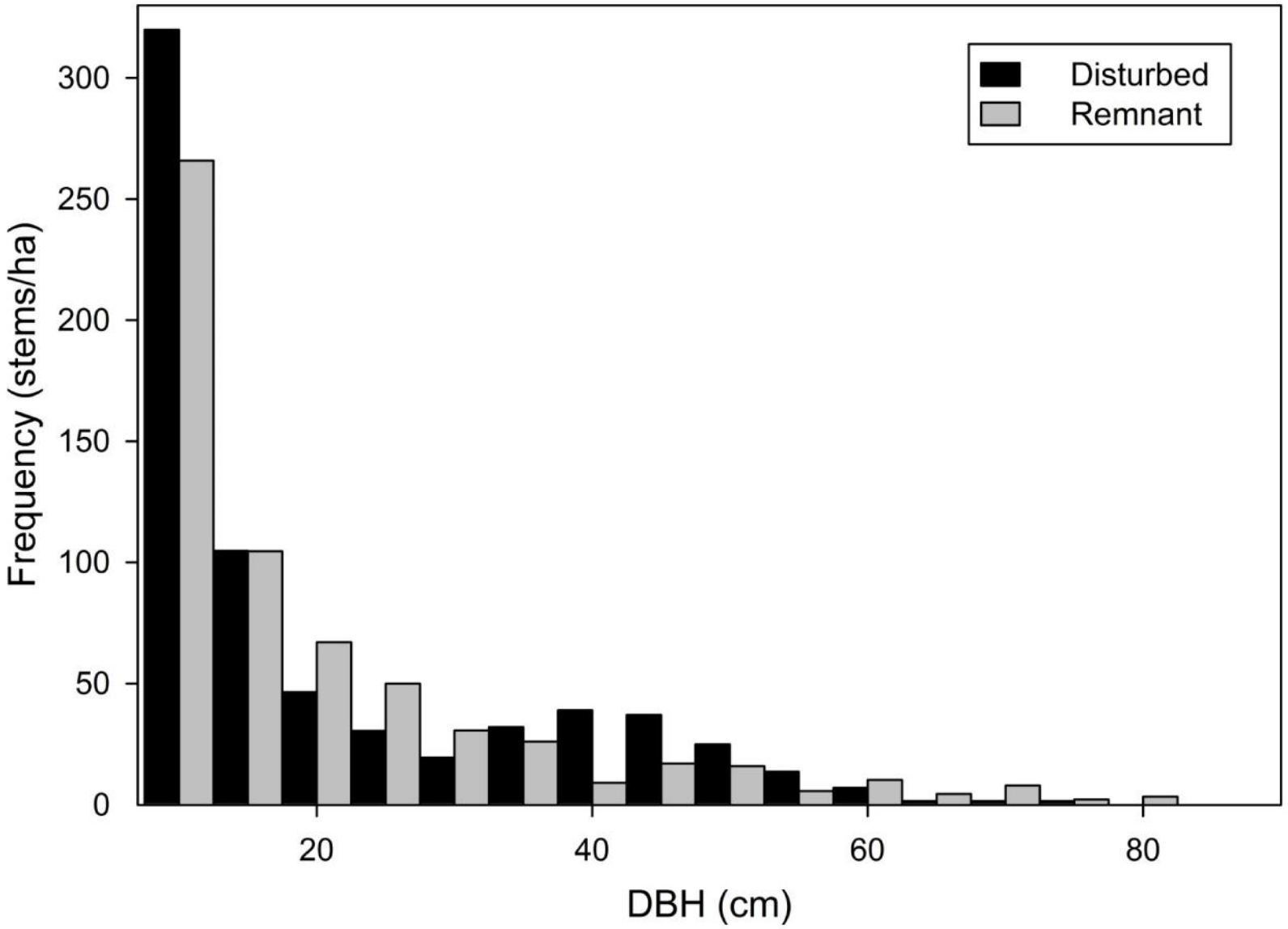
Differences in Structural Complexity

disturbance

Differences in Structural Complexity



