

Long-term logging rotation in mangrove forests maintains belowground carbon storage

Daniel Murdiyarso, Sigit Sasmito

CIFOR

Meriadec Silanpaa

Green Forest Product Tech

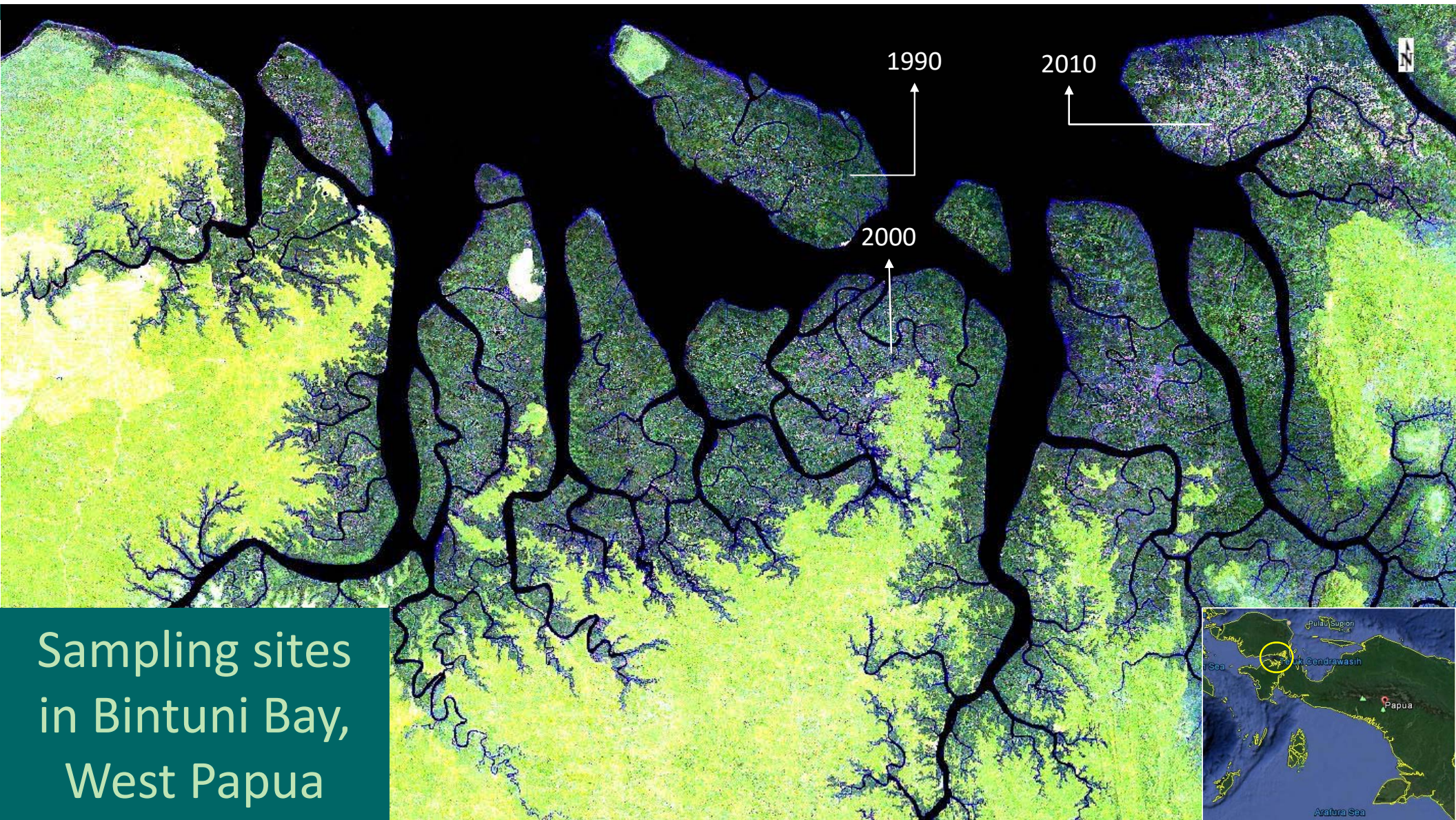


SWAMP

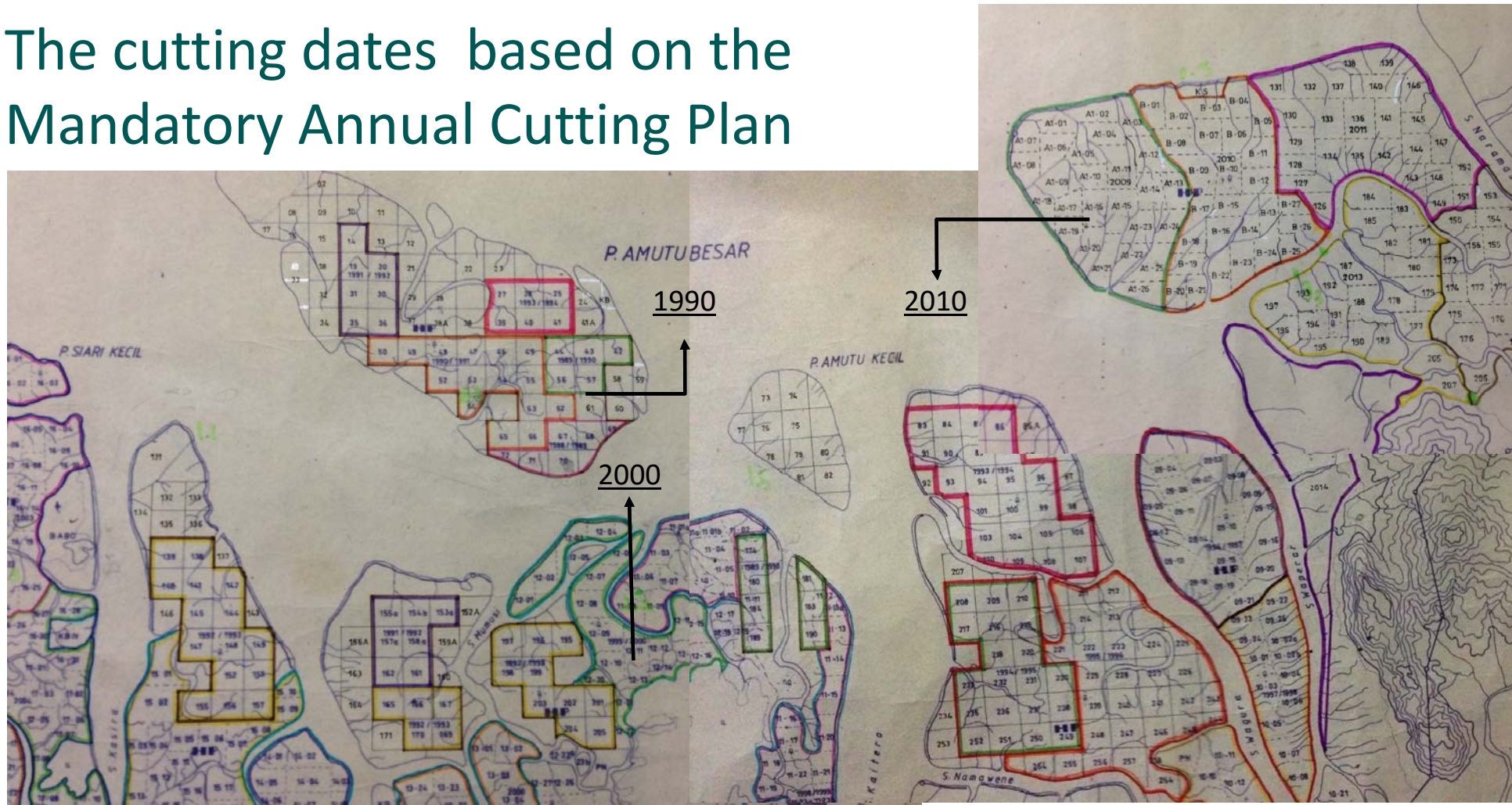
Sustainable Wetlands Adaptation and Mitigation Program



