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Relationship between L-band NRCS and land use classification in Riau Province, Sumatra, Indonesia

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Objectives

✓ to investigate statistical relationship between L-band NRCS and land use type in Riau, Indonesia by comparing **K&C (Kyoto & Carbon Initiative) 50m dual-polarization (HH&HV) mosaic** and **WWF (World Wide Fund for Nature) Riau GIS Land Cover Database.**

✓ to study the possibility of identification of forest & deforested areas by PALSAR

ALOS PALSAR data

✓ K&C 50m dual-polarization Southeast Asia mosaic 2007. Observation date of original data ranges from June 2007 and November 2007.

✓ FBD data path 442 frame 7180 observed on 1) 2007/7/27, and 2) 2007/9/11 are used for coherence calculation.

Land cover data

✓WWF Riau GIS Land Cover Database compiled by Kokok Yulianto <kkkyulianto@yahoo.com> and Yumiko Uryu yumuryu@yahoo.com is used.

✓based on ground observations and LANDSAT images in 2007.

Table. 1 Statistics of comparison between PALSAR dual-pol mosaic and land cover in Riau highlighted in Fig. 3(a).

No.	Land Cover Name based on WWW Riau GIS Land Cover Database Class Codes	Colour	area (%)	HH (dB)	HV (dB)	Texture HH (dB)	Texture HV (dB)
I.	**SPONTANEOUS VEGETATION TYPES**						
1	**Natural Forest**						
	Dry Land		**11.97**				
1	Dry Lowland Forest rather closed canopy		7.19	-7.72	-15.54	0.36	0.17
2	Dry Lowland Forest medium open canopy		3.47	-7.71	-15.69	0.2	0.11
3	Dry Lowland Forest very open canopy		1.28	-7.8	-15.86	0.22	0.15
4	Dry Lowland Forest on Metamorphic Rock		0.03	-8.83	-17	0.67	0.24
	Swampy Area		**20.4**				
5	Peat Swamp Forest rather closed canopy		7.15	-7.87	-15.74	0.08	0.05
6	Peat Swamp Forest medium open canopy		5.94	-7.83	-15.87	0.09	0.06
7	Peat Swamp Forest very open canopy		0.81	-8.06	-16.19	0.1	0.07
8	Swamp Forest rather closed canopy		1.74	-7.27	-15.81	0.12	0.09
9	Swamp Forest medium open canopy		1.56	-7.5	-15.83	0.12	0.1
10	Swamp Forest very open canopy		0.89	-7.67	-16.21	0.14	0.11
11	Mangrove Forest rather closed canopy		1.7	-9.15	-18.41	0.21	0.17
12	Mangrove Forest medium open canopy		0.38	-9.17	-18.45	0.22	0.18
13	Mangrove Forest very open canopy		0.12	-8.35	-17.33	0.22	0.18
14	Young Mangrove		0.11	-9.25	-18.73	0.24	0.25
2	**Secondary Re-growth (Dry & Wetland)**		**10.68**				
15	Forest Re-growth (Belukar)		2.99	-7.79	-16.15	0.2	0.12
16	Shrubs (Semak/Belukar Muda)		1.6	-8.36	-17.3	0.24	0.12
17	Forest Re-growth on Swampy		0.8	-8.07	-16.75	0.18	0.15
18	Shrubs on Swampy		4.22	-8.63	-17.74	0.15	0.11
19	Swamp Grasses/Fernland		0.63	-8.9	-19.05	0.25	0.19
20	Overgrowing Clear cut-Shrubs		0.2	-8.02	-16.4	0.2	0.13
21	Grassland		0.24	-9.34	-19.31	0.38	0.15
II.	**CULTIVATED TYPES AND PLANTATIONS**		**40.66**				
22	Young Acacia Plantation		1.89	-8.34	-17.52	0.14	0.09
23	Acacia Plantation		5.34	-8.21	-16.72	0.12	0.08
24	Paraserianthes Plantation		0.05	-7.56	-15.61	0.14	0.06
25	City Park (Hutan Kota)		0	-8.18	-16.61	0.28	0.17
26	Young Oil Palm Plantation		4.28	-8.79	-18.56	0.15	0.1
27	Oil Palm Plantation		9.76	-7.95	-18.09	0.12	0.07
28	Small Holder Oil Palm		1.55	-8.15	-18.04	0.16	0.1
29	Small Holder Young Oil Palm Plantation		1.09	-8.81	-18.58	0.19	0.12
30	Mosaic of Small Holder Oilpalm and Rubber		1.74	-8.42	-18.12	0.19	0.1
31	Rubber Plantation		1.04	-7.31	-15.71	0.17	0.09
32	Small Holder Rubber		4.85	-7.79	-16.4	0.18	0.1
33	Coconut Plantation		4.85	-8.42	-18.03	0.14	0.09
34	Mixed Agriculture		2.14	-8.67	-18.27	0.24	0.12
35	Mixed Garden		0.57	-8.06	-17.82	0.26	0.15
36	Paddy Field		1.51	-9.19	-19.77	0.26	0.18
III.	**NON VEGETATION TYPES**		**16.28**				
37	Cleared, for Acacia Plantation		2.68	-8.31	-18.29	0.14	0.11
38	Cleared, for Oil Palm Plantation		0.97	-8.93	-19.21	0.15	0.13
39	Cleared		2.33	-9	-19.2	0.2	0.13
40	Sand Mining		0.01	-9.38	-19.27	0.32	0.19
41	Burnt		0.06	-8.71	-18.68	0.24	0.17
42	Sediment		0	-13.37	-25.28	0.89	0.14
43	Water Body		8.79	-19.55	-29.96	0.22	0.31
44	Town		0.12	-6.13	-16.9	0.39	0.19
45	Settlement		0.53	-7.48	-17.61	0.21	0.13
46	Factory		0.01	-8.37	-18.66	0.55	0.32
47	Airport		0	-12.01	-21.57	0.47	0.21
48	Fishpond		0.01	-11.32	-21.26	0.27	0.17
49	Oil Mill		0.12	-8.43	-18.25	0.27	0.15
50	Cloud or no information		0.65	-8.54	-17.88	0.17	0.1

