

Research Article

Cite this article: Lovelock B, Ji Y, Carr A, and Blye C-J (2023) Tourists' (mis)understandings of nature: international and domestic visitors' perceptions of invasive alien plants in New Zealand. *Invasive Plant Sci. Manag* **16**: 240–252. doi: [10.1017/inp.2023.30](https://doi.org/10.1017/inp.2023.30)





Received: 11 May 2023
Revised: 4 October 2023
Accepted: 13 October 2023
First published online: 24 November 2023

Associate Editor:
Guillaume Fried, ANSES

Keywords:
Cultural perceptions of nature; invasive alien species; nonnative species

Corresponding author:
Brent Lovelock;
Email: brent.lovelock@otago.ac.nz

Tourists' (mis)understandings of nature: international and domestic visitors' perceptions of invasive alien plants in New Zealand

Brent Lovelock¹ , Yun Ji² , Anna Carr³  and Clara-Jane Blye⁴ 

¹Professor, Department of Tourism, University of Otago, New Zealand; ²Research Assistant, Department of Tourism, University of Otago, New Zealand; ³Associate Professor, Department of Tourism, University of Otago, New Zealand and ⁴Instructor, School of Health and Human Performance, Dalhousie University, Halifax, Canada

Abstract

Tourism, one of the world largest economic sectors, moves a substantial body of individuals and materials about the world and is implicated in the spread of invasive plants and is itself impacted by biological invasions that can degrade touristic landscapes and affect destination communities. Tourists constitute not only an immediate biological threat, but through their landscape and biota preferences also constitute a substantial economic and ecological force that has implications for invasive plant management in destinations. Tourists and the tourism industry are therefore significant stakeholders in invasive plant introduction, spread, and management. This paper discusses an onsite survey ($n = 231$) of domestic and international visitors in New Zealand, a destination where invasive species are an important ecological and economic issue. Findings show that visitors have a low understanding of the presence and level of threat of invasive plants and express preferences for some plants that are highly invasive. However, there were substantial variations across the international sample, with visitors from Asian and European ethnicities expressing significantly different attitudes toward a range of invasive plants. Asian visitors were more likely to show preferences for some plants that were seriously invasive and to be more accepting in general of invasive plants within landscapes and less supportive of invasive species eradication. These findings suggest that attitudes toward invasive plants and their management may be culturally determined, which poses challenges for managers aiming to generate awareness and support from across diverse tourist cohorts for invasive species control. There are also challenges for gaining support from the tourism industry for invasive plant control programs where particular “charismatic” or attractive invasive plants may contribute to touristic landscapes and visitor itineraries.

Introduction

New Zealand is an island nation supporting a relatively high number of endemic species (McNeely 2011). Tourism is the nation's major export earner (until the impacts of COVID-19) and relies heavily on New Zealand's endemic fauna and flora, its landscape, and the nation's 100% pure and green image (Hayes and Lovelock 2017). However, New Zealand has been profoundly affected by invasive alien species (IAS), particularly since the early 19th century following European colonization (Beattie 2011). Many areas of New Zealand now comprise mixed biodiversity with native and introduced species (De Lange et al. 2009). Yet we know very little about how tourists perceive our “invaded” landscapes or the extent to which they may support IAS management—especially if this impacts upon tourist vistas.

Decisions about IAS management are largely based on stakeholders' perceptions of their impacts (Shackleton et al. 2019a). However, attitudes toward IAS can be diverse and are influenced by a range of factors (Shackleton et al. 2019a, 2019b). Some IAS may even be perceived as having both positive and negative impacts (Kourantidou et al. 2022). This means that successful IAS management is often challenging because of the disparate values of multiple social groups or stakeholders (Fall 2021; McNeely 2011; Shackleton et al. 2007). Thus, incorporating stakeholder perspectives is considered to be critical to the success of IAS management (Head 2017; Warren 2001).

Tourism is a globally important activity involving the international movement of 1.4 billion people and domestic movement of 9 billion people (pre-Covid 19; UNWTO 2020). This movement significantly contributes to, and is affected by, biological invasions (Anderson et al. 2015; Barros et al. 2022; Hall and Baird 2013; Oded and Ram 2015; Pickering and Mount 2010). Invasive species can decrease the overall naturalness and biodiversity (Villéger and Brosse 2012) that many sites rely on as elements of their destination competitiveness (Lovelock 2007). IAS can also impact landscape aesthetics and degrade the ecosystem services that support tourism activities (Hall 2015). Conversely, some IAS are perceived to enhance destinations from the

© The Author(s), 2023. Published by Cambridge University Press on behalf of Weed Science Society of America. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.



Management Implications

The fiscal and political realities of invasive plant management mean that invasive plant managers need to engage more closely with their stakeholders, as invasive plant control is sometimes viewed as unnecessary or as itself being environmentally harmful. Where invasive plants exist within tourist destinations, this means engaging with visitors in order to:

- increase awareness of invasive plants and the need for their management;
- enlist visitors as “citizen scientists” and/or as volunteers in detection and control of invasive plants; and
- build a constituency of support for ongoing funding of invasive plant management.

To engage effectively with visitors, however, requires an in-depth understanding of those visitors and how they perceive invasive plants, and what their attitudes are toward invasive plant control. As few studies have explored tourists’ awareness of, attitudes toward, and understanding of invasive plants, this research contributes in two major ways; first by alerting managers to the generally low level of awareness and understanding of invasive plants among visitors. Managers cannot assume that even *local* visitors will recognize the threats from some invasive plants, particularly those that are perceived as “attractive.” Second, the study demonstrates that tourists cannot be treated as a homogenous cohort—visitors from different countries and ethnicities may not have a shared awareness of the invasive plant problem or, importantly, a shared understanding of the importance of invasive plant control.

The implications of the above are:

1. Managers need to adopt different approaches for different tourist segments in order to provide convincing and effective messaging regarding the invasive plant problem.
2. Managers may need to take cultural advice upon how best to communicate such messages.
3. Managers will need to work with the tourism industry (i.e., tourist guides and companies) to identify the best mechanisms for engaging with a diverse cohort of visitors.
4. Managers will need to consider how they “counteract” information (e.g., imagery from tourism social media) that celebrates the existence of some “charismatic” or attractive invasive plants where those plants are entrenched within tourist itineraries.

perspectives of both the visitor and the tourist industry and have become entrenched and valued as attractions or tourism products (Hayes et al. 2023; Shackleton 2019b).

However, compared with our ecological understanding of invasives, relatively little is known about the critical social dimensions of IAS (Yletyinen et al. 2021) and particularly about tourists’ perceptions of IAS (Nikodinoska et al. 2014). Research on tourists instead more broadly addresses biosecurity perceptions and behaviors (e.g., Kim et al. 2021; Melly and Hanrahan 2020). While we do know that environmentally engaged visitors may be more aware of IAS and supportive of management (Johnson 2022; Rossi et al. 2022), our knowledge of how attitudes toward IAS vary across social groups is limited. Yet this is potentially important, not only because of the cross-national nature of tourism, but also

because of our increasingly culturally and ethnically diverse societies (e.g., Gest 2021). If IAS managers are to develop messaging that resonates across and within different social groups, then it is important to research the IAS perceptions and attitudes held by different social groups. Research already suggests that nature and landscape preferences can vary across social groups, for example, by race/ethnicity (Buijs 2009; Buijs et al. 2009; Viriden and Walker 1999). Likewise, the IAS literature acknowledges that because perceptions are socially and culturally constructed, individuals from different backgrounds and with different demographic profiles may be expected to have different perceptions of IAS and different attitudes toward their management (Shackleton et al. 2019b). This has empirical support in some IAS research, for example, Solano et al.’s (2022) recent study on firewood and IAS translocation, which revealed race and education as the strongest predictors of behavior. However, we have yet to fully explore potential sociodemographic links with IAS awareness and attitudes.

Ethnicity and Attitudes toward Nature and IAS

Considering the focus of this study, to compare national/ethnic understandings of and attitudes toward IAS, we draw upon literature that more broadly considers ethnic/racial comparisons of nature preferences. Previous research has found distinct variations in nature/landscape preferences according to ethnicity and cultural background (Buijs et al. 2009; Herzog et al. 2000; Kaplan and Herbert 1987; Lovelock et al. 2011; Yu 1995). The majority of studies on this topic have been undertaken in North America and focus on differences between African American, Hispanic, and White ethnic/racial groups (e.g., Taylor 2018; Viriden and Walker 1999; for an overview of this body of research, see Whiting et al. 2017).

But more fundamentally, it has been argued that human–nature relationships vary cross-culturally. In Western societies, this is conceptualized as a human–nature separation (Bruun and Kalland 2014; Kellert et al. 1995), wherein authentic nature from a Western perspective is often portrayed as “wild” and “pristine,” free from human-related influences and impacts (e.g., Johnson et al. 2005). However, many non-Western and indigenous cultures consider nature and the environment as being intertwined with the human world, for example, Māori in Aotearoa New Zealand (Harmsworth and Awatere 2013).

