

# Lessons from Catastrophe: Risk Management in Oral Societies

## Les leçons de la catastrophe : la gestion du risque dans les sociétés de culture orale

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### Abstract

Knowledge about periodic catastrophe in oral societies, representing a form of risk management, was accumulated and communicated for sometimes thousands of years.

Three thematic examples are discussed. First, the use of 'storytelling' in oral societies was largely for pragmatic reasons ; only in literate contexts has storytelling become culture-defining and a form of entertainment. In oral societies, storytelling was supplemented by art and performance to ensure that practical information about risk history was comprehensively communicated across generations. Second, many oral societies occupying regions with geographically-bounded risks (like active volcanoes or exposed coasts) developed place-avoidance protocols that kept people away from dangerous areas – an effective form of risk management. Third, growing evidence suggests that many oral societies developed ways of recognizing precursors of disaster (especially earthquakes and volcanic eruptions) that allowed people to remove themselves from danger zones before catastrophe occurred.

Both modern (literate) and oral societies had comprehensive systems of risk planning and management that enable them to survive periodic catastrophe. Understanding and combining approaches is helpful to future risk management.

KEYWORDS: ORALITY, LITERACY, RISK MANAGEMENT, PLACE AVOIDANCE, PRECURSORS, STORYTELLING

### Résumé

Dans des sociétés de culture orale des connaissances sur des catastrophes périodiques, qui représentent des formes spécifiques de gestion du risque, ont été accumulées et transmises parfois pendant des millénaires.

Dans cet article seront développées les trois thématiques suivantes. 1) Dans les sociétés de culture orale les récits « légendaires » ont principalement une raison d'être pragmatique ; seulement dans les sociétés lettrées les récits représentent une forme d'expression caractéristique d'une culture et associée au divertissement. Dans les sociétés de culture orale, les récits étaient associés à des représentations figurées et à des performances sous la forme de danses ou de chants, afin de garantir que les informations pratiques des histoires au sujet du risque encouru puissent être transmises de façon adéquate. 2) Beaucoup de sociétés de culture orale établies dans des régions géographiques à risque (aires volcaniques, zones côtières fragiles...) ont développé des stratégies d'évitement qui maintiennent les habitants éloignés des zones dangereuses, ce qui représente une forme de gestion du risque bien réelle. 3) De plus en plus des données suggèrent que beaucoup de sociétés de culture orale ont développé des formes de reconnaissance des signes précurseurs d'un désastre (tout particulièrement les tremblements de terre et les éruptions volcaniques) qui ont permis aux populations concernées de quitter les zones menacées avant que la catastrophe ne se produise.

Tant les sociétés modernes de culture écrite que les sociétés de culture orale ont élaboré des systèmes exhaustifs de préparation et gestion du risque qui leur permettent de survivre à des catastrophes périodiques. Comprendre et combiner ces différentes approches est de la plus grande utilité pour la gestion des risques futurs.

MOTS CLÉS : ORALITÉ, CULTURE ÉCRITE, GESTION DU RISQUE, ÉVITEMENT D'UN LIEU, PRÉCURSEURS, RÉCIT.

## Introduction

Scientific understanding of the ways in which oral (pre-literate) societies acquired, stored and communicated knowledge appears incomplete. This suggestion has been reinforced recently by several studies demonstrating that comprehensive time-deep bodies of knowledge existed in oral societies and helped them endure for often tens of thousands of years.<sup>1</sup>

Literate people often have difficulties in objectively comparing the functionalities of literate and pre-literate societies.<sup>2</sup> A good example concerns risk management. In modern technological societies, extraneous risk is managed by authorities/governments on behalf of everyone. While risk management involves global/transboundary risks (like pandemics and global warming), risk profiles are generally specific to particular countries/regions. Thus, tsunami risk is higher in Japan than many other places because of the presence of numerous active tsunamigenic sources off its islands' coasts. Risk arising from volcanic activity is higher in southern Italy than many other parts of the Mediterranean because of the relative abundance of active volcanoes.

