THE EXPERIENCES OF USING ALOS IMAGERY FOR SUPPORTING THE NATIONAL FOOD SECURITY IN INDONESIA:

Case study in Java Island

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Java island is the center of the national rice producer in Indonesia. Due to population increase, the rice production in Java tends to decrease from time to time. The decrease of the rice production is mainly caused by agricultural land conversion into settlements and industrial areas. This condition threatens the national food security particularly for the food availability aspect. The phenomenon of the agricultural land conversion makes the Department of Agriculture plan to establish the standard land of rice field areas. The establishment of the standard land of rice field areas needs the accurate and up-to-date spatial data. Currently, the data availability concerned is limited. The existence of remote sensing technology with a high resolution such as ALOS PRISM and AVNIR-2 gives a chance to answer the limitation of the accurate and up-to-date spatial data to establish the standard land of rice field areas.
Objective

To assess the use of ALOS PRISM and AVNIR-2 imageries for mapping the rice fields, compared to Landsat 7. The results are expected as inputs for the establishment of the guideline of mapping the standard land of rice field areas.
MATERIALS AND METHODS

Location

The study is focused on the rice field areas with the flat topography in the districts of Subang, Sragen, and Jember as well known rice producer areas.
## MATERIALS AND METHODS

### Data Used

<table>
<thead>
<tr>
<th>Imagery Types</th>
<th>Path/Row or Path/center</th>
<th>Acquisition</th>
<th>Spatial Resolution (m)</th>
<th>Bands Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALOS PRISM</td>
<td>110/3730</td>
<td>13 April 2007</td>
<td>2.5</td>
<td>Panchromatic</td>
</tr>
<tr>
<td>ALOS AVNIR-2</td>
<td>103/3750 98/3770</td>
<td>13 April 2007 5 June 2007</td>
<td>10</td>
<td>4,3,2</td>
</tr>
<tr>
<td>Landsat 7</td>
<td>118/66 119/65 122/64</td>
<td>10 May 2005 17 April 2005 15 May 2005</td>
<td>30, 15</td>
<td>7,4,2, dan 8</td>
</tr>
</tbody>
</table>

Ancillary data: topographic map 1: 25,000
lad cover map 1: 250,000 (2000)
Analysis

- The Interpretation of imageries used visual interpretation supported by secondary data and field surveys. The interpretation of rice field features recorded on the ALOS PRISM and AVINIR-2 was directly digitized on the computer screen which was iterated at the various scales.

- The use of the visual interpretation in this study considers the following reasons:
  - The spatial variation of land cover at the rice fields varies in close distance. This condition is due to the different time of rice planting.
  - The database of rice field areas is developed on the basis of vector format.
  - The editing of vector data resulted from the conversion of raster data extracted from the satellite imageries is time consuming.

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Analysis

- The digitizing feature of imageries used ArcGis ver. 9.2 and was conducted after the iteration (by zooming in or zooming out) of image display on the computer reaches the optimal scale.
- The results of digitizing feature were saved into SHP files which were used to calculate the rice field areas.
The contrast, roughness, and detail features of digital satellite remote sensing data are determined by spectral and spatial resolution. The spectral resolution determines the detectability of electromagnetic wavelength to detect features on the earth surface. The spatial resolution of imagery relates to map scale. The higher spatial resolution of imagery, the more detailed scale of map.

In this study, the display of ALOS PRISM with the spatial resolution of 2.5 m reaches the optimal scale of 1:5,000, while that of ALOS AVNIR-2 (combination of band 4,3,2) with the spatial resolution of 10 m reaches the optimal scale of 1:25,000. At the scale of 1:1,000, the pixels of ALOS PRISM start broken. For ALOS AVNIR-2, the pixels start broken at scale 1:1,5000.
IMAGE DISPLAY OF ALOS PRISM

1:25,000  1:10,000  1:1,000  1:5,000
IMAGE DISPLAY OF ALOS AVNIR–2
(Combination of Band 4,3,2)
Quantitative Method is not a good choice for mapping rice fields at detail scale

- The accuracy of mapping rice fields is mainly affected by the spectral and spatial resolution of images and the interpretation methodology used.
- Each object on the earth surface has different characteristic of spectral reflectance
For mapping rice fields at detail scale, the quantitative method of image interpretation which is based on the reflectance values of objects is not a good choice because the land cover types at the rice field area vary spatially in close distance. This land cover variation which reflects different reflectance values is caused by the different time of rice planting.

