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## FINAL SUBMITTED MANUSCRIPT

### No time for smokescreen skepticism: A rejoinder to Shani and Arad

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Highlights

- Rejoinder to claims of Shani and Arad (2014)
- Extent of scientific consensus on climate change indicated
- Evidence for climate change is observational and predictive
- Extent of tourism related emissions indicated
- Concern of climate denial for scientific debate and communication

ABSTRACT

Shani and Arad (2014) claimed that tourism scholars tend to endorse the most pessimistic assessments regarding climate change, and that anthropogenic climate change was a "fashionable" and "highly controversial scientific topic". This brief rejoinder provides the balance that is missing from such climate change denial and skepticism studies on climate change and tourism. Recent research provides substantial evidence that reports on anthropogenic climate change are accurate, and that human-induced greenhouse gas emissions, including from the tourism industry, play a significant role in climate change. Some positive net effects may be experienced by some destinations in the short-term, but in the long-term all elements of the tourism system will be impacted. The expansion of tourism emissions at a rate greater than efficiency gains means that it is increasingly urgent that the tourism sector acknowledge, accept and respond to climate change. Debate on tourism-related adaptation and mitigation measures is to be encouraged and welcomed. Climate change denial is not.

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Keywords: Climate change; Global warming; Skepticism; Denial; Agnotology

## 1. Introduction

Climate change is one of the most contentious areas of public debate of science. However, in scientific terms it is not, what Shani and Arad (2014, p.82) incorrectly refer to as, "highly controversial". Anthropogenic climate change is now clearly accepted within the scientific community (Anderegg et al., 2010; Cook et al., 2013; Doran & Zimmerman, 2009; Oreskes, 2004). As with all areas of scientific knowledge there is systematic interrogation and debate of knowledge claims, results, models, methods, and procedures. However, to dismiss scientific knowledge claims by discrediting climate change science is to deliberately misrepresent both the scientific literature and scientific consensus on the subject. The recent 'research' paper in *Tourism Management* on it being a "time for environmental skepticism" on climate change and tourism (Shani & Arad, 2014), or to what they refer as "climate change hype" (Shani & Arad 2014, p.83) is such a misrepresentation.

Shani and Arad (2014) claim that

- “virtually all” [“tourism scholars and researchers”] “ignore the critical debate on the accurateness and implications of the theory of anthropogenic global warming (AGW), which in actual fact is far from being conclusive” (p. 82);
- “the theory of AGW is, in fact, under intense scientific dispute” (p. 83);
- "there are shaky scientific foundations to the hypothesis that $CO_2$ concentration in the earth’s atmosphere accounts for significant temperature fluctuations, empirical evidence indicates that the sun activity is a more plausible cause for climate variation" (as well as “natural factors” including “changes in the galactic environment") (p.83);
- "no definitive evidence exists to verify that climate is driven by the concentration of $CO_2$ in the earth’s atmosphere" (p. 83); and
- “the theory of AGW is highly controversial among climate scientists” (p.84).

This paper provides a brief response to these statements and to their litany of climate change denial and misrepresentation. Throughout the paper the terms climate change and anthropogenic climate change (ACC) are preferred to AGW given that increases in globally averaged atmospheric and ocean temperatures are one part of the broader changes within the climate system and, hence, global climate change (IPCC, 2013a).

## 2. The ‘unequivocal’ consensus on anthropogenic climate change

There *is* scientific consensus with respect to the reality of ACC. The Intergovernmental Panel on Climate Change (IPCC) (2013b, p.2) concluded, “Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased”. The conclusions of the IPCC along with many other scientists are that climate change is real and well advanced. It is not just a future possibility. Evidence for climate change is observational as well as predictive (IPCC, 2013a).

The IPCC concludes it is extremely likely (>95% level of certainty) “that human influence has been the dominant cause of the observed warming since the mid-20th century” (IPCC, 2013b, p.15). It is also “extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together” (IPCC 2013b, p.15).

