THE IDENTIFICATION OF INDICATOR GRASS SPECIES OF GRASSLAND DEGRADATION BASED ON THE FIELD SPECTRAL CHARACTERISTICS

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1. INTRODUCTION

Grassland degradation has a strong impact on regional environment and climate, as well as on economical development. At present, remote sensing of grassland degradation has mainly involved detecting changes of vegetation indices [1]. But detecting changes by vegetation indices are always proved ineffective, as grassland vegetation with different characteristics may still produce similar vegetation index values [2]. In the initial stage of grassland degradation the grassland community always has similar biomass, but vegetation species have changed. So the indicator grass species of grassland degradation need to be distinguished from a variety of species in grasslands.

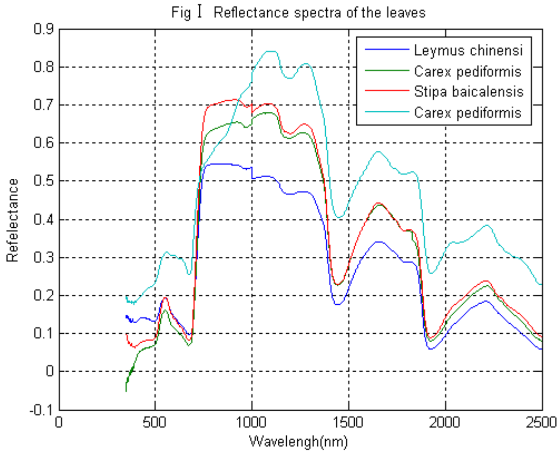
In order to research the identification method of grass species indicating grassland degradation, the Hulunbeier meadow land was chosen as a study object. The community of typical Hulunbeier meadow grassland is mainly composed of four constructive grass species, *Leymus chinensis, Stipa baicalensis, Carex pediformis and Artemisia frigida.* While *Artemisia frigida* is regarded as the typical indicator species, can be found in degraded grassland and dry areas. In this study, the hyper-spectral reflectance of more than fifteen main grass species was used and the suitable spectral analysis method was established to classify the indicator grass species of typical healthy and degraded grasslands.

2. ANALYTICAL PROCEDURE AND METHOD

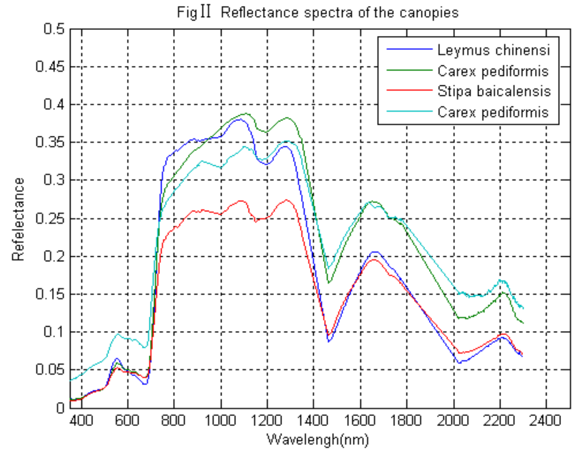
Field test were conducted at Bar Chen-Hu Zuoqi, Bar Xin-Hu Youqi, Bar Xin-Hu zuoqi, Ewenke qi and Hai Laer district in Hulunbeier City, Inner Mongolia, China, during 11/8/2008 and 16/8/2008. Reflectance spectra of leaves and pure canopies of the four dominant grassland species, as well as reflectance spectra of mixed grass community were measured using ASD FieldSpec 3 with a wavelength range of 350–2500nm. The wavelength resolution is 1 nm.

For reflectance spectra of the leaves(FigⅠ), the Linear Fitting method and ratio index has been proved effective to identify *Artemisia frigid* and *Leymus chinensis*. Firstly the Linear Fitting method is used to calculate gradient of spectral slope in wavelength range of 800-1000nm, the slope of *Artemisia frigida* is maximal, so *Artemisia frigid* can be identified. Then the ratio of R400nm and R630nm is calculated, the ratio index of *Leymus chinensis is* maximal, so *Leymus chinensis* can be identified. Other species can also be distinguished by the combination of the two methods.

Fig Ⅰ Reflectance spectra of the leaves



FigⅡ Reflectance spectra of the canopies



As to canopies' spectrum(FigⅡ), the combination of derivative Analysis of Hyperspectral Data and ratio index is proved effectively to distinguish the reflectance spectra. Differential of the reflectance spectra will reduce the signal-to-noise ratio and derivative method is notoriously sensitive to noise [4]. So some form of smoothing prior to the derivative analysis may be required at first [3]. In this paper, Savitzky–Golay Smoothing has been chosen to filter the spectra. In one-order derivative spectrum, *Leymus chinensis* has a maximum between 725nm and 730nm; derivative value at 662nm of *Artemisia frigida* is larger than value at 572nm. Based on above characteristics, it is easy to identify *Artemisia frigid* and *Leymus chinensis.* Similar to the leaves' ratio index, the ratio of reflectance at 400nm to the reflectance at 730nm is calculated, the ratio index of *Artemisia frigida is* maximal, and *Artemisia frigida* can be identified. *Artemisia frigida,* the indicator grass species of grassland degradation, has an obvious difference with other species of grass canopy.

Then by means of numerical simulation, the mixed pixel spectra that *Artemisia frigid* owns different proportion with the *Leymus chinensis* or *Stipa grandis* canopies or soil were simulated, it was found that if the proportion of *Artemisia frigida* or *Leymus chinensis* is more than 30%, the mixed pixel spectra has the similar characteristics with the pure canopies. Then *Leymus chinensis* and *Artemisia frigid* can be identified in the mixed pixel. At last the several mixed spectra measured in field were used to validate the result. Based on the characteristics found before, the grass species such as *Artemisia frigida*, can be identified from reflectance spectra of mixed community, the accuracy can reach 90%.

3. CONCLUSION AND DISCUSSION

In conclusion, the Linear Fitting method, derivative Analysis and ratio index have been found to be effective on identifying the grass species that indicate grassland degradation. These methods should be used in multi-temporal hyper-spectral image. But there are still many problems need to solve. Such as how to extract the endmember from lots of spectra of mixed grass species and how to decompose the mixed pixels and calculate proportion of different species accurately. Above questions will be research in future study. The combination of hyper-spectral images and vegetation indices owns good prospects in monitoring and detecting vegetation changes.

4. REFERENCE

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