

December 2017

Calculating Risk, Denying Uncertainty: Seismicity and Hydropower Development in Nepal

Christopher Butler

University of California - Santa Cruz, cjbutler@ucsc.edu

Matthäus Rest

University of Munich, m.rest@lmu.de

Follow this and additional works at: <https://digitalcommons.macalester.edu/himalaya>

Recommended Citation

Butler, Christopher and Rest, Matthäus. 2017. Calculating Risk, Denying Uncertainty: Seismicity and Hydropower Development in Nepal. *HIMALAYA* 37(2).

Available at: <https://digitalcommons.macalester.edu/himalaya/vol37/iss2/6>



This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/).

This Research Article is brought to you for free and open access by the DigitalCommons@Macalester College at DigitalCommons@Macalester College. It has been accepted for inclusion in HIMALAYA, the Journal of the Association for Nepal and Himalayan Studies by an authorized administrator of DigitalCommons@Macalester College. For more information, please contact scholarpub@macalester.edu.



Calculating Risk, Denying Uncertainty: Seismicity and Hydropower Development in Nepal

Acknowledgements

The authors thank Sienna Craig, Mark Turin, and two anonymous reviewers for their valuable comments on this article. Research was supported by the Swiss National Science Foundation, the Humer Foundation for Academic Talent and the European Research Council-funded project 'Remoteness and Connectivity: Highland Asia in the World.'

Calculating Risk, Denying Uncertainty: Seismicity and Hydropower Development in Nepal

Christopher Butler
Matthäus Rest

If Ulrich Beck's definition of 'risk society' describes societies increasingly structured by preoccupations with future environmental threats and related insecurities created by modernization, then Nepal's hydropower community would appear to be quite the opposite, propelled into environmental denial by twin demands for domestic electricity and revenue earned through hydroelectric export. Our research reveals that prior to the April 2015 earthquake in Nepal, the hydropower community was engaging in what Eviatar Zerubavel calls 'socially organized denial,' largely ignoring the uncertainties associated with seismic activity. Earthquakes and tremors were viewed as unavoidable realities that should not impede hydropower development. This denial, we argue, was shaped not only by local political realities and demand for electricity, but also by a larger desire to capitalize on available funds from international finance, which are highly contingent upon Nepal presenting itself as a 'safe' zone for investment.

Our study focuses on the elites of Nepal's hydro community: the developers, investors, water experts, and government officials who occupy the 'upstream' positions at which scientific knowledge is produced and adjudicated. On one hand, the denial or omission of earthquake potential that we witnessed seems to identify the ineluctable challenges that Nepal faces in attempting to integrate its economy into global markets; on the other hand, it indicates the desire of the private sector to reap profits from hydropower in spite of obvious geophysical dangers. These dangers, we argue, are a bankable risk for these elites. However, for the people directly affected by new hydropower infrastructures, these are risks and uncertainties threatening already vulnerable livelihoods.

Keywords: seismicity, hydropower, infrastructure, uncertainty, financialization of risk, Nepal.

Introduction

The Nepal April 2015 earthquake devastated infrastructure in the middle third of the country. It rendered many roads, paths, bridges, and hillsides structurally unsafe for use or habitation. Several hydropower plants were also knocked off-line—a staggering blow for a country already contending with year-round load shedding, and needing reliable energy to fuel its reconstruction efforts.

Given the country's deep-seated aspirations for hydropower as a future pathway to development (Butler 2016; Lord 2014; Rest 2012), analyses of the damage to existing plants and those under construction quickly emerged. The Nepal Electricity Authority reported that 150MW (megawatts) of electricity generation had been lost in the earthquake from a national portfolio of just 774MW (Pangeni 2015), and that this loss represented an 'acutely small level of...capacity in a nation of 28 million people' (Schneider 2015). Furthermore, several projects in development were set back months and years due to road devastation, project repair needs, and construction materials being diverted to other post-quake reconstruction needs, such as shelters, roads, hospitals, and schools. "This is a huge setback to Nepal," Ram Siwakoti from Chilime Hydropower told the *Nepali Times*, "[W]e will need a lot of time and money to recover fully" (Rai 2015). Khadga Bisht, president of the Independent Power Producers Association of Nepal (IPPAN), called the earthquake, "[t]he most devastating blow to Nepal's energy sector after the Maoist war" (ibid).

As the Nepali government and development agencies continued to tally earthquake damage and future losses, the hydropower community generated its own assessments (IPPAN 2015). In the months following the disaster, quake-induced landslides followed, exacerbating the already-sluggish efforts to restore hydropower plants. Project officials at the Bhote Kosi project, a 45MW plant, estimated its generation losses at 2,36GWh (gigawatt hours), or \$30 million (Pangeni 2016). Six months after the earthquake, the government's long-awaited Post-Disaster Needs Assessment reported total energy sector losses approaching NRs. 18.75 billion—or \$178.5 million—and an energy shortfall of 93MW by the start of 2016 (Giri 2015).

For the first time in decades, the earthquake and its after-effects ushered doubt into discussions about the viability of large-scale hydropower in Nepal and its ability to buoy the economic prospects of the nation. Since the government opened the hydro sector to private interests in 1992, hydro professionals have battled vociferously for a business milieu with qualities common to private sectors in nations around the world: low regulation,

investment-friendly tax rates, and expedited processes for socio-environmental approval of projects (Butler 2016). But the earthquake had given weight to a host of associated concerns, all of which would complicate hydro-constructions even further: glacial lake outburst floods (ICIMOD 2011) and the increased likelihood of landslides (Rai 2016).

