Ground Truth Database for Vegetation Remote Sensing

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1.Introduction

In the vegetation remote sensing application, especially on quantitative estimation of vegetation parameter such as standing biomass, we must built some indirect estimation models connecting the physical parameter value and the spectral information obtained from remote sensing data. Therefore, we should correct the ground truth spectral reflectance data and physical parameter applicable for modeling. Actually, so many ground measurement were carried out by many researchers and we can find measured reflectance data in many literature. In most cases, however, since ground measurement was made for a specific purpose focused on author's interest, these data are difficult to use for the other applications. In addition, after making the tables or plots of spectral data, we can not know the detail condition of the target.

Considering the continental scale or global scale vegetation monitoring, we need ground truth data and the models designed from them for each typical vegetation type. Currently, it is very difficult to make a standard style for common-usable ground truth database because required parameters for the modeling depend upon what kind of information we want to estimate. But , at least, it is able to select the common information to be measured and/or recorded for each vegetation type.

In following section, which kind of information should be contained in the ground truth database and required specification for spectral measurement system are proposed.

2. General information to be contained in the database

For most vegetation remote sensing application, target of reflectance measurement is vegetation 'colony', not a single leaf. Thus, we should consider the change of reflectance in various observing and light incident geometry, coverage ratio of vegetation, background effect, structure of vegetation colony, etc. The most important information to be cleared is which factor affects apparent spectral reflectance in how much magnitude. In order to create the ground truth database applicable for remote sensed data analysis, we need some models describe the effect of sun-target-sensor geometry and the

vegetation colonies structure.

In table 1, general information to be contained in the spectrum database for grassland measurement are listed. For other vegetation type, items listed in 2nd line of the table will be changed. But observing condition should be always recorded. And the measurement always should be made in various different observing geometry.

Table 1. The information to be contained in the database. (for grassland measurement)

Observing condition	Location & time of Observation, Solar zenith & azimuth angle, Sensor viewing zenith & azimuth angle, observing height, Sensor's field of view spectral resolution
Target condition	average grass height, coverage ratio, background spectral reflectance

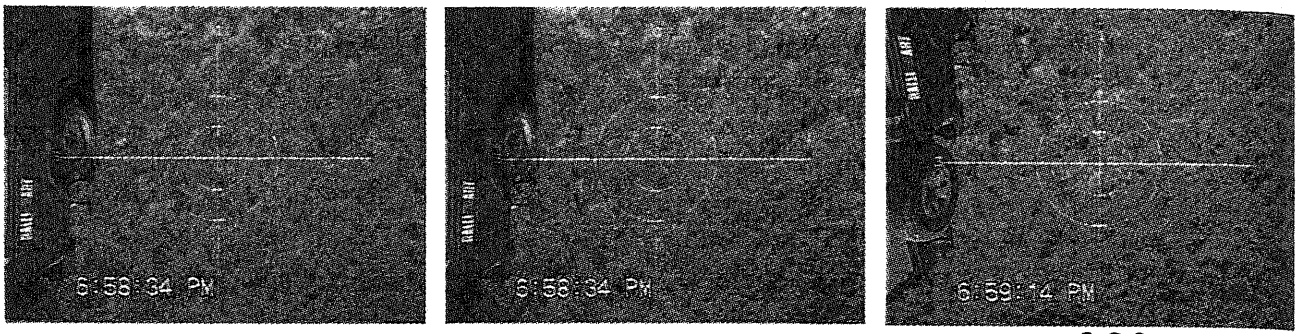
In addition, recording the image of the target is important information for the spectrum database. If the database has image information of the target, user can see the condition of the target such as vegetation coverage condition, shadowing condition, etc.

