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## A policy to strengthen pastoral communities and to restore cultural landscapes for climate change adaptation and sustainability

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**Key words** : cultural landscape, climate change adaptation

**Introduction** Traditional pastoral networks evolved in arid lands which lack natural resources needed to allow humans to adapt and cope with climate variability. Spatially large landscapes are critical to offset climate variability. The traditional pastoral community and cultural landscape (consisted of seven land types: four seasonal, reserve and *otor* pastures and haylands) is a prime example of a coupled social-ecological system. Cultural landscapes were fragmented with the administrative-territorial division changes during last century. Global warming is slowly developing, and may eventually reduce water and forage resources. Over the last sixty years, surface air temperature in Mongolia has increased by 1.8°C. Spring is becoming increasingly dry as a result of warmer temperatures and decreased precipitation. The Mongolian pastoral systems are among the regions extremely vulnerable to climate change due to its sensitivity to climate variability. A restoration of cultural landscapes at multiple scales is a cost effective adaptation option to climate change. The goal of this research was to develop adaptation options to climate change for pastoral communities with participation of herders, local government officers and scientists.

**Materials and methods** Participatory method, social learning and questionnaire.

**Results** Livestock per capita has good correlation with the income per capita since the main income for herders comes from livestock. Batsumber and Altganat pastoral communities have the highest income (Table 1). The other four communities occur along the transect: Forest steppe, mountain steppe, dry steppe and desert steppe. Household numbers in the herders group, livestock and income per capita and completeness of cultural landscape increased along this transect. Herders living in the riparian zones during the summer and fall are lacking four land types out of seven parts of cultural landscape (4/7). Socio-economic vulnerability of the communities were calculated based on the distance to market, income, loss of animals during the 1999-2002 *zud* and diversification of economy. Pastoral communities from Tov aimag had less socio-economic vulnerability due to high income and short distance to the market.

**Table 1** Studied pastoral communities.

Name	Sum & Aimag	Ecosystem Type	Number of Households	Livestock per capita sheep unit	Income per capita US\$	Cultural landscape index	Socio-economic vulnerability
Batsumber	Altanbulag Tov	Riparian/ forest steppe	21	100	1,200	4/7	2.3
Altganat	Argalant Tov	Forest steppe	15	181	1,877	5/7	2
Santbayanbulag	Hujirt Ovorhangai	Riparian/ forest steppe	8	41	574	4/7	3.3
Ihburd	Hujirt Ovorhangai	Mountain steppe	8	49	618	5/7	3.2
Hondiin Zaraa	Sant Ovorhangai	Dry steppe	15	83	827	6/7	3.4
Erdene-Ovoo	Sant Ovorhangai	Desert steppe	17	79	972	6/7	3.5

Adaptation to climate change options suggested for restoration of cultural landscapes from the participatory community workshops were: introduction of community based conservation and sustainable use of natural resources, add and protect water points for additional pasture, develop agreements between the neighbouring sums for use of *otor* and reserve pastures by the herders of other neighbouring sums, and finally an enlargement of administrative-territorial units (for instance, combining several sums into one unit) in order to restore cultural landscapes. Diversification of economy and intensification of livestock industry through ecotourism and farming, and protection of riparian ecosystems from degradation and desertification, and taking animals from *otor* pastures during the summer period, were suggested for pastoral communities living in the riparian zones. Protection of critical springs from livestock degradation was critical for communities living in the mountain and forest steppe.

**Discussion and conclusion** Strengthening of traditional pastoral communities living in non-equilibrium rangelands with modern technologies such as renewable energy and ICT, transformation of herders living near settlement and water points into sustainable farmers, and reform of administrative-territorial division restoring cultural landscapes appear to be the best options for sustainability of coupled social-ecological systems with increased resilience and adaptive capacity to climate change.