GIS/RS multi-scale approach for the assessment of mangrove species composition and coverage

Rocky Kaku, Vanuatu Fisheries Department
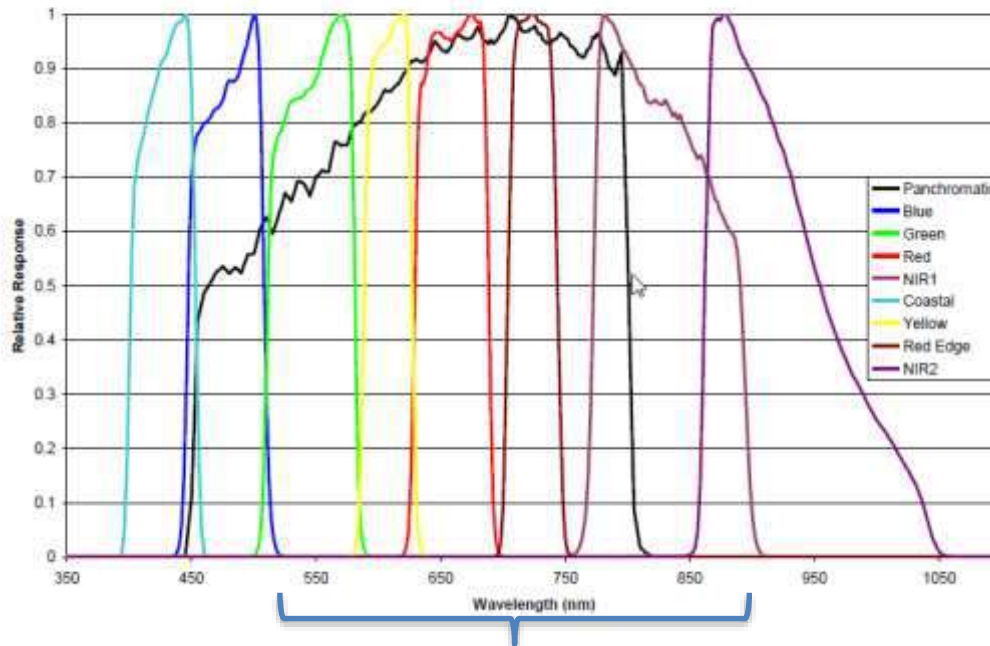& Franck Magron, Pacific Community

Methodology

1. Preparation of field survey using satellite imagery (WV2 – 8 bands)

2. Sampling points in the mangrove (field work)

3. GIS mapping and analysis

WV2 spectral bands

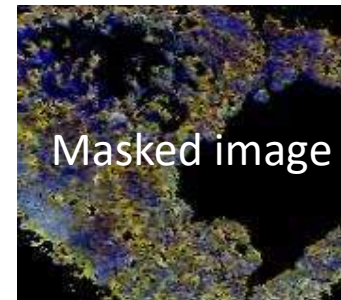Figure 2: WorldView-2 Relative Spectral Radiance Response (nm)
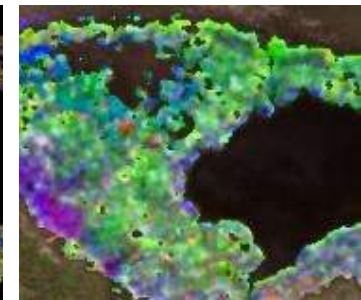

