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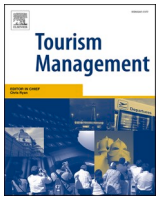

Current issues in tourism: Mitigating climate change in sustainable tourism research

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ABSTRACT

This paper adopts a problematising review approach to examine the extent of mitigating climate change research in the sustainable tourism literature. As climate change has developed into an existential global environmental crisis and while tourism's emissions are still increasing, one would expect it to be at the heart of sustainable tourism research. However, from a corpus of 2573 journal articles featuring 'sustainable tourism' in their title, abstract, or keywords, only 6.5% covered climate change mitigation. Our critical content analysis of 35 of the most influential papers found that the current methods, scope and traditions of tourism research hamper effective and in-depth research into climate change. Transport, the greatest contributor to tourism's emissions, was mostly overlooked, and weak definitions of sustainability were common. Tight system boundaries, lack of common definitions and incomplete data within tourism studies appear to hamper assessing ways to mitigate tourism's contribution to climate change.

1. Introduction

The growth in tourism emissions runs counter to trends in other industries and popular opinion. Polls indicate that, even during the pandemic, citizens recognised climate change as the top challenge, (European Investment Bank, 2020). Yet, while other industries move towards zero emissions by 2050 in line with the Paris Climate Agreement (UNFCCC, 2015), tourism's emissions are expected to triple in that period (Gössling & Scott, 2018), severely threatening tourism's "very product" through climate change (Scott & Gössling, 2018, p. 6). Despite a substantial number of academic papers addressing sustainable tourism since the 1990s - Buckley (2012) found over 5000 publications about sustainable tourism - the tourism sector shows little progress in mitigating climate change. In fact, Scott (2021, p. 1) observes "what we have done for the past 30 years has not prepared the sector for the next 30 years of accelerating climate change impacts and the transformation to a decarbonised global economy." Gössling and Scott's examination of tourism leaders' perspectives on interpreting information in decision-making, even documented some systematic "fabrication of uncertainty to justify non-action" (Gössling & Scott, 2018, p. 2071). No wonder Scott and Gössling (2021, p. 199) conclude that there is "no evidence that the declarations have altered the growth trajectory of sector emissions or influenced the integration of climate change into tourism policy and planning".

The situation described above evoked fundamental questions: Why was sustainable tourism research not more effective for decision-making to mitigate tourism's impact on climate change? Is there something wrong with the research in sustainable tourism, or even in tourism research in general? We argue that there is – among other issues – an epistemological problem with the tourism research tradition (Tribe, 2004), which hampers appropriate research into the impacts of tourism on the climate and its mitigation which has not changed with the introduction of sustainable tourism research. To analyse the situation, we examine the tools, models and theories of research in sustainable tourism through a problematising review and show to what extent they deliver compelling insights to policymakers and industry leaders in mitigating climate change.

Our approach differs from other systematic literature reviews. It critically examines how research is done, rather than providing a wider overview of all insights from sustainable tourism research related to climate change mitigation. The evaluating framework we developed allowed systematic comparison of papers considering climate change mitigation and other sustainable tourism research. Overall, this study aims to answer the research question: *How adequate is sustainable tourism*

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research to effectively assess tourism's contributions to climate change and options for mitigation?

To do this, we gathered and documented 2573 reviewed journal articles about sustainable tourism research published up to 2019, before the distortions caused by the outbreak of COVID-19. Keywords were identified and their trends described. We also analysed the distribution of papers and their citations over journals, and journal types.

The following problematising review examines and assesses 35 of the most influential journal articles on sustainable tourism research using an evaluation framework with a 4-point scale for each of the aforementioned aspects. The framework identifies the key elements of tourism affecting CO_2 emissions (see Section 3.2). It assessed the various definitions of sustainability as adopted in the 35 papers, the inclusion of transportation and the scope and system boundaries applied in the tourism system researched. The framework, developed before the analysis, evaluated whether or not each element enhanced understanding of the contribution to climate change mitigation. The validity of the framework was endorsed by the clear differences identified between papers including and omitting climate change mitigation.

Our *corpus* consists of papers using the term 'sustainable tourism' without investigating how they defined 'sustainable'. We believe that sustainability can only be reached when all elements, planet, people and profit, meet certain criteria. This means that a paper with a focus on people, should check also economic and environmental issues if relevant for the discussed case or theory. Generally, papers discussing mitigation acknowledge the importance of other topics such as economy, employment and small island developing nations (e.g. Michailidou et al., 2016; Neger et al., 2021; Scott & Gössling, 2018). Often, sustainable tourism papers about non-climate impacts, but with obvious consequences for emissions, omit the discussion of climate change (e.g. Gascón, 2012).

This article is structured as follows: Section 2 provides a literature review discussing the definition of sustainability, tourism's emissions and some background to a problematising review. Section 3 explains how the initial sample of 2573 articles in peer-reviewed journals was selected, the analysis of that sample, and the evaluating framework used for the content analysis of the 35 influential articles. Section 4 describes the findings and Section 5 explores the implications of the findings. Conclusions are drawn in Section 6.

2. Literature review

2.1. Sustainability

It is generally accepted that sustainability includes three aspects: economic, social and environmental, the oft-used triple-bottom-line (Elkington, 1994). However, the Triple P is frequently misinterpreted as just balancing social, economic, and environmental benefits including substituting one form of benefits for another, e.g. economic benefits for environmental harms, an idea rejected by its inventor (Elkington, 2018). This weak sustainability (Davies, 2013) ignores the need to keep below critical environmental thresholds and to avoid destroying the global ecosystem. The economic 'bottom line' is profit, without which no enterprise can survive for long. Social bottom lines are less clear and may vary extensively over time.

The Paris Agreement, as an environmental bottom line, aims to keep the temperature rise below 1.5–2.0 °C (UNFCCC, 2015). It is currently estimated that to have a 66% chance of limiting temperature rises to 2 °C, from 2018 onwards, no more than about 1200 Gton of CO_2 accumulated emissions can be added to the atmosphere and to have a 66% chance of keeping it below 1.5 °C, only 470 Gton can be emitted. These carbon budgets require zero-emissions once the budget has been used up. According to climate science, exceeding 2 °C will definitely cause irreversible tipping points and these are probable at 1.5 °C (Höhne et al., 2020, pp. 25–28). Therefore, just as climate mitigation research generally takes account of other impacts like economy, employment and small island developing nations (IPCC, 2018), we feel research about other sustainability topics, should in the process of writing the paper also consider potential impacts on the climate.

2.2. Tourism and emissions

Tourism and travel accounted for 4.9% of global CO_2 emissions in 2010, with more than half from air transport (Gössling & Peeters, 2015). Tourism and transport emissions grew until April 2020, when the COVID-19 crisis caused a decline of between 60 and 80% in air transport, with evidence of increasing domestic tourism in many countries (Gössling & Higham, 2021). Hopes of more sustainable tourism development after COVID-19 (Lew et al., 2020) have been dashed by many governments spending billions of Euros on saving airlines, increasing climate change with limited economic effect. Increasingly, it appears that business will return to 'normal', and the crisis will only slightly delay the growth in emissions. Without COVID-19, a 'business-*as*-usual' growth tourism scenario was forecast to use between 29% and 65% of the remaining carbon budget between 2015 and 2100 (Peeters, 2017), while contributing only 3.2% of global GDP (WTTC, 2018). These shares were reduced by 1–2 percentage points by COVID lockdowns according to a recent study based on the same model (Peeters & Papp, 2023).

