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"Deriving forest maps and products from the K&C Initiative mosaics"

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Outline
University of Leicester K&C data uses

- Congo basin FNF mapping [incorporation of rainfall estimate data]

- Forest biomass mapping in Mexico and Siberia

- Palm oil plantation mapping

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Sample tile (study area)

- 5 degree tile

- Four countries, inc. Sangha Trinational park

- Range of land cover types

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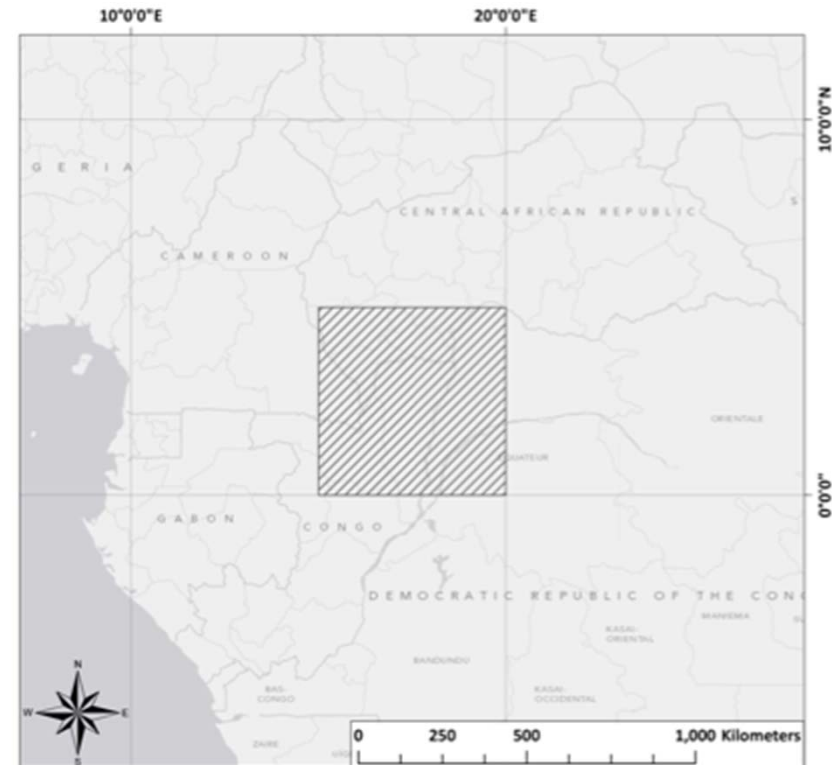
Classification of PALSAR mosaic

- Training/validation data manually interpreted from Google Earth imagery (~1000 four hectare squares)

- Support Vector Machine using PALSAR HH, HV σ^0

- Filtered to remove isolated pixels

- Validated from manual dataset – Google Earth

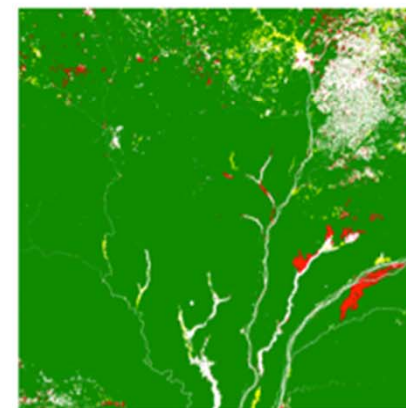- 2007-2010 forest change calculated (post-classification)

