RESEARCH AND DEVELOPMENT OF HIGH RESOLUTION SATELLITE IMAGE AND FOREST STRATIFICATION METHOD OF FOREST AREA USING GIS

MyungHee Jo, KwangHyun Cho

Department of Satellite Geoinformatics Engineering., Kyungil University

mhjo@kiu.ac.kr . riskyful@nate.com

ABSTRACT ... Recently, information-oriented whole domain and scientific management method for nation-wide territory is widly being used due to the remarkable development such as GIS and RS. In addition to this, request for analyzing forest spatial information has been increasing to manage forest resources efficiently. Although forest information using satellite image and GIS has been built to analyze a large amount of forest information scientifically, there are many difficulties to gather information because normally forest area is large and difficult to access..
This research uses high resolution satellite and digital aerial photograph around Kyungju city area to classify forest area, and stratifies forest area through a spot survey and a comparison of sample area. It will be possible for us to draw a more detailed map of forest area than 1/25000 map of forest area through these works.

KEY WORDS: High Resolution Satellite Image, Map Of Forest Area, GIS, Forest Stratification

1. INTRODUCTI

Max In the past, forest information was extracted using status understanding and aerial photograph interpretation with the forest survey conducted by forest expert in order to extract forest information. Moreover, produced theme blueprints pertaining to the forest areas were not used often by the general public since ordinary people could not interpret the data easily when it comes to the analysis of the forest status since the details of the research and indication methods were very different depending on the purpose of the production.

However, demand for the analysis of diverse spatial forest information such as forest location, forest vegetation, agrotype and so forth, needed for the effective forest resource management is increasing every day due to the scientific advancements. To conduct prompt and scientific analysis to meet the demands for diverse forest information, use of satellite image data and GIS analysis method is increasing.

This research targets the area around the Yangnam-myeon where aciculilignosa and broadleaf of the forest area located in the Dongbu region of the Gyeongju City are dispersed evenly to stratify clinical findings by abstracting characteristics of the spatial information using high resolution satellite images and diverse SMLs when it comes to the clinical study at the target location.