Similarly, Asian perspectives of nature, which are particularly articulated in Buddhism, Daoism, and Hinduism, portray humans and the natural environment as a harmonious unity (Bruun and Kalland 2014; Harper and Snowden 2017; Kellert et al. 1995; Tu 1989). Empirical research does lend support to this view; for example, a study of Asian New Zealanders’ relationships with nature suggests that their experiences are less reliant on perceptions of naturalness (ecological integrity) (Lovelock et al. 2011), a finding reinforced by Packer et al. (2014) with Chinese visitors in Australia. But how such an Asian cosmology of human–nature relations may specifically impact perceptions of IAS has not been explored. Han (2006) contends that the relationship Chinese have with animals and plants differs from that of Westerners in that it hinges on understanding what enjoyment the animal or plant might provide; the Chinese are not interested in the plant or animal for its intrinsic value. Its invasive status may therefore be irrelevant.

Of course, to consider that all Chinese (or all Asians) subscribe to a consistent human–nature cosmology runs the risk of essentializing Chinese-ness and/or Asian-ness (Li et al. 2021),

just as it would be a generalization to say that all Westerners subscribe to the human–nature dichotomy described earlier. From the perspective of this research, these are merely labels to be used as convenient starting points to explore whether and how attitudes to IAS may vary. Meanwhile, complicating attempts to draw conclusions regarding the relationship between race/ethnicity and attitudes toward nature (and IAS) are previous findings suggesting that other demographic factors may also play a role; for example, gender and age have also been found to influence individuals' perceptions of nature and naturalness (Norgaard 2007; Sang et al. 2016).

Studies of Tourists and Invasive Species

There are limited studies of tourists' perceptions of and attitudes toward nature and environmental management that have a focus on invasive species. Barros et al.'s (2022) edited collection on tourism, recreation, and biological invasions is a welcome addition and includes a useful summary of work in this area (Shackleton et al. 2022). Those studies that do address invasive species (e.g., Ansong and Pickering 2015; Bravo-Vargas et al. 2019; Zhang et al. 2021) reveal variation in the way that visitors assess the threat from such species. For example, Sharp et al. (2011) found that visitors with higher levels of formal education and a biocentric value orientation indicated more support for certain invasive species control measures.

Nanayakkara et al. (2018) found that visitors' understandings of aquatic invasive species in Canada was organism dependent, but also connected with several demographic (age, sex, and education) variables, including place of residence (rural vs. urban); however, they found that race had no measurable effect. In their qualitative study of international visitors in eco-sanctuaries in New Zealand, Zhang et al. (2021) did, however, find examples of nationality (and familiarity with the species) influencing visitors' attitudes toward particular IAS. Likewise, other research on tourists in New Zealand has demonstrated variation between domestic and international tourists in their level of ecological knowledge, attitudes toward nature, and attitudes toward invasive species and their control (Lovelock 2007). However, in that study, international visitors were examined as one social group, and ethnic or cultural differences were not considered. While not addressing IAS specifically, Packer et al. (2014) found differences in attitudes toward nature among visitors based upon nationality and ethnicity.

A simple explanation for such variation in tourists' attitudes regarding IAS may be that they just have a lower level of awareness of IAS and the problems they cause within the destination regions that they are visiting. This may account for any domestic/international variation in attitudes. However, some researchers (e.g., Vining et al. 2008) claim that due to industrialization, urbanization, and disconnection from the natural environment, even the domestic general public may not recognize the threat from IAS. For international tourists, however, this is likely to be exacerbated by their visits taking place within unfamiliar ecosystems.

Collectively, the literature cited suggests that visitors' perceptions of and attitudes toward IAS may be linked with a range of demographic factors, including place of residence and race/ethnicity. Therefore, there is a need to investigate visitors' understandings of IAS and how this may vary across the range of visitors that the destination typically receives. This information may help in the development of appropriate IAS-related communication strategies for different visitor groups (Zhang et al. 2021). This is particularly important for destinations such as

New Zealand, where IAS pose a significant ecological and economic problem and where there is a large and diverse inbound market of nature-based tourists. Previous studies have addressed public opinion on invasive species and their control in New Zealand (W Fraser 2001; A Fraser 2006; Russell 2014), but limited research has been undertaken on tourists and the tourism industry in relation to IAS (Gawith et al. 2020; Lovelock 2007; Lovelock et al. 2022).

Consequently, this research aims to address gaps in our knowledge regarding cultural variation in perceptions of IAS, with a focus on tourists and their attitudes toward invasive plant management—specifically addressing the influence of visitor status (domestic/international) and sociodemographic factors such as nationality and ethnicity. This study extends the social dimensions of invasive species research into the tourism sphere and provides insights for agencies tasked with IAS management, where tourists and the tourism industry are critical stakeholders.

Materials and Methods

The aim of this research was to describe and compare visitors' perceptions (awareness, attitudes, values) of the natural environment and a range of introduced plant species based upon different sociodemographics defined by place of origin, ethnicity, age and gender. Thus, descriptive and comparative methods were considered most appropriate for this study, as they are commonly used in the social sciences to compare similarities and differences among groups (Williams 2007).

A questionnaire was developed for the purpose of the study, with some items broadly developed from Lovelock (2007), but the questionnaire was expanded and adapted to focus on flora rather than fauna and to include species that could commonly be expected to be encountered by visitors in their travels through New Zealand (see [supplementary material](#)). The questionnaire also drew broadly on other social dimensions studies on invasive plants (e.g., Bravo-Vargas et al. 2019; Lindemann-Matthies 2016). The first section aimed to examine participants' preferences for a range of commonly encountered flora in their New Zealand itineraries. The rationale for this being that we need to know about visitors' perceptions of and attitudes to commonly encountered invasive plants in order to develop appropriate environmental messaging for visitors around invasive plant management (ultimately with the aim of building a constituency of support from visitors for invasive plant management). For this section, we adopted a photo-elicitation approach (Harper 2002), noting that this has been used successfully in other studies of invasive species (e.g., Lovelock 2007; Zhang et al. 2021). Ten images of plants commonly found in New Zealand were presented to participants. Among these plants, beech forest (*Nothofagus* spp.) was the only native species, the remainder—mixed pasture grass, Scottish thistle [*Cirsium vulgare* (Savi) Ten.], pine forest (*Pinus* spp.), mixed exotic coniferous forest (*Pinus* spp., *Pseudotsuga menziesii* (Mirbel) Franco) gorse (*Ulex europaeus* L.), willows (*Salix* spp.), Russell lupin (*Lupinus polyphyllus* Lindl.), wild exotic conifers (*Pinus* spp., *Larix decidua* Mill.)—all introduced, with the latter four species also being invasive. Participants were asked to rate each plant using a 5-point scale (1 = do not like at all, 5 = like very much). One of the 10 photos (Figure 1G) contained wild conifers, but these were set within a native grassland landscape, and participants appeared to experience some confusion, many asking the surveyors which species their responses should be based on. Thus, the responses to this image were excluded from the analysis.

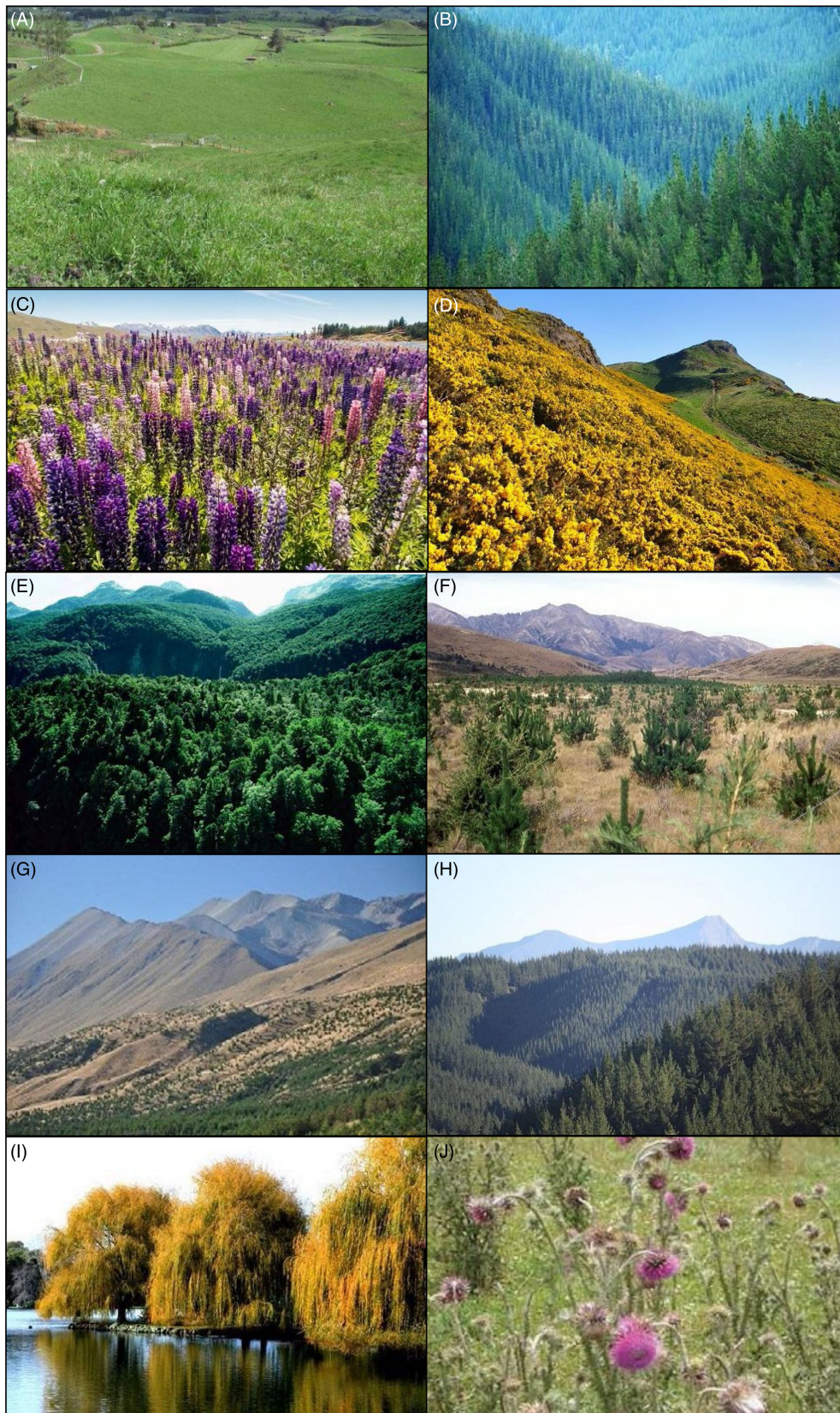


Figure 1. Images of species included in the survey: (A) pasture grass; (B) pine forest; (C) *Lupinus polyphyllus*; (D) *Ulex europaeus*; (E) beech forest; (F) wilding conifers; (G) wilding conifers; (H) exotic forest; (I) *Salix* spp.; (J) *Cirsium vulgare*.