Risk management strategies in such modern societies are typically underpinned by long-term datasets that identify incidences/magnitudes of particular types of risk, together with an understanding of their precursors and their commonest impacts, from which optimal risk-minimization strategies are developed and disseminated. These responses generally depend on the ability of populations to read and write, so that they can be instructed in risk management and response.<sup>3</sup> Until quite recently, little has been understood about risk management in oral societies. Often it is implicitly assumed that oral societies had little or no long-term site-specific understanding of risk and that their survival was consequently a result of luck rather than design. Yet it has now become increasingly clear that many oral societies were as risk-aware as those of today.<sup>4</sup> The delay in acknowledging this is largely because of the difficulties literate people have in interrogating pre-literate knowledge systems, specifically our ability to see past the medium of communication (often dismissed as 'myth' or 'legend') and recognize its pragmatic foundations.<sup>5</sup>

To illustrate these points, this study looks at catastrophe – extreme events over the occurrence of which people have no control – and the ways in which oral societies processed and communicated their understanding of this. Using several examples, it is argued that oral

societies had not only a sophisticated understanding of many types of catastrophe but also time-tested ways of both recognizing its onset and managing associated risks. This is not a romanticization of the past. Many such societal understandings were wrong and sometimes increased (not decreased) a population's exposure, something that happens still,<sup>6</sup> but their intent was clear.

*Section 2* discusses how knowledge about catastrophe was retained and communicated in oral societies. *Section 3* uses several examples to explain how 'storytelling' was used as an effective tool for communicating risk. *Section 4* focuses on the understudied topic of place avoidance, one of the simplest and most effective risk management strategies. *Section 5* looks specifically at precursor recognition in oral societies while *Section 6* discusses what lessons today's literate societies might learn from all this.

## Knowledge processing in oral societies

As is the case with literate societies, the goal of oral (pre-literate) societies was to endure. The *raison d'être* of their oral traditions was to achieve this. To optimize the chances of each new generation surviving, all the knowledge that had been accumulated by a particular group of people was transferred orally – as completely as possible – to their successors.<sup>7</sup> To make particular pieces of information more memorable (and therefore more likely to be communicated again), it was commonly exaggerated, sometimes mythologized to involve the activities of superhuman beings.<sup>8</sup> Many scientists have celebrated particular instances of compendious knowledge retention in oral societies<sup>9</sup> without always acknowledging that the (intergenerational) communication of knowledge was not simply through storytelling (verbal communication). It is now clear that oral societies also used a variety of mnemonic devices, some material, some mental, to organize and retain information.<sup>10</sup> Other cultural expressions served a similar purpose, ranging from song and dance, poetry and performance<sup>11</sup> through to stone arrangements, rock art and sand drawing.<sup>12</sup> While today, observers generally regard these expressions as aesthetic – which in many cases they have become – they were not traditionally so. All functioned as *aides mémoires* (memory aids) intended to store and communicate knowledge, even to prompt recollection of particular details.

<sup>6</sup> Antwi-Agyei *et al.* 2018; Müller *et al.* 2017; Nunn *et al.* 2021.

<sup>7</sup> Kelly 2015; Sugiyama 2021.

<sup>8</sup> Barber and Barber 2004; Nordvig 2021.

<sup>9</sup> Sugiyama *et al.* 2020; Zurita-Benavides *et al.* 2016.

<sup>10</sup> Kelly 2016; Schneider 2002.

<sup>11</sup> Blackwell 2015; Carey 2001; Reichl 2021.

<sup>12</sup> Alivizatou 2012; Brady 2010; Nyland and Steberggløkken 2020.



Figure 1. Nabukelevu Volcano, western end of Kadavu Island, Fiji (Southwest Pacific). [photo by L.Lancini]

Especially within the last few years, it has become clear that knowledge can be retained and communicated within oral contexts for thousands of years, far longer than has been generally accepted. For example, in Australia there are currently 26 groups of Indigenous (Aboriginal) stories of submergence and coastal-land loss that must have survived orally for more than 7000 years.<sup>13</sup> There are memories of volcanic eruptions in Australia and elsewhere that are of comparable antiquity.<sup>14</sup>

For these oral traditions to be sustained in recognizable form over several millennia, storytelling (and its complements) must have had a high degree of replication fidelity, something that was achieved in most oral contexts by rigid rules governing the nature of intergenerational knowledge transfer.<sup>15</sup> It has been realized in several contrasting contexts that modern risk management can be effectively informed by incorporating 'traditional knowledge' that accumulated in oral contexts.<sup>16</sup>

## Risk management through storytelling

One of the most conspicuous methods of intergenerational knowledge transfer in oral societies, which has endured into the era of literacy, is storytelling. The function of storytelling has changed from a largely pragmatic one in oral societies to one that is today concerned with sustaining cultural identity and entertainment in literate contexts.<sup>17</sup> To illustrate the former situation – and to exemplify the role of pre-literate storytelling in risk management – four case studies are described.

