Mapping paddy rice across Monsoon Asia with ALOS PALSAR

APPLIED GEOSOLUTIONS, LLC

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Introduction

The Food and Agriculture Organization and the World Food Program estimate more than one billion people are currently undernourished. At the same time urbanization is converting cropland to urban land uses under the umbrella of socioeconomic development. Resilient and sustainable agricultural development is critically needed to ensure more self-sufficiency in crop production and to enhance livelihoods in developing countries.

Monitoring of **cropland extent**, **cropping intensity** (single, double, and triple crops), **irrigation**, and **crop production** is required to support food security programs. In collaboration with the Japan Aerospace Exploration Agency (JAXA) Kyoto & Carbon Initiative (K&CI) we are using **ALOS PALSAR** to **map paddy rice** across key regions of Monsoon Asia. Rice represents one of the world's most important crops providing energy to more than a billion people and occupying 11% of arable land. A PALSAR acquisition strategy was developed with a goal of having spatially and temporally consistent data at continental scales with adequate revisit frequency and timing to develop large-area systematic products. While Daichi is no longer collecting satellite observations due to a low load power generation failure, a wealth of data exist in archives for science development and contributions to food security programs.

Objectives

o Overarching goal: utilize ALOS PALSAR to develop operational products to support food security and assess agricultural changes
o **Objectives: map rice extent, cropping intensity**, **crop calendar** across Indochina with multimode ALOS PALSAR

