B-51.1.2 Studies on Database of Various Information about the Intake and Uptake of the Green House Effect Gasses

Contact person Genya SAITO
Division of Information Analysis,
National Institute of Agro-Environmental Sciences
Kannondai, Tsukuba, Ibaraki, 305, JAPAN
Tel.+81-298-38-8192, Fax.+81-298-38-8199
E-mail genya@niaes.affrc.go.jp

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Abstract

The final goal of this research is to implement a database storing various information about the intake and uptake of the green house effect gasses (GHG). We made a system for the databases of GHG, examined the protocol between the databases and some existing models, and developed real GHG database at Pasir mayang area in Sumatra.

This system analyses remote sensing data to obtain land use change and surrounding environmental conditions at target point, and has a geographical information system in raster and polygon types for a spatial information database. The system also links up a digitizer and a large-scaled scanner to input geographical information, and automatic CD-Rom changer as a data sever. The protocol between these databases and some existing models was examined, and the types of input parameters, which must be prepared, were determined.

Using LANDSAT/TM data, we determined land cover of Pasir mayang area in 1992 and 1995. Logged forest was the most dominant land-cover in the area, followed by rubber and secondary vegetation (rubber jungle), fallow land (bush/shrubs), grassland and bare land (clear cut area). Between 1993 – 1995, logged forest area decreased, while rubber jungle and fallow land increased Due to this, above ground carbon stock of the area decreased 6.3%. Comparison of the total green house gases flux of the two period time studies based on land-cover have showed that there was an increase flux of nitrous oxide and carbon dioxide and absorption reduction of methane.

Key Words Environmental Condition of Field Measurements, Remote Sensing, Data Server, Raster Type Data, Vector Type Data,

1. Introduction

Deforestation, conversion of forest into non forest land use/land cover, gives significant impact on the net increase of atmospheric carbon. In addition, land-use and land cover results in changes in greenhouse gases dynamics. Flux of carbon dioxide, nitrous oxide and methane of soil surface were measured at various land-use/land cover types by the ground survey group of our project. We want to develop the spatial database to estimate the flux mount of GHG in target area using ground measurement data.

2. Research object

Flux or emission of greenhouse gases measurements usually are conducted at a point location, therefore problem arise when emission estimation will be used for scaling up are estimation into a national or regional areas whereas biophysical variation are exist. The research aimed to make dada base for the estimation of regional emission based on several points emission measurement using GIS.

3. Research method

a. Making a system for the databases of GHG

This system analyses remote sensing data to obtain land use change and surrounding environmental conditions at target point, and has a geographical information system in raster and polygon types for a spatial information database.

b. Examining the protocol between the databases and some existing models

The protocol between these databases and some existing models was examined, and the types of input parameters, which must be prepared, were determined.

c. Developed GHG database at Pasir mayang area in Sumatra

Using LANDSAT/TM data, we determined land cover of Pasir mayang area in 1992 and 1995. Pasir mayang area is 33km (east to west) and 20km (north to south) and is listed as Fig. 1. In the area, estimation of total above ground carbon stock are calculated by multiplying the value of ha by total area of each land cover. The same method was applied for calculating the total emission of greenhouse gases

Fig. 1 Pasir mayang area

4. Result and Discussion

a. Making a system for the databases of GHG

Developed system of this study is listed Fig. 2. The system also links up a digitizer and a large-scaled scanner to input geographical information, and automatic CD-Rom changer as a data sever.

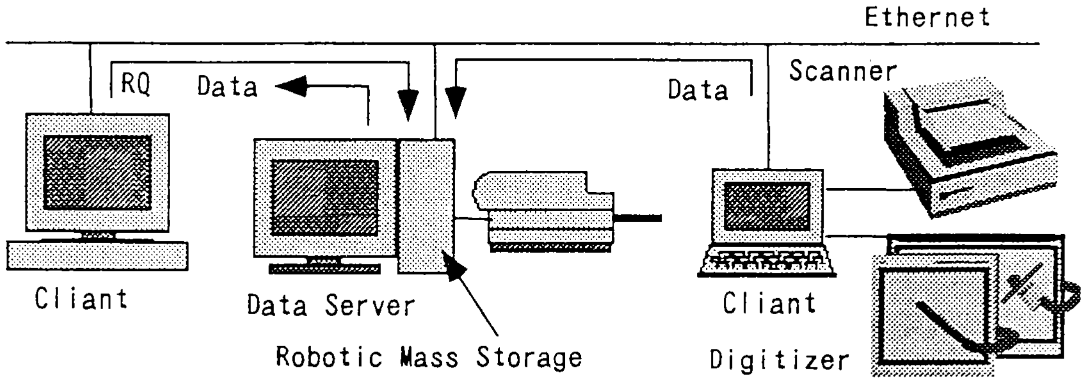

Fig. 2 Developed database system of this study

b. Examining the protocol between the databases and some existing models

In Fig.3, we listed the protocol and the types of input parameters between the databases and some existing models.

