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Disasters as Contingent Events: Volcanic Eruptions, State Advisories, and Public Participation in the Twentieth-Century Philippines

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By revisiting the eruptions of Taal in 1911, Hibok-Hibok in 1951, and Pinatubo in 1991, this article interrogates Greg Bankoff's argument that "cultures of disaster" in the Philippines produce "coping mechanisms" manifested in public apathy and the state's failure at mitigation. It argues for historical contingency as illustrated by the relative success at disaster mitigation in Pinatubo's case, despite extreme challenges. It highlights the warning system in which the Aeta who lived on Mount Pinatubo, along with volcanologists and other key actors, played crucial roles. The Aeta's nonscientific perspective was not an obstacle to understanding risks and taking defensive action.

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Published in 2003, Greg Bankoff's book, *Cultures of Disaster*, stands out as a landmark publication in disaster studies, especially in relation to the Philippines. The book contains much valuable information on the different kinds of disasters from natural hazards that the country has experienced over the centuries. Bankoff (2003, 152) makes the incisive observation that disasters, far from being simply meteorological or seismic phenomena, "are embedded in the political structures, economic systems and social orders of the societies in which they take place. Above all, they are historical events in that hazards are diachronic happenings, they occur as part of a sequence or process that determines a particular person's or people's vulnerability." Disasters are to be understood in their social and historical context. As part of this context, Bankoff argues that a highly disaster-prone country such as the Philippines has undergone "cultural adaptation" as a way of living—a "frequent life experience"—that enables people to "come to terms with hazard in such a way that disasters are not regarded as abnormal situations but as quite the reverse, as a constant feature of life" (ibid., 153, 179).

Filipinos are said to have adapted to disasters through the "normalisation of threat," which in turn has been "a significant factor influencing the development of cultures in the Philippines" (ibid., 163). These cultures contain "coping mechanisms that have evolved in order to permit communities to come to terms with the constancy of hazard and to mitigate the worst effects of disaster" (ibid.). These coping mechanisms "are visible in the historical records of architectural adaptations, agricultural practices and migration patterns and in the popular manifestations of calculated risk assessment, resignation, mysticism, self-reliance and reciprocity common to many cultures in the archipelago" (ibid., 178). The resulting practices "represent a distinctive pattern of activity and behaviour among Filipinos" (ibid., 163).

Ambiguities and Prevarications in Cultures of Disaster

Amid its path-breaking and provocative insights, *Cultures of Disaster* contains several prevarications and dilemmas. Because of the work's importance, its propositions require serious interrogation. The "cultural manifestations" of "coping mechanisms" (ibid., 170) are on the surface contradictory, and as such call for conceptual refinement and fine-tuning.

However, it should be made clear that, as Bankoff (2016a) admits, since completing the manuscript for the book about fifteen years ago, his "thoughts have developed quite considerably since then." His subsequent work has sought "to stress the dynamism" of what he calls civic community and civil society in the Philippines (Bankoff 2016b; cf. Bankoff 2007, 2012, 2015). Nonetheless, the book remains the locus classicus of disaster studies in the country, as evinced by the citations in virtually every article in this special double issue. For this reason this article's engagement is with the text of *Cultures of Disaster*.

In his book, Bankoff (2003, 167) asserts that "*bahala na*," which is "usually, if somewhat erroneously, translated as simply fatalism," "is equally an active calculation of the odds as it is a passive sense of acceptance of one's fate." This assertion may well be valid, but it raises many questions. What view of reality explains the tensions that hold these two contradictory positions together? Does "bahala na" involve action and inaction simultaneously, or is it a case that some situations call for action while others require inaction but explicitly justified in each case as "bahala na"? What notions of risk, vulnerability, and capacity to respond to threats are implicated in "bahala na"? More broadly, how does one square calculated risk taking with resignation? When does one respond to hazards and disasters by becoming self-reliant, and when does one immerse one's self in mysticism? When is fatalism a predisposition to inaction, and when is it a search for meaning?

Despite the fact that adaptation is a social process, the formulation about cultures of disaster inadvertently tends to be static and ultimately ahistorical: cultures of disaster end up being depicted as basically unchanging. Bankoff's (ibid., 176) discussion of the eruption of Mayon Volcano in 1897 as having been seen as God's punishment is followed by the assertion that "such ideas have not lost currency with the passing of time." However, rather than presenting data on people's views of Mayon's eruptions at present, the discussion veers away to floods in Central Luzon in the 1970s and in Ormoc in 1991. Although people's views of the latter events may indeed evince notions of divine retribution, we are left to wonder if people who live in proximity to Mayon still subscribe to such notions.[1] Data from the same location where there has been a recurrence of the same event will allow us to determine if, in the given context, such views do not lose currency with the passage of time.

In 1934 Fr. Miguel Selga of the Manila Observatory described *tifonitis* as "a pathological state owing to nervous overstimulation produced by the frequency or extraordinary intensity of typhoons" (ibid., 174–75), which

leads Bankoff to impute an unchanging history of mass hysteria in response to recurring typhoons. Tifonitis, which Father Selga theorized as arising from "the passing of five strong typhoons in quick succession between 15 October and 10 December 1934" (ibid., 175), indicates, according to Bankoff, a generic state of mind "referred to as *nasisiraan ng ulo*, the fear of losing control over one's life and of one's destiny, perhaps, even over one's mind" due to the "fickleness of a hazardous world, the unpredictability of when a disaster might occur and the element of chance as to whom it might affect" (ibid., 173–74). Which types of individuals and social groups are vulnerable to this mental state? Is it a mass phenomenon? Do they recover from the trauma? If this is a protracted condition given the "fickleness of a hazardous world," how then does adaptation, or living with risks and disasters that, as Bankoff (ibid., 163) puts it, "mitigate[s] the worst effects of disaster," happen? From tifonitis to nasisiraan ng ulo, *Cultures of Disaster* provides a blanket portrayal of seemingly static perceptions and aberrant behavioral patterns of Filipinos, which renders its formulation about cultures of disaster prone to essentialist thinking. Although the author probably did not intend to do so, Philippine culture is reduced to a pathological state.[2]

Even as people adapt to disasters, Bankoff suggests, they also remain fatalistic at the same time. They prepare for disasters, yet they know they cannot do much about it. They hear government advisories about the weather, but they do not believe these warnings and think that "government agencies could do little to reduce the damage caused by natural forces" (ibid., 171). There appears to be a twinning in the lack of efficacy of self/society as well as of the state in mitigating disasters. The lack of efficacy translates to lack of confidence and trust in the government. "The concept of *bahala na* has its political parallel in the degree to which the Filipino public lack confidence in the government's ability to protect its citizens" (ibid.).

Typhoon Advisories, Public Trust, and Apathy

Bankoff pursues the issue of the public's distrust of government by discussing reactions to the storm warning system of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) as gauged by survey data collected in the early 1990s. He notes that the agency's "weather forecasts have a popular reputation for being notoriously inaccurate and undependable" (ibid.). Studies of tornado warnings suggest that the frequency of false alarms and missed events heighten the perception of inaccuracy that corresponds to less trust in the entity that provides public advisories, which in turn diminishes the likelihood that people will take protective action (Simmons and Sutter 2009; Ripberger et al. 2015).