Data & Approach

❑ Multimode & multitemporal L-band SAR obs
❑ Integrate finebeam, Mosaics, Strips

Application flow chart
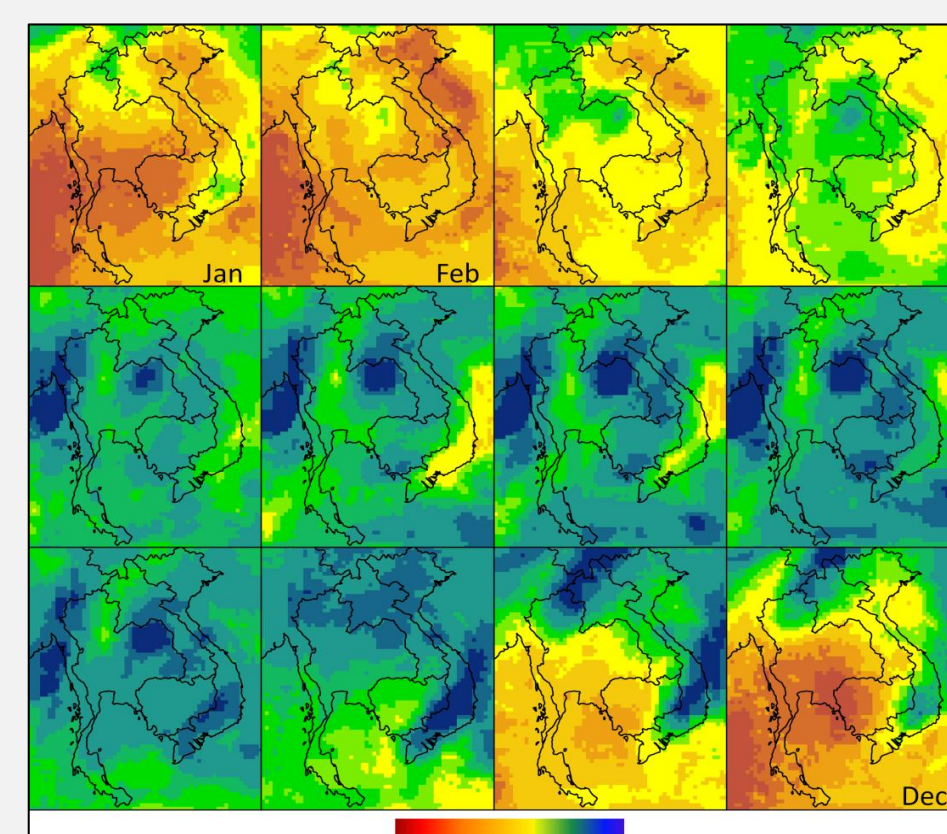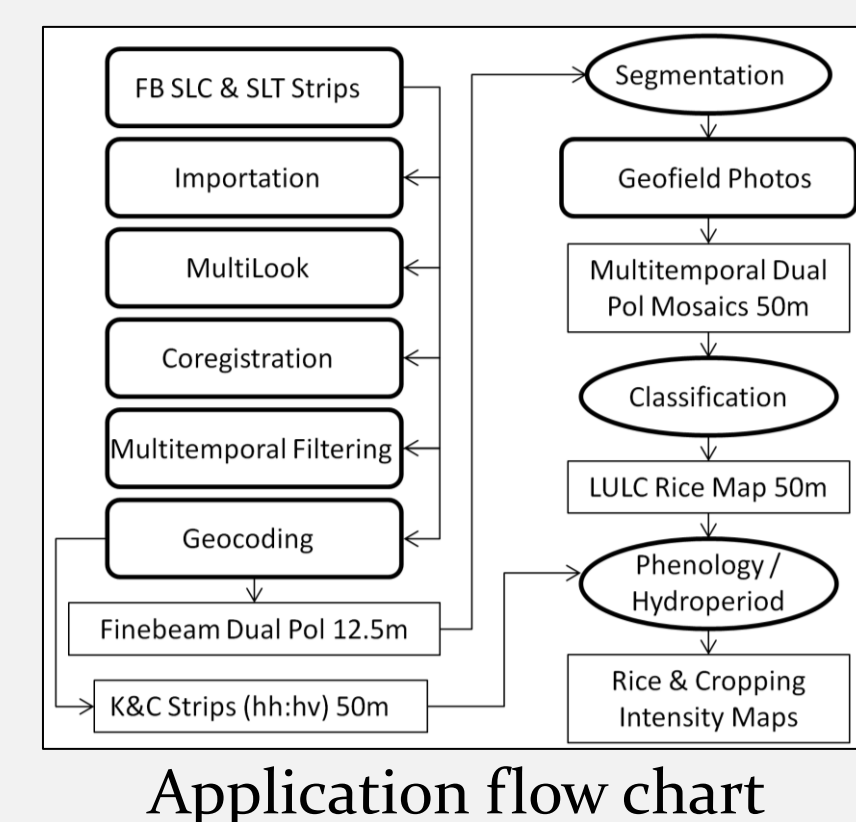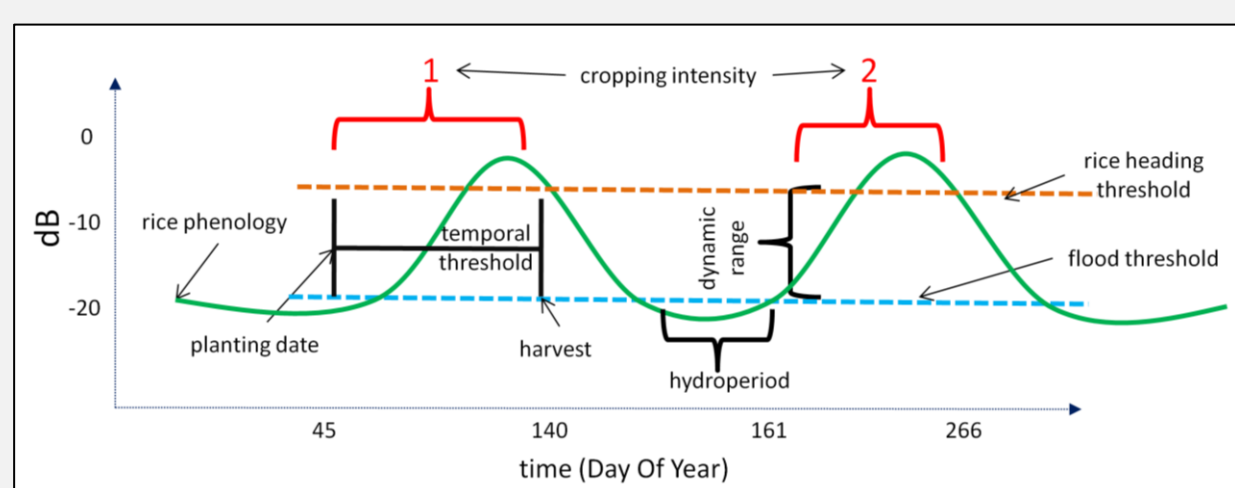
❑ PALSAR sigma nought @ 34.3 incidence angle & key paddy attributes used for mapping
❑ Operational mapping approach feasible by linking known interrelationships between these factors
❑ Mean monthly accumulated precipitation as estimated from TRMM 3B43 used to guide irrigation and crop cycles
❑ A Classification And Regression Tree (CART) based on random forest generated a basic LULC map from dual pol (HH:HV) multitemporal (2008-2009) PALSAR Mosaics (~50m)
❑ Operational thresholding of Slant Range (SLT) K&CI Strips isolated hydroperiod and dynamic range with TRMM & DEM