To some Nepalis, this new reflexivity on the safety of hydropower was long overdue (Thapa & Shrestha 2015). But to others, the idea that serious doubt would suddenly re-enter conversations about hydro-futures, seemed delinquent and incongruous with the stated aim of turning Nepal into a 'hydropower nation' (Lord 2014). To investigate these contradictory perspectives on hydropower and seismicity, we draw on six years of fieldwork in hydropower development in Nepal, including detailed examinations of the private sector, and attending hydropower-related conferences, seminars, and presentations at government institutions, private hydropower company headquarters, and civil society-sponsored events. We have each—together and separately—conducted interviews with more than 80 private sector hydropower representatives regarding their attitudes and opinions about hydropower, Nepali economic development, the environmental and economic impacts of hydropower, and seismicity. What we have learned through these interactions is that our interlocutors work hard to render seismicity as a calculable risk while denying the inherently uncertain character of their calculations. Through this move, we argue, large-scale hydropower development in Nepal becomes a business option. At the same time, it brackets out the fact that people living in close proximity to these future hydropower sites will have no devices at hand to calculate the risks emanating from them, and will encounter growing levels of uncertainty when it comes to the ramifications of seismic activity.

"You just accept the risk."

At the 2013 IPPAN Power Summit in Kathmandu, Nepali military in drab green uniforms ringed the large ballroom at the Soaltee Hotel. Men in business suits socialized over coffee and tea, waiting for Nepal's interim president, Ram Baran Yadav. And then the ballroom went dark—the first of seven power cuts for the day. The fact that this was a hydropower conference couldn't have made the irony any thicker. After President Yadav and other ministers arrived on stage, the crowd sat through a morning of benedictory wishes from the Nepali government, the country representatives of well-known lending institutions, and a few foreign diplomats. Each speaker told the audience that the future of Nepal depended on hydropower development.

In the afternoon, the head of an interest group speaking for private hydro developers addressed the crowd, stressing the need to create 'bankable' projects that would appear 'friendly' to foreign companies and assure them of profitable returns on investment. But the prospect of improved electricity and infrastructure for Nepal, he said, was only half the story. If Nepal could capitalize on its 6,000 rivers, hydro development could move the entire country out of its 'developing' status, and, by virtue of free markets, signal the fulfillment of the democratic principles first pursued during the Jan Andolan movement in 1990. His remarks were met with vigorous applause, and he concluded his presentation with a quote ascribed to Confucius: "Set the goal right, but if it can't be reached, don't adjust the goal. Hasten the pace."

The topic of risk—a specific type of risk—dominated the proceedings. A morning roundtable on the financial viability of hydropower projects discussed 'acceptable risk allocation' and 'sovereign risk,' which were the risk factors foreign investors would have to anticipate in an environment in which their investments would not necessarily be covered by the same legal protections they could expect at home. Then there were slideshows on commercial risks for domestic developers, including currency fluctuations and market variability on fuel prices and construction materials. Finally, another presenter summarized the project risks in terms of cost overruns, worker performance, and the availability of heavy construction machinery.

Beneath the surface of this roundtable, and many other presentations from the conference, lingered a perceptible anguish that felt like blame—blame on the Nepali government, and, in particular, the Nepal Electricity Authority (NEA), the country's parastatal responsible for electricity generation, transmission, and distribution. When NEA's director presented his energy demand forecasts to the audience, he sought to temper their claims and expectations by saying the free market itself was unpredictable in terms of risk, a remark that drew a long line of angry business people to the microphone for the Q&A. No, they argued, the free market was the solution: it would distribute risk in a way that would stimulate production and provide benefits for people in Nepal. They argued that it was the government who inhibited this process. The country head of the Asian Development Bank told the audience that mitigation of risk should not be the private developer's burden.

Away from the conference scene, our interviews with private hydro professionals also revealed a surprising lack of acknowledgment of the potential for earthquakes to pose a serious threat to the country. When questioned

directly about seismicity concerns, most respondents bracketed seismic risk apart as an unpredictable, and thus negligible, externality. As one developer put it, "Natural calamities can happen anywhere. You just accept the risk." A few years earlier, in conversation with an Indian hydropower engineer who was preparing one of the major new foreign-funded projects in Nepal, one of us asked about the danger of a dam failure caused by an earthquake. He replied: "This is a silly question. All the components will be defined on the basis of earthquake risks." That was that.

And yet, as quickly as a developer dismissed questions about seismic risk, they would also vouch for the unpredictability of rivers. One respondent admitted that he was concerned with the number of dams proposed for construction in the case of seismic activity: "I've spent 35 years on these rivers... You always have that risk... they are unpredictable." A second developer told us, "The Himalayas are young mountains and still have a lot of motion in their formation." But when asked if he thought Nepal should curb its aspirations for hydro development, he dismissed the notion because time was of the essence: "If we don't build hydropower now, India will build its own and no longer need electricity from [Nepal]." So, how do we explain this disjuncture between earthquake awareness and lack of preparedness, particularly, for our purposes, in the hydropower sector? How did these equally central discursive themes move in parallel for so long? Interviewed by Spotlight Nepal, Bigyan Shrestha, CEO for the Upper Tamakoshi Hydroelectric Project made this admission:

Just parroting the lessons of 1934 earthquake and focusing in Kathmandu alone would not be enough. The situation has changed a lot in the last eight decades. There are many hydropower projects, road projects and other infrastructures close to epicenters and seismically vulnerable areas. So far as hydropower plants are concerned, mountains and Himalayan foothills are considered as good sites because rocks are strong and good in these areas. Thus, these areas have now turned into hub[s] for hydropower. Before [the] April 25 earthquake, no one had made an exact calculation on how earthquakes would damage these projects. Nepal lies in a seismically active zone, particularly the Himalayas and hills, we need to seriously study seismic vulnerabilities of the region before taking the projects. (Shrestha 2015)

Indeed, our own research echoes Mr. Shrestha's point. Having conducted hundreds of interviews with hydro-professionals and politicians for the past six years in Nepali and English, we have noted a lack of concern expressed by

this group regarding the earthquake potential. Discussions about seismicity risks were rare, and, when discussed at all, commonly bracketed as an uncontrollable negative externality that could not and should not deter hydro development.