However, Bankoff (2003, 171; 2004, 107) does not dwell on the issue of accuracy (which calls for an examination of the state of scientific expertise and instruments of PAGASA) because the discussion shifts to the comprehensibility of storm warnings: "it became clear that local people had problems comprehending weather bulletins and appreciating their urgency." In other words, the issue was transposed into a communication problem, to which PAGASA responded by modifying its warning system.[3] To find out the public's reception of the modified system, PAGASA commissioned the opinion polling firm Social Weather Stations (SWS) to collect survey data using a set of closed-ended questions. In the paragraphs that follow, we revisit briefly the survey data as interpreted by SWS and by Bankoff to make the point that the proposition about cultures of disaster rests on rather shaky ground.

After presenting the survey data, Gerardo Sandoval (1994, 6) of the SWS concluded,

> After three survey rounds, public satisfaction with PAGASA's performance has remained high. As the 1992 survey data reveal, people feel that storm signals issued by PAGASA are considered adequate to avoid danger and help prevent destruction brought by typhoons. The issued signals are also considered as a reliable basis to decide on whether or not to evacuate from their respective areas.

It would appear that the public trusted PAGASA's storm warnings in a way that would make them take appropriate action. Despite these results, Bankoff (2003, 171; 2004, 107–8) stressed that "trust in the efficacy of PAGASA remains low," citing the finding that "49 per cent of people considered government agencies could do little to reduce damage caused by natural forces."

Actually respondents were asked two very similar questions about what ordinary people and the government could do about the harm that storms inflict; the 49 percent cited by Bankoff referred to those who said government could do little, while 47 percent said that citizens too could do little about the "destruction" (*kapahamakan*) caused by typhoons, a matter deemed to be "in the hands of God" (Sandoval 1994, 4–5, 8–9). In other

words, just under half of the respondents thought that neither the people nor the state could do anything about the kapahamakan (misfortune, misery, disaster, injury, accident) wrought by typhoons. Indeed, the question could be interpreted as asking if anyone could temper the fury of typhoons—which could raise issues about the survey design's validity.

What is interesting is Bankoff's (2003, 172; 2004, 108) succeeding assertion based on these data: "The result is a population inured and apathetic to disaster and a political system that lacks the will to make long-term plans." Both the state and the citizenry are depicted as locked in paralysis by cultures of disaster. The original proposition that "the Filipino public lack confidence in the government's ability to protect its citizens" (Bankoff 2003, 171) has progressed to a thesis about a total loss of efficacy to do anything, a state of apathy, which could be deemed a societal "coping mechanism" in response to the frequency and pervasiveness of cyclonic storms. Not only does it simplify the situation, but the proposition also leaves little room for the possibility that societies, as well as scientific methods, can learn from the past and evolve in time.

In the concluding chapter, the book's ambivalence comes to the fore. To what extent does an ecology that is so prone to disasters shape human behavior? Surely the environment must be a determinative force? Bankoff hedges his answer. "Of course," he admits, "the extent to which recurrent environmental forces are accorded significance in determining aspects of people's behaviour is fraught with conceptual and definitional problems and is simply 'unprovable' in the final event" (ibid., 179). He then takes cover by avowing that "the degree to which the frequency and magnitude of natural hazard may be responsible for influencing certain characteristic features of behaviour common to most Filipino cultures is *certainly intriguing*" (ibid., 179–80, italics added).

In effect he asks: Are there really cultures of disaster? He provides his own answer that brings us back to PAGASA and the storm warning system:

> Perhaps the strongest recognition that a particular 'culture' exists in the Philippines is suggested by the puzzlement evident in the meteorological survey independently commissioned by PAGASA on the effectiveness of its typhoon warning system that it had made considerable efforts to improve. On the one hand, the results of the questionnaires clearly indicated that the agency's revised storm warnings were now considered comprehensible, reliable and adequate to avoid danger and prevent destruction. But a substantial proportion of Filipinos were still fatalistic about their or their government's ability to limit damage caused by these physical events, believing that power over the number of deaths and the degree of devastation rested instead with divine providence. (ibid., 181)

With the public regarding typhoon advisories as "comprehensible, reliable and adequate to avoid danger and prevent destruction," yet believing that destruction is foreordained and little or nothing can be done about it results in a tension that is also the evidence that a culture of disaster probably exists. Bankoff leaves us with a puzzle.[4]

Disasters as Contingent Events

A solution to Bankoff's conundrum is to rephrase the question away from trying to determine whether or not cultures of disaster exist in the Philippines. Rather, we may ask: Under what conditions do people choose inaction and resignation in response to state advisories? Or, put positively, under what conditions do people take action and adopt defensive measure as a result of state advisories? The powerful but often misinterpreted word "culture" is intentionally avoided in this reformulation because of how easily it incites interpretations in homogenizing and static terms.[5]

Reframing the question in this way compels us to view events in their proper historical context: to treat societies as dynamic, changeable, and open to contingencies. (In fact, Bankoff [2012] applies a nuanced analysis of contingent historical factors in his study of a typhoon-induced flood in San Isidro, Nueva Ecija, in September 1887.) This reframing should also make us realize that societies are not homogeneous; given the diversity of views, predispositions, and notions of risk, people's responses to warnings will not be uniform even in a single locality. Moreover, dealing with disasters is subject to contestation. Distrust of institutions and scientific expertise is real but not immutable and certainly not insurmountable. Organized action can minimize the severity of disasters, without necessarily disregarding or disparaging nonscientific perspectives. It is possible to communicate scientific information in ways that make people understand the risks. As Loh Kah Seng (2014) has shown, sections of the urban poor population appropriate knowledge from technical experts on flooding in the Marikina Valley,

although the process of adapting "modernist" responses is contingent upon local factors, such as the mediating role of nongovernment organizations (NGOs) and the local community's own processes of coming to terms with the worsening inundations.

Additionally, the hazards themselves are not uniform and cannot be homogenized because they vary in terms of predictability, detectability, certainty, lead time, duration of impact, and visibility (Mileti and Sorensen 1990, 6-1). Thus there can be no single, generic warning system for all types of hazards, a fact that confounds the projected outcomes from any single advisory. The diversity in the types of hazards compels a nuanced and differentiated analysis based on contextual factors and circumstances, as suggested above. In this light, an investigation of specific historical cases can reveal the dynamic processes involved in negotiating information and advisories on forecasted events, with outcomes and public responses far from being predetermined. In seeking to demonstrate this alternative approach, this article focuses on advisories to the public, specifically concerning volcanic eruptions. In fact, Bankoff (2003, 162) uses the phrase "in the shadow of the volcano" as the metaphor for living with natural hazards. However, it must be emphasized that, although seemingly constituting a single type of disaster risk, volcanic eruptions are not all the same: some may have a long or short prediction time, and some impending eruptions can be more easily detected than others (Mileti and Sorensen 1990, 6-9–6-10).

In applying this alternative framework, we may ask: How have Filipinos responded to the threat of volcanic eruptions? Specifically, under what circumstances have they put themselves in harm's way, and under what circumstances have they taken protective action? What has been the role of state advisories in these eruptions? To answer these questions, this article revisits three main events: the eruption of Taal in 1911, Hibok-Hibok in 1951, and Pinatubo in 1991. The bulk of the analysis focuses on Mount Pinatubo's eruption, when huge casualties were avoided—a point muted in Bankoff's (ibid., 69–72) main discussion of Pinatubo's eruption, although he remarks that the state volcanology agency "earned considerable public praise" and its director "much accolade for his expert monitoring of the Pinatubo situation" (ibid., 84–85; cf. Bankoff 2004, 106).

