

# 1 Introduction: Tourism, Recreation and Biological Invasions

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## 1.1 Introduction

Tourism, recreation and invasive non-native species (INNS) are interlinked socio-ecological phenomena that have enormous impacts on biological conservation and human development and well-being globally in both positive and negative ways. Tourism and recreation have long been seen as both an opportunity for conservation as well as a potential threat to the very same object that is the basis for their activity, nature. On the other hand, biological invasions have been shown to be one of the most important threats to biodiversity, one that instead of slowing keeps increasing with time (Pyšek *et al.*, 2020).

Tourism, recreation and invasive species do not always affect biodiversity and human well-being in the same manner and they might also have disparate impacts for different stakeholders, which can lead to contentious public debate, and social conflict with implications

for international policy (Estévez *et al.*, 2015). Regardless of the relevance of these factors, there have been only limited efforts focused on studying the connections between invasion, tourism and recreation. For example, since 1999 global organizations and initiatives such as the Convention on Biological Diversity (CBD) and the International Union for Conservation of Nature (IUCN) have dedicated specific chapters and initiatives on tourism and conservation, and also on the threat of invasive species on biodiversity, but rarely have these efforts included an explicit dialogue across these issues. In the second decade of this millennium, and while facing multiple global crises, it is imminent that we need more integration to achieve conservation goals. The role of tourism and recreation on invasions and the multiple feedbacks among these drivers requires a more holistic approach in order not only to improve understanding but, more importantly, improve policy and management.

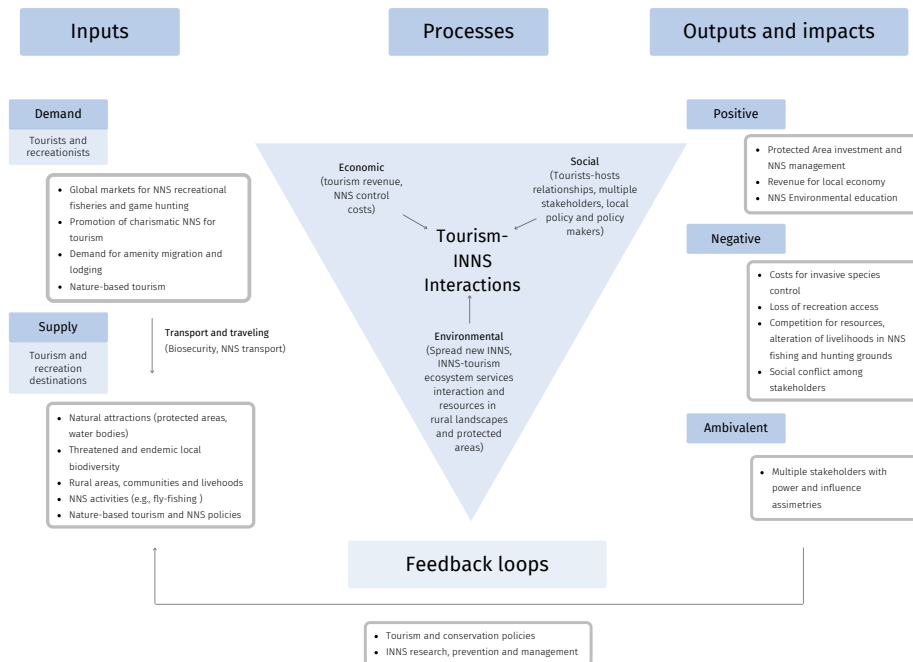
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It is therefore encouraging that research on invasive species and tourism is becoming increasingly prominent and interdisciplinary. There are high stakes for both biodiversity and people, including positive and negative impacts for economic development, ecological integrity and human well-being. In particular, invasive species can severely harm natural ecosystems of protected areas but also landscapes of food production, from where people obtain essential benefits for traditional and sustainable livelihoods. For example, INNS are the global fourth cause of bird decline and extinction (Lees *et al.*, 2020) and birds are the main assets of local communities for developing birdwatching or nature-based tourism. It is also fair to say that the rise of interdisciplinarity and the increasing dialogue between social sciences and natural sciences (which is not without difficulties) may

be responsible for the recent interest in the connections between tourism, recreation and biological invasions (Vaz *et al.*, 2017).

