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ORIGINAL PAPER

Complexity of Mongolian stakeholders' dzud preparation and response

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Abstract This paper explores the ways that Mongolian pastoral-nomadic herders and supporting aid organizations anticipate, interpret, and respond to dzud, a form of winter storm that prevents livestock grazing and often results in large-scale herd deaths. Analysis is drawn from organizational reports, government speeches, and mass media that have been collected to give a complex, multi-faceted understanding of the collection, distribution, and interpretation of data pertaining to the social and scientific construction of this natural hazard. Using critical discourse analysis, this study asks how herder perspectives and needs have been incorporated into reports and action plans of international development organizations. The collected documents provide insight into the ways that knowledge is constructed, disseminated and valued among policy makers, development planners and herders. Additionally, the findings indicate disagreement between stakeholders as to when to declare a national emergency, and how to best help herders respond to the increasing frequency of dzud. While some organizations rely on traditional recovery mechanisms, others have turned to technological solutions, all aiming to assist herders in adequately responding to and recovering from one dzud before another occurs. From the analysis of policy proposals, this study aims to understand and inform the ways that international development programs, government officials, and herders work to preserve pasturelands and herding lifestyles threatened by dzud.

Keywords Mongolia · Nomadic-pastoralist · Dzud · Climate change · Emergency response

1 Introduction

Mongolia has a long history of pastoral-nomadic herding, or the seasonal migration of human communities alongside their herds of sheep, goats, cattle, camels, horses, and/or yaks. The livestock sector makes up 16% of Mongolia's GDP, employs 336,000 herders,

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and support one million people in a nation of 3 million (Batima et al. 2006; UNDP and NEMA 2010; UNData 2017). While livestock contribute to a small percentage of Mongolia's GDP, for herders, livestock can constitute approximately 63% of a household's assets (IFAD 2014). When weather is predictable, herders are able to follow their traditional lifestyles, leading mostly self-sufficient lives. This lifestyle has, however, always been at risk of natural hazards such as the *dzud*, "severe winter weather storms in which extreme cold, heavy snow and strong winds prevent cattle and other animals from feeding over long periods of time" (Batchullun 2005). Climate change has led to increasingly unpredictable weather and more violent dzud, resulting in new forms of vulnerability among herding communities (Batima et al. 2006; Girvetz et al. 2012). Climatic changes are occurring alongside other radical changes in tradition and land access such as privatization and mining, all of which call into question the mobility and sustainability of Mongolia's herding communities (Upton 2009). The resulting new forms of vulnerability, which affect both human and animal populations, present a special case whereby Mongolian policy makers and international aid organizations must contend with a unique set of social and land use traditions which are not found in other Asian nations (Batjargal and Enkhjargal 2013; Kelman et al. 2016).

Mongolia's transition to democracy and the collapse of the USSR has produced an additional set of difficulties for the national response to climatic events. When Mongolia was aligned with the USSR, it was able to access a set of international aid programs, veterinarians, and emergency response services (Begzsuren et al. 2004; Government of Mongolia 2001). Since the democratic transition, Mongolia has struggled to put together its own system of natural disaster response and management. The need for such services was made apparent as citizens left urban communities to reclaim traditions of pastoral-nomadic herding. This migration to the countryside allowed families to regain their cultural heritage as well as provide for themselves in a time of economic and social transition. However, it also produced problems as new herders were not yet educated in disaster preparedness and response (Batima et al. 2006; Janzen 2005). Because they lacked training and experience necessary to prepare herds for winter storms, new herders were severely affected by the 1991–2001 dzud which killed millions of animals in a short period of time, resulting in both immediate food and economic losses as well as long-term ecological dangers such as rotting animal carcasses which are breeding grounds for diseases and threaten to pollute ground water supplies (ADB 2010; BBC 2000; UNDP and NEMA 2010). The economic impact of a dzud is so large that the International Fund for Agricultural Development reports that dzud offset any economic gains made by mining projects (IFAD 2014). This effect is illustrated by Mongolia's poverty rate, which declined to below 30% during the years 2003 and 2009, years that were not affected by dzud. However, the rate quickly rose to 34% during the 2009–2010 dzud when herders lost both animals and pastures (IFAD 2014). When Mongolian herders are asked to rank the largest problems affecting their communities, they commonly respond by ranking dzud at or near the top of their lists (IFAD 2014; Lise et al. 2006; Saramento and Reading 2016; Sternberg 2014; Swift 2007).

Dzud are not new; they have been recorded in historic documents from across the Eurasian Steppe, including parts of the former USSR, Mongolia, and China (Batchullun 2005; Conte 2015; Endicott 2012). What is new, however, is that the frequency and severity of dzud changes commonly attributed to climate change and El Niño (Bat 2016; Batima et al. 2006; Girvets et al. 2012). This paper is designed to investigate Mongolia's preparation for and response to the dzud. From my survey of organizational and academic literature, I have found a large collection of studies and reports regarding dzud, but little agreement about the best ways to mitigate herders' risk and loss. This paper examines the

complexity of these multiple, and sometimes mutually exclusive recommendations, by national and international policy advisors and analysts. In what follows, I introduce my sample selection and study methods. Then I explore the history of Mongolian dzud and the definitions of dzud utilized by the Mongolian government, aid organizations, and international media. Next, I attend to the predictions and evidence that dzud are increasingly common due to climate change. Finally, I analyze the ways that organizations have proposed better preparation forecasting, response, and relief programs to help herders overcome the effects of dzud.

2 Method and design

This study analyzes dzud reports from 1999 to 2015. These reports were collected from international aid and development organizations (such as the ADRA, ADF, FAO, Mercy Corps, Red Cross, SDC, UNFPA, UNDP, UNICEF, WHO, World Vision, and World Bank), the Government of Mongolia, and international mass media such as the New York Times which featured interviews with development and/or government officials.

Analysis of these reports is guided by three clusters of questions:

1. How are dzud defined? Are dzud defined differently by different organizations, and if so, what are the policy-making implications of those differing definitions?
2. How do aid organizations prepare for and respond to dzud? In what ways to their preparations and recommendations differ, overlap, or contradict?
3. How do reports indicate consultation and cooperation with local herders? Are herders welcomed as equal-part planners, decision-makers, and/or recipients of emergency aid?

2.1 Document collection

A total of 50 English language reports regarding dzud that had occurred between 1999 and 2015 were collected from the Web pages of development organizations and Mongolian government offices. While there are certainly more internal documents regarding dzud, this study was designed to understand the public facing reporting and discussion of dzud, and for that reason, only publicly accessible documents were consulted. Additionally, while there are many more Mongolian language documents, I have chosen to focus on those designed to reach an international audience and have therefore only analyzed English language documents. I have, however, consulted Mongolian language documents for information on the 2015–2016 dzud which was ongoing as I wrote this paper. Scientific reports have also been consulted for background regarding the causes and classification of dzud as well as proposed policies and preventative measures for future dzud.

