

Mapping Land Cover and Land Use in Monsoon Asia through MODIS, PALSAR and Landsat imagery



Xiangming Xiao

Center for Spatial Analysis, University of Oklahoma

<http://www.eomf.ou.edu>

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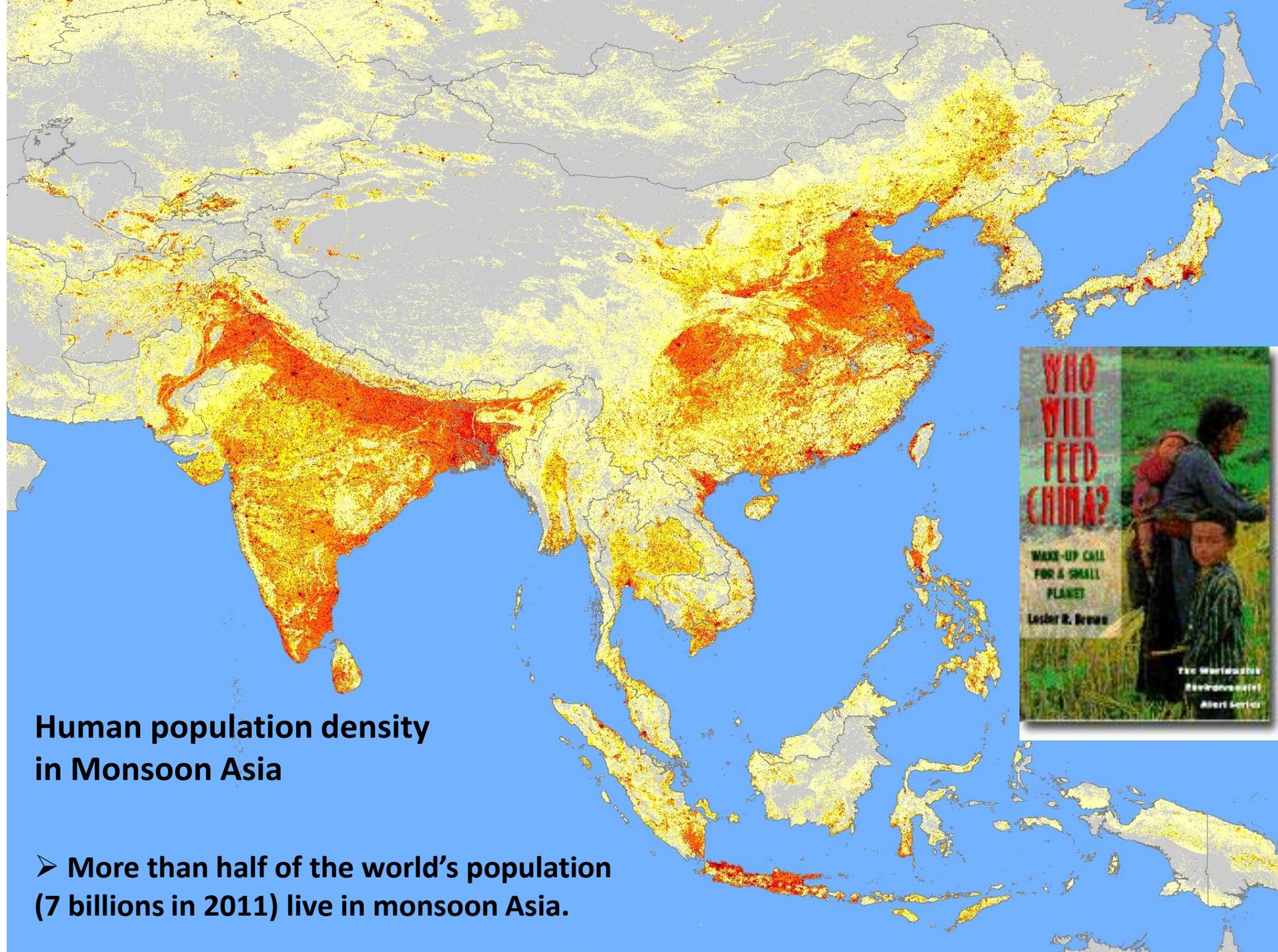
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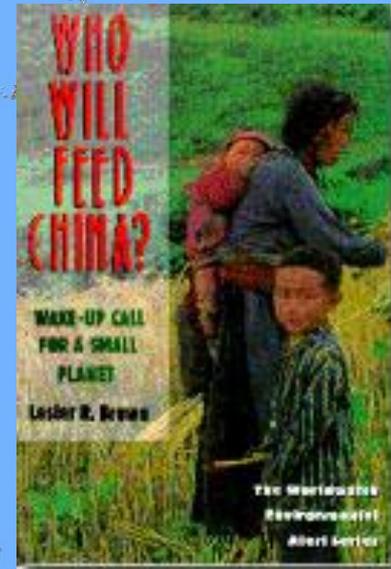
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Manzul Hazarika, Nalin enevirathne





Human population density in Monsoon Asia

- More than half of the world's population (7 billions in 2011) live in monsoon Asia.



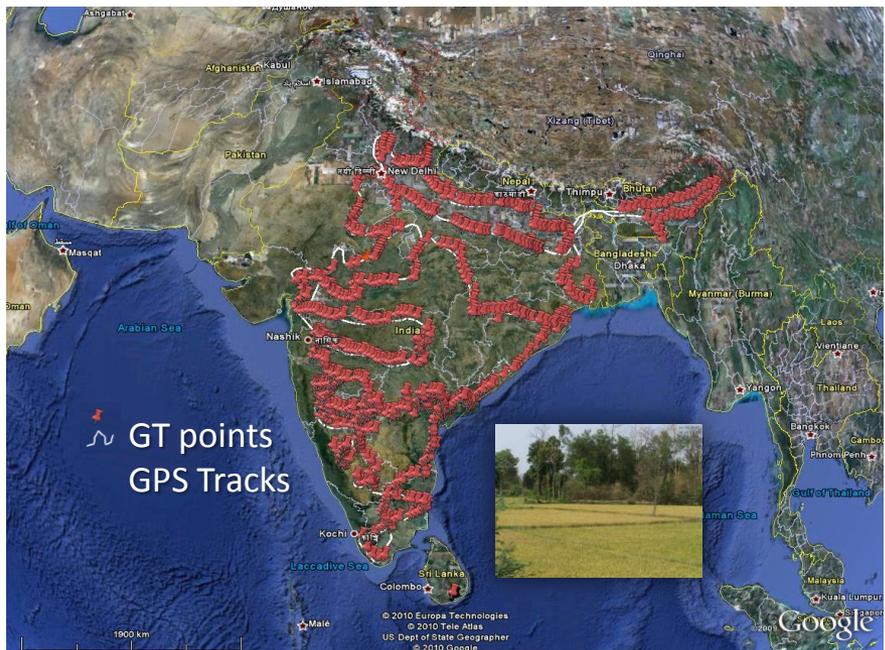
Community Remote Sensing

To engage citizens & socialize pixels

GPS- camera



Geo-tagged field photos



Global Geo-Referenced Field Photo Library - Mozilla Firefox

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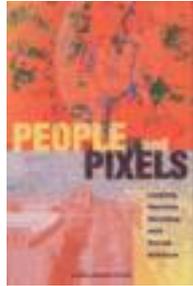
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Support of the Geo-Photo Library to the LCLUC community and citizens

1. Algorithm development
2. Data product validation



A collaboration between EOMF and the IIASA Geo-Wiki project

IIASA Global Land Cover Data Production validation initiative

Cloud-sourcing to label and classify geo-referenced field photos

10546 photos in public at EOMF (available to the community)

