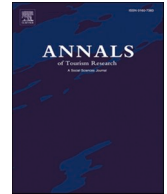




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## The Tourism Climate Change Knowledge System

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## ABSTRACT

Effective climate change action relies on the production of relevant knowledge. This review provides an interdisciplinary meta-analysis to critically assess tourism and climate change knowledge production across three knowledge domains: academic, practical and political. Building on existing tourism knowledge frameworks and applying systems thinking, the Tourism Climate Change Knowledge System is developed consisting of five knowledge dimensions: Source of knowledge, Knowledge creation, Influence on knowledge, Knowledge content and Knowledge impact. Results reveal how knowledge differs across domains and what barriers impede effective knowledge generation. While some links could be identified, there remains a disconnect between academic knowledge outputs and practical and political knowledge needs. The holistic lens enables the formulation of recommendations to enhance the production and use of knowledge.

## Introduction

The knowledge field of tourism and climate change has expanded considerably, reflecting growing interest, evidence and concern related to the role tourism plays in global environmental change; both as a contributor and recipient of impacts. The science (e.g. [Intergovernmental Panel on Climate Change \(IPCC\), 2018](#)) suggests that tourism businesses and destinations are likely to face increasingly drastic changes in the future ([Scott et al., 2012](#); [Scott et al., 2019](#)), and the sector needs to learn how to adapt to climate change impacts ([Hughey & Becken, 2014](#); [Mycoo, 2014](#)). Already, tourism stakeholders on the ground are accumulating knowledge and experience associated with weather patterns, extreme events and environmental changes (e.g. [Becken & Wilson, 2016](#); [Payet, 2007](#); [Vodenska & Gössling, 2018](#)).

At the same time, scientist have clearly stated that significant reductions in greenhouse gas emissions (GHG) are required at all levels to stay within 'safe' limits of climate change as agreed on in the Paris Agreement ([IPCC, 2018](#)). This need for rapid decarbonisation does not spare tourism ([Scott et al., 2016](#)), with calls for the tourism industry to act on climate change gathering momentum ([The SunX Program & World Travel & Tourism Council, 2019](#)). In response to both the climate science and political and practical imperatives, academics have sought to extend knowledge on a wide range of carbon-focused research questions (e.g. [Cohen et al., 2011](#); [Lenzen et al., 2018](#); [Peeters et al., 2019](#)). Despite a growing body of knowledge, tourism practice – it appears – has changed little ([Sharpley, 2020](#)), with destinations continuing development in exposed locations and investment into carbon intensive technologies and market segments. The paradox of “knowing better and losing even more” ([White et al., 2001](#), p. 81), presents a challenge for tourism as the sector prepares for a different future. The apparent contradiction (or gap) between theory and practice warrants an investigation into what type of knowledge is currently produced, and how scientific knowledge links to tourism stakeholders’

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approaches to managing climate change risk and developing relevant policy.

The existence of a ‘knowledge-action’ gap is not unique to the context of tourism. Examining the related field of vulnerability and resilience, [Weichselgartner and Obersteiner \(2002\)](#) argue that a barrier to addressing environmental hazards may not be a lack of knowledge but the inadequate transfer of it from researchers to decision makers. Thus, there is a need to better understand the way tourism and climate change knowledge is created, shared and used. Others, expressing frustration about the lack of action by the tourism sector, have argued that incremental changes will be insufficient to address the climate crisis, but only a paradigm shift will deliver the required outcomes ([Becken, 2019](#); [Hall, 2019](#)). A paradigm shift will equally affect knowledge generation and practice, as “the way in which problems are framed and how knowledge is produced has significant implications for policy development and societal outcomes” ([Abson et al., 2017](#), p.35).

Several reviews of the academic tourism and climate change literature were conducted in the past ([Becken, 2013](#); [Fang et al., 2018](#); [Hernandez & Ryan, 2011](#); [Kaján & Saarinen, 2013](#); [Njoroge, 2015](#)). However, all reviews have focused on one particular knowledge domain (scientific), and on identifying emerging themes, rather than on the wider parameters of the knowledge production system. Academic research often claims to inform policy and practice; however, a comparison between scientific and applied tourism and climate change knowledge is lacking. Moreover, a critical reflection on the context of either domain of knowledge is missing, raising questions about what we know about tourism and climate change knowledge, but also about what we do not know (i.e. ‘known unknowns’).

This paper defines and examines the Tourism Climate Change Knowledge System to answer the following research questions:

1. What are the elements that make up the Tourism Climate Change Knowledge System?
2. Does knowledge on tourism and climate change differ across different knowledge domains (academic, practical, political)?
3. Where are barriers to knowledge transfer, and how can the system be improved to enhance the generation and use of relevant tourism and climate change knowledge?

## Background

This section introduces the concept of a tourism climate change knowledge system and the knowledge domains and processes that form part of it.

### *The tourism knowledge system*

Knowledge systems, like any other system, are highly complex and multi-dimensional structures that interconnect different variables towards a common goal, function or purpose ([Bertalanffy, 1969](#); [Meadows, 2008](#)). Variables are understood to include inputs and outputs, and feedback loops between variables control the direction in which the system evolves. Knowledge systems evolve as a result of the interaction between multiple actors, including amongst others those related to innovation, policy and management. Interaction results in joint learning and informs how the actors advance their course of action, be it related to further knowledge generation, investment, training or policy design ([Röling, 1992](#)). Given the complexity of the tourism phenomenon ([Hall & Butler, 1995](#)), the increasing interest in applying systems thinking to tourism is not surprising (e.g. [Loehr, 2020](#); [Ruiz-Ballesteros, 2011](#)). However, tourism climate change knowledge has not been explored to date from a systemic perspective.

The Tourism Climate Change Knowledge System in this paper draws on [Tribe and Liburd’s \(2016\)](#) Tourism Knowledge System that aimed to provide a more holistic understanding of tourism knowledge by identifying the system elements that influence knowledge generation in tourism ([Table 1](#)). The system is made up of inputs, ‘the world of tourism’, and outputs, ‘tourism knowledge’. These are linked and influenced by two areas of tourism knowledge production: disciplines of tourism and extra-disciplinary tourism knowledge (problem centred knowledge, value-based knowledge, web 2.0, and Indigenous knowledge). [Tribe and Liburd \(2016\)](#) provide a useful basis for assessing tourism and climate change knowledge generation, factoring in the multi-disciplinary nature of the topic (e.g., [Jafari & Brent Ritchie, 1981](#)).

The knowledge system is subject to various filters, as it is exposed to or influenced by an external ‘knowledge force field’ ([Tribe, 2006](#)). The force field allows us to examine what it is that a person sees and does not see when looking at the world of tourism. It reminds us of the need to reflect on which lens (analytical strategy) is being used, how individual understanding is processed, and what the external sociological forces are (e.g. rules, norms, ideology) ([Tribe & Liburd, 2016](#)). Power and position often shape the framing of a problem and the approach chosen to examine it. As a result, knowledge production and absorption are highly subjective ([Lai et al.,](#)

**Table 1**

The system elements of the Tourism Knowledge System.

