

Blue carbon and biodiversity within Suriname's mangrove forests using a multipurpose NFI

Gianni Wip¹, Verginia Wortel², Ansmarie Ngu Chin Tjon², Gunovaino Marjanom³, Jasper Feyen¹, Sarah Crabbe¹, Rawien Jairam⁴, Dorothy Traag³, Gwen Landburg⁴, Marchal Lingaard⁵

¹Foundation for Forest Management and Production Control, Paramaribo, Suriname. ²Center for Agricultural Research and Development Suriname, Paramaribo, Suriname. ³The National Herbarium of Suriname, Paramaribo, Suriname. ⁴National Zoological Collection Suriname, Paramaribo, Suriname. ⁵Nature Conservation Division Paramaribo, Suriname

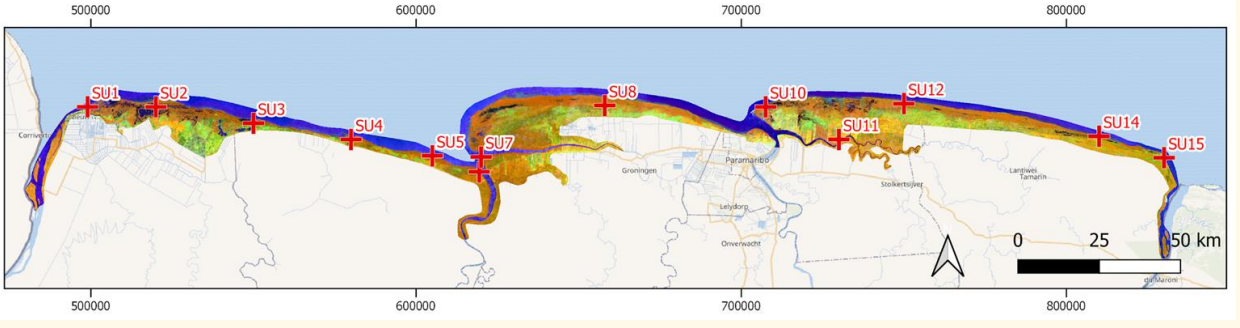


Introduction & project goals

Set up a mangrove biodiversity monitoring system, by embedding the system in existing structures of the National Forest Monitoring System (SBB, 2017), building on these structures, and further strengthening them.

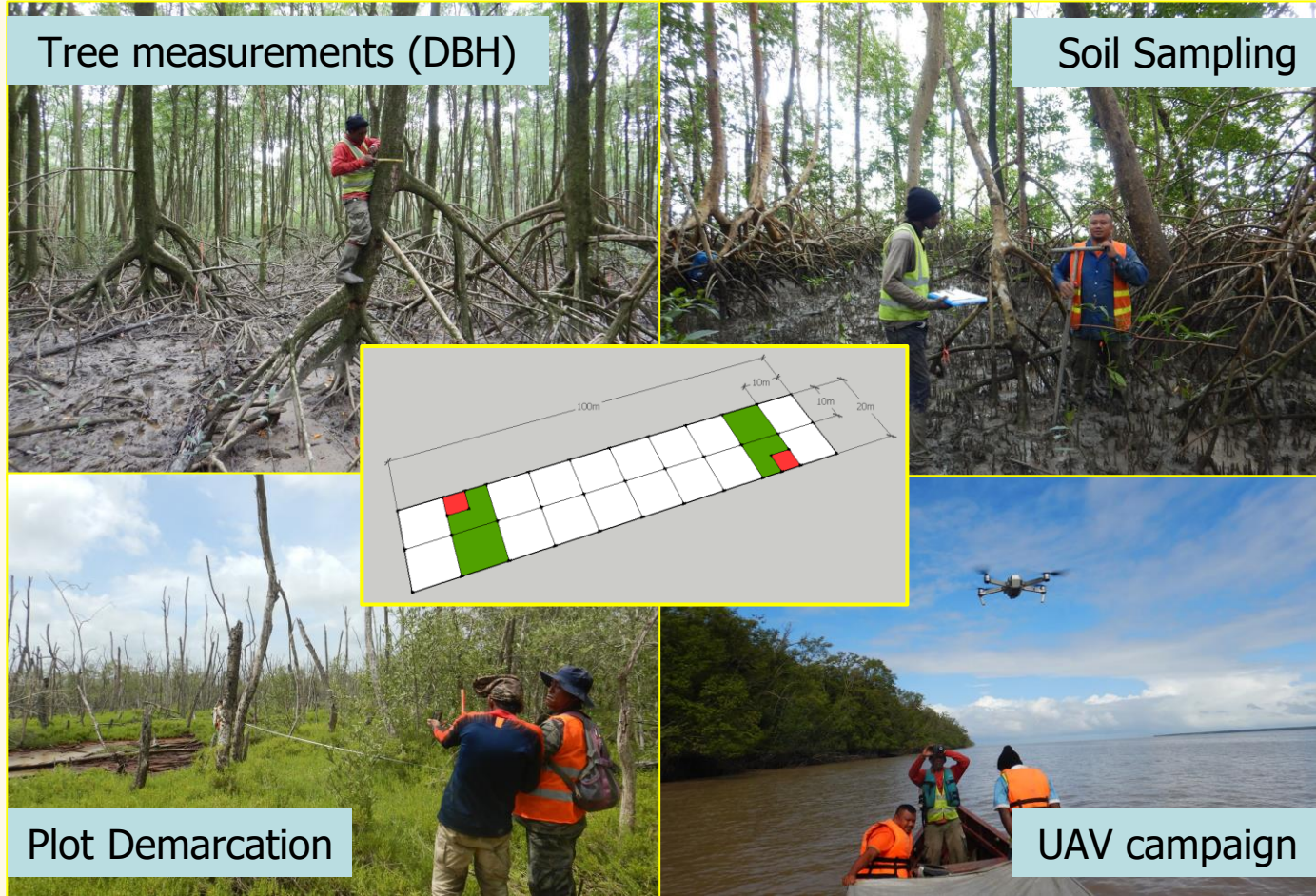
Specific project expectations can be summarized as follows:

