Identification of Hyperspectral Characteristics of The Main Plants in *Seriphidium transiliense* Desert Grassland

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Abstract: Ground hyperspectral images of sericite–Artemisia desert grassland in different seasons were obtained by a soc710 VP imaging spectrometer. Analysis of variance was used to extract the main species *Seriphidium transiliense, Ceratocarpus arenarius*, and *Petrosimonia sibirica* and the spectral characteristic parameters and vegetation indices of bare land in different seasons. On this basis, Fisher discriminant analysis was used to divide the samples into a training set and test set according to a ratio of 7:3. The spectral characteristic parameters and vegetation indices were used to identify the three main plants and bare land. Results showed that under Fisher discriminant analysis, whether using the spectral characteristic parameters or vegetation indices, the identification model established by the vegetation indices had the best discrimination accuracy for the test set samples of *S. transiliense*, *C. arenarius*, *P. sibirica* and bare land. Although the total discrimination accuracy of the test set samples exceeded 80% in different seasons, the identification model established by the vegetation indices had the best discrimination, reaching 100.00%, 95.60%, 100.00% and 95.90%, respectively, and a total accuracy of 98.89%.

Introduction

Convenient and rapid identification of the composition of and change in natural grassland communities is of great significance for identifying grassland type, quantity and quality and monitoring grassland degradation and restoration. Hyperspectral remote sensing, one such technology, is mainly used in spectral feature extraction because of its many bands and narrow channels (Yu et al., 2018) and its strong advantages in grassland vegetation classification and recognition (Irisarri et al., 2009). The ecosystem of *S. artemisia* desert grassland is fragile and concentrated in Xinjiang, China. Overgrazing and general degradation have seriously damaged the animal husbandry production of herders and threatened the biodiversity of grassland and the ecological security of oases (Jin et al., 2011). Therefore, to further improve the identification accuracy and utilization of the identification parameters for the main plants in a grassland community, this study used an imaging spectrometer to collect spectral images of the *S. artemisia* desert grassland community, established spectral characteristic parameters and vegetation indices, and analyzed these spectral characteristic parameters and the vegetation indices of the main plants. The sensitive identification parameters in different periods were selected, and the identification objects were classified by Fisher analysis to provide a theoretical basis for the classification and identification of grassland plants.

Methods and Study Site

Study area

The dominant species is *S. artemisia*, and the subdominant species are the annual plants *C. arenarius* and *P. sibirica*, and bare land are identified in this study. A 500 m long transect was arranged every 150 m, with a total of 6 parallel transects. Five 30- × 30-m transects with a spacing of 30 m were arranged along each transect. Five transects were arranged on two

diagonal lines of the transects with a 5-point sampling method as data acquisition points. According to the field of view of the instrument, the area of the transect was set as 0.5 × 0.6 m, with a total of 150 transects. An SOC710VP imaging spectrometer was used to collect spectral data of plant communities in the field (spectral range 400~1000 nm, resolution 4.68 nm and number of bands 128), and the spectral measurement time was from 11:00 to 16:00 in April, June and September 2018 (solar altitude angle > 45°). The measurements were taken on sunny, cloudless, and windless or less windy (wind < 3 m/h) days. After the spectral data was processed by first order differential, feature parameter screening and vegetation index calculation, the recognition model was established for four types of recognition objects.

Results and Discussion

Vegetation index model and accuracy evaluation

In April, *S. transiliense* had an accuracy of 88.89%, *C. arenarius* an accuracy of 92.22%, and *P. sibirica* an accuracy of 96.67%. The bare land and all plants were placed in the correct category, with an accuracy of 100%.

In June, *S. transiliense* had an accuracy of 100%, *C. arenarius* an accuracy of 95.56%, and *P. sibirica* an accuracy of 100%. Bare land and all plants were placed the correct category, with an accuracy of 91.80%, yielding a total average accuracy of 95.90%.

In September, *S. transiliense* had an accuracy of 100% and *C. arenarius* an accuracy of 75%. Classifying bare land and the other two plants had an accuracy of 94.44%. The other objects were incorrectly identified as bare land three times, with an accuracy of 96.81%, yielding a total average accuracy of 95.63%.

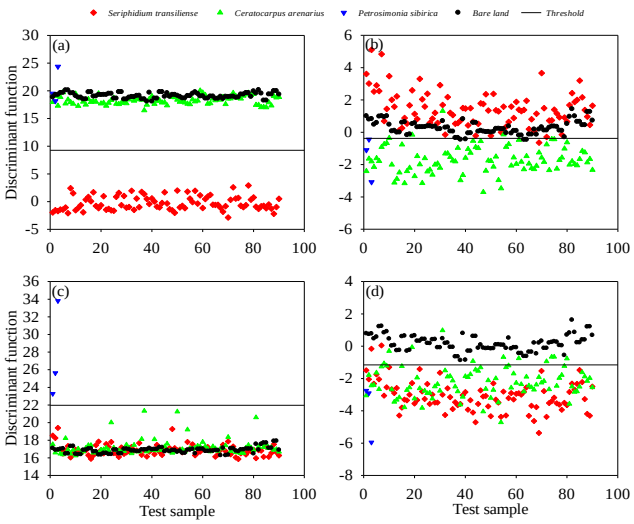

Fig. 1 Classification based on the vegetation indices in June.

Conclusions

Considering the identification period and parameters, the vegetation indices were used successfully to identify the three main plants and bare land of *S. transiliense* desert grassland in June, provide theoretical basis for classification and recognition of grassland plants.

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