Cultivating Ice over Time: On the Idea of Timeless Knowledge and Places in the Himalayas

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Abstract: Assumptions that local communities have an endogenous capacity to adapt to climate change stemming from time-tested knowledge and an inherent sense of community that prompts mobilisation are becoming increasingly common in material produced by international organisations. This discourse, which relies on ahistorical and apolitical conceptions of localities and populations, is based on ideas of timeless knowledge and places. Analysing the water-place nexus in Ladakh, in the Indian Himalayas, through a close study of glacier practices as they change over time, the article argues that local knowledge is subject to change and must be analysed in light of changing conceptions and experiences of place by the state and by local populations alike.

Keywords: climate change, adaptation, local knowledge, glaciers, Himalayas, India

Résumé : La présomption que les communautés locales ont une capacité endogène d'adaptation au changement climatique qui résulte d'un savoir à l'épreuve du temps et d'un sens intrinsèque de communauté, lequel appelle à la mobilisation, est de plus en plus courante dans le matériel produit par des organisations internationales. Ce discours, qui repose sur des conceptions ahistoriques et apolitiques de localités et de populations, se fonde sur des idées de lieux et de savoir hors du temps. Analysant le lien eau-lieu au Ladakh, dans l'Himalaya indien à partir d'une étude approfondie de pratiques liées aux glaciers et comment celles-ci changent au fil du temps, cet article postule que le savoir local est sujet au changement et doit être analysé à la lumière de conceptions et d'expériences changeantes de lieux tant par l'État que par les populations locales.

Mots-clés : changement climatique, adaptation, savoir local, glaciers, Himalaya, Inde

Introduction

Co-produced by the United Nations Development Program, the documentary film *Revealed: The Himalayan Meltdown* examines the impacts of glacier recession in the Himalayas on the lives of people in several Asian countries (Fries 2011). In the opening, the narrator's voice tells viewers that "the people of Asia are … harnessing determination, spirituality and science to adapt and survive in the face of Himalayan meltdown." In this way, the film seems to idealise the capacity of local communities to absorb global-level environmental changes. In presenting various technologies developed in response to climate change, the 45-minute documentary depicts populations affected by receding glaciers as having abundant resources with which to cope with their new reality. Moreover, the Himalayas and surrounding areas become a place of unity, where people are gathering around a common goal. In closing, the film emphasises the profuseness of local knowledge and its infallibility in addressing a global phenomenon, the narrator telling viewers that "change has come to the Himalayan glaciers and now it is up to the people and governments of Asia to adapt to these changes. The ways in which they adapt is as diverse as the millions of people who inhabit the region."

These tropes of local knowledge and community values as inexhaustible resources for climate change adaptation echo the language of publications produced by international development organisations. For instance, a recent report produced by the United Nations on the value of traditional knowledge for climate change adaptation argues that "resilience in the face of change is rooted in indigenous knowledge and know-how, diversified resources and livelihoods, social institutions and networks, and cultural values and attitudes" (Nakashima et al. 2012, 9; see also Agarwal and Narain 1997). Albeit this is likely an effective appeal to the film's target audience – not only policy-makers and non-governmental organisations (NGO) representatives but also the general

public – the depiction of local knowledge and the endogenous ability of communities to mobilise as a means to adapt to environmental change is part of a rhetorical construct rooted in development discourse. Under closer examination, however, this discourse is in dissonance with the reality on the ground. As much as local knowledge and socio-cultural characteristics need to be taken into consideration in assessing climate change adaptation, we cannot assume that local knowledge invariably equates with resilience.

In this article, I explore the relationship between local knowledge and various actors' conceptions of landscapes and places in Ladakh in the Indian Himalayas, including international organisations, the state, and local populations. Since the harnessing of local knowledge for climate change adaptation is increasingly valued by policy-makers, there is a need to examine critically certain assumptions about places and communities on which this discourse rests. I maintain that the production of the state in Ladakh has altered its waterscape or, in other words, "the culturally meaningful, sensorially active places in which humans interact with water and with each other" (Orlove and Caton 2010, 498). I study what I term "ice cultivation," namely practices of growing glaciers either by enlarging already existing masses of ice or by creating new, artificial glaciers. In elaborating this close study of glacier-related practices as they change over time in Ladakh, I consider the place–water nexus as a prism through which to demonstrate that knowledge as a situated practice is not static but, rather, is subject to change influenced by changing state conceptualisations of a place.

The Himalayas have been described as one of the world regions most vulnerable to climate change (Cyranoski 2005), a phenomenon that especially impacts local glaciers (Armstrong 2010; Bolch et al. 2012). In the Northern Indian region of Ladakh, the repercussions are especially salient: glacier meltwater is the primary source of water in the region, which receives less than two inches of rain and three to four inches of snow per year, as the Himalayan mountains prevent the entry of the monsoon into the region (Norphel and Tashi 2014, 200). Farmers in Ladakh widely acknowledge the recession of glaciers, and, in some villages, water stress has become tangible, particularly during the crucial spring sowing season. In examining how these changes are locally experienced, it is important to recognise that there is a pressing need to address questions of climate change adaptation and that local knowledge such as that developed by Ladakhis over time can indeed provide insightful knowledge on climate change and responses to it, which anthropologists have greatly contributed to demonstrating in various contexts (see Crate and Nuttal 2009). It is also important to recognise, however, that popular mobilisation and the uses of local knowledge in responding and adapting to climate change are more complex processes than what is suggested by the film *Revealed: The Himalayan Meltdown* and many other didactic materials and publications on climate change adaptation.

Basing my discussion on fieldwork conducted in Ladakh during 14 months between 2011 and 2013, I aim to show that local knowledge changes over time, that certain environmental practices can fall into disuse or evolve, and that the capacity to mobilise in the face of environmental changes is not an intrinsic feature of small collectivities. I carried out research in the Sham Valley of Ladakh, in the Leh district, a region of North India that shares borders with both China and Pakistan (see Figure 1). During the British colonial administration, Ladakh's economy was based largely on subsistence agriculture and livestock rearing, and the influence of the state in the economic development of the region was virtually nonexistent. After independence, successive wars between India and the two neighbouring countries transformed Ladakh into a strategic border area. Drawing on my fieldwork, I argue that the socio-economic transformations that took place in the region as a result of the production of the independent Indian state have significantly altered how Ladakhis engage with Ladakh as a place. As a result of antagonistic relations with neighbouring countries, state making in Ladakh following the independence of India entailed not only the development of state institutions, but also the militarisation of the region. Today the army is a key employer in the region, which recruits Ladakhis as soldiers and provides a source of income for many others supplying support services. In both cases, employment with the state has crucial consequences for demographic dynamics and people's engagement with the environment as people are driven outside villages.