Mangrove classification

Visible bands   Visible bands   Red edge & NIR bands   PCA all bands
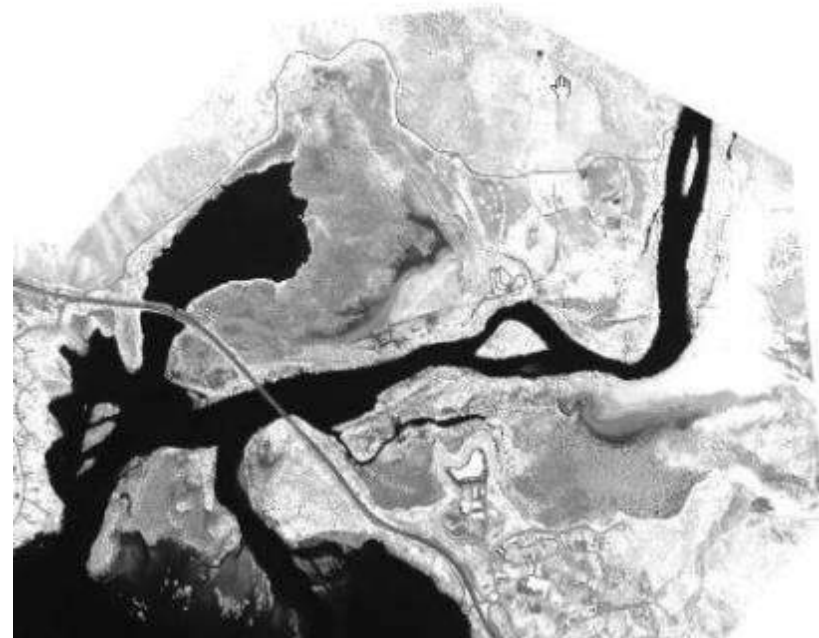
Mangrove remote sensing
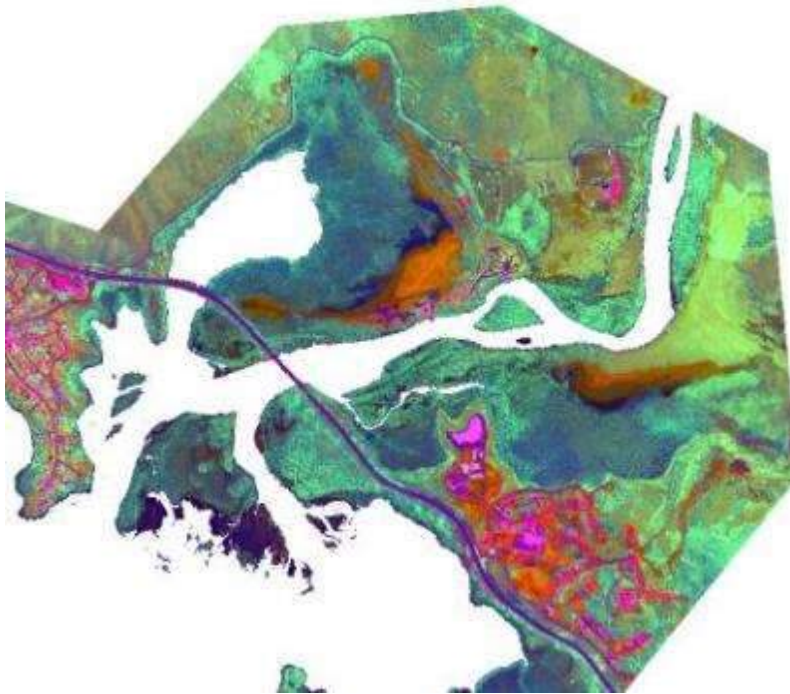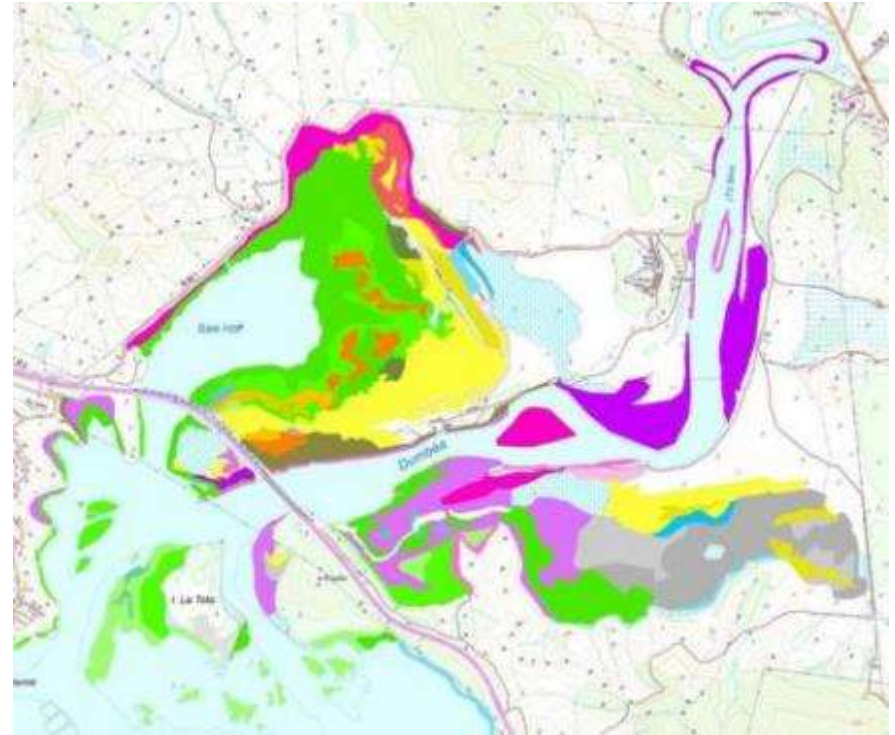

Visible bands 4,3,2

NIR-1 band (7)

Mangroves areas are wet and appear darker than bare soil, urban areas and grass fields on near-infrared bands.