System element (traditional systems theory)	Tourism Knowledge System element (after <a href="#">Tribe &amp; Liburd, 2016</a> )
Input	The world of tourism
Output	Tourism knowledge
Processes	Two areas of tourism knowledge production: disciplines of tourism and extra-disciplinary tourism knowledge, and networks.
Environment	External force field
Feedback	Feedback (not further defined)

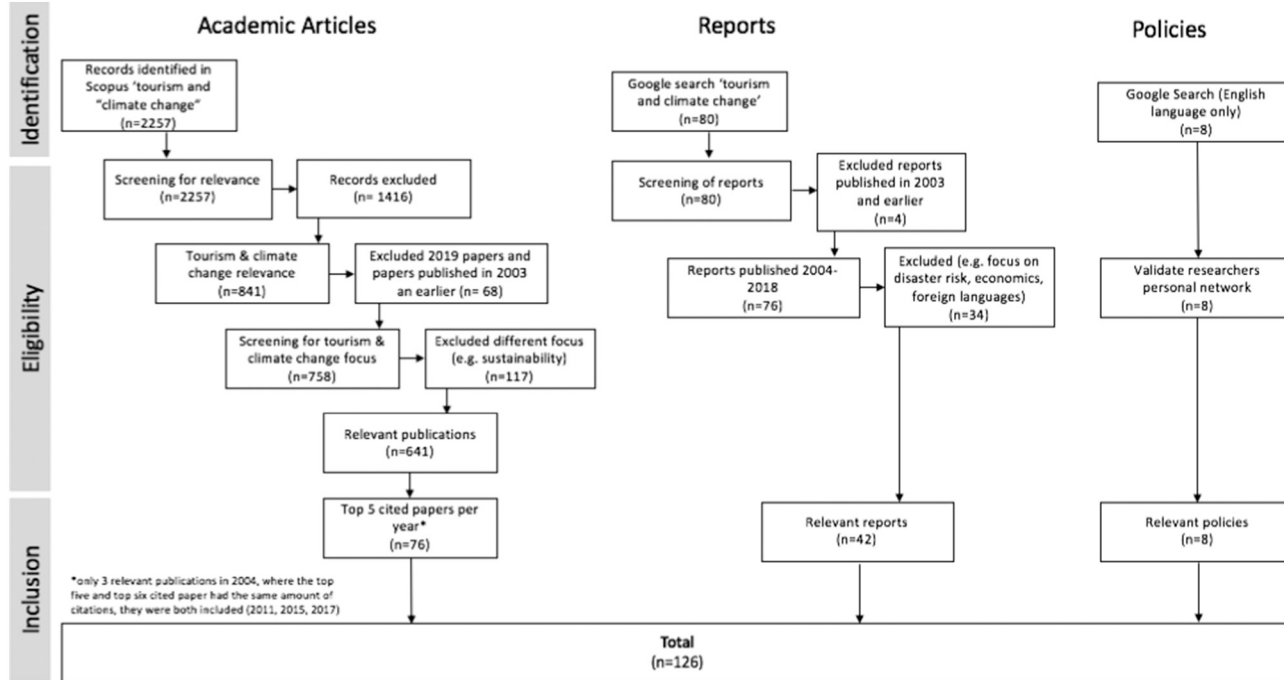


Fig. 1. Publication selection process.

2015). Importantly, the framework developed here may help identify gaps, constraints and limitations of knowledge.

### *Knowledge domains*

According to [Habermas \(1987\)](#), three types of interests influence the pursuit of knowledge: technical, practical and emancipatory, all creating different types of knowledge outputs. This suggests that knowledge differs based on the purpose it was developed for. In tourism, and broadly reflecting Habermas' typology, [Bertella \(2011\)](#) borrows a knowledge classification from rural studies which differentiates scientific, managerial and political, and local knowledge. Scientific knowledge is derived from research, whereby political and managerial knowledge focus on organisation of, and actions by the industry ([Bertella, 2011](#)). Local knowledge refers to traditions and socio-cultural aspects. The opportunity to integrate between the different knowledge types, specifically scientific and local knowledge, has been recognised in climate change studies where Indigenous and/or community knowledge are critical to successful adaptation ([Nalau et al., 2018](#)). However, local knowledge is commonly shared orally, or via art, craft and ceremonies ([Turnbull, 1997](#)), and more challenging to acquire for a review such as this one. We therefore focus on three knowledge domains which represent the issues of the world of tourism and climate change in publicly available documents: Academic, practical and political.

### *Research paradigms and ideology*

The way researchers from a particular academic discipline understand problems is influenced by their worldviews, paradigms, interest and background knowledge ([Tribe, 2006](#)). Traditionally, different research paradigms underpin the motivations for knowledge creation, for example positivism, constructivism or interpretivism, and critical theory. Each of these take different stances regarding physical (or objective) 'realities', as opposed to socially constructed perceptions how people make sense of, or challenge, a phenomenon. Paradigm in this study refers to [Kuhn's \(1970\)](#) broad interpretation of the term paradigm as an orientation shared by members of a group that instigates certain ways of thinking, behaving and conducting research, thereby unifying the group ([Vogel, 2009](#)). Here, we refer to it as a research paradigm to differentiate it from political beliefs ([Hall, 1993](#)), which we denote to as ideologies.

Ideologies refer to the symbolic constructions and belief systems that underpin a paradigm. They are "basic frameworks of knowledge and evolve from social interactions and serve as vehicles of thought" ([Vogel, 2009](#), p. 88). There are four features of ideologies: (1) they consist of beliefs and are thus cognitive frameworks, (2) the beliefs are interconnected, (3) they provide identity and consciousness to a group, and (4), they relate to behaviour of the group members ([Vogel, 2009](#)). This suggests that ideologies are powerful in influencing both knowledge production and action.

While neoliberal ideologies dominate in tourism ([Dwyer, 2018](#)), alternatives with a stronger sustainability focus are emerging. Some of these still subscribe to the economic growth model, albeit with green credentials ([Hall, 2013](#)). One prominent feature of research speaking to such ideology is a focus on technological advancements and efficiency. This view is also reflected within a more sustainability-oriented ideology of ecological modernisation. This 'green growth' concept is promoted by major international bodies such as the United Nations World Tourism Organisation (UNWTO) or the Organisation for Economic Co-operation and Development (OECD). Increasingly, and maybe in the face of growing environmental and social crisis, the concept of de-growth is given greater consideration ([Milano et al., 2019](#)) and 'alternative sustainable futures' are being explored ([Dwyer, 2018](#)). In summary, there are different ideologies that influence the knowledge field and world of tourism at any time, shaping the problems tourism and climate change knowledge seeks to address.

### **Methodology**

This review employed a qualitative methodology whereby the researchers adopted a critical approach to current tourism and climate change knowledge. This supported the application an interdisciplinary meta-analysis of existing knowledge outputs representing three domains of knowledge: Academic, practical and political knowledge. The meta-analysis applied here extends beyond synthesising existing literature but instead asks questions concerning key assumptions and influences shaping previous studies.