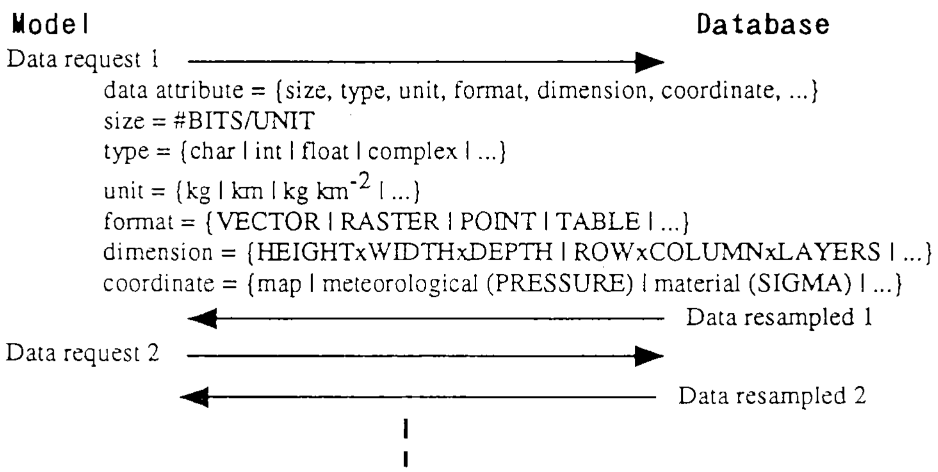

Fig.3 Protocol and the types of input parameters between databases and models.

c. Developed GHG database at Pasir mayang area in Sumatra

The land cover maps of Pasir mayang area in 1993 and 1995 were indicated as Fig. 4. Estimation of above ground carbon stock are calculated by multiplying the unite value by total area of each land cover using the land cover maps of Pasir mayang area in 1993 and 1995. The same method was applied for calculating the total emission of greenhouse gases. These results are shown as table 1 and table 2.

