Economic Costs of the 2012 Floods on Tourism in the Mopani District Municipality, South Africa

Article *in* Transactions of the Royal Society of South Africa · April 2016

DOI: 10.1080/0035919X.2016.1167788

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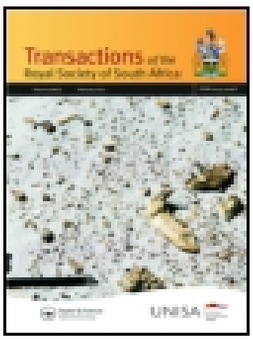

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Transactions of the Royal Society of South Africa

ISSN: 0035-919X (Print) 2154-0098 (Online) Journal homepage: http://www.tandfonline.com/loi/ttrs20

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To cite this article: J.M. Fitchett, G. Hoogendoorn & A.M. Swemmer (2016): Economic costs of the 2012 floods on tourism in the Mopani District Municipality, South Africa, Transactions of the Royal Society of South Africa, DOI: 10.1080/0035919X.2016.1167788

To link to this article: http://dx.doi.org/10.1080/0035919X.2016.1167788

Transactions of the Royal Society of South Africa, 2016
http://dx.doi.org/10.1080/0035919X.2016.1167788

Economic costs of the 2012 floods on tourism in the Mopani District Municipality, South Africa

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The landfall of Tropical Storm Dando resulted in a severe flood event in the Lowveld region of the Limpopo Province in South Africa from 17 to 19 January 2012, with over 500 mm of rainfall recorded over a 24-hour period. The Mopani District Municipality declared a local state of disaster following these floods. Interviews conducted with 24 lodges and conservation establishments indicate a total direct cost of R58.92 million, 'costs' of loss of business of R4.230 million, and an increase in long-term expenses, including insurance, adaptation and mitigation, of R458 600. Due to the low response rate, the economic damage to the tourism sector exceeds that of the 42 farms and 11 local businesses interviewed. Damage ranged from the loss of household contents to the complete destruction of all buildings on the property. The capacity for tourism establishments to recover from the floods depended primarily on the type and value of their insurance. Additional strain was placed on tourism establishments through the damage to roads, poor water supply during the floods, the removal of trees, and a loss of the aesthetic quality of the region. This case study provides a valuable insight into the nature and severity of the impacts of floods on the South African tourism sector, and contributes to projecting impacts of global climate change on tourism in developing countries.

Keywords: flooding; tourism; accommodation establishments; climate change adaptation; insurance

INTRODUCTION

Research on the impacts of climate change on tourism has increased over recent decades (Hall & Higham, 2005; Becken & Hay, 2007; Scott *et al*., 2012; Kaján & Saarinen, 2013). This research has predominantly been confined to the global North, where detailed meteorological, social and economic datasets are easily available (Amelung *et al*., 2007; Perch-Nielsen *et al*., 2010). A subsect of this discipline considers the impacts of flooding on the tourism sector, with a particular focus on the role of climate change (see Faulkner & Vikulov, 2001; Fernandes, 2016 for exceptions). Little research explores climate change and tourism in the global South, and even less in southern Africa where the majority of research emanates from Botswana (cf. Hambira *et al*., 2013; Hambira & Saarinen, 2015). South Africa hosts a relatively unique set of climate change threats, a lowered adaptive capacity, and a less resilient tourism sector (Rogerson, 2012; Hoogendoorn & Rogerson, 2015; Fitchett *et al*., 2016a; Hoogendoorn *et al*., 2016). Given the limited research focus on impacts of climate change on tourism in Southern Africa (Preston-Whyte & Watson, 2005; Ziervogel *et al*., 2014), including those from floods, this paper provides one of the first case studies exploring the impacts of flooding on tourism. This provides a valuable bench-mark for projecting and proactively adapting to future scenarios of climate change related to flooding (Pielke, 2007). One of the projected impacts of climate change in Southern Africa is a continued southwards trajectory of tropical cyclone and tropical storm tracks, increasing the probability of landfall in southern Mozambique and the Limpopo Province of South Africa (Fitchett & Grab, 2014; Nash *et al*., 2014). Associated with these tropical cyclones and tropical storms are storm surges in coastal regions, and severe rainfall events and flooding extending into the interior (Reason & Keibel, 2004; Reason, 2007; Ziervogel et al., 2014; Chikoore *et al*., 2015). While literature exists on the frequency, extent and severity of these events both historically and under climate change scenarios (cf. Jury *et al*., 1999; Mavume *et al*., 2009; Malherbe *et al*., 2012), the impacts of these storms on the tourism sector have not been reported.

