The spatio-temporal dynamics of Himalayan Balsam (*Impatiens glandulifera*) within the Scheldt estuary

RESEARCH INSTITUTE NATURE AND FOREST

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Introduction

Himalayan balsam (*Impatiens glandulifera*; **fig. 1**) is an annual plant species that is native to East Asia and was introduced into Europe as a garden ornamental. Since the mid-20th century, the species started to become widely established in the wild.

Here, we use relevé data of 85 permanent plots from the tidal freshwater zone of the Scheldt and its tributaries to showcase the species' spatio-temporal trends, and try to explain its occurrence as a function of local habitat factors.

Results

Himalayan balsam became ever more ubiquitous in the freshwater zone over the last 20 years. The relevés show both the downstream colonization of the species, as well as the local expansion along the lower Scheldt's mid-course (**fig. 2**). It is the single most recorded plant species over all years, and now occurs in about 90% of the permanent plots (**fig. 3**).

Fig. 1 – Himalayan balsam (*Impatiens glandulifera*).

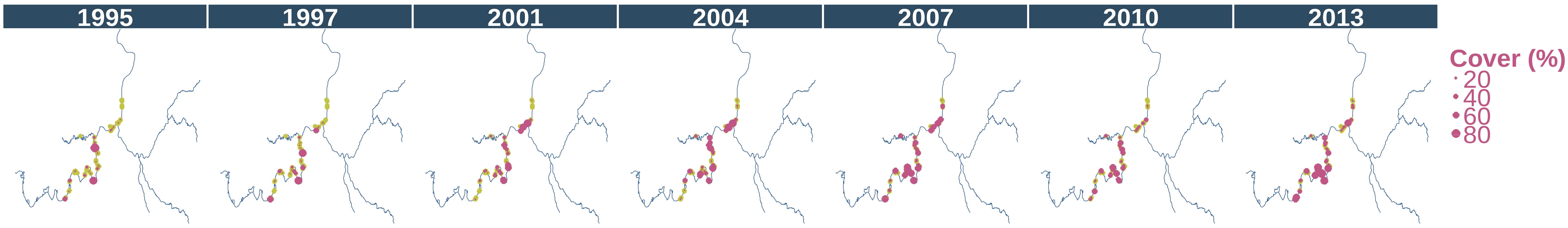

Fig. 2 – Location of the permanent plots along the Scheldt and Durme (in green, n=85), and the cover of *I. glandulifera* throug time (purple).

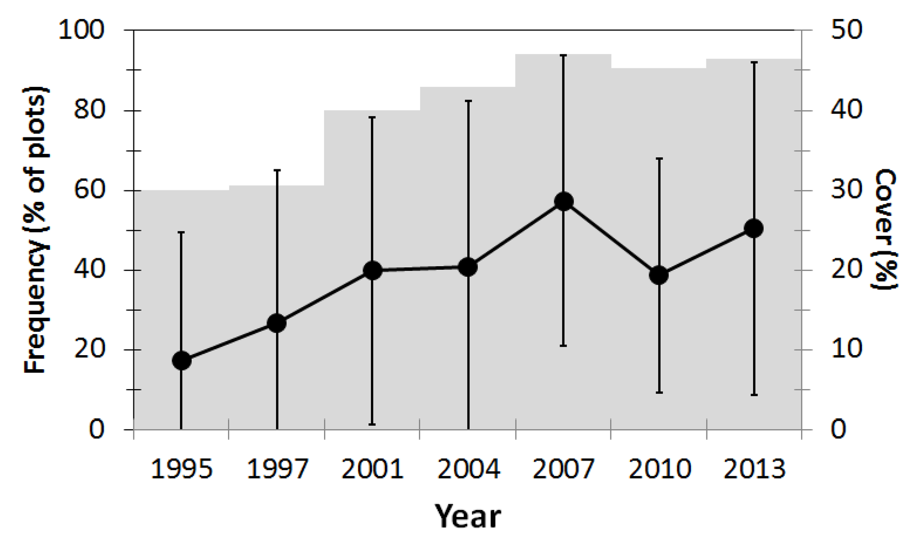

Fig. 3 – Frequency (bars) and mean cover (circles, ± st.dev.) of Himalayan balsam through time.