This study relies on published documentary sources, which are a valuable treasure trove of information about these volcanic eruptions. These sources include, for Taal and Hibok-Hibok, news features and scientific reports. In Pinatubo's case, scientists produced detailed studies that were documented intentionally to benefit the wider epistemic community and published in a formidable and hefty 3.8-kilogram volume titled *Fire and Mud* edited by Christopher Newhall and Raymundo Punongbayan (1996). This volume includes useful accounts of the scientists' experiences, which, although written from the strategic position they occupied in this event, are very useful for being comprehensive, reliable, and reflexive. A major limitation of this study concerns my inability to conduct interviews with the Aeta and the various groups that worked with them. Providentially the stories of several Aeta survivors were documented in 1993 and 1995 and published in Hiromu Shimizu's (2001) *The Orphans of Pinatubo*. Missionary nun Emma Fondevilla (1991) also recorded the experiences of the Aeta in her community and published in *Eruption and Exodus: Mt. Pinatubo and the Aytas of Zambales*. Enough insights can be gleaned and pieced together from the available published sources to appreciate the contingencies involved in each of these eruptions.

Taal's Eruption in 1911

While the Volcanological Survey of Indonesia was established in 1920 under Dutch rule (van Padang 1983, 3, 23) and despite the location of the Philippines on the Ring of Fire and its history of volcanic eruptions, neither the Spanish nor American rulers of the archipelago set up a separate entity to study and monitor the country's volcanoes. The Jesuits set up the Manila Observatory in 1865, which was made into a colonial state institution in 1894 and subsequently reorganized by the Americans into the Philippine Weather Bureau in 1901. The bureau was concerned mainly with meteorological and seismological conditions.

Probably the country's most devastating volcanic eruption under the watch of the United States was that of Taal, which culminated on 30 January 1911. The official death toll was placed at 1,335 persons, although this number probably did not account for all who perished; the eruption also obliterated six or seven villages on Pulo Volcan, the volcano island (Saderra Masó 1911, 18; Pratt 1911, 81; cf. Hargrove 1991, 161–76). The Spanish Jesuit Fr. Miguel Saderra Masó (1911, 18), assistant director of the Weather Bureau, wrote, "The appalling number of victims is doubly painful if we compare it with the exceedingly small death list of the great eruption in 1754. It would seem that then nobody lived on Volcano Island." In 1911 the migrants who had settled on Volcano Island did not or could not interpret

the volcano's tremors and emissions as warnings of an impending eruption, and so they did not flee to safety. Their reaction stood in stark contrast to those in nearby towns, who were in a state of panic as stated below. Evidently no local or external entity provided any advisories.

Fr. Saderra Masó (ibid., 26) ended his report by highlighting what he considered a "very remarkable" circumstance:

> For two entire days preceding the great eruption, the volcano was rumbling and ejecting mud and ashes, while the earth trembled incessantly; and yet, neither on Volcano Island nor in the nearest villages of the western shores was there to be found a single person capable of informing the authorities or inducing his neighbors to take some precautionary measures! It is hoped that this terrible experience will serve as an incitement to take the necessary steps in order to avoid the recurrence of, or at least to lessen the effects of similar disasters in the future, as far as this can be done by human intelligence, energy, and foresight.

Yet, other accounts suggest that members of the public were sending advisories to state officials, to no avail. On 28 January morning, the American who worked as tourist guide to the volcano had cabled the Bureau of Science that Taal was in eruption (Worcester 2012, 334). "Meanwhile various other telegrams had been received at Manila, stating that a huge column of black 'smoke' had been pouring out of the crater since early morning, and that sinister subterranean rumblings were causing panic among the people of the neighboring towns" (ibid.). Given the lament of Fr. Saderra Masó, apparently no one in the colonial government took notice of the telegrams that were sent at least two days prior to the worst explosion. The information sent to the Bureau of Science would appear not to have reached the Weather Bureau, and neither did the latter warn the public despite the series of earthquakes its observatory had recorded and traced to the region of Taal days before the eruption.

In his report the American governor-general emphasized humanitarian assistance to the victims, but made no admission of the state's lack of discernment and no mention of the mitigation of similar disasters in the future (Philippine Commission 1912a, 27).[6] Perhaps the summary statement of Wallace Pratt (1911, 81) of the Bureau of Science was indicative of the colonial state's vacillating response: "The magnitude of this eruption of Taal has been both exaggerated and belittled." Secretary of the Interior Dean Worcester (1912, 353) also reported that "There was at the outset a woeful lack of appreciation of the magnitude of the calamity . . . both by the Manila public and by government officials, accustomed as they all were to greatly exaggerated first reports of the damage caused in the Philippine Islands by typhoons, conflagrations, earthquakes."[7]

Worcester (ibid., 366) also raised the question, "What precautions should be taken to prevent future great loss of life?" He made two recommendations: (a) the "sweeping and absolute" prohibition of settlement on Volcano Island and (b) the establishment on Volcano Island and on the mainland of observation points to monitor "seismic disturbances" so that "timely warning" could be given (ibid., 367). By 1914 there was a "seismic and geophysic station at Ambulong, Taal" (Philippine Commission 1915, 119). By the 1920s scientists of the Weather Bureau were observing volcanic activities not only of Taal in Batangas but also of Bulusan in Sorsogon and Mayon in Albay, using ambulant seismic instruments (Alvarez 2015, 3). However, the Weather Bureau was not particularly renowned for studying volcanoes. The fact that Taal remained quiet for over fifty years until its eruption in 1965 and the country's other active volcanoes were temporarily quiescent worked in the bureau's favor.[8]

Learning from Hibok-Hibok

Not until the eruption of Mount Hibok-Hibok on Camiguin Island on 4 December 1951 did the Philippines find the impetus to set up an entity that would institutionalize the science of volcanology and issue warnings as well as impose preventive and mitigating measures. The number of casualties from Hibok-Hibok's eruption could not be ascertained—perhaps 1,000 to 3,000 people died from pyroclastic flows—as human remains could be retrieved only from the "less dangerous" zone (cf. Ty 1951, 4). About six months after the eruption, the state's response was embodied in a novel legislation. Republic Act 766 creating the Commission on Volcanology was signed into law on 20 June 1952 (Philippine Congress 1952, 3216).

Hibok-Hibok had erupted in 1948 with no casualties and again in 1950 when 65 people were killed (Ty 1951, 4), a number that was not earthshaking. One could say that these eruptions were part of the "normal" threat that accompanied life in the shadow of a volcano. In these two earlier eruptions, the earth gave the usual telltale signs of an impending volcanic eruption, which alerted people to take precaution or leave its vicinity. However, in 1951 local residents said they did not observe anything unusual. "Although

a thin cloud of grayish smoke wreathed its summit, the inhabitants of the locality felt no alarm. 'It was a common sight and we had been so used to seeing it that we paid not the slightest attention to it any longer,' said a farmer" who survived (ibid.). But at around 7:30 AM on 4 December the volcano erupted unexpectedly.