The extent of the scientific consensus on ACC in peer-reviewed scientific literature, which is also the source material for the IPCC (e.g. Anderegg et al., 2010; Doran & Zimmerman, 2009); as well as supporting statements from scientific associations (Science, 2001); is substantial. Cook et al. (2013) examined 11,944 climate abstracts of peer-reviewed articles from 1991–2011 matching the topics 'global climate change' or 'global warming'. They found that 66.4% of abstracts expressed no position on ACC/AGW, 32.6% endorsed ACC/AGW, 0.7% rejected ACC/AGW and 0.3% were uncertain about the cause of climate change. Among abstracts expressing a position on ACC/AGW, 97.1% endorsed the consensus position that humans are causing climate change. Cook et al. (2013) also invited authors to rate their own work. Compared to

abstract ratings, a smaller percentage of self-rated papers expressed no position on ACC/AGW (35.5%). Among self-rated papers expressing a position on ACC/AGW, 97.2% endorsed the consensus. For both abstract ratings and authors' self-ratings, the percentage of endorsements among papers expressing a position on ACC/AGW marginally increased. The quantum of peer-reviewed papers rejecting the consensus on ACC is extremely small. The existence of a scientific consensus, especially one as overwhelming as exists for human-induced climate change, raises the level of confidence that the overall findings of that consensus are correct (Bedford & Cook, 2013). There is no scientific controversy although there is an ongoing systematic interrogation of knowledge claims. The misrepresentations of the scientific knowledge on climate change by Shani and Arad (2014) provides a basis for the further study of agnotology but not of climate change.

According to Shani and Arad "most apocalyptic predictions regarding AGW are based on simulations of the IPCC's computer climate models, which so far have not demonstrated a high level of accuracy" (2014, p.83). Yet, available evidence suggests that as a result of scientific norms of dispassion, skepticism, rationality, and restraint as well as IPCC reports being a synthesis of research undertaken by thousands of scientists funded from hundreds of different sources the reports are conservative interpretations of climate change that favour less rather than more alarming projections (Brysse et al., 2013). The IPCC does not assume that warming is occurring at a "destructive rate" as Shani and Arad (2014, p.82) claim. The word destructive is not used in the AR5 WGI report on the science of climate change (IPCC, 2013a). Nevertheless, the IPCC (2014a) does emphasise the risks posed by climate change especially with respect to food, water and human security (see also IPCC, 2012). Contrary to Shani and Arad's (2014) claims, the benefits of climate change do not outweigh the costs. Even Tol (2013), whose work Shani and Arad (2014) cites, suggests that climate change is not beneficial anymore in the 21st century. "Most rich and most poor countries benefitted from climate change until 1980, but after that the trend is negative for poor countries and positive for rich countries. In the 21st century, impacts turn negative in most countries, rich and poor. Future climate change is a reason for concern" (Tol, 2013, p.127).

Climate models do not reproduce single events but rather they produce statistical properties describing the climate. They therefore capture trends in the climate system not its internal variability. Climate models reproduce observed large-scale mean surface temperature patterns very well (pattern correlation of ~0.99) (IPCC, 2013a) and their performance continues to improve. There is "very high confidence" that "models reproduce observed continental- scale surface temperature patterns and trends over many decades, including the more rapid warming since the mid-20th century and the cooling immediately following large volcanic eruptions" (IPCC, 2013b, p.13). Model accuracy has improved for regional scales, but continues to be lower than for the global scale (IPCC, 2013a). Although global mean surface temperature has not risen as rapidly as before, it has still been increasing (IPCC, 2013a). Nevertheless, it must be stressed, "the average rate of warming at the Earth's surface is only one piece in the climate change puzzle" (Nature Geoscience, 2014, p.157). Simultaneously, ocean warming, ocean acidification and high rates of warming in high latitudes, among other expressions of climate change, continue to occur (IPCC, 2013a).

Shani and Arad (2014, p.83) claim, "Further studies also confirm that major temperature fluctuations occurred before man-made $CO_2$. If the IPCC's assessments are accurate and natural factors scarcely play any role in today's climate, we would expect a rather flat

and uninteresting climate history, which is certainly not the case (Vahrenholt, 2012)." Vahrenvolt (2012) is a commentary piece in *The Telegraph* newspaper by a climate denier, it is not a peer reviewed article. The IPCC does not claim "natural factors scarcely play any role in the climate." The IPCC (2013a, p.11) explicitly state, "Natural and anthropogenic substances and processes that alter the Earth's energy budget are drivers of climate change." The issue is that natural processes alone cannot explain the current changes to climate, including mean atmospheric temperatures. Other claims by Shani and Arad (2014, p.83) with respect to "shaky scientific foundations to the hypothesis that $CO_2$ concentration in the earth's atmosphere accounts for significant temperature fluctuations", are supported by references to non-peer-reviewed material from the Heartland Institute and other conservative think tanks, such as the Cato Institute, as well as selective citation of other sources that discuss natural processes that potentially affect climate in specific locations and times. Similar misreadings and selective citation occur with respect to Shani and Arad's claims over historic $CO_2$ concentrations, temperatures, and the so-called current warming 'pause' (Mann et al., 2014).

