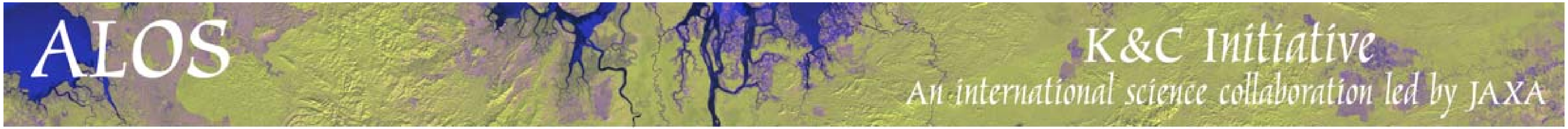
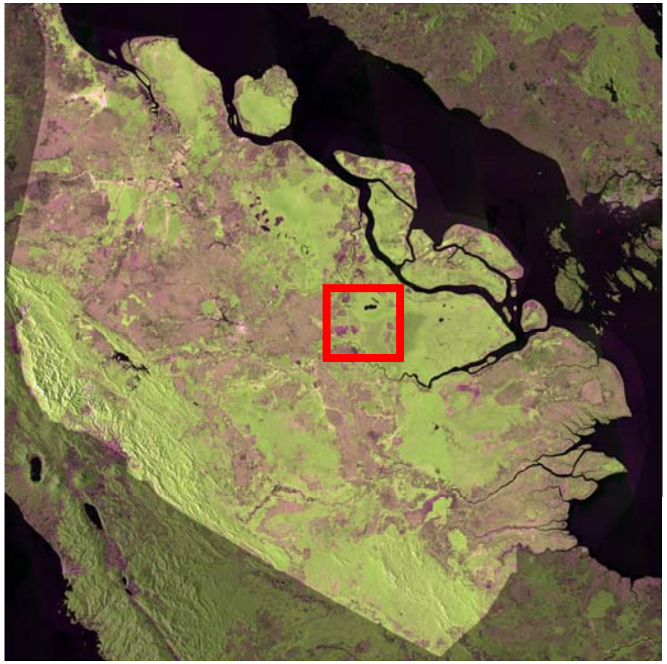


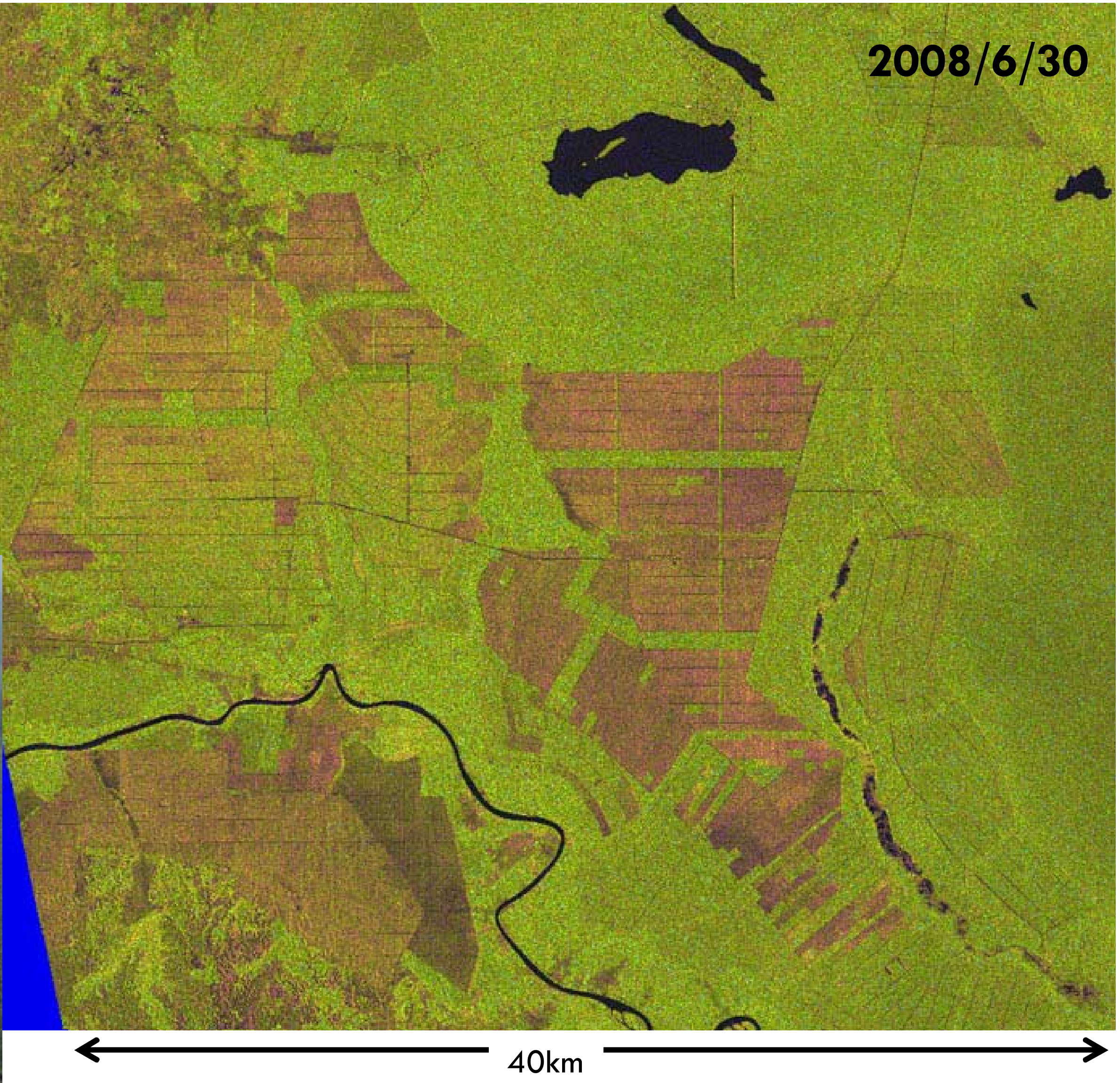
An L-band NRCS characteristic on an acacia plantation cycle

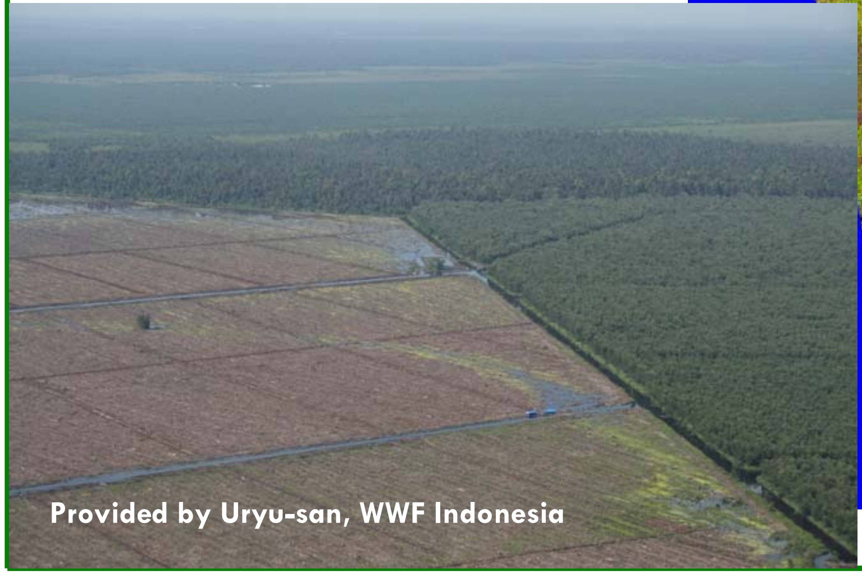
Osamu Isoguchi (JAXA), Masanobu Shimada (JAXA), Preesan Rakwatin (JAXA), Nicolas Longepe (JAXA), and Yumiko Uryu (WWF)