- Insight into the status of mangrove forest cover in Suriname;
- Insight into the status of mangrove forest in Suriname with a specific focus on biodiversity
- Provide carbon stock estimates of the mangrove forest in Suriname.



Methodology

Field Inventory



Sampling and inventory works took place along a 700 m transect line in which 4 rectangular Permanent Sample Plots (PSP) of 100m X 20m size were set up in between 100 m buffers. For floristic species validation observations, photos and botanical collections were taken. In addition, lifeforms and cover were recorded and estimated (Braun-Blanquet).

Data analysis

Remote Sensing analysis: Supervised classification in Google Earth Engine (GEE) of a fusion of Sentinel-1 and 2 imagery with a Random Forest (RF) machine learning technique for mapping the actual mangrove forest cover and mangrove species domination. An assessment of the historical mangrove cover of selected years was done with Landsat imagery from 1987-2018 in GEE with a Random Forest classifier.

Above ground biomass: Biomass data was processed utilizing R software and applying the Chave *et al.* (2014) equation.

Biodiversity assessment:

- **Mammals:** Data from camera traps was studied
- **Birds:** Visual and auditory line transect observations were analyzed
- **Floristic:** Data from the field survey and botanical collections were processed and analyzed on species diversity within mangrove vegetation.

Results

A) Carbon Stocks

Pools considered:

1. AGB (Eq.1) standing deadwood included
2. The *Avicennia germinans* pneumatophores and seedlings.
3. Soil (Eq.2) Range: 150-250 MgC/ha
 - (Eq1) $AGB_{est} = \exp(-1.803 - 0.976E + 0.976\ln(p) + 2.673\ln(D) - 0.0299(\ln(D))^2)$
 - (Eq. 2) $SC = \text{bulk density} * \text{soil depth interval} * \% \text{ Carbon concentration}$

District	Nickerie			Coronie			Saramacca	Commewijne		Marowijne
SU ID	1	2	3	4	5	6	7	10	11	15
Above ground Carbon Stock (ACS) (Mg ha⁻¹) by stem diameter class										
10-20	39.44	23.37	29.9	57.96	54.32	19.17	57.99	79.42	22.12	29.41
20-30	34.36	3.49	26.87	21.25	92.91	63.95	87.12	44.27	44.3	66.08
30-40	10.23	0	7.75	6.39	26.86	91.94	46.83	0	82.83	71.44
40-50	0	0	0	0	3.93	34.67	5.68	0	78.84	29.31
50-60	0	0	0	0	0	0	0	0	51.53	17.77
>60	0	0	0	0	0	140.72	0	0	33.64	0
Total ACS	84.03	26.86	64.52	85.6	178	350.5	197.62	123.69	313.26	214.01
Soil Organic Carbon (Mg/ha) until sample depth										
30 cm	50.65	95.37	60.57	51.53	37.72	99.92	56.65	107.25	125.72	97.92
100 cm	192.60	247.40	181.17	164.22	151.03	284.76	207.38	237.54	540.20	230.11

B) Biodiversity Assessment

Mammals: A giant anteater (*Myrmecophaga tridactya*) was detected. Various crab eating raccoon (*Procyon cancrivorus*) were detected and an old puma track (*Puma concolor*).

