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Erasmus Mundus Masters Course in Tropical Biodiversity and Ecosystems

Like A Drone Come True: Comparison of Satellite and Drone Imagery for Mangrove Mapping

BY MONIKA RUWAIMANA

ITTO International Tropical Timber Organization

International Conference on Sustainable Mangrove Ecosystems

18–21 April 2017
Bali, Indonesia

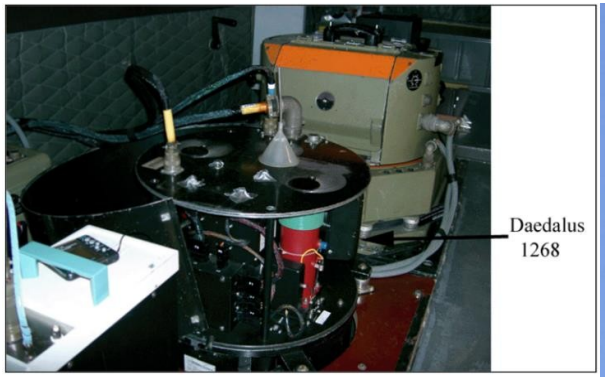
CLOUD FREE REMOTE SENSING

Airplane platform :

Flight operational **10.500 - 59.000 USD** 1999 price (Green et al., 2000)

Drone platform

Equipment **500-5000 USD**



http://www.landscaperesearchcentre.org/Project%203841/MultiSpec/The%20Instruments.htm

http://www.latimes.com/local/lanow/la-me-ln-west-hollywood-drones-20160120-story.html

http://www.parrot.com/usa/companies/sequoia/

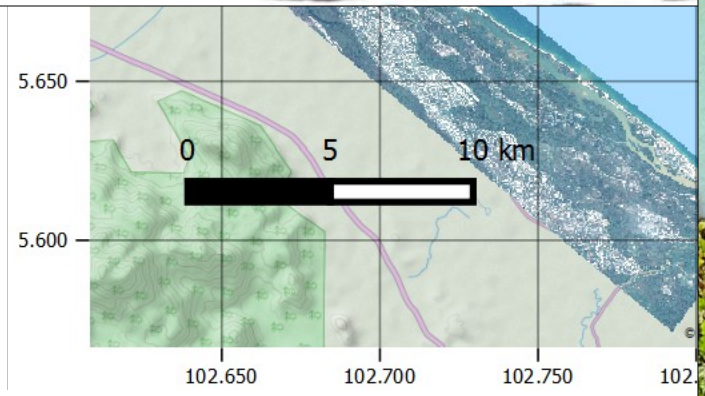
OBJECTIVES

http://www.satimagingcorp.com/satellite-sensors/pleiades-1/

1. To compare the image's quality (spatial, spectral, radiometric and temporal resolutions)
2. To compare the efficiency (cost, coverage, and processing time)
3. To compare the classification accuracy

*First study investigating the usefulness of drone in mangrove mapping.

