The seasonal changes of green forest area distribution: A case study of Tsukuba city, Japan.

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1. Motivation

Green spaces are a great benefit to our environment. More green space within the city limit can improve the urban environment. Japan has four seasons (winter, spring, summer, autumn). Each season has unique climatic conditions. Distribution of the green forest area mostly depends on climatic condition.

The motivation of this study is to identify the changes of green space distribution by seasons in Tsukuba city area.

2. Introduction

The greener area can be seen in the city limits in developed country such as Japan. It helps to reduce the urban stress. The percent study reveals that the spatial changes of the green forest area during spring and winter seasons and finds out the capacity of space-born data to capture the seasonal vegetation changes.

3. Study Area

The study was carried out Tsukuba city covers a 5 km radius from the city center. Total land area is 100 square kilometers.

4. Methodology

Field work carried out in two steps. First field work carried out to find sample point to classification and second field work conducted to find the accuracy of the calcification.

In this study, Landsat- 8 OLI/TIRS (May 02, 2015 and January 31, 2017) imagery all acquired in the spring and winter seasons were used. Cloud-free Landsat images (<10%) were collected. Figure 1 shown methodology adopted to the present study. Digital number (DN) values of the multispectral bands have been converted into surface reflectance values. The reflectance value of the images classified using Maximum Likelihood classification. Green areas were separated from others categories after classification. Changes identified comparing two green areas. Field work conducted to find sample points for classification and find out accuracy of classification.
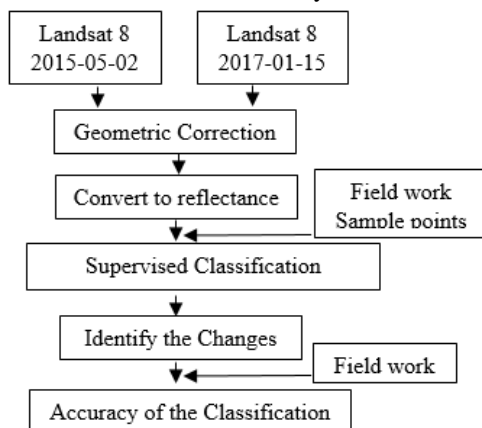

Figure 1: Methodology flow chart

5. Results and Discussion

Figure 2 shows the result of the classification of the green area in the spring and winter seasons. The less green area can identify near the city center during the two seasons. The greener forest areas can be seen in North and West part of the city. Seasonal changes can see in the whole area of the green forest area located. Figure 3 representing the changes of the green forest area during the two seasons. In the spring season, 20% of green forest area can see in the study area. But it has decreased up to 13.5% in the winter. Most of the changes can observe in the north, northwest, southwest and southeast part of the study area.

During the fieldwork, more than 50 locations were observed in the study area. There were mismatches of actual observation and classification. Some area showed green in the classification, but there are not green infield. Another area high canopy cover is not green in the winter season but the second layer of the forest are green. The accuracy of the result depends on the spatial resolution of the satellite images. Landsat 8 OLI/TIRS is 30×30 grid size. Most of the green area along the road and some small green area cannot find in Landsat images. However, during the field work, the larger green patches were considered to check the accuracy of the classification (figure 4). Finally, 87% of overall accuracy was obtained. No human interactions found during the field work in reducing the green area in Tsukuba city.
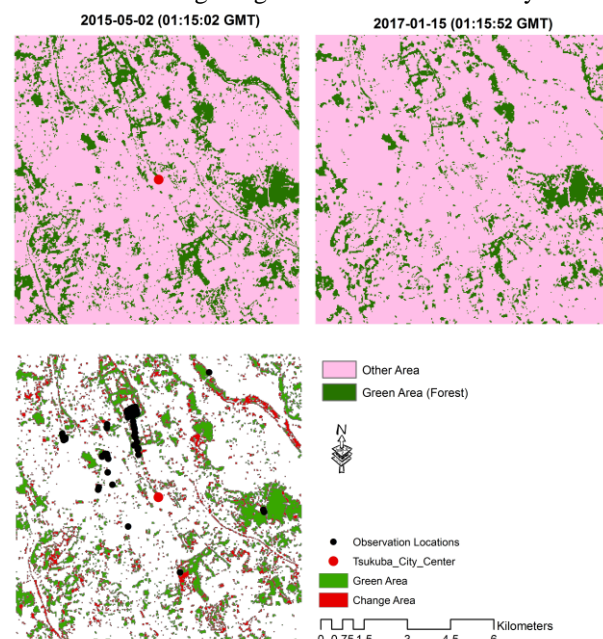

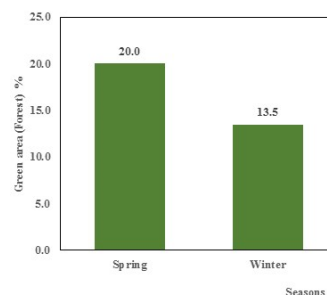Figure 2: Green forest area distribution (spring to winter)

Figure 3: Changes in green forest area (Spring to winter)

Figure 4: Nongreen forest and green forest area