POSSIBILITIES OF INTEGRATED WATER RESOURCES MANAGEMENT AND ENVIRONMENTAL MONITORING USING RS MULTI-DATA ANALYSIS AND GIS

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

INTRODUCTION

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 urban area and its surroundingsin Makassar, South Sulawesi, Indonesia, the dam also proves capable of providing irrigation for 25,472 ha of rice fields (Fig. 1(A).

During dry season, though there is sufficient water in the primary canals of the BiliBili Irrigation System, some farmers, especially in the lower area, cannot grow rice crops because of water insufficiency due to canal damage, water loss before reaching lower area, inadequate water gate control, and so on. But the actual situation has been unidentified neither spatially nor temporally. And that is one of obstacles of agricultural development in the area.

The integration of remote sensing and Geographic Information Systems (GIS) can be expected as a useful tool for the integrated water resources management and environmental monitoring.(Ehlers et al., 1991). In this paper we will discuss about possibilities of appropriate evaluation of water availability and cropping pattern, which are very important indicators for water resources management, by integrating remote sensing multi data analysis and GIS. Remote sensing multi data analysis means using variety of resolution data analysis from different sensors (Fig.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)

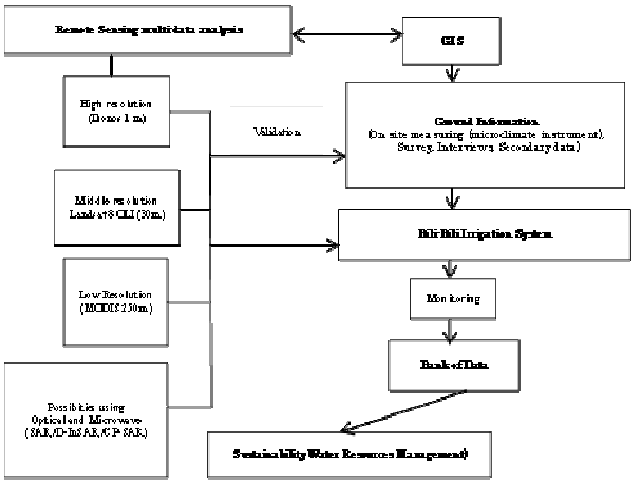

Figure 2. Approaches of integrating RS multi-data analysis and GIS Scheme

RESULTS AND DISCUSSION

We successfully to extract data from Ikonos (GeoEye-1) about land use existing (Fig.1.(B), Modis data analysis about cropping pattern and water availability (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 the Bili-Bili Irrigation System. After that, we will validation with ground information which is extract from water use data analysis ,weather data and ground survey, then we collect all data in data bank using GIS analysis.

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 from microsatellite to monitoring environment problem like subsidence and ground water problem issue in irrigation area. Because this is the main problem issue for the future, we can see of human activity especially farmers' explore of water from ground water in dry season to be increased every year.

Ikonos data analysis

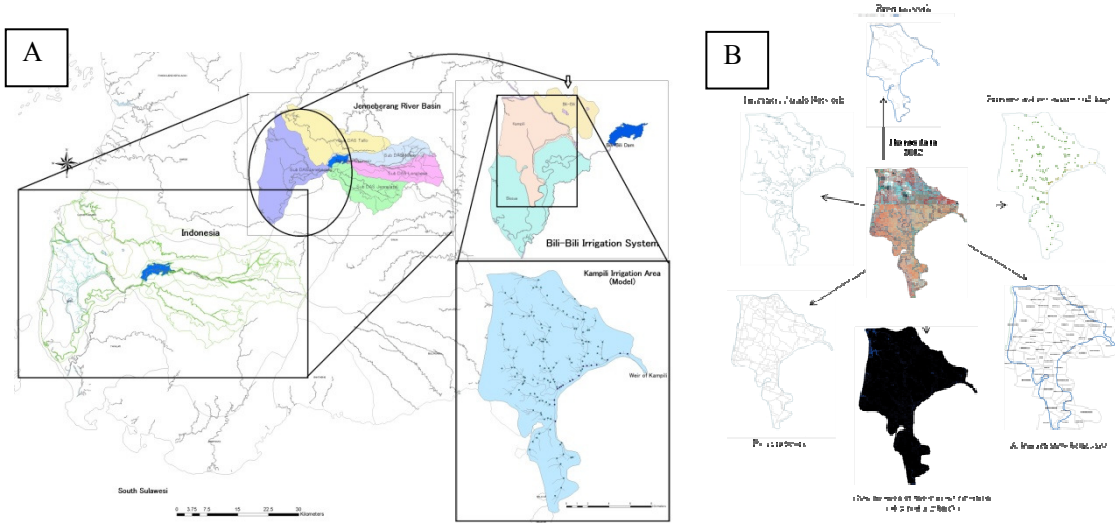

Figure 1 (A)Study site location, South Sulawesi, Indonesia. (B) Extraction of Ikonos data for spatial data analysis to observe the current situation with more accurate.