TRMM PPT estimates

Finebeam & Polarimetric Analyses

❑ Finebeam (FB) single, dual, and quad pol PALSAR used for scaling
❑ FB sites in Cambodia, China, Indonesia, Malaysia, Thailand, Vietnam
❑ Single Look Complex (SLC) used to optimize complete signal
❑ Decomposition routines run to characterize scattering mechanisms
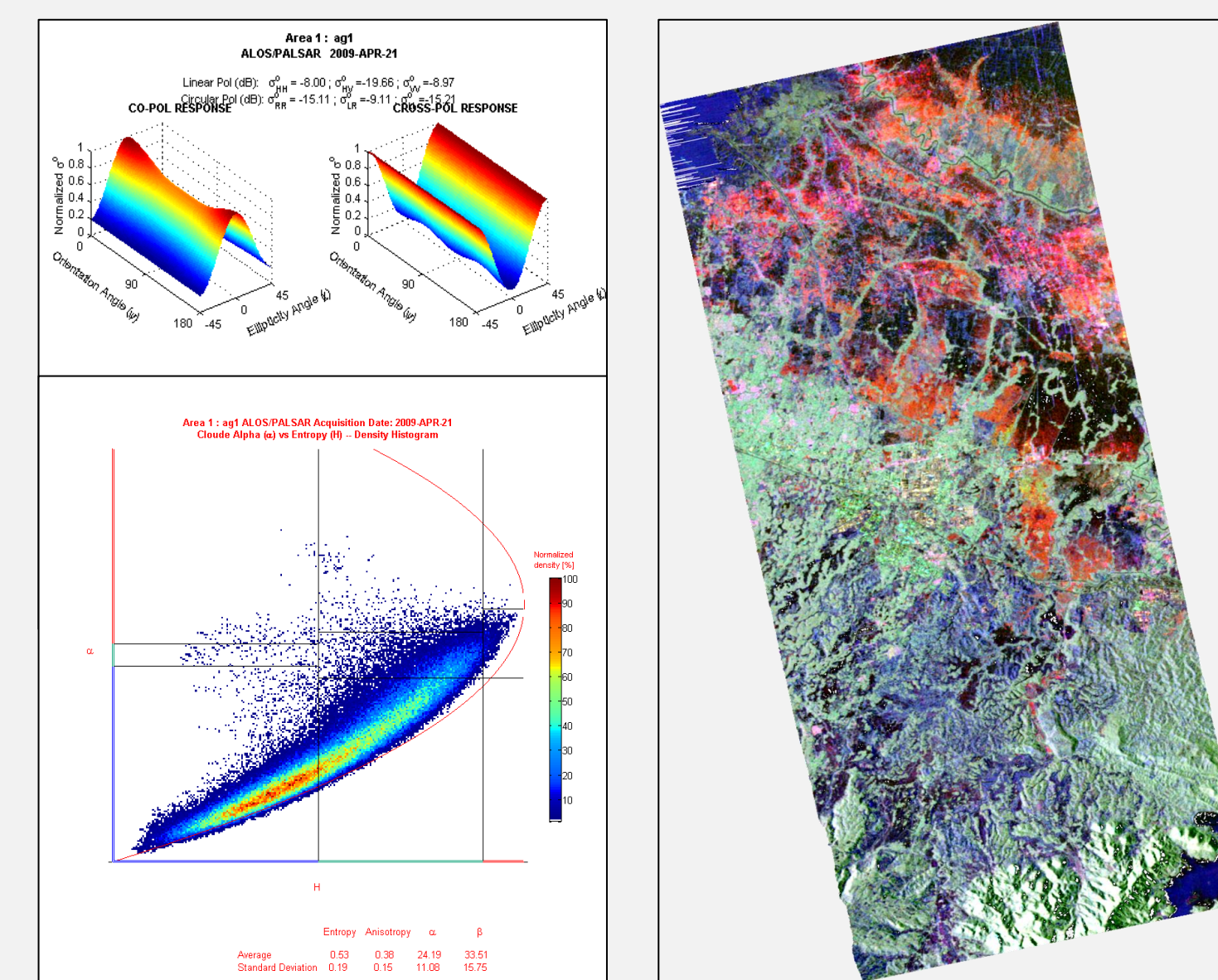❑ Random Forest CART & thresholding approaches executed
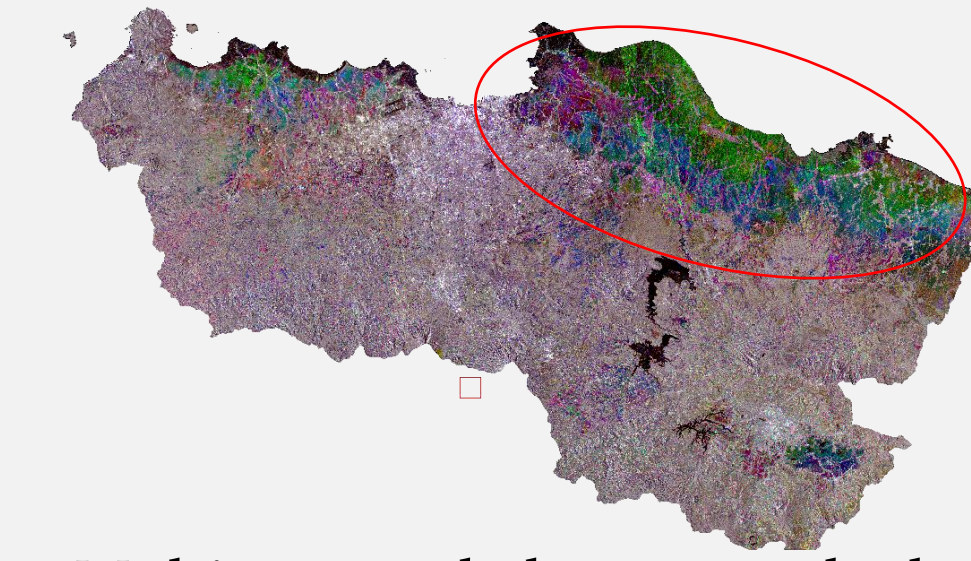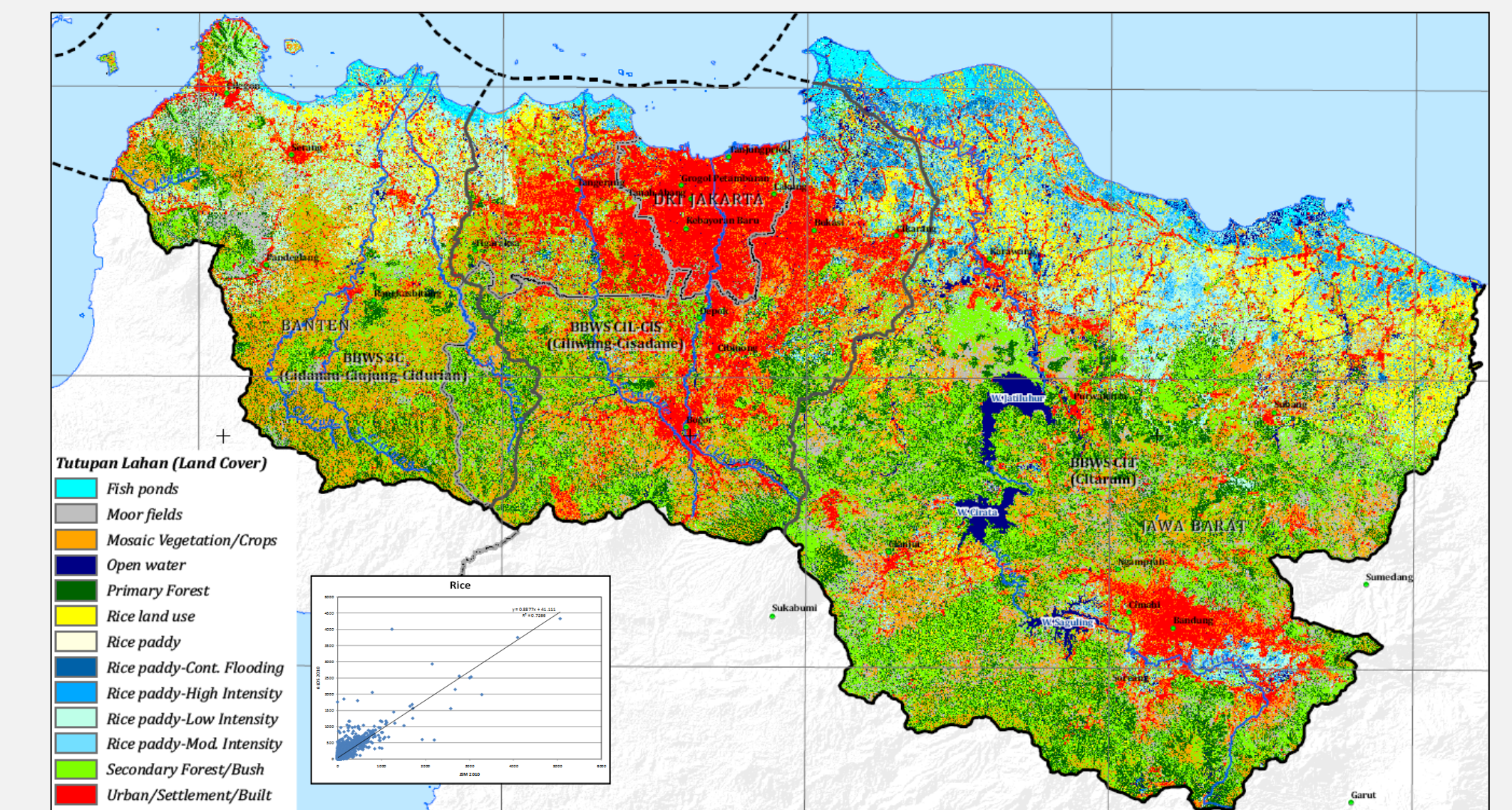
Multitemporal obs capture hydroperiod