Nature-based tourism is now a big portion of the tourism global industry, which is based upon the experience, enjoyment and outdoor recreation of people in natural or semi-natural spaces. Therefore it creates a 'system' with inputs and outputs including environmental, economic and social interactions as a result of tourism. Newsome *et al.* (2013) called these interrelationships the Natural Area Tourism functional system (Fig. 1.1). Invasive species might play multiple roles within this system, for example through being spread by tourists and tourism industries for various reasons, through improving or negatively impacting tourism and recreation. This complexity arises from, for example, unintentional species introductions as



**Fig. 1.1.** Tourism functional systems and invasive non-native species (INNS), including inputs, processes and outputs from and across interactions between economic, social and environmental dimensions of tourism. Throughout the chapters in this volume, key examples of interactions between invasive species and tourism offer and demand are discussed. Modified from Newsome *et al.* (2013) Natural Area Tourism functional system.

a result of tourists' mobility to purposeful ones motivated by different users such as hunters or anglers, or even the introduction of charismatic species as tourist attractions. Unfortunately, while invasive species may benefit some industries or particular stakeholders, they can also adversely affect human well-being and the livelihoods of others, which can lead to intense conflicts over management.

In these complex scenarios, tourism and recreation may also provide the grounds to educate the public, in terms of ecoliteracy, environmental awareness and on the threats posed by invasive species. It has now been well studied that the discovery of nature and biodiversity can awaken pro-environmental attitudes of visitors when they return back home, including the education of the impact of INNS and how better to relate to these organisms. In fact, environmental awareness on INNS may be particularly relevant in natural areas where most nature-based tourism occurs, increasing citizen awareness and support of INNS management and policies.

Any assessment on the links between tourism, recreation and biological invasions will not be complete without considering the emerging risk posed by pathogens and pests. The current coronavirus disease 2019 (COVID-19) pandemic has brought attention to the urgency of controlling the mobility of organisms, including invasive species and pathogens, across the world. Concepts such as One Health and the more recent One Biosecurity emphasize the need for integrated approaches that consider the multiple interactions between people and nature. Tourism by definition mobilizes people, resources and information from one place to another, with the resulting economic input to local economies but also threatening biodiversity and potentially human well-being. Globalization has raised the bar for the precautionary approach when dealing with novel organisms and the tourism and recreation industries are now under more pressure to comply with these requirements.

From this brief introductory overview, it is clear that much more is needed to advance understanding of the integration of the concepts of tourism, recreation and invasive species and how to confront common threats to biodiversity and human well-being, while ensuring tourism sustainable practices and the proper management of problematic invasive species. We, as

editors, have outlined some of the complexities in Fig. 1.1, hoping to guide the reader through the different chapters presented in the book.

## 1.2 Aims and Structure of the Book

Through this book we aim to bring together the interrelationships between tourism, recreation and biological invasions, as a way to provide a better understanding on how these factors interact and affect nature conservation, tourism development and recreational opportunities and how to manage these issues better in the future (Fig. 1.1). For this we have compiled a unique set of case studies to improve broad-scale understanding and establish the basis for future work on the subject. The book is split into three core sections, Parts 1–3, which illustrate how both tourism and recreation sectors can: (i) facilitate and promote biological invasions through introductions, spread (pathways) and disturbance; (ii) how these invasions can have positive and negative impacts on the sector; and (iii) how engaging with the social dimensions and stakeholders is needed to improve INNS management within the tourism and recreation sector.

