

# Development of Agricultural GIS on Shonai Area in Northeast Japan Using Satellite Data

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## Abstract:

For agricultural management, it is important to establish GIS and maintain GIS data. It is necessary to develop the agricultural GIS in a short time and at low cost. The agricultural GIS is difficult to build up only agricultural side, and it must be linked with natural disaster mitigation system. For the same reason, data collection of ground survey is not suitable at the agricultural GIS. Remote sensing techniques maybe fit the data collection and utilization of satellite data is recommended. We are testing on Shonai area in northeast Japan, how to extract GIS information of land use/cover, especially the growth of crops in the agricultural fields using satellite data. We are checking the spatial resolution on earth and establish method of crop identification using satellite data

**Keywords:** Agricultural database, GIS, Remote Sensing,

## 1. Introduction

For agricultural management, it is important to establish GIS and maintain GIS data. Recently, Geographical Information System (GIS) is well developed at civil engineering of urban area with computer-aided design (CAD) and transportation system with global positioning system (GPS), however in agricultural side GIS is not well developed yet. The reasons are as follows. 1) Data inputs of the GIS load too many works and that are very high costs. 2) It is necessary to revise data each season or every year. For the reasons, agricultural GIS is difficult to build up only agricultural side, and it must be linked with natural disaster mitigation system[1]. Usually we use the GIS for agricultural management, and if disasters happen the GIS could work as disaster mitigation and damage determination system. At these GIS, satellite remote sensing data may be useful both for agriculture and disaster mitigation. Data collection of ground survey is not suitable for the disaster mitigation side and for agricultural side. Remote sensing techniques maybe decrease data input cost and good for land cover determination for the system.

## 2. Methods

### 1) Analysis Procedure

For the development of agricultural GIS linked with the GIS of disaster mitigation, voluntary members gathered and discussed, and those members started voluntary project of “Agricultural GIS in Shonai district”. The project tested the advantage of satellite data.

### 2) Target Area

Target area is Shonai district, in Yamagata Prefecture, northeast Japan, and listed Fig. 1. The district is a famous agricultural area for rice and young soybean (Edamame) in Japan.



**Fig. 1 Target Area**

### 3) Instruments and Software

At Shonai Branch, Experimental Station for Agricultural Production, Yamagata General Agricultural Research Center established original agricultural GIS system using PCs. The GIS was based on GiStar that was developed by Kawasaki Laboratory, Earthquake Disaster Mitigation Research Center, National Research Institute for Earth Science and Disaster Prevention. The start and some content pages of GiStar were listed Fig.2

We also use ARC/GIS of GIS software, and Erdas/Imagine, Multi-Spec, eCognition, PG-Streamer of remote sensing software, and the software were used on the PCs at Remote Sensing Laboratory, Field Science Center, Graduate School of Agriculture Science, Tohoku University.

### 4) Satellite Data

We used satellite data as follows,

1. OrbView observed on 30 Nov. 2003.
2. SPOT/HRV observed on 15 Aug. 2004, 4 Sep. 2004, 15 Sep. 2004.
3. Terra/ASTER observed on 21 May 2005.
4. Landsat/TM or TM+ observed on 12 Aug. 2000, 2 Sep. 2002.

## 3. Results

### 1) Analysis for Characteristics of Each Satellite Data

High-resolution satellites are operated by commercial companies and there are IKONOS, QuickBard and OrbView. We use OrbView for the study, and the data have very high resolution at 1m of Panchromatic and 4m of Multispectral mode, and the Swath Width is only 8km. If there are data, the data are very useful for each agricultural field detection. Each agricultural field is clearly understood in Japan but the data are too expensive to use for agricultural side.

SPOT/HRV is at 5m of B&W and 10m of color mode, and the cost is reasonable or a little bit expensive. We barely can distinguish each agricultural field and used the data for land use analysis in this study and salt damage analysis[2].

Terra/ASTER is 15m resolutions for multi-band for visible area and a little lower than SPOT/HRV. Terra/ASTER data are very cheap and it is suitable for agriculture side. The one and only Terra/Aster works and it is very difficult to get suitable acquisition time. Landsat/TM or TM+ has long time archive data, and it is suitable for change detection and historical analysis. The data price is almost suitable at Landsat data using old data discount.

## 2) Revision of Polygon Data on Agriculture Field

The test fields data of Agricultural GIS in Shonai district were used for the digital polygon files made by land improvement project. These data were a little bit old data, and we need to revise field polygon data. OrbView data were very suitable for the purpose. The sample listed Fig.3, and the left-side image is polygon data of agriculture fields, and the right-side image is OrbView image of same area.

## 3) Classification of Land Use

Using four kinds of satellite data such as Orbview, Spot, ASTER and Landsat, we preformed land use classification, and compared the results each other. We showed the result of land use classification using SPOT data as Fig. 4.

## 4) Producing of Good Taste Rice

Hokkaido Central Agricultural Experiment Station, in Japan, succeeded in producing good taste rice using satellite data[3]. This method is that, they detected the fields of high chlorophyll concentration in near-harvest time, which nitrogen was over input and they recommend reducing nitrogen fertilizer at next year production. We plan for nitrogen diagnosis in growing period of rice using satellite data and agricultural GIS, and the result of diagnosis affects the amount of additional fertilizer in the measured rice.

## 4. Discussions

Remote sensing data of satellite is very important for agricultural GIS, but the cost is larger than payment by agricultural section. We want more free data as RiceSat that were recommended by ACRS.

