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MONGOLIA

AGRICULTURAL SECTOR RISK ASSESSMENT

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Acronyms

CPI	Consumer Price Index
CV	Coefficient of Variation
Dzud	Severe winter storm
FAO	Food and Agriculture Organization of the United Nations
GAO	Gross Agricultural Output
GCC	Government Catastrophe Coverage
GDP	Gross Domestic Product
GFC	Global Financial Crisis
LIIP	Livestock Insurance Indemnity Pool
LSU	Livestock Unit
MFALI	Ministry of Food, Agriculture and Light Industry
NEMA	National Emergency Management Agency
NSO	National Statistical Office of Mongolia
SEC	State Emergency Commission
SDC	Swiss Agency for Development and Cooperation
UNDP	United Nations Development Programme

Foreword

Risks in agricultural systems are inherent, ubiquitous, and varied. Agriculture is an exceptionally risky economic sector, and particularly in settings like Mongolia which are subject to extreme weather and variability from one year to the next. Here, production is often characterized a perpetual cycle of shock and recovery that deters agricultural investment and innovation, and severely inhibits the development of the sector over time. Vulnerability to risk can also reinforce poverty traps and undermine what otherwise might be pathways out of poverty. In addition to production related shocks such as weather, pests, and disease, fluctuations in the prices of commodities and inputs represent another important source of risk for public sector finance as well as producers' income. The prevalence and complexity of risks facing agriculture systems in developing countries makes *reducing risk and vulnerability* a core pillar of the World Bank Group Agriculture Action Plan for 2013-2015.

The magnitude of risks facing Mongolian agriculture has made the sector's development extraordinarily volatile over the last 25 years as it underwent de-collectivization. Livestock in particular has seen rapid and largely unsustainable rates of growth in terms of numbers of animals and herders, and in so doing has become acutely vulnerable to the severe winter weather events known as *dzuds*. Periodic droughts and other production risks have also affected the country's much smaller crop agriculture, much of which is geared for the production of feeds. And price volatility poses serious systemic risks which affect large proportions of the rural population.

This study was undertaken to assess the systemic risks facing Mongolian agriculture and to identify gaps in current risk management practices within the sector. It was carried out by the World Bank in collaboration with partners in the Mongolian Government, primarily the Strategy Planning and Policy Department of the Ministry of Industry and Agriculture.

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The study was carried out by a World Bank team comprising Charles Annor-Frempong (Task Team Leader), Åsa Giertz (Co-Task Team Leader), Vikas Choudhary, Garry Christensen, Boldbaatar Shagdar , and Jeremy Swift. The team is thankful to Mark L. Lundell, Iain Shuker, Nathan Belete, Bert Hofman, and James Anderson for their support and leadership, and to Coralie Gevers and Klaus Rohland for their guidance and support and to the team.

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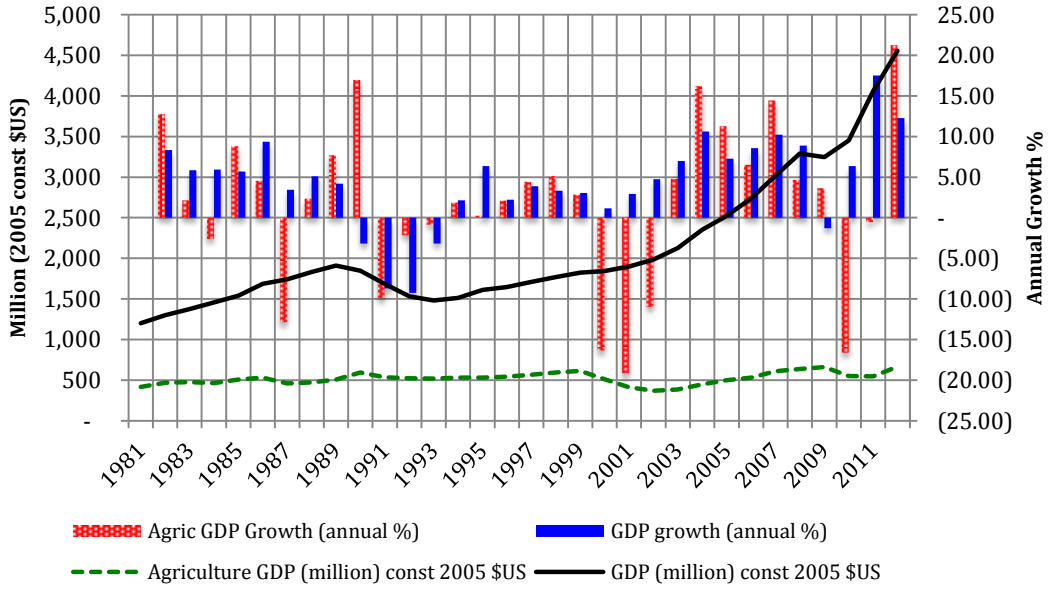
Executive Summary

With its abundance of grazing land and harsh climate, Mongolia is most suited to extensive livestock production – with herders practicing nomadic and semi-nomadic pastoralism for hundreds of years. Livestock production currently accounts for 75 percent of Gross Agricultural Output (GAO) in current prices and employs 30 percent of the economically active population. The limited area allocated to crop production is dominated by dry land wheat production supplemented by other cereals, fodder crops, potatoes, and vegetables.

The level and sources of Mongolia's economic growth, and the contribution of agriculture to this growth, have varied markedly over the last 30 years (Figure A). The agricultural growth rate has exhibited pronounced volatility, dipping into negative territory in 10 out of the past 30 years. Three distinct patterns of economic management account for these differences: the centrally planned economy that lasted until 1989, a period of transition and structural reform from 1990 to 2000, and the acceleration of economic growth after 2000 in response to reform and the increasing influence of mineral extraction. Many of the production risks that have emerged after de-collectivization are results of the changing structure of the agriculture sector. Less state intervention has meant less support to the sector, but also less regulation, which has led to especially the livestock sector expanding rapidly in terms of herders and animals, but also becoming more vulnerable to adverse shocks. An overview of these changes provides useful insights into the sources and levels of agriculture sector risk, their impact on overall growth, and the relative importance of short-term shocks versus medium-term economic transformation.

Figure A. Trends in National and Agricultural GDP



Source: World Bank Development Indicators

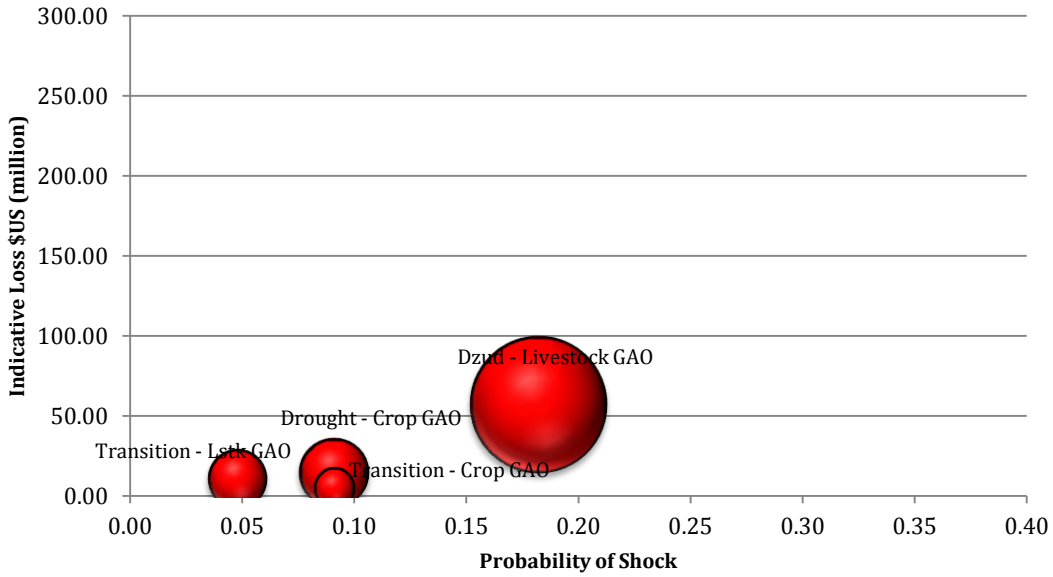
Despite significant efforts by the Government of Mongolia to manage agricultural risks, recent shocks, and in particular the 2009-2010 dzud, have inflicted large losses on producers and other actors, and have revealed important gaps in existing mechanisms for managing risk.

The shocks that affect the agriculture sector appear to have a moderate impact on the overall economy. Agricultural growth in Mongolia varies much more than overall economic growth. Although GDP growth rates fell in response to the major dzuds of 1999-2002 and 2010, no economic contraction took place. The structural reforms of the early 1990s and the exogenous shocks of 2008-2009 had much larger impacts on the national economy.

The risk analysis discussed in this document pointed to four major sources of risk: dzuds, drought, generalized price shocks associated with exogenous adverse events such as the Asian Financial Crisis, and the policy shocks associated with economic transition during the early 1990s. Livestock, cashmere and mutton emerge as the commodities most vulnerable to risk while wheat has the highest probability of incurring risk.

Applying constant prices, dzuds emerge, as expected, as by far the most important shock to physical output (Figure B). Not only do dzuds occur more frequently than other types of adverse event, they also incur higher costs. Drought is a much less significant risk, occurring with lower frequency than dzuds and predominantly affecting crop production, which accounts for only one quarter of total GAO.[1] The mobility of animals and the capacity to move them in the event of a drought appears to limit its impact on livestock production.

Figure B. Shocks to Physical Output (constant prices)



Source: FAOSTAT, Author's calculations

Mongolia has experienced three major macro-economic shocks over the last two decades: i) the transition period between 1990 and 1995; ii) the Asian financial crisis of 1997; and iii) global financial crisis of 2008-09. The consequences of these macro-economic shocks for Mongolian agriculture become evident when measuring the joint impact of production and price shocks on real prices. While the types of policy shock

[1] It should be noted that droughts in Mongolia most often are associated with dzuds, and losses in those years are in this report attributed to the dzuds. The droughts refered to here are those that occurred independently of dzuds.

associated with transition are unlikely to recur, the possibility of generalized price shock such as the Asian financial crisis is a continuing risk.

The analysis confirms the need to focus on risk management in the livestock sector, not only because the incidence of shocks to livestock production is relatively high but also because it accounts for three quarters of the value of agricultural output and employs about one quarter of the total workforce. The rural poverty rate is moreover substantially higher at 35 percent that the urban poverty rate of 23 percent and more effectively managing risks relating to livestock promises to both prevent poverty traps and promote growth across the greater agriculture sector.

The current emphasis on measuring risk in terms of physical losses needs to be broadened. While the physical losses due to dzuds are often high, and are always highly visible, the less visible impact of macro-economic shocks can result in much higher losses to sector output. Mongolia's growing dependence on mineral exports and world commodity markets makes it increasingly vulnerable to such exogenous shocks.
Because the main effects of drought are on crops, and the crop sub-sector is relatively small in Mongolia, droughts tend to have limited impacts on the greater agriculture sector as a whole. Nevertheless, given the country's strategic objective of increasing domestic grain production, incorporating the potential for droughts into its risk management framework will be important.

A number of risk management measures (mitigation-transfer-coping), both public and private, are already in place in Mongolia. Depending in large part on their knowledge, capabilities, and resources, pastoralists prepare their herds and camps for approaching winters and for the ever present possibility of a dzud. In 2006, the Government of Mongolia launched public-private weather based index insurance for livestock owners in collaboration with the World Bank, transferring production risks to insurance companies and a reinsurer – the National Emergency Management Agency. The Agency is responsible for helping herders to cope with extreme dzuds and provide fodder support to livestock owners through its Emergency Reserve. Efforts are also underway to introduce conservation agriculture and other soil and water conservation measures.

Despite the broad range of ongoing risk management activities, especially on the production side, adverse shocks continue to have significant impacts on the Mongolian agriculture sector. Dzuds, the largest source of production risk, continue to have larger impacts now than in the past. Droughts and price volatility also continue to pose systemic risks to producers and to the sector as a whole. The limitations of risk management became apparent during the last dzud and the large scale livestock mortality that resulted from it. These limitations were evident in approaches used both by the public and private sector.

The current risk management landscape in Mongolia has a number of key characteristics which quickly became evident during the analysis.

- A large number of initiatives currently underway across the mitigation-transfer-coping spectrum.
- A strong emphasis on disease management.
- Dzud management is more focused on coping, through NEMA, and transfer, through the livestock insurance program.
- Investment in mitigation measures is relatively limited despite their multiple benefits (risk management as well as productivity improvement).

- Sustainable land, pasture, and herd management warrants more attention and stronger policy shifts.

The risk assessment recommends the following mitigation measures to improve resilience of the agriculture sector.

- Strengthening and scaling-up winter preparation practices, such as household production of hay and forage among herders.
- Increase awareness and knowledge of winter preparation activities through advisory services and information campaigns.
- Facilitate otors in the incidence of extreme weather events and educate new herders on how to use otor as a mean to mitigate risks.[2]
- Aimag and soums should set aside pasture land to be used only when a dzud has been declared.
- Strengthen the Livestock Early Warning System (LEWS) in gathering, monitoring, and disseminating early warning information such as weather forecasts and pasture quality indicators.
- Strengthen pasture tenure security.
- Strengthen herders' network for information sharing and risk management.
- Emphasize appropriate land use, conservation agriculture, and drought tolerant varieties for crop risk management.
- Improve coordination among various agencies to increase effectiveness of emergency and post-emergency response.
- Explore mechanisms for rapid access to emergency finance, including contingent finance.
- Devise incentives to the crop sector to promote risk mitigating practices.
- The Government's agricultural support program could be applied more strategically for risk management purposes.

The livestock sector's long-term resilience should be strengthened with particular emphasis on ensuring a sustainable balance between livestock numbers and pasture availability and carrying capacity. This will become even more important in a changing climate and as competition by households and industries over available water resources increases. The size and sustainability of the livestock sector will be largely determined by a number of factors that related directly to public policy, including legislation concerning land access and use, agricultural policies, environmental regulation, and sanitary and food safety standards, among others.

[2] Otor means migration and refers to the practice of quickly moving livestock long distances to better pastures, away from the herder's regular pastures. It's a traditional form of risk mitigation for herders in Mongolia.

I. Introduction

The changing structure of Mongolian agriculture has made the sector more vulnerable to risk., The sector has undergone dramatic changes since the end of the collective period. The post-transition environment has facilitated rapid growth over the past two decades, especially for livestock output, which accounts for three quarters of Mongolia's agriculture. The decline in public services for risk mitigation together with a shift in other forms of interventions has made the sector more vulnerable to adverse shocks. This is especially evident when analyzing the impact of Mongolia's most visible adverse shock – the severe winter weather events known as dzuds. The livestock sector is dominated by nomadic herders who rely heavily on available natural resources to cope with Mongolia's extreme weather conditions. The increase in animal numbers has meant less available pasture area per animal and less opportunity to mitigate the effects of hard winters and dzuds.

A more open economy and more reliance on export revenues from extractive industries have also exposed the agriculture sector to external macro-economic shocks and international price volatility. The country's mostly traditional livestock sector is becoming more market-oriented, and increasingly exposed to these external risks.

Despite significant efforts by the Government of Mongolia to maintain response capacity in the event of an emergency, recent shocks to the sector and in particular the 2009-2010 dzud, resulted in large losses to producers and other actors in the sector, and revealed important gaps in existing risk management mechanisms. The *objective* of this report is therefore to *identify, analyze, quantify, and prioritize risks to the agriculture sector*, as well as to *identify areas of risk management that need further scaling up and strengthening*.

A good deal of work has been conducted on agricultural risks in Mongolia. Most of this has focused on livestock, and especially in connection to dzuds. This sector-wide assessment analyzes agricultural risks more comprehensively, covering both livestock and crops at production, market, and enabling environment levels. It ranks and prioritizes these risks based on their importance to agricultural performance and their impacts on stakeholders. It also provides an overview of current risk management mechanisms and suggests ways to strengthen them, based on local needs and on experiences from other countries.

The team conducted quantitative and qualitative assessments of agricultural risks based on information provided by the Ministry of Industry and Agriculture, NEMA, other stakeholders, secondary information, and field interviews. A methodology designed by the World Bank has been applied to analyze the scope of the losses due to adverse shocks. Analysis of the sources, frequency and severity of agricultural risk relies on extended time series data, preferably for between 20 and 30 years. Relevant data were drawn from the FAOSTAT website, the National Statistical Office of Mongolia, and from World Bank Development Indicators. A field mission was undertaken in October and November of 2013 to consult with stakeholders, including herders, farmers, Government agencies, private sector investors, and donors.

The report was requested by the World Bank Country Management Unit (CMU) and the Government of Mongolia and is a self-standing part of an analytical series on Mongolia's

agriculture sector that was conducted in 2013-14. Financing was provided by the CMU and a Multi Donor Trust Fund (MDTF) supported by the Netherlands Ministry of Foreign Affairs and the Swiss Secretariat of Economic Affairs (SECO).

II. Agriculture in Mongolia - An Overview

With 1.55 million km^2 of land and 3 million people, Mongolia is one of the largest and least densely populated countries in the world. Its land-locked location, sprawling geography, and extreme climatic conditions further add to its unique characteristics – and to its vulnerability to risk. Steppe accounts for nearly 80 percent of the total land area and approximately 85 percent of the country is more than 1,000 meters above sea level. Some 70 percent (113 million ha) of the total land area is natural grazing land. Only 612,000 ha (0.5 percent) is classified as arable land, of which 480,000 ha is currently cultivated. The irrigated area is even smaller, at approximately 35,000 ha.

With its abundance of grazing land and harsh climate, Mongolia is most suited to extensive livestock production – with herders practicing nomadic and semi-nomadic pastoralism for hundreds of years. Currently, livestock production accounts for 75 percent of Gross Agricultural Output (GAO) in current prices and employs 30 percent of the economically active population. The limited area allocated to crop production is dominated by dry land wheat production; supplemented by other cereals, fodder crops, potatoes and other vegetables.

With its abundance of grazing land and harsh climate, Mongolia is most suited to extensive livestock production.

2.1 Agro-Climatic Conditions

A dry, continental climate predominates with major seasonal differences in temperature. Summer temperatures range from 15°C in the mountains to 45°C in the southern desert regions. Winter temperatures average -15°C in the coldest months and can fall as low as -40°C. Average annual rainfall is 230 mm but varies across agro-climatic zones, from 50 mm/year in the southern Gobi desert to 500 mm in the mountain areas in the north. The growing season ranges from 70-120 days, with most growth in the spring. This cold, dry climate results in high risks for both livestock and crop production, in both winter and summer.

There are six agro-ecological zones in Mongolia. With the exception of Alpine Tundra, each of them are important for livestock and crop production. Table 1 shows their relative importance in terms of land area, grazing area and livestock production. Most crop production occurs in the grassland steppe region of northern, central Mongolia.

The five main agro-ecological zones differ in terms of their livestock and pasture management systems, their sources and levels of risk, and the approaches to risk management that are employed by producers and other stakeholders. The Mountain and Forest Steppe zone has the highest concentration of livestock because it offers year round grazing, with a limited need for seasonal movement of livestock, adequate water, and shelter from winter storms. Inter-annual movement of livestock to other regions only occurs in very bad years. Seasonal livestock movements occur over much longer distances in the Mountain Taiga and Grassland Steppe regions, and inter-annual movements occur more often. Severe winters are a major risk in the mountain taiga

zones, while summer drought and limited access to grazing and water are more frequent problems in the grassland steppe zone. More variable climatic conditions in the desert steppe and desert zones oblige herders to move their livestock more frequently and over much wider areas. Pasture production patterns are less regular and there is greater reliance on inter-annual movement of livestock in response to adverse climatic conditions in both winter and summer.

Table 1. Main Agro-Ecological Zones of Mongolia					
Zone	**% of Total Area[1]**	**Average Annual Precipitation[1] (mm)**	**% of Grazing Area[2]**	**% of Livestock[2] (LSU)**	**Land Use[1]**
Alpine Tundra	3.0	na	na	na	Reindeer, Yaks
Mountain Taiga	4.1	300-500	22	14	Horses, cattle, yaks
Mountain and Forest Steppe	25.1	200-300	12	43	Year round grazing, all livestock except camels
Grassland Steppe	26.1	150-250	27	25	Year round grazing, all animals except camels. Crop production
Desert Steppe	27.2	100-200	24	14	Camels, horses and goats
Desert	14.5	< 100	15	5	Camels, horses and goats

Sources: [1]Johnson et al (2006); [2]Swiss Agency for Development and Cooperation (2010)

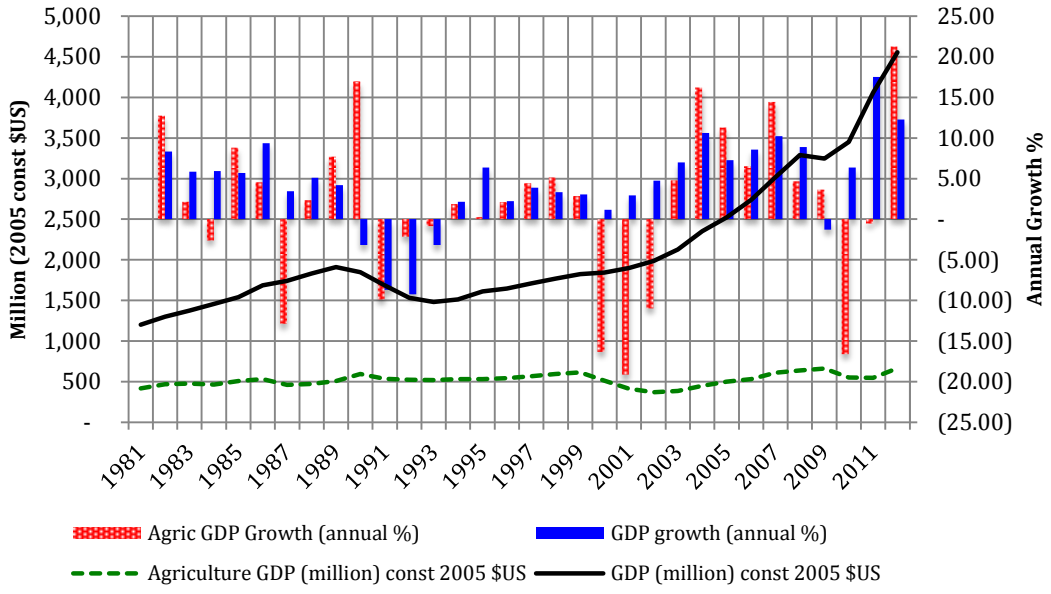
The impact of climate change is also apparent (SDC 2010). Average annual temperatures have increased by approximately 2°C during the last 60 years, increasing water losses from evapotranspiration. Precipitation patterns have also changed with an 8.7-12.5 percent fall in the central grassland steppe and desert regions and a 3.5-9.3 percent increase in the eastern and western regions. The impact of these changes is most severe in the central and desert regions, due to the combined impact of higher temperatures and lower rainfall. Elsewhere, precipitation has increased or stayed the same.

2.2 National and Agriculture Sector Growth

The level and sources of Mongolia's economic growth, and the contribution of agriculture to this growth, have varied markedly over the last 30 years. Three distinct patterns of economic management account for these differences: the centrally planned economy that lasted until 1989, a period of transition and structural reform from 1990-2000, and the acceleration of economic growth after 2000 in response to reform and the increasing influence of mineral extraction (Figure 1). An overview of these changes provides useful insight into the sources and levels of agriculture sector risk, their impact on overall impact growth, and the relative importance of short-term shocks versus medium-term economic transformation.

The final 10 years of central planning, from 1980 to 1989, was a period of moderate economic growth, punctuated by the impact of adverse climatic conditions on crop and livestock production in 1983-84, and a dzud in 1987-88 (See Box 1). Agriculture accounted for 30-35 percent of total GDP in the mid 1980's, so agricultural shocks had a marked impact on overall economic growth – particularly the dzud in 1987-88.

Figure 1. Trends in National and Agricultural GDP



Source: World Bank Development Indicators

Economic output fell sharply after the end of central planning in 1989 and the initiation of structural reform towards a market economy. Crop production collapsed quickly in the absence of public support for state-owned grain farms and livestock numbers also fell slightly initially. Livestock numbers then grew quickly after 1993, as herders responded to the removal of restrictions on livestock ownership and to open access to grazing land. Low growth characterized the period from 1995-1999, due to the impact of the Asian Financial crisis in 1997, the Russian Ruble crisis in 1998 and falling mineral prices, but structural reform continued. A succession of dzuds from 1999-2001 then resulted in a contraction of agricultural output, which remained important enough part of the economy to slow overall recovery.

Box 1. The Mongolian Dzud

Dzud is a Mongolian word for the impact of adverse climatic conditions on livestock numbers and livestock production. It typically occurs when a summer drought is followed by a harsh winter. Summer drought reduces the availability of grazing, weakening livestock and reducing their ability to build up the fat reserves needed to carry them through the winter. Harsh winter conditions result from blizzards, heavy and/ or long-lasting snow, extreme cold or ice-bound pasture – all of which limit the ability of animals to graze during the winter and cause death from extreme cold. As these conditions combine in different ways, herders denote the following types of dzud:

White Dzud. Caused mainly by heavy snowfall, leading to snow depths of more than 20 cm in the mountain areas and 10 cm in semi-desert areas.

Black Dzud. Caused by lack of water during summer, followed by lack of snow during winter.

Iron Dzud. Occurs when pasture is covered by a sheet of ice, which inhibits livestock movement and prevents them from uncovering grass under the snow.

The Mongolian Meteorological Service defines *Dzud* as a snow cover of more than 25 cms, a sudden prolonged snow storm, 2-3 cm of frozen snow cover, or prolonged extreme cold. *Dzuds* are also defined by their geographic coverage (a single valley or a whole ecological or administrative zone) and by their duration (severe *Dzuds* exceed 20 days). However, attempts have been made to isolate a limited set of climatic parameters that correlate with livestock losses but no strong relationship has been found, which makes mitigating for the impacts of dzuds more challenging.

Sources: UNDP-NEMA. Dzud National Report 2009-2010. November 2010; FAO, 2003

Dzud is a Mongolian word for the impact of adverse climatic conditions on livestock numbers and livestock production.

Strong economic growth has characterized the period since 2002, in response to economic liberalization and the widening impact of mineral extraction on exports, investment and employment. The agriculture sector has also grown strongly during this period in response to increasing livestock numbers, increasing cashmere exports and the growth of domestic demand for livestock products. National GDP fell in 2008-2009 in response to the global financial crisis and a fall in mineral prices, and agricultural GDP contracted sharply in 2010 following a particularly severe dzud. But rapid recovery followed both shocks. Agriculture sector growth has been much lower than economy-wide growth, nevertheless, with a consequent decline in agriculture's share of GDP from 35 percent in 1981 to 15 percent in 2012 measured in constant 2005 US dollars.