Carrying out field surveys across Bangladesh, China, Indonesia, and Thailand.

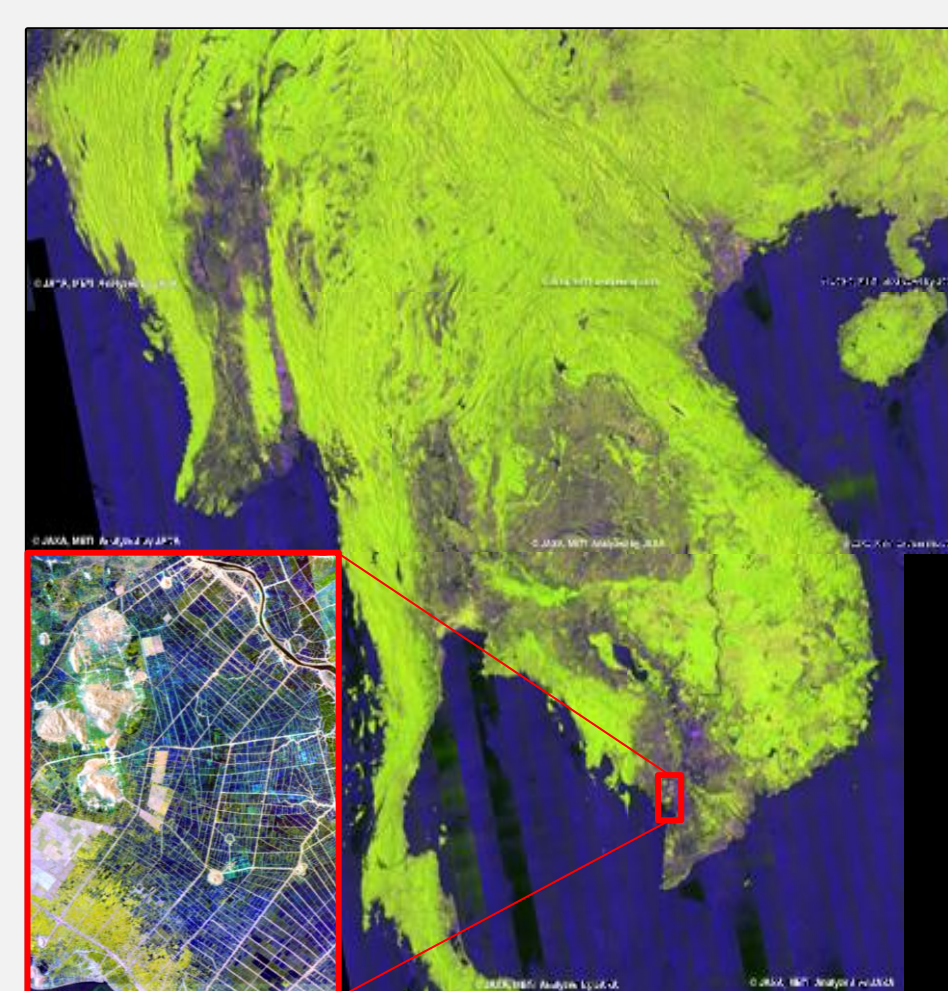Multitemporal finebeam (HH) RGB (DOY: 310, 264, 172).

Scattering profile and decomposition showing R:double bounce, G:canopy, B:rough surface.