### *Identification of relevant publications*

Publications from a range of sources were considered for analysis. Peer-reviewed articles were selected as the key source to represent academic knowledge. In addition, industry or project reports helped gain insight into managerial and practical knowledge, as these are often commissioned by international tourism organisations, associations, businesses, destinations and non-governmental organisations. The knowledge reflective of public authorities was assessed based on publicly available policy documents ([Hall & Jenkins, 1995](#)).

The selection of documents followed a systematic process which has previously been applied to tourism research ([Yang et al., 2017](#)). The search terms 'tourism' and 'climate change' were used in combination to identify a long list of literature, which was then further refined ([Fig. 1](#)). Scopus was deemed an appropriate search engine to identify academic articles as it covers a large variety of journals across disciplines. Reports and policies were identified through a Google search, whereby policies were limited to dedicated tourism and climate change policies and strategies ( $n = 8$ ). These eight documents included here were identified as part of a study on tourism and climate change policy integration ([Becken et al., 2020](#)). This broad search identified a large number of articles ( $n = 2257$ ) and reports ( $n = 80$ ) which were further screened and reduced to documents published between 2004 and 2018 (inclusively). The 15-

year timeframe of this review covers the first identified tourism-climate policy document (2005) and includes the increase in research activity from 2004, following the first UNWTO conference in Djerba (2003). The reduced lists were screened again in detail to exclude those documents that did not focus on tourism and climate change at their core.

Reports and policies identified in languages other than English were excluded. Only reports with identified authors/publishers were included to limit results to formally published outputs ( $n = 42$ ). Academic papers were sorted according to number of citations. The top five highest cited papers per year were extracted for analysis ( $n = 76$ ) as papers with the highest citations are often regarded as landmarks with significant contribution and impact (e.g. Ritchie & Jiang, 2019). Books or book chapters were not included.

*Criteria and framework for analysis*

A coding framework was developed based on the literature discussed above. As shown in Fig. 2, five distinct knowledge dimensions were identified, each captured through several knowledge variables. ‘Source of knowledge’ refers to knowledge system inputs and is represented by the knowledge domain as well as regional and geographical parameters. ‘Knowledge creation’, represented by the purpose of knowledge creation, different disciplines and methods, reflects the process of knowledge production (Tribe & Liburd, 2016). The ‘Influence on knowledge’ links to Tribe and Liburd’s environmental influences (force field) on knowledge production. ‘Knowledge content’ is the system output and can be assessed by the climate change scope and focus of investigation. Finally, ‘Knowledge impact’ refers to system feedback. Capturing feedbacks is challenging, and for this present analysis it was decided that the stated aims and objectives of each publication are indicative of the knowledge it sought to create or represent and the types of influences it claimed to make in terms of wider changes in either the ‘real world of tourism’ or its corresponding knowledge system. In addition, advancements of knowledge production impact how knowledge is produced in the future and therefore, evidence of such advancements were also considered as system feedback.

All documents were analysed following the above framework, and information against each of the variables was tabulated (Table 2). Three variables (i.e. purpose, ideology and outcome) required thematic content analysis by coding relevant text using NVivo12. The majority of coding was conducted by the lead researcher but regular discussions of codes and categories and double coding of ambiguous sections by the co-researcher helped avoid bias. The development of nodes and child nodes informed the creation of codes and themes for each of the variables (Saldana, 2016). While this part of the review is subjective, it allows for an assessment of data beyond pre-confirmed categories. For example, the aims and objectives as stated in the documents were coded into seven themes. These were then entered into an Excel spreadsheet for quantification using SPSS 25. In addition to populating the variables, the thematic content analysis provided depth in understanding the differences between the three knowledge domains as well as how the system elements link. It also helped identify a number of cross-cutting issues.

Knowledge Dimension	Knowledge Variable	System Element
Source of knowledge	Knowledge domain Origin (region & geographical focus)	Input
Knowledge creation	Purpose/motivation Fields/disciplines Approach (Method)	Process
Influence on knowledge	Paradigm Ideology	Environment (force field)
Knowledge content	Climate change scope Tourism system elements Tools developed	Output
Knowledge impact	Objective/aim (outcome) Advancements	Feedback

Fig. 2. Framework for assessing the Tourism Climate Change Knowledge System, based on General Systems Theory and its system elements.

**Table 2**  
Overview of variables and their sources.

	Variable	Source
Source of knowledge	Knowledge domain	The type of publication (academic article, report, policy).
	Region <sup>a</sup>	The country and/or region the document focused on (e.g. case study location).
	Geographical focus <sup>a</sup>	The geographical features the document focused on (if any) (e.g. coral reefs).
Type of knowledge creation	Purpose/motivation of knowledge	Qualitative coding based on the purpose statements within the document and other evidence in text (e.g. empirical studies commonly conducted to create knowledge; reviews to synthesise knowledge and position papers to advocate).
	Themes/journal disciplines	Based on journal discipline/publisher of report and the lead agency which commissioned the policies. Where this was not clear, Scopus was used to inform discipline areas of academic papers.
	Approach (Method)	Based on method described in the document. This was not extracted for policies as they often do not include this information.
Influence on knowledge	Research Paradigm	High level, very broad categorisation according to research method and statements made in the document. Not coded for policies due to missing information on methodology.
	Ideology	Qualitative coding informed by Dwyer's (2018) framework of the traditional and dominant, neoliberal ideology vs. an alternative sustainability mindset.
Knowledge content	Climate change scope	Whether the document focused on adaptation (or areas that inform adaptation such as vulnerability assessments), mitigation (including areas that inform mitigation, such as tourism's contribution to carbon emissions), or both.
	Tourism sector elements <sup>a</sup>	Based on what element(s) of the tourism sector the document created knowledge on. Where a holistic approach was taken and interconnections between elements was recognised, this was coded as taking a systems approach.
Knowledge impact	Tools developed	Identification of tools developed as part of the document.
	Objective/aim <sup>a</sup>	Qualitative coding whereby nodes and categories were based on text stating the aim and objectives of each document.
	Advancements	Areas where advancements were achieved.

<sup>a</sup> Multiple responses possible.

### Limitations

The sampling method is quantitatively biased towards academic articles as the majority of documents selected for this study were influential academic articles. Despite considerable search, only eight dedicated tourism and climate change policy documents could be found (three from Australia; one each from Samoa, Saint Lucia, Bulgaria, South Africa and India). Despite the extensive search and systematic approach to developing the list of reports included, the wide spread of publishing agencies and geographic regions covered, the data base may not be representative as the real number of reports on this topic is unknown. Our sample indicates that it is easier to access academic articles and rate their influence in a standardised way (e.g. by citations) than it is for other outputs that form part of the knowledge system. Many industry or policy documents are not publicly available, or they are not in English. Moreover, they are difficult to categorise in terms of their importance.