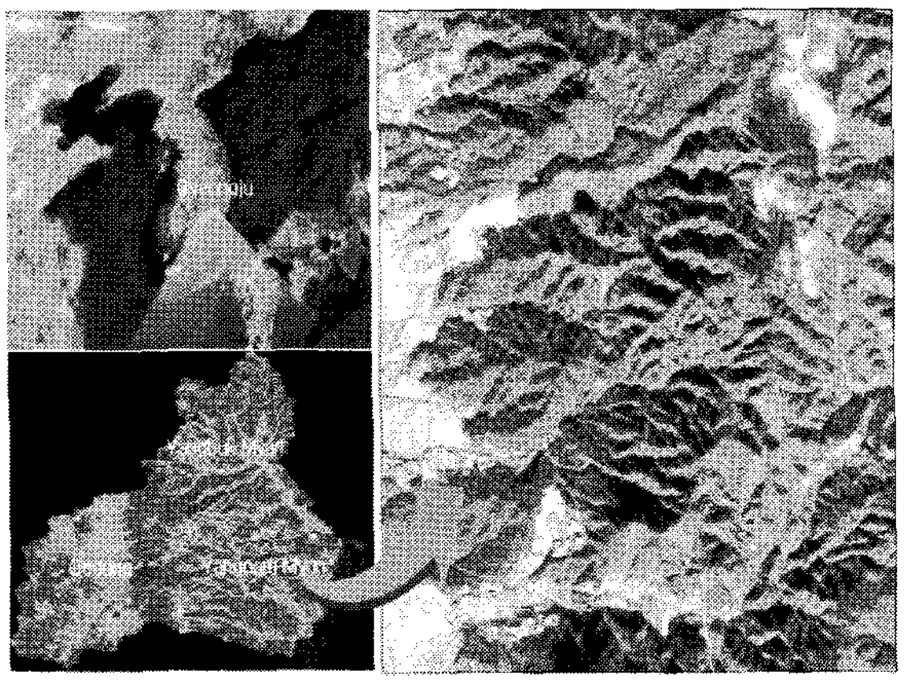

Figure 1. Study area

2. RESEARCH MATERIALS AND METHOD

As for the base data, high resolution QuickBird satellite image, filmed on April 2, 2004 was used, and the data was subjected to Orthorectification processing using RPC to ensure correction of the accurate information on the location.SML (Spatial Modeler Language), which is the language for the extraction of the spatial information was used to conduct clinical analysis using high resolution QuickBird, and the pixel value of the Float type was processed by PCA(Principal Component Analysis, PCA) , NDVI(Normalized Difference Vegetation Index) models, and aciculilignosa and broadleaf regions and forest and non-forest areas were distinguished through the unsupervised classification of the individual images

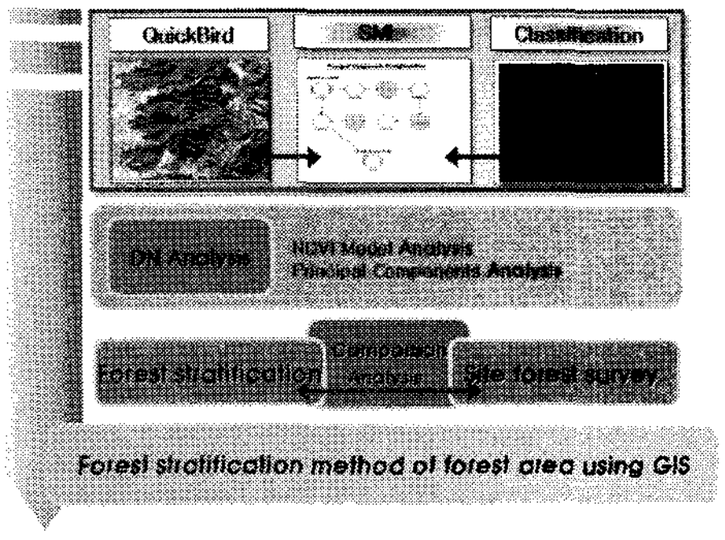

Figure 2. Flow chart

3. EXTRACTION OF THE CLINICAL FOREST INFORMATION USING SML

3.1 AbstrImage classification using PCA

Image data obtained at the bands of diverse wavelength ranges look similar at times, and they can be interpreted as same information. To eliminate or decrease reiteration of this multi spectrumdata, it is necessary to focus on the mutual relation between the variates to avoid losing information as much as possible. Moreover, (Principal Component Analysis (PCA) which indicate measurement values of many variates into summarized version was used. The image that was subjected to conversion as the main substance clarifies the objects that were not discernable on the original image data or enables preservation of the important information pertaining to the original image as is but in smaller scale. Image obtained as such is subjected to unsupervised classification to discern forest and other regions.