Tropical storm Dando developed in the south western Indian Ocean and made landfall on the southern African east coast on 17 January 2012 (Chikoore *et al*., 2015). A timeline of events, developed from the FarmWatch records and through interviews with business owners in the region, confirmed that rainfall commenced in Hoedspruit at approximately 03:30 h. By 07:00 h flooding had occurred on major arterial roads, and all roads leading towards rivers were closed. At 13:00 h a dam wall adjacent to the R531 arterial road collapsed, resulting in considerable damage to this road. Rainfall ceased at 12:30 h on 18 January 2012, by which point 500 mm had been recorded. River flow of 3400 m^3s^{-1} was measured in the Olifants River entering the Kruger National Park (Aurecon, 2012). The overflow of the Blydepoort Dam and Klaserie Dam resulted in 1500 m^3s^{-1} flow downstream into the Blyde River and 800 m^3s^{-1} flow in the Klaserie River, respectively (Aurecon, 2012; Chikoore *et al*., 2015). Numerous small earthen dams burst along the Klaserie River downstream of the Klaserie Dam, as well as smaller rivers in the area.

Surges resulting from these dam bursts were reported to be responsible for damages to many of the tourism establishments downstream. The Mopani District Municipality declared a local state of emergency in terms of the Disaster Management Act [57 of 2002 Art 55(1)], necessitating evacuations, and providing legal support for the implementation of disaster management measures. Efforts to reduce immediate threats from the flooding continued for a further two weeks, including the delivery of food and water, efforts to remove flood water, medical assistance, and the rebuilding of bridges and roads (Aurecon, 2012).

The results of the flood included the destruction of business infrastructure, the loss of business during periods of rebuilding of both individual facilities and the arterial roads and bridges and utilities, and long-term costs incurred through the increase in insurance premiums for the region (Aurecon, 2012; Chikoore *et al*., 2015). The nature and extent of the costs incurred by various sectors is however uncertain, and may be under-reported due to the private nature of South African insurance policies, and the variations in government support across different sectors. Furthermore, the knock-on effects of a natural disaster are difficult to quantify at a broad regional scale, and require information at the scale of individual businesses (Pielke, 2007). To project the threats of climate change to tourism in southern Africa it is important to first understand the impacts of contemporary extreme weather events on the tourism sector (Conway, 2008; Rogerson & Sims, 2012; Fitchett *et al*., 2016b). Furthermore, adaptation strategies employed during contemporary storm events facilitate an improved understanding of likely future damages and responses (Conway, 2008). The lowveld region is host to one of South Africa's premier tourism products, the world famous Kruger National Park as well as one of the largest areas of private game reserves in the world. Numerous rural communities bordering these protected areas are reliant on income generated from ecotourism (Saayman & Saayman, 2006; Spenceley, 2006; Spenceley & Goodwin, 2007), and therefore it is important to consider viable adaptation and mitigation strategies to protect the economic value of the park and the private reserves, not only for their role in conserving bio-diversity and heritage, but also for the different tourism economies reliant on them.

STUDY REGION

The Mopani Municipality is located in the Lowveld region, in the eastern half of Limpopo Province, South Africa. This Municipality falls within the greater Kruger conservation area. The region is marginally subtropical, with relatively warm year-round temperatures and high summer rainfall (Fitchett *et al*., 2016a). Hoedspruit has a mean (1977–1990) annual maximum temperature (T_{max}) of 29 °C and minimum temperature (T_{min}) of 16 °C (Open Africa, 2014; Fitchett *et al*., 2016a). Most of the 500 mm mean annual rainfall occurs between October and March, with the remainder of the year receiving negligible precipitation (Fitchett *et al*., 2016a). The precipitation in the region is fed predominantly by the moist air intruding from the Indian Ocean. Occasional tropical cyclones and tropical storms which follow a trajectory south of Madagascar or which develop in the Mozambique Channel make landfall in southern Mozambique, resulting in sudden, short-lived extreme storm events in north eastern South Africa (Fitchett & Grab, 2014; Chikoore *et al*., 2015). The economic activity of the region is dominated by agriculture and tourism. The tourism sector is primarily nature-based, and includes game farms, nature reserves and national parks (Myer & De Crom, 2013). Climate change projections for the region include increasing temperatures, reduction in mean annual precipitation, but paired with an increase in short-lived flood events (Davis, 2010).