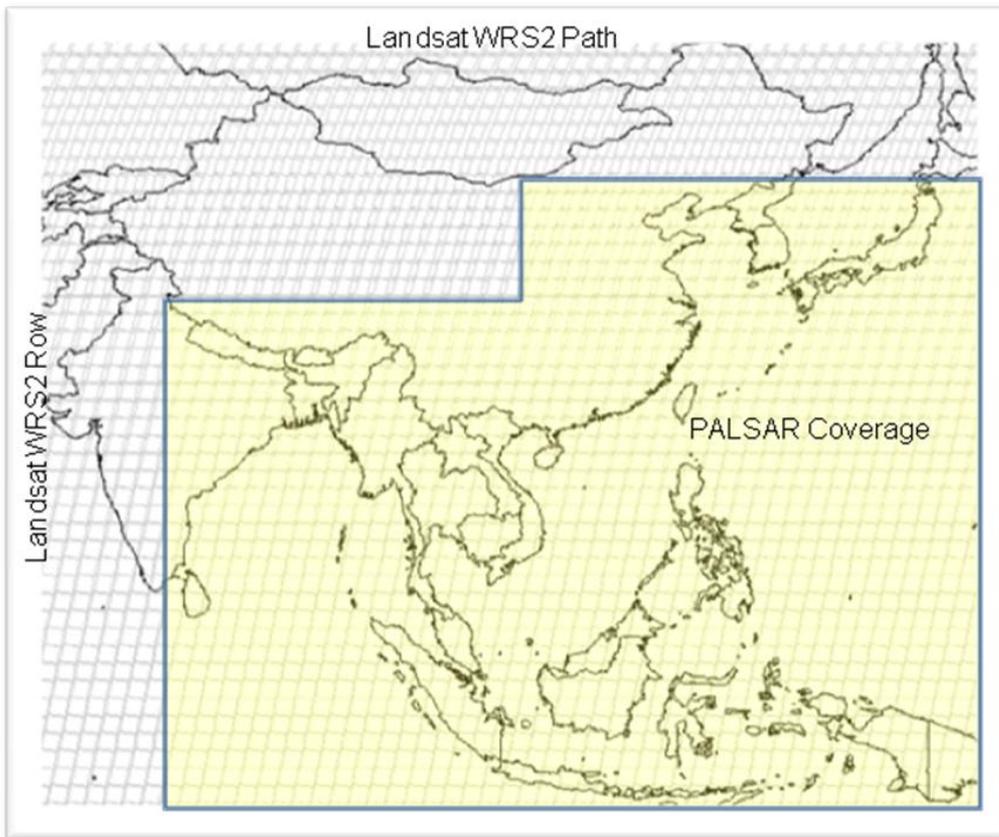


Global Geo-Referenced Field Photo Library

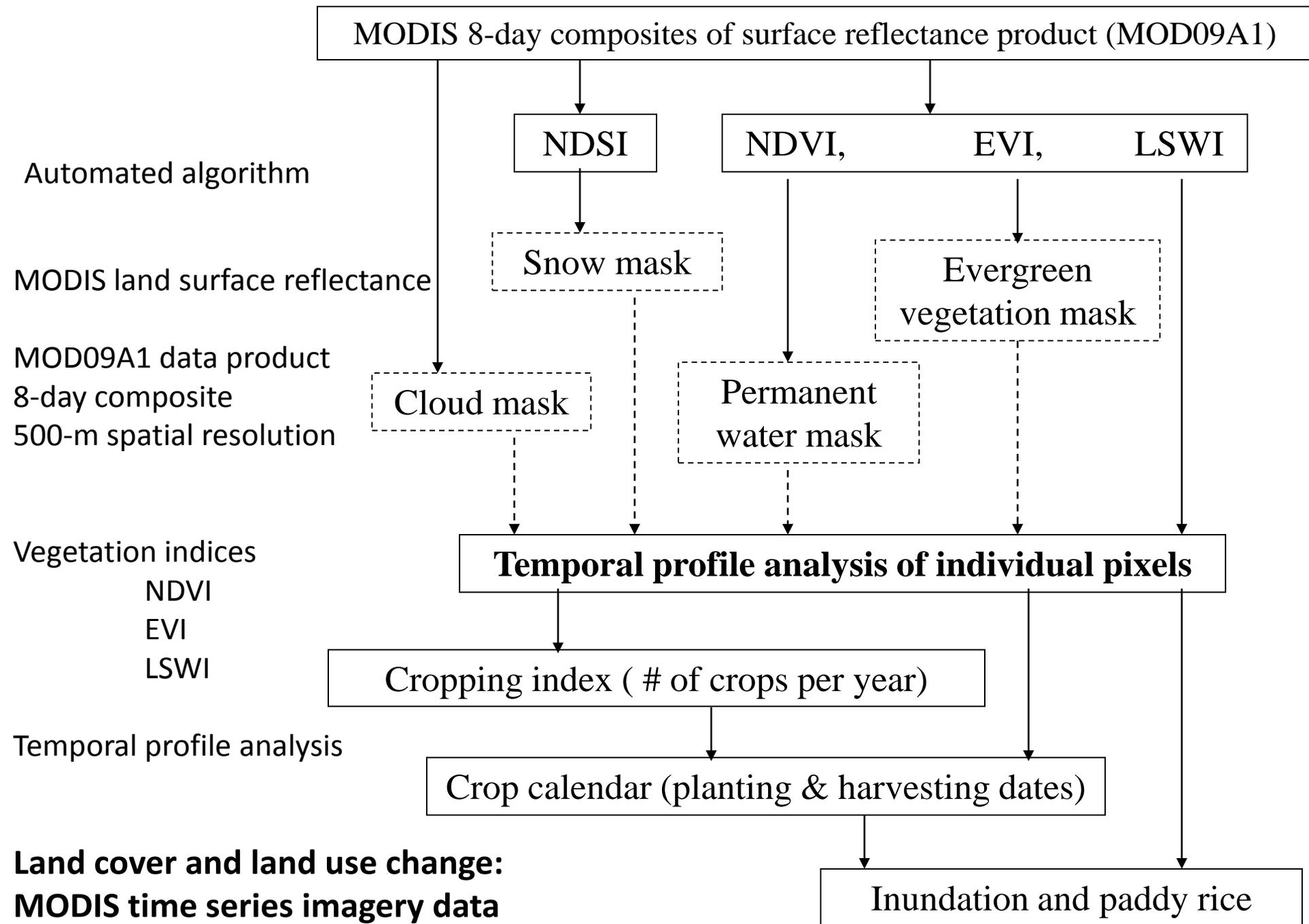


Land cover mapping from multi-sensor imagery at multiple resolutions

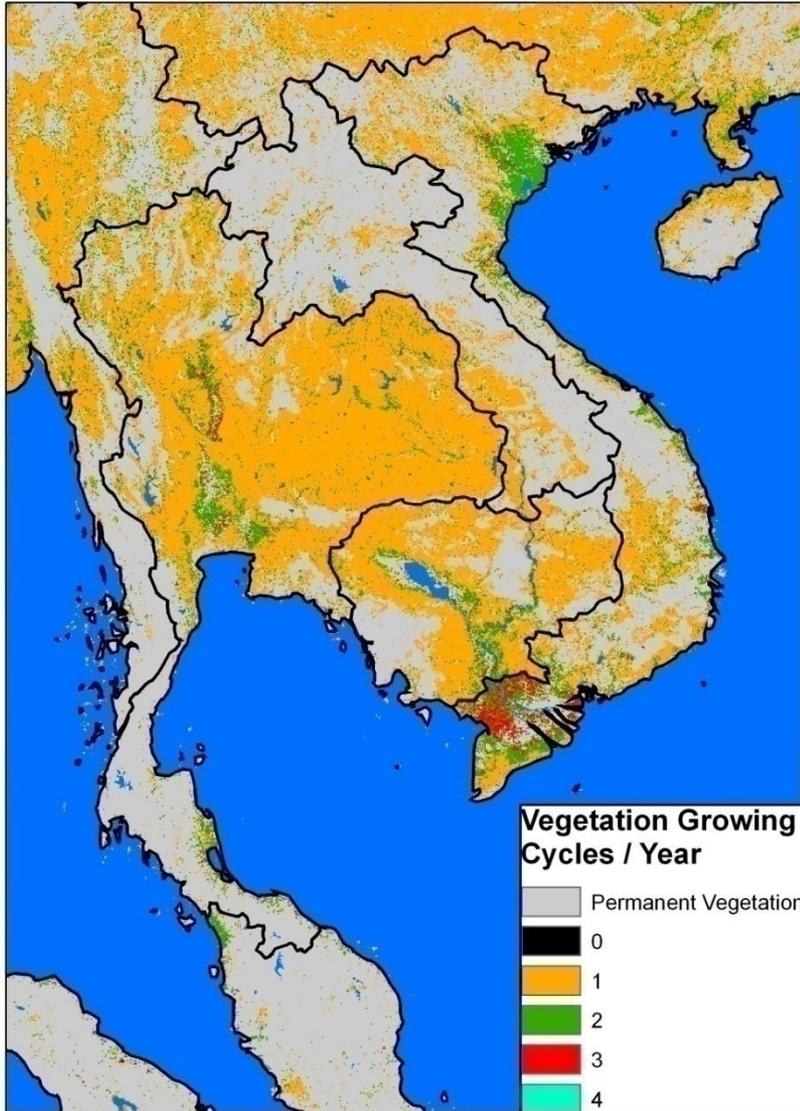
1. MODIS time series data for cropland and forests (500-m, 250-m)
2. PALSAR multiple temporal ScanSAR data for paddy rice agriculture (100-m)
3. PALSAR 50-m mosaic data for cropland and forests (50-m)
4. Landsat, PALSAR and MODIS data for cropland and forest (30-m)