Background



PALSAR FBD 343 Red: HH Green: HV Blue: HH/HV

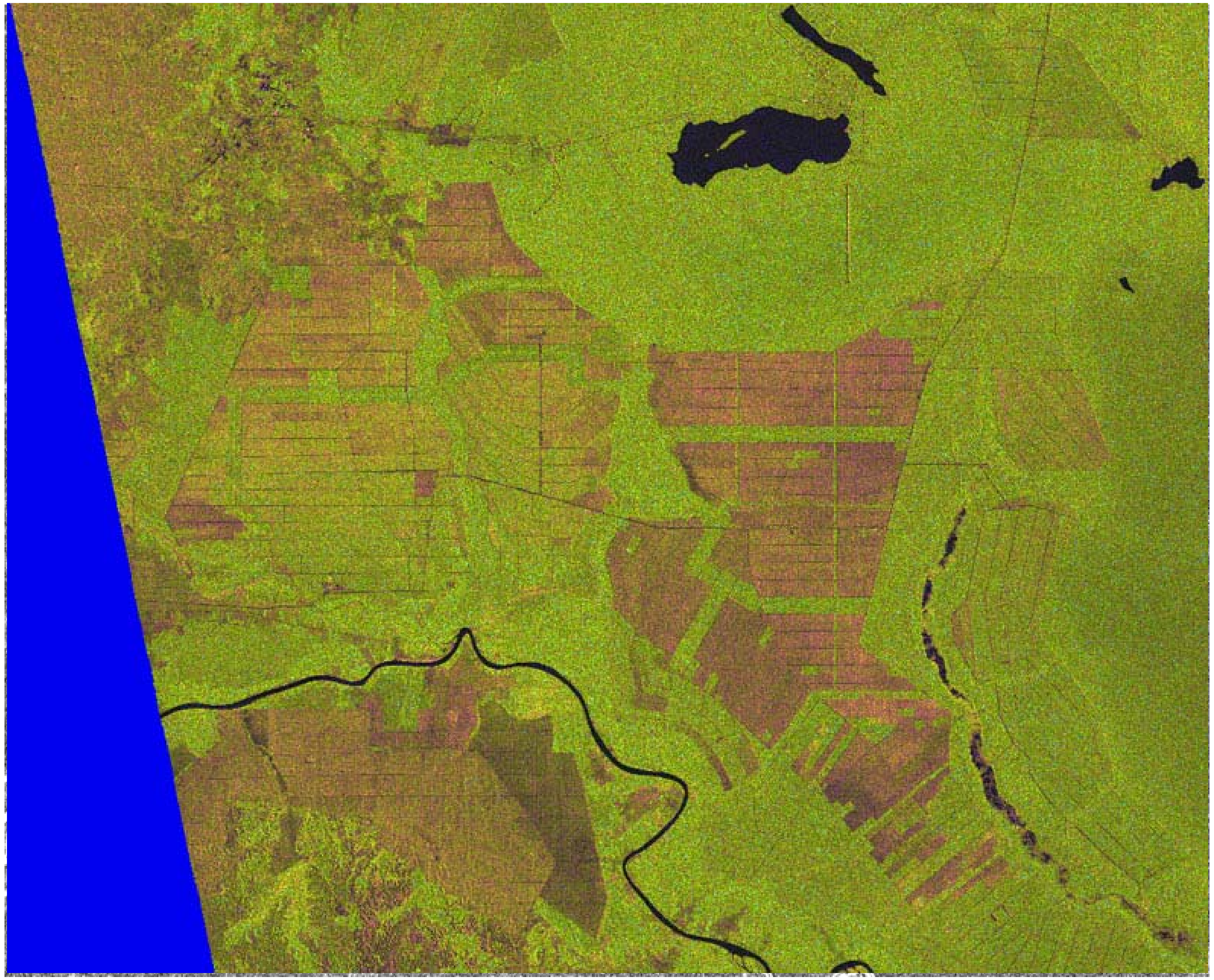




Provided by Uryu-san, WWF Indonesia

Background

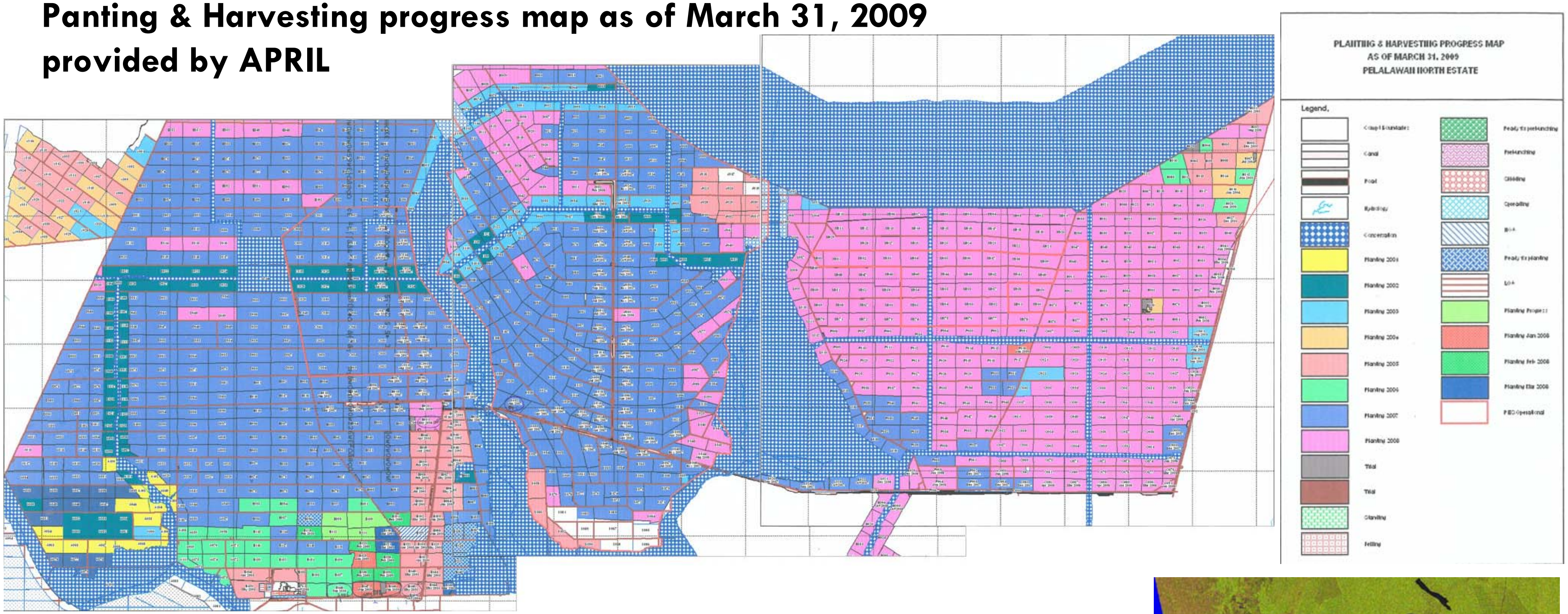
Variance of L-HH from 1.5 years ScanSAR time series



- ✓ Dependence of L-band NRCS change on harvesting and plating cycles for better classification
- ✓ Knowledge about NRCS signal change in relation to deforestation

Method

Panting & Harvesting progress map as of March 31, 2009 provided by APRIL

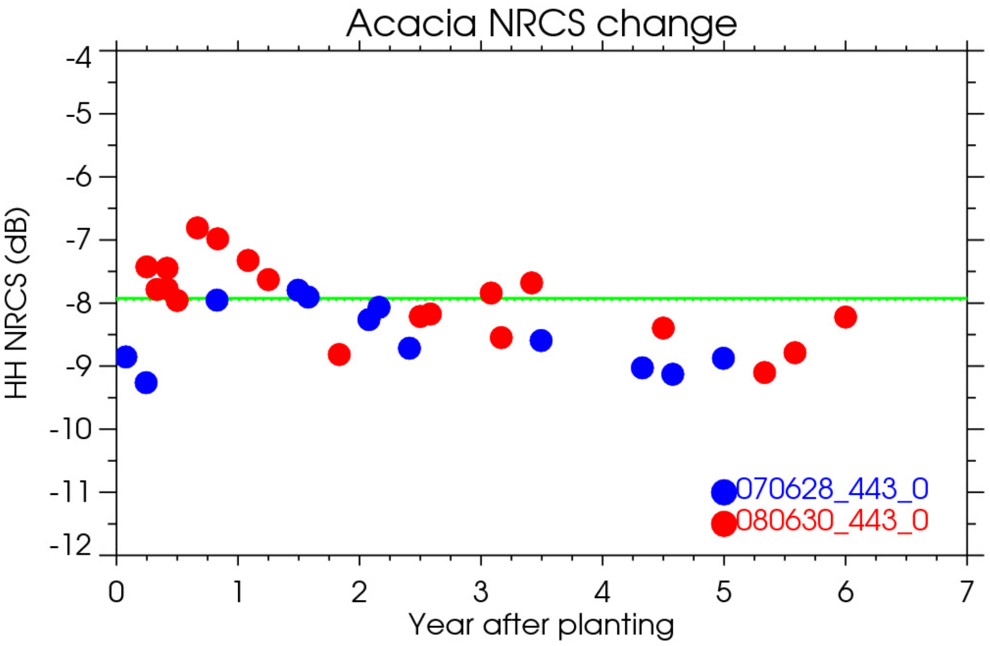

PLANTING & HARVESTING PROGRESS MAP
AS OF MARCH 31, 2009
PELALAWAN NORTH ESTATE
Legend.
Compt Boundaries
Canal
Road
Hydrology
Conservation
Planting 2001
Planting 2002
Planting 2003
Planting 2004
Planting 2005
Planting 2006
Planting 2007
Planting 2008
Tidal
Tidal
Standing
Felling
Ready for preloading
Preloading
Gridding
Operating
HCV
Ready for planting
LOA
Planting Progress
Planting Jan 2008
Planting Feb 2008
Planting Mar 2008
FBD Operational

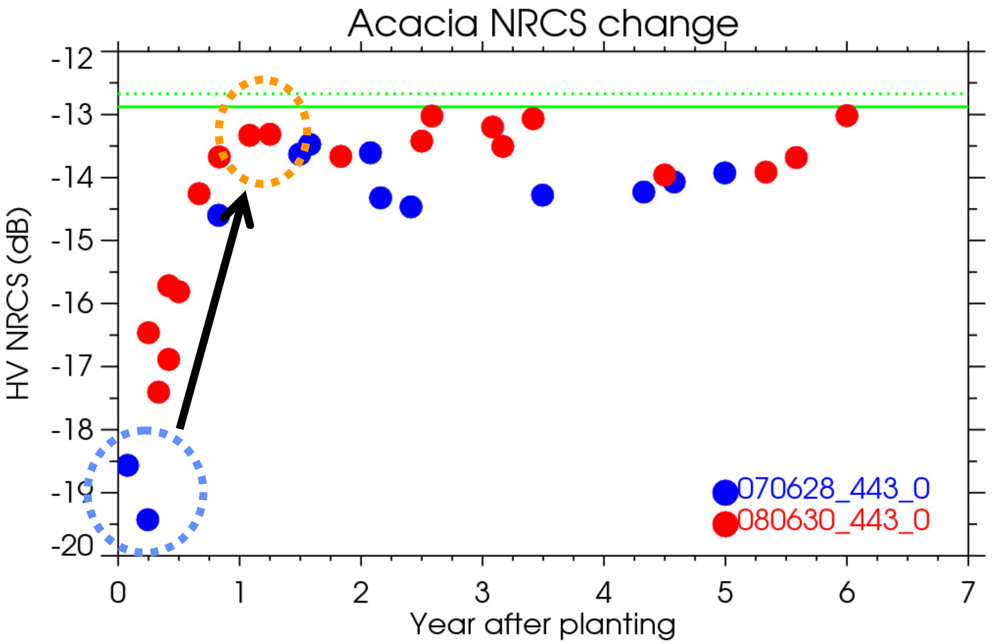
- ✓ HH & HV signal change as a function of time after plantations (tree age) by using FBD images.
- ✓ HH signal change in relationship to a planting & harvesting cycle by using ScanSAR data.

Results

-HH/HV changes on tree age

HH & HV signal of acacia plantation as a function of tree age
- based on 2007/6/28 and 2008/6/30 FBD 343 data and planting time