CART products generated with FB PALSAR & kabupaten (district) agreement for rice
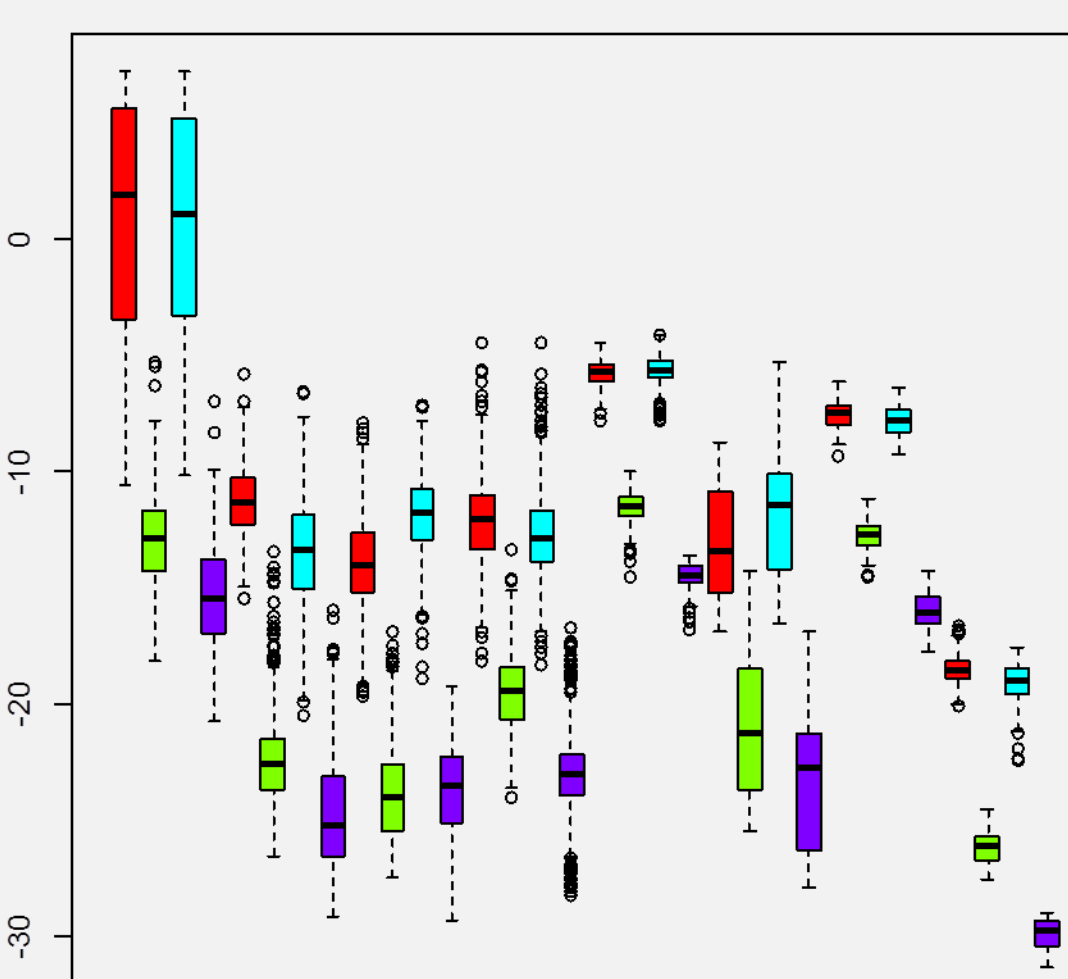
Operational Maps with Palsar Mosaics & K&C Strips
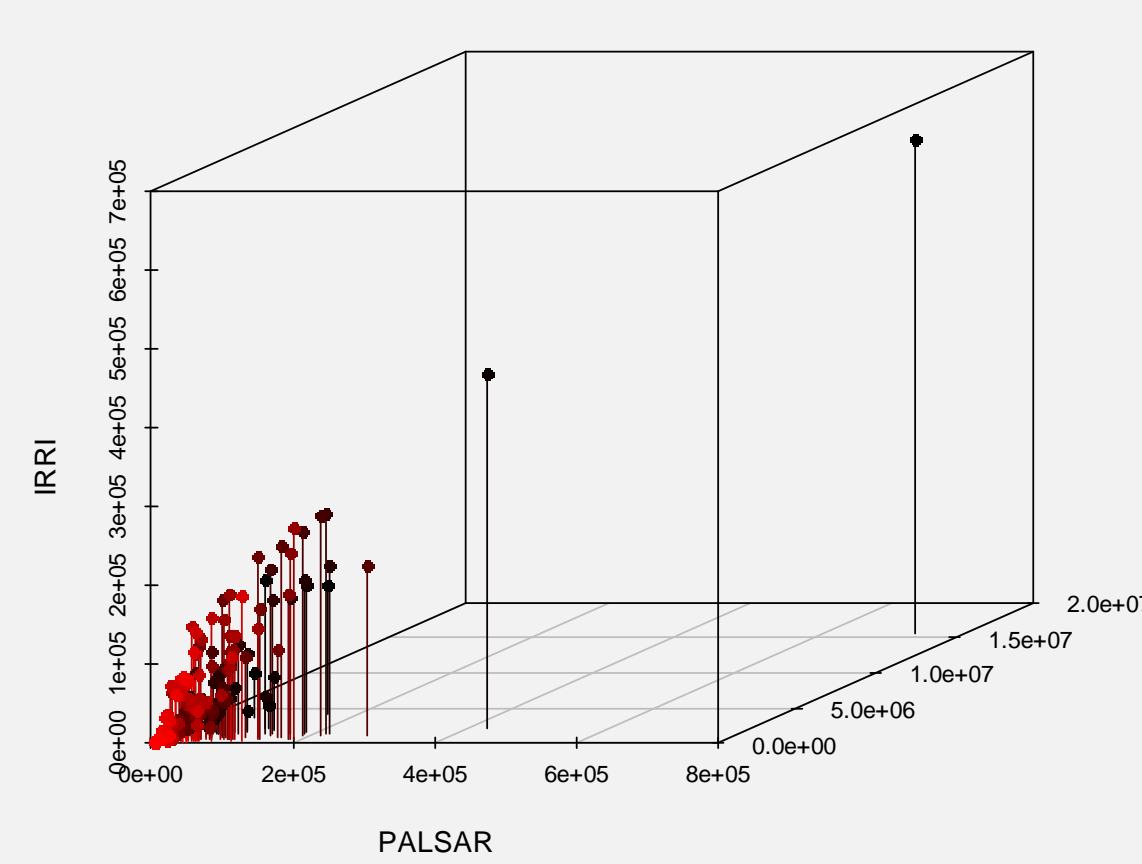
Palsar Mosaics (50m)