This review includes the most influential academic papers in English language and thereby excludes other papers potentially covering important topics related to the field. Including these would likely widen the scope of the Tourism Climate Change Knowledge System, possibly disproportionately so exactly because they are not mainstream (either because of the topic or author). While this review extends the analysis of knowledge outputs to include reports and policy documents, and thus includes information often overlooked in published literature reviews, the omission of non-English language publications continues to be a challenge in literature reviews (e.g. Becken, 2013). Future research could broaden the scope for industry publications and policy documents, building on the findings generated in this research. This study used a ternary spectrum of ideologies, noting that there are other ideologies that sit between the two extremes. Developing a more detailed spectrum, and better understanding how different ideologies impact knowledge production are important areas for future research. Finally, qualitative approaches to data analysis cannot be completely free of subjectivity (Hennink et al., 2011). Coding of several variables involved interpretation of text and meanings, although consistency in coding was enabled through the use of a code book.

## The Tourism Climate Change Knowledge System

### Overview of the system

The Tourism Climate Change Knowledge System is visualised in Fig. 3, including its key system elements: inputs, processes, environment, outputs and feedbacks. Each of the elements is discussed in more detail below. A summary table of the results is provided in the supplementary material.

### Knowledge dimension and the key difference between knowledge domains

#### Source of knowledge

Source of knowledge represents the input into the system. Most influential academic articles took a global perspective to tourism and climate change (Fig. 4). In contrast, reports were mostly country or region specific (with an exception of reports such as UNWTO &

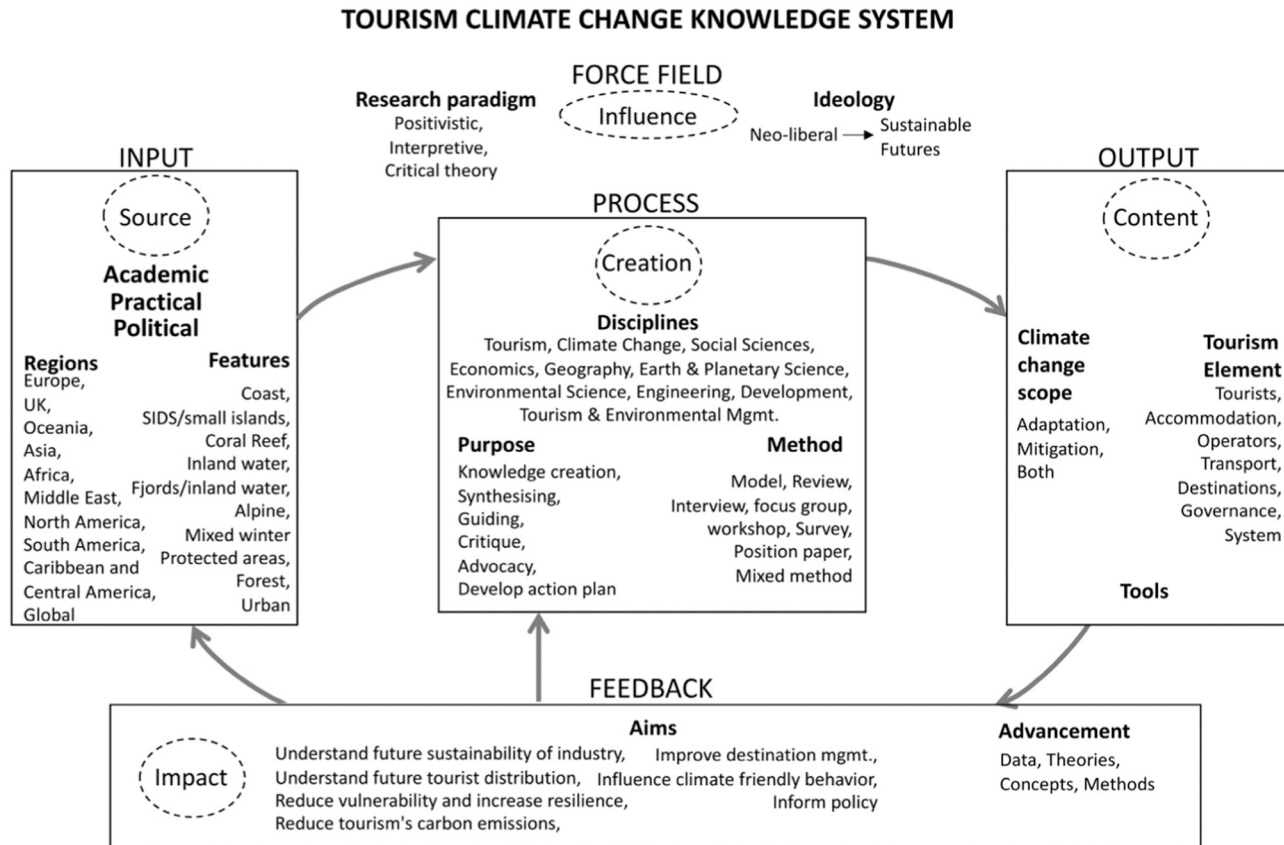


Fig. 3. The Tourism Climate Change Knowledge System.

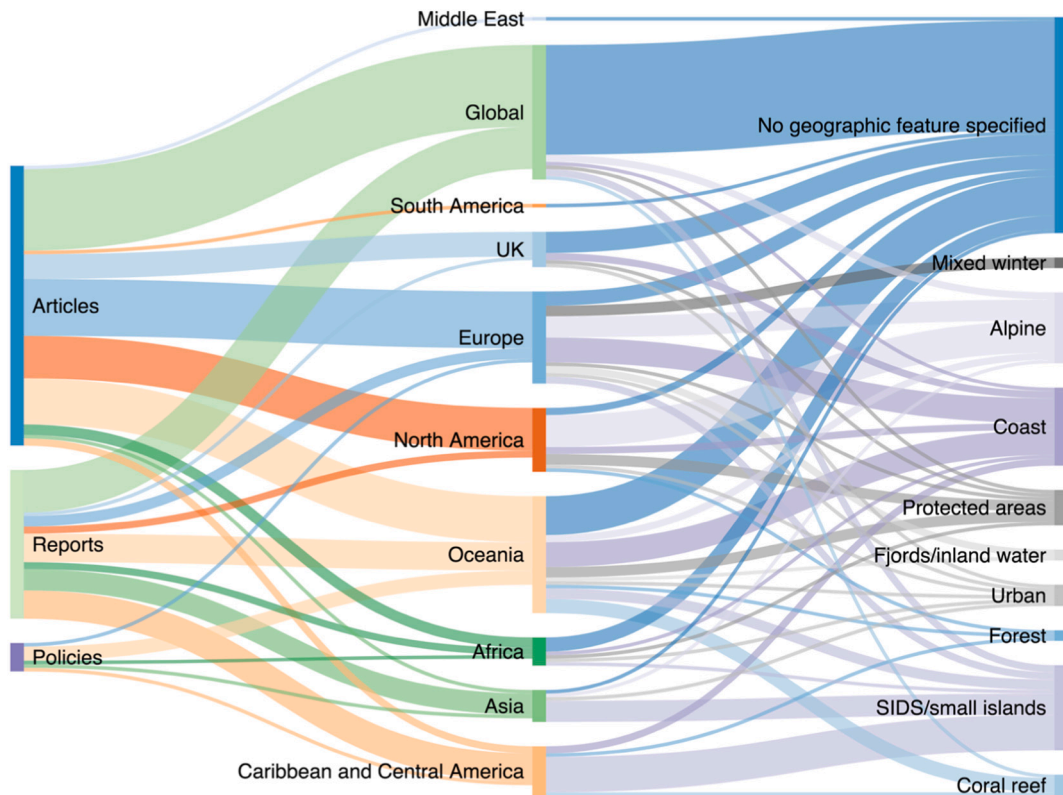


Fig. 4. Geographical region and features addressed per knowledge domain, whereby one document may focus on one or more regions and features.