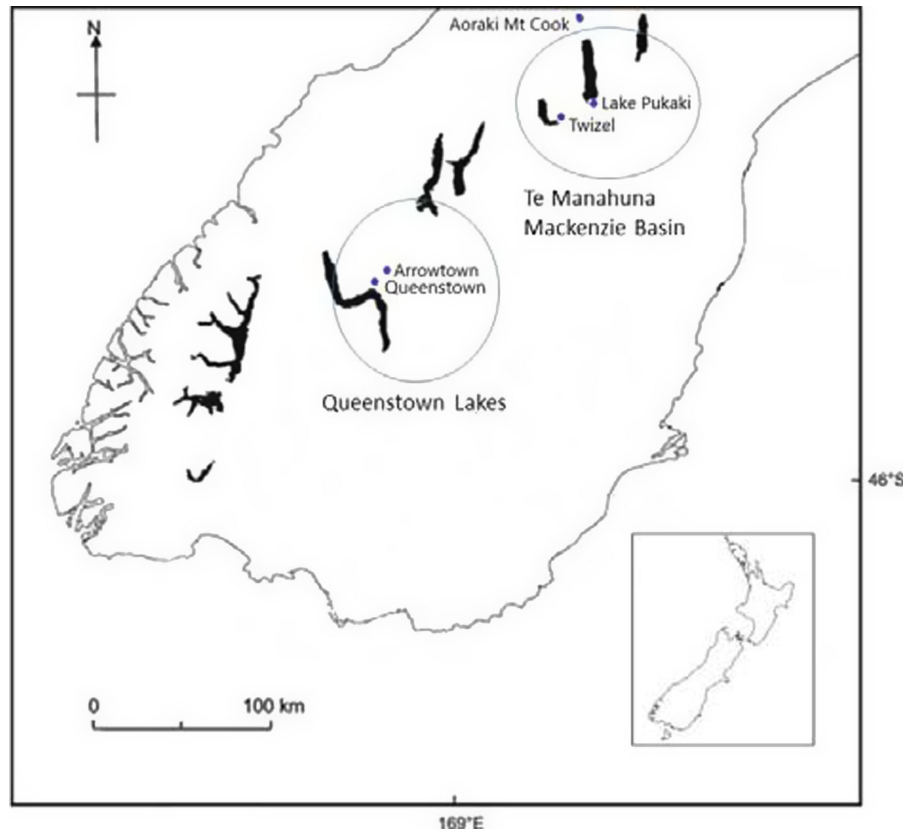


Figure 2. Study area, South Island, New Zealand.

The second section aimed to examine participants' perceptions (values, beliefs, and attitudes) of "naturalness" (natural environment) in relation to the presence of introduced species. A set of 12 statements covered the following aspects: participants' knowledge of New Zealand's IAS (4 items); participants' beliefs about the natural environment (4 items); and their attitudes toward invasive species and their control (4 items). For all 12 statements, participants were asked to rate the extent of their agreement on a 5-point Likert-type scale (strongly agree to strongly disagree). The final section contained sociodemographic questions addressing visitor status (domestic/international), nationality, ethnicity, gender, age, and whether they were a member of any environmental group.

The questionnaire was conducted in both English and in Mandarin, because Chinese visitors are the second largest tourist group in New Zealand (MBIE 2018). The questionnaire was originally designed in English and then was translated into Mandarin. Independent back-translation was undertaken to check consistency, and a pilot study was conducted with 12 Chinese individuals to ensure it was perceived by Chinese respondents correctly. Interviews were conducted with participants individually to determine whether they had any difficulties understanding the survey content. No key issues or problems were indicated by respondents during the pilot study. As this study required collection of primary data from human participants, ethical approval was gained before the distribution of the pilot and main surveys (University of Otago, approval D18/029). The aim of the research project was disclosed to participants before they started the survey through an information sheet provided on-site. Participants were assured anonymity in the final report and could choose at any time to withdraw from the survey.

Study Location

This study took place within two tourism regions in Te Waipounamu the South Island of New Zealand: Te Manahuna Mackenzie Basin and the Queenstown Lakes district (Figure 2). Both regions have spectacular natural landscapes and are important tourism destinations for both international and domestic tourists, being popular for sightseeing, camping, hiking, fishing, hunting, cycling, water sports, and snow sports (Gawith et al. 2020). Aoraki/Mt Cook (New Zealand's highest mountain and a key attraction in Te Manahuna Mackenzie Basin) was visited by more than 1 million visitors in 2018, and Queenstown (New Zealand's premier resort town) received 3.9 million visitors in 2019 (MBIE 2018; Sage 2019). Both areas have important historical, spiritual, and cultural significance to the indigenous Māori of Te Rūnanga o Ngai Tāhu, the local iwi (tribal group) (Greenaway et al. 2015).

The landscapes of both regions have been through substantial changes for a variety of reasons, including the damming of lakes and canal system construction for hydroelectricity, expansion of farming, intensive grazing, and planting of exotic conifers (Thompson 2011). Much native vegetation has been replaced by introduced plant species over the last 100 yr. Wild conifers (mainly *Pinus*, *Larix*, and *Pseudotsuga* spp.) have become problematic, spreading rapidly, eliminating native plants, and undermining the naturalness and uniqueness of landscapes (Dickie et al. 2014; Howell 2016). Similarly, *L. polyphyllus*, a decorative perennial garden plant, invades the braided riverbeds that are characteristic of the region, reducing the nesting habitat for birds, while providing refuge for introduced predators.

The survey was distributed during the summers of 2019 and 2020 at popular viewpoint sites near Queenstown and Arrowtown and at Twizel and Lake Pukaki in Te Manahuna Mackenzie Basin, where most of the visitors to these areas would stop for photo-taking opportunities. A convenience sampling technique was used to recruit the next available visitor at the viewpoint site who was willing to take part in the survey (Etikan et al. 2016). Surveys were self-completed, mainly via iPad (hard copies were available for respondents who preferred this medium). There were two researchers on site distributing the survey to visitors. One of the researchers was Mandarin speaking. Fruit and candy were available as incentives for survey participants.

SPSS v. 24 was used for data analysis. Normality was assessed by examining the skew and kurtosis values for all scale items (Fields 2013). All items met Kline’s (2010) criteria of skew less than 3 and kurtosis less than 10, indicating normally distributed data. Descriptive techniques were utilized to compute frequencies and means for responses within each response category for all questions by sociodemographic group. Independent *t*-tests (with equal variances not assumed) and one-way ANOVA tests (with the Bonferroni post hoc test) were utilized to determine the significance of differences in the mean scores of participants’ ecological knowledge and participants’ perceptions of the natural environment and introduced species among segregated groups defined by sociodemographics.

Results and Discussion

Demographic Profile of Participants

Of the 238 responses, seven were either not fully completed or demographic information was incomplete, reducing the effective sample size to 231. A series of post hoc analyses were conducted using G*Power (Faul et al. 2009) to determine the adequacy of the achieved sample size for the statistical tests of the study. Table 1 summarizes the tests conducted, settings used according to accepted conventions, and level of power achieved. The tests showed that the sample size of 231 produced suitable power levels for the statistical tests in this study.

The majority of the visitors (about three-quarters of the sample) were international, with New Zealand domestic visitors comprising the remaining one-quarter of the sample (Table 2).

There were slightly more female respondents than male respondents. The number of “other” gender group respondents (*n* = 3, 1.3%) was limited in the sample, precluding this as a category for comparative statistical analysis. Visitors in the 18- to 29-yr-old range formed the largest age group, comprising more than one-third of the sample, followed by the 30- to 39-yr-old group. Of the international visitors, the majority came from Europe, followed by China, then other Asia, Australia, and North America. Visitors were mainly of two ethnicities, with European comprising just under half of the sample, followed by Asian at 42.4%. There were limited numbers of Māori and Pasifika participants in this study (about 2%), precluding comparative statistical analysis of these groups, thus it was decided to combine them with the “other” ethnicity group.