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SVM and JAXA FNF comparison

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Results – forest area

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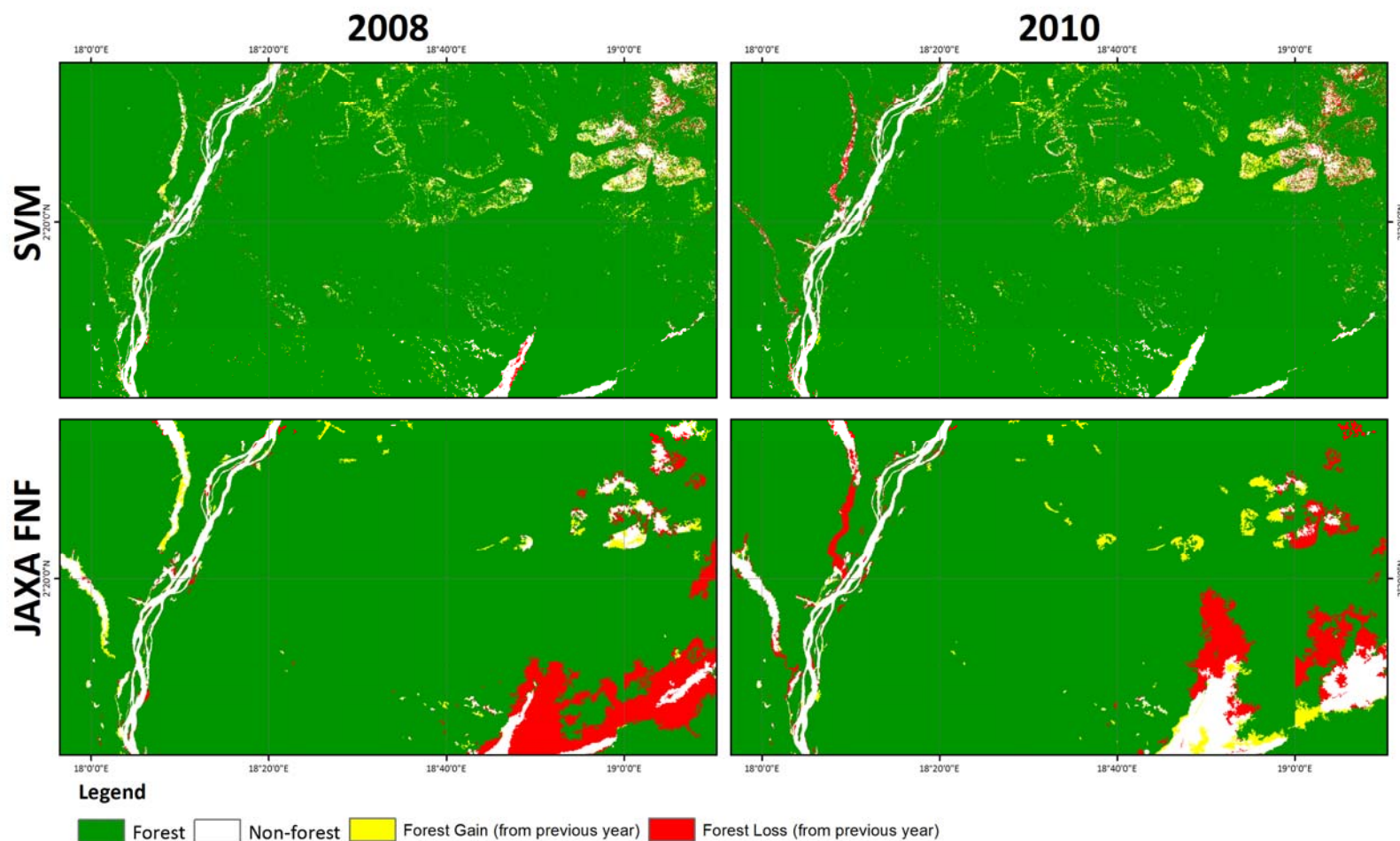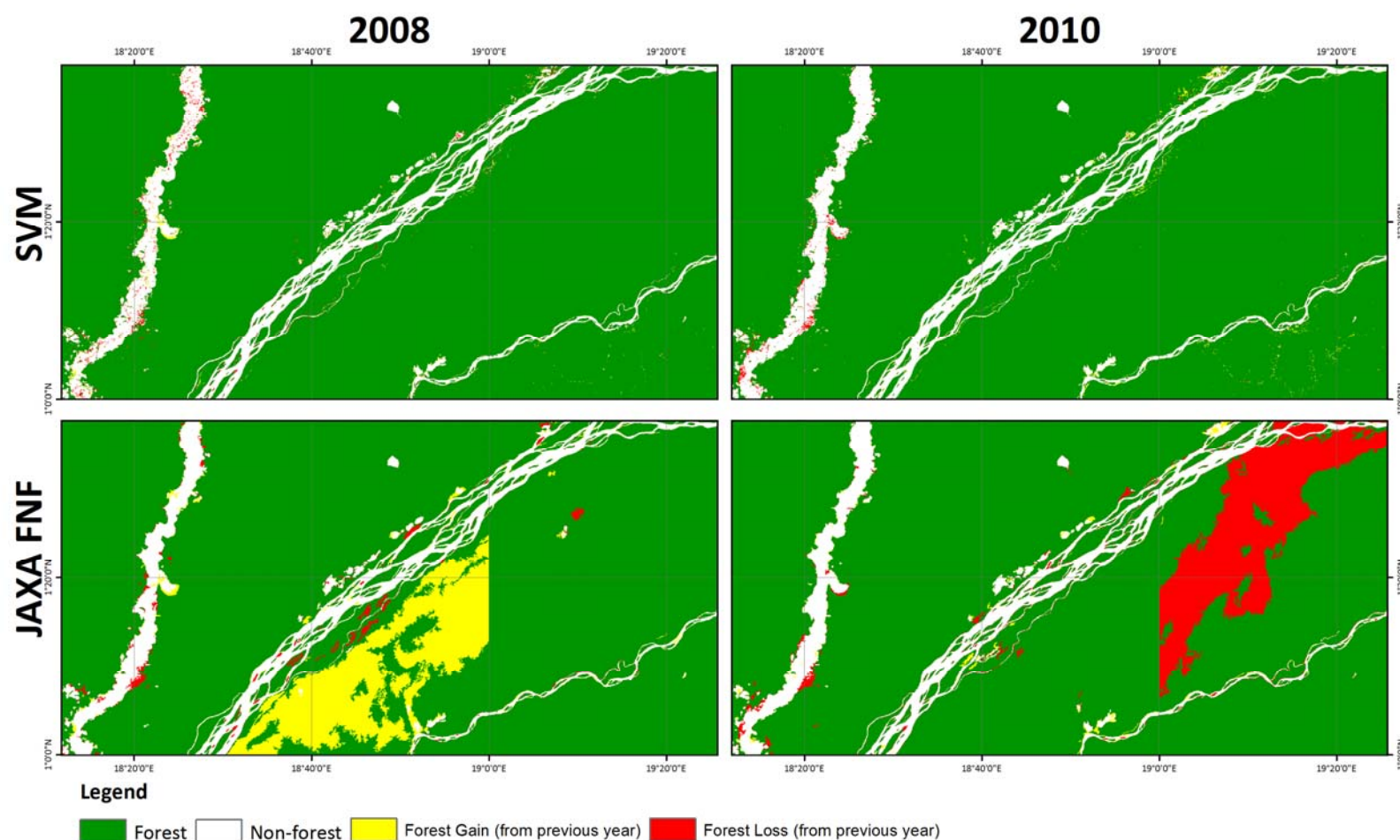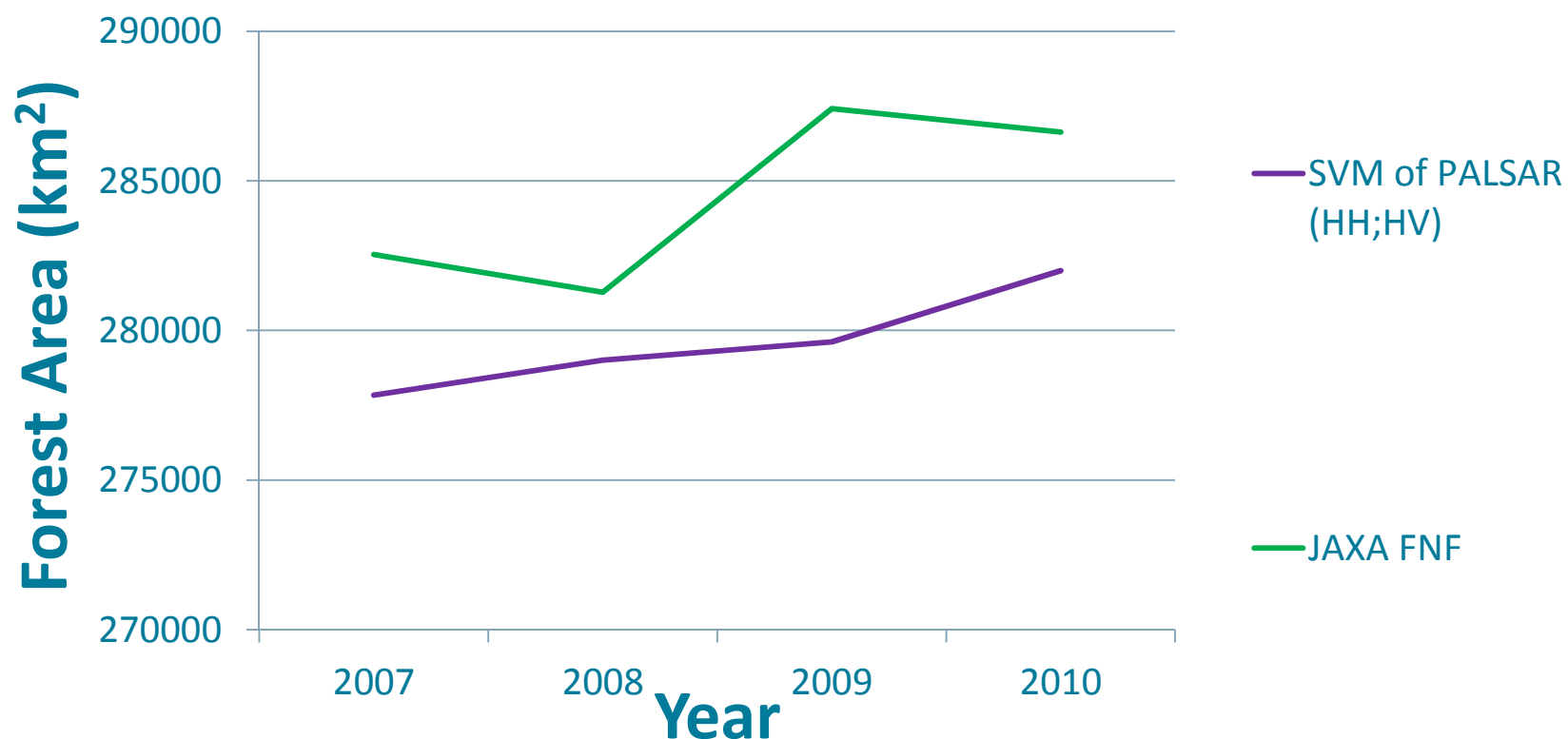
Results – accuracy

