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Central Tibetan famines 1280–1400: when premodern climate change and bad governance starved Tibet*

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Abstract

From the late-1200s to the mid-1400s, the river valleys of Central Tibet experienced both droughts and political upheavals. This combination of inclement weather and administrative dysfunction led to a series of famines. Although the famines were noted at the time, they were later forgotten in Tibetan narratives, and this is the first time that they are the subject of historical study. In this article we analyse the historical narratives of famine – found in biographies, histories and poems – and compare them with the region's paleoclimatic records, focusing particularly on changes in temperature and precipitation. We begin by discussing the famines' climatic and political causes and their relationship to broader South and East Asian climatic- and famine-related events. We then outline the Tibetan religious, societal and government responses to these events. These responses include the community's initial reactions, and the multiple magical and managerial strategies they eventually developed to stave off famines.

Keywords: Climate history, Environmental history, Famine, Tibetan Plateau, Governance

བློ་གཏད་གངས་རིར་བཙོལ་ནས། ཞིང་ཆུང་ཐན་པས་འཚོགས་སོང་།
Trust in snow mountains, and drought will parch your field.

ཚག་སྐོ་བྱང་ན་འགོ་དང་། ཟུ་གེ་བྱང་ན་མཐའ།
If there is a calamity at the top, there will be famine in the periphery.

Tibetan proverbs

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In 1327, Rangjung Dorjé (Rang 'byung rdo rje, 1284–1339), who had been recognized as the third Karmapa reincarnate as a child, took refuge in Karma Monastery (Karma dgon) in Kham (Khams), eastern Tibet, after fleeing fighting and famine around the capital, Lhasa (Lha sa), in Central Tibet (Dbus gtsang). Despite having lived through several wars and earlier famines, he was shaken by what he saw on his journey to Kham. He claimed to have witnessed cannibalism and child abandonment. "People were", he said,

> crying out as they died on the road. A few people ate the flesh of others; a few sold their children for food. Others, wracked with hunger, jumped in the river. Wailing, and wailing they didn't know night and day; their skeletons were barely covered with the skin that hung off them, off bones and heads. Their [corpses] burned like vegetation.[1]

Rangjung Dorjé's analysis framed the events he witnessed within Tibetan Buddhism's cosmology and a multi-species (including supernatural entities) worldview. He claimed that capricious spirits were a primary cause for the famine and that the suffering people were analogies for beings from Buddhism's three lowest realms: hell-beings, hungry ghosts and animals. Along with these supernatural causes, however, he also highlighted two material bases for the famine: government ineptitude and climate change. Notably, these two factors align clearly with those that contemporary famine studies recognize as the two most prominent causes of famines.

By the time Rangjung Dorjé witnessed the famine, the Tibetans had been subject to Mongol Imperial rule (approx. 1244–1354) for many decades. Although the Mongol court had granted them a degree of autonomy because of their relationship with Tibet's religious elites, the Tibetans' inclusion within the larger Mongol Empire nevertheless created political, social and environmental upheavals in Central Tibet. By the time of the famine that Rangjung Dorjé witnessed, almost the entire Tibetan Plateau was indirectly ruled by the Beijing- and-Xanadu-based Great Yuan section of the greater Mongol Empire. Central Tibet's river valleys – where Rangjung Dorjé was based and where the most significant agricultural communities had developed – were ruled by local hierarchs who were directly recognized by the Mongol Great Khan but answered to his representative in Tibet, the Great Lord of Sakya (Sa skya) Monastery.

When Rangjung Dorjé wrote his critique of the famine's causes, he disparaged the Sakya hierarchs, who had been fighting among themselves and with other local rulers for years. The region's governance had suffered due to this infighting and the competition between many of the local rulers, Sakya and non-Sakya, for lucrative Mongol patronage. As the region's power elites fought over handouts from the Mongol court, ordinary Tibetans were required to pay taxes and offer labour services to their local lords, the Sakya administrators,

1 Rang 'byung rdo rje, *Rang 'byung rdo rje'i gsung mgur* (Bidung, Bhutan: Kunchhap, 1983), 392.1–5. Translated in R. Gamble, *Rangjung Dorje Master of Mahāmudrā* (Boulder: Shambhala Publications, 2020), 113.

and the Mongols.[2] The Mongols' patronage of local rulers, which was provided in exchange for allegiance and the provision of religious adepts to the Mongol court, weakened the social contract between the rulers and those they ruled. As Rangjung Dorjé and other contemporaries noted, this governmental structure did not create incentives for good economic or environmental management. In Rangjung Dorjé's description of the famine, he places blame for the famine on all levels of government. He accuses the then Mongol Emperor, Jayaatu Khan (Jayaγatu qaγan, 1304–1332), of corruption and describes Tibet's premier local ruler, the Great Lord of Sakya (Sa skya slob dpon), Özer Sengge ('Od gser seng ge, d. 1329), as "a 'great' bandit, a 'great' crook."[3]

The other material cause that Rangjung Dorjé claims regarding the famine – which, again, contemporary famine studies also regularly cite as a cause of famine – was a changing climate. "Rain does not fall," he notes, "the harvests are poor, and what little that does grow is carried away by frosts and hail."[4] Inclement weather is not an unusual topic in Tibetan literature, but there is a particular focus on climate in the writing of this time that is notable even within this tradition.

This uptick in reports of a changing climate from the late 1200s and throughout the 1300s corresponds with paleoclimatic evidence of a changing climate. Studies of natural archives such as ice cores, stalagmites and pollen sediment suggest that the Tibetan Plateau experienced a shift from a warm to a cold period around this time. This shift aligns roughly with a climate shift in much of the Northern Hemisphere that is known as the transition from the Medieval Warming Period (*c*.950 CE–*c*.1250 CE) to the Little Ice Age (*c*.1260 CE–*c*.1850 CE). The timing of the shift in Tibet, however, emphasizes the scientific consensus that this climatic alteration was not spatially coherent or global and occurred at different times around the Northern Hemisphere.[5] In Central Tibet's riverine valleys, the climate shifted towards the end of the thirteenth century.[6] This region's altitude, fragile agricultural

2 L. Petech, *Central Tibet and the Mongols: The Yüan-Sa-Skya Period of Tibetan History* (Rome: Istituto Italiano per il Medio ed Estremo Oriente, 1990), 50. Rang 'byung rdo rje, *Gsung mgur*, 392.1–5. Byang chub rgyal mtshan, *Bka' chems mthong ba don ldan* (Lha sa: Bod ljongs mi dmangs dpe skrun khang, 1989), 35−6.

3 Rang 'byung rdo rje, *Gsung mgur*, 392.1–5. 'Od gser seng ge's rule is detailed in Petech, *Central Tibet and the Mongols*, 80–2.

4 Rang 'byung rdo rje, *Gsung mgur*, 392.1–5.

5 R. Neukom, N. Steiger, J.J. Gómez-Navarro, Jianghao Wang and Johannes P. Werner, "No evidence for globally coherent warm and cold periods over the preindustrial Common Era", *Nature* 571, 2019, 550–4.