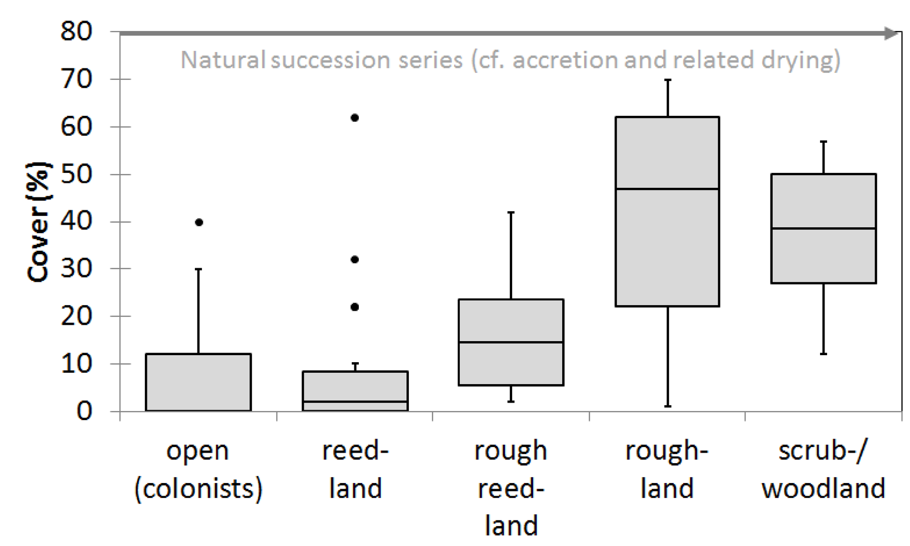

Fig. 4 – Box plots of Himalayan balsam cover according to the main vegetation types in tidal areas.