STUDY AREA – SETIU WETLAND



Material and Method

DRONE IMAGERY


FHD0178.JPG


FHD0179.JPG


FHD0180.JPG


FHD0181.JPG


FHD0182.JPG


FHD0183.JPG


FHD0184.JPG

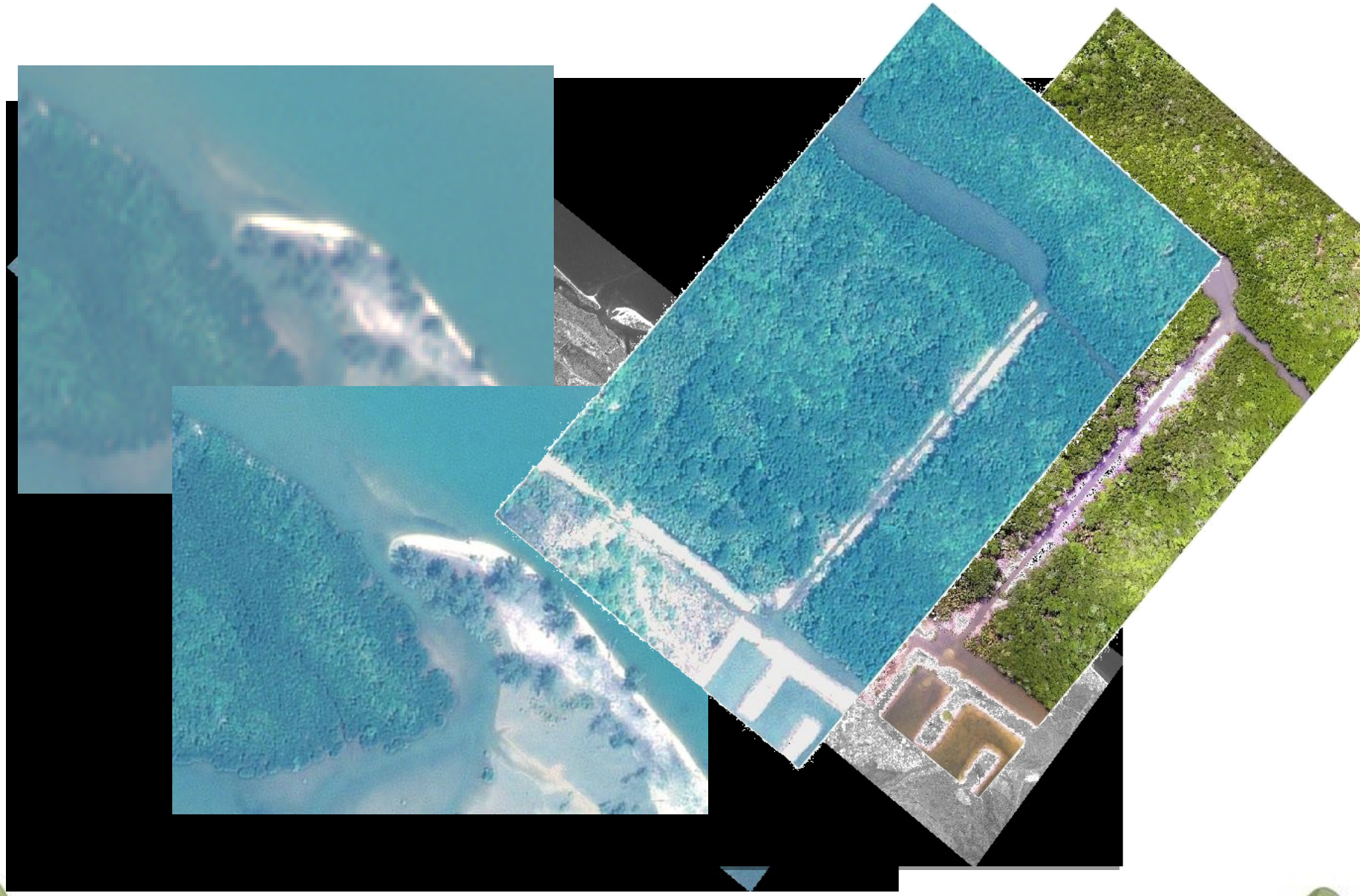

FHD0185.JPG


FHD0186.JPG

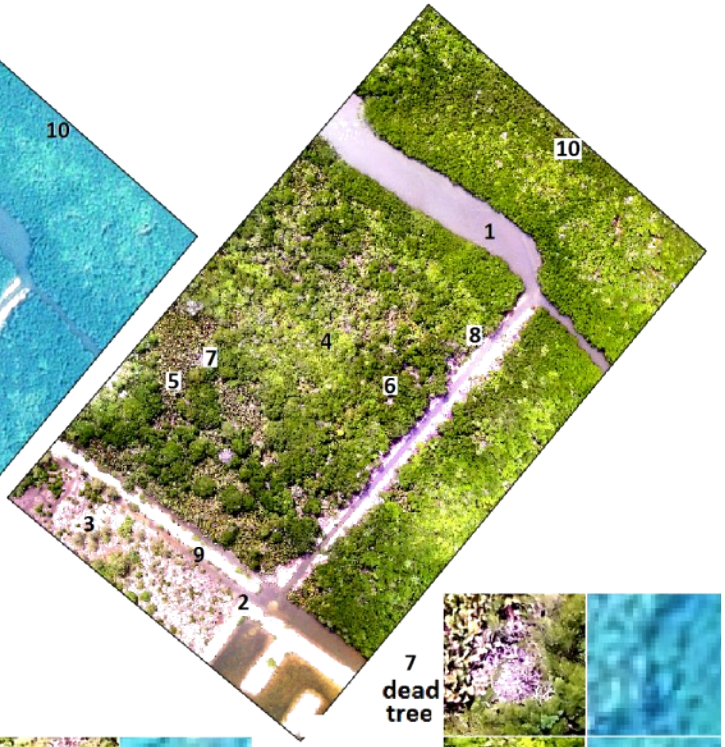

FHD0187.JPG

Material and Method

SATELLITE IMAGERY