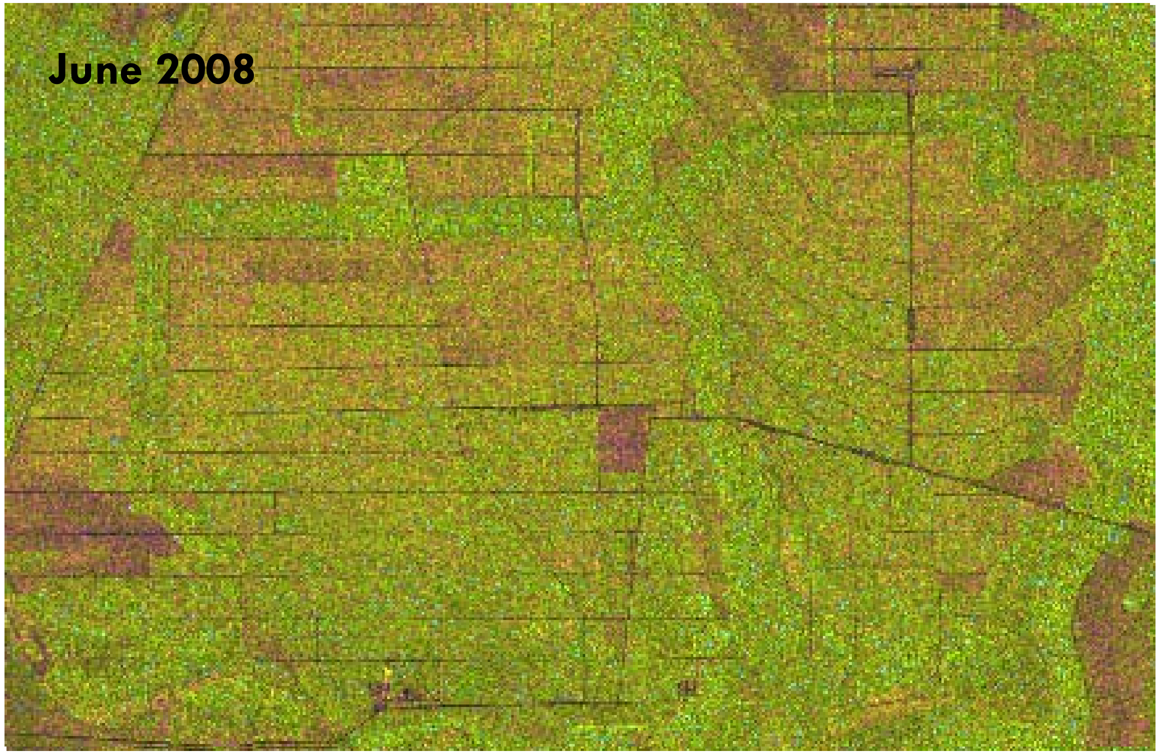


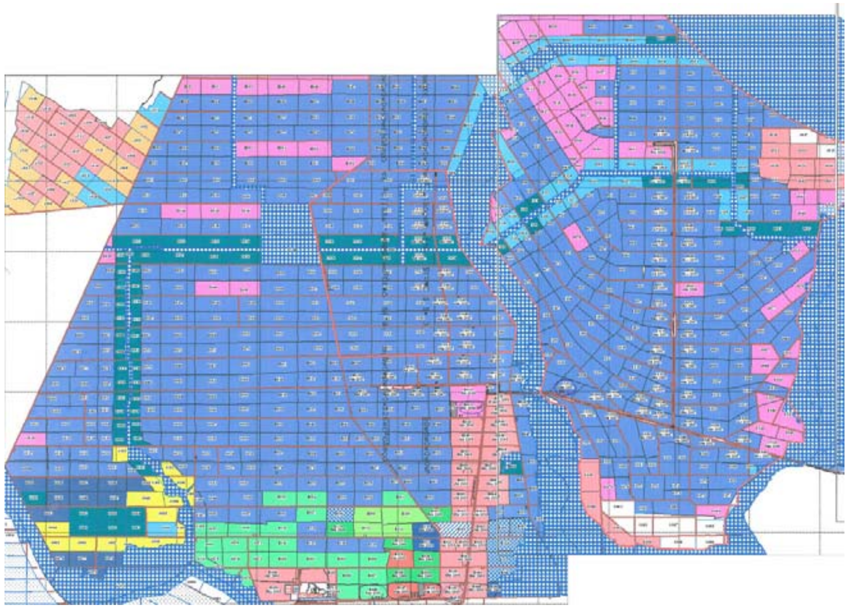
- ✓ **HH seems to decrease gradually .**
- ✓ **HV rapidly increases and gets saturated after almost 1 year.**

Results

-HH/HV changes on tree age

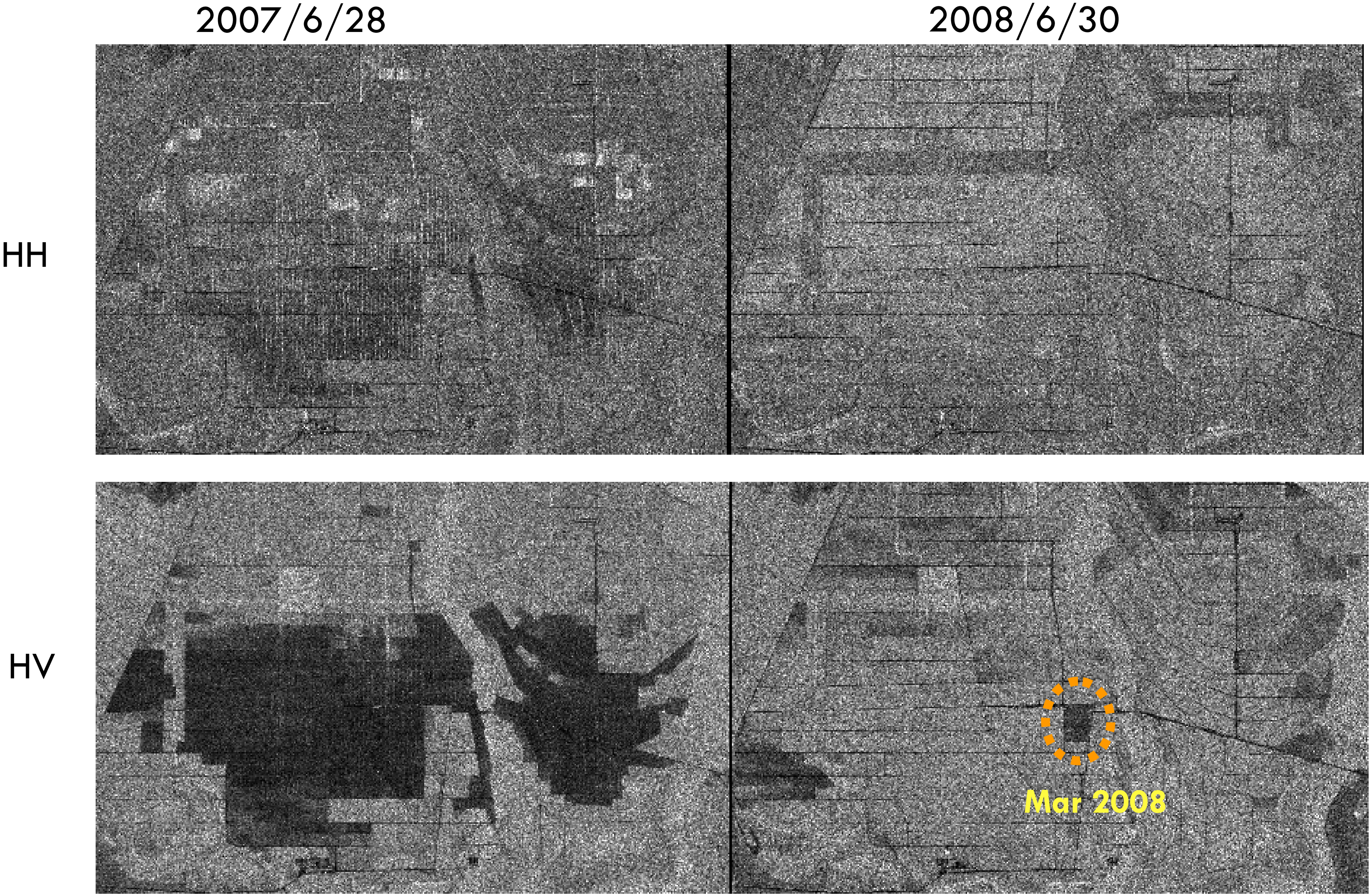
Red: HH Green: HV Blue: HH/HV





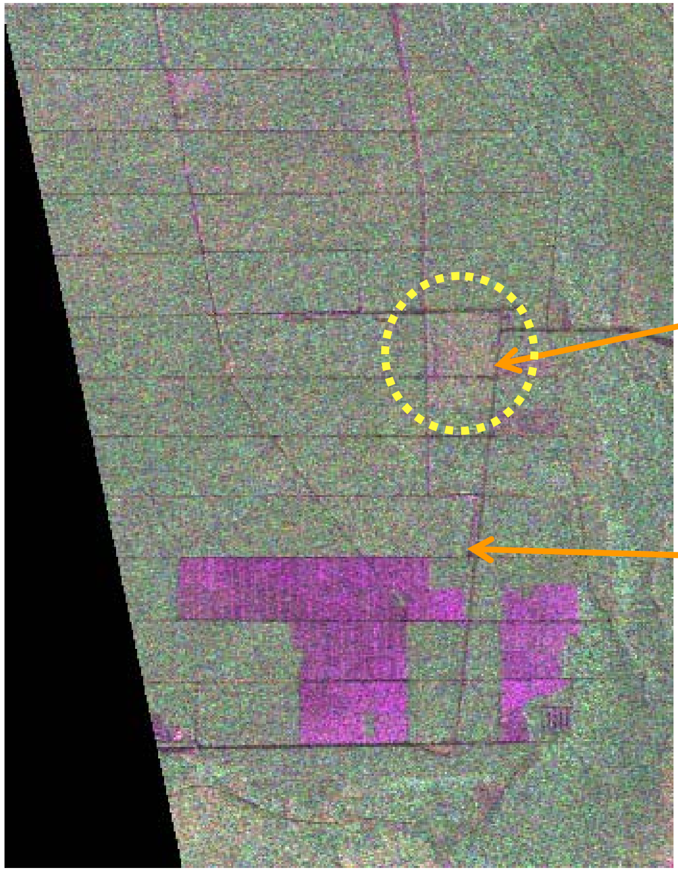
Results

-HH/HV changes on tree age


2007/6/28
2008/6/30
HH
HV
Mar 2008

Results
-HH/HV changes on tree age

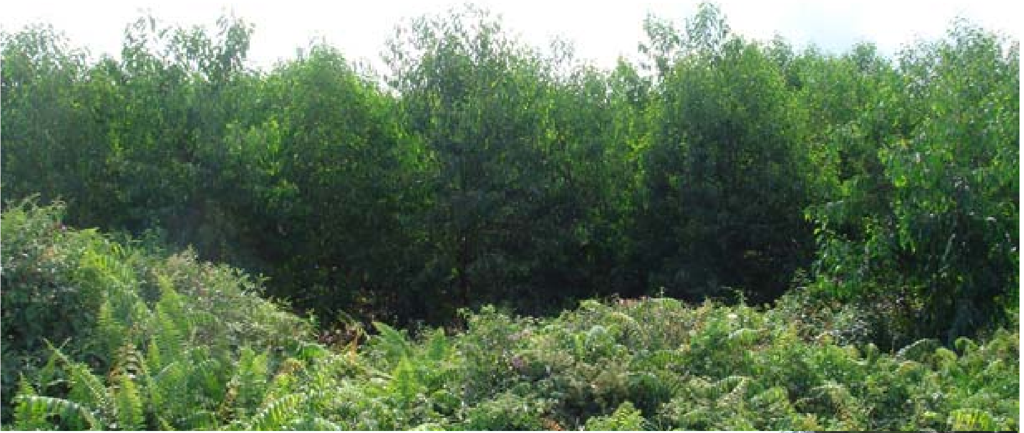
POL 23.1 2009/5/13



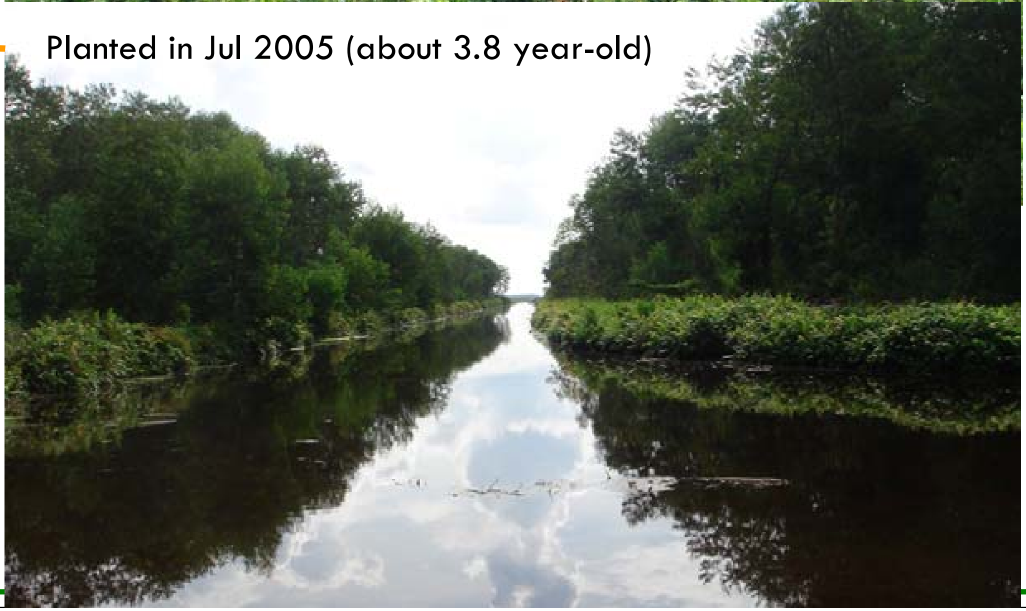
HH: little large
HV: almost same

Photos taken 2009/4/6

Planted in Mar 2008 (about 1.1 year-old)