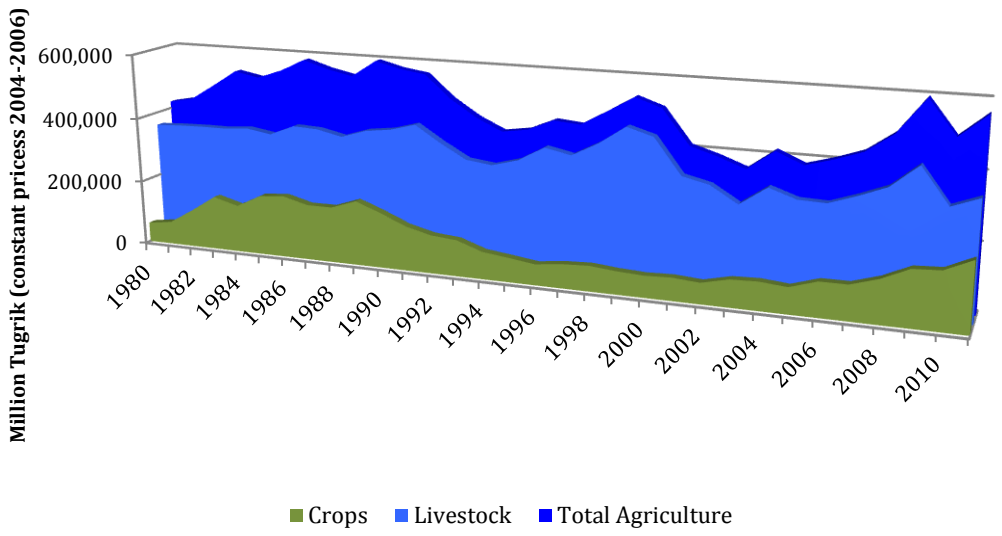
Agriculture sector shocks appear to have a moderate impact on the overall economy, even though the variability of agriculture sector growth is much higher than that for overall economic growth. GDP growth rates fell in response to the major dzuds of 1999-2002 and 2010, but there was no economic contraction. Structural reform during the early 1990s and exogenous shocks in 1997-1998 and 2008-2009 had much greater impacts on the national economy.

2.3 Aggregate Livestock and Crop Production

Analysis of GAO (in constant prices) shows the respective contributions of livestock and crop production to both overall GAO and the variability of GAO (Figure 2). Note that trends in livestock GAO represent changes in the value of livestock output. Changes in livestock numbers are captured, nevertheless, as GAO is measured as the number of livestock multiplied by the average output per animal. Livestock production is the major source of GAO, ranging from 86 percent in 1980 to 63 percent in 2011 in constant prices (FAOSTAT). Crop production exhibits much higher overall variability, with volatility[3] of 20.46 versus 10.81 for livestock production. The sources and levels of risk for each subsector have changed markedly over time, as discussed below.

[3] Volatility is measured as the standard deviation of the percent annual change in livestock and crop production (World Bank Development Report, 2013).

Figure 2. Components of Gross Agricultural Output



Source: FAOSTAT

The impact of Mongolia's three different periods of economic management is also apparent in Figure 2. The state retained wide-ranging control of livestock production through collectively owned *negels* during the final decade of planning from 1980 to 1990. Most livestock was state-owned and access to grazing was closely controlled in order to balance livestock numbers with the availability of feed resources. Winter forage production was also emphasized to protect against dzuds. These measures helped to minimize livestock losses during adverse climatic events, as shown by the modest impact of the 1987 dzud on livestock GAO. In contrast, crop production became a major source of agriculture sector risk during this period, as the socialist government sought to raise cereal production on state owned grain farms. Despite the limited suitability of Mongolia's land and climate for cropping, cereal cultivation was increased from 557,500 ha in 1980 to 673,400 ha in 1989 through expansion onto grazing land. Crop yields became more variable as a result, and crop production more risky.

Crop production collapsed during the period of transition and structural reform from 1990-2000. By 2000 cereal cultivation had fallen by 71 percent to 195,000 ha and cereal yields had fallen from 1.21 t/ha (average for 1987-89) to 0.67 t/ha (average for 1997-99). The cultivation of forage crops also fell, from 118,000 ha in 1990 to less than 1,000 ha in 2000 (NSO). Livestock output fell from 1990 to 1994, and then increased steadily as herders responded to the end of government controls on livestock ownership and access to grazing. The combination of increased livestock numbers and minimal forage production left herders highly exposed to the succession of dzuds that occurred from 2000 to 2002.

The post-reform period since 2000 has been characterized by the growth of both crop and livestock production. But crop production has become much less variable and livestock production more variable – in marked contrast to the pre-reform period. Cereal cultivation had increased to approximately 300,000 ha by 2012, with an average yield of 1.5 t/ha (2009-12), in response to subsidies and the adoption of modern systems of conservation agriculture. The combination of continued growth in livestock numbers, overgrazing, and inadequate forage production has further increased the

vulnerability of livestock production to adverse climatic events – as witnessed by the huge livestock losses following the dzud of 2009-2010.

This overview of recent political and economic history highlights the extent to which agricultural policy can influence the vulnerability to risk. Pre-reform policies helped to reduce the risks of livestock production, while significantly increasing the risks associated with crop production. Post-reform policies have had the opposite effect, reducing the risk of crop production and raising the risks of livestock production. Discussion in the next two chapters provides further insight into the reasons for these changes.

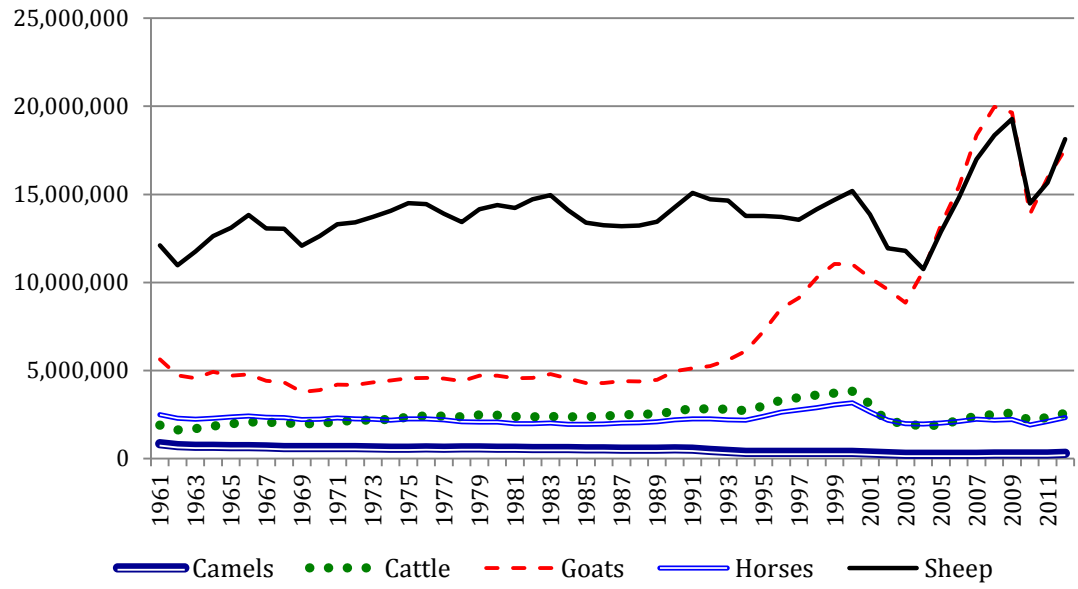
III Trends and Characteristics of Livestock Production

Sustainable livestock production depends on maintaining a balance between livestock numbers and available pasture resources

In a pastoralist management system, sustainable livestock production depends on maintaining a balance between livestock numbers and available pasture resources, supplemented where feasible with forage production. In principle, herders achieve this balance by moving their livestock according to grazing availability at different times and in different areas, relative to the requirements of their livestock. In practice, public ownership of grazing land makes this system increasingly difficult to sustain when livestock numbers and grazing pressure increase. This chapter examines trends in livestock numbers and the corresponding availability of communal grazing and forage production since the 1980s, and considers the impact of these trends on vulnerability to risk, and the losses incurred from adverse events.

The relative stability of livestock production during the era of central planning is illustrated in Figure 3, which shows the evolution of livestock numbers since 1961. Herd composition was also relatively stable during this period, with sheep as the major source of livelihoods. Reform resulted in a rapid (122 percent) increase in goat numbers from 1990 to 2000 in response to the high demand for cashmere and the higher fecundity and shorter breeding season for goats. Cattle and horse numbers increased by approximately 40 percent from 1990 to 2000, while sheep numbers stayed more or less constant and camel numbers declined. Hence, in addition to increasing grazing pressure, the doubling of goat numbers also dramatically changed herd composition.

Figure 3. Trends in Livestock Numbers



Sources: FAOSTAT, NSO

Livestock numbers fell sharply in response to the successive dzuds of 2000-2002, with high losses across all livestock groups. Both goat and sheep numbers then recovered rapidly from 2002 to 2009, reaching even higher levels than before, while cattle and horse numbers recovered partially and camel numbers continued their long-term decline. These changes further altered herd composition, with sheep and goats now in equal numbers. Both goat and sheep numbers fell sharply again during the dzud of 2010, together with a fall in horse and cattle numbers. However the 2010 dzud did not result in any further changes to herd composition.

Reform has thus contributed to a major increase in the year-to-year variability of livestock numbers, with a particularly sharp increase since 2000, as shown by a comparison of the observed volatility for each of the three decades since 1980 (Table 2). The underlying reasons for this increase in volatility, and its implications for the risks of livestock production are the focus of the remainder of this chapter.

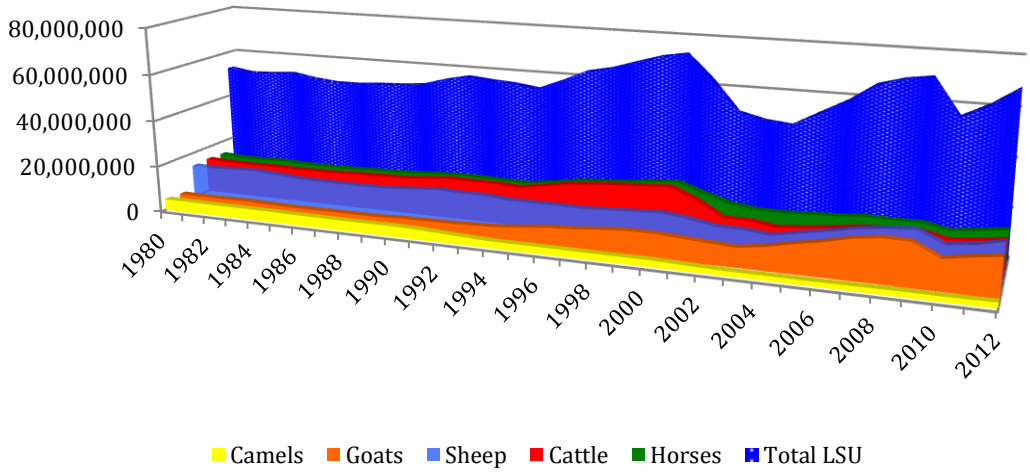
Table 2.	**Volatility of Livestock Numbers by Decade 1980-2012**				
	Sheep	**Goats**	**Cattle**	**Horses**	**Camels**
1981-1990	3.56	4.85	2.48	2.75	1.03
1991-2000	3.60	6.20	4.41	4.17	5.42
2001-2012	13.93	15.76	14.68	9.81	6.56
All Years	8.66	10.64	9.32	6.78	5.08

Source: FAOSTAT, NSO

The overall impact of these changes in livestock numbers can be discerned by converting livestock numbers to Livestock Units (LSU), which reflect the requirements of different animals for feed.[4] Figure 4 confirms the extent to which the overall increase in livestock numbers has been driven by the increase in goat numbers. It also shows that goats, sheep, cattle, and horses now compete equally for grazing, in contrast to 1980 when the demand for grazing for goats was relatively low. The increase in goat numbers has been most pronounced in the Khangai region, which accounts for most of the mountain and forest steppe zone, where grazing pressure is highest (Table 1).

[4] Sheep = 1 LSU; Goats = 0.9 LSU; Cattle = 6 LSU; Horses = 7 LSU; Camels = 8 LSU (FAO, undated).

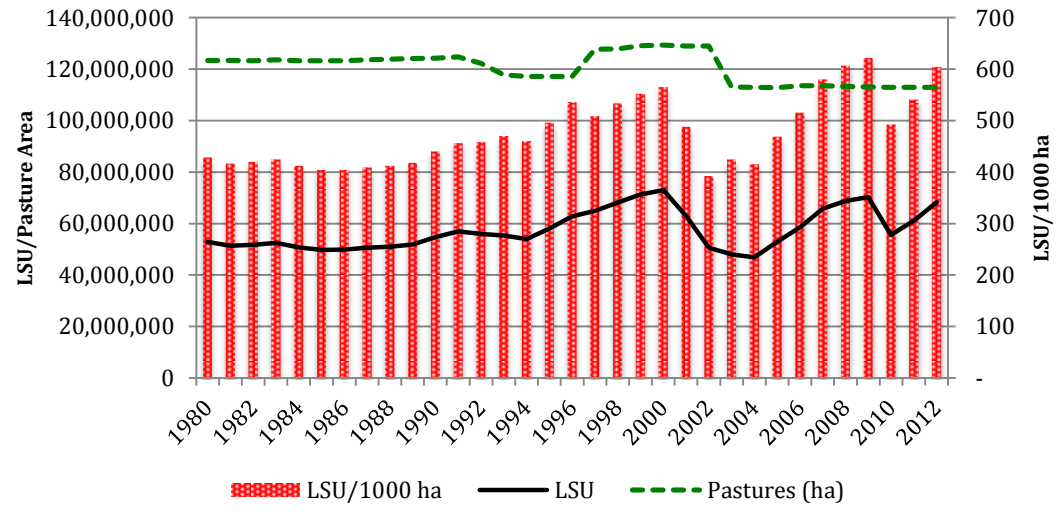
Figure 4. Trends in Livestock Units



Sources: FAOSTAT, NSO

The impact of these changes on grazing pressure, and its implications for risk, is shown in Figure 5. Stocking rates were fairly constant during the 1980s, at approximately 400 LSU/1000 ha of pastureland. They then increased to 570 LSU/1000 ha in 2000 in response to rising livestock numbers. The losses caused by the sequence of dzuds from 2000-2002 then reduced stocking rates to their pre-reform level. Stocking rates returned to even higher levels in 2009 in response to the recovery of livestock numbers, and a reduction in grazing land due to its transfer to settlements, mining, roads and protected areas. Stock losses during the 2010 dzud reduced stocking rates slightly but they have since recovered to 600 LSU/1000 ha – a 41 percent increase from 1980.

Figure 5. Trends in Grazing Pressure

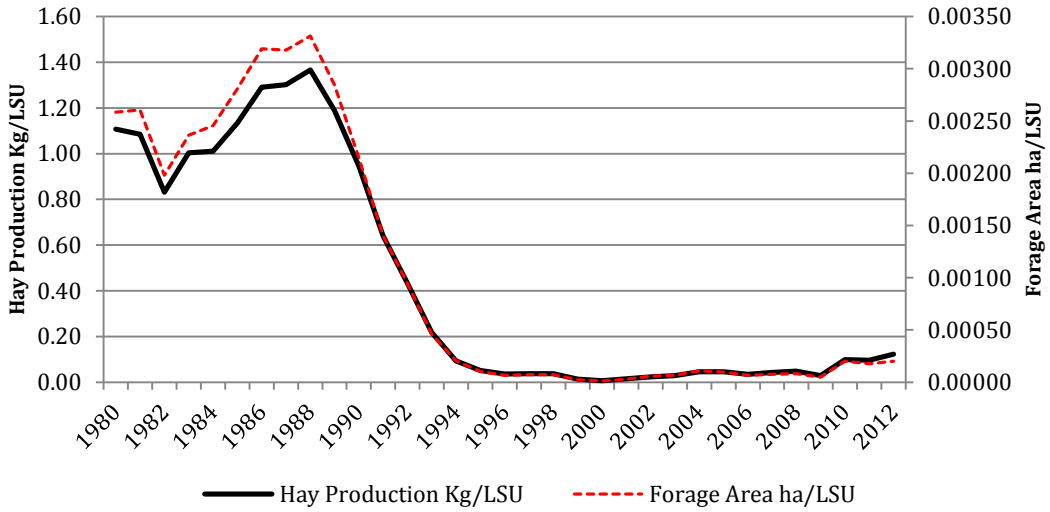


Sources: FAOSTAT, NSO

Parallel trends in hay and forage production have reduced the availability of winter feed, further exposing livestock production to the risk of dzuds (Figure 6). Hay production, which accounts for approximately 85 percent of conserved feed, rose from 1.1 kg/LSU to 1.37 kg/LSU during the 1980's in response to strong government support. It then plummeted to 0.01 kg/LSU in 1999 in the absence of both public and private efforts to

maintain pre-reform production levels. A slight recovery has occurred since the 2010 dzud, but overall hay production remains low at 0.12 kg/LSU. Forage production, measured as the forage area cultivated, follows an identical trend, and for the same reasons. Note also that both hay and forage production/LSU are low in absolute terms. Even in the pre-reform period total reserves amounted to approximately 15-20 days of conserved feed/LSU/year. Any reduction from this low level leaves herders highly vulnerable to the loss of grazing from a dzud. Local government authorities are now encouraging herders to increase hay production and improving the storage and management of public hay reserves, but the overall level of reserves – public or private – remains inadequate.

Figure 6. Trends in Hay and Forage Production

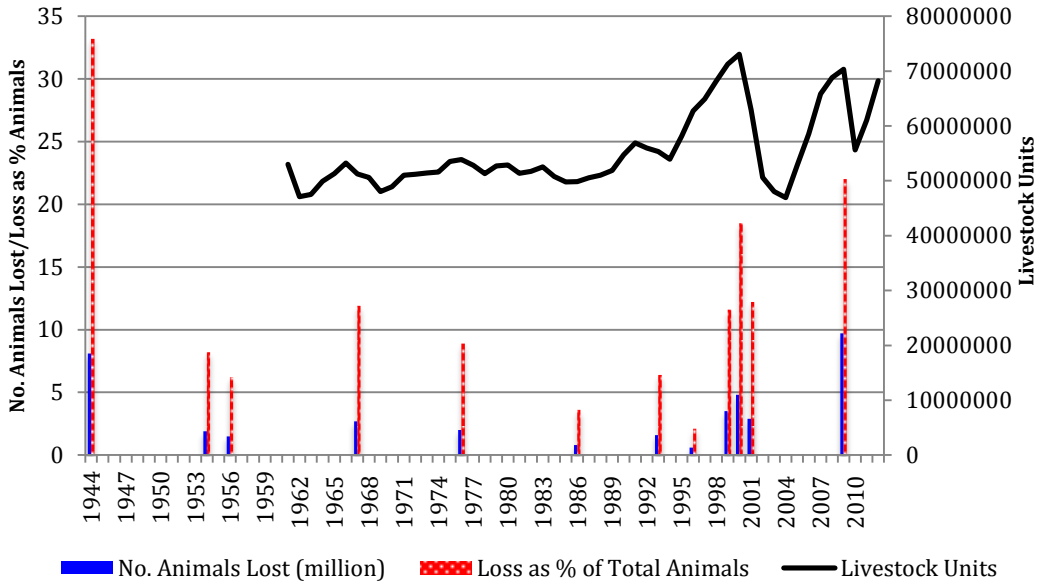


Sources: FAOSTAT, NSO

The liberalization of livestock production in combination with a reduction in Government sector employment after reform encouraged many new herders to enter the sector. In the decade following de-collectivization, the number of herdsmen rose by 70 percent, from 247,450 in 1991 to 421,400 in 2000. Most of these new herdsmen lacked the experience to manage livestock successfully in harsh conditions. They incurred heavy losses during the dzuds of 2000-2002 and a high proportion left herding as a result. The number of herdsmen has continued to fall since – to 289,400 in 2012. The entrance of new herders in the sector and their apparent exposure to dzuds and other risks highlight the need for strong programs for herder education, particularly through traditional "apprentice" systems. By working for experienced herdsmen for 3-4 years, new herders acquire an understanding of seasonal pasture production patterns, the suitability of different pasture types to different livestock, access to water, livestock husbandry, feed conservation and strategies for risk management.

Climate change has added a further dimension to the risks of livestock production, over and above the impact of policy change, overgrazing and herder dynamics (SDC, 2010). Increased temperatures have been accompanied by higher precipitation in the western and eastern regions and lower precipitation in the central and desert regions. The frequency and severity of winter and summer drought has increased as a consequence, as observed by the succession of dzuds since 2000.

Figure 7. Frequency and Impact of Dzuds (1944-2012)



Sources: FAOSTAT, NEMA, UNDP

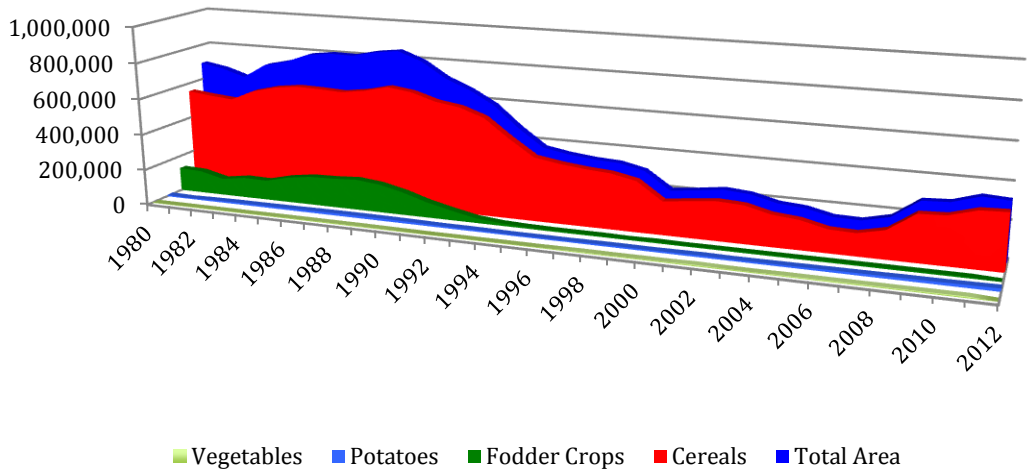
The relative impact of human-induced versus climate change factors on the frequency and severity of production shocks is difficult to gauge. Figure 7, which depicts the incidence and impact of the worst dzuds since 1945, shows clearly that there has been a marked increase in the frequency and impact of dzuds since 1999. It also shows that the increased impact of dzuds coincides with the post-reform increase in livestock numbers and grazing pressure. This suggests that while the increased frequency of dzuds is attributable to climate change, the increased impact of these dzuds is also attributable to to human factors.

IV Trends and Characteristics of Crop Production

Crop production currently accounts for approximately one quarter of GAO (in current prices), despite the limited suitability of Mongolia's land and climate for cropping. Wheat is the most important crop with 86 percent of the total area cropped. All cereals combined account for around 90 percent of the total area cropped (Figure 8). Potatoes are the next most important crop with 5 percent of the total area, followed by fodder crops (4 percent) and vegetables with 1-2 percent. Crop production risks are inherently high owing to Mongolia's low rainfall and reliance on dry land production systems. These risks are further increased by the narrow production base, the limited resultant capacity to diversify this risk, and the concentration of crop production in northern central Mongolia. Crop production risk is thus both high and highly covariate.

In Mongolia, crop production currently accounts for approximately one quarter of Gross Agricultural Output (in current prices).

Figure 8. Crop Area (ha)

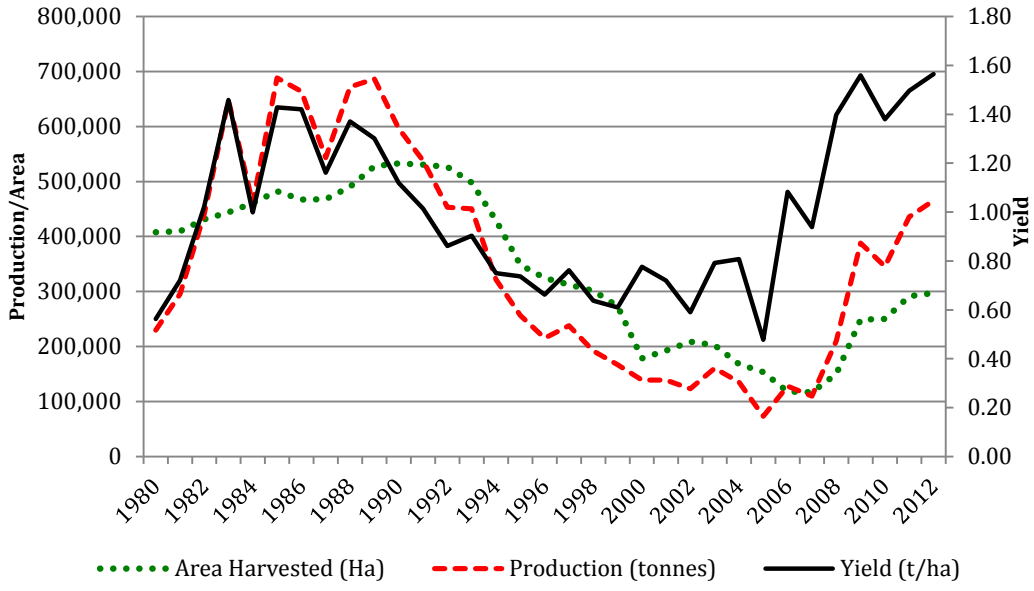


Sources: FAOSTAT, NSO

The Government sought to increase cereal production during the 1980s by assisting the large state-owned cropping farms to expand wheat production onto grazing land. Much of this land was unsuitable for cropping, however, and it became barren and useless for either crop or pasture production. Crop production then plummeted after independence, from 797,300 ha in 1990 to 146,700 ha in 2004, due to the collapse of the state-owned crop farms.

Wheat production began to recover in 2007 as private, corporate farms took over the state-owned grain farms (Figure 9). Largely as a result of Government subsidies, these new farms have invested heavily in large-scale cultivation and harvesting machinery and have introduced the management practices required for modern conservation agriculture. Wheat is now harvested every second year to allow adequate moisture to be replenished in the soil, as practiced in the extensive, dry land cropping regions of North America and parts of Kazakhstan. Production has quadrupled since 2007, with a doubling of the area planted and higher and more stable yields. The Government is now encouraging further expansion of cereal production, hopefully in a more sustainable manner than during the pre-reform period.