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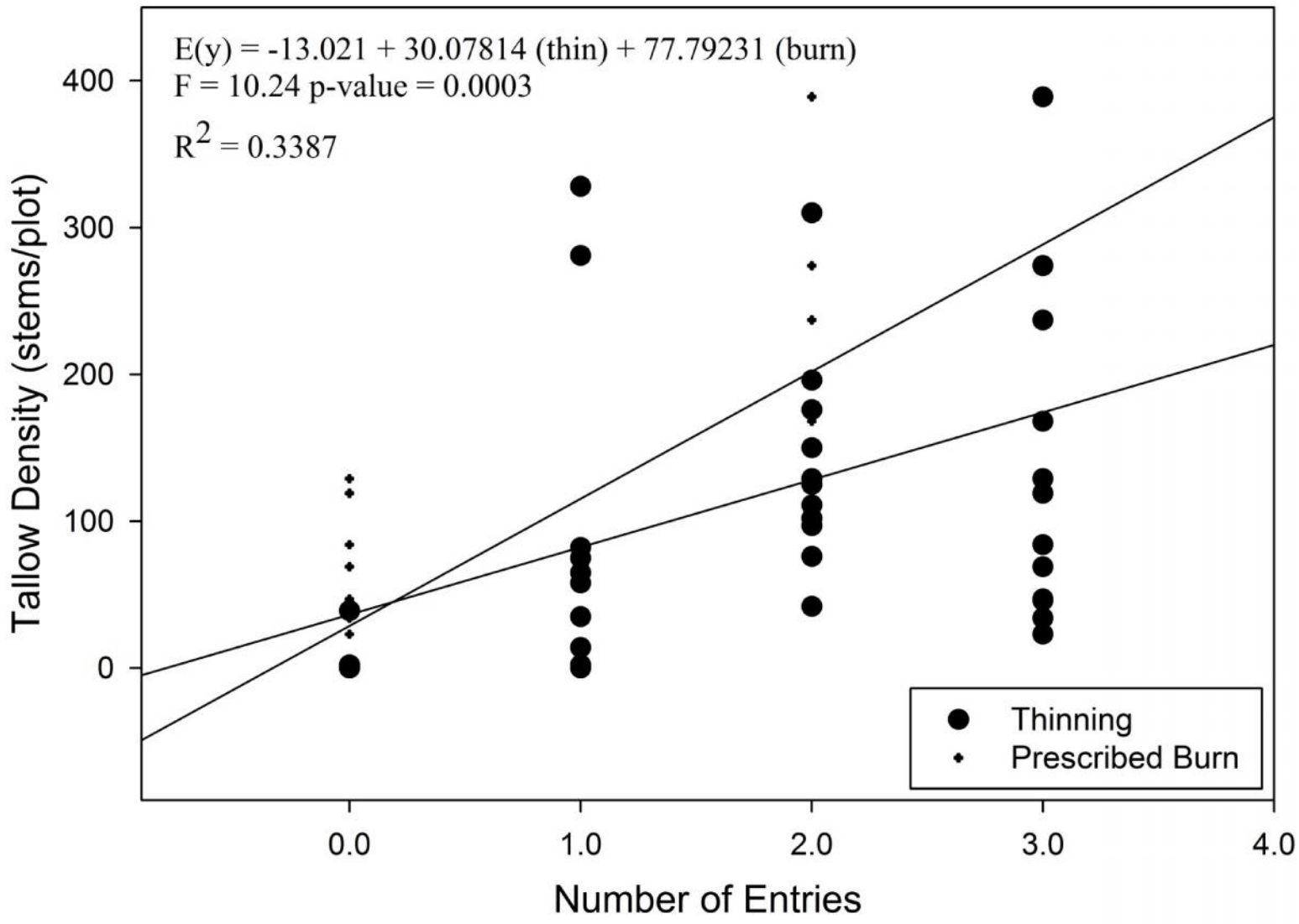
Results – Modern Forestry Practices

