Effects of Government Policies and Natural Disasters on the Patterns of Forest Cover Change in the Sichuan Giant Panda Sanctuary (China)

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Summary

Government policies shape human activities that drive land cover changes and impact wildlife habitats. Since the early 2000s the Chinese government has been implementing two of the largest ecological conservation policies in the world: 1) The Natural Forest Conservation Program (NFCP) and 2) the Grain-to-Green Program (GTGP). At the same time China is also pushing to escalate economic growth through a grand development scheme, the West China Development Program (WCDP). The main goal of this project is to understand the effects of conservation and development programs on the spatio-temporal dynamics of forest cover in the Sichuan Giant Panda Sanctuary. Many townships experienced drastic reductions in the amount of forest cover before the implementation of the NFCP and GTGP, even inside nature reserves [2,3]. This trend was reverted in the years after the implementation of conservation policies. However, some townships are still losing forest cover despite their implementation. These townships are located in the eastern portion of the Sanctuary, which tend to be more subjected to human activities enhanced by the implementation of the WCDP. In addition, some of the net gains in total area of forest cover in Wenchuan County were reversed by the May 12, 2008 Wenchuan earthquake. However, the combined effects of development and earthquake-induced landslides would have severely reduced the area of forest without the implementation of conservation policies.

Field Data

The 1994, 2001 and 2008 image datasets were geometrically and radiometrically registered to one another. The 2007 image dataset were corrected using 5th-degree polynomials in ENVI. The classification scheme (fuzzy classifier) was calibrated for the 2007 image dataset using ground control points and the coefficients of the classification were applied to the other datasets. Areas under clouds and cloud shadows were removed from the entire image time series. Annual rates of forest cover change were calculated as [3]:

\[ R = \frac{A_{i} - A_{t}}{A_{t}} \times 100 \]

Where \( R \) is the forest cover change rate (%) per year, \( A_{i} \) is forest area at the beginning of the period, \( A_{t} \) is forest cover at the end of the period, \( t \) is the number of years between the beginning and ending periods. \( R \) takes negative (positive) values if the changes are due to losses (increases) of forest cover.

Study Area

The study area covers 72 townships comprising the UNESCO World Heritage Sichuan Giant Panda Sanctuary in 12 counties (color coded) of Sichuan Province, China. The epicenter of the May 12, 2008 Wenchuan earthquake (one of the worst natural disasters in China during the last 60 years) is also shown.

Methods

The 1994, 2001 and 2008 image datasets were geometrically and radiometrically registered to the 2007 image dataset and maps of the distribution of forests in 1994, 2001, 2007 and 2008 were obtained using a supervised classification of the Landsat TM data. The classification scheme (fuzzy classifier) was calibrated for the 2007 image dataset using ground control points and the coefficients of the classification were applied to the other datasets. Areas under clouds and cloud shadows were removed from the entire image time series.

Results: Effects of the Earthquake on Forest Cover

Conclusions & Future Work

- In the 1994-2001 period the forests declined at annual rates that varied between 0.6 and 1.8%.
- In the 2001-2007 period the forests recovered at annual rates between 0.5 and 1.9%, although some townships towards the east are still experiencing overall forest cover losses.
- The Wenchuan Earthquake induced drastic losses in forest cover, particularly in the townships in close proximity to the epicenter.
- Without conservation policy implementation the combined effects of development and earthquake-induced landslides would have drastically reduced the forest cover.
- Socio-economic conditions will be integrated to further explain the dynamics of forest cover change across the Giant Panda Sanctuary.

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References