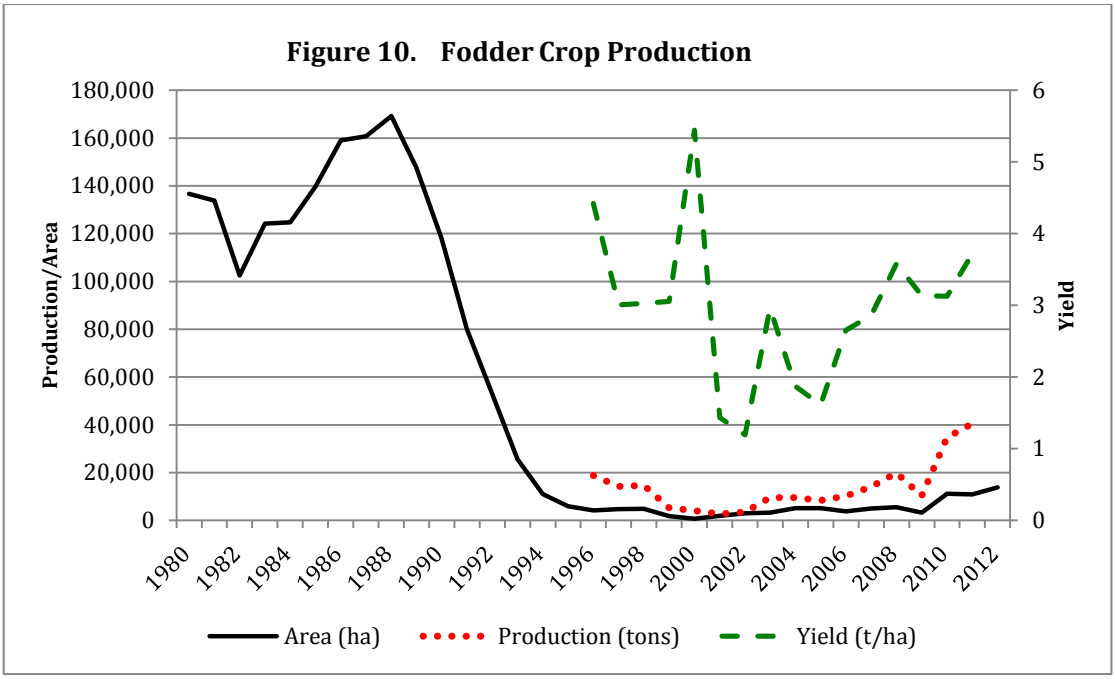
Figure 9. Wheat Production



Sources: FAOSTAT, NSO

The area allocated to fodder crop production is only 10 percent of what it was in 1980 (Figure 10). Production increased sharply after the 2010 dzud in response to increased area and higher yields, but it remains a minor component of overall crop production despite its importance for livestock production. Supply is constrained by the limited amount of land suitable for crop production. Fodder demand is growing in response to increased livestock numbers and the increased risk of dzuds, but herders prefer to increase hay production rather than grow or buy fodder. Most of the current demand for fodder comes from intensive livestock farmers that produce milk and meat for urban markets, but this represents a small component of total livestock production. In addition, NEMA contracts fodder production for emergency reserves and for distribution during harsh weather conditions, and little effort is being made to encourage private production and distribution chains.

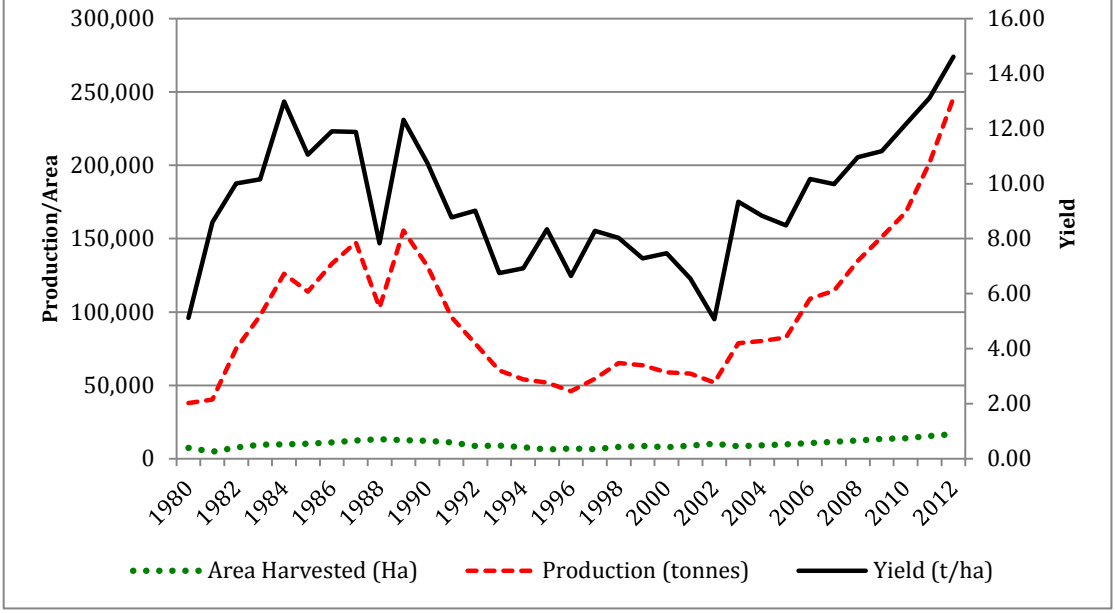
Figure 10. Fodder Crop Production



Source: NSO

Potatoes are grown in most parts of Mongolia for household consumption. Commercial production is strongest in the Central region, which accounts for 60 percent of the total area and 70 percent of total output. Production fell after independence, as with other crops, due to a fall in yields and area (Figure 11). A strong recovery began in 2003, with a threefold increase in production by 2012, driven by increases in both yield and area. Yields also appear to have become more stable. Most of this increase in production has occurred in the Central Region and in response to growing demand on urban markets.

Figure 11. Potato Production



Source: NSO

V. Agriculture Sector Risks

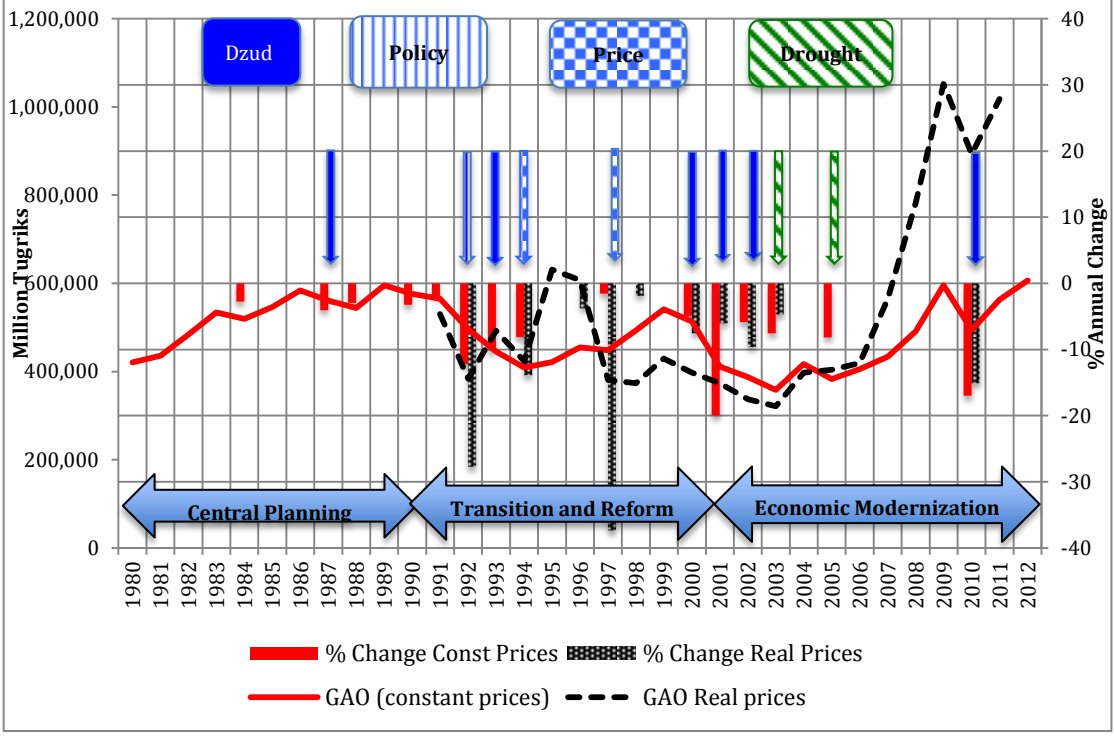
The main sources of risk to Mongolia's agricultural sector are reviewed in this chapter. The risks fall under three categories: production risk, price risk and a general set of risks associated with the enabling environment for agriculture.

Box X. Defining Agricultural Risk

In this report, risk is defined as exposure to a significant financial loss or other adverse outcome the occurrence and severity of which is unpredictable. It thus implies exposure to substantive losses, over and above the normal costs of doing business. Agriculture is inherently variable as producers incur moderate losses every year due to sub-optimal climatic conditions at different times in the production cycle and/or modest departures from expected prices. For the purposes of this report, risk refers to the more severe and unpredictable adverse events that occur beyond these smaller events, measured as the inter-annual variation of the value of output.

Figure 12 depicts the impact of these risks on aggregate agricultural output. It is based on analysis of trends and inter-annual variation of GAO, juxtaposed with information on the occurrence of different shocks for the period 1980-2012. GAO is measured in both constant prices, to show how these shocks impact production alone, and in real prices to show the combined impact of these shocks on prices and production. The analysis of GAO in real prices is for the period 1991 onwards because inflation data were not reported prior to 1991.

Figure 12. GAO: Trends and Adverse Events



Sources: FAOSTAT, World Development Indicators, Various news sources.

A number of salient factors are apparent in this graphic. Note first that while livestock related shocks are the most widely observed source of variability in GAO, not all shocks are the result of dzuds. Drought also has an impact and price and policy shocks were

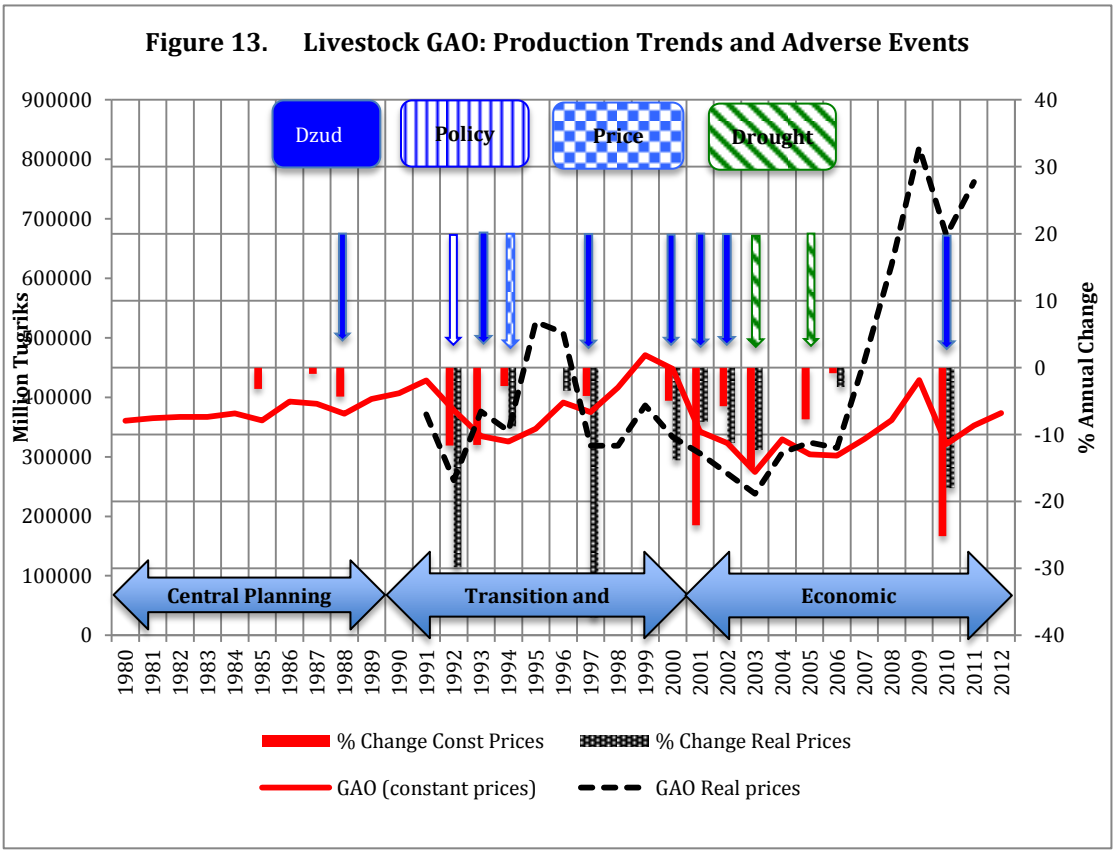
severe during the period of transition. It is also apparent that many of the officially reported "shocks" to output actually have a modest influence on GAO. Only six of the sixteen downside variations depicted above lead to a fall in GAO greater than 10 percent, and only two lead to falls of more than 20 percent. Comparison of change measured in constant versus real prices also shows that the worst shocks are the result of adverse changes in both production and prices – as evidenced by the fall in real GAO in 1997. Finally, it is pertinent to note the relatively low impact of the "shocks" to GAO during the central planning period prior to 1990. The benefits of economic reform do not yet appear to have extended to agricultural risk management.

5.1 Livestock Risks

Although dzuds are the most important source of livestock production risk, they are not the only risk. Blizzards and drought are further risks together with livestock disease, fires, sandstorms, and price volatility. The impact of the main livestock risks on livestock GAO is depicted in Figure 13, for the period 1980-2012, using the same methodology as above. Dzuds and droughts are the main risks. As for total GAO, a high proportion of the observed "shocks" to the livestock sub-sector have a moderate impact. Of the fifteen observed downside changes to livestock GAO, eight result in a drop of less than 10 percent and only four result in an inter-annual decline of more than 20 percent. The impact of the worst shocks is also most severe when measured in real terms, suggesting that both production and prices are affected.

Dzuds, blizzards, drought, disease, fires, sandstorms, and price volatility all pose risks to livestock production.

Figure 13. Livestock GAO: Production Trends and Adverse Events



Sources: FAOSTAT, World Development Indicators, Various news sources

5.1.1 Dzuds, Blizzards and Frosts

Twelve dzuds have occurred since 1944, as reported by the National Programme on Protection for Livestock from Droughts and Dzuds (Table 3). Livestock losses varied from 0.6 million head in 1996-97 to 9.7 million head in 2009-2010. Measured as a proportion of total animals, the 1944-45 dzud was the most severe with losses equivalent to 33.2 percent of the national herd, followed by the 2009-10 dzud with losses of 22 percent. The impact on particular livestock species appears to vary according to the type of dzud and the region it affects, with sheep and goat losses highest in the 2009-2010 dzud and cattle and horse losses highest during the succession of dzuds from 1999-2002. Many of the reported dzuds had a minimal impact on overall livestock output, as noted above, although their impact was devastating for affected herders and communities.

Table 3: Frequency and Impact of Dzuds – 1944 to 2012

Year	Adult Animal Losses (million)	As % of National Herd
1944-1945	8.1	33.2
1954-1955	1.9	8.2
1956-1957	1.5	6.2
1967-1968	2.7	11.9
1976-1977	2.0	8.9
1986-1987	0.8	3.6
1993	1.6	6.4
1997-1997	0.6	2.1

1999-2000	3.5	11.6
2000-2001	4.8	18.5
2001-2002	2.9	12.2
2009-2010	9.7	22.0

Source: Dzud National Report 2009-2010. UNDP-NEMA

Available data suggest that blizzards have a much lower impact on livestock production than dzuds (Table 4). The blizzards of 1980 and 1992 are the only ones that appear to have had a significant impact on livestock numbers and GAO, with relatively low losses in the others. Severe frosts in 2003 also resulted in heavy livestock losses. Blizzards and dzuds are difficult to distinguish, however, and a blizzard can be one of the causes of a dzud. Frosts can also be associated with dzuds.

Table 4: Frequency and Impact of Blizzards and Frosts– 1980 to 2012

Year	Adult Animal Losses (million)	As % of National Herd
1980	0.6	2.5%
1988	0.01	**
1991	0.006	**
1992	0.5	2.0%
1993	0.1	0.4%
1995	0.048	0.2%
1996	0.01	**
2003 (frost)	0.21	0.84%

** Less than 0.05 percent
Source: FAOSTAT; Project data, varying sources

5.1.2 Droughts and Feed Shortages

Although most droughts are associated with dzuds, droughts occurred independently of dzuds in 1980, 2003, 2005 and 2006 (Table 5). There are no official data on the impact of the droughts in 2003, 2005 and 2006 although corresponding trends in livestock numbers and livestock GAO suggest that the impact was minimal. The impact of the droughts in 2000, 2001 and 2009 is attributed to the dzuds during these years.

Table 5: Frequency and Impact of Droughts – 1980 to 2012

Year	Adult Animal Losses (million)	As % of National Herd
1980	1.5	6.2
2000	Associated with dzud	na
2001	Associated with dzud	na
2003	Associated with frosts	na
2005	No data	na
2006	No data	na
2009	Associated with dzud	na

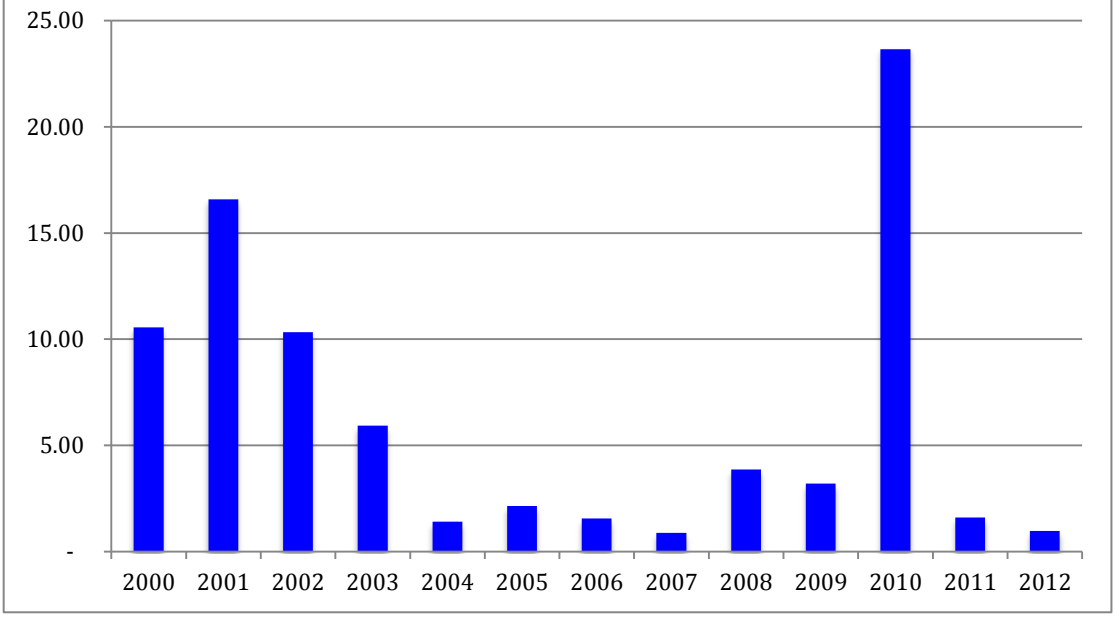
Source: FAOSTAT; Project data, varying sources

5.1.3 Livestock Disease

During "normal" years, total livestock losses are very low. Official records for the period 2000-2012 show that total livestock losses averaged 2.4 percent during the years from 2003-2009 and 2011-2012 (Figure 14). As livestock disease is the major source of loss during these (non-shock) years, this suggests that the underlying risks from livestock

disease are very low. Good animal husbandry and an effective system of public and private veterinarians explain much of this low risk.

Figure 14. Livestock: Average Annual Loss (%)



Source: NSO, Statistical Year Books

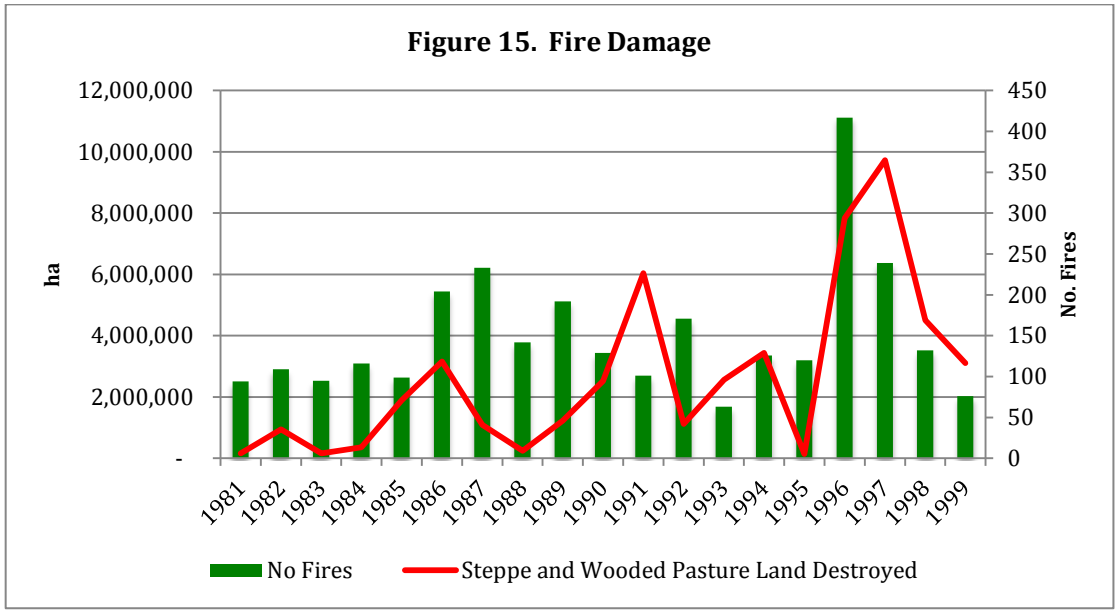
The major disease risk appears to come from foot and mouth disease, for both domestic and wild, cloven-hoofed animals. Foot and mouth outbreaks infected 45,000 domestic animals in 2001 and 20,500 domestic animals in 2010. Both outbreaks occurred in the eastern border aimags of Dornod and Sukhbataar, suggesting that infection came from across the border. A further outbreak infected 1.5 million gazelles in 2011, showing that wild animals are also at risk (and a source of infection). The relatively low number of domestic animals infected in the first two outbreaks suggests that the risk of foot and mouth is low at the national level, although it may be much higher at regional (aimag) level.

The latent risk to such a large livestock sub-sector is high nevertheless, first because it is difficult to prevent cross-border transmission in a country with long, sparsely populated border regions and highly mobile livestock populations; and second because transmission via wild animal populations is even more difficult to control. Border closures after the foot and mouth outbreak of 2001 have also made live animal exports to Russia and China virtually impossible, depriving the sector of a proven source of revenue. Export earnings fell from US$ 1.2 - US$3.5 million prior to 2001, to less than $50,000 by 2004, with no sign of recovery as of 2012.

5.1.4 Fire

Wild fires occur annually in the mountain forest and steppe zones, mostly during the spring months from March to June, with an average of 50-60 forest fires and 80-100 steppe fires each year. Approximately two-thirds of these fires occur in the northern aimags of Bulgan, Selenge and Khovsol where livestock production is less important (IFFN, 2002). From 1981 to 1999, these fires destroyed an average of 2.64 million ha of grazing land/year (IFFN, op cit), equivalent to approximately 2 percent of total pasture

land. Approximately 95 percent are caused by human activity, but the frequency and severity of wildfires increases markedly in dry years.



Source: International Forest Fire News.

Figure 15 shows that the worst recent fires occurred in 1996 and 1997, following a period of very dry winter and spring months. These fires resulted in the deaths of 29 people, the destruction of 218 houses and the loss of 11,700 animals. Approximately 7.83 million ha of pastures and wooded grazing land was destroyed in 1996 and 9.73 million ha in 1997 – equivalent to 7 percent of total grazing land.

5.1.5 Rodents

Available research suggests that rodents infest some 40 million ha of pasture, of which 19 million hectares is heavily infested (Nolte, 1996). Of the more than 60 species of rodent in Mongolia, Brandt Voles are regarded as the greatest threat. In heavily infested areas they consume up to 80 percent of vegetation during the spring growing season. Their burrowing also damages pasture roots, slowing pasture recovery and changing pasture composition. Eradication programs covered approximately two million hectares a year prior to 1990. This fell to approximately 100,000 ha a year during transition but rose to 620,000 ha in 2013 (NEMA).

As grazing pressure increases, the risks posed by fires and rodents are likely to become more acute, principally through their impact on pasture availability. Future risk management strategies will therefore need to assign higher priority to mitigating these two hazards.

5.1.6 Other Risks

Livestock production is subject to a range of other hazards, including dust storms, floods, predation, and theft. None of these hazards has a major impact at the aggregate level, as suggested by the level of livestock losses reported in Figure 14 for "normal" years and the hazard specific data in Table 6.