Caught Unawares?

The idea of the ‘Big One’ has been a long-running existential threat in Nepali discourse since the 8.0 magnitude Nepal-Bihar earthquake in 1934 that killed an estimated 11,000 people. And the general seismicity of Nepal is also a largely accepted truth, supported by the country’s various policies, plans, and programs dedicated to disaster preparedness and risk reduction. These include the Natural Calamity Relief Act of 1982, the Nepal Risk Reduction Consortium formed in 2009, and the Kathmandu Valley Earthquake Risk Management Project. That the April 25 earthquake occurred on a Saturday likely saved thousands of lives because school was not in session and that morning many Nepali were outdoors enjoying the spring weather. That the diminished loss of life was owed to any sort of preparation on the part of the Nepali government and its many multinational supporters was generally discounted (Sharma 2015; Useem, Kunreuther & Michel-Kerjan 2015).

Considering the current state of hydropower generation in Nepal, it might be surprising to learn that in Nepal electricity production started in 1911, more than 100 years ago, with a 500 kW (kilowatt) hydropower plant on the outskirts of Kathmandu. The fact that the second plant was not built until 1934 shows that feudal elites of the time did not see electricity as a means to increase productivity. Instead, they regarded it as a luxury item, primarily used to generate power for lighting their palaces in downtown Kathmandu (Gyawali 2003: 72). To this day—at least in people’s imagination—access to electricity remains closely related to access to political and economic power.

The arrival of post-World War II (WWII) aid in the region did not expedite hydropower generation in Nepal in the same ways as it did in other parts of the region, like India and Pakistan. A World Bank report from 1964 stated that only the cities of Kathmandu and Biratnagar enjoyed a regular electricity supply, and that only one-fifth of the national generating capacity of 10 MW came from hydropower. After an additional 20 MW of hydropower production was slated for commission in the late 1960s, the World Bank authors reasoned that, ‘there seems to be no need for any other major additions to generating capacity for the time being’ (World Bank 1964: 32). This attitude towards electricity production has been a

long-standing complaint voiced by many of our interlocutors in the hydro sector who blame the Bank’s decades of conservative forecast projections for the long delay in hydropower production.

While the World Bank report underestimated (by today’s needs) the potential for hydropower consumption in Nepal, it did recognize the need for an improved institutional arrangement of electricity production and distribution. Eventually, and with strong support from the Bank, the government created the Nepal Electricity Authority (NEA) in 1985 to establish ‘an independent electricity authority to be run on a businesslike basis,’ as already demanded in the 1964 report (ibid: 33)—a goal of which the NEA has fallen short of meeting, in the opinion of most Nepalis with whom we have spoken. NEA operates as the owner of all transmission infrastructure and as the sole distributor of electricity to end consumers. Additionally, NEA generates approximately two-thirds of the country’s hydropower.

Since 1990, the private sector (also referred to as ‘independent power producers’) has been allowed to construct hydropower projects, but this sector must negotiate power purchasing agreements with the NEA. This mandatory arrangement has been the long-standing focal point of conflict between the NEA, the private sector, and individual electricity consumers. The NEA has developed a reputation as one of the most dysfunctional institutions in a country without a shortage of badly managed government offices, and has consistently run at a loss in terms of revenue: a condition they blame on the weak Nepali rupee, but which the public and many development agencies blame on workplace inefficiencies, a bloated workforce backed by a powerful and inflexible union, and blatant corruption. Recent investigative journalism inquiries have revealed that significant blame for the last decade of load-shedding in Nepal was due to NEA officials selling and redistributing electricity to industrial consumers illegally in exchange for lucrative kick-backs (Sangraula 2017).

However, despite these complicating issues, post-earthquake multi-national financing has begun to flow into the country. In fall 2016, the International Finance Corporation (IFC)—the private sector arm of the World Bank—announced its intention to increase its portfolio in Nepal from its original pledge of \$500 million in 2014. IFC’s country director for Nepal, Wendy Werner, said the investments, particularly in hydropower, would bring qualitative change to Nepal’s economy and way of life. Similarly, other multi-national organizations, such as the Italian-Thai Development Corporation (a stakeholder in

the planned Upper Karnali hydroelectric project), the China-based Sino Hydro corporation, as well as Indian developers SJVN and GMR, have looked to invest in Nepali hydropower. Despite the lack of specific data on all of these new actors, we did not find a different approach towards seismicity when compared with local industry representatives, in our numerous conversations with some of these multi-national actors.

These concerns and struggles voiced by the private sector belie the fact that, as far as hydropower development is concerned, the current moment is indeed a crucial one for them. Growing disdain and impatience for government ineptitude and public perceptions of its rent-seeking behavior have placed significant political intentions and support behind private interests and companies in order to lead Nepali development in this century. For this reason, understanding the private sector's view of seismicity is crucial because it holds significant favor and influence in determining the manner and scope of debates about both hydropower and development more generally. In today's discussions about what constitutes 'risk,' the private sector is establishing a worldview in which risk is not about natural factors, but is rather about economic ones, over which they spin an illusion of control and management.

