Dynamic Monitoring of Ecological Environment of Ejin Banner Oasis Using Remote Sensing Technology in Newly 15 Yars

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Abstract: Desertification is one of the most serious environment and socioeconomic problems in the world and China today. Land of sandy desertification almost covers everywhere in Ejin Banner (County), Inner Mongolia. Using remote sensing method can expediently acquire some information such as desertification's status, and effect of harnessing desertification. In this paper, ecological change situation from 1986 to 2000 in Ejina Oasis is researched. The result is followed: (1) Area of water body of Lakes in Northeastern Ejin Banner are distinctly reduced. (2) Area of the oasis is rapidly shrunk. From 1986 to 2000, the area is reduced 61.48%, average 4.39% annually. (3) Condition of oasis growing is declined. The oasis's ecological environment trends to bad. Its main reason is what human activities exceeded the load capacity of natural resources such as water and land. By means of self-restorative ability of natural vegetation and human's scientific conservation, that the oasis's ecosystem maintains dynamical balance and the environment recovers is possible.
Keywords: oasis ecology, environmental remote sensing, dynamic monitor, ejina Banner

The spatial process of the ecological and environmental change can be reappeared by analyzing multi-temporal remote sensing data. In arid region, where fogs and clouds are rare, such optical remote sensing data as Landsat TM can be acquired well-quality images. This provides conveniences for applying Landsat TM RS technology of nice-priced, high spectral resolution and moderate spatial resolution to ecological and environmental monitoring. Some studies have been done on the desertification of soil and the evolution of ecological environment in the Black River Valley including Ejina Banner Oasis. In this paper, with the aid of the rapid, in-time, objective, reliable RS data, the newest report is presented on the ecological situations in Ejina Banner Oasis.

1 Brief survey of region background

Ejina Banner Oasis is situated in the northwest of the Inner Mongolia Autonomous Region, neighboring Alxa Youqi to the east, Gansu Province to the south and west and Mongolia Country to the north, which covers an area of 1.02×10^5 km^2. Generally, the ground of the banner slopes from southwest to northeast by degrees, having the feature of low in the middle and high all around. The banner is between 898 m—1,598 m above sea level. Within the boundaries of this region, low mountain and residual hill covers nearly 47.15% of the total area, Gobi as 5.93 %, desert as 45.17 %.

Owing to be in the hinterland of Asia Continent, the region have a obvious characteristic of continental climate what is extremely hot in summer and severe cold in winter, where the annual precipitation is 37 mm and the annual evaporation is as high as 3,841.5 mm. Lying in the middle and the northeast of the Ejin Banner, the famous Ejina Banner Oasis originates from the alluvial fan district of the lower Heihe Valley, which is a large interior river valley in Northwest Arid Region of China. Beside, there're three main lakes, i.e. Swan Lake, Sub Nur lake and Gaxun Nur lake.

Land of sandy desertification has covered everywhere in the banner, including region of modern river delta. By statistics, the area of modern sandy land is approximately 1.56×10^6 km^2, among which that of drifting dune is 9.53×10^5 km^2, that of while fixed and semi-fixed dune is approximately 6.02×10^4 km^2. In addition, Gobi covering sand or gravel covers an area of 4.83×10^6 km^2, and area of sandy desertification is 6.39×10^6 km^2. The area constitutes 62.32 % of the land's total areas and is about 1.7 times of that of the oasis, which is a collection of tilled land, woodland, grassland and water area. While

drifting dune accounts for about 14.92 % of land of sandy desertification, and about 61.28 % of sandy land affected by wind and Gobi makes up about 75.60 % of land of sandy desertification. The land types above constitute the active region of modern desertification in this basin [1].

2 Dynamic Monitoring of Ecological Environment by remote sensing

The condition of ecological environment in Ejin Banner Oasis can be reflected by such factors as the water's area of lake, the area and coverage quality of oasis, etc.

2.1 Analysis of Feasibility of Remote Sensing technology

In arid region where fogs and cloudy are rare, such optical satellite remote sensing as Landsat TM can obtain well-quality, high spectral-resolution and proper-spatial-resolution images, furthermore; the choused spectrums band of images have strong suitability for geographical. So remote sensing technology is applied widely.

Figure 1 presents the change of oasis environment in Ejin Banner Oasis during fifteen years from 1986 to 2000.

