

Potensi Teknologi Drone untuk Lingkungan Hidup & Kehutanan



HIKMAT RAMDAN
WEBINAR.bpsdm.klhk
15juli.2020



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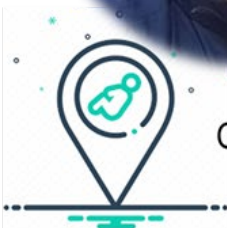
Study Programs

Prodi Rekayasa Kehutanan,
Rekayasa Pertanian, Magister
Biomanaajemen, dan Program Profesi
Insinyur ITB.



Academic Teaching

Remote Sensing & GIS Kehutanan
Pengelolaan Bentang Alam Terpadu
Pengelolaan Jasa Ekosistem
Manajemen Kawasan Konservasi
Survey dan Pemetaan
Analisis & Pemodelan Spasial Biodiversitas
Etika Profesi Insinyur



Garut West Java
26/11/1971

Birth



Pengelolaan DAS &
Hidrologi, Pengelolaan
Bentang Alam Terpadu,
GIS & Spatial Modelling,
Ecosystem Services,
Solid Waste System

Educations

S1- Forest Management (IPB)
S2 – Watershed Management (IPB)
S3 – Natural Resources & Management (IPB)
Professional Engineer in Forestry Engineering (ITB)

Dr.Ir. Hikmat Ramdan, S.Hut, M.Si, IPU

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Dosen Sekolah Ilmu & Teknologi Hayati ITB

Founder IMC [Indonesia Mapping Community]



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HUMAN & ECOSYSTEMS

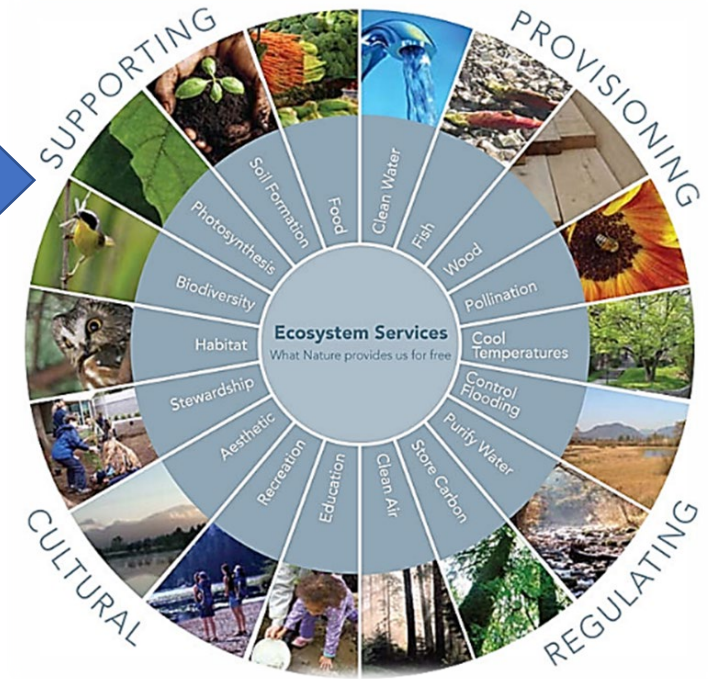


HUMAN AS
ECOLOGICAL BEINGS

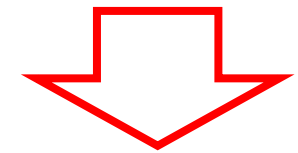


ECOLOGICAL
SPACES

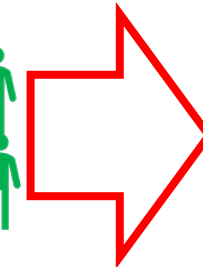
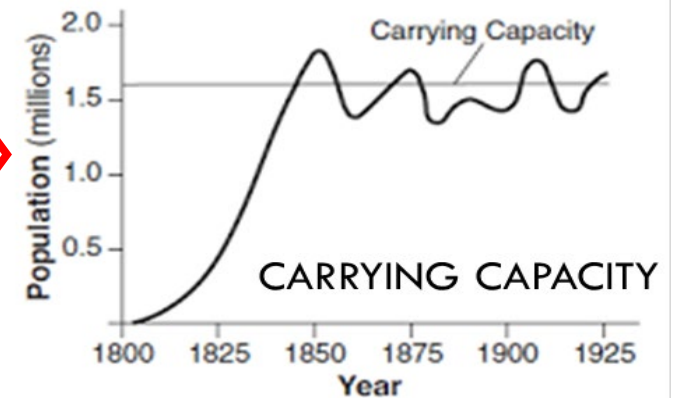
Number
Relative Abundance
Composition
Interactions



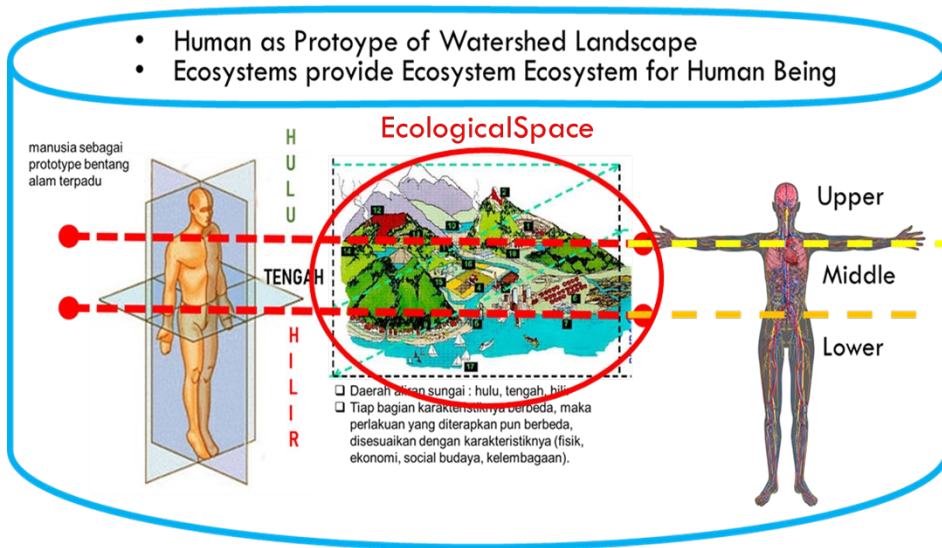
NATURAL CAPITALS



Population Size

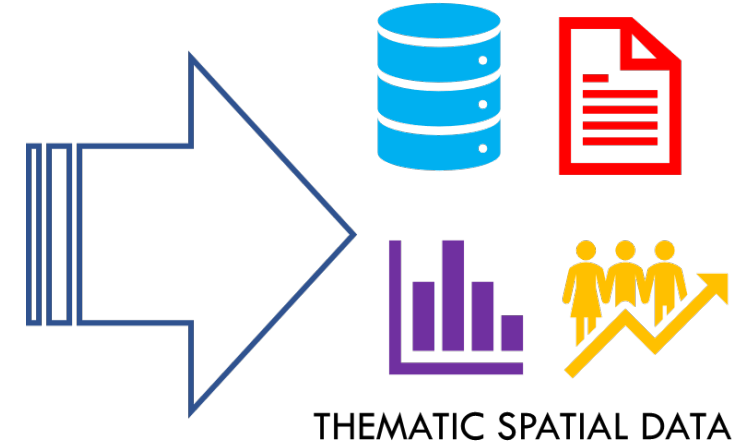


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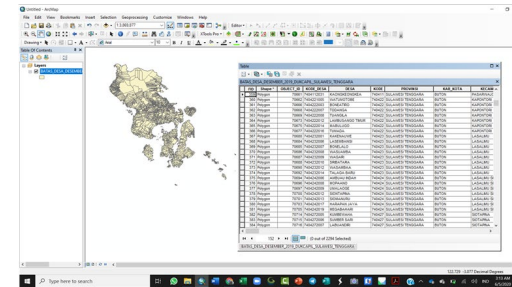


Development Activities Are Always Related To Spatial

Spatial planning, Natural Resource Potential, Population, The economy, Social, Infrastructure, Transportation, Conservation and Preservation of the Environment, Forestry, Agriculture, , etc.