Table 6: Frequency and Impact of Selected Other Risks– 1980 to 2012

Year	Pasture/Adult Animal Losses (million)	As % Pasture/National Herd
Dust Storms		
1992	5.1 million ha pasture	4.1% of total grazing
2002	0.030 million animals	0.1% of total herd
2008	0.242 million animals	0.6% of total herd
2009	0.323 million animals	0.7% of total herd
Floods		
1993	0.015 million animals	0.06% of total herd
2009	** (1700 animals)	**

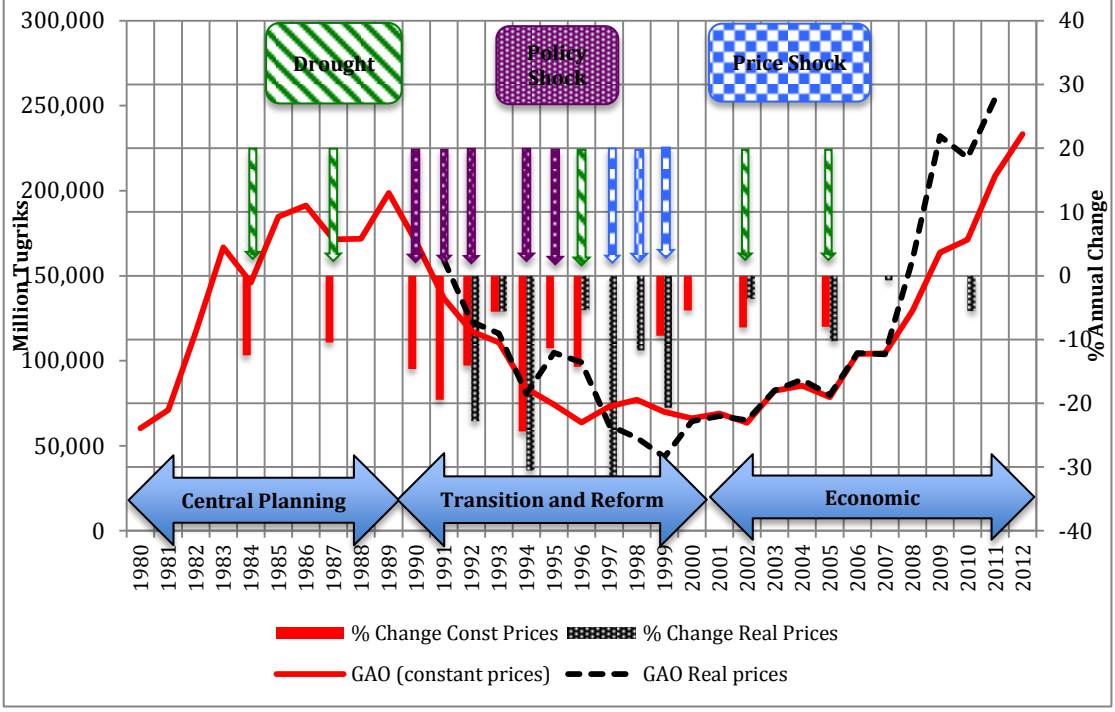
**Less than 0.05 percent
Source: FAOSTAT; Project data, varying sources

Dust storms occur in the spring, particularly in the southern desert regions. Livestock losses from the worst of these storms have ranged from 29,800 animals in 2002 to 322,844 in 2009. Heavy spring rains can lead to *flooding*, although available data shows that livestock losses are low – ranging from 1,700-15,000. There are no data on the impact of *predation* by wolves, leopards, bears, foxes and birds of prey; or from *animal theft,* although their impact is unlikely to be significant.

5.2 Crop Production Risks

Most of the observed shocks to crop production are the result of adverse climatic conditions, policy shocks associated with transition and price volatility. Figure 16 below shows downside variation in half of the years from 1980 to 2012, with GAO falling by more than 10 percent in 11 of 33 years. Policy shocks during the transition period from 1990 to 2000 accounted for half of these events. It is also noticeable that these transition policy shocks had a larger impact on GAO than shocks associated with adverse climatic events and price volatility. The risk of crop disease is low as a result of Mongolia's freezing winters.

Figure 16. Crop GAO Production Trends and Adverse Events



Sources: FAOSTAT, World Development Indicators, Various news sources

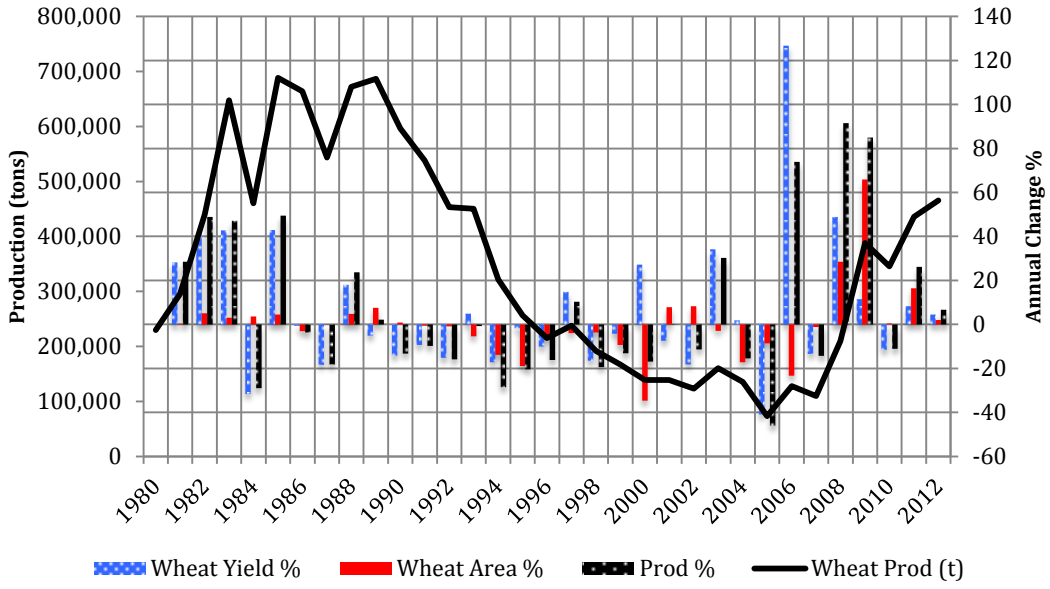
Most of the transition policy shocks resulted from successive reductions in the area cultivated due to the loss of government support for state owned crop farms. Yields also fell owing to lack of fertilizer and seed. With the main components of the economic transition now being completed this source of policy risk is now unlikely to recur. The adoption of modern conservation agriculture should also reduce production risks, as indicated by the relatively low frequency and severity of observed production shocks since 2000.

While the timing and magnitude of crop production shocks are evident from time-series data, there is less clarity on why these shocks occur. Available information refers to "crop failure" and "drought," rather than specifying whether yields fell as a result of moisture stress during crop maturation, or adverse weather conditions during harvest which can reduce both yield and area. Sharp production declines are also observed during dzud years, presumably in response to the summer droughts that precede harsh winter conditions. Short-term crop production shocks are thus attributed to "drought" for purposes of analysis, where they result from yield shocks. Sharp area variations typically occur in response to policy (e.g. transition) or market risks. Analysis focuses on wheat and potatoes, which account for 75-80 percent of total crop GAO.

5.2.1 Wheat Production Shocks

For the period 1980-2012, wheat production was subject to severe shocks (more than 25 percent fall in production) in 1984 and 2005 (Figure 17). In each case, the fall in production was due to a sharp yield decline resulting from drought. The lesser production shocks in 1996 and 1998 are also attributed to drought, and the shocks in 1987 and 2000 to the drought related impact of dzuds. Further sharp declines in production in 1992, 1994 and 1995 are attributed to the longer-term impact of transition and structural reform.

Figure 17. Wheat Production Shocks

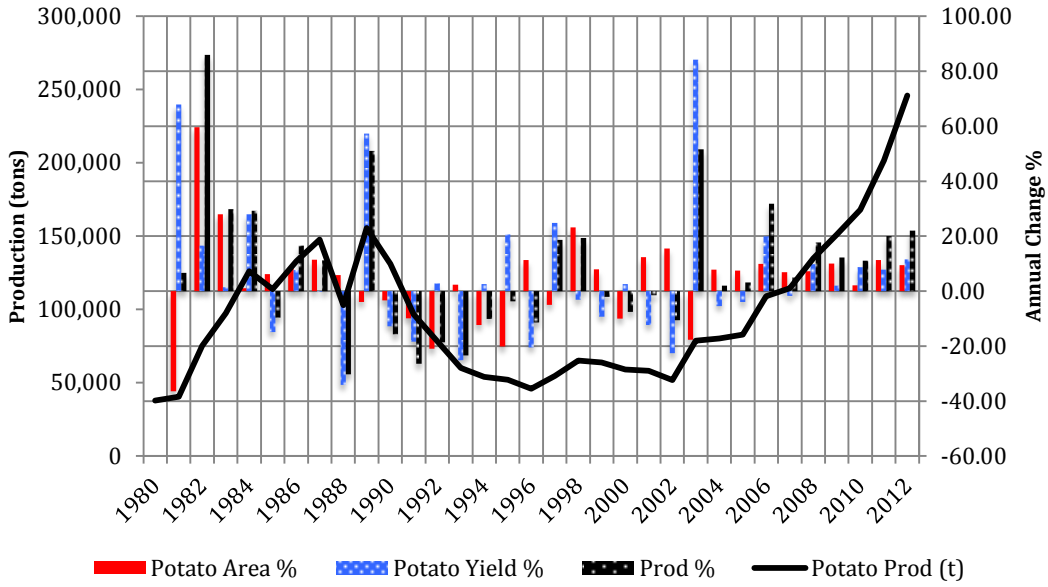


Source: FAOSTAT

5.2.2 Potato Production Shocks

Climate related shocks to potato production are less numerous and less severe than for wheat. Both the incidence and severity of these shocks have also fallen dramatically since the onset of economic recovery in 2000 (Figure 18). The largest, climate related production shock occurred in 1988 in association with the 1987/88 dzud. Two smaller dzud related production shocks occurred in 1993 and 2002. Further production shocks in 1990, 1991 and 1992 are attributed to the longer-term impact of transition and structural reform.

Figure 18. Potato Production Shocks

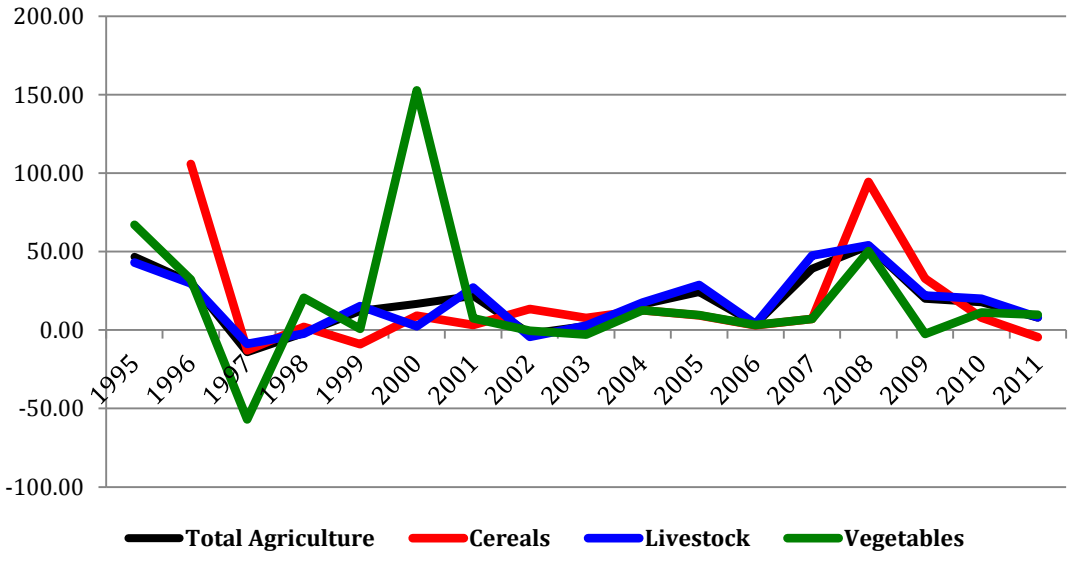


Source: FAOSTAT

5.3 Price Risks

The analysis of price risk focuses on producer prices for live animals and the six main agricultural commodities: beef, mutton, cow milk, wheat, potatoes and cashmere – which together account for 75-80 percent of GAO. General trends in producer prices are evident in Figure 19 below. The most severe, generalized price shock occurred in 1997 in response to the Asian financial crisis that resulted in economic contraction regionally depressing prices of major commodities, including agricultural commodities. A generalized producer price "correction" also occurred in the aftermath of the global food price crisis in 2009.

Figure 19. Annual Percent Change in Agriculture Producer Price Indices



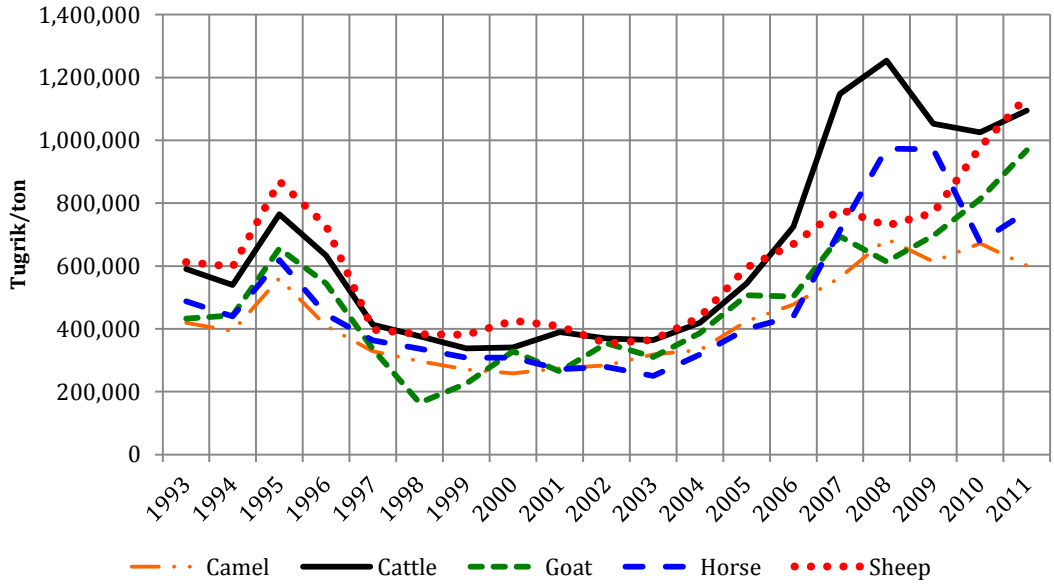
Source: FAOSTAT

Analysis draws on annual producer prices for the period 1993-2011 except for meat and cashmere where price data were limited to the period 2003-2012. Real prices (2005=100) were used to remove the influence of high inflation during the period of analysis, by deflating nominal prices by the consumer price index (CPI).

5.3.1 Live Animal Prices

Animal liveweight prices (in tugrik/ton) are used as a proxy for live animal prices. Figure 20 below shows that these prices move in unison, although there is a gradual widening of the difference between prices for different livestock over time. General economic trends are the major cause of downside movements in live animal prices, with the largest fall in price during 1996-1998, a period dominated by the Asian financial crisis, falling mineral and cashmere prices and slower economic growth. Lesser price falls occurred during the succession of dzuds from 1999-2002 and during the dzud of 2009-2010, as farmers offloaded their stock in response to feed shortages.

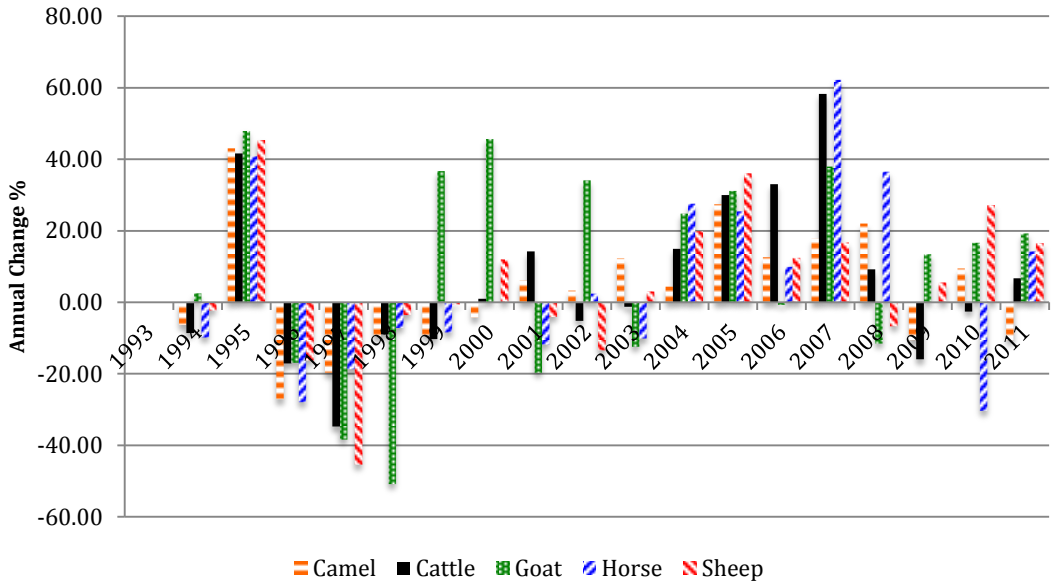
Figure 20. Real Animal Liveweight Prices (2005=100)



Source: FAOSTAT

Sheep and goat prices fell the most from 1996-1998 (Figure 21). This may reflect the lower return from goats in response to falling cashmere prices and falling demand for mutton – which is generally the most expensive meat. Horse and cattle prices fell more sharply during the 2009-2010 dzud, particularly the former, suggesting that they were offloaded heavily.

Figure 21. Annual Variability in Real Live Animal Prices

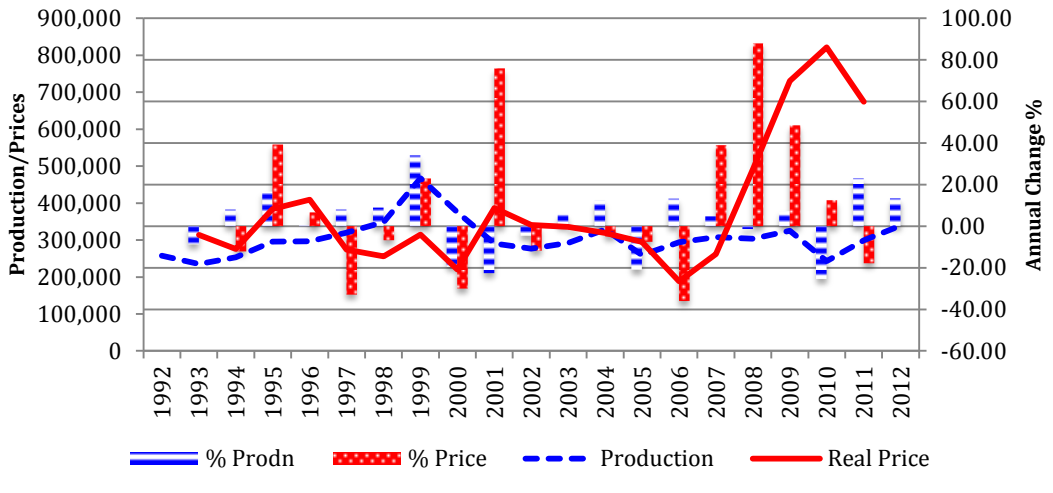


Source: FAOSTAT

5.3.2 Milk and Meat Prices

Real cow milk prices were relatively constant in real terms from 1993-2007, and then increased rapidly in response to strong economic growth, increased domestic demand, and stagnant production (Figure 22). In most cases, annual price variation corresponds to a change in production, with increased production leading to a fall in prices – as would be expected. This observation holds for the sharp fall in real milk prices observed in 2006, and the lesser fall in milk prices in 1994 and 2011. The parallel fall in both production and milk prices in 2000 may result from a slightly longer-term adjustment, as it follows a year of peak production and higher prices in 1999. Milk prices also fell sharply in 1997 due to the economic downturn induced by the Asian financial crisis.

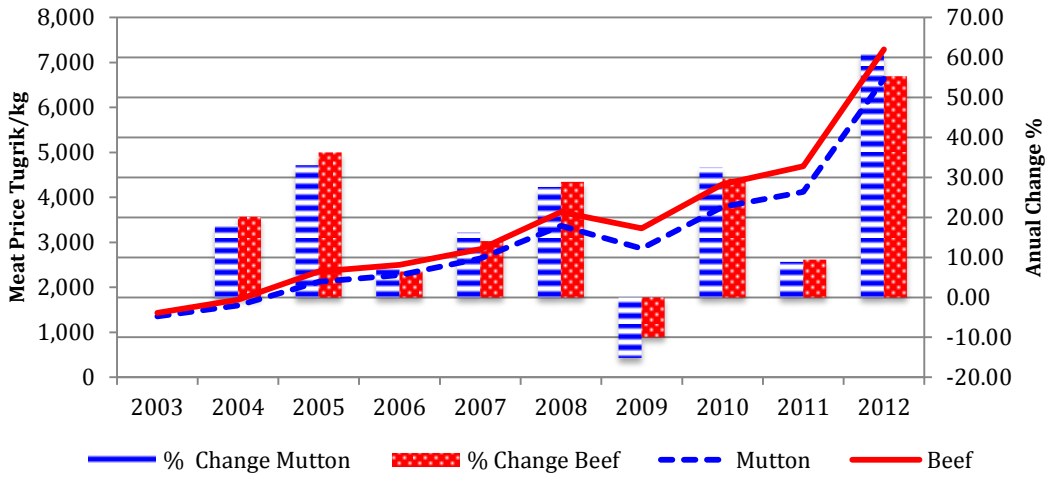
Figure 22. Cow Milk Production and Prices



Source: FAOSTAT

The analysis of meat prices is less instructive because data are available for a much shorter period (2003-2012). Real prices for both beef and sheep meat follow a general upward trend during this period, as would be expected, in response to growing domestic demand. A modest fall in real prices occurs in 2009 (Figure 23), which coincides with a short-term economic contraction in Mongolia in response to the global financial crisis and falling mineral and cashmere prices, but overall there is little observed price instability.

Figure 23. Real Meat Prices

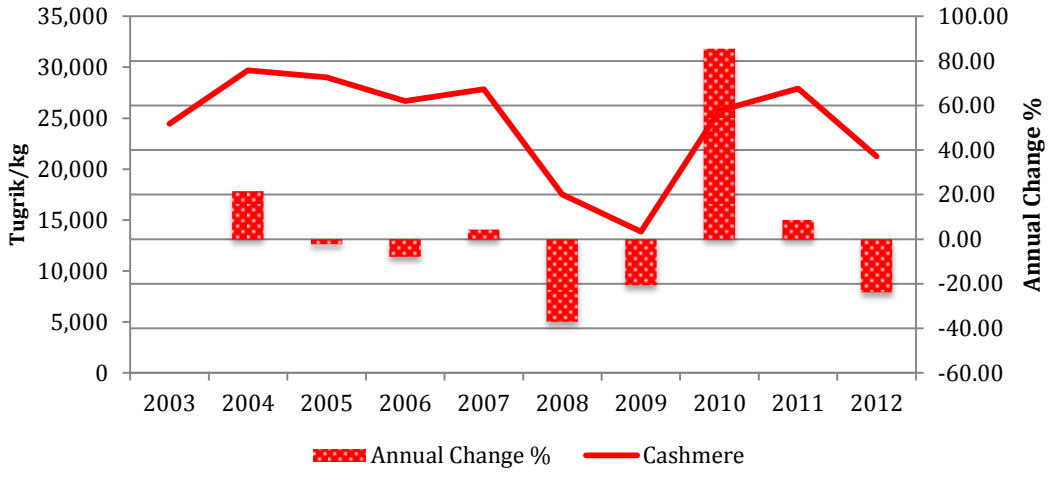


Source: National Statistical Office, Mongolia

5.3.3 Cashmere Prices

Cashmere prices reflect trends in global demand for luxury products. Real prices fell sharply in 2008 and 2009 as a result of falling world demand in the aftermath of the global financial crisis (Figure 24). They recovered fully by 2010, but have been somewhat erratic since then due to the slow and uncertain recovery of the global economy.

Figure 24. Real Cashmere Prices

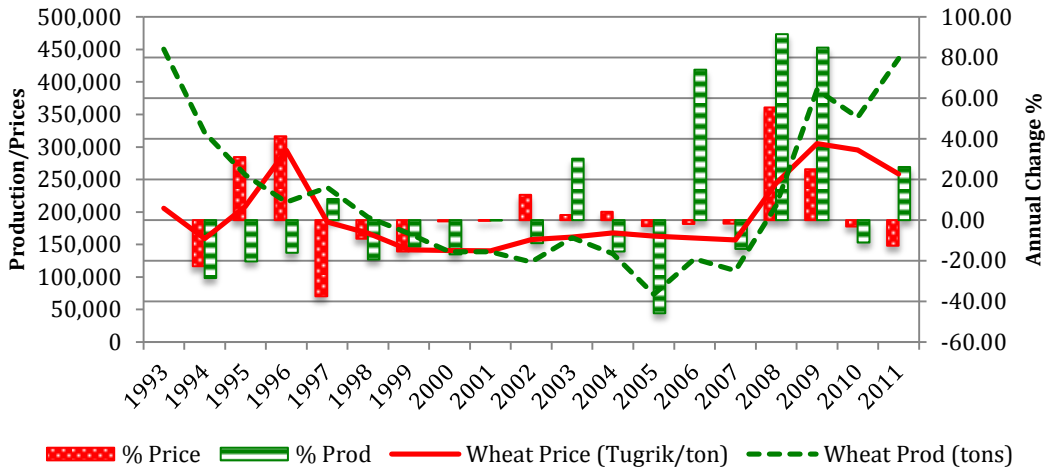


Source: National Statistical Office of Mongolia.

5.3.4 Wheat and Potato Prices

Real producer prices for wheat and potatoes follow very similar trends, with high downside variability during the period of transition, stable prices from 2000-2007 and then higher prices in 2008-2009 in response to the global food price crisis. Prices for both commodities also fell in 1997 as a result of the Asian financial crisis. Wheat price variability is higher than that for potatoes due to the higher inherent variability of wheat production, although the increased importation of wheat and flour since 2000 has helped reduce this variability (Figure 25).