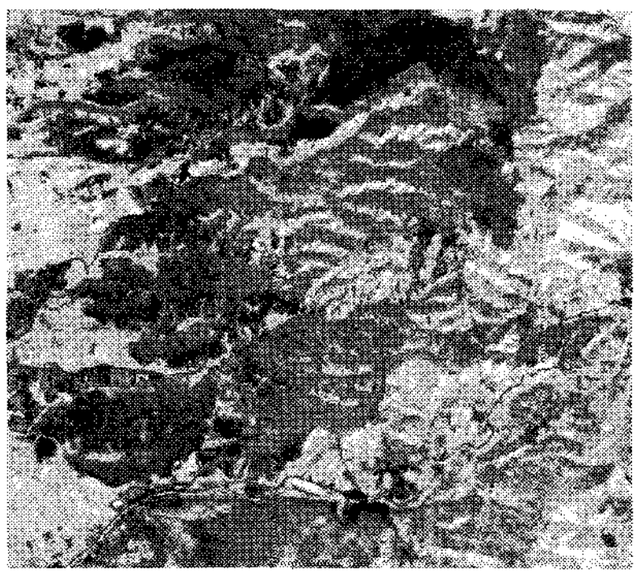

Figure 3. PCA 4Band image

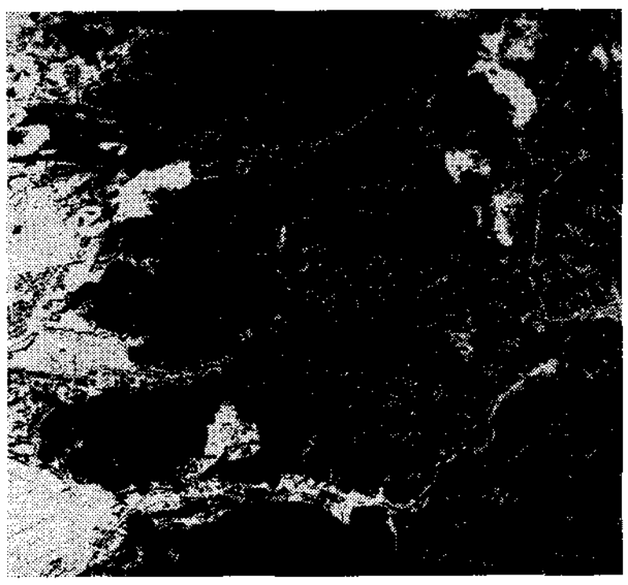

Figure 4. Unsupervised classification

3.2 Image classification using NDVI

Image Normalized Difference Vegetation Index (NDVI) was used to discern the aciculilignosa and broadleaf regions that are distributed in the forest region. NDVI emphasizes the reflective characteristics of the vegetation by obtaining the difference from the two images - visible ray and near infrared rays' wavelength ranges, and this is the vegetation index that is most frequently used that entails normalizing after dividing by the sum of the two images. Reflection rate by each wavelength range caused by vegetation changes according to the incidence angle of the sun´s ray and the satellite's photographing angle. And because the value surveyed differs depending on the status of the atmosphere, it is possible to reduce their effect somewhat with normalization.

