Research Square

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High matrix vegetation decreases mean seed dispersal distance but increases long wind dispersal probability connecting local plant populations in agricultural landscapes

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Research

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Abstract

Background

Seed dispersal plays an important role in population dynamics in agricultural ecosystems, but the effects of surrounding vegetation height on seed dispersal and population connectivity on the landscape scale have rarely been studied. Understanding the effects of surrounding vegetation height on seed dispersal will provide important information for land use management in agricultural landscapes to prevent the spread of undesired weeds or enhance functional connectivity.

Methods

We used two model species, Phragmites australis and Typha latifolia, growing in small natural ponds known as kettle holes, in an agricultural landscape to evaluate the effects of surrounding vegetation height on wind dispersal and population connectivity between kettle holes. Seed dispersal distance and the probability of long-distance dispersal (LDD) were simulated with the mechanistic WALD model under three scenarios of “low”, “dynamic” and “high” surrounding vegetation height. Connectivity between the origin and target kettle holes was quantified with a connectivity index adapted from Hanski and Thomas (1994).

Results

Our results show that mean seed dispersal distance decreases with the height of surrounding matrix vegetation, but the probability of long-distance dispersal (LDD) increases with vegetation height. This indicates an important vegetation-based trade-off between mean dispersal distance and LDD, which has an impact on connectivity.

Conclusions

Matrix vegetation height has a negative effect on mean seed dispersal distance but a positive effect on the probability of LDD. This positive effect and its impact on connectivity provide novel insights into landscape level (meta-)population and community dynamics — a change in matrix vegetation height by land use or climatic changes could strongly affect the spread and connectivity of wind-dispersed plants. The opposite effect of vegetation height on mean seed dispersal distance and the probability of LDD should therefore be considered in management and analyses of future land use and climate change effects.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the latest manuscript can be downloaded and accessed as a PDF.