6 Ann V. Rowan, "The 'Little Ice Age' in the Himalaya: A review of glacier advance driven by Northern Hemisphere temperature change", *The Holocene* 27/2, 2016, 292–308. Rowan describes a temperature shift. The following three studies describe concurrent precipitation decline: (1) Zhe Sun, Kan Yuan, Xiaohuan Hou, Kejia Ji, Can Ge Li, Mingda Wang and Juzhi Hou, "Centennial-scale interplay between the Indian Summer Monsoon and the Westerlies revealed from Ngamring Co, southern Tibetan Plateau", *The Holocene* 30/8, 2020, 1163–73; (2) Minhui He, Bao Yang, Achim Bräuning, Jianglin Wang and Zhangyong Wang, "Tree-ring derived millennial precipitation record for the south-central Tibetan Plateau and its possible driving mechanism", *The Holocene* 23/1, 2013, 36–45; (3) A. Sinha, L. Stott, M. Berkelhammer, Hai Cheng, R.L. Edwards, B. Buckley, M. Aldenderfer and M. Mudelsee, "A global context for megadroughts in monsoon Asia during the past millennium", *Quaternary Science Reviews* 30/1–2, 2011, 47–62. C. Morrill, J.T. Overpeck and J.E. Cole describe an abrupt change

ecology, and position at the intersection of two climate systems,[7] the Indian Summer Monsoon and the Westerlies – a colder, drier system that enters the Plateau from Central Asia – meant that it was particularly affected by these changes.

Droughts and some famines had already plagued the region towards the end of the Medieval Warming Period when warming had pushed Tibetan agriculture out of its most productive climatic limits.[8] The changing climate of this interim period known as the Medieval Warming Period and the Little Ice Age (1280–1400) was, however, even worse. According to observations at the time, there was less rain, and much precipitation fell as hail. This climatic shift was disastrous for farmers trying to grow barley.[9] These historic observations align with climate studies research within the region that suggests a general link between lower temperatures and hail events in the valleys,[10] and temperature and precipitation declines during this period.[11] When these factors were combined with the mismanagement of Tibet's economy within the Mongol Empire, a series of famines ensued.

The records of Tibet's early Little Ice Age famines provide, therefore, yet another example of how famines occur through a combination of an unplanned event and a government's inability to respond effectively to that event with equitable food distribution. As Amartya Sen noted in his study of Indian famines: "Starvation is the characteristic of some people not having enough food to eat. It is not the characteristic of there being not enough food to eat. While the latter can be a cause of the former, it is but one of many possible causes."[12] Food shortages occur from time to time in most areas of the world; they may

in temperature and the Monsoon around 1300 CE, "A synthesis of abrupt changes in the Asian Summer Monsoon since the last deglaciation", *The Holocene* 13/4, 2003, 465–76.

7 Morrill et al., "A synthesis of abrupt changes in the Asian Summer Monsoon", 465–76. Morrill et al. refer to the entirety of the Monsoonal area in their studies. As their map on p. 476 shows, the Central Tibetan River Valleys sit in a transitional zone between the two climate systems.

8 Evidence of droughts in the area can be found in: Sun et al., "Centennial-scale interplay between the Indian Summer Monsoon and the Westerlies", 1163–73; He et al., "Tree-ring derived millennial precipitation record", 36–45. Evidence of famines from this period can be found in the biographies of Śākyaśrībhadra translated and analysed in Leonard W.J. van der Kuijp, "Review of David Jackson, 'On the lives of Śākyaśrībhadra (?–?1225)'", *Journal of the American Oriental Society* 114/4, 1994, 611. There is also evidence of famines in Tibetan histories from later times that draw on non-extant sources. The clearest example of this is, Dpa' bo gtsug la 'phreng ba (1504–64), *Chos 'byung mkhas pa'i dga' ston*, vol. 1 (Pe cin: Mi rigs dpe skrun khang, 1986 [1545]), 721.

9 Rang 'byung rdo rje's song describes this phenomenon, *Gsung mgur*, 392.1–5. As does Byang chub rgyal mtshan, *Bka' chems mthong ba don ldan*, 46–7.

10 Tian Zou, Qinghong Zhang, Wenhong Li and Jihong Li suggest a link between hailstorms and cold weather events (and their lack in warm weather), "Responses of hail and storm days to climate change in the Tibetan Plateau", *Geophysical Research Letters* 45/9, 2018, 4485–93.

11 Sun et al., "Centennial-scale interplay between the Indian Summer Monsoon and the Westerlies", 1163–73. He et al., "Tree-ring derived millennial precipitation record", 36–45.

12 Amartya Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation* (Oxford: Clarendon Press, 1981), 1.

result from several factors, such as droughts or floods; and in Tibet, as Rangjung Dorjé and others note repeatedly, hailstorms frequently destroy crops just before harvest season.[13] However, for food shortages to metastasize into a famine, they need to be combined with government ineptitude, malfunction or malice. People in a particular area may starve despite average (or even higher than average) crop production, and starvation can occur when governments have supplies of foodstuffs sufficient to feed their populaces but decline to do so.[14]

Just as famine studies provide an important context for understanding the occurrence of and response to Central Tibet's premodern climate change, the Plateau's distinctive environment and the Tibetans' religiously inspired response to the crises combine to offer a unique setting for a famine study. Most famine research has focused on areas of dense population, low altitude, and colonial or modernist political systems.[15] The Plateau's fragile ecology, high altitude, mountainscape-induced climate variability and limited arable land combine to form an environmental setting that is atypical for this field. The relationship between its multi-levelled government and Tibetan Buddhism also marks it as an unusual study site in famine studies.[16] Within the Tibetan Buddhist worldview, weather, crop yields and governance are thought to be outcomes of a complex network of karmic and supernatural causes. Humans experience the karmic fruits of their actions through both material fortunes and misfortunes and the capricious nature of local supernatural spirits and gods.[17] Thaumaturges like Rangjung Dorjé possess a combination of supernatural and political power that enables them to intervene with both divine and human rulers. This purported ability meant they were frequently asked to pray or perform rituals to ensure these calamities did not occur, and their reputations rested on their perceived ability to control elements and intercede with rulers. Rangjung Dorjé and others,

13 Rang 'byung rdo rje, *Gsung mgur*, 392.1–5.

14 Sen, *Poverty and Famines*, 7. Sen notes that some of the worst modern famines have occurred in situations where there was no significant per capita decrease in available food. Mike Davis outlined how India and China's many nineteenth-century famines occurred as a result of disinterested colonial governance in *Late Victorian Holocausts: El Niño Famines and the Making of the Third World* (London: Verso Books, 2002). Anne Applebaum (*Red Famine: Stalin's War on Ukraine*, New York: Penguin/Doubleday, 2017) characterizes the devastating Holodomor famine (1932–1933) that decimated the population of Ukraine as a deliberate genocide. In *The Harvest of Sorrow: Soviet Collectivization and the Terror-Famine* (London: Arrow Books, 1988), Robert Conquest agreed with this assessment, but later, after viewing new evidence from Soviet archives, revised his position: "with resulting famine imminent, he could have prevented it, but put 'Soviet interest' other than feeding the starving first – thus consciously abetting it": see Stephen G. Wheatcroft, "The turn away from economic explanations for Soviet famines", *Contemporary European History*, 27/3, 2018.

