

SIMULATION FOR NPP OF GRASSLAND ECOSYSTEM IN QINGHAI-TIBETAN PLATEAU BASED ON THE PROCESS MODEL

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1. Introduction

Qinghai-Tibetan Plateau is the highest altiplateau in the world. It almost occupies 1/4 in China. Because of its special geographical position, it is very meaningful for global carbon cycling research to estimate net primary productivity (NPP) of grassland ecosystem in Qinghai-Tibetan Plateau.

The main methods for estimating NPP of grassland ecosystem are harvesting, statistical model, parameter model and process model. Harvesting is an essential method for estimating net primary productivity of grassland ecosystem. It has been a validation data for other method for its simple and credible. However, harvest can only be used in small region because of its laborious and destructive. With the development of computer technique, statistical and parameter models have been popular methods for estimation net primary productivity of grassland ecosystem. Monteith (1972) calculated NPP through the energy conversion efficiency (ϵ) and the solar radiation absorbed by vegetation. While there will cause much error if ϵ is a constant in global. CASA model get ϵ considering environment, vegetation kinds and respiration rate (Potter, et al., 1993). Statistical and parameter models combine all control parameters to estimate NPP, which has been an important method for NPP estimation. However, these models can't explain net primary productivity in theory. So process models are developed. Process models are built based on physiological and ecological processes. Photosynthesis, evapotranspiration, autotrophic respiration, and dry matter partition are used to estimate NPP, such as FOREST-BGC model (Running, et al, 1988), TEM model, BIOME-BGC model (Foley, 1994), BEPS model (Liu, et al., 1997).

In this paper, considering the characteristics of grassland canopy, we modified boreal ecosystem productivity simulator model (BEPS) in forest ecosystem to grassland ecosystem and applied it into Qinghai-Tibetan Plateau.

2. Methodology and data

In this paper, boreal ecosystem productivity simulator (BEPS) model was explored. It uses a strategy of separating sunlit and shaded leaves of forest ecosystem. However it is difficult to differentiate the sunlit and shaded leaves of grassland. So the hypothesis of horizontal homogeneity and vertical layer was put forward for grassland canopy and BEPS was modified into GEPS (grassland ecosystem productivity simulator) to simulate the NPP of grassland ecosystem. The photosynthesis rate of each grass layer was firstly simulated and then integrated to get total canopy photosynthesis rate. Then, the NPP of grass was estimated by subtracting autotrophic respiration from total canopy photosynthesis rate.

With MODIS products (MOD15A2 and MOD12Q1) and routine meteorological data taken from National Meteorological Information Center in China (<http://cdc.cma.gov.cn/>), net primary productivity of grassland ecosystem was simulated in Qinghai-Tibetan Plateau in 2006 based on GEPS. All MODIS products were reprojected to Albers Conical Equal Area (ACEA) and meteorological data were interpolated using Kriging method to get the spatial distribution maps with the same spatial resolution of MODIS products.

3. Result and conclusion

The result shows that NPP of grassland ecosystem in Qinghai-Tibetan Plateau is between 20 and 500 $\text{gC}/\text{m}^2\cdot\text{a}$ (Fig.1), which is close to the other studies (Table 1). The spatial distribution of NPP of grassland ecosystem in Qinghai-Tibetan Plateau has the trend of decreasing from east to west. So we can draw a conclusion that the process model - GEPS - is suitable to simulate NPP of grassland ecosystem in Qinghai-Tibetan Plateau.

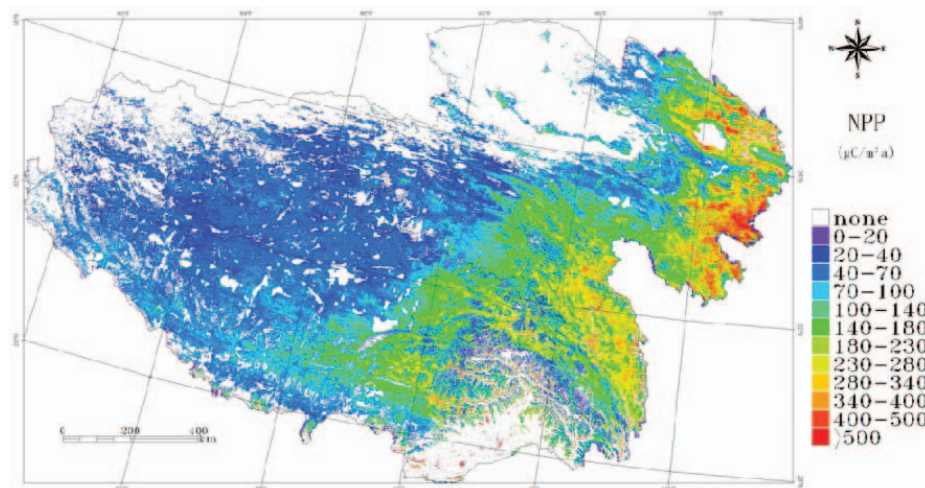


Fig. 1 The spatial distribution of NPP of grassland ecosystem in Qinghai-Tibetan Plateau in 2006

Tab.1 Comparison of simulated NPP for different research

Researchers	Model	Simulated year	Simulated region	NPP of grassland ecosystem ($\text{gC}/\text{m}^2\cdot\text{a}$)
Sun (2000)	LUE-Remote sensing	1992-1993	China	116-191
Liu (2001)	BEPS	1993-1999	China	271
Piao (2001)	CASA	1997	China	131-154
Feng (2004)	BEPS-China	2001	China	122.6
Gao (2007)	CASA	1981-2004	North Region in Tibetan Plateau	48.1
Zheng (2006)	BEPS	2002	Naqu region	62.4
This paper	GEPS	2006	Tibetan Plateau	109.7

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