Drivers of woody encroachment in Illinois wetlands

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Introduction

Wetlands are incredibly important ecosystems, providing critical habitat to wildlife and a number of ecosystem services that are important to human life. However, since 1818, Illinois has lost 90% of its historical wetlands. Woody species encroachment is one major threat to these important ecosystems. Historically, herbaceous emergent wetlands were kept free of woody species by a number of mechanisms, including wildfires and hydrologic conditions that favored herbaceous species such as grasses and forbs. Unfortunately, humans have altered many of these natural controlling mechanisms. Both globally and in Illinois, a trend of **woody species encroachment has been observed in wetland areas historically dominated by herbaceous plant species.** During woody encroachment, invading trees and shrubs close the wetland canopy, driving out numerous plants and animals adapted to open canopy conditions and threatening biodiversity.

Understanding the factors that promote woody encroachment may inform future conservation and restoration efforts and help conservation managers prevent further degradation and protect these valuable ecosystems.

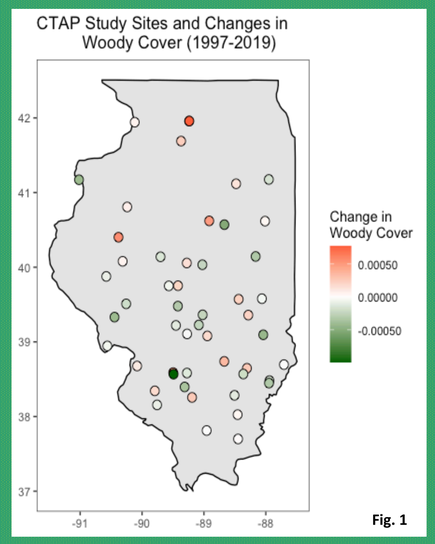

Fig. 1

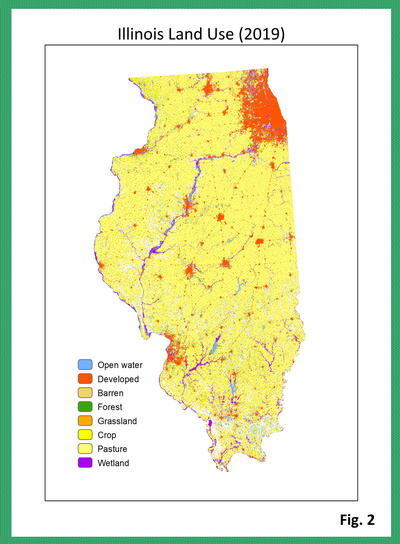

Fig. 2

Figure 1: Wetland study sites in Illinois showing degree of change in woody cover from 1997-2019 for each site.

Figure 2: Predominant land use types in Illinois, 2019. Map created from USGS National Land Cover Database.

Fig. 3a

Two common woody invaders in IL:

Fig. 3a, left: Common buckthorn (*Rhamnus cathartica)*

Fig. 3b, right: Japanese honeysuckle (*Lonicera japonica)*

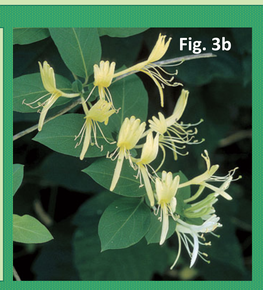

Fig. 3b

Methods

The Illinois Natural History Survey Critical Trends Assessment Program has collected vegetation data at over 200 wetland sites in IL every five years dating back to 1997. Using this data, we calculated the percent change in total woody cover at each site over time. To determine drivers of this change, we focused on habitat fragmentation and, as a proxy for hydrological change, changes in land use around each site. Using the landscape metrics tool in R and data from the USGS National Land Cover Database, we quantified habitat fragmentation and determined the percent change in land use types in a 1000m buffer zone around each site. The landscape metrics we used to assess fragmentation were aggregation, patch density, and distance to the nearest wetland. Linear regressions were then conducted in R to assess patterns of woody cover in relation to fragmentation and surrounding land use change at each site.

Results

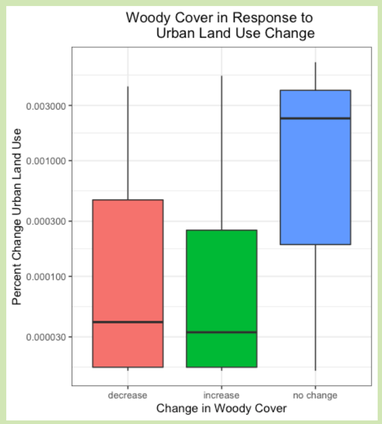

Figure 4: Patterns of change in total woody cover at the site level in relation to percent change in urbanized land in the 1000m buffer zone surrounding each site. No significant relationship is detected.

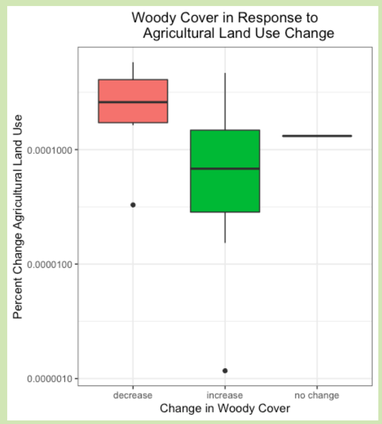

Figure 5: Patterns of change in total woody cover at the site level in relation to percent change in agricultural land in the 1000m buffer zone surrounding each site. No significant relationship is detected.

Results Cont.

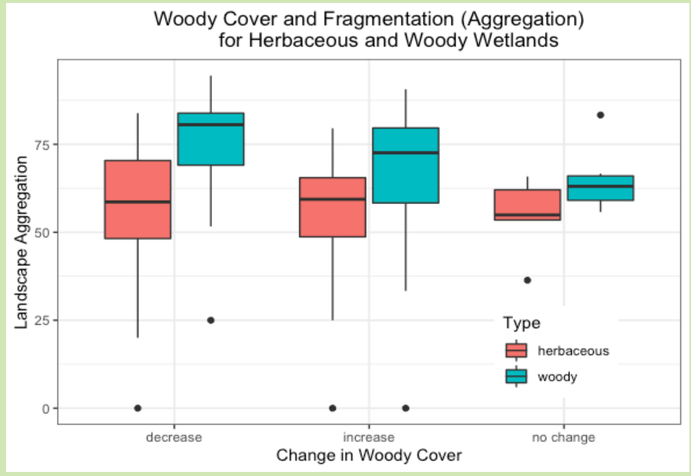

Figure 6: Change in woody cover at both herbaceous emergent and floodplain forest (woody) wetland sites in relation to habitat fragmentation, measured by landscape aggregation. (Note: Sites with higher aggregation numbers are less fragmented landscapes, while sites with low aggregation numbers are highly fragmented landscapes.) While woody wetlands tend to be located in less fragmented landscapes, no significant relationship was detected between landscape aggregation and patterns of change in total woody cover.

Discussion

Woody cover increased in 95 CTAP sites from 1997-2019. However, we found that neither habitat fragmentation nor changes in surrounding land use had a significant effect on woody cover at CTAP wetland sites. Woody encroachment is typically driven by a combination of factors, not all of which were tested in this study. Additionally, changing land use around each site may not accurately reflect hydrological change, since hydrological systems are much more large and complex. Actual hydrological data would likely provide a better understanding of hydrological change than our proxies of land use change. If substantial hydrological data can be acquired, future studies should assess the impacts of hydrological change on woody cover in wetlands. Additionally, future studies should examine the impact of fire regimes on woody encroachment in wetlands.

Acknowledgements

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