

Monitoring of bamboo forest damage using multi-temporal satellite images and meteorological data

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1. Introduction

Bamboo is an important natural resource in China. The total size of the moso bamboo (*Phyllostachys pubescens*) forests in the Fujian Province is approximately 830,000 ha. From the late 1980s to the turn of the century, bamboo forest damage or disturbance occurred continuously in different locations because of pest (e.g., mites) outbreaks with a loss of biodiversity caused by plantation method changes. In order to monitor the bamboo forest changes, extract the damaged portions using the Landsat TM data and estimate the damage degree of the abnormal bamboo parts, a comprehensive methodology was developed. A combination of the bamboo forest damage changes in the time series with meteorological data shows that the lower the value of the lowest monthly mean temperature in Fujian indicates a lesser amount of damage.

2. Study area & Data

2.1. Study area

The study area is located in the north-central Fujian Province and ranges from 25°05' N to 28°12' N and from 116°12' E to 120°50' E (Fig. 1). The dominant forested landscapes in the study area include bamboo, fir and pine. In addition, paddy field, orchard and other trees are in this area.

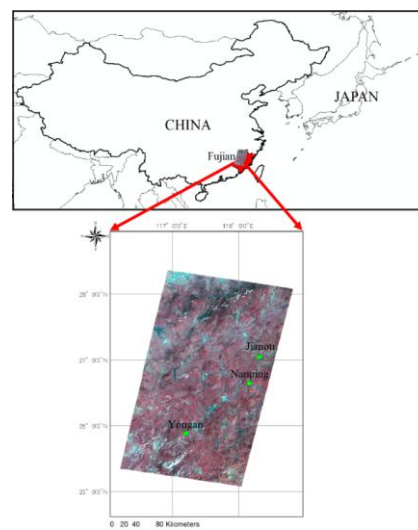


Fig. 1 Study area.

2.2. Data

In this study, satellite images and meteorological data were used. Images of the Landsat TM (Table 1) were obtained for bamboo forest classification, damaged part extraction and damage degree estimation. Meteorological data of 3 field survey regions from 1990 to 2010 were utilized for analysis of the influence of climate change on pest damage occurrence.

3. Methods

Based on the field survey data, the supervised classification method was used to distinguish the bamboo forest from the other forest types. Regarding the characteristics of moso bamboo, mite feeding reduced the chlorophyll content in the bamboo leaves causing the leaves of the damaged bamboo plants to turn yellow. This change indicates that the damage occurrence is related to the “greenness” of the forest. Furthermore, tasseled cap transformations of the Landsat data reduce the data volume and enhance the data interpretability by emphasizing structures in the spectral data. The tasseled cap transformations, band 2, which corresponds to “greenness”, was used to estimate the damage degree of the bamboo forest. Combined bamboo forest damage rate in the time series with lowest monthly mean temperature of objective year to analyze the effect of low temperature on bamboo forest damage outbreak.

4. Results and discussion

This study indicates that the Landsat time series can be used to effectively monitor the bamboo forest and used to map the bamboo forest distribution and growth situation. The supervised classification method is well-suited for the extraction of bamboo forest parts from complex forested landscapes. Low temperatures could decrease the severe damage outbreak.

Table 1 Dates of the Landsat TM scenes.

Date of imagery	Sensor
Oct. 09, 1988	Landsat TM
Oct. 20, 1992	Landsat TM
Oct. 10, 2000	Landsat TM
Oct. 05, 2004	Landsat TM
Oct. 03, 2009	Landsat TM