As Ladakhis are mobilised to serve in this state project, an aging generation of farmers in the villages is increasingly left on their own to maintain upkeep on family farms. The interplay between these differing conceptions of Ladakh as a place has implications for practices through which people engage with the environment and, ultimately, for how they relate to glaciers, the primary source of water in the region. In retracing changes over time in glacier practices as a form of water management, I attempt to show that certain "images of communities" – what Tania Li (1996) defines as idealised, historically inaccurate depictions of homogeneous resource-managing bounded communities – as depicted

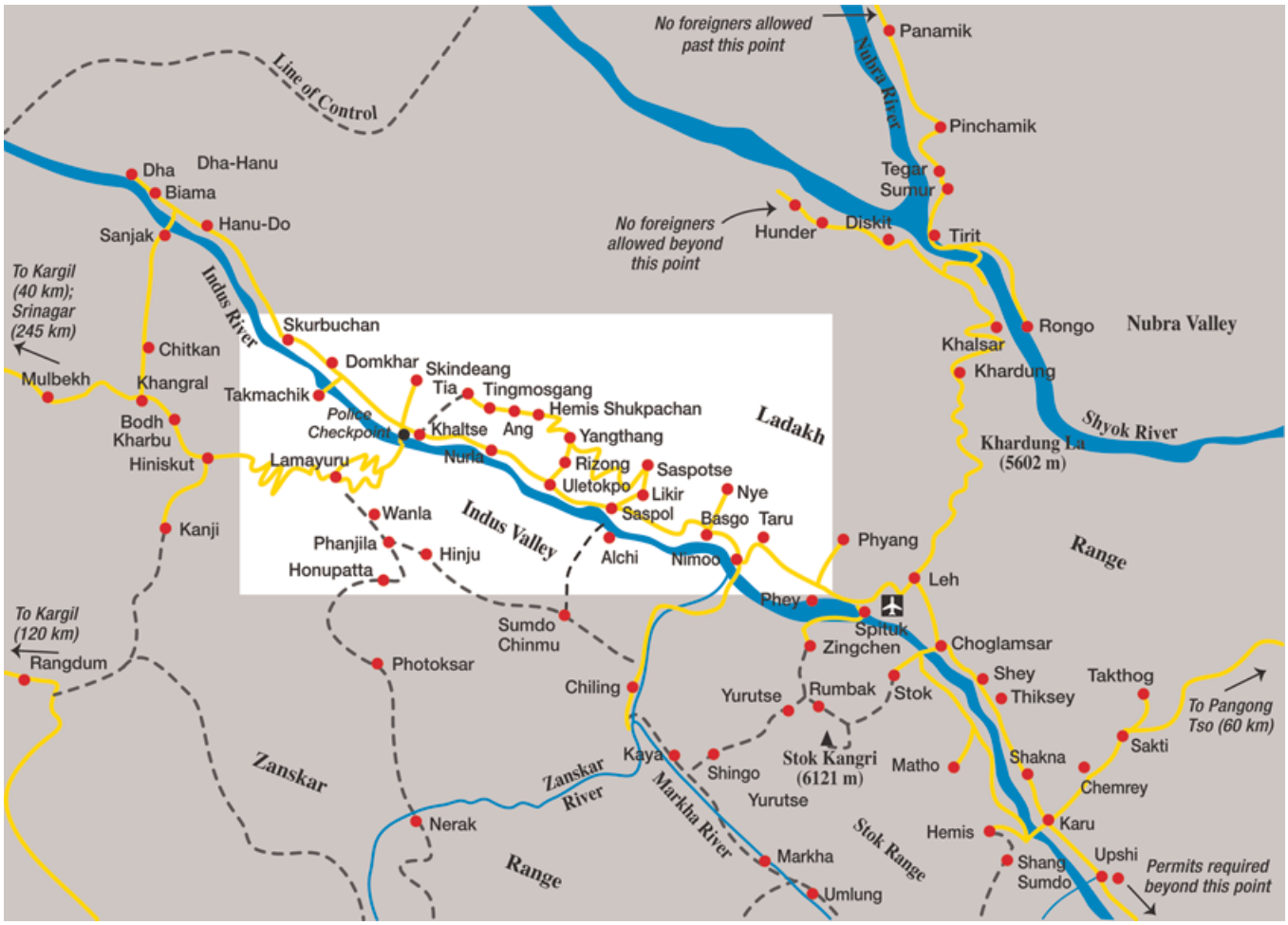

Figure 1: Sham Valley of Ladakh (adapted by Karine Gagné from a Lonely Planet map)

by international organisations in material about climate change adaptation are based on ideas about timeless knowledge and places. Local knowledge, including water management, I argue, is subject to change and must be analysed in light of how the state impacts, directly and indirectly, on cultural practices and arrangements through which people engage with places.

The remainder of this article is divided into seven sections. First, I discuss conceptual approaches to development, local knowledge, and place. Next, I trace the contours of the recent political history of Ladakh and its transformation into a border area after the independence of India. I follow with a discussion on social and environmental changes taking place in Ladakhi villages today. The subsequent two sections examine past and current glacier practices in Ladakh. I then conclude by linking the case of glacier practices in Ladakh to the broader literature on place and knowledge, showing how this contributes to discussions of the water–place nexus.

Ideas of Timeless Knowledge and Places

Anthropologists have demonstrated how through the use of maps, visual imagery, and narratives places often are imagined and constituted from a distance (Ganapathy 2013; Kahn 2011; Orlove 1993; Raffles 2002). Despite the continuing development of critical approaches to place and knowledge, ideas of timeless knowledge and timeless places persist, rooted in a discourse about geographically distant others that has been long criticised by post-colonial scholars (Fabian 1983; Pratt 1992; Said 1978). In this way, ideas of naturally cohesive communities prove to be a form of "essentialism" (Spivak 1990) that typecasts communities, including those of the Himalayas, as the bearers of an inherent sense of community, as having an innate capacity to mobilise to accomplish collective action, and as being the custodians of enduring knowledge about the environment. My approach to this discourse builds on scholarship that explores local knowledge – in particular, its integration

into development projects – as well as on scholarship on the social and political dimensions of spatiality.

Depictions that draw on ideas of timeless knowledge and places are part of a discourse that reflects current approaches to development. Adopted by development planners as a panacea to environmental problems, the paradigm of sustainable development has since the 1980s gained widespread acceptance and has become the leitmotif of international development. This paradigm is the result of a shift of development agendas away from a strictly scientific approach to agriculture and natural resource management that was characterised by policies and measures implemented by experts with the assumption that projected growth in production would lead to the eradication of poverty (Chambers and Ghildyal 1985; McCorkle 1989). Some scholars, however, have argued that sustainable development is essentially a profit-driven model only nominally focused on environmental concerns (Escobar 1995; Sachs 1992).