UNEP, 2008), and all policies were context specific. The analysis confirms geographic hotspots of knowledge generation in Europe, Oceania, North America and the Caribbean and Central America (contains mainly Belize and Costa Rica as Central American countries). There was a gap of influential articles, reports and policies for the Middle East, South America, Africa and Asia. The analysis highlights considerable knowledge on islands and coastal environments, but less so, for example, on urban destinations.

**Knowledge creation**

Knowledge creation reflects the processes within the system. These are influenced by the purpose and motivation for the

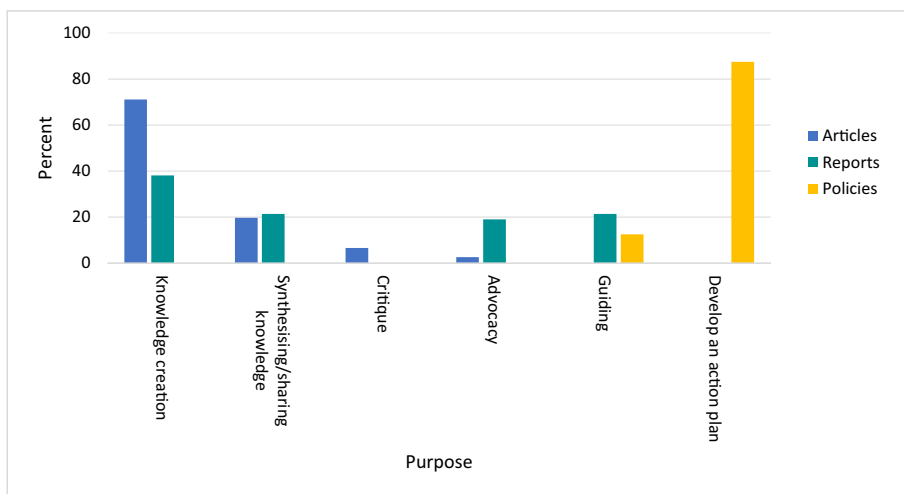


Fig. 5. Purpose of knowledge creation for the three knowledge domains with categories on the left representing knowledge production and categories on the right turning knowledge into practice.



development of outputs. The main purpose in academia – as stated in the papers – was to create new knowledge (71.1%), synthesise knowledge (e.g. a review of literature) (19.7%) or provide critique (6.6%) (Fig. 5). Reports, instead, aimed to create knowledge (38.1%), synthesise knowledge (21.4%), provide guidance (21.4%) or communicate a specific position through advocacy (19%). The purpose of policies was predominantly articulated as developing an action plan (87.5%) or providing guidance (12.5%).

Documents reviewed originated from a wide range of disciplines and fields. Different to previous reviews (e.g. Fang et al., 2018), just over half (52%) came from tourism studies, although other disciplines, such as climate change, environmental science, and economics, contributed as well (Fig. 6). Most policies (63%) were generated with prevailing environmental science influence as reflected by the lead agencies.

Academic articles and reports typically provided detail on the approach or methodology applied to meet stated aims and objectives, whereas policy documents often did not discuss methods. Nevertheless, and across the corpus of all knowledge domains, a wide range of methods were identified which contributed to the creation of tourism and climate change knowledge. These can be categorised into models and simulations, reviews, surveys, interviews, focus groups, workshops, position papers and mixed methods. The modelling approach was most popular for academic papers (34.2%), and reports tended to rely on reviews (42.9%) and mixed methods (26.2%).

*External influence*

To better understand external forces, the research paradigm was identified for academic papers and reports. Policies did not contain information on a research paradigm. A broad classification of the dominant research paradigms shows that most articles and reports reflected a positivistic paradigm (64.4%), whereas 21% were anchored in an interpretive paradigm. Only 4% of documents were approached from a critical theory paradigm, all consisting of articles. A small number of articles and reports appeared to reflect mixed stances (10.2%), evident, for example, in the combined use of qualitative and quantitative methods.

Furthermore, and to determine underpinning ideology, documents of all three domains were coded as being ‘neoliberal’, ‘mid-way’ or ‘sustainable’. Many articles (40.8%) and reports (42.9%) reflected a neoliberal ideology. These documents were classified neoliberal due to their framing of the importance of growth, a focus on expenditure as a key measure of success, and preference of business as usual (e.g. Rutty et al., 2017; Shih et al., 2009; Steiger & Mayer, 2008). They also appeared to focus on business profitability and expressed support for deregulation (Dwyer, 2018). No policy document was classified as neoliberal; likely because Governments that decide to develop a specific tourism and climate change policy are likely to be motivated by environmental concerns and future-oriented thinking.

About one third (30% of articles and 33% of reports) of outputs reflected a mid-way ideology, although for policy documents the share was much higher (75%). Mid-range documents focused on sustainable growth and efficiency but failed to ask critical questions