2.2 Document analysis

The collected documents have been analyzed using critical discourse analysis (CDA), an interdisciplinary, "problem-oriented" research methodology. In this paper, the problems studied include increased frequency of the dzud, government changes in Mongolia, and herders' need for emergency services. CDA is a methodology "concern[ed] with power as a central condition in social life…not only the notion of struggles for power and control,

but also the intertextuality and recontextualization of competing discourses in various public spaces and genres" (Wodak 2006, p. 187). It is my argument that these networks and hierarchies of power are especially important in Mongolia after a dzud, where at-risk and impoverished herders reconcile not only their immediate needs, but a complex network of international and national development policies, presumptions, and development paradigms.

CDA can be conducted on micro- (individual actors within a organization), meso- (locals and organization interaction), and macro- (social institutional) levels. For the case of this study, the micro-level is where herders engage with organizations, and the macro-level is where organizations produce institutional reports (with and sometimes without the engagement of herders). I have focused on a macro-level analysis, asking how the collected documents contextualize the sociopolitical contexts of Mongolian herding communities, how those communities are presented to audiences in technical sphere deliberation, such as international development and policy making, and how dzud response mechanisms are designed to include herding communities and knowledge. To be true to the method, I have not brought my own ethnographic interviews with herders to this study, nor have I included my own interviews with aid organizations or at risk communities. The resulting study contributes to the body of literature on vulnerability and resilience within development literature (Kelman et al. 2016). The analysis is guided by Swift's (2007) argument that storms such as the dzud are by nature interdisciplinary and can only be understood through interdisciplinary study.

This study aims to understand—at a macro-level—how national and international agencies discuss and report on dzud. The following analysis interweaves the collected body of literature to understand the ways that dzud are defined, declared, responded to, and reflected upon when preparing for future storms. Then, the discussion section asks how reading these reports among themselves is enlightening as it highlights the absences of herder participation in planning and response and prompts useful questions for both future analysis and development work.

3 Defining dzud

Dzud are a type of natural disaster that has effected Mongolia throughout history. Historic documents indicate that 15 dzud occurred in the eighteenth century, 31 in the nineteenth century, and 43 in the twentieth century (Batchullun 2005). Then, between 1945 and 1997, fifteen dzud were recorded (Batima 2006; Begzsuren et al. 2004). Since 1997, dzud have occurred in 1999–2000, 2000–2001, 2001–2002, 2009–2010, and 2015–2016. While some scholars estimate that dzud will occur every 8–12 years (Fernandez-Gimenez 2012), others estimated that two or three dzud will occur every decade (Begzsuren et al. 2004) or even once every two years (Marin 2010). Dzud occur in the winter and as such are sometimes recorded by the year in which they began, and in other cases by the range of years in which they occurred. Throughout this text, I have utilized the range of years, such as 2009–2010.

All dzud result in the loss of herds, having the largest effect on ungulates such as yak, cattle, horses, and camels and a smaller, but still seriously effect sheep and goats (Lkhagvadorj et al. 2013). While livestock often die as a direct result of dzud, human populations seldom experience starvation and famine during a dzud, though famine and starvation have occurred as symptoms of dzud. Mongolia has only faced three famines between 1940 and 2015 (Bat 2016) but has experienced 13 dzud in that period of time.

The 1944–1945 dzud resulted in the loss of 8.76 million animals, or 32.2% of the national herd (Batima 2006). Then, the 1967–1968 dzud resulted in the loss of 2.6 million animals, or 11.9% of the national herd. Historic records indicate that these dzud were among the most severe ever experienced in Mongolia. However, with the assistance of the USSR, Mongolian herders were able to access emergency services and supplies, resulting in minimal loss of livestock and pastureland.

Mongolia began transitioning to democracy in 1989, a process which included the break up of state-run livestock cooperatives known as *negdels*, the privatization of herds and a transition in the Mongolian workforce as citizens left urban jobs to sustain themselves and their families as pastoralists. This change was dramatic, in 1989 less than 18% of the workforce was herders, but by 1998 the percentage grew to 50% (Sneath 2003, p. 442). These new and traditional herders faced a plethora of problems, including collapse of rural public services such as winter shelters, emergency fodder, and veterinary services (Potkanski 1993; Ziegler et al. 2011). The effect of these changes was seen during the 1999–2000 and 2009–2010 dzud when herders were unable to access previously available emergency services and supplies (Government of Mongolia 2001; Sneath 2012). One quarter of the national herd was lost during the 1999–2000. The 1999–2000 dzud, the worst in Mongolia's recorded history, held a record until the 2009 dzud (Girvetz et al. 2012). Speaking with the BBC during the 2000 dzud, PM Amarjargal estimated that damages reached 1 billion USD (BBC 2000).

Since independence, the Mongolian government's dzud relief projects have been dependent on monetary assistance and goods donated from organizations such as the International Red Cross. The distribution of this aid has at times been slow and poorly organized. These delays have caused problems as Mongolia struggled to recover from the 1999–2000 dzud before the 2000–2001 and 2001–2002 dzuds hit, affecting an estimated 70% of the country's pasturelands and leading to the loss of 12 million animals. More than 12,000 herding families lost their entire herds during this time, and many others maintained so few animals that they were also living in poverty. Reports of the 1999–2002 dzuds indicate the remarkable stresses which herders faced, resulting in 40% decreases in Mongolia's gross agricultural output, and a 38% decrease in GDP (Mongolian Statistical Yearbook 2003).

Dzud struck Mongolia again in 2009–2010 resulting in the loss of between 8.4 and 10 million livestock, or an estimated 20% to 22% of the national herd (Girvetz et al. 2012; Sayed 2011; UNDP and NEMA 2010). Reports that focus only on effected areas indicate losses ranging from 34% (Baas et al. 2012) to 67% of regional herds (IOM 2010). Many reports indicate that the 2009–2010 dzud set a new record as the most severe in Mongolia's recorded history. Beyond the loss of animals, herders suffering from the 2009–2012 dzud also took on a large amount of debt or found themselves unable to repay preexisting debts. Interviews with herders illustrate the magnitude of these losses. For example, the New York Times reported "Mr. Lkhagvasuren crammed two dozen of the weakest goats and sheep into his yurt. The unlucky ones, more than 1000 animals, froze to death in a great heap outside his front door. 'I tried everything but could not fight against nature,' he said tearfully in a recent interview, the stench of rotting flesh overpowering despite a devilish wind. 'I am broken and lost.'" (Jacobs 2010).

During better climatic conditions, a herder can sell off livestock to raise capital or pay off debts. However, once a dzud has begun, roads become impassable, and herders are unable to reach markets. For example, during the 2010 dzud, Red Cross workers reported that the roads were blocked by 50 cm of snow and in some areas the snow reached 100 cm (Red Cross 2010b). Additionally, because a herd is commonly used for loan collateral,

herders who have lost most or all of their herd experience difficulty qualifying for the loans which would allow them to rebuild their herds (IOM 2010).

The most recent dzud analyzed in this study is the 2015–2016 dzud that effected an estimated 225,788 herders (Khural 2016; UNDP 2016) across 221 of Mongolia's 331 soums (districts) who lost approximately 904,100 livestock (Amarsaikhan 2016; Batzaya 2016). Early responses included dispersing food and nutritional supplements for women and children (UNFPA 2016) and the distribution of aid to herders via pastoral user groups (SDC Green Gold 2016). The cost of recovery was estimated at 14.27 million USD, yet only 6.36 million was allocated or donated to the cause (UNDP 2016). Even once temperatures began to rise, Mongolians continued to face risks from the dzud because snow rapidly melted and flooded settled areas (Uyanga 2016).

