Identifying Eco-corridor Location Reconnecting Fragmented Forests Using Remote Sensing Techniques[1)]

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I. Introduction

The land use in the metropolitan area has been changed rapidly due to the urban expansion in South Korea during the last half-century. As urban areas expand, they cause fragmentation of natural environments(Fleury and Brown, 1997). In many land transformation procedures, fragmentation causes shrinkage and the decrease in size of forests. These fragmentation and shrinkage effect all ecological patterns and processes, from genes to ecosystem functions(Forman, 1995). Ultimately it deteriorates the biodiversity of the region. So, a regional greenway network is proposed to reconnect fragmented landscape elements in an ecological way(김귀곤과 최준영, 1998, Bueno, 1995, Ministry of Environment in Korea, 1995). In order to complete this reconnection, it is necessary to identify the size and location of fragmentation and shrinkage, then to pinpoint the location of ecobridge(Labaree, 1992).

For identifying the fragmentation and shrinkage of forest, multitemporal remote sensing(RS) data combined with other geographical information system (GIS) data are used to delineate the areal changes, showing the impact and trend of the changes in green space and vegetation cover efficiently.

Therefore, the purpose of this study is as follows,

First, to delineate forest fragmentation and shrinkage in the metropolitan area by using multitemporal high resolution remote sensing data. Second, to identify the eco-corridor location reconnecting fragmented forests. Ultimately the purpose of this study is to contribute to the restoration of urban green spaces.

II. Materials and Method

1. Study area

The study area was Daejon metropolitan area located at the central part in South Korea. From 1970's the economy and population of the metropolitan area have grown rapidly mainly due to the relocation of government-supporting research institutes and some government agencies.

2. Data used in this study

For remote sensing(RS) data, Korea Multi-Purpose Satellite-1(KOMPSAT-1) Electro Optical Camera (EOC) images with 6.6m resolution and 1:20,000 or 1:10,000 scale air photo images were used to enhance the accuracy of image interpretation for identifying the forest fragmentation. For thematic data, 1:5,000 scale digital topographic maps were used to select

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ground control points(GCP's). 1:25,000 scale city planning map, and 1:25,000 scale land use maps were also used. Wildlife habitat map was produced based on the field survey results. From 1999 December to 2002 January, the footprint and excrement of vertebrates concerned were checked in the field. They are wild-boars, Chinese water-deers, and raccoons. Of these three species, wild-boar is a key species. It habitat contains Chinese water-deer whose habitats also contains raccoon habitats.

3. Method

Multitemporal RS data sets were used to detect and delineate forest distribution, fragmentation and shrinkage between date of imaging precisely. First, the forest distribution map in 2000 was extracted from visual interpretation of KOMPSAT-1 EOC image by referring to the land use maps published by Korea Institute of Construction Technology. However, several forests were omitted in the land use map because of different classification schemes. So, these omitted forests were corrected by visual interpretation of KOMPSAT-1 EOC images. Second, the forest distribution map in 1954 was made in the same way using air photos taken in 1954(1:10,000 or 1:20,000). Forest distribution maps of each year were overlaid to calculate changed area(Ahn, 2001).

Using the wildlife habitat map and the forest distribution comparison map between 1954 and 2000, the eco-corridor location was identified. If habitat type is constant, area is the most important factor in patches concerned(Dramstad, 1996). It is based on major ecological values of large patches. In this study site, a wild boar is the key species in biological diversity. The forest distribution map and the wildlife habitat map were used to pinpoint the location of eco-corridor for increasing the biodiversity for these species.

III. Results and Discussion

There were several large forests in the Daejon(except downtown) area in early 1950s. In 1954, there were two forests larger than 100km^2 in the study area as we can see in Table 1. There were four forests whose area was 50~100km^2 and six forests whose area is 10~50km^2. There were 17 forests whose area is 1~10km^2, and 114 forests whose area is smaller than 1km^2. However, there were no forests larger than 100km^2 in 2000. There were three forests whose area is 50~100km^2, and 11 forests whose area is 10~50km^2. There were 62 forests whose area is 1~10km^2, and 637 forests whose area is smaller than 1km^2. It means the large forests have been fragmented. As a result, the average size of the forest patch decreased and the number of patches increased after the fragmentation.