Rosi Braidotti and colleagues (1994, 127) note that sustainable development stands out from classic development in its implementation, since it is articulated around decentralised management. It is established and legitimised through a set of measures and concepts that value the capacity of local populations to actively participate in the implementation of development initiatives, including through notions of "traditional" and "community" management of natural resources. Hence, participatory discourse on development and the promotion of empowerment for local communities both provide legitimation for the transfer of the management of resources to communities (Cooke and Kothari 2001; Guijt and Shah 1998, 7–9).

The concept of local knowledge has become a recurring theme in sustainable development discourse and has generated a wealth of discussions in academic circles. Sometimes defined as traditional ecological knowledge, it may be defined as a body of empirical know-how about the environment, based in situated practices that requires an intimate acquaintance with a locality that is developed by small-scale users of natural resources. Issues addressed by various contributors range from the virtues of local knowledge for biodiversity conservation (Nazarea 1999, 2006) to the incommensurability of local systems of knowledge with Western scientific views on ecosystems (Ingold 1996; Nadasdy 2003). Some have focused on epistemology, stressing the ontological differences between local and scientific ways of knowing, while others have emphasised the mutual influences between these two knowledge systems (Agrawal 1995; Ellen and Harris 2000; Raffles 2002). Other researchers and practitioners contend, in addition, that the integration of local knowledge provides a complementary perspective to Western scientific approaches to natural resource management (Berkes 1999; DeWalt 1994; Gadgil et al. 2003).

Within sustainable development discourse, local knowledge is often framed in terms of the capacity of collectivities to mobilise, with the apparent expectation that this capacity is a natural attribute of the prospective beneficiaries of development. Certain authors have critiqued the assumption that lies at the heart of this discourse by pointing at historical changes and power dimensions of community institutions. In the context of India, several scholars have argued that this discourse is symptomatic of the environmental historiography of the region, which assumes that the pre-colonial period was characterised by a form of homeostasis in terms of natural resource management (Baviskar 1999; Sharma 2002; Sinha, Gururani, and Greenberg 1997; Sivaramakrishnan 2003).

Studying water management – in particular, tank irrigation in South India – David Mosse (1997) has demonstrated how policy-makers' discourse on community development has failed to take into account the historical development of local practices. Common property resources, Mosse emphasises, cannot be isolated from socio-cultural contexts and viewed exclusively in economic terms. Through a historical analysis, Mosse demonstrates that tank irrigation involves more than the securing of water supplies. Rather than being a product of a moral economy, the management of common property institutions such as water tanks in Tamil Nadu State has long served the interests of high caste members of communities, both during the pre-colonial period and during colonial India. The establishment of relations of dominance and control is thus a crucial dimension of the management of water commons. Tank irrigation, as a public institution, Mosse convincingly argues, was then part of the "symbolic production of locality" (see Appadurai 1995), as the construction and maintenance of water tanks resulted in the generation of "symbolic capital" in the form of honour and authority for individual leaders (see Bourdieu 1977). These insights strongly suggest that water management cannot be isolated from the cultural politics that frame resource use.

As awareness of the present and future limits it poses to development has grown, climate change has infused development agendas. This is clearly reflected in the documentary *Revealed: The Himalayan Meltdown*, which includes a vignette about a group of workers in Bhutan who move heavy stones by hand in an effort to drain Lake Thorthormi. Their aim is to prevent a glacial

lake outburst flood, a natural hazard whose incidence is projected to increase in the Himalayas with global warming.[1] Adaptation to climate change is thus conflated with development as a response to climate change since it creates work opportunities that contribute to support poor mountain communities (see also Patel 2013). Along similar lines, the recent integration of local knowledge into climate change adaptation initiatives can be traced to its appreciation in the fields of development and decentralised resource management. Scholars interested in issues of climate change and resilience have come to incorporate the concept of local knowledge into their analyses (Berkes, Colding, and Folke 2000; Carpenter et al. 2001; Couzin 2007). But, often, local knowledge is once again perceived as a panacea for various environmental problems. Thus, as global warming alters the course of water in certain landscapes, ideas about traditional ecological knowledge and utopian communal institutions, previously used to justify neoliberal prescriptions for economic development (Baviskar 2007, 3), today serve an agenda for climate change adaptation that is perhaps well intentioned but arguably misguided in its application.

However, what about the very place from which this knowledge emerges? As scholars of science studies have convincingly argued, the production of knowledge is intricately linked to places (Knorr-Cetina 1981; Latour and Woolgar 1986; Ophir and Shapin 1991). If these early laboratory studies have made important contributions to our understanding of the link between knowledge and places, they have also tended to treat places as unchanging and as dispassionate environment that can be entirely manipulated by humans. But bringing into conversation critical approaches to knowledge and to place is essential to allow us to ponder the implications of the promotion of certain images to tackle such critical questions as climate change adaptation. Over the last two decades, anthropologists have demonstrated that places cannot be treated as mere backdrops to culture. Anthropological approaches to place and space have developed in recent years along several avenues: authors have studied localities as embodied, gendered, inscribed, contested, and as redefined by processes of globalisation and transnationalism (see Feld and Basso 1996; Gupta and Ferguson 1997; Low and Lawrence-Zùniga 2003). This scholarship has come to encompass new perspectives in which landscape, rather than being a Western framing device, is instead a prism through which to understand how people relate to their surroundings (see Hirsch 1995).

Through a study of the affective aspects of topography, many contributions to this literature reveal that landscapes resonate with cultural significance since they function as repositories of collective memory, mythology, and social identity and, thus, provide a gateway to decoding the worldviews of specific peoples (see Basso 1996; Cruikshank 2005; Thornton 2007). Marxist geographers, for their part, have investigated how systems of power constrain spatial knowledge and experience (Harvey 1973; Massey 1994; Soja 1989). Henri Lefebvre's (1991 [1974]) processual approach to space has been influential in this body of work. For Lefebvre, space was more than an entity that preceded culture; it was the product of a dialectical process between material and ideological matters. Moreover, in his view, the theorisation of space was contingent on a thorough understanding of the human experience of space. Lefebvre's work has had much influence on anthropological approaches to place (Kahn 2011; West 2006). Overall, new developments in interdisciplinary approaches have compelled scholars to more carefully consider the dynamics at play in the production and experience of space, place, and landscape, including those related to political economy and cultural processes.

