

Article

Sustainable Tourism and the Grand Challenge of Climate Change

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Abstract: Global climate change represents a grand challenge for society, one that is increasingly influencing tourism sector investment, planning, operations, and demand. The paper provides an overview of the core challenges climate change poses to sustainable tourism, key knowledge gaps, and the state of preparedness in the tourism sector. As we begin what is widely considered a decisive climate decade, low sectoral preparedness should be highly disconcerting for the tourism community. Put bluntly, 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 decarbonized global economy. The transition from two decades of awareness raising and ambition setting to a decade of determined collective response has massive knowledge requirements and necessitates broad sectoral commitments to: (1) improved communications and knowledge mobilization, (2) increased research capacity and interdisciplinary collaboration, and (3) strategic policy and planning engagement. We in the tourism and sustainability communities must answer this clarion call to shape the future of tourism in a decarbonized and post +3 °C world, for there can be no sustainable tourism if we fail on climate change.

Keywords: climate change; climate risk; decarbonization; adaptation; sustainable tourism; sustainable development goals



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1. Introduction

The COVID-19 pandemic brought global tourism to a sudden and unprecedented cessation as travel restrictions and stay-at-home orders expanded rapidly in late March 2020. The massive disruption to the tourism economy was very evident early on [1] and continues to be documented by the United Nations World Tourism Organization (UNWTO) [2] and other tourism organizations [3–5]. While the pandemic and economic recovery will continue to reshape tourism for the foreseeable future, with three safe and high efficacy vaccines now entering final approvals and distribution [6], the terrible toll on public health will significantly decline throughout 2021, enabling the resumption of safe travel and gradual restart of international tourism. What form the post-pandemic tourism recovery takes remains uncertain and a matter of critical debate in tourism scholarship [7]. While some are skeptical that meaningful transition toward sustainability will emerge given the almost exclusive industry focus on returning to business as pre-pandemic as rapidly as possible [8], other scholars and sector observers view the pandemic crisis as a critical moment for reflection on how the post-pandemic recovery could serve as a catalyst for responsible and sustainable tourism transformation [7,9].

Regardless of how recovery unfolds, the devastating tragedy the COVID-19 pandemic has wrought upon the lives and livelihoods of millions and the immense economic damage to businesses and much of the tourism sector worldwide offers important lessons for society. Parallels with the more slowly unfolding climate crisis have often been raised. Neither the SARS-CoV-2 virus or climate have any regard for politics or borders, and both

demonstrate the immense value of scientific expertise and rapid multilateral response. A critical differentiator is that with development of effective vaccines, society can now foresee a post-COVID-19 pandemic era over the next one to three years. The same cannot be said of the climate crisis, which will not be resolved in the lives of those working in the tourism sector today or even their grandchildren. Tourism for sustainable development must take the long view, and as Schaal [10] (p. 2) poignantly reminds us, “If you consider the potential long-term impacts of climate change on the world—and the world of travel—then the COVID-19 pandemic will likely come to be viewed as a very painful, tragic footnote”.

Evidence of the disruption of the global climate system has been unrelenting and observed changes are rapid in comparison to the pace of the natural variations in climate that have occurred throughout Earth’s history [11,12]. Land and sea surface temperatures continued the multi-decade warming trend. Human activity has warmed the world by approximately 1.2 °C [13] since pre-industrial era (1850–1900) and the past decade (2010–2019) has been the warmest on record, with the warmest six years all being since 2015 [14]. Land surface temperatures north of 60° have warmed at more than twice the global rate (nearly +3.5 °C) [11]. More than 90% of additional energy accumulated from the human enhanced greenhouse effect is stored in the oceans, with multiple recent studies confirming that the world’s oceans (especially the upper 2000 m) the warmest in recorded human history and warming 40% faster than projected by the UN Intergovernmental Panel on Climate Change (IPCC) [15]. Over the last decade, arctic sea ice extent has shrunk to the lowest in the 42-year satellite record [14], and recent studies reveal the Greenland ice sheet has entered a new irreversible state of disintegration [16].

Consistent with the expected physical responses to a warming climate, the frequency, intensity, and duration of extreme heat, heavy precipitation, and drought events are increasing in most continental regions of the world [11,17]. Heat waves have already increased in frequency and intensity and are also projected to become more frequent and last longer in the future [14,18]. The influence of human activities on worldwide risk of droughts is observable [19], and since the early 1980s, the wildfire season has lengthened across a quarter of the world’s vegetated surface [20]. At the global scale, the frequency and intensity of heavy precipitation events has increased over the second half of the 20th century [18]. Tropical cyclone intensities and precipitation amounts increase with ocean warming [21,22]. If you find the recurrent headlines of climatic disasters already disconcerting, we are but in the early stages of climate disruption. Many new climate records were set throughout 2020, but they will not last long.

