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Biosecurity Breaches and Tourist Vectoring: Assessing the Impact on Host Community Perception in Ireland

Domhnall Melly[a*]; James Hanrahan[b]; Emmet McLoughlin[c]

[a] Department of Marketing, Tourism and Sport, Atlantic Technological University Sligo, Ireland; [b] Department of Marketing, Tourism and Sport, Atlantic Technological University Sligo, Ireland; [c] Department of Tourism, Hospitality and Events, Cardiff Metropolitan University, UK

*Correspondence: Domhnall.Melly@atu.ie

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ABSTRACT: This research investigates host community perceptions of biosecurity breaches and tourist vectoring in Ireland. The study employs a qualitative methodology using semi-structured interviews with 77 members of host communities. Respondents were randomly selected residents of two tourist destinations: County Sligo and County Clare. A thematic analysis was conducted on the interview transcripts. The findings show that host communities are aware of threats from tourist vectoring, particularly environmental damage from invasive species. However, there needs to be more awareness of economic and sociocultural impacts. Host communities believe the tourism industry must safeguard destinations from vectoring risks and advocate for more public consultation and empowerment in biosecurity planning to incorporate resident values. Recommendations include raising impact awareness through education, involving the community in developing appropriate mitigation measures, and integrating community participation into sustainable tourism planning for more effective and ethical biosecurity risk management, along with support for tourism through the Social Exchange Theory (SET).

KEYWORDS: responsible tourism; education for sustainable development; perception; awareness; knowledge

Introduction

Tourism and biosecurity are intertwined through the unintentional movement of alien species and diseases due to tourist activities. Biosecurity, defined as the protection of economic, environmental, and human health from harmful organisms (Hall, 2005), covers a broad scope intersecting several disciplines. From a tourism perspective, vectoring involves any organism that carries non-native species and diseases between different species (Wilson et al., 2017). Tourists inadvertently vector harmful biosecurity threats, including invasive alien species (IAS) and diseases, making tourism a primary contributor to biosecurity breaches. Tourism acts as a pathway for these threats, creating resentment among local communities despite economic benefits. This issue has evolved with globalization, influenced by tourist behaviors and motivations. For instance, recreational activities and gear used by canoeists, kayakers, anglers, and hillwalkers have transported IAS and diseases globally (Anderson et al., 2014;

Pickering et al., 2016). An example is the mass mortality of Ireland's native, white-clawed crayfish due to the crayfish plague spread by contaminated angling equipment (Biodiversity Ireland, 2018; DHLGH, 2023). Efforts to control and eradicate IAS and diseases can generate controversy and require extensive resources (Estévez et al., 2015; Crowley et al., 2017). Despite tourism's economic and social benefits, especially in rural Irish communities, resident perceptions can be negatively affected by environmental damage (Gioria, 2018), human health impacts (Rosselló et al., 2017), and harm to agriculture (Paini et al., 2016). These issues highlight the need for robust biosecurity risk mitigation and meaningful public involvement in sustainable tourism planning through the lens of Social Exchange Theory (SET).

The global tourism industry is increasingly scrutinised for its impact on community development and sustainability, focusing on balancing economic growth and social sustainability for destination communities. Dwyer (2018) highlights how powerful corporations, through economic liberalization, erode democracy and community control by influencing intergovernmental negotiations and regulations. Tourism creates opportunities for biological invasions that harm local environments and cause social conflicts over resource allocation, as well as trade-offs between biosecurity risk mitigation and other societal needs (Hall, 2019). The prioritization of unrestricted trade and human mobility as key pathways for biosecurity breaches remains contentious (Hall, 2011). Research by Robinson and McNeill (2022) highlights the severity of biosecurity risks introduced by international and domestic tourism and underscores the importance of tourist awareness and communication of biosecurity measures for outdoor recreation (Melly & Hanrahan, 2020). Biosecurity and tourist vectoring from a human health standpoint have received significant attention, particularly during the COVID-19 pandemic (Hall et al., 2020). Despite biosecurity breaches causing harm to ecosystems fundamental to human well-being (Pejchar & Mooney, 2009; Herfst et al., 2017), there is limited insight into their impact on host communities in current academic discourse. Furthermore, globalization, driven by improved human mobility, may have altered host community perceptions of tourism and biosecurity breaches, presenting a knowledge gap for policymakers and planners in mitigating tourism biosecurity risks while respecting community perceptions and minimising trade impediments.

