

Report as of FY2007 for 2006GU70B: "Watershed Land Cover Change Detection in Guam"

Publications

Project 2006GU70B has resulted in no reported publications as of FY2007.

Report Follows

PROJECT SYNOPSIS REPORT

Project Title: Watershed Land Cover Change Detection in Guam

Problem and Research Objectives

Much of land cover change (LCC) has been recorded qualitatively through the use of comparative photography and historical reports, however little quantitative information has been available at watershed scale. It is currently possible to detect LCC and determine the trends in ecological and hydrological condition at watershed scale using advanced geo-spatial technologies such as satellite remote sensing, GIS, and GPS. These technologies provide the basis for developing landscape composition and pattern indicators as sensitive measures of environmental change and thus, may provide an effective and economical method for evaluating watershed condition related to disturbance from human and natural stresses.

Landsat satellites can provide multi-date satellite imagery back to 1972 (Landsat 1), and Landsat 5 and Landsat 7 are still on orbit. Land cover has been derived from a multi-date satellite imagery database to detect changes on the Earth. Recent surveys indicate that land cover/use changes have a direct and enormous effect on water quality and environmental change. Watershed water quality and ecosystem are threatened constantly by both human impacts like forest fires and development and also natural phenomena like storms and droughts. In addition, the combined uses of GIS, remote sensing and GPS tools have been highlighted with respect to their advantages in watershed applications.

Spatial and temporal modeling of changes in wetlands and badlands in Southern Guam watersheds was identified as one of the highest priority research needs for Guam on the Guam Advisory Council meetings of November 15, 2004 and October 4, 2005. Multi-date Landsat satellite imagery were used to measure changes of watershed land cover from 1973 to 2001 for Guam. Topographic map of 1978 for Guam and recent IKONOS imagery was used as auxiliary information to improve land cover classification accuracy. The study area focused on all 14 watersheds in Southern Guam. The main objectives of this project aimed to extract land cover information from Landsat images and therefore to measure changes of land cover in the watersheds in the southern Guam.

Methodology

The principal investigators (PIs) searched available data, and preprocessed the data for land cover classification in ERDAS IMAGINE, a geospatial imaging processing software. GIS, remote sensing and GPS were the main geo-spatial technologies used to complete the project's objectives. GIS, remote sensing and GPS technologies were integrated to obtain land cover information, and measure the changes of land cover.

Principal Findings and Significance

The land cover information of 1973 and 2001 for all watersheds in the southern Guam has been obtained. Because of bad quality of Landsat Multi-Spectral Scanner (MSS) satellite image of 1973, digital line graph (DLG) data with data acquisition data as late as January 1, 1975 was used with Landsat MSS data of 1973 to extract land cover information. Land cover of 2001 was extracted from Landsat Thematic Mapper (TM) satellite image of March 15, 2001. By comparison of the land cover between 1973 and

2001, the following conclusions can be made. The watersheds in southern Guam were mainly covered by forest and grassland for both the years of 1973 and 2001. The area of forest increased by about 3% from 1973 to 2001, but the area of grassland decreased by over 17% between 1973 and 2001. The built-up/urban area increased by over 3 times from 1973 to 2001, and most of the increased urban areas occurred in forest and grassland. The area of water body decreased by about 50% in the past three decades. Most of decreased water areas was lost to urban areas. Land cover is an important factor for soil erosion and water quality evaluation. Information about changes of land cover over time will help government agencies in interest take proper measures to protect soil from erosion and improve water quality, and therefore may help them with decision making. The land cover information can also be applied for environmental modeling and assessment, and analysis of relationship between land cover change and climate change.