	Classification Data	2007 Training Data			2008 Training Data			2009 Training Data			2010 Training Data		
		F	NF	Total	F	NF	Total	F	NF	Total	F	NF	Total
SVM	F	6198	237	6435	6210	276	6486	6201	270	6471	6207	332	6539
	NF	26	723	749	14	684	698	23	690	713	17	628	645
	Total	6224	960	7184	6224	960	7184	6224	960	7184	6224	960	7184
	Prod. Acc	99.58	75.31		99.78	71.25		99.63	71.88		99.73	65.42	
	User. Acc	96.32	96.53		95.74	97.99		95.83	96.77		94.92	97.36	
	Overall Accuracy			96.34			95.96			95.92			95.14
		F	NF	Total	F	NF	Total	F	NF	Total	F	NF	Total
JAXA FNF	F	6125	290	6415	6168	284	6452	6173	417	6590	6187	422	6609
	NF	99	670	769	56	676	732	51	543	594	37	538	575
	Total	6224	960	7184	6224	960	7184	6224	960	7184	6224	960	7184
	Prod. Acc	98.41	69.79		99.10	70.42		99.18	56.56		99.41	56.04	
	User. Acc	95.48	87.13		95.60	92.35		93.67	91.41		93.61	93.57	
	Overall Accuracy			94.59			95.27			93.49			93.61

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Change results

- 2007-2010

- Net (slight) increase in forest area

- Post-classification change

- Linear features caught by higher resolution

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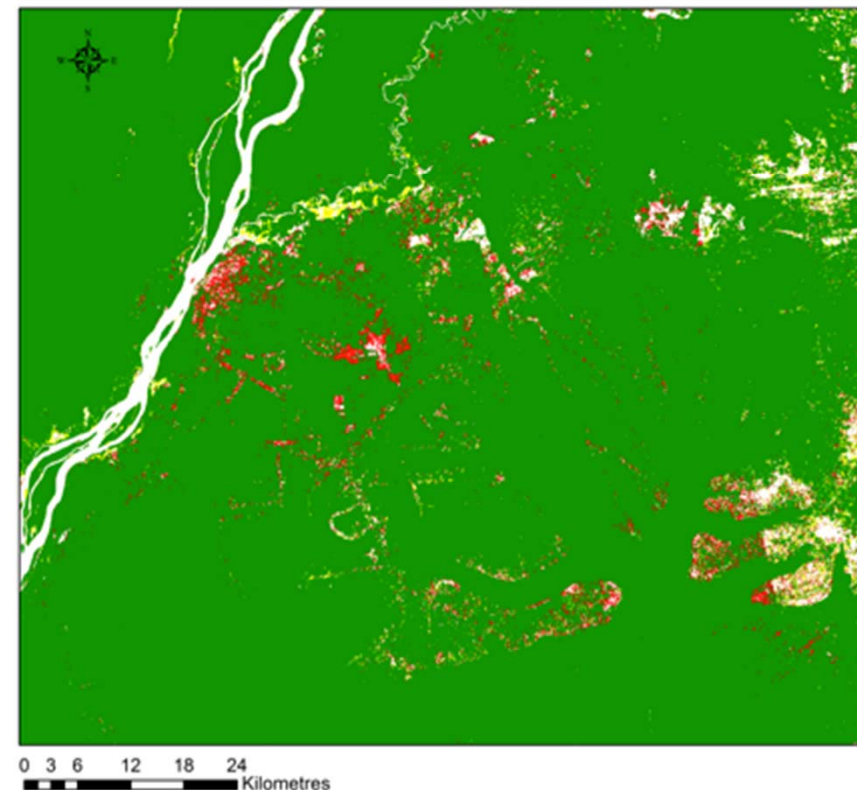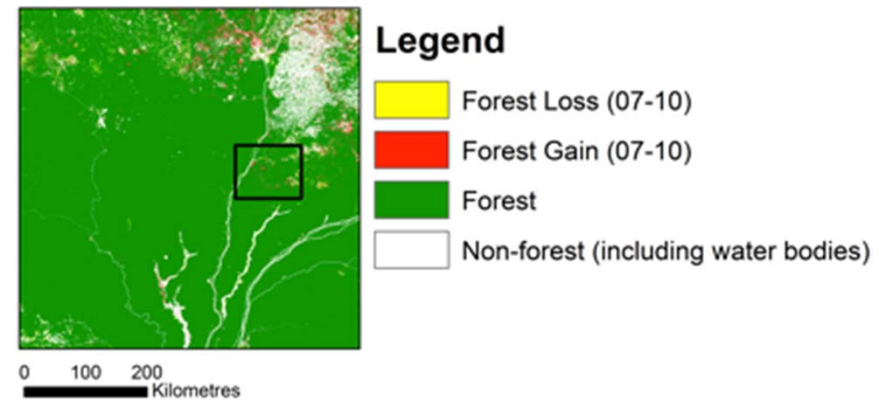
RFE / PALSAR date combination

- RFE2.0 from NOAA CPC

- Rainfall data show seasonal variance between strips

RFE2.0:

- Daily rainfall estimate

- 0.1 degree res.

- ~500 ground rain gauge stations

- 4x daily SSM/I, AM-SU

- Meteosat IR cloud top temp (half-hourly)