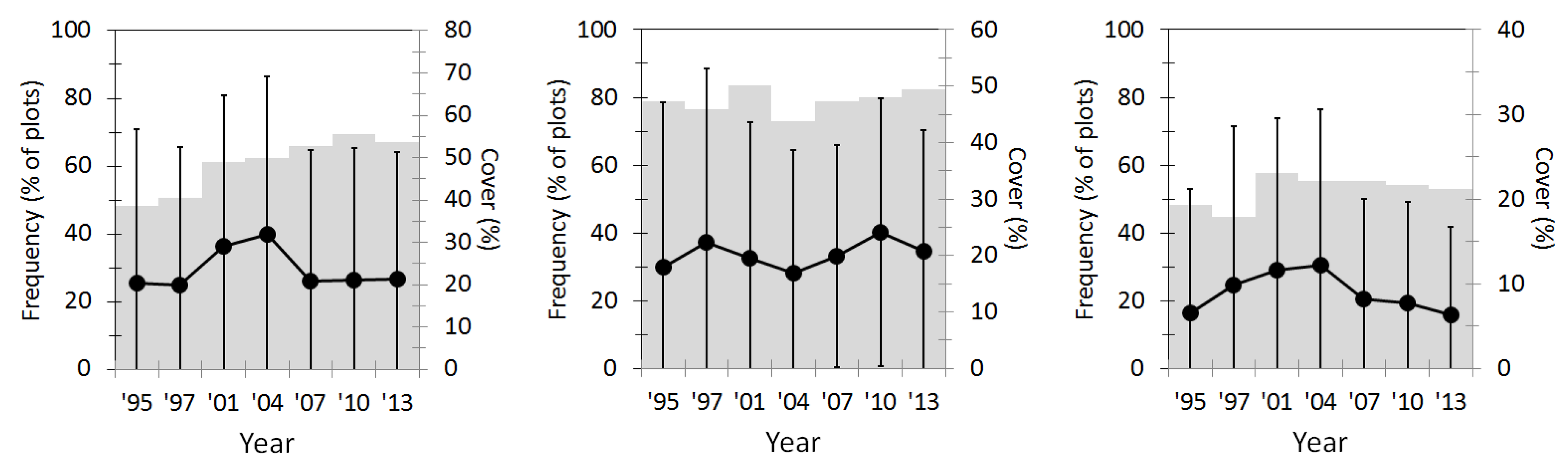

Fig. 5 – Frequency (bars) and mean cover (± st.dev.; circles) of *Phragmites australis* (left), *Epilobium hirsutum* (middle) and *Urtica dioica* (right) through time.

The species occurs in various types of vegetation, yet is found most optimally in roughened vegetation characteristic for later-successional stages, determined by sediment accretion and related hydrological change (**fig. 4**).

The species' overall increase does not appear to be univocally linked to directional trends in the cover of the other dominant and ecologically related species *Phragmites australis*, *Urtica dioica* and *Epilobium hirsutum.* However, its marked increase between 2004 and 2007 did coincide with a drop in the cover of *P. australis* and *E. hirsutum* (**fig. 5**). It is unclear whether the observed trends represent mutual competition among species, patterns of succession (above), or both.

We tested for explanatory site factors by means of fuzzy set ordination, which is particularly suited for testing multivariate data against specific hypothesized relations (**fig. 6**). Of all hydrological variables included, the best results were found for inundation frequency as derived from topographical data. When looking into detail, Himalayan balsam tends to be typical for plots with a low inundation frequency or plots that become frequently inundated yet harbour a vegetation that is indicative for drier conditions (**fig. 7**). We suggest this is due to local drainage of the water received, with the species profiting from well-drained conditions.

This latter finding corroborates the apparent observation that Himalayan balsam is relatively under-represented in newly established inundation areas that have a controlled reduced tide, and thus less extreme drainage conditions (cf. Sigma plan). Such restoration projects may thus prove particularly succesful in breaking local dominance of the species.

As similar long-term plot vegetation data is available from tidal zones along the Dutch Meuse (e.g. The Biesbosch), these tests may become replicated as to further investigate the occurrence and effects of Himalayan balsam invasion in riverine habitats.