Visitors’ Plant Preferences

Participants were asked to rank the degree to which they liked each plant in the group of plants described earlier, using a 5-point scale (1 = don’t like at all, 5 = like very much). Results show significantly different preference patterns between domestic

Table 1. Power analysis

Test	Settings	Power
Post hoc analysis for <i>t</i> -test (2 groups)	$\alpha = 0.95$, medium effect size = 0.5, total sample = 231	0.95
Post hoc analysis for ANOVA (3 groups)	$\alpha = 0.95$, medium effect size = 0.25, total sample = 231	0.93
Post hoc analysis for ANOVA (6 groups)	$\alpha = 0.95$, medium effect size = 0.25, total sample = 231	0.84

Table 2. Survey demographic overview.

	<i>n</i>	Percentage %
Visitor status		
NZ visitors (domestic)	56	24.2
International visitors	175	75.8
Nationality (International Visitors) ^a		
Australia	24	12.8
Europe	56	29.9
North America	23	12.3
China	45	24.1
Other Asia	26	13.9
Other	13	7.0
Ethnicity ^b		
European	111	48.1
Asian	98	42.4
Other	22	9.5
Age		
18–29	82	35.7
30–39	62	27.0
40–49	34	14.8
50–59	28	12.2
60+	24	10.4
Gender		
Male	104	45.2
Female	123	53.5
Other	3	1.3
Environmental group member		
Domestic	6	2.6
International	19	8.2
Total	231	100.0

Age and gender data were missing for one respondent.

^a12 Twelve respondents recorded dual citizenship between New Zealand and another country.

^bEuropean ethnicity is the equivalent of Caucasian or White ethnicity.

Table 3. Visitors’ plant preference by domestic/international status (scale: 1 = don’t like at all, 5 = like very much).

Plant	Domestic (M ± SD)	International (M ± SD)	All (M ± SD)
Beech forest	4.4 ± 0.9	4.2 ± 0.8	4.2 ± 0.9
<i>Lupinus polyphyllus</i> *	4.3 ± 1.2	4.5 ± 0.8	4.5 ± 0.9
<i>Salix</i> spp.	4.1 ± 1.0	4.2 ± 0.8	4.2 ± 0.9
Pasture grass	3.5 ± 1.3	3.5 ± 1.1	3.5 ± 1.1
Wild conifer	2.6 ± 1.2	2.7 ± 1.1	2.7 ± 1.1
Pine forest**	3.4 ± 1.4	3.9 ± 1.0	3.8 ± 1.2
Exotic forest**	3.3 ± 1.1	3.7 ± 1.1	3.6 ± 1.1
<i>Cirsium vulgare</i> **	2.5 ± 1.5	3.1 ± 1.2	2.9 ± 1.3
<i>Ulex europaeus</i> **	3.1 ± 1.5	4.1 ± 1.0	3.8 ± 1.2

**P* < 0.05.

***P* < 0.01.

visitors (New Zealanders) and international visitors (Table 3). New Zealand native beech forest (the only native plant in the selection) was rated highest by New Zealand domestic participants, while international participants rated *L. polyphyllus* as their favorite. International participants reported a higher mean score

Table 4. Visitors' plant preference by nationality (scale: 1 = don't like at all, 5 = like very much).

Plant	Australia (M ± SD)	Europe (M ± SD)	North America (M ± SD)	China (M ± SD)	Other Asia (M ± SD)	Other (M ± SD)
Beech forest	4.2 ± 0.8	4.1 ± 0.9	4.4 ± 0.7	4.2 ± 0.8	3.8 ± 0.9	4.3 ± 1.0
<i>Salix</i> spp.	4.0 ± 1.2	4.1 ± 0.8	4.2 ± 0.8	4.3 ± 0.8	4.4 ± 0.9	4.2 ± 0.7
<i>Lupinus polyphyllus</i>	4.3 ± 1.2	4.4 ± 0.8	4.5 ± 0.7	4.7 ± 0.8	4.9 ± 0.4	4.5 ± 1.0
Pasture grass**	3.4 ± 0.9	3.1 ± 1.0	3.5 ± 1.1	4.0 ± 1.2	3.7 ± 1.0	3.5 ± 0.9
<i>Ulex europaeus</i>	4.0 ± 1.1	3.9 ± 1.0	4.0 ± 1.1	4.1 ± 1.1	4.2 ± 0.8	4.1 ± 1.5
Wild conifer*	2.5 ± 1.2	2.4 ± 1.0	2.8 ± 1.0	3.1 ± 1.1	2.9 ± 1.1	2.8 ± 0.9
Pine forest**	3.3 ± 1.3	3.5 ± 1.1	4.2 ± 1.1	4.3 ± 0.7	4.2 ± 0.8	3.8 ± 1.1
<i>Cirsium vulgare</i> *	2.6 ± 1.5	2.8 ± 1.0	3.1 ± 1.3	3.5 ± 1.3	3.3 ± 1.0	2.8 ± 1.2
Exotic forest**	3.3 ± 1.2	3.4 ± 1.2	3.9 ± 1.1	4.1 ± 0.8	4.1 ± 0.8	3.6 ± 1.0

*P < 0.05.

**P < 0.01.

Table 5. Visitors' plant preference by ethnicity (scale: 1 = don't like at all, 5 = like very much).

Plant	European (M ± SD)	Asian (M ± SD)	Other (M ± SD)
Beech forest	4.2 ± 0.9	4.2 ± 0.8	4.6 ± 0.9
<i>Salix</i> spp.	4.1 ± 0.8	4.2 ± 1.0	4.4 ± 0.8
<i>Lupinus polyphyllus</i> ^a	4.3 ± 1.0	4.6 ± 0.8	4.8 ± 0.4
Pasture grass ^a	3.3 ± 1.1	3.8 ± 1.2	3.6 ± 1.1
<i>Ulex europaeus</i> ^a	3.3 ± 1.3	4.1 ± 1.0	4.2 ± 1.4
Wild conifer ^a	2.4 ± 1.0	3.0 ± 1.1	2.6 ± 1.0
Pine forest ^a	3.5 ± 1.2	4.2 ± 0.9	3.4 ± 1.5
<i>Cirsium vulgare</i> ^a	2.6 ± 1.3	3.4 ± 1.3	2.7 ± 1.3
Exotic forest ^a	3.3 ± 1.1	4.0 ± 0.9	3.4 ± 1.3

P < 0.01 (Scale: 1=don't like at all, 5=like very much).

Table 6. Visitors' knowledge of naturalness and invasive plants in New Zealand by domestic/international status.

Statement	New Zealand visitor M ± SD	International visitor M ± SD	t-test
New Zealand landscapes are generally very natural or pure	2.3 ± 1.1	1.8 ± 1.0	t (225) = 3.454, P = 0.001
NZ landscapes are generally more biodiverse than other landscapes overseas	2.4 ± 1.1	2.3 ± 1.1	t (222) = 0.608, P = 0.544
There are many invasive plant species in NZ's landscapes	2.7 ± 1.0	2.3 ± 1.0	t (223) = -4.434, P = 0.000
NZ native grassland and alpine ecosystems are greatly impacted by invasive plant species	2.7 ± 1.1	2.7 ± 1.3	t (223) = -1.317, P = 0.01

Scale: 1=Strong agree, 5=Strongly disagree.

for five exotic species: *L. polyphyllus*, pine forest, exotic forest, *C. vulgare*, and *U. europaeus*.

When the data were analyzed by nationality (Table 4), significantly higher preferences were shown by visitors from China and other Asia for five introduced species, including invasive wild conifers.

Participants of different ethnicities also showed significantly different preference patterns (Table 5). While the only native plant

in the sample (beech forest) received the highest ranking by European ethnicity participants, those of Asian ethnicity ranked the invasive *L. polyphyllus* their favorite. Asian visitors had significantly higher preferences than participants of European ethnicity for seven of the eight listed introduced species: *L. polyphyllus*, pasture grass, wild conifer, pine forest, exotic forest, *C. vulgare*, and *U. europaeus*.

Male participants and female participants showed some significant differences: female participants rated *L. polyphyllus* the highest out of all plant species, rating this invasive species significantly higher than did male participants. Three species were rated significantly differently by participants based on their ages, with older participants showing lower preferences for two invasive species (*U. europaeus* and *C. vulgare*). There were no significant differences for plant preferences between environmental group members and nonmembers.

Visitors' Knowledge of Invasive Species in New Zealand

Participants' knowledge of the extent of the IAS problem in New Zealand landscapes was examined through four statements. For each statement, participants were asked to rate their extent of agreement using a 5-point Likert-type scale (1 = strongly agree, 5 = strongly disagree). Differences among social groups defined by demographics were examined utilizing comparative analyses (t-test, one-way ANOVA test). Generally, participants tended to rate New Zealand's habitats as being highly natural and pure; international visitors significantly more so than domestic visitors. Participants showed some level of awareness of ecological problems facing New Zealand in terms of IAS. Domestic visitors showed better knowledge of New Zealand's natural environment and a higher level of awareness of ecological problems facing New Zealand than international visitors (Table 6).

For international visitors, knowledge of New Zealand's natural environment varied according to nationality (Table 7). Participants from China and other Asia (significantly more so than other international groups) tended to rate New Zealand's landscape as being highly natural and pristine and New Zealand's landscapes as being more natural than those found overseas. In the analysis by ethnicity, Asian participants tended to rate New Zealand's landscapes as highly natural and pristine and having greater biodiversity than overseas landscapes (Table 8). Asian participants also showed lower awareness of the ecological problems facing New Zealand than European participants. There were no significant differences among age groups or by gender or environmental group membership.