## 3. Tourism and climate change: research and response

According to Shani and Arad,"It seems far too hasty and irresponsible to recommend that the tourism industry take drastic and expensive courses of action that are based on climate forecasting models that have demonstrated very limited success" (2014, p.83). Recognition of ACC is based on more than just models (IPCC, 2013a). The contribution of anthropogenic greenhouse gas (GHG) emissions to warming has been at least 50% since 1950 and continues to grow, further pushing surface temperature up. In order to reduce the impacts of climate change emissions will need to be reduced by *all* sectors including tourism (IPCC, 2014b).

Tourism contributes to climate change through emissions of GHGs of which $CO_2$ is the most recognised. Others include methane ($CH_4$), nitrous oxides (NOx), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride ($SF_6$), and various short-lived GHGs that are important in the context of aviation and, to a lesser extent, cruiseships (Scott, Hall & Gössling, 2012). Tourism transport, accommodation, and activities are estimated to have contributed approximately 5% to global anthropogenic emissions of $CO_2$ in 2005 (UNWTO-UNEP-WMO, 2008; World Economic Forum (WEF), 2009). The majority of tourism-related $CO_2$ emissions are associated with transport, with aviation accounting for 40% of tourism's overall carbon footprint, followed by car transport (32%) and accommodation (21%) (UNWTO-UNEP-WMO, 2008). Cruise ships provide an estimated 19.2 Mt $CO_2$, and account for around 1.5% of global tourism emissions (Eijgelaar et al., 2010). The UNWTO-UNEP-WMO (2008) and WEF (2009) assessments do not include the impact of non-$CO_2$ short-lived GHGs. When radiative forcing (RF) is considered it was estimated that tourism contributed 5.2–12.5% of all anthropogenic forcing in 2005, with a best estimate of approximately 8% (Scott, Peeters & Gössling, 2010; Gössling, Scott & Hall, 2013). Tourism related land use change is a further, though unquantified, contribution to climate change.

Given that the rate of growth in tourism is increasing at a significantly higher rate than efficiency gains (WEF, 2009), the absolute contribution of tourism to climate change is increasing and, without substantial change, will continue to grow in the foreseeable future (Dubois et al., 2011; Gössling, 2013; Gössling, Hall, Peeters & Scott, 2010; Gössling, Scott & Hall, 2013; Owens et al., 2010; Peeters & Dubois, 2010; Peeters & Landré, 2012). There are limits to efficiency gains. Given tourism growth forecasts

(UNWTO, 2011), measures such as carbon caps and trade schemes, offsetting and behavioural change must be applied if tourism is to meet its emissions targets (Cohen et al., 2014; Dubois et al., 2011; Gössling et al., 2013; Hall, 2014; Peeters & Dubois, 2010). Such changes do not necessitate a radical reduction in the number of tourist trips, rather a reduction in the emissions per trip, in order to help lower the absolute amount of emissions created by tourism. The close connection between the implementation of climate change mitigation and adaption measures and sustainable tourism strategies will also lessen negative human impacts on ecosystems and biodiversity that constitute the environmental services on which well-being depends (Millennium Assessment, 2005).

Climate change also threatens the relative attractiveness and sustainability of tourism destinations and, over time, the tourism system overall. This will occur over various time scales depending on the specific factors e.g. sea level rise, snow loss, ocean acidification, coral bleaching, species loss (Gössling, Scott, Hall, Ceron, & Dubois, 2012; Scott, Hall & Gössling, 2012). Tourism system wide effects will impact economic well-being and propensities to travel. Although some destinations and generating regions may benefit from climate change in the short-term, the longer-term systemic effects will have significant consequences for tourism everywhere. This is of especial concern for least developed countries that are affected by climate change and emphasise tourism as a development mechanism (IPCC, 2014a; Scott, Gössling & Hall, 2012).