Picking up on these critical reflections about place and knowledge, I argue that water management through glacier practices in Ladakh raises questions that extend beyond the management of natural resources. The fact that, as I will demonstrate, glacier practices are changing concomitantly with the reconfiguration of the landscape of Ladakh by the state raises questions about the link between knowledge and places.

The Politics of Place: Becoming a Borderland

Upon arriving by air in Leh, the capital of Ladakh, a first time visitor can be bemused by the nature of the destination. In this part of the Himalayas, the mystical utopia of Shangri-la, depicted by James Hilton (1933) in his book *Lost Horizon*, gives way to a landscape blighted by a succession of unsightly, tin-roofed military barracks fenced off with barbed wire. In a region of such vast natural expanses, it would be an exaggeration to say that military installations have become ubiquitous. Yet their frequent recurrence throughout the landscape is telling of Ladakh's sensitive geostrategic position.

The high-altitude trans-Himalayan region of Ladakh in the northern Indian state of Jammu and Kashmir is flanked by the two highest mountain ranges in the world, the Himalayas to the South and the Karakoram to the North. In this vast region, people have settled

sparsely, in narrow valleys, tucked in between mountains, forming small oases in the cold desert of steppes, steep mountains, and ice summits. Although geographically in Ladakh, the Karakoram constitutes the northernmost border; beliefs about the Himalayas, which stretch 1,500 miles across the north of the subcontinent, as a natural border for India have long prevailed (Mathur 2013). In much more recent sources, the same trope pervades British colonial accounts.[2] British administrators initially considered the region to be a dangerous, unexplored hinterland but gradually came to see it as a natural border for British India, while it expanded its imperial interests on the subcontinent in the mid-nineteenth century (Aggarwal 2004, 217). This perspective, however, changed after the independence of India when conflicts with neighbouring countries showed that the "naturalness" of the border was a discursive construct rather than an immutable fact.

In 1947, the vast region known as British India gained independence from British rule and the former dominion split into the sovereign states of Pakistan and India, during what became known as the Partition of India. More than 500 princely states had no option but to join either of the two emerging nations, among them Kashmir, under whose authority came Ladakh, its eclectic population mix including a range of religious confessions, each largely concentrated in separate geographical areas. After some hesitation, the loyalty of the maharaja of Kashmir eventually swung toward India. Ensuing conflict over the control of Kashmir eventually led to the first war between India and Pakistan (Gutschow 2004, 24–25).[3] Subsequently, in 1962, the Sino-Indian War erupted when Chinese troops seized the uninhabited territory of Aksai Chin, in the northeast part of Ladakh, which India still claims as its own today.

As a consequence of these conflicts, previously fluid borders became demarcated, sealed, and strictly guarded. To the west and to the north, the line of control separates India from Pakistan, while to the east the line of actual control marks the border between India and China. On all sides, armies vigilantly protect their territories, while periodic attempts at recapturing parcels of land from neighbours are recurrent. The sealing of the previously fluid border between India and Tibet, which is now under Chinese control, also cut off centuries-old trade routes in and out of Ladakh, which was once a feeder of the Great Silk Road, thus restricting Ladakhis' mobility (see Rizvi 1999). But the tracing of these borders was only one side of the story – from then on, life along the borders changed significantly.[4]

After its first war with Pakistan and the war with China, the Indian state had no choice but to acknowledge Ladakh's primary importance as a strategic border region. And recurring incursions by both China and Pakistan over the borders proved that Ladakh and its vast tracts of empty land had to be safeguarded or, in other words, territorialised. Ladakh's total area of 60,000 square kilometres is divided between the districts of Leh and Kargil, the former having the lowest population density in India, with three persons per square kilometre. Hence, after the independence of India, Ladakh's lack of infrastructure and largely uninhabited territory have contributed to a perception of the region as a weak link in independent India's national security.

In his study of racialised regimes and land conflicts in Zimbabwe, Donald Moore (2005, 7) identifies the use of political technologies in the production of territory, including its presumed "natural" features. In the context of the mountains of Ladakh, Moore's analysis is useful in examining the Indian state's changing perception of the Himalayas. In Ladakh, following international conflicts, the mountains that once were imagined as a natural fortress, now needed human intervention to be effective. The state began investing in the development of infrastructure to control the territory (see Demenge 2011), and, importantly for our discussion, successive border conflicts prompted India to militarise Ladakh, which has now become a strategic border region, its frontiers being among the most contested in the recent history of South Asia. The Indian state's policies in the region have culminated in the transformation of Ladakh as a place into a fortress, profoundly impacting both the local economy and the everyday life of the population.

Researchers investigating social and environmental changes in Ladakh have tended to emphasise the impact of globalisation or outside influence brought by the tourist industry (Norberg-Hodge 1992, 1997; Singh 1997), failing to consider that militarisation has become a dominant force of development in the region and a motor of change in urban as well as rural areas (Aggarwal and Bhan 2009; Tsering 2008). In particular, the army, which employs Ladakhis as soldiers and provides a source of income for many others who provide support services, became a key employer in the region. Since Ladakhis are mobilised to participate in the state's territorialisation project, militarisation contributes to reconfiguring the household economy. Since the Indian army does not make its employment statistics available, tracing a well-delineated portrait of current Ladakhi employment in the military is difficult. However, army presence is certainly tangible in the region. In 2005, the number of

army personnel posted in Ladakh was said to amount to one-third of the total population of the entire region (Rigzin 2005). Although contingents from all over India are stationed in the region, a significant number of Ladakhis are employed in the Ladakh Scouts regiment, which counts about 6,000 soldiers (Ladags Melong 2005). This figure does not include those who are not enlisted but nevertheless work for the army in various support functions, including porters, mechanics, and others. Moreover, besides enrolment in the army, many Ladakhis find employment in paramilitary forces whose role is to protect the border, including the Indo-Tibetan Border Force, the Indo-Tibetan Border Police, and the Sashastra Seema Bal. In fact, most Ladakhis have at least one family member either serving in, or retired from, the armed forces (see also Ladags Melong 2005, 29).