Multitemporal (08/09) dual pol (HH:HV) used to map LULC classes. Mekong Delta insert.
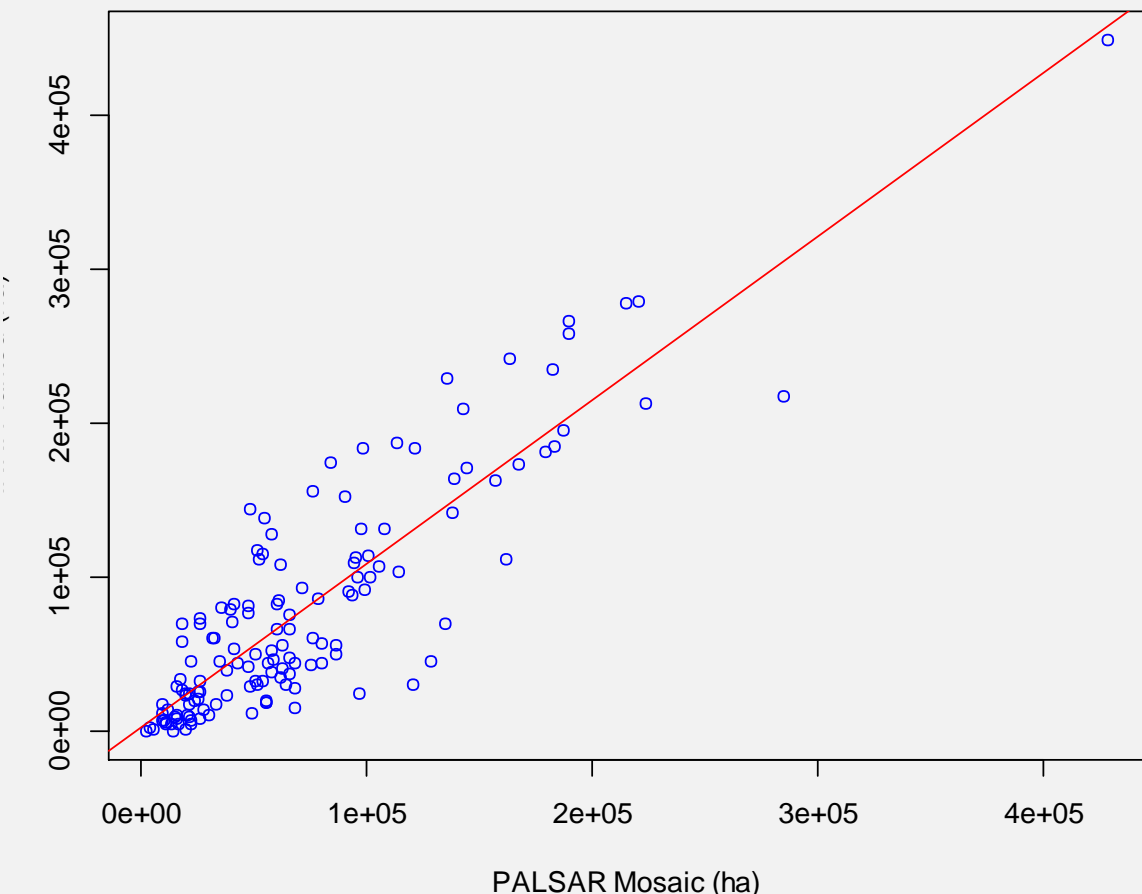
Palsar 50m Mosaic Training Distribution