Figures

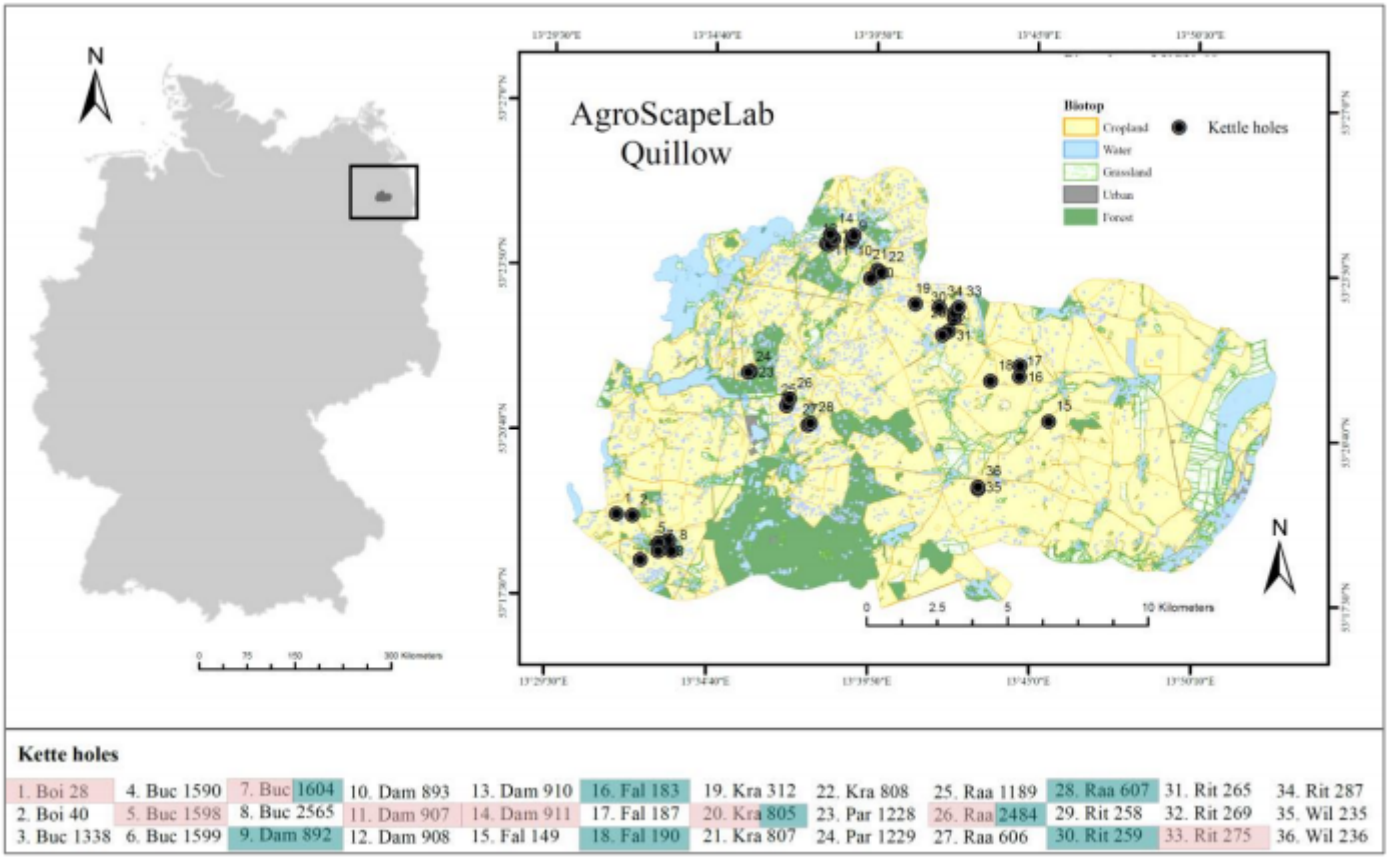

Figure 1

Study area

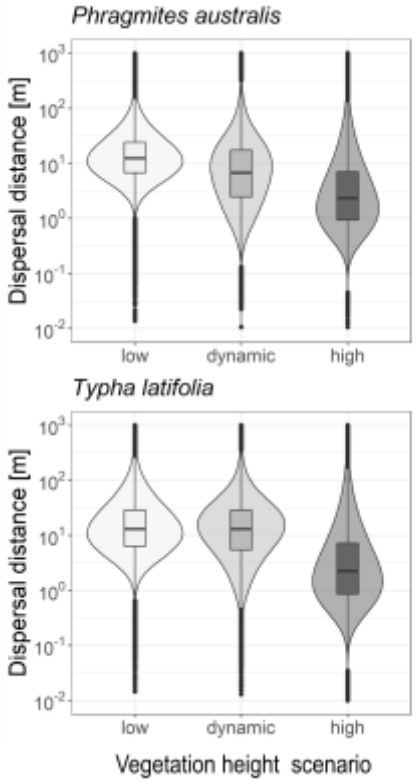

Figure 2

Variation in seed dispersal distance in various scenarios of simulation.

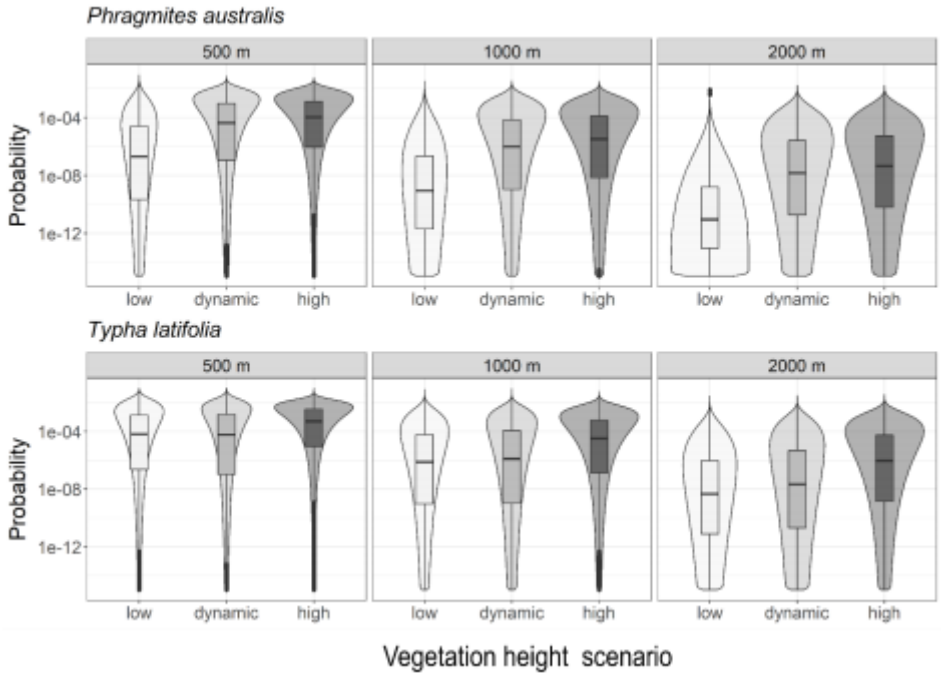

Figure 3

Probability of long-distance seed dispersal with different threshold distances and in various scenarios of simulation.

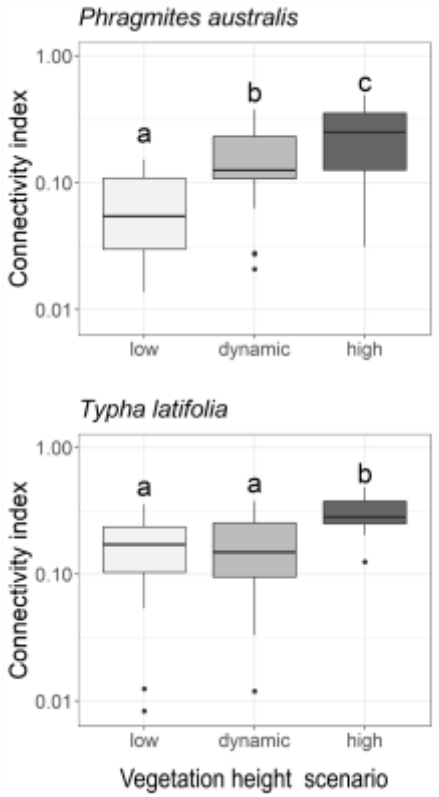

Figure 4

Variation in connectivity index in various scenarios of simulation.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryMaterial.pdf