Our argument begins from a premise that society shapes patterns of perception, memory, and organizational aspects of thinking. In this context, we ask how people cope with information that is available. Like so many people around the world who are now well-versed in the reality and potential effects of climate change, hydropower professionals' and government officials' actions seldom reflect what the scientific community has long known about the Himalayas: it is a relatively young geologic area, exceptionally prone to seismic activity (Champati ray et al. 2006; Khattri 1987; Kumar Nath 2004). These geologic qualities, then, should be reflected in national discourse around hydropower, which calls for extreme and transformative impositions of infrastructure into such natural landscapes. And yet, our research and experience show it was not.

At the core of this discussion is a consideration of both risk and uncertainty, as well as of the competing definitions and interpretations of risk. We are not the first to ask these questions. In their updated volume, Thompson et al. (2007) note that a dearth of solid research about Nepal's environmental problems had manifested itself as a milieu of uncertainty regarding how the country could address its ecological challenges. On one hand, no one doubted that forests were being over-harvested for timber; aerial photographs could show completely denuded hillsides. But,

how much over-harvesting had taken place, and by what percentage? And how much replanting and time would these hillsides need to recover? The absence of these facts thwarted action on the part of Nepali institutions.

With respect to hydropower, we focus on how uncertainty is, or is not, expressed in terms of risk. Our research suggests that the private hydropower sector and related development agencies are giving more and more weight to a rationalized view of risk, much along the lines of Ulrich Beck's view of risk, which focuses on what *can* be measured, as opposed to what *should* be measured (2006). This view contrasts starkly with the perception of local residents living around future and present hydropower sites. Following Arjun Appadurai (2011) we argue that directly affected people are not actually dealing with risk, but extreme uncertainty about the future of their lives, homes, and livelihoods—far beyond their access to electricity. Whereas professionals use models to project the structural integrity of dams and potential earnings from electricity sales, the people living in close proximity to hydropower projects have no way to calculate and manage the 'risks' that these interventions will mean on the ground.

Socially Organized Denial

The slow government response to the 2015 earthquake in Nepal threatens to exacerbate social inequality, alter community structures, and generate new patterns of economic and social conflict. How is it that this major catastrophic event has failed to cause a strong response from the hydropower industry? What can explain the disjuncture between lived experience and public concern? What can we say about the prevailing opinions about seismicity that existed prior to the 2015 earthquake and continue to neutralize or muffle a stronger outcry for stricter regulations on hydropower development? To discuss this issue, we engage what Eviatar Zerubavel calls 'socially organized denial' regarding the risks of hydropower in a seismically active area (2002). Conventional thinking suggests that if people understood the threat of earthquakes in the Himalayan region, they would change their thinking about matters such as hydropower, just as we would expect that people would take more substantial initiatives to fight climate change once the scientific evidence reached the level of preponderance. And yet, this is not the case.

The concept of socially organized denial traverses the fields of psychology and sociology to investigate "the mental processes of attending and ignoring" (Zerubavel 1997: 11) in "response to social circumstances, and carried out through a process of social interaction" (Norgaard

2006: 352). While much of this work has focused on human enormities (Cohen 2001) and political apathy (Eliasoph 1998), we are joining a conversation with Norgaard who has used cognitive sociology to investigate and interpret the various means by which Norwegians, among others, have resisted to engage with climate change initiatives in the face of mounting evidence and impacts (2011).

Socially organized denial is context-specific, informed and shaped by the culture(s) in which it forms. Individuals negotiate prevailing ideologies and engage in identifiable patterns of rhetoric, which we can analyze in order to delineate the boundaries within which the debate over a particular issue is confined. As we will see in our examples to follow, debates about seismicity and hydropower are strictly limited within a narrative in which Nepal's future and hopes are inextricably tied to its success in hydropower development. Therefore, discussions that stray too far from this central argument tend to be few and unexpressed.

Various groups within a debate, which occupy distinct positions of power, have unequal access to move discussions toward their guiding points of reference. Sutton and Norgaard (2013) were correct to connect this element of organized denial to Gramsci's concept of hegemony (1971), that dominant groups maintain their positions culturally by securing collective consent to their ideas. This discussion suggests that while hegemonic discourses are cultural processes bound by perception, many forms of denial are produced (and contested). Culturally prescribed norms about how to think (or *not think*) about things reflect a particularly insidious form of social control.

If socially organized denial is shaped in response to social circumstance, Nepali hydropower's version of denial would be defined by the country's long-standing and frustrating attempts at development. Numerous scholars have documented the deeply engrained nature of development in Nepal (cf. Pigg 1993; Shrestha 1997), wherein being developed (*'bikasi'* in Nepali) or not developed (*'abikasi'* in Nepali) prevails as a fundamental distinction between urban and rural populations, and between those who are 'modern' and those who are not. This frustration is further compounded by an unstable and unproductive government which has, as of this writing, re-formed 26 times since the democratic revolution in 1990, each new iteration bringing in a new roster of ministers and visions to lead the country who are ultimately unable to succeed.

No country can improve its economic standing and the livelihoods of its residents without a stable and reliable source of energy (Barnes and Floor 1996; Lee 2005). In this context, Nepal's weak economy has opened space for the

private sector to state its case for leading development, arguing that state-led and donation-backed programs have failed to make appreciable returns for the average Nepali. The hydropower sector has seized this moment to fight for decreasing regulation of their industry, suggesting that for every day that passes, every drop of water that cascades from the mountains without passing a turbine represents lost revenue and opportunity for the country. Both the Nepalese state and the hydropower industry only see 'falling water' (Gyawali 2003). By this standard, expediting hydro development and downplaying the inherent risks makes 'sense.'