Transport to and from the destination (O/D) accounts for approximately 75% of tourism's energy use and emissions, with air transport accounting for just over 20% of all trips, but about 50% of emissions, (Gössling & Peeters, 2015). Long haul trips, especially those over 6000 km, are enjoyed by a small proportion of tourists, but cause high emissions (Peeters & Landré, 2012). Emissions can be reduced by attracting closer markets/choosing nearer destinations, encouraging longer stays and fewer trips and switching away from energy-intensive modes, especially flying (Kamb et al., 2021).

Related to transport, is the disproportionate focus on international tourism which distorts understanding of the tourism system. Domestic tourism, accounting for 80% of tourism trips and 73% of all tourism revenues (WTTC, 2018), offers opportunities for economic development with far fewer long haul flight emissions. The severity of the problem means that all stakeholders, "governments and international organizations, the tourism industry and destinations, consumers/travellers, and research and communication networks", need to act, as noted by the Davos Declaration on Climate Change and Tourism (Scott, 2021, p. 10). Flying suffers from a high attitude-behaviour gap (Cohen et al., 2016), making behavioural change unlikely to reduce flying without significant changes in policies and the supply of tourism products.

2.3. Sustainable tourism research and climate change mitigation

The widespread use of the term 'sustainable tourism' in academic literature as well as in the industry and among policymakers, can be considered "one of the great success stories of tourism research and knowledge transfer" (Hall, 2011, p. 649). Unfortunately, it seems to fail to advance science, or serve policymakers, the tourism industry and NGOs with insights enabling these stakeholders to take action to mitigate the climate change caused by tourism (Scott, 2011). While the lack of action may be caused by "the unwillingness of key actors in tourism policy networks" to learn from science and acknowledge policy failure Hall (2011, p. 649), we hypothesise that it might also be due to deficiencies in tourism research itself. For example, Gren and Huijbens (2012) suggest that tourism studies are grounded in theory that excludes 'the earth' and most physical things. If so, research will be unable to provide convincing evidence for the major changes required in tourism and transport.

Deficiencies in tourism research were noted in the 1980s, including: conceptual weakness, lack of focus, mainly descriptive, one-off destination centred case studies, a lack of theoretical foundation and significant issues with data quality and compatibility (Cooper, 2003). While noting the risk of tourism research staying in the pre-paradigmatic stage as defined by (Kuhn, 1970), Cooper (2003), saw grounds for optimism.

However, McKercher and Prideaux (2020, p. v) found that tourism research still suffers "vague and fuzzy boundaries" and is scattered over a range of disciplinary silos, lacks clear definitions and has still failed to reach the paradigmatic phase.

Research into tourism's climate change mitigation lacks some basic tools, such as: clear, common definitions, agreed system boundaries and compatible data collection about tourism transport and transport modes used. Only with such information can detailed CO_2 emission inventories be compiled. Even the international UN/OECD's useful definition of tourism "the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited", is often ignored in texts and in empirical data. This is unfortunate as this broad definition includes all the physical elements of tourism causing CO_2 emissions.

Section 2.2 shows that most emissions stem from transport for tourism and particularly from air transport. The main parameter determining emissions is the distance travelled between home and destinations. Unfortunately, transport and tourism geography are often omitted in tourism research as Hall et al. (2014) showed by a keyword search of tourism papers published between 1973 and 2013. They found a small minority (3.4%) refer to geography and even fewer (0.8%) mention GIS (Geographical Information Systems), suggesting a lack of the quantitative data and scientific techniques needed for large scale and global research.

Tourism research fails to provide the local and global data needed for detailed CO_2 emission inventories and policy recommendations, such as data per arrival like distances travelled, transport modes used, occupancy rates of cars, busses, trains and aircraft, types of accommodation used and carbon-intensive tourism activities like helicopter flights. Transport research may help to fill some gaps, but defines tourism rather differently (see an early attempt to combine tourism and transport data and models by Peeters et al., 2007). Reducing emissions needs to include the whole tourism system including transport and distances to introduce policies that discourage long-distance travel, especially flying, and promote the use of electric trains and cars, and domestic rather than international tourism. Furthermore, a strong interpretation of sustainability and a long-term view are essential.

2.4. Problematising literature reviews

Systematic literature reviews play a significant role in mapping and synthesising a specific domain of research and providing a reference point for further debates (Patriotta, 2020). Many scholars find systematic literature reviews beneficial, identifying and summarising evidence from earlier research (Boell & Cecez-Kecmanovic, 2015). Problematising literature reviews differ from other systematic reviews such as critical, integrative, theoretical and semi-systematic reviews (Alvesson & Sandberg, 2020; Hoon & Baluch, 2020) by interrogating the core assumptions of a research tradition (Alvesson & Sandberg, 2020, p. 1300).

The primary aim of a problematising review is to re-evaluate the current understanding of phenomena by challenging the current ways of thinking about it (Alvesson & Sandberg, 2013). This can create opportunities for new ways of understanding the literature and research paradigm of a domain. A principal ambition in a problematising review is to challenge conventional thinking into new approaches through re-conceptualising existing knowledge. The four core principles behind problematising reviews include reflexivity, reading more broadly but selectively, problematising rather than accumulating knowledge, and "less is more" (Alvesson & Sandberg, 2020). A problematising review, rather than debunking a knowledge area, interrogates the research tradition and (a) its assumptions about nature and reality, (b) the foci of studies and major issues of interest about the phenomenon and (c) methodology (Kuhn, 1970).

3. Methodology

3.1. Selecting the corpus

A Scopus database search (March 2019) found 2573 articles in peer-reviewed journals with the term 'sustainable tourism' in their title, abstract or key words. The search code was TITLE-ABS-KEY ("sustainable tourism") AND (LIMIT-TO (DOCTYPE,"ar")). Scopus searches using "ar" only select articles in peer-reviewed journals.

This is a much broader search than previous reviews such as Guzeller and Celiker (2019); Xiao and Smith (2006), who focused on one and Ruhanen et al. (2015) whose review included four journals. We found fewer documents than Niñerola et al. (2019), who, using Scopus, traced 4647 articles relating to tourism and sustainability published between 1987 and 2018, but their search terms included related words such as 'ecotourism' and 'ecology'.

Within the body of 2573 peer-reviewed journal articles, we identified 168 articles whose abstract, title, or keywords contained at least one of the following climate mitigation related terms: 'climate change', 'greenhouse gas', 'emissions', or 'mitigation'. The full search code in Scopus was TITLE-ABS-KEY ("sustainable tourism") AND (TITLE-ABS-KEY ("climate change") OR TITLE-ABS-KEY ("greenhouse gas") OR TITLE-ABS-KEY ("emissions") OR TITLE-ABS-KEY ("mitigation")) AND (LIMIT-TO (DOCTYPE,"ar")).

The 2573 articles were entered into an Excel database recording the following details: Publication Year, Title, Authors, Journal Title, Volume, Issue, the number of citations (excluding self-citations), whether climate change mitigation terms appeared in the title, keywords or abstract and whether or not the article appeared in a tourism journal (where the journal-title included: Tourism, Travel, Recreation, Leisure, Hospitality or Hotel).

