APBON
Asia-Pacific Biodiversity Observation Network

Expectations from APBON

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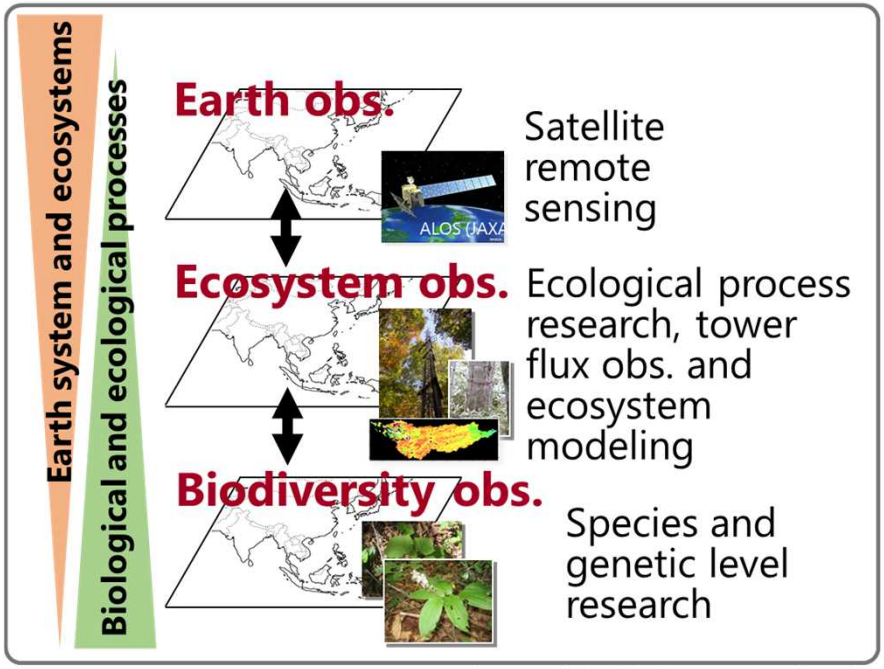
APBON

Mission

1) Contribution to sound decision making related to biodiversity conservation based on scientific information
2) Facilitation of the utilization of existing biodiversity data
3) Coordination of a regional network

Activities

1. Monitoring changes of biodiversity
   - ✓Biodiversity mapping
   - ✓Identification of key drivers
     Land use change, Climate change
2. Networking of the observations networks
   - ✓Sharing information through the networks
3. Capacity building



(Muraoka et al. 2012 in APBON book)