The militarisation of Ladakh, along with the bureaucratisation of the state and processes which have been defined as modernising (Pirie and Van Beek 2008), in providing employment outside the villages, are all contributing to rural depopulation and to the current displacement of agriculture as a primary means of subsistence. In fact, in 1971, 65 percent of the Ladakhi workforce was classified as cultivators. By 2011, this proportion had decreased dramatically to 28 percent (Government of Jammu and Kashmir 2012). Over the past decades, Ladakh has witnessed an important trend of rural to urban migration. In 1981, 94 percent of the population lived in rural areas, whereas the number had fallen to roughly 65 percent in 2011.[5] In the villages, where agro-pastoralist activities remain the primary source of income, this translates into a critical lack of workforce; adjusting to off-farm employment is a reality for most Ladakhi households today (see also Dame and Nüsser 2011, 187; Dawa 1999; Dollfus and Labbal 2009). In addition, fuelling the trend away from farming is the availability of very low-cost staple foods from the Public Distribution System (PDS), India's largest poverty reduction scheme. In Leh district, more than 98 percent of households are holders of PDS ration cards. The cards enable people to buy a limited quota of wheat and rice at subsidised prices at local ration stores, which today operate in most villages (Dame and Nüsser 2011, 188–190; see also Dollfus and Labbal 2009, 100). Yet farming continues to be central to food security in Ladakh. Regardless of the major economic restructuring that the region has undergone since 1947, family farms remain the primary producers of food for both personal consumption and sale (Dame and Nüsser 2011, 186).

Since the independence of India, the state has become a major employer in Ladakh, and the economic condition of the local population has become in great part contingent on the presence of the army. Combined with an increasing reliance on imported foods, the region has shifted away from self-sufficiency toward far-reaching dependence on the state. As Ravina Aggarwal (2004, 41) best put it, this has resulted in "a culture of dependency." Another major consequence is that engagement with the environment is becoming increasingly circumscribed. With the displacement of the agro-pastoralist economy, the time Ladakhis spend working the land and navigating high pastures has been dramatically reduced, if not entirely supplanted. Both of these changes and the changing village dynamics, to which I now turn, have crucial implications for the vitality of environment-related knowledge and practices.

Along Ladakhi Waterways

From Kangri Chenmo (large glacier), which feeds Likir village, a trek downhill for about ten kilometres opens one's view onto a wide pasture that leads to Khatsatse, the community's cattle-grazing seasonal settlement, which provides easy access to the high pasture. Until a decade ago, villagers attending to pastoralist activities would spend their summers here. During the day, animals (yaks, dzo, sheep, and goats) would graze the nutritious alpine plants between Khatsatse and Kangri Chenmo. With the toll of the recent economic restructuring, Khatsatse has become a nearly deserted place today, as most villagers are no longer able to keep domesticated animals due to a lack of workforce in the villages – while the elderly do not have the stamina to trek to the high pasture with animals, many younger people work or study elsewhere. And those who take animals to pasture avoid going as high as Khatsatse, preferring to let their livestock graze on smaller pastures nearer the village.

From Khatsatse, another ten-kilometres trek down leads to the bottom of the valley, the furthest extent of Likir village lands. The arid slopes that form the valley of Likir village are brought to life in spring when the snow covering the surrounding summits and the local glacier begin their seasonal melt. Through ingeniously complex arrays of channels, the precious melt water feeds the streams that irrigate the terraced fields sculpting this landscape. Glaciers and snow are the two fundamental sources of water in Ladakh, where the Indus and the Shayok contribute to irrigate no more than 10 to 15 percent of the region's cultivated lands (Norphel and Tashi 2014, 199). In Ladakh, irrigation management depends on community-level rules, which have been the object of several studies. There is a general consensus that Ladakh's traditional management system

provides an equitable and sustainable mode of water allocation (see Angchok and Singh 2006; Gupta and Tiwari 2008; Gutschow 1997; Labbal 2000). Each village has its own rotational scheme, but all consist in allotting water to certain channels during the growing season. The regulation of the irrigation of water is the responsibility of the *churpons* (lord of the water) who is nominated each year and whose role is to distribute water impartially.[6] Although disputes over water allocation do occur, Kim Gutschow (1997, 106–107) notes that abuses are relatively rare, in part because derogating from local arrangements is very difficult, as villagers keep a keen eye on one another, and cheating is difficult to conceal (for example, a wet field).

Like the community-managed *kuhl* systems studied by Mark Baker (2007) in India's lower western Himalayas, the management of water at the village level in Ladakh persists despite significant socio-economic changes during the past decades. Yet, Gutschow (1997, 114) has also observed that as villages become more anonymous under the influence of the cash economy, increasing anomie may alter the traditional surveillance mechanisms that previously acted as a sufficient deterrent against abuse. Another factor acting in the region is India's National Watershed Development Program, introduced in 1995. Implemented by various local NGOs and government agencies, the program aims to enhance irrigation and invigorate agricultural activity through participatory approaches. Watershed development programs have made limited inroads in Ladakh, but where they have, their related activities, put in place by local NGOs, have led to issues of trust due to a lack of accountability (see Mankelow 2003). As other authors have noted in similar contexts, the benefits of participatory programs often fail to reach less affluent members of communities (Cooke and Kothari 2001; Guijt and Shah 1998, 3; Sivaramakrishnan 2000). In rural India, village affiliation is often a lifetime term, and as Nicholas Hildyard and colleagues (2001) aptly point out, those who go against affluent members, who often take control of local participatory development committees, risk social difficulties as a result. As I observed during my fieldwork in Likir, the approaching implementation of a watershed program in the village was welcomed by many who expected it to stimulate the village economy, while others feared the initiative would trigger the type of negative dynamics described above.

Notwithstanding their intended goal, schemes to improve irrigation and land productivity stand in contrast with present-day patterns of land use in the Sham Valley. In Likir, closer to the high pasture, terrace fields are overgrown with weeds and show no sign of the tell-tale furrows of ploughing that mark other lower village lands in spring. Similar scenes of abandoned land recur throughout the Sham Valley; in the absence of sufficient workforce, many farmers have decided to leave fallow those lands that are most difficult to cultivate (see also Yamaguchi et al. 2016). A little over three decades ago, scenes of village life in Likir were immortalised by Edward Bastien (1983) in the ethnographic documentary *Cycles of Interdependence*. The film shows a community for whom agriculture was central to survival, deeply enmeshed in religious and social arrangements and surrounded by rituals that defined the village's social time. Today, changing engagement with Ladakh as a place contributes to the abandonment of many rituals associated with the success of the farming season in the local cosmology (see also Dollfus 2008). Moreover, and significantly for the present discussion, in displacing agriculture as the ultimate source of livelihood and in contributing to the rural exodus, the economic restructuring of recent decades has broken many of the lay community arrangements that underpinned agrarian activities.