Risk and Uncertainty

In his essay, 'The Cultural Nature of Risk,' Åsa Boholm rhetorically asks what social anthropologists can contribute to risk research. His answer is: context (2003: 174). He roots his conclusion in a discussion of Mary Douglas and Ulrich Beck, who differ in how they regard the need for an analytic distinction between traditional and modern models of risk. For Douglas and other cultural theorists, Boholm writes, "explanations in terms of 'risk' in modern society are understood to fulfil the same social function as explanations in terms of destiny, supernatural agency, or broken taboo in traditional societies" (2003: 165). In other words, for cultural theorists, risk, like taboos, is subjectively chosen and culturally constructed to exert social control over a population, thus eliminating the need to analytically separate the concept of 'risk' from the concept of 'taboo.'

Beck, by contrast, posits risk as a new element that permeates all modern interactions and discourse, the product of an economic system that attempts to simultaneously instantiate and mystify risk through de-contextualized calculations and rational decision-making models (1992). In this way, risk appears 'objective.' He defines risk as "phenomena and causality in the natural world that can have harmful effects" (Boholm 2003: 161). This 'objective' and modern notion of risk differs from the cultural theory turn in the sense that it stands apart from society in the realm of mathematics, unlike the notion of taboo, which grounds itself in the community and its behaviors.

Boholm seeks a middle ground when it comes to analyzing risk—a ground in which we root our analysis. To call something a 'risk' implies values and subjective judgment, and yet, determining probability of events and occurrences through statistics has a largely accepted predictive ability. The power of numbers and rational models can illuminate optimum paths devoid of human errors in judgment. However, history is rife with examples of people and institutions choosing otherwise. The 2008 global recession,

triggered by the collapse of the American housing market, is perhaps one of the best examples of this incongruity: trillions of dollars were lost due to a subjective belief that housing values would always rise, when, in fact, a closer look at the details showed collapse was imminent (Lewis 2011).

With respect to the Nepal earthquake, a subjective definition of risk might attend to how hillsides are utilized, occupied, and maintained. This could affect settlement patterns as populations move to higher ground to avoid earthquake-induced landslides, such as those in Langtang and Gorkha which obliterated several villages (Pokhrel 2015). In rural areas such as these, natural disasters have often been explained as angry divine responses to transgressional human behavior. On the Sunkoshi River in 2014, 150 people were killed in a landslide that several residents attributed to misbehavior at a local *naga*, or serpent spirit, shrine (Personal communication Weena Pun, 15 August 2014). The 2015 Everest avalanche triggered by a falling serac was interpreted by many as divine retribution to the increasing mass tourism that was despoiling relations between human and more-than-human entities (Personal communication, Ben Ayers, 22 February 2016; see also GlacierHub 2015). In line with our broader argument, these explanations show that for people facing living conditions shaped by deep uncertainties and a severe lack of reliable scientific data, calculating (or even estimating) risk in these terms is not a strategy they apply widely.

An objective interpretation of risk would calculate the time since the last earthquake, seismometric readings of vibrations in the earth's crust, and measurements of the levels of escaping radon gas. In spite of these preferred optics with which to gauge potential earthquakes, the scientific community has no illusions about its ability: "The USGS [United States Geological Survey] nor any scientist have ever predicted a major earthquake. They do not know how, and they do not expect to know in the foreseeable future" (USGS 2016). Curiously, however, the USGS goes on to say, "Based on scientific data, probabilities can be calculated for potential future earthquakes" (ibid). And this is a key admission. While no one can predict earthquakes, we operate and build in a world where probabilities and speculation are used to determine levels of risk.

Thus, in our study of socially organized denial, the definition of risk in Nepal appears to be a site of contestation—much like the battles over taste (Bourdieu 1984), official knowledge (Dove 2006), and scientific standards (Latour 1993). What will be the hegemonic view of risk in Nepal's infrastructural development? Our research suggests that the increasing rise of the private sector is shifting its views of risk away from being subjective and

culturally-determined, and towards an understanding of risk as objectively calculable. This process is aided and abetted by the private financial interests and development agencies that fund hydropower projects.

Much of the risk research today tends to focus on capitalism and the financial mechanisms that are spawned to create value amidst rules and regulations that seek to limit fraud and excessive gain. Though seemingly a far-cry from the topic of earthquakes and hydropower, it is the general orientation of financiers and their reliance on models, predictability, and the data they choose to analyze that draw our interest. The highly-rational form of risk assessment that we witness in Nepali hydropower seems to reflect an ascendance of financial institutions worldwide, generally: to define risk, to suggest means for hedging risk, and to determine how much risk the individual is responsible for vis-à-vis other individuals and/or corporations. Like finance, we need to inspect the legitimating principles guiding hydropower construction in Nepal. As the 2015 earthquake reminds us, it appears the 'techniques of calculability...have far exceeded the organizations and tools for its management, hence opening a new distance between expert and popular understandings of risk (Appadurai 2011: 528). The ethos of hydropower professionals working in Nepal, those who play and shape the game, perpetuates a process that is 'simultaneously discursive, technical, institutional, and ideological' (ibid: 526), by which they attempt to push uncertainty out of the picture, albeit not entirely successfully.

Appearances and Spectacular Accumulation

Socially organized denial has a specific context and temporality in which it emerges to influence public thinking about earthquakes, hydropower, and risk. But there is more going on here than simple denial. At this particular historical moment, as Nepal searches for development and electricity, it is not enough that the hydro industry simply goes about its work. It needs to sell a vision, a future, not just for the average Nepali, but, more importantly, for the finance needed to build these projects, and for the government to help create more favorable conditions for completing this work.