While many of the reports in this study assess the effect of dzud in a specific year, taking a long-term view of dzud since 1997 indicates significant impact on human communities and herds. A single dzud might not have a significant impact on food security or nutrition. However, a series of dzud could have disastrous effects on a communities' food supplies, resulting in chronic undernourishment (Ziegler et al. 2011) and cause families to enter the family into a cycle of poverty whereby the loss of a herd forces the family to buy food at market, costing money which cannot be earned back because the family no longer has a herd (Batima et al. 2006).

Dzud are covariate risks, which affect all herders in area and sometimes all herders in a providence. This means that emergency response systems need to be prepared to respond to disaster on a catastrophic scale. Emergency workers are often tasked with responding to dzud, while they themselves are at risk of losing their own herds and face treacherous travel conditions between field sites (Sayed 2011). Rural roads can become difficult to cross during dzud, and if possible, herds are moved to better pastures before a storm occurs. As a result of poor infrastructure and the migration of their neighbors, herders who remain in their winter pastures can experience severe isolation during dzud. Interviewing herders during the 2015–2016 dzud, Ikegami (2016) reports speaking with a herding family that had not seen anyone outside of their family in five months.

3.1 Defining and declaring dzud

The preparation for and response to a dzud requires accurate weather forecasting as well as an understanding of Mongolia's changing climate. Predicting future dzuds is made difficult as scholars and researchers disagree on the early warning signs and mitigating factors. For example, some studies indicate that dzud are caused by a summer drought that is followed by a harsh winter with a good deal of snow or ice (Girvetz et al. 2012; UNDP and NEMA 2010; UNDP 2016; Thrift and Byambabaatar 2015). Other studies indicate that a dzud can occur during a harsh winter, but need not be preceded by a spring drought. However, a drought can increase the intensity and impact of a dzud as herders are in poor health before the winter even begins (Begzsuren et al. 2004; Sternberg et al. 2009; UNDP and NEMA 2010). For example, a dzud is preceded by a summer drought that prohibited the necessary growth of grasses on which herds graze and fatten for the winter (Batima et al. 2006). If the livestock are not properly fattened, they will be at risk of starvation during a dzud, (UNDP and NEMA 2010). Those that survive the winter will have fewer live births and produce more offspring with birth defects in the spring (Fernandez-Gimenez 2012) and may not survive through a second winter (Tachiiri et al. 2008). According to Begzsuren et al. (2004), 4.8% more livestock are lost in years in which both drought and dzud occur than in years where there is only a dzud.

Scholars and government agencies also differ in their opinions of when to declare a dzud, and when to declare that a dzud is a national emergency. Most reports analyzed for this study indicate that a dzud is occurring when temperatures below −46° centigrade continue over a period of days or for a month (Batima 2006). This extreme cold results in exceptional livestock losses due to hunger, fatigue and famine throughout the herd (Addison et al. 2013; Batima 2006). Because there are no clear criteria for defining dzud and declaring a national emergency, the Government of Mongolia has at times been slow in declaring that dzud is a national emergency. This has tied up funding which international aid and development organizations can only spend on emergency situations. But what of dzud which are not preceded by drought? The literature does not indicate an agreement on if and when those dzud might also be declared emergencies. Yet, when reviewing historic dzud, it is apparent that even without a spring drought, winter dzud can result in massive loss of livestock.

Additional problems in predicting and declaring a dzud occur because not all dzud are the same. Mongolians use five terms to describe dzud; tsagaan dzud (white—deep snow); khar dzud (black—harsh cold without snow); tumer dzud (iron—impenetrable ice); khuiten dzud (cold—high-speed winds and deep snow); and khavsarcan dzud (combined deep snow and sudden temperature drop) (Batima 2006; Batjargal and Enkhjargal 2013). Mongolia is a large country, and some areas are affected differently and more severely by dzud than others (Middleton et al. 2015). Analyzing the differences between dzud indicates the range of vulnerabilities facing Mongolian herders and the need for specified response protocols. For example, a tsagaan dzud is characterized by deep snow, but a khar dzud is characterized by a lack of any snow (a winter drought) combined with extreme cold and winds (Begzsuren et al. 2004). The presence of snow and its eventual melting radically changes the need for emergency supplies and preparations for spring grazing.

Despite this fine-tuned differentiation, many English language texts classify all dzud under the same term that describes the symptoms, not the causes of dzud. For example, Ziegler et al. define dzud as "a Mongolian word used to define any condition that stops livestock from grazing grass" (Ziegler et al. 2011, 215). Despite the increasing occurrence of dzud, reports have continued to describe the storms as "random" (IFAD 2014) or "unprecedented" (Save the Children 2011). Presenting dzud, as random, unprecedented, or otherwise un-understandable may work to raise funding and support immediately following one storm. But this rhetorical framing does not fully capture contemporary Mongolia where dzuds are occurring on a more frequent basis. This labeling is sufficient when calling for aid, but the classification of a type of dzud could be helpful when applying that aid to specific problems and understanding what response services are needed.

While analysts such as Swift (2007) write that classification of dzud is not nearly as important as the loss of livestock, preventing the loss of livestock may depend on understanding the dzud classification and quickly declaring dzud as an emergency. Additionally, specific classification of dzud would enhance academic and governmental assessment of the ways that dzud are changing due to climate change (UNDP 2000). This type of classification can serve as a persuasive definition, which rhetorical scholars indicate have dramatic implications on the ways that the public receives and responds to information (Zarefsky 2009). These definitions play an important role in encouraging donations, allocating aid, and ensuring that crises are responded to in a timely manner. Such definition will be come more important if, as climate scientists predict, dzud occur with increased frequency.

4 Preparing for and responding to dzud

Climate change will affect the impact and frequency of dzud (Batima et al. 2006; Girvets et al. 2012), and reports are beginning to link the occurrence of dzud and El Niño (Bat 2016). In 2006 it was estimated that over 80% of Mongolia's land was at risk of climate extremes (Batima 2006). In addition to asking for aid to combat specific effects of the dzud, Mongolia's National Climate Committee is working to better understand the dzud and coordinate national responses to climate change (Batjargal and Enkhjargal 2013; Jeggle et al. 2007). The adaptations have included legal changes. For example, line 54.9 of the 2002 Land Law specifically addresses the dzud by requiring that provincial governments work with local governments to determine "reserve rangelands to be used in the events of natural disasters, dzud and droughts, including its boundaries and limits." Other legislation, such as the Disaster Management Law of 2003 and the revised law of 2005 demonstrate Mongolia's development of a legal framework to prepare for and overcome dzud on a national, organizational level.

