

An initial study on ecological environment changes after emergent water transportation at lower reaches of Tarim River, China based on remote sensing technique

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Abstract: Tarim River is the longest continental river in China. Its downstream ecological environment declination and valley remedy got great concern. To improve ecological environment of lower Tarim River, "Emergent water transportation project for Tarim river valley remedy" was carried out from May 2000. Water was transported five times till May 2003. Several periods MODIS image was used to monitor water body in river channel. Two periods ETM image was used to interpreter changes of environment. Area of vegetation in 1999 was similar with 2001, but become better in total. The normalized difference vegetation index (NDVI) and vegetative coverage reflected environment changed better.

Keywords: Tarim River, ETM, NDVI

1. Introduction

Tarim River is the longest continental river in China. It flows through Taklimakan Desert from west to east, and finally entered Taitema Lake. Its length is 1321km. Its downstream ecological environment declination and valley remedy got great concern. Water amount was decreased gradually. Length of lower river cut-off was about 400km. Taitema Lake, tail of the river dried up. *Populus euphratica* forest reduced significantly. Vegetation degradation and land desertification happened.

2. Emergent water transportation project

To improve ecological environment of lower Tarim River, "Emergent water transportation project for Tarim river valley remedy" was carried out from May 2000. Water was transported five times till May 2003 from Daxihai water reservoir whose water was abundant these years. Water qualities were 100 million m³ between May

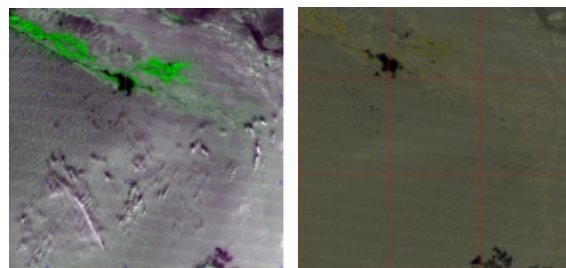
14 and July 13 in 2000, 227 million m³ between November 3 in 2000 and February 5 in 2001, 400 million m³ between April 1 and November 17 in 2001, 330 million m³ between June 7 and November 10 in 2002, and about 300 million m³ in 2003. Finally water came into Taitema Lake after flowing through 300km.

3. Changes of ecological environment

Practical data and remote sensing technique were both applied to dynamically study ecological environment changes.

1) MODIS

Several periods MODIS image was used to monitor water body in river channel and Taitema Lake. Water surface area gradually enlarged from river channel to Taitema Lake. Figure 1 shows water transportation path in 2002 and 2003. Water in river channel was watched. Green plants appear at two sides of lower reaches of Tarim River.



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Fig.1 EOS/MODIS Monitoring

2) ETM

Two periods remote sensing image was used to interpret changes of environment. ETM Images were selected in 1999 and 2001 respecting before, in the middle water transportation. Third period image will be bought this month. Figure 2 shows change of ETM images after water transportation. Perhaps because supplying water had not widely affected vegetation along river channel, whole area of oasis seems changed not two much, but color of some areas are redder, which reflected plants developed in local area. So local area is selected to study changes of ecological environment changes.

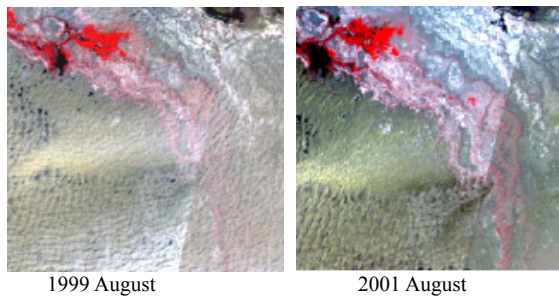


Fig.2 ETM image Monitoring

Figure 3 shows changes of ETM images in 1999 and 2001. Obviously vegetation is better in 2001 than in 1999 because of water transportation.