This research addresses the gap in understanding host community perspectives on tourism's biosecurity impacts through an exploratory qualitative methodology. The research question is: "How does the host community perceive the impacts of biosecurity breaches due to tourist vectoring in Ireland?" To answer this, the study explores community perceptions of tourist activities, biosecurity breaches, and their involvement in tourism planning. Additionally, it investigates ethical considerations within the tourism industry and community participation in mitigating biosecurity risks. Addressing these factors could lead to more sustainable destinations by empowering the host community through consultation and participation in sustainable tourism planning, ensuring robust community-informed risk management and mitigation (Hall, 2015; Gruber et al., 2018).

Literature Review

Biosecurity Breaches and Tourism Activity

Tourism is an efficient pathway for the global movement of biosecurity threats (Hulme & Firn, 2015). Despite the tourism industry's significant €9.5 billion contribution to the Irish economy in 2019 (Fáilte Ireland, 2021), biosecurity breaches can offset many economic benefits and cause significant environmental harm. The rapid global diffusion of COVID-19 highlighted the issue of tourist vectoring (Gössling et al., 2021). Even before this, tourist vectoring of biosecurity threats was recognised as a severe threat to global environments, agriculture, and human health due to globalization (Minchin, 2003; Wilder-Smith et al., 2003; Zieritz et al., 2017). The societal implications depend on host community support for tourism. Through SET, community support can change based on residents' tolerance for tourism development, moderating the relationship between perceived negative impacts and tourism support (Qin, 2021). Nugroho and Numata (2020) found that perceived costs in tourism more strongly influence support for tourism development than perceived benefits, especially in community-based tourism (CBT). Higher community tolerance may reduce the impact of perceived negative effects on residents' support for tourism. This relationship involves factors such as perceived positive and negative impacts, personal benefits, industry involvement, and community attachment (Rua, 2020). Thus, community perceptions are crucial in understanding the relationship between the tourism industry and the host community.

The need for a comprehensive national biosecurity plan outlining robust tourism biosecurity risk management and destination-level planning has become a prerequisite in a world that is increasingly connected through tourism and globalisation (Hall, 2019; Melly & Hanrahan, 2021; Melly & Hanrahan, 2022). Outdoor recreational tourist activities facilitate the movement of biosecurity threats as “hitchhikers” or “stowaways” on tourist’s equipment, clothing, footwear, luggage, or through hull fouling on boats, for example (Anderson et al., 2014; Pickering et al., 2016). Tourism and globalisation, along with climate change, have exacerbated the ability, range, and invasiveness of biosecurity threats (Hulme, 2017; Hall, 2019). The resulting increase in biosecurity breaches and the severity of their impacts have led to more intensive control and eradication projects, putting strain on local destination resources. Therefore, prevention is the key through the strategic and efficient allocation of resources to mitigate tourism biosecurity risk that is aligned with host community perceptions. Existing research has argued that the development of vector mitigation measures, including 'check, clean, dry,' supported by effective tourist awareness-raising measures, is needed to mitigate the risk of introducing IAS and diseases through outdoor recreational tourist activities (Coughlan et al., 2019; Melly & Hanrahan, 2020). The subsequent requirements for biosecurity monitoring of biosecurity threats and vectors, effective tourist awareness through communication channels incorporating smart mobile technology, and rapid response to prevent or eradicate IAS before they become established in a new environment are of high importance (Smith et al., 2020; Melly & Hanrahan, 2022). However, to support SET, community perception of the costs and negative impacts of biosecurity breaches from tourism vectoring could be critical to community support for the allocation of destination resources (Nugroho and Numata, 2020).

Host Community Perceptions and Tourism Impacts

Early research suggests that host communities will support tourism development if the benefits exceed the costs. However, potential conflict can arise when tourism development

negatively impacts community well-being (Jones et al., 2000; Naidoo and Sharpley, 2016). This suggestion aligns closely with SET, where residents are more inclined to support tourism development when the perceived benefits outweigh the costs (Andriotis, 2005; Nunkoo, 2016). In this context, host community perceptions of tourism development are often mediated by the potential for economic gain, community attachment, environmental values, and the degree of host community involvement in the tourism planning and decision-making process (Rasoolimanesh et al., 2015). Obradovic and Tešin determined that while the local population's acceptance and tolerance of tourists are critical in more vulnerable destinations, public consultation can facilitate more sustainable practices that encourage healthy socio-economic tourism development while preserving natural and cultural resources for future generations (Obradović & Tešin, 2023). However, a study by Rua (2020) discovered that despite the importance of relationships and interactions between tourists and residents for tourism support through the feeling of 'proudness', it is the costs of tourism that intensify community perceptions of tourism and their support for it. Understanding host community perceptions of tourism biosecurity breaches and their impacts is therefore crucial to understanding the bigger picture of community support for tourism and could help guide planning approaches to mitigate tourism biosecurity risk efficiently.