Road construction was the main reason for forest fragmentation among human activities. The increase in road construction and urbanization between 1950s and 2000s explained most of the changes in forest number and size.

Figure 1 shows the fragmentation of the first largest forest(144.6km^2) in 1954. It was divided into 80 forests in 2000. The serious fragmentation occurred at Sahpjae and Mhilmokjae due to the No. 1 and No. 3 general national road(GNR) construction as we can see in Figure 1. Forests smaller than 1km^2 covered 11.0km^2(72 forests), forests from 1 to 10km^2 covered 26.7km^2(6 forests), forests from 10 to 50km^2 covered

Table 1. Area and number of forests in 1954 and 2000

	1954		2000	
	Number	Area (km^2)	Number	Area (km^2)
> 100	2	254.6	0	0.0
50 ~100	4	248.7	3	218.1
10 ~50	6	154.6	11	205.9
1 ~10	17	67.9	62	174.3
< 1	114	16.0	637	95.2
Sum	143	741.8	713	693.6*

* : rounding error

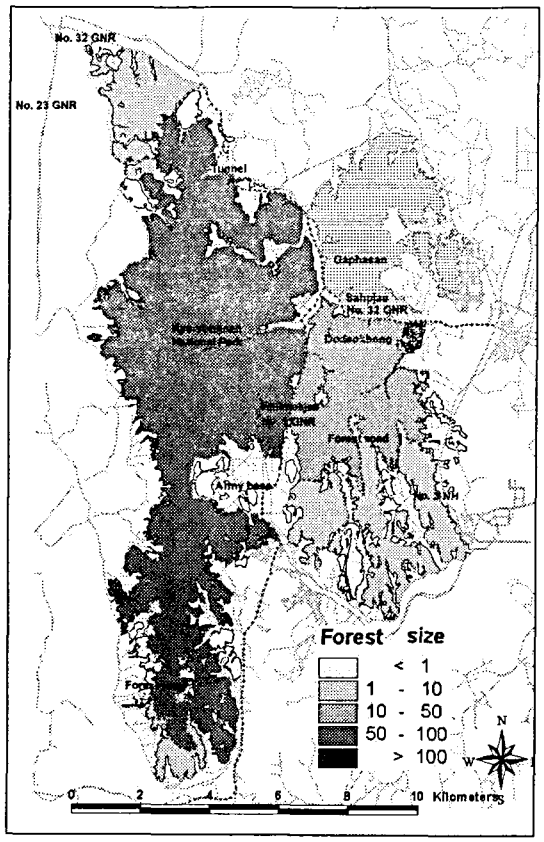

Fig. 1. Fragmentation of Gyeryongsan forest in 2000(1st)

20.6km^2(one forest), and forests from 50 to 100km^2 covered 82.3km^2(one forest).

The 1954 data in this study provides the landscape in Daejon Metropolitan Area before urbanization and road construction, which is very useful for figuring out the original landscape for the restoration.

V. Conclusion

The following conclusions were derived after doing this study.

First, the forests in Daejon Metropolitan Area decreased from 741.8km^2 in 1954 to 693.6km^2 in 2000, while the number of forest increased from 143 in 1954 to 713 in 2000.

Second, the largest forest area was 144.6km^2 in 1954. However, there were no such large forests in 2000. The largest forest area was 82.3km^2 in 2000. The number of forest larger than 50km^2 decreased from 6 in 1954 to 3 in 2000. The most serious fragmentation occurred due to the road construction.

Third, eco-corridors should be constructed at Mhi-lmokjae and Sahpjae in Gyeryong Mountain National Park. It will reconnect the 122.5km^2 of three fragmented forests(81.3km^2, 20.6km^2 19.6km^2) into a single larger forest. The second eco-corridor should be reconnected at Haengjeong. It will reconnect the two fragmented forests(58.9km^2, 46.2km^2) into 105.1km^2 of a single larger forest. Then, the third eco-corridor should be reconnected at Baemi. It will reconnect the two fragmented forests(76.8km^2, 16.2km^2) into 93.1km^2 of a single larger forest.

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