

Biotope Mapping in Korea. History of biotope mapping and consideration of a new method

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1 ABSTRACT

Korea has experienced rapid expansion of the cities. The fact that urban environment has been getting worse, however, forces us to consider urban ecosystem in landscape planning. The government has made such a series of maps as a map of land suitability evaluation, a map of actual vegetation, a map of land environment and so on. And the local government intends to use those maps for various development works. But their mapping scale (1:25,000) and the quality of images were not available because they were made just at the beginning of 1990s. So, with those maps, it's nearly impossible to make sustainable city plan and solve the conflicts between development and conservation. Biotope map, however, can be a candidate to solve those problems in Korea. Seoul accomplished biotope mapping for the whole city area in 2000. Now, since then, about 10 cities established it, and many other cities are also planning to carry it out. Since 2000, LiDAR data has begun to be produced nationwide in Korea. Siheung city, in 2006, started a biotope mapping using LiDAR for the first time in Korea. They surveyed the land use and current vegetation of Siheng with the high resolution color areal photograph (in 0.25m resolution) before doing a field survey. The biotope map of Siheung is still under construction using LiDAR data. They are trying not only to analyse the structure of the forest as a biotope but also to characterize the land use type. Recently, Korea government has started a new R&D named "U-Eco City" to make a sustainable city using Ubiquitous-IT technology. It also includes a study to make and update biotope map using high resolution images and LiDAR data, so will help make landscape plan for sustainable cities in Korea.

2 BEGINNING OF BIOTOPE MAP IN KOREA

2.1 Limitation in national maps for spatial evaluation of ecosystem and environment.

Korea has a small area, but it has various natural environments such as mountain, river, islands, and foreshore. The mountain, agricultural land and foreshore hold 65%, 21% and 3% of the country respectively, so the area that can make city lacks absolutely. The consistently increasing demands for dwelling, business, and factory area give rise to damages and decrease in natural area. The indiscreet development brought a breaking of the creature habitation place and the extinction crisis of the wild animals. It is expected that the demand for the development lasts and the requirement is about 4% of the country area. However, the government made various environmental maps to prevent the imprudent development, and to break off the tangle between development and the maintenance of the excellent natural environments. The most typical maps are as follows. :

Item	Scale	Mapping year	Purpose
Land suitability evaluation	-	2003-2005	Land evaluation for soil, location, practical use in management and planning in urban area Other urban area for management planning
Actual vegetation map	1km □ 1km	1988-1990	Survey of plant community Status of vegetation in land
Natural ecosystem map	1:25,000	Drawing up 1997-2002 Renewal in 03.2005	Management of nature on site. Construction of spatial information on distribution pattern of fauna and flora
Land environment map	1:25,000	Drawing up	Zoning for land conservation and development

		2002-2005 Renewal every year	Nature conservation during the construction
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Tab. 1. Status of national maps for spatial evaluation of ecosystem and environment (S.K.Hong, 2005)

These maps are used for environmental impact assessment, land environmental assessment, tourist development plan. But they have a limit to reflect the present nature situation of the area in detail: you can see on the left part of the figure 1. It is effective to develop blue and green network nationwide, but, due to the lack of basic data on the ecological characteristics and conservation measures, urban planning process cannot consider all aspects of ecological conservation.

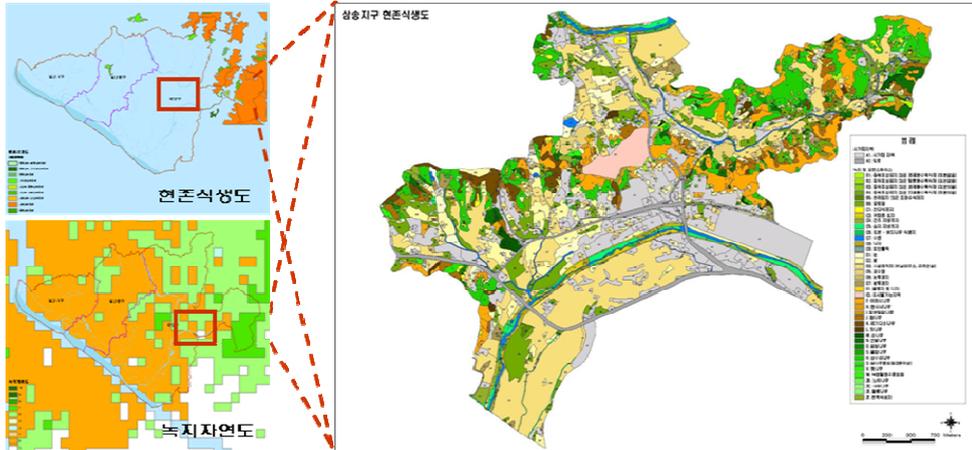


Fig 1. National map (left) and Biotope map of Samsong restrict (part of Goyang city) (right)

2.2 Making biotope map leading by local government

Local government wasted administration power to solve the social tangle between development and conservation of the excellent environments for a long time. Furthermore, the perception that the disappearing local valuable resources must be protected is growing as some conditions around people is changed, which means workday decrease, income increase, and cognition about the environment is altered. And some materials to judge a dispute between development and conservation of developing area are required. Therefore Seoul city established “Urban Eco-team, Urban Planning division”. Biotope mapping started from Seoul in 2000 and performed by the local government mainly. Now about 10 cities established since that and many cities prepare to make biotope map (C.H.OH, 2008).