METHODS

As an introduction and justification to the methods adopted, it is important to note that this study forms part of a broader research focus on the impacts of climate change on tourism in South Africa (cf. Hoogendoorn *et al*., 2015; Hoogendoorn & Visser, 2015; Rogerson, 2014; Pandy & Rogerson, 2013). As part of a broader study to validate the calculation of costs of the floods, interviews were conducted with a total of 75 businesses in the Mopani Municipality, including farms, retail stores, tourism accommodation establishments, services, conservation initiatives, and smaller private businesses (Figure 1). Interviewees were selected according to availability using a door-to-door approach. Of these respondents, 24 comprised the owners of tourism accommodation establishments, which form the focus of this study. This constitutes a small proportion of the total number of accommodation establishments in the region, which was estimated for 2012 at 178 listed companies. Consequently, total damages for these 24 establishments are reported per region, rather than averages for the sector, and analyses of specific damages are made for individual respondents. All of the accommodation establishments can be classified as small businesses, operating guesthouses and bed-and-breakfast accommodation establishments with less than 20 beds. Interviews conducted were structured, and included descriptions of the loss and damages to the property, financial costs of repair or replacement, details of insurance claims and support, loss of business and associated costs, increased expenses during the floods, and long-term cost implications of the floods. Data was collated for all respondents, and analysed from the quantitative economic perspective (Pielke, 2007), and qualitatively to assess behavioural responses and preparedness strategies (Conway, 2008).

RESULTS

The interviews with the respondents highlighted a range of impacts of the flooding event on the tourism sector in the region. These include damage to personal and municipal infrastructure as a result of the flood; financial costs, incurred over short-, medium- and long-term periods following the floods; and a decrease in booking numbers due to negative impacts of the flood on the tourist perceptions of the region. For the purpose of this study, short-term costs are defined as those incurred during the period of, and within 24 hours following, the flood event; mid-term costs are defined as those which were incurred over the month which followed the flood event; and long-term costs defined as those incurred over the following year or longer. This classification was made on the basis of clear divisions within the data. Relative costs are difficult to ascertain, as each of the accommodation establishments experienced different types of damage to capital of ranging value. The adaptation strategies adopted by the accommodation establishments, both before and after the flood, are explored to determine the influence of direct losses in informing more pro-active adaptation approaches.

