Hazard-human interaction in the Gobi Desert

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The Gobi Desert has been an iconic example of remoteness. Marco Polo wrote about the 'desert of death' in 1298, and it was not named until the French cartographer Lisle labelled the 'Gobee' in 1706. The area beyond the Great Wall was known as a '*terra nullius*', devoid of identifying features and harbouring 'barbarians to the north' (Figure 1). In the 19th century a British explorer labelled it the 'wretched desert that buried cities in sand'.[1]

The Gobi is unusual in that it is a cold desert (with temperatures as low as –40°C), in which extreme winters and drought create a harsh environment for people following a traditional agro-pastoral way of life. The dryland is home to more than 30 million residents and the world's fastest growing economy, Mongolia. But it is also China's main domestic energy source. The desert has therefore emerged as a dynamic space in a strategic geopolitical region. Today, climate change, socio-economic transition, rapid development and government policy are all acting to reconfigure the societies, the environment and our conceptions of the Gobi.

Climate hazards

In the marginal dryland, the predominant livelihoods – farming and herding – face an unforgiving natural environment. Extreme winters, drought, storms and dust challenge the lives of people dependent on the land (Figures 2, 3). In severe winters (*dzuds*), animals are unable to forage for food because of snow depth, ice cover or cold temperatures – factors that result in high livestock mortality. In the past, *dzuds* were considered effective in removing weak animals from the breeding stock; in today's money-driven economy, *dzud* spells disaster. Most of the region's precipitation occurs in the summer, and therefore drought is particularly damaging to pasture vegetation and crops. Drought reduces harvests and restricts animal weight-gain, increasing the risk of winter starvation. Both *dzud* and drought cause or contribute to a loss of income, livelihood collapse, out-migration, and the social disruption that results.

In 2010, Mongolia experienced an intense *dzud* that was the country's 'worst ever' disaster: approximately 25 per cent of the national herd was lost. In 2011, northern China's extreme drought was the most severe since the Communist Party came to power in 1949. These critical events framed the research I undertook on 'Human-Hazard Interaction in the Gobi Desert, Asia' during my British Academy Postdoctoral Fellowship. The recent disasters highlight the great exposure to, and impacts of, climate hazards in the two countries. In an era of modernisation and settlement, these hazards dominate the physical environment and have significant implications for society and governance.

Recent human change

Traditionally home to Mongolian pastoralists, the landscape has recently been reshaped. The desert has marginal productivity, yet ethnic Han farmers – originally encouraged to move into the area by Mao – have converted parts of the Chinese Gobi to cropland, drawing on groundwater sources and irrigation from the Yellow River. Over time, the Chinese experience has shifted from expanding cultivation to land degradation, desertification and vulnerability to environmental conditions.

In Mongolia, the transition from Soviet communism to democratic capitalism has opened the country to the world, and shifted responsibility from the state to households and communities. Weak governance has enabled mobile pastoralism to continue, whilst limiting the help that people may receive from authorities, and increasing their exposure to endemic natural hazards.

Across the Gobi, mining redirects policy, economics and engagement with the environment. In Mongolia, the world's largest new copper and gold mine is

1. F. Forsyth, 'On the Buried Cities in Shifting Sands of the Great Desert of Gobi', *Proceedings of the Royal Geographical Society and Monthly Record of Geography, New Monthly Series*, 47 (1877), 1–18.

Figure 1
The Seldon Map (*c.* 1620, Bodleian Library) depicts the Gobi Desert as a blank space north of the Great Wall of China. Writing identifies 'barbarians to the north' – exemplifying the external, 'foreign' concept of the Gobi.

transforming the concept of the desert and life in it, as residents ask how mining will affect pastoralism and their ability to maintain identity and culture. In China, the expanding extraction of coal, iron ore and rare earth elements has significant implications for local residents and the environment. Companies, whether state-owned enterprises in China or international corporations in Mongolia, are generating revenue and wealth that overwhelm herding and farming communities. Customary livelihoods have little power or ability to shape development, protect the grassland or benefit from large enterprises that provide new revenue sources. In fact, mining depletes water resources, degrades the landscape and minimises other livelihoods. In Mongolia, resource extraction has led to national debate and protest; in China, such engagement is not possible.