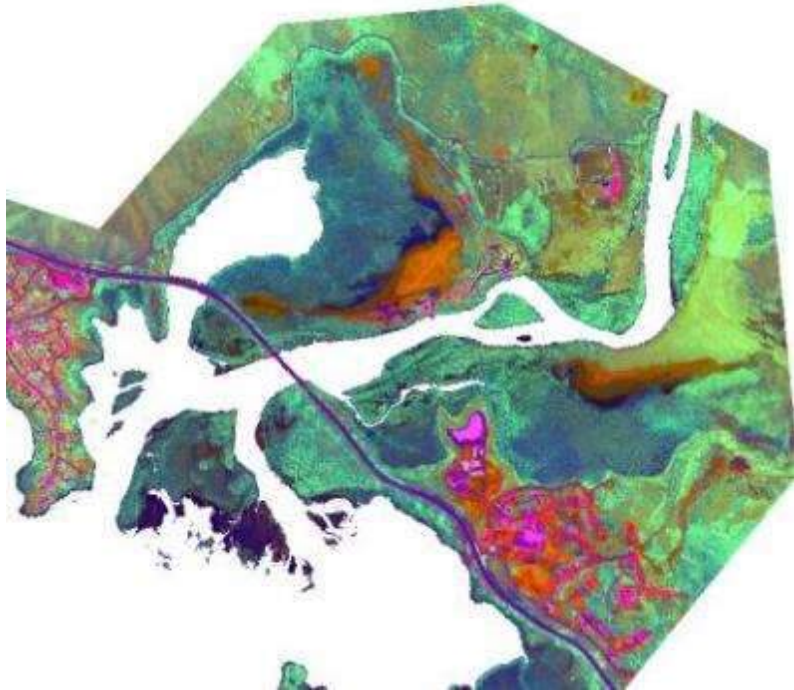# Mangrove remote sensing

PCA excluding water

Mangrove map (from NC Atlas)

A PCA* on all bands excluding water furtherly highlight differences between bare soil (orange), urban areas (magenta), grass fields (light green, khaki) and mangrove areas (sea green, aquamarine).

* PCA = Principal Component Analysis

Mangrove remote sensing

PCA excluding water

Classification from PCA

Forest

Grass fields

Mangrove

Bare soil
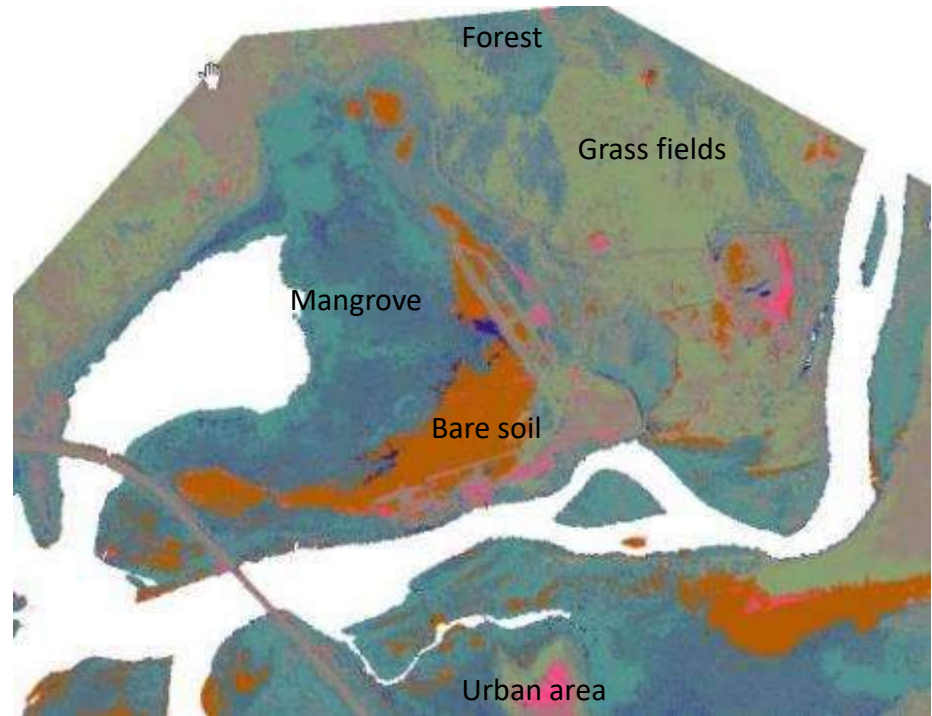
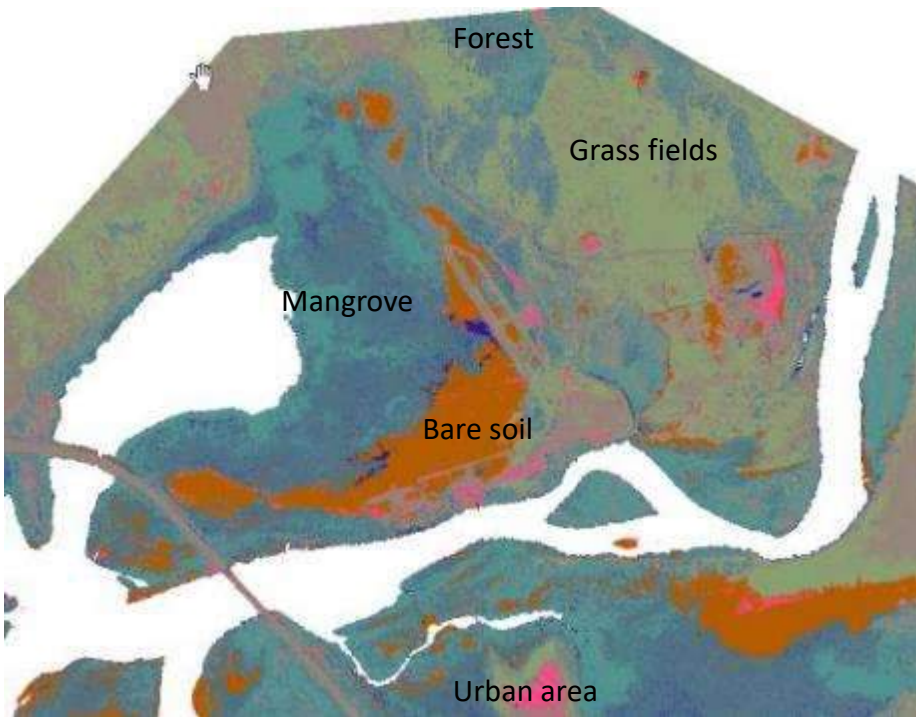Urban area