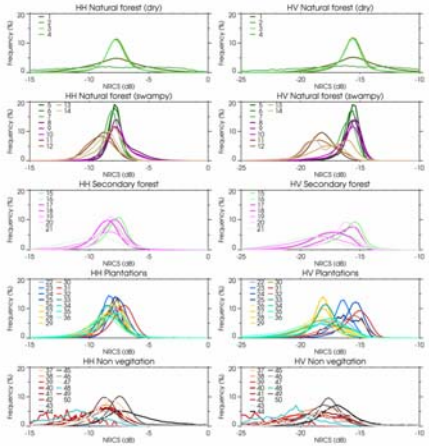

Fig. 1 Histograms (%) of NRCS in (left) HH and (right) HV for each land cover class. Class numbers and their colors correspond to those in Table. 1.

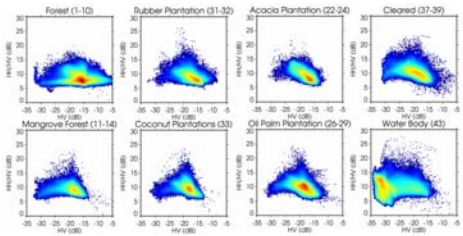

Fig. 2 2-D histograms (dB) for 8 land cover classes as functions of HV and ration of NRCS in HH over HV (HH/HV). Class numbers correspond to those in Table. 1.

Statistics of comparison

✓ **HH channel**: no significant difference among natural forest (-7.7dB), plantation (-8.2dB), and cleared (-8.7dB). Mangrove forest is 1.3dB lower than other swamp forests. Rubber plantation (-7.3dB) is the highest level for all classes.

✓ **HV channel**: plantations (except for Acacia and Rubber) (-18.2dB) and cleared (-19dB) are **2-3 dB** lower than natural forest (-15.8dB). No significant difference between Acacia (-16.6dB) and Rubber (-15.8dB) plantations and natural forest. Mangrove forest (-18.2dB) is 2.2dB lower than other swamp forests, being same level as plantations.