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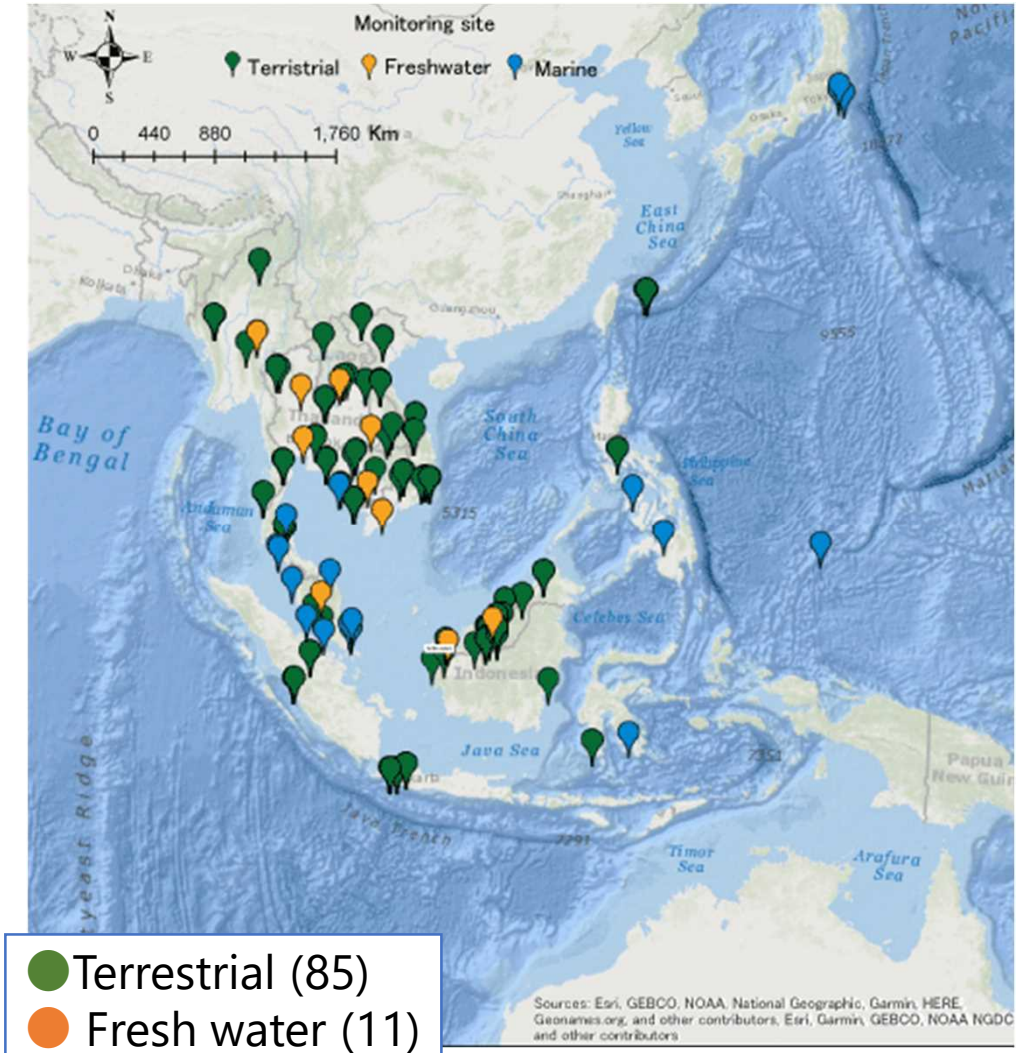
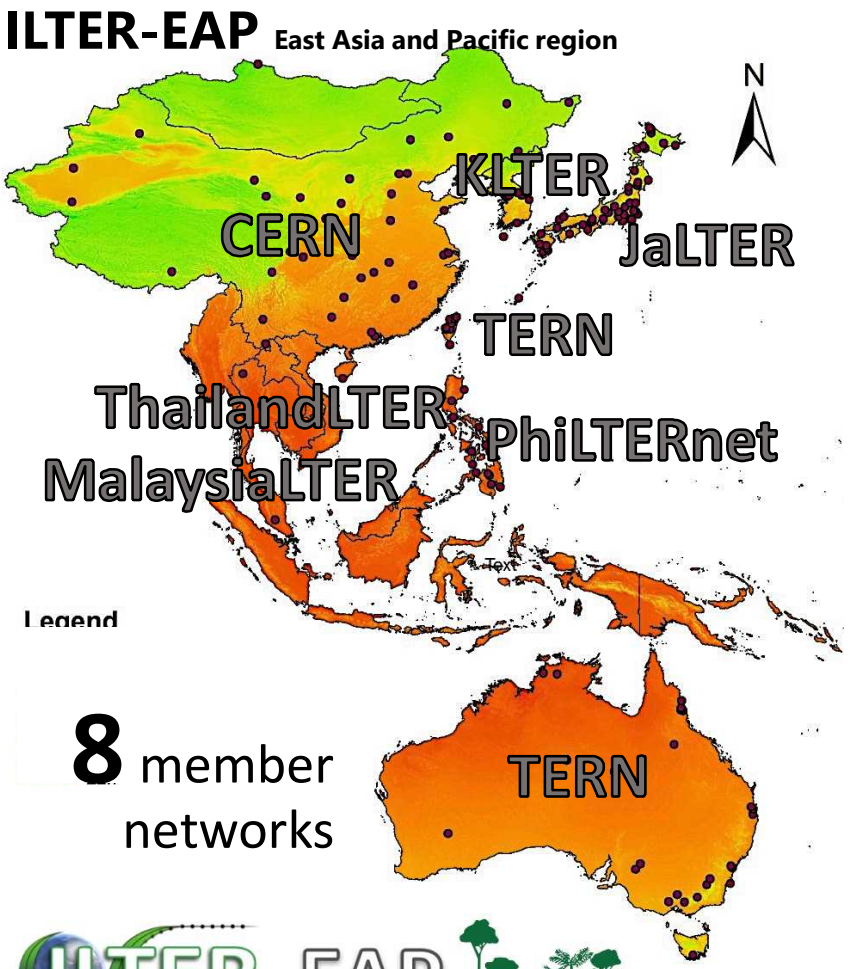
Biodiversity monitoring sites



- Terrestrial (85)
- Fresh water (11)
- Marine (20)



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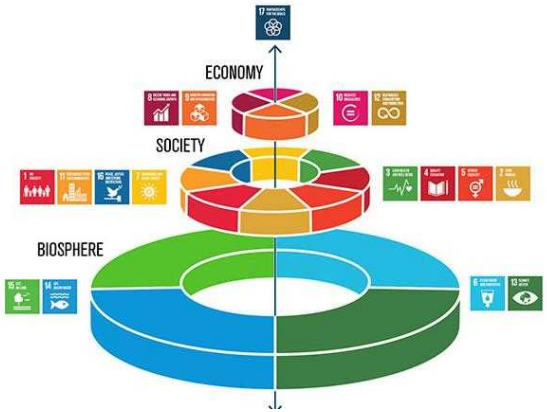
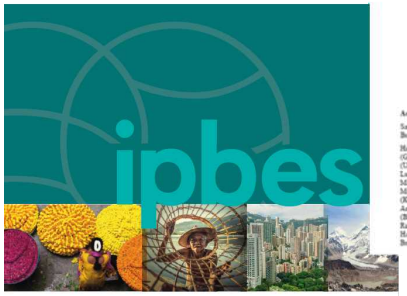
Vision & Challenges of APBON

- The Earth observation – increasing the societal demand
- APBON will strive to supply the scientific evidence to develop sound assessments and facilitate policy-making
- **Promoting interdisciplinary research** and problem-solving approaches with filling the knowledge gaps
- **Strengthening biodiversity observation networks, collaboration with other TGs.**
- Promoting the data accessibility, deliver our information and knowledge to global platforms such as CBD and IPBES





Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

- ADVANCE UNEDITED VERSION -

6 May 2019

https://www.ipbes.net/assessment-reports/

Vision & Challenges of APBON

Our challenges include...