The next task was to select a smaller number of the more significant articles for more detailed contents analysis. 'Significance' was measured by the journal ranking and article citation metrics. Four metrics were calculated using two of the best-known journal ranking systems: the SCImago Journal Rank (SJR, Guerrero-Bote & Moya-Anegón, 2012) and the journal's h-index (Glänzel, 2006) in conjunction with the article citation rate as given in the Scopus bibliometric databases (Elsevier, 2021). Figure A1 in Annex I of the Supplemental File shows a loose relationship between SJR and journal h-index. Multiplying each of the journal indexes by the number of article citations created the SJR-based and the H-index-based metrics, respectively. To accommodate the problem of newer publications having had less time to generate citations, two 'correction' formulas were used to select top-ranked papers from each 5-year publication period. The average citation rate of all 2573 articles was plotted against time (see Figure A2 in Annex I of the Supplemental File) to produce a quadratic correction function. Now four metrics were calculated.

1. The article's citation rate multiplied by the SJR
2. The article's citation rate multiplied by the h-index
3. The article's citation rate multiplied by the SJR times the correction formula for the year of publication
4. The article's citation rate multiplied by the journal h-index times the correction formula for the year of publication

The top-ten ranking articles for each five-year period between 1990 and 2019 (1990–1994, 1995–1999, etc.) were identified for each metric, and those identified by at least three of the metrics were chosen for articles not mentioning climate change mitigation, resulting in 26 articles being selected. The criteria were loosened for articles mentioning climate change mitigation to generate a large enough sample for comparison. Here the articles had to meet at least two of the metrics, which selected nine articles. Fig. 1 shows the cascade of processes based on Bhui et al. (2015). The resulting number of 35 articles was suitable for in-depth contents analysis. Of these 35 articles, 26 omitting climate

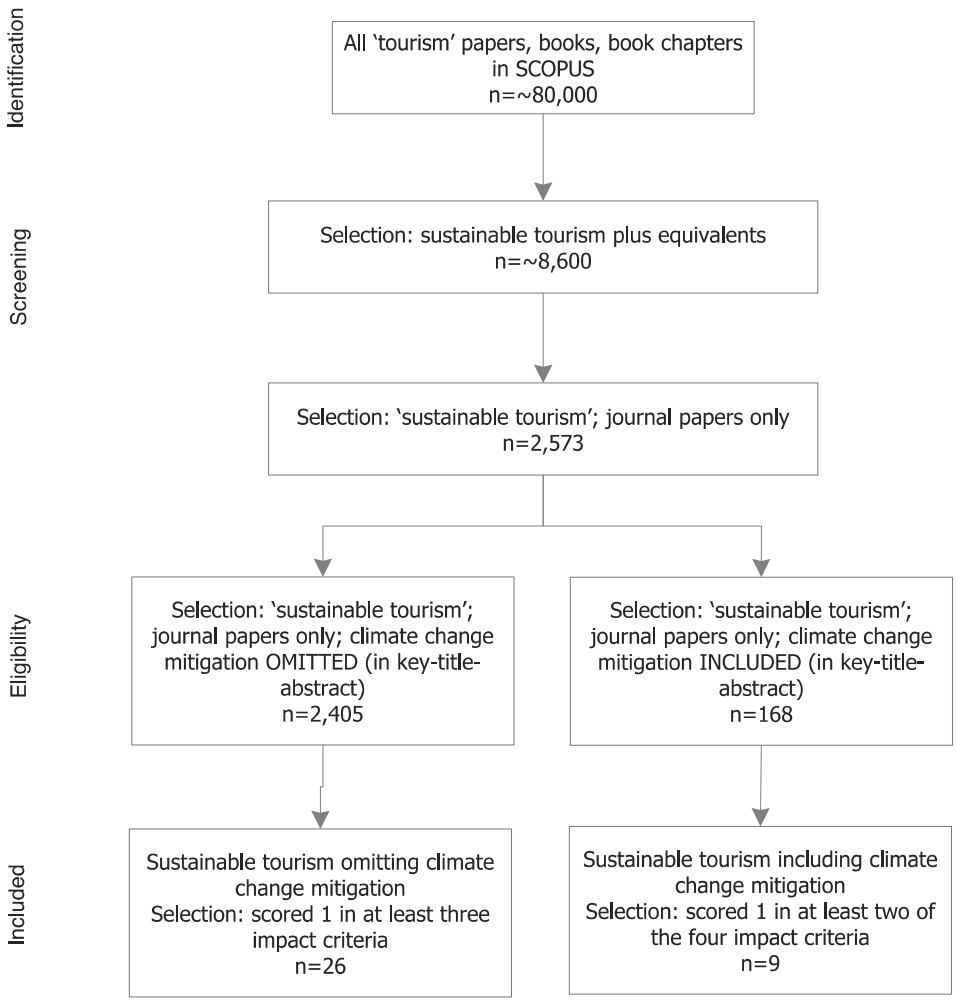

Fig. 1. Cascade diagram showing the selection of articles for the quantitative analyses (n = 2573) and the qualitative content analysis (n = 35). Based on (Bhui et al., 2015).

change (Boley et al., 2017; Castellani & Sala, 2010; Choi & Sirakaya, 2006; Dwyer et al., 2009; Erkuş-Öztürk & Eraydın, 2010; Flagestad & Hope, 2001; Font, 2002; Hall et al., 2012; Hunter, 1997; Hunter & Shaw, 2007; Kiatkawsin & Han, 2017; Ko, 2005; Lee, 2013; Li et al., 2008; Miller, 2001; Miller et al., 2010; Moscardo, 1996; Pritchard et al., 2011; Reynolds & Braithwaite, 2001; Ryan, 2002; Saarinen, 2006; Saxena, 2005; Sims, 2009; Tosun, 2001; Vu et al., 2015; Waligo et al., 2013) and 9 including climate change (Barr et al., 2010; Gössling, 2002; Gössling & Buckley, 2016; Gössling et al., 2002; Gössling & Peeters, 2015; Gössling et al., 2005; Michailidou et al., 2016; Scott, 2011; Weaver, 2012).

3.2. Evaluation criteria

To evaluate whether the sustainable tourism research was adequate to assess climate change mitigation, each of the 35 selected articles required a standardised set of criteria. This conceptual framework, based on the literature and researchers' experience, was developed through logical deductive reasoning (Downward & Mearman, 2007, p. 86), standardised the procedure and ensured each reviewer addressed each aspect within the framework for each article. This resembles the frameworks and taxonomies used in reviews of medical literature, allowing "effective modes of information management" (Mazza et al., 2013, p. 2). A conceptual framework is "a particular way in which people conceive and formulate ideas and thoughts about a particular phenomenon" (Rwegoshora, 2016, p. 4). A similar framework is suggested by Lew (1987) for researchers evaluating past research into a destination tourist attraction. We compiled our own criteria for the essential elements to perform adequate climate mitigation-related tourism research.

The criteria included how sustainability was defined, whether transport and its emissions and distances covered were seen as part of the tourism system, who was ascribed responsibility for change and the temporal and geographical scope of the research. Each criterion for each article was evaluated through a 4-point scale: 'not at all adequate', 'very little adequate', 'somewhat adequate' and 'to a great extent adequate'. In cases where the criterion was irrelevant in the context of the article evaluated, no points were assigned. Table 1 provides an overview of the criteria adopted for the assessment of the shortlisted manuscripts (see also sections 2.1, 2.2, and 2.3 for background information about the importance of all the elements in the Table).