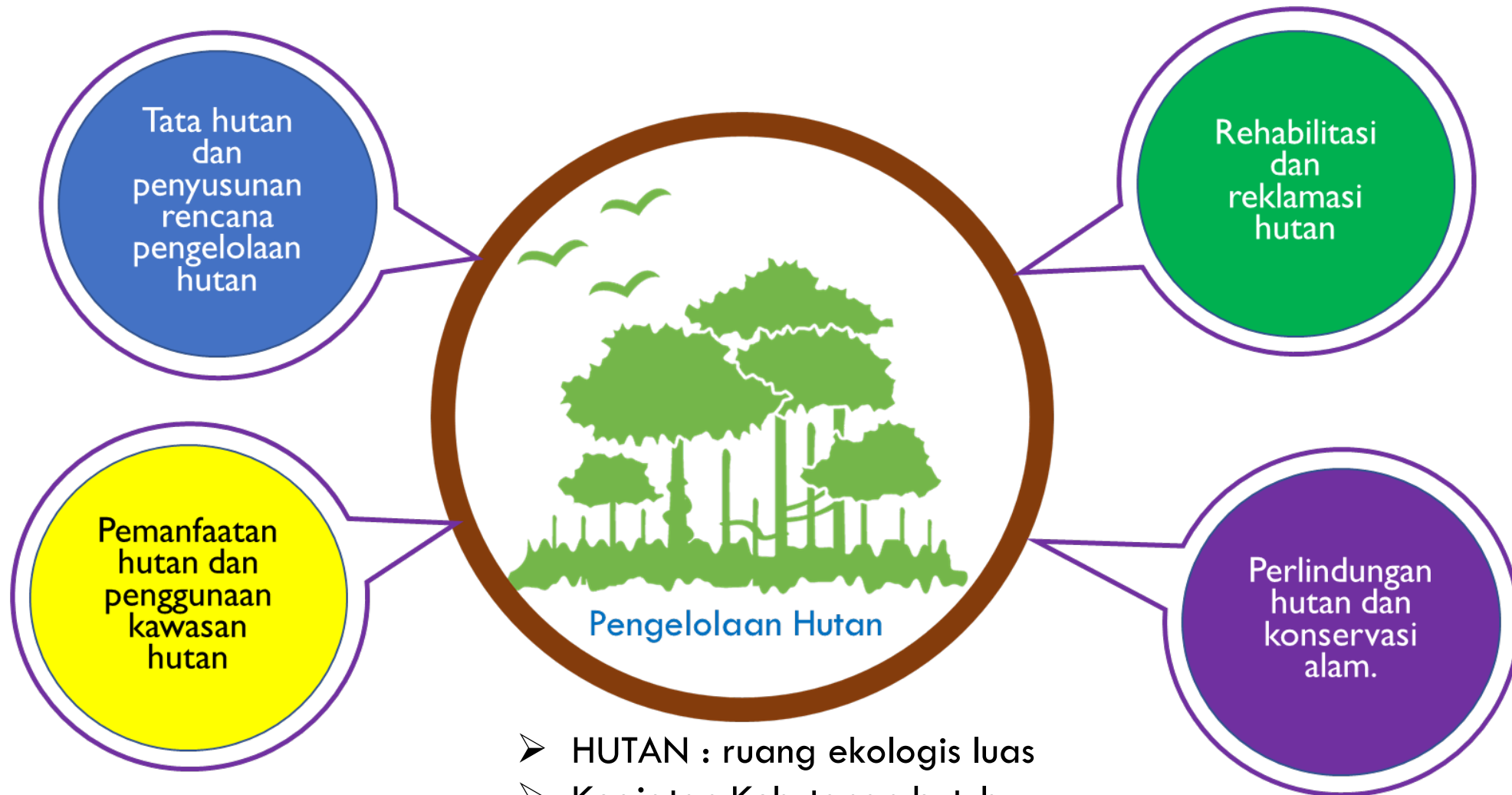


Spatial thinking is thinking about **the space** in which we live.



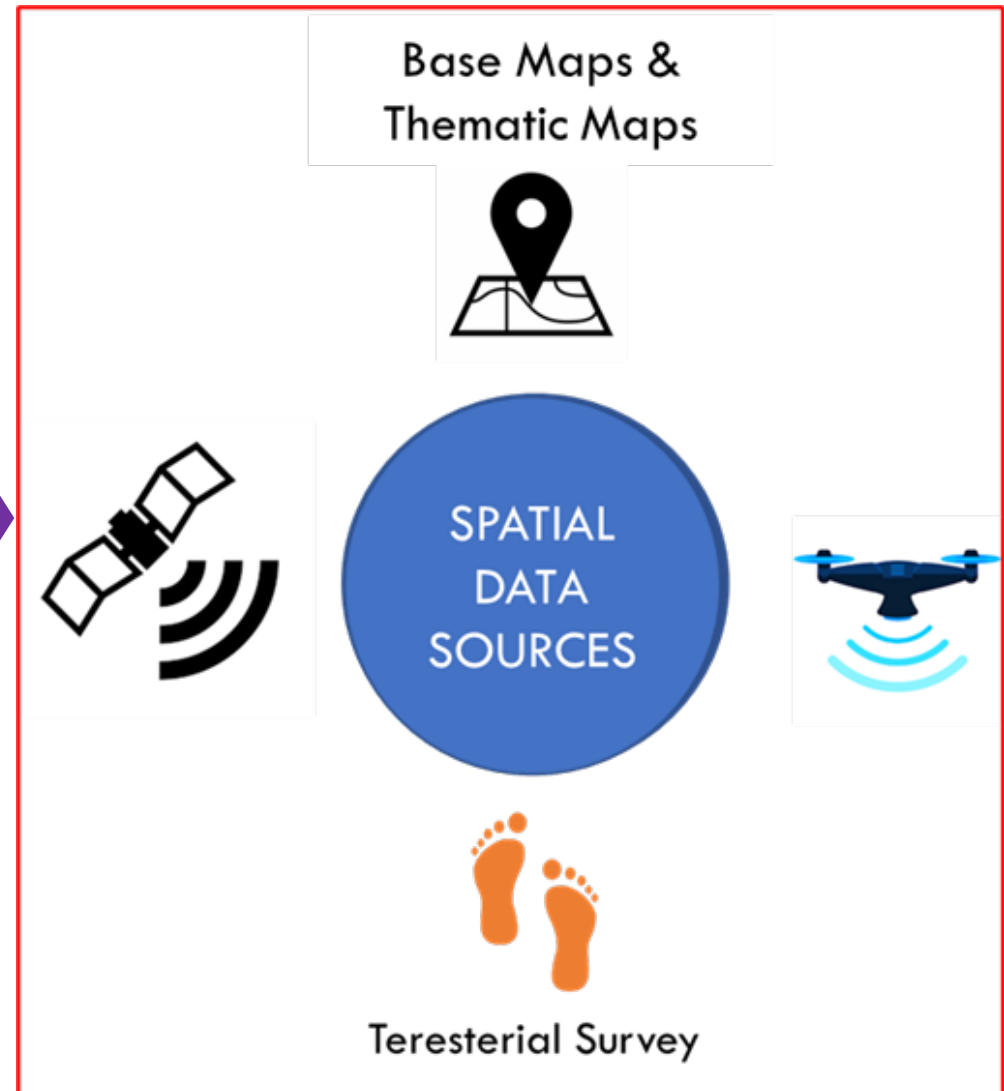
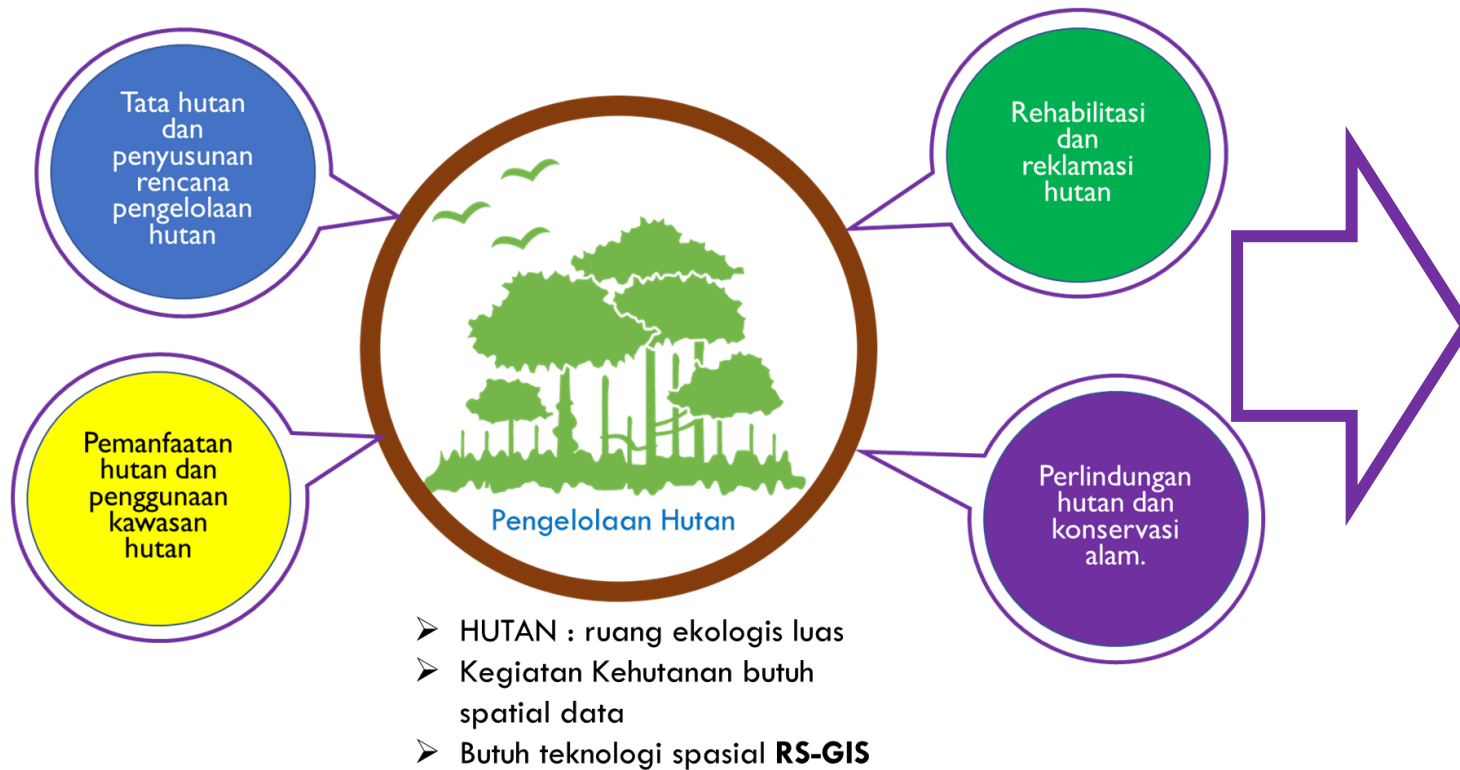
Spatial Actions
IN OUR ACTIVITY

Whether we realize it or not,
SPATIAL ACTIVITIES
are actually inherent in our daily lives



- HUTAN : ruang ekologis luas
- Kegiatan Kehutanan butuh spatial data
- Butuh teknologi spasial **RS-GIS**

PENGELOLAAN HUTAN & DATA SPASIAL



Data Spasial

Base Maps &
Thematic Maps



SPATIAL
DATA
SOURCES



Terrestrial Survey



Streets

Land Use

Administrative Areas

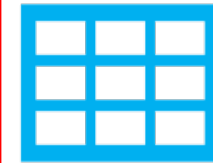
Hydrography

Elevation

Imagery

Integrasi
dan Analisis
Data

Data Non Spasial



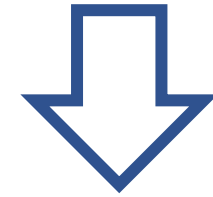
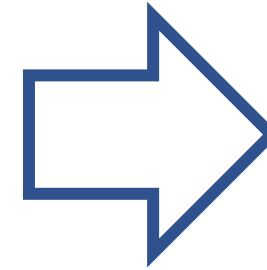
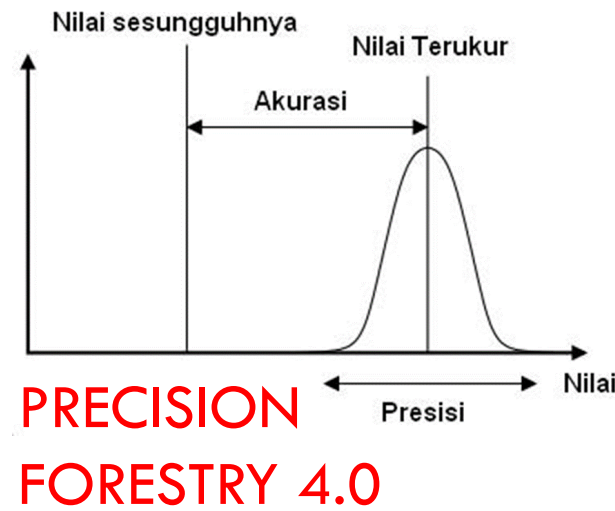
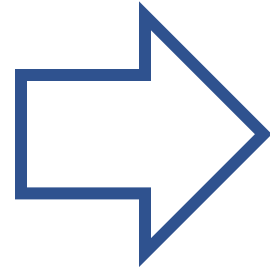
Visi	Misi	Kebijakan	Strategi	Program	Kegiatan	Lokasi	Stakeholder	Biaya	Sumber Dana
				Kriteria Program/Kegiatan					
TABEL UMUM PERENCANAAN KEGIATAN KEHUTANAN									