City	Established at	Size of City (□)	Established area(□)	Scale	Status of utilization and management
Seoul	2000	605	605	1:3,000	Renewal in 5 years
Sungnam	2001	142	142	1:1,000 1:5,000	Served by intranet in Sungnam city hall
Daegu	2001	886	76	1:5,000	
Chungju	2005	153	153	1:5,000	
Kwangyang	2006	448	177	1:1,000 1:5,000	
Busan	2007	765	216	1:1,000 1:5,000	
Koyang	2008	267	267	1:1,000 1:3,000	Served by intranet in Goyang city hall
Chunan	2008	635	635	1:5,000	

				1:25,000	
Siheung	2009	130	130	1:1,000 1:5,000	In progress
In preparation	Soonchun, Changwon, Wonju, Dangin, Seosan				

Tab. 2. Biotope mapping in Korea: current status

Some local government made biotope map for whole area of the city, while others made it for a part. The guidelines for the establishment of ecological status map in Seoul (in 11.2002) were provided on the basis of the map of Seoul (in 2000). They contained the purpose of establishment, period of survey and revision, methodology for urban ecological status, management of the examiners, biotope patterning method, and GIS establishment of the investigated data. These became the official guidelines of the Ministry of Environment (sep.2005). And they renewed in Jan. 2007 and Mar 2008(C.H.OH, 2008).

3 THE CHANGE OF PRODUCING BIOTOPE MAP

Korean Biotope maps are made by benchmarking Berlin system, however new methods are developing using IT-technology to reduce time, labor and expense. The change of biotope mapping method will be discussed as three steps; the beginning, the prosperity and the turning point.

3.1 The beginning

Seoul City made the biotope map for the first time in 2000. At that time, Biotope map of Seoul benchmarked Berlin's. They surveyed the flora and fauna with the digital map in the scale of 1:3,000 as a basic map, and edited the data using the IKONOS image to modify the border of Biotope cell and improve the accuracy.

Seoul City, in 2005, renewed the biotope map using the IKONOS image to piece out newly developed and altered areas. Especially, the new and changed areas were surveyed by the method of the 2nd step which will be discussed in the paragraph of 3.2.



Survey the site → edit the border of Biotope cell

Fig. 2. The method of Seoul Biotope map

They surveyed typical Biotopes: structure of botanical ecology, status of wildlife habitats and status for the human environment. And six kinds of biotope maps are composed by these Biotopes: Map of land use type, Map of impermeable pavement, Map of actual vegetation type, Map of biotope type, Map of biotope evaluation and Map of each biotope evaluation. The Ministry of Environment adopted these six maps as the typical guidelines for Biotope mapping.

3.2 The prosperity

Since the 1st step working, it was recognized that the exact bordering of Biotope cell is important. As a result, the method with using the images was activated seriously. In General, the Biotope maps are made by

Comprehensive biotope mapping method. And It is divided into two parts, i.e. Sunghnam-Kwangyang method and Goyang-Siheung method, according to the degrees of using images.

3.2.1 Sunghnam- Kwangyang Method

Sunghnam-Kwangyang method brings various images into making Biotope maps. The digital maps scaled 1:1,000 and 1:5,000 are used in survey of some parts of the city. And IKONOS, Landsat and Quickbird are used in making Biotope maps. The method for making the maps is similar with that of Berlin, but the method for evaluating Biotopes based on the statistics and indications are controversial. Because the data just started to be constructed in Korea are so small to compile statistics. However, the method is useful to people in the point that it gives combined information of whole city.



Fig. 3. Sunghnam Biotope map / Kwangyang Biotope map

3.2.2 Goyang-Siheung Method

Goyang-Siheung method uses not only images but also field survey data, so the conditions on the wildlife habitats are constructed in detail. Generally, Goyang method and Sihengng’s are not different. However, Goyang method uses IKONOS images which are easily degraded by cloud and shadow while Sihengng’s uses high resolution color areal photograph (in 0.25m*0.25m resolution). The properties of Goyang method are as follows. Biotope border is divided using the IKONOS images and digital maps, and then Biotope map is completed by adding field survey data. It has advantages in the point that basic data on the wildlife habitats can be constructed in Korea which has lacks of environmental information. However, it costs lots of time, labor and expense. And it’s not easy for general people to understand the maps. Furthermore the tangle between development and conservation is so severe that the maps are not open to general people and only served by intranet in Goyang city hall.