Private hydropower interests advance this vision through a series of tropes about water as national destiny, hydropower as development, and the fulfillment of democratic promise. To be successful, private hydropower has to present a confident image of certain profit in order to realize itself through foreign investment—whether from private firms or development banks. They engage in what Tsing calls the 'economy of appearances.' Promoting hydropower as profitable and its associated risk as cal-

culable is a “conjuring trick, a drama... a self-conscious making of... spectacle [as] a necessary aid to gathering investment funds” (Tsing 2000: 118). When you trace out the string of people who desire hydropower to arrive as a business, who want certain returns, who want discussions of risk circumscribed to the topic of guaranteeing profit, you can understand how they could be convinced to deny serious credence to possible earthquakes. It doesn't fit the narrative.

The private hydropower narrative sells images of illuminated rural homes, children studying late into the evenings under lamps, social programs sprouting up from fully-filled government coffers, and urban homes stocked with modern appliances, surging to life, at any time of day, with the press of a button. Nature must be ‘made into loot,’ and Nepal is told it's not water but money that pours down its rivers, unrealized and wasted. This conjuring trick has its roots in notions of frontier culture, asking participants to see a landscape that doesn't yet exist, the same way that the US gold rush invited white immigrants to envision the American West. It is reminiscent of Georg Simmel's (2011: 482) insight about the monetization of value: “Gauging values in terms of money has taught us to determine and specify values down to the last farthing...The ideal of numerical calculability has been made possible in practical, and perhaps even in intellectual, life only through the money economy.”

These private sector machinations in support of finance are possible due to a prevailing national discipline that says development is necessary, and the government has failed in its responsibility to deliver development. This argument effectively produces a political quietude that does not question risk and dismisses protest as the work of rogue individuals rather than legitimate groups (Adhikari 2011), which then enables the state to draw in military suppression of future protests without much comment from the public. Hydropower becomes a tool of what Tsing refers to as ‘spectacular accumulation,’ a means of creating ‘value’ through speculation and spectacle, and often at great cost to those who would reap none of the profits. Investors are “looking for the appearance of success. They cannot afford to find out if a product is solid,” or free from risks such as earthquakes (Tsing 2000: 141). To meet this demand from the market, hydro developers must sell potential, not product. And uncertainty cannot be entertained within this model.

Conclusion

As Nepal develops and becomes a ‘global nation,’ it needs to be noted that this term connotes an opening up process in which new areas submit to foreign investment, first and foremost the hydropower sector. In order to attract foreign capital, hydropower developers engage in complex calculations of the risk involved in these projects. However, such risk calculations may be entirely beside the point if earthquakes cannot be accurately predicted. Based on our interviews, the main datasets included in these risk analyses focus on the development of electricity production and consumption tariffs, which are combined with assessments of the political developments in India and China. At the moment, we sense an extreme amount of urgency to bring the proposed and long delayed large-scale projects on track (and eventually on line) before the Indian government follows through with its announcements to substantially increase its solar and nuclear power generation. This would effectively erase Nepal's ability to profit from the harvest of hydropower, and would dismiss the electricity-export-driven development model Nepalese elites have been working on for decades.

Most importantly, though, these risk analysis models exclude those factors that cannot be calculated: reduced water flow and the increased danger of glacial lake outburst floods due to climate change, and the threat of future earthquakes. If discussed, these natural events are conceptualized like financial risks, that is, risks that can be managed through calculation. But the seismic risk to a potential hydropower site simply cannot be calculated. What we are actually talking about, then, is uncertainty. As Appadurai (2011: 524) reminds us, “uncertainty remains outside of all financial devices and models.”

The denial of uncertainty serves an important purpose in maintaining the promise of Nepal as a future ‘hydropower nation’ (Lord 2014). As with many other financial devices, it helps to obscure the fact that those who make a living with the financialization of risk are seldom those who have to live with the uncertainties produced by its ramifications. In the case of hydropower development in Nepal, the affected communities have always already been among the most vulnerable: predominantly peasants who subsistence-farm in geologically highly unstable mountains. Many of these families are indigenous, and already contend with institutionalized forms of discrimination that inhibit their ability to provide for themselves.

In other words, we suggest that the private sector is poised to exploit what Frickel and Vincent (2011) call ‘undone science,’ places where horizontal and vertical knowledge gaps intersect, leaving a void wherein uncertainty about environmental issues can be amplified or denied for political gain. In post-Hurricane Katrina New Orleans, some parishes had extensive soil sampling for contamination while other areas were neglected. When activists complained, the US Environmental Protection Agency deepened their testing, but did not expand it to those neglected areas. In this way, the scientific community learned more information about fewer locations, which did not necessarily improve the level of knowledge overall. In a similar fashion, the lack of seismic knowledge as it relates to hydropower construction provides another opening in which the private sector can advance its position—by claiming the importance of thorough studies on safety and environmental impact—without actually knowing whether the structures it designs will be prepared to withstand a major earthquake. On the other hand, civil society and anti-dam activists cannot marshal an opposition to dam construction in seismic zones beyond supposition. That is, having little evidence for their position, they can only warn about the danger of dam breach as a possibility rather than a likelihood. In Nepal’s energy-starved, development-seeking context, theirs is indeed a weak position.

Through local employment, electrification, improved infrastructural access, and possible local social development, hydropower projects may open up exciting potentialities for local communities. Recent project development agreements, such as the one for the Upper Karnali Hydroelectric Project, have the availability of shares for affected people written into the terms of the contract. In some parts of Nepal, share options in hydro projects have attracted high levels of interest from local small-scale investors (ShareSansar 2016).

But, communities around these proposed dam sites will also have to live with the increased uncertainties these projects will bring to their villages. Generations of rural communities have been taught that the village is a backward place and that the Nepalese state will change those conditions (Pigg 1992). Perhaps it is not surprising, then, to note that it was predominantly old women who expressed negative feelings about the imminent hydropower boom in the Arun valley (Rest 2012). Whether the 2015 earthquakes will change the discourse on risk and uncertainty on the Nepalese hydropower frontier remains to be seen. In line with Boholm’s proposition, we are convinced that we will need more anthropological research to address this question.