CLASSIFICATION

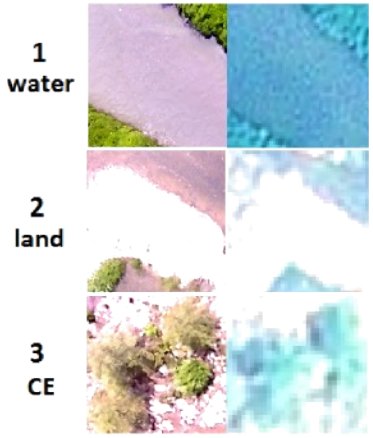


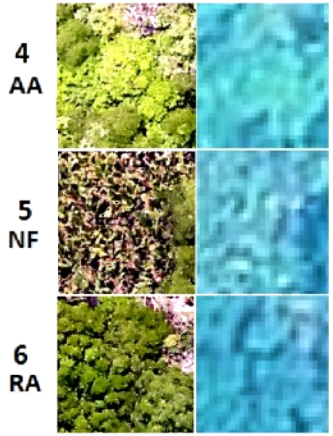
SATELLITE AND DRONE

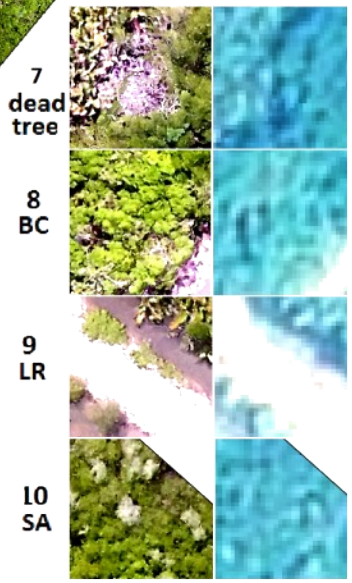
- water
- land
- CE
- AA
- NF
- RA

DRONE ONLY

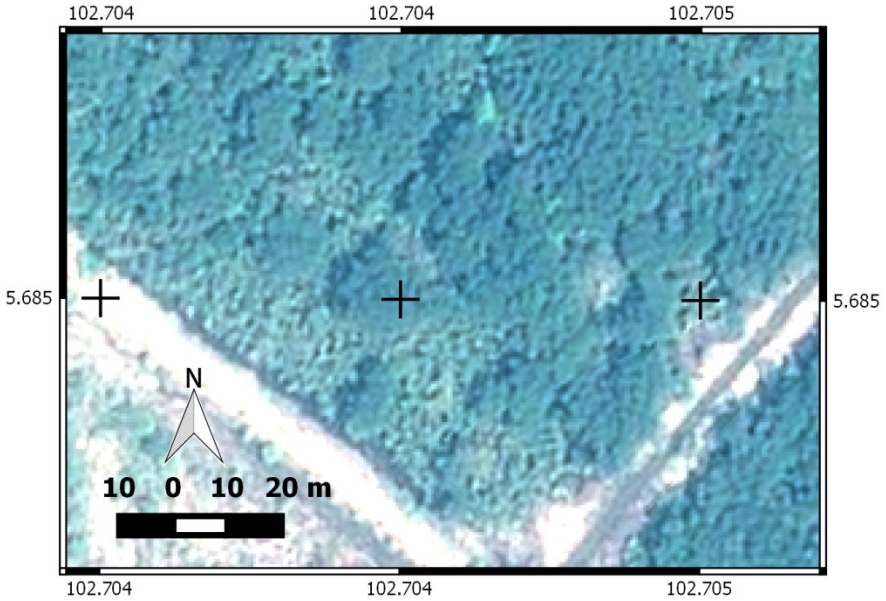
- water
- land
- CE
- dead tree
- AA
- BC
- LR
- NF
- RA
- SA

