Extreme weather events and internal migrations in Mongolia

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Introduction

Assessments of extreme weather events on society are urgent issues in the world. Sustainable Development Goals (SDGs) mentioned that build the resilience of poor to reduce their vulnerability to climate extremes (Target 1.5), and significantly reduce the number of people affected by natural disasters by 2030 (Target 11.5). Especially, population migration that associate with extreme weather events are largely affect livelihoods. However, multiple drivers affect population migration (Black et al. 2011) and it makes difficult to detect a causality between extreme weather events and migration. Mongolia has a long history of nomadic pastoralism, and there is the unique close interconnectedness between societies and their ecosystem. Severe winter disasters ("*dzuds*") hit Mongolia in 1999-2002 and 2009-2010 (Rao et al. 2015). These disasters affected many livelihoods due to loss of 20-30 % of livestock (Figure 1). Here we examine the causality between climatic winter disasters and internal migrations in Mongolia.

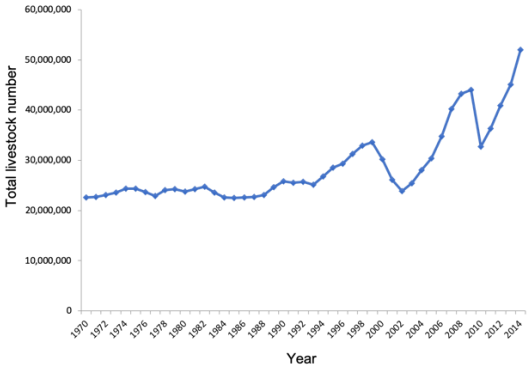

Figure 1 Temporal changes of livestock population during 1970-2016
Data: Mongolian Statistical Information Servide

Study site

Mongolia is located in north-east Asia, represents a coupled socio-ecological system (Chen et al. 2018, Kakinuma et al. 2019). Over 70% of land is used by agriculture, and most of the are rangelands. About 26 % of the population is herder and main livestock types are sheep, goats, cattle, horse and camel. The number of herders relative to the rest of the population has been gradually decreasing since the 1990s, (Figure 2).

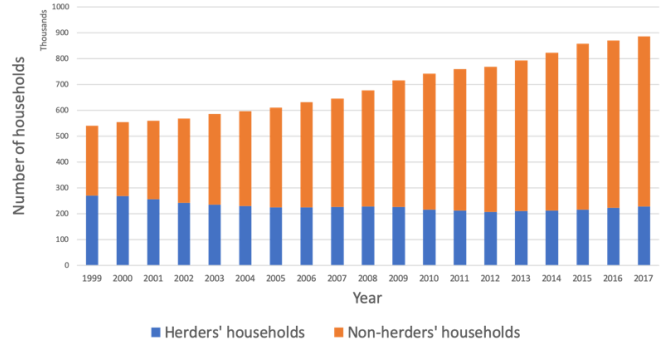

Figure 2 The number of herder' and non-herders' households during 1999-2017

Urban and rural population have been changed after 1990s (Figure 3). The number of population in urban increased and around 65% of the population lives in urban settlements, primarily in Ulaanbaatar (National Statistics Office of Mongolia 2016). Especially, the number of population increased rapidly during 1998-1999 and 2009-2010 when were winter disaster periods (Figure 3).

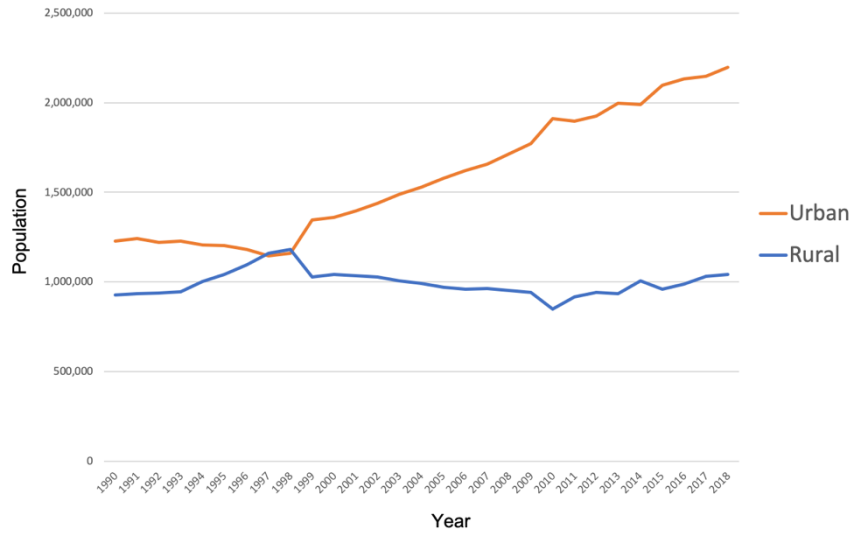

Figure 3 Temporal change of urban/rural population during 1990-2018
Data from National Statistics Office of Mongolia

Methods

We checked migration flow within the country by using a census data in 2000. Data are derived from Integrated Public Use Microdata Series (IPUMS). Then we demonstrated Empirical Dynamic Model (EDM) (Sugihara et al. 2012) that a time series analysis to identify causality between the climatic factors or livestock number and population migration. We used net migration data (National Statistics Office of Mongolia 2016), climate data and change of livestock number for all of prefectures during 1995-2015.

Results and Discussion

Herders moved from the western region (Uvs and Zavkhan prefectures) to the central or northern regions (Bulgan, Selenge and Tov prefectures) during 1996-2000 (Figure 4). Some herders moved to Ulaanbaatar but the number of internal migrants was larger in Bulgan and Tov prefectures than that is in Ulaanbaatar. The result suggested that herders move from the western to the northern and central regions where have good access to capital while they are keeping their livestock. There are possibility that the increase of population in Ulaanbaatar during 1998-1999 were caused by non-herders, or previously herders who lost their livestock due to the winter disaster.

As a result of EDM, we detected a causality between livestock change and net migration in the northern and southern regions. We didn't identify the causality in the eastern, central and western regions. These results suggested that people in the northern and southern regions migrated that are caused by livestock changes. We showed empirical evidences that extreme weather disasters may accelerate population internal migration in Mongolia.

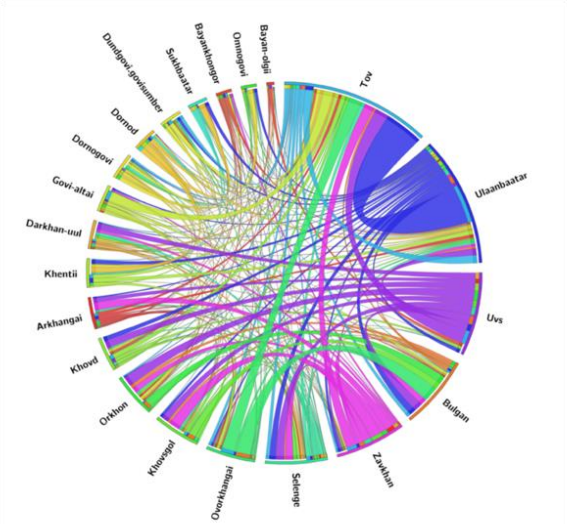

Figure 4 Herder's migration flow during 1996-2000

Data from Integrated Public Use Microdata Series (IPUMS)

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