SUSTAINABLE MANAGEMENT OF INVASIVE SPECIES

Edited by
Ming Hung Wong
Timothy R. Seastedt

World Scientific

SUSTAINABLE MANAGEMENT OF INVASIVE SPECIES

This page intentionally left blank

SUSTAINABLE MANAGEMENT OF INVASIVE SPECIES

Edited by

Ming Hung Wong
The Education University of Hong Kong, China

Timothy R. Seastedt
University of Colorado, USA

World Scientific

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI • TOKYO

Published by

World Scientific Publishing Europe Ltd.

57 Shelton Street, Covent Garden, London WC2H 9HE

Head office: 5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

Library of Congress Cataloging-in-Publication Data
Names: Wong, M. H., editor. | Seastedt, Timothy R., editor.
Title: Sustainable management of invasive species / edited by Ming Hung Wong,
The Education University of Hong Kong, China,
Timothy R. Seastedt, University of Colorado, USA.
Description: Hackensack, NJ : World Scientific, [2025] |
Includes bibliographical references and index.
Identifiers: LCCN 2024017634 | ISBN 9781800615830 (hardcover) |
ISBN 9781800615847 (ebook) | ISBN 9781800615854 (ebook other)
Subjects: LCSH: Introduced organisms. | Invasive plants. | Introduced animals.
Classification: LCC QH353 .S88 2025 | DDC 333.95/23--dc23/eng/20240509
LC record available at https://lccn.loc.gov/2024017634

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library.

For any available supplementary material, please visit
https://www.worldscientific.com/worldscibooks/10.1142/Q0467#t=suppl

Desk Editors: Balasubramanian Shanmugam/Rosie Williamson/Shi Ying Koe

Typeset by Stallion Press
Email: enquiries@stallionpress.com

Printed in Singapore

https://doi.org/10.1142/9781800615847_fmatter

Preface

An invasive species refers to a species introduced to an environment and becoming overpopulated, leading to ecological and/or economic damage to the new environment. Although invasions of well-established ecosystems by living organisms are natural, human activities greatly facilitate their introduction and expansion. In fact, throughout history, humans have profoundly enhanced the rate, scale, and geographic range of invasions. These species have dispersed both accidentally and deliberately since their earliest migrations. This dispersal accelerated in the age of discovery and more recently has occurred even more rapidly due to increasing international trade. Notable examples of invasive plant species include English ivy and Japanese knotweed, and invasive animal species include New Zealand mud snails and European rabbits.

It is vital to manage invasive species sustainably because invasions rates are increasing and the effects and management of each invasion is costly. To be sustainable, we must address environmental, social, and economic factors affecting the causes, impacts, and control of various invasive species across multiple spatial and temporal scales. There are issues associated with effective management that achieve ecological goals through social support, and these must be identified. We hope policymakers will consider sustainability principles when developing management agendas and policies.

This book comprises 16 chapters grouped into four parts: Governance, Emerging technologies or detection and assessment, Assessments for management actions, and Applications and opportunities,

with contributions worldwide, including authors from eight countries: Bangladesh, China, Malaysia, Mexico, Russia, India, Portugal, and the United States. We appreciate their enthusiasm and dedication.

Ming Hung Wong
Timothy R. Seastedt
25 October 2024

https://doi.org/10.1142/9781800615847_fmatter

About the Editors

Ming Hung Wong is an advisor/research chair professor at The Education University of Hong Kong; a member of the European Academy of Sciences and Arts; a professor emeritus at Hong Kong Baptist University; and the Chang Jiang Chair Professor of the Ministry of Education, China. He served as the editor-in-chief of *Environmental Geochemistry and Health* (Springer Nature) for 20 years (2002–2023). Professor Wong was the coordinator of "Regionally Based Assessment of Persistent Toxic Substances" for Central and Northeast Asia and a panel member (along with two other experts) of "Chemicals Management Issues of Developing Countries and Countries with Economies in Transition", sponsored by UNEP/GEF, during 2001–2003 and 2010–2012, respectively.

In addition to a PhD from Durham University, UK, Professor Wong received a DSc from the same university and a DSc from Strathclyde University (UK) for his significant contributions. His broad research interests include ecotoxicology, ecological restoration, and resource reuse. He has published more than 840 scientific papers and has been involved in editing several books and journal special issues. He was awarded the Croucher Senior Fellow (Croucher Foundation of Hong Kong) in 1997, the Royal Society Visiting Fellow (Royal Society, UK) in 2000, the Milton Gordon Award for Excellence in Phytoremediation (International Phytotechnology Society) in 2016, Fellow of the Society of Environmental

Geochemistry and Health (SEGH) in 2018, and a silver medal (Food Waste for Fish Culture) of the International Inventions (Geneva) in 2019.

