Land use and land cover change in Xinjiang over past 50 years and its ecological effects

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Agenda

1. LUCC data over past 50 years
2. Result of LUCC over past 50 years
3. Driving forces of LUCC over past 50 years
4. Ecological effect of LUCC
5. Data basis of Central Asia
1. LUCC data over past 50 years

About Xinjiang
Population: 20,000,000
Area: 1,600,000KM²
1. LUCC data over past 50 years

- Key study areas: the northern Tianshan Mountains and Tarim River
1. LUCC data over past 50 years

LUCC data including 4 periods in the format of both raster and vector, covering all of Xinjiang

- First period: 1950-1960’s
- Second period: 1970’s
- Third period: 1990’s
- Fourth period: 2000’s
1. LUCC data in the raster format

1171 relief maps at the scale of 1:100 000 in the 1950-1960s’
1. LUCC data in the raster format

1970’s 112 MSS images
1. LUCC data in the raster format

Xinjiang TM Image mosaic in 1990’s from 112 Landsat TM scenes
1. LUCC data in the raster format

Xinjiang ETM Image mosaic in 2000 from 111 Landsat ETM scenes
1. LUCC data in the vector format

Xinjiang’s LUCC maps in the 1960’s (left) and 2000’s (right)
1. LUCC data in the vector format

LUCC in the Northern Tianshan Mountains from 1960’s to 2000’s
1. LUCC data in the vector format

LUCC maps in the Tarim River from 1960’s to 2000’s
2. Results of LUCC over past 50 years--Xinjiang

- Reservoir and pond increased by 210%, 1430 KM²
- Town increased by 33%, 600 KM²
- Farmland increased by 55%, 23210 KM²
- Woodland declined by 39%, 30702 KM²
- Lake declined by 54%, 6495 KM²
- Glacier and snow declined by 1044 KM²
- Sand land increased by 2286 KM²
- Salty-alkaline land increased 433 KM²
### 2. Results of LUCC over past 50 years--Xinjiang

<table>
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<tr>
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<th>1960</th>
<th>2000</th>
<th>Contrast between 2000’s and 1960’s</th>
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2. Result of LUCC over past 50 years—North Tianshan Ms

- Reservoir and pond increased by 162%, 141 KM²
- Town increased by 886%, 445 KM²
- Farmland increased by 147%, 10442 KM², Accounting for 45% of the increase of Xinjiang
- Woodland declined by 42%, 4636 KM²
- lake declined by 23%, 351 KM²
- glacier and snow declined by 28%, 1044 KM²
- sand land increased by 477 KM²
- salty-alkaline land increased 596 KM²
2. Result of LUCC over past 50 years—North Tianshan Ms

LUCC in the Northern Tianshan Mountains from 1960’s to 2000’s

<table>
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<tr>
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<th>Constituent Proportion</th>
<th>%</th>
<th>Change</th>
<th>%</th>
<th>Contrast between 1960’s and 1970’s</th>
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<td>63.7</td>
<td>-3.92</td>
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2. Result of LUCC over past 50 years—Tarim River

- Farmland increased by 62%, 636 KM²
- Town increased by 52%, 13 KM²
- Woodland declined by 51%, 4885 KM²
- Reservoir and pond increased by 10%, 8 KM²
- Sand land increased by 543 KM²
## 2. Result of LUCC over past 50 years—Tarim River

### LUCC in the Tarim River from 1960’s to 2000’s

<table>
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3. Driving forces of LUCC in Xinjiang over past 50 years

For the oasis, its LUCC was mainly driven by human activities. Natural driving forces is relatively weak.

- large-scale land reclamation and exploitation of water resources in Xinjiang has resulted in the conversion of desert land to anthropogenic oases

- Some native vegetation types have degraded and some were replaced by anthropogenic vegetation types or even totally eliminated for settlements
3. Driving forces of LUCC in Xinjiang over past 50 years

In the 1990’s

- the average annual temperature increased by 0.78°C,
- annual precipitation increased by 12~15% in the mountainous regions and by 30~40% in the plain areas
- annual runoff volume increased by 19.4%
3. Driving forces of LUCC in Xinjiang over past 50 years

Resulting in vegetation increase by 5.76%
4. Ecological Effects of LUCC on groundwater table

- The groundwater table was declining at an average annual rate of 20-45cm in the alluvial fan oasis.
- The groundwater table was very slowly rising at an average annual rate of 2-7cm in the alluvial plain oasis.
4. Ecological Effects of LUCC on groundwater quality

The mineralization of groundwater was relatively stable in the alluvial fan oasis, usually <0.5g/l.

Generally rising in the alluvial plain oasis, indeed worse >2g/l.
4. Effects of LUCC on natural lake

- Mountain lakes seldom influenced by human-induced LUCC
- Lakes in the Middle reaches (for example Bosten lake) doubly influenced by the runoff in the mountain and LUCC in the plain: dynamic water table and mineralization
- Lakes in the lower reaches reduced usually, most dry up.
4. Ecological Effect of LUCC on oasis soil

The change of Organic matter content in seven regions in the past 20 years

- 80年代初 (early 1980s)
- 90年代末 (late 1990s)

东疆：The east area of Xinjiang;
准北：The north area of Jungar Basin;
准南：The south area of Jungar Basin;
伊犁：Yili area;
塔北：The north area of Tarim Basin;
塔西：The west area of Tarim Basin;
塔南：The south area of Tarim Basin

The change of Organic matter content in seven regions in the past 20 years
4. Ecological Effect of LUCC on oasis soil

The change of available nitrogen content in seven regions in the past 20 years

- **East Area of Xinjiang (东疆)**
- **North Area of Jungar Basin (准北)**
- **South Area of Jungar Basin (准南)**
- **Yili Area (伊犁)**
- **North Area of Tarim Basin (塔北)**
- **West Area of Tarim Basin (塔西)**
- **South Area of Tarim Basin (塔南)**
- **Whole Region (全疆)**
4. Ecological Effect of LUCC on oasis soil

The change of available phosphorus content in seven regions in the past 20 years

- **East area of Xinjiang** (东疆)
- **The north area of Jungar Basin** (准北)
- **The south area of Jungar Basin** (准南)
- **Yili area** (伊犁)
- **The north area of Tarim Basin** (塔北)
- **The west area of Tarim Basin** (塔西)
- **The south area of Tarim Basin** (塔南)
- **Full region** (全疆)

- 80年代初 (early 1980s)
- 90年代末 (late 1990s)
5. Data basis in the Central Asia

Population: 60 000 000
Area: 4000 000 km²
5. Data basis in the Central Asia

MODIS/NOAA Receiving systems, which can receive images covering the Central Asia.
5. Data basis in the Central Asia

5.8 m IRS images covering the most areas of the Central Asia
5. Data basis in the Central Asia

15 m Landsat ETM images covering the entire Central Asia
Thank you for your attention