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CONTOH PEMANFAATAN DATA SPASIAL

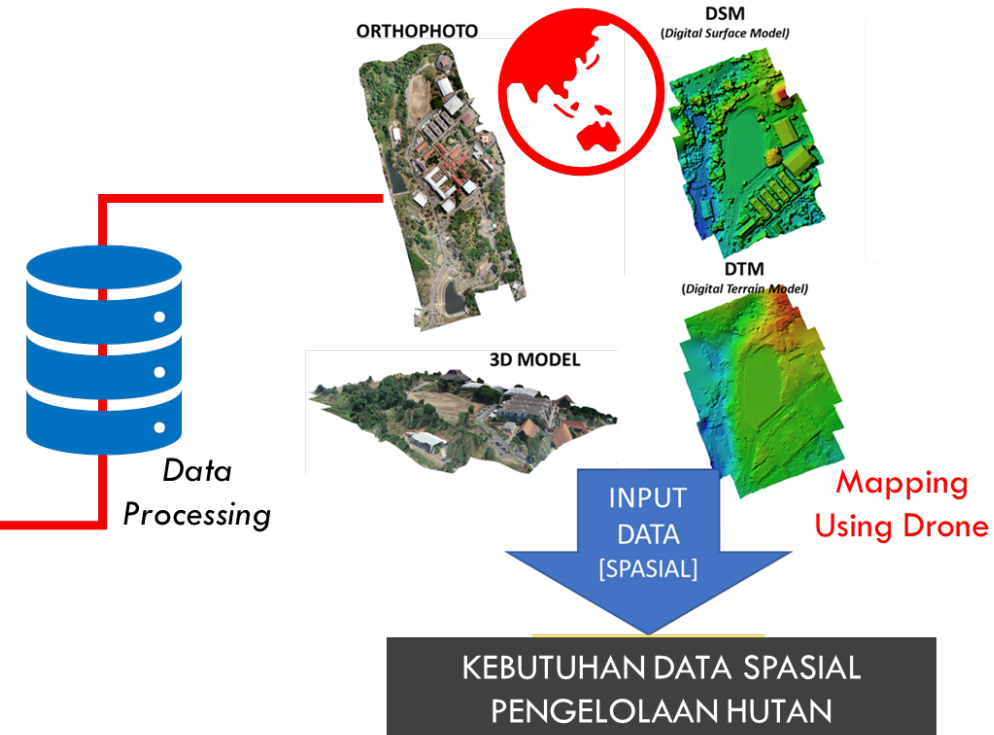
- Salahsatu karakteristik HUTAN : Ruang dengan areal yang sangat luas
- Butuh Teknologi : RS & GIS
- Fungsi Teknologi :
 1. Memudahkan Pekerjaan
 2. Meningkatkan Nilai Tambah

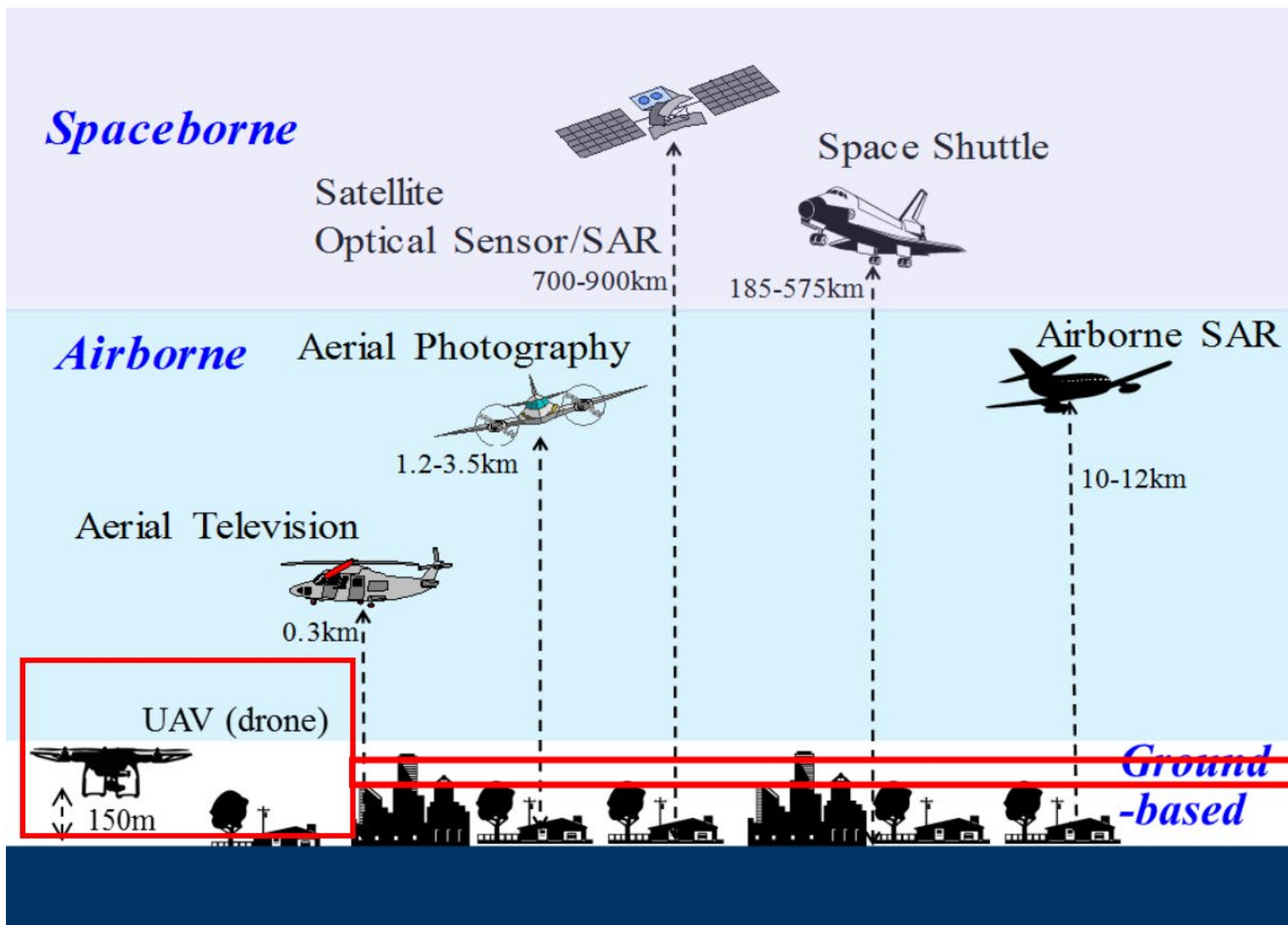


MENGAPA DRONE LHK ?



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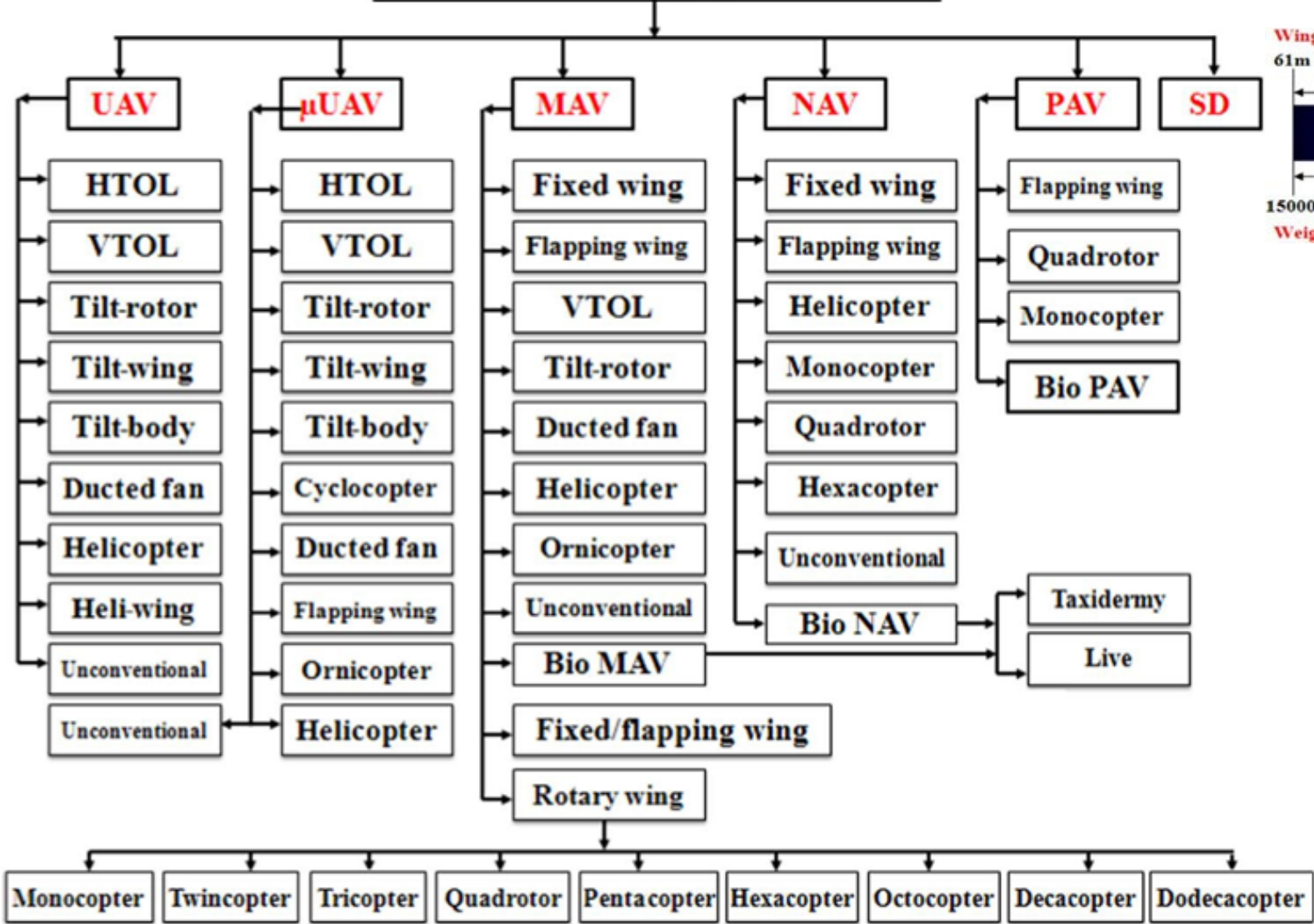
Various platforms and sensors used for remote sensing (Yamazaki & Liu, 2016)

MENGAPA DRONE ?