Box and whisker plot of training classes. Eight major land types are shown by year (08/09) and mode (HH:HV).
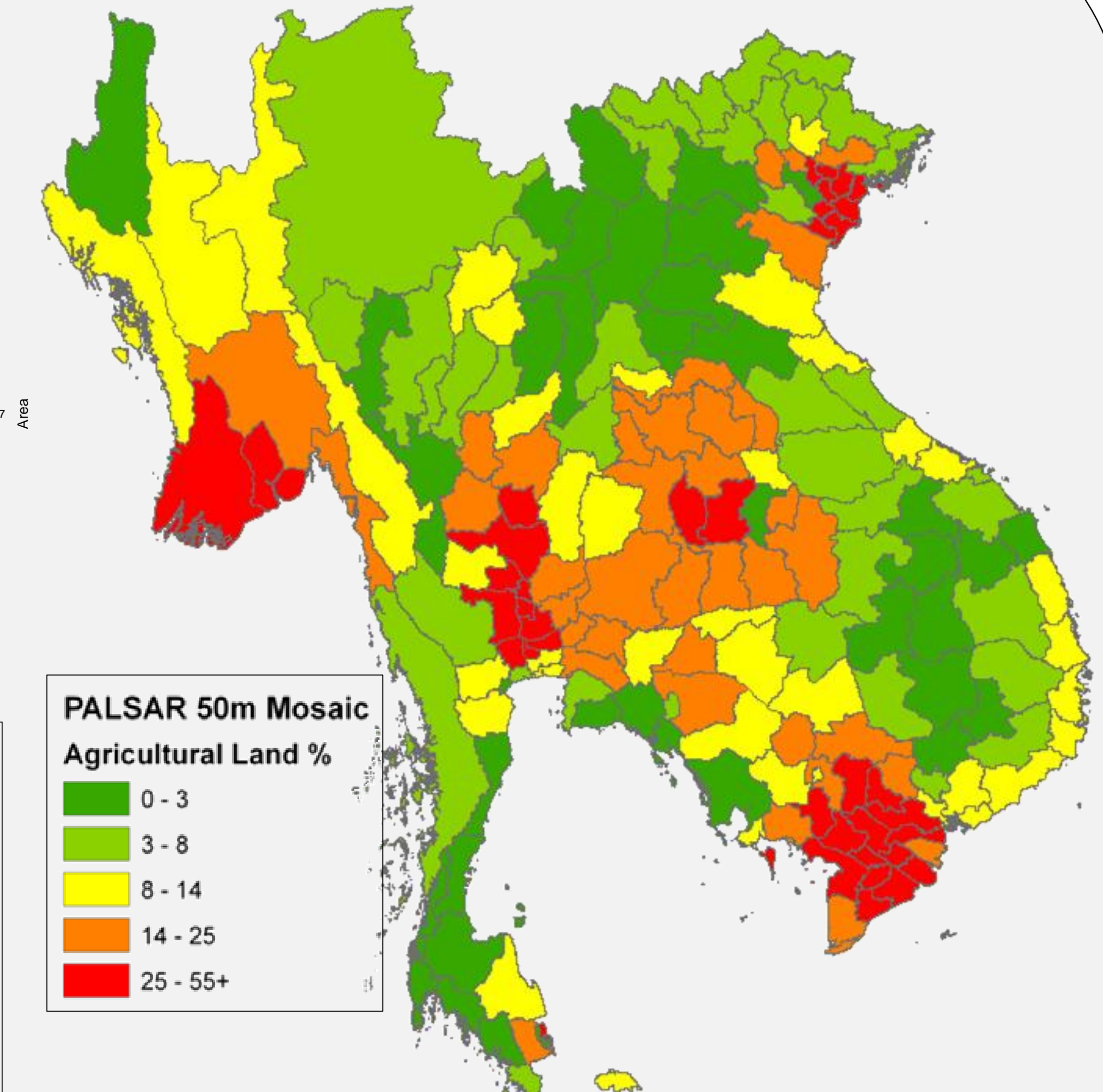
3D Rice Scatterplot

Rice area scatter plot

CART generated LULC map focused on agricultural LULC. Heat map of SLT Strips used to extract dynamic attributes

PALSAR 50m Mosaic
Agricultural Land %
0 - 3
3 - 8
8 - 14
14 - 25
25 - 55+

Assessing and refining large –area classifications, crop calendar, and hydroperiod maps.