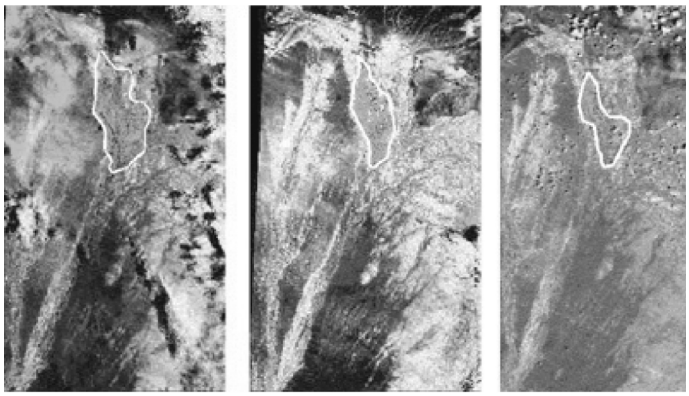

Fig. 1 Dynamic images of remote sensing in Ejin Banner Oasis In figures, the main scope of oasis is signed by white line. According to images, area of oasis of oasis is warming continually. (RS data is offered by Satellite Ground Station of Chinese Academy of Sciences).

2.2 Areas of oasis and water body nearby distinctly reduced

There is a large black area, which refers to water body, in the northern and eastern of the image in 1986. As shown in Figure 1, area of lake water in the northern and eastern of the oasis are distinctly reduced from 1986 to 1992 up to 2000, while disappeared basically in 2000. According to former investigation, Sub Nur lake and Gaxun Nur lake dried up respectively in 1961 and 1992. During this period, there are twelve lakes, sixteen fountains and four swamps dried up in Ejin Banner, so that it is difficult for people and livestock drinking water. Some shepherds turned to be "ecological refugees, and migrated to that place and another"[2].

2.3 Area of oasis is rapidly shrunk

From 1960's to the early 1980's, the areas of Gobi and desert with vegetation coverage being lower then 10 % have increased about 4.62×10^4 km^2, average 2333 km^2/a.While from 1987 to 1991,the area have increased by 5.6 %, approximately 1.6×10^4 km^2/a. By means of GIS analyzing Figure 1, we can come out that the relative rate of area change of Ejin Banner Oasis in 1992 is 18.93% smaller than that in 1986, that is decreased by 6.49% each year; while the area in 2000 is 36.91% smaller than that in 1992, its average decrease by 6.15% annually. Its average decrease by 6.15% each year. On the whole, from

1986 to 2000 the area of oasis was reduced by 6 % steadily. During this fifteen years the oasis area had decreased by 61.48 %, average 4.39 % annually.

2.4 Condition of quality of the oasis is sharply declined

Seen from Figure 1, in this oasis, the color in green becomes lighter and lighter, which shows that the quality of vegetation coverage is declining accordingly. By the year of 2000, the distribution of the original forest vegetation becomes island-shaped, no longer as dense and large-area as before. At the same time, the condition of the natural vegetation is also degenerating along the banks of east and west river.

3 Main cause and countermeasure for Ejin oasis degeneration

That human activity has an effect on frail ecology environment is man reason for desertification. In other words, land use mode and intensity is main factors for influencing the development or reversion of desertification. In the past 40 years, desertification is continually expanding in arid and semiarid area in North China, the speed of which is 1,560 km^2 /a in average from 1950's to the mid 1970's while that in the recent ten years is 2,460 km^2/a[3].

In Ejin Banner Oasis, drying and warming of climate and potential soil desertification affect ecological deterioration, but the main reason is the unreasonable utilization of land and water resources. In Alax region, there used to be many rivers and lakes densely covered [4,5], so today abundant groundwater resource exists. It is an important factor for the existence of the oasis. However, population explosion, over-reclamation and over farming has destroyed Gobi, which leaded to the exposure of sandy soil underground and then to the desertification under the effect of drafting by wind. In addition, in river valley and the overuse or withholding of water in upstream caused water scarcity even no water and vegetation decline, which resulted in the degeneration of ecological environment of the oasis. Finally, the increase of population and used-water volume and the overexploitation of groundwater caused the rapid decline of the groundwater level, expansion of groundwater funnel area and ecological degradation of vegetation.

In Ejin Banner, research of the ecological construction by man-made oasis indicates that riverside Gobi can restore into the oasis, which provides the scientific basis for the comprehensive environmental improvement of Juyanhai Lake oasis. In order to restore the ecological environment of oasis, we should do—make rational use of water resources in the whole basin, engage in scientific constructions and rational operations of the water conservancy project in the lower reaches and study the appropriate population capacity and farming capacity to reduce the pressures came from population and environment. If we make systemic analysis and scientific renovation by means of the advanced technology such as remote sensing , it is possible for the oasis's ecological restoration.

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