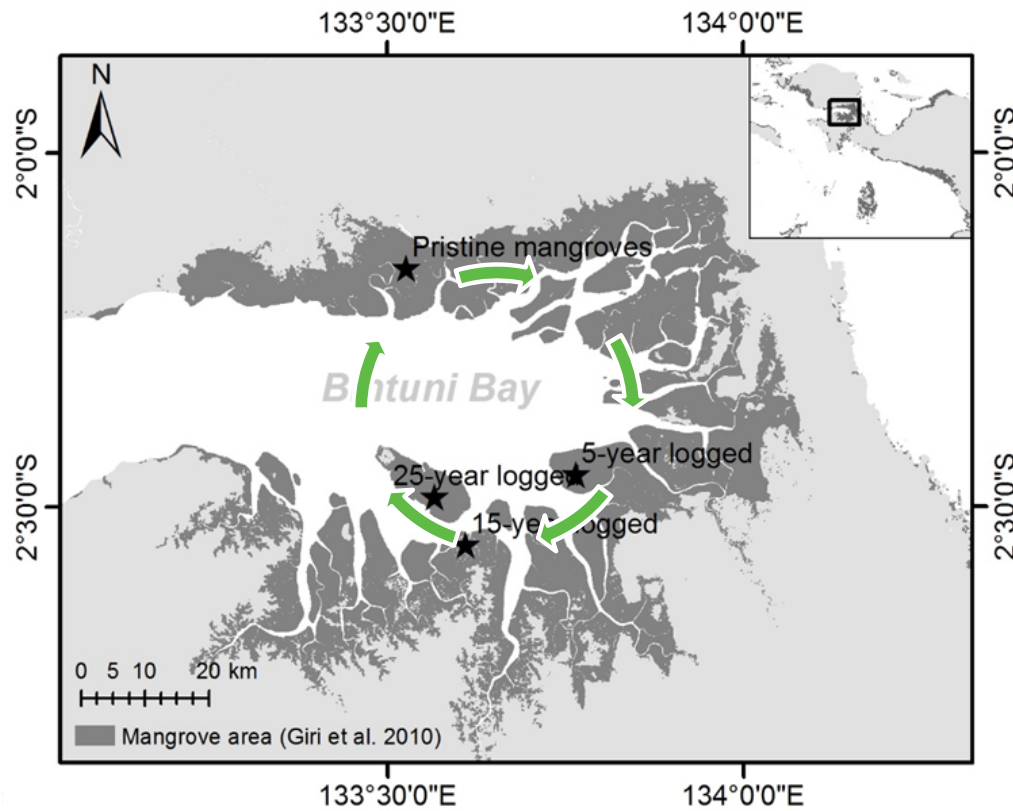
RESEARCH
PROGRAM ON
Forests, Trees and
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The cutting dates based on the Mandatory Annual Cutting Plan



Sampling sites in Bintuni Bay, West Papua



Pristine



25 yrs



15 yrs

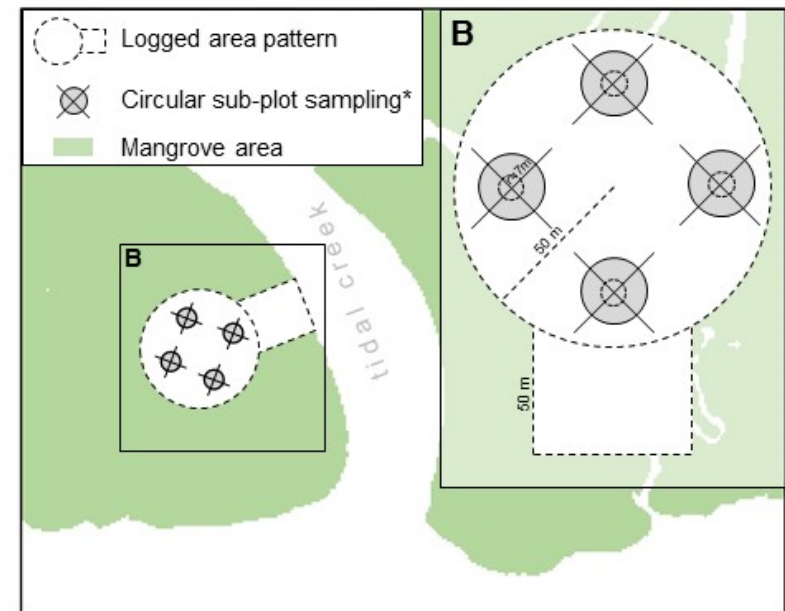
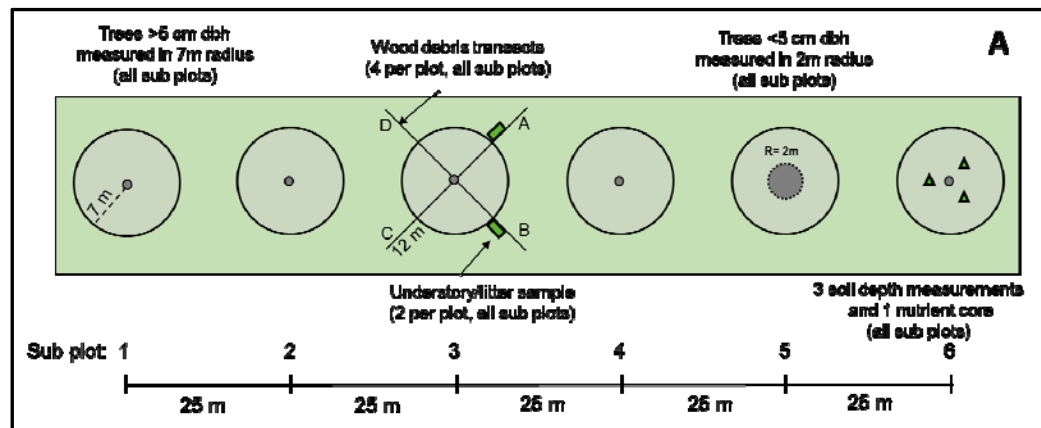