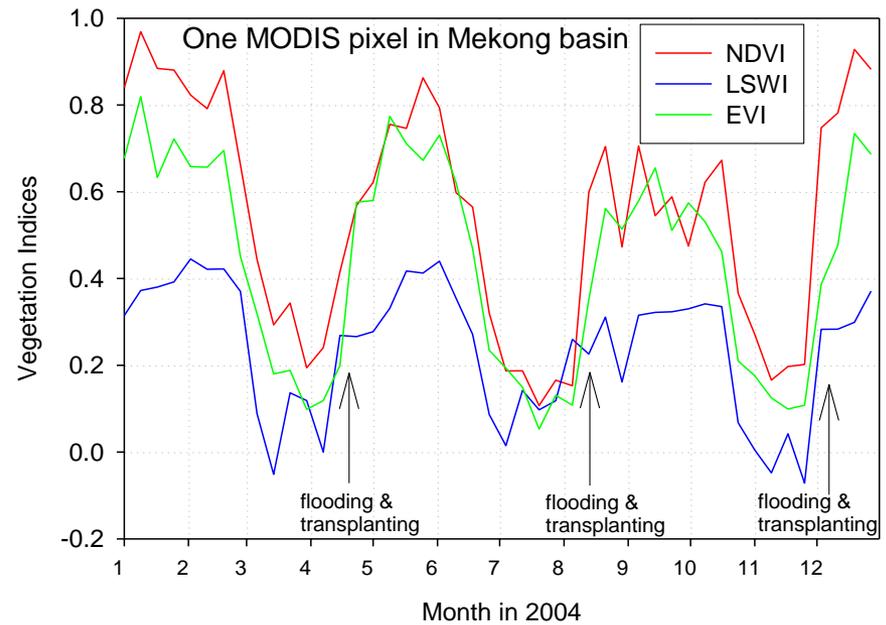
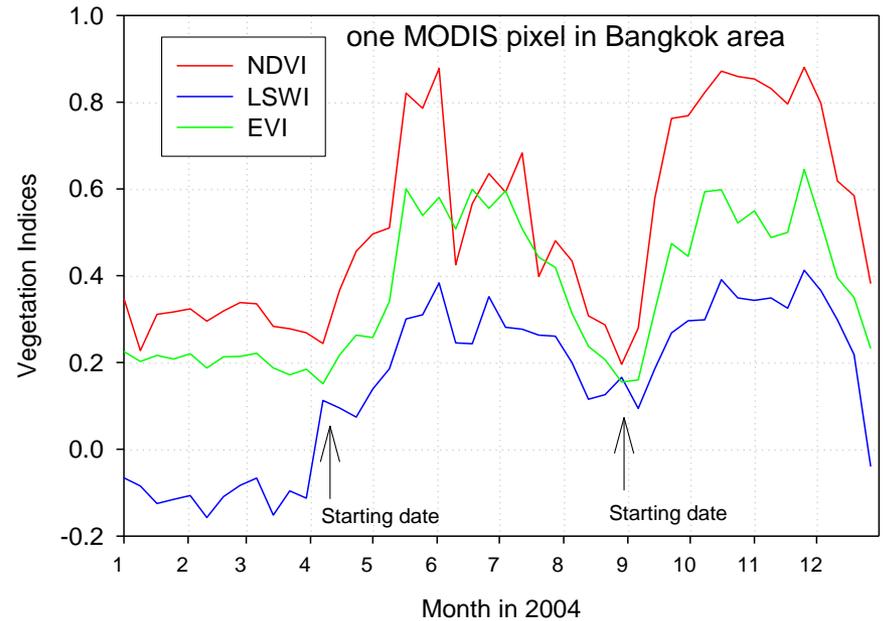
- National land cover dataset
- Fused PALSAR/Optical data
- Automated algorithms
- Support ongoing projects
 - MAIRS
 - Disease ecology
 - Global Irrigation Maps
 - GHG assessments