Host Community Participation and Empowerment

While there can be considerable divergence around the meaning of empowerment across social sciences, for example, the involvement of disadvantaged minority groups in the political decision-making process (Banducci et al., 2004; Perry and Laws, 2020), host community participation in tourism decision-making can encourage a strengthened sense of unity and integrity among residents. It is, therefore, essential to provide an accurate definition of empowerment that encapsulates the tourism-specific context, representing impacts on the host community's quality of life. Aghazamani and Hunt provide a comprehensive explanation of empowerment in the context of tourism as a multidimensional, context-dependent, and dynamic process that provides humans, individually or collectively, with greater agency, freedom, and capacity to improve their quality of life as a function of engagement with the phenomenon of tourism (Aghazamani & Hunt, 2017).

While a sense of unity can unequivocally entice more comprehensive sociocultural benefits (Hanrahan & McLoughlin, 2015), the capacity to improve destination residents' quality of life can entail their enforcement of local environmental concerns through local planning and could lead to a higher community tolerance of tourism. In the context of biosecurity breaches, an informed and empowered community could ensure tourist vectoring is fully and adequately considered within tourism planning processes so that appropriate tourism biosecurity risk mitigation resources are allocated. Thus, host community participation in tourism planning can ensure that decision-making is forged through host community values, concerns, and understanding, representing a process of empowerment as a fundamental component of sustainable tourism development (Cole, 2006). Considering community involvement in the tourism industry creates more positive perceptions of the impacts of tourism (Rua, 2020), facilitating host community participation and empowerment in tourism planning and management could lead to increased support for tourism development (Nunkoo, 2016). Equally, tourism planners and other stakeholders listening to the concerns and attitudes of the host community can achieve improved decision-making due to the local community's perceptions of tourism development being considered at the tourism decision-making stages.

Biosecurity firmly exists within the sustainable tourism spectrum as it converges across ecological, economic, and social impacts on host communities, thus requiring its full integration into conventional planning approaches. A particular focus is placed on the need for an evidence-based planning approach through readily available indicator systems to assist tourism planners in sustainably planning for tourism, such as the European Tourism Indicator System (ETIS) (McLoughlin & Hanrahan, 2023; McLoughlin et al., 2018). The central aim is to balance tourism's benefits with the negative impact tourism development brings, thus requiring an equilibrium between costly and harmful biosecurity breaches versus beneficial tourism activity.

A controversial predicament brought about by such a balance is deciding on an acceptable level of harm to a destination through the facilitation of tourism. This places a focus on the question of what level of tolerance a host community is willing to accept from tourism development and, in this case, impacts from biosecurity breaches from tourist vectoring. Such debate attracts attention to destination-carrying capacities (Butler, 2020) and the use of various models to determine the limits of acceptable change to a destination (McCool, 1994). This complex determination requires input from all key tourism stakeholders, including comprehensive public consultation from the host community, to establish the acceptable level of risk from tourists vectoring biosecurity threats and, thus, specific biosecurity indicators contained within a sustainable tourism planning indicator system. Adopting an indicator system within tourism planning allows planners to analyse destinations with objective parameters while monitoring progress towards sustainable development (Font et al., 2023). However, critical to SET, community perceptions should take precedence within this process as a fundamental determination of tourism tolerance and support.

Within a biosecurity context, the integration of evidence-based metrics of specific biodiversity loss through biological invasions of species identified on the EU list of invasive alien species of concern (European Union, 2022) and the ECDC classification of infectious diseases (European Centre for Disease Prevention and Control, 2018). Utilising tourism planning biosecurity indicators along with host community empowerment may balance tourism development with effective biosecurity risk mitigation through evidence-based planning, which also captures community perceptions. Tourism planners would be informed where and when to strategically allocate appropriate resources to target biosecurity risk, considering the benefits of proactive risk mitigation through a pre-border, border, and post-border approach (Melly & Hanrahan, 2022), while also aligning with host community tolerance. However, it is noted that some destinations needed help with data collection and stakeholders' involvement in the implementation process, thus affecting the reliability and timeliness of indicator data (Modica et al., 2018). This again emphasizes the importance of stakeholder involvement in the planning process to streamline data collection processes. Citizen science, as the intentional involvement of the public in scientific research and monitoring, has been increasingly influential in supporting the early detection of pests and diseases (Pocock et al., 2020). Incorporating the mass participation of the host community, in which records of IAS and disease can be made by any individual, typically using smartphone applications and websites (Thomas et al., 2017), citizen science as an effective surveillance and monitoring tool could bridge the gap in timely data collection required for successful application of the ETIS from a biosecurity perspective. Embedding real-time data through host community involvement may benefit from adopting functional participation and empowerment within the planning process for their destination.