5 yrs





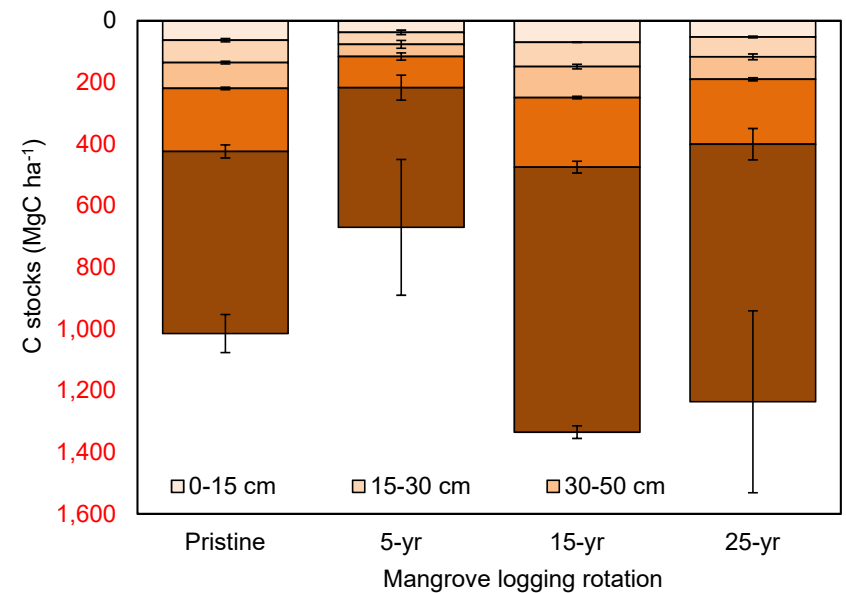
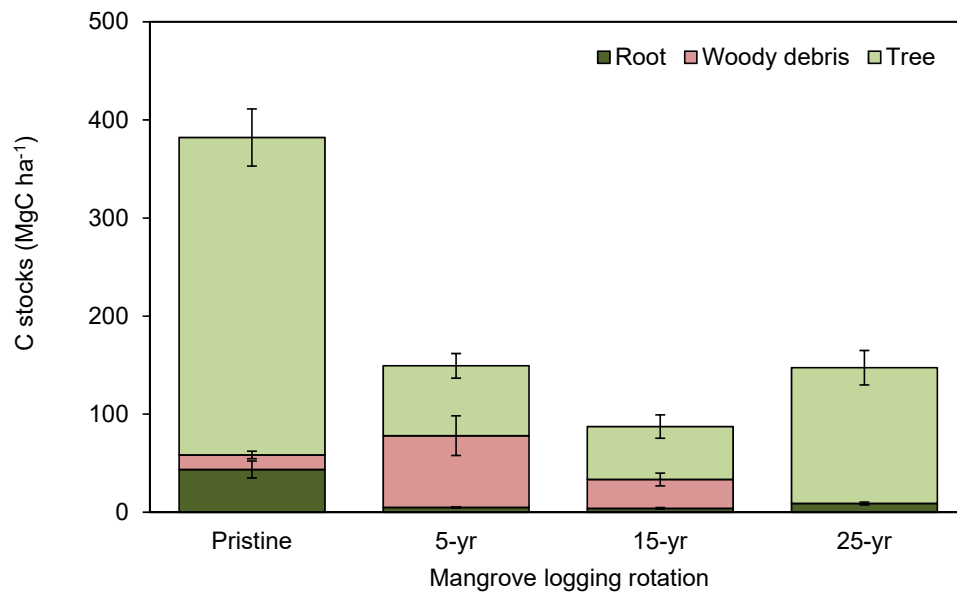
Sampling plot designs