Christopher Butler (PhD, sociology, University of California, Santa Cruz, 2016) is an independent scholar living in Kathmandu, Nepal.

Matthäus Rest (PhD, ethnology, University of Zurich, 2014) is an anthropologist. After visiting positions at the University of Oxford, the Nepā School of Social Sciences and Humanities in Kathmandu and UCLA, he currently splits his time between the University of Munich and his family’s farm in rural Austria. He is writing a book on the suspension of the Arun-3 dam in North Eastern Nepal. Apart from unbuilt infrastructures, he likes to think about the future of global milk production and the Krampus.

The authors thank Sienna Craig, Mark Turin, and two anonymous reviewers for their valuable comments on this article. Research was supported by the Swiss National Science Foundation, the Humer Foundation for Academic Talent and the European Research Council-funded project ‘Remoteness and Connectivity: Highland Asia in the World.’

References

- Adhikari, Prakash. 2011. 900MW Upper Karnali Project: Maoist Leaders Warn Government over Contract. *The Kathmandu Post*, June 13. <<http://kathmandupost.ekantipur.com/printedition/news/2011-06-13/900-mw-upper-karnali-project-maoist-leaders-warn-govt-over-contract.html>> (accessed on April 29, 2017).
- Appadurai, Arjun. 2011. The Ghost in the Financial Machine. *Public Culture* 23 (3): 517-539.
- Barnes, Douglas and Willem Floor. 1996. Rural Energy in Developing Countries: A Challenge for Economic Development. *Annual Review of Energy and the Environment* 21 (1): 497-530.
- Beck, Ulrich. 1992. *Risk society: Towards a new modernity*. Thousand Oaks: Sage.
- . 2006. Living in the World Risk Society. *Economy and Society* 35 (3): 329-345.
- Boholm, Åsa. 2003. The Cultural Nature of Risk: Can There be an Anthropology of Uncertainty? *Ethnos* 68 (2): 159-178.
- Bourdieu, Pierre. 1984. *Distinction: A Social Critique of the Judgement of Taste*. Cambridge: Harvard University Press.
- Butler, Christopher. 2016. *Knowledge, Nature, and Nationalism: The Upper Karnali Dam in Nepal*. Ph.D. Dissertation, Sociology, University of California, Santa Cruz.

- Champati Ray, P. K.; Suvarna Dimri, R. C. Lakhera, and Santosh Sati. 2006. Fuzzy-Based Method for Landslide Hazard Assessment in Active Seismic Zone of Himalaya. *Landslides* 4 (2): 101.
- Cohen, Stanley. 2001. *States of Denial: Knowing About Atrocities and Suffering*. Cambridge: Polity Press.
- Dove, Michael R. 2006. Indigenous People and Environmental Politics. *Annual Review of Anthropology* 35 (1): 191-208.
- Eliasoph, Nina. 1998. *Avoiding Politics: How Americans Produce Apathy in Everyday Life*. Cambridge: Cambridge University Press.
- Frickel, Scott and M. Bess Vincent. 2011. Katrina's Contamination: Regulatory Knowledge Gaps in the Making and Unmaking of Environmental Contention. In *Dynamics of Disaster: Lessons on Risk, Response and Recovery*, edited by Rachel Dowty and Barbara Allen, 11-28. London: Earthscan.
- Giri, Sanjeev. 2015. Hydropower Projects Knocked Out by Earthquake Still Offline. *The Kathmandu Post*, October 6. <<http://kathmandupost.ekantipur.com/news/2015-10-06/hydropower-projects-knocked-out-by-earthquake-still-offline.html>> (accessed on April 29, 2017).
- GlacierHub. 2015. Mountain Spirits and the Shaking Earth. *GlacierHub*, October 20. <<http://glacierhub.org/2015/10/20/mountain-spirits-and-the-shaking-earth/>> (accessed on July 9, 2017).
- Gramsci, Antonio. 1971. *Selections from the Prison Notebooks*. New York: International Publishers.
- Gyawali, Dipak, ed. 2003. *Rivers, Technology and Society: Learning the Lessons of Water Management in Nepal*. Kathmandu: Himal Books.
- ICIMOD. 2011. *Glacial Lakes and Glacial Lake Outburst Floods in Nepal*. Kathmandu: International Centre for Integrated Mountain Development.
- IPPAN. 2015. *Earthquake Affected Operations Projects*. Kathmandu: Independent Power Producers Association of Nepal.
- Khattari, KN. 1987. Great Earthquakes, Seismicity Gaps and Potential for Earthquake Disaster Along the Himalaya Plate Boundary. *Tectonophysics* 138 (1): 79-92.
- Kumar Nath, Sankar. 2004. Seismic Hazard Mapping and Microzonation in the Sikkim Himalaya through GIS Integration of Site Effects and Strong Ground Motion Attributes. *Natural Hazards* 31 (2): 319-342.
- Latour, Bruno. 1993. *We Have Never Been Modern*. Cambridge: Harvard University Press.
- Lee, Chien-Chiang. 2005. Energy Consumption and GDP in Developing Countries: A Cointegrated Panel Analysis. *Energy Economics* 27 (3): 415-427.
- Lewis, Michael. 2011. *The Big Short: Inside the Doomsday Machine*. New York: W.W. Norton.
- Lord, Austin. 2014. Making a 'Hydropower Nation': Subjectivity, Mobility, and Work in the Nepalese Hydroscape. *Himalaya* 34 (2): 111-121.
- Norgaard, Kari Marie. 2006. "We Don't Really Want to Know" *Environmental Justice and Socially Organized Denial of Global Warming in Norway*. *Organization & Environment* 19 (3): 347-370.
- . 2011. *Living in Denial: Climate Change, Emotions, and Everyday Life*. Cambridge: MIT Press.
- Pangeni, Rudra. 2016. Damaged Hydropower Plants Yet to Bounce Back. *Republica*, April 18. <<http://admin.myrepublica.com/economy/story/40755/damaged-hydropower-plants-yet-to-bounce-back.html>> (accessed on April 29, 2017).
- . 2015. Earthquake Damages Over Dozen Hydropower Projects. *Republica*, May 5. <<http://admin.myrepublica.com/economy/story/20398/earthquake-damages-over-dozen-hydropower-projects.html>> (accessed on April 29, 2017).
- Pigg, Stacy Leigh. 1992. Investing Social Categories Through Place: Social Representations and Development in Nepal. *Comparative Studies in Society and History* 34 (03): 491-513.
- . 1993. Unintended Consequences: The Ideological Impact of Development in Nepal. *South Asia Bulletin* 13 (1&2): 45-58.
- Pokhrel, Rajan. 2015. At Least 56 Settlements to be Relocated. *The Himalayan Times*, June 30. <<http://thehimalayantimes.com/nepal/at-least-56-settlements-to-be-relocated>> (accessed on April 29, 2017).
- Rai, Om Astha. 2015. Back to the Dark Age. *Nepali Times*, May 29. <<http://nepalitimes.com/article/nation/earthquake-elongates-electricity-rationing,2283>> (accessed on April 29, 2017).
- . 2016. Preparing for the Big Flood. *Nepali Times*, August 5. <<http://nepalitimes.com/article/nation/preparing-for-the-big-flood,3190>> (accessed on April 29, 2017).