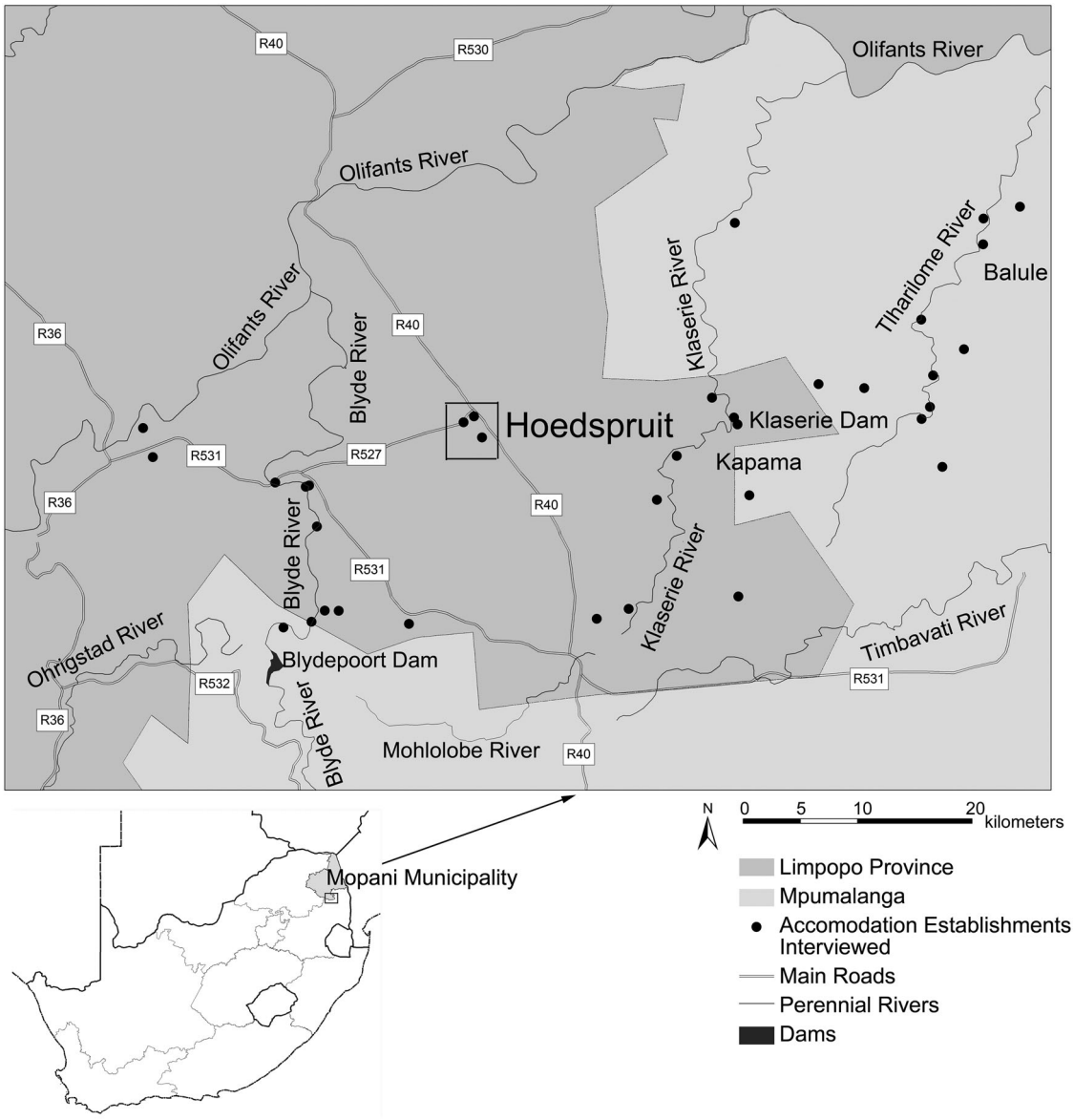

Figure 1. Map of the study region indicating the location of the individual establishments interviewed.

Financial costs

Financial costs resulting from the flood were incurred at three temporal scales: short-term mid-term and long-term. Across all categories, the worst affected region was Klaserie, followed by the Blyde River area and Timbavati (Table 1). These areas are located within the region of greatest precipitation during the floods, but additionally have a larger density of accommodation establishments, with 18 located alongside rivers (Figure 1). Lodges built close to seasonal and small perennial rivers were most severely affected, and 16 respondents explained that at the time of construction, it was assumed that these smaller rivers would never overflow their current channels.

Short-term costs

The short-term costs predominantly comprise the damage to infrastructure and loss of personal belongings incurred during, and in direct response to, the floods. These costs were incurred by the individual accommodation establishments, where damage to their property and infrastructure, and loss of personal belongings occurred (Table 1). Costs relating to infrastructural damage were also incurred by the local municipalities, where infrastructural damage included the destruction of roads and bridges, water pipelines, electricity substations and powerlines, and the sewage and sanitation networks. Twelve of the accommodation establishments reported to have had household and business insurance, but the nature of the damage and the costs incurred was so considerable that of those, only four establishments received insurance pay-outs covering more than 50% of the costs (Figure 2). In most cases, this was due to variations between the insured and actual value of the infrastructure, whilst for some accommodation establishments damage exceeded the maximum insurance pay-out. The total short-term, direct costs incurred by the accommodation establishments as a result of this flood is totalled at R50 million (US$3.08 million, 9 February 2016). In some instances, the short-term costs, and the small proportion of these costs covered by insurance,

Table 1. Costs incurred by accommodation establishments, averaged by municipal and sub-municipal geographic regions.

Area	Number of respondents	Cost to repair/ replace property (ZAR)	Cost of loss of business (ZAR)	Cost of increased expenses (ZAR)	Total claimed from insurance (ZAR)	Non-claimable expenses (ZAR)	Irreplaceable (ZAR)
Balule	1	0	0	0	0	0	0
Blyde	7	6 800 000	1 880 000	51 000	6 800 000	230 000	–
Hoedspruit	4	0	0	0	0	0	
Kapama	1	0	0	0	0	0	
Klaserie	6	15 000 000	0	0	10 000 000	0	Personal items
Timbavati	5	8 284 000	2 350 000	407 600	4 662 000	1 479 600	200 000 trees

1ZAR = US$0.06 on 9 February 2016.

resulted in the business closing down immediately. In other cases, the business was not insured for this nature of damage. The majority of accommodation establishments were evacuated within a few hours of the commencement of the flood, and no guests could arrive during the flood, resulting in a loss of income during the period of the flood.

