Helicopter based observation of vegetation

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Abstract

Remote sensing is a very effective technology for analyzing forests on a large scale. In recent years, the spatial resolution of sensors mounted on satellite has greatly improved and detailed observations can be made. However, in order to identify and characterize vegetation, the resolution of satellite imagery is still not high enough. It is necessary to acquire higher resolution data such as an airplane to be able to discern each leave or crown.

In this study, vegetation observations using a video camera mounted on a helicopter were planned and carried out.

If pixel size in much smaller than crown one, it is possible to image processing. We focus to develop a method to measure the size of each crown.

ITRODUCTION

Forests play an important role in the environment conditions for life on the earth. The forests have seasonal cycle and changing year to year. The external factors such as the harmful insects may damage the forests. Conditions around forests are not constant. The size and form of the crown of the tree is different by the age and species. Usually the volume of the crown is proportion to amount of CO_2 absorption. Therefore measurement of the size of crown is important.

We can get detail conditions of the forests at ground-base monitoring, however it is difficult to measure the large area constantly in cost and labor. The remote sensing is useful to observe large area periodically.

Generally, in the remote sensing of the vegetation each pixel operation based on spectral characteristics of the vegetation is used. However in this way it is hard to measure the expanses of brightness values as a crown area. In this study, the expanses of brightness values were used to analyze crown size and its distribution.

2. EQUIPMENTS AND DATA

2.1 Observations from Helicopter

Observations from helicopter were done on November 19, 2000. The helicopter hovered over the observation area at Kanazawa university campus and photographed using video camera. The distance from instruments to target was about 300 m, which was confirmed by a rangefinder (Bushnell YARADAGE PRO 1000). In this study, the image taken by video camera was used.

2.2 Video Camera and image

The video camera used in the observation is a SONY DCR-PC-100. This camera was as digital camera. The image size is 1152 x 864 pixel and spatial resolution on the nd is 20 cm/pixel. Each channel (RGB) has 8 bit of color depth, and the total color n is 24 bit.

3. ANALYSIS

Fig.1 shows the overview of analysis method. The goal of this method is to draw a crown as a circle. We assume that the same crown consists of similar color leaves and branches. This feature was used to identify a crown area. Fig.2 shows the each step of images processing.

3.1 Calculation of radius size of similar color circle

At first, the center of the circle area is selected as target to judge the pixels in the area to have similar brightness values. The brightness value of central pixel is used as standard and an acceptable range is set. If all brightness values in the judge area are within acceptable range, it is judged as the area that has similar brightness value. The circle area is extended until dissimilar brightness value is found. The radius of the maximum circle of similar area was recoded as a data. All pixels in the image were processed as the same manner.

Removal of redundancy radius

After all pixels are processed, there are many small circles in a large circle. These small circles are redundancy information for and they should be removed. In this way, small circles that existed inside the large circle were able to removed.

3.2 Reconstructed image

The image of radius distribution is difficult for a man to understand. To make understandable image, the radius distribution was reconstructed. The method of reconstruction is to draw circle area by original brightness value of target pixel.

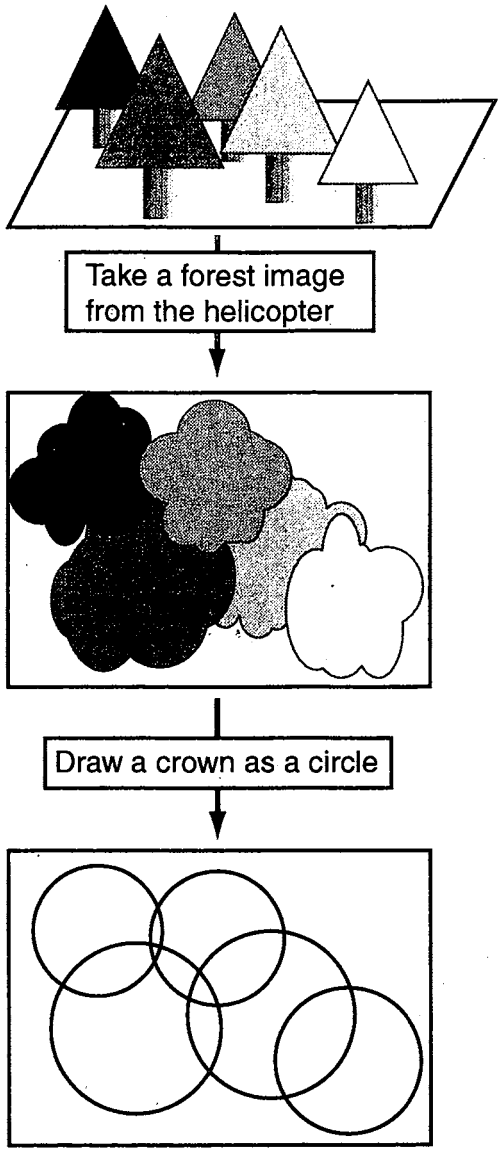
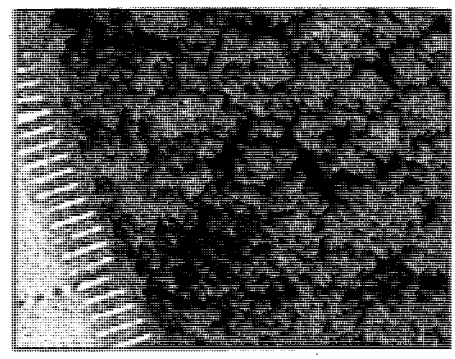
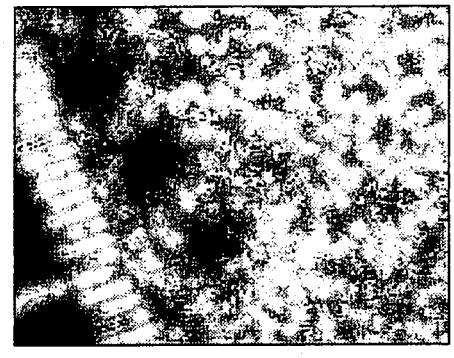