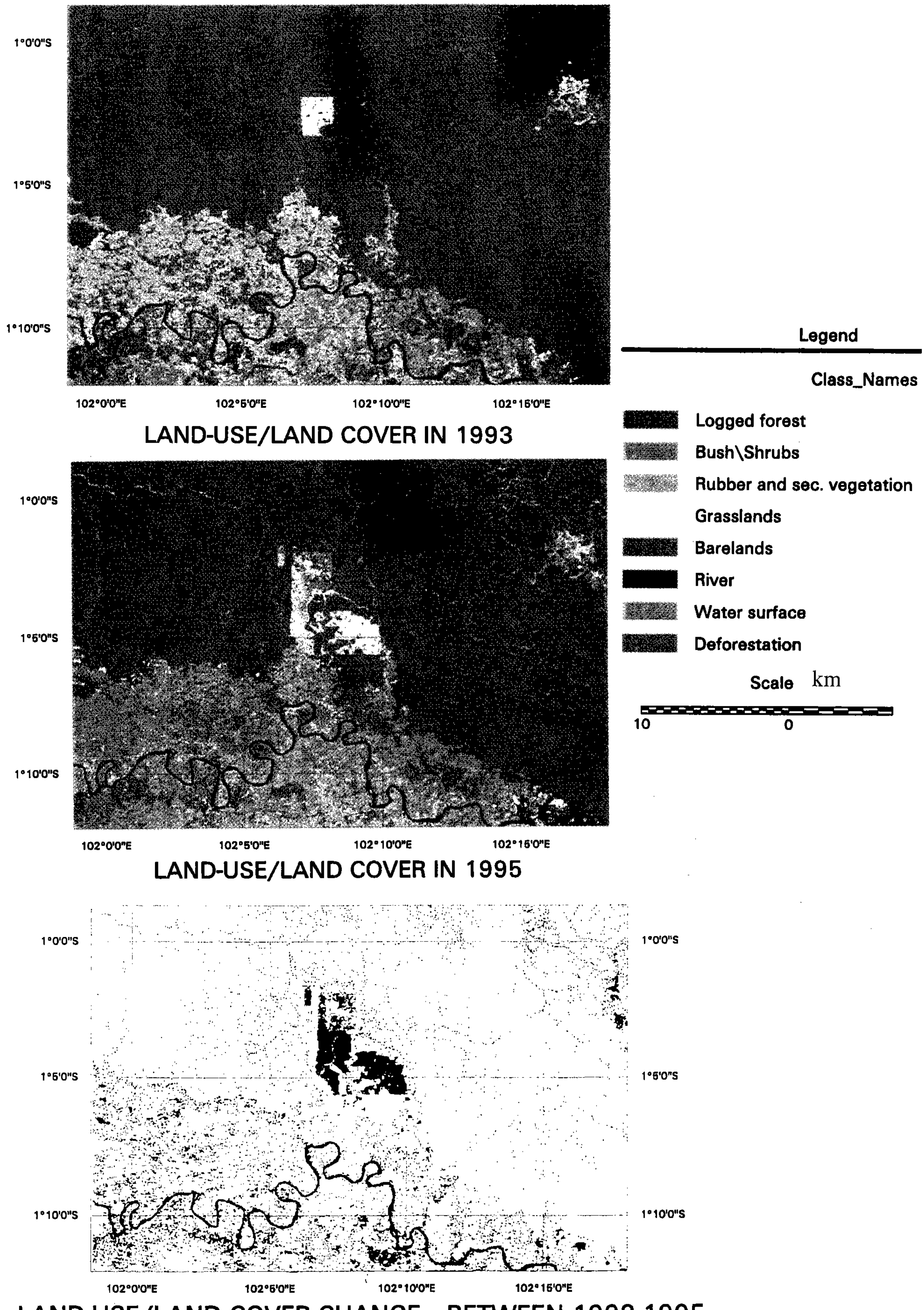

Fig. 4 Land cover maps of Pasir mayang area and changes in 1993 and 1995

Table 1. Land cover and above ground carbon stock changes in Pasir Mayang between 1993 – 1995

Land cover	Carbon stock per ha (ton/ha)	Area in 1993 (ha)	Total above ground Carbon stock in 1993 (ton)	Area in 1995 (ha)	Total above ground Carbon stock in 1995 (ton)
Logged forest	155.2	68,529.5	10,634,270.75	63,235.5	9,812,758.4
Bush/Shrubs	15.0	10,224.8	153,372.0	10,450.3	156,754.5
Rubber and sec. Vegetation.	35.5	6,541.8	232,233.9	11,414.3	405,207.7
Grass land	6.0	3,156.5	18,939.0	3,468.3	20,809.8
Bare land	0.0	986.3	0	870.5	0
Total in 1993		89,438.9	11,038,815.7	89,438.9	10,395,530.4

Note: Above ground biomass was estimate using allometric equation, conducted by Biotrop

Table 2. Soil green house gas emission changes of Pasir Mayang between 1993 and 1995

Land-cover	Carbon dioxide (ton/hour)		Nitrous oxide (kg/hour)		Methane (kg/hour)	
	1993	1995	1993	1995	1993	1995
Logged forest	241.4	222.8	7.343	6.776	-9819.3	-90607.7
Fallow land	59.4	60.7	2.041	2.086	-4.5	-4.6
Rubber and secondary vegetation	31.0	54.0	1.328	2.317	-1.3	-2.2
Grassland	19.1	20.9	0.347	0.381	0.0	0.0
Bareland	6.1	5.4	0.326	0.117	-73.2	-64.6
Total	357.0	363.8	11.194	11.679	-9898.3	-9132.1

Note : calculation was made based on mean value of 10 months (10 time) measurement conducted by Dr. Tsuruta. The measurements were made in January, February, March, June, July, August, September, October, November and December.

Logged forest was the most dominant land-cover in Pasir mayang, followed by rubber and secondary vegetation (rubber jungle), fallow land (bush/shrubs), grassland and bare land (clear cut area) (Table 1). Between 1993 – 1995, logged forest area decreased of about 5 300 ha, while rubber jungle and fallow land increased 4872 ha and 225 ha, respectively. Due to this, above ground carbon stock of the area decreased from 11.1 million ton to 10.4 million ton, or have loss of about 0.7 million ton.

Table 2. summarized the greenhouse gases emission of soil in 1993 and 1995. Comparison of the total green house gases flux of the two period time studies based on land-cover have showed that there was an increase flux of nitrous oxide and carbon dioxide and absorption

reduction of methane.

5. Concluding remarks

There are two problems faced in the development of spatial database and scale up the emission estimation:

a. variability of sources (materials) in term of scale/accuracy, and data generation's methodology used.

b. limited field measurements or availability of unit/value of green house gas emission/flux in term of ecosystem and seasonal variability.

Those two problems will have a great impact on the accuracy of the estimation result. Measuring the accuracy of the measurement is also another important problem.

6. References

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