3. Required specification of spectrum measurement instrument

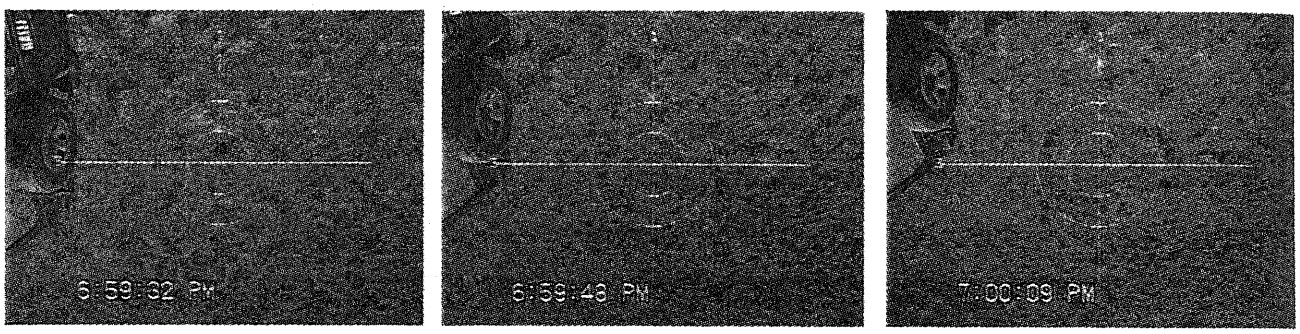
In order to built the models describe the spectral reflection in various conditions, we should make many measurement for same target. For this purpose, spectrum measurement instrument which has capability of quickly measurement is required. This is very important point to design the measurement instrument system. Because, if it takes long time for changing the sensor geometry, we cannot make measurement for various sensor geometry in the same solar geometry.

CEReS has developed the prototype system for grassland spectral measurement instrument. This system can change the sensor geometry by remote control.

In July 1995, we made field measurement for grassland in Mongolia and checked the efficiency of the system. Figure 1 and 2 shows a part of the measurement result. We successes to obtain the spectral reflectance data in various sensor's geometry in short time.



0° 20° 30°



40° 50° 60°

SZ : 63°
SA : 275°
Scan Direction :
275°(Forward scan)

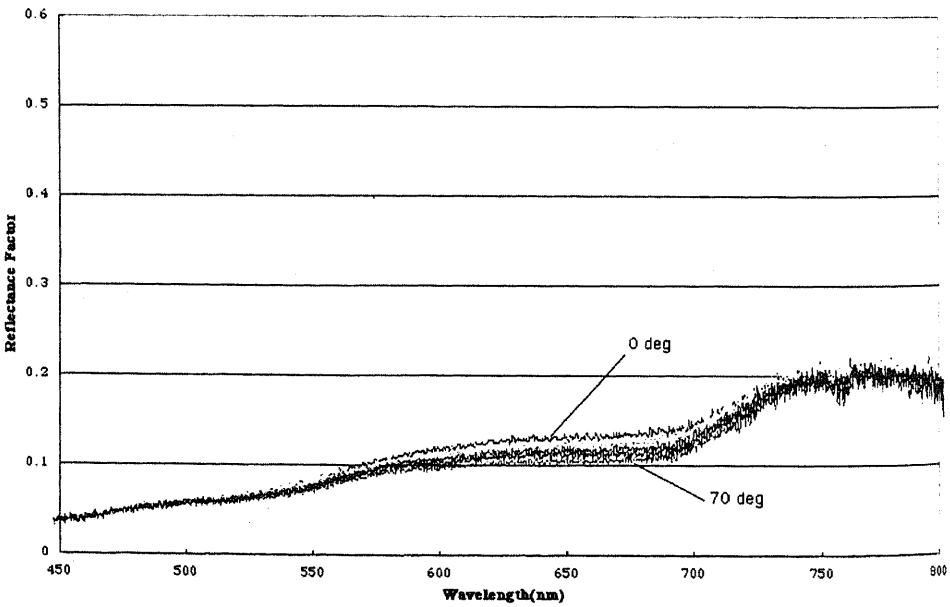
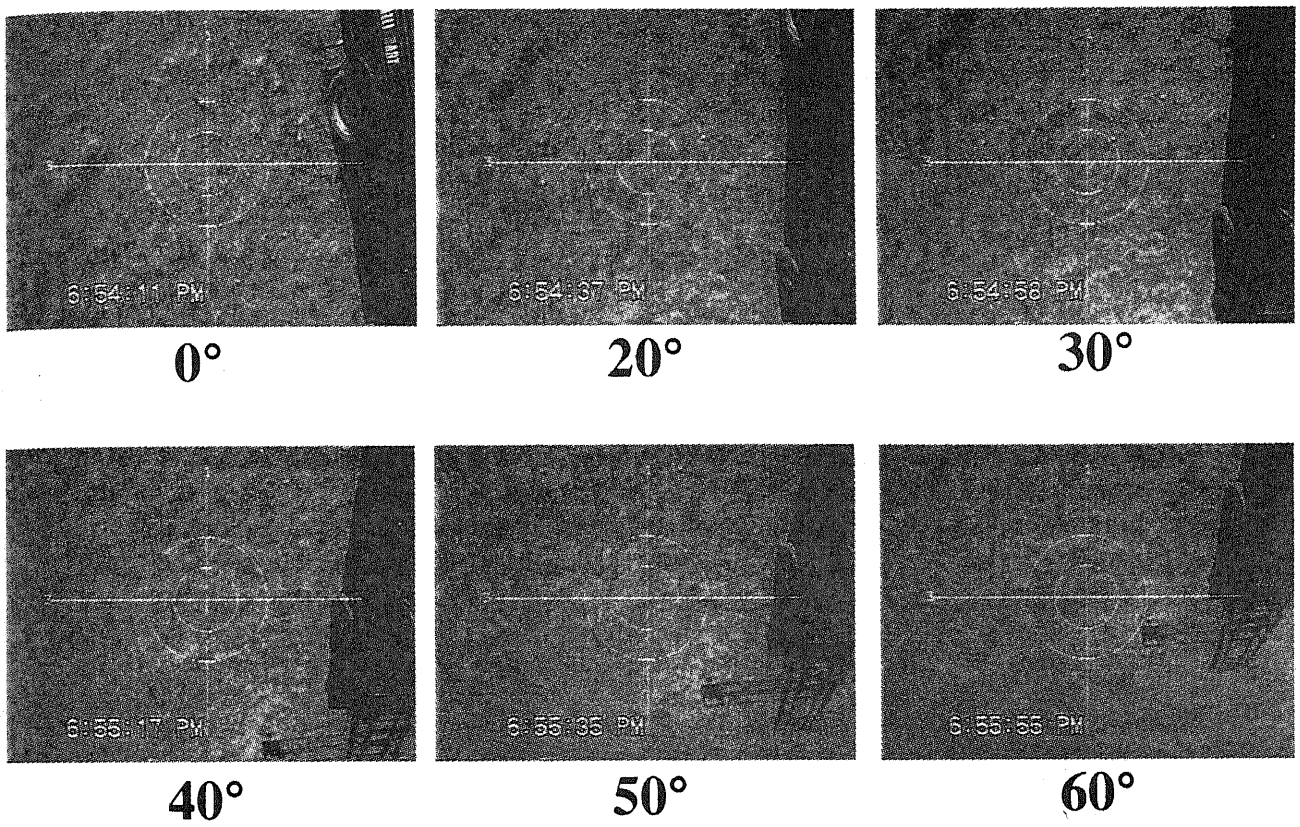