- Rest, Matthäus. 2012. Generating Power: Debates on Development Around the Nepalese Arun-3 Hydropower Project. *Contemporary South Asia* 20 (1): 105–117.
- Sangraula, Bikash. 2017. How Nepal Got the Electricity Flowing. *Christian Science Monitor*, January 16. <<http://www.csmonitor.com/World/Asia-South-Central/2017/0116/How-Nepal-got-the-electricity-flowing>> (accessed April on 29, 2017).
- Schneider, Keith. 2015. Nepal Earthquake Damages at Least 14 Hydropower Dams. *Circle of Blue*, May 5. <<http://www.circleofblue.org/2015/world/nepal-earthquake-damages-at-least-14-hydropower-dams>> (accessed April on 29, 2017).
- USGS. 2016. USGS FAQs. *United States Geological Service*, November 16. <<https://www2.usgs.gov/faq/categories/9830/3278>> (accessed on April 29, 2017).
- Sharma, Dinesh C. 2015. Nepal Earthquake Exposes Gaps in Disaster Preparedness. *The Lancet* 385 (9980): 1819–1820.
- Shrestha, Bigyan. 2015. Upper Tamakoshi Damage Manageable. *New Spotlight Nepal*, September 11. <<http://www.spotlightnepal.com/News/Article/Upper-Tamakoshi-Damage-Manageable>> (accessed on April 29, 2017).
- Shrestha, Nanda. 1997. Becoming a Development Category. In *Power of Development*, edited by Jonathan Crush, 266–277. London: Routledge.
- Simmel, Georg. 2011. *The Philosophy of Money* London: Routledge.
- ShareSansar. 2016. Arun Kabeli to Issue IPO Worth Rs 15 Crore (10%) for Project Affected Resident of Panchthar & Taplejung District from Jestha 3; AHPC Has 24.13% Stake in the Co. *ShareSansar*. <<http://www.sharesansar.com/c/arun-kabeli-to-issue-ipo-worth-rs-15-crore-10-for-project-affected-resident-of-panchthar-taplejung-district-from-jestha-3.html>> (accessed on April 29, 2017).
- Sutton, Barbara and Kari Marie Norgaard. 2013. Cultures of Denial: Avoiding Knowledge of State Violations of Human Rights in Argentina and the United States. *Sociological Forum* 28 (3): 495–524.
- Thapa, Gaga and Kashish Das Shrestha. 2015. Natural Disasters and Nepal's Energy Security. *The New York Times*, May 25. <<http://dotearth.blogs.nytimes.com/2015/05/25/one-two-punch-of-earthquakes-and-landslides-exposes-hydropower-vulnerability-in-nepal>> (accessed on April 29, 2017).
- Thompson, Michael; Michael Warburton and Tom Hatley. 2007. *Uncertainty On a Himalayan Scale*. Kathmandu: Himal Books.
- Tsing, Anna Lowenhaupt. 2000. Inside the Economy of Appearances. *Public Culture* 12 (1): 115–144.
- Useem, Michael; Howard Kunreuther and Erwann Michel-Kerjan. 2015. From Nepal Quake, Lessons for the U.S. *Philadelphia Inquirer*, April 27. <<http://www.philly.com/philly/blogs/thinktank/From-Nepal-quakeLessons-for-the-US-from-Nepal-quake.html>> (accessed on April 29, 2017).
- World Bank. 1964. *The Economy of Nepal*. Washington DC: International Bank for Reconstruction and Development/International Development Association.
- Zerubavel, Eviatar. 1997. *Social Mindscapes: an Invitation to Cognitive Sociology*. Cambridge: Harvard University Press.
- . 2002. The Elephant in the Room: Notes on the Social Organization of Denial. In *Culture in Mind: Toward a Sociology of Culture and Cognition*, edited by Karen Cerulo, 21–27. New York and London: Routledge.