Recent research (awaiting publication) in the Kadavu Island group (Fiji, Southwest Pacific) focused on gathering oral narratives about an eruption about 2500 years ago (800-350 BC) of Nabukelevu, an active volcano at the western extremity of the main island (Figure 1). Most stories include narrative details that recall landscape changes associated with volcanism, including volcano upgrowth, tephra falls and island creation, landsliding, earthquakes and tsunamis. The breadth of narrative detail suggests that a comprehensive recollection of this event was encoded into contemporary oral traditions so that future generations would know what might occur during a subsequent eruption – a form of communal risk management. Yet as time went on without a similar event recurring, these traditions became fragmented and localized, so that today no one group of Kadavu residents knows all the details. The stories also became didactic, explaining subsequent tribal divisions and a whole range of landscape features.<sup>18</sup>

When literate people first reached the area around Crater Lake (Oregon, USA), they transcribed stories told them by Klamath Indians that involved a battle between two gods that had resulted in the terminal eruption and collapse of Mt Mazama and the creation of Crater Lake, an event known to have occurred about 7600 years ago.<sup>19</sup> Details of these stories were supplemented by conspicuous place avoidance (see next section) and involved details about the pre-eruption landscape, the nature of the eruption and its effects on people, and their interpretation of why these events took place and how the area remained a threat. This can also be seen as risk management, in this case sustained for almost eight millennia.<sup>20</sup>

<sup>1</sup> Blackwell 2015; Carey 2001; Mahuika 2019; Nunn 2018.

<sup>2</sup> Ong 1982.

<sup>3</sup> Gephart *et al.* 2019.

<sup>4</sup> Cronin and Cashman 2008; Minc 1986.

<sup>5</sup> Kelly 2015; Mahuika 2019; Nunn 2021b.

<sup>13</sup> Nunn and Reid 2016.

<sup>14</sup> Nunn 2018; Nunn *et al.* 2019; Wilkie *et al.* 2020.

<sup>15</sup> Kelly 2015; Sugiyama *et al.* 2020.

<sup>16</sup> Bardsley *et al.* 2019; Cashman and Cronin 2008.

<sup>17</sup> Ong 1982.

<sup>18</sup> Cronin, Ferland *et al.* 2004; Nunn 1999, 2018.

<sup>19</sup> Egan *et al.* 2015.

<sup>20</sup> Deur 2002; Most 2006.



Figure 2. Samothrace Island, Aegean Sea, Greece [photo by Marsyas].

#### Risk management through storytelling in Antiquity

The identification of oral traditions in Antiquity is complicated by the fact that these were already written down a very long time prior (6th century BC at the latest), and that they have undergone modification over the centuries at the hands of the various authors who have transmitted them to us. This phenomenon is accentuated by the cultural influences on the Greek myths from other civilizations, in particular the Near Eastern ones. One famous example is the myth of the “universal” flood, with Deucalion and Pyrrha as protagonists, which has been mentioned by Greek authors since the 6th century BC.<sup>21</sup> Yet, unlike the “canonical” version of the flood of Deucalion and Pyrrha caused by rain (like the Near Eastern traditions of the Noah-type flood), in many places the flood of the Greeks is very often a marine flood, referred to as *kataklysmos*, a term also used to designate tsunamis. This is the case for certain islands in the Aegean Sea, such as Rhodes or Samothrace, located in areas where there is indeed seismic activity likely to produce periodic flooding of coastal areas by a tsunami (Figure 2). According to local traditions related by Diodorus of Sicily (1st century BC), in a mythical past a great flood (*kataklysmos*) resulted in the submersion of all the low-lying coastal areas of these islands.<sup>22</sup> Many of their inhabitants disappeared, excepting some who, surrounded by the waters, had quickly taken refuge in the highest places.<sup>23</sup> In Samothrace, landmarks marking the limits of the inundation and sacrificial altars had kept alive the

<sup>21</sup> Caduff 1986. The most complete version of the myth that has come down to us dates back to Roman times (1st-3rd century AD): Apollod. 1. 7. 2. Ov., *Met.* 1. 253-347.

