EXTRACTION OF NON-POINT POLLUTION USING SATELLITE IMAGERY DATA

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Abstract: Land cover map is a typical GIS database which shows the Earth's physical surface differentiated by standardized homogeneous land cover types. Satellite images acquired by Landsat TM were primarily used to produce a land cover map of 7 land cover classes; however, it now becomes to produce a more accurate land cover classification dataset of 23 classes thanks to higher resolution satellite images, such as SPOT-5 and IKONOS. The use of the newly produced high resolution land cover map of 23 classes for such activities to estimate non-point sources of pollution like water pollution modelling and atmospheric dispersion modelling is expected to result a higher level of accuracy and validity to various environmental monitoring results.

Keywords: Land Cover Map, Non-Point Source of Pollution

1. Introduction

In this study, described about Ministry of Environment's Land cover classification system that widely used a Remote Sensing technology and a Geographic Information System technology all over the world.

Also, achieved modelling that selects the pollution load estimation model present, practical use possible and applies land cover map to Kyungan River basin of attraction. And then, examined the pollution load estimation possibility that utilize land cover map through comparative analysis with existing study finding.

2. Land Cover Map

Land Cover Map refers to typical GIS-DB that expresses sort form as terrain feature of land surface according to fixed ecological standard and has homogeneous special quality in form of map.

This map is used to basic data of various field such as non-point source of pollution Estimation, urban planning, atmospheric dispertion modeling and natural environmental management because reflect best present circumstance of ground surface.

1) Class of Land Cover Classification

Class of land cover classification can establish very variously according to practical use purpose. In this study, composed to 23 items so that can basically reflect ecological special quality of land surface and utilize on whole environment business as Non-Point Source of Pollution estimation, space planning and basic data of various models.

1. Name of each item was examined American USGS classification system and European Union's CORINE project, and then decided the names that consider of various land surface and small Patch size that is caused by topography and climate.
2. Considered ratio of areas and seasonal special quality that each classification item is occupying.
3. In all-out plan of country dimension roll important position do item that is useful in knowing modelling and monitoring business choose.
4. Collected various opinions within extent of environmental management business.

Table 1. Category of Land Cover Classification.

Level 1		Level 2	
Category Name	Code	Category Name	Code
Urban & Built up	100	Habitation units	110
		Industrial units	120
		Commercial units	130
		Recreational units	140
		Transport units	150
		Public units	160
Agricultural areas	200	Rice fields	210
		Crop fields	220
		House crop fields	230
		Orchard	240
		The others	250
Forests	300	Broad-leaved forest	310
		Coniferous forest	320
		Mixed forest	330
Grassland	400	Natural grassland	410
		Golf course	420
		The others	430
Wetlands	500	Inland wetlands	510
		Coastal wetlands	520
Barren	600	Mine sites	610
		The others	620
Water bodies	700	Inland Waters	710
		Marine waters	720

2) Methodology

IRS-1C/D and Landsat TM/ETM+ used as a basic data, and inflected Digital Map, stock map and Natural Environmental map etc. used as a reference data. Image data was chosen that have been filmed most recently confirming with photographing angle, image state and the photographing matter. Ground control point was used DGPS measurement data of 1m-error range that possess from the Ministry of Environment. Image data was secured homogeneity of data by rational special quality uses picture of similar same season.

Considered so that seasonal clothes special quality may be classified using satellite image of multiplex time. Fusion image of Landsat and IRS data were applied Radiometric image fusion method that emission special quality preservation of each pixel is available.

Deciphered boundary line and attribution of classification items using reference data of digital map, Stock map and land use map.

3) Result of the classification

In this study, compared with land use map to examine manufacture validity of land cover map and propriety of classification contents.

A part that difference of land cover map and land use map appears from classification item of marsh place, golf course, built-up sites and so on.

