

## An analysis of drought evolution characteristics based on standardized precipitation index: a case study in Southwest Guizhou Autonomous Prefecture, China

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### ABSTRACT

Drought is a worldwide concerned issue which causes huge losses in agriculture, economic and damages in natural ecosystems. The precise assessment of drought evolution characteristics is essential for agricultural water management and drought resistance, while such work is rarely reported. Thus, eight meteorological stations located within the Southwest Guizhou Autonomous Prefecture (SGAP) were selected, and the Standardized Precipitation Index (SPI) was used to assess the drought evolution characteristics. The results revealed that the drought occurrences number in Pu'an station was the largest (23 droughts), and the average drought duration in Xingren station was the longest (48.75 months). Moreover, the drought characteristics of the eight stations have account for the largest proportion under normal conditions, was more than 60%, the frequency of drought disaster occurring in Xingren is the highest (30.05%), followed by Wangmo (23.73%). The results of this study will provide theoretical guidance for drought resistance and agricultural production in Southwest Guizhou Autonomous Prefecture of China.

**Keywords:** Weather indices, MLR techniques, PCA, forecast

The drought, which caused by climate periodic variation, is a major natural hazard to both human societies and ecosystems (Ashraf *et al.*, 2015; Rahman *et al.*, 2018). Generally, droughts occur randomly and could be last for long-term in large areas (Dai, 2013; Hu *et al.*, 2017). Compared with other natural disasters, drought possesses more negative impact on agricultural production, food safety and economic development (Bal and Minhas, 2017; Ashraf *et al.*, 2015; Chen *et al.*, 2015; Yang *et al.*, 2016). Drought is considered as one of the most detrimental climatic hazards, while rare reports and efforts can be reached so far (He *et al.*, 2011; Khadr *et al.*, 2017). According to the previous studies, the amount of precipitation and the duration of drought period are the main factors of the drought, and drought mainly results from the deficiency of precipitation, which needs further water supplement for alleviating the water shortage in agricultural productions (Rahman *et al.*, 2018). Meanwhile, it should also take into account the timing (i.e., the principal season of occurrence, delays in the start of the rainy season) and the effectiveness (i.e., precipitation intensity, number of precipitation events) of the rains (Pai *et al.*, 2011). Moreover, change in global surface temperature, and precipitation pattern may increase the drought duration, its severity, and frequency of occurrence (Kostopoulou *et al.*, 2017).

Southwest Guizhou Autonomous Prefecture (SGAP) is located in the southwest of China, which has grievously suffered from drought, main spring drought in recent decades. SGAP has an agro-based economy and most of the state falls in the seasonal drought area. SGAP is a major produce area of flue-cured tobacco in China, and the economic value of flue-cured tobacco production plays an important role in agricultural production in the whole state (Yang *et al.*, 2019). In recent years, due to the uneven distribution of rainfall resources, different degrees of water supply and demand in SGAP's major tobacco areas, especially in the transition period (spring) of flue-cured tobacco, which caused a huge impact on the growth of flue-cured tobacco and obstructed the normal growth and development of flue-cured tobacco (Yang *et al.*, 2019).

It is evident that the drought has become a significant factor restricting the yield and quality of many crops, and the economic losses caused by droughts far exceed those by other natural disasters. So far, there is basically no systematic analysis of the regularity, frequency, extent, and duration of drought in most of China's major agricultural planting areas, and this has a great impact on water saving, drought resistance, and agricultural production. Therefore, it is urgent to analyze the evolution of drought conditions in agricultural planting