

Spatio-temporal change of grassland distribution in central Inner Mongolia in China

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Abstract. Grassland is one of most important ecosystems in northern China and is threatened by strong land use pressure and poor protection. We selected central Inner Mongolia as a study area to explore spatio-temporal change of grassland distribution in the north of China. Obtaining land use data from remote sensing maps, we classified it into six types: forest, grassland, wetland, farmland, artificial surface and others. Then grassland was assigned into four secondary categories: meadow, steppe, tussock and herbaceous greenbelt. On the base of RS and GIS, we made an analysis of grassland distribution from 2000 to 2010. Result shows: 1) during this period, distribution of grassland decreased 1472.68km², accounting for 0.45%; 2) steppes took up the biggest percentage of total area, which experienced lighter decline compared with herbaceous greenbelts; 3) differing from the total trend, tussock suffered little degradation while meadows expended to some degree.

Introduction

Grassland is one of the most extensive ecosystems in the world and plays a key role in ecosystem services, carbon balancing and climate regulation [1]. Over past decades, earth has undergone dramatic environmental changes and grassland displayed greater vulnerability than other ecosystems [2, 3]. In China, grassland is the most widespread land type occupying about 40% of nation's territorial area [4]. About 78% of grasslands are located in the northern temperate arid and semi arid zones of China [5]. Grasslands are very important for local people, because they are the easiest among all vegetations to clean for cropping and most suitable for grazing [6,7]. However, since 1970s most of grasslands suffered heavily from harsh climate, population growth and extensive land use, resulting in a severe land degradation and productivity decline [8,9,10]. Understanding the change pattern of grassland is attached much weight.

Inner Mongolia, which takes up the biggest percentage of grassland in China, located in the Mongolian Plateau, consists of six plateaus from east to west: the Hulunbuir Plateau, the Xilingol Plateau, the Wulanchabu Plateau, the Ordos Plateau, the Bayannor Plateau, and the Alashan Plateau[11]. Human land use in this region has experienced a series of transitions from primitive agriculture and fisheries in prehistoric periods to nomadism that lasted for a few 1000 years and to secondary nomadism with increasing agriculture and urbanization during the past decades [12,13]. However, in the past decades, grasslands in Inner Mongolia degraded to a certain degree due to human activity and climate change [14]. Before we take measures to protect local grassland, having a good acknowledgement of how it varies is of importance. Our objective are to: 1) systematically classify grasslands into four types and help readers have a good knowledge of landscape pattern of grasslands, and 2) to provide the information on dynamic variations of Inner Mongolia's grasslands

in the past decade and facilitate further study carried about degradation of grassland in the future.

Study area

Study area concludes the Xilingol Plateau and the Wulanchabu Plateau (Fig. 1) in the central Inner Mongolia where most of grasslands are located. Inner Mongolia is in the north of China, covering an area of 120 million ha and accounting for 12% of China's land area. Its climate is dominated by continental climate with mean annual temperature from -2 to 6 °C and mean annual precipitation varying from 40 to 450 mm. Inner Mongolia has several types of zonal vegetation including temperate coniferous and deciduous forest, meadow steppe, typical steppe, desert steppe, steppe desert, desert because of varying precipitation. Grasslands of different kinds are the most dominant vegetation, occupying 78.8 million ha, about 67% of Inner Mongolia's territory [15].