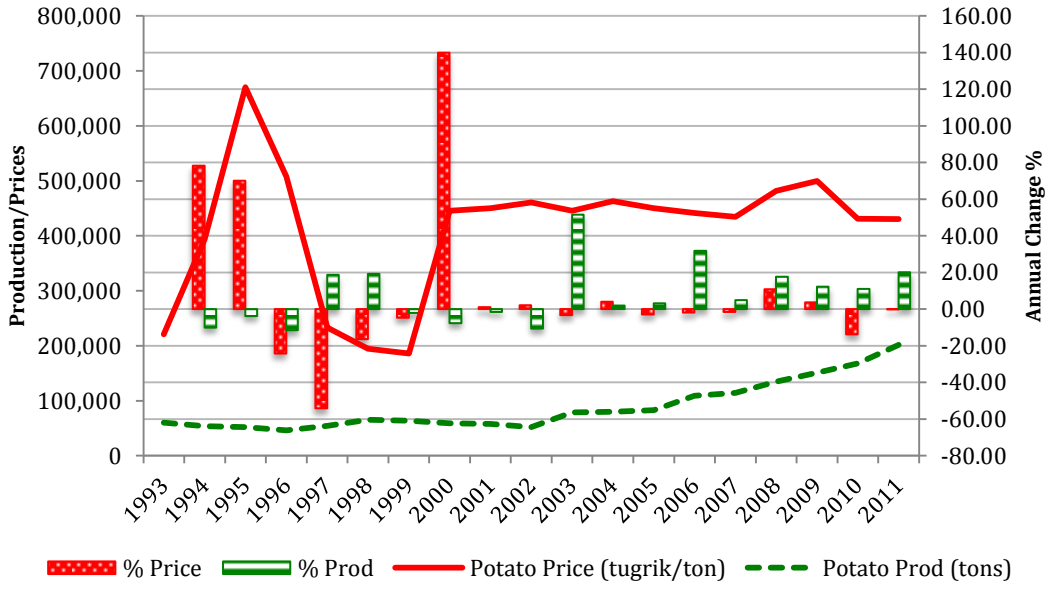
Figure 25. Wheat: Real Prices and Production



Source: FAOSTAT

The combination of stable but increasing potato production and increased access to imports has resulted in very stable real prices for potatoes since 2000 (Figure 26). Even the global food price crisis had only a moderate impact on potato prices.

Figure 26. Potatoes: Real Prices and Production



Source: FAOSTAT

The combination of more stable production and improved access to imports should help to reduce the incidence of short-term shocks to producer prices for both wheat and potatoes for the foreseeable future.

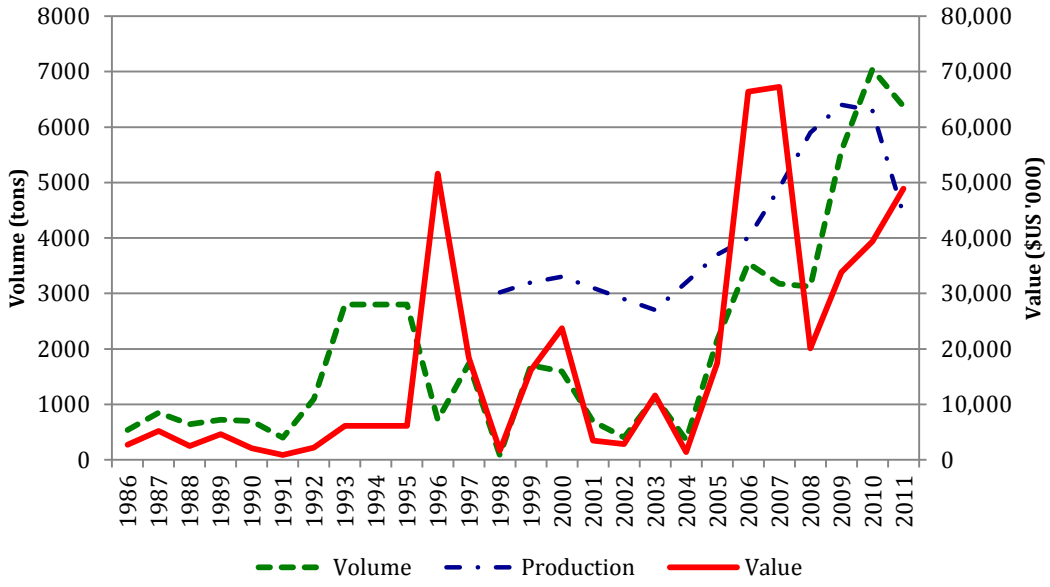
5.4 Enabling Environment Shocks

Further risks arise from changes in the broader political and economic environment in which agriculture operates. These changes can be both internal and external. At the macro level, Mongolia's steady economic growth for the last twenty years has been broken only by the global financial crisis in 2008-2009, which resulted in a 1.6 percent contraction of GDP in 2009 (Figure 1). The sharp fall in world commodity prices caused by the global financial crisis led to reduced export earnings, lower incomes, higher interest rates (especially on forex loans) and reduced public and private investment. For agriculture, it resulted in lower prices and reduced export earnings from cashmere, lower domestic demand for crop and livestock products and a fall in GAO. The overall economy recovered rapidly in 2010, despite the severe dzud of 2009-2010, due to IMF support, a rebound in copper prices and increased copper and coal exports. Economy wide growth also slowed during 1996-1998, and GAO fell, due to the combined impact of the Asian financial crisis, falling international commodity prices, and the Russian ruble crisis (Figure 2).

Internal policy changes pose a risk when they are made quickly and erratically, giving farmers and business agents little time to adjust. Within the agriculture sector, cashmere has been most subject to frequent policy change. An export ban was imposed on raw cashmere from 1994-1996 to encourage domestic processing. To facilitate membership into the WTO in 1997, the Government agreed to replace this ban with an export tax bound at 30 percent on the condition that it was terminated after 10 years. Government eventually imposed a flat tax of 4,000 MNT/kg on raw cashmere exports and the WTO subsequently agreed to extend the deadline for termination of this tax to 2012. Further policy changes include a producer subsidy of 5,000 MNT/kg on raw cashmere in 2008, to offset the impact of low world cashmere prices, together with US$8.6 million of low interest loans to cashmere processors. This support was terminated in 2009. Following termination of the export tax on raw cashmere in 2012, the Government decreed that all raw cashmere must now be sold through a newly formed Commodity Exchange established for agricultural commodities.

A review of trends in cashmere production and trade suggest that these policy changes have not resulted in any undue instability. Figure 27 below shows that most major shifts in the production and export of cashmere have been the result of underlying changes in supply and demand, rather than the policy changes outlined above. Official production figures for 1998-2011 show that production declined slightly from 2000-2003 as a result of livestock losses during the succession of dzuds from 1999-2002. It then increased as goat numbers grew again. Production then fell again following the dzud of 2009-2010.

Figure 27. Cashmere Production and Export



Sources: FAOSTAT, NSO

The volume and value of exports increased rapidly during the early 1990s in response to liberalization of the livestock sector and high world prices for cashmere. The export ban appears to have inhibited export growth from 1994-1995 and to have contributed to a fall in exports in 1996 – a period of very high prices. However, subsequent analysis has shown that much of this decline in official exports was the result of smuggling (World Bank 2003). Lower exports from 1997-2004 reflect the collapse of world markets in 1996-97 due to the Asian financial crisis and the lower output from 2000-2003 following the 1999-2002 dzuds. Exports recovered after 2004, despite the export tax, due to increasing production and the recovery of world demand for cashmere. Smuggling and tax evasion have continued, however, and domestic processors continue to operate at less than half of their capacity – suggesting that export restrictions have had a limited impact on these two issues.

A potential threat to domestic export and indeed the sector as a hole is that of *Dutch Disease* and the possibility that revenues from the booming mineral export will drive up the nominal exchange rate or prices on non-tradable goods and services. This would negatively affect other export products, such as agricultural commodities, and also make imported products more competitive compared with domestically produced goods. The value of tugrik has, indeed, appreciated significantly over the past years, although it depreciated again in 2013-14 due to falling investments and mining revenues. There have also been signs of Dutch Disease in the agricultural sector with reported labor shortages both in primary production and in the cashmere industry, and although cashmere as a luxury good is less price-sensitive than many commodities, an appreciating exchange rate does have long-term effects on competitiveness. In order to maintain macroeconomic stability, the Mongolian Parliament passed the Fiscal Stability Law in June 2010, which imposed limits and ceilings on fiscal deficit, expenditure increases and public debts (World Bank 2013). If implemented effectively, this will help mitigate the risk of Dutch Disease. Nevertheless, Dutch Disease imposes long-term constraints on the agriculture sector rather than unpredictable risks.

VI. Frequency, Severity and Costs of Adverse Events/ Risk

In order to design and target risk management measures, the importance of each of the risks discussed in the previous chapter must be better understood. This is done by analyzing the frequency, severity, and costs of adverse events over a given period of time. The cost and severity of these events is measured as the fall in the value of gross agricultural output. Application of this methodology requires a consistent set of data on both production and prices, over an extended time period. The data used come from FAO and domestic sources. More details can be found in Annex 1.

6.1.1 Separating Risk from the Normal Cost of Doing Business in Agriculture

For agriculture, small changes in yields and prices are part of the normal cost of doing business. Output and price loss thresholds were thus derived to distinguish major adverse events from smaller inter-annual variations in output. Variation in output beyond these thresholds is regarded as a shock or risk event. The basis for setting these thresholds is described in Annex 1. A summary of the thresholds used for analysis, rounded to the nearest 5 percent, is presented in Table 7.

Table 7: Thresholds for Risk Analysis

	GAO Constant Price	GAO Real Price	Commodity Price
Total GAO	10%	10%	na
Livestock GAO	10%	10%	na
Crop GAO	10%	10%	na
Beef	10%	15%	10%
Mutton	10%	15%	10%
Cow Milk	10%	15%	10%
Cashmere	10%	15%	10%
Potato	10%	15%	10%
Wheat	15%	20%	10%

Source: Author's calculations

Note that the real price thresholds for aggregate measures of agricultural output are lower than those for individual commodities, due to the offsetting effects of different commodities within the aggregate. For individual commodities the threshold for analysis measured in constant prices is also lower than that measured in real prices. Output measured in constant prices reflects the variation due to production only, while output measured in real prices reflects the joint impact of variation in both production and price.

6.1.2 The Value of Losses

Official information on losses due to adverse events is derived in different ways and is invariably approximate. Analysis was thus based on estimates of the "indicative" value of losses, to provide a more consistent basis for comparison. While these estimates draw on actual data as much as possible, it is emphasized that they represent indicative not actual losses. Indicative loss values are also compared to the total value of GAO in the relevant year to provide a relative measure of the magnitude of loss.

For **production risks** the value of GAO "lost" for each adverse event was first calculated in tugrik as the difference between the actual change in output and the threshold change

in output, using *constant producer prices* (2004-2006). The resultant value was converted into US dollars at 2012 exchange rates and also expressed as a percentage of the value of GAO. The same methodology was used to derive the **combined impact of production and price shocks,** based on actual production and *real prices*. This captures the joint impact of price and production shocks – which is the reality that the sector faces.

For **price risks** the actual value of output in real terms was compared with the notional value of output resulting from a 10 percent (threshold) fall in *real prices* relative to the previous year. The total loss due to a price fall was then calculated in tugrik at real prices (2012=100) as the difference between actual GAO and the notional GAO at threshold prices. This approach allows the loss due to adverse price events to be captured more independently of losses due to an adverse fall in production, although it does not fully remove the joint endogeneity of prices and production.

6.2 Production and Price Risks in Mongolia's Agricultural Sector

Analysis of the major shocks to aggregate output since 1991 based on the above methodology gives an overview of the causes and impacts of shocks to the sector. The following broad conclusions emerge:

- Dzuds emerge as the most common source of shock – as expected.
- The dzuds in 2001 and 2010 had the greatest impact on physical output (GAO measured in constant prices). Both dzuds followed a period of rapid increase in primarily goat and sheep number, above grazing capacity.
- The most severe shock, in 1997, was mainly due to the impact of a severe price shock caused by the economy-wide impact of the Asian financial crisis.
- The initial stages of economic transition also resulted in severe shocks to GAO, across all components of agriculture, particularly in 1992. These shocks were largely due to falling livestock numbers and a decline in cropped area.
- Shocks to crop GAO were more frequent and severe during economic transition, as crop production was hit harder by these policy shocks and took longer to recover. Crop GAO has been relatively stable since 2000, and has helped to offset the impact of dzud related shocks to the livestock sector.

Dzuds and price shocks are the major risks for livestock commodities, as shown by indicative losses for cow's milk, beef, mutton and cashmere (2003-2012 only). (See Annex 1). These shocks reflect the influence of adverse macroeconomic shocks as well as commodity specific shocks due to climate and price volatility. For mutton, beef and cashmere the analysis shows that the impact of dzuds can extend beyond the immediate weather related livestock losses due to its impact on post-dzud production levels. Price shocks emerge as low frequency events for all commodities, although their impact is quite strong. Drought is also a low frequency event, with an impact similar to that of a smaller dzud.

Price shocks and droughts are the main risks for the two main crop products – wheat and potatoes. A different pattern of shocks emerges compared to livestock, however, with a much greater impact of economic transition on crop production during the early 1990s and a more frequent impact of drought. Economic transition resulted in a rapid fall in the area planted in the early 1990s, particularly for wheat. Both wheat and potatoes were then hit by the price shocks that occurred after the Asian financial crisis

in 1997, and droughts in 1996 and 1998. Output has been relatively stable for both crops since then, apart from a drought in 2005.

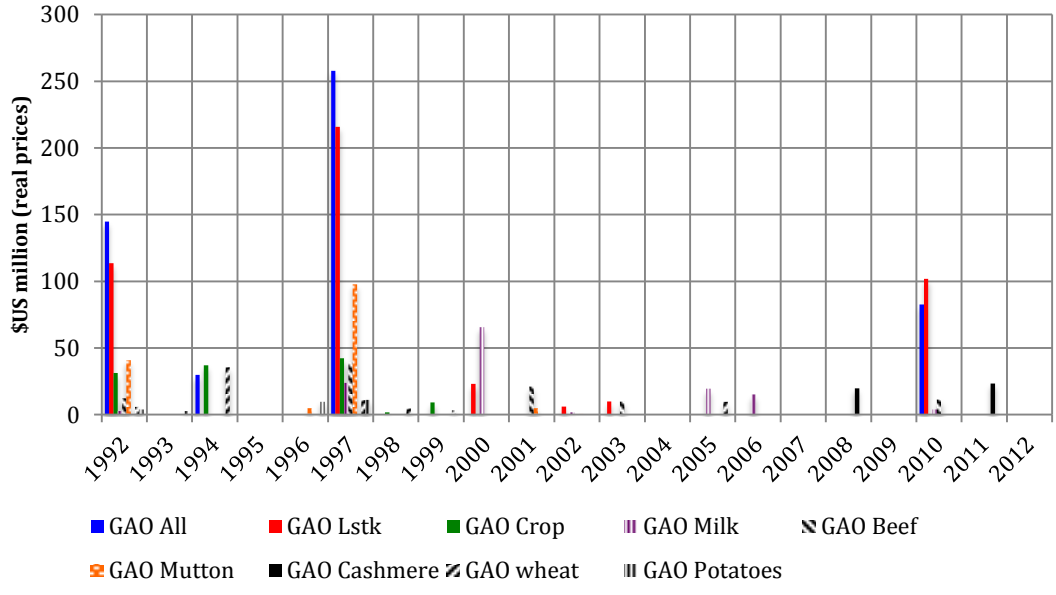
A high proportion of the observed producer price shocks are a response to adverse events outside the sector, which have a significant impact on the agriculture sector. Price shocks were analyzed separately for the livestock and crop commodities examined above, using real prices as the basis for analysis. Generalized producer price shocks occurred in response to the Asian financial crisis in 1997, and to the correction of agricultural commodity prices after the global food price crisis in 2009. At the commodity level, cashmere prices fell in response to the global financial crisis in 2008, and wheat prices fell in parallel with world prices after they spiked in response to the global food price crisis. The remaining price shocks appear to reflect instability in domestic markets. Milk prices are the most volatile, with sharp price swings in response to fluctuations in production. Paradoxically, milk and mutton prices also fall sharply during some dzud years when production falls. The smaller observed price shocks for beef, wheat, and potatoes are also difficult to explain.

6.3 A Timeline of Agriculture Sector Shocks: 1992-2012

Graphical depiction of the shocks described above provides useful additional perspective on the incidence and magnitude of agriculture sector shocks during the last twenty years (Figure 27 and 28 below). The two figures are drawn to the same scale to allow comparison of the relative magnitude of the observed shocks, measured in constant and real prices. Commodity price shocks are excluded from these figures as the impact of these shocks can be inferred from the difference between shocks measured in real versus constant prices.

The joint impact of adverse events on production and prices shows that the most severe post-transition shock occurs in 1997 in response to the economic slowdown caused by the Asian financial crisis and falling international commodity prices (Figure 28). Economic transition had a significant impact in 1992 due to its impact on production.

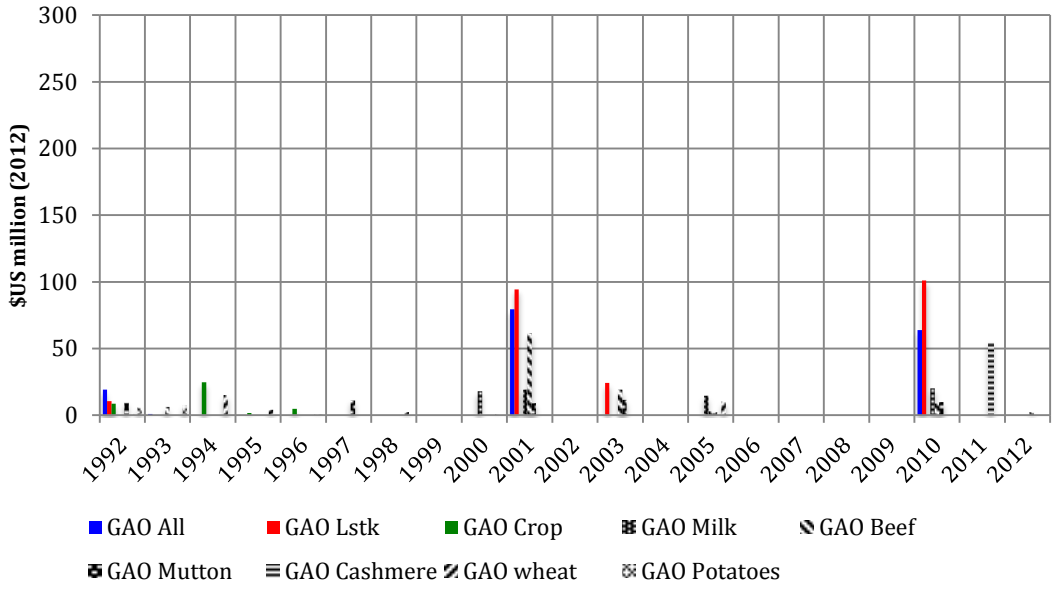
Figure 28. Indicative Losses (US$ m) real prices



Sources: FAOSTAT, NSO, Author's calculations

The dzuds of 2001 and 2010 had the biggest impact on physical output, as measured in constant prices (Figure 29). The large loss in cashmere GAO in 2011 is largely a result of the 2009-10 dzud, which reduced goat numbers.

Figure 29. Indicative Losses (US$ m) - constant prices



Sources: FAOSTAT, NSO, Author's calculations

VII. Ranking and Prioritizing Agricultural Sector Risks

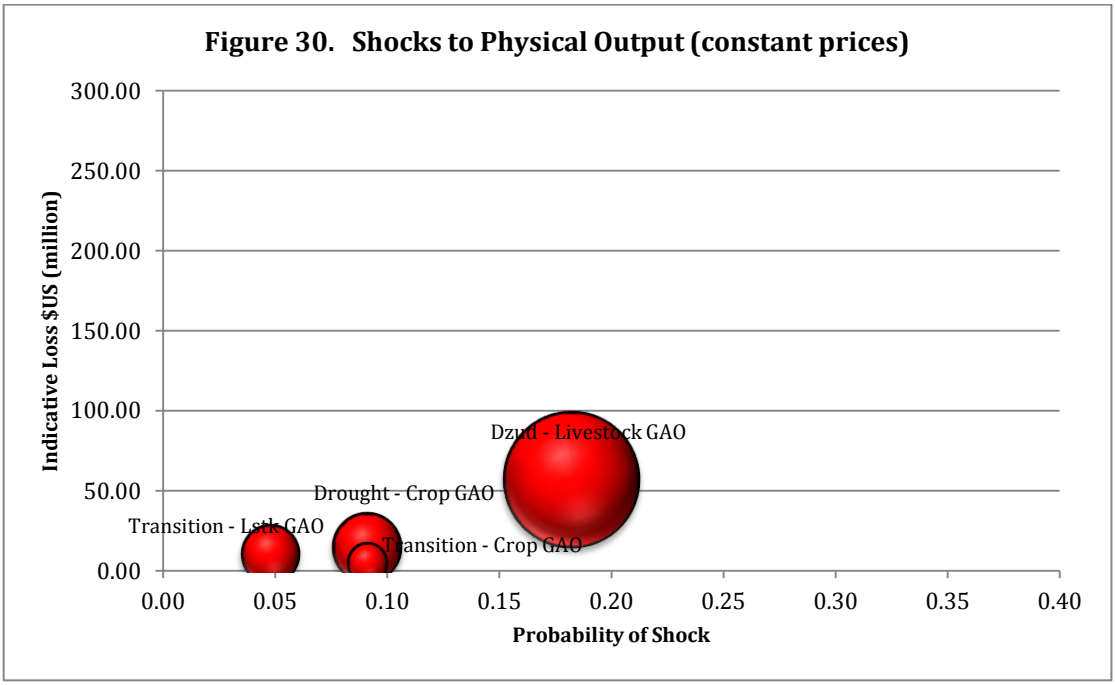
The optimal allocation of resources available for risk response relies on a clear understanding of the priorities for risk management. Ranking the types of risk the sector faces and the commodities most vulnerable to these risks, also facilitates the choice and design of measures to strengthen risk response and the types of support needed by the public and private sector agents responsible for risk management. Four major risks to agriculture emerge from the preceding analysis: dzuds, drought, generalized price shocks associated with exogenous adverse events such as the Asian financial crisis, and the policy shocks associated with economic transition during the early 1990s. Livestock in general and cashmere and mutton in particular emerge as the commodities most vulnerable to risk, while wheat has the highest probability of incurring a shock.

To discern their relative importance, each category of risk is quantified according to two parameters: (i) the average indicative cost of the observed shocks above the relevant threshold, during the relevant time period; and (ii) the frequency of these shocks, expressed as the number of events during the relevant time period (e.g. three events in 21 years: frequency = 0.14). The same approach is then applied to individual commodities. Results are presented for both constant prices and real prices.

7.1 Types of Risk to Mongolia's Agricultural Sector

As expected, dzuds emerge as the most important shock to physical output (Figure 30). Not only do dzuds occur more frequently than other types of adverse event, they also incur higher costs. Drought is a much less serious risk, occurring with lower frequency than dzuds and predominantly affecting crop production, which accounts for only one quarter of total GAO. The capacity to move animals in the event of drought appears to limit its impact on livestock production. The costs of economic transition to production are low as (i) livestock production recovered rapidly (see Chapter I), and (ii) crop production contributes a relatively small share to sector output.

Figure 30. Shocks to Physical Output (constant prices)



Source: FAOSTAT, Author's calculations

Note: The bubble figure is two dimensional and the bubbles demonstrate the frequency and the aggregate scope of the impacts, here in terms of losses from the specific peril.

Box 2. Macro-Economic Shocks and their Consequences for Agriculture

Mongolia has experienced four major macro-economic shocks in the 20 years since independence: i) the collapse of central planning and the subsequent period of transition from 1990-95, ii) the Asian financial crisis of 1997, iii) the global food price crisis of 2008-2009, and (iv) the global financial crisis of 2009. Each of these shocks had major implications for agriculture. Following the breakup of the former Soviet Union, livestock numbers fell from 1990-1992 and cereal production fell continuously from 1990 to 2006. The Asian financial crisis in 1997 and its associated economic slowdown, resulted in a generalized fall of agricultural producer prices. Cashmere prices fell in response to the global financial crisis in 2008, and wheat prices fell in parallel with world prices in the aftermath of the global food price crisis in 2008-2009.

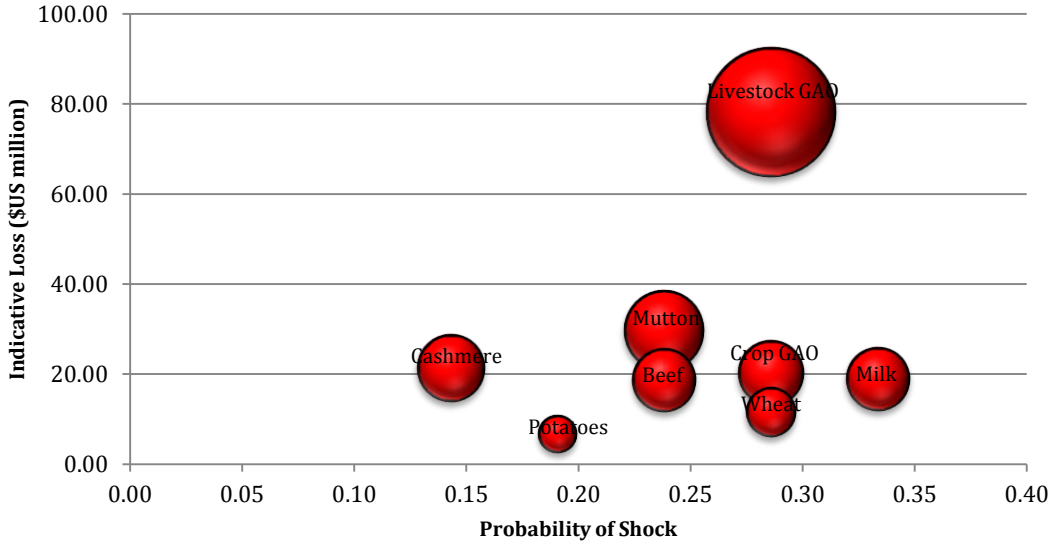
The impact of these macro-economic shocks for agriculture is evident from the analysis of inter-annual changes in GAO, measured in real prices (as shown in Figure 27). The most severe shock to agriculture resulted from the Asian financial crisis, which resulted in a 43% fall in GAO (in real prices). The impact of the collapse of central planning was also severe, with a 24% fall in livestock GAO (in real prices) in 1992. .

While the policy shocks associated with transition are unlikely to re-occur, generalized price shocks such as the Asian Financial crisis are a continuing risk. A worldwide economic recession or slowdown is also likely to depress cashmere prices – Mongolia's major agricultural export and a critical income source for herder households. Mongolia's narrow economic base and heavy reliance on mineral exports means that its domestic economy, and so domestic demand for agricultural products, is extremely vulnerable to shifts in world demand and prices for minerals.

7.2 The Impacts of Risk on Different Commodities

The overriding importance of shocks to the livestock sub-sector is evident in Figure 31, which shows the frequency and severity of joint production and price shocks (measured in real prices). Both crop and livestock output is subject to shocks of one form or another in three years out of ten, but the average indicative cost of these shocks for livestock is almost four times higher than for crops. Milk is the most volatile commodity owing to its higher price variability (see Figure 33 below). The other commodities are subject to a mix of production and price shocks. The largest of these commodity specific shocks are attributed to the impact of economic transition in 1992 and the generalized price shocks observed in 1997.