The Table lists our 13 criteria divided into three categories (sustainability, tourism & transport and scope & scale). The following list is based in the impacts of tourism on emissions (section 2.2) and the tourism system and definitions (section 2.3). The list presents our rationale for assessing the adequacy of understanding and enhancing climate change mitigation in tourism for each element in the Table. Some criteria will improve understanding of mitigating climate change, others require recommendations or conclusions to reduce tourism's emissions. These are indicated by *understanding* and *enhancing*.

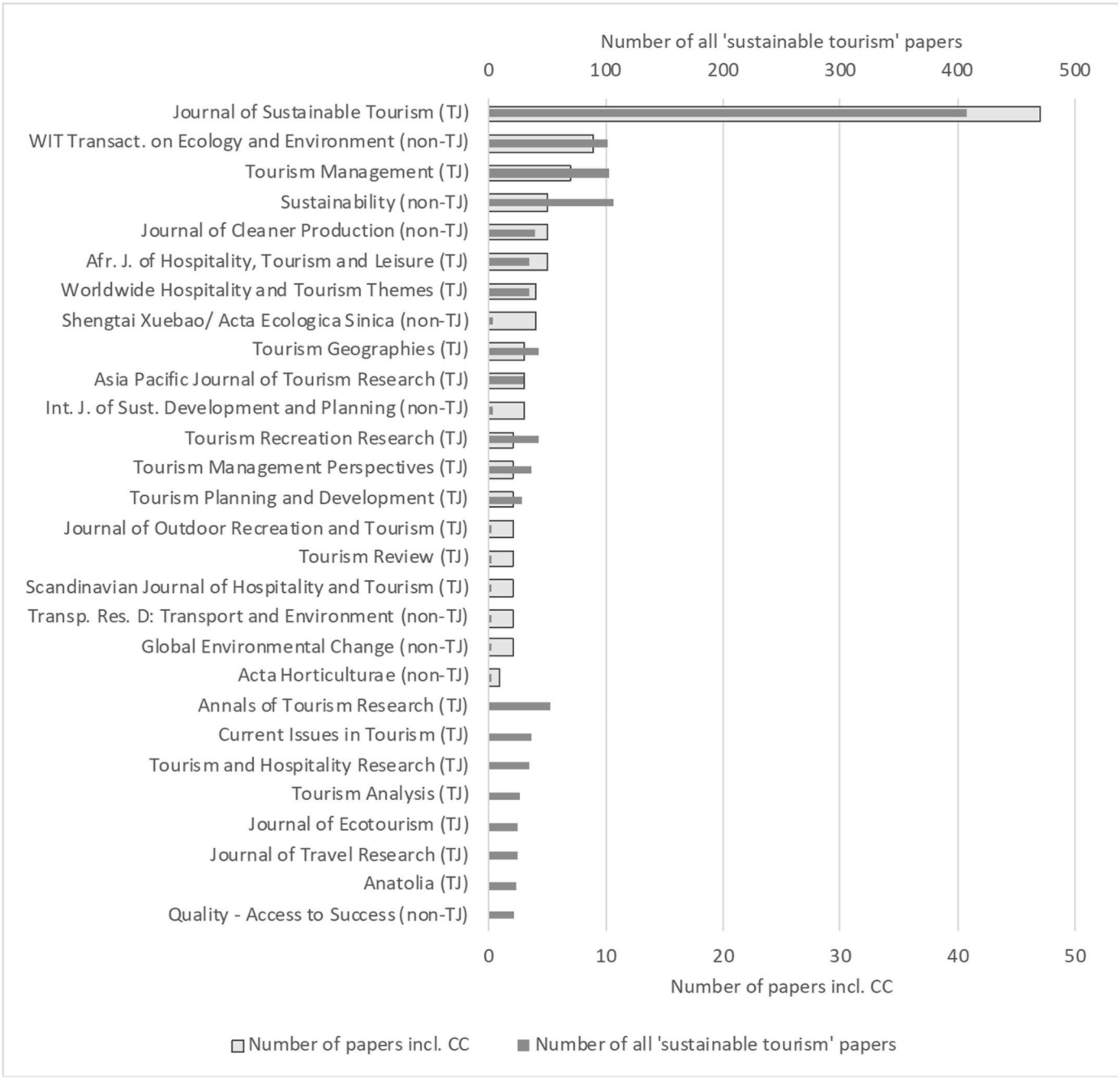

Fig. 2. Overview of the top-20 journals including and top-20 journals omitting climate change mitigation. Notes:journals with both including and omitting climate change mitigation articles are included in only one line, hence the total number of journals adds to 28, not 40. The horizontal axis differs between including and omitting climate change mitigation articles to align scales. TJ means Tourism Journal; non-TJ a non-tourism journal.

3.2.1. Sustainability

- Triple P balancing or limiting (understanding): +2 indicates the paper applies a combination of balance and hard limitations, +1 that it only looks at limitations, and −2 only at balance. 'Limitations' include the internationally agreed (IPCC, 2021) carbon budget, while 'Balance' ignores hard limitations to favour economic benefits for some stakeholders, rather than ensuring an equal distribution of costs and benefits within the limitations.
- Sustainability level (understanding): +2 indicates the paper assumes a 'strong' sustainability level, needed to avoid dangerous climate change (Rogelj et al., 2019). −2 indicates weak sustainability.

3.2.2. Tourism & transport

- Includes O/D transport (understanding): +2 indicates the paper incudes O/D transport (transport between origin and destination), −2 that it ignores OD-transport. This is imperative to policy-making, because the majority of tourism's emissions come from O/D-transport (Gössling & Peeters, 2015).
- Role of transport distance (understanding): each paper including the impact of transport distance is coded +2. Transport is the most important parameter determining the carbon emissions of a tourism trip (Peeters & Landré, 2012).
- Recommended transport distances (enhancing): related to the previous criterion, recommendations to reduce average transport

Table 1
Overview of the criteria framework to assess a paper's adequacy with respect to mitigating climate change including its shading and coding.

		Adequacy for understanding/enhancing climate change mitigation				
	Criterion (normal font for understanding and *italic for enhancing*	To a great extent (+2)	Somewhat (+1)	Irrelevant in the context of the article's content (0)	Very little (-1)	Not at all (-2)
Sustainability	Triple P (balance or limiting)	+2: Balance + hard limitations	+1: only limiting	0: N/A		-2: Balance without limits
	Sustainability level	+2: strong sustainability assumed		0: N/A		-2: weak sustainability assumed
Tourism & Transport	Includes O/D transport	+2: sees consequences of O/D transport		0: N/A		-2: does not consider consequences of O/D transport
	Role of transport distance	+2: Includes transport distances		0: N/A		-2: Transport distances not included
	Recommended transport distances	+2: Recommended transport distances		0: N/A		-2: Infers distances to be increased
	Position on air travel	+2: Discourages air travel		0: N/A		-2: Promotes air travel
	Position on short/long-haul travel	+2: Promotes short-haul travel		0: N/A		-2: Promotes long-haul travel
	Position on length of stay	+2: Aims to increase stay length	+1: No change in length of stay	0: N/A		-2: Promotes short-stay
	Position on rail/public transport	+2: Promotes		0: N/A		-2: Does not promote
Scale	International and Domestic tourism	+2: International & Domestic included	+1: Domestic only	0: N/A	-1: Both domestic omitted	-2: Only international
	Scenario view	+2: Long-term		0: N/A	-1: Short-term	-2: No temporal aspect
	Tourism geographical scope	+2: Global	+1: National/ regional	0: N/A		-2: Destination/ Local
	Responsibility for sustainable development	+2: Governments + Enterprises	+1: Governments or enterprises	0: N/A	-1: Consumers	

distances work towards reducing emissions so are scored +2. −2 scores indicate proposals inferring increased distances.