1. **Scaling-up the observational area**
   - Geographical gaps, Temporal gaps
   - Scaling-up monitoring of Ecosystem processes/functions

with Remote sensing team

2. **Understanding relationships between species diversity and ecosystem functions**
   - Species diversity vs Biomass
   - Species diversity's contribution to ecosystem services, mitigation of climate change

with Carbon/GHGs TG

From April 2016- March 2019 (3yrs)

Development of methodology for species and functional diversity assessment in Southeast Asian tropical forests using high-resolution 3D monitoring technique

~Toward understanding the feedback mechanism of climate change to tropical forest ecosystems~

Atmosphere **Climate change**

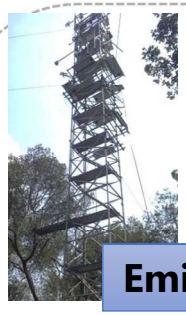
Increase in CO_2 level and temperature

Environmental issue In tropical forests

Tropical forest ecosystems

Ecosystem functions

Biodiversity



Canopy 3D structure

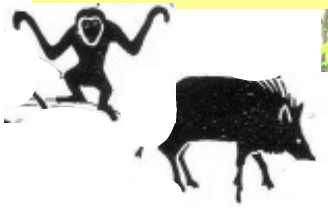
UAV - SfM

Light environment

Habitat

Distribution of animals

Camera trap
DNAs in flood of mosquitos



Emissions of BVOC

Response to CO_2 and temperature in forest floor

Plant phenology・ Primary net production

Mentoring camera

Canopy stricture

Relationship with tree species diversity

Evaluation of sustainability of tropical forest ecosystems by 3D monitoring technique

http://www.nies.go.jp/biology/en/research/frame/pasohsyonaia.html

Species diversity and canopy structure of a tropical tree community in Malaysia

Yayoi Takeuchi, Habura Borjigin, Nobuko Saigusa (National Institute for Environmental Studies, Japan), Kaoru Niiyama, Tamotsu Sato (Forestry and Forest Products Research Institute, Japan), Toshinori Okuda (Hiroshima University), Hamdan Omar, Azharizan Mohammad Norizan (Forest Research Institute Malaysia)

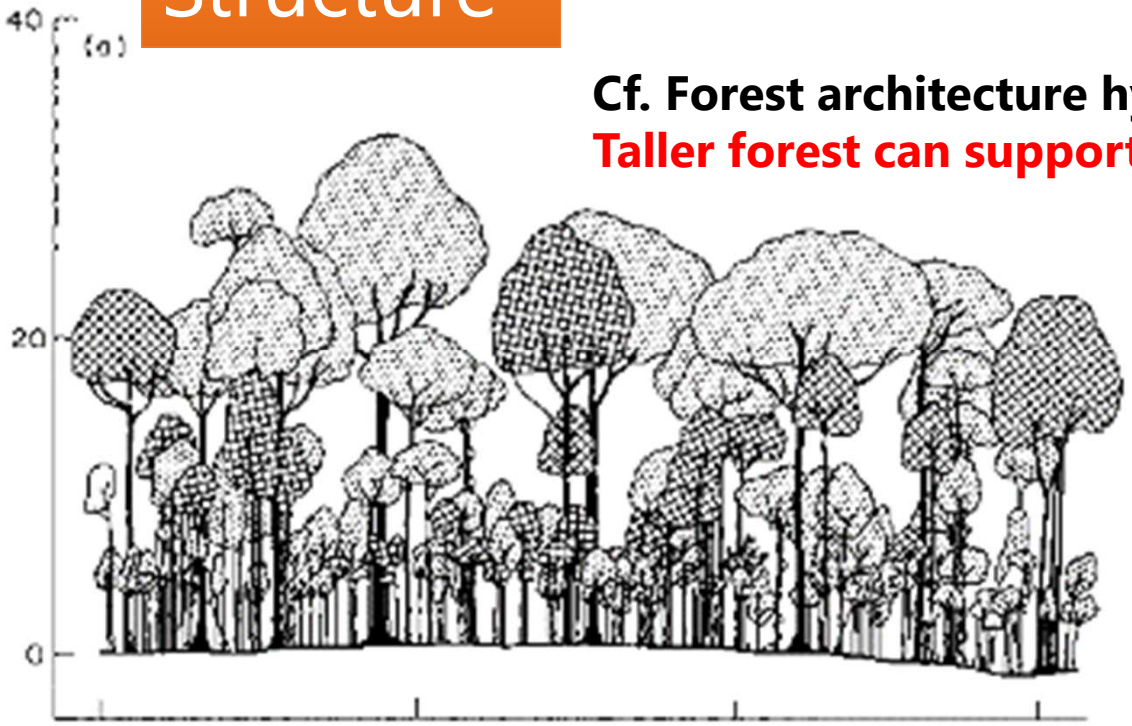
"Forest canopy"