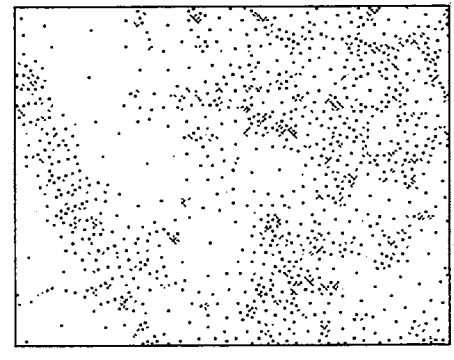
Fig.1 Overview



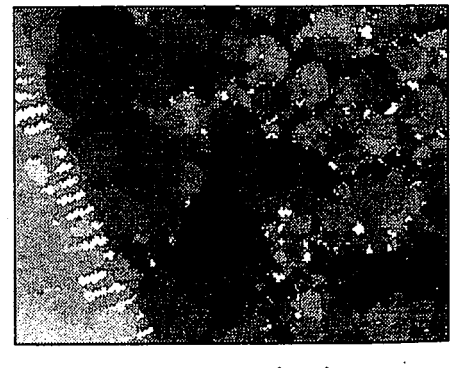
(a) Original image



(b) Radius distribution



(c) Distribution without redundancy radius



construction image

tep of the process

4. RESULTS

To estimate this method two spots that are different in distribution of crown size were analyzed. Fig.3 shows a result of reconstructed images and Fig.4 shows its histograms. In the original images, the spot A consists of small crowns and the spot B includes large crowns. The reconstructed image of spot B includes large circles and other image of spot A consists of small circles. In the histogram, the area which radius is more than 1.2 m is larger in spot B than spot A, and the area less than 1 m is larger in spot A than spot B. Therefore this method is useful to know a trend of crown size.