Planted in Jul 2005 (about 3.8 year-old)

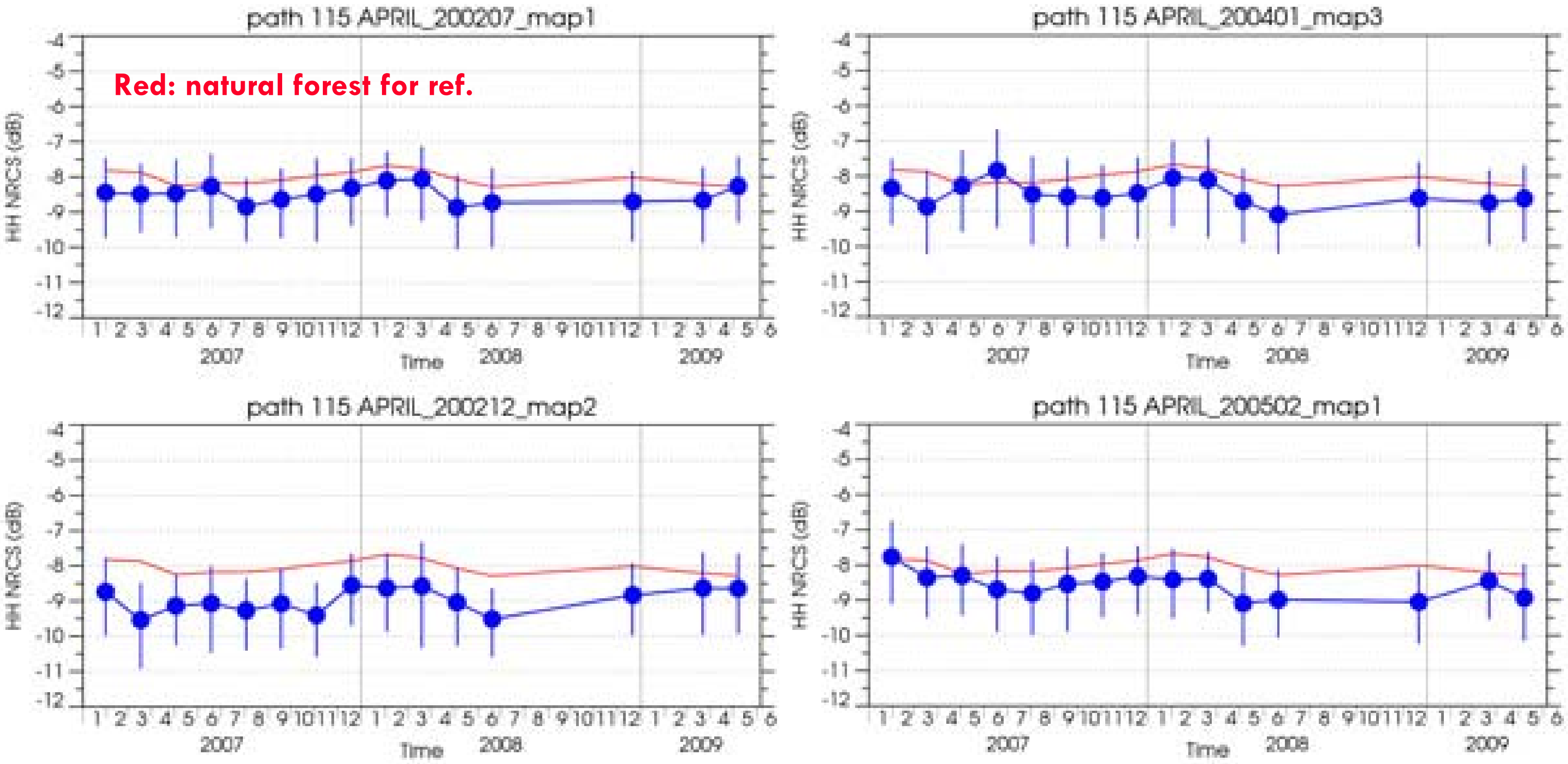


Growth is fast!!

Results

-HH changes on plantation cycle

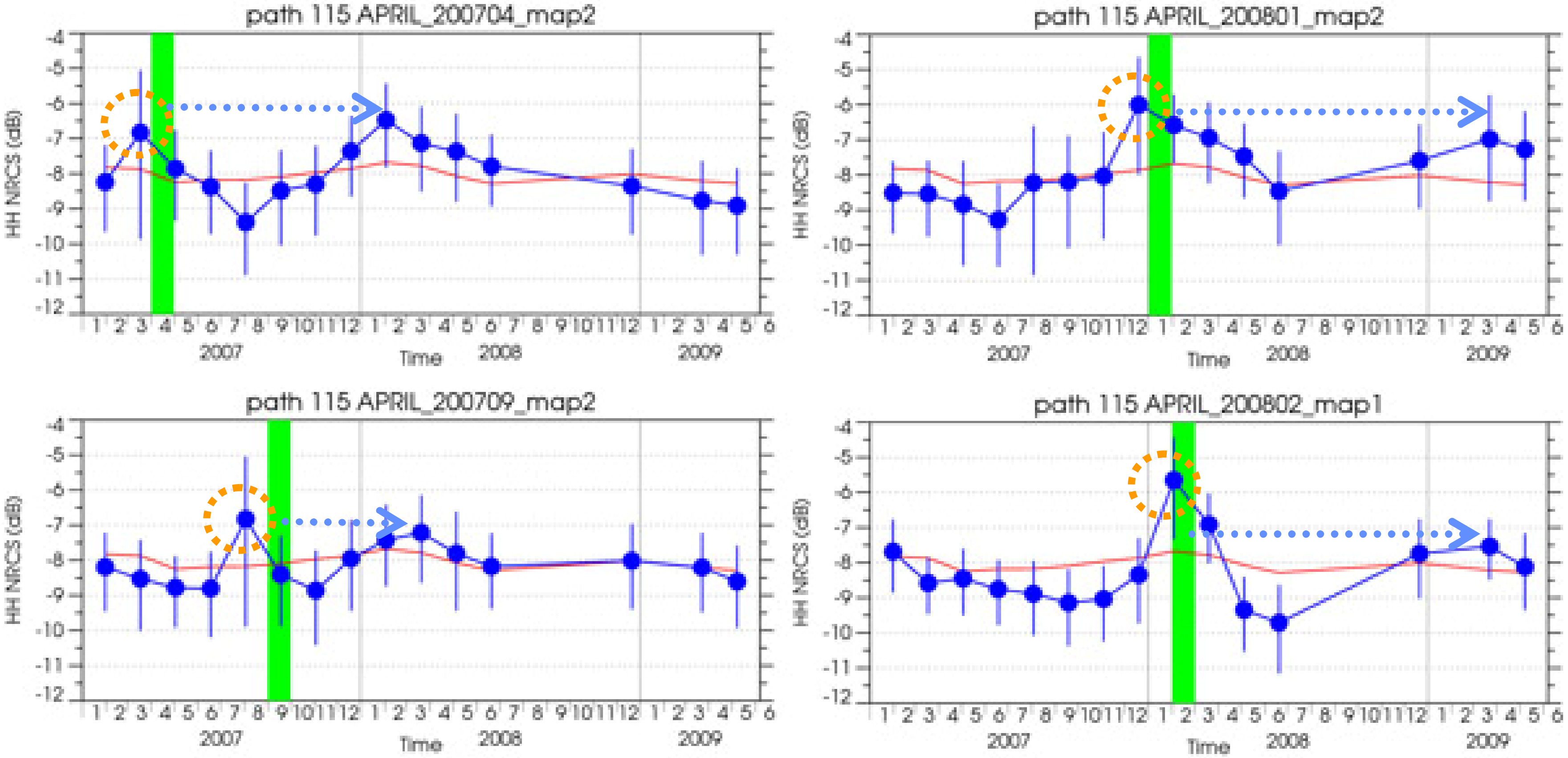
L-HH time series of acacias planted in **2002-2005** (older acacias)
-derived from ScanSAR (path 115: **inc. angle~36°**)



- ✓ Same seasonal cycle and amplitude as natural forests.
- ✓ Signal level: 0.5-1dB smaller than natural forests.