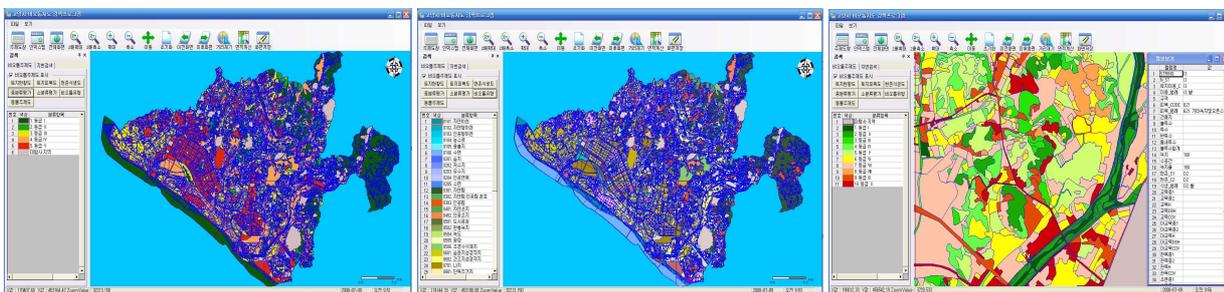


Fig.4. Map of biotope evaluation, Map of biotope type and detailed materials of Goyang city

3.3 **The turning point**

Both methods in Step 2, i.e. Sunghnam-Kwangyang and Goyang-Siheung methods, have some week points as well as some merits. To minimize the field survey and make the exact bordering of Biotpe cell, as a national R&D, several subjects of U-Eco City are considering how to use LiDAR data, high resolution color areal photograph (in 0.25m resolution), and NIR in Biotope method. In addition, a terminal to communicate the

field survey data to the main server in real time is developing using the IT technology. These tries will not only reduce time, labor and expense to make Biotope map but also contribute to construction of national environment data base.

4 PROBLEMS IN MAKING BIOTOPE MAP

Some problems are rising to the surface as the Biotope map is used with activity.: Difficulties in classification, evaluation and management of Biotope map. The Biotope map is essential to Korea in which development predominates conservation. The Korean government are trying to adopt unified guidelines for Biotope map made individually in local government with consistency. For example, the parts indicated by red circles are the same area in the left and right figure in Fig. 5. However, the area in the left, made in Seoul city, is assigned to the absolute conservation area while the area in the right, made in Sungnam city, is the conservation area but is not restricted.

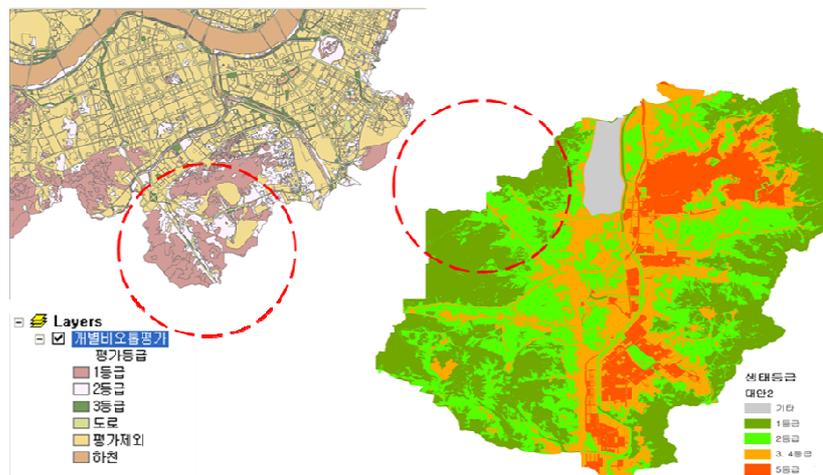


Fig. 5: Disagreement of Biotope evaluation

5 SUMMARY

To summarize, why and how the Korean Biotope map is made are reviewed from the beginning. Despite some problems and lack of enough environmental data base, it is hopeful that the national government are directly trying to construct and study the Biotope maps. As a result, the local governments which have not been interested yet in making the Biotope map are started to take a growing interest and make endeavor in making the Biotope map.

6 REFERENCES

- Seoul Development Institute (2000a), Biotope mapping and guideline for establishment of ecopolice in Seoul (I). Seoul Development Institute, Seoul
- Seoul Development Institute (2000b), Biotope mapping and guideline for establishment of ecopolice in Seoul (II). Seoul Development Institute, Seoul
- Seoul City (2001), Biotope mapping guideline for Seoul, Seoul Development Institute, Seoul
- Seongnam City (2001), City biotope map and GIS data base. Seongnam City, Seongnam.
- S.K.Hong et al. (2005), Applications of biotope mapping for spatial environment planning and policy: case studies in urban ecosystem in Korea. *Landscape Ecol. Eng* (2005) 1: 101-112
- Goyang City (2006), Biotope mapping and Landscape guideline for Goyang city (I). Korea Institute of Construction Technology, Goyang City
- Siheung City (2007), Biotope mapping of Siheung City. Institute of Construction Technology, Siheung City
- Goyang City (2008), Biotope mapping and Landscape guideline for Goyang city (I). Korea Institute of Construction Technology, Goyang City
- Chung-Hyun Oh (2008), Korea-German international workshop, Dongkuk University.

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