- **Major ecological processes**
- **Major environmental factor**
- **Forest attributes**

Species diversity influenced by forest structure in finer scale

- 3D-forest structure would be a key for species coexistence

Horizontal Structure → Light → Niche / Competition



Cf. Forest architecture hypothesis (Kohyama 1993)

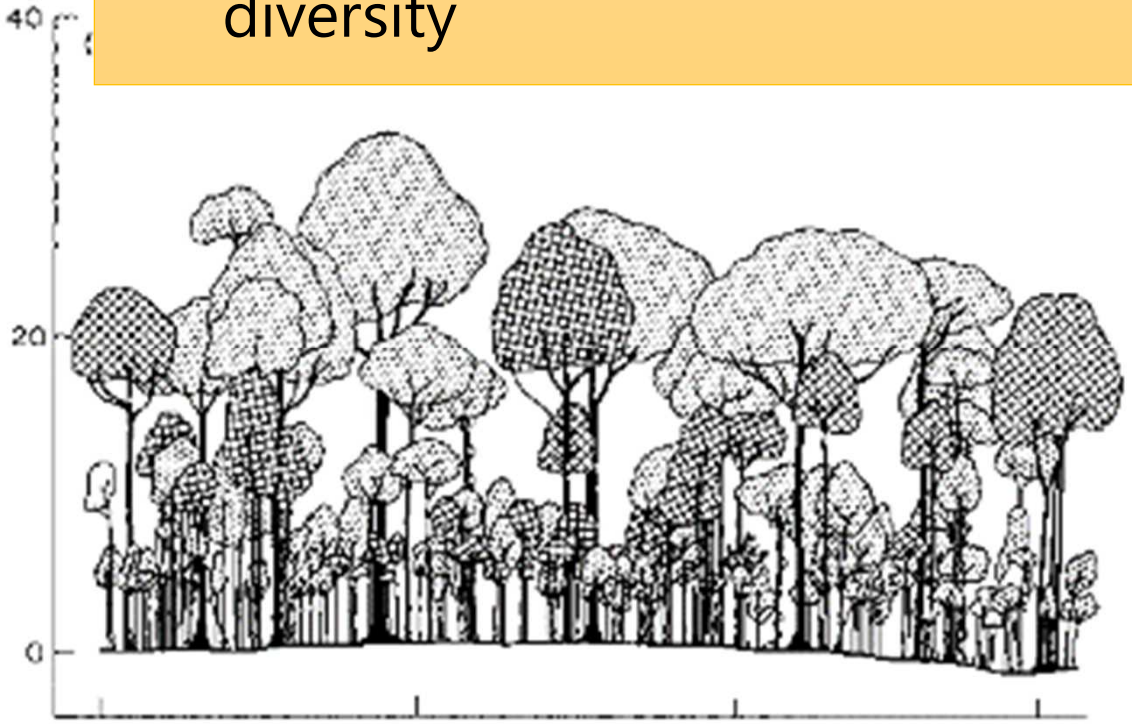
Taller forest can support more species

Objective

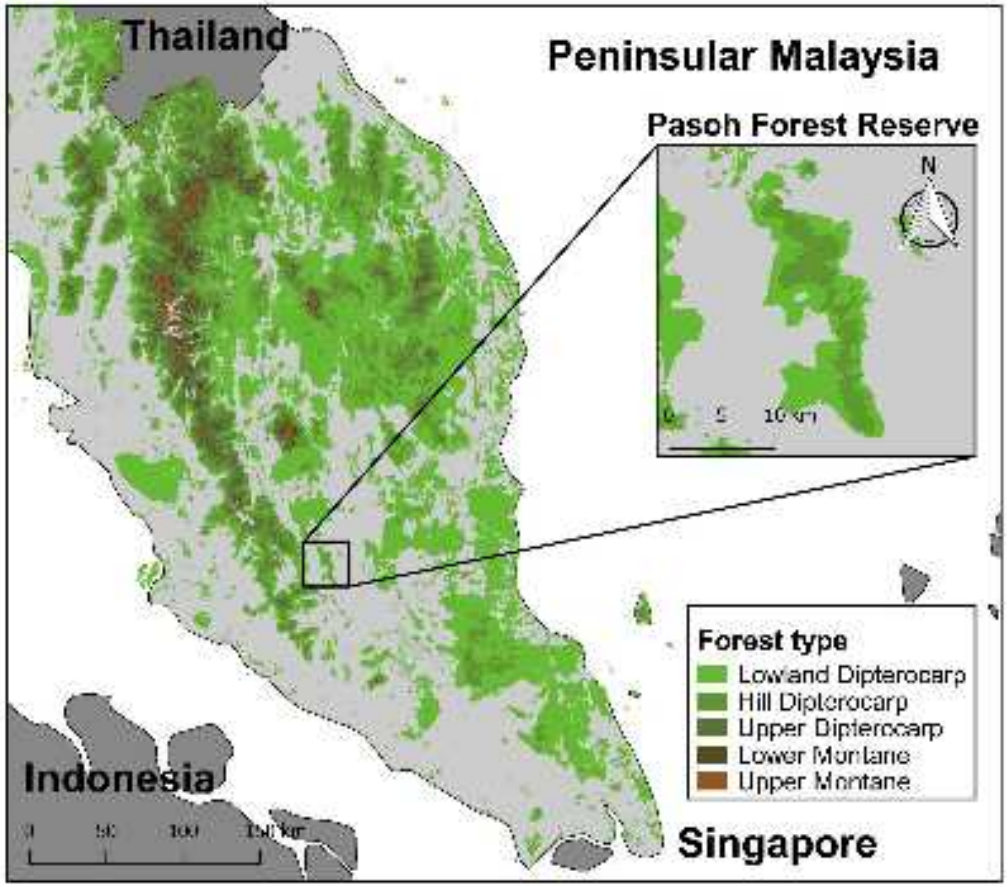
To understand the relationship between forest structure and species diversity