Figure 31. Joint Production and Price Shocks by Commodity (real prices)

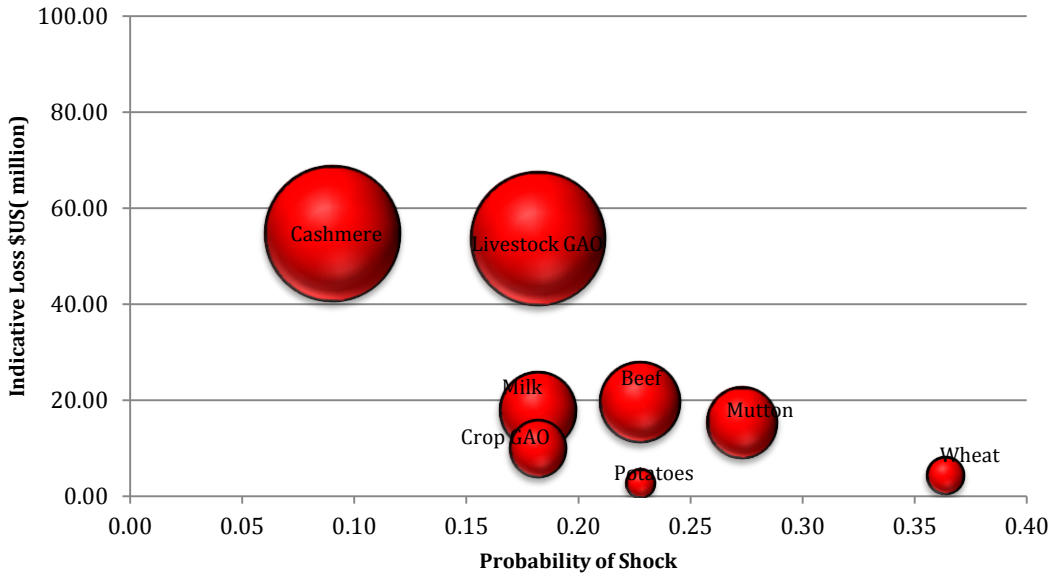


Source: FAOSTAT, NSO, Author's calculations

Analyzing the impact on physical output shows wide variation in risk profiles between different commodities (Figure 32). Wheat is most prone to adverse events because of its vulnerability to drought, although the average indicative cost of these shocks is low relative to livestock. This high vulnerability to drought will increase further if production is expanded onto unsuitable land – as occurred during the period prior to independence. Current plans to support a new program of wheat expansion should be tempered by this experience. Note also that the frequency of adverse events for overall crop production is much lower than that for wheat, due to the stabilizing influence of potato production.

Of the livestock commodities the large observed shock to cashmere production is attributed to a post-dzud fall of goat numbers. Cashmere production fell by 30 percent from 2010 to 2011, from 6,300 tons to 4,400 tons, in response to a 29 percent fall in goat numbers during the dzud of 2010. Mutton production is the most volatile of the other livestock commodities, although the indicative losses for milk, beef and mutton are similar, and moderate at 2-3 percent of aggregate GAO.

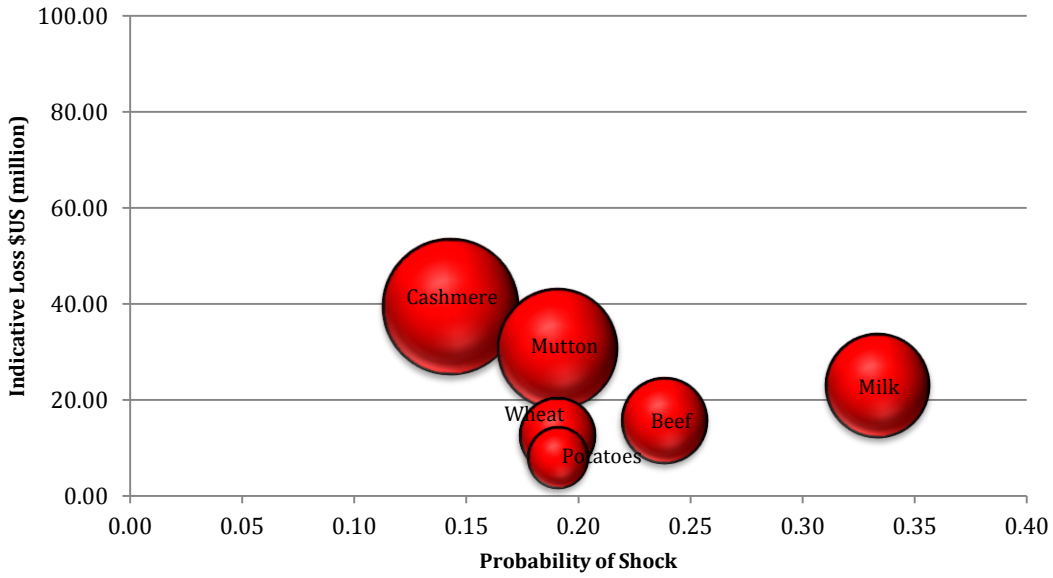
Figure 32. Shocks to Physical Output by Commodity (const prices)



Source: FAOSTAT, NSO, Author's calculations

The incidence and cost of price shocks is consistent with observed trends in commodity prices (Figure 33). Milk prices are the most volatile, mostly in response to variability in domestic market conditions. Cashmere price shocks are less frequent, but incur relatively high indicative losses when they do occur due to the value of cashmere output. Mutton and beef have similar risk profiles due to their similar production environments and role in household consumption. Wheat prices are stabilized by improved access to imports (for wheat) and potato prices by the comparative stability of domestic production. The impact of generalized price shocks in response to the Asian financial crisis is apparent, as is the impact of the global financial crisis on cashmere prices. But the reasons for other, smaller price shocks due to domestic market conditions are more difficult to discern.

Figure 33. Commodity Price Shocks (real prices)



7.3 The Impacts of Risks on Stakeholders

Poverty Impacts of Dzuds and Herders' Ability to Cope

Extensive livestock herders are those who carry the main burden of dzuds. A viable livestock herd is somewhere between 100 and 200 animals, and as late as in 2010, 70 percent of remaining herding households were estimated to fall below this threshold.[5] Exactly how these herders are affected by a dzud in terms of poverty and malnourishment is not clear; poverty and undernourishment in Mongolia has declined steadily over the past two decades in both urban and rural areas. However, these herders are highly vulnerable to different risks such as dzuds, diseases, price volatilities, and theft and tend to drop out of the sector at times of shocks rather than recuperating after losses (World Bank 2009). In addition to full-time herders, there is a significant number of part-time herders, and herders that move in and out of the sector depending on season and non-agricultural employment.

During the last dzud, the poorest herders proved to also be the most vulnerable in that they lost proportionally more animals. There are several reasons for this, importantly the level of knowledge but also the fact that large herd sizes cope better in severe colds as animals provide a natural shelter for each other. Poverty in terms of lack of assets and access to credit also makes small herders unable to invest in preventive measures, such as feed and shelter. Further, it is more difficult for herders with smaller herds to migrate their livestock over longer distances in search for better pastures.

The poorest herders proved to be the most vulnerable to Dzud, as they lost proportionally more animals.

Table 8 provides an overview over different groups of herders and their risk management strategies:

Table 8. Categories of Herders in Mongolia

	No of animals	Characteristics	Share of herding hh	Risk Management
Large-scale commercial herders	> 500	Provide full-time employment for family members and adequate incomes. Good access to pastures and inputs.	6%	Can move livestock long distances if necessary, winter preparation with hay and fodder production.
Small-medium scale commercial	200-500	Adequate incomes to support herding	25%	Vulnerable to dzuds by their limited

[5] Rasmussen and Dorling (2011) points out that when all households owning livestock are included, 76% fall below the limit of 200 animals. Presumably, this includes part-time farmers, and the 70% figure should, therefore, be a better estimate of household vulnerable specifically to sector risks.

herders		households but families are of middle or lower wealth levels and have limited access to capital. <300 sheep units is considered subsistence herding.		access to capital.
Small full-time herders	< 200	These herding households often have herds <100 animals, are poor without alternative sources of incomes, and are often dependent on state support. Would like to exit the sector if possible.	No data	Highly vulnerable to dzuds.
Periodic herders	often < 200	This group of herders enters and exits the livestock sector depending on economic circumstances. For this group, herding is a safety net.	No data	
Part-time/periodic herders	< 200	This group has small herds that function as one of several sources of income. The herders don't always own their own livestock.	No data	

Source: World Bank, 2009

Different size of herders also have proportionally different sources of incomes, which means that they are affected differently by especially price changes but also depending on which animals that most resilient to a given risk. Notably, the poorest herders derive a significant share of their income from other activities (Table 9).

Table 9. Income structure of herders (%)

No. sheep units	Meat	Milk	Cashmere	Other
Up tp 300	20	51	5	24
301-800	47	34	7	13
801-1300	56	26	9	9
Over 1301	54	28	14	4
Average	44	35	9	13

Source: World Bank, 2009

The Impacts on Consumers from Prices Increases

Consumers are sensitive to changes in meat prices and consumption is highly correlated with incomes, especially in urban areas. The richest 20 percent of Mongolia's population consumes five times as much meat as the 20 percent poorest. Fresh meat is preferred and supply chains for frozen meat products have only recently begun to evolve. Consumers do not differentiate between cuts of meat or substitute high-end meat

products for less expensive meat in times of hardship. Instead, poor consumers give up meat entirely in such periods. The Government has a price stabilization program, and abattoirs process frozen meat on Government contracts that are sold at subsidized prices for low-income consumers (World Bank Livestock Report, 2009).

Calorie share from wheat is relatively high in Mongolia, accounting for 44 percent of caloric intake, which means that price changes in wheat directly impact consumers' food budgets and consequently other expenditures (World Bank 2011). However, as a result of income increases, the share of household expenditures allocated to food has declined over the past years, from about 58 percent in early 2000 to 40 percent a decade later. This has made consumers proportionately less vulnerable to food price changes than previously. The food price crisis in 2008 had less impact on them than it would have a decade earlier. Similarly, multiple transfer systems are in place to improve food security among vulnerable groups. Although social transfers are not directly linked to price changes, social transfers increased in Mongolia from the mid-2000 and are targeting particularly sensitive groups through the Child Money Programme (CMP), such as young families and families below the poverty line with more than two children, which according to the UN would have cushioned some of the impacts of the price changes for these families (UNDP/RCC Policy Note).

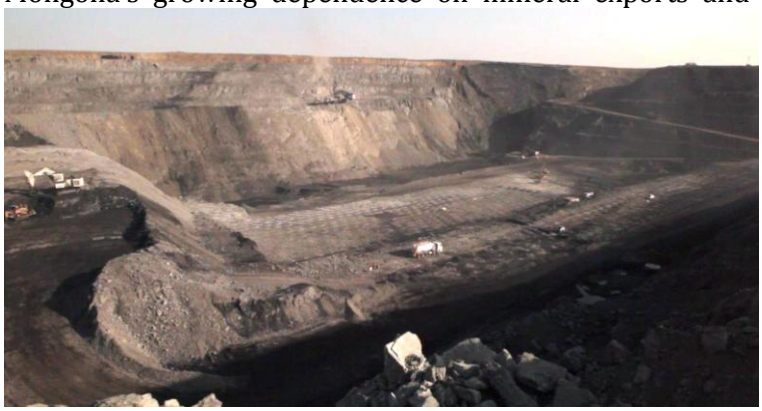
7.4 Implications for Risk Management

The analysis confirms the need to focus on risk management in the livestock sector, not only because the incidence of shocks to livestock production is relatively high but also because the sub-sector accounts for three quarters of the value of agriculture sector output and employs about a quarter of the total workforce[6]. The analysis also suggests that the current emphasis on measuring risk in terms of physical losses needs to be broadened. While the physical losses due to dzuds are often high, and are always highly visible, the less visible impact of macroeconomic shocks can result in high losses to sector output as well.

Many of the production risks that have emerged after de-collectivization are a result of the changing structure of the agriculture sector. Less public sector support and a less regulated sector in combination with more producers have resulted in increased vulnerability and higher losses in the event of a shock. Pastures are being overused and one study shows that in some areas, being used at between two and nine times their carrying capacity (Rasmussen and Dorlig 2011). This impedes winter preparation, especially the fattening of animals, and exacerbates the impact of dzuds. Further, targeted subsidies and other support to certain livestock and crop distort farmers' and herders' incentive to diversify, which could render them more vulnerable to production and price shocks.

[6] Total agricultural employment was 32.6 percent of total employment, 2011 figure (WDI, accessed April 2014)

Mongolia's growing dependence on mineral exports and world commodity markets makes it increasingly vulnerable to such exogenous shocks. Droughts mainly affect crops and although fairly frequent, they have a relatively small impact on sector output. Nevertheless, given Mongolia's strategic objective to increase domestic grain production, it will be important to incorporate crop risk management into any risk management framework. Diversifying agriculture, including more focus on value added, will also make it more resilient to risks to individual commodities and support the Government's objective of diversifying the economy.

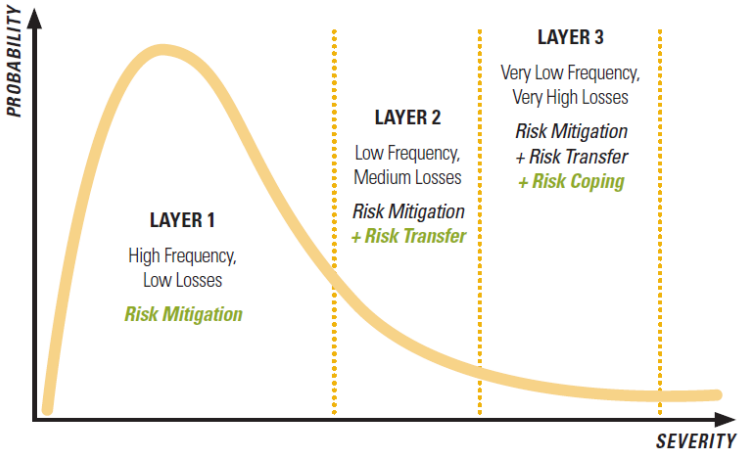


A mine in Mongolia – the country's growing dependence on mineral exports and world commodity markets makes it increasingly vulnerable to such exogenous shocks.

VIII. Risk Management

Agricultural risk management is not a one-time intervention but rather an ongoing process that adapts to changing conditions over time – including change within the agriculture sector itself. As the sector modernizes, actors and stakeholders change, supply chains become more organized, and the nature of risks is transformed. Risks might also alter depending on the role assumed by the Government, the policies of trade partners, and the shape of global markets. Different types of risks require different risk management measures on part of both the private and the public sectors. Risks that are frequent but have limited impacts tend to be best managed through mitigation measures. Less frequent risks that have larger impacts may be transferred to a third party. And more uncommon risks that wield severe negative impacts are likely to be managed by Governments through coping mechanisms and other support programs (see figure 34). Risk management for any country will likely involve a combination of all three types of instruments, and both the private and the public sector.

Figure 7: Risk Layering



8. 1 Suggested Prioritizes for Risk Management

The acute threat of dzuds makes sustainable land (grazing) and herd (livestock) management and winter preparedness imperatives of effective risk management. While improved access to winter feed and better coordination of disaster response to dzuds is essential, it is not a substitute for a more rational balance between livestock numbers and the availability of grazing. Table 8 summarizes the priorities for improved risk management in Mongolia based on the findings of the risk assessment exercise.

Herders are cleaning corrals before winter arrives - the acute threat of dzuds makes sustainable grazing and herd management and winter preparedness imperatives of effective risk management.

Table 10: Risk Prioritization and Related Solutions

	Mitigation	***Transfer***	***Coping***
Production Risks			
Dzud (livestock)	Winter preparation; hay and fodder production	Livestock insurance for herders	Fodder reserve and distribution of fodder
	Otor[7] migration	Disaster livestock insurance for Government intervention	Availing grazing land and otor migration corridors
	Weather monitoring for early warning		Weather monitoring for early warning
	Sustainable land management		
	Sustainable herd management (herd sizes, composition etc.)		
	Strengthen herder networks and capacity		
Drought (crop)	Ensure that only land suitable for crop production is used Drought tolerant varieties and Good Agricultural Practices Conservation agriculture,	Crop insurance for especially larger producers	

[7] Otor means migration and refers to the practice of quickly moving livestock long distances to better pastures, away from the herder's regular pastures. It's a traditional form of risk mitigation for herders in Mongolia.

	good soil and water management, minimum tillage if applicable		
Market Risks			
Price shocks	Diversification Storage		

Public and private sector risk management measures are on-going in each of these priority areas in Mongolia. Depending on their knowledge, capacities, and resources, herders prepare their herds and camps for winter and the possibility of a dzud each year. The Government of Mongolia launched public-private index insurance for livestock owners in collaboration with the World Bank in 2006, and has since expanded its coverage, transferring production risks to an insurance company and a reinsurer. The National Emergency Management Agency is responsible for helping herders cope with extreme dzuds and provide fodder support to livestock owners through the Emergency Reserve. Efforts are underway to introduce conservation agriculture and other soil and water conservation measures to manage drought risk.

Few mechanisms are currently available to manage the risks associated with macroeconomic shocks, including those which bring about price shocks. Economic diversification and less reliance on particular commodities can effectively offset some of this risk over time. For the public sector, administering programs for macroeconomic stabilization and a social safety net can be instrumental in cushioning the impacts of macroeconomic shocks. Mongolia has a relatively well-developed social safety net system in place to compensate for income losses, even though there is scope for strengthening it (Benson 2011). Price volatility is a major concern but there are currently few mechanisms in place to manage price risks. Contract farming is limited, partly due to the structure of the sector, and partly because of liquidity limitations in Mongolia's processing industry.

Despite the broad range of ongoing risk management activities, especially on the production side, adverse shocks continue to have a significant impact on the sector. Dzuds, the largest source of risk to agricultural production, have larger impacts now than in the past, and drought and price volatilities continue to pose a systemic risk to producers and the sector. Annex 2 provides an overview of experience and learning from the 2009-10 dzud. Large scale livestock mortality during the last dzud and the resulting adverse consequences for herders and broader agricultural sector reveals important gaps in risks management for both the public and the private sector approaches in Mongolia.

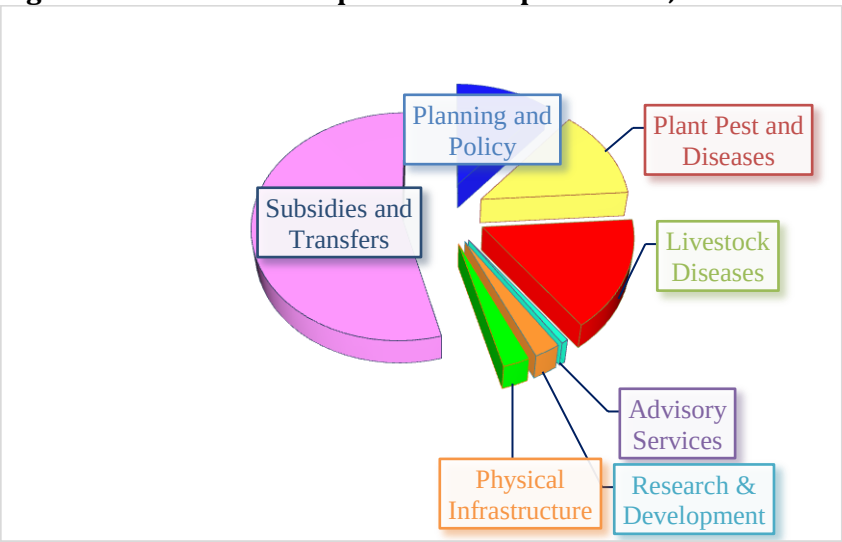
In Jinst *Soum* (district), some herders created this small reserve pasture by fencing it. They use the reserve for weak and baby animals during heavy snow falls and blizzards.

8.2 Current Risk Management Landscape

The findings of the Mongolian Agriculture Sector Expenditure Review indicate that the Government spends substantial budgetary resources on livestock and plant disease and pest management. Yet public expenditures on dzud and

drought preparedness are comparatively limited despite these being much greater sources of risk. In FY 2013, the country's livestock disease control program received 16 percent of the functional budget and plant disease control received 13 percent. The lion's share of the functional budget, some 62 percent, went to subsidies and transfers, and another 11 percent went to policy and planning. R&D and advisory services by contrast together received only 4 percent.

Figure 9: Functional Composition of Expenditures, 2013



Source: Mongolia Agriculture Sector Public Expenditure Review, World Bank 2014

Table 11 highlights the high priority allocation for disease management compared with the limited share allocated for managing other risks. While this has resulted in quite effective management of livestock and crop pest and disease in Mongolia, limited investment in mitigation of dzud, drought, and other risks renders Mongolian agricultural sector vulnerable to risks.

Table 11: Percentage of MIA's Functional Budget Allocated 2008-2011

Functional items	Functional Allocations				Average over the period
	2008	2009	2010	2011	
Disease Management	21.9	25.3	21.2	23.4	23.0
Planning and policy	12.7	13.9	10.4	12.8	12.5
Research & development	3.9	3.0	3.2	2.0	3.0
Physical infrastructure	17	15.2	16.8	12.5	15.1
Advisory Services	9.4	9.7	8.8	10.3	9.6
Market Linkages	8.5	7.2	12.9	11.5	10.0
Crop and horticulture	13.7	14.7	12.7	13	13.5
Seed Capacity Development	12.9	11.9	14	14.5	13.3

Source: Mongolia Agriculture Sector Public Expenditure Review, World Bank 2014

The share of subsidy and transfers, to help producers and the overall agriculture sector has increased significantly in recent times. Table 12 provides a brief overview of subsidy program which illustrates that subsidies allocation for management of risk is relatively limited. Less than 5 percent of total agriculture subsidy allocation (see table 13) are for

activities (pasture management) which could partially contribute to improved risk management.

Table 12: Subsidy Funds/Programs for Producers and Processors in Mongolia

Name of Fund/Subsidy	Nature and Purpose	Subsector/Commodities covered	Responsible/Administrative Unit(s)	Period and size of fund
Livestock Conservation Fund	**Output-based payments** for wool and cashmere; **Technical assistance** (grants and loans): pastureland irrigation, feed purchases, etc.	Primary (herders) and intensive agriculture; In 2013 these payments will include skin, hide and meat milk of all animals except camels.	Unit for Livestock Conservation Fund Ministry of Industry and Agriculture	Established in 2001; In 2012 - 30 billion MNT.
Crop Protection Fund	**Output-based payments** for wheat; **Technical assistance** to wheat farmers (grants and soft loans)	Primary agriculture (wheat farmers, sea buckthorn, some vegetable producers)	Unit for Crop Protection Fund Ministry of Industry and Agriculture	Established in 1997; Cash payments started since 2009. In 2012 some 30 billion MNT of which 11 billion MNT in form of cash payments
Fund for wool and cashmere processors	**Subsidized credit** to promote domestic processing and raise domestic vale added production	Agricultural products and processing Industry	Department of Coordination for Light Industry (MIA)	Established in 2011; Total loans in 2011 – MNT 97.8 billion (USD 66.3 million) for wool processing companies, and MNT 28.7 billion (USD 19.5 million) for cashmere processing
Meat Supply Stabilization Program	**Subsidized credit** granted to support the development of cattle, horse, sheep, pig and poultry meat, increase the slaughtering weight, increase the share of dam in overall pasture livestock herd and the number of offspring's	Meat Processing Industry (Meat)	Department of Coordination for Food Industry (Ministry of Industry and Agriculture)	Established in 2005; Not clear if it will continue
Small and Medium Enterprises Development Fund	**Subsidized credit** granted to support small and medium enterprises, increase employment and expand production	Processing Industry, Primary Agriculture and Intensive Agriculture	SME Fund Unit (Ministry of Labor)	Established in 1992; 2012 – MNT 28.9 billion made subsidized by SME with 40% for agriculture
Staple Food Price Stabilization Program	**Subsidized credit** granted to build meat warehouse capacity, milling capacity and encourage intensive livestock production	Food Processing Industry (meat and milling) and Intensive Agriculture	Department of Coordination for Food Industry (Ministry of Industry and Agriculture)	Approved in November 2012; Estimated budget for 2013: **Meat Processors** MNT 87 billion (USD 57.9 million); **Intensive Livestock farming** MNT 100 billion (USD 66.6 million) over next 3 years; **Wheat flour millers** MNT 63 billion (USD 42 million)
Subsidies/grants to deal with hazards/risks in livestock sector (part of Mongolian National Livestock Program)	**Subsidizes and grants** to protect livestock producers from *dzuds*, involves increased emergency fodder reserves, irrigate pasture land, rodent/pest control of pastures and better management and coordination of activities between the central and regional governments	Primary agriculture (herders), and intensive agriculture	Unit for Livestock Conservation Fund (Ministry of Industry and Agriculture)	Established in 2012; Irrigation MNT 6.5 billion (USD 4.3 million); Rodent control 1.8 billion (USD 1.2 million); Feed MNT 1.5 billion (USD 1 million). Estimated budget for 2013 is MNT 7 billion (USD 4.66 million), MNT 1.7 billion (USD 1.13 million) and MNT 1.5 billion (USD 1 million)
Tax concessions	Herders full tax exemption Other famers pay 50 percent tax on taxable income	All herders and farmers	Ministry of Finance	Long standing program. There are no estimates of the total tax forgone; the MoF is working on such estimates.

