

# **Risks, impacts and management of invasive plant species in Vietnam**

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# Declaration

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted to a degree or diploma at any tertiary education institution.

## Human ethics

The research in chapter 5 presented and reported in this thesis was conducted in accordance with the *National Statement on Ethical Conduct in Human Research* (2007), the *Australian Code for the Responsible Conduct of Research* (2007) and Murdoch University policies. The proposed research study received human research ethics approval from the Murdoch University Human Research Ethics Committee, Approval Number 2017/033

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# Statement of co-authorship

The following people and institutions contributed to the publication of work undertaken as part of this thesis:

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We the undersigned agree with the above stated “proportion of work undertaken” for the above published peer-reviewed manuscripts contributing to this thesis.

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# Abstract

In Southeast Asia, research on invasive plant species (IPS) is limited and biased by geography, research foci and approaches. This may hinder understanding of the extent of invasion problems and effective management to prevent and control IPS. Because biological invasions are a complicated issue involving multiple disciplines, this thesis utilized diverse approaches to evaluate risk, impacts, and management of IPS in Vietnam. Distribution models of 14 species predicted that large areas of Vietnam are susceptible to IPS, particularly in parts bordering China. Native IPS, which are often overlooked in assessment, posed similar risks as non-native IPS. From the model results, a native grass *Microstegium ciliatum* was selected to quantify its impacts on tree regeneration in secondary forests. A field experiment in Cuc Phuong National Park found that tree seedling abundance and richness increased within one year of grass removal; this effect strengthened in the second year. These results highlight the impacts of IPS on tree regeneration and the importance of IPS management to forest restoration projects. Given the risks and impacts of IPS, strategic management is needed to achieve conservation goals in national parks (NPs). However, interviews with both state and non-state entities revealed poor and reactive management of IPS in Vietnamese NPs from national to local levels. Institutional arrangements challenge IPS management in Vietnam. Involvement of multiple sectors with unclear mandates leads to overlaps in responsibilities and makes collaboration among sectors difficult. Lack of top-down support from the national level (legislation, guidance, resources) and limited power at the local level weakens implementation and ability of NPs to respond to IPS. The findings of this thesis provide important information for achieving effective management of IPS in Vietnam. Knowledge of vulnerable areas and species likely to invade and cause impacts can help Vietnam efficiently allocate management resources to prevent and control IPS, but adjustments to institutional arrangements and enhanced cooperation may be necessary to ensure management occurs.

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# Chapter 1. Introduction

## Introduction

Invasive species (IS) are one of the most important threats to global biological diversity (Mack et al., 2000; Rejmánek, 2000). They have colonized virtually every ecosystem type on Earth, affected the native biota (Vitousek et al., 1997) and contributed to the local and global extinction of hundreds of species (Pimentel et al., 2005; Vitousek et al., 1996; Wilcove et al., 1998). In extreme cases, the environmental changes wrought by IS can be irreversible (Kumar, 2012). While the number and impact of IS are increasing, resources for management are limited (Perrings et al., 2010). Thus, prioritization for management is required (Gaertner et al., 2014; Kumschick et al., 2012). Recognizing this challenge for countries, Aichi target 9 from the 2011–2020 Convention on Biological Diversity Strategic Plan emphasizes the importance of identifying species and prioritizing control measures for IS management (Convention on Biological Diversity, 2010).

While developed countries have advanced programs for establishing priorities for preventing and controlling invasive species, less developed countries have slow responses to IS. One of the regions susceptible to biological invasion is Southeast (SE) Asia but the region has the greatest shortfall in responding to both existing and potential IS (Early et al., 2016). Lack of awareness by the public and managers (Pallewatta et al., 2003), as well as institutional constraints on IS management, are hindering the region in the prevention and control of IS. The constraints include unclear responsibilities, lack of political commitment and collaboration, and insufficient law enforcement (Elahi, 2003). A deficit of studies on IS in SE Asia (Nghiem et al., 2013; Peh, 2010) may substantially preclude the delivery of sound scientific advice to secure political and public support and identify priorities for IS management. As IS are understudied in the region, impacts of current invasion as well as future ecological or economic harms are not fully recognized (Lowry et al., 2013). Furthermore, the complexity of IS management involves multiple