Medium-term costs

The predominant source of medium-term costs in the weeks and months following the flood were incurred through loss of business during the period of reconstruction of both private and municipal infrastructure. Where possible, individual guesthouses performed repairs in order to facilitate the re-opening of at least a few rooms and re-establish the key administrative activities. However, where municipal damage was severe enough to block off roads and bridges, access to the guesthouses was prevented, resulting in complete loss of income until these were repaired. Further prolonged municipal issues resulted in the interruption in water supply for the month following the flood. Whilst some water was brought into the region by tankers, this was barely sufficient for the local population, resulting in a further need to close down accommodation establishments and subsequent loss of income. The loss of business to the respondents has been calculated at R4 million (US$250 000, 09/02/2016), but this is likely a large underestimate due to the low response rate from the total of 178 establishments. A few estimates were provided by the respondents of costs incurred through having to stay elsewhere during the repairs of infrastructure, and heightened costs in obtaining food and freshwater in the region whilst municipal repairs were underway. For one respondent these costs of food and accommodation for himself, his family and all retained permanent staff during the 6-month period of re-building was estimated at R1 700 000 (US$100 000, 9 February 2016). Notably, in the majority of cases the short-term costs exceeded the medium-term costs, but the short-term damages were more extensively covered by insurance.

One of the respondents who manages a four star resort in the region summarised these medium-term costs as follows: "*We had no electricity for four days and also no water for more than two weeks and lack of water usage for more than three weeks. This meant no swimming pool facilities. No guest will stay in such conditions.*" A second respondent related that they had to close down their lodge for a period of 6 weeks, and despite their income protection insurance, lost R10 000per day (US $617, 9 February 2016) directly as a result of lack of occupation of rooms by visitors which amounts to R420 000 (US$25 910, 9 February 2016). Further costs incurred by that establishment as a direct result of the flood included repairs to all vehicles, generators, geysers, fridges and air conditioners, structural damage to the building infrastructure.

Additional medium-term costs included those incurred through the need to clean up the area following the floods. Due to the rapid movement of flood water, a large amount of debris – both natural and artificial – was deposited throughout the region. Furthermore, in the aftermath of the flood, respondents reported a large number of water bottles being dumped in the region. Not only was the clean-up of these

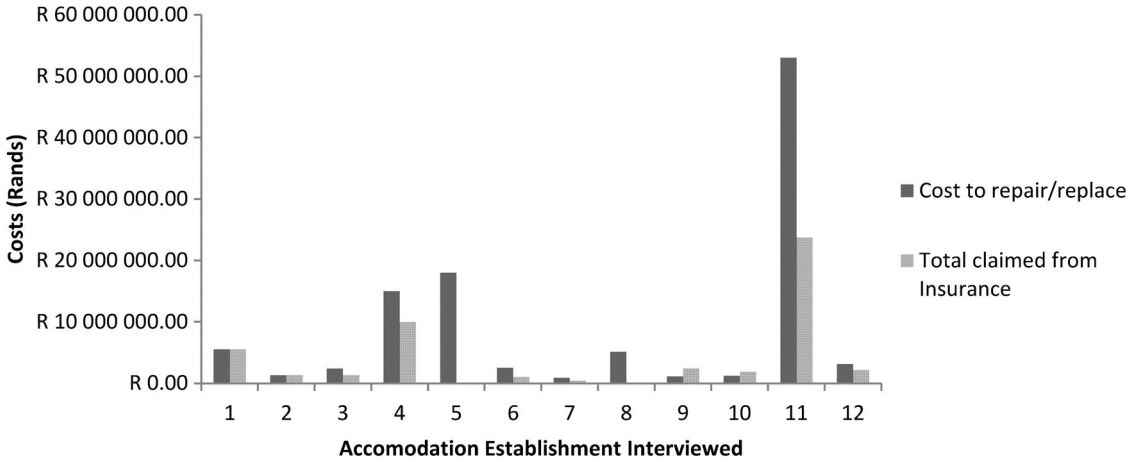

Figure 2. Discrepancy between values of the total costs incurred and insurance claims for the 12 establishments that lodged insurance claims.

dumped items necessary from a health perspective, but the tourism sector relies heavily on the aesthetics of a region to attract tourists, and thus this was of high priority. Respondents either hired workers to perform these clean-up operations, which incurred costs of wages, or undertook the work themselves, in which case they lost out on time in the business. One respondent indicated that additional costs were incurred through additional waste and building rubble removal.