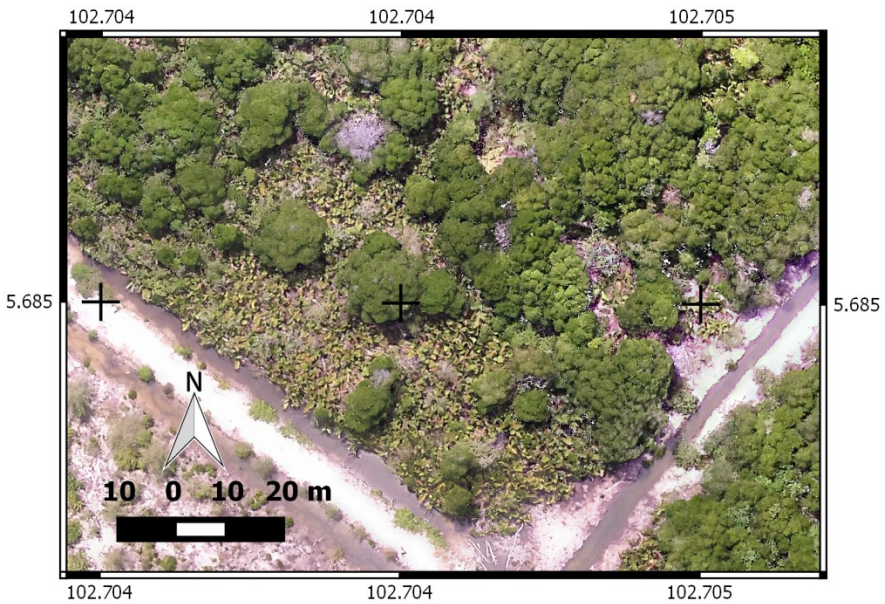






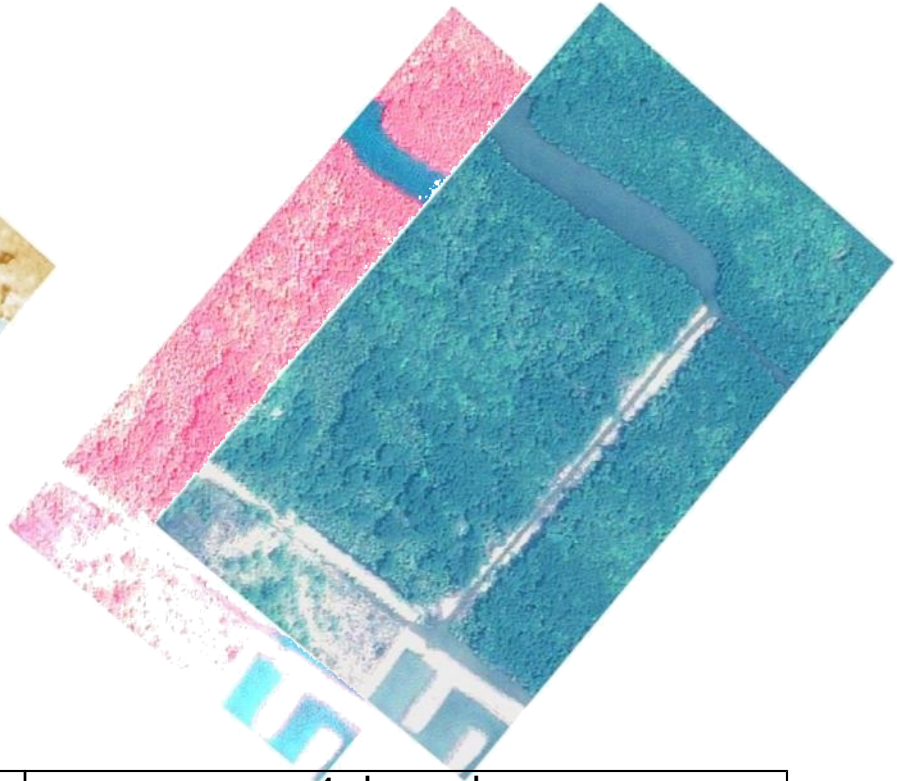
RESOLUTION - SPATIAL





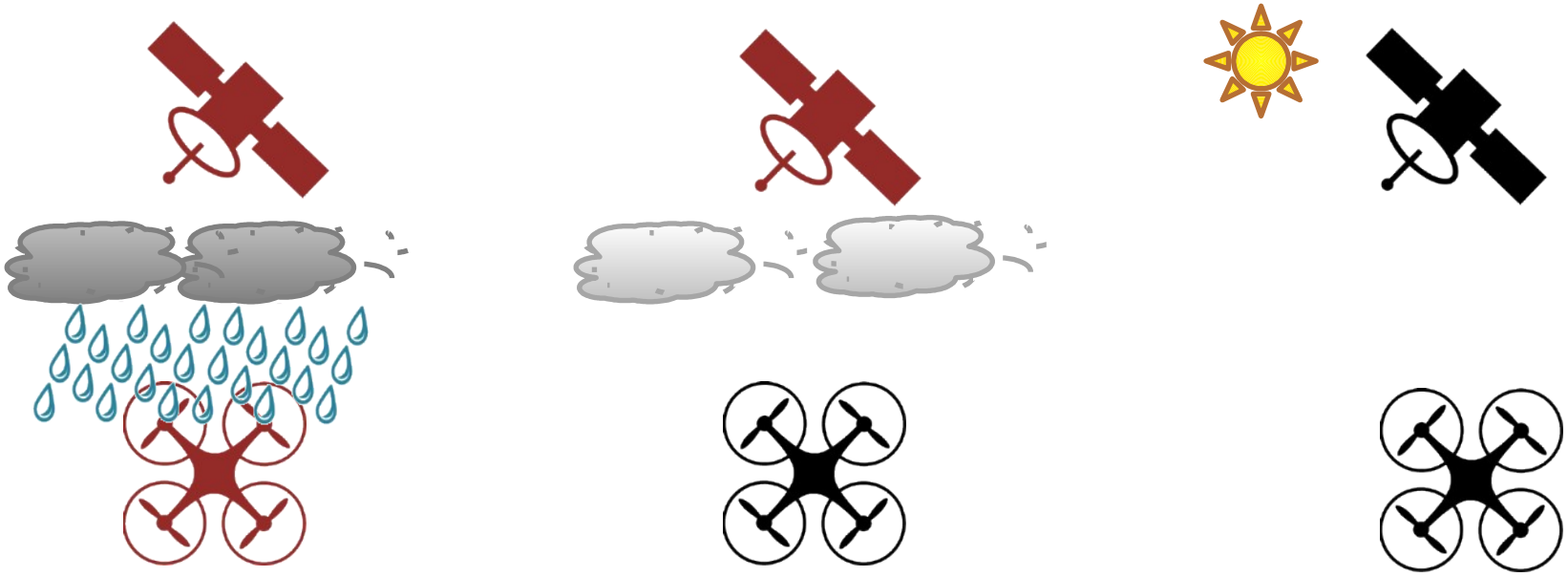
200 cm multispectral	2.8 cm maximum
50 cm panchromatic	**5 cm** for analysis
Spatial resolution is **fixed**	Spatial resolution is **varied** depend on flight altitude

RESOLUTION - SPECTRAL

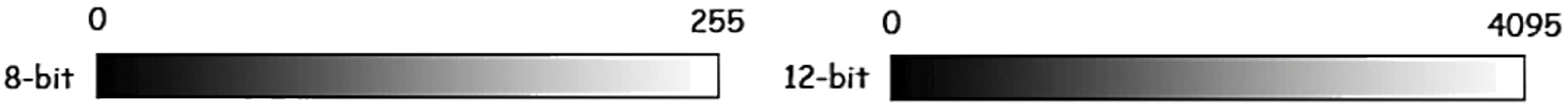


7 channels	4 channels
RGB camera 400-700 nm (R,G,B)	B 430-550 nm; G 500-620 nm; R 590-710 nm
IR camera 850-1200 nm (B,R,NIR)	NIR 740-940 nm; Pan 470-830 nm
DEM available	-
Broad sensors	Narrow and specific sensors
Auto-exposure, image change depend on light (Nijlan *et al*., 2014)	No auto exposure