Mongolian offices respond to these reports, and the need for structural support through the National Alleviation Program (NPAP) and National Emergency Management Agency (NEMA) which has offices in each providence, provides training and information, and coordinates emergency responses (UNDP 2007). Attention to these local offices is apparent in NEMA's list of tasks which must be undertaken by local governments to prepare for a dzud—such as organizing otor, ensuring fodder reserves, and marking water access points (UNDP/NEMA 2010). Additionally, Fernandez-Gimenez et al.'s (2012) report addresses the need for local governments to collaborate with herder-lead initiatives and NGO's. Yet, as Mongolia's emergency response system as well as administration and budgeting, are top-down, none of the collected reports argue for localized control. What these legislative changes and new governmental agencies do, however, is fulfill the need for greater national organization as the frequency of dzud increases and herders are beginning to face year-long vulnerability. In what follows, I begin my analysis by examining the ways that international aid organizations, government offices, and scholars are engaging with the long-term implications and planning for dzud.

While many reports list the work that others have done, in the table below I highlight the activities that the collected documents indicate have been successful, or have been recommended for the future. The collected documents demonstrate an emphasis on general preparation, supported by improved modeling and support systems such as fodder reserves. Organizations also emphasized the need to better coordinate in the advance of a storm and suggested use of communicative technologies to quickly deliver news and forecasts to herders.

Preparation for a dzud	Citations
Advanced modeling	Batima (2006), Bolor-Erdne et al. (2008), Fernandez-Gimenez et al. (2011), Marin (2010)
General preparation	Batjargal and Enkhjargal (2013), Dorj et al. (2013), Fernandez-Gimenez (2012), Goulden et al. (2016), IFAD (2014), Jacobs (2010), Swift (2007) (For FAO), Red Cross (2010a, b), Thrift and Byambabaatar (2015), UNDP (2011), UNICEF (2010)
Fodder	Fernandez-Gimenez et al., Fernandez-Gimenez et al. (2012)
Civil and legal regulation	Batima (2006)
Transportation and infrastructure	ADB (2010)

Preparation for a dzud	Citations
Medical	Dorj et al. (2013), Fernandez-Gimenez (2012)
Coordination of international aid and request for aid	UNDP (2011) UNDP/NEMA (2010), Ziegler et al. (2011)
Forecasting and monitoring weather	Batchullun (2005), Diener (2011), Swift (2007) (for FAO), UNDP/NEMA (2010), Urgamal et al. (2011), USAID (2016)
Radio alerts—Gobi Forage radio and livestock early warning	Ariungerel et al. (2012), Batchulluun (2005), Dorj et al. (2013) Urgamal et al. (2011)
Television alerts	IOM (2010)
Cellular/SMS alerts	Commissions Regulatory Commission of Mongolia (2016), Hay (2014), Mercy Corps (2016), World Bank (2014)

The collected documents indicate that there is sufficient communicative infrastructure in place to foresee a storm as well as to alert herders of an oncoming dzud. However, provisional preparations, such as the collection and storage of fodder, are seldom supported or mentioned in the collected reports. This absence is surprising because Fernandez-Gimenez (2012), Fernandez-Gimenez et al. (2011) as well as reports from the socialist area indicate that fodder reserves have a major, positive impact on herders' dzud survival.

4.1 Responses during a dzud

Next, I assessed the collected documents for their recommendations and report of success for activities carried out during a dzud. The majority of the reports emphasized traditional response systems, based on *otor,* and designed aid programs around this tradition. The Mongolian word otor, a modified form otorlokh, is used to describe traditional movement of herders from a frequently visited pasture to a new pasture with superior grasses as a way to respond to environmental changes (Addison et al. 2013; Mearns 2004; Murphy 2011, 2012; Humphrey and Sneath 1996; Sheehy 1996; Upton et al. 2013). Historically, communities practiced otor to overcome poor pasturelands. Then, during the socialist period, herders were collectivized and their migrations were directed by state allocation of grazing spaces. These migrations, as well as preparation of fodder supplies, meant that although dzud occurred during the socialist period, herd loss was minimal (Upton 2010). Contemporary herders who practice otor lose far fewer animals than those that stay in afflicted winter campsites (Middleton et al. 2015). Yet, due to a lack state transportation between pasturelands, and the absence pack animals necessary to make the moves by themselves, many herders are unable to practice otor (Fernandez-Gimenez 1999). The stakes are high for families facing a dzud. For example, interviews conducted with herders by Save the Children in 2010 indicate "[The dzud has] meant a lot of emotional distress for me. I worked a lot to raise [my livestock] to this level so that my children could be better educated and have a better life. You're ruined by just one disaster (Save the Children 2011, p. 5).

Many of the collected reports began by emphasizing an early response, including the need for the government of Mongolia to declare a national emergency and then request emergency funds. Emphasis was also placed on how to best care for animals, or ensure the survival of the healthiest animals. This included distributing fodder, restocking depleted herds either through short-term loans or insurance payouts. Note, the fodder here is often brought in mid-storm, not the pre-stocked fodder addressed in the prior section. Because

animals that die during a dzud cannot be consumed by humans, the reports also detailed the need for human food assistance and an attention toward human security, particularly among the poorest community members.

Actions during and immediately following a dzud	Citations
Early response and logistics	Batchulun (2005), Red Cross (2010a, b), Urgamal et al. (2011), UNDP (2011), UN Coordinator (2016), UNDP/NEMA (2010)
Disaster declaration	Chiu (2016), UNDP (2007, 2011)
Emergency funding	ADB (2010), EU Commission (2016), UN Coordinator (2016), Sayed (2011) (for UN)
Fodder	Addison and Brown (2014), CPR (2013), Batima (2006), Campbell (2011), Chiu (2016), Red Cross (2010a, b), IOM (2010), Swift (2007) (for FAO), Urgamal et al. (2011), UNDP/NEMA (2010)
Veterinary services	Fernandez-Gimenez (2012), IOM (2010), Murphy (2011), UN Coordinator (2016)
Index-based livestock insurance and flex credit	Annor-Frempong (2014), Batima et al. (2006), Ericksen (2014), FAO (2014), IFAD (2014), IOM (2010), Sayed (2011) (for UN), Skees (2002) (for WB), Swift (2007), Swiss Aid (2013)
Buy more animals/restocking	Batima et al. (2006), Campbell (2011), IOM (2010), Swift (2007) (for FAO)
Remove dead animals	ADB (2010), UN Coordinator (2016), UNDP/NEMA (2010)
Reproductive health and human security	Murphy (2011), UN Coordinator (2016), Red Cross (2010a, b)

The multiple recommendations for dzud response indicate the complexity and difficulty of responding to a dzud. While some organizations focus on immediate public health needs, such as removing dead animals, others focus on maintaining what is left of a herd and possibly restocking herd animals in advance for future storms. Many organizations focus on livestock insurance and flex credit, especially those written after 2014 when the Index-based Livestock Insurance Law was passed. Yet, some herder advocacy groups are cautious about supporting these solutions. They indicate that while insurance is an excellent option for unpredictable storms, when dzud are occurring every couple of years, herders will not have enough time to make back borrowed funds, and will not be able to file a insurance claim every year.

4.2 Future plans

Finally, I assessed organizational proposals and suggestions for how future dzud should be best managed. Often times these recommendations were found at the end of a report, though several organizations published reports only featuring recommendations. The diverse recommendations can be clustered into discussions of land policy, community support, finances, and research.