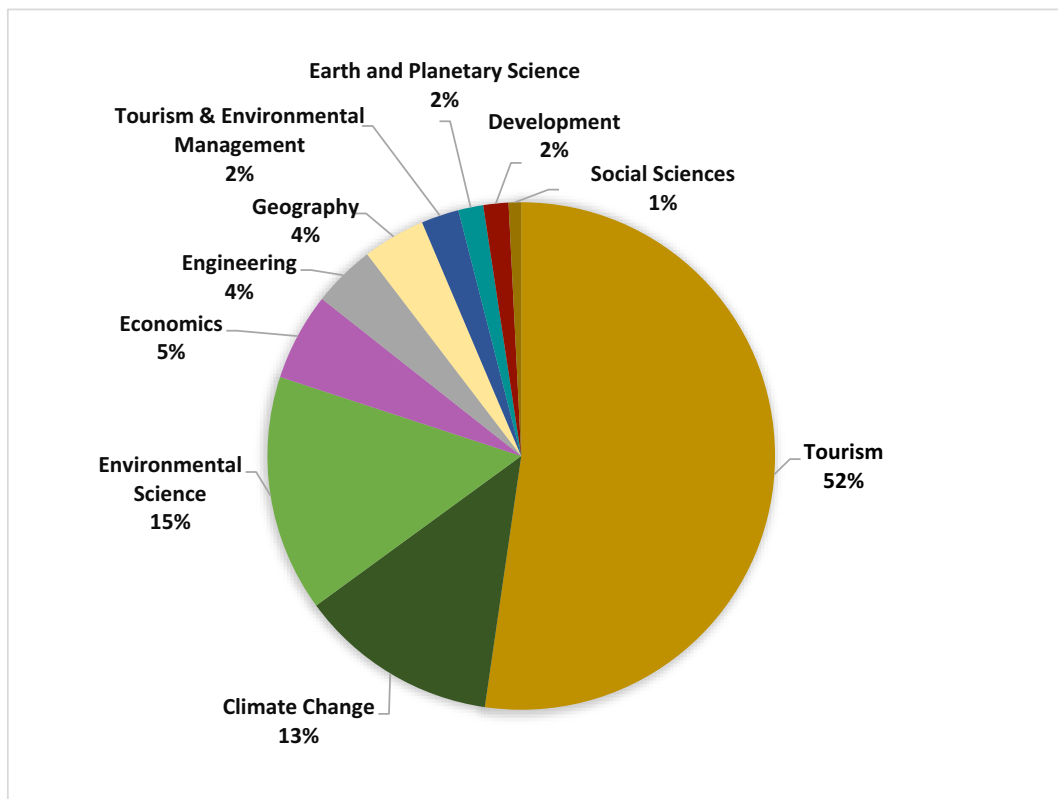


Fig. 6. Disciplines influencing tourism climate change knowledge.

about the current system (e.g. Samoa Tourism Authority, 2012; Schliephack & Dickinson, 2017; Shakeela & Becken, 2015). They also supported the view that sustainability should be enhanced through existing market mechanisms.

The smallest group of documents was classified as being embedded in a deeper sustainability ideology, represented by 29% of articles, 25% of policies and 24% of reports. This group of documents questioned the benefits of tourism growth, focused on creating net value, used broader metrics for measuring success and considered ways of recognising non-use values of resources (e.g. Cohen et al., 2011; Gössling et al., 2013; Joshi et al., 2016; Payet, 2007). Outputs tended to favour strong regulation, considered potential risk to future generations, and people and their stewardship of nature were deemed more important than returns to business (Dwyer, 2018).

**Knowledge content**

Half of all documents focused on climate change adaptation, and 27% of documents on mitigation. Only 23% reflected knowledge on both adaptation and mitigation. The greater interest in climate change impacts and how tourism may have to adapt to survive is perhaps not surprising, as it might be of more immediate economic relevance. This finding aligns with the identified dominance of neoliberal ideology that centres around business interests. Out of all knowledge domains, policies took a more holistic approach and covered both adaptation and mitigation (62.5%), as opposed to only 33% of reports and 13% articles.

Knowledge created in articles and reports focused on a range of system elements comprising the tourism sector. These included tourists, accommodation, transportation, operators, governance and destinations. Naturally, research on destinations often included a combination of these elements, since a destination is a composite of services, businesses, and community, amongst others. Most articles focused on one element in more depth, typically either the tourist or the destinations (40.3% of articles each). The strong interest in destinations was also reflected in reports (61.9%), but many (47.6%) considered two or more elements in combination. All policies focused on destinations and governance. Overall, outputs focused on accommodation and transportation (external to the destination, i. e. international travel) were limited. Only few documents took a holistic systems approach by explicitly researching links across system elements. For example, these included the impacts of climate change on different tourism system elements and the feedbacks this creates (Scott et al., 2012), or the interactions between the climate system, social structures and natural environment in the Seychelles (Payet, 2007).

**Knowledge impact**

Knowledge impacts were identified based on the aims and objectives stated in documents as well as advancements in the field. These reflect the feedbacks created from system outputs on either the world of tourism or the knowledge system. Academic articles sought to address a wide range of tourism and climate change issues (Fig. 7), whereas reports had less diverse aims, and policies were mostly (87.5% of the eight) targeted at reducing vulnerability and increasing resilience (the most common aim overall). Less common were aims to assess the future sustainability of the industry (e.g. 21.1% of 76 articles) and how this might be impacted upon by climatic changes (e.g. Amelung & Nicholls, 2014). Only few articles and reports specifically aimed to influence policy. For example, the Tourism and Transport Forum (2009) outlines the industry’s position in response to climate change risk, including its exposure to changes in mitigation policies, and advocates for a climate response that maintains competition and innovation.

Knowledge generation created feedback loops between knowledge domains, impacting the generation of future knowledge. For example, reports commonly used IPCC scenarios (that aggregate scientific knowledge) and downscaled climate change projections to determine destination-specific impacts and vulnerabilities (Hosterman & Smith, 2015). Similar, reports often summarised relevant academic studies (e.g. Payet, 2007), or combined biophysical data (e.g. hazard assessments) with socio-economic studies (e.g. on

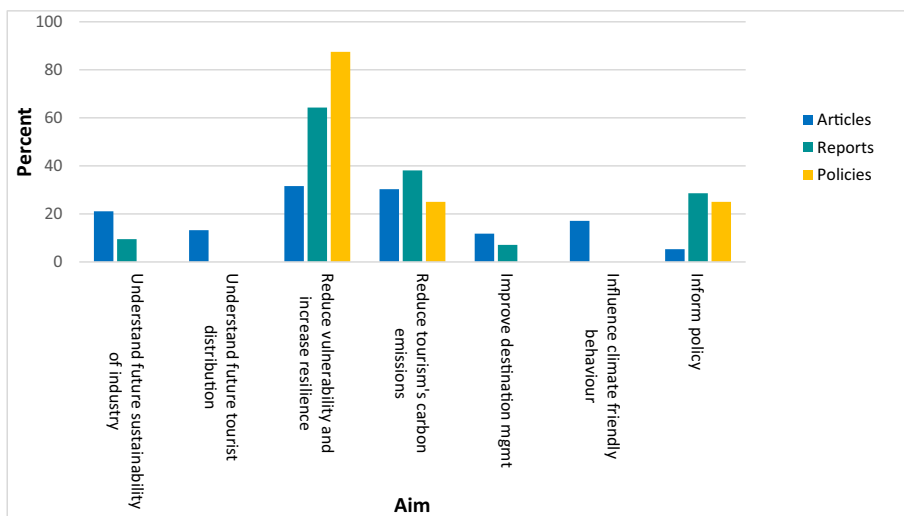


Fig. 7. Knowledge impact as stated in document aims and objectives.

behaviour and economic cost-benefits). Such data integration produced information tailored to the needs of destination decision makers, for example vulnerability maps (Climate & Development Knowledge Network, 2014).

Synthesising academic research through reports is a way to disseminate scientific knowledge to decision makers and practitioners who may not have the resources to consult the primary literature. These reports are then often used to inform policies. For example, Simpson et al. (2008) was referred to in the South African National Tourism and Climate Change Action Plan (Department of Tourism Republic of South Africa, 2011), noting that most policy documents do not provide references. While this sequence of diffusion across knowledge domains from article to report to policy may not always be the case, findings suggest that reports play an intermediary role. Despite evidence of some links, the availability of and access to context-specific data and knowledge has been raised as an issue in documents across all three knowledge domains (e.g. Fang et al., 2018; Scott et al., 2016; Scott & Lemieux, 2009; Shih et al., 2009; Vodenska & Gössling, 2018). The differences between the three knowledge domains, and how these link to each of the system elements, are summarised in Table 3.