Forest structure

Land cover type	Stand density (individual ha ⁻¹)		Basal area (m ² ha ⁻¹)	DBH (cm)	Species relative frequency (%)
	Seedling (DBH<5cm)	Tree (DBH>5cm)			
Pristine mangroves	2,890 ± 872 ^a	747 ± 24 ^a	18.8 ± 1.6 ^a	24.5 ± 1.2 ^a	Bg (35.5), Rm (32.7), Ct (11.8), Ra (11.8), Xg (7.0), Am (0.8), Cs (0.2)
5-year logged	47,075 ± 8,858 ^b	1,048 ± 203 ^a	16.8 ± 3.3 ^a	15.9 ± 0.4 ^b	Ra (71.2), Bp (25.0), Rm (3.2), Am (0.6)
15-year logged	7,663 ± 1,095 ^a	2,137 ± 431 ^b	18.7 ± 6.6 ^a	9.9 ± 0.5 ^c	Ra (91.0), Bp (5.4), Cd (2.2), Am (1.1), Xg (0.4)
25-year logged	–	2,735 ± 70 ^c	42.3 ± 2.6 ^b	13.0 ± 0.0 ^{bc}	Ra (91.3), Rm (4.4), Bp (1.8), Bg (1.6), Ct (0.6), Sa (0.4)
p-value	0.0001**	0.0001**	0.0001**	0.0001**	

C stocks in various pools of mangroves at different time after logging



Differences in soil bulk density and carbon density

Soil depth interval	Pristine		5-yr		15-yr		25-yr		p-value
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Bulk density (g cm⁻³)									
0 – 15 cm	0.61	0.03	0.54	0.04	0.39	0.06	0.47	0.06	0.003**
15 – 30 cm	0.59	0.02	0.51	0.04	0.35	0.04	0.58	0.08	0.001**
30 – 50 cm	0.57	0.02	0.46	0.07	0.33	0.02	0.50	0.07	0.001**
50 – 100 cm	0.63	0.03	0.47	0.06	0.33	0.02	0.54	0.07	0.001**
100 – 300 cm	0.76	0.03	0.55	0.03	0.57	0.05	0.59	0.11	0.001**
p-value	0.001**		0.632 ^{ns}		0.001**		0.774 ^{ns}		
Carbon density (mg C cm⁻³)									
0 – 15 cm	42.28	2.14	25.30	2.39	46.60	3.25	35.29	2.89	0.001**
15 – 30 cm	47.76	1.88	25.95	3.64	52.73	4.52	42.90	6.36	0.001**
30 – 50 cm	41.87	1.69	20.48	3.98	49.95	2.71	36.72	1.91	0.001**
50 – 100 cm	40.91	2.11	21.84	4.52	45.64	2.46	38.75	6.82	0.003**
100 – 300 cm	37.43	2.36	20.74	4.50	41.47	1.67	36.87	9.84	0.006**
p-value	0.013**		0.748 ^{ns}		0.126 ^{ns}		0.788 ^{ns}		

** = highly significant (95%CI)
 * = significant (90%)
 ns = non-significant

Concluding remarks

- The logged-over forests demonstrated to be less diverse in terms of species richness – poses management challenges
- Above ground C stocks were recovered relatively rapidly after 5 years of logging; generally declined after 15 years due to naturally thinning; and picked up again after 25 years
- Soil C stocks at all stands were maintained high after logging due to cutting techniques – provided that rooting systems are not disturbed
- Sedimentation processes and rates under logged-over mangroves merit further studies



Thank you
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