(1) Characterizing forest canopy structure by UAV-SfM

(2) Exploring forest canopy index which infer tree species diversity



Pasoh Forest Reserve



50ha plot CTFS/FRIM, 1987~

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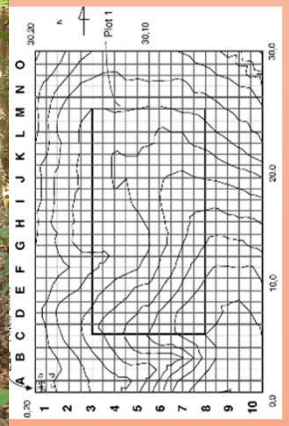
6ha plot FFPRI, 1994~

Canopy tower
& walkway

Several 1ha plot FRIM, 1960s

Field Observation & survey

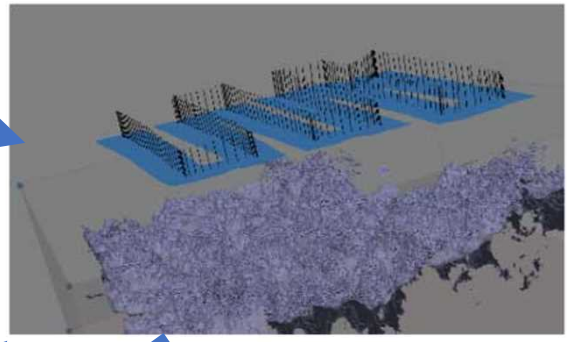


Tree species diversity & size

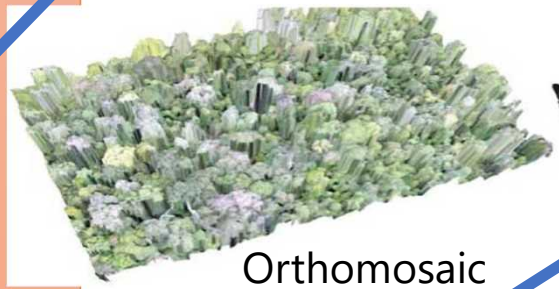
Photos by a UAV

Ground control points

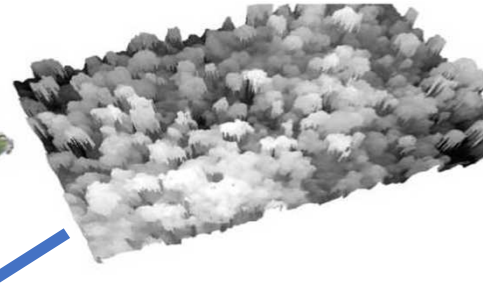
Computation



Structure from Motion (SfM)

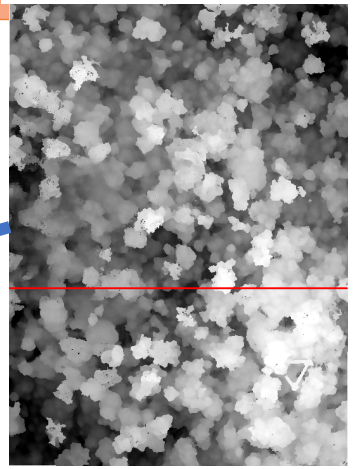


Orthomosaic image

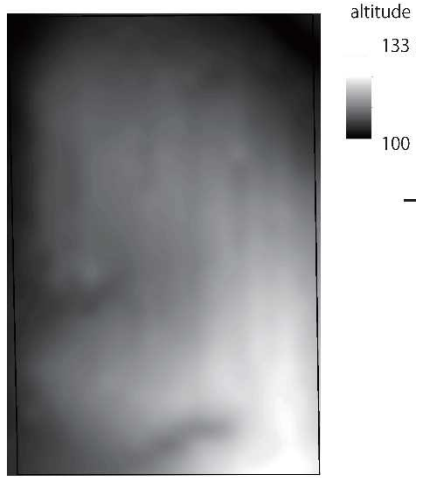


Digital Surface Model (DSM)

Digital Elevation Model (DEM)



Digital Canopy Height Model (DCHM)



