

# Outdoor recreation and plant biosecurity in the Snowy Mountains region of NSW Australia

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**Summary** We report on research conducted to understand how people undertaking outdoor recreation activities might perceive their role in contributing to biosecurity management. The research explored visitors and residents' knowledge, experience, meanings and practices of recreation and biosecurity in the Snowy Mountains region of NSW, Australia. An online survey investigated the routines and activities that occur when packing for, undertaking and unpacking from outdoor recreation trips. The survey looked at where, why and how people undertake some form of action to clean their recreation clothing and equipment, including how these routines might change or stay the same for different types of recreation activities. Biosecurity is the product of not just individual behaviour but is the result of social cultural factors in everyday recreation life. The results have relevance for managing landscapes where the issues of biosecurity and recreation are reflected.

**Keywords** plant biosecurity management, outdoor recreation, snowy mountains, equipment, online survey

## INTRODUCTION

Globally, recreation and nature-based tourism contributes to the risk and threat of unwanted or invasive species moving beyond their natural or normal range. Invasive microscopic algae, pathogens, and plants can move and be moved intentionally and unintentionally through ecological pathways of water, wind, soil, animals as well as via socio-economic pathways of trade and transport of goods and material, human mobility and changes to land use and via tourism and recreation (Robbins 2004, Jussaume and Ervin 2016).

Strong evidence points to the role of recreation-users as unintentional carriers of invasive plant material on their clothing and equipment (see (Whinam *et al.* 2005, Pickering and Mount 2010, Pickering *et al.* 2011, Auffret and Cousins 2013; Ansong and Pickering 2014, Smith and Kraaij 2020).

Biosecurity is a response to manage the negative impact of invasive species on the environment and the tourist economy. Biosecurity management refers to actions to identify, search for, report, clean, brush down, or otherwise support activities that prevent the

spread of plant material (NSW Department of Planning and Industry 2012).

The research investigated to what extent biosecurity features in the minds and actions of outdoor recreation users in the Snowy Mountains Region. This research has wide application to all agencies managing biosecurity and recreation activity. The Snowy Mountains region has high environmental values in the face of increasing demands and pressures for recreation-tourism use and development (NSW Government Department of Environment and Conservation 2006). The research has relevance not only to managing the protected area of Kosciuszko National Park (KNP), but also across alpine regions globally where the issues of biosecurity management and recreation use are reflected.

## MATERIALS AND METHODS

The study site comprised the protected area of Kosciuszko National Park (KNP) and the adjoining Local Government Areas (LGA) of Snowy Valleys to the west of KNP and Snowy Monaro on the eastern flank of the park.

Outdoor recreation residents and visitors to the region were surveyed using an online questionnaire starting in January 2022. The survey was run until 31 May 2022. Preliminary data was downloaded 30 April 2022. The questionnaire was administered via Qualtrics. Survey distribution was via a QR code and an anonymous html link. Additionally, a website (<https://recreation.study>) provided potential respondents with information on the research and a link to the survey.

Printed advertising material was provided to recreation users at various points within the region including trailheads, mountain bike parks, camping areas, boat ramps and at backcountry huts in KNP. Printed material was placed at local shops, cafes and accommodation places throughout the region as well as outside the LGA. Promotion also included the use of social media sites and print media in regional newspapers. Emails were sent to recreation clubs and land/environment groups. This distribution strategy aimed to access a wide cross section of the community who may have undertaken outdoor recreation activities in the region at any time.

**Data analysis** 233 responses were analysed using SPSS v27 for descriptive and cross tabulations.

## RESULTS

Descriptively, respondents were male (54 %), female (45 %) or preferred not to say. Respondents ranged in age from 20-75 years. Generally, most respondents reported as visitors (69 %) to the region who on average have been visiting for 24 years. A proportion of respondents were permanent residents whilst others were visitors with property or employment connection within the region as they own land/house, have seasonal employment or have membership within an organisation/group (Table 1).

**Table 1.** Description of respondents who have undertaken outdoor recreation activities within the Snowy Mountains region.

