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High Mountain Melt-Down: Local Perceptions of Changing Melt-Water Resources in Mustang, Nepal

The histories and development of societies are inextricably interlinked with their environmental contexts (see Diamond, 1997, and Radkau, 2008). And the element on Earth to which peoples' fortunes and fates are perhaps tied the most, and now even more in a world gripped by climate change, is arguably and convincingly water (see Tvedt et al., 2008). Nowhere else is the dependence on and struggle to control water more evident than in arid regions, where it is literally the lifeblood of societies calling the desert home. The case of Mustang, Nepal, for all of its dryness—in addition to its highness—is perhaps even more exceptional an arid human habitat by virtue of the fact that its agro-pastoralist Tibetan Buddhist Loba inhabitants depend on meltwater trickling, and at times roaring down from the ice and snowpack of the high Trans-Himalayan peaks above.

Today, global climate change and warming are causing glaciers and snowpacks worldwide to retreat at accelerating rates (Lemke et al., 2007), threatening the viability of these "water towers of humanity" (Liniger et al., 1998). Local livelihoods and environmental stability for the estimated 40% of humanity that depend on mountain melt water (Beniston, 2003) are jeopardized in turn, making people more vulnerable and exposing them to greater uncertainty. If the snowline rises 150m in altitude for every 1°C increase in temperature, as Beniston (2003) asserts, the capacity of mountains in Mustang and similar regions to harbor ice and a snowpack far enough into the dry, hot summer months (JJA) to water the *gyapre* or buckwheat crop would be greatly diminished. But to what extent melting snow and glaciers will affect people living in large river basins remains unclear fueling an ongoing debate surrounding the "melting water towers" (meltwater contribution to downstream hydrology varies greatly from river to river depending on other inputs, such as monsoon rain in the Ganges). The meltwater irrigators of Mustang, located at the figurative and literal

top of the “melting water towers” chain, are aptly situated observers of the some of the first local signs of global climate change, and witnesses to the first impacts of this chain on humanity.

This paper describes Loba perceptions of climate change, and their implications, with emphasis on water as their main agricultural resource. The eyewitness accounts and cultural memory of encounters with water are an important contemporary case of water-society interactions, which date back to the dawn of humanity, and surface throughout the history of academic inquiry into human-nature interlinkages.

Literature on water and society: culture or nature?

The Marxist-materialist inspired Karl Wittfogel made the first major inroads into the discussion of water-society relations through his hypothesis on the “hydraulic civilization” (Wittfogel, 1957). The hypothesis suggests that the origin of despotic, totalitarian rule in Chinese history evolved from the creation of large bureaucratic structures needed to control large-scale irrigation works. Critics have always attacked its environmental determinist roots, and the universal validity of the conjecture was disproved in a flood of works that documented the dominant role of bottom-up management in several irrigation cultures (see Lansing, 1987, Rivera, 1998, Gelles, 2002, Paerregaard, 1993, Martínez Saldaña and Palerm Viqueira, 2000 among others). In short, models of water control, among other common pool resources, are not necessarily dependent upon state bureaucratic control (Ostrom and Gardner, 1993).

But others still, including the relatively unknown work of John Hitchcock (see Mikesell, 2002) on the Magar culture group in the hills and highlands of the Nepal Himalaya came to the conclusion that environment still exhibits an overall determining factor for certain cultural traits. And this was despite his best efforts to prove cultural constancy in spite of environmental variability. Different ethnic groups and cultures from similar environments held many cultural features in common, as echoed in Lamadrid’s (2008) comparison of arid, high mountain irrigation cultures in Nepal and Peru. Since some aspects of culture are more closely tied to specific environmental conditions, we return to another Marxist-materialist’s vision of humans and nature; culture and water: Julian Steward. He coined the concept of the “cultural core”, or “the constellation of features which are most closely related to subsistence activities and economic arrangements” of a society. The

features of the “core [include] such social, political, and religious patterns as are empirically determined to be closely connected with these arrangements” (Steward, 1955:37)—or in other words, those patterns most “intimately related to the bio-physical environment in which it has evolved” (Aase, 2005). This “cultural ecology” is most clearly seen in the context of agriculture, as in Turner and Brush’s (1987) “farming systems approach”, which reflects the environmental limits of cultivation systems and strategies and by association the core cultural traits that accompany them.

Today there’s a growing literature on local effects of climate change on water and resource management, through local perceptions (see Crate and Nuttall, 2009a, Casimir, 2008, Orlove et al., 2008). What implications does climate change have for of the conceptualization of the society-water relationship? In this case, local perceptions of water resource changes hold the key to understanding the implications of climate and environmental changes on suspected core linkages between people and the environment in Mustang, to help see their vulnerabilities and resilience to climate change in clearer light.

The setting: Lumbuk creek watershed

Mustang is an isolated, barren, high-altitude district in Western Nepal, at the southern edge of the Tibetan Plateau, cornered in by the rain-blocking Annapurna and Dhaulagiri massifs. Indeed, with only 250 mm of annual precipitation (GNMFD, 2006), much of which falls as snow in winter, meltwater comprises the most important source of water for agriculture. Snow- and ice-melt flows through small side streams in the headwaters of the Kali Gandaki River—one of the mightiest and holiest tributaries of the Ganges mainstem—diverted further by *yura* and *tsingu* (ditches and irrigation reservoirs, respectively, in the Mustangi dialect of Tibetan), ultimately into thirsty barley and buckwheat fields terraced onto steep, broad alluvial fans flaying out at the mountains’ feet. One particular side tributary, and the focus of this case, is Lumbuk Creek. This stream is flanked by the three villages of Dhakarjhong, Phalyak and Pakling which share, and often fight over the water draining from a relatively low 5717-meter high peak above. The low altitude of this mountain, as mentioned above, complicates the issue of receding snow and ice for Lumbuk Creek and the people utilizing it if the small, debris covered glacier observed there disappear and the snowline rises too high with temperature.