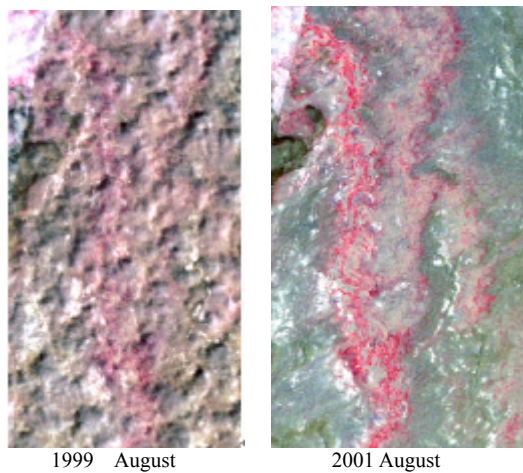


Fig. 3 Changes of ETM image of Local area

3) NDVI

Vegetation indexes were calculated through Landsat ETM. Image was firstly pre treated. There are several kinds of vegetation indexes such as RVI, GVI, DDVI, PVI, EVI and NDVI etc. After comparison,

the normalized difference vegetation index (NDVI) was be used. The equation is as below:

$$NDVI = \frac{Band4 - Band3}{Band4 + Band3} \times 127 + 128$$

NDVI was shown in figure 4, it could be seen that plants become well than before.

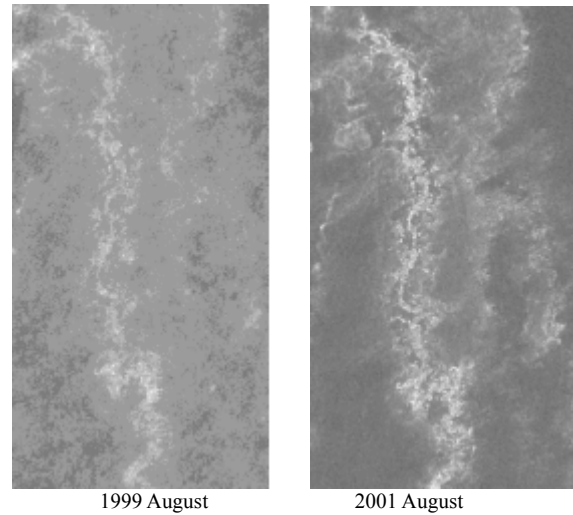


Fig. 4 NDVI Changes of ETM image of Local area

4) Vegetative coverage

Vegetative coverage concept is considered for NDVI to estimate ecological environment. Figure 5 is variation of vegetative coverage in 1999 and 2001 in local area at lower reaches of Tarim River, color of deep blue means high vegetative coverage. It can be seen that vegetation in 2001 is better.

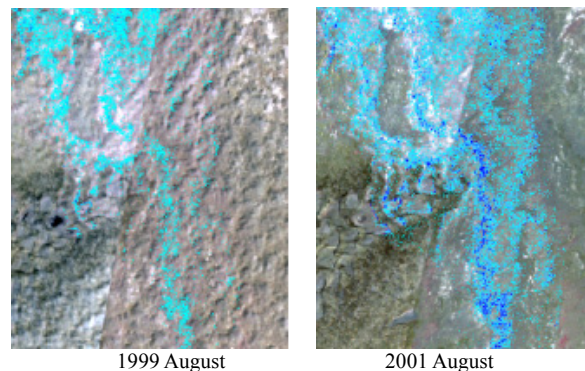


Fig.2 Vegetative coverage changes between 1999 and 2001

Table 1. Vegetative coverage of whole lower reaches(km²).

Time	High	Medium	Low
1999	79.98	423.45	519.22
2001	136.85	503.84	848.01

Notes: high means vegetative coverage is greater than 60%, medium means vegetative coverage is greater than

30% and lower than 60%, low means vegetative coverage is lower than 30%.

and Environment. 16(2):27-31

Table 1 is vegetative coverage of whole lower reaches. It can be seen that vegetative coverage in 2001 is bigger than in 2001.

5) Groundwater

Groundwater table level rise at two side of river channel. It effecting scope is about 1.5km. Some dry populus euphratica forest relives after groundwater level rise. Rising extent is even about several meters.

4. Conclusions

“Emergent water transportation project for Tarim river valley remedy” was carried out from May 2000 to improve ecological environment. Several periods MODIS image was used to monitor water body in river channel. Two periods ETM image was used to interpreter changes of environment. Area of vegetation in 1999 was similar with 2001, but become better in total. The normalized difference vegetation index (NDVI) and vegetative coverage reflected environment changed better.

All of these results showed that water transportation improved ecological environment in lower reaches of Tarim River. More results will be made till third period image comes.

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