Atmospheric concentrations of greenhouse gases, the primary driver of contemporary climate change, continue to increase at rates unprecedented in the geologic record. According to the [14], global emissions of CO₂ reached record levels in 2019 and the global average of atmospheric carbon dioxide in 2019 reached 410.5 ppm, a new record high and a level that last occurred 3.5 million years ago. Although COVID-19 disruptions of the global economy and travel have reduced carbon emissions in 2020 (an estimated 7% [23]), atmospheric concentrations continue to rise. The global climate system will continue to respond to these elevated levels of atmospheric GHG and ongoing high levels of emissions, so that additional future climate change is unavoidable. The eventual magnitude of climate change and associated risks in the decades and centuries ahead will be determined by the choices to reduce GHG emissions made over the next 30 years. Ripple et al. [12] (p. 8) emphasize that, “Scientists have a moral obligation to clearly warn humanity of any catastrophic threat and to ‘tell it like it is’” and “On the basis of this obligation and the indicators presented, we declare, with more than 11,000 scientist signatories from around the world, clearly and unequivocally that planet Earth is facing a climate emergency”. The 2020s are a decisive decade to bend the emissions curve to achieve the central goal of the UN Framework Convention on Climate change—avoid dangerous interference with the global climate system and address the unfolding climate emergency.

Global leaders of government, business, and civil society emphasize the imperative to respond to the grand challenge of climate change, which has continued to top the

list of the World Economic Forum's annual Global Risks rankings for much of the last decade [24]. The UN Secretary-General António Guterres has referred to climate change as an existential threat to humanity [25]. This sense of urgency was confirmed by the more than 1800 sub-national jurisdictions, representing more than 800 million people in more than 30 countries, that have made climate emergency declarations in support of society-wide mobilisation on climate action [26]. Social momentum to confront the climate emergency has also been intensifying. Driven by youth-led groups such as Fridays for Future, the Sunrise Movement, and Extinction Rebellion, the largest climate demonstration involving more than 7 million people worldwide took place in September 2019 [27]. Public opinion polling in 14 countries found 71% of adults globally agree that climate change is as serious a crisis as COVID-19 and government actions should prioritize climate change in the pandemic economic recovery [28]. A prominent expression of this social change for tourism is the "flight shaming" movement, which as Gössling et al. [29] point out, has shifted the social norm from a perspective that government and technology will solve this emission problem, to one of personal accountability ("your flight, your responsibility"). The business community has likewise begun to reckon with the threat climate change poses to the global economy and financial systems, as well as the risk growing public concern represents for future investors, customers, and employees. The Climate Action 100+ group [30] of over 500 institutional investors collectively managing over USD 47 trillion in assets was launched to ensure corporations take strong action on climate change, through improved governance, emission reductions, and strengthen carbon and climate-risk disclosures. Over a thousand companies worldwide have committed to setting science-based emissions reduction targets [31] that increasingly include net-zero carbon ambitions.

The Paris Climate Agreement [32] (p. 22) represents the international consensus (signed by 195 countries) to decarbonize the global economy so as to avoid the consequences of dangerous climate change by limiting global warming to "well below 2 °C" and ideally stabilize the climate system at +1.5 °C above pre-industrial levels. While the transition to decarbonize the global economy is unmistakably underway in some parts of the world [33], the United Nations Environment Programme (UNEP) [23] annual global emissions report makes clear that despite 20 years of international climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), the international community has not yet set in motion the deep emission reductions required to avoid dangerous climate change. In order to remain within the Paris Agreement climate policy guardrail, the IPCC [11] estimated that global CO₂ emissions will need to be reduced 50% by 2030 and reach net-zero by mid-century. Read that sentence again and let it sink in. To achieve these targets would require emissions to drop approximately 7.6% per year from 2020 to 2030 for the 1.5 °C goal or 2.7% per year for the 2 °C goal. That is equivalent to the decline in 2020 resulting from the COVID-19 pandemic [23]. Such a rate of year over year reduction is far greater than any country has achieved. With the emissions gap not closing, multiple analyses conclude the prospect of achieving the Paris Agreement targets are unlikely considering emissions trajectories (e.g., as low as 5% chance [34]). Recent estimates from the World Meteorological Organization [24] warn that the 1.5 °C threshold could be exceeded by 2024, although at first temporarily, casting doubt on whether Earth's climate can be permanently stabilised at 1.5 °C warming.

The Paris Agreement highlighted the gap between the voluntary emission reduction ambitions of the Parties and their consensus policy objective and created a framework that requires Parties to report on their progress and update emission reduction goals every five years (starting in 2023). The expectation being that the first round of pledges would get countries moving in the right direction and that each successive global stocktaking round would see enhanced ambition progressively close the emissions gap. Evidence of ambition raising can be found in the more than 120 countries that have recently committed to or are considering net-zero emission targets by 2050, although it remains unclear how these goals will be accomplished [23]. The massive investment in COVID-19 economic recovery offers the prospect to accelerate the low-carbon transition, but independent analyses [23,35]

conclude this opportunity has largely been missed. Analysis of the potential CO₂ emission implications of the massive COVID-19 economic stimulus packages by G20 countries (estimated at over USD 3.5 trillion) has revealed that with some exceptions (Western Europe, South Korea, and Canada) governments to date have failed to harness this once in a generation investment to advance climate action, with most spending predominantly high-carbon or having no discernible effects on GHG emissions.

