

Development of an Integrated Model for Evaluation of Pasture Carrying Capacity and its Vulnerability based on Water Resources in Arid and Semi-arid Regions-----A Case Study in Mongolia

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Arid and semi-arid regions cover 41% of the global land area and near 2 billion people (34.7%) live there, where fragile environment is getting more vulnerable due to climate change and human activities. Pasture carrying capacity and its vulnerability can be recognized as the integrated indicators for SDGs in arid and semi-arid regions. Our previous study revealed that climate change in past few decades caused the obvious degradation of permafrost, the water deficit of land-surface, and then the decrease of pasture productivity and carrying capacity. However, beside climate change, land use/cover changes caused by human activities such as urbanization, cultivation and mining industry may also have a large influence on pasture carrying capacity. In such regions, it is essential for us to develop some indicators to be used for sustainable management of pasture ecosystems.

In this study, we have developed an integrated model based on water resources to evaluate the pasture Carrying Capacity (CC), Grazing Pressure (GP) and Vulnerability Index (VI) under the influences of both climate change and land use/cover changes, such as urbanization, cultivation and mining & so on (Figure 1). The input data include the pasture net primary production, land use, gradient of slope and grazing density, etc. In order to evaluate the impact of land use/cover changes, we applied the model to four target areas: urban area (Ulaanbaatar City) and steppe area (Altanbulag Soum) in semi-arid regions of northern Mongolia and mining area (Khanbogd Soum) and desert (Manlai Soum) in arid regions of southern Mongolia, and the estimated result was shown in Figure 2, which indicates:

Carrying Capacity (CC): steppe area > urban area > desert area > mining area

Grazing Pressure (GP): urban area > steppe area > mining area > desert area

Vulnerability Index (VI): urban area > mining area > desert area > steppe area

We also applied the model to the Soum level in Mongolia and found that the areas with high vulnerability expanded rapidly, especially in central Mongolia in last decades. We are now trying to use the model to do sensitivity analysis to parameters, such as water accessibility, harvest index and so on, to be able to evaluate the efficiency of adaptation strategies, such as well construction for enhancing groundwater usage, forage plantation for enhancing harvest index and so on.

Keywords: Pasture Carrying Capacity, Environmental Vulnerability, Arid and Semi-arid Regions, Water Resources

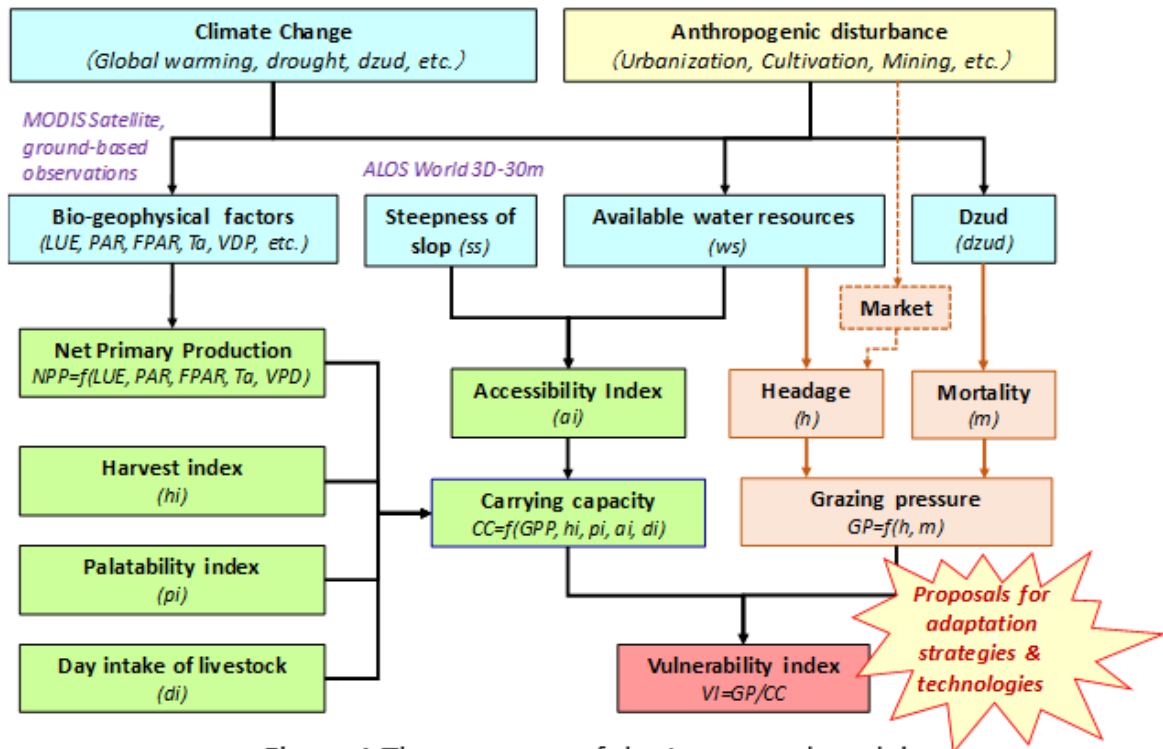


Figure 1 The structure of the Integrated model

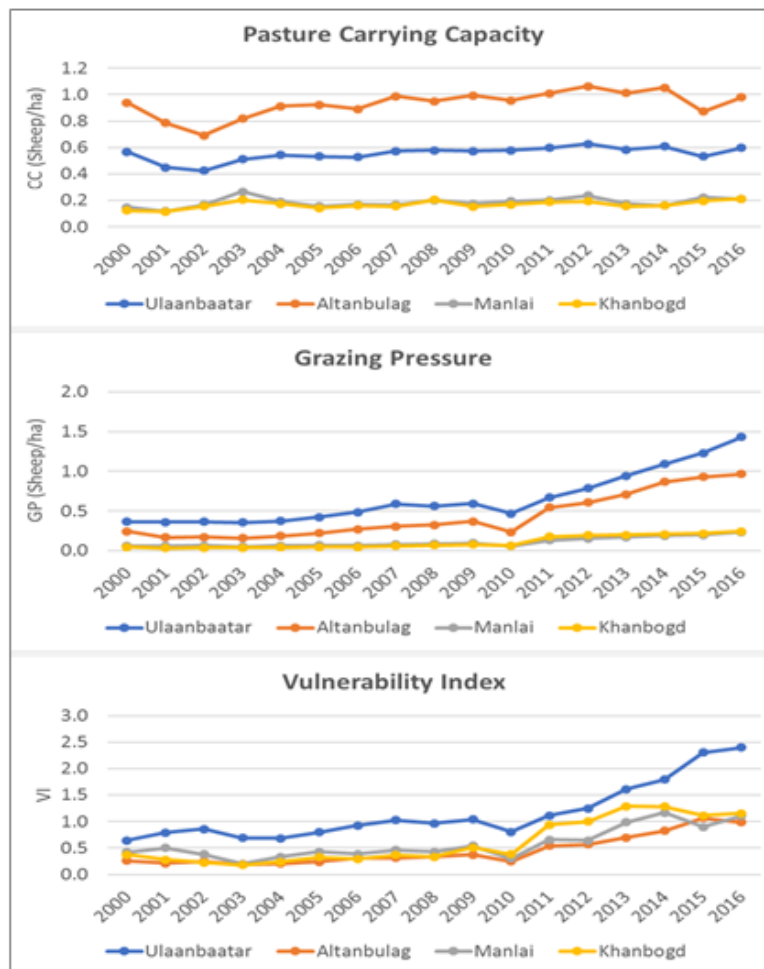


Figure 2 Evaluated pasture CC and VI in four target areas