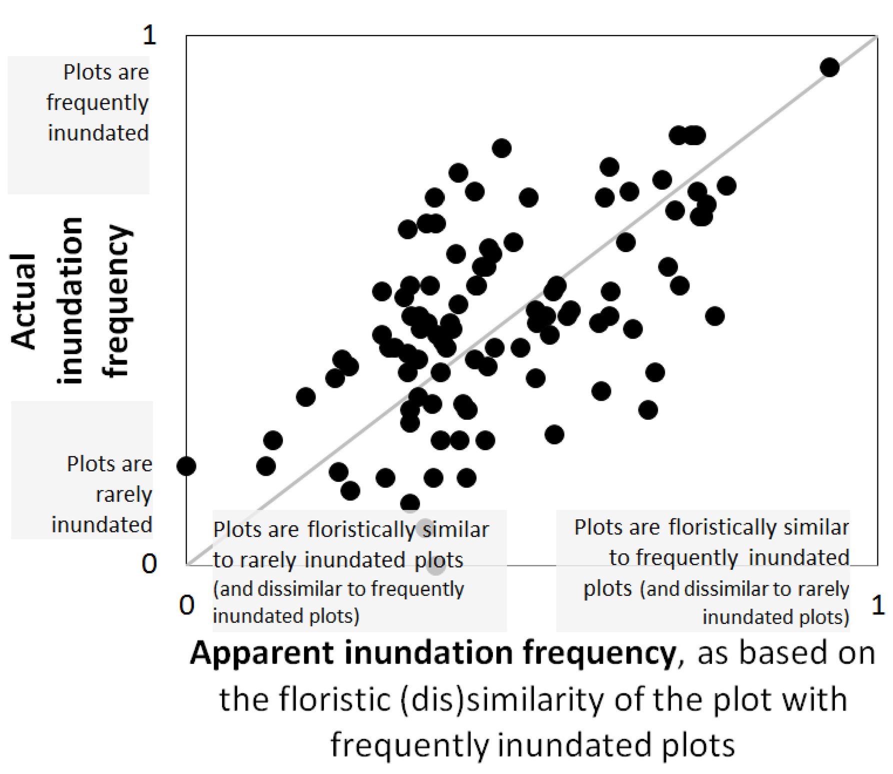

Fig. 6 – Ordination graph of the 2007 relevé data with regard to inundation frequency, also explaining some basics for interpretation. Grey line represents equality. The general diagonal trend indicates that environmental factors correlated with inundation frequency exert a significant influence on vegetation composition.

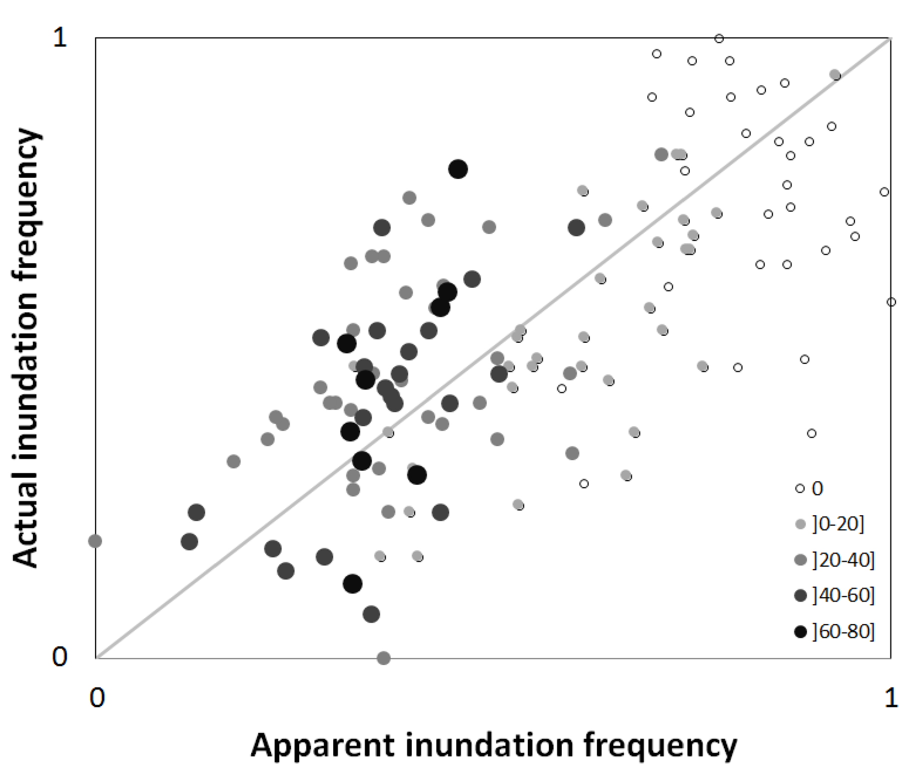

Fig. 7 – Overlay of fig. 6 indicating the cover of Himalayan balsam. Most of the respective plots cluster above the equality line.

Related reading :

Van Ryckegem et al. (2013) MONEOS – Geïntegreerd datarapport INBO: toestand Zeeschelde 2013. INBO report INBO.R.2014.2646963 **|** Gyselings et al. (2011) Ontwikkeling van één schorecotopenstelsel voor het Schelde-estuarium. INBO report INBO.R.2011.31. **|** Roberts (1986) Ordination on the basis of fuzzy set theory. Vegetatio 66: 123-131.