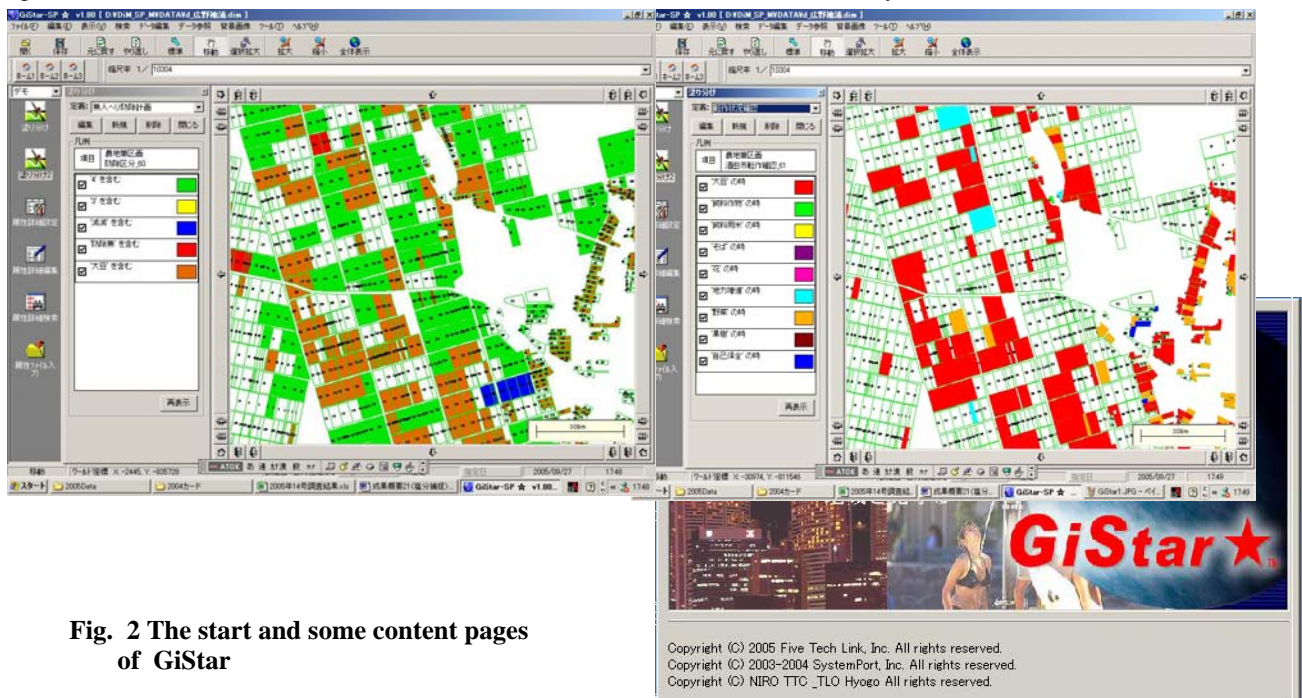
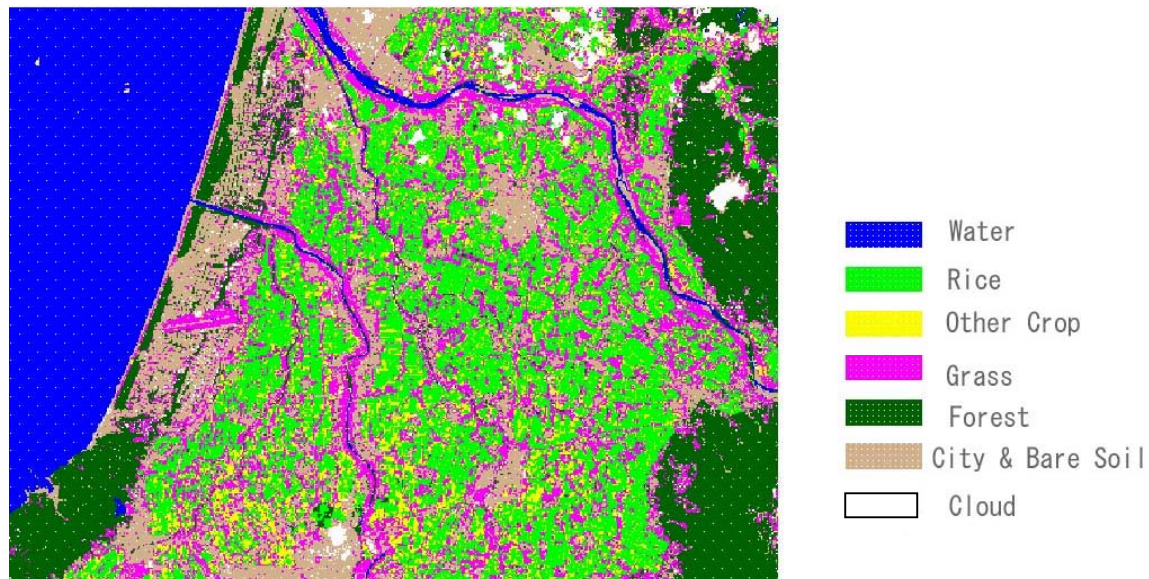


Fig. 2 The start and some content pages of GiStar





**Fig. 3 Field Polygon and OrbView Data**



**Fig. 4 Land Cover Classification Using Spot Data**

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