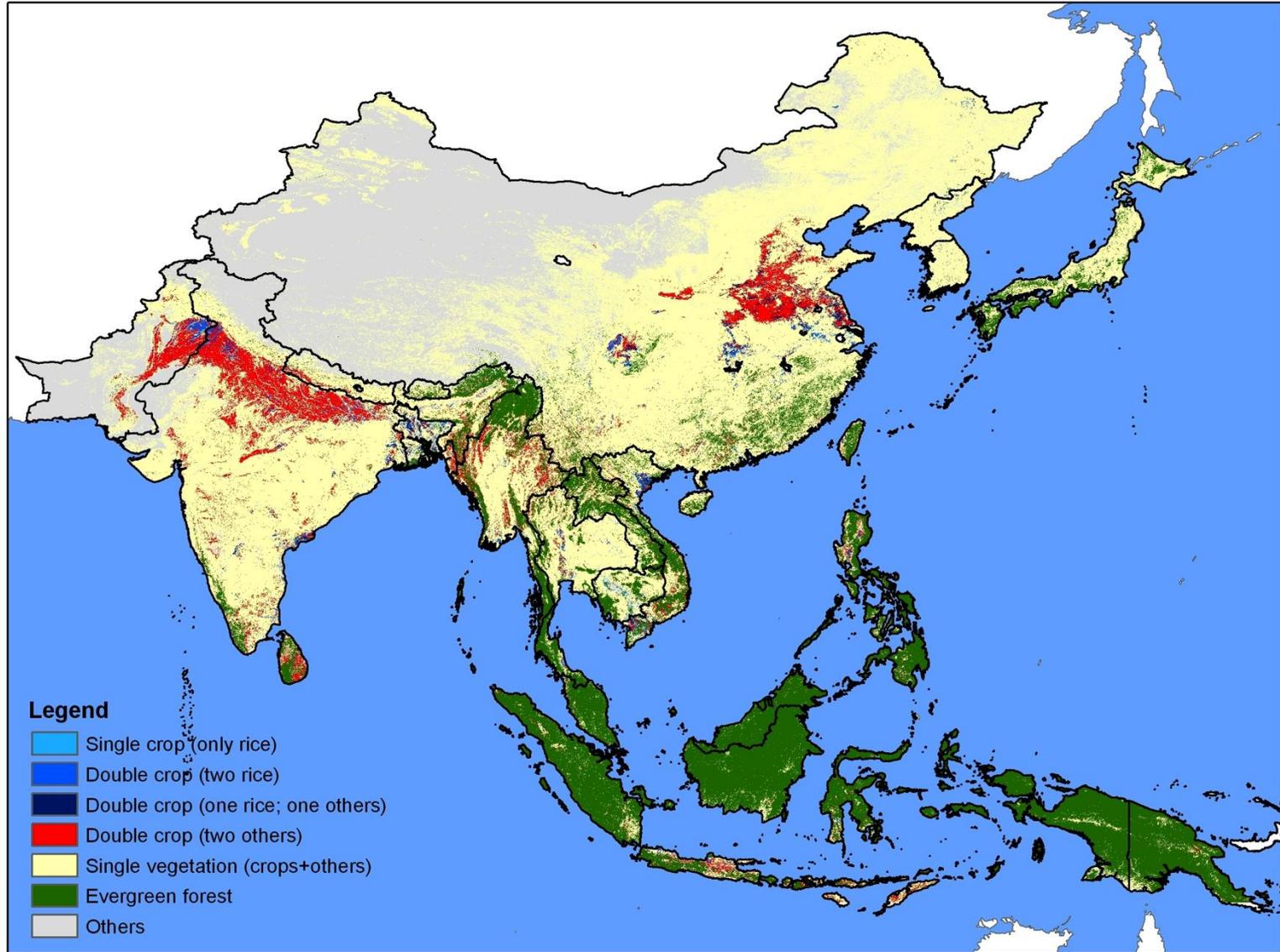
Cropland dynamics and maps: from MODIS



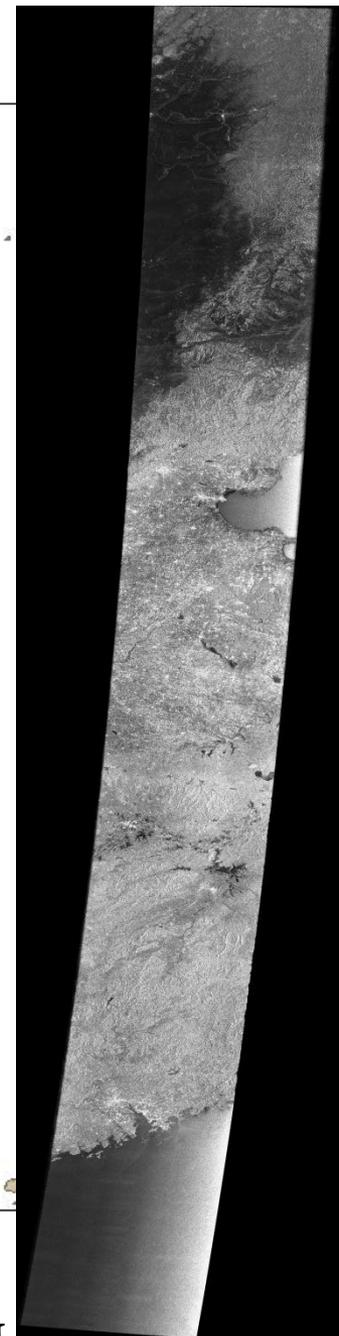
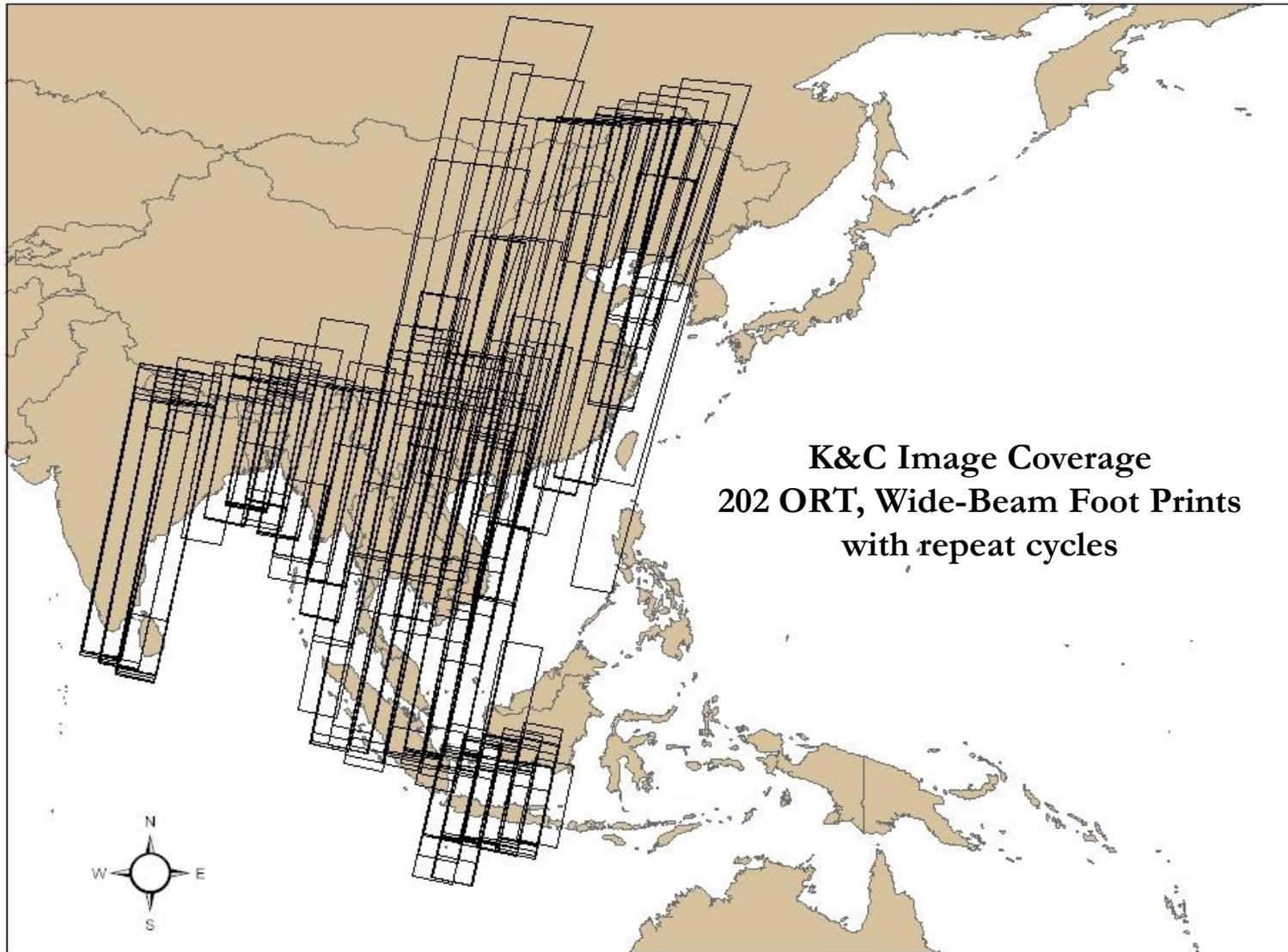
Cropping index map in 2004



MODIS-based map of cropland and evergreen forest in monsoon Asia in 2004

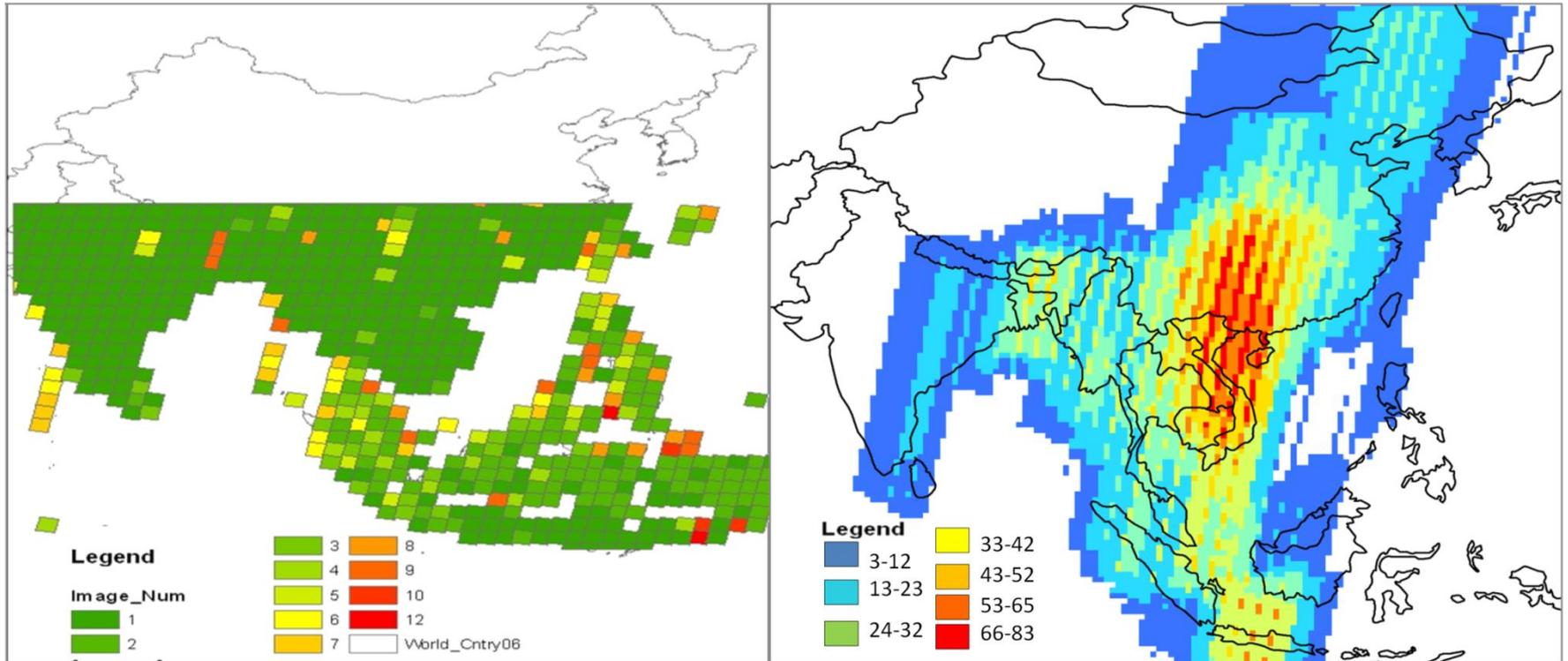


PALSAR ScanSAR image acquisition in JAXA/ALOS K&C Initiative



**ALOS PALSAR K&C Image over eastern Asia (China)
November 11, 2007, ORT, Cycle 15, Path 103; S-N Extent: 16 to 53 N**

Multi-temporal PALSAR ScanSAR imagery



South East Asia GLS2005 Landsat TM/ETM+

South East Asia K&C ScanSAR strips 2007-2009 ORT/SLT

Regional / Local & Large area / Continental Mapping

- Complications from Landsat phenology and Alos viewing geometry for large areas
- Strategically fusing Landsat and PALSAR at multiple scales
- We use regional local scale analysis to scale up to Monsoon Asia. We have focused on five local scales in China, India, Indonesia, Japan, Thailand

Two mapping approaches for integrating PALSAR and optical imagery

➤ **Operational rice monitoring**

- Using sigma nought/gamma threshold approach
- Optical data used as masks/phenology descriptors
- Uses multitemporal JAXA ALOS PALSAR K&C Strips (~75m; HH mode)
- Products include:
 - Rice paddy extent
 - Hydroperiod
 - Cropping Intensity
 - Crop calendar