2007-2010 3 day accumulated Rainfall Estimate

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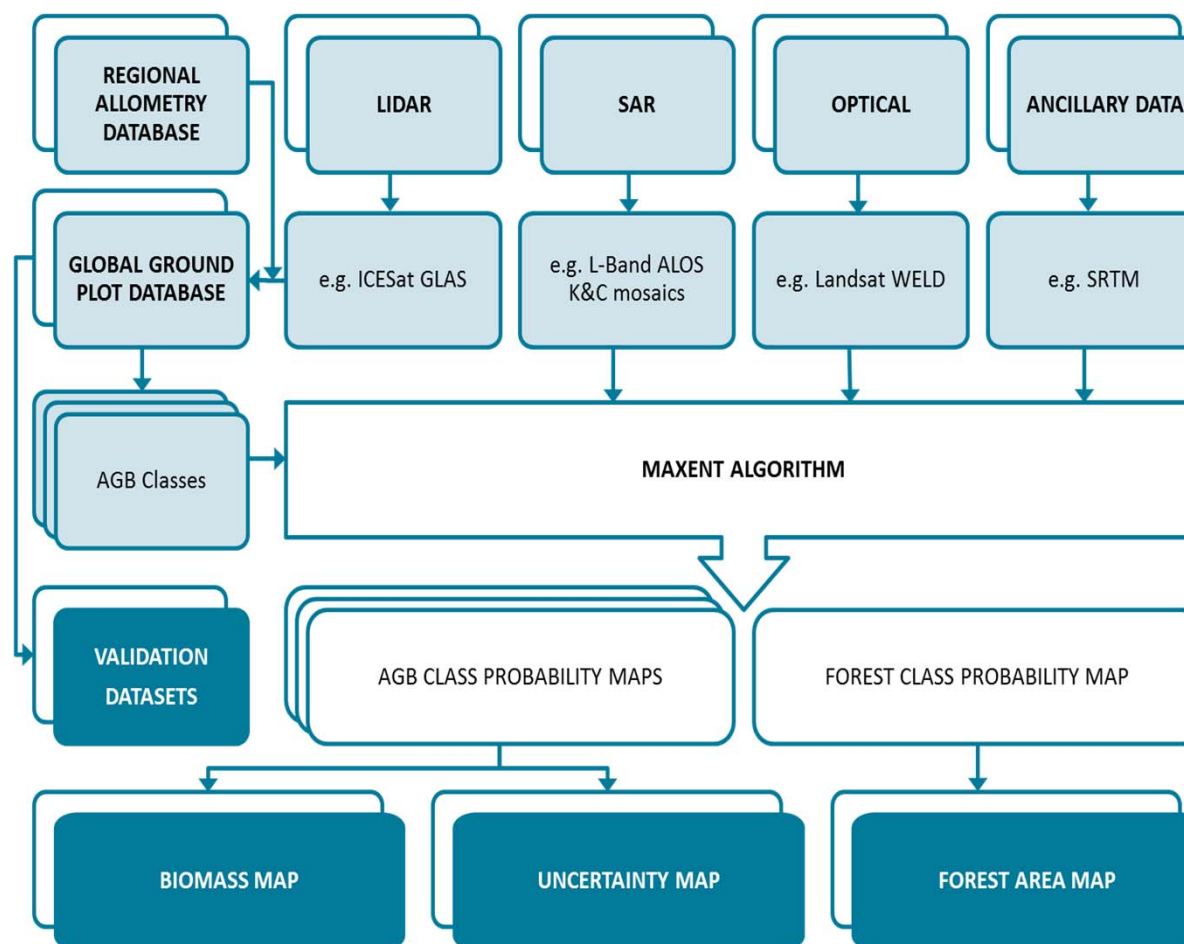
Discussion Points

- Pixel based classification has potential to detect fine scale change

- Supervised classification removes some ambiguity in flooded areas

- K&C Initiative Mosaics remove barrier to SAR

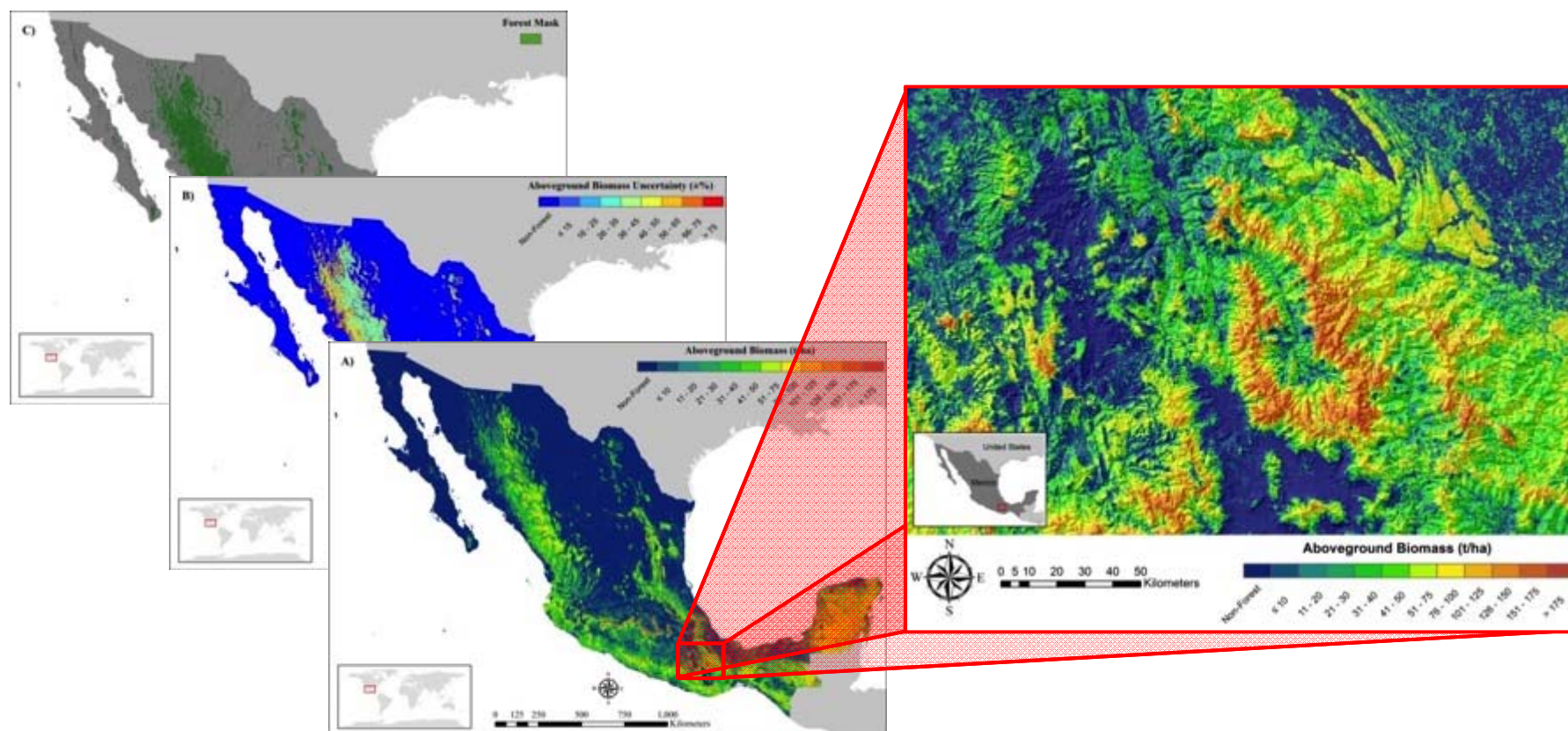- JAXA FNF - Urban mask from HH

Discussion

- How to incorporate RFE flooded forest?

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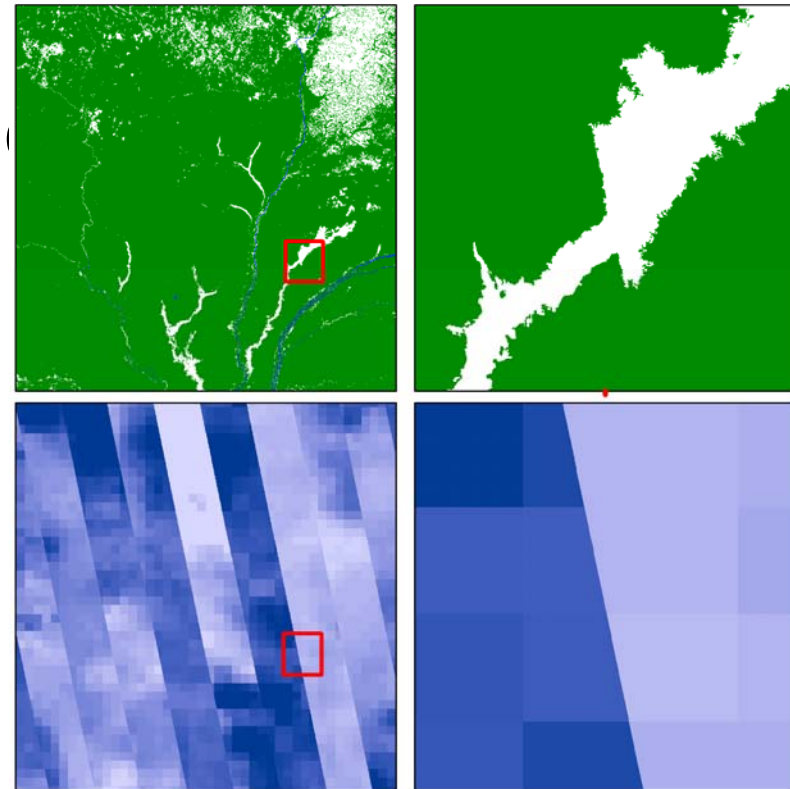
Global and regional forest biomass mapping:
A data mining approach

