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Spatial changes of wind erosion-caused landscapes and their relation with wind field in China

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Based on the results of remote sensing investigations of the landscapes of 1995 and 2000, the national distribution of sandy desertified land and its interaction with other landscapes are classified, and five zonal types are distinguished. The data of nationally distributed 400 meteorological stations of 1999 are processed. With the GIS method, the data are spatially interpolated, and the national database of wind field concerned with wind erosion is established. In arid and semi-arid areas of China, the intensity of wind field is one of the key factors that controls the development of landscape especially in desert and its adjacent area. Different indexes are set up to describe the intensity of wind field, the method suggested by the wind erosion prediction models of RWEQ is also adopted to express the intensity of wind. The Weibull distribution is used to describe the wind field in China. Based on the analysis of the process of the wind erosion-driven landscape changes, this article proposes and discusses the control measures of wind erosion.?

Spatial changes of wind erosion-caused landscapes and their relation with wind field in China ZHANG Guo-ping¹, LIU Ji-yuan², ZHANG Zeng-xiang¹, ZHAO Xiao-li¹, ZHOU Quan-bin¹ (1. Institute of Remote Sensing Applications, CAS, Beijing 100101, China; 2. Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China) As one of the important factors, wind has influence on the distribution of the landscapes and their spatial variations. Wind carries a range of items, including heat energy, water, dust, aerosols, pollutants, snow, sound, seeds, spores, and many small insects from one cell to the adjacent cell (Forman and Godron, 1986). Wind erosion, as has been called the integration of the flow of energy and mass dedicating much to the formation of sandy desertified landscape, is microscopically reflected in the transportation and deposition of the soil particles; whereas it is macroscopically reflected in the process of sandy desertification as well as the expansion of the wind eroded landscape. Not just to the land degradation, the decline of the visibility of the atmosphere and so-caused air pollution, the radiation balance of air-soil energy cycle is also influenced followed with the impact on the global environmental changes. Taking wind as a factor that drives the landscape changes, it will dynamically contribute to the forecast of the evolution of the wind erosion-caused landscape changes. In China, due to strong winter monsoon after 2.5 Ma, the Loess Plateau has been formed with an area of about 430,000 km² (Liu, 1985). Gobi, desert and the Loess Plateau are distributed approximately from northwest to southeast along Northwest China. And the landscapes in these areas show a close relation to the wind erosion. Thereupon, the wind with different energy causes the fraction of soil particles and the sandy desertification. With the nationally covered LANDSAT TM images in 1995 and 2000, the sandy desertification in China is investigated and the changes of sandy desertified land are analyzed. The data from nationally distributed 400 meteorological stations include the wind direction and wind speed with four records each day throughout the year 1999. The time intervals of the four records are at 02:00, 08:00, 14:00 and 20:00 hours respectively. Then for each meteorological station, there are 1420 records on the speed and direction of wind. The number of 1-16 is used to replace the 16 main cardinal directions of wind. To the calm period, the number of 17 is used. The data are processed with program coded in computer language of FORTRAN90. The working environment is based on the GIS platform of ARC/INFO8.0. The point data of the position of meteorological stations are generated to point coverage. The projection for the map is ALBERS. The results are interpolated with the method of Inverse Distance Weighted Interpolation (IDW). The grid size for each map is 1 km. The spatial distribution and temporal changes of the wind energy are then analyzed. Based on the res

ults, the development of wind eroded landscapes and their relation with the wind energy can be discussed. 1 The changes of sandy desertified land from 1995 to 2000 in China Figure 1 The distribution of the sandy desertified land in China (1995-2000) 2 The distribution of the intensity of wind field 2.1 The changes of wind direction and its influence 2.2 The distribution of the intensity of wind field Figure 2 The mean annual wind speed in China in 1999 Figure 3 The distribution of the factor of wind intensity in China in 1999 Figure 4 The frequency of wind speed in spring and summer of 1999 in Tailai County, Heilongjiang Figure 5 The distribution of Weibull-k in China Figure 6 The distribution of Weibull-c in China 3 The relation between the distribution of landscape and wind field 4 The measures to cure wind erosion and sandy desertification 4.1 The stabilization of sand dunes 4.2 The protection of existing grasslands 4.3 The construction of forest belts 4.4 The utilization of wind energy 5 Discussion In China, the intensification of wind field becomes the most important factor that dedicates to the sandy desertification process. From the calculation of the distribution of wind field in 1999, the strong wind fields all exist in the Qinghai-Tibet Plateau, Northwest China, Northeast China and the coastal area of Southeast China. From investigations of the distribution of desertified land and its changes from 1995 to 2000, most of the lost land is distributed in areas where wind speed is great and the lost grassland becomes the main landscape type in the arid and semi-arid areas of China. Based on the relation between the distribution of wind field and the sandy desertified land, different control measures should be taken to suit different kinds of sandification process. The remote sensing survey data from 1995 to 2000 confirm the results which were reported before sand dunes fixation. The protection of grassland and construction of forest belts are in great need. Combined with the data of the distribution of wind field, the aforementioned measures are also reconsidered. The paper points out the utilization of wind energy is prospective to the wind erosion control in China. However, the nationally covered wind erosion model is also an urgent need for the guidance of wind erosion control. References

关键词: remote sensing; sandy desertification; Weibull distribution; desertification control in China; wind energy?