15 Olivier Rubin, "The precarious state of famine research", *The Journal of Development Studies* 55/8, 2019, 1633–53.

16 We understand that many cultures around the world have supported religious intermediaries who it is understood can mediate with and moderate the weather. We are not stating that these intercessions are unusual. Rather, that they are an unusual subject for the study of a famine.

17 Toni Huber and Poul Pedersen, "Meteorological knowledge and environmental ideas in traditional and modern societies: the case of Tibet", *Journal of the Royal Anthropological Institute* 3/3, 1997, 577–97.

whose biographies we will refer to in this article, acted as intermediaries between the spirit world, the Mongol overlords, and local people, and they recorded these events in their writings.

These records, and data from many palaeoecological studies of Tibet, provide more data about this event than is usually available to premodern historians. In this article, we compare the scientific evidence for climate change during this period and reports from Rangjung Dorjé and several of his contemporaries' biographies to trace the complex and interrelated factors that led to this series of famines in thirteenth- and fourteenth-century Central Tibet. The pollen and ice archives provide a detailed record of climatic change during this time, but no real sense of how the Plateau's population responded to these changes. These details can only be found in Tibetan writing from this period.

We approached this literature in two ways. First, we conducted a broad search of the textual corpus and noted a concentration of references to famine during the first few centuries of the second millennium, particularly towards the end of the Mongol Empire (1206–1368). We then noted that many of the descriptions of famine during this time came from religious and political hierarchs such as Rangjung Dorjé, his teacher Orgyenpa Rinchendrup (O rgyan pa Rin chen grub, 1229/1230–1308/1309), his previous reincarnation Karma Pakshi (Kar ma pak shi, 1204/1206–83), and his student Tai Situ Jangchub Gyeltsen (Ta'i si tu Byang chub rgyal mtshan, 1302–64). Jangchub Gyeltsen's insights into famine management are exceptionally insightful as he became the first of the Pakmodrupa (Phag mo gru pa) hegemons who ruled much of Central Tibet during the fourteenth to seventeenth centuries as the Mongol Empire lost power.

We use these sources to discuss these famines in this climatically unstable period, their climatic and political causes, their relationship to broader East and Central Asian climatic-, political- and famine-related events, and how Tibetan society and governments responded to them through magical and management famine prevention strategies.

Central Tibetan food landscapes

In the past and today, the Tibetan Plateau's economy has been based on a combination of agriculture and pastoralism. The majority of the population has supported itself through varying percentages of subsistence agro-pastoralism and long-distance trade networks.[18] While trade networks transverse the Plateau, however, its environmental history is intensely varied, and individual areas have followed their respective economic and environmental trajectories. Central Tibet's fertile river valleys, for example, have had a distinct agricultural rather than pastoral history. What is more, the agricultural systems Tibetans developed in this region compensated for altitude, climate variations and uneven hydrology by a complex reorganization of its ecology.

18 Nicholas Paltridge, Jin Tao, Murray Unkovich, Alessandra Bonamano, Alexandra Gason, Samantha Grover, John Wilkins, Nyima Tashi and David Coventry, "Agriculture in Central Tibet: an assessment of climate, farming systems, and strategies to boost production", *Crop and Pasture Science* 60/7, 2009, 627–39.

Agricultural settlement in the Yarlung Tsangpo (Yar klungs gtsang po) River Valley and the valleys of its two main tributaries – the Nyangchu (Rnyang chu) River near Gyantse and Shigatse and the Kyichu (Skyid chu) River near Lhasa – has a history stretching back at least 3,500 years.[19] Most of the polities in the Yarlung Tsangpo River Basin developed structures related to the concerns of their agricultural communities. Power, wealth and religious institutions were closely associated with the realities of farmers' lives. These valleys were also the centres of wealth for Central Tibet. Some pastoralists ('*brog pa*) who inhabited non-arable regions such as the Changtang Plain (Byang thang or Northern Plain) became wealthy through wool and salt trade but rarely accrued as much wealth as the more affluent people of the river valleys.

Pollen analysis in the Lhasa region has revealed that the Lhasa plain was cleared of juniper (*juniperus*) and buckthorns (*hippophae*) to create pastoral and agricultural fields.[20] Some of its numerous wetlands were later drained to plant agricultural fields and build temples.[21] This pattern of land clearing and wetland drainage was repeated in arable regions throughout these river valleys. Given the region's inconsistent precipitation, most river-valley fields have relied on irrigation. These irrigation systems directed the water that seeped out at the top of the valleys through springs (*chu mig*), streams (*chu phran*) or groundwater discharge (*chu mgo*) into canals (*yur ba*) and then to fields. Runoff water would slowly make its way through additional canals into the larger rivers. Maintenance of irrigation systems was usually shared among communities that appointed a villager as "water chief" (*chu dpon*). This person, on advice from the village, would decide water allocations for each field or family.[22]

The irrigation system depended on a combination of spring snowmelt to moisten the ground and June rain for planting. Even with irrigation water stored in reservoirs, June rain was required for routine agricultural procedures. June

19 Xingquan Zeng, Yu Guo, Qijun Xu, Martin Mascher, Ganggang Guo, Shuaicheng Li, Likai Mao, Qingfeng Liu, Zhanfeng Xia and Juhong Zhou, "Origin and evolution of Qingke barley in Tibet", *Nature Communications* 9/1, 2018, 1–11.

20 Knut Kaiser, Lars Opgenoorth, Werner H. Schoch and Georg Miehe, "Charcoal and fossil wood from palaeosols, sediments and artificial structures indicating late Holocene woodland decline in Southern Tibet (China)", *Quaternary Science Reviews* 28/15–16, 2009, 1539–54.

21 The draining of shallow lakes or wetlands on the Lhasa and Yarlung Valley Plains is recorded in several Tibetan historical accounts. See, for example, Dpa' bo gtsug lag 'phreng ba, *Chos 'byung mkhas pa'i dga' ston*, p. 166–7. This draining process has also been examined in Per K. Sørensen, "Lhasa Diluvium. Sacred environment at stake: the birth of flood control politics, the question of natural disaster management and their importance for the hegemony over a national monument in Tibet", *Lungta* 16, 2003, 85–134. And the paleoecology of the region was examined in Georg Miehe, Sabine Miehe, Frank Schlütz, Knut Kaiser and La Duo, "Palaeoecological and experimental evidence of former forests and woodlands in the treeless desert pastures of Southern Tibet", *Palaeogeography, Palaeoclimatology, Palaeoecology* 242/1–2, 2006, 54–67.

22 Robert B. Ekvall and James F. Downs, "Notes on water utilization and rule in the Sakya Domain, Tibet", *The Journal of Asian Studies* 22/3, 1963, 293–303. Zhao-fei Liu, Zhi-jun Yao, Cheng-qun Yu and Zhi-ming Zhong, "Assessing crop water demand and deficit for the growth of spring highland barley in Tibet, China", *Journal of Integrative Agriculture* 12/3, 2013, 541–51.

rain depended, in turn, on moist monsoon winds ascending onto the Plateau up the river valleys. Until recently, in most years the monsoon rains watered the Plateau from May to September. Hailstorms – which often fell at the end of the monsoon in September when the crops were ready for harvest – were a recurring hazard that could destroy a season's work.[23]

The combination of spring melt and Monsoon rains was sufficient to support human settlement for thousands of years, and this is still true today. The region's human adaptations to the environment are one reason for this sustainability, but so is its particular climate. Most of the Plateau is an arid or semi-arid zone, with inconsistent rain and permafrost affecting soil temperatures and the ground's soaking capacity, creating only a few places or "niches" in which agriculture is possible.[24] The river valleys are at a lower altitude than most of the Plateau, meaning they contain less permafrost; they also sit at the intersection of two weather systems – the Indian Summer Monsoon and the mid-latitude Westerlies – and can receive precipitation from both events. The Indian Summer Monsoon system is more prevalent in the eastern and southern sections of these basins. It delivers "up-and-over transport (of moisture) at event scales" to the basins. Studies show it delivers more than half of the region's precipitation between July to September, dragging moisture up from the Bay of Bengal.[25] The Westerlies provide less precipitation and do so in winter, falling as snow and ice.