Table 7. Visitors' knowledge of naturalness and invasive plants in New Zealand by nationality.

Statement	Australia (M ± SD)	Europe (M ± SD)	North America (M ± SD)	China (M ± SD)	Other Asia (M ± SD)	Other (M ± SD)	One-way ANOVA
New Zealand landscapes are generally very natural or pure	2.1 ± 2.1	2.0 ± 1.0	2.2 ± 0.3	1.4 ± 0.8	1.4 ± 0.6	2.2 ± 0.8	$F(5, 180) = 4.64, P = 0.001$
NZ landscapes are generally more biodiverse than other landscapes overseas	2.8 ± 1.2	2.8 ± 1.2	2.6 ± 1.1	2.12 ± 1.0	1.8 ± 0.8	2.5 ± 0.9	$F(5, 180) = 3.062, P = 0.011$
There are many invasive plant species in NZ's landscapes	2.4 ± 1.0	2.7 ± 0.9	2.5 ± 1.2	3.2 ± 1.1	2.7 ± 0.9	1.9 ± 0.7	$F(5, 178) = 4.320, P = 0.001$
NZ native grassland and alpine ecosystems are greatly impacted by invasive plant species	2.3 ± 1.1	2.6 ± 0.9	2.4 ± 1.2	3.0 ± 1.1	2.9 ± 1.2	2.1 ± 0.9	$F(5, 179) = 3.470, P = 0.005$

Scale: 1=Strong agree, 5=Strongly disagree.

Table 8. Visitors' knowledge of naturalness and invasive plants in New Zealand by ethnicity.

Statement	European (M ± SD)	Asian (M ± SD)	Other (M ± SD)	One-way ANOVA
New Zealand landscapes are generally very natural or pure	2.2 ± 1.1	1.5 ± 0.1	2.4 ± 1.2	$F(2, 227) = 17.426, P = 0.000$
NZ landscapes are generally more biodiverse than other landscapes overseas	2.6 ± 1.2	2.0 ± 1.0	2.6 ± 1.2	$F(2, 224) = 7.527, P = 0.001$
There are many invasive plant species in NZ's landscapes	2.4 ± 1.0	2.8 ± 1.1	2.5 ± 1.3	$F(2, 225) = 5.176, P = 0.006$
NZ native grassland and alpine ecosystems are greatly impacted by invasive plant species	2.3 ± 0.9	2.8 ± 1.1	2.8 ± 1.2	$F(2, 225) = 6.511, P = 0.002$

Scale: 1=Strong agree, 5=Strongly disagree.

Table 9. Views on managing ecosystems and invasive species by domestic/international status.

Statement	NZ visitor (M ± SD)	International Visitor (M ± SD)	t-test
Natural environments sometimes need active management intervention	1.8 ± 1.0	2.0 ± 1.0	$t(222) = 1.631, P = 0.104$
Invasive plant species in NZ's landscapes should be eradicated	2.3 ± 1.0	2.9 ± 1.2	$t(222) = -3.295, P = 0.001$
Non-native plant species should be eradicated in NZ's natural landscapes	2.7 ± 1.3	3.0 ± 1.3	$t(223) = -1.317, P = 0.189$
It is important that humans continue their role of managing landscapes	1.8 ± 0.9	1.9 ± 1.0	$t(224) = 3.008, P = 0.003$
There is no such thing as a "bad" plant or animal species	3.7 ± 1.3	3.4 ± 1.4	$t(222) = 0.139, P = 0.142$
It is simply too difficult and expensive to control the spread of invasive plant species	3.6 ± 1.2	3.2 ± 1.4	$t(224) = 1.575, P = 0.117$
If an introduced plant or animal is in a place long enough we can eventually consider it to be natural	3.6 ± 1.2	3.1 ± 1.2	$t(224) = 3.008, P = 0.003;$
The spread of pests and weeds into natural areas should be accepted	4.2 ± 1.2	3.8 ± 1.3	$t(222) = 1.631, P = 0.104$

Scale: 1=Strong agree, 5=Strongly disagree.

Visitors' Views on Invasive Species and Their Management

Participants were given eight statements related to IAS and ecosystem management in general. Significant differences were found between domestic and international visitors for three items (Table 9). New Zealand visitors were less likely to accept long-standing invasive plants as native species and more likely to support their eradication and the active management of ecosystems.

Participants from China and other Asians showed higher acceptance of introduced species and less support for eradication (Table 10). They more strongly supported the statements "There is no bad plant or animal species" and "If an introduced plant or animal is in a place long enough, we can eventually consider it to be natural." Compared with participants from Australia, Europe, and North America, they were also more likely to acknowledge the difficulty and cost of invasive species management.

Significantly different responses were also received from respondents of Asian ethnicity compared with other ethnicity groups for six items (Table 11). In a similar manner to responses by

nationality, Asian participants demonstrated higher tolerance and acceptance of introduced species than European participants.

While there were no significant differences by gender, there were differences among age groups for a number of items. Those from the 30- to 39-yr-old and 40- to 49-yr-old groups showed less support for eradication of invasive species than other age groups. Participants in the 30- to 39-yr-old group seemed to more strongly support the view that "There is no such thing as a 'bad' plant or animal species" than those from other age groups. This group also seemed to have greater concerns about the difficulty of IAS control than the older age groups. Older participants (50- to 59-yr-old) showed less support for the statement "If an introduced plant or animal is in a place long enough, we can eventually consider it to be natural." Non-environmental group members showed a higher tolerance of the spread of pests and weeds into the natural environment than did members, while also showing stronger agreement with the statement "There is no such thing as a bad plant or animal species."

Table 10. Visitors’ views on managing ecosystems and invasive species by nationality.

Statement	Australia (M ± SD)	Europe (M ± SD)	North America (M ± SD)	China (M ± SD)	Other Asia (M ± SD)	Other (M ± SD)	One-way ANOVA
Natural environments sometimes need active management intervention	1.6 ± 0.9	2.1 ± 1.1	1.9 ± 0.9	1.9 ± 1.0	2.1 ± 1.0	1.5 ± 0.7	$F(5, 180) = 1.697, P = 0.138$
Invasive plant species in NZ’s landscapes should be eradicated	2.1 ± 0.9	2.7 ± 1.1	2.7 ± 1.3	3.6 ± 1.1	2.8 ± 1.2	2.6 ± 0.9	$F(5, 177) = 6.453, P = 0.000$
Non-native plant species should be eradicated in NZ’s natural landscapes	2.4 ± 1.2	3.0 ± 1.2	2.4 ± 1.5	3.5 ± 1.3	3.0 ± 1.4	2.5 ± 1.0	$F(5, 178) = 4.20, P = 0.001$
It is important that humans continue their role of managing landscapes	1.5 ± 0.7	2.3 ± 1.0	1.7 ± 0.8	1.8 ± 1.1	1.8 ± 0.9	1.9 ± 1.2	$F(5, 180) = 2.632, P = 0.025$
There is no such thing as a ‘bad’ plant or animal species	4.0 ± 1.2	3.9 ± 1.2	4.2 ± 1.2	2.5 ± 1.2	2.6 ± 1.5	3.2 ± 1.8	$F(5, 178) = 10.583, P = 0.000$
It is simply too difficult and expensive to control the spread of invasive plant species	3.6 ± 1.5	4.0 ± 1.1	4.0 ± 1.2	2.01 ± 0.9	2.8 ± 1.3	2.89 ± 1.2	$F(5, 179) = 16.733, P = 0.000$
If an introduced plant or animal is in a place long enough we can eventually consider it to be natural	3.8 ± 1.4	3.3 ± 1.1	3.8 ± 1.1	2.5 ± 1.1	2.3 ± 0.9	3.1 ± 1.3	$F(5, 180) = 9.024, P = 0.000$
The spread of pests and weeds into natural areas should be accepted	4.1 ± 1.3	4.2 ± 1.1	4.1 ± 1.2	3.5 ± 1.3	3.2 ± 1.2	4.1 ± 1.4	$F(5, 177) = 3.801, P = 0.003$

Scale: 1=Strong agree, 5=Strongly disagree.

Table 11. Views on managing ecosystems and invasive species by ethnicity.

Statement	European M ± SD	Asian M ± SD	Other M ± SD	One-way ANOVA
Natural environments sometimes need active management intervention	1.9 ± 1.0	1.9 ± 1.0	1.8 ± 1.0	$F(2, 227) = 0.079, P = 0.924$
Invasive plant species in NZ’s landscapes should be eradicated	2.4 ± 1.1	3.1 ± 1.2	2.6 ± 1.1	$F(2, 224) = 7.950, P = 0.000$
Non-native plant species should be eradicated in NZ’s natural landscapes	2.7 ± 1.3	3.2 ± 1.3	2.6 ± 1.4	$F(2, 225) = 5.319, P = 0.006$
It is important that humans continue their role of managing landscapes	1.9 ± 1.0	1.8 ± 1.0	1.8 ± 1.1	$F(2, 226) = 0.171, P = 0.843$
There is no such thing as a ‘bad’ plant or animal species	4.1 ± 1.2	2.7 ± 1.3	4.0 ± 1.3	$F(2, 223) = 36.628, P = 0.000$
It is simply too difficult and expensive to control the spread of invasive plant species	4.0 ± 1.1	2.5 ± 1.2	3.8 ± 1.3	$F(2, 226) = 43.876, P = 0.000$
If an introduced plant or animal is in a place long enough we can eventually consider it to be natural	3.7 ± 1.1	2.6 ± 1.1	3.7 ± 1.3	$F(2, 226) = 30.547, P = 0.000$
The spread of pests and weeds into natural areas should be accepted	4.3 ± 1.2	3.4 ± 1.3	4.2 ± 1.3	$F(2, 224) = 16.943, P = 0.001$

Scale: 1=Strong agree, 5=Strongly disagree.