Source: Review, estimation and analysis of agricultural subsidies in Mongolia, World Bank 2014

Table13: Funds to Support Agricultural Production and Processing (Million MNT)

	2008	2009	2010	2011	2012	2008-12 (Avg)
Size of funds supporting primary agriculture and agro-processing sector	**71,780**	**72,261**	**61,890**	**300,063**	**126,886**	**126,576**
I. Primary agriculture	**69,153**	**60,028**	**49,190**	**117,498**	**103,240**	**79,822**
I.1. Crop production programs	**24,458**	**47,810**	**38,017**	**68,496**	**48,979**	**45,552**
A. Crop Production Fund	***24,309***	***42,074***	***30,764***	***39,241***	***44,854***	**36,248**
A1. Wheat subsidies	*11,164*	*8,665*	*10,906*	*14,471*	*27,830*	**14,607**
A2. Fertilizer subsidy	*614*	*230*	*0*	*0*	*0*	**169**
A3. Crop loans 1/	*12,531*	*33,180*	*19,858*	*24,770*	*17,024*	**21,472**
B. SME Fund Crops *(Loans)*	***149***	***5,736***	***7,253***	***29,255***	***4,125***	**9,304**
I.2. Livestock Production programs	**44,695**	**12,217**	**11,173**	**49,002**	**54,261**	**34,270**
A. Livestock Conservation Fund	***30,560***	***0***	***0***	***17,806***	***31,510***	**15,975**
A1. Herders -Sheep and camel Wool subsidies	*0*	*0*	*0*	*9,827*	*29,436*	**7,853**
A2. Herders -cashmere subsidies	*30,500*	*0*	*0*	*0*	*0*	**6,100**
A3. Tech support loans 2/	*60*	*0*	*0*	*7,979*	*2,074*	**2,023**
B. Pasture management *(irrigate pastures, rodent/pest control)*	***11,500***	***5,228***	***5,815***	***3,170***	***5,823***	**6,307**
B1. Grants	*10,550*	*4,848*	*5,415*	*3,035*	*5,423*	**5,854**
B2. Loans	*950*	*380*	*400*	*135*	*400*	**453**
C. Vet. Services - vaccines, services *(Subsidy)*	***2,526***	***844***	***2,954***	***8,754***	***13,392***	**5,694**
D. SME Fund Livestock *(Loans)*	***109***	***6,146***	***2,404***	***19,272***	***3,536***	**6,293**
II. Agro-processing industry	**2,628**	**12,233**	**12,701**	**182,565**	**23,646**	**46,754**
A. Meat Stabilization Fund *(Subsidies)*	***2,400***	***2,400***	***1,400***	***8,000***	***10,800***	**5,000**
B. SME Fund Food processing *(Loans)*	***228***	***9,833***	***11,301***	***48,065***	***5,746***	**15,034**
C. Wool Processors *(Loans)*	***0***	***0***	***0***	***28,700***	***4,700***	**6,680**
D. Cashmere Processors *(Loans)*	***0***	***0***	***0***	***97,800***	***2,400***	**20,040**

Source: Review, estimation and analysis of agricultural subsidies in Mongolia, World Bank 2014

The National Emergency Management Agency (NEMA) is responsible for implementing *ex ante* and *ex post* responses to all types of natural disaster and is the principal agency that helps herders cope with dzud risks. In the event of a dzud, NEMA coordinates and finances the provision of hay and fodder, the movement of herders and livestock to alternative grazing areas, clearing of roads, search and rescue for endangered people and the disposal of livestock carcasses. The details of budget and expenditure on NEMA to help affected populations cope with risks were not available. See annex 3 for further details on NEMA.

The Government of Mongolia launched livestock insurance program in 2006, partially in response to 2000 dzud, to transfer the risk to commercial insurance markets. This public-private partnership (see annex 4 for details) insurance is multi-layered, covering high to very low frequency losses (from 6 to 30 percent losses). Soum level thresholds (indices) of livestock mortality are the basis for payouts and are based on NSO livestock loss statistics for the previous 40 years. Some 15,992 herder households were insured in 2012, and 2.46 million livestock, equivalent to 11 percent of all herder households and 6 percent of livestock (World Bank 2012). Penetration rates vary from 10 to 35 percent in

different aimags, and will likely vary widely as penetration increases into the newly covered aimags. Livestock insurance is making a powerful contribution to risk management. The largest groups of users are the most vulnerable herder households, with smaller herds of fewer than 200 animals. In addition to reduced risk, these herder households are also benefitting from improved access to credit and slightly lower loan interest rates. Both factors enhance their ability to smooth household income and invest.

A salesman is introducing the innovative Index-based Livestock Insurance to a herder. Livestock insurance is making a powerful contribution to risk management.

For cashmere price volatilities, the other main risk to Mongolia's agricultural sector, there is currently no well-established transfer mechanism. A commodity exchange for cashmere was established in 2013 in an attempt to better monitor the cashmere market, formalize trade, and make cashmere prices and trade more transparent. However, although the commodity exchange is made mandatory for all cashmere trade, the number of brokers (i.e. traders) allowed to participate on the exchange is limited to 32, restricting the potential market mechanisms of the exchange. Thus, what effects it will have on cashmere prices has yet to be seen.

In addition to the Government, a number of donors are engaged and supporting a wide array of programs (see table 12). The World Bank, IFAD, FAO and JICA are engaged in projects that helps improve pastureland management.

Table 14: Donor Off-Budget Expenditures (Commitments) on Agriculture (Millions US$), 2012-2016

Donor	Project Name	Amount (US$ million)	% of total
Swiss Development Cooperation	Animal Health Project	20.5	27.3
European Union	-	1.0	1.3
Asia Development Bank(ADB)	-	2.5	3.3
Millennium Challenge Corporation (MCC)	Peri-urban Rangeland project	5.9	7.9
JICA	Enhancing the Extension System for Comprehensive Crop-Livestock Management	2.0	2.7
UN	Improving Food Security for Rural Disadvantaged Population of Mongolia	1.3	1.7
UN	South-South Cooperation—Technical Assistance for Food Security Program	1.3	1.7
FAO	Integrated Livestock-based Livelihoods support program	12.5	16.7
IFAD	Market and Pasture Management Development Project	11.5	15.3
KOICA	Establishing an agricultural model enterprise in Khalkh gol soum	4.0	5.3
World Bank	Livestock and Agricultural Marketing Project (LAMP)	12.5	16.7
Total		**75.0**	**100**

Source: Mongolia Agriculture Sector Public Expenditure Review, World Bank 2014

Analysis of the existing risk management landscape reveals some key insights.

- A large number of initiatives are currently underway, across the mitigation-transfer-coping spectrum in Mongolia.
- There is a strong emphasis on disease management.
- Zhud management is more focused on coping, through NEMA, and transfer, through livestock insurance program.
- The investment on mitigation measures is relatively limited despite their multiple benefits (risk management as well as productivity improvement).
- Sustainable Land, pasture, and herd management warrants more attention and stronger policy shift.

8.3 Strengthening Agricultural Risk Management in Mongolia

While the Government of Mongolia has been very active in the area of agricultural risk management, this analysis has found considerable imbalance between the great priority assigned to disease risk and coping and transfer and the relative neglect of mitigation. Efforts to reduce the exposure to these risks are relatively underfunded. This section turns to a number of recommendations to improve this balance in Mongolia, and in so doing, substantially improve overall risk management.

Strengthen winter preparation practices among herders. The Government has an important role in strengthening knowledge of winter preparation and ensuring that decentralized monitoring of preparedness is in place. Winter preparation is a set of activities that herders carry out each year in anticipation of a severe winter that include animal nutrition, camp preparation, fodder and hay storage, and slaughtering of part of the herd. This knowledge has proven crucial in how well herders cope with a dzud (see Box 2). At the same time, this knowledge is no longer passed on between generations within the herding community to the extent that it once was. The profession has become much more mobile, with herders entering and exiting the sector. Important tools for this would be advisory services and information campaigns, in line with FAO's recommendations in the Winter Preparedness Report and Local Contingency Plans.

Herders were preparing fodder for winter – winter preparation is a set of activities that herders carry out each year in anticipation of a severe winter that include animal nutrition, camp preparation, fodder and hay storage, and slaughtering of part of the herd.

Facilitate otor migration in the incidence of extreme weather events and educate new herders on how to use otor as a mean to mitigate risks.[8] The main mitigation

[8] Otor migration is the tradition risk management method of moving animals to distant pastures where there are adequate forage supplies for winter. It means rapid move of animals due to adverse local grazing

measure adopted by individual household herd owners is *otor:* an irregular, long-distance move, outside the normal seasonal migrations, undertaken to fatten animals in autumn as a part of winter preparation, or to avoid or respond to winter disasters. Households which go on otor in general lose fewer animals than those which do not. As the amount of snow that accumulates often requires heavy equipment to remove, the Government has an important role in opening up snowbound routes so that remote herders can move their animals. Otor also requires good capacity in terms of adequate labor, knowledge of the location of otor pasture reserves, management skills, and information networks – something which advisory services and local governments can have an important role in strengthening.

Aimag and soums should set aside pasture land to be used only when a dzud has been declared. Although otor migrations can occur in any year to fatten animals, otor is particularly important as a response to a dzud. However, herds moving on emergency otor may have a negative impact on herds resident in the refuge area by grazing down available forage. Conflicts arise rapidly in these circumstances. As a practice stemming from the collective period, areas are set aside throughout Mongolia for herders to take their animals on otor but the legal status of such areas is unclear. Also, the level of organization and scheduling of use of these areas has declined with no clear attribution of responsibilities. Local government or herder joint planning of emergency otor is essential to provide emergency otor and avoid conflicts among herders.

A shelter built by herders for their animals during the winter

The Government has a clear role in gathering, monitoring, and disseminating early warning information such as weather forecasts and pasture quality indicators. Numerous donor programs have improved the information available for forecasting and assessing the onset of a dzud, including the World Bank financed Livestock Eearly Warning System (LEWS) under the Sustainable Livelihood Project (SLP). This information base includes medium-range weather forecasts and assessments of grazing availability, winter feed stocks and livestock numbers. While there is ample scope to further strengthen this information base, more emphasis could be placed on: (i) improving herder access to and trust in this information; and (ii) on the SEC using it to establish more graduated thresholds for disaster warnings and response. The system for monitoring the evolution of potential emergencies will need to become more pro-active and continuous, based on a series of clearly defined thresholds for differentiated levels of action.

Pasture tenure security is a critical feature of mitigation and public institutions have a clear role in awarding and ensuring tenures. Improved pasture management

conditions (over 15 - 20 km from the main camp) with only a few herders, without moving the main camp and leaving the family behind.

and household hay making can only take place where households, camps, and larger groupings have secure rights over (i) winter and spring pastures[9], and (ii) hayfields.[10] There need to be an unambiguous land law in place and monitoring and facilitation for implementation.

Box 3. Reducing Livestock Mortality from Dzud by Good Winter Preparedness

Winter preparation is the way herders mitigate the substantial risks of pastoral life. Comprehensive winter preparation puts individual and small groups of herders in a position to manage a certain level of dzud, drought or other hazard. Beyond this level government will have to intervene. But if all herders were skilled in the techniques of winter preparation the impact of natural disasters would be substantially reduced.

The difference in losses during the last dzud between three herders within a limited geographic area shows the importance that knowledge has in managing risks. All three herders were nomadic herders and lived within a radio of about 30 km^2; however, as a result of their preparation and risk management skills, there was a large gap between the three herders in the losses they experienced. During the last dzud in 2009/2010 the country as a whole lost 22 percent of its livestock. Of the three herders, the first herder with a 1,400 mixed livestock herd lost 10 animals, the second with a 1,300 mixed livestock herd, lost 10 percent of his herd, and the third, who had about 140 animals (sheep, horses, and cattle) and thus a subsistence farmer below the national poverty line, lost 50 percent of his livestock.

When talking to the three herders it was clear good winter preparation was the principal determinant for how well the animals coped during the dzud. The winter preparedness includes fattening up animals, selective and early de-stocking, preparing adequate winter feed and fodder, preparing and repairing winter shelter, altering herd composition, toughing up animals through temporary migration, and a host of other measures. The herder who lost 50 percent of his herd did not undertook adequate winter preparedness measures due to lack of knowledge and resources while the herder who lost only 10 animals is one of the most knowledgeable and resourceful herder who strongly emphasizes the value of good winter preparedness. Considering the exposure to dzud risk and influx of inexperienced herders in recent times, the aim should be to raise the level of knowledge and skill of all herders to the level of today's best herders, through training in winter preparation techniques conducted by those best herders.

Source: Authors

Support existing networks between herders and encourage inclusiveness by incentivizing supportive camps. Networks are an essential element of social relationships among herders and become especially significant at a time of grave livelihood disturbance such as dzud. These networks are the means through which herders negotiate access to otor pastures, and if necessary acquire the extra labor needed for a long distance move in hostile environmental conditions. Exchange of knowledge, experience and techniques are also important but wealthy herders often

[9] The winter/spring pastures on which the group spends the danger period for *dzud* starting from early autumn, through winter to late spring. Various alternatives have been tried under the present law, but it has proved difficult to provide the assurance needed for groups to be able to leave their winter/spring reserve pastures unoccupied while members graze distant summer and autumn pastures. At present one herder often stays behind to protect these pastures, not always successfully. This is often a route into conflict when groups allocate these pastures as their own reserve and arrive back in early autumn to find that someone else has already grazed down the pasture. Rights to camp sites are widely accepted in customary land dealings, rights to winter/spring pastures also, although free-riding is common. Experimental attribution of use rights certificates to winter-spring reserve pastures of *khot ail* camps and larger semi-formal groupings of households are underway and have shown some promise.

[10] Exclusive use of hayfields is also claimed by individual households and groups although there are commonly disputes over this. If hayfields are not fenced they may be grazed by passing herds. Lack of secure tenure is a strong disincentive to household hay making.

have the best networks while herders with fewer animals, new herders, and those with limited kin networks are disproportionally likely to suffer herd losses. A way to strengthen these networks and to ensure that they are inclusive also in a mobile sector could be through incentives to *supportive camps*. Supportive camps form part of a network of herders and is often led by a successful herder. Traditionally, it provides support to herders, especially in times of difficulty, but herders may also work for the leader for periods to learn. These camps can be given a more formal role in strengthening the networks, introducing new herders to best herding practices, and integrating them into existing networks.

Improve crop production practices for better risk management. Considering the emphasis the Government places on increasing domestic grain production, it will be important to incorporate crop risk management into any risk management framework. This will involve a) preparing and adhering to a land use plan[11] and ensuring that only the land suitable for crop production is used and that marginal and vulnerable land is ineligible for cultivation; b) putting more emphasis on conservation agriculture, minimum tillage if applicable, good soil and water management practices, and improving irrigation efficiency; and c) promoting more drought tolerant varieties. In addition, crop insurance for larger commercial farmers could be helpful.

Improve price risk management through better information systems and through strengthened policy evaluation of on-going price interventions. Price volatility, largely stemming from underlying supply or macroeconomic shocks, is a major risk and stabilizing the supply, improving information systems, and storage infrastructure could contribute to reduced volatility. The agriculture sector, especially livestock, is still an informal system which limits the use of financial price risk management instruments (hedging, forward contracts, etc.). Price stabilization funds have been set up by the Government which could, in theory, help stabilize prices. Further analysis could be conducted to understand the actual impact of these stabilization funds in reducing price volatility and to explore areas for further improvement.

Strengthen the coordination between government agencies, levels of government, and donor organizations to improve the effectiveness of emergency and post-emergency response. The 2009/10 dzud revealed deficiencies in coordination between the departments and agencies involved in the dzud relief. This concerns identification of adverse events, response in the case of emergency, and financing of activities. When a state emergency or disaster has been declared, as in the case of the 2009/10 dzud, resources and personnel should be mobilized also from other departments that are not directly related to the agriculture sector. Although NEMA has strong capacity, a single agency cannot maintain stand-by capacity for a large-scale emergency. During the collective period for example, the army usually availed vehicles for clearing snow in distant areas. The lessons learned from the 2009/10 dzud are described in detail in Annex 2.

Box 4. Responsiveness in Emergency: Lessons from Mexico's Scalable Social Safety Nets

Mexico's Programa de Empleo Temporal (PET) provides an example of a multi-agency response program that is triggered in times of emergencies. PET is an inter-agency social safety net program overseen by the Ministry of Social Welfare while implemented by several line ministries. The responsibilities of each party and the coordination mechanisms are defined by a Parliamentary act, which requires the ministries involved to share a common beneficiary

[11] This has already been supported to a certain extent by the World Bank financed Sustainable Livelihood Project (SLP)

database (registry). All implementing agencies receive data from an early warning system that allow them prepare an emergency response or scale up in affected localities through PET. In response to climate events and natural disasters, the Government of Mexico used PET to provide rapid support to an additional 900,000 people between 2007 and 2011. The following components have proven important to allow PET to scale up in response to crises: (a) early warning systems are linked to programming; (b) contingency plans are established; (c) contingency financing is available; and (d) institutional capacity is in place ahead of crises.

Source: World Bank, 2014(a)

Secure rapid access to emergency finance, including access to contingent finance. Given the difficulty of mobilizing adequate finance during the 2009/10 dzud, both from the Government's budget and from donors, there is a need to establish a formal mechanism for availing sufficient funding during an emergency event. In a World Bank evaluation of Mongolia's response to the 2009/10 dzud, Benson (2011) outlines a series of recommendations for how to do this, including setting up a contingency fund with support from donors to be made available in the event of an emergency. Further analysis of contingent funding mechanism and its deployment in Mongolia should be explored.

For longer-term risk mitigation, incentivize sustainable herd structures and pasture management. As was seen in the report, many of current production risks in the livestock sector are closely linked with overgrazing and disproportional livestock mixes and herd sizes. Rather than providing specific output subsidies that distort incentives for alternative production, agricultural supports programs can be used to incentivize environmental practices and more optimal herd sizes to prevent overgrazing and ensure that pastures remain productive into the future. And though support to outputs is generally less optimal, making it conditional on recipients' compliance with well-defined practices to encourage improved land-management and sustainable use of natural resources. Investment support can also be provided for risk mitigating and more sustainable practices and pasture management. Box 5 describes Uruguay's successful experience in supporting investments and related agricultural services for improved natural resource management.

Box 5. Incentivizing Improved Natural Resource Management: The Uruguay Integrated Natural Resources and Biodiversity Management Project

Uruguay faces similar challenges as Mongolia but a successful initiative helped farmers adapt economically and environmentally sustainable practices.

Uruguay's agricultural sector is vital for the economy as it accounts for 70 percent of export (including processing) and occupies around 13 percent of the labor force. The main component is livestock and the extensive beef production sector uses 80 percent of the country's land, 70 percent of which is currently natural pasture. At the same time, emerging crop sectors compete for available agricultural land, thereby necessitating increased productivity on available pastures.

By supporting on-farm agro-environmental and climate-smart investments to reduce the vulnerability of livestock producers to Uruguay's increasing climatic variability, the Integrated Natural Resources and Biodiversity Management Project contributed to radically improving natural resource management in Uruguay. Interventions promoted by the project were improved management of natural pastures, enhanced soil quality, increased accessibility to water, rehabilitated native forests, and biodiversity management. In addition to supporting on-farm investments, the project also financed complementary services, including technical assistance to farmers, training to all segments of the rural population, and improved communication and dissemination. Technical services provided by private professionals in extension were upgraded and more fully integrated with sound practices. The well-targeted combination of demonstrations through on-farm investments and knowledge management led to tangible behavioral changes among farmers and mainstreamed biodiversity conservation in production system as well as in national agricultural institutions' agendas, which allowed for the creation of joint ventures for better rural practices. Today, some 25 percent of the country's vulnerable family farmers adopted economically and environmentally sustainable practices.

As a result of these interventions, the conservation of 243 native species was supported, including 79 listed on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List, 18 identified by the Convention on International Trade in Endangered Species of Wild Fauna and Flore (CITES), and 51 defined as National Priorities. The project generated about US$33.5 million per year total incremental income for project beneficiaries along with significant environmental externalities for the benefit of the Uruguayan productive landscape, and is estimated to have saved over US$30 million avoided loss in livestock production due to summer droughts.

The project was financed by the World Bank and the Global Environment Facility (GEF) and is now being followed up by the Sustainable Management of Natural Resources and Climate Change Project, with an expanded scope and focus on climate-smart agriculture.

Source: The World Bank, 2014(b)

8.4 The Way Forward

The study has highlighted that dzuds, price volatility, drought and macroeconomic shocks have emerged as the four biggest risks for the agriculture sector. The vulnerability of Mongolian agriculture to these risks is likely to be further exacerbated by climate change. The Government of Mongolia is running a number of programs to manage agricultural risk. There are, however, some areas, especially in the mitigation sphere, which could be strengthened. Stronger emphasis on winter preparedness, improving herders' skills, facilitating otor migration, improving early warning systems, setting aside pasture land for extreme weather, and other measures may help to reduce livestock mortality and losses.

The Government's agricultural support program can be applied more strategically for risk management purposes. Subsidies are currently a large share of the Government's agricultural budget, mainly targeting livestock and wheat production. Given the size of the Government's support to the private sector, there is ample opportunity to reward farmers for applying sustainable pasture management and herd sizes. And both services and investment support can be used to strengthen risk management skills among herders and to rehabilitate winter shelters and other risk management infrastructure. Subsidies to encourage herders to destock could be used as an early response mechanism in this context, and herders without adequate feed reserves and/or those who don't destock can be judged ineligible for subsequent public support. And rather than financing restocking after a dzud, income diversification should be encouraged.

Similarly, incentives can be provided to the crop sector to promote risk mitigating practices. While subsidies have proven highly effective in encouraging production, making them conditional on farmers using suitable land management practices such as techniques to improve soil moisture can target these public expenditures more purposefully. The Agricultural Expenditure Review carried out by the World Bank in 2014 also found a large discrepancy between producer support and current allocations to R&D. Focusing more R&D on developing climate resilient crop varieties and improving conservation agriculture for the local environment will be even more important in a changing climate and limited water resource availability.

The long-term resilience of the livestock sector can only be strengthened by ensuring a sustainable balance between livestock numbers and pasture availability. Striking this balance will become increasingly challenging with climate change and as Mongolian agriculture comes into more competition for water resources from households and industries. The public sector has a major role to play in supporting agricultural development and in introducing and enforcing regulations to protect environmental resources and promote sanitary and food safety standards. Public policy will need to effectively engage agriculturists in achieving sustainable land, pasture, and herd management in Mongolia.

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Annex 1: Methodology and Quantification of Losses

Official information on losses due to adverse events is derived in different ways and is invariably approximate. To provide a more consistent basis for comparison, analysis was thus based on estimates of the "indicative" value of losses. While these estimates draw on actual data as much as possible, it is emphasized that they represent indicative not actual losses. Indicative loss values are also compared to the total value of GAO in the relevant year to provide a relative measure of the magnitude of loss.

Loss Thresholds

Loss thresholds were set initially to distinguish major adverse events from smaller, inter-annual variations in output. For the inter-annual variation of aggregate measures of GAO, which all followed a normal distribution[12], these thresholds were set at approximately one (downside) standard deviation from the mean of the inter-annual variation. For individual commodities initial estimates were also made on this basis, where a normal distribution was discerned (approx. 50% of variables). Where inter-annual deviation did not follow a normal distribution, threshold estimates were based on the average of the downside inter-annual deviations. Final thresholds were then set, based on these estimates and observed experience of the incidence and level of adverse events. All thresholds were rounded to the nearest 5%. Results are presented in Table 13.

Table 15.	**Thresholds for Risk Analysis**		
	GAO Constant Price	**GAO Real Price**	**Commodity Price**
Total GAO	10%	10%	na
Livestock GAO	10%	10%	na
Crop GAO	10%	10%	na
Beef	10%	15%	10%
Mutton	10%	15%	10%
Cow Milk	10%	15%	10%
Cashmere	10%	15%	10%
Potato	10%	15%	10%
Wheat	15%	20%	10%

Source: Author's calculations

Note that the real price thresholds for aggregate measures of agricultural output are lower than those for individual commodities, due to the offsetting effects of different commodities within the aggregate. For individual commodities the threshold for analysis measured in constant prices is also lower than that measured in real prices. Output measured in constant prices reflects the variation due to production only, while output measured in real prices reflects the joint impact of variation in both production and price.

The Indicative Value of Losses

For **production risks** the value of GAO "lost" for each adverse event was first calculated in tugrik as the difference between the actual change in output and the threshold change in output, using *constant producer prices* (2004-2006). The resultant value was converted into US$ at 2012 exchange rates and also expressed as a percentage of the

[12] Based on the Shapiro-Wilk test.

value of GAO. The same methodology was used to derive the **combined impact of production and price shocks,** based on actual production and *real prices*. This captures the joint impact of price and production shocks – which is the reality that the sector faces.

For **price risks** the actual value of output in real terms was compared with the notional value of output resulting from a 10 percent (threshold) fall in *real prices* relative to the previous year. The total loss due to a price fall was then calculated in tugrik at real prices (2012=100) as the difference between actual GAO and the notional GAO at threshold prices. This approach allows the loss due to adverse price events to be captured more independently of losses due to an adverse fall in production, although it doesn't fully remove the joint endogeneity of prices and production.

Application of this methodology requires a consistent set of data on both production and prices, for an extended time period. Of the various sources of data available, FAOSTAT's data series (1991-2011) on the value of gross agricultural production and producer prices was considered the most suitable. These data allowed the analysis of risk over a 20-21 year period for all products except cashmere where suitable FAOSTAT data were not available. For cashmere, data from the NSO were used for the period from 2003-2012. The analysis of price risk for beef and mutton was based on prices derived from GAO and production as there were no relevant price data. However further analysis showed that these derived prices were consistent with relevant live weight price data.

The various shocks derived from this analysis were attributed to specific events on the basis of interviews with officials in national and regional government, farmers and traders, plus information from published reports and internet sites.

The impact and causes of the major shocks to aggregate output since 1991 are summarized in Table 14 below, first for total GAO and then for livestock and crop GAO separately. Results in both constant and real prices are presented to show the impact on production alone (constant prices[13]) and the joint impact of shocks to production and prices.

[13] FAOSTAT: Constant producer prices calculated as average for 2004-2006.

Table 16. Impact and Causes of Adverse Events for Aggregate Agricultural Output					
Item	**Year**	**Indicative Loss Value[ab] (2012)**			**Causes**
		tugrik (m)	**$US (m)**	**% GAO**	
Aggregate GAO					
Constant Prices	1992	-26,318	-19.360	2.5%	Economic transition
	1993	-1,407	-1.035	0.2%	Dzud, Economic transition
	2001	-108,038	-79.475	12.4%	Dzud
	2010	-86,880	-63.91	8.4%	Dzud
Real Prices	1992	-196,857	-144.811	24.3%	Economic transition
	1994	-40,364	-29.693	4.5%	Price shock
	1997	-350,616	-257.920	43.6%	Price shock (Asian fin crisis)
	2010	-112,229	-82.558	6.0%	Dzud
Livestock GAO					
Constant Prices	1992	-14,529	-10.687	1.4%	Economic transition
	1993	-12,240	-9.004	1.3%	Dzud, Economic transition
	2001	-128,273	-94.360	14.8%	Dzud
	2003	-33,018	-24.288	4.4%	Post-Dzud production fall
	2010	-137,314	-101.010	13.2%	Dzud
Real Prices	1992	-154,324	-113.523	19.0%	Economic transition
	1997	-293,264	-215.731	36.5%	Price shock (Asian fin crisis)
	2000	-31,360	-23.069	3.7%	Dzud
	2002	-8,098	-5.957	1.1%	Dzud
	2003	-13,280	-9.769	2.0%	Post-Dzud production fall
	2010	-138,319	-101.750	7.3%	Dzud
Crop GAO					
Constant Prices	1992	-11,788	-8.671	1.1%	Economic transition
	1994	-33,766	-24.839	3.9%	Economic transition
	1995	-2,395	-1.762	0.3%	Economic transition
	1996	-6,671	-4.907	0.7%	Drought
Real Prices	1992	-42,533	-31.288	5.2%	Economic transition
	1994	-50,286	-36.992	5.6%	Price shock, transition
	1997	-57,348	-42.186	7.1%	Price shock (Asian fin crisis)
	1998	-2,228	-1.639	0.3%	Drought
	1999	-12,382	-9.108	1.4%	Drought, price shocks
	2005	-501	-0.368	0.1%	Drought

Sources: FAOSTAT, Authors calculations

[a]Calculated as the difference between the actual inter-annual change in GAO and the threshold change in GAO.