23 References about June rains and September hail are found throughout Tibetan historical records and biographical literature. There is a collection of hail histories in *Rang byung gnod 'thse ser skyon skor* (Lhasa: Bod ljongs mi dmangs dpe skrun khang, 1987). See also Anne C. Klein and Khetsun Sangpo, "Hail protection", in *Religions of Tibet in Practice* (Princeton: Princeton University Press, 2007), 400–10. Charles Bell describes the need to protect crops from hail during his early twentieth-century stay in Tibet, *The People of Tibet* (New Delhi: Motilal Banarsidass Publishers, 1992), 40.

24 Research into pre-historic agriculture on the Plateau has highlighted the limited amount of arable land there. Research that has highlighted the development of agriculture on the Tibetan Plateau includes the following: G. Miehe, S. Miehe, K. Kaiser, C. Reudenbach, L. Behrendes, La Duo and F. Schlütz, "How old is pastoralism in Tibet? An ecological approach to the making of a Tibetan landscape", *Palaeogeography, Palaeoclimatology, Palaeoecology* 15, 2009, 130–47; Jade Guedes d'Alpoim, Sturt W. Manning and R. Kyle Bocinsky, "A 5,500-year model of changing crop niches on the Tibetan Plateau", *Current Anthropology* 57/4, 2016, 517–22. There is some debate about the altitudinal limits of agriculture in Tibet. We note, for example, John Vincent Bellezza's counterarguments in favour of a larger percentage of croplands at 4,000-metre altitudes than Guedes et al. allow (see J.V. Bellezza, "A 5,500-year model of changing crop niches on the Tibetan Plateau: a comment", *Current Anthropology* 58/4, 2017, 537–8). But these arguments are not directly relevant to our discussion of crop distribution.

25 Sun et al., "Centennial-scale interplay between the Indian Summer Monsoon and the Westerlies", 1163–73. There have been multiple studies of how these systems influence Tibet's climate in more recent times: Wenhao Dong, Yanluan Lin, Jonathon S. Wright, Yi Ming, Yuanyu Xie, Bin Wang and Yong Luo, "Summer rainfall over the southwestern Tibetan Plateau controlled by deep convection over the Indian subcontinent", *Nature communications* 7/1, 2016, 1–9. Wen-wen Qi, Bai-ping Zhang, Yong-hui Yao, Fan Zhao, Shuo Zhang and Wenhui He, "A topographical model for precipitation pattern in the Tibetan Plateau", *Journal of Mountain Science*, 13/5, 2016, 763–73. Youping Chen, Mary H. Gagen, Feng Chen, Heli Zhang, Huaming Shang and Hongfan Xu, "Precipitation variations recorded in tree rings from the upper Salween and Brahmaputra River valleys, China", *Ecological Indicators* 113, 2020, 106189.

The west of the central river valleys is more influenced by Westerlies, and overall precipitation rates are lower. The two systems are, furthermore, highly influenced by temperature changes. The Indian Summer Monsoon system is much more active in warmer climatic periods than it is in colder periods, when the Westerlies become more dominant.[26]

Despite the region's general amenability to agriculture, not every valley or section of a valley had the same hydrology. People who lived in regions with either less consistent precipitation or less groundwater and snowmelt were much more vulnerable to temperature variations.[27] Both rain-fed agriculturalists and pastoralists were dependent on precipitation for plant growth. Pastoralists needed rain and snowmelt to replenish streams with which they could provide water to their yaks, sheep, goats and other animals. If precipitation did not occur at the right time, both farmers and pastoralists had to rely on stores of grain. Local lords generally kept these reserves in their fortresses (*rdzong*) or at local monasteries, or a combination of both. Like the system of water distribution, allocation of stored grain relied upon efficient governance mechanisms to work correctly.[28]

Central Tibet's agricultural system sat within several different environmental timescales and worked sustainably within some and not within others. Within the yearly seasonal cycle, the Tibetans had developed a method for reproducing grains for themselves and fodder for their animals from the confines of the moist river valley flats and human-made, rain-fed pastures on drier hills. The deforestation in which they had engaged was nowhere near as intensive as that which occurred after the People's Republic of China began occupying the region in the 1960s, but it nevertheless transformed the region's ecosystem and had a drying effect.[29] This longer-term drying combined with the Mongol-era climate shift and dysfunctional imperial governance to force economic and environmental change. The changes the Tibetans made due to these famines ensured their survival within a primarily subsistence economy until the cataclysms of the

26 Sun et al., "Centennial-scale interplay between the Indian Summer Monsoon and the Westerlies", 1167–9.

27 Variations across the Plateau and the link between precipitation and temperature were demonstrated in Lei Zhong, Yaoming Ma, M.S. Salama and Zhongbo Su, "Assessment of vegetation dynamics and their response to variations in precipitation and temperature in the Tibetan Plateau", *Climatic Change* 103, 2010, 519–35. This study was not focused on paleoclimates, but as it studied the relationship between topography and precipitation variability, it acts as a good marker for continued precipitation variability.

28 Some of Byang chub rgyal mtshan's most scathing criticisms are for those who do not sow, harvest and store grain, *Bka' chems mthong ba don ldan*, 17. There is not the same evidence in his reports, however, of the sophisticated granaries, taxation and redistribution programmes that are described in later premodern polities. Paljor Tsarong outlined the functions of the barley supply office from a later period in "Economics of a Tibetan state treasury: the Barley Supply Office", *The Tibet Journal* 23/2, 1998, 3–10. C.W. Cassinelli and R.B. Ekvall explain the taxation and distribution of grain in premodern Sa Skya in *A Tibetan Principality: the political system of Sa skya* (Ithaca: Cornell University Press, 1969), 120.

29 Georg Miehe, Sabine Miehe, Martin Will, Lars Opgenoorth, La Duo, Tsering Dorgeh and Jianquan Liu, "An inventory of forest relicts in the pastures of Southern Tibet", *Plant Ecology* 194/2, 2008, 157–77.

twentieth century unfolded. They did not, however, address the underlying problems of deforestation that had accompanied the valleys' human occupation.