Using the non water it is possible to do a first classification and extract areas with similar signatures. This might include vegetation not belonging to the mangrove area.

Mangrove remote sensing

Classification from PCA

Reflectances for mangrove classes

The classification can be used as a mask to select only pixels with a signature belonging to the mangrove classes

Mangrove remote sensing

Pixels for mangrove classes → PCA on selected pixels
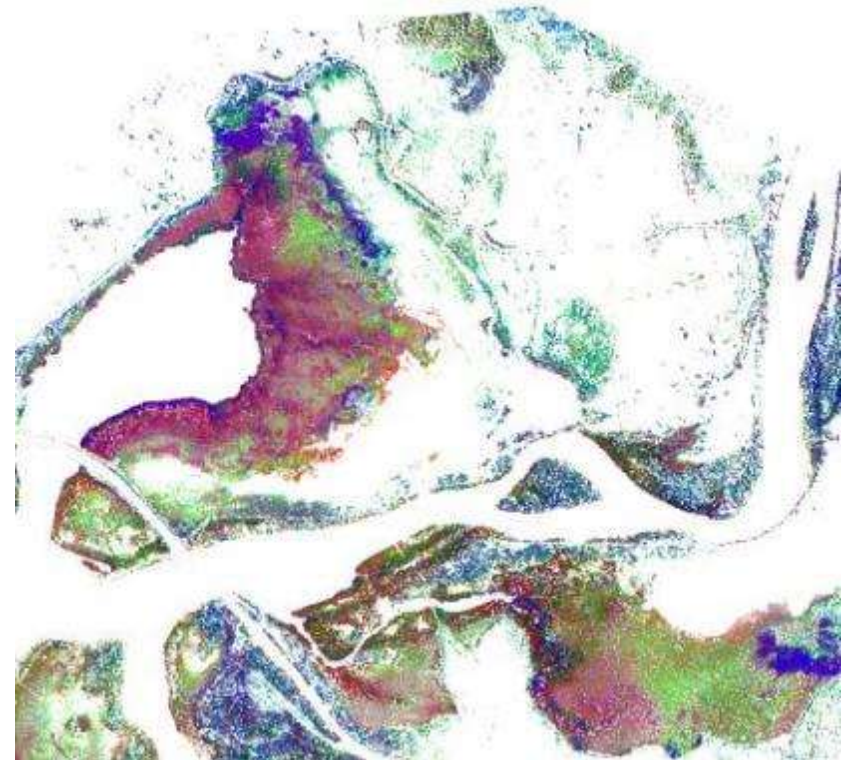
Finally a PCA on the mangrove class pixels highlights the differences (species composition, cover and exposed soils)