> With a quaking blast [Hibok-Hibok] heaved its sulphurous stomach, tossed red-hot boulders bigger than a man across the northeastern portion of Camiguin, sent up clouds of red-hot ash and deadly chlorine. A torrent of glowing molten lava rolled in all directions. Three and a half miles away in Mambajao (pop. 21,000), the island's capital and largest village, children on the way to school, women washing clothes, men on the way to their fields were buried in the rush of lava, burned to death by ashes or killed by gas.
>
> From the scene, TIME Correspondent Carlos Weber cabled this report: "The air was filled with the stench of decaying bodies and sulphur. For miles and miles there was no sign of life—just stony silence and the stripped, twisted forms of ash-grey men, women, children and dogs. In one corner of what used to be a hut, I saw 17 bodies huddled together in death. Two, about eight or nine years old, were hugging each other. About 100 yards away was a carabao, bathed in ash and dead, but still standing. As I left, a chicken crossed my path. Its right side was grey and seared, the other side untouched. It was the only living thing I saw there." (*Time* 1951)

In the next four days the volcano erupted four more times. Aggravating matters was the onslaught of a typhoon that passed by the island. Survivors were evacuated from Camiguin and brought to other islands on fishermen's boats and military ships. Some refused to leave the island, the journalist explaining that they believed the eruption had been God-ordained (ibid.). Thousands, however, evacuated to safety, even if, I would surmise, they did not necessarily disavow their religious beliefs. Many left Camiguin for good (Ty 1951, 53).[9]

The eruption of Hibok-Hibok in 1951 was the first major volcanic disaster for the independent Philippines. It caused great consternation for the young republic, and apparently it led to the consensus that things could not go on in the old usual way, that things had to be done differently. This response was captured and institutionalized in the passage of the law that created the volcanology agency.[10] The state's response was facilitated by the fact that the science of volcanology had long been in existence, and therefore a scientific solution was well within the realm of possibility. Filipinos did not have to modify their conceptions of volcanic eruptions, many of which were informed by cosmological and magical beliefs. All it needed was for a section of society, mainly actors within the state, to take action and mobilize scientific expertise, which until then had been distributed within the state apparatus, and to centralize them into one agency dedicated to the monitoring of volcanoes.[11] This entity was also authorized to take decisive action.

Republic Act 766, section 3, mandated the Commission on Volcanology to, in its words:

> 1. Investigate and conduct studies of all active Philippine volcanoes;
> 2. Establish necessary facilities in order to predict their eruption in advance, if possible;
> 3. Formulate in advance and in detail specific plans of action and of relief in the event of the eruption of any volcano;
> 4. Recommend to the President of the Philippines such measures as may be necessary to protect life and property in areas which may be affected by volcanic eruptions, including the declaration of certain areas as closed to human habitation or subject to regulation; and
> 5. To perform such other duties as may be necessary to carry out the purposes of this Act. (Philippine Congress 1952, 3215)

Rather than resignation, helplessness, or fatalism, the language of the law clearly evoked a worldview that was determined to make human intervention spell a difference in the next volcanic eruption. But the "if possible" clause in the second item was a subtle admission that perfect prediction of an eruption was probably not possible. Still, there was the determination to do more than be left simply to the mercies of nature. The creation of the Commission on Volcanology participated in "the modernist aspiration of mitigation" (Head and Gibson 2012, 704). Society remained in the shadow of the volcano, but the volcano was also to be shadowed by the state.

Pinatubo and Disaster Mitigation

Four decades later, state expertise on volcanology—the commission was reconstituted in 1982 into the Philippine Institute of Volcanology (PHIVOLC) and, with seismology added to it, became PHIVOLCS in 1984 (Alvarez 2015)—would play a critical role in making the cataclysmic eruption of Mount Pinatubo from 12 to 15 June 1991 turn out to be far from being the deadliest. Pinatubo's eruption is considered the largest ever to affect a densely populated area (around 500,000 people lived in the vicinity surrounding Pinatubo) and the second largest eruption in the twentieth century. As PHIVOLCS head Raymundo Punongbayan and colleagues (1996, 67) would admit subsequently, "most worrisome of all, we could see from the geologic record of Pinatubo that its previous eruptions were so large that a recurrence would threaten several hundred thousand unsuspecting people. The ingredients for a colossal disaster were on hand." In the end, "The number of casualties at the height of the June 1991 eruptions was small (only 200 to 300) despite the violence of the explosions and the vastness of the area affected" (Tayag et al. 1996, 87). About 180 people were killed by roofs that collapsed from the weight of accumulated wet ash, exacerbated by the arrival of a typhoon; about 100 people died from various other causes, "including several tens from pyroclastic flows and another several tens from lahars" (Punongbayan et al. 1996, 81). Despite these deaths as well as severe problems in the relocation sites and the ensuing years of devastation from the lahars (cf. Bankoff 2003, 69–72, 97–102, 167–68), a colossal disaster had been averted.

The intervention of volcanologists was crucial, but it was not easy in the context of Pinatubo. Since the creation of the volcanology commission in 1952 these experts had gradually established their reputation in cautioning the public in areas of the country with active volcanoes (Mayon, Bulusan, Taal, Hibok-Hibok, and Kanlaon), where a monitoring system had been in place and people had learned to appreciate the warnings issued by volcanologists. In Mayon's case, for instance, decisive intervention by PHIVOLCS during the September 1984 eruption resulted in the evacuation from the danger zone of over 44,000 persons who were temporarily housed in forty-two evacuation centers, with no casualties reported despite houses being submerged and crops and fields extensively damaged by the volcano's ejecta (UN Department of Humanitarian Affairs 1984). In contrast, in the vicinity surrounding Pinatubo there was no established credential for the volcanologists since Pinatubo had been dormant in the preceding 500 years or so. Its eruptive history was unknown to most everyone. The Aeta communities on Mount Pinatubo had no oral tradition about an extant volcano, or if they had it had vanished through the centuries. As one Aeta declared, "Noon, hindi namin alam na ang Pinatubo ay bulkan. Hanggang noong umusok ang Pinatubo, may balita mula sa gobyerno na bulkan pala ang Pinatubo" (Previously, we did not know that Pinatubo was a volcano. Until Pinatubo began to smoke, there was news from the government that Pinatubo was after all a volcano) (Shimizu 2001, 154).[12] In the case of Mayon, the Cagsawa Church ruins from the 1814 eruption stand as a perennial reminder of a past catastrophe. As Robert Tantingco (2011, 84) put it, "Unlike Bicolanos and Batangueños who grew up in the shadow of their respective volcanoes, there was nothing in their history that prepared Kapampangans, intellectually or psychologically, for a volcanic eruption."

Given the protracted hiatus since Pinatubo's last eruption, among local institutions and government entities there was no established system for dealing with an eruption and no learning curve for people living around Pinatubo. PHIVOLCS contemplated bringing in people living near recently active volcanoes such as Mayon and Taal to testify about volcanic eruptions, but in the end they did not and considered it "probably fortunate" as the visitors' testimonies might have diminished the impending violence of Pinatubo, which the eruptions of Mayon and Taal in living memory could not match (Punongbayan et al. 1996, 78). Intervention was further complicated by the fact that, unlike Mayon, Bulusan, or Taal, Pinatubo straddled three provinces that contained numerous large cities and towns and hundreds of villages; the US and Philippine military bases; and festering local and national political disputes.