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# Country-level Mapping: Mexico

INPUTS: AGB from Forest Inventory data, MODIS VI, K&C ALOS PALSAR Mosaics, and SRTM metrics.
OUTPUTS: (A) Aboveground Biomass, **(B)** Uncertainty, and **(C)** Forest Area Maps (250m resolution)
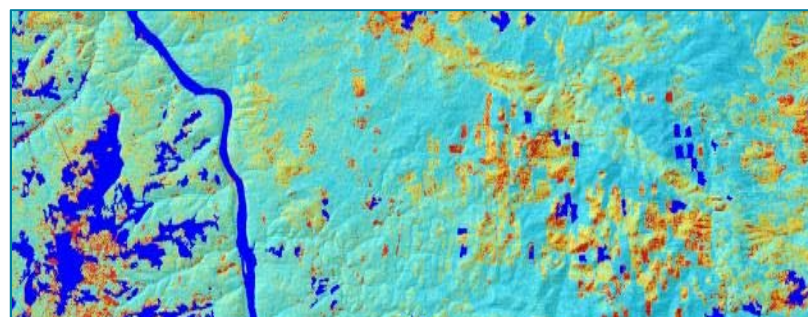
Sensor Contribution and Validation

Left: Percent contribution by sensor and per biomass range to the AGB map

Right: Validation of the AGB map using an independent plot dataset. Warmer colours indicate higher point density. Solid line: y = x

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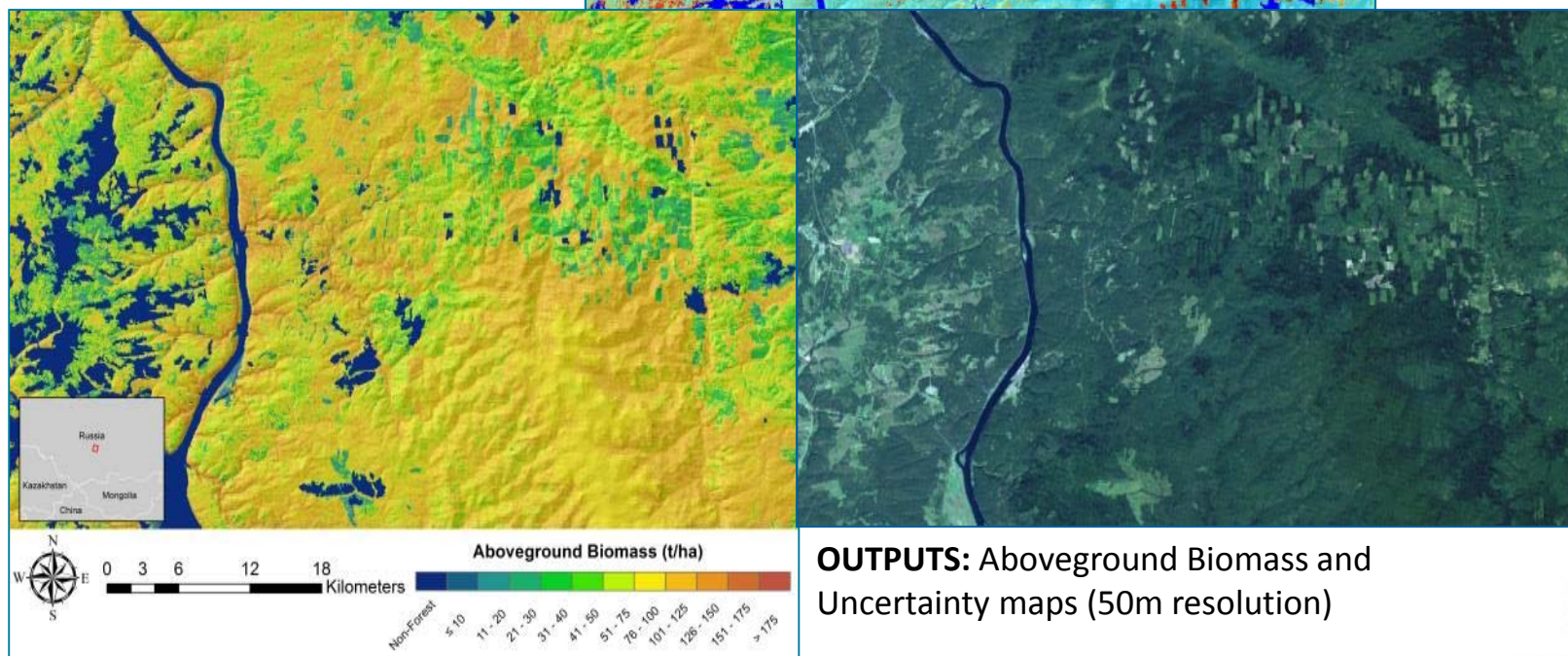
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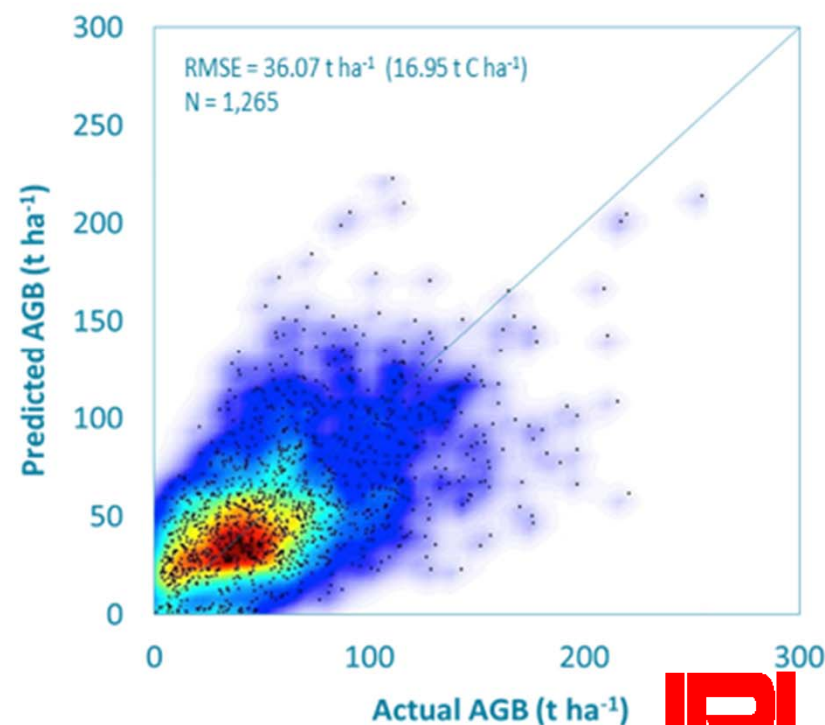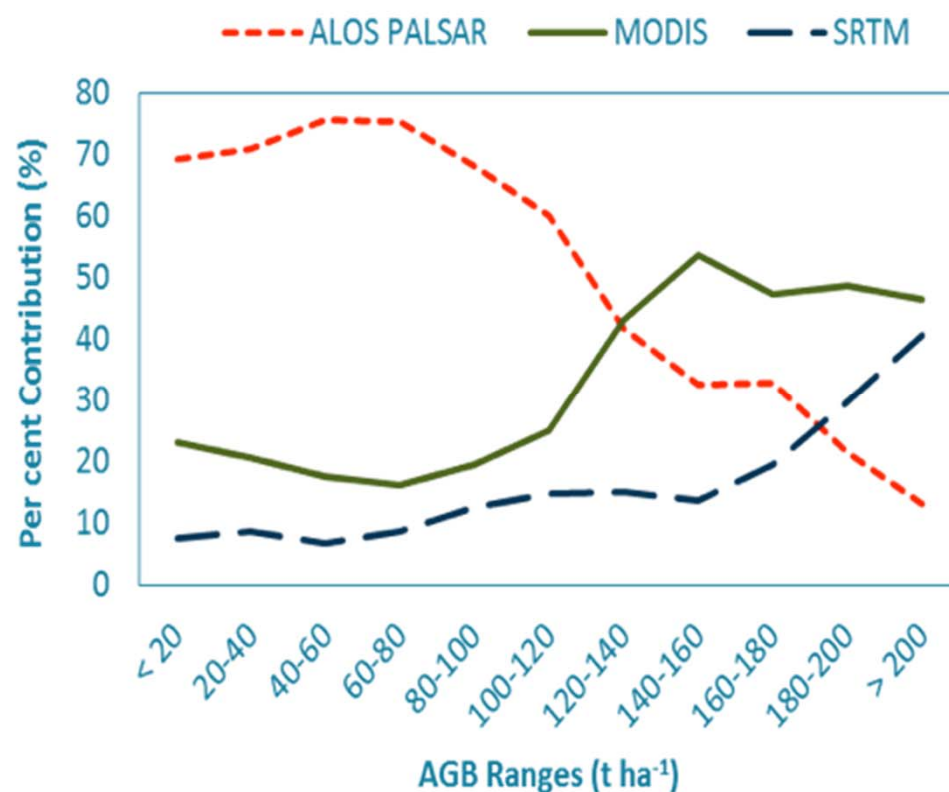
AGB Maps Krasnoyarsk Krai (Central Siberia)