## Discussion – the science-policy-practice interface of tourism and climate change

### *A holistic view on tourism climate change knowledge production*

This is the first review that positions research on tourism and climate change within a wider knowledge system. This is important because only by understanding the wider system can we gain an appreciation of the drivers that influence what knowledge is produced, and who has access to it. Uncovering those drivers is critical in interpreting the corpus of work and its impact on informing actions. The Tourism Climate Change Knowledge System revealed several gaps and constraints which act as barriers to actions. The following section discusses the functionality of the system and pathways to making real world progress on climate action.

Purpose influences how knowledge is created and what outcomes it produces. The main purpose of academic outputs in this review was to create new knowledge. The stated rationale of practical outputs (reports) ranged from knowledge creation to inform action by providing guidance and advocacy. The purpose of policies was action oriented. While these results confirm the role each domain plays in the knowledge system, they do not explain why tourism remains a vulnerable and carbon intense industry. In the broader context of sustainable tourism, Sharpley (2020) reminds us that thousands of academic articles on this topic have led to little progress on the ground. Understanding the wider context in which knowledge is produced might help. In systems thinking, Meadows (2008) argues that complex, self-organising systems gear towards a ‘system goal’. If the system does not produce desired outcomes, it is often because the goals of the system are not defined or measured correctly. In academia, the measures of success are publications and research funding (Hall, 2010, 2019). The goal of industry is to generate profits, and governments aspire to deliver economic growth and employment.

These goals were reflected in the outputs across the knowledge dimensions (see framework in Fig. 2). The majority of articles and reports supported a neoliberal ideology, centred around growth and aspects of climate change that are closely tied to business interests such as (economic) vulnerability. Only a small number of academic articles applied a critical research paradigm, and voices representing different worldviews and values, such as those of Indigenous peoples, are largely missing across all domains. The holistic view taken in this study made it possible to uncover the extent to which knowledge production for climate action in tourism is embedded in the dominant growth-oriented ideology (Becken, 2019). In other words, only that type of knowledge is produced that sits comfortably with the goals of the wider system (Dwyer, 2018). Since knowledge production generally has to be commissioned and funded this is not surprising. The lack of independence of tourism and climate change knowledge from the external force fields raises the question if it is possible at all to inform system change from within the system. Barriers and opportunities to improve climate action, and possibly system shift, are explored in the following.

### *Barriers to action*

Differences in institutional settings, including divergent objectives, needs and priorities, represent a major barrier to knowledge mobilisation from academia to practice (Weichselgartner & Kasperson, 2010). Moyle et al. (2017, p. 704), for example, argue that “the literature tends to raise problems, rather than provide solutions”. Further, researchers search for models that are generalisable, whereas decision-makers require tailored answers, highlighting a disconnect between knowledge production in academia and the need for practical solutions by industry. Such discrepancies affect feedback loops between domains, leading to knowledge gaps, inaccessibility and lack of exchange.

### *Availability and accessibility of relevant knowledge*

The availability of context specific data has been identified as a barrier across all three knowledge domains. According to Dilling and Lemos (2011), the salience of climate change knowledge is compromised if it is not at the right scale and time frame required by decision makers (Shih et al., 2009). Models and simulations, for example to calculate carbon emissions, require specific data sets and baselines (Scott, Gössling, et al., 2016), and if these are lacking the analysis requires many assumptions that increase uncertainty around the findings (Weaver, 2011). Lack of data compromises the production of detailed results and recommendations important for local climate change decision making (Porter et al., 2014). It may also explain a lack of longitudinal studies, for example on the effectiveness of adaptation interventions. Data availability and access to knowledge may be influenced by other factors inherent to each of the three knowledge domains, including communication, language, knowledge format and in some instances even mistrust (Weichselgartner & Kasperson, 2010). It may also be linked to power, as “data monopolies and media coverage strongly influence the

**Table 3**  
Tourism climate change knowledge characteristics across the three domains.

System	Dimension	Academic	Practical	Political
Input	Source of knowledge	General	Project/case/region specific	Specific to jurisdiction
Process	Purpose motivation	Advance knowledge (theoretical) understanding of field), disseminate information. Only source of critique.	Pragmatic; focused on implementation. Synthesise information relevant to country/region. Provides guidelines and often represents industry views (lobbying).	Context specific. Organisation and regulation of the industry. Development of actions.
Process	Knowledge creation	Mainly tourism and to lesser extent other disciplines.	Tourism agencies/departments and to lesser extent climate change and environmental groups.	Environment agencies/departments and to lesser extent tourism and climate change agencies.
Force field	Influence	Represents both traditional neoliberal and alternative sustainability views.	Leaning towards traditional neoliberal.	Leaning towards alternative sustainability.
Output	Knowledge content	Focus on either adaptation or mitigation. Creates knowledge specific to each part of the tourism sector with preference for tourists and destinations.	Knowledge produced mainly on adaptation or adaptation and mitigation combined. Focus on destination element.	More holistic informing both adaptation and mitigation. Strong destination and governance focus.
Feedback	Aim	Broad stated impacts.	Reduce vulnerability and increase resilience, to lesser degree reduce carbon emissions and to inform policy.	Reduce vulnerability and increase resilience, and to improve governance.
	Impact	To inform creation of new knowledge and theories, methods and techniques. Establish concepts in the field.	Translation of scientific knowledge and recommendations for practitioners and policy makers.	Provides direction in form of guidelines, action plans, legislation.

knowledge–power relationship” (Weichselgartner & Kasperson, 2010, p. 274).

Strengthening feedback loops between elements would improve accessibility to knowledge. Stronger networks need to be created, not only with an inter-disciplinary but a transdisciplinary focus. While Tribe and Liburd (2016) note that the wider academic study of tourism linking with the hard sciences remains limited, the field of tourism and climate change provides an opportunity to bridge this gap. This study found that almost half of all outputs were generated in disciplines outside of tourism and Fang et al. (2018) found that in the case of tourism and climate change research several environmental/atmospheric journals are more influential than tourism journals. Drawing from multiple disciplines increases researchers’ ability to overcome theoretical and methodological limitations and biases, leading to deeper learning as a result (Becken, 2013; Rutty et al., 2017). Transdisciplinary knowledge networks consist of people across many domains (e.g. scientists, policy makers, NGOs, businesses) and institutions who share knowledge across an area of practice (Cole & Browne, 2015). Multi-domain networks will improve access to context specific data (Scott & Lemieux, 2009) and support the creation of knowledge relevant to a wider range of stakeholders. Existing networks include SunX or the Action for Climate and Tourism Network (ACTN),<sup>1</sup> groups consisting of representative across domains focusing on finding solutions for low carbon and resilient tourism. Another example identified in this review includes the ‘Queensland Tourism Climate Change Response Plan’ (Becken et al., 2018) which was a partnership between State Government, an industry association and a University, and led to the establishment of a long-term steering group.