Moreover, PHIVOLCS needed external assistance, which it received when a three-person team from the US Geological Survey "arrived in the Philippines on April 23, bringing with it a large cache of equipment that had been developed or purchased specifically for emergencies such as this" (ibid., 71). Amid the difficult decision to mount an observation point at Clark Air Base, because at that time "the Philippine and U.S. governments were locked in negotiations over renewal of the bases agreement, and . . . Philippine government agencies were not generally allowed to operate on Clark Air Base," the team of volcanologists at Clark "made it a firm policy to remain strictly apolitical and to provide all volcano information first to the

[Philippine] Office of Civil Defense and then to all other interested parties including the U.S. Air Force" (ibid.).

Given its augmented expertise PHIVOLCS issued warnings, to which initially local people and officials would not give credence. To be able to predict an eruption was an attribute of the deities, and chief volcanologist Punongbayan was not perceived as godlike. As he reminisced in early 2005 in a talk on the December 2004 Indian Ocean tsunami given at the Institute of Philippine Culture, Ateneo de Manila University, there were people who had asked him pointedly about his warnings concerning Pinatubo, "Ano ka? Diyos?" (What are you? God?). Nonetheless, as discussed below, a combination of events involving a host of groups, organizations, and communities resulted in the saving of more than 20,000 lives from "certain death" (ibid., 67).

As it turned out, as PHIVOLCS officials put it succinctly,

> The management of the Pinatubo Volcano eruption crisis of 1991–92 represents the highest point in the development of volcanic disaster mitigation in the Philippines. State-of-the-art volcano monitoring techniques and instruments were applied; the eruption was accurately predicted; hazards zonation maps for the anticipated destructive agents were prepared and disseminated about a month before the violent explosions; an alert and warning system was designed and implemented; and the disaster response machinery was prepared and mobilized on time. (Tayag and Punongbayan 1994, 2)

Evidently a major factor that helped minimize the number of casualties from Pinatubo's eruption was a prompt and accurate public advisory system that, despite limitations, was remarkably successful, especially considering "the complex socioeconomic and political context in which the warnings had to compete for the attention of those at risk" (Punongbayan et al. 1996, 67).

The Aeta and the Initial Trigger to Public Warnings

Existing studies enable us to look back to the public's participation and responses to warnings about the impending eruption of Pinatubo. Here we look at some of the key moments based on the four major components of a warning system: (1) the source and timing of the warning, (2) the warning message, (3) the warning transmission, and (4) the recipients' response (Tayag et al. 1996, 87–88). The analysis is limited to the eruption in 1991 and excludes subsequent small eruptions; it also excludes discussion on lahar and lahar warnings, which had shortcomings and went through a learning curve after the June 1991 eruptions.[13]

In Pinatubo's case, the source and timing of the warning was most crucial. Significantly the initial trigger did not originate from scientists, who had not installed any monitoring device on Pinatubo. Rather it came from the indigenous Aeta who lived on its slopes (cf. Shimizu 1989). "They lived by the volcano's rhythm, timing the planting and harvesting of their crops by the volume of steam rising continuously from a natural vent on the upper slope. A relatively dense steam meant a good harvest; a thin one augured a sparse yield" (Bautista 1996, 153). In early August 1990, the Aeta on the northwest side of Pinatubo noticed something unusual: "rumbling sounds, ground cracks, and a landslide covering about 2 to 3 ha on the upper northwest face of the volcano" (Punongbayan et al. 1996, 69). The Aeta did not know that what they had observed was related to volcanic origin, but they became sufficiently apprehensive. Some Aeta were members of Lubos na Alyansa ng mga Katutubong Ayta ng Sambales (LAKAS) or Negrito People's Alliance of Zambales, a federation of Aeta village organizations on the western slope of Pinatubo formed in 1984 as an outgrowth of literacy classes held under the auspices of the Franciscan Missionaries of Mary (FMM) and formally registered with the SEC in 1987 (Fondevilla 1991, 9; Shimizu 2001, 29). As such, they had an organization that passed on the information to a resident FMM nun, Sr. Emma Fondevilla, who then reported the matter to the PHIVOLCS. However, the agency's response team did not relate these observations to volcanic activity, deeming them aftershocks of the strong tectonic earthquake along the Philippine fault, about 100 kilometers northeast of Pinatubo, that occurred on 16 July 1990 (Punongbayan et al. 1996, 69) and responsible for what was dubbed as the "Baguio earthquake" of 1990.

About eight months later from when they first observed something unusual, in late March 1991, the Aeta detected once more the unusual signs of the mountain's restiveness through rumblings and tremors. Then on 2 April there were explosions and the opening of new steaming vents. Hundreds of panic-stricken Aeta fled their homes, converging in a village 12 kilometers from the base of the mountain (Fondevilla 1991, 23). Again, Aeta members of LAKAS promptly reported their observations to the missionary nun, who in turn passed the information to PHIVOLCS on 3 April 1990

(Punongbayan et al. 1996, 69). Only then did PHIVOLCS begin to monitor Pinatubo and issue public advisories, although the agency's volcanologists initially thought the observed activities to be "purely hydrothermal" and they labeled the volcano's condition simply as "unstable" (ibid., 70–71).

Because the scientists had no baseline data, they turned to the Aeta for help in understanding the unrest: "Aeta residents told us that nothing like this had happened within their memories or oral traditions, so, at least, we knew that the unrest was substantially greater than anything of the past several decades" (ibid., 72). Indeed, an elderly Aeta man confirmed, "Parating pumupunta ang taga-PHIVOLCS sa akin para makinig tungkol sa kasaysayan ng panahon" (Those from PHIVOLCS often come to me to listen to stories of old) (Shimizu 2001, 243).

But even as the Philippine National Oil Company (PNOC) brought in their instruments to "establish, positively or negatively, the direct or indirect connection between the geothermal diggings and the hydrothermal explosion of Pinatubo," the Aeta "asked forgiveness" from Namalyari, their deity, "for allowing men and machines to desecrate their mountain" (Fondevilla 1991, 53). An Aeta man recalled that the PNOC had entered their area in 1984 by order of the government, but he felt that it was not right for them to interfere with Pinatubo ("hindi karapat-dapat na makialam sa Pinatubo") (Shimizu 2001, 111). In fact, some Aeta blamed the PNOC for triggering Pinatubo's eruption (ibid., 141–42).

This critical juncture is an object lesson that any "culture of disaster" that might have prevailed among the Aeta did not pose an insurmountable barrier to disaster preparedness, particularly in relaying critical information that, back in 1911, Fr. Saderra Masó had identified as of utmost importance. On the contrary, it was not so much a "culture of disaster" but the existence of a critical *network* linking the Aeta's LAKAS to PHIVOLCS, with the FMM serving as a strategic intermediary node that enabled "indigenous knowledge" to interface with scientific expertise, benefiting the latter and rescuing the former.

Warning Message, Transmission, and Public Responses

In areas with actives volcanoes, warnings about an impending eruption would be transmitted locally through the area's Disaster Coordinating Council (DCC), with a separate transmission system to national offices (Tayag et al. 1996, 91). In Pinatubo's case, "warning messages were formulated at PHIVOLCS' main office and transmitted simultaneously through the DCC hierarchy, major national and local newspapers, radio and television stations, nongovernmental organizations (NGOs), and directly to the endangered inhabitants" (ibid.).