INPUTS: AGB from Forest inventory, Landsat WELD, K&C ALOS PALSAR mosaics, and Categorical layers
Forest mask: K&C FNF

Independent Validation:
RMSE = 36.4 t ha^{-1}
(18.2 t C ha^{-1})
N = 581

Aboveground Biomass (t/ha)

Non-Forest, ≤ 10, 11 - 20, 21 - 30, 31 - 40, 41 - 50, 51 - 75, 76 - 100, 101 - 125, 126 - 150, 151 - 175, > 175

0 3 6 12 18 Kilometers

OUTPUTS: Aboveground Biomass and Uncertainty maps (50m resolution)

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Global Mapping

MAPPING LEVELS	SPATIAL RESOLUTION	OPTICAL	SAR	LIDAR	ANCILLARY DATASETS
GLOBAL REGIONAL NATIONAL	1 km - 250 m	MODIS, SPOT VGT, MERIS, PROBA-V	ALOS PALSAR (1/2), SAOCOM, Sentinel-1, BIOMASS	ICESat, ICESat-2, GEDI	SRTM, MODIS VCF, Land Cover
SUB NATIONAL	< 100 m	Landsat (e.g. WELD), Sentinel-2	ALOS PALSAR (1/2), SAOCOM, Sentinel-1, BIOMASS	ICESat, ICESat-2, GEDI	SRTM, Landsat PTC, Land Cover

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Conclusions

- This approach can use the synergies between different Earth Observation data products to produce wall-to-wall AGB maps and their uncertainty

- It is applicable to the current and forthcoming series of new satellites and sensors from the ESA Copernicus Program (i.e. Sentinels), JAXA (i.e. ALOS PALSAR 2), and NASA (i.e. Landsat, IceSAT-2, GEDI)

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"Monitoring Oil Palm Plantation Dynamics Using Radar and Optical Satellite Imagery in Indonesia and Malaysia"

- S.E. Asia meets about 80% of the global demand of palm oil.

- Palm oil plantations are responsible for deforestation or forest conversion; peat subsidence; habitat destruction; loss of biodiversity and GHG emissions.

- BUT potentially beneficial - boosting their economy, producing jobs and reducing poverty (Obidzinski et al., 2014).
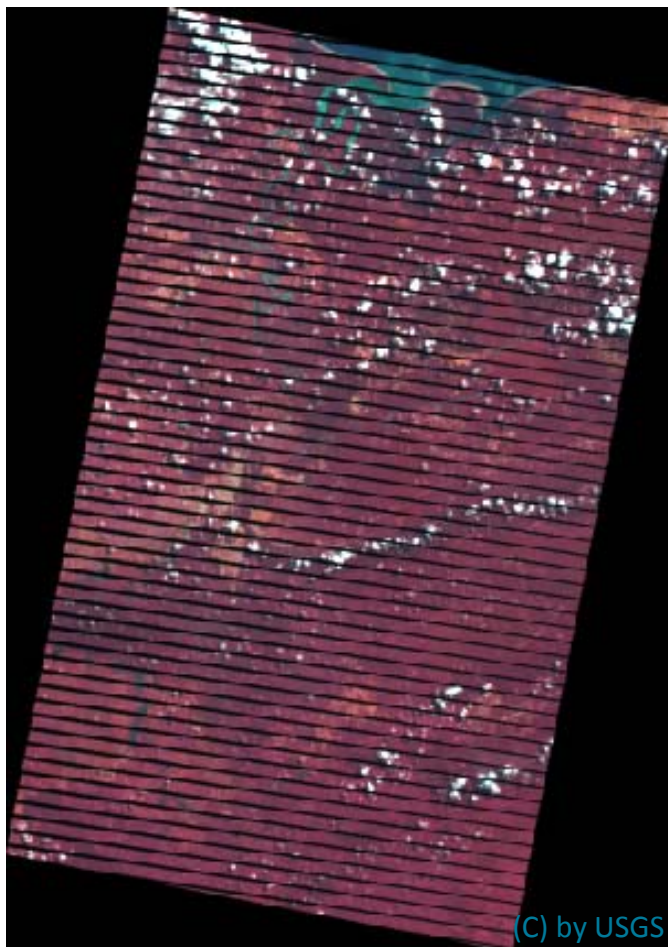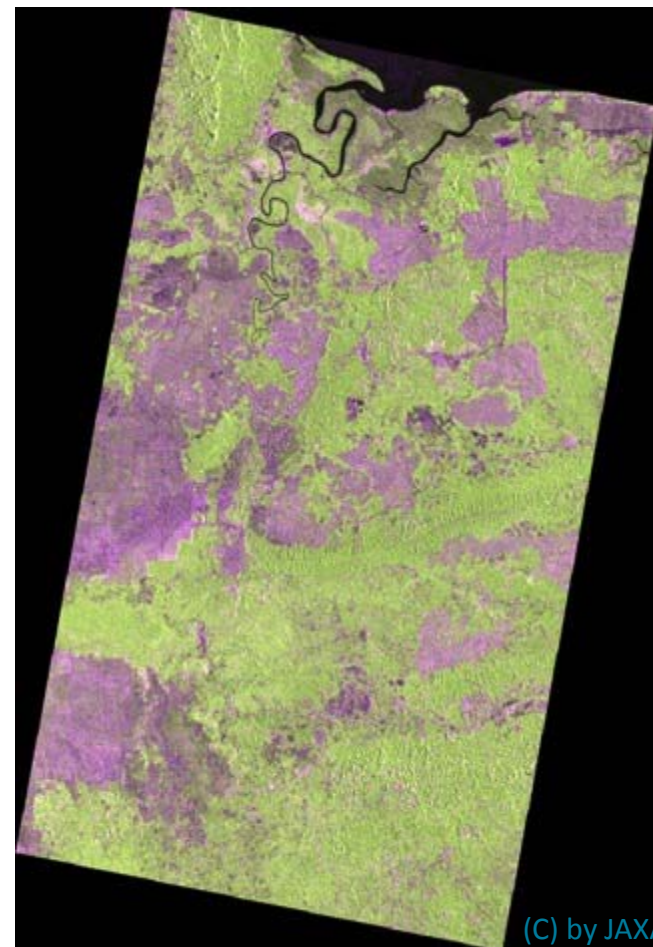