Reports recommending land policy changes were split into three groups: traditional migration systems, fencing off collective lands to prevent off-season use of pasturelands, and selling land to individual herders. The bulk of the collected documents specifically

rejected ideas of fencing and privatization by reporting on the historic success of otor, which only works when land is publically held and freely accessible.

Regarding community support, some reports indicated a preference for new community structures, such as those supported by the German Gesellschaft fur Internationale Zusammenarbeit (GIZ) that train herders to cope in Mongolia's post-de-collectivization period. Other reports supported Pastoral User Groups, a method sponsored by the Swiss Development Corporation which also engages collective action to meet pasture management and livelihood goals. Overall, the authors did not agree on how herder groups should be organized, managed, or supported. However, there is general support for the idea that herding communities must be supported and aid programs should ensure that those groups are consulted for future dzud response plans. This need to address the community collectively was emphasized in reports by organizations who had attempted to only reach the "poorest of the poor" only to find that impoverished families were already integral parts of much larger community networks and support structures.

Reports also explored a diversity of new services for herders, ranging to psychological assistance to new technology and easier access to the market so that herders can sell live animals in advance of a dzud. Finally, many reports ended by emphasizing the need for interdisciplinary research as well as new evaluation metrics, which would allow aid workers to most adequately understand and respond to dzud.

Recovery and future plans	Citations
Land ownership, privatization, and fencing	CPR (2013), Mayer ND, Schmidt (2006)
Against land privatization	Batima et al. (2006), Driscoll, Ericksen (2014)
Government enforcement of land regulations	Batima et al. (2006), Fernandez-Gimenez et al. (2011), Murphy (2011), Swift (2007) (for UN)
Grazing fees	CPR (2013)
Control livestock numbers and herd growth	CPR (2013), Jacobs (2010), Mongolia (2010)
Breeding after dzud/selective breeding for herd strength	Batima (2006)
Otor and other traditional movements such as otor and supporting community systems	Batchulun (2005), Batima et al. (2006), Batjargal and Enkhjargal (2013), Enkh-Amgalan (2011), Ericksen (2014), Fernandez-Gimenez (2012), FAO (2014), Hess et al. (2010), Zhen et al. (2010), Mahboob (2012) Murphy (2011), Red Cross (2010a, b), Thompson et al. (2012)
Negdel/traditional community support	Ericksen (2014)
Pastoral user groups	FAO (2014), Fernandez-Gimenez (2012), Fernandez-Gimenez et al. (2011), UNDP/NEMA (2010)
Focus on the poorest herders	IFAD (2014) (which notes this didn't work), IOM (2010), Red Cross (2010a, b)
Network for information/educate herders	Batima (2006), Batima et al. (2006), Enkh-Amgalan (2011), Fernandez-Gimenez et al. (2011), Hess et al. (2010), IFAD (2014), Swift (2007) (For FAO), UNDP/NEMA (2010)
Child and family programs	Groppo and Schindler (2014), IFAD (2014), Save the Children (2011), Red Cross (2010b, 2016)
Psychological help for herders and herding traditions	Batjargal and Enkhjargal (2013), Campbell (2011), Murphy (2011), Red Cross (2010a, b), Save the Children (2011)

Recovery and future plans	Citations
Prevent urban migration	IOM (2010)—many reports indicate that this migration either does not occur or is temporary
Stop overreliance on outside aid	Fernandez-Gimenez et al. (2011), Murphy (2011)
Debt prevention	IFAD (2014), IOM (2010), Murphy (2011), Swift (2007) (for FAO)
Diversify economy	Fernandez-Gimenez et al. (2011), IFAD (2014), Mayer ND
Market access for herders	Lkhagvadorj et al. (2013)
New herding technology	FAO (2014)
Interdisciplinary research	Batima (2006), Datima et al. (2006), Batjargal and Enkhjargal (2013), EU Commission (2016), FAO (2014), Red Cross (2010a, b), UN Coordinator (2016)
New evaluation metrics—focusing on community, not family and herd structures	Driscoll, IFAD (2014), Thrift and Byambabaatar (2015), Upton (2008)

While not all of the proposed plans are mutually exclusive, they are seldom considered in parallel. None of the reports consider all of the proposed options, and even when considering the most commonly discussed solutions, such as otor, there is little agreement of how such historic systems should be supported. Additionally, while the diversity of proposals appears to indicate many opportunities for Mongolian herders, few reports indicate which, if any, herders were consulted in the creation of these recommendations. The FAO (2014) report speaks at length regarding the lack of herder perspectives, indicating that even though their team worked hard to interview herders, the lack of transportation infrastructure confined interviews to within 2 h of the aimag (provincial) center.

5 Discussion

When read as a collective body of literature, the documents analyzed in this paper provide a detailed understanding of how dzud are defined, prepared for and responded to. Utilizing CDA at a macro-level, these documents also provide an insight into the ways that knowledge is constructed, disseminated, and valued among policy makers, development planners, and herders. While an organizational report could never include every interview or narrative, it is striking how few herders are directly quoted in the collected documents. Drawing upon the rhetorical tool of persuasive definitions, these collected documents can be understood as specifically framed texts, which are designed to encourage a specific type of reaction, be that the allocation of resources to a region of Mongolia or organizational fundraising in preparation for a future dzud.

This paper was guided by three questions; the definition of dzud, preparation and response to dzud, and herder involvement in decision-making. Regarding the first question, a definitional shift is ongoing as scientists reshape understanding of the severity and frequency of duzd. The need to address each dzud's peculiarities, while also predicting and preparing for future storms, will continue to be a problem for Mongolia and organizations working in the region. As is illustrated in the transition from Soviet aid distribution to post-

democracy programing, the level of human preparation and intervention is often just as important as the storm severity.

The second question addressed preparation and response to dzud. While all of the collected documents include recommendations for responding to future dzud, those recommendations frequently rely on technological solutions supported by international resources. New technology has also been helpful, but the USSR's system of disaster relief was reported to have been successful before these new technologies were invented or implemented. The withdraw of Soviet aid is attributed to the severity of the 1999–2002 dzuds (Begzsuren et al. 2004; Government of Mongolia 2001), yet contemporary aid programs either focus on inventing new methods of dzud response or foster solutions which are dependent on international assistance. The problem in these internationally funded and supported dzud responses is that they are likely to disappear when international political upheavals or the collapse of markets in another part of the world divert aid funding.

The third research question asked how do reports indicate consultation and cooperation with local herders? Are herders welcomed as equal-part planners, decision makers, and/or recipients of emergency aid? Many reports indicate the need to include herders in the decision-making process, training, and capacity building. Yet, forums where herders can participate are often organized, facilitated, and funded by outside organizations. For example, herders interviewed and quoted in the collected reports continually point to the expansiveness of the dzud (FAO 2014), and need for specific types of aid. They focus on aid that will allow them to quickly restock their herds, take out short-term loans, and enable otor, the traditional form of migration during a time of dzud. Yet, these remedies are either overlooked or only included as a small part of many aid packages. It is troubling that instead of invite herders as decision-makers, many reports rely on vignettes which frame herders as helpless, suddenly impoverished and fully reliant on international aid. From a critical discourse analysis perspective, two elements of these reports reveal the power hierarchies at play in these reports: framing of herders as victims and the lack of attention to herder requests for specific forms of aid. The inclusion of herder perspectives, followed by implementation of programs that are different from what herders have asked for, entrenches a hierarchy of decision-making that prevents herders from playing an active role in decision-making and emergency response. When proposing and implementing market solutions, aid organizations express problems including that herders are either not able to finance a loan (because their herds have been lost) or cannot to pay back a loan on schedule when another dzud occurs. It is for this reason that international aid utilized for loans might be better used for directly restocking animals. This is the remedy most frequently asked for by herders, and documented in the collected reports, but rarely appears in market facing analysis or future recommendations.