Table 12. Visitors’ “IAS orientation” by demographic grouping (scale: 1 = accept IAS, 5 = eradicate IAS).

Visitor origin ^a	New Zealand 3.8	International 3.4	All 3.5			
Nationality ^a	Australia 3.9	Europe 3.8	North America 4.0	China 2.6	Other Asia 2.7	Other 3.23
Ethnicity ^a	European 4.0	Asian 2.8	Other 3.9			
Age ^a	18–29 3.5	30–39 3.2	40–49 3.4	50–59 4.0	60+ 3.8	
Gender	Male 3.6	Female 3.4				
Environmental group ^a	Member 4.2	Nonmember 3.4				

^a $P < 0.05$ (Scale: 1 = ‘Accept IAS’, 5 = ‘Eradicate IAS’).

Visitors’ “IAS Orientation”

A mean score was calculated from the latter four of the eight items specifically referring to the place of invasive species in the environment to create an “IAS orientation” scale. Cronbach’s alpha ($\alpha = 0.808$) indicated that the internal consistency of the scale is acceptable. The scale gives an overall indication of each participant’s position regarding IAS; the lowest possible score of 1 on this scale indicates an acceptance of IAS, and the highest possible score of 5 indicates a desire to eradicate IAS (Table 12).

Overall, participants were moderately unaccepting of IAS, but there were significant differences between groups. New Zealand tourists were significantly less accepting of IAS than were international tourists. Similarly, there was a significant difference in means among international groups; participants from China and other Asians scored significantly lower than visitors of other nationalities, indicating higher acceptance of IAS than other international groups. There was also a significant difference in means among the three ethnicity groups. Asian participants

showed a higher level of acceptance of IAS than those from European and other ethnicities.

Older visitors (above 50 yr old) had lower tolerance and acceptance of IAS than younger age groups (under 50 yr old). There was no difference between males and females in mean scores for IAS orientation. However, participants who were environmental group members scored differently from nonmembers, being less accepting of IAS.

The study revealed that many tourists, especially international tourists, had low awareness of the ecological problems associated with IAS and that their expressed preferences for commonly encountered New Zealand flora included a number of serious environmental weeds. These preferences, however, varied significantly among participants by visitor origin and ethnicity. Many international participants were unclear about the extent of the invasive plant problem in New Zealand. This may be associated with New Zealand's hybridized landscapes that support a wide range of invasive alien species. Adding to this confusion, some of these invasive plants, (e.g., *L. polyphyllus*), were historically spread for the purpose of landscape "improvements" and for tourism. Thus, international visitors encountering such plants in touristic locations that otherwise have a high degree of natural integrity may believe they are native plants. In fact *L. polyphyllus* received very high preferences from both domestic and international participants—most likely because of their attractive flowers. This supports the view that certain traits of species (i.e., aesthetic value of flowering plants) may influence visitors' perceptions and attitudes toward particular invasive species and their management (Knight 2008; Shackleton et al. 2019b). Further to this, the legitimacy of *L. polyphyllus* in the landscape is perpetuated by its ubiquitous (and largely unchallenged) presence in formal and informal touristic imagery (Hayes et al. 2023). This poses a challenge for managers wishing to eradicate an attractive species that now features in the itineraries of many tourists.

Importantly, international participants showed significantly lower support for eradication of IAS than did domestic participants. This may be attributed to a lower awareness of the ecological problems associated with IAS. However, when considering different visitor groups—defined by nationality and ethnicity—differences in participants' ecological knowledge and awareness of ecological problems were apparent. Participants from China and from other Asian countries not only showed a poorer knowledge of New Zealand's flora and a lower awareness of the impacts caused by invasive plant species compared with participants from other international groups, but also demonstrated higher preferences for some invasive plants. Most importantly, however, the IAS orientation results for Asian participants indicated higher levels of acceptance of IAS in general than did the results for European participants.

These variations along ethnic lines support previous studies undertaken with residents in which individuals from different ethnicities have expressed distinct preferences for the natural environment and landscapes (e.g., Buijs et al. 2009; Herzog et al. 2000; Kaplan and Herbert 1987; Lovelock et al. 2011; Virden and Walker 1999). Similarly, Zhang et al. (2021) found variation between Asian and Western visitors to eco-sanctuaries regarding perceptions and attitudes toward some endemic and introduced species. In our study, the differences between Asian and European ethnicities and in particular the Asian visitors' significantly different IAS orientation scores, pose some questions about ethnicity and human–nature relations. If we accept that the Asian cosmology of human–nature relations is different from, and more environmentally aligned than, the Western cosmology (Harper

and Snowden 2017), this may in part explain these findings. However, the Asian human–nature cosmology could manifest in different ways in terms of Asian orientation toward IAS. This critically depends upon how "nature" is defined. If nature in the Asian cosmology is taken to mean exclusively "natural nature" (i.e., indigenous vs. introduced), then we could expect in our survey results a closer alignment between Asian and European visitors' preferences, attitudes, and their IAS orientations. But this was not the case, thus suggesting that "nature" in the Asian cosmology is more all-encompassing, not distinguishing between indigenous and introduced—a sort of "place for everything," rather than "everything in its place" approach. This finding is supported by Lovelock et al. (2011), who reported that Asian New Zealanders' experiences of nature-based recreation were less reliant on perceptions of naturalness, and human presence in nature was acceptable and even desirable. Similarly, Packer et al. (2014) found that Chinese visitors had a more anthropocentric view of nature than did Australian visitors. Han (2006) contends that the relationship Chinese have to animals and plants is one that hinges on understanding what enjoyment the animal or plant might provide. Under this assumption, the Chinese are not interested in the plant or animal for its intrinsic value. Rather, if the plant can bring pleasure through its presence in the landscape (e.g., a hillside of attractive yet invasive wilding conifers, or a riverbed abundant with the beautiful flowering yet invasive *L. polyphyllus*) then its invasive status is irrelevant.

Challenging these assumptions is not only the homogenization of "Asian" or "Western" but also the view that the East–West distinctions in human–nature relations may be a fiction in contemporary globalized society (e.g., see Bruun and Kalland 2014). Furthermore, the rapid industrialization and urbanization experienced in many Asian countries in recent decades has meant that over time people have started to lose their connections with, and knowledge about, the natural environment and the processes that support ecosystems—mirroring such trends in Western societies (Vining et al. 2008).

Further confounding any ethnicity- or nationality-based differences in perceptions of IAS are other sociodemographic factors; in this study, participants in the older age group (above 50 yr) demonstrated better knowledge of plant origins and a higher awareness of ecological impacts of invasive plant species. This aligns with previous studies concerning intentions to support invasive species management (e.g., Bremner and Park 2007), which have found that sociodemographic factors, including age and gender affected support—with those from older age groups being willing to pay more for invasive species management (García-Llorente et al. 2011). However, this study aligns (partly) with previous research that has found no relationship between gender and knowledge/attitudes toward IAS (Ansong and Pickering 2015; Bardsley and Edwards-Jones 2006). Environmental group members did have significantly different orientations than nonmembers, being less accepting of IAS, supporting the view that individuals affiliated to different interest groups such as recreational clubs and environmental or animal rights organizations may have different perceptions and attitudes toward IAS and their management (Shackleton et al. 2019b).

Understanding tourists' perceptions and attitudes toward IAS and their management is crucial for environmental managers who wish to generate support from this group to help achieve conservation outcomes (Mameno et al. 2020). Tourists constitute a substantial body of individuals moving about the world, posing not only an immediate biological threat (Melly and Hanrahan 2020),

but through their landscape and biota preferences also constituting a substantial economic and ecological force that has implications for IAS management in destinations.

The findings from this study provide empirical support for the view that tourists often struggle to see IAS as a threat within a destination (Greenaway et al. 2015). Ironically, although visitors often travel to seek experiences associated with a high level of naturalness or wildness, the landscapes that they encounter (Karlisdóttir 2013; Urry 2002) may have large populations of invasive species. They may remain unaware of environmental problems such as IAS that significantly undermine the integrity of the natural environment and biodiversity (Perrings et al. 2002). This is important, as Rossi et al. (2022) revealed a link between visitors' IAS knowledge and their willingness to support IAS management. However, this study suggests that engaging tourists as supporters for IAS management or eradication may be problematic when they have "contrasting conservation narratives" (Zhang et al. 2021: 9) that do not align with official IAS management initiatives.

Complicating any efforts to engage or educate tourists in IAS management efforts is the heterogeneity of inbound visitor markets. Our findings support the notion that human/nonhuman relationships are not politically neutral and that all visitors to a destination do not see spaces and places through the same lens; there is no singular nature, only a diversity of natures (McNaughten and Urry 1998). Our finding that attitudes toward naturalness and IAS varied across different nationalities and ethnicities suggests that visitors cannot be treated as one homogenous cohort. In particular, the emergence of large tourist markets from generating regions where there may be divergent views of nature and of IAS poses challenges for conservation managers wishing to engage with and draw upon the support of these visitors (e.g., visitors from China, which before COVID-19 represented New Zealand's second-largest international visitor market and one of the most valuable in terms of holiday visitor spend [Tourism New Zealand 2021]). Thus, understanding the knowledge and attitudes of *different types of visitors* is important in designing targeted and market-specific communication strategies with a view to obtaining support across these potentially important stakeholder groups in IAS management.