Many of Shani and Arad's (2014) questions and claims rest on the presumption that ACC, including tourism's contributions to climate change, does not exist. *It does*. Are they highly contested by the scientific community in scientific terms. *No*. Is there lack of a "critical approach" (p.84) or ignorance of "critical debate" (p.82). *No*. There is a substantial, and increasing, body of peer-reviewed research on tourism and climate change (e.g. see reviews in Becken & Hay, 2012; Kaján & Saarinen, 2013; Scott, 2011; Scott, Gössling & Hall, 2012; Scott et al., 2012; Scott & Matthews, 2011; UNWTO-UNEP-WMO, 2008). Within this body of research there are significant debates and engagements over the framing of ACC as a scientific and societal problem. But, unlike Shani and Arad (2014), there is not a denial that ACC exists.

**Conclusions: No Time for climate change denial**

The climate change controversy that should be acknowledged is the extent to which a subject of importance is being deliberately misportrayed by vested economic and political interests (Dunlap, 2013; Friel, 2010; Hulme, 2009; Manne, 2012; Oreskes & Conway, 2010). Climate change science recognises that it must improve communication of its work especially where disagreement and uncertainties exist (Anderegg, 2010; Weichselgartner & Kasperson, 2010). However, improvements in communication can only go so far when competing against extensive campaigns by some organisations, including the role of conservative think tanks with respect to organised environmental skepticism, to discredit climate change science (Gleick, 2010; Jacques et al., 2008; Manne, 2012).

There is substantial critical debate over many aspects of climate change, not only over levels of confidence and uncertainty, but also the paradigms and frameworks within which it is understood as a problem to be managed and solved (Hall, 2011, 2013; Scott, 2011). This has therefore meant substantial contestation over issues of adaptation, mitigation, vulnerability and resilience and the different transition trajectories that

should be followed. Such areas are where debate should be focussed especially in light of issues of policy learning and flexibility, climate change governance, the role of the market, consumer behaviour, opportunity costs and development.

Shani and Arad (2014) do not contribute to this debate. It is not a research paper. It could, at best, be described as a commentary or viewpoint. We would argue that it should not even have been published. Not because we disagree with it. But because it hides behind a smokescreen of extremely poor science and deliberately misrepresents the status of scientific knowledge and consensus on climate change (see also Nuccitelli, 2014). A liberal interpretation of what can be published is not an excuse to publish anything. Shani and Arad (2014) do not provide adequate standards of evidence for their knowledge claims. Alternative and outlier studies have their place and should be valued for the perspectives they can bring with respect to problem definition and paradigm change. But they must have a suitable standard of evidence whether by direct research results and/or reputable peer-reviewed sources – and a commentary in *The Telegraph* is not peer-reviewed science. As Oldfield and Steffen (2014, p.74) observed, "The bottom line is clear. Denying the relevance and validity of Earth System science is a highly risky, and possibly catastrophic, approach for humanity to take towards its future". Or, as Tol (2008, p.37) noted, "Denying that there is a problem [of climate change] is just dumb."

What may change perceptions that ACC does not exist or is negligible? In some cases better communication may help, in others a weather event such as a hurricane, flood or heatwave may occur that makes climate change more believable (Hall, 2006; Kaján, 2013; Lejano, Tavares-Reager & Berkes, 2013; Schmidt, Ivanova & Schäfer, 2013; Greenberg, Weiner, Noland, Herb, Kaplan & Broccoli, 2014), even though from a climate science perspective the occurrence of a single high-magnitude weather event cannot be specifically connected to climate change, although the likelihood of intense weather events may have increased (Scott, Hall & Gössling, 2012; IPCC 2013a). However, no matter what arguments are presented there will always be those who will not accept the evidence if it is incongruent with their belief system (Hoffmann, 2011). As Dunlap (2013, p.693) observed, "there is little doubt that many individuals actively involved in the denial campaign are not skeptical of climate science but are in full denial, and no amount of evidence will convince them of the reality of AGW." Taking action to achieve limits to climate change is not just an economic and technical challenge, it raises profound questions of ethics, values and risk, including the responsibility we bear towards future generations, those who will be most affected, and other species. How these questions can be answered is a vital debate as is the selection of means to achieve desired ends. Debate therefore is welcomed and encouraged. Denial is not.

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