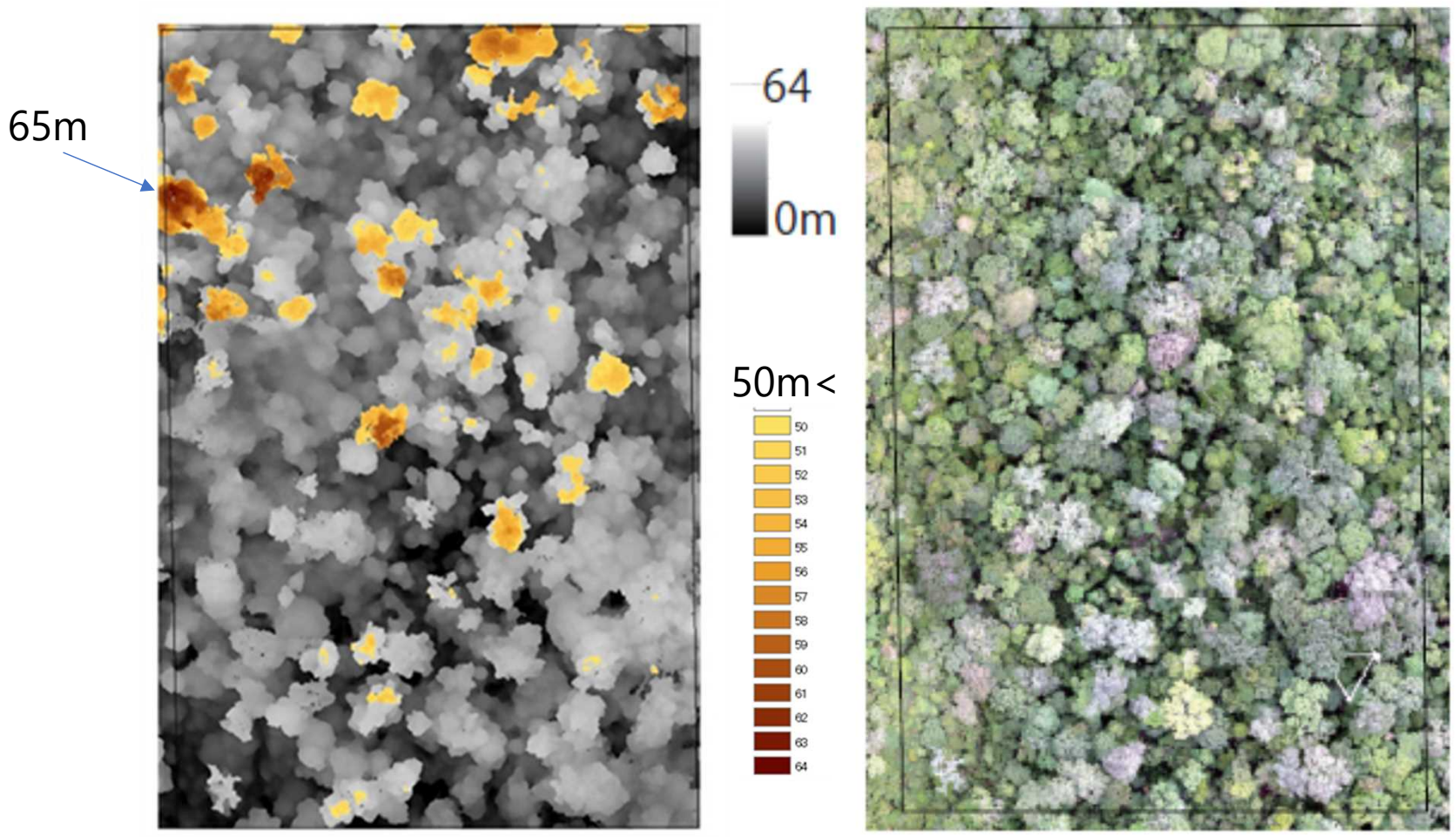
Statistical Analysis

Species diversity index & Canopy index

Result

Canopy height

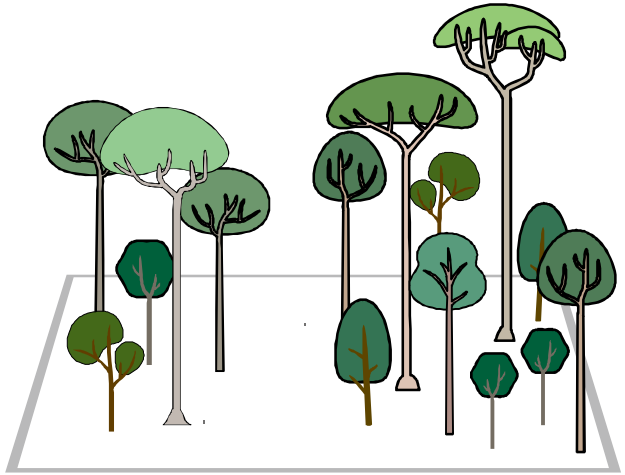
Orthomosaic image

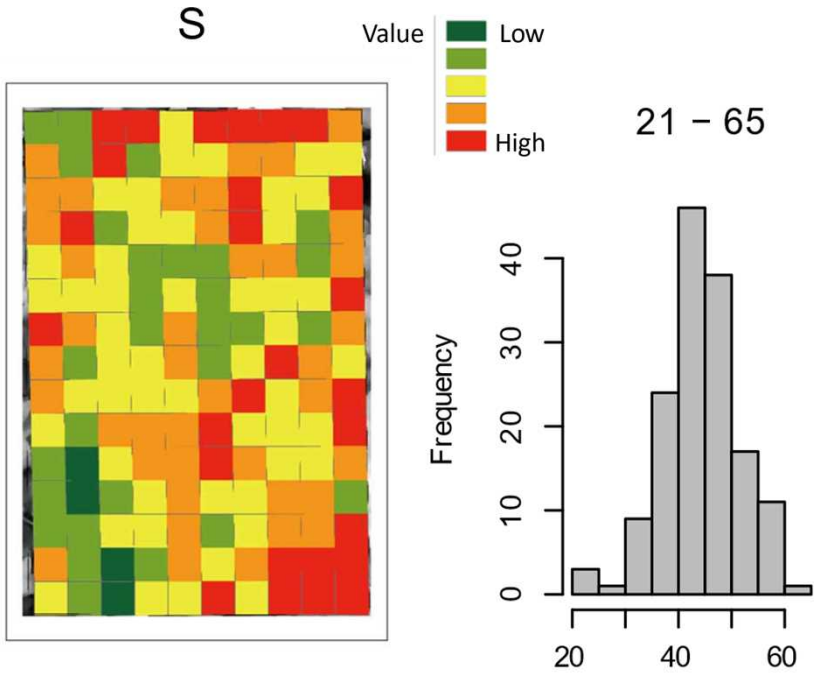


Species diversity index

Species diversity index	
S	Species richness
H	Shannon's index
simp	Simpson's index
invsimp	Inverse simpson's index
J	Evenness

73 individuals
56 species

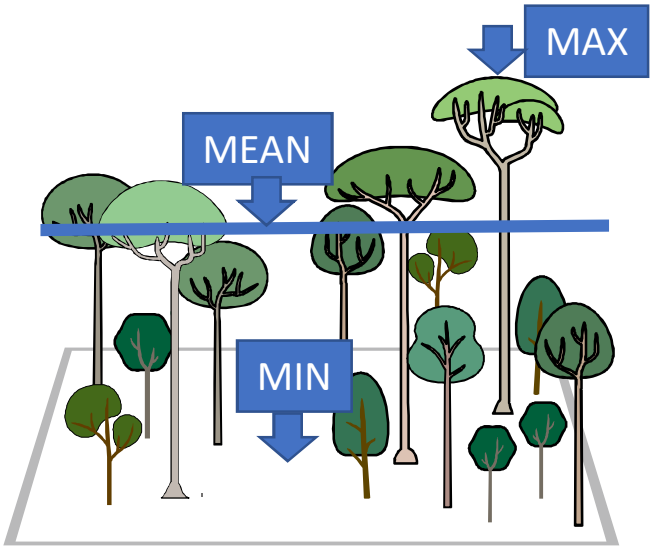