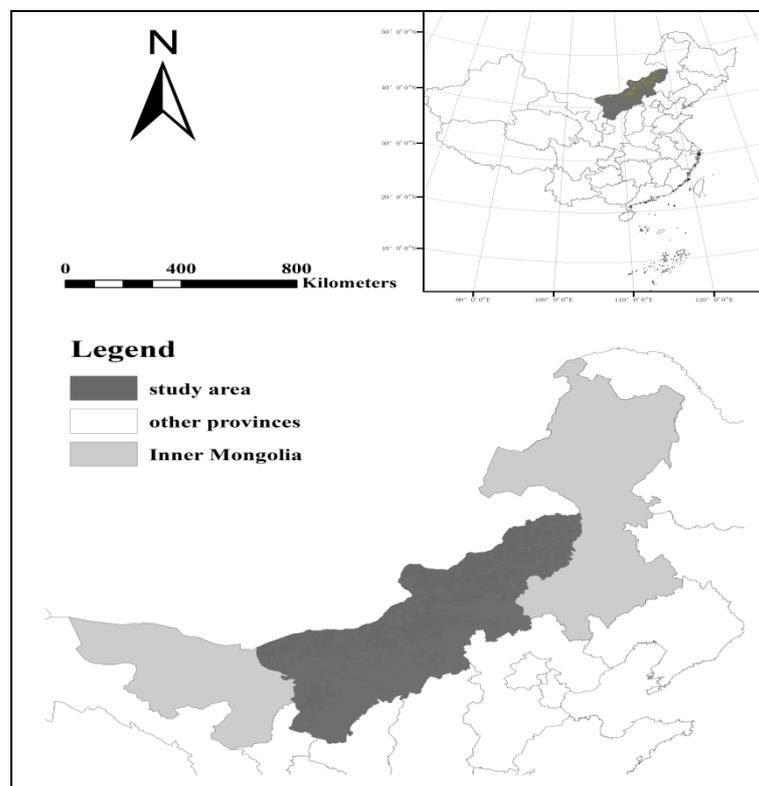


Fig.1, location of study area

Method

We used Landsat ETM remote sensing images in 2000 and remote sensing images in 2010 obtained from Satellite Environment Center for research. Land use/cover was classified into six primary types corresponding to the land use/cover types of Intergovernmental Panel on Climate Change (IPCC) including forest, grassland, wetland, farmland, artificial surface and others. Secondary land use/cover types were classified based on the Land Cover Classification System (LCCS) and grassland system consisted of meadow, steppe, tussock and herbaceous greenbelt. (Fig. 2). On the base of RS and GIS, we made an analysis of distribution of grasslands in Inner Mongolia from 2000 to 2010.

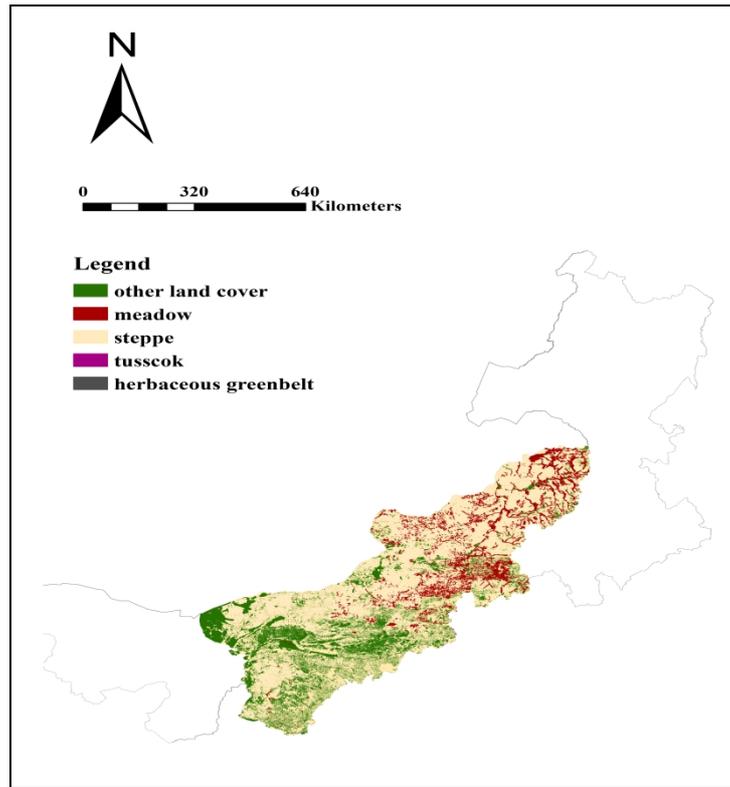


Fig.2, land cover of grassland in study area in 2010

Results and conclusions

Total trend of grassland Most of grasslands are located in the central area of Inner Mongolia and they are mainly decided by climate. During the past decade, climate factors were unevenly distributed in space and time. Precipitation decreased from southwest to northeast while temperature showed a contrary trend, which favored regional dominant plant community growth. From 2000 to 2010, distribution of grassland had a decrease of 1472.67km²(Table 1), accounting for 0. 45% of total area.

Waving in distribution of 4 grasslands Steppes take up the biggest percent of total area, which experienced smaller decline compared with herbaceous greenbelt, showing stronger reliance while herbaceous greenbelt suffered the most severe decline in the past decade. It can be assumed that dominant communities in herbaceous greenbelt are more easily to be affected by human activity and climate. Differing from the total trend, tussock suffered little degradation which is too small to calculate while meadows expended to some degree, which attributed to ecological restoration projects funded by government.

Table 1, Distribution of wetlands in 2000 and 2010 in Inner Mongolia

Types	Area of distribution[km ²]		
	2000	2010	decline in the past decade [%]
Meadow	12440.24	12468.90	-0.23
Steppe	316187.20	314687.30	0.47
Tussock	4.38	4.38	0
Herbaceous greenbelt	15.73	14.30	9.09
Total	328647.55	327174.88	0.45

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