$$NDVI = \frac{NIR - red}{NIR + red}$$

NIR = Near Infrared band
red = Red band

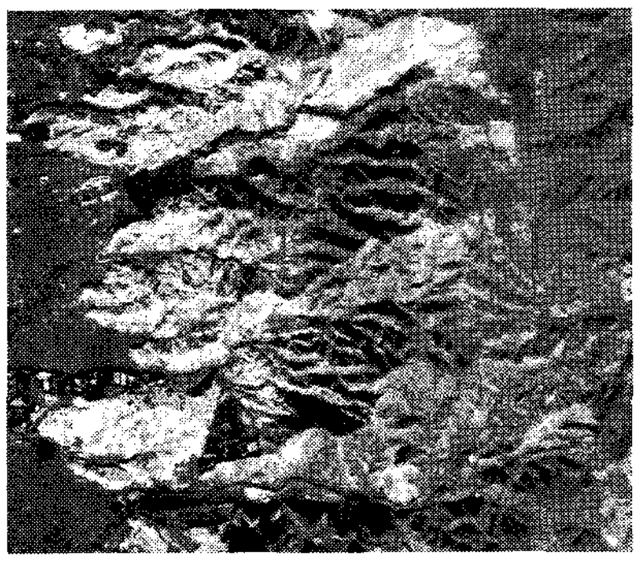

Figure 5. NDVI image

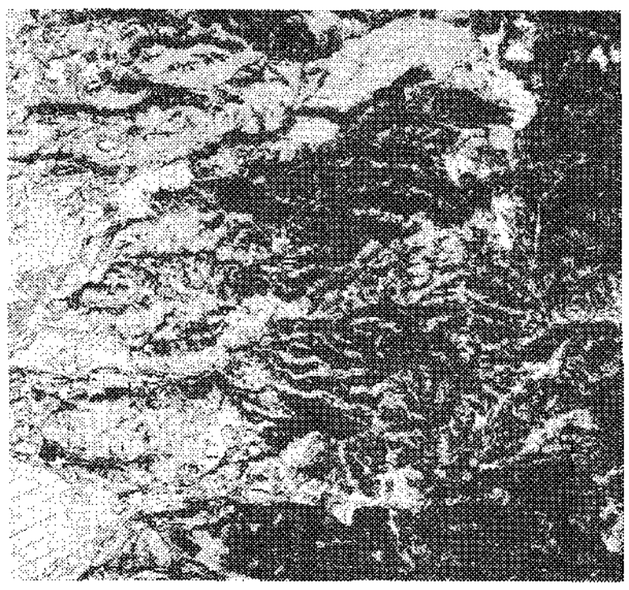

Figure 6. Unsupervised classification

3.3 Clinical stratification using unsupervised classification

Image obtained through the PCA was delegated with the value of zero when it comes to the value of opacity except for the soil. Image obtained through the NDVI was delegated with the value of zero when it comes to the value of opacity for the aciculilignosa region. NDVI and unsupervised classification were conducted for the aciculilignosa forest, extracted after exporting based on the reiteration of the two images onto the original image. And clinical stratification was conducted for the aciculilignosa forest that has similar spectrum values.

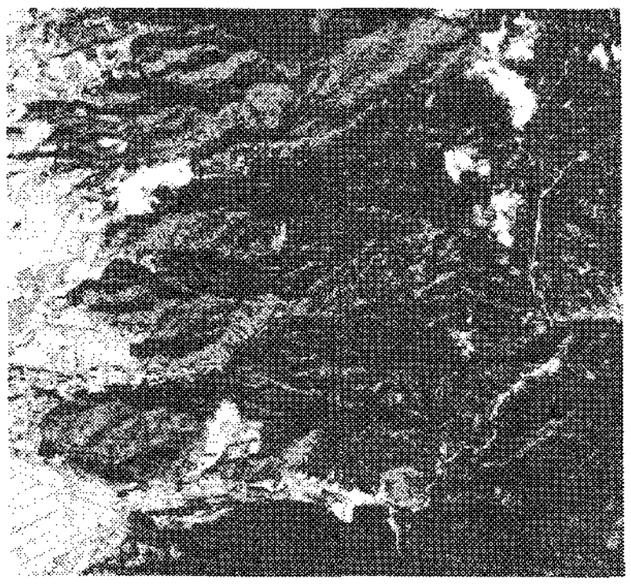

Figure 7. Image reiteration

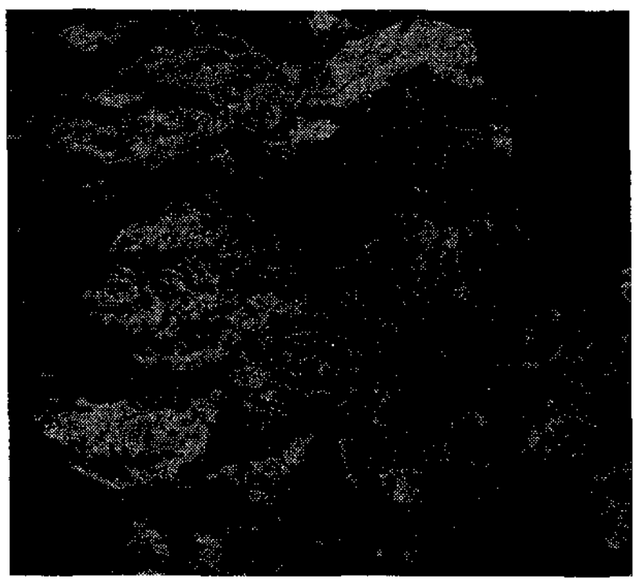

Figure 8. Unsupervised classification

4. COMPARISON AND VERIFICATION

PCA and NDVI models were used to discern aciculilignosa and broadleaf regions, and to stratify clinical data for the aciculilignosa region.

Sample place was selected for the target region based on the stratified image, followed by the execution of the field research to verify accuracy level.

