

LAND USE DYNAMICS IN TARI BASIN OF PAPUA NEW GUINEA USING MULTI SENSOR SATELLITE DATA

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ABSTRACT: The Tari basin in Papua New Guinea Highlands is inhabited by indigenous Huli people and has been experiencing significant change in its environment and resource condition over the last few decades. For a proper understanding of the human-environmental interaction in this area, it is necessary to take into account the people's culture, their agricultural practices, community groupings and to use the information related to the physical environment in this context. This paper describes a study in this area to combine information from multi satellite data, namely, Landsat MSS, Landsat TM, SPOT HRV, and IKONOS, together with the physical and socioeconomic information. It is expected that such a study will be useful in understanding the complexities of social-environmental changes taking place in the area and in suggesting appropriate policy measures for the effective management of the resources.

1. INTRODUCTION

Resources degradation together with the growing population pressure have been issues of important concern for environment and sustainability in many parts of the world, especially in the developing countries. The problem becomes serious especially in the fragile mountain areas and watersheds, where the forest degradation is likely to cause the degradation of the whole living environment. It has been show that remote sensing and GIS could be useful in such studies of degradation of resources at various levels of study (Pahari and Murai, 1996).

The study area is the Tarin basin inhabited by Huli-sepaking people and is in the southern Highlands Province of Papua New Guinea. It is located between 142°45' E and 143°10' E longitude, and between 5°40' S and 6°00' S latitude. It has been observed that this area has witnessed considerable resource degradation over the last few decades, together with the increasing population, growing at a rate of above 2% per year (Umezaki et. al, 2000).

2. DATA AND METHOD

2.1 Data Used

A variety of data including satellite data, physical and socioeconomic data have been utilized for this work. These are the followings:

Satellite data:

Landsat MSS data acquired on 19/08/1972

Landsat TM acquired on 20 September 1994
SPOT HRV multispectral data acquired on 19/06/1988
Ikonos data acquired in August 2001 (to be used).

Other data:

Aerial photographs for 1995, 1978

Digital elevation model based on the 1:100,000 topographic map obtained from Australian national university

Population data, hamegini boundaries, streams, roads, etc

Besides we have also the household information on socioeconomic aspects collected from the field.

2.2 General Methodology

The general methodology used in this study consists of the following:

2.2.1 Image processing of satellite data

Satellite data namely, Landsat MSS from 1974, SPOT HRV from 1988 and Landsat TM from 1994 have been classified into broad land use classes using supervised maximum likelihood classification. The training areas have been selected with the aid of some aerial photographs obtained for different dates and judgment based on known information.

2.2.2 Multitemporal analysis

A multitemporal analysis has been performed to see the trends of land use dynamics by using data from seventies until the present time.

2.2.3 Integrating with other sources of data

The data from remote sensing classification has been integrated with other sources of data, such as digital elevation model, hamegini boundaries, environmental zones etc to understand the land use dynamics in relations to physical and socio-economic factors.

2.2.4 Combination of large area broad study with small area detailed studies

The research method we are employing is a combination of study on a wide area by using multitemporal satellite data such as MSS, TM and HRV to get a wide synoptic view of the environmental and resource condition on the area. This is then combined with a very detailed and focused study on selected small villages with the aid of high resolution IKONOS data together with extensive field information.

3. PRELIMINARY RESULTS AND DISCUSSION

So far the preliminary classification has been made by using maximum likelihood classification of the satellite data based on information from aerial photographs and known information. Figure 1 shows the results of such classification. The categories of interest are primary (original) forest, secondary forest (forest after regrowth in areas cleared by people for shifting cultivation), new garden (newly formed garden under cultivation) and old garden (garden

several years old with some regrowth), grass fallow ; and others such as bare soil and built up area have been placed under a single category. Large areas of gardens occupying the land area can be seen clearly with this figure, and also by comparing this with the digital elevation model, it was seen that most of the primary forest areas have been in the higher elevation or steep areas. This can be explained by the relative physical difficulty for people to clear this forest.

This preliminary analysis will be further improved by making ground truth at the study area and then relating the land use dynamics with various factors such as population density, community management, terrain condition, etc.

Also, high resolution IKONOS data (4 m in multispectral and 1 m in panchromatic) has recently been obtained and work is underway to make a detailed analysis for the selected area using this data, so as to link the resource degradation with the daily farm practices and the local resource management system.