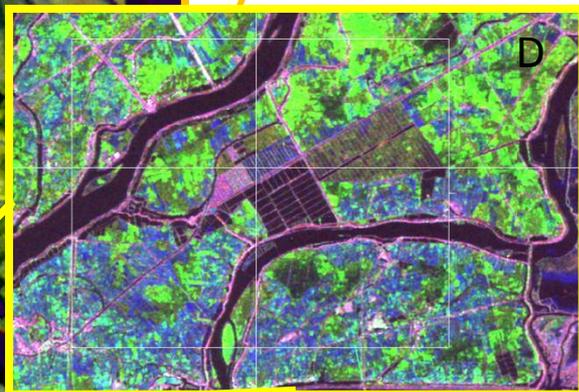
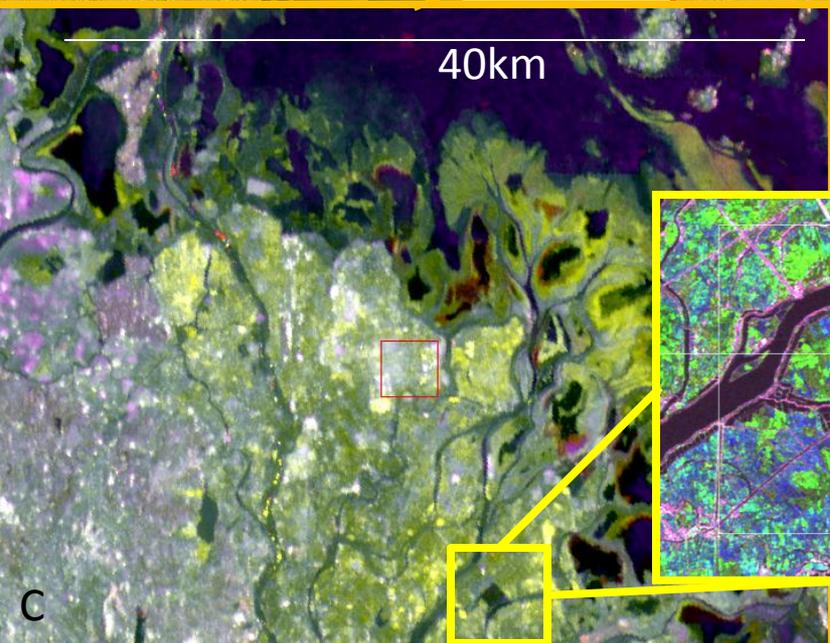
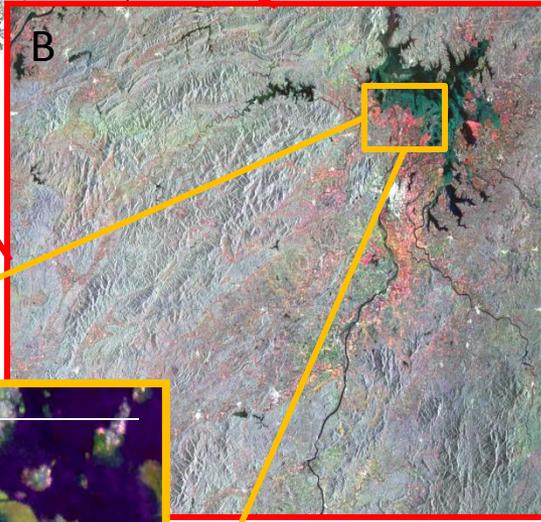
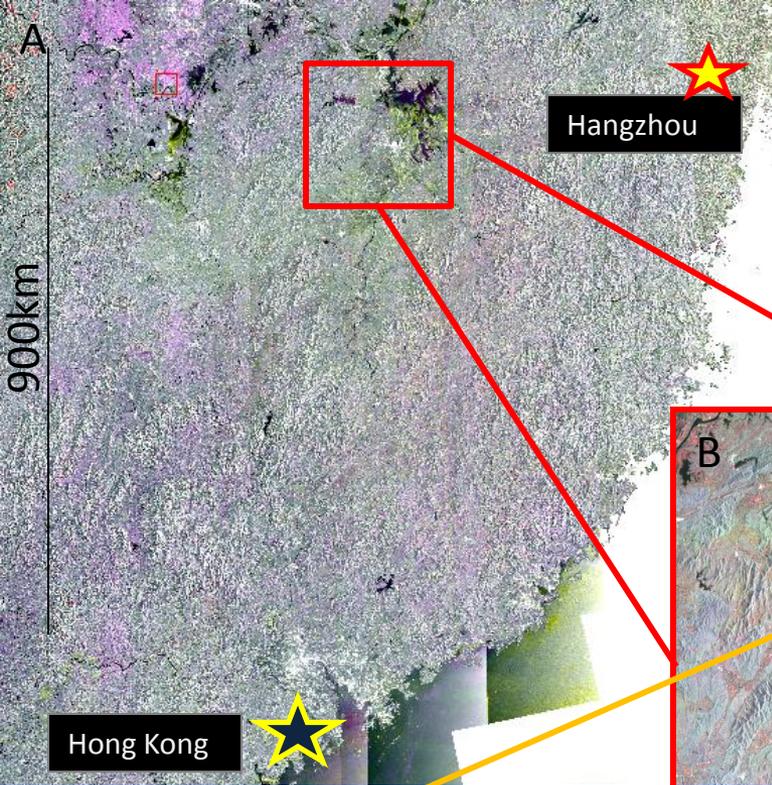
➤ **Decision Tree LULC maps**

- LCCS hierarchical framework using CART algorithm
 - Ranging scales from fine-beam to continental
 - FBS/D/Q @ ~12-15m spatial resolution
 - PALSAR Mosaics (HH:HV) twice a year @ 50m res
 - Integrate Landsat GLS2005 mosaics with PALSAR @ variety of scales
 - K&C Strips & MODIS used for phenology/attributes

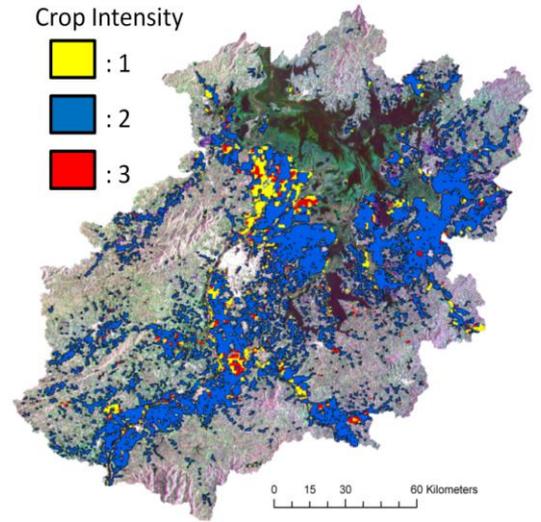
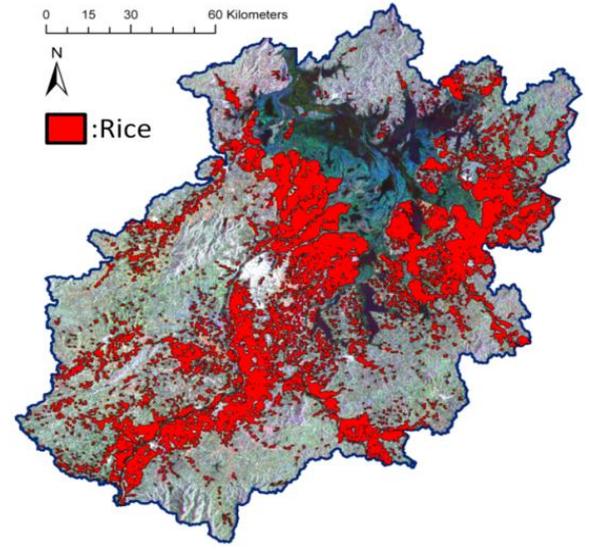
Rice field from multi-temporal PALSAR ScanSAR