Methods

Qualitative research remains a common methodological approach in tourism academia (Vogler, 2023), gaining increasing importance over time (Nunkoo, 2020; Wilson et al., 2020). Therefore, this research adopted a qualitative approach using semi-structured interviews with host community members to assess the impact of biosecurity breaches and tourist vectoring. As argued by Creswell and Creswell (2018), qualitative methods allow for in-depth exploration of perspectives, attitudes, and experiences. They are best suited to situations where little is known about the topic under examination (Jennings, 2010). Therefore, this approach formed an appropriate basis to determine the host community's perception of biosecurity breaches and tourist vectoring in Ireland.

By employing semi-structured interviews, the researchers were able to generate data, thus enabling them to bridge the gap between what people say they do and what they do (Fink, 2000). This approach also allowed for respondent engagement through one-on-one discussions with the host community, gaining insights into their perspectives on the impacts of biosecurity breaches and tourist vectoring. In this context, semi-structured interviews facilitated focused discussions on predetermined elements related to tourist vectoring while allowing participants to elaborate based on their experiences (see Table 1). These questions were formulated after thoroughly reviewing international literature on biosecurity, tourism, and their associated impacts on host communities. For example, respondents were asked, ‘Do you think biosecurity breaches as a result of tourism can negatively impact the local community?’, and ‘Do you think host communities should participate in Ireland’s biosecurity planning process?’ While each question encouraged respondents to provide statistical context related to the addressed issues, it also allowed them to verbally elaborate on specific points, adding depth and context to the research findings.

Table 1: Interview questions to capture host community perceptions

Host Community Perception
-What is your understanding of tourists vectoring biosecurity threats?
-What is your understanding of tourist vector mitigation measures?
-Are you aware of negative impacts from tourist vectoring?
-Do you think there are any negative environmental impacts from tourist vectoring?
-Do you think there are any negative economic impacts from tourist vectoring?
-Do you think there are any negative socio-cultural impacts from tourist vectoring?
-Do you think the tourism industry has an ethical responsibility to protect host community from tourist vectoring biosecurity threats?
-Do you think that the host community should participate in Ireland’s biosecurity planning process?
-Do you think that there should be biosecurity education in place for the host community?
-What is your perception of tourist biosecurity communication in Ireland?

This research employed a simple random sampling approach to select host community members randomly from strategically chosen destinations in Ireland due to their popularity in outdoor recreational tourism activities, which are known pathways for biosecurity breaches. The critical advantage of random sampling was its ability to ensure an unbiased selection of respondents (Teeroovengadum & Nunkoo, 2018). This approach was centred on the defined target population of the Republic of Ireland, meaning community members could be selected randomly within this defined population (Pace, 2021). Utilising randomised sampling among this defined population ensured that each community member had an equal and fair chance of being selected for an interview (Robinson, 2014). The defined target population was based on

the research's aims and scope, leading to the completion of 77 face-to-face, semi-structured interviews with members of the host community at tourist locations in Co. Sligo and Co. Clare, Ireland. Respondents were randomly selected residents of the Co. Sligo and Co. Clare locations due to hiking, hillwalking, kayaking, stand-up paddling, which are significant tourist vectors for biosecurity breaches and are all popular in these areas. These locations have had issues with biosecurity breaches such as Rhododendron (Rhododendron Ponticum), Japanese Knotweed (Fallopia Japonica), and Zebra Mussel (Dreissena Polymorpha), all high impact IAS and at high risk from tourist vectoring. The significance and scale of the tourism industry in these locations would replicate that of many communities throughout Ireland, making the findings relevant to the broader Irish context. Interviews were conducted between September 2019 and February 2020, and respondents were approached and asked to participate using a participant information sheet and an informed consent form. The interview duration ranged from approximately 14 minutes to 21 minutes. The sample size was deemed significant enough to address the research questions adequately while avoiding the risk of repetitive data. All interviews were subsequently transcribed, facilitating a thematic analysis of key issues and patterns. Thematic analysis, a widely accepted method for interpreting written text, was employed, according to Braun and Clarke (2006) and Walters (2016). A coding scheme was developed to group responses with similar themes, enabling a comparison of the host community's views regarding biosecurity impacts and tourist vectoring (see Table 2). This process involved the development of codes, which allowed for the reduction of larger amounts of data into small chunks of meaning.

Table 2: Coding Scheme for host community views regarding biosecurity impacts and tourist vectoring.