When interviewed by the New York Times during the 2010 dzud, Akbar Usmani, the resident representative for the United Nations Development Program, indicated "we expect the ripple effects for months and years to come" (Jacobs 2010). The largest and most immediate take away from the reports collected for this analysis is that dzud need to be considered as regularly occurring events which have produced new forms of vulnerability with long ranging implications. A clear criterion to determine that a dzud is occurring is needed so that aid and response can be quickly mobilized (World Bank 2011). This labeling is modeled in UNDP reports that classify dzud as a recurring phenomenon that results in national emergencies. However, the clear labeling of "national emergency" is lacking from many other reports. By anticipating future dzud, aid organizations would be better able to stockpile resources and quickly mobilize provisions during a dzud, resulting

in herder resilience and preventing the death of many animals and loss of community livelihoods. Dzud are not random, but rather are increasingly frequent storms that stress the social and political fabric of Mongolia. But with planning, education, international assistance, and a focus on building the capacity of herders to respond to these storms, Mongolia can successfully mitigate the harms of this natural hazard.

References

Addison J, Brown C (2014) A multi-scaled analysis of the effect of climate, commodity prices and risk on the livelihoods of Mongolian pastoralists. J Arid Environ 109:54–64

Addison J, Davies J, Friedel M, Brown C (2013) Do pasture user groups lead to improved rangeland condition in the Mongolian Gobi desert? J Arid Environ 94:37–78

Amarsaikhan B (2016) Weekly humanitarian snapshot highlights dzud in Mongolia. Montsame: Mongolian News Agency, Ulaanbaatar, Mongolia

Annor-Frempong C (2014) Mongolia—MN—Index-Based Livestock Insurance: P088816—implementation status results report: sequence 12. World Bank Group, Washington D.C

Ariungerel D, Enkhzaya D, Enkhbad D, Udval G (2012) A current and prediction condition on pasture in the Gobi region, Mongolia. In: Paper presented at the 33rd Asian conference on remote sensing. Pattaya, Thailand

Asian Development Bank (2010) Mongolia: Dzud disaster response project. Project Number 44178-012

Baas S, Tessitore S, Jelly T (2012) Rethinking pastoral risk management in Mongolia. In: Werger M, van Staalduinen M (eds) Eurasian steppes: ecological problems and livelihoods in a changing world. Springer, Dordrecht

Bat B (2016) Монголд ган гачиг нүүрлэхийг анхааруулжээ. Retrieved from: http://www.nsc.gov.mn/?q=en/node/338. Accessed October 10, 2016

Batchulluun Ch (2005) Sasakawa recognition interviews. UN Office for Disaster Risk Reduction. http://www.unisdr.org/files/5386_sasakawa2005recognitionsinterviews.pdf. Accessed October 10, 2016

Batima P (2006) A final report submitted to assessments of impacts and adaptations to climate change. AIACC Project No. AS 06. START Secretariat, Washington, DC

Batima P, Bat B, Tserendorj T (2006) Evaluation of adaptation measures for livestock sector in Mongolia. AIACC Working Paper 41, Washington, DC

Batjargal Z, Enkhjargal B (2013) Interference impact of global warming and globalization on the society and ecosystem in Mongolia. In: Yamamura N et al. (eds) The Mongolian ecosystem network: environmental issues under climate and social changes. Springer, Japan

Batzaya N (2016) Төлийн хорогдол ихэсч, эх мал жилбэ муутай байна гэв. Olloo.MN. http://olloo.mn/n/27933.html. Accessed October 10, 2016

BBC News (2000) Mongolia faces calamity. http://news.bbc.co.uk/2/hi/asia-pacific/694716.stm. Accessed October 10, 2016

Begzsuren S, Ellis JE, Ojima DS, Coughenour MB, Chuluun T (2004) Livestock responses to droughts and severe winter weather in Gobi Three Beauty National Park, Mongolia. J Arid Environ 59:758–796

Bolor-Erdne L, Angerer J, Granville-Ross S, Urgamal M, Narangarel D, Tsogoo D, Stewart T, Sheehy D (2008) Gobi forage: an early warning system for livestock in the Gobi region of Mongolia. International Grassland Congress, Khukhhot

Campbell R, Knowles T (2011) The economic impacts of losing livestock in a disaster Economists at Large. Society for the Protection of Animals, Melbourne

Center for Policy Research (CPR) (2013) What is the policy for livestock sector reform? Center for Policy Research, Mongolia. http://www.cpr.mn/en/index.php?option=com_content&view=article&id=137:what-is-the-policy-for-livestock-sector-reform&catid=31:advocacy&Itemid=46. Accessed October 10, 2016

Chiu J (2016) Mongolian livestock succumb en masse to the freezing dzud. IRIN. http://www.irinnews.org/news/2016/03/07/mongolian-livestock-succumb-en-masse-freezing-dzud. Accessed October 11, 2016

Conte TJ (2015) The effects of China's grassland contract policy of Mongolian herders' attitudes towards grassland management in northeastern Inner Mongolia. J Polit Ecol 22:79–97

Diener A (2011) Will new mobilities beget new (im)mobilities? Prospects for change resulting from Mongolia's trans-state highway. In: Brunn SD (ed) Engineering earth. Springer, New York, pp 627–641

Dorj O, Enkhbold M, Lkhamyanjin S, Mijiddorj Kh, Nosmoo A, Puntsagnamil M, Sainjargal U (2013) Mongolia: country features, the main causes of desertification and remediation efforts. In: Heshmati GA, Squires VR (eds) Combating desertification in Asia, Africa, and the Middle East: proven practices. Springer, Dordrecht

Endicott E (2012) A History of land use in mongolia. Palgrave, New York

Enkh-Amgalan A (2011) The livestock sector needs drastic policy reform. Center For Policy Research, Mongolia. http://www.cpr.mn/en/index.php?option=com_content&view=article&id=120:the-livestock-sector-needs-drastic-policy-reform&catid=31:advocacy&Itemid=46. Accessed October 10, 2016

Ericksen A (2014) Politics of responsibility in increasingly hazardous climate: the case of herding in post-socialist Mongolia. University of Arizona, School of Anthropology, Arizona

European Commission for Humanitarian Aid and Civil Protection (2016) Mongolia: helping herder families following the harsh 'dzud' winter. http://ec.europa.eu/echo/field-blogs/photos/mongolia-helping-h. Accessed October 22, 2016

Fernandez-Gimenez ME (1999) Sustaining the steppes: a geographical history of pastoral land use in Mongolia. Geogr Rev 89(3):315–342