Environmental changes are also altering Ladakhi waterways. Today, at the bottom of the valley of Likir village, farmers face water shortages. One the last houses of the village belongs to a man named Lobsang Chotak. At 81 years of age, Lobsang Chotak and his wife take care of their field on their own, as their children have not taken over the family farm. Their task is complicated by hydric stress, which now systematically affects the hamlet where they live. Like in many other villages of the Sham Valley, water is scarce in spring during the critical growing season, something villagers attribute to decreased snowfall and the recession of the local glaciers. Others see in it a lack of will by villagers to act on water problems. As a man once told me, "in those days, people used to do many things for water and now they are not bothered at all." Today, villagers are seemingly increasingly reliant on state institutions to address shortages. The hamlet where Lobsang Chotak has his parcels of land is connected to the main stream by only one rivulet, something the government has long promised to address by digging additional channels but has so far failed to do. In the meantime, the villagers wait. In the face of unfulfilled promises and seeing his tree plantation dry up, Lobsang Chotak's response has been to leave some of his land uncultivated. His situation reflects that of many farmers in the Sham Valley today. Aging, a depleted workforce, environmental problems, and the general lack of mobilisation in the villages is compelling growing numbers of farmers to stop cultivating parts of their land.

Past Glacier Practices in Ladakh

The recession of glaciers is widely acknowledged among Ladakhis, especially elders, like Lobsang Chotak, who have seen the change over the years. Their observations are corroborated by studies of glacier movements in Ladakh (Kamp, Byrne, and Bolch 2011; Pandey, Ghosh, and Nathawat 2011; Schmidt and Nüsser 2012). Glacier recession may be linked to changing meteorological conditions in the region, characterised by a decrease in snowfall and warmer temperatures (Shaheen, Wani, Wani, and Norphel 2013), a causal link firmly established in the eyes of Ladakhi farmers. In the Sham Valley, glaciers are relatively small in size and located at low altitudes, making them particularly at risk (see Inman 2010, 29; Schmidt and Nüsser 2012, 107). Researchers have started to document the impact of the recession of glaciers on communities of Ladakh (Angmo and Heiniger 2009; Banerji and Basu 2010; Mingle 2015). The impacts of glacier recession must also be considered in light of compounding factors such as changes in water use – increased excavation of tube wells – and changes in crop patterns (see Gondhalekar et al. 2013).

My research suggests, in addition, that changes in village dynamics, the dismantling of community arrangements, and the discontinuity in local practices may also function as exacerbating factors. Soon into my fieldwork in the Sham Valley, when discussing glacier recession with Ladakhis elders, I was introduced to a practice of ice cultivation. Several villagers, all aged over 80, recounted that in their youth they saw their elders trekking to the glacier of their village with bags of charcoal, which they would spread on the glacier ice in an effort to ensure its regeneration. Intrigued by these accounts, I asked every person I met in the course of my fieldwork if they knew of this custom. In this manner, I collected sparse, but informative, details on ice cultivation. Many people in the Sham Valley, elders in particular, were aware of the practice, either because they had heard older people talking about it or because they had once seen villagers leaving for the local glacier carrying bags of charcoal. Only two of my informants had seen the practice performed in person, but they could not provide many details, as both were well above 80 years of age and had been very young at the time. However, all of them described the practice as a means of growing and preserving glaciers. In one village, oral history holds that one of the local glaciers was grown to its present size by villagers placing charcoal on a small glacier. According to my informants, the charcoal made snow stick to the ice, creating moisture, which generates more ice as winter sets in. Many said this was done when "there was a fear that the glacier would go."[7]

While factual details on the history of the practice in Ladakh may be scarce, information on glacier-grafting practices in Baltistan, a neighbouring region in today's Pakistan with close links to Ladakh dating back centuries, particularly through trade (see Rizvi 1999), sheds light on glacier cultivation practices in the region. The earliest documented reference to glacier growing in Pakistan is attributed to British colonial administrator D.L.R. Lorimer, who observed it in Baltistan in the 1920s.[8] According to linguist Georg Buddruss (1993), who took an interest in the question, Shina speakers in the region talk of the cultivation of glaciers as "to cause ice to sit" in the sense of "to remain."[9] In his analysis of a Shina language text, Buddruss also reports the use of charcoal in ice cultivation, which is placed in a dug-out ditch in a high shadowy place and layered with gourds of water, ice, and straw, the entire assemblage then left in the ground.[10] Ingvar Nørstegård Tveiten (2007) provides a comprehensive study of glacier grafting in Baltistan, where he conducted research among glacier growers. His findings are similar to those of Buddruss and shed light on what the practice may have involved in Ladakh (see also Faizi 2007). Tveiten reports that local belief holds that ice is either male or female: male ice is covered with debris (stones, soil) and is characterised by little or no movement, while female ice is whiter, grows more quickly, and yields more water. According to the glacier growers Tveiten interviewed, it is important to have ice of both sexes to grow a glacier. Glaciers are cultivated by adding female ice to male ice; in the process, villagers bring blocks of female ice and gourds of water to glacier sites primarily of male ice. Once the ice and water are set in place, the area is insulated with charcoal, sawdust, pieces of cloth, and wheat husks or nutshells. Snowmelt flowing into the grafted glacier helps it to grow and pockets of cold air between the layers of material ensure adequate insulation. Using these methods, a self-sustaining glacier measuring approximately a dozen metres across emerges within four years. The result is more an ice patch than a glacier in the conventional sense, but, according to villagers, it serves its function efficiently, increasing the flow of water available for irrigation, which enables them to cultivate more land.

The potential for such small ice formations to produce measurable changes in water volumes available for irrigation and, thus, impact crop yields remains open to discussion. For the purposes of the present discussion, it will suffice to note that Tveiten agrees with Kenneth Hewitt, a glaciologist who observed glacier grafting in Baltistan in the early 1960s, that the subjective value attached to glacier growing is significant since it contributes to appease communal anxiety during periods of

climatic stress (Douglas 2008, 39). Whether the former practice of glacier cultivation in the Sham Valley was similar to those observed by Tveiten and others in Baltistan is likely to remain without a definitive answer, but it is reasonable to assume that such practices shared similarities across the region. Reports of the use of charcoal in both Baltistan and Ladakh strengthen this assumption.[11] All indications are that the practice belongs to the past. Elders saw it performed in their childhood but not since.

At this point, it is important to address an apparent paradox: how is it that, in the recent past, villagers used to carry out technical interventions oriented toward the protection and the regeneration of local glaciers but that, now, these practices are no longer performed despite widespread recognition of glacier recession in Ladakh? Making sense of this paradox requires us to take into consideration the social ramifications of Ladakh's economic restructuring. Importantly, elders' descriptions of the practice of ice cultivation in Ladakh and accounts of glacier grafting in Baltistan reported by Tveiten both depict practices that require community mobilisation. In both cases, coordinated groups of people transported large quantities of materials (for example, ice, husks, charcoal) to high altitudes to perform technical interventions. The available information, in addition, does not suggest that glacier growing in Ladakh was directed by any state authority; in any case, at the time of the Dogra rule, before the independence of India, the authorities exhibited little interest in the local population beyond taxation purposes (see van Beek 1996, 105). Rather, glacier practices were the result of communal arrangements, as they remain in Pakistan today. In Ladakh, on the other hand, the displacement of the agrarian economy, as outlined above, has led to the abandonment of many communal arrangements. Sandhya Ganapathy (2013, 103) uses the term "placeways" to refer to "the nexus of cultural practices, behaviors, and ideas relating to people's engagements with place." Thus, in Ladakh, state intervention has significantly contributed to alter placeways, with crucial implications for glacier practices. As villages are drained of their agragrian workforce, the transmission of knowledge about the environment is hindered. As agro-pastoralism as a mode of subsistence is displaced, associated cultural practices erode. And, as I will now discuss, the state increasing pervasion of the fabric of everyday life impacts the way people relate and respond to a changing environment.