Forest Harvesting Operations
Thinning

Prescribed Fire

disturbance

Results – Modern Forestry Practices



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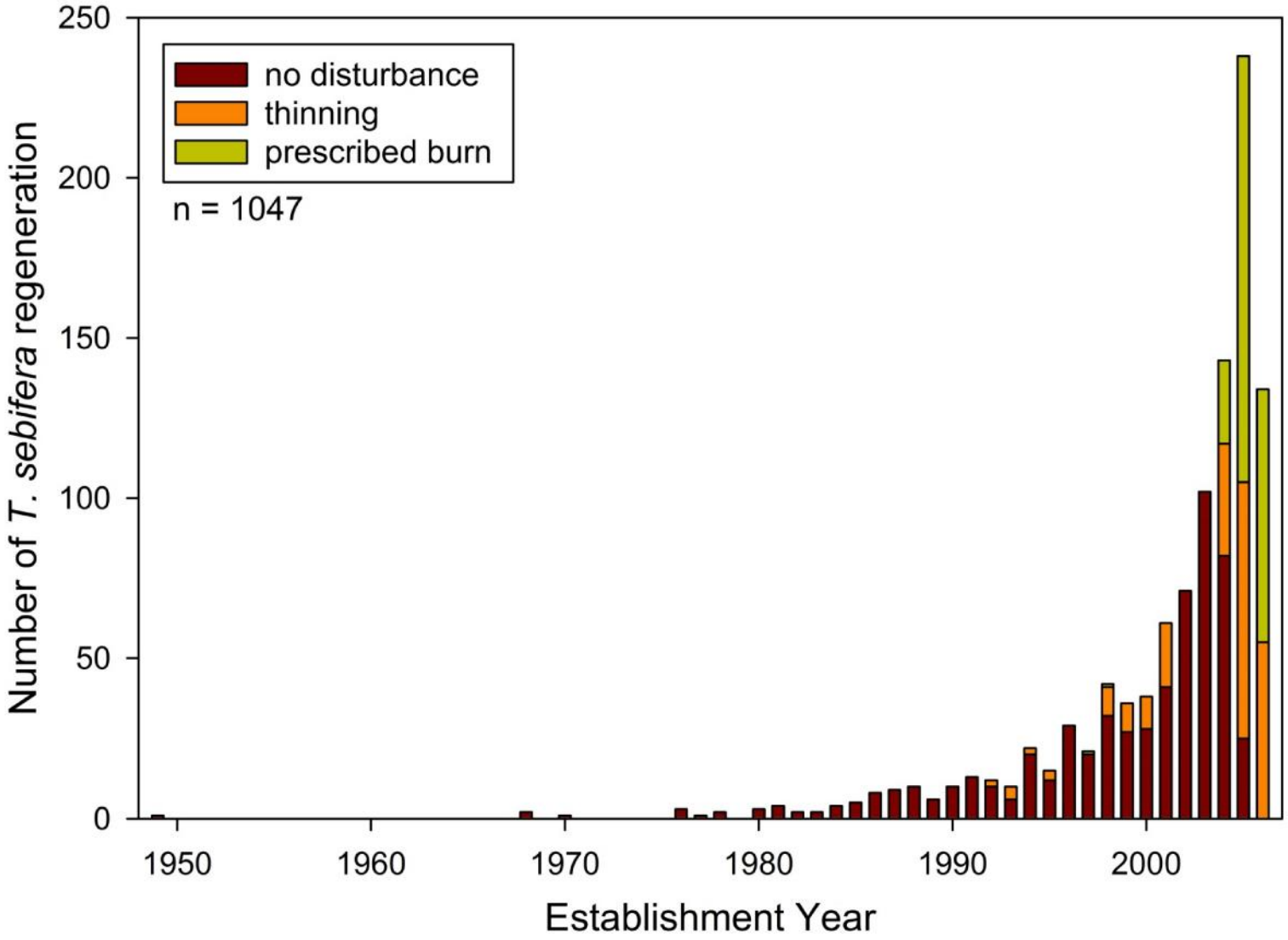
Results – Modern Forestry Practices



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Conclusions

- Chinese tallow dominated disturbed stands that were cleared for agriculture and restored to plantations in the 1970s, in contrast to the remnant stands which were much less invaded
- Remnant stands were more complex compositionally and structurally, which may allow to have greater resilience
- Common silvicultural practices, such as thinning and prescribed burning, may further facilitate Chinese tallow establishment

In disturbed forests, Chinese tallow invasion may be the symptom, rather than the driver, of ecological degradation induced by human perturbations.

disturbance

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