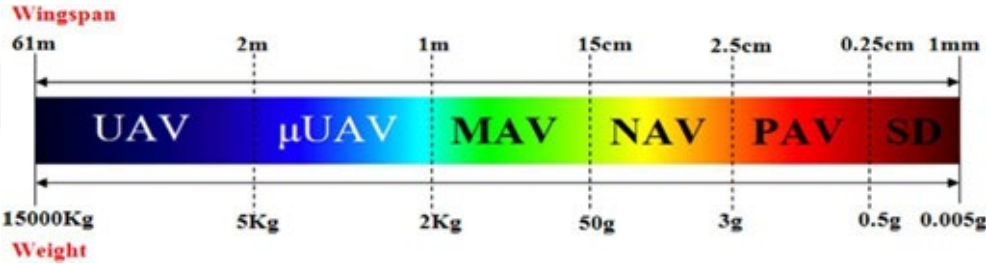


fields of the new digital economy (5G communications, the use of commercial drones, the internet of things, digital health, advanced manufacturing and so on)

Unconventional category of air drones



Spectrum of drones from UAV to SD

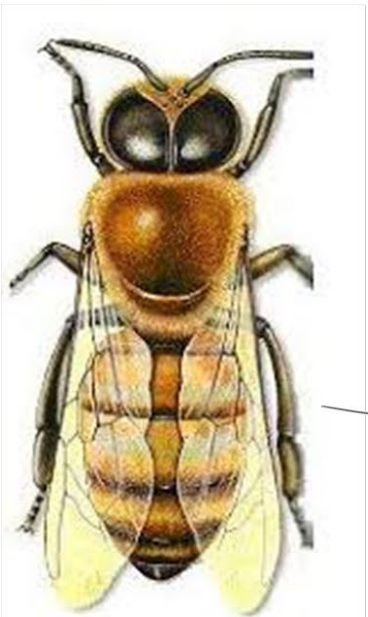


there is a spread spectrum of drones from UAV class with **maximum wing span of 61 m** and weight of 15,000 kg to **smart dust (SD)** with minimum size of 1 mm and weight of 0.005 g. Between UAV and SD at both ends of the defined spectrum, there are various types of drones, which are called **micro drones**, such as **micro unmanned air vehicle (μUAV)**, **micro air vehicle (MAV)**, **nano air vehicle (NAV)**, and **pico air vehicle (PAV)**



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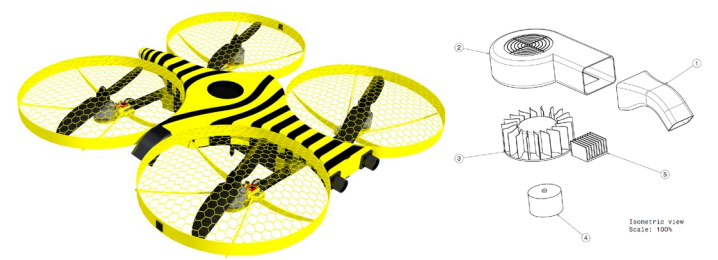
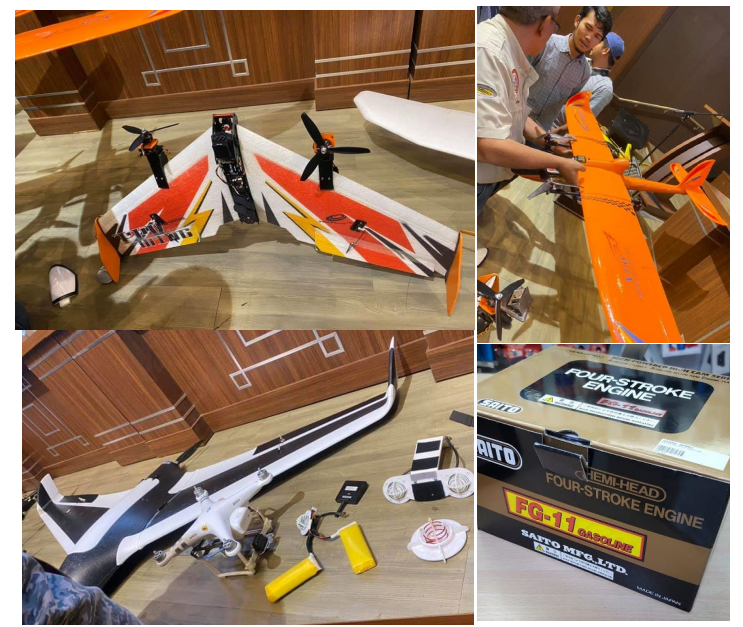
Hassanalian, M and A. Abdelkefi. 2017. Classifications, applications, and design challenges of drones: A review. Progress in Aerospace Sciences 91 (2017) 99–131.10



DRONE

“lebah jantan, dari telur yang tidak dibuahi”

from very small, small, medium to large

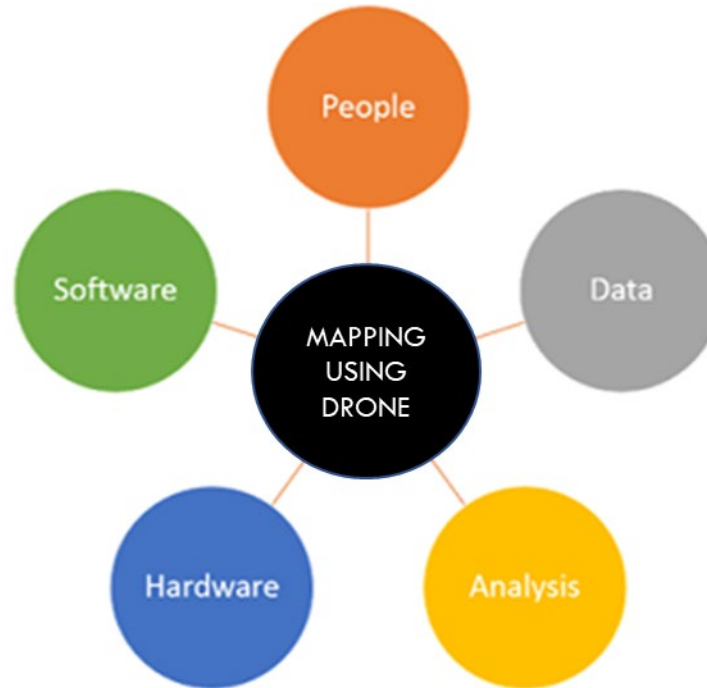


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Hampir Semua Kegiatan
Kehutanan Membutuhkan
Data Spasial



Identifikasi
Parameter
Spasial
Kegiatan
Kehutanan



OUTPUTS
Orthophoto, DSM, DTM, 3D
+
[Khusus u Drone Multispektral
Bands Combination & Single Bands]

Analisis Spasial
Kegiatan-kegiatan
Kehutanan



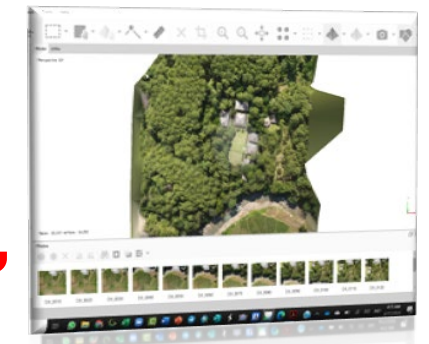
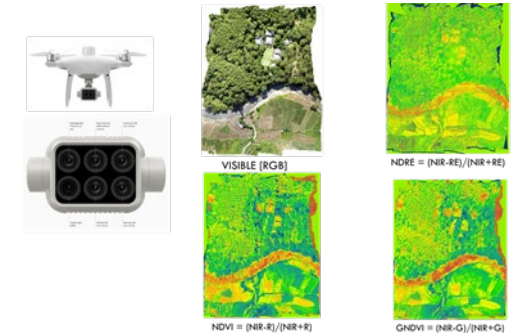
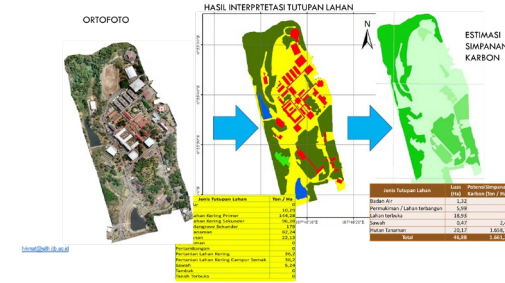
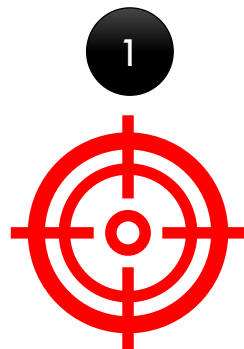
Component	Activities
People	Drone Pilot, Data Processing & Analyst
Hardware	Drone, Computers/Laptops
Software	Softwares for Data [Acquisition, Processing, Interpretation, Analysis and Reporting]
Data	Ddata format in accordance with the purpose
Analysis	Analysis is chosen according to the purpose

Langkah Penting Operasional Drone4LHK

1. Mendefinisikan tujuan kegiatan
2. Persiapan Penerbangan (Pre-Flight)
3. Akuisisi Data Spasial
4. Pengolahan Data Spasial
5. Interpretasi Data Spasial
6. Analisis Data & Pelaporan