Different national responses to climate hazard

The Gobi has become a transboundary space, with hazard parameters and risks defined by country rather than the physical environment. Climate vulnerability depends on national policy, land-use practices and socio-economic factors, which differ between China and Mongolia. Community resilience – the ability to cope with and adapt to extreme events – becomes socially constructed rather than environmentally determined. The existence of two systems in one landscape allows one to question whether disasters are physical or human-driven events, and to identify the significant role of policy and governance in the desert. With states that are opposed in beliefs, perceptions of history, political systems and engagement with nature, climate extremes make clear the role of humans in determining hazard exposure and landscape sustainability.

Climate hazards highlight both the vulnerability and the resilience of households and communities to extreme events. There are two main processes in managing and reducing exposure to hazards. The first is the adoption of effective coping strategies, such as adapting livelihood practices to environmental conditions. The second is to improve response capability by providing support and infrastructure to reduce the impact of events. Both processes will reflect the history of a region and its society, as well as the government's interaction with and interest in rural areas. The first acknowledges and encompasses natural conditions and limitations; the second depends on human action in a created system.

Mongolia exemplifies adaptation to the environment.

Figure 2
Snow-covered winter camp and animal corral in Mongolia.

Figure 3
Dust storm, farming region, Gansu, China.

Herders' traditional practices mitigate natural forces through migration, animal selection, herd numbers, camp location, reserve pastures and livestock offtake. However, when disaster occurs, the state has little response capability, exacerbating a process that in 2010 triggered a downward spiral of ever-greater animal mortality and livelihood loss.

In China, strong state control limits residents' ability to maintain their customary coping strategies or adjust cropping and herding patterns to physical conditions. Indeed, policy can create new risk by supporting measures that have negative consequences. For example, farmers are encouraged to erect plastic greenhouses that are shredded by the wind, and fencing and restricted access to pasture contribute to high levels of land degradation. However, infrastructure and support enable the state to respond with emergency aid, fodder for livestock, new irrigation or wells for farmers, and loans and subsidies that can reduce the impact of disaster.

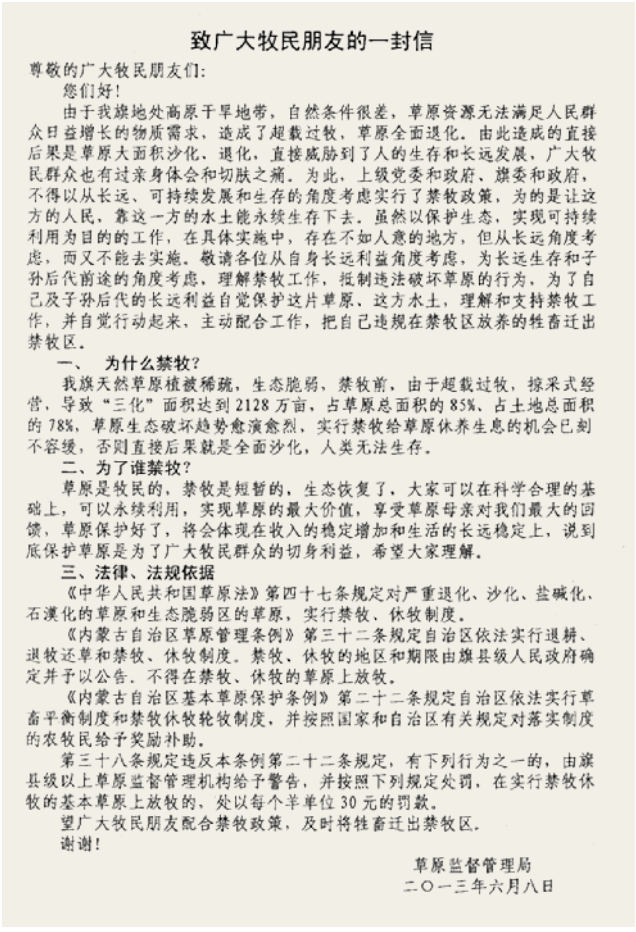
Thus, in the Gobi's shared environment, Mongolia lessens vulnerability before a hazard occurs, but lacks post-event resilience. China's manipulated environment displaces risk from natural factors to anthropogenic forces; this creates new forms of vulnerability at the local scale, yet when disaster strikes the system is better able to cope.