Theme	**Theme**	**Theme**
Host community understanding of tourist vectoring and biosecurity breaches	Host community perception of negative impacts from tourist vectoring	Host community participation in Ireland's biosecurity planning process
Codes	**Codes**	**Codes**
Comprehension of tourist vectoring and biosecurity breaches.	Comprehension of negative impacts of tourist vectoring	Ethical responsibility of the tourism industry.
Unaware about tourist vectoring and biosecurity breaches.	Concerned about negative impacts from tourist vectoring.	Community participation desired.
	Resentment towards tourists because of tourist vectoring.	Biosecurity education desired.
	Lost tourism support because of tourist vectoring.	

This allowed for the data relating to opinions and thoughts relating to biosecurity breaches and tourist vectoring to be captured and configured by evaluating qualitative responses as codes against themes. Throughout the coding process, strict measures were taken to ensure the anonymity and confidentiality of respondents' responses.

Results

The rapid growth of tourism has increased the risk of introducing and spreading exotic diseases and pests (Hulme & Firn, 2015; Shackleton et al., 2019). These environmental, economic, and sociocultural impacts can affect local acceptance of tourism, especially in vulnerable destinations (Obradović & Tešin, 2023). Understanding host community perceptions of tourist vectoring and biosecurity breaches provides valuable insights for tourism planners. This understanding helps gauge the need for public consultation, empowerment, and participation in the planning process, promoting sustainable tourism development (Ahmad & Abu Talib, 2015; Rasoolimanesh et al., 2015).

Host community understanding of tourist vectoring and biosecurity breaches

Tourists introducing biosecurity threats worldwide pose a significant concern for communities hosting destinations (Anderson et al., 2014; Shackleton et al., 2019). Specifically, these threats can result in the loss of native biodiversity, increased flood risk, decreased water quality, adverse effects on agriculture and tourism industries, and negative social impacts (Gioria, 2018; Paini et al., 2016; Rosselló et al., 2017).

To effectively mitigate biosecurity vectors, measures such as cleaning and disinfecting tourists' footwear, fishing gear, canoes or kayaks, and boats are essential for preventing biosecurity breaches and minimising the impacts of any existing breaches (Anderson et al., 2014; Pickering et al., 2016). Interviews with community members have indicated a lack of awareness within the host community regarding biosecurity issues:

> "I do not know enough about vector mitigation measures which are currently in place to comment" (Respondent 24).

> "I hope there are enough vector mitigation measures for tourists in place. We have to have faith in the professionals employed in this area" (Respondent 32).

> "I don't know but I suspect no. There is very little awareness" (Respondent 45).

A lack of awareness and recognition of the effectiveness of vector mitigation measures can be considered a barrier to effectively managing tourist biosecurity risks (Hanrahan & Melly, 2019). Host community members can be a practical and cost-effective resource for implementing and enforcing biosecurity vector mitigation measures. Therefore, alongside developing specific biosecurity vector mitigation measures, it is essential to provide adequate education and communication for tourists and the host community.

Host community members can play a crucial role in preventing the impacts of biosecurity breaches by assisting with monitoring and eradication efforts (Pocock et al., 2020; Thomas et al., 2017). This pivotal role is exemplified in various global biosecurity strategies (Department of Primary Industries, 2013; Hawaii Invasive Species Council, 2016; Ko Tātou - This is Us, 2018). However, before incorporating host community involvement into Ireland's national biosecurity strategy and making it a valuable component of tourist biosecurity management, host community members must first become aware of the potential for tourists to introduce biosecurity threats (Bryce et al., 2011; Hall, 2015).

Host community perception of negative impacts from tourist vectoring

The possibility of substantial benefits from tourism being outweighed by the severe and enduring impacts resulting from tourist vectoring should raise serious concerns for host communities. These concerns are particularly significant, as the perception of these impacts can influence local support for tourism. Furthermore, the potential for social conflict arising from resource-intensive biosecurity breaches may be reduced through a better understanding of the adverse effects of tourist vectoring (Estévez et al., 2015; Hall, 2015). Respondents expressed their comprehension of these impacts, but alarmingly, they also voiced apprehensions regarding tourism-related biosecurity risks. Additionally, there was evidence of host community resentment towards tourism due to these impacts:

> "If an area becomes infected with a non-native species, it can have a very bad effect on local plant and/or animal life. Waterways are also very susceptible to invasive species which can have a detrimental effect on local aquatic life within host communities" (Respondent 17).

> "Biosecurity breaches from tourism create resentment as "blow-ins" are destroying environments for long term locals" (Respondent 34).

> "Yes, and I believe that the community's behaviour towards tourists would be negative as a result of a biosecurity breach from tourism" (Respondent 61).