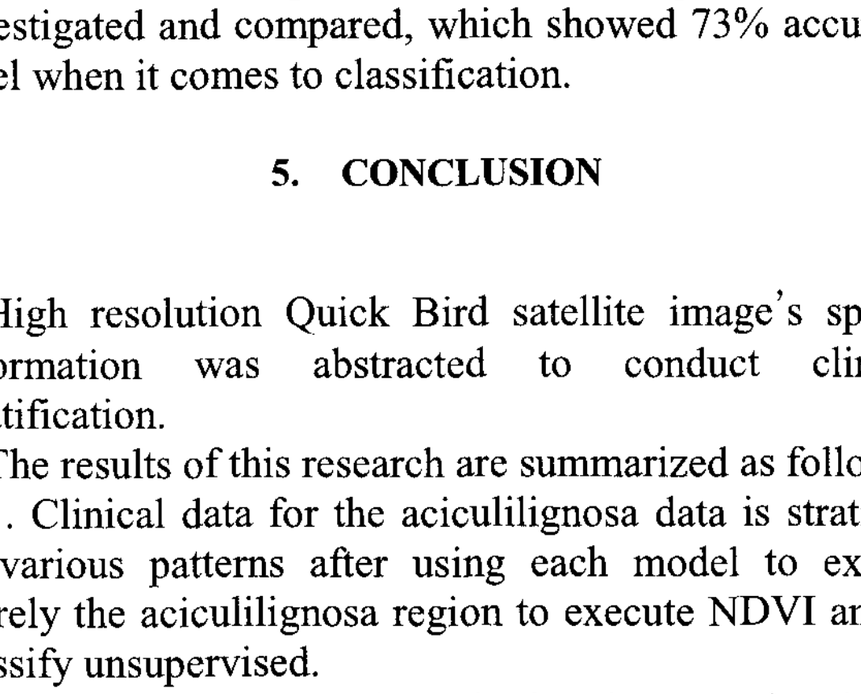

Figure 9. Classsification accuracy

Tratified clinical part and selected sample place were investigated and compared, which showed 73% accuracy level when it comes to classification.

5. CONCLUSION

High resolution Quick Bird satellite image's spatial information was abstracted to conduct clinical stratification.

The results of this research are summarized as follows.

1. Clinical data for the aciculilignosa data is stratified in various patterns after using each model to extract merely the aciculilignosa region to execute NDVI and to classify unsupervised.

2. Aciculilignosa and broadleaf regions can be clearly discerned, but precise research is not carried out due to the difficulty in approaching the site. Thus, verification on the clinical aciculilignosa stratification is difficult.

Effective use of the SML language, which was verified in this research can help embody stratification of the clinical data at the forest region in an increasingly prompt and scientific manner.

Going forth, precise field study should be conducted as well as satellite image and TCT(Tasseled Cap Transformation) analyses that offer diverse band characteristics. Moreover, other analytical methods should be used to conduct increasingly precise stratification of the clinical data.

Reference

1. A Study on the Developing of Forest Resources Database, Ministry of Agriculture and Forestry research and development the final report, 1998.12, p.345..

2. Floyd F. Sabins, 1996, Remote Sensing Principles and Interpretation, Third edition.

3. John R. Jensen, 1996, Introductory digital image processing, Prentice Hall. Remote Sensing in Mangrove Research-Relationship Between
Vegetation Indices and Dendrometric Parameters: A Case for Coringa, East Coast of India ,22nd Asian Conference on Remote Sensing, pp.567-572.

4. Kiyoshi Honda, 2003, Applicantion of Remote Sensing on Forest, FGIS 2003 Workshop, pp141-234.

5. Liang-Chien Chen, Chiu-Yu 도 Lo, 2002, The Generation of True Orthophotos from IKONOS Geo Images, Acrs 2002 Abstract Book. pp.261.

6. Myung-Hee Jo, (2006) The Development of Forest Information Management System using Satellite images based Real Mapping Technology, 2006 FGIS Workshop, pp.357-373.

7. Myung-Hee Jo, Wan-Young Song, (2003) Study on Preparing Forest Disaster Map using GIS and RS, Proceedings of International Symposium on Remote Sensing 2005, pp.687-690

8. Myung-Hee Jo, (2001) The Development of a Forest Resource Management System using Spatial Information Technology, pp117-130.

9. Seung-Ho Lee, (2003) detected the damage tree of pine bursaphelenchus xylophilus using digital aerial photo and high-resolution satellite image, pp.329-337.