Land Cover types at the rice field area:

- Planting preparation (wet soil)
- New Planting (water dominant)
- Vegetative phase
- Generative phase
- After harvesting
- Corns
- Bare soils
Variation of Land Cover Types at the Rice Field Areas

(21 Oct, 2009, Cianjur)
- Trees
- Corn
- Generative phase

(20 Oct, 2009, Cianjur)
- Trees/Coconuts
- Planting preparation

(13 June, 2009, Cianjur)
- Vegetative phase
- After harvesting

(24 Oct, 2009, Subang)
- Generative phase
- After harvesting
- Planting preparation

(21 Oct, 2009, Cianjur)
- Trees
- Vegetative phase
- After harvesting
Variation of Land Cover Types at the Rice Field Areas

(13 June, 2009, Jember)
Vegetative phase
New planting
Bare soils

(17 August, 2009, Sragen)
Vegetative phase
After harvesting

(23 Oct, 2009, Subang)
New planting
Vegetative phase
Bare soils

(21 Oct, 2009, Cianjur)
Generative phase
After harvesting
Bare soils
a) ALOS AVNIR-2 daerah kabupaten Sragen, 1: 25,000

b) ALOS PRISM daerah kabupaten Subang

c) ALOS AVNIR-2 daerah kabupaten Jember, 1: 25,000

d) Landsat ETM daerah kabupaten Sragen, 1: 100,000

INCREASING ACCURACY
<table>
<thead>
<tr>
<th>No.</th>
<th>Districts</th>
<th>Data Source</th>
<th>Rice Fields (ha)</th>
<th>Settlements (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sragen</td>
<td>Landsat 7</td>
<td>65,920.52</td>
<td>11,806.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALOS AVNIR-2</td>
<td>44,138.88</td>
<td>21,585.46</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area changes (%)</td>
<td>- 33</td>
<td>+ 83</td>
</tr>
<tr>
<td>2.</td>
<td>Jember</td>
<td>Landsat 7</td>
<td>73,801.82</td>
<td>26,211.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALOS AVNIR-2</td>
<td>71,703.34</td>
<td>44,397.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area changes (%)</td>
<td>- 3</td>
<td>+ 69</td>
</tr>
<tr>
<td>3.</td>
<td>Subang</td>
<td>Landsat 7</td>
<td>79,704.94</td>
<td>11,631.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALOS PRISM</td>
<td>75,705.60</td>
<td>13,289.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area changes (%)</td>
<td>- 5</td>
<td>+ 14</td>
</tr>
</tbody>
</table>

The rice field areas interpreted from ALOS PRISM and AVNIR-2 are smaller than that from Landsat 7 due to the generalization factor.
CONCLUSIONS AND SUGGESTIONS

- Alos PRISM and ALOS AVNIR-2 can be used for rice field mapping at the scales of 1,5000 and 1: 25,000 respectively, particularly at the areas with the flat topography and no cloud cover.
- These two imageries are able to detect the smaller features (settlements) that cannot be detected by Landsat 7. This better detectibility of ALOS imageries results in the increase of rice field area accuracy. The settlement features around the rice field areas that cannot be detected by Landsat 7 can be separated by ALOS PRISM/ALOS AVNIR-2.
- The use of ALOS PRISM/AVNIR-2 for rice field mapping using visual interpretation is a good choice, considering that the land cover at the rice field areas vary spatially in close distance.
- Because of the detectibility of ALOS AVNIR-2 due to land cover variation at the rice field areas, this imagery is potential for monitoring rice production using the quantitative method.
- The visual interpretation is a practical way for systematic rice field mapping rather than quantitative method.
Thank You

Terima Kasih