Understandably, host community members might experience feelings of resentment towards tourism, especially given the magnitude of negative impacts resulting from a biosecurity breach. However, these sentiments of community pride could be channelled and leveraged to promote greater host community empowerment and active participation in the tourism planning process.

A crucial element in this process is ensuring that the host community's understanding of the sociocultural impacts of tourism-related activities is effectively incorporated into developing management strategies, thereby maintaining the destination's social sustainability. Among host community members, there was a widespread consensus regarding the sociocultural consequences of tourist vectoring in host communities:

> "It is possible that the Irish community turns against tourists as a contaminated area" (Respondent 8)

> "Possibly if tourists from a disease hotspot are coming into an area, then people in that area might be reluctant to engage with them" (Respondent 46)

> "Yes, it can have a big impact on the community's willingness to accept tourists to a destination, especially when a biosecurity breach can be very costly" (Respondent 62)

Dealing with the repercussions of a biosecurity breach can deplete precious community resources, including volunteers, which can heighten social tension between communities and tourists. Nevertheless, most host community members are well aware of the sociocultural implications of tourist vectoring, primarily because of the ongoing social consequences resulting from current biosecurity breaches. However, these sociocultural impacts can be mitigated by implementing appropriate host community education, awareness programs, and

impact assessments and integrating the community into future biosecurity planning approaches.

Host community participation in Ireland's biosecurity planning process

Despite the tourism industry's heavy reliance on the environment and host communities for a wide range of tourism services and experiences (Sisneros-Kidd et al., 2019), there is a pressing need for more comprehensive tourism planning that incorporates biosecurity mitigation measures into destination plans and guidelines (Melly & Hanrahan, 2021). This necessity arises due to the potential for significant environmental damage within destinations resulting from tourist vectoring. Hence, the tourism industry should be responsible for implementing appropriate vector mitigation measures to safeguard the destination's resources and protect the host community from the adverse impacts of tourist vectoring. Respondents expressed strong sentiments regarding the tourism industry's responsibility in this regard:

> "Yes, 100%. Tourism is a very important industry for our economy, but the integrity of our water supplies, wildlife and environment are far more important" (Respondent 5)

> "Absolutely, tourism acts as a catalyst for biosecurity threats to occur. They have a moral duty to protect the environment" (Respondent 23)

> "If they're marketing to bring people to the country, they should equally market how biosecurity threats can negatively impact an island as small as ours" (Respondent 29)

> "It's a must that the tourism industry keeps informed and aware of any ongoing possible biosecurity risk travelling into the state" (Respondent 65)

> "It would have to be a collaborative effort with other industries as relevant in different communities. It makes sense that the tourism and environmental protection agencies would lead out on it" (Respondent 74)

The host community strongly believes in the tourism industry's ethical responsibility to shield them from biosecurity threats introduced by tourists. Embracing sustainable tourism principles within the planning process can foster mutual environmental and cultural understanding among locals and tourists, fulfilling the ethical obligation to anticipate and manage destination impacts in host communities and prevent potential backlash.

Incorporating host community members into the biosecurity planning process ensures that their concerns regarding the economic, environmental, and social repercussions of tourist vectoring are thoroughly considered. Moreover, involving the host community in the tourism planning and development process aligns with the concept of resident empowerment and is vital for the long-term sustainability of tourism (Ahmad & Abu Talib, 2015; Hanrahan & McLoughlin, 2015; Obradović & Tešin, 2023). This strong consensus among the host community regarding their involvement in the biosecurity planning process was also evident in respondent comments:

> "Yes, this would be a great idea for informing of biosecurity risks and also an inclusive way of getting the community involved with reducing any risks" (Respondent 36)

> "Yes, when there is planning, the community should be involved. They deserve to be a part of deciding prospective solutions as it affects them" (Respondent 42)

> "The local communities know best what is required in their area. They are expert by experience" (Respondent 54)

> "Very important to involve local community in preventing tourist vectoring. They are the people that live and benefit from tourism, it's their place. This will have a good effect on everyone" (Respondent 65)

> "I believe host communities are better equipped to pinpoint the exact negative effect of a biosecurity breach. They have more eyes on the ground to identify vectoring by tourists" (Respondent 70)

> "Definitely to raise general awareness within the host communities" (Respondent 75)

Community members collectively agreed that involving the community in the biosecurity planning process can raise public awareness about biosecurity. Furthermore, community participation can serve as an invaluable component of tourism biosecurity risk mitigation by integrating community-specific knowledge, values, and the unique perspectives of residents into the tourism biosecurity planning process.

