

## Assessment of climate change impact on socio-ecological system in Mongolia

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Coping with future climate changes are one of the most important issues in the world. Climate change impacts are often determined by the contribution and interaction of three primary components, namely, hazard, exposure, and vulnerability. While a number of recent scientific efforts have assessed climate change impacts within this hazard-exposure-vulnerability framework, most of these have focused on developed regions such as the UK, the US and Canada. There is high uncertainty of vulnerability of social and ecological systems that may have important role in countries where livelihoods are largely dependent on natural resources, and climatic hazards affect society through ecosystem conditions. Mongolia, a country located in north-east Asia, is one such example of a coupled socio-ecological system. Over 70% of the country is rangeland and Mongolians have developed a system of nomadic pastoralism to use scarce and variable vegetation. Our study focuses on socio-ecological interactions and reviews historical trends of hazard, exposure and vulnerability for assessing climate change impacts over Mongolia.

Climate trends are critical for last several decades and thus hazard may be increasing in Mongolia. Temperature is increasing with high confidence in all regions. Precipitation is slightly decreasing with medium confidence across the country, especially in northern and central regions. Exposure would also be increasing especially in northern, central and western regions, because livestock population are concentrating in these regions after 1990. Generally, less productive ecosystems (e.g. low plant productivity and less species richness) are vulnerable to extreme climatic events such as drought. In that sense, southern region may be more vulnerable to climate changes than other regions. However, if we focus on pastoral mobility forms for drought, we get contrasting conclusions. Pastoralists in southern region keep mobility to variable and scarce vegetation while pastoralists in northern region are less mobile because of stable and much vegetation. Exclusive managements in northern region are able to maximize the number of livestock only under stable precipitation regimes. But at the same time, it is difficult to escape from hazardous areas when it is drought. Thus, in terms of rangeland management, northern region would be more vulnerable to increase of drought intensity. Although northern and central regions have high ecological productivity, they have high livestock density (high exposure) and their rangeland management doesn't adapt well to drought (high vulnerability). Therefore, we suggested that these regions have to prepare to climate changes for sustainable rangeland managements.

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