Perceptions of change

In light of the potential depletion of ice and snow, many changes in water resources have been observed by Lumbuk villagers in the recent past, which can be grouped into three main types: First, less snow and more rainfall have been noticed, an effect felt in the neighboring Trans-Himalayan valley of Manang (Dannevig, 2007) and across the greater Himalayan region. This is accompanied by earlier melting of the snowpack, which translates into earlier peak runoff, which compromises the *nak*, or summer growing season, and the buckwheat crop in particular. There are only 2 planting periods in Mustang as-is, and a reduction to only 1 would be devastating to their food security. Second, the drying of springs has been noticed, affecting fields adjacent to Phalyak village's *gompa* or monastery, traditionally cultivated by its monks. Along with Dhakarjhong's desiccating drinking water spring, these events only compound the outflow of villagers to Nepal's and the world's large cities for a more secure and diversified livelihood. Increased migration has a negative feedback on water allocation for irrigation, according to locals, caused by the labor vacuum that migrants leave. Villagers are compelled by shortages in both water and people—seen as harbingers of *kaliyuga* or the end times—to go on pilgrimage to a local shrine high up on Lumbuk Creek, where they pray for more water with powerful *lamas* or monks. Thirdly, villagers have experienced less water in general, as evidenced by the fact that they no longer have to build a bridge across the creek, which floods less nowadays. Less creek water has led to the recent abandonment (circa 1999-2000) of a large swath of fields belonging to Dhakarjhong. Yet there is some disagreement on whether a lack of water or of labor is the main cause of this.

Water as an environmentally, culturally and politically embedded phenomenon

Interestingly, the notion of any “change” in the overall abundance of water was challenged. Many people here deny adamantly that any decrease in water has occurred. Even if there had been markedly less water in the past 5-10 years, this was no significant shift away from “normal”. As people stated time and again, “we’ve always had water scarcity here”. And furthermore, as the ancient buildings and terraced fields, abandoned and not, of Lumbuk and neighboring areas attest, scarcity has not deterred people from making a living off the land here for upwards of 3 millennia (see Knörzer, 2000, and Gurung et al., 2004). Oftentimes, when defending the ephemeral nature of water in the area, villagers would

indulge in the legend of the “Arya Lama”, a monk who ages ago cursed the villagers of Lumbuk Creek when they plotted to kill him, in order to rid themselves of his abusive barley tax; a tribute he levied for performing rituals to appease *Ihu*, a serpent god inhabiting springs and sacred juniper trees, and other deities who controlled and ensured the availability and abundance of water. The curse made both water and trees scarce in the Lumbuk area. This etiological narrative reveals Lumbukis’ local ecological consciousness (Lamadrid, 1992) and locally embedded knowledge which informs their irrigation practices (Chhetri, 2008). And even in addition to the legends and realities of water scarcity, the villages have endured conflict over water, as told by Dhakarjhongis in another story as an addendum to the Arya Lama legend. They tell of an influential villager from a neighboring Thakali (a local ethnicity) village, called a *Subbha* who had certain legal rights granted by the Nepali state to write deeds to land and water. He came to Phalyak village and offered them more water from Lumbuk Creek, then wholly controlled by Dhakarjhong, which is the upstream stakeholder of the stream. In exchange for the deed, he demanded land in the village, which they readily gave him. When presented with the deed, the Dhakarjhongis, who only claimed right to the water orally, could not argue prior appropriation to the court, and so lost over 50% share of the stream to Phalyak. Today’s management regime, where Dhakarjhong irrigates for 2 days and Phalyak for 3 in a rotating cycle, reflects this past conflict. For Dhakarjhongis, this is seen as a continuation of the situation of aridity and scarcity first initiated by the Arya Lama trickster. And yet despite the endemic aridity, victimization by tricksters throughout the ages and changing political structures in the Lumbuk area, irrigated agriculture has nonetheless persisted.

Conclusion: resilience or vulnerability?

Indigenous perceptions of change and cultural constructions of Lumbuk’s water system cast revealing light on the complex trajectory of melting ice and snow in Mustang, but also the wider headwaters of the greater Himalayan region. The ways of seeing of these “cultures of habitat” (Nabhan, 1997) have the potential to give us profound insight into peoples’ resilience as part of complex environmental systems, as well as their vulnerabilities in the face of environmental adversity. Through perceptions and cultural narratives of local environment, the Lobas *position themselves* within their environment, providing a glimpse into a deeper “core” of human-nature relationships that result in their durable, if not

sustainable management of water for irrigation. Despite past adversities, the villagers of Lumbuk have adapted, as their management of water today attests. But as recent perceptions of decreasing water reveal, climate change will act as a threat multiplier (Crate and Nuttall, 2009b), casting greater uncertainty on the Lobas' resilience in the face of future environmental change. As sure as water is fluid, it is now and forever more a shifting cornerstone of Loba society.

Figure 1: Cleaning of the *tsingu* or irrigation pond in Dhakarjhong, with Nilgiri Mountain behind



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