The book covers a vast array of climatic regions and ecosystems across all continents, from tropical to temperate mountains, oceans and freshwater systems, to terrestrial Antarctica. It also covers different invasive organisms, including terrestrial and aquatic plants and animals and microorganisms. Because of the nature of tourism and recreation that embrace a large spectrum of activities, this book provides examples from a range of activities undertaken in these settings including hiking, skiing, recreational fishing and hunting, boating, zoos, gastro-tourism and diving, among others. Despite our efforts to cover the diversity of aspects related to tourism, recreation and biological invasions, we know there are still many gaps, not only in this book but also in the international literature. These are gaps we encourage researchers to fill across the globe.

The question addressed in Part 1 *How do Tourism and Recreation Facilitate Biological Invasions?* is covered by eight chapters including global and regional case studies in terrestrial and aquatic systems. Chapter 2, 'Nature-based

Tourists as Seed Dispersal Vectors' (Pickering and Ansong), reviews 48 studies across the globe on how tourists contribute to the dispersal of non-native plants in natural and protected areas, including from different activity types and clothing equipment. The review provides information about what species are commonly dispersed, what factors affect seed dispersal and the implications for biodiversity. It also provides management guidelines to minimize seed dispersal as well as future research directions to address these issues. Chapter 3, 'The Role of Roads and Trails for Facilitating Mountain Plant Invasions' (Barros *et al.*), examines how tourism infrastructure can act as vectors for non-native plant introductions. The chapter consists of a global study, using a standard protocol developed by the Mountain Invasion Research Network (MIREN), in mountain roads and trails that range from boreal, to tropical and temperate ecosystems. The study illustrates the interacting effects of elevation and disturbance on the diversity and distribution of INNS at global and regional scales and provides key recommendations to minimize plant invasions in these settings.

Chapter 4, 'Fungal Invasions and Potential Spread Through Tourism and Recreation' (McGrath-Blaser and Longo), addresses the mechanisms of spread of fungi through tourism and recreation vectors and how it affects wildlife, with a special focus on chytrid fungi. It provides a review of major vertebrate fungal pathogens that are most likely to be spread through human use as well as develops a framework to control direct and indirect vectors of spread.

Chapter 5, 'The Role of Human Activities in the Introduction of Non-native Plants to Antarctic and Sub-Antarctic Islands' (Fuentes-Lillo and Cuba-Diaz), addresses the problems of INNS in Antarctic ecosystems. The authors review what common non-native plants occur, their documented impacts and main vectors for dispersal. They also provide detailed information about historical changes in tourism as well as the biosecurity measures undertaken for the removal and prevention of further plant introductions into these fragile ecosystems.

Chapter 6, 'Recreational Fishing as a Major Pathway for the Introduction of Invasive Species' (South *et al.*), provides a detailed overview of how freshwater recreational fisheries have contributed to invasions of non-native

species, including plants and animals. Through case studies it illustrates with examples intentional and unintentional introductions as well as discussing the conflicting issues between different stakeholders to tackle the problems of INNS. Chapter 7, 'The Role of Hunting, Zoos and Aquaria as Pathways for Vertebrate Invasions' (Monaco *et al.*), describes how these activities have contributed to the introduction of INNS of mammals and birds. The authors provide detailed historical data about introduction events as well as illustrating with case studies different species introduced through these sources. The authors discuss the current policies undertaken at regional and global scales and provide clear management recommendations to minimize further introductions.

Chapter 8, 'Plant Invasions Associated with Ski Resorts' (McDougall and Cavieres), provides a detailed description of how mountain tourism amenities can contribute to plant invasions through intentional and unintentional introductions. The authors also address the extent of plant invasions based on available data, current management practices and the impacts of INNS to native biodiversity in the face of climate change. The last chapter of this section, Chapter 9 'The Role of Second Homes in Non-native Plant Invasions' (Novoa *et al.*), addresses a problem that is often overlooked when examining the different pathways of INNS plant introductions. The chapter provides detailed information about how second homes can favour the introduction and dispersal of INNS and this is supported with case studies from different countries of the world where second homes have become popular.