- Position on air travel (enhancing): papers promoting increased air travel, creating more emissions, are scored −2 as aviation is one of four 'hard to abate' sectors (Energy Transitions Commission (ETC) 2018)
- Position on short/long-haul travel (enhancing): Papers recommending reducing distances, and thus emissions, between market and destination are scored +2.
- Position on length of stay (enhancing): an increase of length-of-stay (+2) offers the potential to reduce the number of trips and concomitant transport without loss of tourism revenues at the destination (Michailidou et al., 2016).
- Position on rail/public transport (enhancing): proposals to increase rail and public transport are rated +2, as these modes show significant lower emissions per passenger-kilometre (Gössling & Peeters, 2015).

3.2.3. Scope & scale

- International and domestic tourism (understanding): Most tourism research is limited to international tourism, while 70–80% of tourism is domestic (WTTC, 2018), which generally generates fewer emissions per visit (Neger et al., 2021). Papers considering both domestic and international are scored +2, those with only domestic tourism (+1), if both omitted (−1), and those only contemplating international tourism (−2).
- Scenario view (understanding): because climate scenarios are studied over decades and centuries (up to the year 2450; Hansen et al., 2013), long-term scenarios (+2) are inevitably needed to understand the effects of policies.
- Tourism geographical scope (understanding): a global scope (+2) helps to understand the full impacts of transport between destination and markets, unlike a destination-only scope.
- Responsibility for sustainable development (understanding): to achieve the strong sustainability needed to mitigate climate change and the concomitant limitation of the global emissions budget, requires a shared responsibility of governments plus enterprises (+2). Consumers are generally unable to anticipate the consequences of their current behaviour in the long term, let alone the wider social issues involved in mitigating climate change (Kamb et al., 2021).

Section 3.3 describes how the above criteria were applied in the content analysis of the 35 most influential 'sustainable tourism' papers selected. Note that papers about climate change mitigation and tourism not mentioning sustainable tourism were omitted from this study.

3.3. Contents analysis

Once the criteria and values had been established, two reviewers (see coding in Annexes) fully evaluated each article for the factors and completed a separate spreadsheet. These were then compared, discrepancies highlighted and discussed with a third reviewer. The two main reviewers are senior researchers from different disciplines, working for decades in the field of sustainable tourism and climate change mitigation. The third reviewer was a junior researcher. Many of the discrepancies hinged on the difference between 'not relevant' and 'not included', but eventually, the reviewers concurred, sometimes on a third value. A logbook was kept providing citations and arguments for the final choice of options (see Annex II in Supplemental File). The process of comparing and logging independent assessments and evaluating different valuations by a third reviewer helped to achieve rigorous scrutiny of the results. The three assessors agreed on all of the 455 choices, after three rounds of assessments. The last round was a long discussion solving any remaining differences in the choices.

4 Findings

4.1. Analysis of the 2573 articles

This section describes some global analyses of the full body of articles published with 'sustainable tourism' in their title, keywords or abstract. It shows in which journals the papers were published, their citation ratings and which topics were trending when between 1996 and 2019.

The 2573 sustainable tourism articles were published in 586 journals and over half of the articles (1309) were published in tourism journals. Only 168 (6.5%) of the 2573 articles in our database mentioned climate change mitigation related keywords and these were distributed over 13% of all the journals in our dataset. Unsurprisingly, the *Journal of Sustainable Tourism* (henceforth tourism journals are denoted by italics) published the highest share of articles, with 360 (15%) of the articles omitting climate change mitigation and 47 (28%) of those including it (see Fig. 2). More surprising is that the Swiss open access journal, Sustainability, is the second most used non-tourism journal publishing 'sustainable tourism' articles, with 107 in total, but only five include climate change mitigation. *Tourism Management* is the second tourism journal publishing relatively numerous 'sustainable tourism' articles, both omitting and including climate change mitigation.

Seven journals (*Journal of Ecotourism, Tourism Analysis, Tourism and Hospitality Research* and *Annals of Tourism Research*) published a total of 209 sustainable tourism articles, none referring to climate change mitigation. Neither *Annals of Tourism* nor the *Journal of Ecotourism* published any sustainable tourism articles including climate change mitigation. Eight other journals published only one sustainable tourism article each, but each referred to climate change mitigation (see Fig. 2). The divide between 'tourism' and 'transport' emerged with only one transport journal, *Transportation Research Part D (Environment)*, in the two top-20 lists: it published two articles, both of which included climate change mitigation.

With an average of 22.8 citations, articles in tourism journals were more cited than those in other journals (averaging 8.0 per article). Articles covering climate change mitigation had higher average citation rates (20.3 per article) than the general average (15.2 per article) although climate change mitigation articles only started to appear in 1997 and only annually from 2005, while sustainable tourism articles have been published every year since 1990. The difference in average citation rates is caused entirely by articles published in non-tourism journals (16.4 versus 7.5). The higher interest in tourism climate change mitigation papers is supported by the 'significance' metric, articles including climate change mitigation score about 60–70% higher than articles omitting climate change mitigation (see Table A1 and also Figures A3, A.4, A.5 and A.6 in Annex I of the Supplementary File for

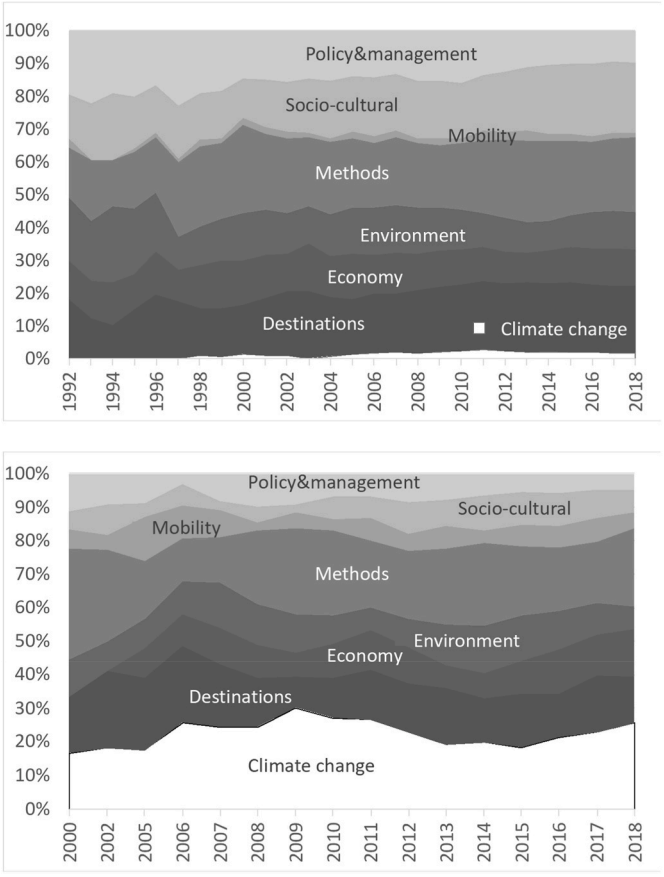

Fig. 3. Overview of the share of title words for all articles with sustainable tourism (upper graph) and for those including climate change mitigation (lower graph). Note: the time-span differs between both graphs. Also, the including climate change mitigation graph misses the years 2001, 2003 and 2004 because no papers were published with any of the title words.

further evidence and trends).