Consequently, the current state of emission reduction progress and ambition remains appreciably out of pace with the transformations required by science-based targets. The most recent UNEP 2020 Emissions Gap Report [23] estimates that if all emission reduction pledges within the Paris Agreement were achieved, the world would be on course for approximately a 3.2–3.5 °C temperature increase in the late 21st century. The IPCC [21] has estimated that with a continuation of current high emissions trajectory global temperatures would increase by 2 °C or more by mid-century and 4.3 °C by the end of the 21st century. More recent climate models have increased the late century estimate to as high as 4.8 °C [36]. It is difficult to overstate the consequences of a high emission +4 °C world. According to the IPCC [21] (p. 8), such a climate future would cause “severe, pervasive and irreversible impacts for people and ecosystems”. Little in society would remain unaffected as coastlines and other parts of the planet would be transformed, extinction risks greatly increased, regional water and food insecurity intensified, hundreds of millions of people displaced, and global economic growth diminished [14,18]. Such outcomes are demonstrably incompatible with progress on sustainable development [37]. While the IPCC’s highest emission scenarios are becoming less likely as countries implement strategies to achieve their emission reduction ambitions, Schwalm et al. [38] argue they remain in close agreement with historical emissions and are the best match through the mid-century under current and stated policies. Burgess et al. [39] in contrast contend the IPCC high emission scenarios are no longer highly plausible levels of CO₂ emissions through late century, because of over estimations of economic growth, coal use, and other factors. While positive, they are unable to account for emissions from accelerating permafrost melt, which could contribute to the realization of IPCC higher concentration scenarios. Therefore, it is imperative that countries and sectors remain committed to both rapid and deep emission reductions, while simultaneously improved knowledge and implement adaptation strategies with a range of climate change futures.

Regardless of whether society achieves a +2 °C world through unprecedented rapid and deep decarbonization or the more extensive impacts of a post +3 °C climate disrupted world are realized, the grand challenge of climate change will transform global tourism over the next three decades and beyond. As we begin this decisive climate decade, with 30 years of published climate change and tourism research behind us and only 30 years before us to fundamentally transform global tourism into a decarbonized and more climate-resilient sector, it is more vital than ever to emphasize that there can be no sustainable tourism if we fail on climate change. The paper will provide an overview of the two core challenges climate change poses to sustainable tourism and examine the state of climate change preparedness in the tourism sector, including capacity in the tourism research community and key knowledge gaps, high level supranational responses, the place of climate change in tourism policy and destination plans, and increasing external pressures for climate action. The paper concludes with an urgent call to accelerate our collective tourism community response to climate change and the imperative for multi and trans-disciplinary collaborations to address the massive knowledge needs that this defining transformation requires.

2. The Two Climate Change Challenges That Will Transform Tourism in the Next 30 Years

The nexus between climate change and tourism is highly complex. Climate change is already influencing tourism sector investment, planning, and operations [40–42]. The direct and indirect impacts of accelerating climate change and extensive policy responses will transform the competitiveness, sustainability, and geography of tourism [43,44]. It is self-

evident that any phenomenon that will adversely affect economic growth in many areas of the world, greatly increase regional water and food insecurity, harm the health and displace more than a billion people, substantially alter many ecosystems and increase extinction risks, increase transportation costs, threaten cultural heritage, and increase security risks is not compatible with sustainable tourism development. These integrated effects of climate change will interact in largely unknown ways with other major macro-scale drivers of tourism development [45,46] to simultaneously generate risks and opportunities that will vary by market segment and tourism region. While it is beyond the scope of this paper to review the multiple pathways by which climate change and climate policy will influence the future of tourism, the two overarching challenges are considered below.

2.1. Managing the Carbon Risk Associated with Transition to Net-Zero Economy

The first climate change challenge faced by tourism is the transition to a low-carbon economy. This includes the enormous process of decarbonizing tourism to achieve the sector's emission reduction ambitions, but also envisioning the place of tourism in the net-zero emission global economy of mid-century. That travel and tourism is a major contributor to climate change has been recognized by the sector since the 2003 Djerba Declaration on Tourism and Climate Change. The scale of tourism emissions was first estimated at approximately 5% of global anthropogenic emissions of CO₂ in 2005 [47]. A more recent analysis [48] increased the estimated contribution to about 8%. Although the current contribution of the tourism sector to global emissions is considerable, the sector's pre-COVID-19 rapid projected growth posed an even greater challenge. Based on industry growth projections, it has been estimated CO₂ emissions from tourism would grow over 135% between 2005 and 2035 [47]. Work by Gössling and Peeters [49] that extended sector growth projections to 2050, estimated a 169% increase (from a 2010 baseline). The most recent UNEP emissions gap report [23] stressed that international shipping and aviation, because they are not covered by country emission pledges to the Paris Agreement, are projected to consume between 60 and 220% of global allowable CO₂ emissions by 2050 under a 1.5 °C scenario. This obviously cannot be allowed to happen, with major, but poorly studied, transitional implications for international tourism.

Tourism cannot be considered sustainable unless it can be eventually decarbonised to a level consistent with the science-based policy targets of the Paris Climate Agreement. The incompatibility of the aforementioned tourism emissions growth trend with requirements to stay within the +2 °C guardrail was identified in the IPCC Fifth Assessment Report [21]. Acknowledging the need to alter this emission trajectory, the World Travel and Tourism Council (WTTC) [50] announced the first emission reduction ambition for the sector at –50% by 2035 (from 2005 levels). This ambition was later endorsed by the United Nations World Tourism Organization (UNWTO). In 2019, the WTTC became a signatory to the UNFCCC Climate Neutral Now initiative, committing to becoming climate neutral (i.e., achieve net-zero emissions) by 2050 and consistent with science-based targets in the Paris Climate Agreement.