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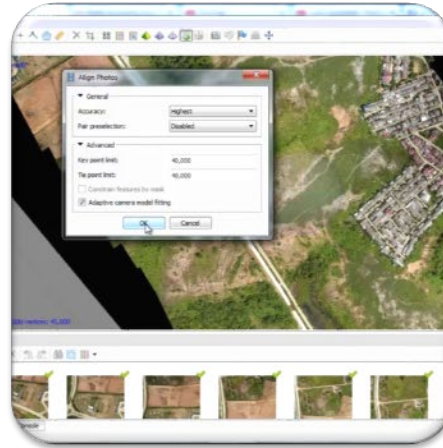




Persiapan



Akuisisi Data



Pengolahan Data

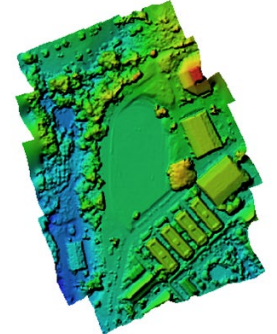
drone4NREM

Natural Resources and Environmental Management

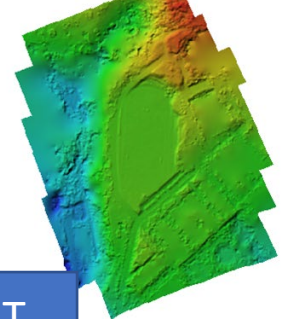
ORTHOPHOTO



DSM
(Digital Surface Model)



DTM
(Digital Terrain Model)



3D MODEL



INPUT
DATA
[SPASIAL]

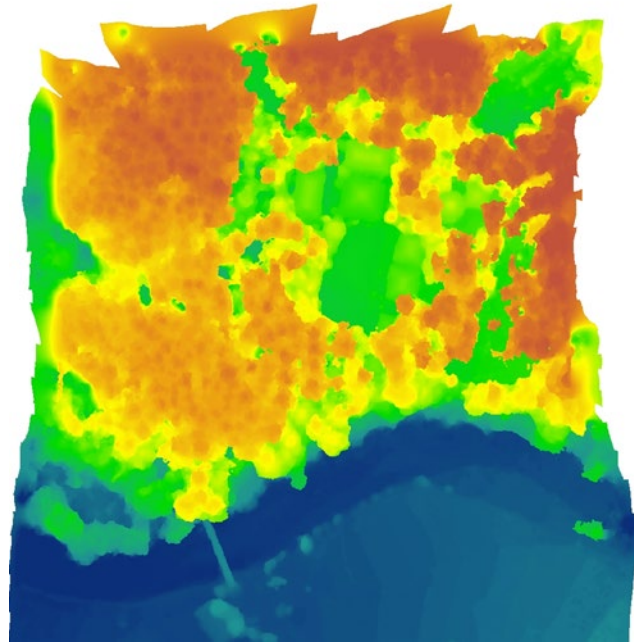
drone4NREM
Natural Resources and Environmental Management



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ORTHOMOSAICS



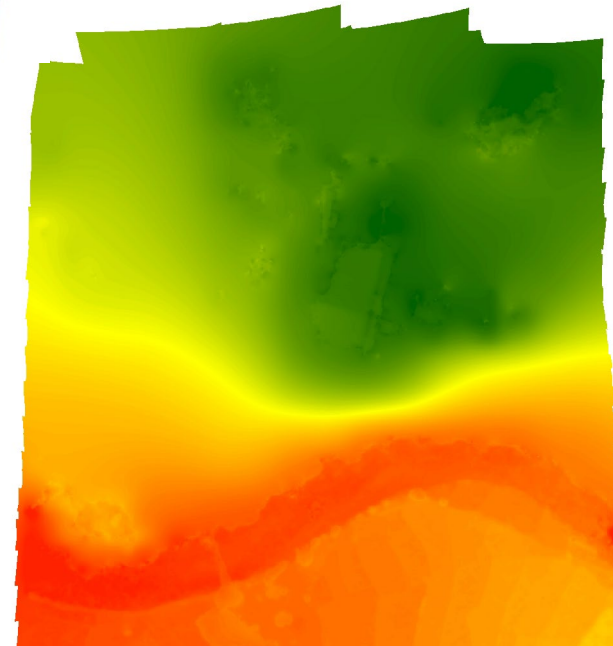
DIGITAL SURFACES
MODELS



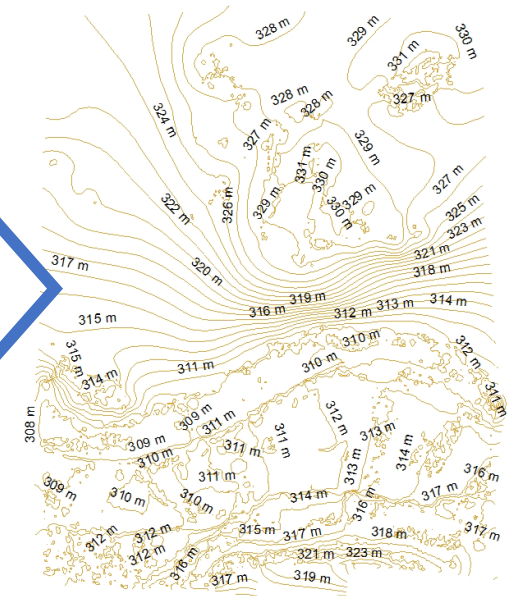
3D MODELS



OUTPUT DRONE



DIGITAL TERRAIN
MODELS





IMAGES YANG BISA DIDAPAT

• KOMBINASI BAND

- VISIBLE (RGB)
- NDVI (*Normalized Difference Vegetation*)
- GNDVI (*Green Normalized Difference Vegetation*)
- NDRE (*Normalized Difference Red Edge*)

Format : JPG

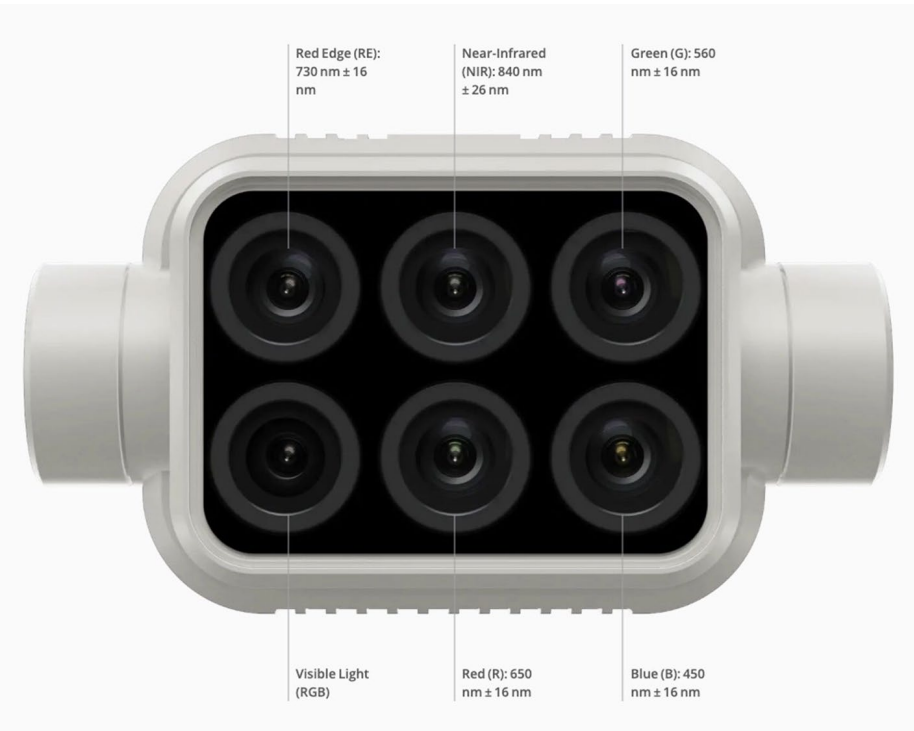
Nilai NDVI, GNDVI, NDRE dan RGB sudah langsung diperoleh, jadi tidak perlu dihitung dengan Raster Calculator

• SINGLE BAND

- RED
- GREEN
- BLUE
- NIR
- RED EDGE

Format : TIFF

Menjadi Input Penting untuk berbagai formula yang menggunakan data raster



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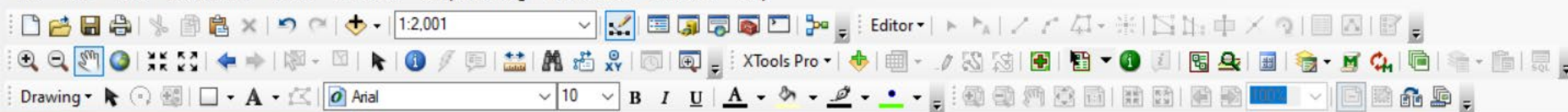


