



# Contrasting effects of climate change on the invasion risk and biocontrol potential of the invasive *Iris pseudacorus* L. between Northern and Southern Hemisphere

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## HIGHLIGHTS

- *Iris pseudacorus* is invading wetlands across humid temperate regions worldwide.
- The climatic suitability of the weed and its candidate biocontrol agents was analyzed.
- Current and future projections were compared to quantify the effect of climate change.
- Increasing invasion risk and low plant-agent overlap predicted in the Northern Hemisphere.
- Decreasing invasion risk and high plant-agent overlap predicted in the Southern Hemisphere.

## ABSTRACT

*Iris pseudacorus* is both a prized ornamental and an invasive aquatic plant that tends to grow dense monospecific stands, displacing the local vegetation and altering the hydrology of freshwater ecosystems. Originally from Europe, this species has historically invaded North America, China and Japan, and more recently spread through Argentina, South Africa and Australasia, where it is now a target for biological control. Field surveys within its native range have led to the selection of three candidate biocontrol agents. Prioritizing the best candidates for different regions constitutes a critical step, which could save significant time and resources before further cost-intensive experimental studies are conducted. Climate change is seldom taken into consideration in the prioritization process. In this regard, climatic suitability can be used to model the potential distributions of weeds and their candidate agents, both in space and time, thus allowing to identify areas at risk of invasion and predict where agents will be able to establish long-term. Accordingly, the objectives of this work were (i) to predict *I. pseudacorus* invasions and range shifts in the context of climate change; (ii) to identify wetland areas most at risk of invasion under present and future climatic conditions; and (iii) to prioritize the best suite of candidate biocontrol agents for different invaded ranges, worldwide. To do so, we modelled the present and future (2040–2060) climatic suitability of *I. pseudacorus* and its candidate agents using the software MaxEnt. Our results highlight a clear distinction between predictions for the Northern and Southern Hemispheres. In North America and eastern Asia, the area climatically suitable for *I. pseudacorus* is expected to increase and shift northwards. As for its biocontrol agents, very low suitability is predicted across these regions, further decreasing under future climatic conditions. On the other hand, climatically suitable areas for the plant in South America, southern Africa and Australasia are predicted, on average, to reduce in response to climate change. A decrease in climatic suitability is also expected for its candidate biocontrol agents which, however, would still maintain a significant range overlap with their host. These results can be used to prioritize areas most at risk of invasion and identify which combination of candidates could potentially provide the best level of control across different invaded ranges.

## 1. Introduction

Biological invasions are recognized as a major driver of biodiversity loss and environmental degradation (Pyšek et al., 2020), especially in freshwater ecosystems (Santamaría, 2002). In particular, invasive alien aquatic plants (IAAPs) are considered a major threat to these habitats

(Vilà et al., 2010). Yellow flag, *Iris pseudacorus* L. (Iridaceae), is a perennial helophyte native to Europe, North Africa and western Asia. Internationally sold as an ornamental plant, this species has historically invaded North America, China and Japan, and more recently spread through Argentina, South Africa and Australasia, where it is now a target for biological control (Hill and Coetzee, 2017; McGrannachan and

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