There remains a wide gap between sector emission projections and stated emission reduction ambitions, with no credible plan to close this gap [51,52]. A WTTC report [53] contended that member companies had improved their carbon efficiency by 20% over the previous decade. An independent analysis found no evidentiary support for such a visible claim [54], with publicly available sustainability reporting from 76 WTTC member companies revealing an almost equal proportion declaring emissions increases as decreases (and the vast majority not reporting on emissions at all). This type of obfuscation leads to accusations of greenwash and risks the sector be considered a “dirty industry” [52], with the “flight shaming” movement being an illustrative outcome. The lack of systematic monitoring capabilities in tourism remains an important barrier to knowing whether the sector is making progress toward its ambitions [55]. The WTTC [40] recognizes this measurement gap must be addressed to facilitate robust disclosure against standardised frameworks and metrics.

While the extent of the emissions gap after the COVID-19 pandemic recovery remains uncertain, closing it will come at a cost. Scott et al. [55] compared the potential costs associated with different policy pathways to achieve the tourism sector's emission ambitions and found investment in emissions abatement within the tourism sector combined with strategic external carbon offsets was the most cost effective over the simulation period (2015–2050). The cost to achieve the –50% target through abatement and strategic offsetting, while significant, represented less than 0.1% of the estimated total global tourism economy in 2020, rising to 3.6% in 2050 as emission reductions became more difficult. How this cost distributed among global travellers would have important implications for regional tourism development and destinations, important research that remains to be completed. An offsetting dominated policy pathway would also expose the sector to uncertain future carbon offset costs and potential changes in climate policy (e.g., hard emission caps on all or parts of the tourism system or reduced limits on allowable carbon trading/offsets) as the global economy seeks to achieve net-zero emissions. Only five years later, some of the technological assumptions of this study need to be reassessed as part of a research agenda (i.e., the potential role of electrification of short-haul flights and hydrogen and synthetic fuels from atmospheric CO₂ capture for longer flights; cost effectiveness of decentralized renewables and storage; the additionality and effectiveness of common offset strategies; the potential of carbon pricing, pandemic social change, and other policy to influence travel demand management [56–60]).

Regardless of the decarbonization progress the tourism sector achieves, countries and other sectors will be pursuing rapid decarbonization strategies most suited to their circumstances. How the global economy decarbonizes has important implications for the tourism sector, both in terms of assisting tourism to decarbonize, but also how transportation costs and access could alter the competitiveness of destinations around the world. Examining the place of tourism in deep decarbonization plans that have been developed to achieve the Paris Climate Agreement +2 °C policy target is revealing. A review of early +2 °C aligned plans found that none explicitly considered implications for international tourism, but all assumed that demand management will play a large role in achieving required emission reductions from aviation [61]. A review of more recent plans, including the first net-zero emissions by 2050 pathway developed by the very influential International Energy Agency (IEA) [62], similarly found that tourism is not mentioned, and that demand management remains a central strategy to address aviation emissions. Behavioural changes are responsible for nearly a third of the CO₂ reductions in the IEA net-zero scenario, including reducing emissions from flying by around 60% in 2030 by eliminating flights of less than one hour long, as well as reducing numbers of both long-haul and business flights by three quarters. It goes without saying that were these changes realized, there would be salient implications for tourism. What policy interventions could create and sustain such a shift in air travel? The International Civil Aviation Organization's CORSIA proposition has been much maligned as completely ineffective for reducing aviation emissions or demand management [63]. Could carbon taxes achieve this transition? The literature suggests carbon pricing would have to be at levels much higher to potentially invoke such change [64–66]. In other words, no emission scenario that achieves the goals of the Paris Climate Agreement includes the growth in air travel that is foundational to industry scenarios of future tourism development (nor anything close to projections of UNWTO or WTTC). Indeed, all assume the opposite, with substantive reductions in international air travel. Tourism remains dangerously blind to the strategies that influential energy and climate plans propose to achieve the low-carbon transition required by the Paris Climate Agreement. As a research community and sector, we remain disengaged from the process of identifying climate solutions at our peril.

Much research is needed to inform the low carbon transition in all components of the tourism system, from international aviation to destination management to traveller behaviours [67–69]. Overcoming the six systemic decarbonization challenges identified by Becken [68] (p. 419) will not be easy: "tourism's embeddedness in the prevailing

growth paradigm, the institutionalisation of interests, the nature of policy making, the inadequacy of incremental improvements, the focus on technological efficiency instead of (behavioural) conservation, and the global distribution of tourism". Doing so and understanding the implications of this transition for destinations (from the community to the country scale) and the largely unexplored salient interlinkages with climate and mobility justice [70] will require much expanded attention of tourism researchers and interdisciplinary collaborations.