Mangrove remote sensing

Field survey is then necessary to determine what species correspond to the PCA

Application to North Efate mangrove

PCA on mangrove area

4 km

Sampling points in the mangrove

Sampled points for the area
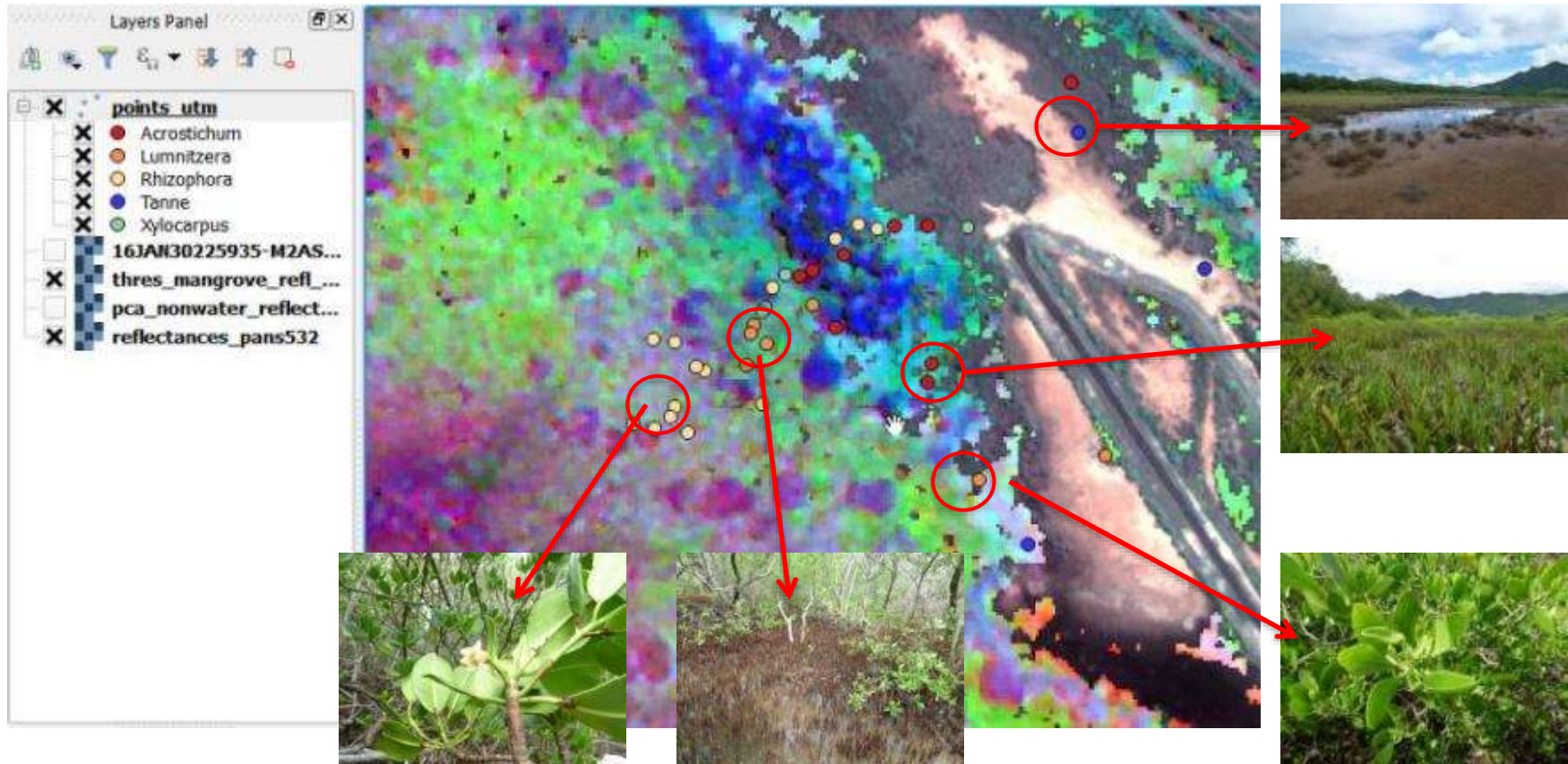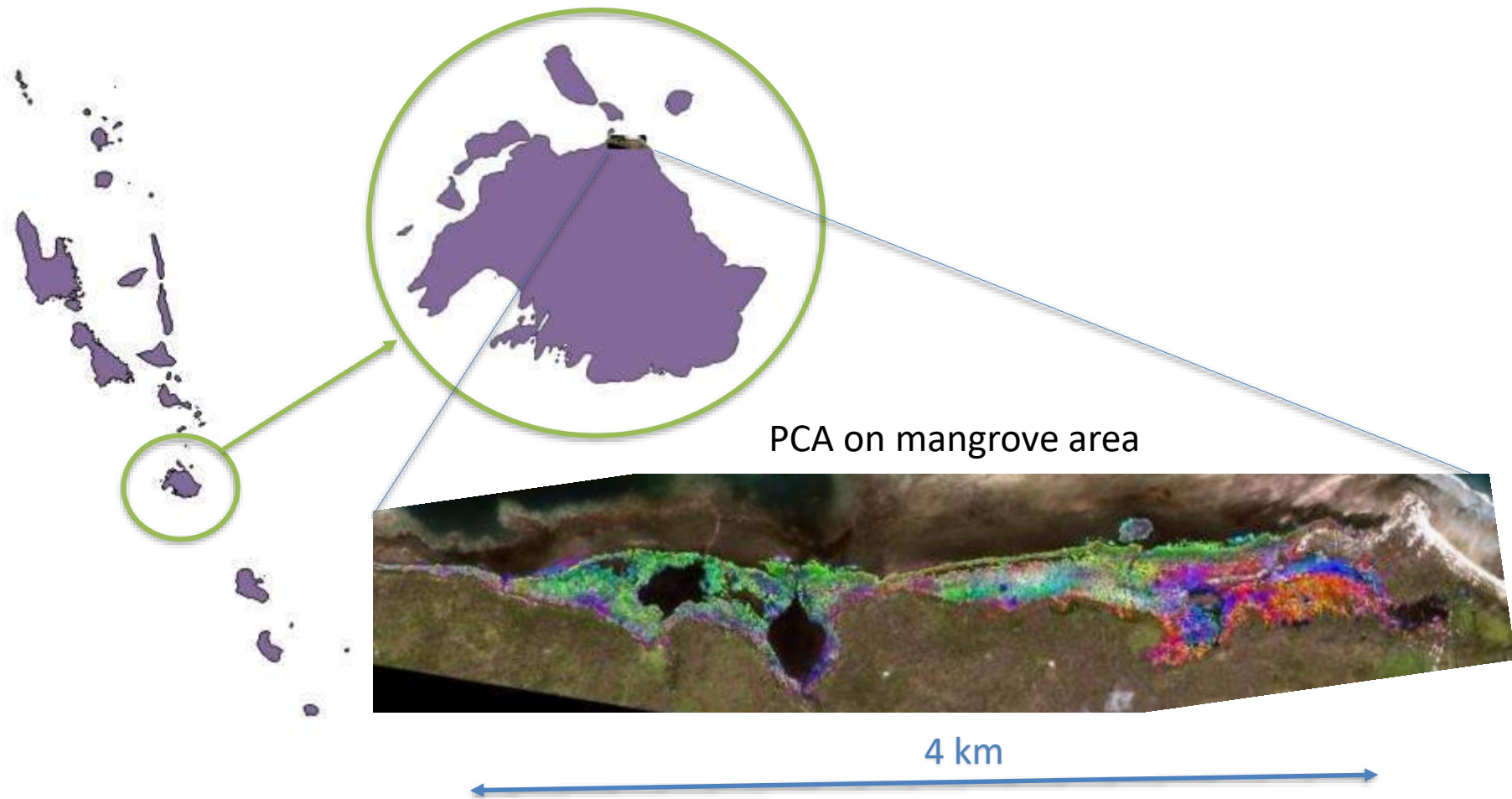

