Forest resource and conservation benefits from ecological restoration programs in China

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   • Beijing-Tianjin Sandstorm Source Control Project

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Key ecological restoration programs in China

a. The Natural forest protection project
b. The Three-North forest shelterbelt project
c. Beijing-Tianjin sandstorm source control project
d. The conversion of cropland to forest Program
e. The Shelterbelt construction project of the Yangtze River Basin
f. The Shelterbelt construction project of the Zhujiang River Basin
g. The Conversion of grazing land to grassland project
h. The ecological protection and construction in the headwaters of the Three Rivers
i. The controlling of karst rocky desertification in Southwest China project
Key ecological restoration programs in China

Main objectives of these project

- Prevent the deterioration of the ecological environment
- Protect biodiversity
- Vegetation restoration
- Adjust the direction of forest resources management
- Protect natural forest resources
- Reduce desertified land
- Protect grassland
- Protect Yangtze River Basin
- Protect Zhujiang River Basin

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Key ecological restoration programs in China

- Natural Forest Protection Program
- Conversion of Cropland to Forest Program
- Natural Reserve Development Program
- Three-North Forest Shelterbelt Project
- Shelterbelt construction project of the Yangtze River Basin
- Coastal Sheltbelt Development Program
Content

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3. Summary
Data and Methods

Multiple scale remote sensing data
1. MODIS products
2. Landsat series
3. Sentinel-2
4. Chinese Gaofen-1/2/6
5. Airborne hyperspectral and Lidar data

Indicators from remote sensing
1. Forest coverage
2. Fractional vegetation coverage (FVC)
3. Net primary productivity (NPP)
4. Carbon sequestration

Methods
1. Change detection
2. Comparison between the areas in and out the project
3. Trend analysis: Theil-Sen median, Mann-Kendall
Data and Methods

Improved forest cover mapping by harmonizing multiple land cover products over China

Data and Methods

- Inside vs outside.
- Domestic vs abroad in typical international basins.
- Before vs after the implementation of the ecological restoration programs.
Forest Change in Natural Forest Protection Project (NFPP) Area

Land cover map in NFPP area in 2000, 2010 and 2020
Forest Change in Natural Forest Protection Project (NFPP) Area

Area in the upper and middle reaches of the Yellow River (N35.626652°, E107.712034°)

Area in the upper Yangtze River (N32.171106°, E110.541715°)
Forest Change in Natural Forest Protection Project (NFPP) Area

Forest change in each area from 2000 to 2020

<table>
<thead>
<tr>
<th>Area</th>
<th>2000</th>
<th>2010</th>
<th>2020</th>
<th>Increase proportion</th>
<th>Increase rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPP</td>
<td>33.07%</td>
<td>33.48%</td>
<td>35.12%</td>
<td>2.05%</td>
<td>6.31%</td>
</tr>
<tr>
<td>Key state-owned forest areas in Northeast China and Inner Mongolia</td>
<td>71.24%</td>
<td>71.69%</td>
<td>72.87%</td>
<td>1.63%</td>
<td>1.65%</td>
</tr>
<tr>
<td>The upper reaches of Yangtze River</td>
<td>52.34%</td>
<td>53.10%</td>
<td>56.91%</td>
<td>4.57%</td>
<td>8.74%</td>
</tr>
<tr>
<td>The upper and middle reaches of Yellow River</td>
<td>14.36%</td>
<td>15.04%</td>
<td>15.81%</td>
<td>1.45%</td>
<td>10.03%</td>
</tr>
<tr>
<td>Key state-owned forest areas in Hainan</td>
<td>70.19%</td>
<td>71.03%</td>
<td>74.25%</td>
<td>4.06%</td>
<td>5.46%</td>
</tr>
<tr>
<td>Key state-owned forest areas in Xinjiang</td>
<td>3.56%</td>
<td>3.76%</td>
<td>3.78%</td>
<td>0.22%</td>
<td>6.76%</td>
</tr>
</tbody>
</table>

FVC Trend in Natural Forest Protection Project (NFPP) Area


FVC trend in NFPP area

FVC trend in the first stage of Natural Forest Protection Project (NFPP) of China (2000—2010)

FVC trend in the second stage of NFPP (2011—2020)

FVC trend since the implement of NFPP (2000—2020)
FVC Trend in Natural Forest Protection Project (NFPP) Area

- Area with increased FVC trend was about 78.22% of the total forest area, while area with decreased FVC only accounted for 9.56% of the total forest area.

- An obviously increasing trend of FVC could be found in the NFPP area, which indicated that the quality of the forest was increasing since the implement of NFPP.

Forest Dynamics in Natural Forest Protection Project (NFPP) Area

- The increased area of TCC was much larger than the decreased area, accounting for 59.68% and 40.34%, respectively.
- Deforestation was effectively curbed, the area of forest loss was significantly decreased, and the area of forest gain significantly increased.

Spatial statistics of forest (a) loss and (b) gain in each county from 1986 to 2018

Benefits of Natural Forest Protection Project (NFPP) Area

Comparison of FVC trend between NFPP area and Non-NFPP area in different ecological zones

Comparison of NPP trend between NFPP area and Non-NFPP area in different ecological zones
Benefits of Natural Forest Protection Project (NFPP) Area

Comparison of FVC trend between areas in China and in neighboring countries in international typical basins

Comparison of NPP trend between areas in China and in neighboring countries in international typical basins

In general, the rate of increasing trend of FVC and NPP in China are larger than that in neighboring countries.
Desertification Land Change in the Beijing-Tianjin sandstorm source control project

The area of desertification land decreased 150.51 km², and the area of arbor, shrub and grass land increased 450.55 km².

Vegetation change from 2000 to 2020

Desertification land change from 2000 to 2020
FVC trend in the Beijing-Tianjin sandstorm source control project

The average vegetation coverage in the study area increased from 0.422 (2000~2002) to 0.519 (2018~2020). Land degradation situation in the study area has been curbed, the vegetation situation is getting better, and the ecological environment is obviously improved.

Ecological Quality in the Beijing-Tianjin sandstorm source control project

Area with significant increases in vegetation coverage, NPP, soil conservation, evapotranspiration, water conservation and habitat quality accounted for 50.94%, 68.88%, 50.00%, 32.43%, 56.11% and 25.59% of the total area, respectively.
Driving Factors of Ecological Quality Change in the Beijing-Tianjin sandstorm source control project

Project measures account for the largest proportion, which is close to 40% of the whole study area. Followed by precipitation factor, which accounts for 30.44%. In particular, project measures are the main factor in Horqin Sandy Land and Mu Us Sandy Land, indicating that the project play a very important role in regional environmental improvement.
Summary

- Multiple remote sensing images provide good data source to evaluate the forest resource and conservation benefits from ecological restoration programs in China.

- In general, both of the forest quantity and quality are increasing since the implement of the Natural Forest Protection Project area and Beijing-Tianjin Sandstorm Source Control Project area. Ecological restoration programs have made notable achievements in China.

- More systematical evaluations are needed to integrate ground measurements (e.g. long-term NFI data, ecological research station observations) with RS observations for more quantitative indicators.
Thank you.

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