A well-informed local population is essential for empowering the host community and engaging them in tourism biosecurity risk mitigation efforts while garnering support for investments in proactive biosecurity prevention (Melly & Hanrahan, 2022). Many community members also emphasised the perceived importance of biosecurity education within the host community:

> "There is definitely education needed for host communities as I don't know much about it" (Respondent 3)

> "The only way host communities can help is if they are educated to know the risks and the preventative measures that communities and tourists can take" (Respondent 17)

> "Educating the host community would help detecting and detaining any biosecurity risk at an early stage" (Respondent 26)

> "Just like any other form of risk (BSE, foot and mouth etc.). However, it needs to be communicated at a reasonable level to all stakeholders" (Respondent 58)

Incorporating community education into the biosecurity framework can bolster local participation in environmental governance and create a cost-effective workforce capable of mitigating widespread adverse impacts. The research findings strongly support this approach in Irish host communities.

A communication and information exchange system are critical to achieving a coordinated biosecurity system by increasing the likelihood of tourists and the public adopting pro-biosecurity attitudes and behaviours (Melly & Hanrahan, 2020). Furthermore, timely and accurate communication of trustworthy tourist vector mitigation measures is imperative for

managing tourism biosecurity risks effectively (Hanrahan & Melly, 2019). Host community members expressed strong concerns about a communication deficit, drawing parallels to Ireland's 2001 agricultural biosecurity breach involving foot and mouth disease:

> "I've never seen any communication when returning to Ireland to capture tourists" (Community Member 87).

> "I can't be sure, but I'd be afraid the precautions taken for foot and mouth may have been put in place only when we knew it was a real crisis. You don't hear anything generally although maybe that's because I'm a resident not a tourist. Having said that we all know how proactive Australia is about these things and the whole country would be aware. I don't know though if we have such serious risks here" (Respondent 22).

> "I've never actually heard of any even though I'm sure there are some measures in place. No harm to make people more aware" (Respondent 59).

> "No, and this should be communicated to tourists via in-flight magazines on airlines and tourist bodies" (Respondent 63).

Host communities in Ireland are aware of the deficiency in biosecurity communication for tourists. Increasing awareness and fostering public engagement through effective communication are essential components of a comprehensive biosecurity program (Lucy et al., 2020). Embracing a host community empowerment approach to convey biosecurity information via coordinators and representatives of local community groups can establish accessible and destination-appropriate communication platforms for disseminating specific vector mitigation measures to tourists. Additionally, this approach can facilitate citizen science initiatives through smart mobile technology.

Discussions

The host community's perception of biosecurity breaches and tourist vectoring in Ireland reveals issues that need addressing but also opportunities to mitigate tourism biosecurity risk. Ram (2021) found that informing the host community about specific biosecurity threats and measures can empower members to participate in vector mitigation. Additionally, the low level of community awareness of tourist vectoring highlights differences in perceptions that influence tolerance for tourism development (Qin, 2021). This lack of awareness may hinder tourism development due to inaccurate perceptions of benefits, negative impacts, and attitudes towards biosecurity risk mitigation.

Theoretical Implications

Similar to any research, this study has limitations that warrant consideration in future work. The qualitative nature and small, geographically concentrated sample limit generalisability to all Irish host communities. As an initial investigation into host community perspectives, the study did not assess actual behaviours or biosecurity impacts. Future longitudinal and observational designs could explore connections between host attitudes, tourism planning participation, and mitigation outcomes. Future studies might also adopt a quantitative

approach through surveys to measure identified themes across a larger, more representative sample of Irish host communities.

Additionally, future research could explore tourists' awareness, attitudes, and behaviours regarding biosecurity risks and vector mitigation actions. Further investigation into effective educational campaigns and communication strategies is also warranted, given host communities' desire for greater public awareness. Assessing the impacts of incorporating community participation programs into the tourism planning process on perceptions, empowerment, and sustainable outcomes could be valuable. Comparative analyses between destinations with and without community engagement could illuminate participation's effects and how more up-to-date host community perceptions of tourism could affect SET. This study establishes a foundation for ongoing investigation into managing tourism sustainability and biosecurity through host community involvement and highlights the importance of host community perceptions in supporting tourism and risk mitigation for tourist vectoring. Despite these limitations, this research offers a crucial first exploration of host community views on tourists' vectoring of invasive species and diseases in Ireland, laying the foundation for further research.