| Gpx File : | GPS 1 - Waypoints_04-JUN-16_GPS1 | | Export data : | | |

Mapping point properties

| Survey * | Paunangisu KfW 2016 | Surveyor : | Rolenas Baereleo | Site * | Paunangisu |

| GPS No * | 1 | Date : * | 2016-05-31 | Time : | 13:50 |

| Waypoint * | 113 | Longitude : | 168.442596 | Latitude : | -17.534031 | |

Photo #s separated by ;   0982;0984

| Canopy height (m) | 5 | Main sediment type : | |

Mangrove species :   Acrostichum aureum

Percent cover :   Add >>

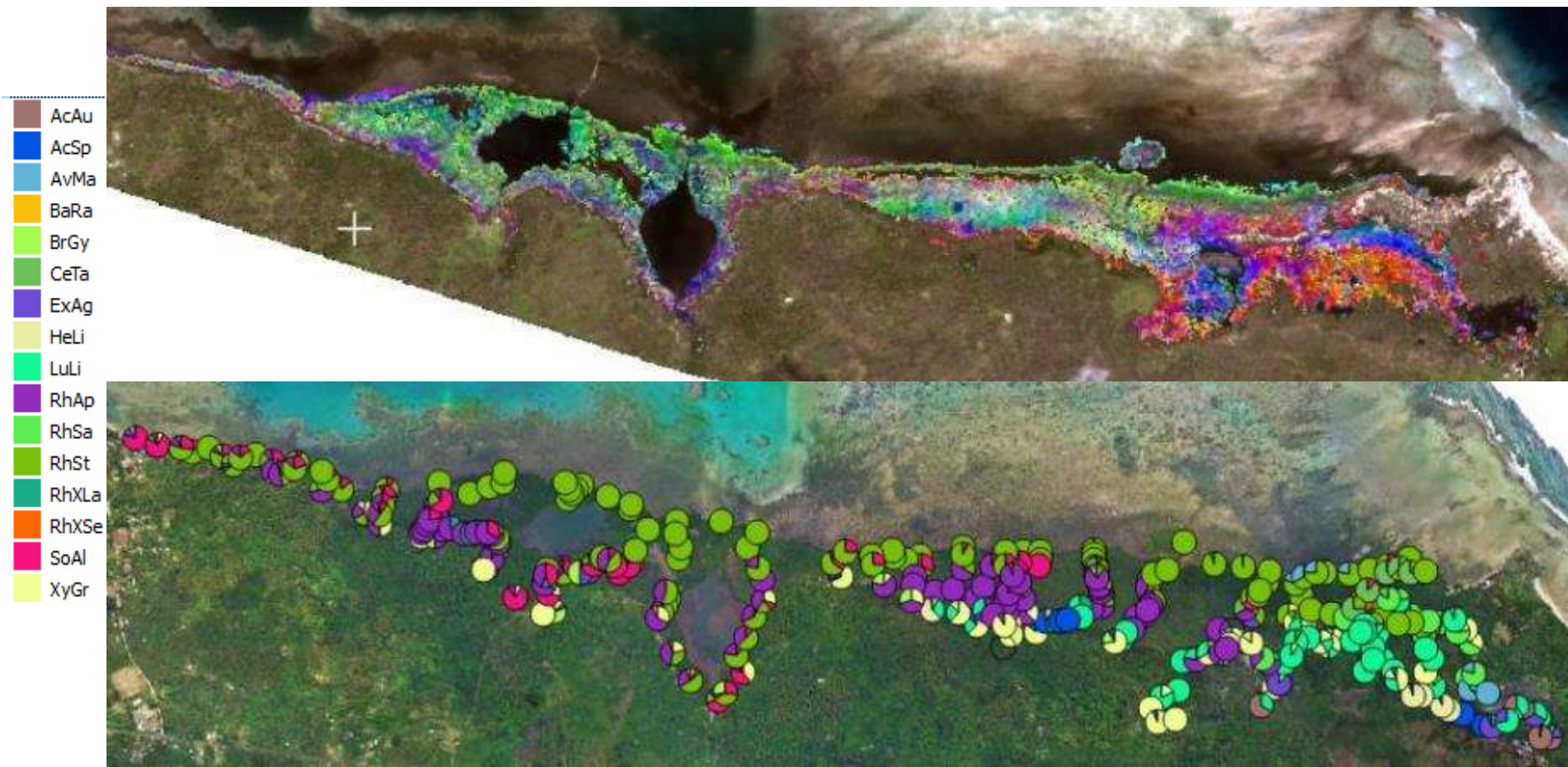| Species	% cover	
Rhizophora samoensis	95	✖
Lumnitzera littorea	1	✖
Total	96	