The alert scheme adopted on 13 May 1991 utilized qualitative criteria as follows:

ALERT LEVEL	CRITERIA	INTERPRETATION
No alert	Background; quiet	No eruption in foreseeable future
1	Low-level seismicity, other unrest	Magmatic, tectonic, or hydrothermal disturbance; no eruption imminent
2	Moderate level of seismicity, other unrest with positive evidence for involvement of magma	Probable magmatic intrusion; could eventually lead to an eruption
3	Relatively high and increasing unrest including numerous b-type earthquakes; accelerating ground deformation, increased vigor of fumaroles, gas emissions	If trend of increasing unrest continues, eruption possible within 2 weeks
4	Intense unrest, including harmonic tremor and (or) many "long-period" (low-frequency) earthquakes	Eruption possible within 24 hours
5	Eruption in progress	Eruption in progress

Source: Punongbayan et al. 1996, 73; Tayag et al. 1996, 90

The intent was to have a warning system that was "simple enough for laymen to use for crisis decisions" but not to "promise a specific prediction," given the paucity of baseline data (Punongbayan et al. 1996, 72). The warning system

> simply noted increasing levels of unrest and correspondingly decreasing assurances that an eruption would not occur within a specified time period. Phrasing like "eruption possible within 2 weeks" was chosen carefully to mean that unrest had risen to such a level that an eruption might occur within that period. Perhaps predictably, the mass media and the general public misread the intent of the wording and concluded, first, that an eruption would occur 2 weeks

> from the date of the warning, and later, after our explanation, that an eruption would occur sometime within the 2 weeks following the warning. The intended distinction between descriptions of unrest and predictions vanished. In retrospect, use of the Pilipino *"ma'aaring mangyari"* ("might occur") would have been clearer than the English "possible." (ibid., 73; cf. Tayag et al. 1996, 98)

In any event, there was something intuitive about the increasing alert levels. "Even though many officials misunderstood the subtleties of the alert levels, they understood clearly that Level 3 was more serious than Level 2 and required urgent preparations, Level 4 was more serious than Level 3 and, for people living near the volcano, required evacuation, and Level 5 was as serious as we could get" (Punongbayan et al. 1996, 73).

Although "multipath warning transmission" was potentially confusing, in Pinatubo's case the warning messages were consistent, speedy, and comparatively effective.

> The 1991 survey showed that 71 percent of the 234 respondents [who lived in the danger zones] knew of the impending eruption before June 9, 1991, the date on which Alert Level 5 was issued, either through their own observation (9 percent) or through their own observation and forewarning from PHIVOLCS, media, local officials, or other people (62 percent). Before June 12, the date of the first large explosive events, 82 percent of the respondents knew of the danger. (Tayag et al. 1996, 92)

That 18 percent had no idea of the danger prior to the 12 June eruption indicated deficiencies in the warning system. Nonetheless, the advisories reached the vast majority.

Importantly the survey responses suggested that the residents were not passive recipients of the volcanic warnings for they actively processed the information that reached them. At least one month before the first major eruption in June 1991, the information that Pinatubo was a long-dormant volcano had been in circulation. The residents effectively triangulated this information with further messages received from the mass media, local officials, and other people as well as with their own observations.

On 23 May PHIVOLCS released a hazard map that indicated the areas that were likely to be affected by pyroclastic flows, ash fall, and lahars (Punongbayan et al. 1996, 75). The hazard map became the basis of evacuation orders issued by the DCC on 7 April, 7 June, and 14–15 June (Tayag et al. 1996, 92). The first evacuation order targeted residents within the 10-kilometer danger zone; the second order, those within the 10- to 20-kilometer danger zone; and the third order, those within the 20- to 40-kilometer danger zone. Of the 234 respondents, 86 percent said they received an evacuation order; those that did not receive were mainly from the most distant danger zone. Most respondents received the order within the day or the day after it was issued—an indication of an efficient message delivery system (ibid.). However, there were a few who did not receive the warnings and others who received the warnings but did not appreciate the gravity of the situation, delaying defensive action or taking no action at all. In the end, more than 60,000 people heeded the warnings and fled to safety (Punongbayan et al. 1996, 67).

Of the 71 percent of the 234 respondents who had received warnings about the eruption, 81 percent took appropriate action by evacuating immediately (for those in the immediate danger zones) or taking other defensive action (among those in the middle and farthest danger zones) (Tayag et al. 1996, 94). However, eight respondents from within the 10-kilometer danger zone who should have evacuated immediately merely took precautionary measures, while thirteen respondents from the 20- to 40-kilometer danger zone overreacted by evacuating before they were ordered to do so. Nonetheless, of those forewarned, 13 percent ignored the warning or waited for the eruption to happen before they took action. Those who dallied thought that the eruption would not be so devastating or they could not bear the thought of leaving behind their possessions, with some Aeta fearing lowlanders would burn their crops and houses. After intensified ash emission on 9 June, many of those who had earlier refused to leave did flee—with external assistance remaining available to those who did not immediately follow the evacuation orders. Among the survey respondents, eventually all except 2 percent (five respondents) evacuated (ibid.).

The Aeta were the most severely affected, with about 7,800 families, or about 35,000 persons, forced to flee their homes in response to the warnings (Bautista 1996, 153). This move was a profound disruption and disorientation in their way of life. Many problems arose in the evacuation sites, resulting in nearly 1,000 deaths from diseases (Shimizu 2001, 26).[14] An entire way of life was uprooted.

It appears that those among the Aeta who had no formal organization did not fare as well as those who had, such as the members of LAKAS. Many perished because of their refusal to heed the warning and evacuation orders, thinking erroneously that the eruption would be just like a strong typhoon ("para lang daw malakas na bagyo 'yan") (Tayag et al. 1996, 97). Instead of evacuating, some opted to shelter in what they called caves; most of them perished, with only a handful of survivors (Shimizu 2001, 61–68). The unorganized Aeta who evacuated found themselves scattered. In contrast, members of LAKAS were able to "critically assess the options opened to them" and in the end they maintained their bond; "the group was kept intact throughout the exodus" (Bautista 1996, 153). They also took responsibility for arranging some critical aspects of the logistics of their evacuation, including their own warning system (Fondevilla 1991, 63–64).[15] As Tayag et al. (1996, 96) concluded, "It is worth pointing out that all of the respondents contacted by the LAKAS organization showed the exemplary appropriate response. All (except one old man who chose to die rather than leave his home)[16] prepared and evacuated promptly."

Communicating Risk, Facing Skepticism

LAKAS members recounted that volcanologists and local officials explained to them the hazards of Pinatubo's eruption. The Aeta understood that what "drove them away" to flee to safety even while Pinatubo had not yet erupted was "*ang bolkan*" (the volcano) (cf. Fondevilla 1991, 57).

A video on volcanic hazards was shown to help them visualize the situation. Aeta leaders explained to other Aeta the process of volcanic formation, and with the aid of the video they "became familiar with terms such as ashfall, pyroclastic flow and mudflow. They studied the initial hazard map released by Phivolcs showing the areas affected by these hazards in the last eruption of Pinatubo" (ibid., 62). They converted the volcanologist's terminology to graspable concepts. As one Aeta man explained, "Apoy yung *pyroclastic*. Parang gasoline daw" (The pyroclastic is fire. Like gasoline, they say) (Shimizu 2001, 67).[17] It was enough to make this man, and many others, understand the risks. As another Aeta stated, "Siguradong nakakamatay, sabi ng mga taga-PHIVOLCS" (It can certainly kill, said those from PHIVOLCS) (ibid., 64–65). Another Aeta narrated,

> Nagsimula ang usok noong Abril hanggang umabot ng Hunyo. Ang mga tao noon ay nangangamba dahil sa patuloy na pag-usok ng Pinatubo. Ang aming paniwala ay hindi ito puputok. Pero ayon sa pagsasaliksik ng PHIVOLCS ay tumitindi ang init ng Pinatubo kaya napilitan kaming lumikas bago ito pumutok. (ibid., 145)
>
> Smoke began to appear on Pinatubo in April and continued until June. The people then were anxious because there was no let up to the smoke coming out of Pinatubo. Our belief was that it wouldn't erupt. But based on the research of PHIVOLCS Pinatubo's heat was intensifying, so we were compelled to evacuate before it erupted.