The title words, as the most compact summary of the article, were analysed for all the articles (2894 different words) and for the subset which included climate change mitigation (699 different words). The most frequent words, excluding the search terms 'sustainable' and 'tourism' in the entire set were 'development', 'management', 'planning', 'case', 'study', and 'local', whereas those of the 'climate change' subset were 'adaptation', 'climate change', 'environmental' and 'carbon'. The words were assigned to eight topic areas to trace changes over time. The proportions of each topic area were then tracked over time to identify trends (see Table A. II and Table A. III in the Supplementary File). While 'methods', 'destinations', 'environment', and 'economy', have similar frequencies in both subsets, 'mobility' is more and 'policy & management' and 'socio-cultural' are less common in the articles referring to climate change mitigation.

Other notable trends in all sustainable tourism articles are.

- The share of policy and management articles reduced by half over time.
- The share of destination-focused articles doubled to almost 20%.
- The proportion of articles related to socio-economic topics overtook that focussing on the environment in 1997.
- Climate change and mobility feature in a small proportion of all sustainable tourism articles.

The share of articles referring to climate change peaks in 2009, declines to a minimum in 2013/2014 and then starts to rise again until 2018. Interest in policy and management declined between 1992 and 2018, while that in destinations increased.

4.2. The 35 most influential articles

Table 2 presents the results for the evaluation of the criteria set in section 3.2 of the 35 articles. Often, the articles do not consider transport between home and destination nor the transport distance between markets and destinations. They focus on local or destination-scale issues, generally incorporate ideas of weak sustainability and only present a short-term view. Seven of the 35 articles explicitly promote long-haul or air transport for the 'sustainable development' of tourism, with no mention of the climatic unsustainability of such tourism.

Table 2 confirms that articles including climate change mitigation generally are using more suitable scales and scopes, and present more relevant outcomes and recommendations for climate change mitigation than the other articles (score of +1 and +2). This supports the validity of our framework.

Fig. 4 shows most papers embracing climate change mitigation align measures with economic enhancement e.g., increasing the length of stay and promoting rail and public transport. Furthermore, many papers assign responsibility to governments and businesses, rather than consumers.

Among papers omitting climate change mitigation, the scores for understanding climate change mitigation are low for categories related to markets (discouraging long-haul, air travel and international tourism), time scale, inclusion of all travellers (international and domestic) and including origin/destination transport. However, their scores tend to be even lower for the type of sustainability level adopted, ignoring O/D-transport and focussing solely on the local destination.

Three papers from the 'omitting climate change mitigation' list scored reasonably: (Dwyer et al., 2009; Hunter & Shaw, 2007; Miller et al., 2010). Two (Dwyer et al., 2009; Miller et al., 2010) included some discussion of climate change mitigation, but not in their titles, abstracts, or key words. The most adequate omitting climate change mitigation paper (Hunter and Shaw, 2007), included energy as an element of ecological footprint and questioned the validity of the sustainability claims of eco-tourism involving long haul flights. Two articles which included climate change mitigation failed to consider the impacts of travel to/from the destination. Michailidou et al. (2016) propose a multi-criteria decision analysis procedure for Greek destinations, but it was destination-focused, so did not consider reducing transport distances or international tourism, despite acknowledging O/D transport to be a climate change issue. Overall, two-thirds of the reviewed papers (23) omitted important pre-conditions for helping to mitigate climate change, which may explain some of the inaction among tourism practitioners. Not including a global context may also have repercussions for other global social and environmental impacts of tourism, like poverty, biodiversity loss, energy and resource use.

The 'including climate change mitigation' articles tended to promote short-haul, reducing transport distances and discouraging air travel more than articles omitting climate change mitigation. However, the most significant difference between the two sets was that the 'including climate change mitigation articles', used a broader geographical scale than the destination, included O/D-transport and took a longer-term view. The most common omission from both groups was domestic tourism, perpetuating a skewed view of the whole tourism market and potentially ignoring the larger low-carbon section of the market.

5. Discussion, limitations and implications

5.1. Discussion

The low share (6.5%) of papers including climate change mitigation in sustainable tourism research is surprising considering the major impact of tourism on climate change mitigation and vice versa. Among all articles about 'tourism', the share goes down to 4.0% (1719 articles out of 42,854), meaning that 'sustainable tourism' research adds little in terms of climate change mitigation. For comparison, we did a similar search on 'transport' and 'sustainable transport' (papers up to and including 2018) and found the share of 'climate change mitigation including' papers increased from 7.3% for 'transport' to 26.7% for 'sustainable transport'. We did the same for sustainable building (19.9%), sustainable agriculture (12.7%) and sustainable development (17.5%), clearly showing sustainable tourism is lagging behind. Also, the most cited papers about sustainable tourism and mitigation appeared in non-tourism journals, suggesting that tourism scholars addressing climate change find it more difficult to publish in dedicated tourism journals.

As our findings demonstrate, climate change mitigation has a low profile in sustainable tourism research, which may be one of the reasons that tourism practices have been slow to address climate change (Scott & Gössling, 2021). Of the 35 most influential papers, 14 recommended developments that may increase tourism's impact on climate. Eleven articles recommended one or more mitigation actions, eight of which related to climate change. In terms of understanding, the situation is worse, with only two papers (both 'including climate change') adequately including all items. The main issues are a weak sustainability approach (24 papers), ignoring O/D transport (22), ignoring transport distance (19), a destination focus (19) and an international market focus (12).

A question is why sustainable tourism research has difficulties applying the most relevant geographical and systemic scope of tourism. We hypothesise that the cause lies in the wider tourism research tradition. The first problem is the lack of globally accepted definitions of tourism, already noted in the 1980s by Dann et al. (1988) but a persisting issue (McKercher & Prideaux, 2020). Early attempts (United Nations & WTO, 2000) to develop both definitions and standardised practices for measuring tourism still fail to provide systematic data about domestic trips, detailed transport mode shares and transport distances (see for instance UNWTO, 2022, p. 2020). The lack of interest in transport is also shown by systematic literature reviews which hardly ever refer to transport and ignore distances (Rahmadian et al., 2022). Guo, Jiang, & Li, 2019 note the absence of truly sustainable development approaches. Still, others, at least, note that "proximity, slower and

Table 2
Results of the content analysis of the 35 most influential sustainable tourism articles.