Table Of Contents



Layers

☐ SINGLE BAND☐ KOMBINASI BAND☒ VISIBLE.tif

RGB

Red: Band_1

Green: Band_2

Blue: Band_3

☒ NDVI.tif

RGB

Red: Band_1

Green: Band_2

Blue: Band_3

☐ GNDVI.tif

RGB

Red: Band_1

Green: Band_2

Blue: Band_3

☐ NDRE.tif

RGB

Red: Band_1

Green: Band_2

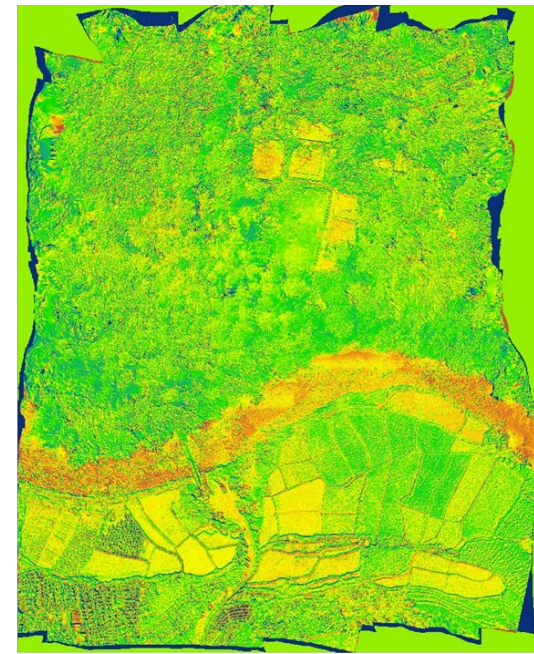
Blue: Band_3

Mosaik Kombinasi Band

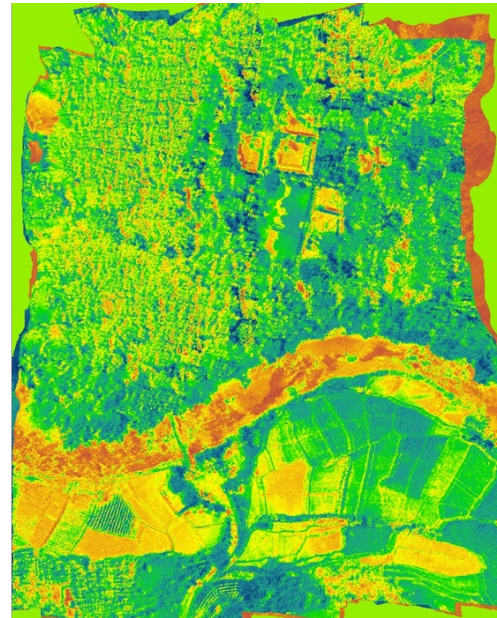




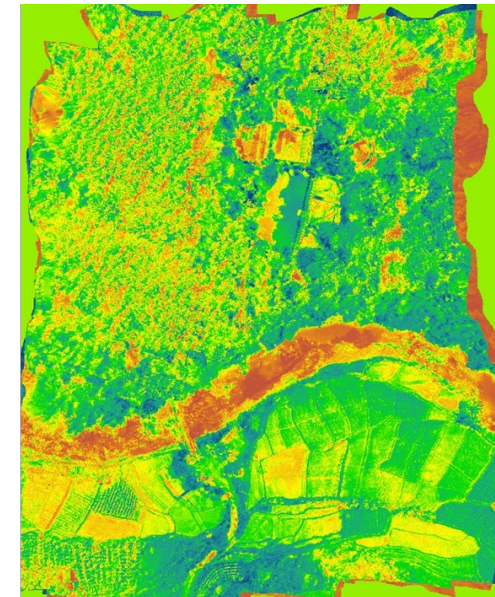
VISIBLE [RGB]



$$\text{NDRE} = (\text{NIR} - \text{RE}) / (\text{NIR} + \text{RE})$$



$$\text{NDVI} = (\text{NIR} - \text{R}) / (\text{NIR} + \text{R})$$



$$\text{GNDVI} = (\text{NIR} - \text{G}) / (\text{NIR} + \text{G})$$

Vegetation Index Calculation

[Based on Single Band of MD]



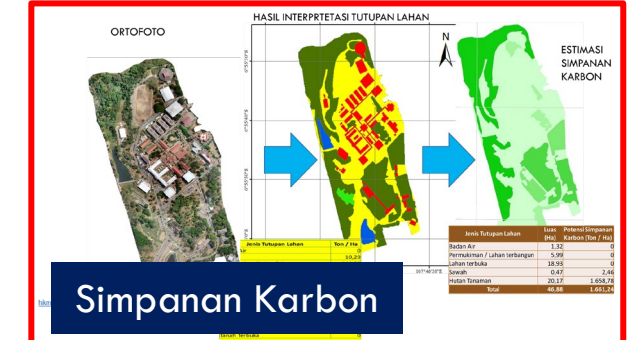
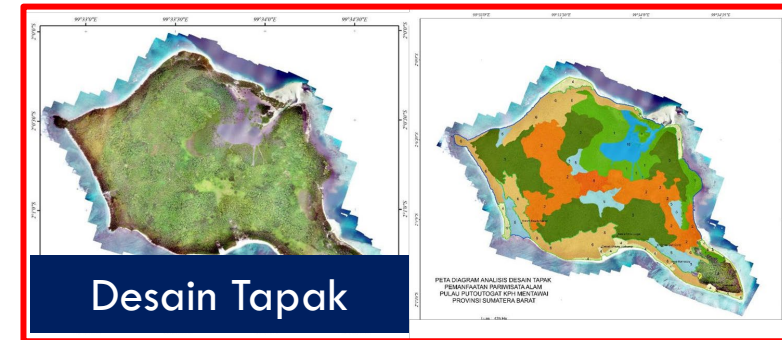
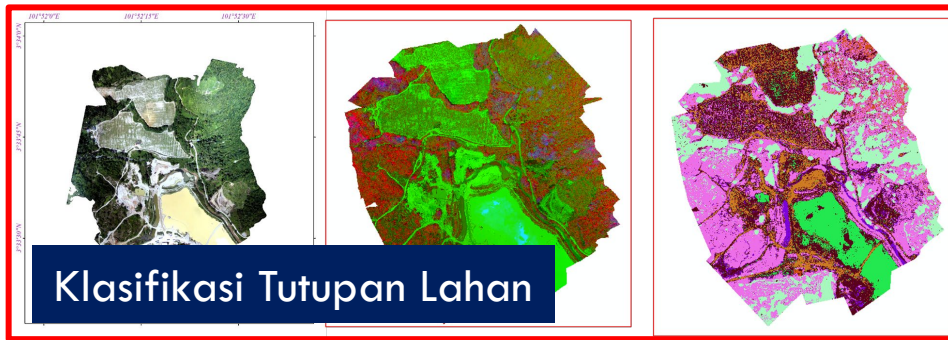
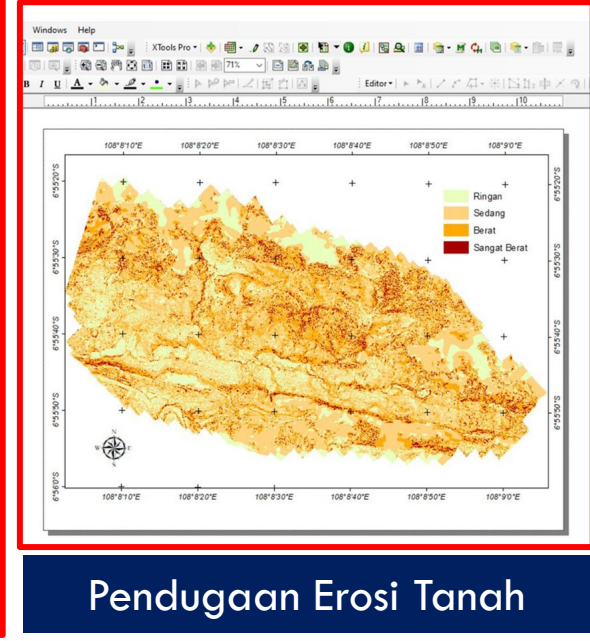
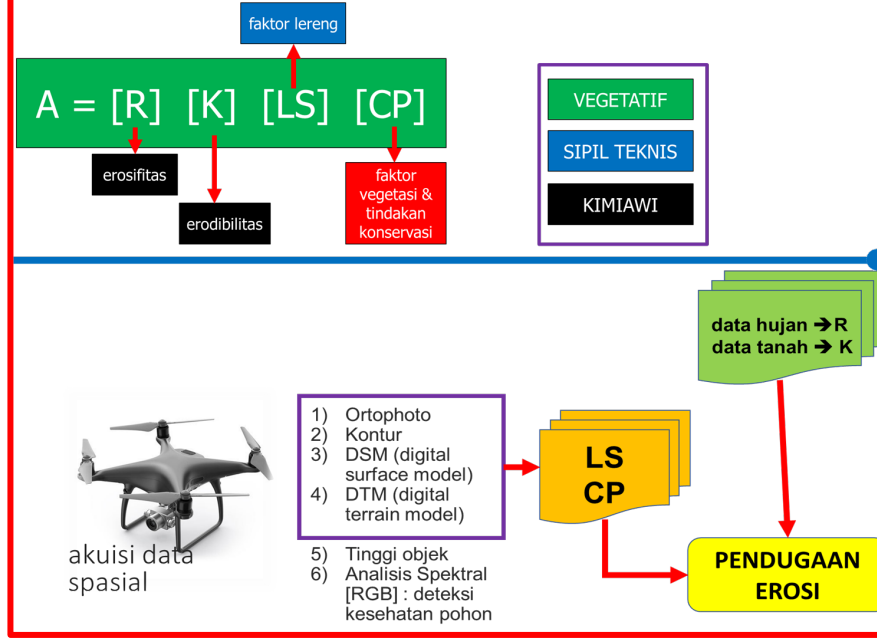
hikmat@sith.itb.ac.id



The diagram shows a 2D coordinate system with a vertical Y-axis and a horizontal X-axis, both represented by purple arrows. Three types of geometric shapes are illustrated in red:

- Points:** A single red dot.
- Lines:** A horizontal red line segment with circular endpoints.
- Polygon:** A closed, irregular red shape.

ATRIBUTES				



RISET Dr Hikmat Ramdan

DRONE⁴BioResources

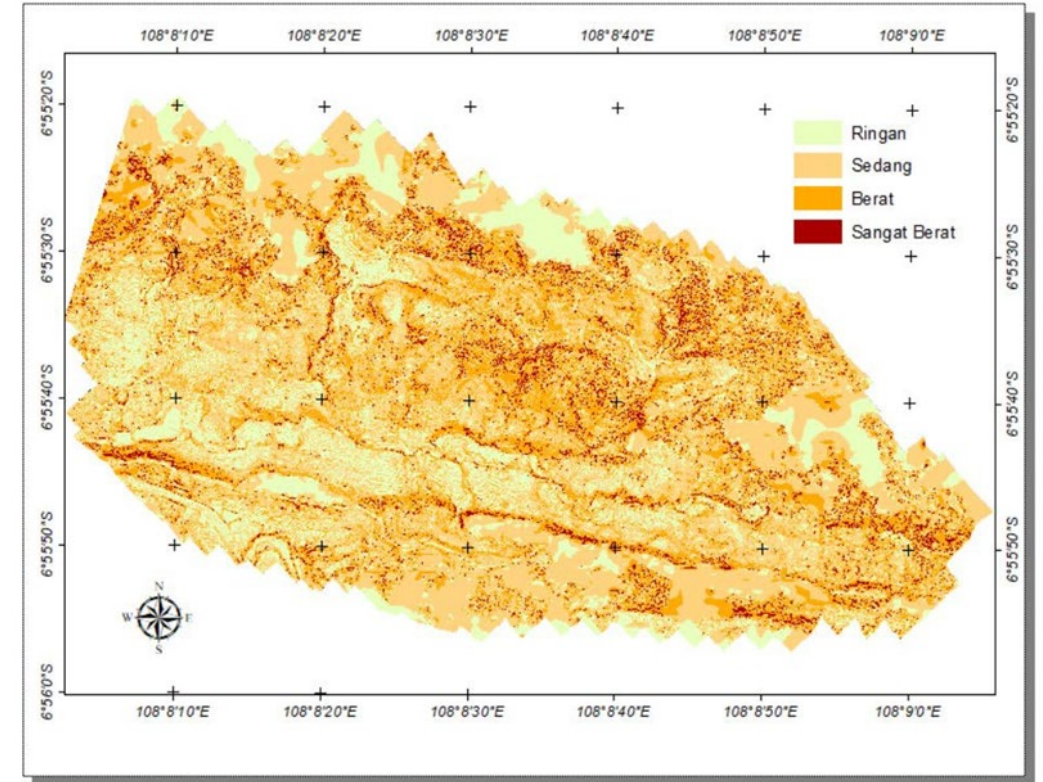
Penelitian dan Pengembangan Teknologi Drone untuk Manajemen Sumberdaya Hayati





akuisi data spasial

- 1) Ortophoto
- 2) Kontur
- 3) DSM (digital surface model)
- 4) DTM (digital terrain model)
- 5) Tinggi objek
- 6) Analisis Spektral [RGB] : deteksi kesehatan pohon