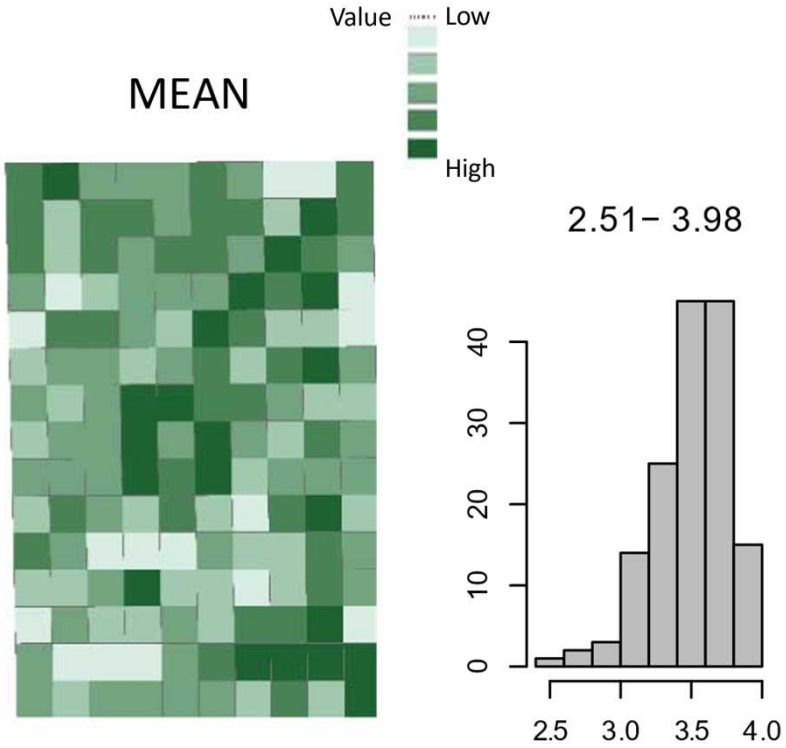


20 x 20 m subquadrate

Canopy structure index

Canopy structure index	
MAX	Maximum height
MIN	Minimum height
RANGE	MAX -Min
MEAN	Mean of canopy height
SUM	Sum of canopy height
STD	Standard deviation of canopy height
tor	Roughness of canopy （3D/2D)





20 x 20 m subquadrate

Application for large-scale biodiversity monitoring using remote sensing

Satellite

What is the measurable biodiversity metrics using remote sensing?