2.2. Managing the Physical Climate Risks of Unavoidable Changes in Climate

As challenging as the decarbonization transition will be for the international community and global economy, the costs and consequences of inaction are far greater [11,37]. The second climate change challenge faced by tourism is adapting to the multi-faceted, and often compounding, environmental and socio-economic impacts of an increasingly climate disrupted world. Tourism is recognized as a sector that is highly sensitive to the impacts of climate change [43,71]. A comprehensive review of how 10 major types of climate change impacts are affecting 89 areas of human health, food, water, infrastructure, economy, and security found that tourism was one of only five areas being impacted by all 10 [72].

The tourism sector is already being impacted by climate-induced changes in environmental systems that are critical assets for tourism [40,41,55]. There is some evidence of the early impacts on tourism assets is contributing to the development of "last chance" tourism markets where travellers visit destinations before they are irreparably damaged or to witness the impacts climate change is having on landscapes [73]. Unfortunately, the impacts and sectoral responses to these many early onset climate change impacts (e.g., heatwaves, major hurricanes, wildfires, landscape, and ecosystem changes) that serve as natural experiments to understand future impacts of conditions that are anticipated to occur more frequently and become more severe with accelerated climate change are not being well studied. In particular, the responses of tourists to these natural experiments offered by climate anomalies and policy changes continue to be major missed learning opportunities that are essential to improve projections of changes in tourism demand patterns [74].

Importantly, what we are currently witnessing is but the tip of the iceberg versus what is anticipated in the decades ahead. Growing evidence indicates that the magnitude of projected impacts on tourism is highly dependent on the magnitude of climate change and that sector harm will be much greater under higher emission-temperature increases [11,43]. Global tourism leaders interviewed by [52] were unanimous that unmitigated climate change (beyond +3 °C) represents a cataclysm for both society and tourism and must be avoided.

Tourism depends on economic prosperity and socio-political stability, and climate change is anticipated to reduce future economic growth [11,75] and political instability [11,76] in many nations. For example, the Organisation for Economic Co-operation and Development [77] estimated the annual impact of 2.5 °C warming on the global economy would range between 0.7 and 2.5% of GDP to 2060 and increase beyond the mid-century. By comparison, a 1.4% reduction in annual global GDP in the UNWTO [78] slower-than-expected economic growth scenario resulted in a large reduction (−22%) in international tourism arrivals in 2030 (1.4 billion instead of 1.8 billion). Both the IPCC [11] and World Bank [37] warn that climate change is already eroding the basis for sustainable development in some countries and no scenario exists by which the Sustainable Development Goals (SDGs) of 2030 could be met in a world transformed by climate change.

While all of the tourism sector will suffer from the aforementioned reduction in global economic growth, the geographic impacts of a changing climate and policy responses will be uneven. A global analysis of the differential climate change risk for tourism, using 27 indicators across 181 countries, found the highest sectoral risk in Africa, the Middle East, South Asia, and Small Island Developing States (SIDS) in the Caribbean as well as Indian and Pacific Oceans [44]. Furthermore, when climate change risk was compared

with the relative importance of the tourism economy (tourism contribution to GDP) the highest-risk–highest-reliance countries were mostly SIDS but included some large tourism economies such as Thailand and Mexico as well. Climate change risk also aligned strongly with regions where tourism growth was projected to be the strongest in the coming decades, including Sub-Saharan Africa and South Asia, with important implications for national development plans, official development assistance programs and international adaptation financing negotiations in developing countries where tourism is a central development strategy. Disturbingly, the substantial regional imbalances in the information base on climate change and tourism reveal geographic gaps in precisely the regions identified as most at risk and more economically reliant on tourism [54]. Addressing these persistent regional knowledge gaps in Africa, the Middle East, South Asia, South America, and many SIDS should be a priority for the tourism and international development assistance communities over the 2020s, efforts consistent with obligations of developed countries under the UNFCCC and Paris Climate Agreement.

Although tourism regions and destinations will be differentially affected by climate change, in the globalised and increasingly interconnected world of tourism, the consequences in vulnerable tourism regions will transverse political boundaries to influence travel patterns, value chains, and tourism investment worldwide. Benzie et al. [79] refer to these as “transnational” risks that reach across national borders, both those with common borders as well as more distant countries. A negative impact in one part of the tourism marketplace may constitute an opportunity elsewhere as climate change alters destination competitiveness. The need for innovative risk assessment methodologies capable of accounting for important transnational impacts associated with international tourism remains a research priority.

Despite differential impacts of climate change, the reality is that all tourism destinations will need to adapt to climate change, whether to manage risks or to capitalize on new opportunities associated with impacts on regional or global competitors. Just as tourism has a massive climate change mitigation gap, so too it has a massive climate change adaptation gap [55,80,81]. Tourism is thought to have relatively high adaptive capacity [80], but very little is known about the capacity of current adaptations to cope with projected climate change, what the costs and benefits may be, who is going to be affected and how, which adaptations are scalable, or which may prove mal-adaptive. The adaptation implementation imperative that has emerged in the climate change literature and praxis, what Klein et al. [82] refer to as “fourth generation” adaptation research, has yet to transfer to the tourism sector. In virtually all destinations, the scale at which adaptation primarily occurs, there remains a highly incomplete information base with which to engage in climate adaptation planning. Few studies consider the wide range of potential impacts and their interactions at the destination scale or consider regional or market segment interactions [43,83]. As Mora et al. [72] warn, the study of climate change impacts in isolation remains common in many sectors but provides incomplete and potentially misleading assessment of the consequences of climate change for a location or sector. Similarly, climate services in support of adaptation in the tourism sector remain underdeveloped [84] and represent another useful area for collaboration between tourism and sustainability research communities.

