Identifying drivers of land degradation in Xilingol, China, from 1975–2015

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Date: 27 Oct 2018
Land degradation

Xilingol, Inner Mongolia, China

Photo source: Batu, 2015
Xilingol, Inner Mongolia, China

Legend
- Study Area
- Mongolia
- Inner Mongolia
- Africa
- Antarctica
- Asia
- Europe
- North America
- Oceania
- South America

Germany

Xilingol

Grassland

Nomadic culture

Animal husbandry
Land degradation

Coal mining, Xilingol

Degradation
Grassland degradation
Surface water loss
Woodland loss

Mining
Livestock
Road
Urban/rural

........
Land degradation


Data sources: Batunacun, et al. 2018
Land degradation

- Analyse temporal and spatial LD drivers dynamic in Xilingol.

- Summarize the ecological policies and discuss possible policy for the future.
Drivers Collection

Drivers

Indicators
- Population
- Livestock
- Temperature
- Precipitation
- Water bodies
- Urban
- Rural
- Road
- Mine
Drivers Collection

Categories

- Human disturbance
- Water condition
- Urbanization / Industrialization

Indicators

- Population
- Livestock
- Temperature
- Precipitation
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- Urban
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Drivers Collection

Categories
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Indicators
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- Mine

Measures
- Density
- Annual average
- Annual total
- Euclidean Distance
Partial Order Ranking Theory

Features of Partial Order Theory (POR)

- POR conceptualises the comparison of elements.
- Possess more than one attribute.
- Rank the drivers of land degradation in Xilingol.
Partial Order Ranking Theory

Features of Hasse Diagram Technique (HDT)

- Visualization of POR.
- Posets: The projects and their indicators.
  
  Data matrix: $Q$

  $Q (N \times R)$

Land degradation: Objects           Drivers: Indicators
## Partial Order Ranking Theory

### Data organization.

**Partial order sets: Posets**

<table>
<thead>
<tr>
<th>Objects/Indicators</th>
<th>Urbanization</th>
<th>Water condition</th>
<th>Human disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>County 1</td>
<td>V11</td>
<td>......</td>
<td>V1n</td>
</tr>
<tr>
<td>County 2</td>
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<tr>
<td>County 12</td>
<td>V121</td>
<td>......</td>
<td>V12n</td>
</tr>
</tbody>
</table>
Partial Order Ranking Theory

Normalization and Orientation.

- **Normalization:**
  Normalized value between $[0,1]$

- **Orientation:**
  Defined as “Strong” and “Weak”
  Strong: Strong effects on LD process.
  Weak: Small effect on LD process.
Partial Order Ranking Theory

- **Hasse Diagram Technique (HDT)**

  - HDT, exemplified by urbanisation drivers between 2000 and 2015.

### The input data of HDT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<tbody>
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<td>0.87</td>
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<td>0.46</td>
<td>0.87</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### HDT

- **Level 1**: XH, DW
- **Level 2**: AB
- **Level 3**: EL, SZ

**The values and effects**

- **Strong**: Increasing values and effects from urbanisation
## Results & Discussion

- **Human disturbance 1975-2000**

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tbody>
<tr>
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<td>0.01</td>
<td>0.09</td>
<td>0.44</td>
</tr>
</tbody>
</table>

### Notes:
- popD: population density
- sheepD: livestock density
### Results & Discussion

**• Human disturbance 1975-2000**

<table>
<thead>
<tr>
<th>County</th>
<th>1975_po pD</th>
<th>2000_po pD</th>
<th>1978she epD</th>
<th>2000she epD</th>
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</tr>
</tbody>
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**Dominant livestock chain**

With both high population and livestock
Results & Discussion

1975-2000

Water condition

Urbanization
Results & Discussion

Order ranking for all drivers in 1975 and 2000

- Human disturbance: dominant driver in **eight** county.
- Water condition: dominant driver in **six** county.
- Urbanization: dominant driver in **four** county.

<table>
<thead>
<tr>
<th>County</th>
<th>Human disturbance</th>
<th>Water condition</th>
<th>Urbanisation</th>
<th>Dominant drivers</th>
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<td>2</td>
<td>Human</td>
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<tr>
<td>DL</td>
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<td>3</td>
<td>2</td>
<td>Human</td>
</tr>
<tr>
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<td>2</td>
<td>2</td>
<td>Human, water and urban</td>
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<tr>
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<td>Human</td>
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<td>Human and urban</td>
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<td>Human and water</td>
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<td>ISO</td>
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<td>Human and Urban</td>
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<tr>
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<td>ISO</td>
<td>2</td>
<td>Urban</td>
</tr>
</tbody>
</table>
Results & Discussion

Order ranking for all drivers in 2000 and 2015

- Human disturbance: dominant driver in eight five county.
- Water condition: dominant driver in six three county.
- Urbanization: dominant driver in four seven county.
Results & Discussion

Order ranking for all drivers in 2000 and 2015

- Human disturbance: dominant driver in eight county.
- Water condition: dominant driver in six county.
- Urbanization: dominant driver in four county.
- Drivers group remained unchanged area: TP and DL.
- No dominant driver area: EL.
- Urbanisation increased and has now become more dominant than human disturbance after 2000.
- Water conditions as a driver causing LD in almost all counties.
Identifying drivers of land degradation in Xilingol, China, between 1975 and 2015. Land use policy (Under review).