Long-term costs

In some cases, the damages to private infrastructure were so severe that the accommodation establishment was shut down for more than a month, with loss of earnings in these cases classified as long-term costs. The majority of long-term costs incurred by the tourism sector, however, derived from changes in insurance premiums. These occurred for two reasons. First, in response to the flood, the 1:50 and 1:100 year flood lines were re-defined. Properties situated within these boundaries needed to move. Those outside, but within close proximity, of these boundaries incurred a large increase in insurance premium due to the increase in flood risk probability. For some of the establishments, insurance claims required the owners to contract a flood engineer to re-establish the 1:100 flood lines at their own cost, estimated at R20 000 (US $1234, 9 February 2016).

Second, all establishments that needed to claim from insurance incurred a higher premium due to their personal change in risk profile. These are classified as 'costs of increased expenses' in Table 1. However, at the time at which interviews were conducted, 10 respondents had been made aware that their insurance premiums were being recalculated, yet only two had yet received a fixed estimate. The traumatic nature of the flood event meant very few tourists who were there during the event would return to the region on a subsequent holiday, whilst the negative media coverage acted as a deterrent for future tourists. This decreased the booking rate, resulting in long-term lack of income. This however is difficult to quantify financially, and most tourism accommodation establishments communicated the sentiments of their visitors, and a broad decrease in booking rates rather than specific numbers.

Preparedness, adaptation and future strategies

The 2012 floods highlighted the reliance of individual tourism accommodation establishments on government to ensure sufficient infrastructure to prevent the flooding of towns, and on insurance to compensate for any damages which are incurred. The large area flooded, the considerable damages to the agricultural and tourism sectors, and the lack of access due to damages to roads and bridges appears to have made respondents aware of the need to have more proactive adaptation measures at the individual level, rather than relying on municipal infrastructure to be sufficiently robust. The shortfall between the total expenses incurred, and those covered by insurance, and the increase in premiums which resulted from placing claims, further emphasised the need for preventative rather than responsive adaptation measures.

Many of the infrastructural adaptations made at individual accommodation establishments were undertaken during the re-building process. The reasons were twofold. First, costs were already incurred in re-building this infrastructure, and thus adaptation measures would largely be absorbed into these costs. Second, as these buildings were damaged in the 2012 floods they were perceived to be at higher risk for future floods, whereas those which were not damaged were believed to be more robust. Adaptation measures included building thicker walls, re-arranging the layout of outdoor facilities to reduce flood risk, and improving the structural integrity of their accommodation infrastructure (Table 2). To prevent flooding of the property itself, lodges situated adjacent to the rivers have placed sandbags along their section, and across the property boundaries. However, few establishments on the edge of river channels have chosen to relocate their buildings at a safer distance from rivers. Furthermore, reconstruction of burst dams is planned or underway, despite the apparent risk of dam bursts on establishments downstream.

For other establishments, adaptation was focused more on better ensuring the safety of the staff and visitors. This included developing improved evacuation procedures, and marking out clear evacuation routes (Table 2). Further adaptation in this regard included accommodation establishments acquiring diesel generators and batteries which they intend to keep charged at all times, and installing a back-up borehole to prevent future water shortages should the municipal infrastructure fail (Table 2). A respondent from an accommodation establishment in the Blyde River area remarked that many of the accommodation establishments joined the local organisation 'FarmWatch', which was previously only subscribed to by the agricultural sector, as this company consistently provided the most efficient and effective relief and support during the flood event itself. Those farms which were registered with FarmWatch received the first emergency warnings and were best able to evacuate and prevent damages (Aurecon, 2012). Following the flood, FarmWatch initiatives included building temporary roads, and liaising with transport and emergency personnel to ensure the safe evacuation of persons trapped by the flood (Aurecon, 2012).

This is not to shift responsibility from the local and municipal government in ensuring improved disaster management strategies and the development of improved long-term adaptation measures. In particular, respondents indicate that these need to include the improvement of roads and bridges in the region to ensure that they are able to withstand high

Table 2. Adaptation measures adopted by the accommodation establishments following the floods.