[b]In 2012 values based on real MNT prices (2012=100) and $US/MNT exchange rates for 2012.

Livestock Commodity R isks

Indicative losses for livestock commodities (Table 15) were analyzed for cow's milk, beef, mutton and cashmere (2003-2012 only). The results reflect the influence of the major shocks identified in Table 8 above, plus further commodity specific shocks due to drought and price volatility. Losses are lower in absolute terms as they are commodity specific, but they show the relative importance of these commodities to overall GAO.

Price shocks emerge as low frequency events for all commodities, although their impact is quite strong. Drought is also a low frequency event, with an impact similar to that of a smaller dzud. For mutton, beef and cashmere the analysis shows that the impact of dzuds can extend beyond the immediate weather related livestock losses due to its impact on post-dzud production levels.

Table 17.	Impact and Causes of Adverse Events for Livestock Commodities				
Item	**Year**	**Indicative Loss Value[ab] (2012)**			**Causes**
		tugrik (m)	**$US (m)**	**% GAO**	
Cows Milk					
Constant Prices	2000	-24,421	-17.964	2.3%	Dzud
	2001	-26,081	-19.186	3.0%	Dzud
	2005	-19,799	-14.565	2.5%	Drought
	2010	-27,406	-20.160	2.6%	Dzud
Real Prices	1992	-3,775	-2.777	0.5%	Economic transition
	1997	-32,270	-23.738	4.0%	Price shock (Asian fin crisis)
	2000	-89,242	-65.648	10.6%	Dzud, price shock
	2002	-2,386	-1.755	0.3%	Dzud
	2005	-26,494	-19.489	3.1%	Drought
	2006	-20,564	-15.128	2.3%	Milk price shock
	2010	-5,415	-3.983	0.3%	Dzud
Beef					
Constant Prices	1993	-8,583	-6.314	0.9%	Dzud, Economic transition
	2001	-83,123	-61.147	9.6%	Dzud
	2003	-26,077	-19.183	3.5%	Post dzud fall in cattle slaughter
	2005	-4,184	-3.078	0.5%	Drought
	2010	-12,203	-8.977	1.2%	Dzud
Real Prices	1992	-16,685	-12.274	2.1%	Economic transition
	1997	-53,294	-39.204	6.6%	Price shock (Asian fin crisis)
	2001	-28,805	-21.190	3.7%	Dzud
	2003	-13,322	-9.800	2.0%	Post dzud fall in cattle slaughter
	2010	-15,400	-11.329	0.8%	Dzud
Mutton					
Constant Prices	1992	-12,803	-9.418	1.2%	Economic transition
	1997	-15,205	-11.185	1.6%	Dzud
	2001	-12,436	-9.148	1.4%	Dzud
	2003	-15,572	-11.455	2.1%	Post dzud fall in sheep slaughter
	2005	-3,362	-2.473	0.4%	Drought
	2010	-13,424	-9.875	1.3%	Dzud
Real Prices	1992	-55,657	-40.942	6.9%	Economic transition
	1996	-6,498	-4.780	0.5%	Drought
	1997	-132,976	-97.820	16.5%	Price shock (Asian fin crisis)
	2001	-6,499	-4.781	0.8%	Dzud
	2002	-586	-0.431	0.1%	Dzud
Cashmere					
Constant Prices	2011	-74,587	-54.867	6.3%	Post dzud fall in goat numbers
Real Prices	2008	-26,810	-19.722	1.6%	Price shock
	2011	-31,574	-23.226	1.5%	Post dzud fall in goat numbers

Sources: FAOSTAT, Authors calculations

[a]Calculated as the difference between the actual inter-annual change in GAO and the threshold change in GAO.

[b]In 2012 values based on real MNT prices (2012=100) and $US/MNT exchange rates for 2012.

Crop Commodity Risks

Indicative losses for the two main crops, wheat and potatoes, were also analyzed for both constant and real prices (Table 16). A different pattern of shocks emerges, with a much greater impact of economic transition on crop production during the early 1990's and a more frequent impact of drought.

Table 18. Impact and Causes of Adverse Events for Principle Crop Commodities

Item	Year	Indicative Loss Value[ab] (2012)			Causes
		tugrik (m)	$US (m)	% GAO	
Wheat GAO					
Constant Prices	1992	-1443	-1.061	0.1%	Economic Transition
	1994	-20,536	-15.107	2.4%	Economic Transition
	1995	-5,716	-4.205	0.6%	Economic Transition
	1996	-985	-0.724	0.1%	Drought
	1998	-3,449	-2.538	0.3%	Drought
	2000	-1,004	-0.738	0.1%	Drought
	2005	-14,147	-10.407	1.8%	Drought
Real Prices	1992	-7,999	-5.884	1.0%	Economic Transition
	1994	-48,294	-35.526	5.4%	Economic Transition
	1997	-14,628	-10.761	1.8%	Price shock (Asian fin crisis)
	1998	-6,208	-4.567	0.8%	Drought
	2005	-13,212	-9.719	1.6%	Drought
Potato GAO					
Constant Prices	1992	-7,789	-5.730	0.7%	Economic Transition
	1993	-9,842	-7.240	1.1%	Dzud
	1996	-710	-0.522	0.1%	Drought
Real Prices	1992	-5,275	-3.880	0.7%	Economic Transition
	1993	-3,620	-2.663	0.4%	Dzud
	1996	-13,152	-9.675	1.0%	Drought
	1997	-15,103	-11.110	1.9%	Price shock (Asian fin crisis)

Sources: FAOSTAT, Authors calculations

[a]Calculated as the difference between the actual inter-annual change in GAO and the threshold change in GAO.

[b]In 2012 values based on real MNT prices (2012=100) and $US/MNT exchange rates for 2012.

Economic transition resulted in a rapid fall in the area planted in the early 1990's, particularly for wheat. Both wheat and potatoes were then hit by the price shocks that occurred after the Asian financial crisis in 1997, and droughts in 1996 and 1998. Output has been relatively stable for both crops since then, apart from a drought in 2005.

Commodity Price Risks

Price shocks were analysed separately for the livestock and crop commodities examined above, using real prices as the basis for analysis (Table 17). A high proportion of the observed price shocks are a response to adverse events outside the sector. Generalised price shocks occurred in response to the Asian financial crisis in 1997. Cashmere prices fell in response to the global financial crisis in 2008, and wheat prices fell in parallel with world prices after they spiked in response to the world food price crisis in 2008-2009.

The remaining price shocks appear to reflect instability in domestic markets. Milk prices are the most volatile, with sharp price swings in response to fluctuations in production.

Paradoxically, milk and mutton prices also fall sharply during some dzud years – when production falls. The smaller observed price shocks for beef, wheat and potatoes are also difficult to explain.

Table 19.	**Impact and Causes of Adverse Events for Commodity Prices**				
Item	**Year**	**Indicative Loss Value[ab] (2012)**			**Causes**
		tugrik (m)	**$US (m)**	**% GAO**	
Cows Milk					
Real Prices	1992	-9,662	-7.108	1.2%	Economic transition
	1994	-3,681	-2.708	0.4%	Production increase
	1997	-63,530	-46.734	7.9%	Asian Financial crisis
	2000	-50,085	-36.843	6.0%	Dzud – reduced demand (?)
	2002	-4,171	-3.068	0.6%	Dzud – reduced demand (?)
	2006	-47,826	-35.182	5.4%	Production increase
	2011	-40,908	-30.093	1.9%	Production increase
Beef					
Real Prices	1992	-10,735	-7.897	1.3%	Economic transition
	1996	-20,549	-15.117	1.6%	Economic downturn
	1997	-57,377	-42.208	7.1%	Asian Financial crisis
	1999	-491	-0.361	0.05%	??
	2009	-18.498	-13.608	0.8%	??
Mutton					
Real Prices	1992	-35,061	-25.791	4.3%	Economic transition
	1996	-25,755	-18.946	2.0%	Economic downturn
	1997	-101,625	-74.757	12.6%	Asian Financial crisis
	2002	-5,317	-3.912	0.8%	Dzud – reduced demand (?)
Cashmere					
Real Prices	2008	-94,135	-69.248	5.7%	Global financial crisis
	2009	-25,340	-18.640	1.1%	Global financial crisis
	2012	-41,656	-30.643	na	World price falls
Wheat					
Real Prices	1994	-17,672	-13.000	2.0%	Economic transition
	1997	-40,586	-29.856	5.0%	Asian Financial crisis
	1999	-3,219	-2.368	0.4%	???
	2011	-7,162	-5.268	0.3%	World prices fall
Potatoes					
Real Prices	1996	-9,243	-6.799	0.7%	Economic downturn
	1997	-25,863	-19.025	3.2%	Asian Financial crisis
	1998	-2,037	-1.498	0.3%	Economic downturn
	2010	-6,695	-4.925	0.4%	???

Sources: FAOSTAT, Authors calculations

[a]Calculated as the difference between the actual inter-annual change in GAO and the notional change in GAO at "threshold" prices.

[b]In 2012 values based on real MNT prices (2012=100) and $US/MNT exchange rates for 2012.

Annex 2: Risk Management: The 2009-10 Dzud

The 2009-2010 dzud was among the most severe experienced in Mongolia. Livestock losses were estimated at 9.7 million head, equivalent to 22 percent of the national herd. An estimated 8,700 households lost all of their animals and 40,000 households lost 50 percent or more. The replacement cost of these livestock was estimated at 264 billion MNT (US$ 192 million), equivalent to 4.4 percent of 2009 GDP (Benson, 2011). The Government launched a major relief operation in December 2009, with an estimated cost of US$ 25 million, to which donors began responding in February 2010. Eventual government financed relief measures amounted to approximately US$ 5 million and donor funded measures to US$ 11–20 million (Benson, 2011).

Dzuds are slow-onset events, with ample opportunity for pre-emptive action. The challenge is in deciding how soon to act and how to calibrate the response to an evolving situation. Drought affected some 70 percent of Mongolia during the summer of 2009, prompting early concerns at the risk of a dzud. An SEC working group confirmed this risk in July 2009 and the National Emergency Management Agency (NEMA) and the Ministry of Food, Agriculture and Light Industry (MFALI) encouraged herders to prepare fodder and consider temporary resettlement to areas with better pasture. Their advice was ignored and feed reserves actually fell relative to previous years (Benson, 2011). Low livestock prices also discouraged herders from destocking. Note that NEMA's capacity to initiate pre-emptive action is restricted, as a hazard or disaster must be declared to have recourse to public reserves or public expenditure.

Heavy snow fell in October 2009, which then melted and iced over – preventing access to grazing that would normally be accessible until December. The State Emergency Commission (SEC) declared a hazard and NEMA began distributing fodder in late December as herders had run out of stored feed. SEC formed another working group in early January and states of disaster were declared in eight aimags. Heavy snow and blizzards and a sharp fall in temperature in January and February led to a re-assessment by SEC in early February and a second in March. By then, disaster and/or dzud was declared in a total of 80 soums in 15 aimags. Snowfalls and below average temperatures continued through March and April, and well into May 2010. It can be noted that many herders experienced heavy livestock losses during these later months, although they were not classified as being in a disaster area.

The late Government response to the dzud was exacerbated by the limited resources available for emergency and post-dzud recovery operations. A total of US$ 16-25 million, or US$ 21-33 per affected person, was raised was raised -- much lower than the US$ 30 million raised for the comparably less severe 2002 dzud[14]. The lack of resources was in part due to the poor response to an international appeal for aid, which generated only 19 percent of the requested amount. Government's limited ability to mobilize financing from its own budget is also evident in that its contribution of US$ 5 million to response activities was relatively low. NEMA's capacity to provide strong leadership and coordination for such a large, multi-agency response was also severely tested, due to its limited human and financial resources, limited equipment and a lack of clarity about the roles and responsibilities of different agencies and authorities at national and local level. Disparate approaches were apparent at the micro level, with donors targeting needy households while government chose to spread assistance evenly across all affected households. Much assistance was given in livestock fodder rather than in cash. Although post-dzud restocking of animals was a priority, actual support for re-stocking was

[14] About 3.5 million livestock was lost in the 2002 dzud.

ultimately limited, due to lack of government resources and lack of clarity as to which ministries and agencies were responsible for this initiative. This lack of clarity between government ministries and agencies as to the responsibility for post-dzud measures was also found to be a general constraint to government efforts to support post-dzud recovery – affecting education, health and employment.

In conclusion, there is a need to ensure timely emergency response that allow for a more graduated basis for public response and which encourages herders to reduce risk and strengthen preparedness for dzud themselves. The sequence of events outlined above highlights not only the numerous opportunities lost for pre-emptive action, but also the difficulty of motivating herders to take pre-emptive action themselves and NEMA's difficulty in deciding when and how to respond.

Annex 3: The National Emergency Management Agency

The National Emergency Management Agency (NEMA) is responsible for implementing *ex ante* and *ex post* responses to all types of natural disaster. It was established in 2004 through and currently employs 3,800 people, including 80 professional staff in Ulan Battar. At national level it reports to the Deputy Prime Minister. Local NEMA agencies operate at aimag level under the Aimag Governor and at soum level under the Soum Governor. NEMA is active in all years in response to fires, droughts and dzud.

Decisions on what constitutes a national or local disaster are made by a separate State Emergency Commission (SEC), which reviews the magnitude of adverse events. Chaired by the Deputy Prime Minister, the 25 member SEC includes the Head of NEMA (as Deputy), high-level representatives from nine line ministries, other government agencies, a civil society organization and the Mongolian Red Cross. NEMA implements the emergency response once a disaster is declared. The SEC also makes all relevant budgetary decisions, including the release of state reserves, and submits these decisions to the Cabinet for approval. The SEC's high level government representation allows it to work quickly, with as little as 8 days required to disburse funding in response to requests for assistance (Benson, 2011). Requests for international assistance for emergency response are also instigated and coordinated by the SEC.

Disaster preparedness, through the use of public reserves, is a critical element of NEMA's mandate. Public reserves of food, grain, fodder, fuel and other goods deemed necessary for national security are held by the State Reserve at strategic locations throughout the country. Additional reserves are held by aimag and soum authorities. The size of these reserves is specified by law. For livestock the aim is to ensure the following level of public and private fodder and hay reserves each year:

Private herders	7 days
Local government	3 days
NEMA	5 days

Public stocks are released on the instruction of the SEC, which also determines the method of release (sales or free distribution) and the use of any resulting revenue. A separate Government Reserve fund is held by the Ministry of Finance for other contingencies, part of which is ring-fenced for disaster events and human and livestock epidemics. The emphasis on public reserves may shift in the future with NEMA placing more emphasis on encouraging herders to carry their own stocks and rationalize livestock numbers, and on the protection of human lives. Recourse to financial reserves and financial support may also become more prevalent, relative to the current emphasis on managing and distributing physical reserves.

In the event of a dzud NEMA coordinates and finances (through SEC) the provision of hay and fodder, the movement of herders and livestock to alternative grazing areas, clearing of roads, search and rescue for endangered people and the disposal of livestock carcasses. Firefighting is also managed and coordinated by NEMA through its local government agencies. Local authorities are viewed as the first line of response for localized adverse events. Inadequate resources often limit their capacity to respond, however, particularly if their budget allocation from NEMA has already been used for other emergencies.

NEMA's capacity for disaster prevention and protection has benefitted considerably from a long-term project to strengthen the national capacity for disaster mitigation and management, funded by UNDP and the Government of Luxembourg. In addition to guiding the establishment of NEMA in 2004, this project has helped to strengthen the legislative basis for disaster management, train staff and provide equipment, strengthen local government capacity for emergency response and develop a national strategy for disaster risk reduction.

Annex 4: Mongolia Livestock Insurance Overview

Working with the World Bank and other donors the government of Mongolia has developed a multi-layered framework for responding to livestock loss, of which livestock insurance is a critical component. The risk layers are as follows:

Layer 1: High frequency losses below a threshold of 6 percent, which herders are expected to cover themselves.
Layer 2: Low frequency losses (one in ten years) below a threshold of 30 percent, covered by livestock risk insurance.
Layer 3: Very low frequency, catastrophic losses above the 30 percent threshold for insurance coverage, to be covered with public funds.

A pilot livestock insurance scheme to cover layer 2 risk was initiated in three selected aimags in Western, Khangai and Eastern regions in 2006 (Uvs, Bayankhongor, and Khentii). The aim was to establish a viable, affordable insurance scheme based on a partnership between government and private insurance companies. Consistent with this objective, an index based insurance scheme was developed to keep costs and premiums low. Soum level thresholds (indices) of livestock mortality were determined as the basis for payouts, based on NSO livestock loss statistics for the previous 40 years.

Actual, soum-level mortality rates are assessed each year by NSO on the basis of a year-end livestock census and a follow-on mid-year survey. NSO survey data is also used to set the soum-level livestock values used as the basis for payouts. Herders can choose the number and type of animal insured (sheep, goats, cattle, yaks, horses, camels are eligible) and whether to cover them for full or partial value. Loss payments are triggered whenever losses exceed the thresholds for each soum, irrespective of the level of loss by individual herders. An insured herder can thus receive a payout even if no losses are incurred.

Insurance Coverage

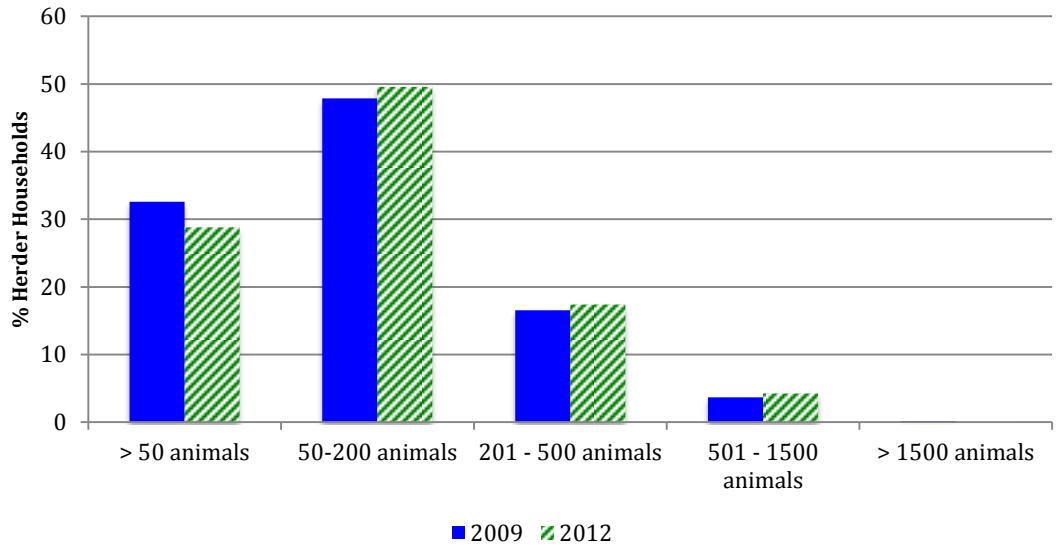
Expansion to other aimags began in 2009, with coverage initiated in all 21 aimags by 2012. Some 15,992 herder households were insured in 2012, and 2.46 million livestock (World Bank, 2012); equivalent to 11 percent of all herder households and 6 percent of livestock. This coverage is expected to grow as penetration increases in the newly covered aimags. An indication of the level of future coverage can be seen in Table 18, which shows coverage for the three original pilot aimags in the seven years since livestock index insurance was introduced. There is considerable variation in the level and pattern of penetration, with the highest coverage in Bayankhongor at 34 percent of herder households and 21 percent of livestock in 2012. Slightly lower coverage is observed in Uvs and very low coverage in Khentii.

Table 20.	**Trends in Livestock Risk Insurance Coverage – Pilot Aimags**						
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
	% Herder Households Insured						
Uvs	11.9%	14.1%	14.0%	19.5%	19.6%	30.6%	28.9%
Bayankhongor	8.2%	14.7%	16.4%	21.1%	17.0%	24.3%	34.3%
Khentii	3.9%	7.8%	10.1%	15.8%	13.2%	10.6%	10.1%
	% Livestock Insured						
Uvs	5.9%	5.5%	5.7%	8.1%	14.7%	18.2%	16.2%
Bayankhongor	6.2%	10.5%	10.2%	16.6%	15.0%	16.3%	20.8%
Khentii	1.8%	2.4%	3.8%	4.9%	6.7%	4.5%	4.2%

Sources: World Bank, 2012; NSO

Analysis of all insured herder households shows that livestock insurance is most actively sought by those with small herds (Figure 36). Almost 50 percent of insured herder households have herds of 50-200 animals and a further 30 percent have less than 50 animals. This pattern is similar in 2009 and 2012, before and after the 2010 dzud. For the country as a whole, these two categories accounted for 22 percent of all livestock owned and 57 percent of herder households in 2012 (NSO). Most of the livestock owned (75 percent) are in herds of 201-1500 animals (NSO), where the interest in insurance appears to be lower. The owners of the largest herds appear to have the capacity to cover livestock losses from their own resources.

Figure 36. Livestock Insurance by Herd Size



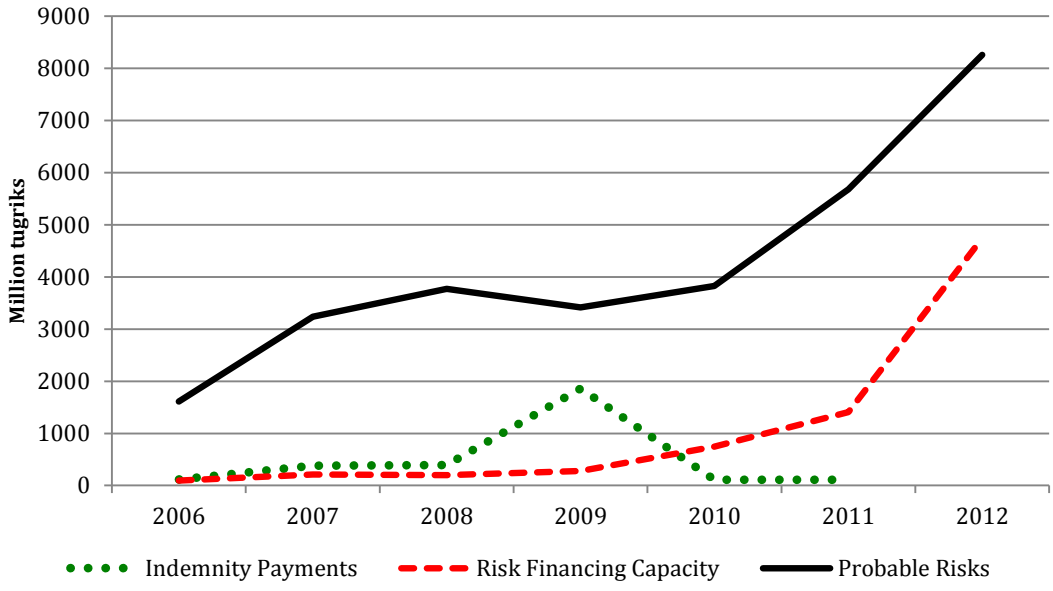
Source: World Bank Implementation Report, 2012

These results suggest that insurance coverage is unlikely to exceed 55-60 percent of herder households and 25-30 percent of livestock in the medium term. Coverage beyond this will depend on the success of an active program to publicize the advantages of insurance more widely and to refine and improve the product to make it more attractive. Livestock insurance is making a powerful contribution to risk management nevertheless. The largest groups of users are the most vulnerable herder households, with smaller herds of less than 200 animals. In addition to reduced risk, these herder households are also benefitting from improved access to credit and slightly lower loan interest rates. Both factors enhance their ability to smooth household income and invest.

Financing Livestock Insurance

The financial viability of commercial livestock insurance was recognized as a major challenge very early in the design of the livestock insurance program. The Mongolian insurance industry lacks the financial capacity to absorb the huge potential losses associated with dzuds. Figure 37 below shows how this disparity between indemnity payments, risk financing capacity and probable risks has evolved since the program's inception.

Figure 37. Financial Capacity for Livestock Insurance



Source: World Bank Implementation Report, 2012

This challenge has been addressed at several levels. A Livestock Insurance Indemnity Pool (LIIP), financed by participating insurance companies on the basis of sales meets part of this need. Government initially augmented this capacity by reinsuring losses (at commercial rates) up to 110 percent of the LIIP's assets – for losses within the 30 percent threshold for Layer 2 risks. A further Contingent Debt Facility was then capitalized with U$S 5 million by the World Bank to cover additional losses – particularly catastrophic losses associated with Layer 3 risk. For the period 2006-2011, 676 million MNT of indemnity payments was financed from the LIIP, 912 million MNT from the Government Reserve account and 1.9 billion MNT from the Contingent Debt Facility (World Bank, 2012).

Several measures to deepen and strengthen the financial capacity for livestock insurance were initiated in 2010. A reinsurance agreement was signed with SCOR to transfer part of the risk exposure of the LIIP to the global reinsurance market. The government re-insurance facility and the Contingent Debt Facility were also formed into a non-commercial Government Catastrophe Coverage (GCC) facility with a capital input of US$ 11.35 million from the World Bank (including unused funds from the original Contingent Debt Facility). Reinsurance of this GCC was also secured with Swiss Re to reduce its risk exposure. Government has also launched plans to create a national capacity for livestock reinsurance, with start-up capital of 30 billion MNT.

While these measures will strengthen the financial capacity to respond to livestock losses through insurance, they will not remove the need for continued public finance. Public expenditure will remain an essential component of commercial livestock insurance, particularly in the event of catastrophic losses and/or in the event of successive dzuds as occurred in 1999-2001. And while livestock insurance is now well established as an important component of risk management – it is unlikely to cover all households and all livestock as noted above. It should thus be viewed as one component of the risk response portfolio.