Timothy R. Seastedt obtained his PhD in ecology at the University of Georgia, working with researchers at a site that became one of North America's first long-term ecological research (LTER) programs. An ecosystem ecologist interested in soil processes, his first academic appointments were at the Konza Prairie at Kansas State University. He continued his association with the LTER efforts and subsequently moved to his present location to become the principal investigator for the alpine LTER programme at the University of Colorado. He never lost interest in plant–soil–consumer interactions and began an effort in the 1990s to understand the causes and consequences of invasive plants and animals in Colorado grasslands. He recognised the need to partner invasive species studies with ecological restoration efforts and has worked with professional restoration groups that concurrently address biodiversity concerns, ecosystem services, and climate resilience. His work now focuses on experiential learning and restoration actions that benefit nature-based climate solutions for the Colorado Front Range. He has co-edited several books and authored or co-authored over 200 research articles. Among his awards is an acknowledgement for participating in the IPCC effort that received the Nobel Peace Prize in 2007, but his most valued accolade is the University of Colorado Chase Community Service Award he received in 2019. This award is given to a faculty member who has contributed exceptional educational, humanitarian, civics, or other service to the community.

https://doi.org/10.1142/9781800615847_fmatter

Contents

Preface v

About the Editors vii

Chapter 1 Introduction: Managing Invasive Species: Problems, Panaceas, and Realities for the 21st Century 1
Timothy R. Seastedt and Ming Hung Wong

Part 1 Governance 15

Chapter 2 Multi-Level Governance of Managing Invasive Alien Species 17
Sidan Wang

Part 2 Emerging Technologies or Detection and Assessment 45

Chapter 3 Management of Invasive Mosquitoes Through Molecular Surveillance 47
Yee Ling Chong, Mac Pierce, Shaolin Han, Lucy de Lataillade, Yunshi Liao, Elliott Miot, Freddy Kuok San Yeo, Benoit Guénard, and Tommy Tsan-Yuk Lam

Chapter 4 Environmental DNA Metabarcoding for Detecting Invasive Species: A Case Study in the Reservoirs of Hong Kong 83
Zhao Ming Wen, Ka Yan Ma, Wai Hong Yiu, Ling Ming Tsang, Ka Hou Chu, and Chi Chiu Cheang

Chapter 5 Invasive Woody Species Identification Using Hyperspectral Imaging Data 107
Pavel A. Dmitriev, Boris L. Kozlovsky, Anastasiya A. Dmitrieva, Tatiana V. Varduni, and Tatiana M. Minkina

Part 3 Assessments for Management Actions 137

Chapter 6 Prevention of Invasive Plant Species 139
Hao Shen, Lan Hong, Wen Jing Yang, and Qing Ye

Chapter 7 Microbe-Assisted Plant Invasion 159
Xun Wen Chen, Min Pan, and Louis Shing Him Lee

Chapter 8 Invasive Plant Pathogens and Their Impacts on Major Crops: Identifying the Worst Offenders of the European Union 187
Raksha Jain, Pedro Rosa, Nitin Bohra, Ana Borges, Rupesh Kumar Singh, Mahipal S. Shekhawat, Francisco R. Quiroz-Figueroa, Pradeep Kumar, Vishnu D. Rajput, Tatiana Minkina, and Henrique Trinidade

Chapter 9 Drought Legacy Effects on the Invasibility of North American Semi-Arid Grasslands 225
Karie Cherwin, Phil Chapman, and Alan Knapp

Chapter 10 Rethinking Plant Invasions During the Climate Crisis: An Ecosystem Management Imperative 251
Timothy R. Seastedt

Chapter 11 Management of Invasive Earthworms in North America 277
Andrea Dávalos, Josef Görres, Bradley M. Herrick, Timothy S. McCay, and Maryam Nouri-Aiin

Chapter 12 Temporal and Spatial Changes of Invasive Freshwater Fish in China Due to Climate Change 311
Ruwei Wang, Linlin Xia, and Feng Wang

Part 4 Applications and Opportunities 343

Chapter 13 Prospects of Invasive Plant Species for Sustainable Food Production 345
Khadeza Yasmin, Mohammad Al Mamun, Md. Abul Kashem, Md. Rokonuzzaman, and Wai Chin Li

Chapter 14 Sustainable Management of a Globally Invasive Species: The Case of Red Swamp Crayfish 401
Jingchun Shi, Li Xiang, and Ming Hung Wong

Chapter 15 Chinese Mitten Crab (*Eriocheir sinensis*): Turning an Invasive Species Into a Valuable Cultured Species 435
Tsun Man Lee, Chun Fung Wong, Yu Bon Man, and Ming Hung Wong

Chapter 16 Growing Invasive Fish in Sewage-Fed Ponds to Improve Water Reuse and Food Security 473
Tsun Man Lee, Uddin Md Saif, Yu Bon Man, and Ming Hung Wong

Index 507

Sustainable Management of Invasive Species, pp. 47-81 (2024)

Chapter 3: Management of Invasive Mosquitoes Through Molecular Surveillance

Yee Ling Chong , Mac Pierce. Shaolin Han. Lucy de Lataillade, Yunshi Liao, Elliott Miot, Freddy Kuok San Yeo, Benoit Guénard and Tommy Tsan-Yuk Lam

https://doi.org/10.1142/9781800615847_0003 Cited by:0 (Source: Crossref)

Abstract:

In environmental and public health management, a number of mosquito species are considered pests and vectors of diseases. They are responsible for transmitting pathogens such as plasmodium and flaviviruses, causing the endemic circulation of those diseases in some countries. Notably, many of these mosquito vectors are exotic species which have undergone geographic expansion over the past centuries, leading to the dissemination of diseases outside of their native range. The spread and establishment of exotic mosquitoes and their associated mosquito-borne diseases (MBDs) are critical due to their public health implications and socio-economic costs. These have been facilitated by trade and globalisation, urbanisation, and climate change. Many countries and regions are vigilant about invasive mosquitoes and include them on the watchlist of their pest surveillance and control programmes. While conventional methods of species identification under microscopes are dominant approaches in mosquito surveillance, recent molecular techniques have been under active development and application in the field. This chapter summarises the state-of-the-art molecular methods, aiming to explain their strengths and limitations in providing timely and informative detection of mosquito invasion events and associated pathogens, which can guide subsequent control measures to hopefully eliminate exotic populations before they become established in new places.