Kelas lereng	Keterangan	Nilai LS
0–8 %	Datar	0.40
8–15 %	Landai	1.40
15–25 %	Agak curam	3.10
25–40 %	Curam	6.80
>40 %	Sangat curam	9.50

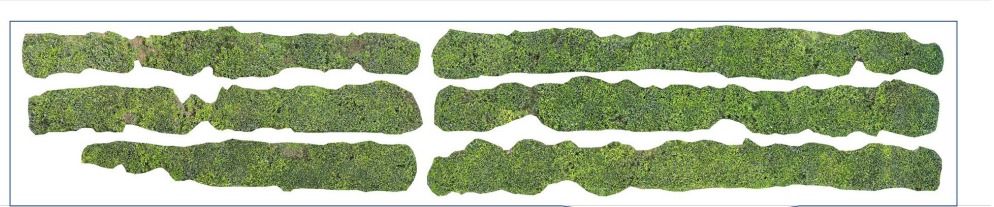
Simanjuntak, H.2018

Analisis Erosi Tanah



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Drone Acquisition : 6 m from ground → 1.4 mm /pixel



Resolusi gambar:
1.4 mm/px



#7
**ANALISIS
KESEHATAN
TANAMAN**
[Perkebunan Teh]



RGB Extraction

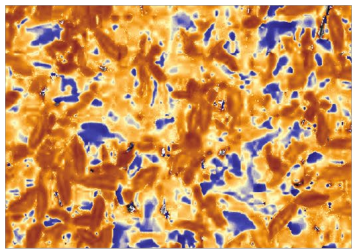
3



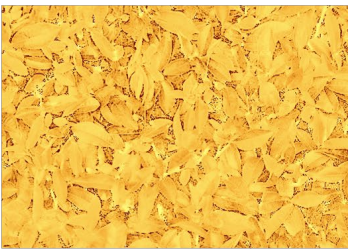
RGB



Grayscale



DGI



GRVI



Tea Health Condition

Klasifikasi Teh

- Daun Tua
- Bercak Daun
- Daun Sehat
- Lipat Daun
- Daun Kuning
- Pantulan Cahaya



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IDENTIFICATION OF HEALING FOREST SPOTS



HF Environmental Parameters

Temperature, Relative Humidity, Light Intensity, Noise, Slope, Vegetation Index, Wind Velocity



Selected HF Spots

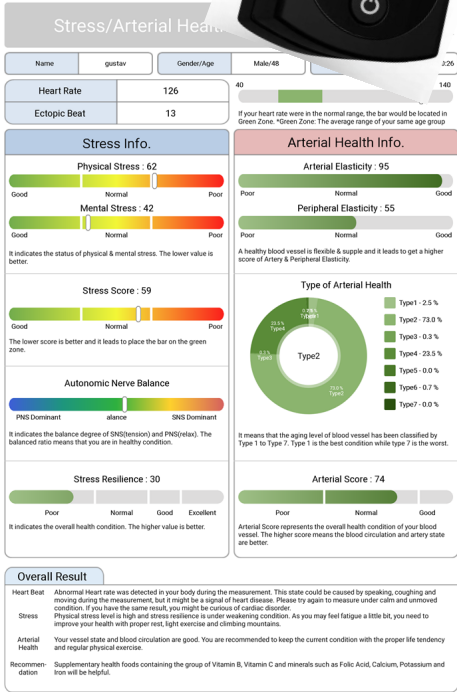


Healing Forest Activities



HEALTH RESPONSES OF HF PARTICIPANTS

Blood Pressure, Heart Rate, Oxygen Level In Blood , Sugar Level In Blood, Stress



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Parameter Lingkungan
Suhu
Kelembaban Udara
Tekanan Bising/Sound Pressure Level (dBA)
Intensitas Cahaya
Kemiringan Lahan
Indeks Vegetasi

Potensi Pemanfaatan Drone berkamera Multispektral & Thermal



Temperature ← → Kelembaban Udara

Tutupan Lahan (potensi kebisingan), Kelerengan, NDVI, Single Band [R,G,B,NIR, RE]



IMAGES YANG BISA DIDAPAT

• KOMBINASI BAND

- VISIBLE (RGB)
- NDVI (Normalized Difference Vegetation)
- GNDVI (Green Normalized Difference Vegetation)
- NDRE (Normalized Difference Red Edge)

• SINGLE BAND

- RED
- GREEN
- BLUE
- NIR
- RED EDGE

Tajuk Jarak

Tajuk Lebat

Kelas	NDVI	Keterangan
1	-1 s/d -0.03	Lahan tidak bervegetasi
2	-0.03 s/d 0.15	Kehijauan sangat rendah
3	0.15 s/d 0.25	Kehijauan rendah
4	0.26 s/d 0.35	Kehijauan sedang
5	0.36 s/d 1.00	Kehijauan tinggi

TajukSedang

Format : JPG
Nilai NDVI, GNDVI, NDRE dan RGB sudah langsung diperoleh, jadi tidak perlu dihitung dengan Raster Calculator

Format : TIFF
Menjadi Input Penting untuk berbagai formula yang menggunakan data raster



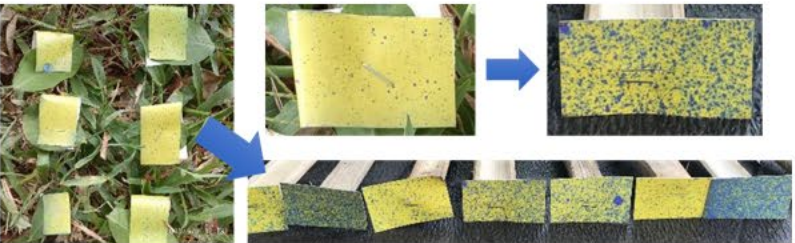
Drone Spayer di HTI



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Drone Pertanian



hikmat@sith.itb.ac.id

Kurikulum Drone⁴LHK

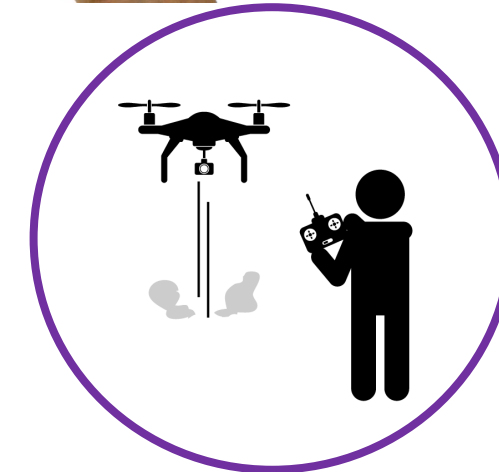
CURRICULUM



Regulasi Penerbangan Drone



Pengenalan Jenis-Jenis Drone



Praktek Lapangan Drone



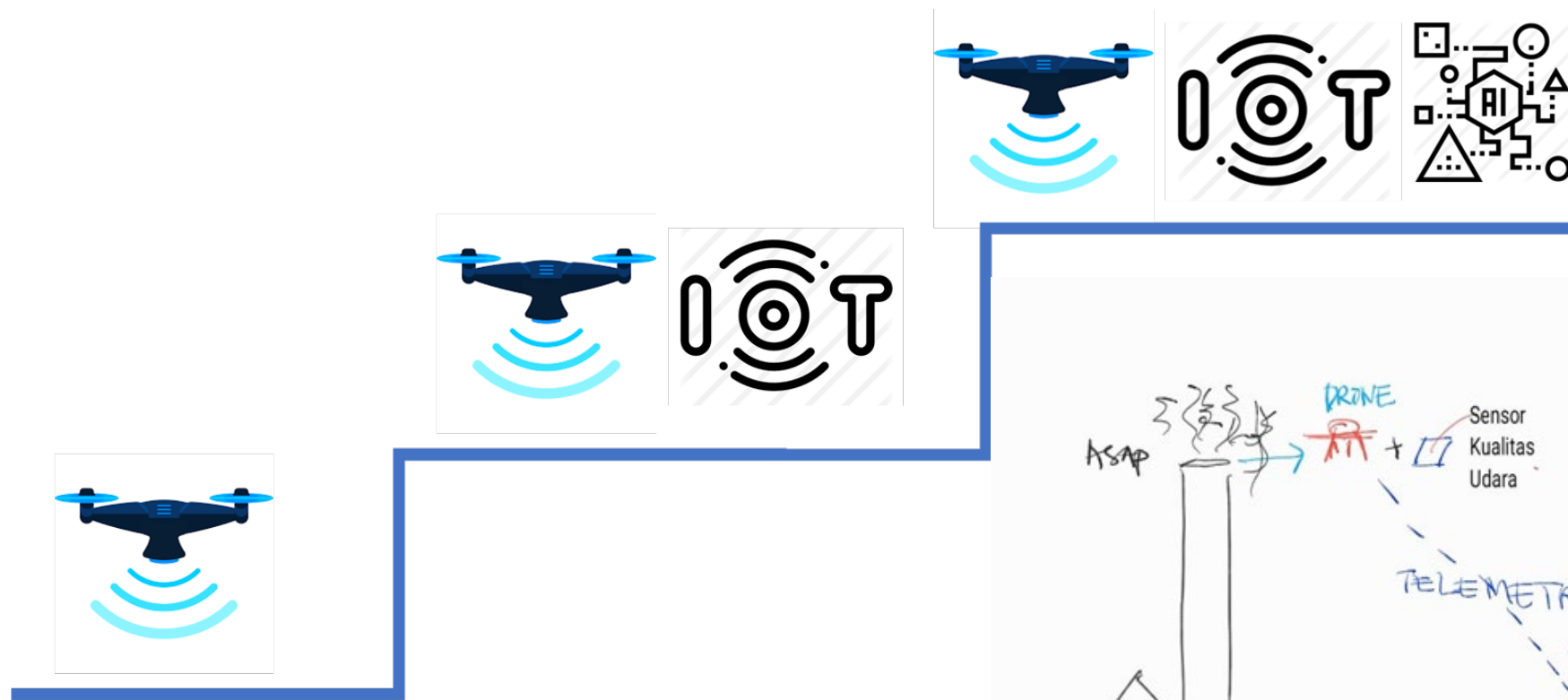
Aplikasi Pemanfaatan
Data Spasial di LHK

