Monitoring and assessing aeolian desertification processes based on a dust erodibility index –A case study in the Xilingol grassland, China

*Jing Wu[1], Yasunori Kurosaki[1], Chunling Du[2], Tao Wang[3]

1. Arid Land Research Center, Tottori University, 2. School of Economics and Management, Inner Mongolia Agricultural University, 3. Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences

Aeolian desertification is land degradation characterized by wind erosion, which is dependent on erosivity and erodibility. Progressive aeolian desertification causes dust to occur frequently, which has negative impacts on the environment and human health. To effectively prevent the expansion of aeolian desertification, it is crucial to monitor the processes of aeolian desertification and understand its mechanism(s). However, due to its complexity, it is difficult to apply a common indicator for monitoring desertification status.
In this study, we assessed aeolian desertification by using a dust erodibility index as an indicator that reflects the vulnerability of the land surface to wind erosion. We used dust occurrence ratio (DOR), which was calculated as the ratio of the frequency of dust occurrence to the frequency of strong winds, to represent the status of aeolian desertification. We evaluted aeolian desertification procesess at one site (Abaga-Qi) in the Xilingol grassland during the period 1974–2013. DOR values during 2001–2013 were notably higher than those in 1974–2000, indicating that land surface conditions became vulnerable to wind erosion in recent years. However, the DOR values trended lower from 2001 to 2013, corresponding to periods in which restoration projects were implemented aimed at combating desertification in China. To understand the mechanism(s) underlying aeolian desertification after the implementation of restoration projects, we conducted multiple regression analysis of climatic variables (precipitation and temperature) and an anthropogenic variable (livestock number) on recent variations (2001–2013) in aeolian desertification. Stepwise multiple regression results indicate that the recent decline in DOR values was associated with abundant precipitation and low temperature during summer of the previous year and a small livestock population at the end of the previous year. Livestock reduction made the greatest contribution. Our results suggest that aeolian desertification can be effectively reversed by reducing the number of livestock in the Xilingol grassland.

Keywords: desertification, erodibility, climate change, human activity, livestock

