

# A dual-spatiotemporal PLS-SEM for quantifying driving mechanisms of change of wetlands

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**Abstract:** Wetlands significantly changed over the past decades. Remote sensing big data provides an effective way to monitor wetlands over large area. There have been many studies on the mechanism of Wetland Distribution (WD), however, further research is needed on the mechanism of Wetland Changes (WC). Therefore, this study proposed a model of the impact of Human Activities Changes (HAC) and natural environment factors changes on WC from a dual-spatiotemporal perspective integrated remote sensing technologies and Partial Least Squares Structural Equation Modeling (PLS-SEM). In the model, Human Activities (HA) are reflected by Gross Domestic Product (GDP) and population. Natural environment is reflected by Fundamental Natural Environment (FNE), which is mainly based on terrain, and Non-stable Natural Environment (NNE), which is mainly based on hydrological and temperature conditions. Landsat surface reflectance images from 1980, 1990, 2000, 2010, and 2020 were used to mapping the wetlands based on the random forest algorithm. The model was used to explore the mechanism of WC in the Pearl River Delta (PRD) from 1980 to 2020, and it can meet the accuracy requirements. The Composite Reliability (CR) of the model is greater than 0.6, and the Average Variance Extracted (AVE) is greater than 0.5. The results show that FNE Changes (FNEC) had a positive impact on WC (mainly referring to wetlands decrease). NNE Changes (NNEC) begin to affect WC after 2010. In addition, HAC had a negative impact on WC from 1980 to 2010, but both negative and positive impacts existed after 2010. By coupling areas of HAC with wetland decrease it is recommended to restrict HA in the southeast of Foshan (areas where HA increase leads to wetland decrease) to protect wetlands; The junction between Zhaoqing and Foshan (areas where HA decrease leads to wetland decrease) requires investment in the natural environment improving. The model proposed in this study is expected to be applied to other areas with severe wetland degradation threatened by HA and natural environment, to assist in wetland restoration and support of SDG15.

**Keywords :** Remote sensing; Wetland change; driving mechanisms; Partial Least Squares Structural Equation Modeling (PLS-SEM); Wetland restoration; Pearl River Delta (PRD)