The abovementioned decarbonization transition and physical climate risks will unfold concurrently in many tourism destinations, compounding response challenges and climate change information needs. Considering how these climate change impacts will then interact with other technological, demographic, social, economic, and political mega-trends that will influence tourism demand and development remains an additional area for future research [45,46]. Similarly, how post-carbon and climate-resilient tourism converges with other dimensions of the broader sustainable tourism agenda, including “degrowth”, “slow”, “responsible”, “pro-poor”, and “regenerative” tourism [85], require important theoretical and pragmatic dialogues. Our inability to more fully capture the complexity of the climate

change and tourism nexus demands new approaches that allow for multi-dimensional problems and non-linear system responses.

3. Tourism Sector Preparedness for Climate Change: A 30-Year Retrospective

Understanding how climate change and policy responses will reshape travel and tourism over the next three decades requires addressing the many major knowledge gaps outlined in the previous section and demands the academy and sector leaders work closely with policy makers and the financial community (including large scale investors and insurers). The question of how prepared the tourism sector is for climate change has been asked periodically by the research and business communities. A decade ago, KPMG's [86] assessment of the climate change regulatory, physical, and reputational risks posed to 18 major economic sectors found tourism to be one of six sectors most at risk and the least prepared. The answer is unfortunately no different in 2020 and deserves critical reflection.

3.1. Response of the Academy

The knowledge requirements to respond strategically and effectively to climate change are immense. If the world agrees we are in a climate emergency, a salient question is whether the tourism research community has developed and dedicated the necessary capacity? Although the climate change and tourism literature began in the mid-1980s, tourism was not even mentioned in the IPCC's First Assessment Report (Figure 1). The literature continued to grow very slowly in the 1990s, so that in his review Wall [87] (p. 614) lamented that, "Although the implications (of climate change) are likely to be profound, very few researchers have begun to formulate relevant questions, let alone develop methodologies which will understand the nature and magnitude of the challenges that lie ahead".

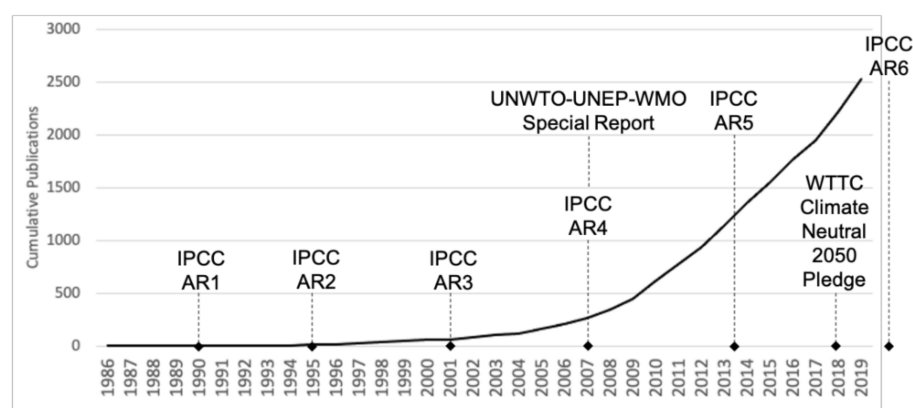


Figure 1. Development of the Climate Change and Tourism Information Base and Sector Engagement. Note: cumulative climate change and tourism-focused journal papers estimated using Scopus.

Climate change and tourism scholarship began substantive growth towards the end of the 2000s (Figure 1). Scott and Becken [80] positively concluded that the field was beginning to emerge from an awareness-raising phase, while other scholars questioned this growing attention on climate change. Weaver [88] (p. 5) questioned whether sustainable tourism research was becoming "dominated—at least rhetorically—by the issue of climate change" and if "tourism's expanding engagement with climate change, as it is currently unfolding, is not necessarily conducive to the interests of tourism sustainability". A review of the percentage of climate change related papers in the top five tourism journals (ranked by impact factor in 2019) over the 2000s would indicate otherwise, with only 1.5% of total publications. The state of climate change in the tourism literature hit what might be considered a low point when a leading tourism journal published a climate change denial paper, in which Shani and Arad [89] (p. 83) falsely claimed that climate change was a "hype" and "under intense scientific dispute". Their inaccuracies, misinformation, and deliberate misrepresentations of the status of scientific knowledge and consensus on

climate change demanded rejoinders by Hall et al. [90,91] because the journal would not retract it.