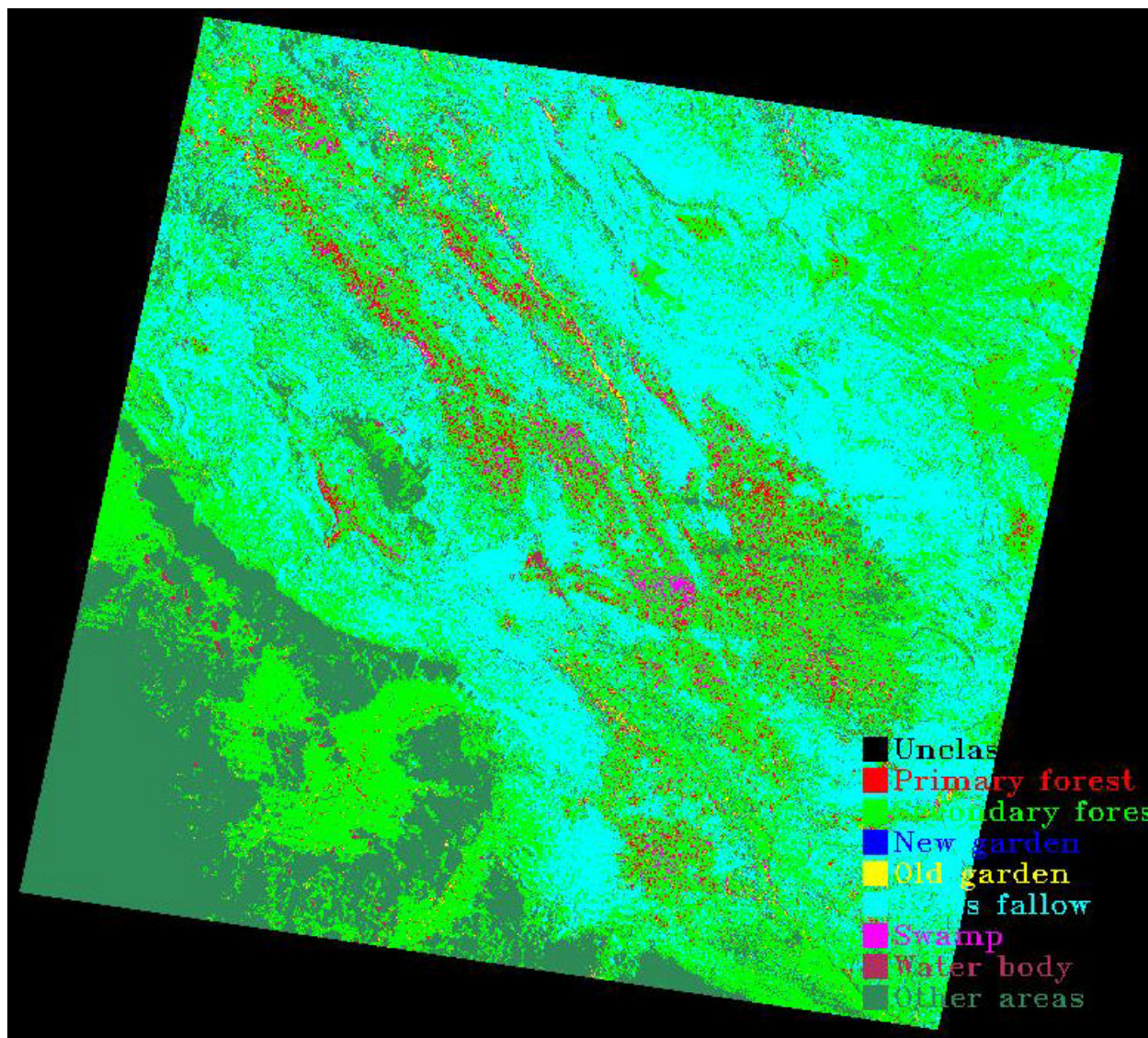


Figure 1: Land use classification from Landsat TM of 1994, covering Tari basin and the nearby area (142°13'52" E to 143°15'45" E and 5°18'33" S to 6°14'53" S)

4. CONCLUSION AND FURTHER WORKS

The preliminary analysis shows that most of the primary forest is now confined to the mountainous areas under steeper slopes, indicating the change in forest condition in other areas due to human pressure. It is expected that with further work aided by ground truth data and analysis of high resolution IKONOS data, the study will lead to detailed explanation of the spatio-temporal aspects of land use and resource change and its relation to the local resource management system.

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