Administrative		Sustainability		Tourism & Transport							Scale			
Reference	Year	Triple P (balance or limiting)	Sustainability level	Including O/D transport	Role of transport distance	Recommended transport distances	Position air travel	Position short/long-haul travel	Position long stays	Position rail/public transport	International & Domestic	Scenario view	Tourism geographical scope	Responsibility for sustainability with
Papers omitting climate change														
(Moscardo, 1996)	1996	0	-2	-2	0	0	0	0	0	0	-1	0	-2	+1
(Hunter, 1997)	1997	+1	0	-2	-2	0	0	0	0	0	0	+2	-2	+1
(Flagestad & Hope, 2001)	2001	-2	-2	-2	-2	0	0	0	0	+2	-2	-2	-2	+1
(Miller, 2001)	2001	0	-2	-2	-2	-2	0	0	0	0	-1	+2	-2	+2
(Reynolds & Braithwaite, 2001)	2001	0	-2	-2	-2	0	0	0	0	0	-1	+2	0	0
(Tosun, 2001)	2001	+1	-2	-2	-2	-2	-2	0	+2	0	-2	+2	-1	+1
(Font, 2002)	2002	0	-2	-2	-2	-2	0	0	0	0	-2	-2	-1	+2
(Ryan, 2002)	2002	0	-2	-2	-2	-2	-2	-2	0	0	-1	+2	-2	+1
(Ko, 2005)	2005	+1	-2	-2	-2	-2	-2	0	0	0	-1	-1	-2	0
(Saxena, 2005)	2005	+2	-2	-2	-2	0	0	0	0	0	+1	+2	-2	+2
(Choi & Sirakaya, 2006)	2006	+2	-2	-2	-2	-2	0	0	0	0	-1	-2	-2	+1
(Saarinen, 2006)	2006	+1	+2	+2	-2	-2	0	0	0	0	-1	-2	+2	+1
(Hunter & Shaw, 2007)	2007	+2	+2	+2	+2	+2	+2	+2	+2	+2	-2	0	+2	0
(Li et al., 2008)	2008	-2	0	+2	+2	-2	0	0	0	+2	+2	-2	-2	+1
(Dwyer et al., 2009)	2009	+2	-2	+2	+2	+2	-2	+2	+2	0	+2	+2	-1	+2
(Sims, 2009)	2009	0	-2	-2	-+2	0	0	0	0	0	+1	0	-2	+1
(Castellani & Sala, 2010)	2010	0	-2	-2	-2	-2	-2	-2	+2	+2	-2	-1	-2	0
(Erkuş-Öztürk & Eraydın, 2010)	2010	0	-2	-2	-2	0	0	0	0	0	-2	-2	-2	+2
(Miller et al., 2010)	2010	0	-2	+2	+2	+2	+2	+2	+2	+2	+2	0	-1	+1
(Pritchard et al., 2011)	2011	0	-2	-2	-2	0	0	0	0	0	0	0	0	0
(Hall et al., 2012)	2012	0	-2	-2	+2	+2	+2	+2	0	0	+2	-2	-1	+1
(Lee, 2013)	2013	0	0	-2	-2	0	0	0	0	0	-2	0	-2	0
(Waligo et al., 2013)	2013	-2	-2	-2	-2	-2	0	0	0	0	0	+2	-2	+1
(Vu et al., 2015)	2015	0	0	-2	+2	-2	-2	-2	0	+2	-2	-2	-2	0
(Boley et al., 2017)	2017	-2	-2	-2	-2	0	0	0	0	0	-1	-1	-2	+1
(Kiatkawsin & Han, 2017)	2017	0	-2	-2	-2	0	0	0	0	0	-1	0	-2	-1
Papers including climate change														
(Gössling, 2002)	2002	+2	+2	+2	+2	+2	+2	+2	0	0	-2	0	+2	+1
(Gössling et al., 2002)	2002	+1	+2	+2	+2	+2	+2	+2	0	0	-2	0	+2	0
(Gössling et al., 2005)	2005	-2	-2	+2	+2	+2	+2	+2	+2	+2	+2	0	+2	+2
(Barr et al., 2010)	2010	0	-2	+2	+2	0	+2	+2	+2	0	-1	0	+2	+1
(Scott, 2011)	2011	+1	+2	+2	0	0	+2	0	0	0	-2	+2	+2	0
(Weaver, 2012)	2012	+1	-2	-2	+2	-2	-2	-2	0	-2	+2	0	-2	+2
(Gössling & Peeters, 2015)	2015	0	+2	+2	+2	+2	+2	+2	0	0	+2	+2	+2	0
(Gössling & Buckley, 2016)	2016	0	+2	+2	+2	+2	+2	+2	+2	0	+2	+2	+2	-1
(Michailidou et al., 2016)	2016	-2	-2	+2	-2	-2	0	0	+2	+2	-2	+2	-2	+1

NOTE: PAPERS ARE GROUPED IN THOSE INCLUDING AND THOSE OMITTING CLIMATE CHANGE AND ORDERED CHRONOLOGICALLY AND THEN ALPHABETICALLY FOR THE FIRST AUTHOR. KEY TO CODING:

TO A GREAT EXTENT ADEQUATE FOR UNDERSTANDING/ENHANCING CLIMATE CHANGE MITIGATION	+2
SOMEWHAT ADEQUATE FOR UNDERSTANDING/ENHANCING CLIMATE CHANGE MITIGATION	+1
IRRELEVANT IN THE CONTEXT OF THE ARTICLE'S CONTENT	0
VERY LITTLE ADEQUATE FOR UNDERSTANDING/ENHANCING FOR CLIMATE CHANGE MITIGATION	-1
NOT AT ALL ADEQUATE FOR UNDERSTANDING/ENHANCING CLIMATE CHANGE MITIGATION	-2

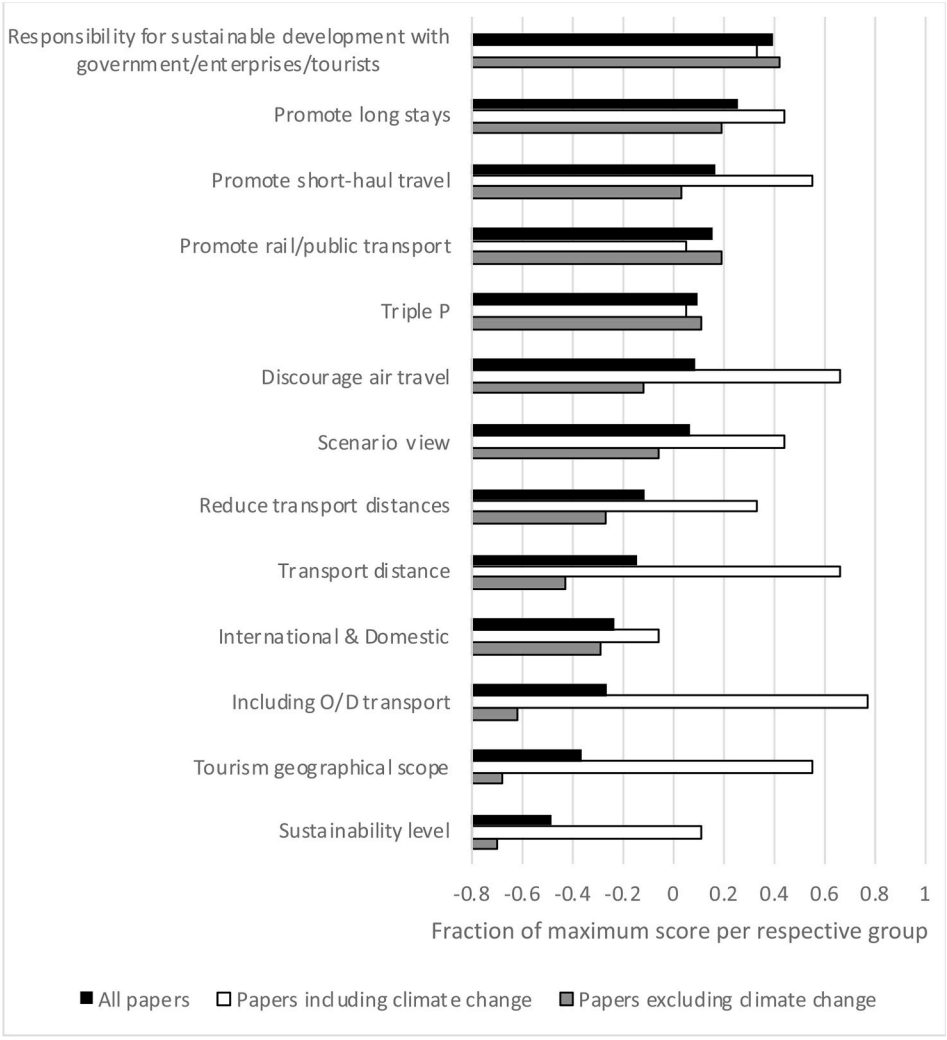

Fig. 4. The scores of articles omitting and including climate change mitigation. Note: the scores reflect a score describing how adequate the article's methods, scope and theory are for researching climate change mitigation ranking from 'not at all adequate' (−1.0) to 'to a great extent adequate' (+1.0).

less energy-intensive travel, and green transport" will be crucial for sustainable tourism (Więckowski, 2021, p. 1).