Managerial Implications

The issues around the host community's concerningly low perception of tourist vector mitigation measures in Ireland go beyond issues of participation in vector mitigation measures but leave the acceptance of tourism in the balance, along with host community support through a lack of tolerance. The findings of this study corroborate findings from existing research highlighting the need for strategic tourism biosecurity pathway management (Robinson & McNeill, 2022) through host community concerns around the tourism industry's perceived inaction around biosecurity breaches. Furthermore, the existing shortfalls in tourists' awareness of biosecurity highlighted by Melly & Hanrahan (2020) were again present from the host community perspective in this study, as a strong element of dissatisfaction around levels of tourist awareness-raising measures was present. This can have several implications, including the host community's perception of the wider tourism industry, potentially harmful host-tourist interactions, and the loss of support for future tourism development as the perceived impacts of tourism are unknown to the host community, thus impacting their support for resource allocation in the mitigation of risk. Although the substantial economic benefits of tourism are well known (Fáilte Ireland, 2021), the industry is negatively impacting the environment that tourism relies on through a lack of tourist vector mitigation measures, which has the additional consequence of creating resentment within the host community. Research by Melly and Hanrahan (2020) indicates that low levels of biosecurity awareness should be addressed through a strategic pre-border and border tourist stage approach set out within a specifically developed national biosecurity strategy. The low perception of tourist vector mitigation measures in place among the host community in Ireland within this study is accompanied by a concerning shortfall of host community awareness about the impacts of tourist vectoring. Although host community participation in the tourism planning process to ensure appropriate tourism biosecurity risk mitigation is incorporated into local planning approaches through resident empowerment while also acting as a pivotal tool to achieve sustainable development (Ahmad & Abu Talib, 2015; Hanrahan & McLoughlin, 2015), their lack of awareness about the impacts of tourism vectoring can also represent a concern for their meaningful participation in the biosecurity planning process. Furthermore, perceptions of tourism could be positively affected through meaningful

community participation in the planning process (Rua, 2020). Therefore, approaches to mitigate tourism biosecurity risk at the host community level should incorporate effective awareness-raising mechanisms by utilising community coordinators and representatives of local community groups. This could disseminate relevant biosecurity information from awareness of impacts and alerts of initial biosecurity breaches and result in the effective roll-out of appropriate risk mitigation measures for tourists to prevent vectoring. This could lead to the informed roll-out of disinfection stations at high-risk locations due to the popularity of outdoor recreational activities where tourists and host community members can adopt appropriate 'check, clean, dry measures for their outdoor recreational equipment. This presents implications for policymakers in the management of environmental tourism destination resources affected by tourist vectoring. Community resentment is now a critical issue for tourism policymakers, and thus, capturing community perceptions within the overall strategic direction, funding, resource allocation, relevant stakeholder inclusion, and meaningful implementation of tourist vector mitigation measures are imperative going forward.

From a planning perspective, existing research has presented host community participation in the biosecurity planning process as an essential component for appropriate biosecurity resource governance in both risk mitigation and dealing with biosecurity breaches (McAllister et al., 2017) and wider support for tourism (Rua, 2020). The substantial support for host participation in biosecurity planning in Ireland may allow tourism planners to adopt a community-led, efficient, and low-cost approach to mitigating biosecurity risk from tourist vectoring. This would build on the efficiencies of biosecurity resource governance and allow for accurate tourism decision-making that is fully inclusive of local community values and views. Having host community participation in the biosecurity planning process would ensure that destination residents have a voice at the decision-making table. However, meaningful participation must be achieved and measured through public meetings, public attitude surveys, stated preference surveys, and round table discussions. This could adequately align host community values of environmental, economic, and sociocultural perceptions regarding tourist vectoring and biosecurity breaches within the biosecurity planning process. This may also achieve accurate metrics to base destination carrying capacity or limits of acceptable change for use within an evidence-based tourism planning approach to align tourism development with SET. By combining community values with relevant biosecurity metrics, including invasive species horizon scanning results to indicate species at risk of tourist vectoring (Lucy et al., 2020), existing numbers of IAS present determined through citizen science monitoring and surveillance (Thomas et al., 2017), along with indicators of biodiversity loss and habitat destruction, would represent a community participation and empowerment-led approach to tourism planning. The subsequent metrics could be utilised within the European Tourism Indicator System (ETIS) to achieve an evidence-based approach to sustainable tourism planning for biosecurity (McLoughlin & Hanrahan, 2023; McLoughlin et al., 2018). This approach would see the appropriate provision of viable resources for local tourist biosecurity management in Ireland. This evidence-informed planning approach would justify allocating local resources to mitigate biosecurity risk where they are most effective by informing the development of tourist biosecurity management components of CDPs. This could also achieve a harmonised relationship between the host community and tourism, as the provision of biosecurity education for the destination host community would itself empower locals through knowledge of the issue of concern while also offering the opportunity to deliver community personnel with the knowledge, skills, and abilities to monitor, identify, communicate, and implement appropriate biosecurity measures.

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