Figure 1. Spectral reflectance of grassland. (Forward scan)



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95°(backword scan)

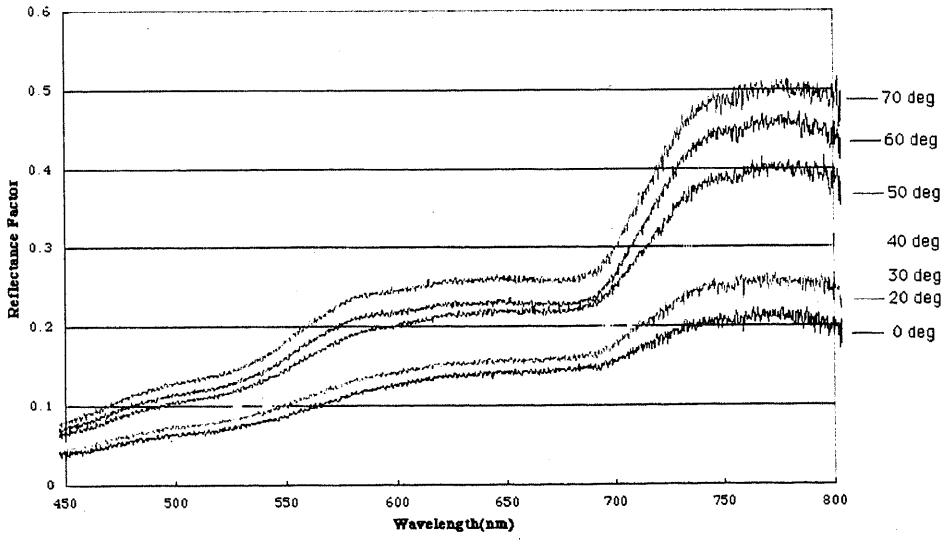

Figure 2. Spectral reflectance of grassland. (Backword scan)