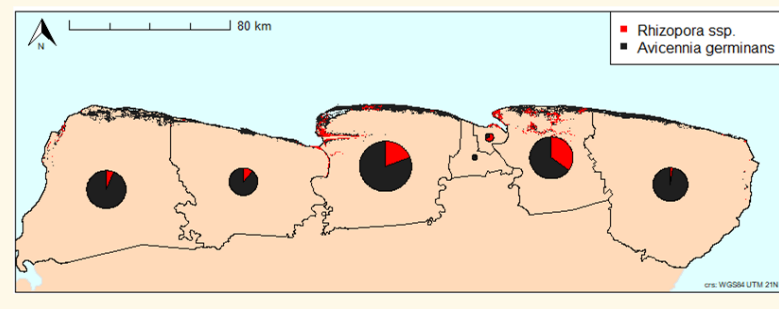
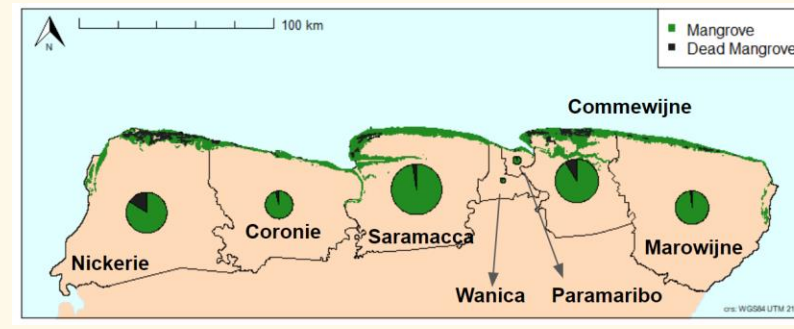
Birds: Six rare sensitive migratory species observed. *Pachyramphus polychopterus*, *Parkesia noveboracensis*, the *Myiodynastes maculatus*, *Aramus guarana*, *Falco peregrinus*, *Coccyzus americanus*

Floristic: The *Avicennia germinans* vegetation can be found along the coast with a diversity of weeds and climbers in the understory (Characteristic specie *Acrostichum aureum*). The vegetation type with *Rhizophora* sp. are specifically found along the river sides with a diversity of epiphytes (Characteristic specie *Montrichardia arborescens*). Consisting each of 38 species, but with a different composition.

C) Mangrove Forest Cover

Mangrove cover in 2018:

- Total of ~89.000ha mangrove and ~15898ha of dead mangrove ('graveyard') stands.
- Kappa index: 84.73%.



- Total of ~74.914ha *Avicennia* and ~15.898ha of *Rhizophora* dominated mangrove forests
- Kappa index: 75.93%

Historical analysis (1988 - 2018):

Mangrove cover area increased with ~1% since 1988. The annual mangrove growth/loss rates are highly connected with the mudbank dynamics on the Guianas coast.

Region	1998-2000		2000-2018		1988-2018	
	Change (km ²)	%	Change (km ²)	%	Change (km ²)	%
Saramacca	19.89	8.3%	30.91	11.9%	50.80	21.1%
Commewijne	-3.07	-1.3%	-25.24	-10.9%	-28.31	-12.1%
Nickerie	36.82	20.8%	-47.45	-22.2%	-10.63	-4.0%
Marowijne	-28.92	-23.6%	37.18	39.7%	8.26	6.7%
Coronie	-0.21	-0.2%	-9.28	-9.6%	-9.49	-9.8%
Paramaribo	-1.27	-12.2%	-1.20	-13.3%	-2.47	-23.9%
Wanica	2.94	128.9%	-1.95	-37.3%	0.99	43.6%
Overall	26.18	3.0%	-17.02	-1.9%	9.16	1.0%

Conclusion

Current methodology has proven to render valuable data in achieving monitoring goals, though some revision, especially regarding the status of biodiversity within the mangrove forest is required going forward.

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