Specially, classified to forest of golf course and surrounding on land cover map in occasion of golf course but classified by golf course single attribute without classification of forest via outer block boundary of golf course in occasion of land use map. (Fig. 1, 2. references)

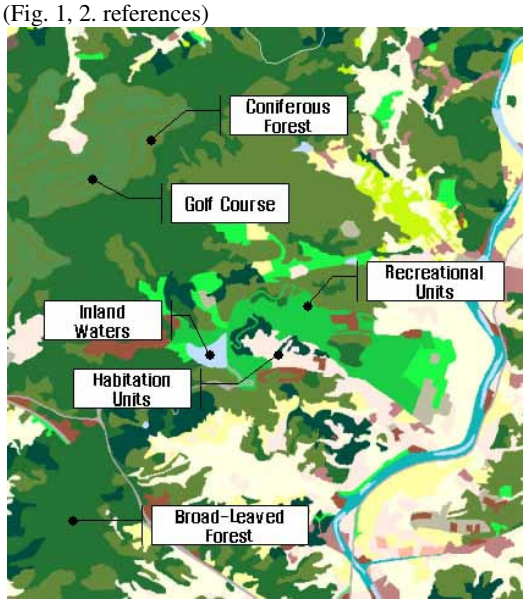

Fig. 1. Land Cover Map

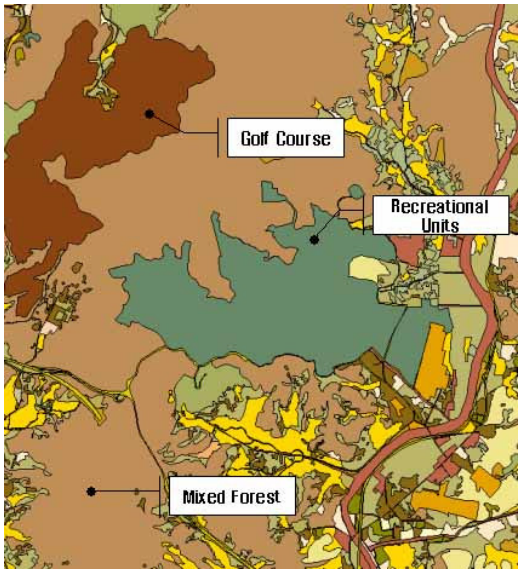

Fig. 2. Land Use Map

3. Estimation of Non-Point Pollution Load

1) Study Area and Methodology

Chosing Gyeongancheon basin of attraction that relative virtue study is achieved much for comparison with existent study finding, and calculated non-point source of pollution to use land cover map.

In this case study, used LTHIA/NPS non-point source of pollution model developing in American EPA that is being used evenly to urban areas and gang of bandits forefinger station, and present load unit for 15 material by habitation, business session, since industry, farmland, 5 usage of forest/grassland.

First, 23 land cover classification item was classified by 5 classification items that load unit exist, and rainfall data used Kyungan observatory data that is situated to Kyunggi-Do.

Table 2. Compare to Results of Non-Point pollution load estimation by Kyungancheon (unit : ton)

Water Quality Items	AnnAGNPS Model	STORM Model	Load Unit Method		Basin Flow Model by GIS Based	
			Estimate of Pollution Load In Kyungancheon Basin	Using Land Cover Map & Ministry of Environment's Load Unit	Land Cover Map (Ministry of Environment '80 - '90)	Land Cover Map (The others)
BOD	946	876	1,784	2,152	985-1,724	1,290
T-N	5,983	1,639	1,624	878	879-1092	1,168
T-P	11	1,237	138	80	164-241	265

2) Result and Investigation

The result of comparing AnnAGNPS model result and STORM model result with in this study's result are shown in Table 2.