The elevation of climate change in international policy placed a new lens on many fields of scholarship and concomitant growth in the tourism literature in the early 2010s (Figure 1). With this growing body of literature, the position of tourism improved in the IPCC Fifth Assessment Report [55], particularly with respect to the recognition of transboundary impacts, the sector's contribution to climate change and its mitigation requirements. The visible lack of progress in terms of the geographical coverage in regions where tourism is a major part of the economy represented a priority for tourism scholars to address. While the nearly three-fold growth in climate change and tourism publications since 2010 (Figure 1) is highly positive, climate-change-related papers make up 3.4% of all publications in the top five tourism journals (ranked by impact factor in 2019) over the 2010s. We as a scholarly community continue to dedicate a meager proportion of our capacity to understand and respond to what is one of, if not, the greatest influence on our sector in the next 30 years (and beyond). Are we researching "like our house is on fire", as Great Thunberg challenges? Clearly not.

As we begin the decisive decade of the 2020s, evidence-based collective action is not possible without a robust foundation of knowledge. The lost time outlined above is not easily recovered, raising an important question germane to the objective of this special issue. Does the tourism research community have the capacity to deliver the knowledge base needed to inform action on the sector's two core climate change challenges? Based on my experience over the last 20 years, I would contend it does not and will not be able to develop it through conventionally trained tourism scholars and professionals graduating from existing tourism management programs. Given the urgency of action required, tourism must, therefore, depend on strengthened collaborations with other disciplines engaged in climate change and sustainability research and practice. Hopefully this special issue will draw attention to this need for greater collaboration and foster new interdisciplinary partnerships so urgently needed.

3.2. Response of International Tourism Organizations

Engagement of supranational tourism organizations tracked the expanding scientific literature. The first multilateral exploration of the complex relationships between climate change, and to a lesser extent, climate policy and tourism occurred in 2003 and resulted in the Djerba Declaration on Tourism and Climate Change. Broadly supportive of encouraging governments and industry to subscribe to climate change conventions and taking action to reduce sector energy use, the scope of tourism sector contribution to climate change and the impact on world heritage and least developed countries that depend on tourism were identified as a key information gap. The Declaration also called upon the Intergovernmental Panel on Climate Change to pay special attention to tourism in its Fourth Assessment Report.

The follow-up Davos Declaration on Climate Change and Tourism organized by UNWTO together with UNEP and WMO included a watershed state of knowledge report by an international team of scholars. This study estimated the scope of tourism emissions for the first time (estimated at 5% of global CO₂ emissions in 2005) and provided an overview of the regional impacts of climate change on tourism assets, infrastructure, and demand [47]. The Declaration identified specific actions for governments and international organizations, the tourism industry and destinations, consumers/travellers, and research and communication networks to reduce emissions, adapt to changing climate conditions and impacts, and secure financial resources to assist poor regions and countries to respond to climate change. The research team [47] (p. 38) emphasized that, "now is the time for the tourism community to collectively formulate a strategy to address what must be considered the greatest challenge to the sustainability of tourism in the 21st century". The follow-up Minister's Summit on Tourism and Climate Change in London (November 2007) further pronounced that "climate change is calling the tourism world to a revolution".

Nearly 15 years later, the response has not matched this rhetoric. The sector joined the UN Common Agenda for Climate Action and committed itself to the goal of becoming climate neutral (net-zero emissions) by 2050. Yet there remains no strategy on how to achieve the deep emission reductions needed or the position of global tourism in a decarbonized economy of 2050. The lack of a credible climate plan has left the sector vulnerable to accusations of greenwash from civil society organizations and will make it increasingly difficult to attract investors, employees, and customers.

Interviews with global tourism leaders [52] demonstrated that many had not internalized the magnitude of carbon and climate risks to the sector or how the political imperatives of the moment have changed. Sector leaders were united in their view that climate change is already affecting tourism, that it represents a significant physical, economic, and reputational risk for tourism development, and that the viability of tourism in some destinations is threatened. While there was general consensus on the need for deep emission reductions, there were differing positions on the urgency of change (decarbonization timelines) and the implications for continued growth in tourism.

3.3. Response of National and Destination Governments

Importantly, leaders confirmed that sufficient high-level information on climate and carbon risks was available to inform policy and action [52]. This has yet to translate into tourism policy and planning. An analysis of tourism sector climate change adaptation and mitigation policy in OECD countries found [92] (p. 9), “The inescapable conclusion is that current [national tourism] policy, with few exceptions, is inadequate to the scale of the challenge, both on mitigation and on adaptation”. Tourism is identified as a high priority in only 16 of the country Nationally Determined Contributions submitted to the Paris Climate Agreement, and a priority in an additional 35 [67]. That many countries where tourism is most at risk to climate change and where tourism is a major component of the economy do not identify the tourism sector as a priority within their NDC submissions signifies a continued need to raise awareness about sectoral risks and implications for advancing SDGs. The most comprehensive review of tourism and climate change policy documents in 61 countries [93] found less than 40% covered the connection substantially and those that did emanated primarily from the climate change community.

Tourism plans have been found to be similarly lacking climate change content and strategy. Climate action plans for tourism destinations remains rare, with some notable exceptions [94,95]. A review of the tourism plans in 12 Caribbean countries [96] found their quality for addressing climate change was quite low, with only 42% of plans even mentioning climate change, none referencing major international or regional climate change accords or legislative frameworks, none indicating any coordination with regional or national climate change scientific or governance lead Departments, very limited information on climate impacts or potential responses, and weak to no existent links between sustainable tourism and climate change. Disappointingly, there was no observed improvement in plan quality in newer plans completed in the last five years. One of the central barriers expressed by tourism planners was the lack of country/destination-specific information base on climate change impacts or implications of policy responses (internally or internationally). Jarratt and Davies [97] arrived at a similar conclusion in their review of coastal tourism plans and policies, stating they generally ignore how destinations might be impacted by or respond to climate change. These observed gaps reveal climate change has yet to become a priority for tourism policy and plan development.