#### *Insufficient or partial knowledge*

This review confirms several geographical gaps including Asia and Africa, suggesting that applying what we already know to other regions is either not a priority for the academic domain (i.e. not incentivised), or the knowledge that exists on those regions is not represented in dominant knowledge outputs. The geographic bias may also be explained by the fact that a small number of academics have a very strong influence on the field (Fang et al., 2018), bringing with them their own research priorities and origins (even if their study focuses on parts of the world other than their home base, it is shaped by the cultural/ideological background of the researcher). The analysis presented earlier shows that influential academic outputs flow into reports and policies, which means that these biases become institutionalised. Because highly cited papers have a tendency to become a legitimate ‘source of truth’, this could result in a situation where a locally more relevant research output is overlooked in favour of a ‘famous’ international source by a recognised expert. This same effect could also constrain input from researchers marginal to the field, or underrepresented groups more generally, including Indigenous people who may present knowledge in different formats (Tribe & Liburd, 2016), or not relevant to the objectives of funding bodies. In summary, the knowledge that is transferred, implemented and further developed, including the formulation of research questions, is often based on the thoughts of a small number of people who undertake research on a subset of destinations and contexts.

The study identified insufficiencies resulting from a lack of integrated thinking. Amongst others, this is reflected in the small number of tourism studies which address mitigation and adaptation holistically. Applying systems approaches helps understand trade-offs, not just between different interventions or policy goals but also between stakeholders and system elements (Loehr, 2020). The imperative to identify synergies is nowhere more apparent than in the case of island destinations where increasing climate risks

<sup>1</sup> <https://www.thesunprogram.com/>; <https://www.linkedin.com/company/actnetwork/>.

combine with stringent carbon reduction policies, demanding strategic approaches to tourism development (e.g. [Caribbean Hotel Association & Caribbean Tourism Organization, 2007](#); [Gössling et al., 2008](#)). Applying holistic approaches to climate change, such as well-being frameworks, and identifying interventions that create ancillary benefits are important areas for future research. Such integrated approaches should go beyond quantitative modelling – a preferred method identified in this review – and include other ways of generating or integrating knowledge ([Kaján & Saarinen, 2013](#)).

#### *Transferability of knowledge*

The review highlights that, while the body of academic literature is growing, there remains a lack of tourism and climate change specific practical and political knowledge which indicates challenges in the mobilisation process. In particular, policies that specifically address the interrelations between tourism and climate change seem scarce, or at least are not available publicly through an online search. This finding suggests that the two-way transfer between the policy and academic domain could be improved in both directions, including via the intermediary of (industry) reports. In addition, results indicate a disconnect between academic knowledge, which is often framed at global levels, and policy knowledge that reflects local needs. This misalignment in scale between climate science, impacts and response has been recognised elsewhere ([Howarth & Painter, 2016](#)).

Previous literature suggests that the tourism industry applies a short-term decision-making frame that relies heavily on ‘climate coping strategies’, rather than future-oriented planning ([Hughes & Becken, 2014](#)). To increase the relevance of theoretical climate change knowledge, [Weichselgartner and Kasperson \(2010\)](#) argue that it needs to be reliable and applicable. Knowledge outputs should therefore incorporate real world experiences and provide tested solutions. Some reports in this review have taken this approach, but wider dissemination to businesses may still be necessary. This additional gap in knowledge transfer could be substantial, given that the majority of tourism businesses are small and lack capacity to access or absorb this information. Tourism businesses thus rely on inter-organisational knowledge creation and transfer, facilitated by ‘hubs’ such as public tourism bodies and destination management organisations ([Raisi et al., 2020](#)). However, it is not unusual for knowledge networks in destinations to be of low connectivity (a lack of links between actors) ([Raisi et al., 2020](#)), and tourism bodies tend to focus on marketing and product development rather than addressing sustainability issues. Just as for knowledge networks discussed above, those ‘hubs’ need to work across sectors to strengthen links with environmental agencies as well as research institutions. Co-creation of knowledge as a new research paradigm will help break down the existing silo approach.

#### *Opportunity: A shift in ideology*

Despite the forces of the larger system that shape tourism and climate change knowledge, several studies reflect the beginning of an alternative ideology; paving the way for more critical voices and diverse research paradigms. A critical – or emancipatory – view is required when the aim of knowledge production is “to foster socially-just pathways for change” ([Nightingale et al., 2019](#), p. 2). An example of such a critical view, for example, relates to growing concerns about tourism’s growth projections ([Scott, Hall, & Gössling, 2016](#)). A small number of recent academic papers apply a critical research paradigm, dissecting the traditional neoliberal ideology and calling for a wider system shift ([Becken, 2019](#); [Hall, 2019](#); [Higgins-Desbiolles et al., 2019](#)). Shifting ideologies were also apparent in tourism climate change policy documents. If the Tourism Climate Change Knowledge System is on the verge towards a new dominant ideology, there is an opportunity to incorporate new types of knowledge, for example those that build on lived experiences and learnings of practitioners. A more inclusive approach would support the integration of underrepresented groups, new worldviews and values. Including these voices will add context and deliver “locally embedded, historically and socially contingent knowledge” ([Weichselgartner & Kasperson, 2010](#), p. 276). Furthermore, those voices may support the creation of more unorthodox knowledge on what a different system could look like and how to get there. This could further support a shift in ideology, which may lead to redefining the underlying system goals in each of the knowledge domains, and thus influence the motivation for knowledge production. As such, the larger system could potentially be changed from within.

#### **Conclusion**

This study applied systems thinking to investigate tourism and climate change knowledge. Following an interdisciplinary meta-analysis of tourism and climate change publications, the Tourism Climate Change Knowledge System was developed. The system elements comprise five knowledge dimensions: Source of knowledge, Knowledge creation, Influence on knowledge, Knowledge content and Knowledge impact. These were assessed across three knowledge domains: academic, practical and political. The systems approach provided a unique lens for assessing the drivers that influence what tourism and climate change knowledge is created, where the differences lie across the three knowledge domains and what impact is created through feedback loops. It therefore helped identify key barriers to the science-policy-practice interface. The findings highlight the lack of holistic approaches that critically address challenging questions about the role tourism plays as a sustainable development option under a rapidly changing climate. A common limitation to knowledge production is a lack of robust and context specific data. This, together with the omission of knowledge (or its in-built biases) on some elements of the tourism system, limits the knowledge required for local decision making. Addressing the above gaps and improving links between the different knowledge domains, for example through networks or co-created projects, would improve the flow of knowledge from academia to industry reports and policy documents. Finally, the assessment uncovered the extent to which tourism climate change knowledge production is embedded within the goals of the wider system, raising questions to what degree knowledge created within the system can lead to system change from within. Including voices representing alternative ideologies may help achieve such a shift.

## CRedit authorship contribution statement

Johanna Loehr conducted the document search, development of framework together with the co-author, data analysis and write up. Susanne Becken contributed to the method applied identifying documents for the review, development of the framework, data analysis and write up.

## Declaration of competing interest

The Authors declare that there is no conflict of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.annals.2020.103073>.

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