<sup>22</sup> These stories may have originated about 7600 years ago when abrupt ice-sheet collapse in North America resulted in a rapid and permanent 5m inundation (not short-lived flooding) of coastlines in the eastern Mediterranean (Nunn 2021b: 104).

<sup>23</sup> D.S. 5. 56; D.S. 5. 47, 2-5. Compatangelo-Soussignan 2020.

memory of the disaster.<sup>24</sup> It is possible that Plato drew on these different local traditions of the Greek world, when in the *Laws* (3. 677a-b), he wrote about the floods that had destroyed on several occasions the population of the earth, affirming that the only survivors had been the shepherds, since they lived in the mountains. Interestingly, the reaction of the inhabitants who rush to the highest parts of the Greek islands, suggests that the function of the myth was precisely that of inducing an adaptive response to the risks of flooding, in particular those of seismic origin. This interpretation is confirmed by analogy with more recent traditions of other countries prone to the risk of tsunamis. In fact, more recently, during the tsunami of December 2004 in the Indian Ocean, people of Andaman Islands, the Moken of Thailand and the inhabitants of the Indonesian island of Simeulue, saved themselves thanks to similar oral traditions<sup>25</sup> that warned people: ‘If you find the seawater receding, you have to go to the hill because something bad will come from the sea’.<sup>26</sup>

<sup>24</sup> D.S. 5. 47, 2-5: And the Samothracians have a story that, before the floods which befell other peoples, a great one took place among them... The inhabitants who had been caught by the flood, the account continues, ran up to the higher regions of the island; and when the sea kept rising higher and higher, they prayed to the native gods, and since their lives were spared, to commemorate their rescue they set up boundary stones about the entire circuit of the island and dedicated altars upon which they offer sacrifices even to the present day (trans. by Oldfather 1939).

<sup>25</sup> Arunotai 2008; Bhaumik 2005; Rahman, Sakurai and Munadi, 2018; Sutton *et al.* 2020. Cf. also Atwater *et al.* 2015: 47, who mention a traditional account, first published in a Japanese elementary schoolbook in 1937, staging a heroic village chief who burns his own rice crop on the summit to attract ignorant villagers lingering dangerously on the beach, thus saving them from the destructive wave of a tsunami. The story seems inspired by an episode that would have occurred in 1854 in the village of Hiro.

<sup>26</sup> Rahman, Sakurai and Munadi 2018: 19. See also Walshe and Nunn 2013; McAdoo *et al.* 2006.



Figure 3. Lake Albano, Lazio, central Italy [photo by L.Lancini].

In Antiquity, examples of ancient “adaptive” myths also concern volcanic phenomena: this is the case of Lake Albano, near Rome in Lazio (Figure 3). Several authors from Antiquity<sup>27</sup> report a prodigious flooding of Lake Albano that occurred in 398 BC during the war between Rome and Veii, after which a delegation was sent to Delphi. An Etruscan diviner was also consulted. What allowed the waters to recede and permitted a return to normal by appeasing the anger of the gods, was the decision to build a channel to direct the flow of the waters. This legend has long been considered merely the story of an unrelated marvel. Yet the prodigious flooding is likely to be a real event: a water overflow causing heavy mudslides called lahars. This phenomenon is triggered by the presence in the lake of carbon dioxide of volcanic origin. Indeed, Lake Albano is a maar and forms part of an extinct volcanic complex where intense degassing is still occurring today. The two elements of the legend, the flood and the canal, can therefore be integrated in the setting of the geology of the place and the history of the recent volcanism of the Colli Albani: as pointed out by the geologists studying Lake Albano, the canal, which was put back into operation in the 4th century, then became an exceptional tool for managing volcanic risk.<sup>28</sup> We have proof that the more recent manifestations of volcanism in this area took place at a time when the shores of the lake were inhabited. In fact, recent archaeological and geological data inform us that the formation of lahars is a more recent phenomenon than was originally believed, namely until at least 5800 BP, and in Roman time as well, these catastrophic phenomena affected the territory of Ciampino.<sup>29</sup> Stories about these dangers may have been preserved for a long time in the local memory and reached the ears of the Romans who were quick to act on them, given the symbolic importance that the Colli Albani had in the myth of the origins of Rome. Another element supports the hypothesis that the Romans were aware of the

<sup>27</sup> Liv. 5. 15-17. V. Max. 1. 6. 3. D.H. 12. 10-12. Plu., *Cam.* 3-4. Cic., *Div.* 1. 100; 2. 69.

