Remote Sensing of Vegetation Change along the Altitude Gradient in Jade Dragon Snow Mountain Using Multi-temporal LANDSAT Data

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Abstract: The Jade Dragon Snow Mountain in Yunnan Province with an altitude of 5,596m is the most southern snow mountain in China, and is one protected nature reserves of Yunnan Province. In low-latitude zone, the Jade Dragon Snow Mountain owns rich vegetation types along altitude gradient. Both climate change and human tourist activities affect vegetation growth in the Jade Dragon Snow Mountain. Vegetation change in the high mountain is considered as a probable sign of environmental Change. The paper was intended to find how much forest changes in the Jade Dragon Snow Mountain paper in the past twenty years using multi-temporal Landsat images.

Multi-year Landsat images were obtained and processed by ortho-rectification correction and atmospheric correction. Because of the summer rainy season in this study area, it is likely to obtain cloud-free Landsat images in winter. Near-anniversary dates in winter were selected in order to reduce the seasonality effect. As synthesized ecological indicator, vegetation indices based on multi-year Landsat images were calculated based on the reflectance data. Several selected normal vegetation indices include the Normalized Difference Vegetation Index (NDVI), the Atmospherically Resistant Vegetation Index (ARVI), etc. Altitudinal characteristics of vegetation change were determined through elevation analysis using ASTER DEM data.

Landsat images and field survey show that vegetation species in the Jade Dragon Snow Mountain have clear altitudinal distribution. Two different coniferous forest types were monitored in this study. The dominant species

of dark coniferous forest above 3200m altitude are fir (Abies) and spruce (Picea asperata). Another type below 3200m altitude is bright coniferous forest dominant of Yunnan Pine (Pinus yunnanensis faranch). There is distinct trend of LANDSAT vegetation indices the past twenty years. The NDVI of dark coniferous forest with high altitude increases from 1989 to 2009, while the NDVI of bright coniferous forest with low altitude exhibits a sharp decrease. The mean NDVI of dark coniferous forest is slightly larger than that of bright coniferous forest in 1989. In 2009, the mean NDVI of dark coniferous forest becomes smaller than that of bright coniferous forest. The case of multi-temporal ARVI dataset has a comparable trend with NDVI data.

Preliminary analysis of the results is that warming likely caused vegetation indices decrease of dark coniferous with high altitude, and the cause of vegetation indices increase in bright coniferous forest is both warming and nature reserves project from the mid-1990s. Vegetation change detection using Landsat vegetation indices is suited for monitoring vegetation in the Jade Dragon Snow Mountain. The monitoring result of vegetation change is important for the protection and sustainable development of Jade Dragon Snow Mountain Garden.

Keyword: The Jade Dragon Snow Mountain, Vegetation change, Altitude gradient, LANDSAT