APPLICATION OF LANDSAT TM AND MULTITEMPORAL JERS-1 SAR IMAGES FOR PADDY FIELD IDENTIFICATION:

A Case Study at Cidanau Watershed, Banten-Indonesia

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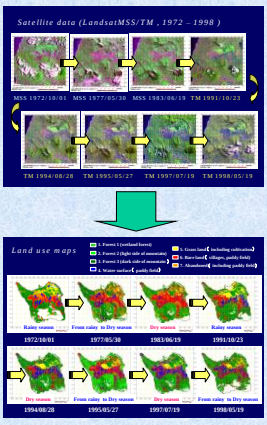
STUDY AREA

Cidanau Watershed (red boundary)
BANTEN PROVINCE, INDONESIA

Flat area, in the middle of watershed 100 m above the sea level



BACKGROUND

PREVIOUS STUDY (Baba & Tsuyuki, 2000):

Water resources quantity and quality degradation.

no significant land use/ land cover changes during 1972-1998

Land-use/land cover is not a single contributed factor

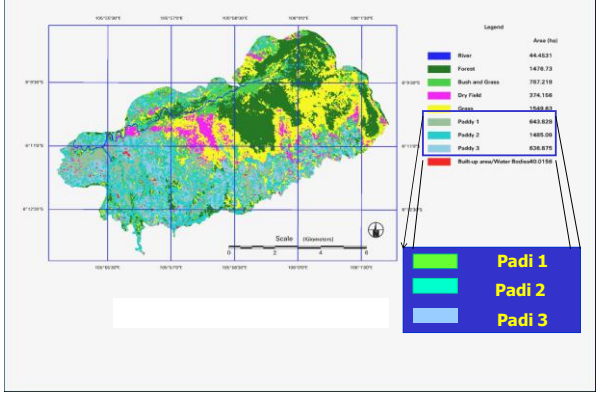
Land-use intensification, Paddy field

Baba and Tsuyuki (2000) have concluded also that Landsat TM alone is not able to differentiate paddy field with water body and grass

Related to characteristic of paddy field and the way of farmer in Indonesia/Rawadanau to plant paddy

small size area per land parcel and apply successive planting

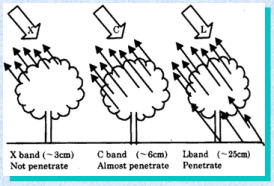
Land-use/land cover based on Landsat 1997



1. How to investigate land-use intensification ?
2. How to overcome difficulties to monitor small parcel of paddy field using successive planting ?

APPLICATION OF JERS-1 SAR L BAND

JERS-1 L Band (RADAR) advantages



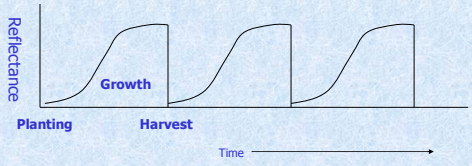
5 meter resolution

RADAR penetrate canopy of vegetation

Reflectance of RADAR influenced by biomass of vegetation and soil surface roughness

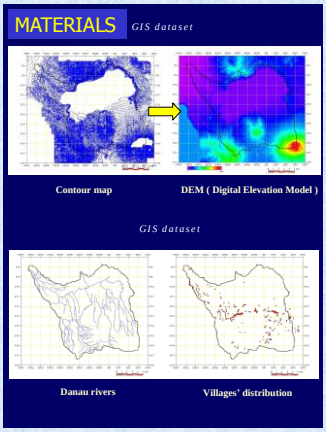
Reflectance influenced by agricultural activities : harvesting, planting,land preparation etc

Paddy field :
decrease and increase of reflectance during one year period
Idle Land (Water, Bareland, Grass, Bush) :
Steady or increase value of reflectance during one year period



Objective

Develop a technique :
Combination of Landsat (optical sensor) and JERS-1 L Band (RADAR) for Paddy Field Identification



GIS DATA SET

Topographic maps (DEM)
Rivers, Settlement, Roads,

IMAGERIES

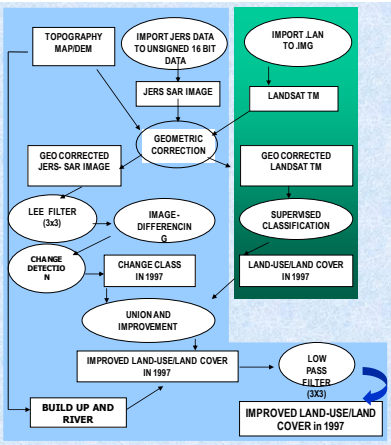
LANDSAT, JERS-1 L BAND

(a) Landsat 1997

(a) 4 January 1997,
(b) 2 April 1997,
(c) 16 May 1997,
(d) 25 September 1997
(e) 8 November 1997

FLOW OF ANALYSIS

- Data Preparation
- Geometric Correction
- Filtering of JERS data
- Determine changes (Thressholding 1 SD)
- Union Landsat analysis with JERS analysis result
- Low pass Filtering

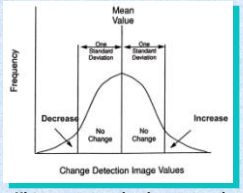


- **JERS-1 SAR Image-differencing,**

$$Dx_{ij}^{k}(t_1,t_2) = x_{ij}^{k}(t_2) - x_{ij}^{k}(t_1) + C$$

Where $Dx_{ij}^{k}(t_1,t_2)$ is differential image, $x_{ij}^{k}(t_1)$ and $x_{ij}^{k}(t_2)$ are images acquired at date t_1 and t_2, and C is a scalar. C is maximum value of 16 bit data (65536)

