GIS Application for Classifying Forest Function

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Abstract

This study presents a GIS application for classifying forest function. According to site-specific conditions such as topography, geography and institution, forests could be functionally classified to one of timber production, water conservation, forest disaster protection, forest recreation, living environment conservation and natural environment conservation. The forest function map was produced for having a systematically and rationally system of forest management under each purpose of utilize and graded from 0 to 1000 by using a factor of estimate and point of weight which was produced by analysis a space of each function. Using the GIS-based approach, a forest function map for a urban forest in Dae-gu was prepared.

Key Words : GIS, Classifying Forest Function, Evaluation Factor

1. Introduction

Tree seedlings are produced under the long-term reforestation plan in Korea. The function of timber production had been considering a mainly function in South Korea. But it is important to consider equally each of function -timber production, water conservation, forest disaster protection, forest recreation, living environment conservation and natural environment conservation- in part of forest management. Continuously, the discussion of the sustainable forest management which is possible is gradually materialized with the international.

[table 1]. Classifying Forest Function

classifying function	**definition**
timber production	supply timber
water conservation	supply using water
forest disaster protection	prevent desolation and protect land of forest
forest recreation	serve comfortable and high quality environment
living environment conservation	the function of resident
natural environment conservation	protect the valuable nature

The foundation research of a scientific system of a forest management by estimate and classify a various function of forest was promoted because the necessary of forest management according to classifying forest function is raised in South Korea since 1990 and it was embossed to a project perform rapidly. Recently the function of forest was classified into six functions, and recommended to make a system of management by each functions[table 1].

2. Materials and methods

1) Study Site

The study site was Mt.Ab and Mt.Choijung in Daegu metropolitan area located at the central part in South Korea. Daegu's water supply rate attained 99.2 percent with the daily water consumption of 378 liters per person. In Daegu there is 50 square meters of park area per person, the largest of 7 metropolitan cities in Korea. The total area of Daegu's parks also turns out to be the largest among all the 7 metropolitan cities. According to the survey in late 2001, Daegu has 126 of parks area, occupying 14.2% of its total area.

2) Data

[table 2] thematic maps utilized in this study

thematic map	timber production	water conservation	forest disaster protection	forest recreation	living environment conservation	natural environment conservation
digital map (1:25,000)	o	o	o	o	o	o
site map	o	o	o			
digital forest map	o	o	o	o	o	
digital forest using map						o
wood-working shop map	o					
distribution of population map				o		
highway IC map				o		
rainfall		o	o			
forest road map	o					

We acquired rainfall data from Korea Meteorological Administration and distribution of population map from National Statistical Office. And wood-working shop map and highway IC map made by ourselves. We used ESRI`s ArcView 3.2 for analysis of geographic information system (GIS).

3) Method

The forest function map was produced for having a systematically and rationally system of forest management under each purpose of utilize and graded from 0 to 1000 by using a factor of estimate(Cha, 2000) and point of weight which was produced by analysis a space of each function.

Fuzzy logic is a superset of conventional (Boolean) logic that has been extended to handle the concept of partial truth : truth values between "completely true" and "completely false". It was introduced by Dr. Lotfi Zadeh of UC/Berkeley in the 1960's as a means to model the uncertainty of natural language.(Won. 2001) Fuzzy logic is suitable for digitalized the function of forest which is indistinct.

(Source: Korea Forest Research Institute, 2004, 'Classifying Forest Function Map Drawing Up')

(1) Timber production

Growth factors are topology, depth of soil, humidity, dryness, slope, shape of slope, density, direction, soil, elevation, and sediment. Management factors are road accessibility, slope, distance until of market.

(2) Water conservation

Growth factors are forest type, age of stand, crown density. Location_weather factor are slope, rain fall, depth of soil, shape of slope, soil texture, country rock, shape of soil, density, area of basin and elevation.

(3) Forest disaster protection

Growth factors are forest type, diameter class, age of stand. Location_weather factor are rain fall, length of slope, shape of slope, location of slope, depth of soil, soil texture, country rock, shape of soil and elevation. We applied a record of average rainfall(record of Korea Meteorological Administration of 1410.45mm) in South Korea from 1995 to 2004 to the function of forest disaster protection.

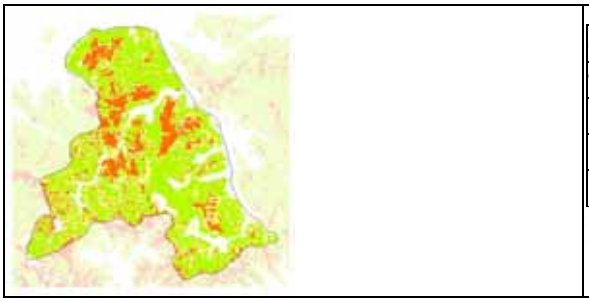
(4) Forest recreation

Growth factors are age of stand, forest type, crown density, origin of forest. Location factors are water system, slope and elevation. Accessible factors are road accessibility and distribution of population.

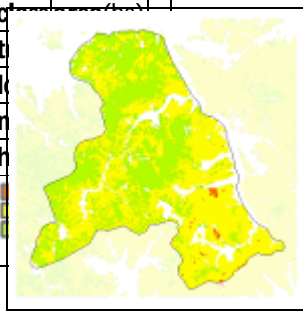
(5) Living environment conservation

Growth factors are origin of forest, age of stand, forest type and crown density. Location factor are slope and elevation. Accessible factor is distance until of town.