Adaptation measure	Number of respondents
Construction of thicker building walls	3
Re-arrangement of lodge facilities	2
Improving structural integrity of buildings	4
Installing sandbags on riverbeds	6
Build higher bridges on property	1
Placing sandbags along property boundaries	3
Improved retaining walls	2
Diversion of storm water	1
Relocation of buildings within property	3
Improved evacuation procedures	7
Acquiring diesel generators	6
Back-up supply of diesel for generators	8
Installing boreholes	2
Moved to a different property	2

volumes of water, disaster strategies to ensure that the provision of fresh water and electricity is maintained throughout a flood event, and measures to increase the speed at which damaged infrastructure is rebuilt. Additionally, respondents indicate that they require improved communication from local government. This includes during the period leading up to the flood event, presenting residents and business owners with accurate risk warnings; during the flood to communicate the safest evacuation routes and procedures; and following the flood to ensure that all residents and businesses have equal and well informed access to their basic rights. During a site visit in November 2015 it became evident that there were still lingering damages from the 2012 floods as certain bridges and roads still showed signs of damage.

DISCUSSION

The primary findings of this study indicate that both the tourism sector and local government were insufficiently prepared for the 2012 floods resulting from the landfall of Tropical Storm Dando. Access to the tourism accommodation establishments in the region was prevented both during and after the flood event due to the destruction of key arterial roads and bridges, and the length of time it took for local government to repair these municipal structures. Freshwater supply was also interrupted in the region for a period of three weeks following the flood event. At the scale of individual accommodation establishments, the costs incurred both directly and indirectly exceeded their own expectations, insurance pay-outs and government sourced reports. The nature of insurance cover, and the resultant insurance pay-out value, was a key determinant of the continued financial and business viability of the tourism accommodation establishments.

The damage incurred due to the 2012 floods indicated the inaccuracy of the flood risks determined from the 1:100 flood line, as tourism accommodation establishments located both within and outside of this region were badly affected. Furthermore, they highlighted the heightened damage caused by severe storms in which the majority of rain falls within a short time period. The frequency of such storms in the Limpopo Province is projected to increase under continued climate change (Fitchett & Grab, 2014; Chikoore *et al*., 2015). The capacity to survive an increase in storms relies predominantly on the capacity of individual tourism accommodation establishments to implement infrastructural adaptation measures to incur less damage during the floods, and on the local government to ensure that municipal infrastructure remains functional throughout these events (Pielke, 2007; Conway, 2008; Ziervogel *et al.*, 2014). The most obvious and effective adaptation measure is to move lodges further away from river banks. Ironically, this is the one measure that has not been implemented, due to the aesthetic appeal of accommodation that overlooks rivers, and of shading provided by tall trees, which are typically only found alongside rivers in the ecosystems of the region. However, the redefining of the 1:100 year flood line prevents a deterrent to this through both the building regulations and the increase in insurance premiums.

Tourism has a heightened vulnerability to natural disasters such as floods as the success of their business relies on their ability to attract tourists (Rogerson, 2016). This requires structurally robust buildings and facilities on their property, good aesthetics of the region and property, and good perceptions among tourists of their safety (Faulkner & Vikulov, 2001; Fernandes, 2016). Floods compromise all three of these factors, with impacts that considerably outlast the duration of the flood event. Accommodation establishments and the broader tourism sector of the region are further affected by broader scale infrastructural damage, particularly when the government is not able to repair damages efficiently and effectively (Hoogendoorn *et al*., 2016). The destruction of roads and bridges prevents access of tourists to the accommodation establishments, directly resulting in loss of business, whilst continued roadworks may discourage tourists from visiting a particular area or put them in danger when they do take the risk to visit (Fitchett *et al*., 2016b). The tourism sector is detrimented in that there is no direct government compensation for losses from natural hazards. The agricultural sector received considerable support from the local government following the floods, due to the national importance of ensuring short- and long-term food security and in the protection of jobs (Nhemachena & Hassan, 2007). However, such mechanisms do not exist for the tourism sector, despite the important role of tourism in the economic growth of the country and the Mopani region (Rogerson, 2016). However, despite the disastrous impact of the floods in this region, the tourism sector and its different constituents do have the adaptive capacity to recover economically after flooding. The tourism sector in this region is well established, and has the financial assets to be resilient against flooding and natural disasters; however under scenarios of climate change and repeated occurrences of flooding, the resilient capacity of the tourism sector will decline systematically and could ultimately collapse (Myer *et al.*, 2013). Many of the gateway communities in the region, often in former homeland areas like Acornhoek and Bushbuckridge in the Mpumalanga Province, are also reliant on the employment opportunities in the region, and so these previously disadvantaged communities could also suffer the brunt of continued decline in the tourism sector (Saayman & Saayman, 2006; Spenceley, 2006; Spenceley & Goodwin, 2007; Myer *et al*., 2013). This is over and above the lack of resilience in term of personal infrastructure in these localities.