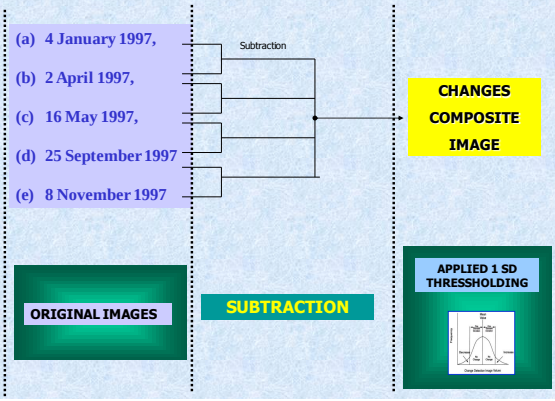
- **Threshold Value**



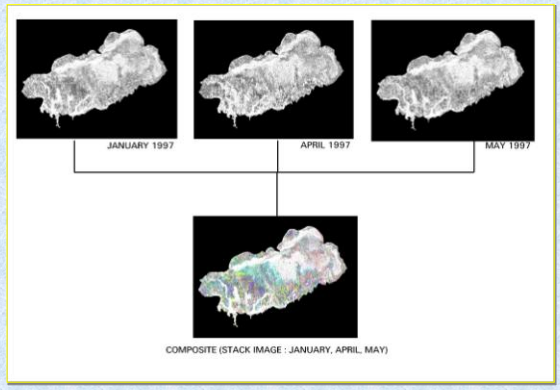
Change threshold of one SD value below and above the mean are selected

Histogram curve, showing mean and one SD threshold (modified from Lunetta and Elvidge, 1999)

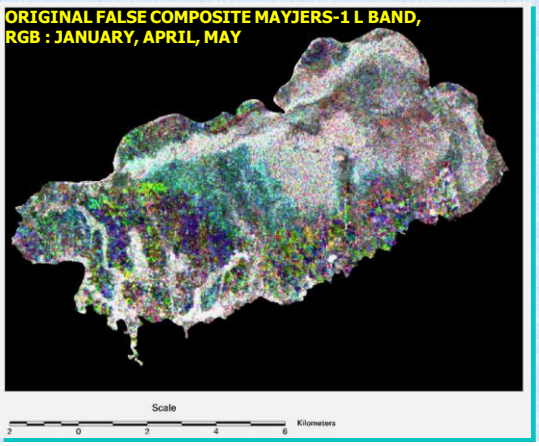
FLOW CHANGE ANALYSIS OF JERS-1 L BAND



ORIGINAL AND ITS COLOR COMPOSITE IMAGE

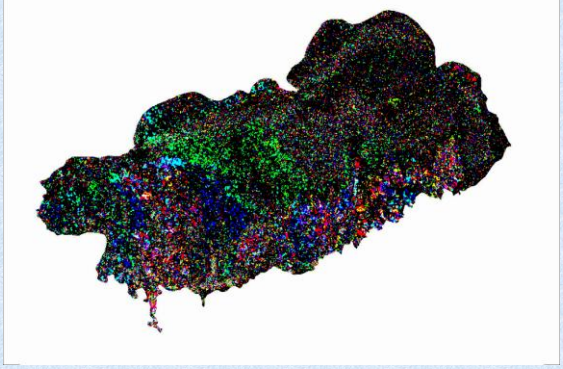


ORIGINAL FALSE COMPOSITE MAYJERS-1 L BAND, RGB : JANUARY, APRIL, MAY

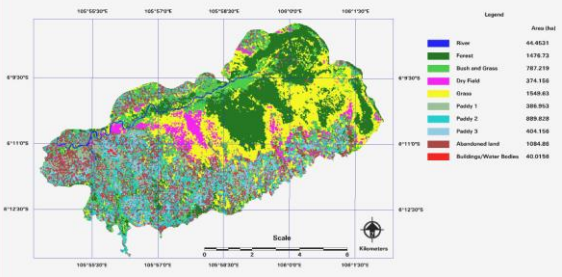


SUBTRACTION COMPOSITE IMAGE

R:G:B = (April-January), (May-April), (September-May)



INFORMATION COMBINATION LANDSAT TM AND JERS-L BAND



		Classified based on Landsat Alone	Classified based on Landsat and JERS
	River	44.45	44.45
	Forest	1476.73	1476.73
	Bush and Grass	787.22	787.22
	Dry Field	374.16	374.16
	Grass	1549.63	1549.63
	Paddy 1	650.64	577.28
	Paddy 2	1489.30	1345.64
	Paddy 3	665.27	585.44
	Unproductive land	0	257.44
	Buildings/Water Bodies	0	40.02

RESULT

1. Area of paddy field detected by Landsat in combination with JERS-1 SAR data is found to be lower than identification result of Landsat alone.

   This is partly explained by the fact that inundated land could be classified as "paddy" by a single Landsat observation data.

2. The methodology is proved to be beneficial for paddy field estimation, even though the parcel size of paddy field is small and farmers are practicing successive planting.

3. However, some improvement and further validation should be taken. Improvement of the method will be directed to detect the level intensification of the paddy field cultivation. To do this, up to date and time series Radar SAR data should be available within a year.

4. The more accurate estimation of land-use area and its utilization intensity could assist in understanding the process of water resources and wetland ecosystem degradation.

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