Description	#	%
Female	104	44.6
Male	126	54.1
Prefer not to say	2	0.9
Resident Snowy Mtns	31	13.3
Own property and visit	12	5.2
Lodge member and visit	24	10.3
Live seasonally and visit	9	3.9
Visitor	161	69.1

Walking/hiking was the activity most undertaken (86 %), followed by camping (66 %), cycling (38 %), nature photography (38 %), picnicking (31 %), swimming in lake/river (30 %) and fishing (26 %). The most recent activity for 60 % of visitors and residents was walking/hiking. Smaller proportions of respondents were cycling/mountain biking (11 %), hunting (9 %), combination of other land-based activities (6 %), camping (5 %), or fishing (5 %) (Table 2).

**Table 2.** Proportion of respondents who have undertaken all types of activities and their most recent activity in the Snowy Mountains region.

Activities	All	Recent
Walking/hiking	85.8	59.2
Cycling/Mtn biking	38.2	10.7
Trail running	9.0	1.3
Orienteering	3.4	0
Rock climbing	6.0	0
Horse riding	4.7	0.4
4WD driving	12.0	0.9
Trail bike riding	2.1	0
Hunting	13.3	8.6
Fishing	25.8	4.7
Boating (motorised)	8.6	0
Canoeing/kayaking	24.9	0.4

Water/wake boarding	3.4	0.4
Sailing	4.7	0
Swimming (lake/river)	30.0	0.9
SUP Boarding	7.3	0.4
Camping	66.1	5.2
Picnicking	31.3	1.3
Bird watching	21.0	0.9
Photography (nature)	37.8	2.1
Art (outside)	2.6	3.4
Food collecting	6.0	0
Other	13.7	3.4

Respondents used a variety of roads to get to the locations they visited in the Snowy Mountains region. Most were on four-wheel drive trails in Kosciuszko NP (26 %) and Snowy Monaro LGA (31 %) and single track in Snowy Valleys LGA (22 %). In both LGAs, one in five respondents were on non-formed trails and single tracks (Table 3). Further cross tabulation indicated that a third of those on non-formed trails were walking/hiking (32 %), trail running (33 %), horse riding (100 %), hunting (55 %), fishing (18 %), camping (33 %) or bird watching (50 %).

**Table 3.** Cross-tabulation of types of roads used to get to locations in Snowy Mountains region.

Road/trail	KNP	SV	SM	Other
Paved	9.6	5.9	3.8	8.7
Gravel	18.6	13.7	9.6	17.4
4wd/service	26.3	15.7	30.8	17.4
Single	19.8	21.6	19.2	17.4
Unmarked	10.8	19.6	13.5	8.7
Non formed	13.8	21.6	21.2	26.1
Other	1.2	3.0	1.9	4.3

With regard to the equipment being used, a majority of respondents used their own equipment when undertaking outdoor recreation activities in the Snowy Mountains (Table 4). More respondents say they wash/clean their equipment after the trip (73 %) than before (52 %). A small proportion do not wash/clean equipment when packing (10 %) or unpacking (6 %) (Table 5).

Three quarters say they remove mud/soil or plant material from their footwear (71 %), socks (57 %), clothing (56 %) whilst they undertake the recreation activity. Only a small proportion (9 %) use a disinfectant on their shoes (Table 6). In terms of using infrastructure for cleaning, less than a third use cleaning stations at the trip start and end but over forty percent say they would use it if there was a cleaning station available (Table 7).

**Table 4.** Source of equipment for the recreation activity in the Snowy Mountains region.

Source equipment	%
Use own equipment	98.3
Borrow before leave home	3.4
Borrow/hire from tourism operator	1.3
Hire from shop in SMR	2.1
Other	1.7

**Table 5.** Proportion who check, clean/wash some or all of their equipment when packing for and unpacking from an activity.

Equipment maintenance	Packing	Unpacking
Check some or all	59.7	49.4
Wash/clean some or all	51.5	73.4
Dry some or all	N/A	39.1
New equipment (so no)	6.0	2.1
Un/pack without doing	10.3	6.4
Other	7.7	2.6

**Table 6.** Proportion who have undertaken biosecurity activity whilst in the Snowy Mountains region.

Personal equipment	%
Remove mud/soil or plant material from footwear	70.8
Disinfect footwear	8.6
Remove from socks	56.7
Remove from clothing	55.8
Remove from Velcro	32.2
Brush gaiters <sup>A</sup>	23.2
Other	12.4
None of the above	17.6

<sup>A</sup> gaiters asked only of walkers/hikers, trail runners and those orienteering.