Contrasting hazard environments

In the transborder region, policy and governance have redefined the environment. Chinese programmes of 'Ecological Resettlement' remove herders from the rangeland, the 'Grain to Green' policy aims to turn farmland and pasture back to grassland, and the 'Three North Shelterbelts' project attempts to plant 56 billion trees by 2050 to combat desertification. A standard government edict was handed out in June 2013 (Figure 4) by the Grassland Surveillance and Supervision Administration, reminding herders to remove livestock from open pasture under penalty of fines and confiscation, whilst also stating that herders could return in 10 years' time once the ecosystem has recovered. In practice, such pastures are often converted to agricultural use or mining operations. Settlement is encouraged positively through loans, compensation, subsidised basic housing and barns, or negatively through taxes, fencing, swipe-card control of water access, confiscation, fines or coercion. Such programmes do not consider climate, exposure or ability to maintain livelihoods in new conditions. Settlement makes maintaining traditional livelihoods difficult, and encourages an exodus of young people into towns or out-migration to jobs elsewhere. An ethnic component finds minorities, as former pastoralists, the frequent target of resettlement.

Mongolia presents a stark contrast to China, being characterised by weak governance and insignificant policy impact or relevance to rural life. Herd numbers, mobility, migration and settlement are household decisions based on environmental factors, customary practices and, now, economic forces. When a disaster like the 2010 *dzud* occurs, limited preparation and response exacerbates hardship and increases animal mortality. Lack of government engagement stems from limited funds, a vast territory and a low population – factors that make sufficient infrastructure for disaster response financially unfeasible. The government looks to the international community (the UN and donor countries) for disaster aid, yet help is difficult to provide in the harsh conditions and remote locations. Limited preparation and a lack of outside relief leave pastoralists responsible for hazard mitigation and community/livelihood well-being.

The outcome is that there are two distinct hazard environments in the arid landscape. One is environmentally based and functions on customary practices. The other is a constructed region focused on reshaping nature to meet definite though not always clearly delineated objectives. Mongolia offers flexibility though limited response; China has reconfigured rural engagement based on infrastructure, development and restricted grassland access. Table 1 identifies some of the notable differences between the two countries and highlights the challenge to reduce hazard impact, encourage local knowledge and mitigation, and provide adequate government support in extreme conditions.



致广大牧民朋友的一封信

尊敬的广大牧民朋友们：

您们好！

由于我旗地处高原干旱地带，自然条件很差，草原资源无法满足人民群众日益增长的物质需求，造成了超载过牧，草原全面退化。由此造成的直接后果是草原大面积沙化、退化，直接威胁到了人的生存和长远发展，广大牧民群众也有过亲身体会和切肤之痛。为此，上级党委和政府、旗委和政府，不得以从长远、可持续发展和生存的角度考虑实行了禁牧政策，为的是让这方的人民，靠这一方的水土能永续生存下去。虽然以保护生态，实现可持续利用为目的的工作，在具体实施中，存在不如人意的地方，但从长远角度考虑，而又不能去实施。敬请各位从自身长远利益角度考虑，为长远生存和子孙后代前途的角度考虑，理解禁牧工作，抵制违法破坏草原的行为，为了自己及子孙后代的长远利益自觉保护这片草原、这方水土，理解和支持禁牧工作，并自觉行动起来，主动配合工作，把自己违规在禁牧区放养的牲畜迁出禁牧区。

一、 为什么禁牧？

我旗天然草原植被稀疏，生态脆弱，禁牧前，由于超载过牧，掠采式经营，导致“三化”面积达到2128万亩，占草原总面积的85%、占土地总面积的78%，草原生态破坏趋势愈演愈烈，实行禁牧给草原休养生息的机会已刻不容缓，否则直接后果就是全面沙化，人类无法生存。

二、为了谁禁牧？

草原是牧民的，禁牧是短暂的，生态恢复了，大家可以在科学合理的基础上，可以永续利用，实现草原的最大价值，享受草原母亲对我们最大的回馈，草原保护好了，将会体现在牧入的稳定增加和生活的长远稳定上，说到底保护草原是为了广大牧民群众的切身利益，希望大家理解。

三、法律、法规依据

《中华人民共和国草原法》第四十七条规定对严重退化、沙化、盐碱化、石漠化的草原和生态脆弱区的草原，实行禁牧、休牧制度。

《内蒙古自治区草原管理条例》第三十二条规定自治区依法实行退耕、退牧还草和禁牧、休牧制度。禁牧、休牧的地区和期限由旗县级人民政府确定并予以公告，不得在禁牧、休牧的草原上放牧。