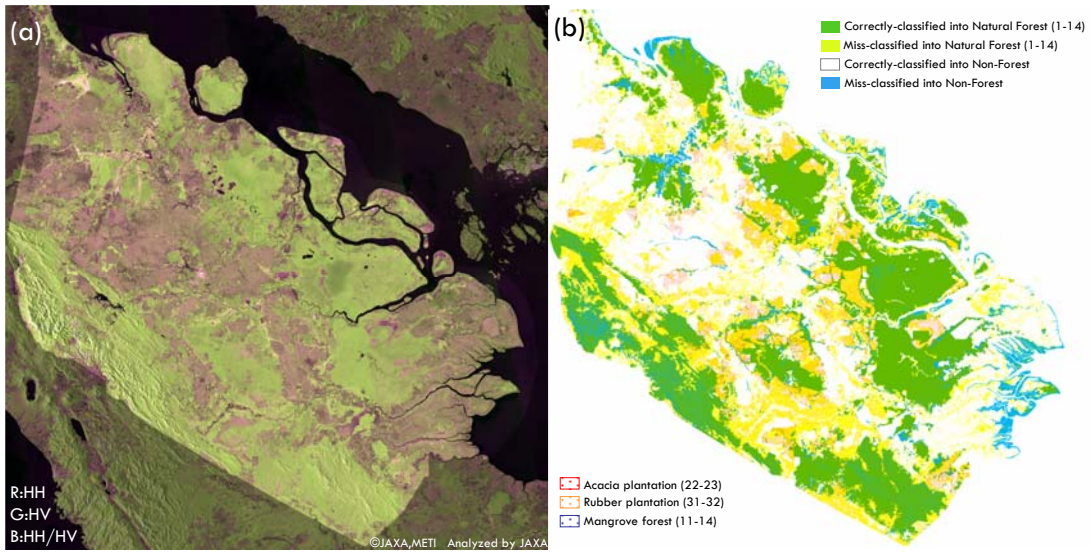

Fig. 3 (a) Color composite of the K&C mosaic around Riau, where studied area is highlighted. (b) Classification result by Maximum Likelihood Method. Areas in Acacia (22-23 in Table. 1), Rubber (31-32) plantations, and Mangrove forest (11-14) based on Land Use Database (Table.1) are hatched.

Classification results

✓ Supervised classification (Natural forest and non-forest) by maximum likelihood method using **HH and HV channels, (texture,** no significant impact**).**

✓ 26.7% of areas miss-classified into forest are **Secondary Regrowth** (15-18), 21% are **Acacia plantations** (22-23), and 20% are **Rubber plantations** (31-32).

✓ 33% of areas miss-classified into non-forest are **Mangrove forests** (11-14).

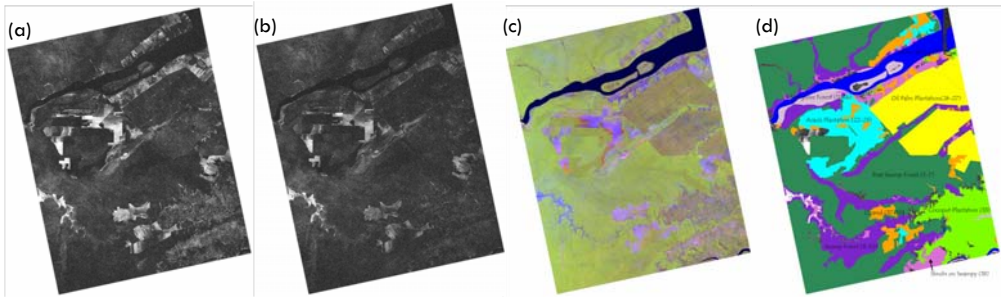

Fig. 4 (a) HH and (b) HV coherence maps derived from 2007/7/27 and 2007/9/11 FBD data. Bp=202m. (c) Color composite image: Red, 2007/9/11 HH amplitude, Green, HV amplitude, Blue, coherence. (d) Land cover map based on Riau 2007 Land Cover Database. Numbers correspond to those in Table.1.

Nest step

✓ Improve classification

✓ Change detection between 2007 and 2008 mosaics for identification of deforested area.

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