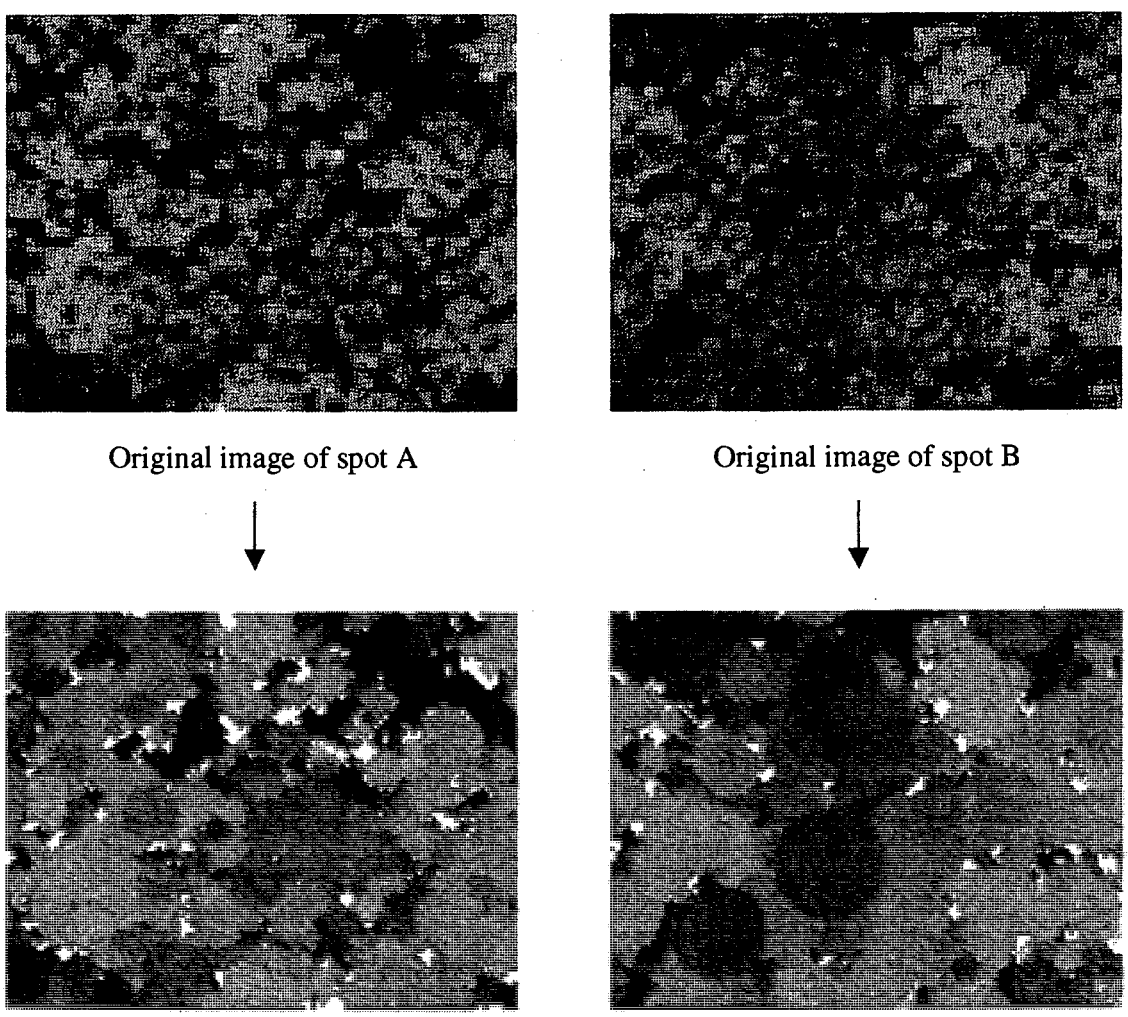


Fig.3 Comparison images of two spots in the observation area

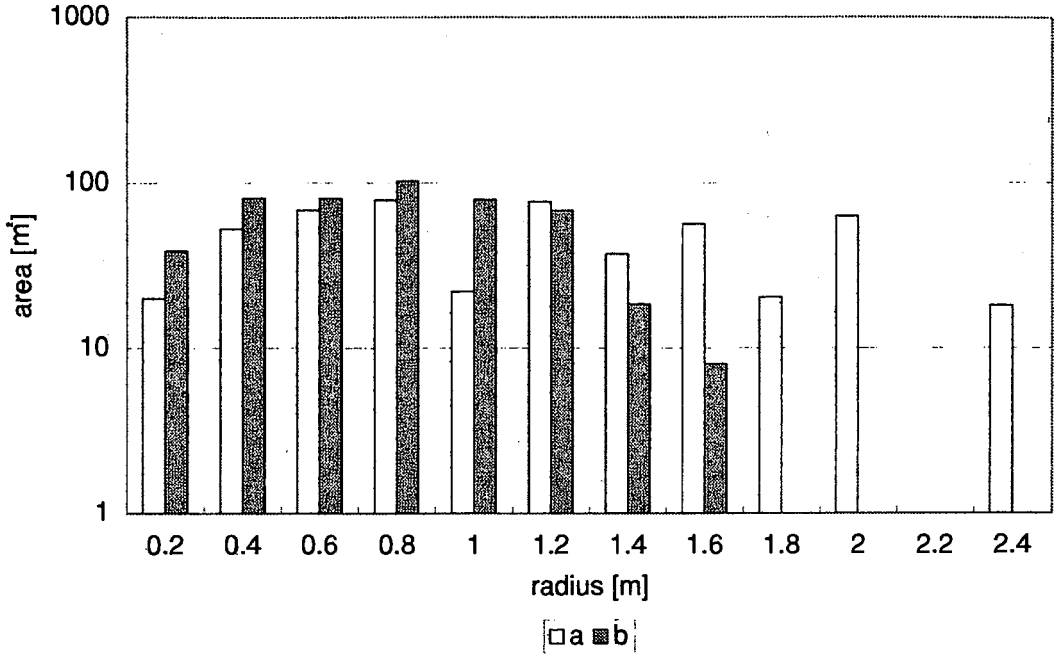


Fig.4 Histogram of two spots in the observation area

5. CONCLUSION

In this study, the image taken from helicopter was processed to analyze the distribution of the tree crown size. The distribution was calculated by the method based on information of colors. The result is effective to know the tendency of the crown size.

Reference

[1]R.KOMURA, M.KUBO, and K.MURAMOTO, "Analysis of relationships between image data and spectrum of vegetation measured from helicopter," Proc. Int. Geosci. Remote Sensing Symp., Sydney, Australia, July 2001.