The findings of this study regarding the costs of the storm damage to the tourism sector, the lack of sufficient preparedness of the sector, and the insufficient financial pay-outs from private insurance and government are of concern given the increased storm threats under climate change (Pielke, 2007). The flood event in question resulted from the landfall of a tropical storm which originated in the South Indian Ocean (Chikoore *et al.*, 2015). Long-term modelling of storm landfall records in Madagascar (Nash *et al.*, 2014) and storm track records from ships, aircraft and satellite images for the south west Indian Ocean (Fitchett & Grab, 2014) indicate that whilst the frequency of these storms has not yet been detected to have increased, there is a notable southwards shift in their trajectory, with a greater proportion making landfall in southern Mozambique and South Africa due to the increase in sea surface temperatures. This directly results in an increased flood risk for the eastern and central region of the Limpopo and Mpumalanga Provinces of South Africa (Fitchett & Grab, 2014). The 2012 floods therefore provide a valuable indicator for the nature and extent of damage likely to be experienced (Chikoore *et al.*, 2015), but moreover the current shortfalls in adaptation strategies from government and the individual tourism accommodation establishments. Improved adaptation to tropical storm induced floods can therefore be modelled on this event, to ensure sufficient and

effective measures are implemented (Pielke, 2007; Conway, 2008).

Of concern to the tourism sector is the role of insurance (Lian-wei, 2003; Becken & Hay, 2007). Whilst the majority of the tourism accommodation establishments had comprehensive insurance for both their infrastructure and their businesses, none of the respondents were paid out in full for their damages. Furthermore, all of the respondents incurred increases in insurance premiums. For all respondents an increase in premiums was incurred due to the re-modelled flood risk for the region, whilst for those who had claimed for their infrastructural damages, a further increase in premiums was charged due to their heightened risk profile. For two respondents, the insurance pay-out was so low that they went out of business, unable to cover the costs of repair. Under climate change projections of more frequent landfall of tropical storms and tropical cyclones in southern Mozambique and northern-eastern South Africa (Fitchett & Grab, 2014; Nash *et al.*, 2014; Chikoore *et al.*, 2015), these insurance premiums are likely to continue to increase, and could potentially become unaffordable (Macdonald *et al.*, 1990; White & Etkin, 1997; Botzen & Van Den Bergh, 2008). Insurance therefore cannot form the primary adaptation measure of tourism accommodation establishments and the tourism sector as a whole to climate change threats. Rather, improved infrastructural adaptation on an individual scale is necessary, combined with an increased pressure on the local government to implement improved adaptation of the municipal infrastructure (Mukheibir & Ziervogel, 2007).

CONCLUSION AND OUTLOOK

This study presents the first quantitative analysis of the impacts of flooding on tourism in South Africa. Research into the impacts of climate change on tourism has developed over recent years, but is concentrated in the Global North. This study highlights the considerable damage, both physically and economically, which a single flood event can cause to the tourism sector of a South African Province. Notably, this study highlights the reliance of individual tourism operators on their insurance providers, and the inadequacy of this as a risk-management strategy. Furthermore, the study highlights the often hidden costs of lack of business incurred while both municipal and individual repairs to infrastructure are in progress. It is argued that to improve the adaptive capacity of a region to climate change, an understanding of the nature of the threat is essential. This case study, while limited to a relatively small geographic region, highlights the nature and extent of flood damages to tourism accommodation establishments, and their capacity to recover. Therefore, not only does this case study begin to address a notable gap in the climate change–tourism literature for southern Africa, but provides valuable information for disaster risk managers.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the efforts of L.L. Bennet, who assisted in the data collection for this study. The Centre of Excellence for Palaeoscience is acknowledged for funding Jennifer Fitchett.

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