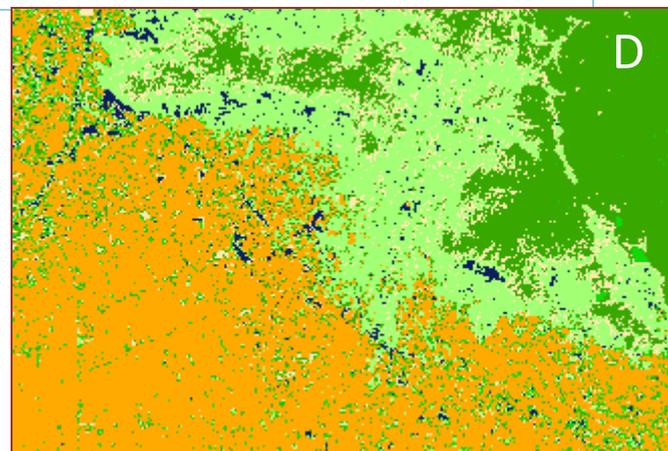
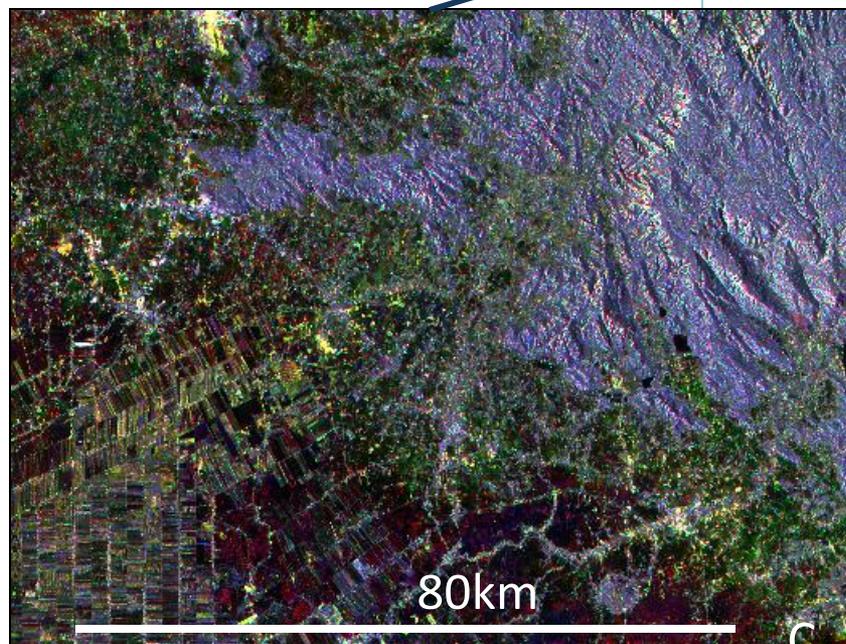
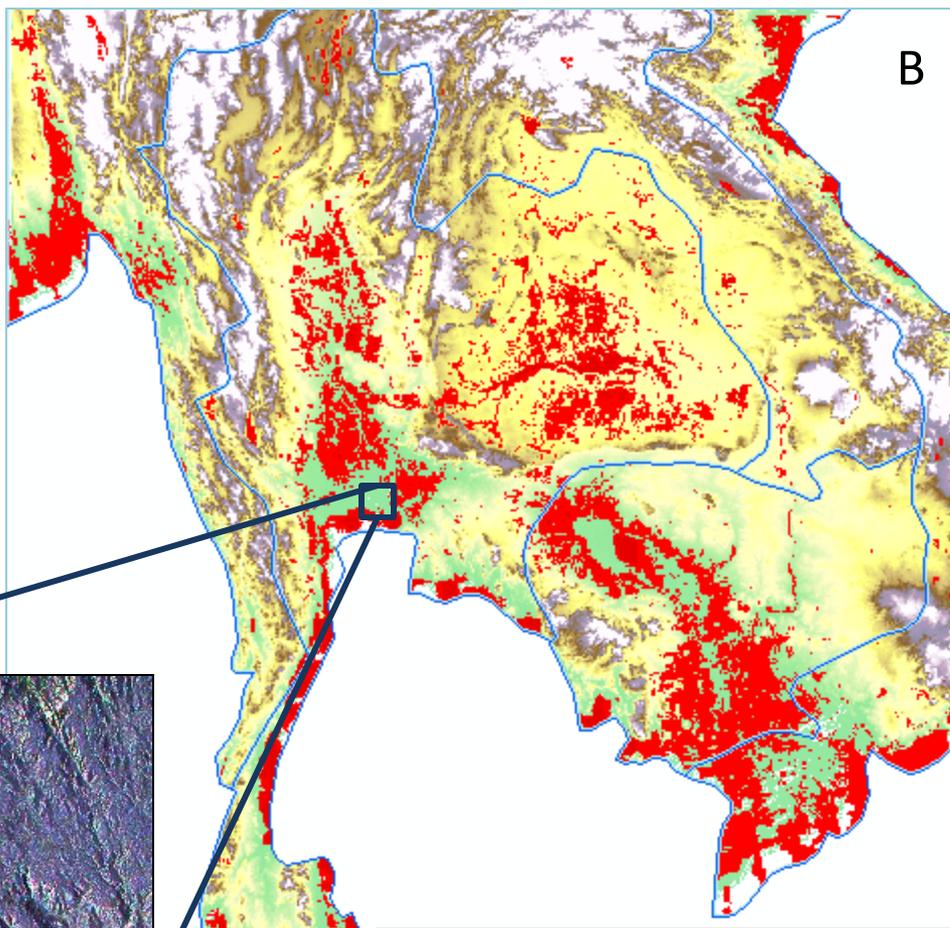
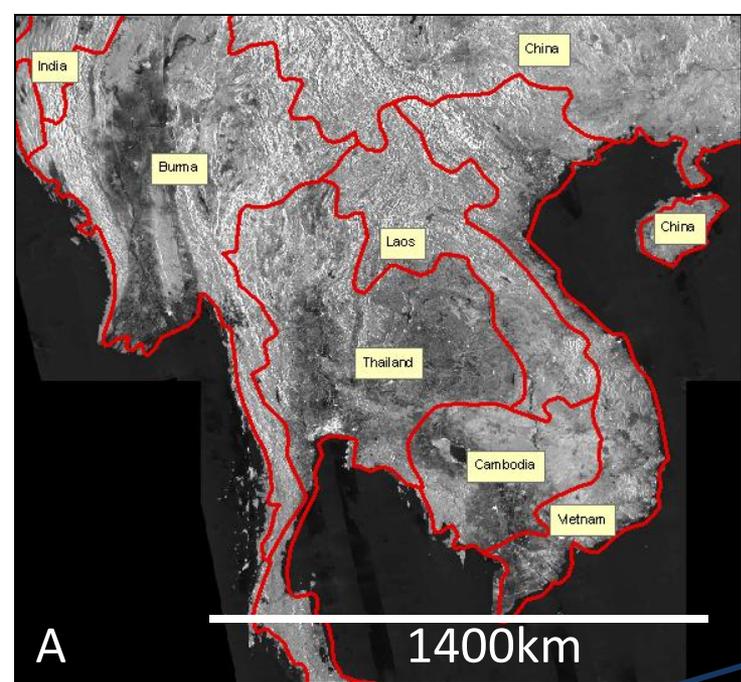
-- to distinguish rice paddy attributes (4-7 obs / rsp @ 42 day cycles + 45% overlap)