A change in the weather

The Mongol-era climate shift was one of several that occurred across the Plateau from the late first millennium. Paleoclimatic evidence suggests these changes occurred unevenly across the region. On the ground, this meant that some valleys would have experienced rapid change while their neighbours in other valleys experienced it at a much slower rate. This divergent climate history has led to a divergence in the data accrued from the planet's ice and pollen stores, and only recently have extensive reviews of data sets given us a better picture of how the Little Ice Age unfolded on the Plateau. These review studies suggest that the Little Ice Age unfolded as a localized event on the Tibetan Plateau.[30] There had already been a generally colder and dry period between 1189 and 1242 towards the end of the Medieval Warm Period.[31] As the Little Ice Age began in the late 1200s, temperatures dropped, glaciers grew and winter precipitation – snow, hail and rain – caused by the Westerlies intensified as the summer rains of the Indian Summer Monsoon diminished.[32] Paleoclimatic evidence from juniper tree-rings collected near Reting (Rwa sgreng) Monastery, and stretching from 1075–2000 CE, show that there was a marked reduction in precipitation at this time which coincided with the Indian Summer Monsoon shrinkage. Prolonged dry spells continued between 1256–1314 and 1329–57.[33]

Both the extra heat towards the end of the Medieval Warming Period and the subsequent cold of the Little Ice Age were generally harmful to this region's human and animal inhabitants. The primary reason why this temperature change affected Tibet's pastoral-agricultural community was the changes it brought about in the region's precipitation levels. This change was particularly evident during the Mongol-era episode of climate change from 1280–1400. During this time, precipitation, particularly much needed summer precipitation, was consistently low for a prolonged period.[34] Central Tibet's "rain window" is narrow in multiple ways. It is seasonally constricted: the meteorological event of the Indian Summer Monsoon brings the greatest concentration of precipitation to these valleys, and it only lasts for a few months. The temperature in which adequate precipitation occurs is also a narrow band; this precipitation must fall as rain rather than snow, ice or outburst events if agriculture is to flourish.

30 Rowan, "The 'Little Ice Age' in the Himalaya", 292–308.

31 A. Sinha, K.G. Cannariato, L.D. Stott, Hai Cheng, R.L. Edwards, M.G. Yadava, R. Ramesh and I.B. Singh, "A 900-year (600 to 1500 AD) record of the Indian summer monsoon precipitation from the core monsoon zone of India", *Geophysical Research Letters* 34/16, 2007. Sinha et al., "A global context for megadroughts in monsoon Asia", 47–62.

32 G. Kathayat, Hai Cheng, A. Sinha, Liang Yi, Xianglei Li, Haiwei Zhang, Hangying Li, Youfeng Ning and R.L. Edwards, 2017, "The Indian monsoon variability and civilization changes in the Indian subcontinent", *ScienceAdvances* 3/12, 2017. Sinha et al., "A 900-year (600 to 1500 AD) record of the Indian summer monsoon precipitation".

33 He et al., "Tree-ring derived millennial precipitation record", 36–45.

34 He et al., "Tree-ring derived millennial precipitation record", 36–45 and Sun et al., "Centennial-scale interplay between the Indian Summer Monsoon and the Westerlies", 1167–9.

The Westerlies bring precipitation, but it falls as ice and snow in winter and is only available, as ice-melt, for the start of the agricultural season. As the summer rains became less reliable during this time and their crops diminished, the people of these valleys had to develop multiple ways to deal with their change in climatic circumstances. These required efficient forms of governance that were not, at least initially, established.

Tibet's much-more-than-human world

As writings from the period reflect, most of the inhabitants of the Tibetan Plateau understood their changing climatic, environmental, economic and political circumstances as the intersected workings of karma and capricious local spirits. They perceived their environment as the abode of a multitude of humans and animals, existing alongside a multitude of supernatural beings whose whims were key causal factors underlying climate change. Across the Tibetan cultural world, the immediate cause of the climatic change was understood to be the region's autochthonous deities who controlled weather phenomena, often in response to human actions.

The otherworldly beings that were thought to influence weather included local spirits such as territorial deities (*yul lha*), elemental lords – earth lords (*sa bdag*), water lords (*chu bdag*) and wood lords (*shing bdag*) – and subterraneous beings called *klu* (which came to be associated with Indian *nāgas*, shape-shifting beings who live in water that appear in Buddhist literature) who inhabited water bodies (lakes, pools, springs, rivers, underground reservoirs, etc.). All these entities were and are understood to react negatively to disturbances, pollution, disrespect, bad behaviour, the breaking of societal norms,[35] and sometimes the arrival of strangers.[36] Nevertheless, because their communication is ambiguous and indirect, ritual specialists were often required to ascertain the precise causes of their anger and how to propitiate them. The influence of these supernatural beings intersects with Buddhist notions of karma.

From the perspective of the Buddhist doctrine of cause and effect (Skt. *karma-phala*; Tib. *las rgyu 'bras*), misfortune (as well as prosperity) is characterized as the immutable results of one's actions. In this sense, when plague, drought or other environmental catastrophes occur, they will be explained as karmic consequences. At the same time, however, there is a long history across the Tibetan Plateau of individuals and communities requesting tantrikas (*sngags pa*), some of whom were prominent religious figures, to intercede on their behalf to ameliorate – or sometimes eliminate – the adverse outcomes of their actions, including the wrath of local gods. The causal reason often given for this ability to intervene is that the devotion, offerings and practices act as a counter cause

35 See, for example: Gtsug lag 'phreng ba, *Mkhas pa'i dga' ston*, 933; Rang 'byung rdo rje, *Rang 'byung rdo rje'i tshigs bcad ma* (Mthsur phu: Mkhan po lo yag bkra shis, 2006), vol. ga, 397–8. Contemporary studies have noted similar attitudes. Emily Woodhouse, Martin A. Mills, Philip J.K. McGowan and E.J. Milner-Gulland, "Religious relationships with the environment in a Tibetan rural community: interactions and contrasts with popular notions of indigenous environmentalism", *Human Ecology* 43/2, 2015, 295–307.

36 Huber and Pedersen, "Meteorological knowledge and environmental ideas", 577–97.

for the adverse outcomes that would otherwise have arisen. They also bring into play the positive karmic stores of the ritual specialist who is asked to intervene.[37]

Local deities were often the focus for the tantrikas' intersessions. They were understood to have a personal relationship with the offended spirits, which enabled them to mediate between deities and people. In their writings, the manifestation of the supernatural entities' displeasure is often presented as an agent of human karma. More recent anthropological studies,[38] however, along with close readings of Mongol-Empire-era texts, suggest that the technicalities of the philosophical intersections between the creation of karma and offences against local deities were not usually of interest to the communities that engaged ritual specialists. When their voices are heard within these texts, these people tend to emphasize both the tantrikas' relationship with local and transregional gods and the effectiveness of their rituals.

There are reports of droughts and famines as far back as recorded history on the Plateau – which is to say from the sixth century CE – and the trope of religious adepts who acted as weather makers and controlled water has an equally long pedigree. Stories of the semi-mythical tantric adept Padmasambhava (*fl. c.* eighth century), also known as Guru Rinpoché (Gu ru rin po che), reported that he was able to manipulate the weather. One of the earliest extant texts that mentions him, the *Statement of Ba* (*Sba bzhed*, dating to the twelfth century but based on ninth-century and later documents), only briefly alludes to him as an itinerant Indian water-specialist, and as the introduction to the English translation of this work indicates, it portrays him as someone with expertise in water engineering and magic:

> The portrait of Padmasambhava as mainly concerned with water magic and sheer water technology … may even hint at a possible attempt to import into Tibet the sophisticated irrigation systems used in his land of origin. … Given the political importance of control over water resources, it is not surprising that the Tibetan political leadership felt more threatened than pleased. Padmasambhava's trip was, therefore, quite unsuccessful.[39]

In early sources, Padmasambhava is portrayed as an Indian tantric adept worthy of respect and imbued with magical power but, as Robert Mayer has noted,

37 Mills, M.A., "Vajra brother, vajra sister: renunciation, individualism and the household in Tibetan Buddhist monasticism", *Journal of the Royal Anthropological Institute* 6/1, 2000, 17–34.