<sup>28</sup> Funicello, Giordano and De Rita 2003; Funicello and Giordano 2010; Nunn *et al.* 2019.

<sup>29</sup> Giordano, De Benedetti and Fischetti 2020.

volcanic nature of the place is that on Mount Albano, at the sanctuary of Jupiter *Latiaris*, it was customary to offer bronze fish.<sup>30</sup> We also know that in Rome, on the day of the *Volcanalia*, August 23, Vulcan was offered animals, which were thrown into the fire, probably fish.<sup>31</sup> Why then sacrifice fish to a god of the fire and do the same for Jupiter, but in a quiescent volcano? A plausible hypothesis is that while the Romans may not have been aware that fire was present on Mount Albano, it is likely they were aware that the sacred Mount Albano hid the fire in its bowels, under the water of the lake. And so the sacrifice of fish, common to both deities, can be explained as a way for the communities of the region to appease the anger of the god, and therefore to hope to protect themselves against other possible catastrophes.

#### Traditions of place avoidance

In many pre-literate societies, it is likely that places known to have once been unusually dangerous were subject to place avoidance protocols, a form of risk management intended to keep people safe within a particular region, even long after memories of specific catastrophic events had subsided. As discussed in the last section, Klamath memories of a volcanic cataclysm remained extant orally for 7600 years or so, but were also converted into practical knowledge through place avoidance. The apparently strange attitude of the Klamath Indian people towards Crater Lake was increasingly commented on after the first Europeans settled this area. In 1886, a survey group recruited two Klamath guides ‘neither of whom had dared travel to Crater Lake before’. Another 19th-century surveyor noted that the Klamath people he hired refused to look at the lake at any time during the survey, instead ‘making all sorts of mysterious signs and staring

<sup>30</sup> Fest. 230 L: *PISCATORIUM AES*. An ancient custom was to call ‘fish coin’ the objects that were thrown in the Mt. Albano instead of fishes (trans. by L. Lancini).

<sup>31</sup> Braconi 2016. Var., L. 6. 20: The *Volcanalia* ‘Festival of Vulcan,’ from Vulcan, because then was his festival and because on that day the people, acting for themselves, drive their animals over a fire (trans. by R.G. Kent 1938).

directly at the ground’ – evidence for place avoidance.<sup>32</sup> Two further examples are given below.

The anglicized word taboo comes from a pan-Pacific word (*tapu* or *tabu*) meaning ‘forbidden’, introduced to the English lexicon in 1777 by James Cook after his visit to the islands of Tonga. Pacific people had many ‘forbidden’ places, some designated as such after particularly dangerous events. One of these is Mt Taranaki, an active volcano on the North Island of New Zealand, for which ‘the designation of the upper slopes as a sacred area (*wāhi tapu*), perhaps after initially being declared out of bounds (*rāhui*), was a deliberate societal response to reduce the impacts of future eruptions’.<sup>33</sup>

A more contemporary Pacific Islands example refers to recent changes in settlement pattern. Before the arrival of Europeans in the region and the rapid conversion of most of its peoples to Christianity, Pacific Island peoples did not usually occupy coastal areas, as most do today. Instead they lived a little inland, often significantly above the shoreline, because they had learned that the edge of the land was a dangerous place with little shelter available when disasters approached, especially those involving strong winds and extreme waves.<sup>34</sup> Missionaries and colonial officials were particularly influential in changing this tradition, requiring Pacific peoples to come together in new settlements along the coastal fringe. In several instances, this proved disastrous.