Interviews with global tourism leaders [52] also emphasized the need for targeted decision-relevant information for climate adaptation and emission reduction strategies at the destination scale, particularly in developing countries. This is consistent with the adaptation implementation phase needs identified by Klein et al. [82] and discussions with tourism planners by [96]. Strengthened collaborations among government, business, non-governmental organisations, and universities were seen as integral to addressing these information gaps and foster shared learning throughout the sector. The need for

stronger climate leadership in the tourism sector was also emphasized, particularly a greater role of leading international and regional tourism organizations such as UNWTO, WTTC, European Travel Commission (ETC), and Pacific Asia Travel Association (PATA). These perspectives echo those of the academy (some 15 years ago [45]), offering optimism for leadership to accelerate collaboration and capacity building in the decisive decade of the 2020s.

The WTTC [53] (p. 5) has acknowledged that, “The next 20 years will be characterized by our sector fully integrating climate change and related issues into business strategy, supporting the global transition to a low carbon economy, strengthening resilience at a local level against climate risks . . .”. The UNWTO and sector leaders demonstrated the capacity for rapid (March 2020) and decisive response to the COVID-19 crisis with the establishment of a Global Tourism Crisis Committee to formulate a sector-wide response to the pandemic. A similar task force to develop a vision of tourism in the decarbonized economy of 2050 and a roadmap to achieve a just transition and climate-resiliency building is long overdue.

4. Conclusions

Climate change is upon us and the consequences of delayed action and overall low sectoral preparedness for should be particularly disconcerting for the tourism community. To continue is to imperil destinations and the livelihoods of millions that depend on tourism as well as the sector’s contributions to the SDGs and international development ambitions beyond 2030. We must acknowledge that what we have done for the past 30 years as tourism scholars and professionals has not prepared the sector for the next 30 years of accelerating climate change and the low carbon transition. While we cannot recover time lost, we must remain positive and guard against the trap of climate despair, which Weschler [98] (p. 1) warns, “leads to a paralysis no less debilitating than, and hardly distinguishable from, denial”. They argue for “resolve” that is needed to avoid the unmanageable and manage the unavoidable of the grand challenge of global climate change.

For tourism, the transition from a two decades of awareness raising and ambition setting to a decade of accelerated collective response requires broad commitment to three tasks: (1) improved communications and knowledge mobilization, (2) increased research capacity, and (3) strategic policy and planning engagement. While the aforementioned discussion has identified many salient knowledge gaps in tourism and climate change, tourism policy makers and planners appear disconnected from the substantive scientific literature that is available. Whether this research is decision-relevant for tourism plans and policy is another question, more on that in a moment, but practitioners remain disconnected from the information base that exists. This disconnect parallels the broader challenge of effective collaboration between the tourism academy and industry on sustainable tourism, where Sharpley [99] (p. P1933) concludes, “Putting in bluntly, sustainable tourism research and policy appear to occupy a parallel universe to the practice of tourism”. The academy must make more extensive use of diverse strategies to overcome what some refer to as the “valley of death” between information providers and users and mobilize our existing information base and new information as it becomes available.

Going forward, our scale of research activity has to become commensurate to the scale of the massive local to global scale information needs for the tourism sector to respond effectively to the climate crisis. Dedicating 1–3% of research output, as measured by the content of high-ranking tourism journals, is clearly insufficient. The urgent need to increase this capacity and bring to bear the diverse expertise required to address the many knowledge gaps identified above can only be accomplished through major efforts to create research partnerships with researchers in climate change and sustainability science and governance more broadly. It is hoped that this Special Issue will serve as a catalyst to develop broad interdisciplinary partnerships to accelerate climate action in the 2020s.

Enhanced research capacity must be accompanied by changes in how we do research on climate change and tourism. It is imperative that the tourism community enhance

transdisciplinary partnerships to support climate action between 2020–2030, particularly the development of tourism policy consistent with national climate commitments, make better use of local knowledge that so far is virtually absent from the climate change and tourism literature, and expand decision-relevant destination scale information to support climate plans (particularly in highly vulnerable destinations). All tourism scholars have sustained engagement with specific tourism destinations and industry, and building on these relationships is fundamental to advancing and mobilizing climate change information rapidly. My 20 years of experience in climate change and tourism indicates that all tourism scholars have an important opportunity to shape demand for climate change information, because demand often lags supply, with many tourism policy makers and planners in the destinations they work still largely unaware about the potential impacts of climate change and policy responses. Such calls for enhanced inter- and trans-disciplinary research on climate change and tourism are obviously not new (see [45,52,68]), but are imperative if governments are to understand how global tourism is impacted by climate change and not overlooked in the development of response strategies. We in the tourism and sustainability communities must answer this clarion call to shape the future of tourism in a decarbonized and post +3 °C world.

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