Fernandez-Gimenez ME (2012) Lessons from the Dzud: photographs by herders from Mongolia's Khangai Mountains and Gobi Desert. Warner College of Natural Resources, Colorado State University

Fernandez-Gimenez ME, Batbuyan B, Batkhishig B (2011) Understanding resilience in Mongolian pastoral social-ecological systems. Colorado State University

Food and Agriculture Organization of the United Nations (FAO) (2014) Report on Ruminant Supply Chains in Mongolia: A Preliminary Assessment of Strategies for Improving Returns, Risk Management, and Productivity. FAO Regional Office for Asia and the Pacific. Bangkok, Thailand

Girvetz EH, McDonald R, Heiner M, Kiesecker J, Davaa G, Pague C, Durnin M, Oidov E (2012) Eastern Mongolian Grassland Steppe. In: Hilty JA (ed) Climate and conservation: landscape and seascape science, planning and action. Island Press, Washington, D.C

Goulden CE, Mead J, Horwitz R, Goulden M, Nandintsetseg B, McCormick S, Boldgiv B, Petraitis P (2016) Interviews of Mongolian herders and high resolution precipitation data reveal an increase in short heavy rains and thunderstorm activity in semi-arid Mongolia. Clim Change 136:281–295

Government of Mongolia (2001) Briefing on the "Zud" situation in Mongolia. http://reliefweb.int/report/mongolia/briefing-zud-situation-mongolia. Accessed October 10, 2016

Groppo V, Schindler K (2014) The impact of extreme weather events on child health: evidence from Mongolia. DIW Econ Bull 12(2014):3–9

Hay M (2014) Nomads on the grid. Slate Magazine. http://www.slate.com/articles/news_and_politics/roads/2014/12/mongolian_nomads_ambitious. Accessed June 15, 2016

Hess S, Boucher T, Dabrovskyy A, Hoorn ET, van Beukering P (2010) Revaluating the effectiveness of community-based conservation in Mongolia's Gobi desert. The Nature Conservancy, New York

Humphrey C, Sneath D (1996) Culture and environment in inner Asia. White Horse Press, Cambridge

IFAD (2014) Mongolia rural poverty-reduction programme project performance assessment. EC 2014/84/W.P.5. https://webapps.ifad.org/members/ec/84/docs/EC-2014-84-W-P-5.pdf. Accessed October 10, 2016

Ikegami M (2016) 2015/2016 Dzud disaster in Mongolia. https://d10rp68l4anj4z.cloudfront.net/projects/271225-2015-16. Accessed October 10, 2016

International Organization for Migration (IOM) (2010) 2009/2010 Mongolia dzud: Displaced rural herder communities response assessment and intentions survey (RAIS). https://www.iom.int/files/live/sites/iom/files/Country/docs/20101214_Mongolia_Assessment_DZUD__FINAL.pdf. Accessed October 10, 2016

Jacobs A (2010) Winter leaves Mongolians a harvest of carcasses. The New York Times, New York

Janzen J (2005) Mobile livestock-keeping in Mongolia: present problems, spatial organization, interactions between mobile and sedentary population groups and perspectives for pastoral development. Senri Ethnol Stud 69:69–97

Jeggle T, Goodyear EJ, Lamjav P (2007) Strengthening the disaster mitigation and management systems in Mongolia project, Phase II. UNDP, Mongolia

Kelman I, Gillard JC, Lewis J, Mercer J (2016) Learning from the history of disaster vulnerability and resilience research and practice for climate change. Natl Hazards 82:S129–S143

Khural (2016) UN agencies supporting vulnerable groups and communities after the dzud. Retrieved from ИРГЭДИЙН ТӨЛӨӨЛӨГЧДИЙН ХУРЛЫН НЭГДСЭН ЦАХИМ ХУУДАС. http://www.khural.mn/en-us/n/pfcon. Accessed October 20, 2016

Lise W, Hess S, Purev B (2006) Degradation and poverty among herders in Mongolia: data analysis and game estimation. Ecol Econ 58:350–364

Lkhagvadorj D, Hauck M, Dulamsuren C, Tsogtbaatar J (2013) Twenty years after decollectivization: mobile livestock husbandry and its ecological impact in the Mongolian Forest-Steppe. Hum Ecol 41:725–735

Mahboob T (2012) Photos: documenting Mongolia's at-risk nomadic herders. Asia society. http://asiasociety.org/blog/asia/photos-documenting-mongolias-risk-nomadic-herders. Accessed October 9 2016

Marin A (2010) Riders under storms: contributions of nomadic herders' observations to analyzing climate change in Mongolia. Glob Environ Change 20:162–176

Mearns R (2004) Sustaining livelihoods on Mongolia's pastoral commons: insights from a participatory poverty assessment. Dev Change 35(1):120–121

Mercy Corps (2016) SMS training for rural citizens. Mercy corps. http://mercycorps.org.mn/beta/index.php/en/news-mcm/656-sms-training-for-rural-citizens. Accessed July 7, 2016

Middleton N, Rueff H, Sternberg T, Batbuyan B, Thomas D (2015) Explaining spatial variations in climate hazards in western Mongolia. Landsc Ecol 30:91–107

Mongolian Statistical Yearbook (2003) http://www.1212.mn/. Accessed January 3, 2017

Mongolia Office of the President of Mongolia (2010) Herder B. Amarjargal: "Dzud shuns diligence." Public Relations and Communications Division. http://x.president.mn/eng/newsCenter/viewNews.php?newsId=176. Accessed October 9 2016

Murphy D (2011) Going on otor: disaster, mobility, and the political ecology of vulnerability in Uguumur, Mongolia. University of Kentucky Doctoral Dissertations, Paper 168

Murphy D (2012) Encountering the Franchise State: Dzud, Otor, and Transformations in Pastoral Risk. In: Knauft B, Taupier R (eds) Mongolia after socalism. Admon, Ulaan Baatar

Potkanski T (1993) Decollectivisation of the Mongolian pastoral economy (1991–1992): some economic and social consequences. Nomadic Peoples 33:123–135

Red Cross (2010a) Rapid assessment of dzud situation in Mongolia. International Federation of Red Cross and Red Crescent Societies, Mongolian Red Cross Society, Ulaanbaatar, Mongolia. http://reliefweb.int/report/mongolia/rapid-assessment-dzud-situation-mongolia-18-26-jan-2010-summary-report. Accessed October 20, 2016

Red Cross (2010b) Mongolia: cold waves. Disaster Relief Emergency Fund Operation Update. http://www.ifrc.org/docs/appeals/10/MDRMN00301.pdf. Accessed October 20, 2016

Red Cross (2016) Emergency appeal operations update. Mongolia: Extreme winter condition. http://adore.ifrc.org/Download.aspx?FileId=138545. Accessed October 20, 2016

Saramento WM, Reading RP (2016) Conservation presence, not socioeconomics, leads to differences in pastoralist perceived threats to argali. J Asia Pacific Biodivers 9:263–270

Save the Children (2011) Save the children Japan in Mongolia: annual report 2010, Ulaanbaatar, Mongolia

Sayed A (2011) Dzud: a slow natural disaster kills livestock—and livelihoods—in Mongolia. The world Bank: East Asia and Pacific on the Rise. World Bank Country Manager Visit to Arkhangai Province, Mongolia