Part 2 of the book, which addresses the question *How can Invasions Impact Tourism and Recreation?*, includes three chapters that describe how terrestrial and aquatic invasive animals and plants can affect tourism activities and users, including impacts on cultural ecosystem services, landscape aesthetics, economic revenue or visitor use patterns. One chapter also discusses the positive effects that INNS can have for tourism and recreation. Chapter 10, 'Negative Impacts on Tourism of Yellow Jackets (*Vespula germanica*) in Wilderness Areas of Chile' (Cerdeira *et al.*), addresses the socio-ecological impacts of the yellow jacket, an invasive wasp that has been introduced to many countries in the southern hemisphere and North America. The authors provide information

about how this species can affect the natural values of protected areas and visitor experiences. The economic costs of recreation loss and for control are estimated for the country of Chile as well as the main challenges faced to tackle this problem. Chapter 11, 'Impacts of Aquatic Plant Invasions on Tourism and Recreation' (Bradbeer and Pattison), highlights the impacts of INNS on freshwater ecosystems and how this affects visitor experiences, access and opportunities, including a wide range of water recreational activities. The authors provide examples from common invasive species worldwide, current initiatives to control them, and the economic costs estimated for the UK for management and control. Chapter 12, 'The Impact of Invasive Aquatic Animals on Tourism and Recreation' (Wood *et al.*), provides a holistic view of this problem, by not only reviewing the negative but also the positive impacts of INNS on the tourism industry and its users. To illustrate the divergent impacts that INNS can have, the authors provide evidence from case studies of different invasive aquatic animals that are common in marine and coastal tourism destinations.

The last section of this book, Part 3, which addresses the question *Why is Incorporating the Social Dimensions when Managing INNS in the Tourism and Recreation Sector Important?* covers five chapters. The authors of this section address the importance of addressing the social aspects to effectively manage INNS in tourism and recreational settings. Chapter 13, 'Tourists' Knowledge, Perceptions and Behaviours Towards Invasive Species' (Shackleton *et al.*), provides a detailed review of the scientific research that has examined different social factors that influence people's attitudes towards INNS and their willingness to support management actions to minimize their impacts. Chapter 14, 'On Visitors' Minds: Knowledge and Perceptions of Invasive Non-native Plant Species in Mountain Ecosystems' (Rossi *et al.*), provides original data from a visitor survey conducted in a popular mountain tourism destination in the Andes. The chapter addresses the links between people's knowledge and attitudes with their level of support to control INNS. Chapter 15, 'Contrasting Tourist Attitudes towards Non-native Species: a Case Study in

Yellowstone National Park' (Johnson), introduces the differences between different types of tourists and how these can affect their visitor experience in relation to INNS. The author illustrates this through two case studies in freshwater ecosystems in the national park, the opposing attitudes of different visitors towards invasive fish, as well as providing examples of management actions currently undertaken to manage INNS in the area.

The two last chapters in this section deal specifically with INNS management. Chapter 16, 'Complexities of Deer Management, Recreation and Hunting Tourism in North-east Victoria, Australia' (Bond), addresses through a case study the current policies for deer hunting and the social and environmental impacts of this activity. The author also highlights conflicts between different tourism operators. Chapter 17, 'Managing Invasive Species in Tourist and Recreation Areas of Montana, USA' (Rew and Larson), provides a detailed review of current management programmes and practices undertaken in this state. The authors give a special focus to invasive plants and aquatic mussels, including information about awareness and prevention programmes as well as current initiatives where citizens are actively involved in INNS detection and control.

In Chapter 18 'Conclusion: a Summary of Current Knowledge and Future Directions on the Interplay Between Invasive Species, Tourism and Recreation', we, the editors of this book, have synthesized key results discussed through the different chapters. Based on the findings and recommendations provided throughout the chapters, we provide take-home messages and recommendations for future research on the topic.

Finally, we hope this book is a useful tool for researchers, students, conservation practitioners and policy makers, and that it encourages more interdisciplinary and cross-cutting research on these topics as well as the implementation of policies and management practices based on the lessons learned to effectively manage tourism and INNS. This is a global key challenge we are facing today given the worldwide increase in tourism and its interactions and implications with regards to biological invasions.

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