Results
-HH changes on plantation cycle

ScanSAR-derived L-HH time series of acacias planted in **2007-2008**
(including harvesting and planting) **Planting**



- ✓ Extremely large signal just before planting: probably due to harvesting
- ✓ **Large amplitude: lower in dry season and higher in next rainy season (within 1 year-old)**

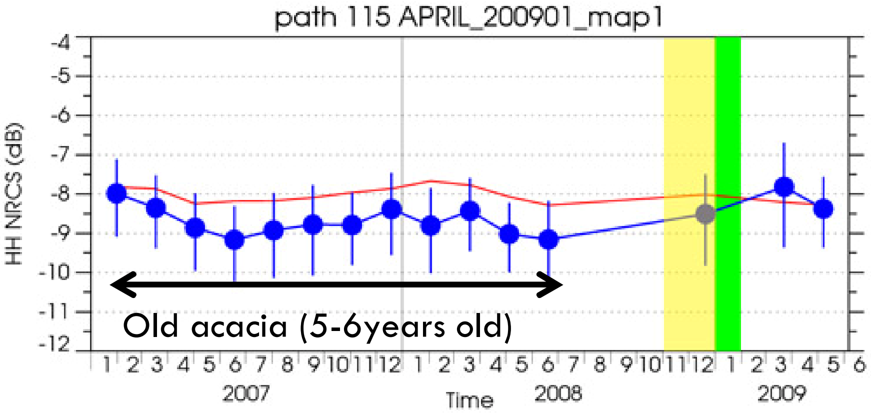
Results
-HH changes on plantation cycle

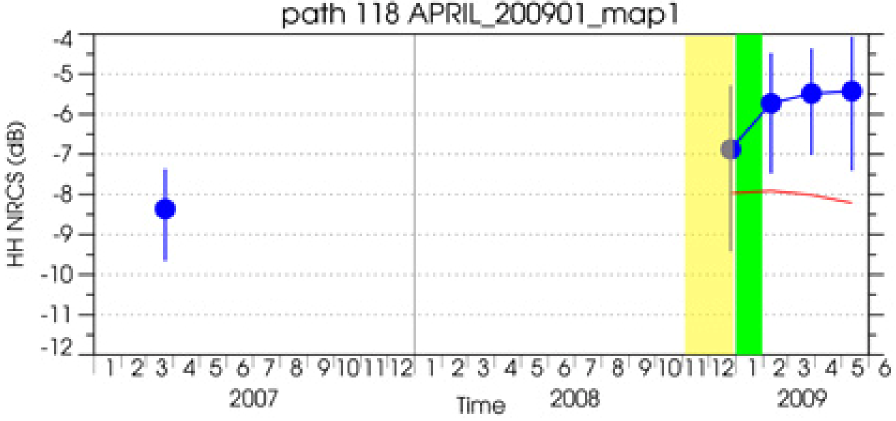
ScanSAR-derived L-HH time series on acacia planted in **2009**
- cases of recent harvesting and planting

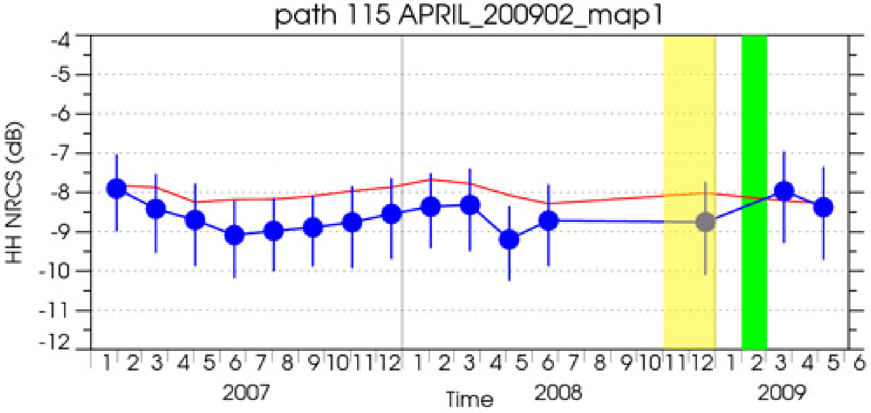
path 115: **inc. angle~36°**

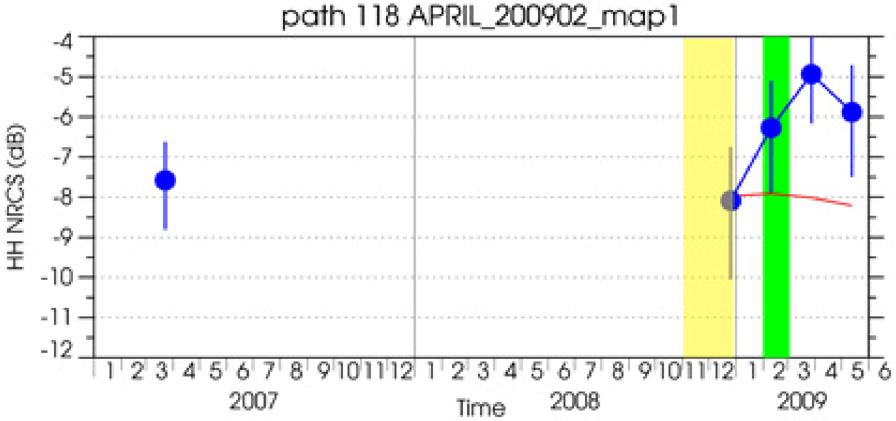
Harvesting **Planting**

path 118: **inc. angle~24°**





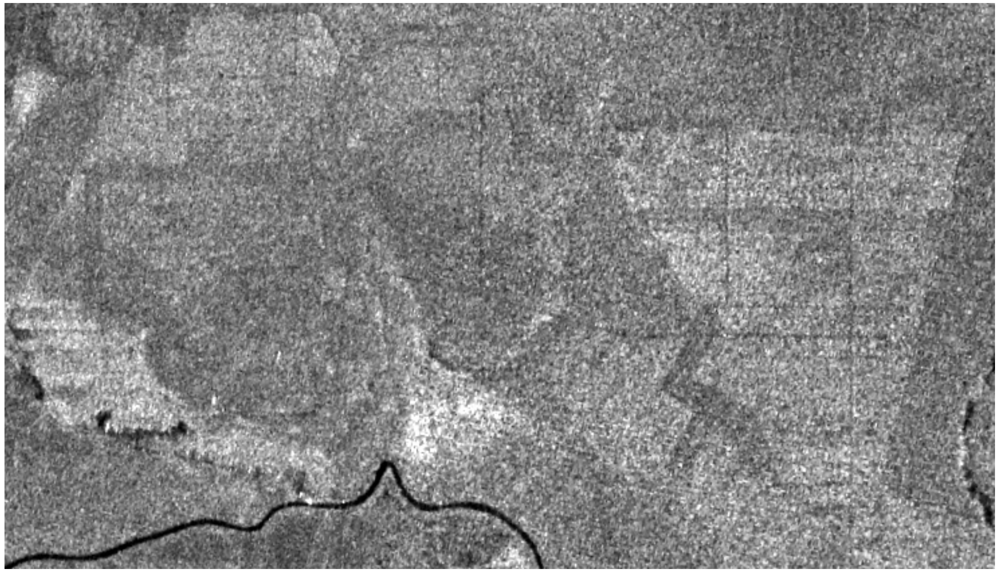




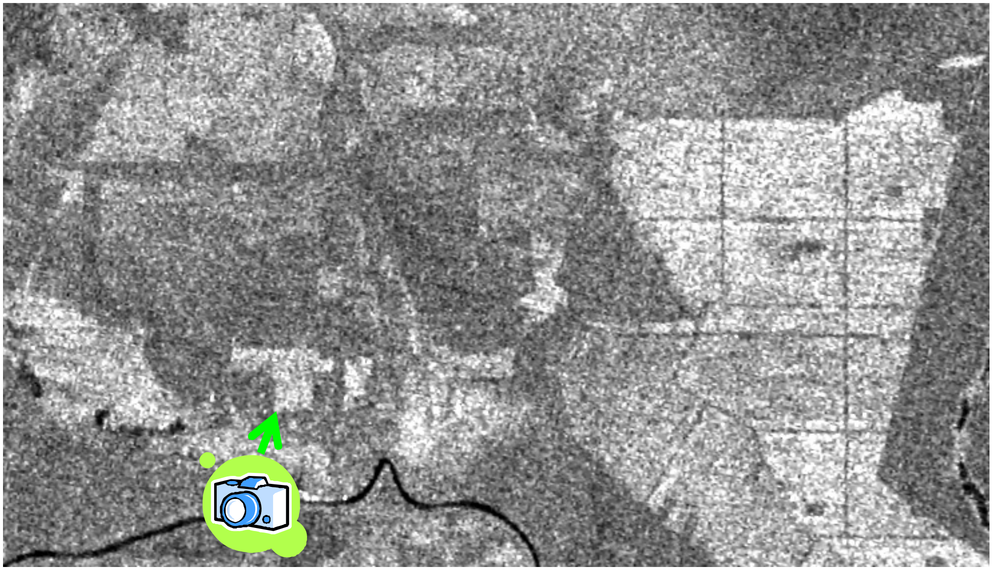
- ✓ Stronger HH signal on baby acacia has strong **inc. angle dependency.**
- ✓ Their differences (2-3dB) can be explained by **a theoretical backscattering from bare soil.**