Schmidt SM (2006) Pastoral community organization, livelihoods and biodiversity conservation in Mongolia's southern Gobi region. USDA Forest Service Proceedings RMRS-P-39

SDC Green Gold (2016) SDC GG dzud project 2016 [video]. https://youtu.be/-wak8X1Kl0A. Accessed October 19, 2016

Sheehy D (1996) Sustainable livestock use of pastoral resources. In: Bruun O, Odgaard O (eds) Mongolia in transition: old patterns, new challenges. Routledge, New York

Skees JR (2002) Examining the feasibility of livestock insurance in Mongolia. World Bank East Asia and Pacific Region Rural Development and Natural Resources Sector: policy working paper 2889

Sneath D (2003) Land use, the environment and development in post-socialist Mongolia. Oxf Dev Stud 31(4):441–459

Sneath D (2012) The 'age of the market' and the regime of debt: the role of credit in the transformation of pastoral Mongolia1. Soc Anthropol 20(4):458–473. doi:10.1111/j.1469-8676.2012.00223.x

Sternberg T (2014) Transboundary hazard risk: the Gobi desert paradigm. Natl Hazards 72:533–548

Sternberg T, Middleton N, Thomas D (2009) Pressurized pastoralism in South Gobi, Mongolia: what is the role of drought? Trans Inst Br Geogr 34(3):364–377

Swift JJ (2007) Institutionalizing pastoral risk management in Mongolia: lessons learned. FAO Project pastoral risk management strategy TCP/MON/0066. http://www.fao.org/nr/clim/docs/clim_070601_en.pdf. Accessed October 20, 2016

Swiss Agency for Development and Cooperation (Swiss Aid) (2013) Swiss Cooperation Strategy Mongolia 2013–2016. Swiss Agency for Development and Cooperation, Berne, Switzerland

Tachiiri K, Shinoda M, Klinkenberg B, Morinaga Y (2008) Assessing Mongolian snow disaster risk using livestock and satellite data. J Arid Environ 72:2251–2263

Thompson R, Tsedendorj B, Alga S, Baatar A (2012) Evaluation of the livelihood support projects of UNDP Mongolia. https://erc.undp.org/evaluation/documents/download/7485. Accessed October 20, 2016
Thrift ED, Byambabaatar I (2015) Management of dzud risk in Mongolia: Mutual aid and institutional interventions. In: Proceedings of the trans-disciplinary research conference: building resilience of mongolian rangelands. Ulaanbaatar, Mongolia
United Nation Development Program (UNDP) (2011) Assessment of development results: Evaluation of UNDP contribution Mongolia. https://www.oecd.org/countries/mongolia/48341570.pdf. Accessed October 20, 2016
United Nations Data (UNData) (2017) Mongolia: country profile. http://data.un.org/CountryProfile.aspx?crName=MONGOLIA. Accessed 3 April 2017
United Nations Development Program (2000) Lessons learnt from the dzud 1999–2000. Project MON/00/302. Ulaanbaatar, Mongolia
United Nations Development Program (UNDP) (2007) Terminal evaluation of the strengthening the disaster mitigation and management systems in Mongolia project, Phase II. https://www.climate-eval.org/sites/default/files/evaluations/374%20Strengthening%20the%20Disaster%20Mitigation%20and%20Management%20Systems%20in%20Mongolia%20Project,%20Phase%20II.pdf. Accessed 10 October 2016
United Nations Development Program (UNDP) (2016) Mongolia: Dzud response and preparedness plan (as of 25 April 2016). http://www.un-mongolia.mn/new/wp-content/uploads/2016/04/MONGOLIA-Dzud-Response-and-Preparedness-Plan.pdf. Accessed 10 October 2016
United Nations Development Program (UNDP) and National Emergency Management Agency (NEMA) (2010). Dzud National Report 2009–2010
United Nations Infants and Children Fund (UNICEF) (2010) Dzud Appeal Fact Sheet. http://www.unicef.org/eapro/dzud_factsheet.pdf. Accessed October 20, 2016
United Nations Office of the Resident Coordinator (2016) Mongolia dzud situation report No. 1. http://reliefweb.int/sites/reliefweb.int/files/resources/RC%2520Mongolia_Dzud_Situation%2520Report_No%25201_14%2520April%25202016%2520%281%29.pdf. Accessed October 20, 2016
United Nations Population Fund (UNFPA) (2016) United Nations hands over supplies for dzud affected households. http://countryoffice.unfpa.org/mongolia/2016/04/11/13723/united_nations_hands_over_supplies_for_dzud_affected_households/. Accessed April 11, 2016
Upton C (2008) Social capital, collective action and group formation: social trajectories in post-socialist Mongolia. Hum Ecol 36:175–199
Upton C (2009) "Custom" and contestation: land reform in post-socialist Mongolia. World Dev 37(8):1400–1410
Upton C (2010) Living off the land: nature and nomadism in Mongolia. Geoforum 41:865–874
Upton C, Moore K, Nyamsuren N, Batjargal E (2013) Community, place and pastoralism: Nature and society in Post-Soviet Central Asia. Leverhulme Trust Research Grant F/00 212/A1, 2010–2012
Urgamal M, Angerer J, Udval G, Ariungerel D (2011) Livestock Early Warning System (LEWS) in Mongolia. In: Conference paper, Diverse Rangeland for Sustainable Society, IX, International Rangeland Congress. 02–08, April. Rosaria, Argentina
USAID (2016) Leveraging science, preserving pastoral livelihoods in Mongolia. August 30, 2016. https://scms.usaid.gov/sites/default/files/documents/1866/08.30.16_USAID-DCHA_Success_Story-Leveraging_Science.pdf. Accessed October 22, 2016
Uyanga G (2016) Шар усны үерийн аман дээр буусан айлуудыг нүүлгэнэ. Olloo.mn. http://olloo.mn/n/26907.html. Accessed October 20, 2016
Wodak R (2006) Critical discourse analysis. In: Seale C, Silverman D, Gubrim JF, Gobo G (eds) Qualitative research practice. Sage, Thousand Oaks
World Bank (2011) Dzud disaster financing and response in Mongolia. http://documents.worldbank.org/curated/en/545251468053109217/Dzud-disaster-financing-and-response-in-Mongolia. Accessed October 20, 2016
World Bank (2014) How telecommunications changed the lives of herders in Mongolia. http://www.worldbank.org/en/news/feature/2014/10/20/how-telecommunications-changed-the-lives-of-herders-in-mongolia. Accessed July 7, 2016
Zarefsky D (2009) Strategic maneuvering in political argumentation. In: van Eemeren FH (ed) Examining argumentation in context: fifteen studies on strategic maneuvering. John Benjamins Publishing, Amsterdam, pp 115–130
Zhen L, Ochirbat B, Lv Y, Wei YJ, Liu XL, Chen JQ, Yao ZJ, Li F (2010) Comparing patterns of ecosystem service consumption and perceptions of range management between ethnic herders in Inner Mongolia and Mongolia. Environ Res Lett 5(1):015001
Ziegler J, Golay C, Mahon C, Way S (2011) The fight for the right to food. Palgrave, New York