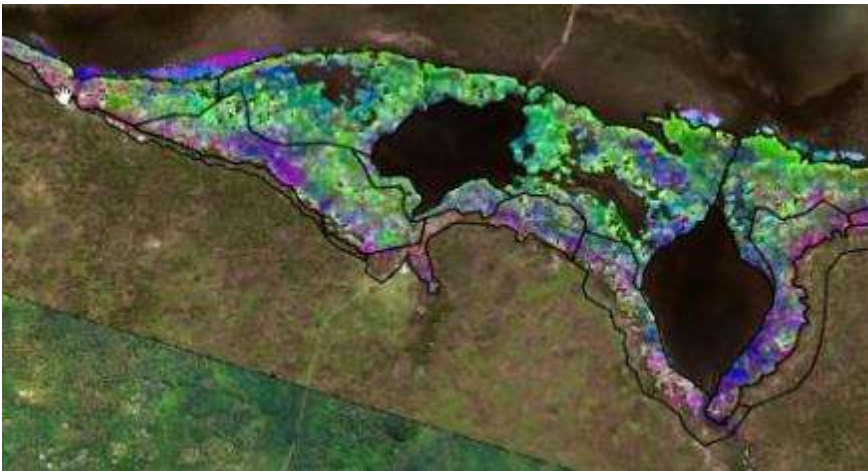Web database interface

Species composition for sampled points
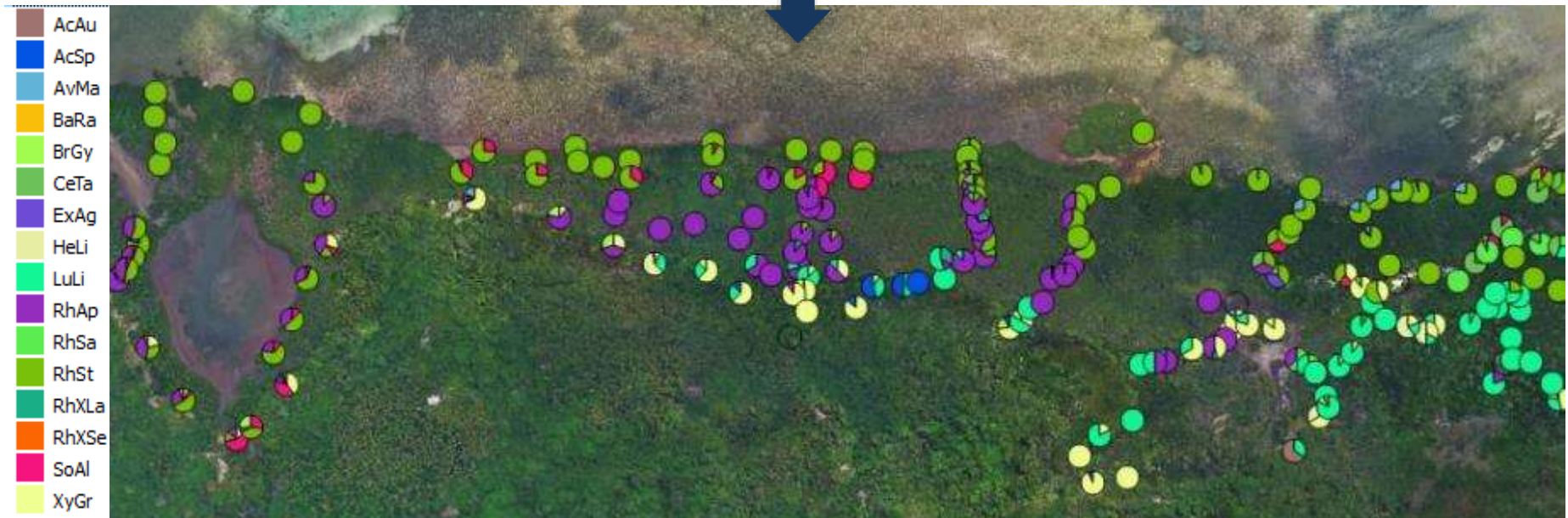
PCA vs species composition for sampled points