One example is that of Aitape (Papua New Guinea) where many Christian converts shifted in the late 19th century to villages along a sand spit that were largely destroyed by tsunamis in 1907 and 1998.<sup>35</sup> In hindsight, these were the worst locations within this tsunami-prone region for people to live, something their ancestors understood (which is why they avoided living there) but not something the foreign missionaries knew about.<sup>36</sup>

A second example comes from Tegua Island (northern Vanuatu) where people all lived inland before 19th-century colonization when they were moved to the coast, exposed to tsunamis and a range of threats attributable to climate change. At Lataw Village, sea level rose 150 mm in the period 1997-2009, leading to the inland relocation of the village. Unfortunately this remains too low to be beyond the reach of tsunamis, leading some commentators to bemoan the lack of consultation with residents who know where the safest places are.<sup>37</sup>

A similar situation was documented more recently on Ono Island in southern Fiji where many coastal-edge

settlements are being relocated inland and upslope – or are planning this.<sup>38</sup> In 2019, a local resident explained My grandfather told me that his grandfather was forever saying it was a mistake for our people to leave the hills and move to the coast. In the hills we were safe from the waves, our land was not being eaten from under us like it is today. But we had no choice – foreigners came along and forced us all to move to the water’s edge. The old ones, they knew it was dangerous and they told us not to go. But we did, here we are and *dina saraga* – too true – we now discover it is a dangerous place! We need to listen to the past.<sup>39</sup>

### Recognizing and responding to precursors of catastrophe

Within the past two decades, research interest in traditional (culturally-grounded) precursors of disaster has grown.<sup>40</sup> Such research is predicated on the idea that people in the (pre-globalized) past would have developed a range of understanding of potentially catastrophic phenomena to help them identify their onset and thereby take appropriate action to avoid their impacts. Indeed it seems quite implausible to suppose that in pre-literate cultures, tied to the same land for thousands of generations, would not have developed an understanding of the precursors to periodic catastrophe. Three examples are given below, one to do with volcanoes, two to do with earthquakes. The volcanic island of Savo (Solomon Islands) erupts every 100-200 years but is also well populated, largely owing to its fertile soils and abundant freshwater which underwrite successful subsistence agriculture.<sup>41</sup> Numerous customary (*kastom*) stories, passed on orally for more than a thousand years, exist among the people of Savo that warn them of imminent eruption. These include increased hydrothermal activity, vegetation die-off, and water accumulation in the volcano crater as well as the shrinking of the island as the loose volcanic sediments deposited along the coast during the last eruption are cut back to the foot of the volcano – ‘a unique empirical chronometer for eruption recurrence’.<sup>42</sup>

With regard to traditional (culturally-grounded) earthquake precursors, there are numerous animal ones of which some appear plausible.<sup>43</sup> In some parts of the world, there is also evidence of non-animal earthquake precursors that were part of the folklore of traditional societies. For example, in Japan an old saying goes as follows – ‘A red light that spreads like

a big fire over an usually dark area at night is a sign of a big earthquake or tsunami close to that area”<sup>44</sup> and has been interpreted as ‘earthquake light’ (EQL), now recognized by some as a preseismic phenomenon.

A more widespread earthquake precursor, grounded in cultural beliefs across Asia, is the prolonged incidence of unusually hot dry weather. A common Japanese saying is “no wind for more than ten days is the sign of an [imminent] earthquake”<sup>45</sup> and in Fiji, prolonged dryness and excessive heat were predicted to hail a 1980s earthquake, which in fact occurred. Informants rationalized the connection by explaining that the land was ‘begging for water’ and was ‘fevered’, something that could be relieved only by an earthquake.<sup>46</sup> Recent research in India, which may have influenced the Fijian tradition, shows that micro-earthquake swarms can be triggered by the onset of the monsoon.<sup>47</sup>