**Table 7.** Proportion who have used biosecurity infrastructure whilst in the Snowy Mountains region.

Infrastructure use	%
Cleaning station start of trip	27.0
Cleaning station at end of trip	17.6
Would use but not available	45.1
Carry own brush/equipment	10.3
Never use a cleaning station	9.4
Other	15.5

## DISCUSSION

The wide range of multiple land and water-based activities being undertaken by respondents reflects the nature-based touristic value of the Snowy Mountains region. Outdoor activities are based mostly in Kosciuszko National Park where there are high environmental values. Activities also take place across the Snowy Valleys and Snowy Monaro LGAs

with trails that cross the borders of KNP and the LGAs. Recreation is therefore important to the region and protecting the environmental and touristic values requires consideration of biosecurity management.

Recreational users undertake biosecurity activities or actions when packing, unpacking and when in the Snowy Mountains region. Around half of the respondents reported they checked, cleaned/washed or dried their equipment when packing and unpacking for activities. Cleaning usually occurred when unpacking rather than at the packing stage. A study undertaken previously in KNP also found respondents more likely to clean after a walk rather than before (Gill *et al.* 2020). The online survey found that cleaning of equipment can be about the upkeep of equipment rather than a response to biosecurity management actions. Some respondents reported that cleaning routines when packing/unpacking are often about checking and maintaining equipment for serviceability whilst being ready for the next recreation outing. As one respondent stated '*It is important not to overstate this. While I do clean and dry equipment as necessary, it is with a view to keeping equipment in good repair, rather than ensuring biological cleanliness.*' Hence there is key link between the cleaning for maintenance and biosecurity purposes in managing land use.

Additionally, checking equipment when unpacking can also reflect the weather conditions, length of trip and the type of trail that recreationalist experienced during their activity. More than half of respondents removed mud/soil or material from shoes, socks and clothing during their recreational activity. This action, removing plant material may reflect the high use of non-formed or unmarked trails where plant material can potentially attach to shoes and clothing. Respondents reported generally that they are using a wide variety of trails including gravel, single and four-wheel drive tracks. These trail types may increase the likelihood of soil or mud attaching to footwear and clothing, depending on the weather. Thus, biosecurity management needs to consider trail conditions and drainage where these might contribute to how biosecurity actions are carried out and routinised.

Further understanding of biosecurity actions in the Snowy Mountains region, places consideration on those who use fixed in-situ cleaning infrastructure whilst undertaking recreation. The survey results indicated that less than a third used a cleaning station at the start of their trip and even less at the end of the trip. Although, a higher proportion of respondents reported that they would use infrastructure if it was available. Anecdotally, during the survey promotion, people indicated that they would use infrastructure as

it was a reminder for them of the biosecurity issues in the region. This was similarly noted in the study by Gill *et al.* (2020). However, observations and interactions at some sites indicated that use was low where the infrastructure was positioned to the side of the track. Therefore, whilst cleaning infrastructure can contribute to uptake of cleaning it needs to be located in such a way that people want to use it.

The results presented in this paper contribute to understanding when, why and how people undertake some form of action to clean their recreation clothing and equipment. The doing or not doing of biosecurity actions such as check, clean/wash and/or dry occur for a range of reasons pertinent to equipment needs and locations visited. The results have relevance for the design and management of walking and mountain bike trails within the Snowy Mountains region. Design can impact the extent to which drainage contributes to build-up of mud sections. Design can also contribute to the provision of integrated cleaning systems at trailheads or nearby which may help people to maintain their equipment but also lead to biosecurity action such as removal of potential invasive plant material.

It is likely that the results may be limited by the use of the self-reporting questionnaire as people may disclose information with a response bias. This bias may contribute to reliability issues. Further study within this research project will consider qualitative research methods that dig deeper to understand the validity and reliability of the study and contribute to understanding the sociocultural impacts on biosecurity management within the Snowy Mountains region.

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