Delineation of zones based on PCA and species composition
and extraction of polygon area in Ha

Intersection of mapping points and polygons

Averaging species composition by polygon

and calculation of a weighted average (using area Ha) for the whole area

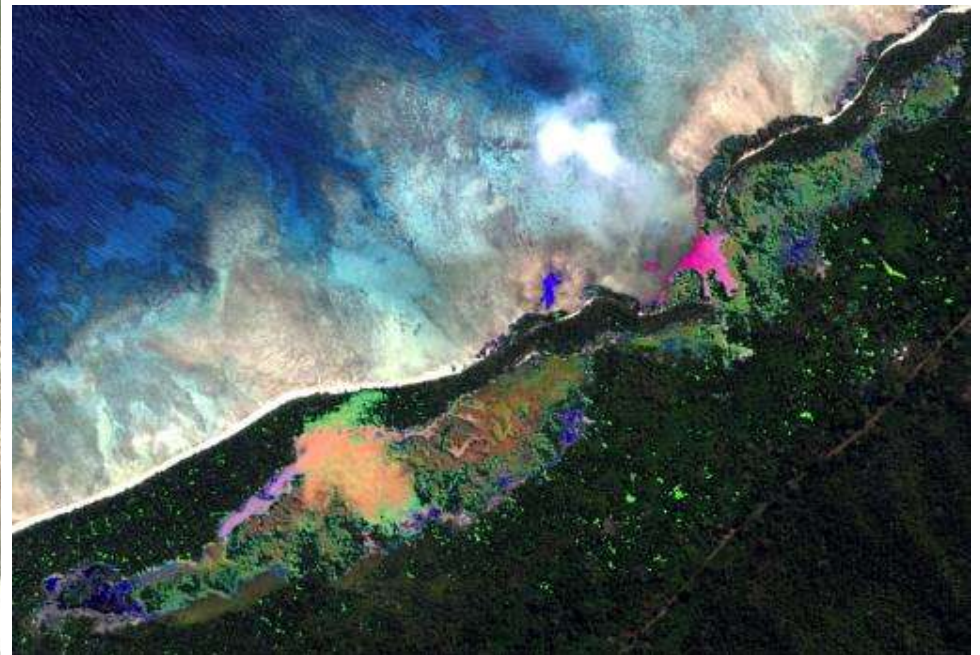| Polygon	AcAu	AcSp	AvMa	BaRa	HeLi	ExAg	CeTa	BrGy	LuLi	RhAp	RhSa	RhSt	RhXLa	RhXSe	SoAl	XyGr	Sum
1	0.0	1.4	0.7	0.0	3.7	0.4	0.0	1.9	12.5	14.3	0.0	1.6	0.0	0.0	3.6	36.8	76.9
2	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	57.8	0.0	0.0	0.3	0.0	64.4
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.5	0.0	42.5	0.0	0.0	6.3	0.0	86.3
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	73.3	0.0	0.0	0.0	0.0	80.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.1	0.0	0.0	0.0	0.0	79.1
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.8	0.0	0.0	0.0	0.0	78.8
7	0.0	0.0	0.5														
8	0.0	0.0	0.0														
9	0.0	0.0	0.0														
10	0.0	0.0	1.0														
11	0.0	0.0	0.0														
12	0.0	0.0	0.0														
13	0.0	0.0	0.4														
14	3.3	3.8	1.6														
15	0.0	0.0	0.0														
16	0.0	10.4	0.0														
17	0.0	0.0	0.0														
18	0.0	0.0	0.0														
19	0.0	0.0	1.3														
20	0.0	0.0	1.3														
21	0.0	0.0	0.0														
22	0.0	0.0	0.0														
23	0.0	0.0	0.0														

Mangrove species distribution

Polygons
- L. littorea dominated
- L. littorea & X. granatum dominated
- R. apiculata dominated
- R. stylosa dominated
- S. alba dominated
- X. granatum dominated

Pie charts
- Acrostichum aureum
- Acrostichum speciosum
- Avicennia marina
- Barringtonia racemose
- Heritiera littoralis
- Excoecaria agallocha
- Ceriops tagal
- Bruguiera gymnorrhiza
- Lumnitzera littorea
- Rhizophora apiculata
- Rhizophora samoensis
- Rhizophora stylosa
- Rhizophora X lamarckii
- Rhizophora X selala
- Sonneratia alba
- Xylocarpus granatum

Similar methodology applied for Aniwa & Emae

Tank yu tumas