source: USDA
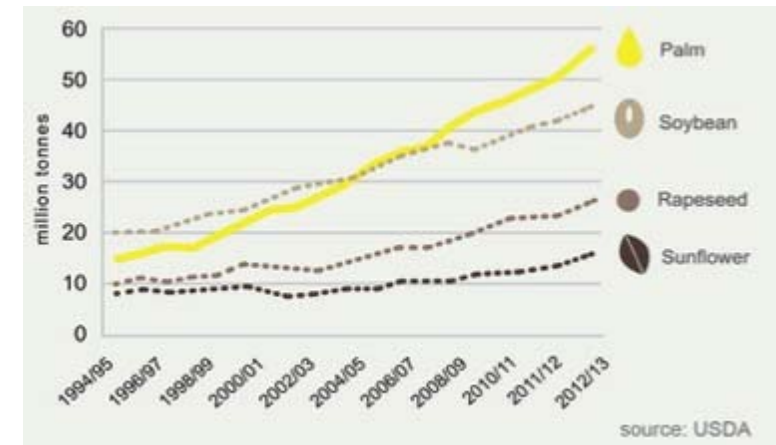
Oil palm is;
- relatively cheap
- most versatile
- high yielding
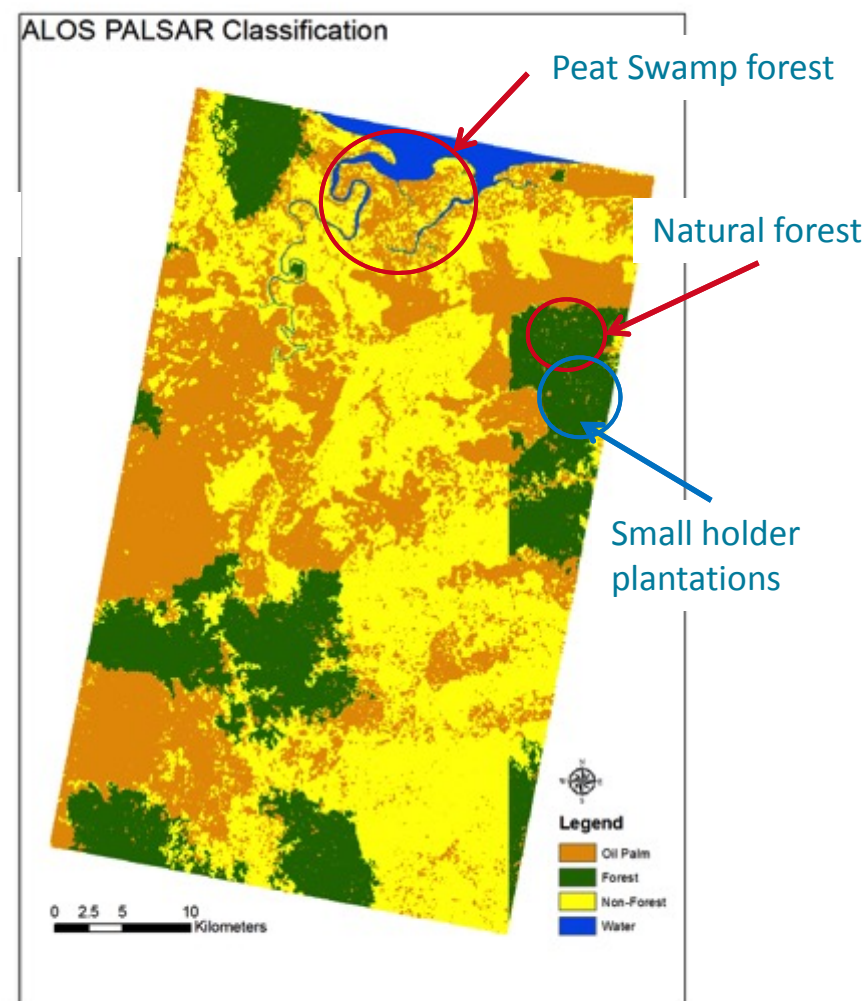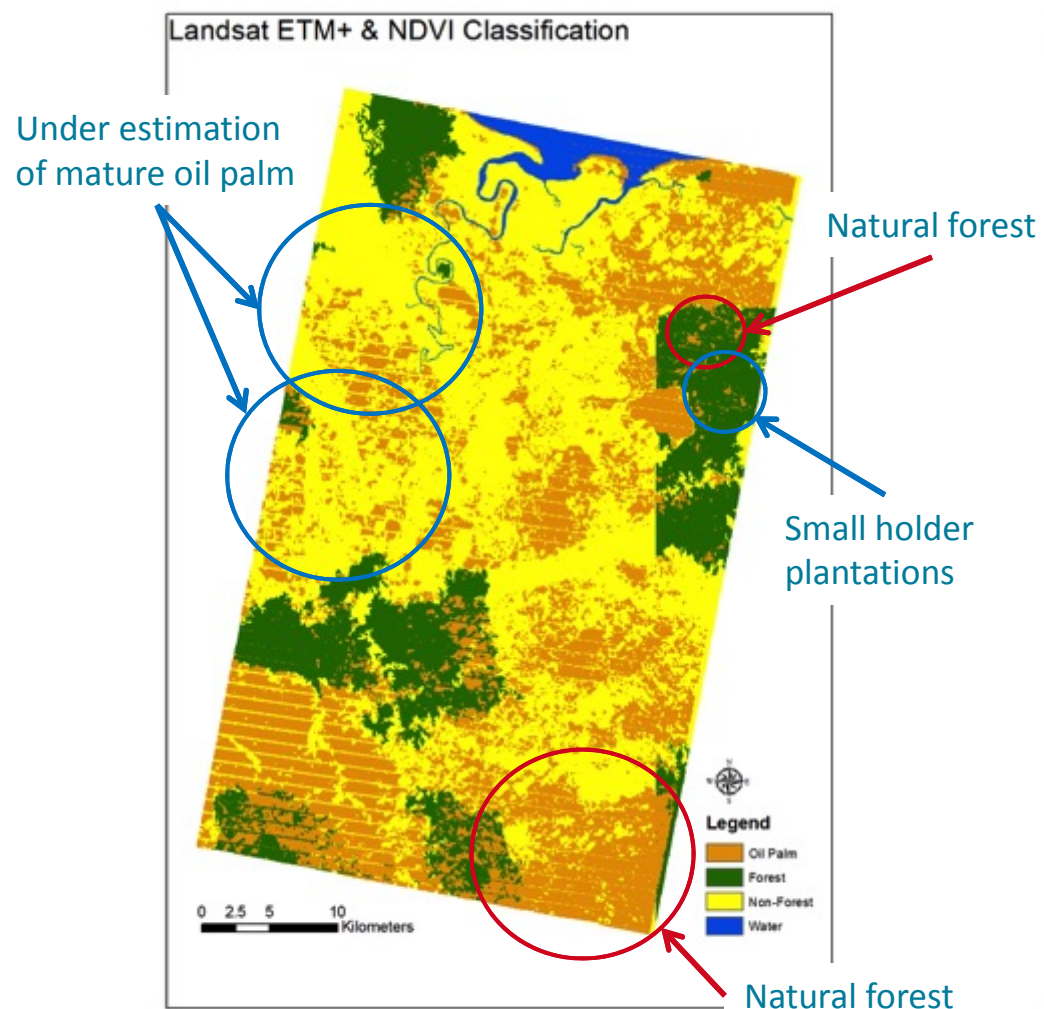- most widely produced