Still another Aeta recalled,

> Hindi pa namin pinapansin ang pagputok ng bulkan noong una dahil wala pa kaming karanasan. Nang pumunta na yung PHIVOLCS, doon kami nakipamalita at sinabing may posibilidad na pumutok. 'Yon ang pinaniwalaan namin. (ibid., 218)
>
> Initially we did not pay attention to the eruption because we never had such an experience. When PHIVOLCS arrived we sought for news and they said an eruption was possible. That was what we believed.

Indeed, the Aeta deemed the information they obtained from PHIVOLCS "credible enough to be their basis for responding to the disaster" (Fondevilla 1991, 48).

The video was strategic in convincing not only the Aeta but also government officials and residents in the lowlands who were skeptical that a volcano existed in their backyard and who did not believe "heretofore unknown geologists" (Punongbayan et al. 1996, 78):

> Fortunately, we had an advance copy of a video entitled "Understanding Volcanic Hazards," produced by the late Maurice Krafft for the International Association on Volcanology and Chemistry of the Earth's Interior (IAVCEI). This video, made in response to the tragic misunderstanding and disaster at Nevado del Ruiz [in 1985 in Colombia where over 23,000 died], shows graphic examples of hot ash flows, ash fall, volcanic mudflows, large volcanic landslides, volcanogenic tsunami, lava flows, and volcanic gases. Superb, sometimes shocking, footage and a simple text illustrate the nature

> of each phenomenon, how fast and far it travels, and its impact on people and houses. (ibid.)

The video was shown to as many people as possible, from the president and cabinet officials, governors, all the way down to local officials, teachers, students, and barangay residents.

The team of volcanologists monitoring Pinatubo relayed information to the public through television interviews and face-to-face meetings with officials and residents. The volcanologists were deliberate about the intensive public education campaign they pursued, cognizant that they faced a question of credibility.

> Residents and their leaders were understandably skeptical about phenomena that they had never seen and that they either could not or did not wish to imagine. Furthermore, we as scientists were largely unknown to those at risk. We were suspected of various faults, chiefly ignorance and utter foolishness, but also of trying to make sensational headlines, pursuing an academic agenda cloaked in concern, conducting counterinsurgency reconnaissance, being dupes of the U.S. military, raising funds for our agencies, land-grabbing, and more. (ibid., 79)

Confronted with skepticism, the scientists admitted that "we did not want to close minds through unduly aggressive messages; neither did we want to be so meek that we were ignored" (ibid.). They were "concerned about the serious consequences of a false alarm and whether we would have a second chance should the volcano not erupt as anticipated" (ibid., 81). Needless to say, it was a stressful time for the volcanologists. "Sleep was difficult, nerves were taut, and we were at our physical and emotional limits. We supported each other as best as we could with encouragement and humor" (ibid.). But, as Punongbayan et al. (ibid., 67, 79) put it, "Fortunately, Pinatubo gave us a brief but unmistakable warning" and, at the end of the day, the issue of credibility was "resolved by the volcano itself."

Conclusion

As Bankoff (2003) rightly points out, disasters are embedded in social systems. But he also attributes to societies accustomed to disasters—"in the shadow of the volcano"— coping mechanisms that form part of so-called "cultures of disaster," which simultaneously seem to mitigate disasters but also consign society to destruction and victimization, distrust and paralysis. As Bankoff (2004, 110) has asserted, "a fuller appreciation of the cultural perception of disaster may prove to be important in explaining both the Nature [sic] of the difficulties encountered and the frequency of failure that regularly greets even the most well-meaning agencies engaged in disaster preparedness and mitigation projects." However, although popular conceptions of natural hazards may be inimical to mitigation in some contexts, the recent history of volcanic eruptions in the Philippines indicates that disasters ought to be seen from the perspective of historical contingency.

The victims of Taal's eruption in January 1911 did not receive any advisory from the colonial state, even though some individuals had detected its possible occurrence and a small window existed to mount an evacuation of Volcano Island. Neither did the victims who had migrated to live on the island understand the signs that pointed to a cataclysm. Although settlement on the island was subsequently prohibited, volcanology did not become a major state initiative, especially as the country's volcanoes remained inactive in the succeeding decades. Consequently, no state agency predicted the devastating eruption of Hibok-Hibok in December 1951; it was not even detected by the traditional means by which people could foresee an imminent eruption. Although not all volcanic eruptions could be predicted with high accuracy and advisories could not always be issued within reasonable time, the country sought to learn its lesson from Hibok-Hibok by establishing a state agency dedicated to volcanology in order to anticipate future eruptions. Since then, the country's active volcanoes have been closely monitored and there have been no massive casualties from subsequent eruptions, such as the major eruption of Mayon in September 1984—giving rise to a different sort of "normalization," one in which volcanologists have effected a working relationship with local officials and the people living adjacent to active volcanoes.

The eruption of Pinatubo in June 1991 was an extremely challenging situation for both the scientists and the unsuspecting public because the volcano had no recent eruptive history, as it had lain dormant for the previous half millennium or so. Identifying the existence of a hazard was a tricky process, and it was not possible to determine with reasonable certainty how much lead time the scientists possessed in issuing warnings to the public. Yet

at risk was a huge population of high density, particularly the Aeta who lived on Mount Pinatubo. Nevertheless, a potentially colossal disaster was averted. Crucially the Aeta with their nonscientific worldview served as the trigger that led to the monitoring of Pinatubo. Indigenous knowledge was transmitted to the volcanology agency through a local NGO and a resident missionary nun, indicating the strategic role played by this network. A relationship between the Aeta and the volcanologists emerged to their mutual benefit: information from the experts was deemed credible, even as the experts had to educate the Aeta about volcanoes. In the process, the Aeta did not have to jettison their cosmological beliefs to appreciate a natural hazard, take precaution, and flee to safety. They trusted the information coming from PHIVOLCS, but had to translate scientific terms to concepts already familiar to them—proving effective in making them comprehend the risks of an eruption and prodding them to action. This instance runs counter to the generalized scenario of distrust and lack of confidence that Bankoff depicts concerning the government and the public in terms of warning systems.

Moreover, despite the use of even the most advanced instruments, warning systems are ultimately multifaceted human processes in close interaction with the natural world. Many lowlanders, including government officials, were skeptical, and initially there was contestation of the experts' statements about Pinatubo. But the survivors processed the advisories they received from various sources that included the mass media, plus their own observations of what was going on in their environment, which led them to agree to an evacuation, even if such action was an emotional and logistical challenge. Here we find no societal paralysis. On their part, the experts underwent a challenging trajectory of understanding the restlessness of Pinatubo. No one knew at that time, but in hindsight all they had was a period of seventy days starting from the Aeta report on 2 April until the formidable eruption on 12 June. Once the scientists had established that an eruption was highly probable, they sought various means to communicate to the public their findings, which were capsulized in a hazard map and the warnings that were issued and disseminated through multiple pathways. In order to remain credible while pursuing a public education campaign, they were mindful of the delicate balance between aggressiveness and timidity in issuing warnings.