Clearly, tourism climate mitigation researchers have struggled with the short-comings of global tourism research practices, definitions, scopes and data. Yet, this seems not to have improved with the arrival and growth of 'sustainable tourism' research since the 1990s. Up to and including 2018, some 1719 articles (90%) had tourism and climate change mitigation in their title, abstract or keywords, but not 'sustainable tourism'. The total share of papers not specifically mentioning 'sustainable tourism', including climate change mitigation, is 4%, however, that count covers a longer period than 1990–2018, which includes a time when climate change was not a common subject. Thus, we tentatively conclude that sustainable tourism, as a specific line of research, has not removed the barriers and deficiencies we found, to address climate change adequately.

5.2. Limitations of the research

Like every literature review, our findings are limited by our methodological choices. While acknowledging that not every sustainable tourism researcher is as focussed on climate change mitigation as we are, we urge them to consider – while doing the research - the impacts on climate change in their recommendations to practitioners. Our criteria, based on decades of experience researching tourism and climate change mitigation, assess the basic systems causing tourism's impact on climate change and the main developments worsening the impact. These criteria may guide researchers on different sustainability issues, to consider direct or indirect impacts on carbon emissions of their conclusions and recommendations. When these are potentially substantial, the climate issue should be discussed. This approach deviates from the standard Systematic Literature Review (SLR) in both its purpose and its approach. Boell and Cecez-Kecmanovic (2015, p. 161) describe a SLR as "a meta study that identifies and summarises evidence from earlier research", but warn they can "undermine critical engagement with literature and what it means to be scholarly in academic work". Our purpose is not to summarise the achievements of sustainable tourism research, but to assess its adequacy to understand and mitigate against tourism's contributions to climate change: hence the choice of a problematising review.

Another criticism of our study is 'why assess research seemingly unconnected to climate change mitigation on how it addresses climate change mitigation?' Why should sustainable tourism research evaluating, for example how to improve a destination's local economy, saving water in hotels or hiring local guides for snorkelling mention climate change mitigation? Sustainability, by definition, requires a holistic approach (Saarinen, 2006), so any sustainable tourism research (also) needs to consider whether the research outcomes might have negative effects on climate change (Scott, 2021). If so, the mitigation issue should

be discussed, but only if it is deemed relevant. The many '0' scores (not applicable) in Table 2 shows that such is often not necessary. This requires some understanding of climate change mitigation and the consequences of recommendations on climate change, which we aim to provide with our paper and our list of criteria. In our view, for tourism to be truly sustainable, even tiny, short-term, local decisions need to align with longer term and global attempts to tackle the biggest challenge to our and future generations.

5.3. Theoretical and practical implications for sustainable tourism research

This research mainly has practical implications for the tourism research community as it points to the lack of theory, data, scope and models to address climate change and other global environmental issues. Focussing on the destination, which is common in sustainable tourism research, often ignores the broader system, such as where tourists come from and how they travel there. The relative absence of domestic tourism in research (covering 80% of the total number of tourists) and non-flight trips (about 75% of the total), obscures not only an understanding of the whole tourism travel system, but also obvious solutions. This may lead to recommendations with negative impacts (e.g., indiscriminately encouraging high-emission forms of tourism like international air travel), while disregarding potential growth-sectors like domestic and short haul tourism by electric train, car or bus. Even small scale, local studies can contextualise their findings and explain how any recommendations help reduce emissions and align with national and global mitigation policies. We recommend that researchers, editors, reviewers and examiners generally try to request where appropriate more holistic definitions of tourism (including transport, transport modes, domestic), and data about travel distances and transport modes of tourists and how recommendations for change of tourism may affect emissions.

A strong upgrade of tourism conceptualisation and data collection is needed: integrating transport and tourism geography to fill gaps in our understanding of tourism. While not a new recommendation (see for instance Miossec, 1976; Mitchell, 1984; Williams & Zelinsky, 1970), such recommendations never have gained traction within the tourism research community nor the sector itself. 'Sustainable tourism' research may have delivered socio-economic insights, but has added less to environmental sustainable development. A change to 'strong sustainability', respecting environmental limitations without trading these for other values, will help shift the balance towards effective mitigation of environmental impacts like climate change.

6. Conclusions

Our problematising review identified 2573 peer-reviewed journal articles about sustainable tourism published since 1990. It aimed to answer the question: *How adequate is sustainable tourism research to effectively assess tourism's contributions to climate change and options for mitigation?* The answer is that, despite the efforts and awareness of a small number of tourism and climate change researchers, sustainable tourism research in general is ill-equipped to address climate change mitigation. However, the lack of adequate definitions, data, and methods is not a problem of sustainable tourism per se, but seems to be a more general problem in the approach of tourism research itself, which is destination- and international tourism centred while ignoring transport and geographical aspects. The higher scores on our evaluation framework of the papers including climate change mitigation support its validity.

There is no time left to endlessly discuss and weigh interests of parts of the industry against the existential threat of runaway climate change. Within less than a decade, global emissions, including tourism's, need to be reduced by 50–60%. Without available technical measures, the only remaining option is a volume reduction of certain high-carbon parts of tourism. Therefore, we urge the global tourism research community to agree on its definition of tourism (preferably adopt the existing broad UN definition), improve its scope, data, theory and methods, including full integration of transport, mobility, and domestic tourism. The above should be applied to local and global data, data that also should become available at an affordable cost for academia. Furthermore, the sustainable tourism research community should embrace 'strong sustainability' in its research to show policymakers the consequences of not taking such an approach.

Impact statement to the paper current issues in tourism: sustainable tourism research and climate change. A problematising review

This paper provides irrefutable evidence of the neglect of climate change mitigation in tourism research addressing sustainability. It demonstrates how individual researchers, editors and supervisors can ensure the impact of recommendations align with climate change mitigation measures, even when applied to apparently non-climate change topics such as social justice, the economic security or biodiversity of specific destinations. The need for common definitions, better understanding of climate change science amongst tourism scholars and more research into the impact of tourism on climate change is articulated and demonstrated. This paper strengthens the calls, heard loud and clear during the lockdown, to consider the local and global consequences of resuming tourism business as usual and step up to the global crisis which threatens not just a lifestyle, but the very survival of humanity.

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Appendix A. Supplementary data

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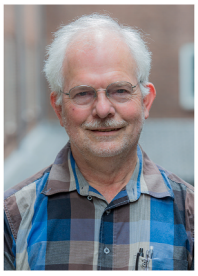

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