The 20th CEReS International Symposium on Microsatellites for Remote Sensing (SOMIRES 2013) and The 231th RISH Symposium Chiba, 8-9 August 2013

Possibilities of Approach Integrating RS Multi-Data Analysis and GIS for Water Resources Management and Environmental Monitoring

The case study of Bili-Bili Irrigation System, Indonesia

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Abstract

The use remote sensing and Geografic Information System (GIS) datas allow more efficient analysis because the temporal and spatial dimensions could be studied at once, especially to generate primary data on irrigated area, cropping pattern and crop yield at disaggregated level and to access the improvement in agricultural productivity and water management in canal irrigation schemes. Another issue in the spatial and temporal dimension of water productivity. A spatio–temporal analysis could broaden the role of models in exploring improved water use in agriculture. The GIS technique helps in integration of satellite data and ground information to evaluate the distribution water performance and to diagnose the inequality in the performance to aid in improving the water management. This paper aims to improve agricultural productivity, water productivity, and environmental monitoring through a predictable, equitable and reliable irrigation service.

Keywords **:** Integration of RS and GIS, Multi data analysis, Water resources management, Environment, Monitoring

1. Introduction

According to Rampisela (2011) The Bili Bili Dam, which completed construction in 1999, has the capacity to store 375 million m^3 of water. Although the primary objectives of the dam are flood control and clean water supply for makassar urban area and its surrounding environs, the dam also proves capable of providing irrigation for 25,472.16 ha of rice fields (fig. 2(A).

Almost every year in irrigated areas of Bili-Bili especially in the lower reaches during the dry season, farmers didn't get water for irrigation. Many problems which is influence the insufficient water in irrigation canals, such as canals damage, water lost to pond (eks making brick), and water gate uncontrol).

The integration of remote sensing and Geographic Information Systems (GIS) has received considerable attention in the literature. Ehlers et al. (1991) first reviewed the necessity of integrating remote sensing with GIS, and discussed the potential of integration in water resource management and environmental monitoring.

In this paper we will discuss about possibilities approach integrating remote sensing multi data analysis and GIS to manage water resources and environment with 2 indicators, that is water availability and cropping patterns. Remote sensing multi data analysis means using variety of resolution data analysis from different sensors (fig. 1).

2. Methods

This research will survey (ground truth; observation, interviews, crop photos time series from few location), spatial analysis, time series analysis, statistical analysis, and collecting data (weather data from on site meteorological station, secondary data from BPS and etc)

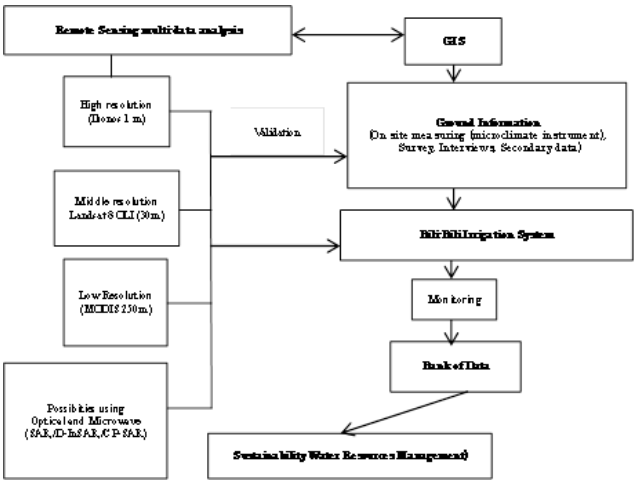


Fig.1. Approaches of integrating RS multi-data analysis and GIS Scheme

3. Results

We successfully to extract data from Ikonos (Fig.2) and Modis

data analysis (Fig.3) and now, we will try to Landsat 8 OLI and SAR data analysis to get more information about water resources and environment condition in Bili-Bili Irrigation System.