38 Woodhouse et al., "Religious relationships with the environment in a Tibetan rural community", 295–307.

39 See Pasang Wangdu, Hildegard Diemberger and Per K. Sørensen, *dBa' bzhed: The Royal Narrative Concerning the Bringing of Buddha's Doctrine to Tibet* (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 2001), 13–14. On pp. 17–18, Padmasambhava is credited with several water-related sorceries: he "tamed a place of boiling water" and "subdued a white *nāga*". He later created magical medicinal water for the king and "carried out numerous miracles concerning water"; these included transforming dry plains into lush meadows and causing springs to burst to the surface of arid land. In spite of these prodigious displays, Padmasambhava was ordered to return to his home region. The text suggests that some ministers feared that his power was too dangerous and that he posed a threat.

several similar figures are also mentioned and appear to be roughly equivalent in stature: "for many Tibetans especially before the twelfth century, Padmasambhava seems to have been just one Indian tantric master among many others, not noticeably pre-eminent."[40] As Padmasambhava's hagiography developed in later centuries, however, the Buddhist clerics who wrote most of Tibet's influential histories augmented his legend and recast him as a mighty sorcerer who subdued Tibet's demons and placed them at the service of the Dharma.[41] But the trope of Guru Rinpoché's ability to control the weather (either with his magical power or with the aid of supernatural forces he had subjugated) was woven into his mythology from an early period.[42]

In later centuries, the biographies of many of Tibet's most influential religious figures incorporated stories of their response to community entreaties for meteorological intercession, and many of them presented themselves as followers or lineal descendants of Guru Rinpoché.[43] The belief system within which they operated was conceptually self-sustaining. Tantrikas could contact supernatural entities for aid, but these beings were capricious and undependable. So if a renowned lama performed rituals to control rain but was unsuccessful, people did not conclude from this that the supernatural beings did not exist or that the claims made by the lama and his supporters were bogus; rather, the fickle spirits they invoked were not inclined to reciprocate, or karmic factors relating to the local populace might be cited as the underlying obstacle.

As Toni Huber and Poul Pedersen noted in their comparison of Tibetan traditional weather beliefs and modern meteorology, for much of Tibetan history, these ritualistic intercessions by tantrikas were local events performed by local communities who were trying to understand larger regional or even global climatic changes.[44] The renowned Tibetan thaumaturges of the Mongol Empire, some of whose biographies we have analysed for this study, were unusual among the premodern Tibetan community in that they were well travelled, had been pressed into weather-making service in multiple countries, and were part of imperial information networks that stretched across Eurasia. Their insights into climatic events and famines were grounded in the much-more-than-human Tibetan world; but as Rangjung Dorje's comments on famine demonstrated, they also included political and economic analysis of the tragedies they were asked to mitigate.

40 Robert Mayer, "Geographical and other borders in the symbolism of Padmasambhava", in Geoffrey Samuel and Jamyang Oliphant of Rossie (eds), *About Padmasambhava: Historical Narratives and Transformations of Guru Rinpoche* (Schongau, Switzerland: Garuda Verlag, 2020), 68–9.

41 See, for example, Jacob Dalton, "The early development of the Padmasambhava Legend in Tibet: a study of IOL Tib J 644 and Pelliot tibétain 307", *Journal of the American Oriental Society* 124/4, 2004, 759–72.

42 Pasang Wangdu et al., *dBa' bzhed*, 53–4. Dalton also discusses several early documents from the Dunhuang caves that associate Padmasambhava with water control magic in "The early development of the Padmasambhava Legend in Tibet", 759–72.

43 Andrew Quintman, "Toward a geographic biography: Mi la ras pa in the Tibetan landscape", *Numen* 55/4, 2008, 363–410. Ruth Gamble, *Reincarnation in Tibetan Buddhism: The Third Karmapa and the Invention of a Tradition* (New York: Oxford University Press, 2018), 105–33.

44 Huber and Pedersen, "Meteorological knowledge and environmental ideas", 577–97.

Weather makers as climate change witnesses

The number and frequency of drought and flood records begin to tick up around the turn of the thirteenth century as the weather started to change more significantly. Leonard van der Kuijp noted one account of famine-induced cannibalism in his translation of excerpts from Jigten Sumgön's ('Jig rten gsum mgon, 1143–1217) biography. In this story, Jigten Sumgön fled his home village because of a famine, but "when he arrived in Dwags-po a great famine took place, and a *zho* of gold would not fetch even seven measures (*bre*) of barley. There were many who, having killed a person, were even eating human flesh."[45]

As the number of climatic crises spiked during this period, descriptions of famines and the demand for Tibet's "rainmakers" increased. The widely popular biographies of Milarepa (Mi la ras pa, 1040/1052–1123/1135), composed during this period, contain examples of this sort of climate control. Milarepa studied black magic to wreak revenge on his family's enemies; one such event involved him persuading a local god to create a hailstorm, which devastated the crops of villagers who were plotting to harm him.[46]

Accounts of meteorological control by tantrikas in the thirteenth and fourteenth centuries frequently incorporate the trope of weather control. There are many examples of these interactions between human adepts and supernatural beings in the biographies and autobiographies of Rangjung Dorjé and his associates. For example, Orgyenpa's biography (written by his student Sönam Öser, Bsod nams 'od zer, thirteenth century) includes several mentions of unseasonable weather and famines, along with Orgyenpa's attempts to redress these problems. In 1255, an earthquake and subsequent famine and plague killed approximately one-third of Kathmandu's population. The famine and pestilence slowly spread up the mountain to his home in Southern Tibet[47]; Orgyenpa chose to leave home but journeyed to the western Himalaya, into Central Asia, then Northern India, and did not arrive in nearby Kathmandu until he was on his way home. He made repeated journeys to Bodhgaya through Kathmandu after this, and in Kathmandu in 1274, on returning from one of these journeys, he met Tibetan refugees who were fleeing another drought and famine in his homeland. They informed Orgyenpa that his home region had experienced several years of bad weather that resulted in depleted stores of foodstuffs. The local aristocrats and monasteries could not assist because they were also struggling to feed themselves.[48]

45 van der Kuijp, "Review of David Jackson, 'On the lives of Śākyaśrībhadra (?–?1225)'", 611.

46 The earliest version of this story is told in Sgam po pa Bsod nams rin chen (1079–1153), "Rje Mar pa dang Mi la'i rnam thar", in *Collected Works of Gampopa* (New Delhi: Khedrup Gyatso Sashin, 1975), vol. 1, 16–26.