RESOLUTION – TEMPORAL & RADIOMETRIC

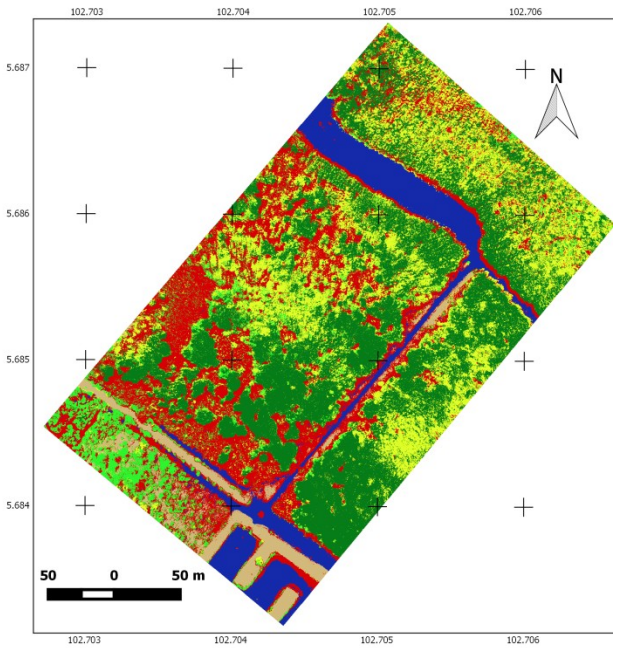


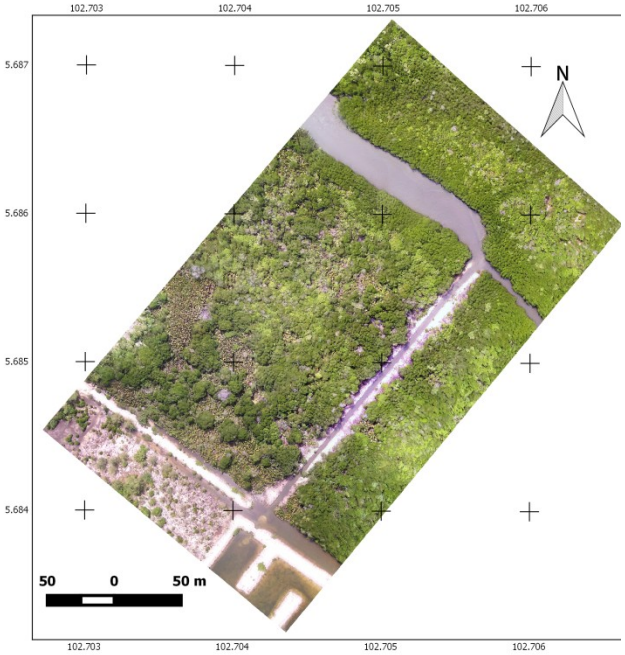
Drone	Satellite Pleiades
Anytime*	Daily

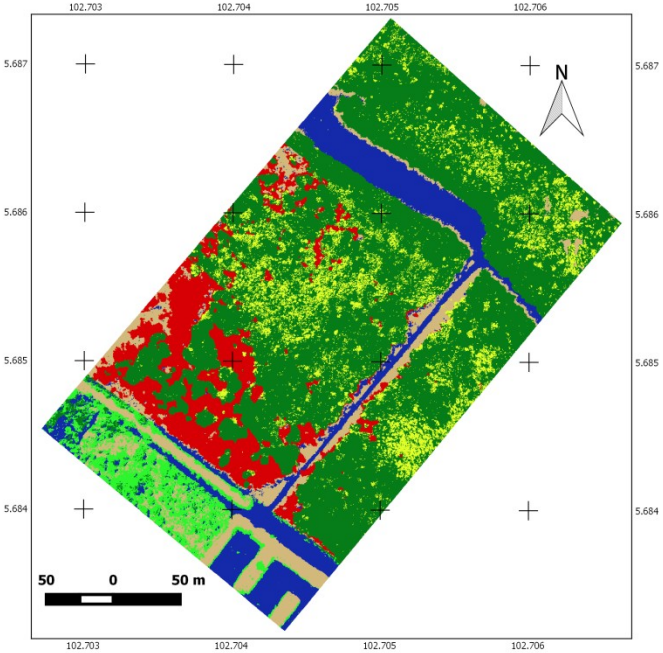


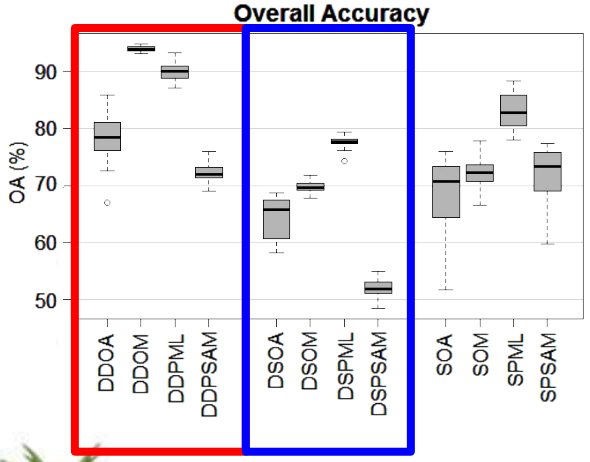
Drone	Satellite
8 bit (0-255)	12 bit (0-4095)