A limitation of this study was that it only captured tourists' general perceptions and attitudes toward IAS; there is a need to further explore the underlying reasons for such perceptions and attitudes. It is likely that in-depth qualitative approaches can be valuable in this regard. While this study points to an East–West divide in terms of IAS perceptions and attitudes among visitor groups, to address any possibility of falling into a culturally essentialist interpretation of these findings (Li et al. 2021), further in-depth qualitative research will be valuable in ascertaining why such attitudes prevail.

There is a need to also consider tourists' knowledge of IAS in their home countries, along with their behavior within the destination country (e.g., length of time in the destination and level of exposure to environmental messaging regarding IAS) and how this may impact upon their IAS perceptions and attitudes. Further studies could explore visitors' responses toward particular IAS management approaches, particularly those related to IAS that are perceived as tourist attractions within destinations.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/inp.2023.30>

Acknowledgments. Funding for this project was provided by the University of Otago. No competing interests have been declared.

References

- Anderson LG, Roccliffe S, Haddaway NR, Dunn AM (2015) The role of tourism and recreation in the spread of non-native species: a systematic review and meta-analysis. *PLoS ONE* 10:e0140833
- Ansong M, Pickering C (2015) What's a weed? Knowledge, attitude and behaviour of park visitors about weeds. *PLoS ONE* 10: e0135026
- Bardsley D, Edwards-Jones G (2006) Stakeholders' perceptions of the impacts of invasive exotic plant species in the Mediterranean region. *GeoJournal* 65:199–210
- Barros A, Shackleton R, Rew LJ, Pizarro C, Pauchard A (2022) *Tourism, Recreation and Biological Invasions*. Wallingford, UK: CABI. 255 p
- Beattie J (2011) Biological invasion and narratives of environmental history in New Zealand, 1800–2000. Pages 343–352 in Rotherham ID, Lambert RA, eds. *Invasive and Introduced Plants and Animals*. London: Earthscan
- Bravo-Vargas V, García RA, Pizarro JC, Pauchard A (2019) Do people care about pine invasions? Visitor perceptions and willingness to pay for pine control in a protected area. *J Environ Manag* 229:57–66
- Bremner A, Park K (2007) Public attitudes to the management of invasive non-native species in Scotland. *Biol Conserv* 139:306–314
- Bruun O, Kalland A (2014) Images of nature: an introduction to the study of man-environment relations in Asia. Pages 1–24 in Bruun O, Kalland A, eds. *Asian Perceptions of Nature: A Critical Approach*. Abingdon, UK; New York: Routledge
- Buijs AE (2009) Lay people's images of nature: comprehensive frameworks of values, beliefs, and value orientations. *Soc Nat Resour* 22:417–432
- Buijs AE, Elands BH, Langers F (2009) No wilderness for immigrants: cultural differences in images of nature and landscape preferences. *Landsc Urban Plan* 91:113–123
- De Lange PJ, Norton D, Courtney SP, Heenan PB, Barkla JW, Cameron EK, Hitchmough R, Townsend AJ (2009) Threatened and uncommon plants of New Zealand (2008 revision). *NZ J Bot* 47:61–96
- Dickie IA, Bennett BM, Burrows LE, Nuñez MA, Peltzer DA, Porté A, Richardson DM, Rejmánek M, Rundel PW, van Wilgen BW (2014) Conflicting values: ecosystem services and invasive tree management. *Biol Invasions* 16:705–719
- Etikan I, Musa SA, Alkassim RS (2016) Comparison of convenience sampling and purposive sampling. *Am J Theor Appl Stat* 5:1–4
- Fall JJ (2021) What is an invasive alien species? Discord, dissent and denialism. Pages 40–54 in Barker K, Francis RA, eds. *Routledge Handbook of Biosecurity and Invasive Species* London: Routledge
- Faul F, Erdfelder E, Buchner A, Lang AG (2009) Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. *Behav Res Methods* 41:1149–1160
- Fields A (2013) *Discovering Statistics Using IBM SPSS Statistics*. 4th ed. London: Sage. 915 p
- Fraser A (2006) *Public Attitudes to Pest Control*. A Literature Review. Wellington: Department of Conservation. 36 p
- Fraser W (2001) *Introduced Wildlife in New Zealand: A Survey of General Public Views*. Lincoln, NZ: Manaaki Whenua Press. 46 p
- García-Llorente M, Martín-Lopez B, Nunes PALD, Gonzalez JA, Alcorlo P, Montes C (2011) Analyzing the social factors that influence willingness to pay for Invasive alien species management under two different strategies: eradication and prevention. *Environ Manag* 48:418–435
- Gawith D, Greenaway A, Samarasinghe O, Bayne K, Velarde S, Kravchenko A (2020) Socio-ecological mapping generates public understanding of wilding conifer incursion. *Biol Invasions* 22:3031–3049
- Gest J (2021) Majority minority: a comparative historical analysis of political responses to demographic transformation. *J Ethn Migr Stud* 47:3701–3728
- Greenaway A, Bayne K, Kravchenko A, Paul T, Samarasinghe O, Rees T (2015) Evaluating (Non-market) Impacts of Wilding Conifers on Cultural Values. Auckland: Landcare Research. 83 p
- Hall CM (2015) Tourism and biological exchange and invasions: a missing dimension in sustainable tourism? *Tour Recreat Res* 40:81–94
- Hall CM, Baird T (2013) Ecotourism, biological invasions and biosecurity. Pages 66–77 in Ballantyne R, Packer J, eds. *International Handbook on Ecotourism*. Cheltenham and Northampton, UK: Edward Elgar