CONTOH MATERI PELATIHAN DRONE UNTUK LHK

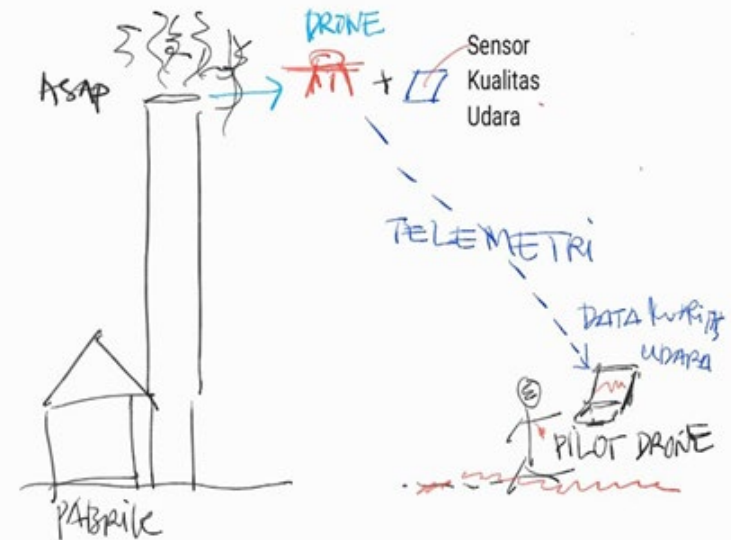
1.	Kebijakan Pemanfaatan Teknologi Pesawat Udara Tanpa Awak (PUTA) di LHK
2.	Regulasi Penerbangan Drone di Indonesia : <i>Controlled, KKOP, Prohibited dan Restricted Area.</i>
3.	Ketentuan Pengoperasian Pesawat Udara Tanpa Awak
4.	Pengendalian dan Pengawasan Pengoperasian Sistem Pesawat Udara Tanpa Awak di ruang udara yang dilayani di Indonesia
5.	Pengendalian dan pengoperasian PUTA yang dilakukan oleh AirNav Indonesia
6.	Pengenalan PUTA Multirotor untuk akuisisi data spasial
7.	Pengenalan PUTA Fixed Wings dan VTOL (Vertical Take off Landing) untuk akuisisi data spasial
8.	Pengenalan PUTA untuk Pertanian (Spraying Drone)
9.	Perencanaan Terbang yang aman dan baik, menyajikan contoh beberapa perangkat lunak perencanaan terbang dan prakiraan kondisi cuaca yang aman untuk penerbangan
10.	Pendalaman Pengenalan Wahana PUTA
11.	Praktek Lapangan penerbangan PUTA VTOL
12.	Praktek lapangan penerbangan PUTA multirotor
13.	Praktek Lapangan penerbangan Drone Pertanian
14.	Pengantar fotogrametri foto udara
15.	Pengenalan SIG LHK
16.	Pengenalan perangkat lunak pengolahan data spasial hasil pemotretan udara PUTA
17.	Praktek pengolahan foto udara PUTA
18.	Studi kasus 1 : Pemanfaatan teknologi PUTA untuk analisis penutupan lahan dan pemantauan tata ruang
19.	Studi kasus 2 : Pemanfaatan teknologi PUTA untuk reklamasi lahan
20.	Studi kasus 3 : Pemanfaatan teknologi PUTA untuk pemantauan kerusakan dan potensi untuk penilaian jasa lingkungan



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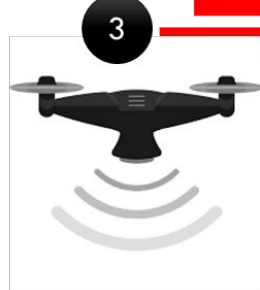


Drone Technology Development



by Hikmat · 10/2/2020
Concept - copyright

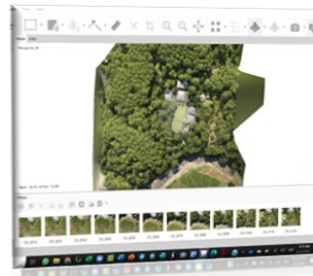
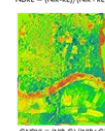
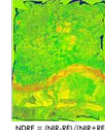
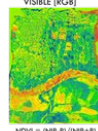
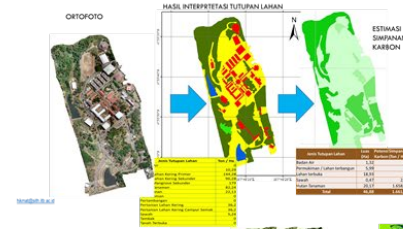
PENUTUP



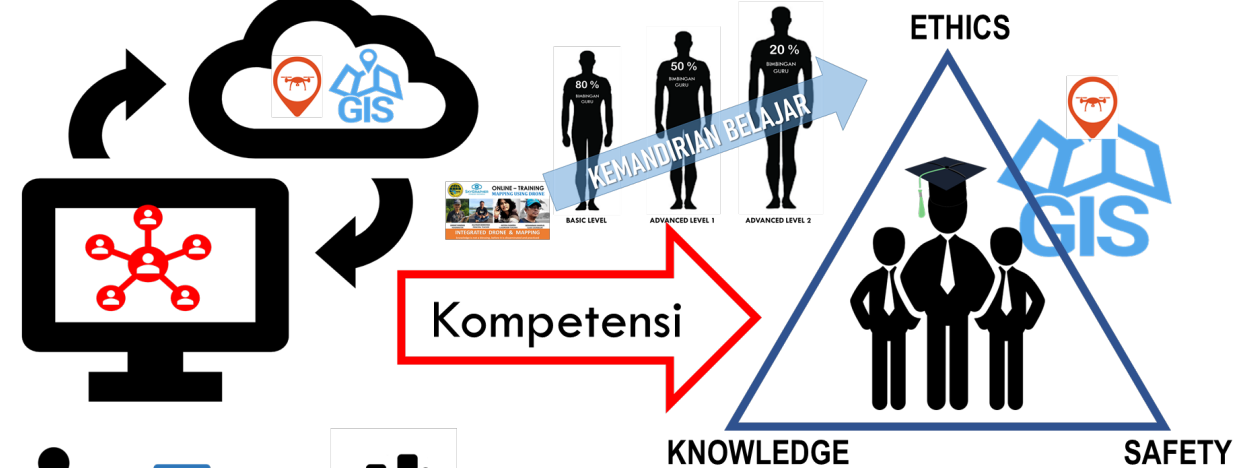
4-6



1. Define OBJECTIVES
2. PRE-FLIGHT
3. DATA ACQUISITION
4. IMAGES PROCESSING
5. INTERPRETATION
6. ANALYSIS & REPORTING



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HEAD MASTER



PRINCIPAL TEACHER



CLASSROOM TEACHER



COUNSELOR TEACHER

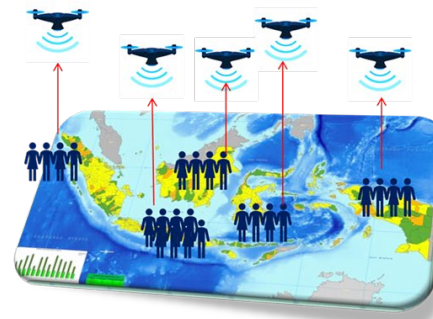
ON-LINE LEARNING :
Students can study in
anytime & anywhere



1. Berbagi Itu Indah
2. Pemberi dan Penerima Ilmu Harus Sama-sama Ikhlas
3. Menjauhi Energi Negatif
4. Berkomitmen Untuk Menyebarkan Ilmu dan Mengamalkannya Secara Ikhlas



Acquisition, Processing, Output [ortho]

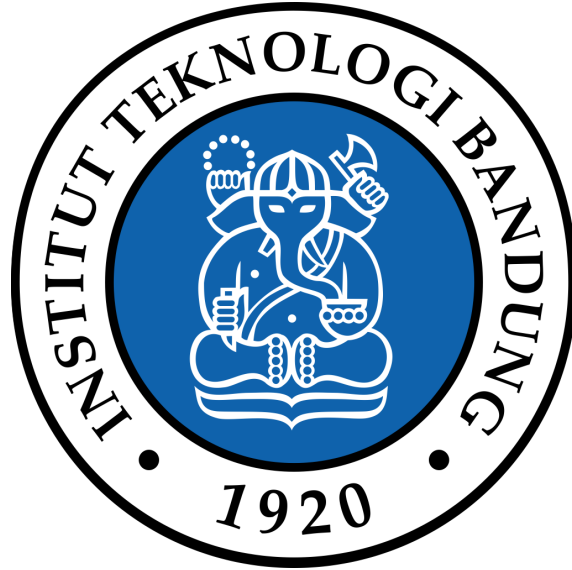


Kegiatan pembangunan daerah selalu terkait dengan spasial (keruangan)

- Tata Ruang
- Potensi SDAL
- Kependudukan
- Ekonomi
- Sosial
- Infrastruktur
- Transportasi
- Konservasi dan Pelestarian Lingkungan Hidup
- Kehutanan
- Pertanian
- dan sebagainya



DATA SPASIAL TEMATIK



Terima Kasih



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