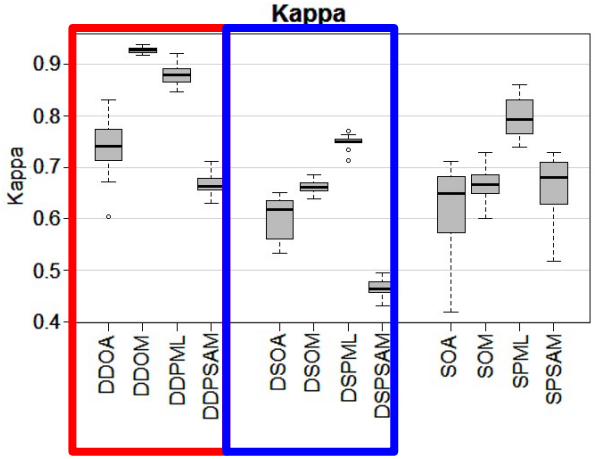
CLASSIFICATION - BEST RESULT











water
land
C. equisetifolia
A. alba
N. fruticans
R. apiculata

drone imagery perform better than satellite imagery

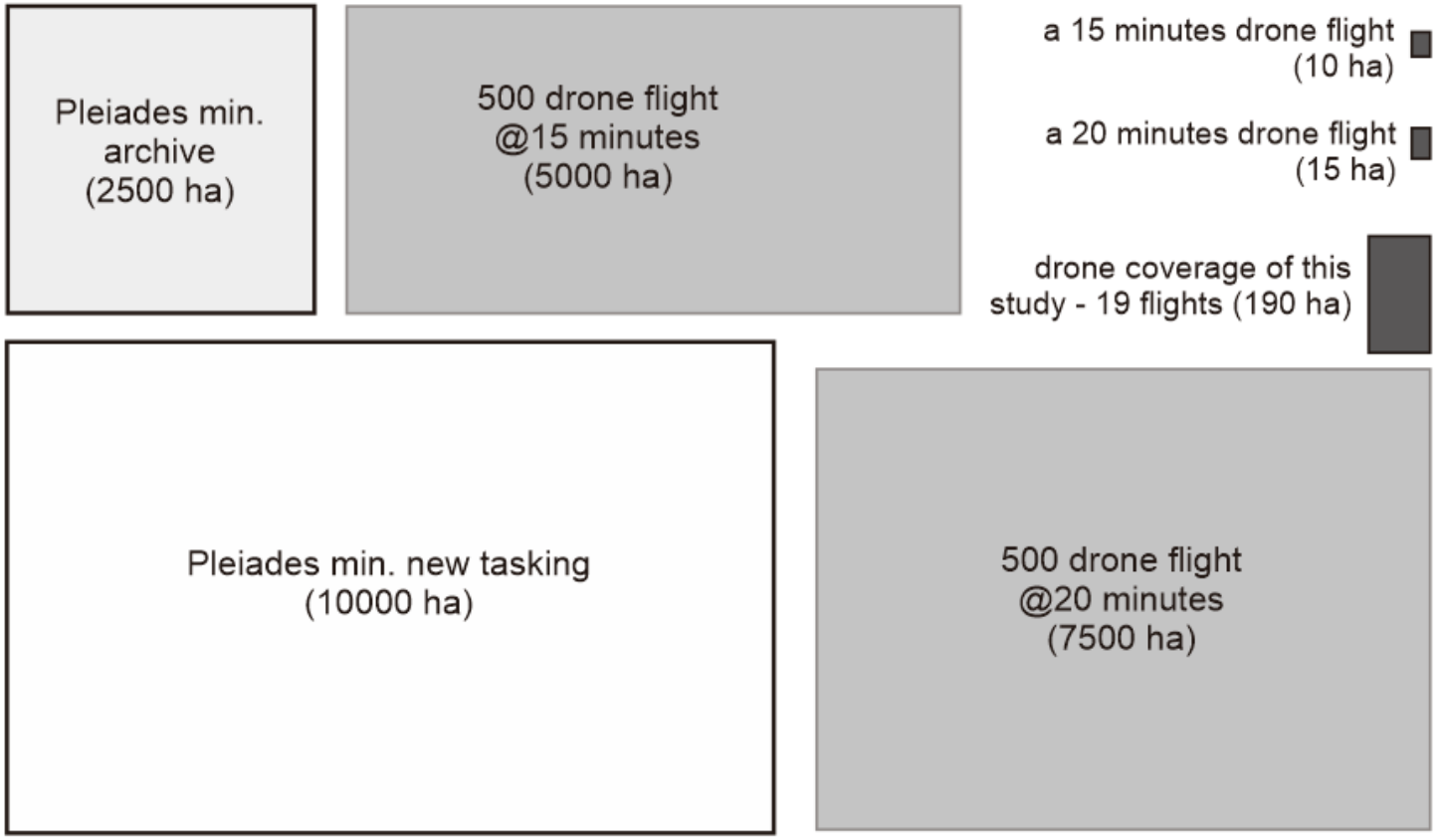
COVERAGE

2013 - 8 minute
2016 - 25 minutes

http://www3.djicdn.com/assets/images/products/phantom/phantom-241

http://www.drone-world.com/media/wysiwyg/12778928_102063112492051

SQ-1.jpg



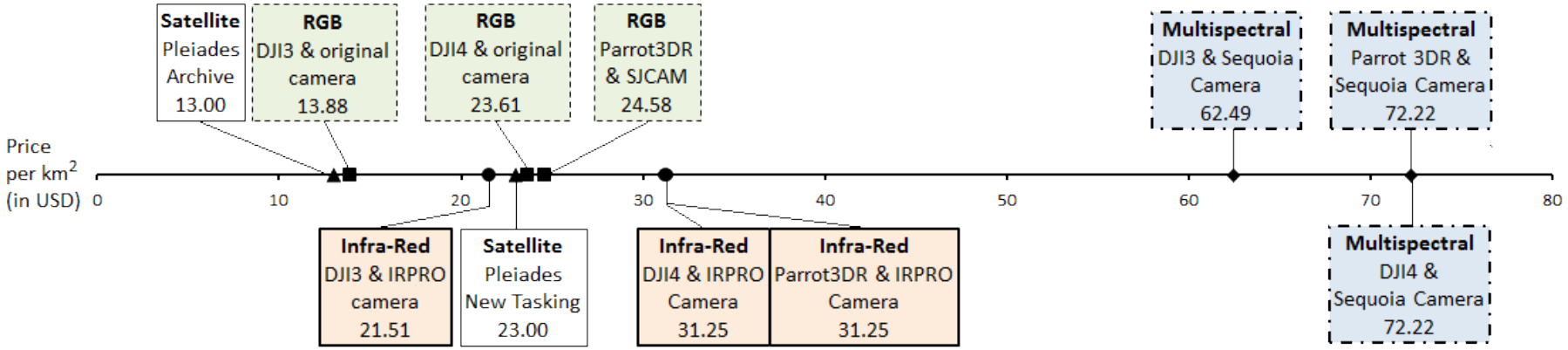
COST

Price breakdown for drone equipment (2015)

Item	Price (USD)
DJI Phantom 2	947
IR-camera + shipping	287
Flytrex logging	85
DJI Datalink	189
Drone bag	59
RGB camera	67
Battery 3@101.25	319
Total	1953

Approximate price (2017)

Drone	Camera	Operational cost
DJI Phantom 3 499	SJ CAM 70	
DJI Phantom 4 1200	IRPRO-GoPro 550	500
Parrot 3 DR Solo 1200	Parrot Sequoia 3500	



ACQUISITION & PROCESSING TIME

	Drone	Satellite
Image Acqusition (day)	**14 days**	**1 day**
Image preparation (hour)	16.5 hours	0.6 hour
Creating ROI (hour)	5 hours	3 hour
Object-based Classification (hour)	18 hours	6 hour
Pixel-based Classification (hour)	50 hours	5 hour
Total Image Processing (hour)	**89.5 hours**	**14.6 hours**

DRONE
2808 MB

Segmented DRONE
194 MB

SATELLITE
12 MB

- **Object based Classification requires less time – segmentation is reducing the data size**
- **Future development on computer power will shorten the processing time**

SUMMARY

- **OBJECTIVE?**

Long term repetitive monitoring OR Short term monitoring?

Resolution needed?

Size of study area?

- **BUDGET?**

Flight time = coverage area

Camera resolution

Price per km^2

- **BE INFORMED –** this technology is changing quickly

ASPECT	Drone Imagery	Satellite Imagery
RESOLUTION		
Spatial resolution	Higher	Lower
	Flexible	Fixed
Spectral resolution	Lower	Higher
	DEM available	DEM not available
Temporal resolution	Higher	Lower
Radiometric resolution	Lower	Higher
COST & COVERAGE (for user)		
Cost for one acquirement	Higher	Lower
Cost for multiple acquirement	Become lower	Not change
Coverage	Smaller area	Bigger
TIME		
Acquisition time	Longer	Shorter
Processing time	Longer	Shorter
ACCURACY	Higher	Lower

Sponsored by:

KEMENTERIAN LINGKUNGAN HIDUP DAN KEHUTANAN

International Society for Mangrove Ecosystems

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