Ikonos data analysis

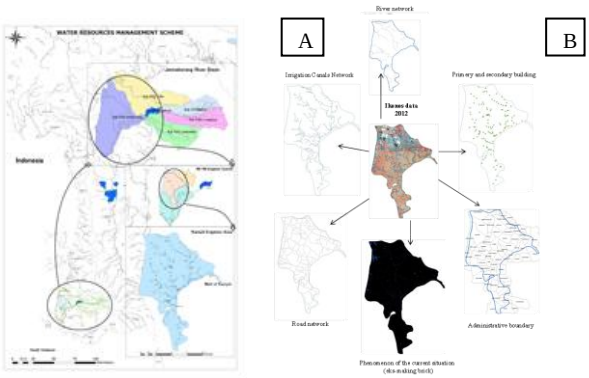


Fig.2 (A) Study site location, South Sulawesi, Indonesia. (B) Extraction of Ikonos data for spatial data analysis to observe the current situation with more accurate

Modis data analysis

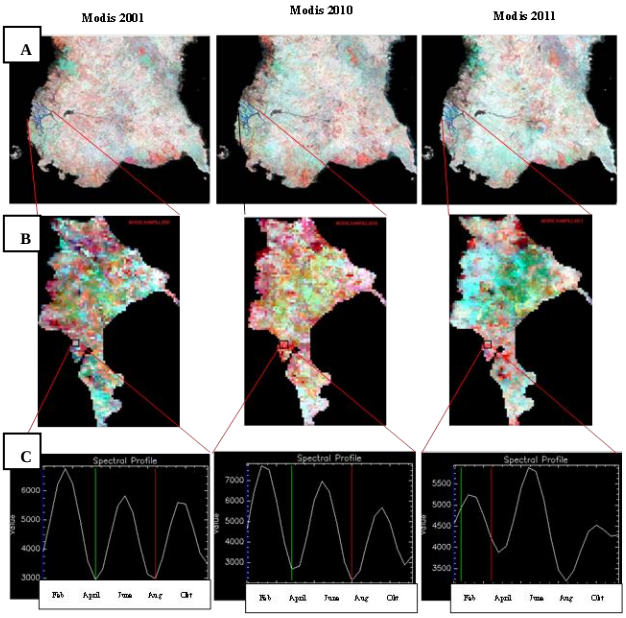
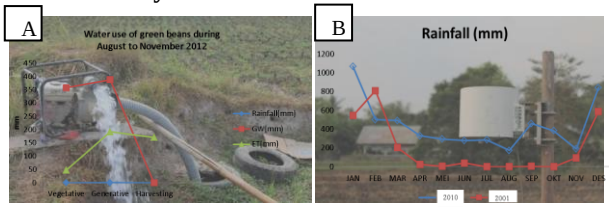


Fig .3. Validation of the underestimated number of crops in 2001, 2010 and 2011 in Bili-Bili Irrigation Area, South Sulawesi, Indonesia (A) EVI MODIS false-color image (R:G:B= Band 6: Band 2: Band 1). (B) Kampili Irrigation Area (MODEL). (C) Average monthly EVI MODIS data in areas where the almost every year insufficient water and number of crops per year decreased in 2010 to 2011 and also we compare within 2001 to 2010 which purpose to know about the copping pattern before and after landslide.

Water use analysis



Source : Sartika & Oue data, 2012

Source: BPS data, 2011

Graph.1. On site measuring data and secondary data in Kampili Irrigation Area (A) Water use of green beans during Dry season (August to November). (B) Rainfall data in 2001 and 2010 from BPS (Central bureau of statistics).

After that, we will validation with ground information which extract from water use data analysis ,weather data (graph.1) and ground survey, then we collect all data in data bank using GIS analysis.

4. Discussion

One of the main advantages of this integrate is its capability to monitoring water resources and environment and easy to making the best management plan. The other hand, we want to try about using SAR and CP-SAR images from microsatellite to monitoring environment problem like the subsidence and ground water problem issue in irrigation area. This is the main problem issue for future because, we can see of human activity especially farmers exlore water from ground water in dry season to be increase every year.

5. Summary

In this paper, we proposed to develop a new approach integrating remote sensing data analysis from different resolution and sensor data. This is integrated will be applicable for irrigated area mapping, cropping pattern management, water requirement, and disaster monitoring. We also proposed the SAR image data for environmental monitoring at Bili-Bili Irrigation area..

Acknowledgements

This Research is part of Water Resources Management Project (C-09-Init) funded by Research Institute for Humanity and Nature (RIHN), Kyoto, Japan. The authors would like to thank the Pelangi Agency of Makassar that provide the bili-bili irrigation system data

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