

Study of Environment in Waterfront Area by Applying Remote Sensing: A Case Study of Incheon International Airport

Ho Jung, Choi

Graduate School of Science and Technology Nagasaki University
1-14 Bunkyo-Machi, Nagasaki 852-8520, Japan
hojung1221@hotmail.com

Sarwar Uddin Ahmed

Faculty of Engineering, Nagasaki University
1-14 Bunkyo-Machi, Nagasaki 852-8520, Japan
ahmed@civil.nagasaki-u.ac.jp

Keinosuke Gotoh

Graduate School of Science and Technology Nagasaki University
1-14 Bunkyo-Machi, Nagasaki 852-8520, Japan
gotoh@civil.nagasaki-u.ac.jp

Abstract: This study aims at examining the environment of waterfronts by applying satellite remote sensing technique. In doing so we have selected Incheon International Airport, Korea as a case. As a method of the study, Normalized Difference Vegetation Index (NDVI) and land cover changes are estimated in and around Incheon International Airport. As a result of the study, we have found vegetation's change in the Airport and variation of neighborhood city by building of waterfront.

Keywords: Satellite Remote Sensing, Incheon International Airport, Waterfront, NDVI.

1. Introduction

In Korea shortage of land area and influx of population in the urban area increased construction and development of waterfronts. This is largely changing the environment in those areas.

One of the big waterfront development projects in Korea is the newly opened Incheon International Airport.

On 16 June 1992 the Government of Korea initiated the project to build a new airport in the sea between the Young-Jong Island and Yong-You Island of Incheon City as shown in Fig. 1.

The airport was named as Incheon International Airport and expected to meet the increasing domestic air passage demand and also to serve as a transit center for Northeast Asia. This new airport was built by sea land reclamation and opened for operation in 2001 [1].

Since the initiation of the airport project, surrounding environment are changing abruptly as different development activities are going on around the airport [2]. Now whether these changes are positive or negative is a big question. Accordingly this study aims to investigate the changes in vegetation activities and land cover changes in and around Incheon International Airport to see the impact of waterfront development activities on the surrounding environment by using satellite remote sensing technique.

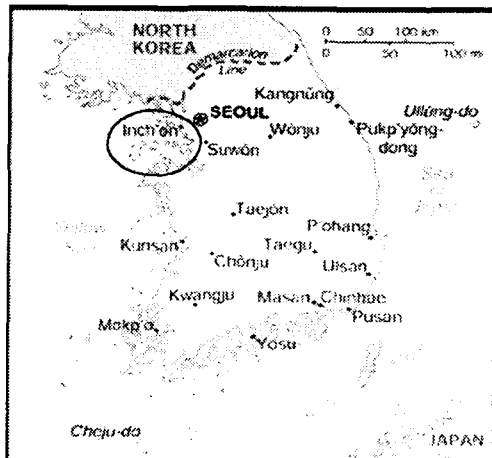


Fig.1 Location of Incheon Int. Airport.

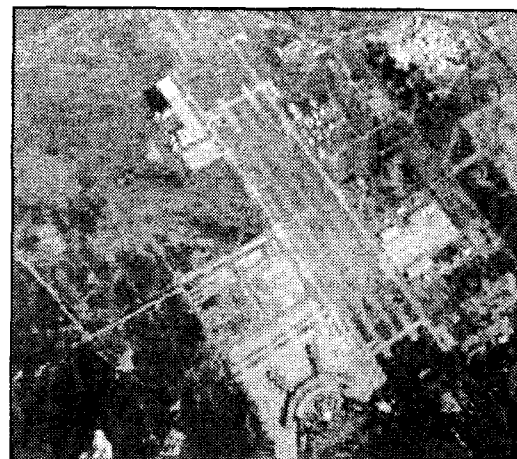


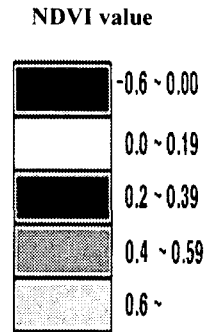
Fig.2 Aerial photo of Incheon Int. Airport. [3]



Fig. 3 NDVI image of 1 November 1989.



Fig. 4 NDVI image of 30 October 2000.



2. Data and Methodology

We have used images from LANDSAT 5 for the analysis (see Table 1). Images of 1989 and 2000 were used for calculating the Normalized Difference Vegetation Index (NDVI) and land cover changes to see the changes in the environment surrounding the Incheon Airport before the start and after the completion of the project. The NDVI is calculated by using the following formula:

$$NDVI = \frac{BAND4 - BAND3}{BAND4 + BAND3} \quad (1)$$

BAND3 Red wavelength of reflectance
 BAND4 Near-infrared wavelength of reflectance

3. Findings

1) The NDVI Result

The results of the NDVI analysis is summarized through Figs. 3~6. If we calculate the change in the area of vegetation then we can see that from 1989 to 2000

vegetation increased by about 33.65 % in the surrounding area of the Incheon International Airport by comparing Fig. 4 with Fig.3. In terms of area the change is about 175.2km² to 234.2km².