Modis data analysis

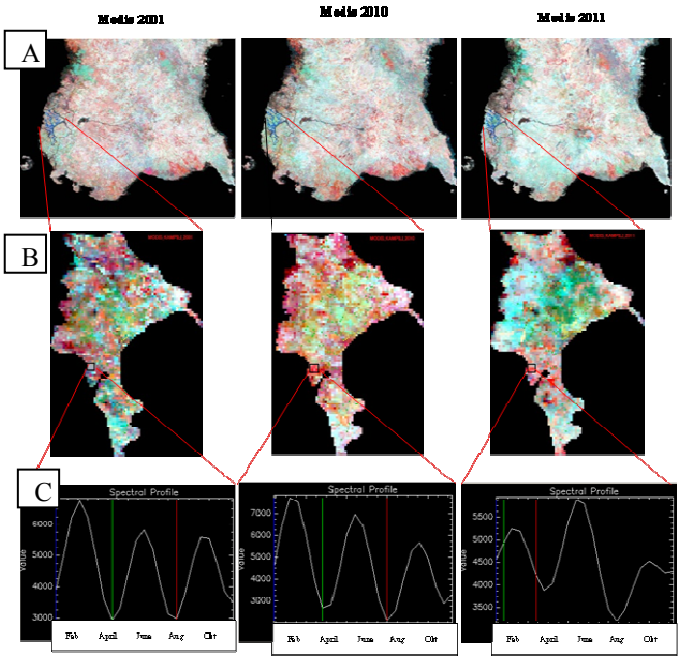

Figure .3. Validation of the underestimated number of crops in 2001, 2010 and 2011 in Bili-Bili Irrigation Area, South Sulawesi, Indonesia (A) EVI MODIS false-color image (R:G:B= Band 6: Band 2: Band 1). (B) Kampili Irrigation Area (MODEL). (C) Average monthly EVI MODIS data in areas where the almost 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 and annual rainfall

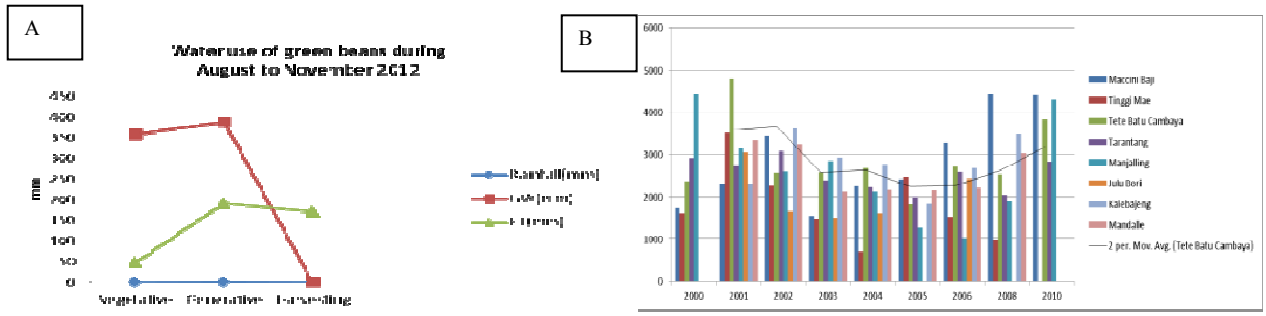

Fig.ure 4. On site measuring data and secondary data in Kampili Irrigation Area (A) Water use of green beans during Dry season (August to November). (B) Rainfall yearly from a few pos rainy in Bili-Bili Irrigation Area (Source: BMKG, 2011).

The climate of Gowa and Takalar district reflects the region's location in the tropics, with temperature and humidity remaining constant throughout the year, and rainfall varying between the season and annual mean rainfall ranging from 2528,21mm up to 4830,91mm (Climate and Meteorology Agency, 2011). From November until March, the zone of heavy rainfall covers most of Gowa, while from May until September, the zone of rainfall is limited, almost of all Gowa and Takalar district dry.

CONCLUSION

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..

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