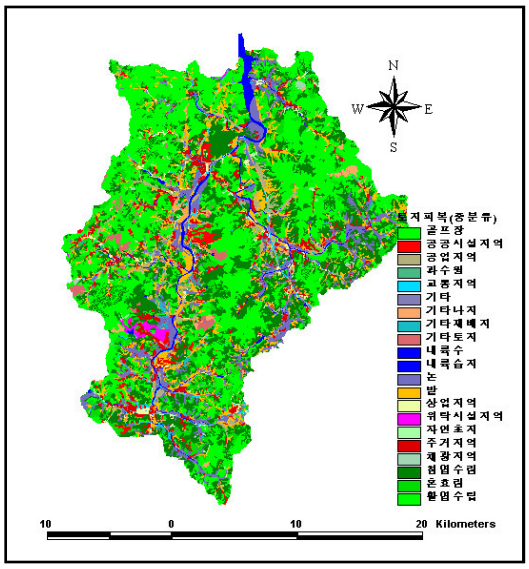

Fig. 3. Level2 Land Cover Map

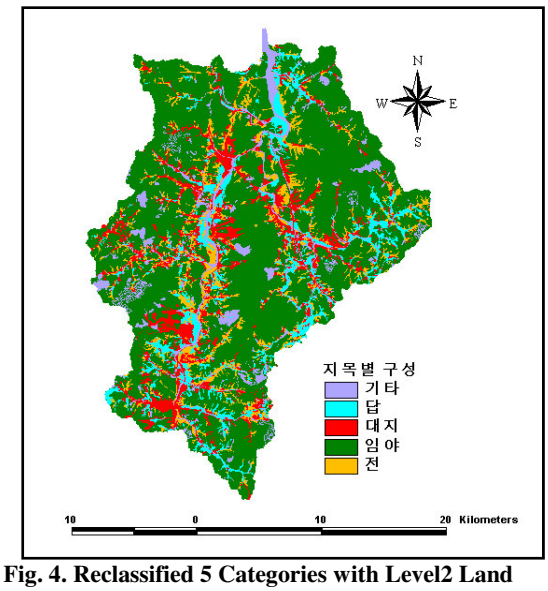

Fig. 4. Reclassified 5 Categories with Level2 Land Cover Map

If analyze land cover map and result that inflect Ministry of Environment's load unit, T-N, T-P displayed a little small but consistent result than other method. The reason that T-N, T-P was a little shown caused by applying load unit after land cover classification items revising into 5 categories(Fig. 3, 4).

GIS base basin of attraction outward flow model used soil map, rainfall data to reference data as that use Ministry of Environment land cover map in '80-'90's and any other engine's land cover map. Load unit is expected that difference can happen a little with actuality of our country because it is American data (LTHIA/NPS).

Method by GIS base basin of attraction outward flow model is considered that accuracy of land cover data is high because fairly consistent result is deduced when compared result that use Ministry of Environment land cover map and result that use the other official land cover map.

4. Conclusions

Land use and Land cover are defining as other concept in the United States of America and Europe, and then practical use of land cover map is emphasized in environment.

Also, Comparing the load unit method and the GIS base basin of attraction outward flow model using land cover map with non-point source of pollution model that verified already. As a result could know thing which of land cover map is high in case of estimating non-point pollution load, because fairly consistent result was deduced.

Exclude subjectivity in non-point pollution load estimation and to get consistent result, data requirement is minimum and method that can exclude manual processing is suitable.

In these side land cover map as a quantitative and a digitizing basic data is very useable for non-point source of pollution estimation.

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References

[1] Ministry of Environment, 1995. *Research of Non-Point Source of Pollution*, Final report.

[2] Ministry of Environment, 2000a. *Management Outline of Non-Point Source of Pollution*, p. 1-10.

[3] Ministry of Environment, 2000b. *Masterplan of Non-Point Source of Pollution Management in Paldang Lake*, Final report.

[4] Ministry of Environment, 2002. *Construction of Land Cover Map Using Satellite Imagery Data*, 3rd report.

[5] European Commission, *Corine Land Cover Technical Guide*, pp. 92-136.
[6] John, A. R. and Xiuping, J., 1998. *Remote Sensing Digital Image Analysis*, 3rd ed., Springer, pp. 259-290.
[7] Te-Ming, T., Shun-Chi S., Hsuen-Chyun, S. and Ping, S. H., 2001. *A new look at IHS-like image fusion methods*, Information Fusion, Vol. 2, pp. 177-186.