47 Zla ba seng ge, "Chos rje rin po che u rgyan pa'i rnam thar gsung sgros ma", in *Grub chen o rgyan pa'i rnam par thar pa byin brlabs kyi chu rgyun*, (Gangtok: Sherab gyaltsen lama, 1976), vol. 1, 235. The earthquakes and famines in Nepal are noted in: Luciano Petech, *Mediaeval History of Nepal* (c.750–1480) (Roma: Istituto Italiano per il Medio ed Estreme Oriente, 1958), 91; Rishikesh Shaha, *Ancient and Medieval Nepal* (New Delhi: Manohar, 1992), 47.

48 Bsod nams 'od zer, *Dpal ldan bla ma dam pa Grub chen U rgyan pa'i rnam par thar pa byin rlabs kyi chu rgyun* (Lhasa: Bod ljongs Bod yig dpe rnying dpe skrun khang, 1997), 132.

These afflictions devastated Southern and Central Tibet and were exacerbated by armed conflict between rival Mongol princes. On one side of this fight was the Great Khan Khubilai (1215–94), who was attempting to suppress a rebellion by the Chagatai Khanate, a Mongol faction based in Central Asia. One of their battles was conducted in Southern Tibet, in Lato Lho (La stod lho), near Orgyenpa's home. He attempted to use his magic to repel them but was unsuccessful. After his failure, he first submitted to the Chagatai following their invasion of the area and then committed himself to Khubilai after his troops recaptured it.[49] Khubilai considered Orgyenpa to be an accomplished weather magician and asked him to perform a ritual dance to summon rain and alleviate a drought that threatened his army. After Orgyenpa's efforts were judged a success, he was summoned to Khubilai's court and assigned the task of removing various types of obstacles; his activities included rainmaking, thwarting earthquakes and stopping rival armies.

His position and duties reflect a common belief among Mongols at the time that Tibetan ritualists were powerful *bayši*, a Mongolian word that combined the idea of a teacher or scholar with that of a sorcerer.[50] *Bayši* such as Orgyenpa, Orgyenpa's teacher – the second Karmapa, Karma Pakshi (Kar ma pak shi, whose name derived from the term *bayši*) – and later Rangjung Dorjé could be used to the Mongols' military and climatic advantage. Sources from this period indicate that the very presence of a Tibetan miracle-worker in the employ of a particular hegemon often served as a deterrent to potential rivals.[51]

Karma Pakshi tutored Khubilai Khan when he was still a prince living in what is now Gansu Province in modern China. Karma Pakshi left Khubilai's camp and went to teach his elder brother, the then Great Khan Möngke (1208–59), at his court in Karakorum. On the way, Karma Pakshi reportedly ended a drought on the Mongol-China borderlands with the aid of the *klu* king Ngagki Dakpo (Sngags kyi bdag po). According to Karma Pakshi's autobiography, Ngagki Dakpo arrived in the parched region amid layers of steam and caused a snowstorm.[52]

After Orgyenpa recognized Rangjung Dorjé as Karma Pakshi's reincarnation, the boy was first raised by Orgyenpa in Southern Tibet and later at the Karmapas' seat at Tsurpu (Mtshur phu) Monastery in Central Tibet. As an

49 Karl-Heinz Everding, "The Mongol States and their struggle for dominance over Tibet in the 13th century", in Henk Blezer and Abel Zadoks (eds), *Tibet, Past and Present: Tibetan Studies I*, (Leiden and Boston: Brill, 2002), 112–14.

50 Leonard W.J. van der Kuijp, "Baγši' and Baγši-s in Tibetan historical, biographical and lexicographical texts", *Central Asiatic Journal* 39/2, 1995, 275–302.

51 van der Kuijp, "Baγši' and Baγši-s in Tibetan historical, biographical and lexicographical texts", 275–302. Gamble, *Reincarnation of Tibetan Buddhism*, 105–33. Tenzin Choephak Ringpapontsang, "Conquering the conqueror: reassessing the relationship between Qubilai Khan and 'Phags Pa Lama", (PhD dissertation, Australian National University, 2016), 24. Shen Weirong, "Magic, power, sorcery and evil spirits: the image of Tibetan monks in Chinese literature during the Yuan Dynasty", in Christoph Cüppers (ed.), *The Relationship between Religion and State (Chos srid zung 'brel) in Traditional Tibet* (Lumbini: Lumbini International Research Institute, 2000), 189–227.

52 Karma Pakshi, *The Autobiographical Writings of the Second Karma-pa Karma-pakśi, and Spyi lan ring mo: A Defence of the Bka'-brgyud-pa Teachings Addressed to G'yag-sde Paṇ-chen* (Gangtok: Gonpo Tseten, 1978), 128.

adult, Rangjung Dorjé travelled extensively in Central and Eastern Tibet and later made two journeys to the Mongol-Yuan court towards the end of his life. His autobiographies are replete with accounts of his weather interventions. As a young man, he extinguished a forest fire by commanding rain and later developed a reputation for being able to manipulate the weather at will.[53] His writings demonstrate a deep concern with climate, and he reported at length on the unfolding tragedy of famines he witnessed and the effects of climatic catastrophes on people in various regions. His previously analysed description of the famine of 1284 is particularly telling as it combines a critique of governance with a description of the weather events, including drought and other contributing factors, that the government mismanaged.

Jangchup Gyeltsen was even more concerned with the role played by governance than Rangjung Dorjé. His analysis of food shortages, their causes and ways to ameliorate them highlighted the connection between official bungling and disastrous famines. Unlike Rangjung Dorjé – who was born into a potter's family and had no estates to manage – Jangchup Gyeltsen was a scion of the influential Lang (Rlangs) clan and had a claim to rule the Pakmodru religious and secular estates. Also, unlike Rangjung Dorjé, he is remembered for pragmatic environmental adaptation strategies involving civil engineering rather than magical climate mitigation.

Jangchup Gyeltsen was an ambitious administrator who was concerned with effective governance. After being given authority over the nearly insolvent Pakmodru estates by the Sakya hierarchs, he reversed the fortunes of the areas under his control and restored them to prosperity. He later fell out with his former overlords and outmanoeuvred them, becoming the most powerful hegemon in Central Tibet. After consolidating his position, Jangchup Gyeltsen paid keen attention to the principles and procedures of good governance. One of his distinctive approaches was to analyse how his relatives bungled their jobs and then figure out how to do the opposite. The lists he created also provided him with a handy catalogue of reasons why he, rather than his rivals, should be governing the Pakmodru estates.[54]

Jangchup Gyeltsen contrasted their ineptitude with his political abilities and his skills in governance. He described his relatives' leaving fields fallow and using up barley stores to make beer (*chang*), the most common alcoholic beverage in Tibet. While they ruled, he noted, famine was common in their lands. He was particularly struck by one incident in which he visited a village that was so hungry that its people did not have enough to offer him, their lord, any food.[55] When he took charge, by contrast, he claimed to have set up rotational field cropping and secure grain storage; he also started a willow reforestation programme that would provide wood for housing and fuel.[56]

53 Rang 'byung rdo rje, *Rang 'byung rdo rje'i tshigs bcad ma*, 389. Gtsug lag phreng ba, *Mkhas pa'i dga' ston*, 931.

54 Byang chub rgyal mtshan, *Bka' chems mthong ba don ldan*, 16, 17, 258, 274.

55 Byang chub rgyal mtshan, *Bka' chems mthong ba don ldan*, 46–4.

56 Byang chub rgyal mtshan, *Bka' chems mthong ba don ldan*, 243. Ruth Gamble and Yangmotso, "Servant-like lords and heavenly kings: Jangchup Gyeltsen and the Fifth Dalai Lama on governance and kingship", *Cahiers d'Extrême-Asie* 24, 2015, 145–68.