《内蒙古自治区基本草原保护条例》第二十二条规定自治区依法实行草畜平衡制度和禁牧休牧轮牧制度，并按照国家和自治区有关规定对落实制度的农牧民给予奖励补助。

第三十八条规定违反本条例第二十二条规定，有下列行为之一的，由旗县级以上草原监督管理机构给予警告，并按照下列规定处罚，在实行禁牧休牧的基本草原上放牧的，处以每个羊单位30元的罚款。

望广大牧民朋友配合禁牧政策，及时将牲畜迁出禁牧区。

谢谢！

草原监督管理局

二〇一三年六月八日

Figure 4
Grassland eviction notice, Inner Mongolia Autonomous Region, June, 2013. The notice states that the region is becoming a desert and that 'we have all suffered'. Move your herds from the restricted area; do this or you will be fined 30 Yuan (£3) per animal. 'We hope our herder friends will co-operate and move animals out of the prohibited area'. It states that 8 per cent of the province and 75 per cent of the local district (unnamed) is degraded (141,866 km2 in total).

Table 1
Physical and social factors that affect hazard dynamics in the Gobi region of China and Mongolia with regard to climate disaster.

	CHINA	MONGOLIA
HAZARD IMPACT – OVERALL	LOW	HIGH
GOVERNMENT	STRONG	WEAK
ENVIRONMENTAL DEGRADATION	MODERATE to HIGH	LOW
MOBILE PASTORALISM	NO	HIGH
AGRICULTURE	YES	NO
DZUD/WINTER IMPACT	LOW	HIGH
GOVERNMENT POLICY	HIGH	LOW
INFRASTRUCTURE	GOOD	POOR
ROLE OF INTERNATIONAL AGENCIES and NGOs	NO	YES

Local impacts, global impacts

Livelihood desires and pressures, climate hazards, marginal resources (water and land) and mining are transforming the Gobi countryside. The undercurrent is the theme of 'closing down the grasslands' of the region. In China, a process of settlement, fencing and restriction speaks to an intentional removal of residents from remote areas into villages and towns. In Mongolia, the challenges of coping with extreme climate events, limited support and a modernising society are changing the role, but not the relevance, of herding livelihoods. New choices have prompted a drift away from the countryside and question the future viability of pastoralism.

Research on the Gobi may seem removed from greater global trends. Yet an understanding of processes at a regional level enabled me to comprehend links between events in China and political change in the Middle East.

A drought in the agricultural region bordering the Gobi in winter 2011 threatened China's winter wheat harvest, which was an issue of great concern to the government since food supply remains a sensitive issue for the Communist Party as a proxy for social stability. China's purchase of wheat on the international commodity market was followed by a rise in global wheat prices that coincided with a shortage in the world's largest wheat importer – Egypt. This was a pivotal event, as bread prices skyrocketed in Egypt and contributed to social unrest.

The political result is well-known; the academic path took much longer. In April 2011 my short piece on how regional drought could have global implications was published in *Nature*.[2] By March 2012 my article 'Chinese drought, bread and the Arab Spring' had been peer-reviewed and published.[3] A year later the idea of how a climate hazard in China influenced the civil unrest in the Middle East was the subject of a *New York Times* opinion article. This reflects what can be a tortuous process of bringing academic research to a public audience.

The Gobi Desert embodies the risks faced by marginal environments in their exposure to climate events. Today, increased warming and volatile precipitation patterns affect agro-pastoral livelihoods that are environmentally-dependent; changes in development, desires and perceptions suggest that inhabitants face an uncertain future. Research shows that the ability to protect against hazards exists as a combination of integrating natural resilience with adequate preparation and response by residents and governments. Balancing climate hazard impact on communities, policy decisions and mining will challenge and reshape the Gobi for years to come.[4]

2. T. Sternberg, 'Regional drought has a global impact', *Nature*, 472 (2011), 169.
3. T. Sternberg, 'Chinese drought, bread and the Arab Spring', *Applied Geography*, 34 (2012), 519-24.
4. See also Troy Sternberg, 'Tradition and Transition in the Mongolian Pastoral Environment', in Troy Sternberg and Dawn Chatty (eds), *Modern Pastoralism and Conservation: Old Problems, New Challenges* (Cambridge: The White Horse Press, 2013), pp. 141-159.