Random Forest input data
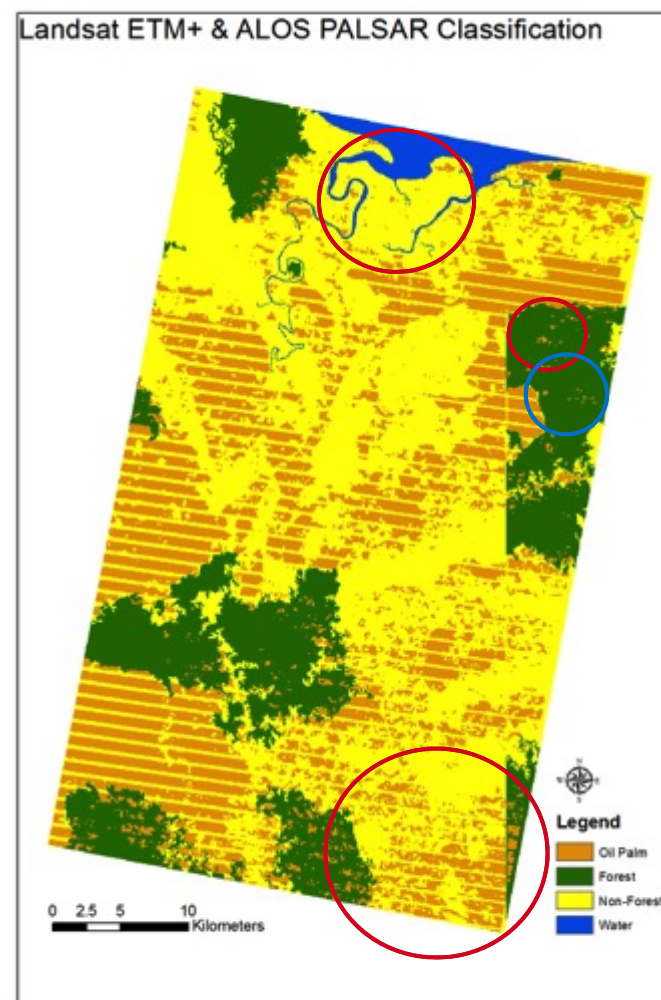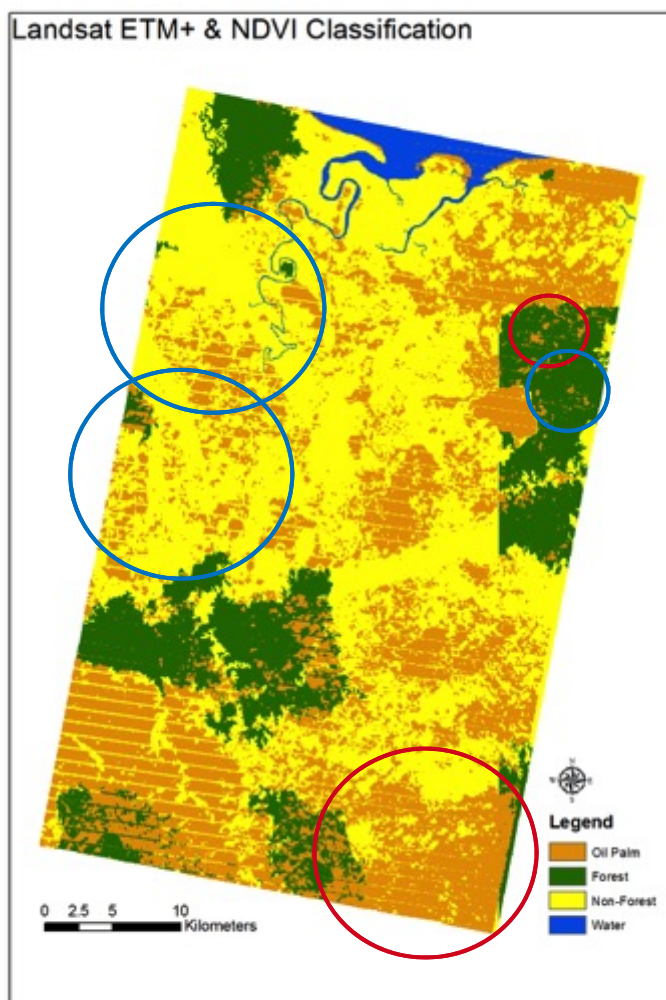

Landsat ETM+ 2010, (RGB: 5;4;3 – SWIR; NIR; Red)

(C) by USGS

ALOS PALSAR 2010, (RGB: HH; HV; HH-HV)

(C) by JAXA

Random Forest classifier results

Landsat ETM+ & NDVI Classification

ALOS PALSAR Classification

Under estimation of mature oil palm

Peat Swamp forest

Natural forest

Natural forest

Small holder plantations

Small holder plantations

Natural forest

Legend
- Oil Palm
- Forest
- Non-Forest
- Water

0 2.5 5 10 Kilometers

Random Forest classifier results

University of Leicester outlook:
Potential K&C contributions/collaborations

- Forest change mapping in the Congo Basin (with RFE input)

- Biomass in woody savannahs, Kruger National Park, South Africa

- Biomass change in Mexico (for Globbiomass & UK NCEO).

- Sarawak oil palm mapping

- Biomass mapping in Central Kalimantan and Kampar Peninsula in Indonesia

- Biomass, drought events, and pollution monitoring in the lowland Ecuadorian Amazon forest

Acknowledgements

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