Reformation and forgetting

Jangchup Gyeltsen's reforms and those of his successors did not fix all Central Tibet's problems. Famines continued throughout the Little Ice Age, and often catastrophic weather events and their effects on food production were too severe to be comprehensively ameliorated through better governance or by the continued interventions of tantrikas. The biography of Tangtong Gyelpo Tsondru Sangpo (Thang stong rgyal po brtson 'grus bzang po, 1361–1485), an itinerant civil engineer and tantric adept who is famous for building 58 suspension bridges and 118 ferry crossings around Tibet, still notes incidences of famine in the region. In 1437, after he was forced to abandon pilgrimage plans because of famine, he visited the Jowo Temple (Jo khang) in Lhasa, where he composed *A Prayer to Dispel Famine*. This prayer is still used regularly today. Invoking the principle that good governance can prevent droughts or other sorts of natural disasters from becoming famines, it reads in part:

> Pacify the harm caused by the four elements;
> Stop inauspicious and untimely wind, fire, rain, and water.
> Let the grains, plants, harvests, and the like
> Mature fully, as if it is a golden age …
> May sicknesses, weapons, and famines be thoroughly pacified.[57]

Extreme weather events continued into the 1500s, deep into the Little Ice Age. As Per Sørensen noted in his study of inundations in Lhasa, there were "hydrological extremes" as the weather alternated between drought and excessive rain in 1543, 1546 and 1551.[58] In 1546 the drought was so intense that "the fields, grass, leaves and the like all dried out. Lakes and ponds did the same, suffocating all the fish in the water as they did."[59]

Gradually, however, successive Tibetan governments worked out ways to adapt to the new climatic norms of the Little Ice Age, and these droughts and floods did not turn into famines. When the Ganden Podrang (Dga' ldan pho brang) came to power a century later in 1642, its officials put in place a climate response regime that worked on both the supernatural and pragmatic levels to famine-proof Lhasa and surrounding areas. The regime engaged in an annual series of propitiatory and supplicative rituals to prevent flood and drought near Lhasa's three main lakes. It kept the region's wells in working order and ensured that there were stores of grains for periods of food shortages. The fifth Dalai Lama, Ngawang Losang Gyatso (Ngag dbang blo bzang rgya mtsho, 1617–82), wrote on the subject of good governance, invoking the example of Jangchup Gyeltsen's measures to protect his people from inclement weather and food shortages.[60] Like the Pakmodru rulers, the Ganden Podrang established a system of grain storage and devoted considerable resources to

57 Per K. Sørensen, Guntrum Hazod and Tsering Gyalpo, *Rulers on the Celestial Plain* (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 2007), 502.
58 Sørensen, "Lhasa Diluvium. Sacred environment at stake", 96.
59 Sørensen, "Lhasa Diluvium. Sacred environment at stake", 116 note 68.
60 Gamble and Yangmotso, "Servant-like lords and heavenly kings", 150–3.

water management and flood control. These included a combination of civil engineering projects and magic, both of which worked in tandem. In 1674, government officials used springs that had been created by their engineers to stave off drought, an example of successful water management.[61]

This combination of ritual and pragmatism continued throughout the Ganden Podrang's reign. During this period, which coincided with the second half of the Little Ice Age, the government set up a yearly regime of rituals to maintain cosmic order. As Charles Bell (1890–1945) noted during his stay in Lhasa in the early twentieth century, these ceremonies would be enacted if the monsoon rains had not arrived by the fourth month, May–June. The monasteries would begin a series of prayers and rituals near Lhasa's springs and its sacred willow trees. If there was still no rain, the rites would be checked and reperformed. If no rain fell after that, all the monasteries would be asked to conduct liturgies for the *klu*.[62] These rituals were, furthermore, coupled with civil works projects designed to control water, such as levees, reservoirs and wetlands.[63]

If all of these measures failed to produce rain, the inhabitants would have to rely on their stores from previous years. Bell reported that "there is a large reserve of food grains in Tibet, which is safe from the danger of serious famine, except when there is a marked succession of crop failures. In times of scarcity, the tenants borrow grain from their landlords."[64] There was only danger of famines if the droughts persisted for an extended period.

At the same time, catastrophic famines occurred in the lowlands of China in 1648, 1661, 1701, 1703, 1722, 1724, 1726, 1744, 1800, 1803, 1805, 1810, 1876 and 1877,[65] and there were more than ten major famines in British India.[66] Eastern Tibet also experienced famine.[67] All of these events occurred due to a combination of climatic and governance issues, and the majority of the casualties could be traced to inept administration. The occurrence of large famines on the plains, while Tibet remained relatively free of such severe food shortages despite its disadvantages in terms of agriculturally productive land and its harsh environment, was probably part of the reason why Wangchuk Deden Shakabpa (Dbang phyug bde ldan Zhwa sgab pa, 1908–1989, the chief accountant (*rtsi dpon*) of the Tibetan government before 1959) made blanket assertions in his history of Tibet that the region had never experienced famines: "in this cold climate, the great harm of famines does not occur, and also, extensive epidemics and infectious diseases do not occur."[68]

61 Ngag dbang blo bzang rgya mtsho, *Bod kyi deb ther dpyid kyi rgyal mo glu dbyangs* (Beijing: Mi rigs dpe skrun khang, 1980), 128–41.
62 Bell, *The People of Tibet*, 36–9.
63 Sørensen, "Lhasa Diluvium. Sacred environment at stake", 85–135. Emily T. Yeh, "From wasteland to wetland? Nature and nation in China's Tibet", *Environmental History* 14/1, 2009, 103–37.
64 Bell, *The People of Tibet*, 224.
65 John J. Hidore, "Climate change and world food production", in William A. Dando (ed.), *Food and Famine in the 21st Century* (Santa Barbara: ABC-CLIO, 2012), 84.
66 Mike Davis, *Late Victorian Holocausts*, 311–41.
67 Yudru Tsomu, *The Rise of Gönpo Namgyel in Kham: The Blind Warrior of Nyarong* (New York: Lexington Books, 2014), 39, 109.
68 Tsepon W.D. Shakabpa, *One Hundred Thousand Moons: An Advanced Political History of Tibet* (trans. Derek Maher) (Leiden: E.J. Brill, 2010), 21–2.

Conclusion

Shakabpa's statement that famine did not occur in Tibet depended on a narrow reading of history; it reflected only the past few centuries and the river valleys of the Central Plateau. As we have outlined here, at other times, particularly in the transition from the Medieval Warm Period to the Little Ice Age, Tibet suffered devastating famines. What is more, these famines occurred not only because the climate changed, but because Tibet's local and Mongol governors had been inattentive and incompetent.

Given that the Tibetan Plateau's climate has been so geographically and temporally varied, we have focused on one region, the agricultural river valleys of Central Tibet, during one period, the late thirteenth to fifteenth centuries. To better understand the role this varied climate has played in Tibet's history and how it has interacted with the various polities that have existed on the Plateau, much more research needs to be conducted about different sites and different periods.