Results
-HH changes on plantation cycle

path 115 2009/3/23 HH **inc. angle~36°**



path 118 2009/3/28 HH **inc. angle~24°**

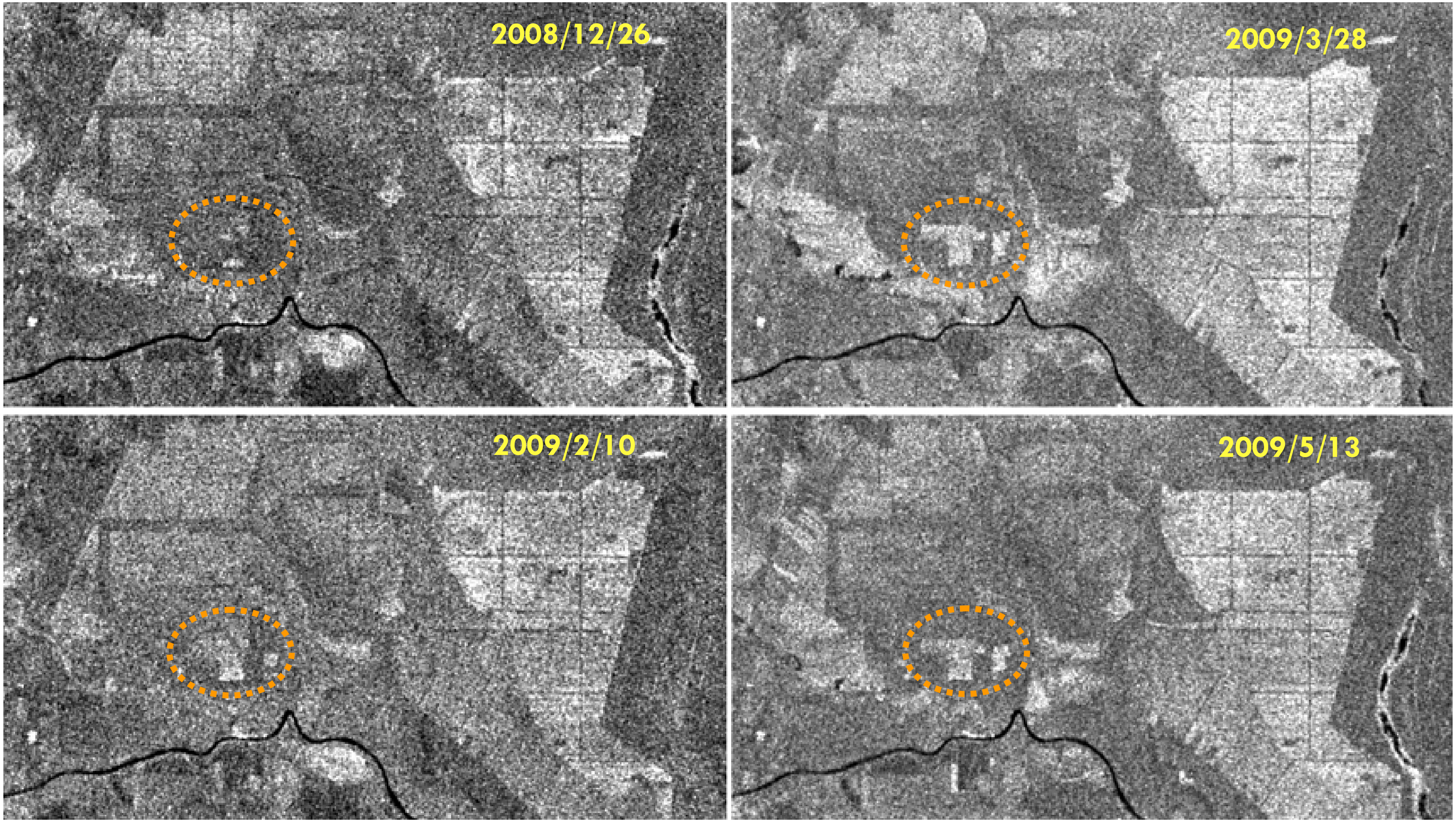


Taken 2009/4/6

Panted in Jan 2009

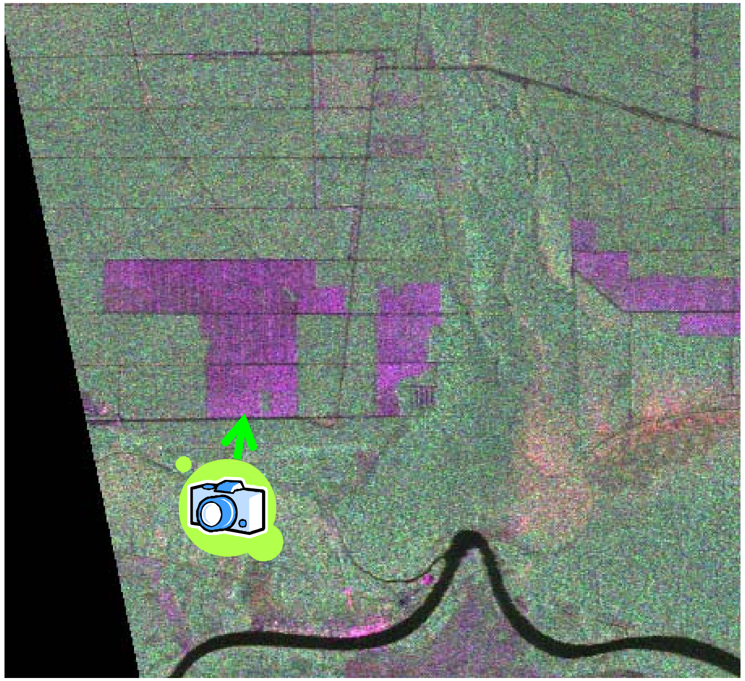
Results
-HH changes on plantation cycle

Path 118 HH **inc. angle~24°**

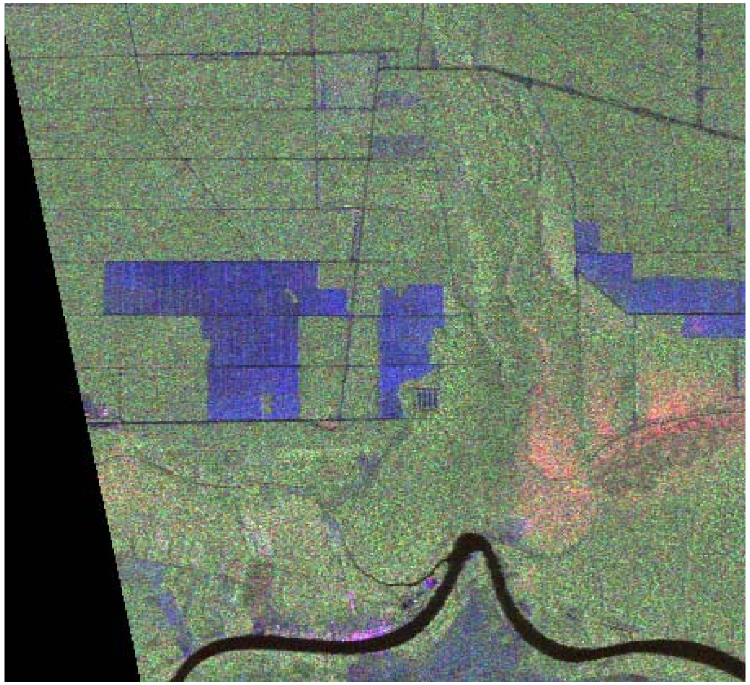

2008/12/26
2009/3/28
2009/2/10
2009/5/13

Results
-HH changes on plantation cycle

POL 23.1 2009/5/13 inc. angle~25°



HH:HV:VV

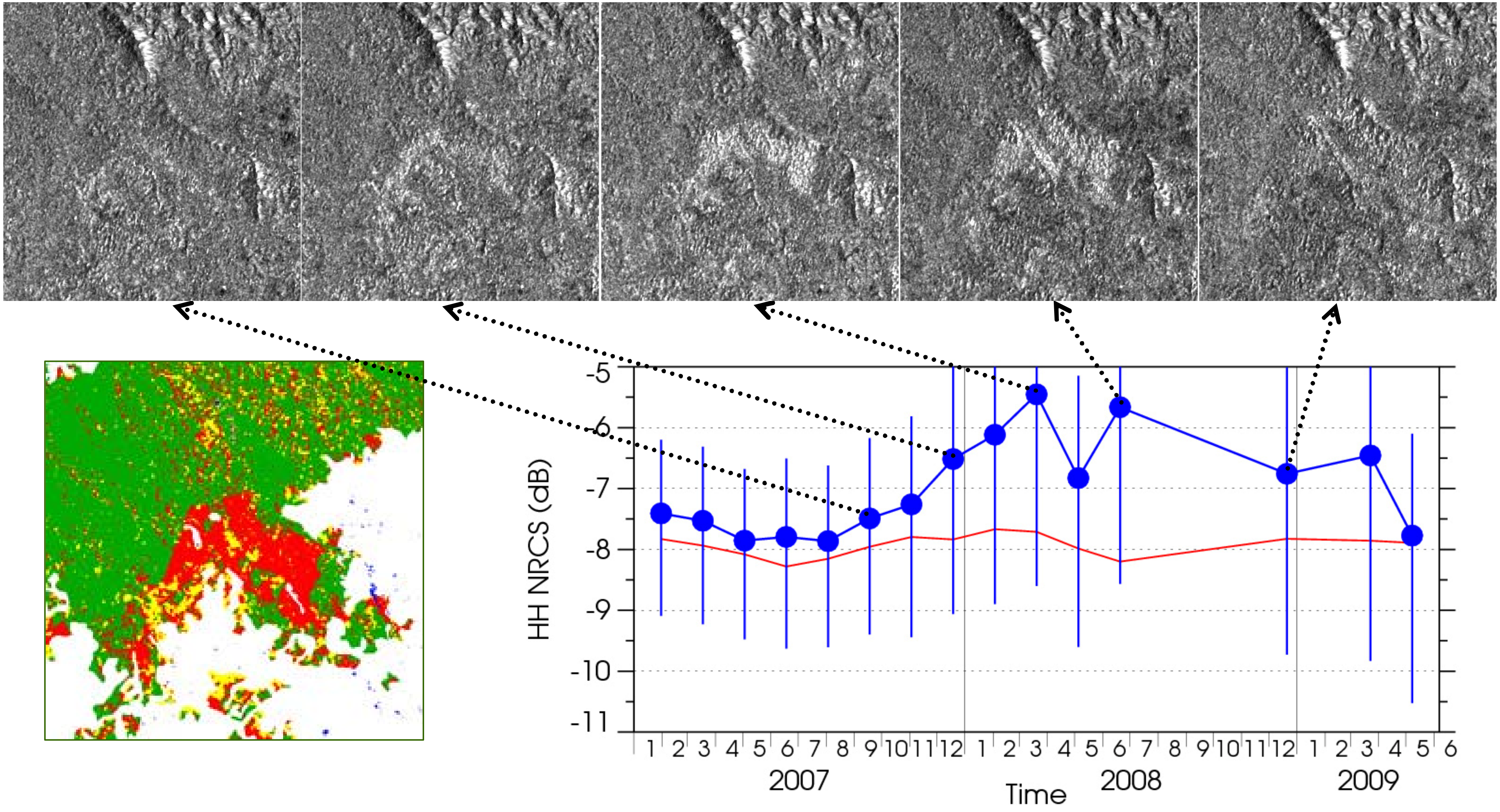


HH-VV:HV+VH:HH+VV

Results

-HH changes on plantation cycle

Similarity to acacia plantation signal



Results

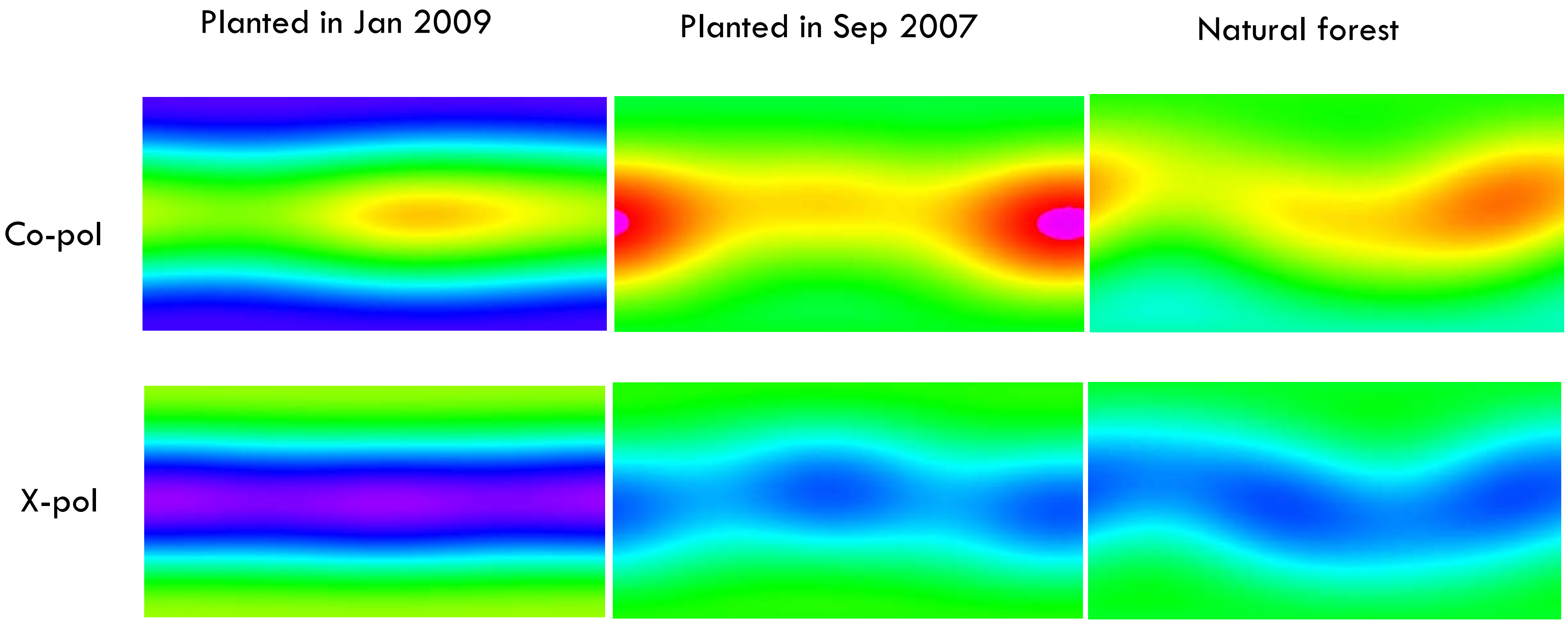
-HH changes on plantation cycle

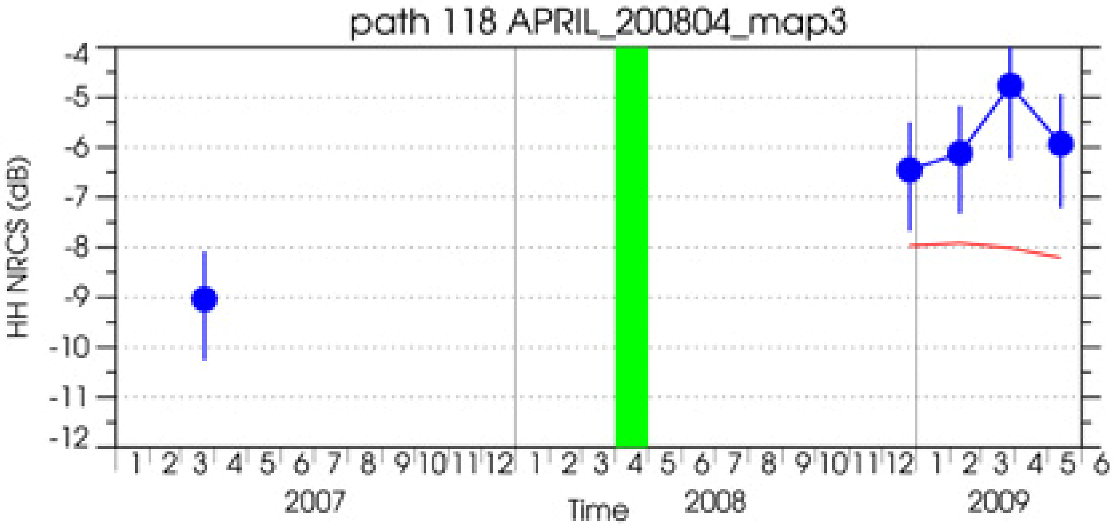
- ✓ Similar HH characteristic is expected for deforested areas.
- ✓ For deforestation monitoring by ScanSAR (HH), incidence angle dependency should be taken into consideration.

Summary

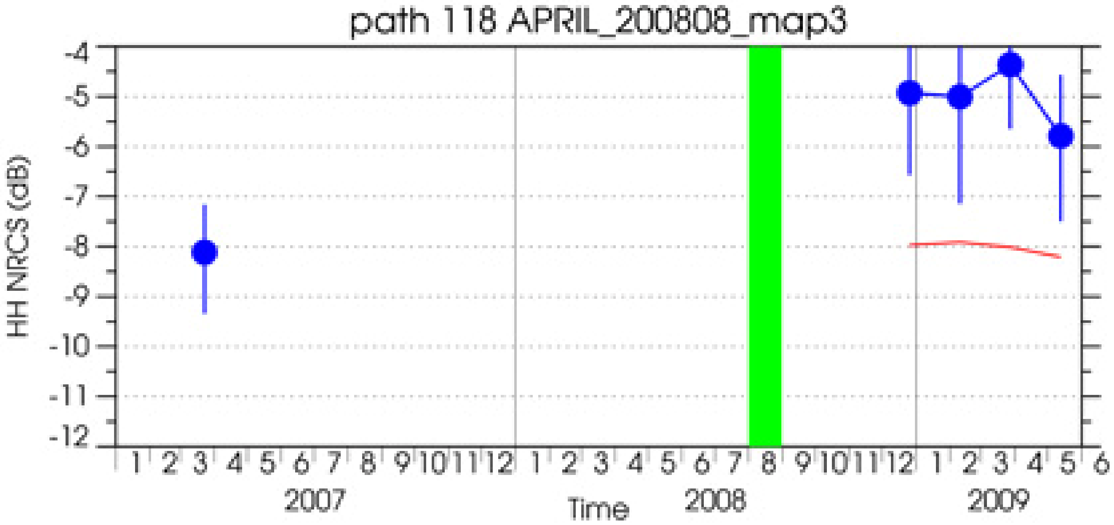
- ✓ **Tree-age-dependent HH & HV signal on acacia plantations**
  - ✓ HV increases rapidly and is saturated after 1 year.
  - ✓ HH gradually decreases getting 0.5-1dB lower than those of natural forests after 2 years.
  - ✓ Higher HH signal especially during first year seems to be attributed to **stronger surface scattering components** (explained by roughness, moisture contents and arrangement ?).

- ✓ **HH signal change associated with a harvesting and planting cycle**
  - ✓ HH of elderly acacias (3-6 years old), which are 0.5-1dB lower than that of natural forests, shows a similar seasonal cycle and amplitude to that of natural forests.
  - ✓ HH of younger (0-2 years old) acacias has larger variability, being higher than that of natural forests in rainy season.
  - ✓ High HH characteristic over young acacias has incidence angle dependency, which can be explained by a theoretical surface scattering model (roughness, moisture contents and arrangement).
  - ✓ For deforestation monitoring by ScanSAR (HH), this incidence angle dependency should be taken into consideration.