○ HH, RSP91-103, ~75m for SE China with Poyang Lake area highlights



JAXA K&C Imagery

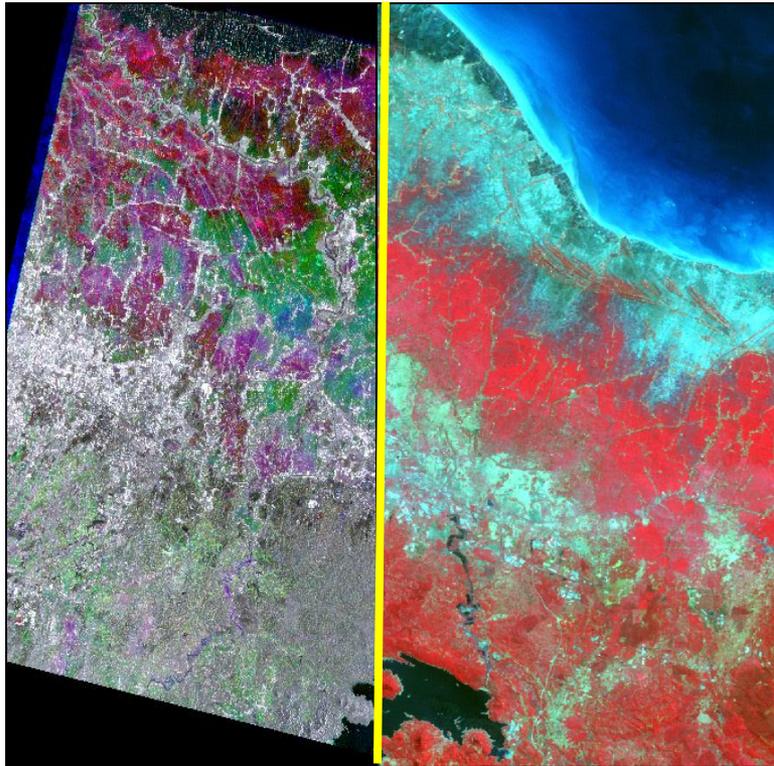




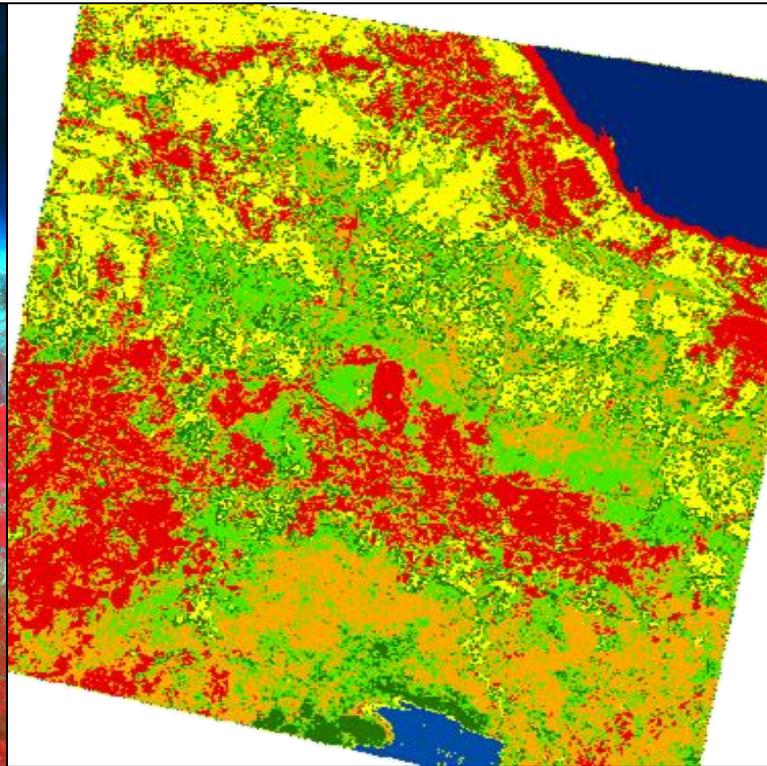
Land cover from PALSAR ScanSAR and MODIS imagery

Land cover from PALSAR ScanSAR FBS (HH) and Landsat imagery

Multi-temporal FBS & Landsat



Decision Tree (Level 1)
Integrated Classification

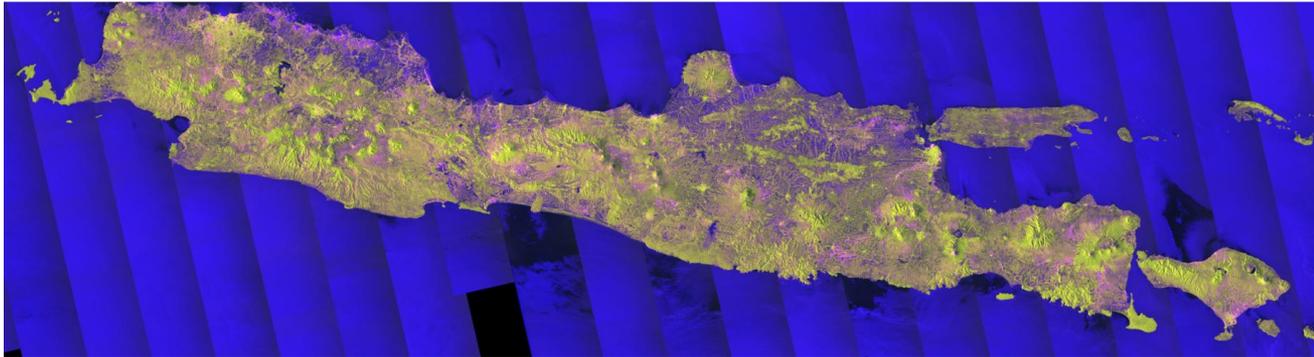


Jawa Barat
Indonesia

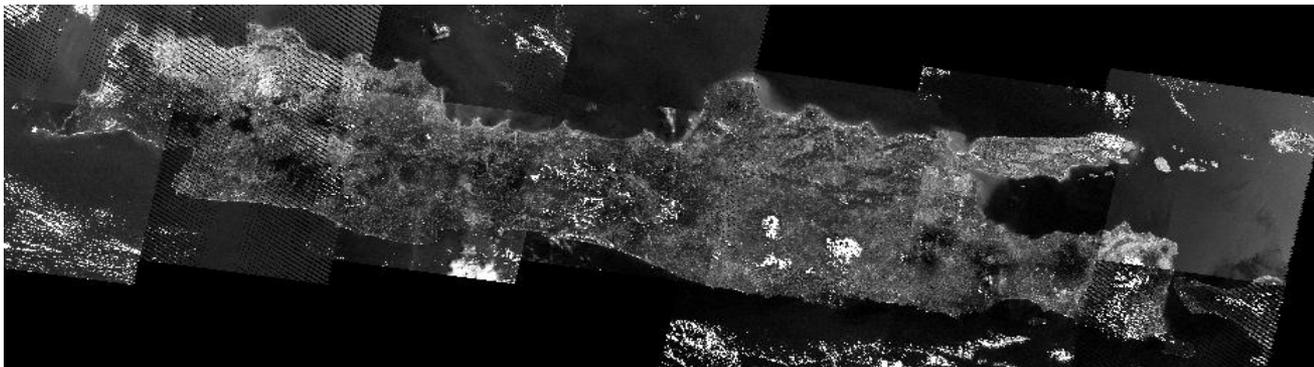


- Integrated Landsat & multi-temporal (FBS) PALSAR ScanSAR products
- CART algorithm; 90% overall accuracy for Level 1
- Open scrub (drier) vs. closed scrub (higher biomass) most confused
- Now integrating climate & DEM to improve descriptors
- Multi-temporal ScanSAR showed 2 crop intensity dominated region

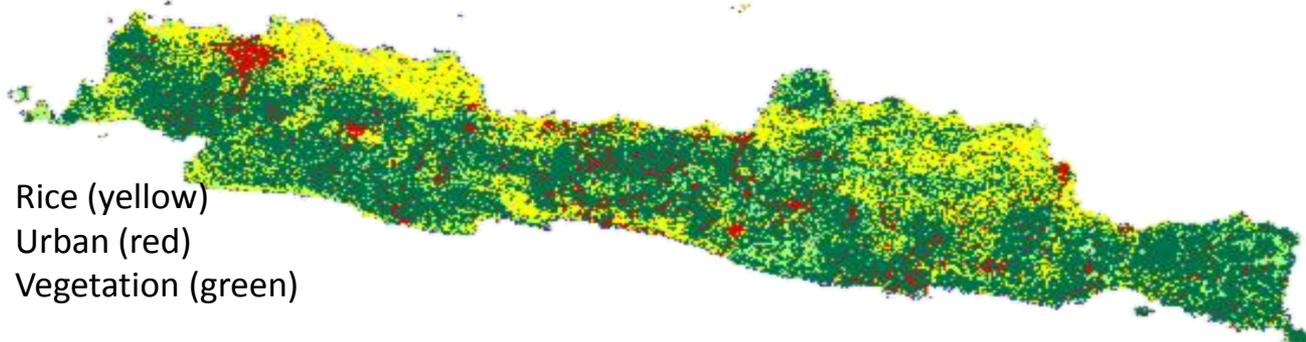
Land cover from PALSAR 50m mosaic and Landsat imagery