Building Artificial Glaciers

In my discussion up to this point, however, I have not meant to suggest that there has been no response at the local level to the water issues Ladakh currently faces. The film *Revealed: The Himalayan Meltdown* brings us at one point to Stakmo village in Ladakh, where Chewang Norphel, a retired civil engineer, demonstrates his widely praised artificial glaciers. Norphel devised an original technique of ice cultivation, using local technology, to produce artificial glaciers that have come to the rescue of farmers affected by the depletion of water resources.[12] As mentioned above, according to my informants, water shortages are most prevalent during the sowing season (April to May). Chewang Norphel's ingenious solution to the problem was to build structures in areas above the villages and below the foothills, where artificial glaciers grow in what can be described as terraced ice fields. These artificial glaciers collect water through a system of channels and walls that efficiently draw in water from the surroundings. Altogether, these structures are active during a four-month span of the year – most of the water accumulates in November, freezes as winter sets in, and starts to melt in early spring as temperatures rise. Since they are built near villages, lower than their natural counterparts, the artificial glaciers provide a timely and accessible water source for the sowing season (Shaheen et al. 2013).

While the film depicts the ingenuous technology as an exemplary case of local knowledge and community cohesion in the service of climate change adaptation, Chewang Norphel's views on the management of the structures at the community level is in dissonance with this depiction. The following excerpt from an interview with Norphel published in *Reach Ladakh*, a local newspaper, in 2013 is particularly evocative of the challenges of adaptation to climate change and community mobilisation:

> Q: What kind of challenges and problems do you face during the course of its [an artificial glacier] construction or afterwards?
>
> A: Funding agencies give money to cover the expenses incur in the construction of artificial glacier. The maintenance is the responsibility of local villagers who are the beneficiaries. Since the villagers do not contribute in the project, their sense of ownership is missing. Most of the time, villagers fail to maintain and repair the structure when damaged and with time, it becomes ineffective. Our people are too dependent on government support system. They don't take initiative to mend the walls and repair the canal without receiving money for their work, even though they understand that they are benefiting from the artificial glacier yet they continue to wait for help. Agriculture is not the prime source of income and livelihood for

some of the people and their interest in farming is getting less and less. Unless the villagers (beneficiaries) take personal interest, it is difficult to undertake a project, because it doesn't guarantees success …

Q: How many artificial glaciers have you built so far? How many of them are in functioning state or being used?

A: So far LNP [Leh Nutrition Project][13] has built 10 artificial glaciers, out of which only two are in good working conditions, which is quite sad and discouraging. They failed due to no maintenance from the villagers.[14]

Artificial glaciers in Ladakh are built by local NGOs such as Leh Nutrition Project under the National Watershed Development Program (see Nüsser, Schmidt, and Dame 2012, 58). They require regular maintenance and must be prepared adequately before the onset of winter each year; these tasks are the responsibility of villagers. Contradicting the view communicated by *Revealed: The Himalayan Meltdown*, according to Chewang Norphel, despite the substantial benefits of artificial glaciers, villagers' failure to mobilise to carry out the collective work of maintenance compromises their sustainability. This is attributable, in Norphel's view, to changing communal patterns at the village level. As he points out, economic diversification means that farming is not an essential subsistence activity for all villagers. For many, the work of maintenance is a burden, and some feel it should be carried out by the state.

The depiction of communities as cohesive and predisposed to mobilisation glosses over many criteria of social differences and changes within the communities. By contrast, there exist a consensus in the relevant literature on the need to consider participatory development and decentralised natural resource management with a view to communities' internal dynamics (see Cooke and Kothari 2001; Mosse 1997). Taking on this approach, an examination of the failure of artificial glacier maintenance at the community level in Ladakh must consider issues of out-migration, internal cohesion, and individual households' reliance on agriculture or other activities. We must also take into account the impact of these factors on the local waterscape. The ramifications of Ladakh's transformation into a border area have altered Ladakh as a place, including its conditions as a place where humans interact with water. Not all aspects of Ladakh's waterscape have changed, however. As discussed above, people continue to observe traditional water management arrangements at the village level, although there is growing interference by the state through watershed development projects. Yet the case of the artificial glaciers and the apathy of villagers toward their maintenance, as characterised by Chewang Norphel, shows that the pervasive intrusion of the state into the fabric of everyday life, in conjunction with other socio-economic changes in Ladakh, has disrupted several patterns of village life. This must be taken into account when considering questions of water management and adaptation to climate change. A perspective that takes all of these factors of change into account is essential to explain why villagers were able to mobilise independently to cultivate and preserve glaciers in the not-so-distant past and why today communities fail to act likewise.

Finally, as Ben Orlove and Steven Caton (2010, 408) explain, "the human sense of place often engages with water as well as with land" (see also Orlove, Wiegandt, and Luckman 2008; Strang 2009). Hence, the management of water as a natural resource must be considered in view of the cultural practices and conceptions associated with the ways in which people engage with places. It is also imperative to examine the relationship between these conceptions and the production of knowledge. In the words of Virginia Nazarea (2006, 323), "local knowledge is cosmos more than corpus, praxis and pulse more than precision and plan." If knowing is shaped by places, it follows that a transformed place may impact the process of knowing and a transformed sense of place may affect practices.