Planted in Jan 2009
Planted in Sep 2007
Natural forest
Co-pol
X-pol



path 118 APRIL_200804_map3

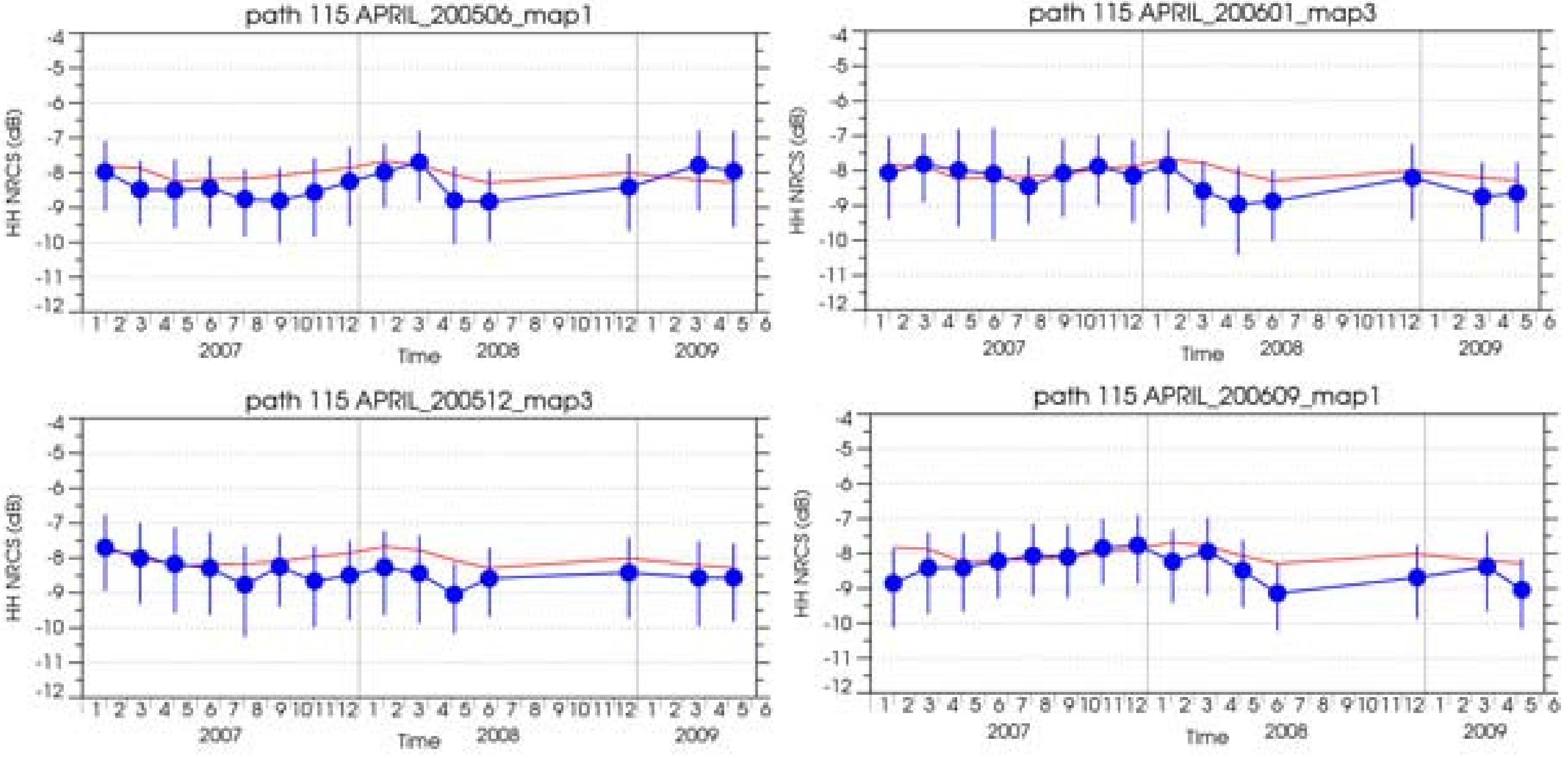


path 118 APRIL_200808_map3

Results

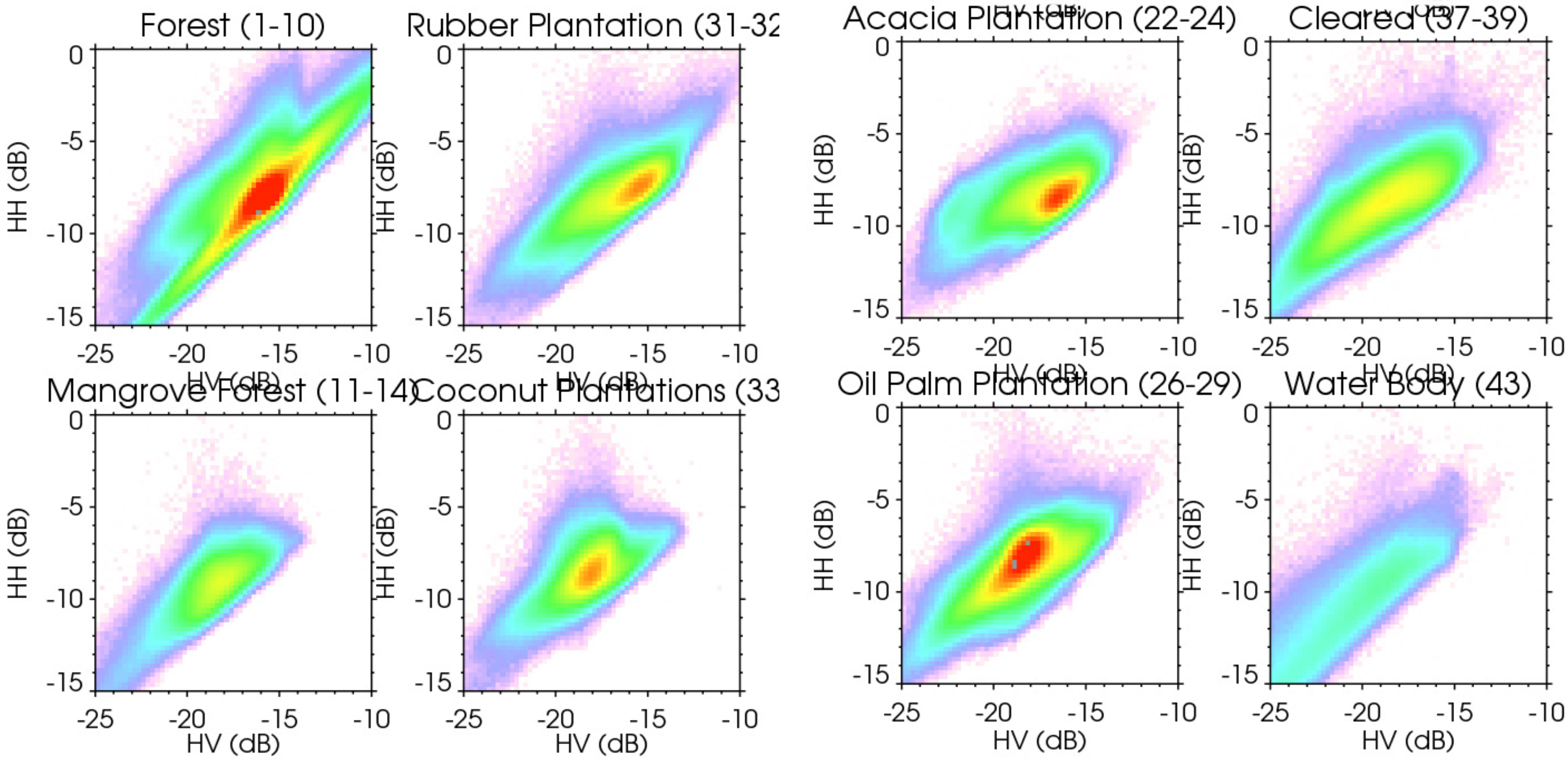
-HH changes on plantation cycle

ScanSAR-derived L-HH time series of acacias planted in **2005-2006** (1-3 year-old acacias)

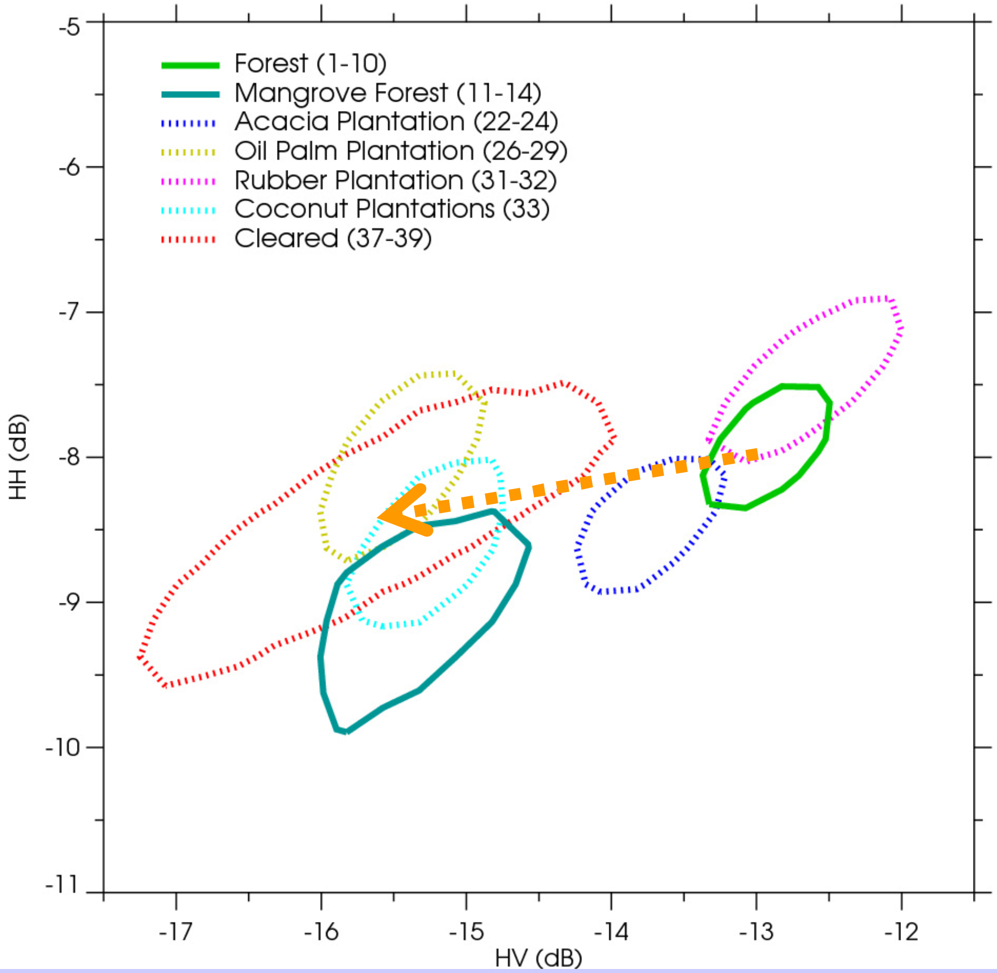


- ✓ Same seasonal cycle and its amplitude as natural forest.
- ✓ **Signal level: almost same as natural forest.**

2-D histograms as functions of HH & HV NRCSs for main land types

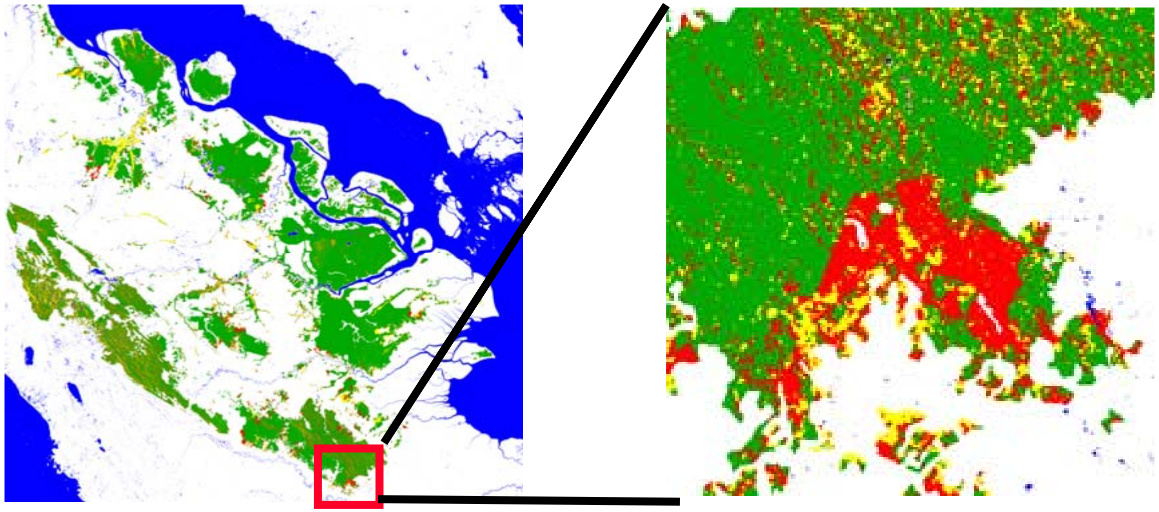


Background



- ✓ **HH&HV: Natural forest ≈ acacia and rubber plantations**
  - ✓ Classification by single intensity mosaic is difficult.
- ✓ **HV: Natural forest 2~3dB** larger than other plantations and **cleared areas**
  - ✓ Detection new deforested area

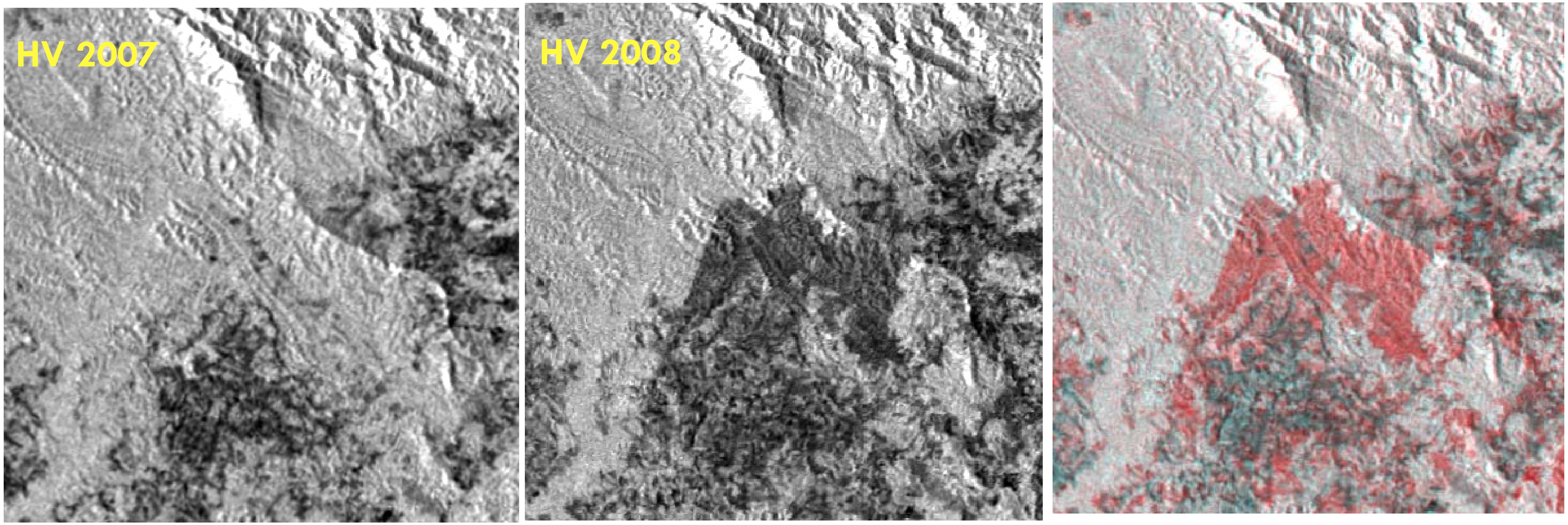
Results
-HH changes on plantation cycle



HV:

- easily identify deforested area
- contribute to estimation

HH:

- no significant difference