### Lessons for today

Today we can access only a very small part of the knowledge held in oral societies during pre-literate times, knowledge that is likely to have represented a comprehensive and time-deep system of risk management in those societies. The purpose of this system was the same as that of modern risk planning – to optimize the preparedness of a society to cope with risk, especially that with precedents.<sup>48</sup> There are two main ways in which the past can enrich contemporary understanding of risk and help its future management. Firstly, as has recently been acknowledged in diverse contexts, knowledge accumulated in oral societies can be used to improve future planning. An example from southern Italy uses precedents of Vesuvius eruption impacts, obtained from archaeology, to make future impact scenarios more realistic.<sup>49</sup> A similar model was used in Sweden to reconstruct past environmental risk and ecological uncertainty in boreal forests and the ways their inhabitants adapted to this over the past 9000 years.<sup>50</sup> A comparable approach has been taken to the future management of drought in Central America and to that of floods in the eastern Mediterranean.<sup>51</sup> Secondly, owing to its culturally-grounded nature, traditional knowledge about risk planning and management is often preferred by (non-western) people in particular places to ‘western’ science-based knowledge.<sup>52</sup> For example, it has recently been argued

that the sustained failure of secular approaches to climate-change adaptation in the Pacific Islands is explicable by the degree to which its people’s decisions are spiritually guided; the way forward is for outside agencies to engage with people’s worldviews rather than sideline them.<sup>53</sup> A similar situation explains people’s resistance to science-based volcano risk planning and management in Indonesia<sup>54</sup> and elsewhere, something that has spawned risk planning which incorporates local residents’ traditional knowledge and understandings.<sup>55</sup> Such developments represent the pathway to a sustainable future for many communities in the ‘developing’ world.<sup>56</sup>

### Conclusion

This study demonstrates that risk planning and management practices existed in pre-literate (oral) societies and can be used to help develop and drive the management of future risk. The nature of pre-literate risk management remains understudied but is important to document in order to gain a fuller appreciation of the ways in which our ancestors survived up until the advent of widespread literacy in the 20th century. Recent research suggests that oral societies were able to accumulate and transfer vast quantities of knowledge from one generation to the next, giving them the best chance of surviving an uncertain future. The same principle applies today – we should not ignore the knowledge accumulated by our pre-literate ancestors just because it is incomplete or difficult to interrogate by conventional (scientific) means. It is there to help us navigate an uncertain future.

One topic that we consider merits further research is the issue of whether or not there is a universal definition of risk, as is implicit in international statements and agreements about disaster, or whether there are many.<sup>57</sup> In support of the latter position, there are some studies which show that more risk-exposed societies had a higher tolerance of risk, even that which had the capacity to cause major damage and the loss of many lives; examples come from the islands of Vanuatu, where catastrophic earthquake-volcano events became normalized in cultural narratives than elsewhere,<sup>58</sup> and from the Lakenche-Mapuche peoples of Chile, whose experience with devastating earthquakes was rationalized in ways that aided recovery.<sup>59</sup>

<sup>32</sup> Nunn 2018.

<sup>33</sup> Lowe *et al.* 2002: 138.

<sup>34</sup> Nunn and Campbell 2020.

<sup>35</sup> Nunn 2009: 149-151.

<sup>36</sup> Fountain *et al.* 2004.

<sup>37</sup> Ballu *et al.* 2011; Siméoni and Ballu 2012.

<sup>38</sup> Atkinson-Nolte *et al.* 2021.

<sup>39</sup> After Nunn 2021b: 279.

<sup>40</sup> Cronin and Cashman 2008; Janif *et al.* 2016; Nunn 2014.

<sup>41</sup> Petterson *et al.* 2003.

<sup>42</sup> Nunn 2018: 58.

<sup>43</sup> Woith *et al.* 2018.

<sup>44</sup> Ikeya 2004: 3.

<sup>45</sup> Ikeya 2004: 8.

<sup>46</sup> Nunn 2021a: 8.

<sup>47</sup> Wadhawan *et al.* 2021.

<sup>48</sup> e.g. Schlich 2013; Serrao-Neumann *et al.* 2015.

<sup>49</sup> Martin 2020.

<sup>50</sup> Hatlestad *et al.* 2021.

<sup>51</sup> Kuil *et al.* 2019; Soroush and Mordechai 2018.

<sup>52</sup> Rai and Khawas 2019.

<sup>53</sup> Luetz and Nunn 2021.

<sup>54</sup> Donovan 2010.

<sup>55</sup> Cronin, Gaylord *et al.* 2004; McNamara *et al.* 2020; Németh and Cronin 2009.

<sup>56</sup> McMillen *et al.* 2017; Nunn and Kumar 2019.

<sup>57</sup> Kelman 2018.

<sup>58</sup> Galipaud 2002.

<sup>59</sup> Kronmuller *et al.* 2017.

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