Significantly the volcanologists did not hesitate in using a video that illustrated graphically the dangers of a volcanic eruption, thus enhancing the warning system with an audiovisual tool, which proved effective. The resolve to use the video was a lesson learned from the misunderstandings that attended the catastrophic eruption of Nevado del Ruiz in Colombia a few years before Pinatubo. In this sense, disaster preparedness, mitigation, and response had a cosmopolitan character, with a volcanic disaster in one part of the world becoming instrumental—as part of a complex set of contextual factors working together—in averting a colossal disaster in another part.

Notes

A schematic version of this article was presented at the workshop "Toward Building a Regional Platform for Risk Reduction in Asia," JSPS Core-to-Core Program, Center for Integrated Area Studies, Kyoto University, 22–23 July 2016. My deepest thanks go to Greg Bankoff for putting up with my quizzing. I am truly grateful that he read this manuscript, even at a late stage, and gave me feedback of inestimable value; I hope I have not been unfair to him and his work. I am also very grateful to Hiromu Shimizu for sending me a personal copy of his valuable The Orphans of Pinatubo. *Thanks, too, to Kerby Alvarez for sharing with me his seminar paper on institutional volcanology. Last but not least, I am truly grateful to the four referees who made very insightful comments and suggestions, which guided me in improving this article. All remaining errors are my own.*

1 I grew up in the Bikol region with the popular lore that Mayon erupts "every ten years" more or less. In this view the eruptions are simply a manifestation of the volcano's secular periodicity. The notion I grew up with might have come from volcanologists, as it is found in Fisher et al. (1998, 238) and Kondratyev et al. (2006, 21). Interestingly, Bankoff's later study on Mayon Volcano's eruptions in 1999–2000 mentions nothing about divine retribution (Bankoff and Hilhorst 2009).

2 The assertions in *Cultures of Disaster* (Bankoff 2003) that are examined in this article are reproduced in Bankoff 2004. So-called premodern or traditional values such as fatalism were debated in the 1960s and 1970s in connection with modernization theory. For the Philippines see, e.g., Guthrie 1971; Lynch 1973; Racelis Hollnsteiner 1973; Bulatao 1973.

3 Recently the issue of comprehensibility has resurfaced with the problems associated with communicating the risk of "storm surge," a term little understood by the public until Typhoon Yolanda (international name: Haiyan) struck on 8 November 2013. See Esteban et al. 2016; Lagmay et al. 2015. But it was certainly not the first time that a storm surge had occurred, as there were twelve recorded events from 1986 to 1989. Until 2013 storm surges were said to be "not very destructive" (CDRC 1992, 58). Yolanda, as we all know, was a massive disaster. To deal with the issue of comprehensible warnings, storm surge and other terms in PAGASA's weather bulletins have been translated to the Filipino language, an endeavor likely to generate new problems in comprehension. See *PDI* 2016.

4 The prevarication disappears in Bankoff (2004, 111), which ends with the confident assertion, "In some societies, natural hazards occur with such historical frequency that the constant threat of them has been integrated into the schema of both daily life and attitude to form what can be called 'cultures of disaster'."

5 Recall the controversy that attended Oscar Lewis's (1959) thesis on the "culture of poverty" starting in the 1960s.

6 In the following year's annual report, the section on the Philippine Weather Bureau was a one-sentence paragraph that read, "The Philippine Weather Bureau has continued to perform, with its usual high degree of efficiency, its very valuable work of seasonably sending out warnings of the approach of the violent storms which periodically sweep through the Archipelago" (US Philippine Commission 1912b, 119).

7 In Worcester's account, what is now referred to as "imperial Manila" lacked confidence in the provinces whence came supposedly highly exaggerated reports on disasters.

8 See Hargrove (1991, 145–47) for a list of Taal's eruptions from 1572 to 1977. A list of "destructive volcanic events" shows that, after Taal's 1911 eruption, mudflow was observed in Mayon in 1915, but no major events happened until Hibok-Hibok began its series of eruptions in 1948 (CDRC 1992, 73).

9 For a newsreel on Hibok-Hibok's 1951 eruption, see British Pathé (2014) available on YouTube.

10 That Hibok-Hibok's eruption was the impetus for this legislation is acknowledged by Filipino volcanologists. See Tayag and Punongbayan 1994, 2.

11 Republic Act 766, sec. 2, specified that "The Commission on Volcanology shall be composed of the Director of Mines, the Director of the Weather Bureau, the Chairman of the Section on Geology, Seismology and Volcanology of the National Research Council, the head of the Department of Geology, University of the Philippines, and a representative of the Geological Society of the Philippines" (Philippine Congress 1952, 3215).

12 A 96-year-old Aeta woman said, "Sa tanda kong ito wala pa akong alam na pumutok ang Pinatubo" (Despite my advanced age, I have never known of Pinatubo erupting) (Shimizu 2001, 108).

13 As Punongbayan et al. (1996, 81) admitted, "The most serious shortcoming of our warnings was that, even though the hazard maps anticipated ash fall, we treated it more as a nuisance than as a deadly hazard. We did not give adequate warning that the accumulated ash would be much heavier than expected because of rain from the typhoon and did not anticipate that roofs which were already burdened by ash would be strained even more by earthquakes during the latter stages of the eruption."

14 The complex cultural, social, and physiological problems associated with the dislocation of the Aeta require an extended discussion that is not possible in the space of this article. For Aeta testimonies, see Shimizu 2001, 141–56; Fondevilla 1991. Cf. Seitz 1998; Macatol and Reser 1999–2000; Gaillard 2006a, b; Marler 2011; Bernstein and Dominy 2013.

15 However, as Shimizu (2001, 29–30) notes, "Soon after the eruption, Mr. Paylot Cabalic, one of the leaders of LAKAS, wanted to become independent and self-determined, free from the patronizing advice, instruction, and guidance of the sisters who had been working earnestly for LAKAS since its establishment." Cabalic formed a separate organization, signaling the crystallization of Aeta ethnic consciousness and empowerment, which was an unforeseen consequence of Pinatubo's eruption, as Shimizu (2001) argues.

16 In fact, this elderly man who was part of the LAKAS community had evacuated at an early stage, but he longed to return to his fields. After one month in the evacuation center he was so agitated as to demand to be allowed to return to his home on Pinatubo, where he died. He is said to have made the appeal: "Kung gusto niyo para hindi ako magalit . . . ibalik ninyo ako doon sa dating lugar. Di bale na kung pumutok iyong Pinatubo. Kung puputok ang Pinatubo ako ang kasama ng ating lupa at halaman na matatabunan. Ako ang kasamang mamamatay ng halaman doon sa Mt. Pinatubo" (If you like so that I won't get angry . . . bring me back there in the former place. It doesn't matter if Pinatubo erupts. If Pinatubo erupts I will be buried together with our land and plants. I will die together with the plants there on Mount Pinatubo) (Shimizu 2001, 58).

17 Geologists explain that "Pyroclastic flows are extremely hot (up to 1000^{0}C), often incandescent and turbulent blasts of volcanic fragments (boulders, pebbles, sand and dust) and hot gases that sweep along close to the ground at great speed" (Tayag and Punongbayan 1994, 3).

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