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RESEARCH ARTICLE

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A significant increase in the normalized difference vegetation index during the rapid economic development in the Pearl River Delta of China

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Abstract

Since 2000, the gross domestic product (GDP) of the Pearl River Delta (PRD) has increased by more than eight-fold. Experiences throughout the world indicate that the impacts of economic development on vegetation are particularly important. This study analyzed the variations in vegetation coverage in the PRD from 2000 to 2016. Moderate resolution imaging spectroradiometer normalized difference vegetation index (NDVI) data were employed, whereas climate data, GDP, and population were also used as influencing factors. Topographic factors were introduced to explain the spatial vegetation patterns, and the impacts of human activities on vegetation were explored. The results revealed (a) the overall vegetation coverage in the PRD showed an increasing trend, and the overall average NDVI increased by 0.0033/a. (b) The spatial pattern did not change greatly, but the high and low NDVI values moved to low elevations and shallow topographic slopes where human activities were prevalent. This trend resulted in increased NDVI values in 38% of the area of the PRD ($p < 0.01$). (c) There was a positive correlation between NDVI and economic growth (GDP, population), with correlation coefficients greater than 0.8 ($p < 0.01$). NDVI is influenced by climate change and human activities (such as afforestation, resident lifestyles, and economic development policies). This study reveals that with good policies, both rapid economic development and vegetation coverage improvements can be simultaneously achieved in a region. The findings of this study are crucial for the sustainable development of the mega-urban agglomerations of the PRD and Guangdong-Hong Kong-Macau Grand Bay.

KEYWORDS

economic development, NDVI, Pearl River Delta, urban agglomeration, vegetation coverage

1 | INTRODUCTION

Over the past several decades, the economy in China has experienced rapid growth. This development process has been accompanied by increases in ecological destruction, consumption, and industrial production (He, Shen, & Zhang, 2018). Economic development has widely led to impacts such as biodiversity decline, soil erosion, and land degradation (Newbold et al., 2015; Tabarelli, Aguiar, Ribeiro, Metzger, & Peres, 2010). These ecological destructions have caused serious environmental problems. An intuitive feeling of people is that vegetation declines in coverage and quality under such circumstances. Vegetation is an active part and primary ecological element of the earth system and plays an irreplaceable role in maintaining human living environments and stabilizing the entire earth ecosystem. Vegetation