2008 PALSAR FBD 50m Orthorectified Mosaics



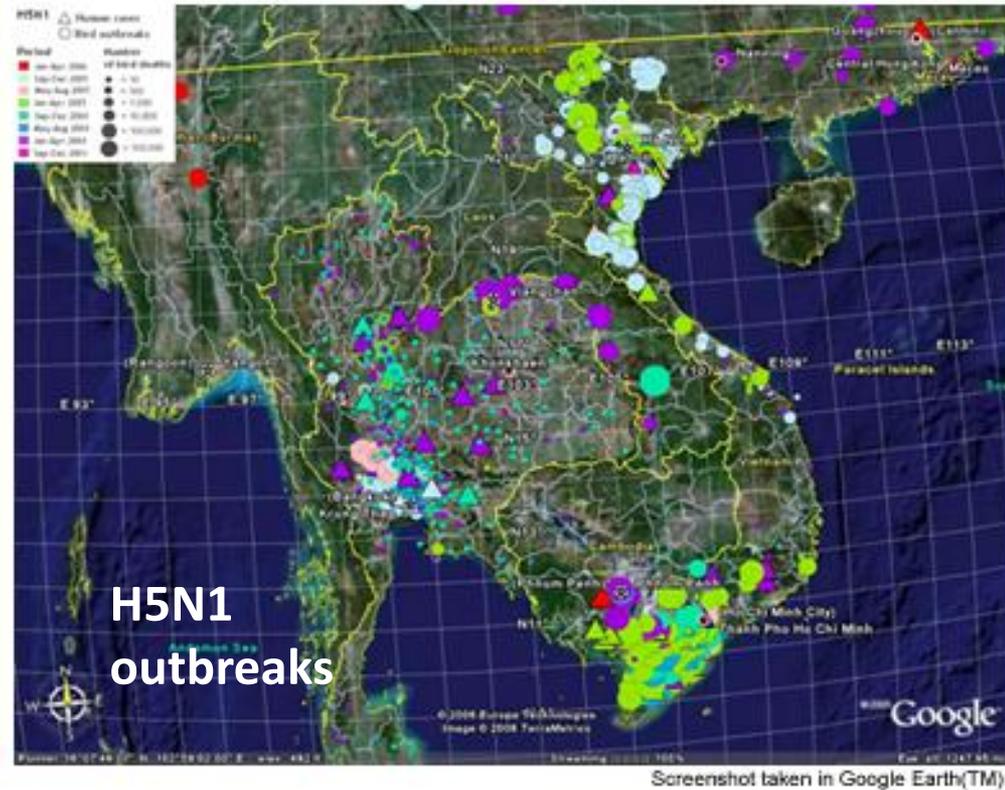
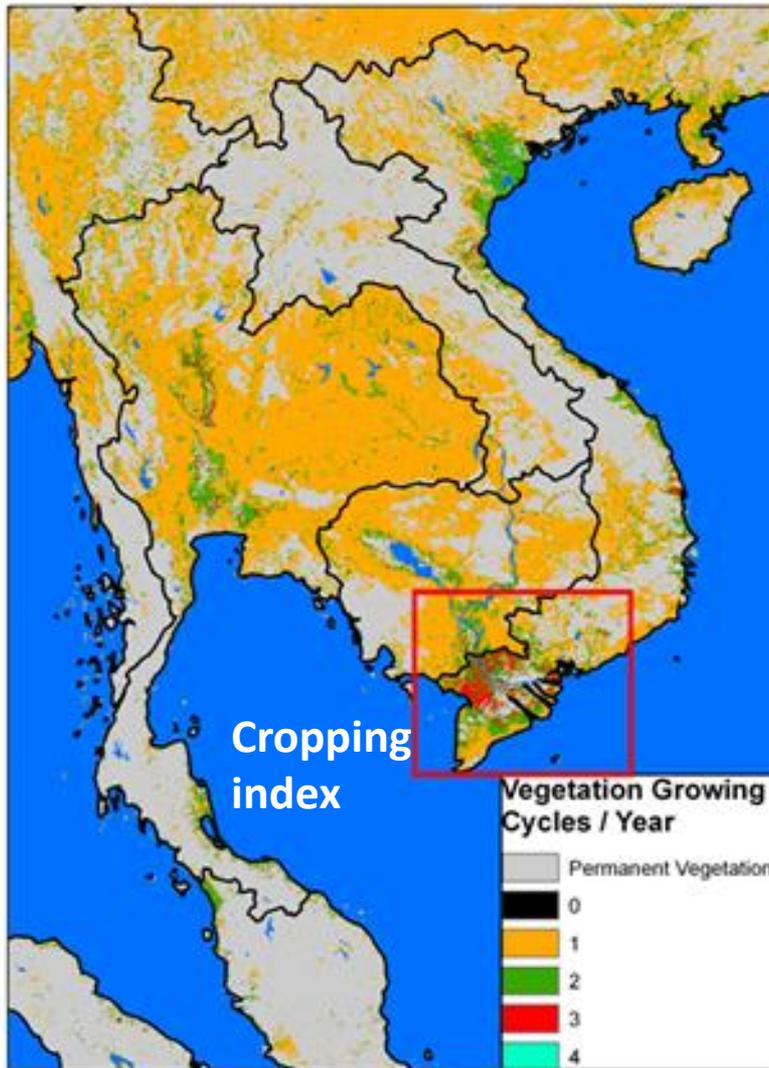
GLS-2005 Landsat TOA 30m Mosaic in Java, Indonesia



Rice (yellow)
Urban (red)
Vegetation (green)

Integrated CART LULC Classification (8 land cover classes: rice, crop/veg mosaic, water, aquaculture, forest, open scrub/shrub, closed canopy shrub/low-biomass woodland/forest)

Disease ecology --- Identify hot-spots and hot-times of H5N1 HPAI

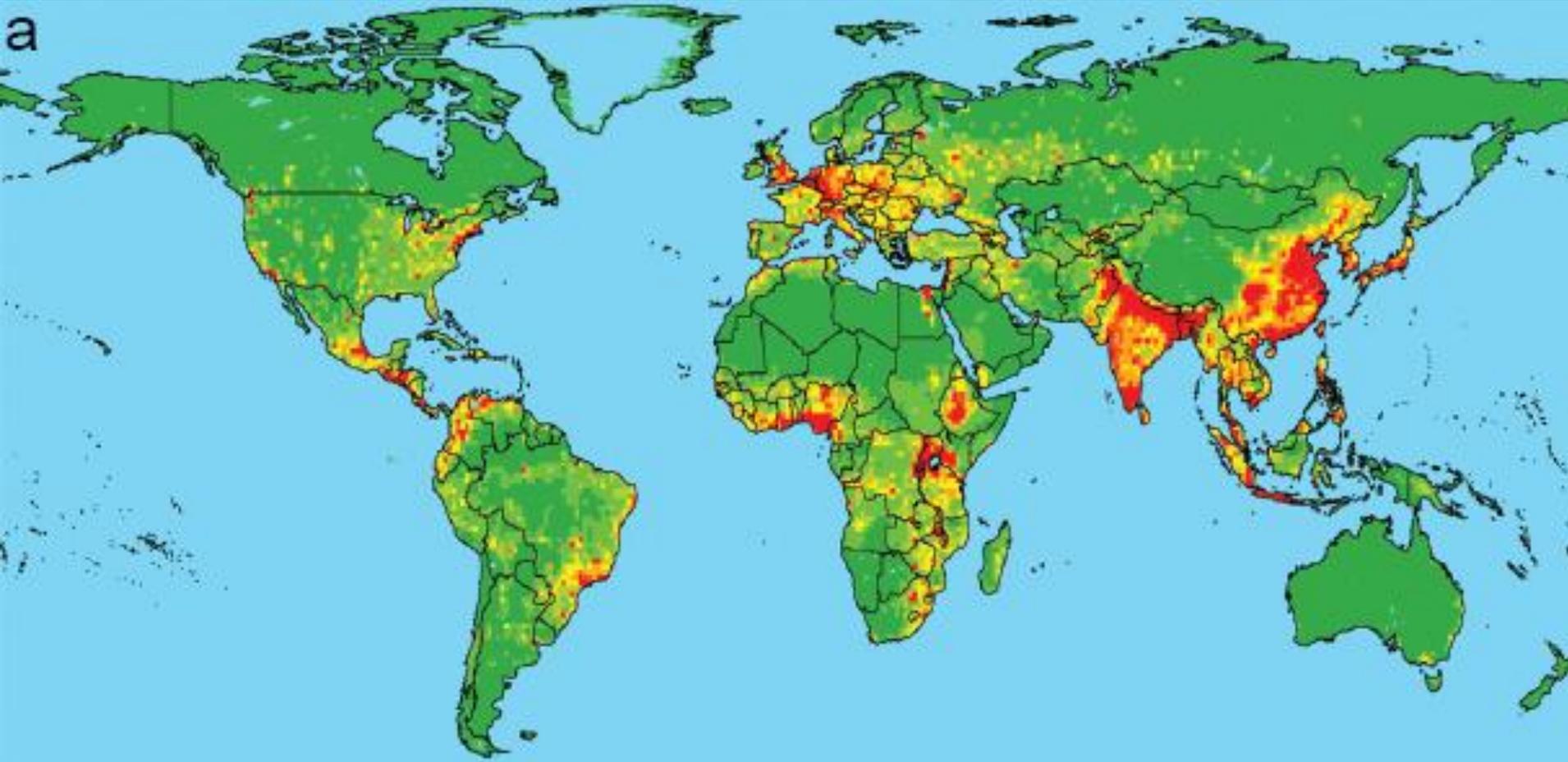


Agriculture – bird flu

These figures show that H5N1 outbreaks in Thailand and Vietnam were concentrated in those area with multiple cropping systems, in particular, multiple paddy rice system.

Traditionally, free-grazing duck system is closely coupled with multiple paddy rice cultivation, which provides foods and water year-around for ducks. The paddy rice – duck system dominate much of Southeast Asia countries.

Disease ecology and public health



Relative risk of an Emerging Infectious Disease (EID) event caused by zoonotic pathogens from wildlife; ~60-76% of recent EID affecting human were zoonoses.

Jones et al., 2008, Nature

Land cover and land use change (transformation and intensification)



Thank you

and

Welcome to visit Oklahoma, USA

