Developing a method of creating the plant species map by remote sensing

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Raw milk accounts for about 10% of the agricultural output in Japan. Despite growing demand for raw milk, milk production has not shown much increase. This is due to the aging of dairy farmers, which has resulted in a serious succession problem. The number of dairy farmers has declined by about one-thirtieth, from a peak of 418,000 in 1959 to 15,000 in 2019, with about 700 dairy farms closing down annually in recent years. In order to ensure a stable supply of milk, it is necessary to prevent a decline in milk production. Feed self-sufficiency rate for daily is declining year by year due to the high supply of imported concentrates feed. Currently, about half of the meadows in Hokkaido are occupied by gramineous weeds. High occupancy of weeds is one of the factors that reduces the raw milk production. The detection of weeds in meadow using remote sensing technology has been attracting attention in recent years. As for broadleaf weeds, measurement with high ground resolution makes it possible to identify weed locations using image recognition technology. However, most of weeds look very similar to the grass and are very difficult to identify visually. It is necessary to estimate the occupancy rate of gramineous weeds by observation and to promote meadow renovation. In previous studies, observations by remote sensing techniques were made using broadband filters with a ground resolution of 3 m and FWHM of 50-100 nm, which made it impossible to discriminate between grasses and gramineous weeds with similar reflection spectra with sufficient accuracy.

In the last year, we developed a tree diagram for identifying plant species with data measured by multi-band camera with 4 selected filters (FWHM of 10nm) from wavelength range of 420 –840 nm onboarded a drone and creation a plant species map of the meadows. The differences in the visible light were emphasized by normalizing the reflectance as the first conditional branch. In addition, by using timothy as a standard sample and taking difference from this, the differences between plant species was emphasized as the second conditional branch. From these emphasized differences, two conditional branches were performed.

In this study, we verifying the tree diagram. First, we captured the three test plots with 4 narrow-band filters. These test plots reveal the plant species and their proportions: the first test plot has grasses grown by species; the second and third test plots have approximately 200 1m x 1m plots each. By comparing these data with the percentages of each plant species estimated from the tree diagram, we verified the accuracy of the tree map created last year.

Based on last year's results, it is estimated that 40% of species with low accuracy and 80% of species with high accuracy identified using the tree diagram, although it varies by plant species. However, since we properly estimate accuracy last year due to the paucity of validation data, we aimed to estimate accuracy more accurately.

Based on this year's results, when only one plant species was growing, as in the first test plot, the plant species identified in most cases.

In conclusion, if a plot has at least one species growing only, it is almost always possible to identify the plant species with the tree diagram.

Keywords: Remote sensing, Agriculture, High ground resolution, Meadow