Conclusion

Ideas of timeless knowledge and places are rooted in an approach to development, dominant since the 1970s, and shape the prevailing discourse on climate change adaptation. In linking a global phenomenon to apolitical and ahistorical depictions of places, ideas of timeless knowledge and places risk obscuring the fact that climate change adaptation is a critical issue with no easy solution and for which local communities do not necessarily have all of the answers. Adaptation to climate change has been the object of recent scrutiny by social scientists. Orlove (2009) argues, for example, that when the concept of "adaptation" is used in top-down appraisals of local communities, it works to obfuscate realities as they exist on the ground. This type of top-down appraisal is also visibly at work in *Revealed: The Himalayan Meltdown*, when, in reference to the challenges posed by climate change, the documentary asserts that, "from the towering height of the Himalayas to the coastal lowlands, solutions will be found … Many will rise to the challenge with physical determination and the sweat of

their brow." In this discourse, adaptation becomes an easy task, to be accomplished by impacted communities, as long as they have the will to do so. Moreover, this view is alive and well in climate change literature, which speaks of "the adaptive capacities of communities" and the need to reinforce "their endogenous resilience based on indigenous knowledge, practices and coping strategies" for adaptation planning and implementation (Nakashima et al. 2012, 26). The reading of local communities as having inextinguishable endogenous capacity to adapt through local institutions, and by means of local know-how, ignores an abundant body of research that, among other things, points to internal tensions within communities and warns against the essentialisation of local knowledge.

In many ways, static depictions of local knowledge and communities for climate change adaptation continue to convey apolitical and ahistorical images of places and communities to promote a coherent discourse about mobilisation and moral economy. Historicising a place through a factually grounded understanding of resource use in practice reveals that places and practices change through time. In my examination of the case of Ladakh and how glacier practices have changed through time, I have discussed how the depiction of Himalayan communities such as in *Revealed: The Himalayan Meltdown* fails to account for changes in the region in recent decades, as exemplified in the case of Ladakh.

The way people in Ladakh engage with glaciers is the product of contested claims over Ladakh as a place. At the regional level, the resulting dynamics have transformed the region into a militarised border area. As the landscape of Ladakh has become contested, so have modes of engagement with it as a place. While farming remains pivotal for food security, it is no longer the sole source of income for a growing number of Ladakhis. Notwithstanding Ladakh's specific history of economic restructuring through the reconfiguration of the region into a border area, the demographic changes the region has experienced since the mid-twentieth century, including significant rural out-migration and the decentralisation of the agrarian economy, constitute a familiar scenario in various parts of the world today. What stands out in the case of Ladakh, however, is that the Indian state's production of a border area has, to paraphrase Henri Lefebvre (1991), altered the production of Ladakh as a place. The material and ideological components of this production are reflected in technical interventions oriented toward glaciers. As the state is having an ever-increasing presence in people's life, from being a source of employment to taking control of resources management, the perceived responsibility of nurturing bodies of ice is seen less as a communal responsibility than as a responsibility of the state. This also has to be considered in light of community changes, as I have argued.

In this study, I have discussed Ladakh's glaciers as a form of water supply and a site of technical interventions. I have also examined the potential for a reconciliation of scholarly approaches on knowledge and place through a study of the water–place nexus as it exists in the region. Taken together, the two facets of the present article constitute fertile ground on which to ponder climate change adaptation. On the one hand, bringing together a critical perspective on knowledge and place avoids thinking of adaptation by falling into environmental determinism and notions of moral economy where water becomes the most decisive factor in social organisation and where its management for adaptation would inevitably compel community mobilisation. On the other hand, it avoids falling into the trap of thinking about the supremacy of technology over natural resources, where water is seen as entirely manipulable through technological innovation. Other factors such as relevant social arrangements and changes within communities must also be taken into consideration. Ultimately, what this case demonstrates is that the production of places by the state has implications for the transformation of places by climate change.

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Notes

1 For a discussion of glacial lake outburst floods in the Himalayas, see Agrawala and van Aalst (2008); Meenawat and Sovacool (2011).

2 See the passage from the 1931 Census of India, cited in van Beek (1996, 111–112). See Cunningham (2005 [1854], 41–81) for a first-hand colonial perspective of the geography of Ladakh and the surrounding mountain chains as natural boundaries separating neighbouring regions and countries.

3 For scholarly treatments of Jammu and Kashmir's accession to India, see also Bose (2003); Lamb (1997).

4 Although Ladakh was arguably a border area under the Dogra rule, the experience of this border, in its poor enforcement on the ground, differed in many ways from the tracing of post-colonial borders that has followed the creation of the new nations of South Asia and that, as Gellner (2013) points out, are associated with a process of territorialisation, often through militarisation, that changed interactions between people and the state.

5 Data extracted from the Census of India 2011, http://www.censusindia.gov.in/pca/pca.aspx (accessed 26 August 2014).

6 There may be more than one *churpon*, depending on the village size.

7 This fear was explained by my informants as a result of seeing "the glacier becoming smaller." Two factors are to be considered. The first is seasonal melt – each year, glaciers melt in spring and summer – but the mass they lose during the warm seasons is usually regenerated in the colder months; glacier retreat implies the insufficient regeneration of seasonal melt, when snowfall is insufficient in winter, for instance. It is plausible that periods of reduced snowfall have prompted villagers to practice "ice cultivation." The other possible factor is the Little Ice Age, roughly dated as taking place between the sixteenth and the nineteenth centuries (Oerlemans 2005) and which Jean Grove (1988, 1–3) describes as a phase of lowered temperatures over most (if not all) of the globe with important consequences in particularly sensitive areas at high latitudes and high altitudes. The Little Ice Age was characterised by the expansion and fluctuation of glaciers in many parts of the world. Given that my informants saw (or heard of) this practice in the early twentieth century, it is possible that the warming that followed the Little Ice Age (if it was present at all in the Himalayas) initiated a process of glacier retreat that people could observe, feel concerned about, and respond to by taking action.

8 Linguist Georg Buddruss (1993, 70–78) reports other such practices elsewhere in Pakistan.

9 Shina, an Indo-Aryan language, is spoken by the Shina people in Gilgit-Baltistan.

10 Buddruss does not mention the age of the text.

11 Additionally, it confirms that the practice served practical, rather than strictly religious, purposes, in contrast to the ritual described by others in the Himalayas (see Norbu and Harrer 1986, 48–50).

12 The work of Chewang Norphel has inspired other initiatives in Ladakh. One such recent initiative is the "Ice Stupa artificial glacier," a mass of ice that resembles a Buddhist religious structure, designed by Sonam Wangchuk, a mechanical engineer and active public figure, locally known for his involvement in alternative education and the development of eco-friendly projects (see also https://www.indiegogo.com/projects/ice-stupa-artificial-glaciers-of-ladakh [accessed 20 March 2015]). See also Grossman (2012) for interventions on the Pastoruri glacier in Peru and Agrawala and van Aalst (2008) for interventions on the Mittelbergferner Glacier in the Austrian Alps.

13 In remote areas of Ladakh, the Leh Nutrition Project, one of the first local NGOs, operates as an alternative to the local government development agencies (Norphel and Tashi 2014, 201).

14 *Reach Ladakh* (4 May 2013), http://www.reachladakh.com/in-conversation-with-mr-chewang-norphel/1569.html (accessed 20 March 2015).

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