Figs.5 and 6 show only the Incheon Airport areas NDVI result. In this area the vegetation has increased by about 25.02% in between 1989 and 2000. Thus from the NDVI analysis it can be concluded that the area of vegetation has increased in the area of the airport since the reclamation work begun.

2) The Land Cover Change Result

Land cover mapping results by unsupervised classification are summarized through Fig.7, Fig. 8 and Table 2. We have classified the whole area into 5 categories: water area, land area, forest/rangeland and building/urban area. From the results of the classification we can see that since the initiation of the airport reclamation project water area decreased by 6.52 percent, land area increased by 66.7 percent, forest and rangeland increased by 15.9 percent and building/urban area increased by 48.6 percent.

4. Summary and Conclusion

We have conducted an environmental monitoring analysis to see the environmental changes of waterfront area by selecting Incheon Airport, Korea as a case and used satellite remote sensing technique. The findings of this study can summarized and concluded as follows:

Table 1 Images used.

Date	Status of the project
1 November 1989	Before the initiation of Airport Project
30 October 2000	Near completion of the Airport

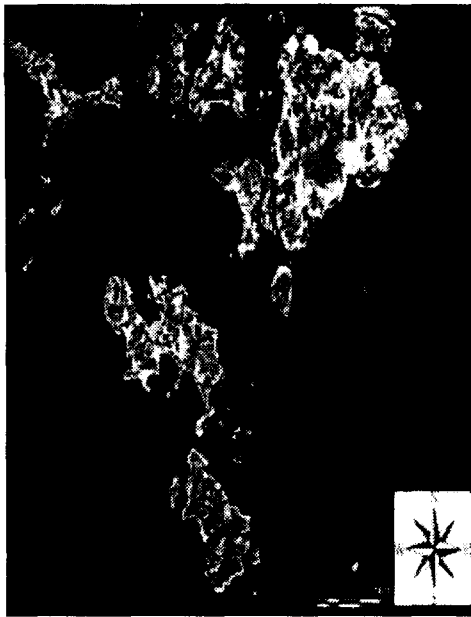


Fig. 5 NDVI image of 1 November 1989 of the Airport Area.



Fig. 6 NDVI image of 30 October 2000 of the Airport Area.

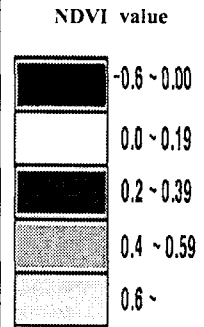
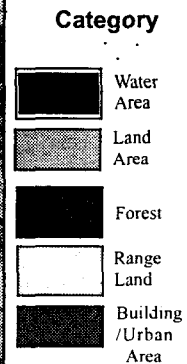


Fig. 7 Landcover image of 1 November 1989 by Unsupervised Classification.



Fig. 8 Landcover image of 30 October 2000 by Unsupervised Classification.



1. From the NDVI analysis we have found that the vegetation activity in and around Incheon Airport has increased in the period between 1989 and 2000. Thus it can be said that, development of waterfronts does not necessarily mean decrease in plantation or greenery.
2. Land cover mapping also confirmed that forest and rangeland increased in the area by 15.9 percent, though buildings has also been increased by 66.7 percent. Hence increase in buildings in the airport area is partially compensated by the rise in forest and rangeland.

From the above discussion we can conclude that, development in waterfront areas does not necessarily mean destruction of natural environment. Planned increase in plantation and their continuous balancing can even increase greenery in the area more than before[4]. In this respect satellite remote sensing can be one of the convenient monitoring instruments as it can monitor a vast area of such development projects in an effective and economic way.

Table 2 Percentage change in land cover.

Category	1989 (km ²)	2000(km ²)	Change (%)
Water Area	501,749	471,006	- 6.52
Land Area	195,171	325,530	+ 66.7
Forest/Range Land	381,942	442,835	+ 15.9
Building / Urban Area	100,017	148,639	+ 48.6

References

- [1] Lee, Sang-Ho. Development Plan and Construction Status of the Incheon International Airport, Korea Steel Structure Society.
- [2] Lee, Sang-Ho. 1996.4 Base Plan of the Incheon International Airport
- [3] URL:<http://www.airport.or.kr> Incheon International Airport Homepage
- [4] URL:<http://www.ifez.go.kr> Incheon Wide Area city Free Economy Territory