- Han F (2006) The Chinese View of Nature: Tourism in China's Scenic and Historic Interest Areas. Ph.D dissertation. Shanghai, China: Tongji University. 270 p
- Harmsworth GR, Awatere S (2013) Indigenous Māori knowledge and perspectives of ecosystems. Pages 274–286 in Dymond JR, ed. Ecosystem Services in New Zealand—Conditions and Trends. Lincoln, NZ: Manaaki Whenua Press
- Harper C, Snowden M (2017) Environment and Society: Human Perspectives on Environmental Issues. 6th ed. New York: Routledge. 448 p
- Harper D (2002) Talking about pictures: a case for photo elicitation. *Vis Stud* 17:13–26
- Hayes S, Lovelock B (2017) “Demystifying” worldmaking: exploring New Zealand's clean and green imaginary through the lens of angling tourists. *Tour Recreat Res* 42:380–391
- Hayes, S., Lovelock, B., & Carr, A. (2023). ‘They sure do have a pretty colour palette!’: the problematic promotion of invasive species as tourism icons. *Tourism Recreat Res*, 1–19
- Head L (2017) The social dimensions of invasive plants. *Nat Plants* 3:1–7
- Herzog TR, Herbert EJ, Kaplan R, Crooks C (2000) Cultural and developmental comparisons of landscape perceptions and preferences. *Environ Behav* 32:323–346
- Howell CJ (2016) Recreating the invasion of exotic conifers in New Zealand. Pages 258–262 in Proceedings of 20th Australasian weeds conference. Perth, Western Australia: Council of Australasian Weed Societies
- Johnson BJ, Hall TE, Cole DN (2005) Naturalness, Primitiveness, Remoteness and Wilderness: Wilderness Visitors' Understanding and Experience of Wilderness Qualities. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Aldo Leopold Wilderness Research Institute. 86 p <https://winapps.umn.edu/winapps/media2/wilderness/toolboxes/documents/vum/Visitors%20Experience%20and%20Wilderness%20Qualities.pdf>. Accessed: March 3, 2015
- Johnson J (2022) Contrasting tourist attitudes towards non-native species: Yellowstone National Park, USA. Pages 141–150 in Barros A, Shackleton R, Rew LJ, Pizarro C, Pauchard A, eds. *Tourism, Recreation and Biological Invasions*. Wallingford, UK: CABI
- Kaplan R, Herbert EJ (1987) Cultural and sub-cultural comparisons in preferences for natural settings. *Landsc Urban Plan* 14:281–293
- Karlsdóttir UB (2013) Nature worth seeing! The tourist gaze as a factor in shaping views on nature in Iceland. *Tour Stud* 13:139–155
- Kellert SR, Soule M, Lease G (1995) Reinventing nature? Response to postmodern deconstruction. Pages 103–121 in Soulé ME, Lease G, eds. *Concepts of Nature East and West*. Washington, DC: Island Press
- Kim MJ, Hall CM, Bonn M (2021) Can the value-attitude-behavior model and personality predict international tourists' biosecurity practice during the pandemic? *J Hosp Tour Manag* 48:99–109
- Kline R (2010) Principles and Practice of Structural Equation Modeling. 3rd ed. New York: Guilford. 427 p
- Knight AJ (2008) “Bats, snakes and spiders, oh my!” How aesthetic and negativistic attitudes, and other concepts predict support for species protection. *J Environ Psychol* 28:94–103
- Kourantidou M, Haubrock PJ, Cuthbert RN, Bodey TW, Lenzner B, Gozlan RE, Nuñez MA, Salles J-M, Diagne C, Courchamp F (2022) Invasive alien species as simultaneous benefits and burdens: trends, stakeholder perceptions and management. *Biol Invasions* 24:1905–1926
- Li M, Tucker H, Chen G (2021) Chineseness and behavioural complexity: rethinking Chinese tourist gaze studies. *Tour Rev* 77:841–858
- Lindemann-Matthies P (2016) Beasts or beauties? Laypersons' perception of invasive alien plant species in Switzerland and attitudes towards their management. *NeoBiota* 29:15–33
- Lovelock B (2007) “If that's a moose, I'd hate to see a rat!” Visitors' perspectives on naturalness and their consequences for ecological integrity in peripheral natural areas of New Zealand. Pages 124–140 in Müller DK, Jansson B, eds. *Tourism in Peripheries: Perspectives from the Far North and South*. Wallingford, UK: CABI
- Lovelock, B., Ji, Y, Carr, A, & Blye, CJ (2022) Should tourists care more about invasive species? International and domestic visitors' perceptions of invasive plants and their control in New Zealand. *Biological Invasions*, 24(12), 3905–3918
- Lovelock K, Lovelock B, Jellum C, Thompson A (2011) In search of belonging: immigrant experiences of outdoor nature-based settings in New Zealand. *Leis Stud* 30:513–529
- Mameno K, Kubo T, Shoji Y, Tsuge T (2020) How to engage tourists in invasive carp removal: application of a discrete choice model. Pages 31–44 in Saito O, Subramanian SM, Hashimoto S, Takeuchi K, eds. *Managing Socio-ecological Production Landscapes and Seascapes for Sustainable communities in Asia: Mapping and Navigating Stakeholders, Policy and Action*. Singapore: Springer
- McNaughten P, Urry J (1998) *Contested Natures*. London: Sage. 320 p
- McNeely JA (2011) Xenophobia or conservation: some human dimensions of invasive alien species. Pages 19–36 in Rotherham ID, Lambert RA, eds. *Invasive and Introduced Plants and Animals: Human Perceptions, Attitudes and Approaches to Management*. London: Earthscan
- Melly D, Hanrahan J (2020) Tourist biosecurity awareness and risk mitigation for outdoor recreation: management implications for Ireland. *J Outdoor Recreat Tour* 31:100313
- [MBIE] Ministry of Business, Innovation and Employment (2018) *New Zealand Tourism Forecasts 2018–2024*. <https://www.mbie.govt.nz/assets/5c05b7bfce/nz-tourism-forecasts-2018-2024-report.pdf>. Accessed: April 16, 2020
- Nanayakkara L, Jurdi-Hage R, Leavitt PR, Wissel B (2018) In lakes but not in minds: stakeholder knowledge of invasive species in prairie lakes. *Biol Invasions* 20:633–652
- Nikodinoska N, Foxcroft LC, Rouget M, Paletto A, Notaro S (2014) Tourists' perceptions and willingness to pay for the control of *Opuntia stricta* invasion in protected areas: a case study from South Africa. *Koedoe* 56:1–8
- Norgaard KM (2007) The politics of invasive weed management: gender, race, and risk perception in rural California. *Rural Sociol* 72:450–477
- Oded C, Ram Y (2015) Tourism is not only the vector of biological invasion but also the victim: evidence from Israel. *Tour Recreat Res* 40:407–410
- Packer J, Ballantyne R, Hughes K (2014) Chinese and Australian tourists' attitudes to nature, animals and environmental issues: implications for the design of nature-based tourism experiences. *Tour Manag* 44:101–107
- Perrings C, Williamson M, Barbier EB, Delfino D, Dalmazzone S, Shogren J, Simmons P, Watkinson A (2002) Biological invasion risks and the public good: an economic perspective. *Conserv Ecol* 6:1
- Pickering C, Mount A (2010) Do tourists disperse weed seed? A global review of unintentional human-mediated terrestrial seed dispersal on clothing, vehicles and horses. *J Sustain Tour* 18:239–256
- Rossi SD, Alvarez MA, Aschero V, Hellvig M, Bonjour LD, Mazzolari A, Scarpa JP, Barros A (2022) On visitors' minds: knowledge and perceptions of invasive non-native plant species in mountain ecosystems. Pages 130–140 in Barros A, Shackleton R, Rew LJ, Pizarro C, Pauchard A, eds. *Tourism, Recreation and Biological Invasions*. Wallingford, UK: CABI
- Russell J (2014) A comparison of attitudes towards introduced wildlife in New Zealand in 1994 and 2012. *J R Soc NZ* 44:136–151
- Sage E (2019) Visitors to Aoraki/Mt Cook Exceed 1 Million. Government Press Release. May 16, 2019. <https://www.rnz.co.nz/news/political/389345/aoraki-mt-cook-visitor-numbers-hit-1m-mark>
- Sang AO, Knez I, Gunnarsson B, Hedblom M (2016) The effects of naturalness, gender, and age on how urban green space is perceived and used. *Urban For Urban Green* 18:268–276
- Shackleton CM, McGarry D, Fourie S, Gambiza J, Shackleton SE, Fabricius C (2007) Assessing the effects of invasive alien species on rural livelihoods: case examples and a framework from South Africa. *Hum Ecol* 35:113–127
- Shackleton R, Pizarro C, Rossi SD (2022) Tourists' knowledge, perceptions and behaviours towards invasive species. Pages 120–130 in Barros A, Shackleton R, Rew LJ, Pizarro C, Pauchard A, eds. *Tourism, Recreation and Biological Invasions*. Wallingford, UK: CABI
- Shackleton RT, Larson BM, Novoa A, Richardson DM, Kull CA (2019a) The human and social dimensions of invasion science and management. *J Environ Manag* 229:1–9

- Shackleton RT, Richardson DM, Shackleton CM, Bennett B, Crowley SL, Dehnen-Schmutz K, Estévez, RA, Fischer A, Kueffer C, Kull, CA, Marchand E, Novoa A, Potgieter LJ, Vaas J, Vaz AS, Larson BMH (2019b) Explaining people's perceptions of invasive alien species: a conceptual framework. *J Environ Manag* 229:10–26
- Sharp RL, Larson L, Green GT (2011) Factors influencing public preferences for invasive alien species management. *Biol Conserv* 144:2097–2104
- Solano A, Rodriguez SL, Greenwood L, Rosopa PJ, Coyle DR (2022) Achieving effective outreach for invasive species: firewood case studies from 2005 to 2016. *Biol Invasions* 24:3321–3339
- Taylor DE (2018) Racial and ethnic differences in connectedness to nature and landscape preferences among college students. *Environ Justice* 11:118–136
- Thompson A (2011) Transforming Merino Country in the Mackenzie. Pages 159–171 in Ruru J, Stephenson J, Abbott M, eds. *Making Our Place: Exploring Land-Use Tensions in Aotearoa New Zealand*. Dunedin: Otago University Press
- Tourism New Zealand (2021) China—Tourism New Zealand. <https://www.tourismnewzealand.com/insights/tourism-data/>. Accessed: May 16, 2022
- Tu W (1989) The continuity of being: Chinese visions of nature. Pages 67–78 in Baird Callicott J, Ames RT, eds. *Nature in Asian Traditions of Thought: Essays in Environmental Philosophy*. Albany: State University of New York Press
- [UNWTO] United Nations World Tourism Organization (2020) UNWTO Briefing Note—Tourism and COVID-19, Issue 3. Understanding Domestic Tourism and Seizing Its Opportunities. <https://www.e-unwto.org/doi/book/10.18111/9789284422111>. Accessed: May 5, 2022
- Urry J (2002) *The Tourist Gaze: Leisure and Travel in Contemporary Societies*. 2nd ed. London: Sage. 200 p
- Villéger S, Brosse S (2012) Measuring changes in taxonomic dissimilarity following species introductions and extirpations. *Ecol Indic* 18:552–558
- Vining J, Merrick MS, Price EA (2008) The distinction between humans and nature: human perceptions of connectedness to nature and elements of the natural and unnatural. *Hum Ecol Rev* 15:1–11
- Virden RJ, Walker GJ (1999) Ethnic/racial and gender variations among meanings given to, and preferences for, the natural environment. *Leis Sci* 21:219–239
- Warren P (2001) Dealing with the human dimensions of invasive alien species within New Zealand's biosecurity system. Pages 105–111 in McNeely JA, ed. *The Great Reshuffling. Human Dimensions of Invasive Species*. Switzerland: IUCN
- Whiting JW, Larson LR, Green GT, Kralowec C (2017) Outdoor recreation motivation and site preferences across diverse racial/ethnic groups: a case study of Georgia state parks. *J Outdoor Recreat Tour* 18:10–21
- Williams C (2007) Research methods. *J Bus Econ Res* 5(3)
- Yletyinen J, Perry GL, Burge OR, Mason NW, Stahlmann-Brown P (2021) Invasion landscapes as social-ecological systems: role of social factors in invasive plant species control. *People Nat* 3:795–810
- Yu K (1995) Cultural variations in landscape preference: comparisons among Chinese sub-groups and Western design experts. *Landsc Urban Plan* 32:107–126
- Zhang G, Higham JE, Albrecht JN (2021) Ecological restoration in Aotearoa New Zealand: contrasting tourist conservation narratives. *Tour Manag Perspect* 37:100761