3. Results and Discussion



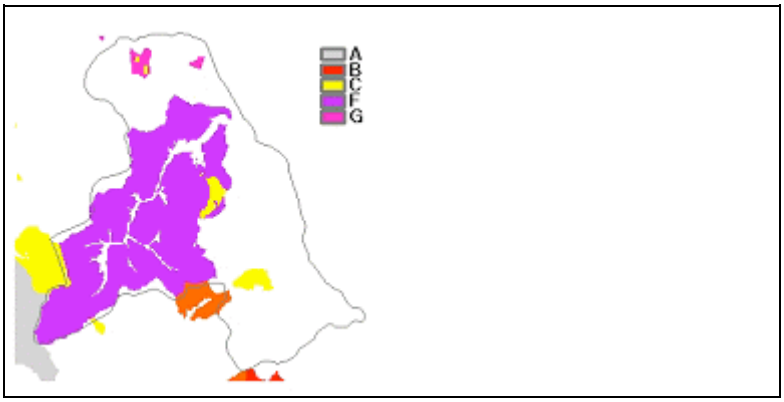
[table 3] Timber production map



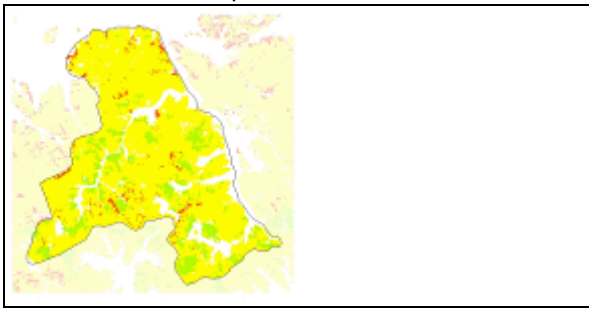
class	area(ha)
total	8,673.07
low	71.23
mid	5,395.34
high	3,206.50

Low
Mid.
High

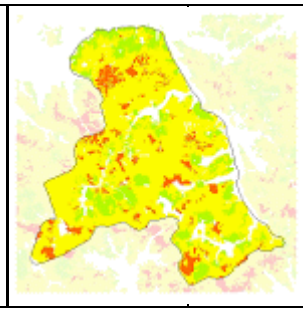
[table 6]Forest recreation map



[table 7]Natural environment conservation map



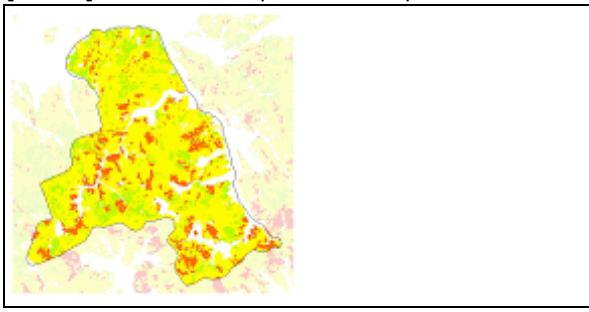
[table 5] Forest disaster protection map



class	area(ha)
total	8,673.07
low	999.41
mid	6,465.10
high	1,208.56

Low
Mid.
High

[table 8]Living environment conservation map



class	area(ha)
total	8,372.96
low	1,366.93
mid	6,055.17
high	950.86

Low
Mid.
High

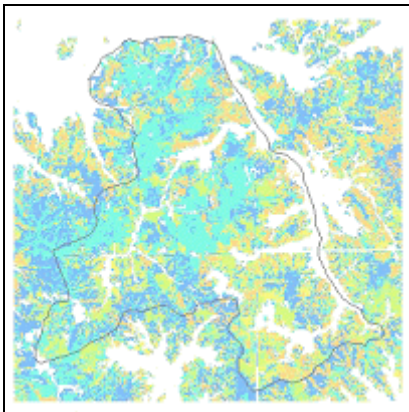
[table 4] Water conservation map

First, the function of timber production appeared whole highly. Because of growth factor that gives an effect to growth of tree is the weight is 0.543. Second, the function of water conservation supply using water. Third, the function of forest disaster protection prevent desolation and protect land of forest. Forth, Forest recreation map. Water conservation and land safeguarding, forests function to provide recreation areas for the people. As the living standard of the people rise, recreational activities is becoming more and more popular, and thus the number of forest users is rapidly increasing.

[table 9] class

class	low	mid.	high
score	0 ~ 333	333 ~ 666	666 ~ 1000

This study area was evaluated well the function of forest recreation. It means this urban forest is suitable to recreation areas for the people. Fifth, the function living environment conservation is for resident. Finally, the function of natural environment conservation showed the area of the valuable nature. And widely area of this map which was product by digital forest using map is natural park(A), protective zone for waterworks(F).



[table 10] Classifying Forest Function Map

The results of classifying forest function map was produced by ranking. Water conservation, Forest recreation, Forest disaster protection, Living environment conservation, Timber production. The function of natural environment conservation excluded the map because the function did not use score. According to the results, the function of water resources supply and the function of forest recreation are good. The ranking is a possibility of being exchanged according to the user and the study area.

4. Conclusion

This study was according to site-specific conditions such as topography, geography and institution, forests could be functionally classified to one of timber production, water conservation, forest disaster protection, forest recreation, living environment conservation and natural environment conservation.

Spatial data of study site used by digital map, digital forest map, digital forest using map, and distribution of population map. And attribute data used distribution of population map and rainfall data. The forest function map was produced for having a systematically and rationally system of forest management under each purpose of utilize and graded from 0 to 1000 by using a factor of estimate and point of weight which was produced by analysis a space of each function.

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