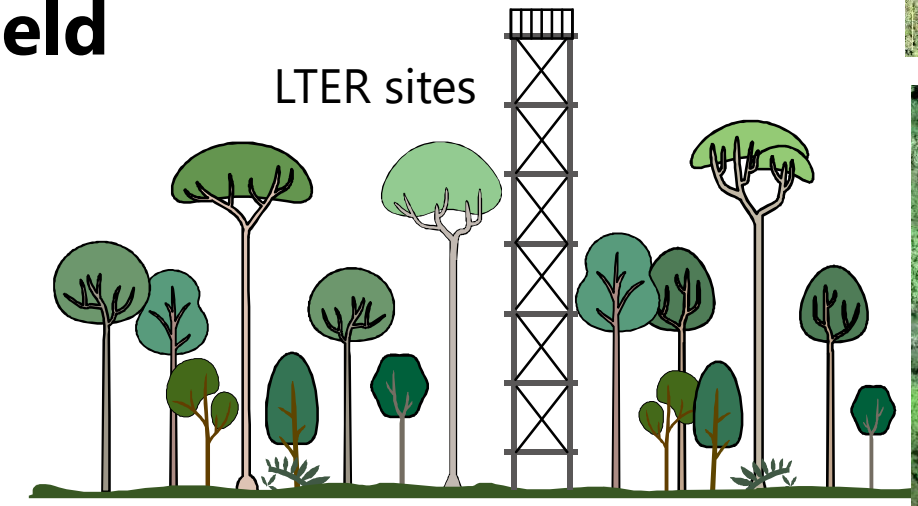
Air

How does Biodiversity relate with Biomass?

Higher species diversity were found in higher canopy

Field

LTER sites



2017

2019

Phenology as a key ecosystem function
-Flowering, flushing, coloring leaves

Ecosystem service

Provisioning service

-food production

-raw material

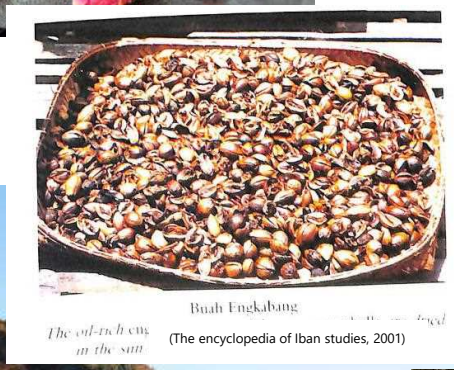
Regulating service

-pollination

-carbon storage

Cultural service

-recreation/tourism



(The encyclopedia of Iban studies, 2001)

Phenology observation

SENTINEL

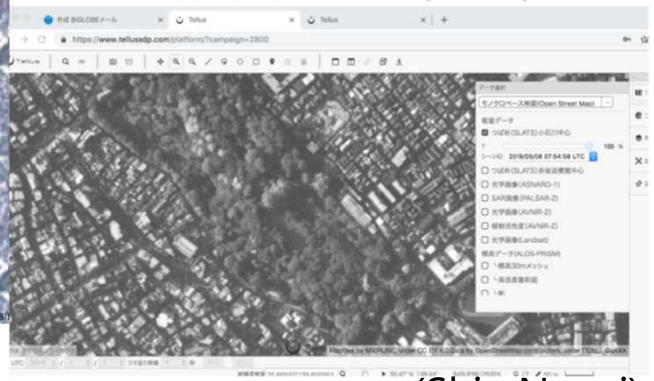
Seasonal RGB images observed by SENTINEL-2
at Koishikawa Botanical Garden in Tokyo (10m res.)

Satellite

SLATS

Phenology observations by advanced optical satellites
(e.g., SLATS; Tsubame, m resolution)

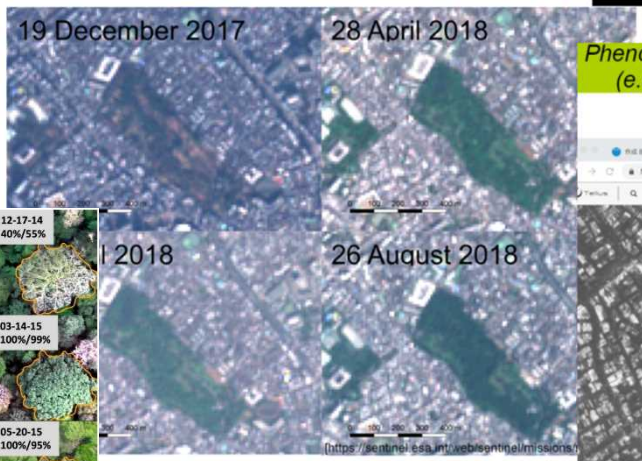
At Koishikawa Botanical Garden in Tokyo on 8 May 2019



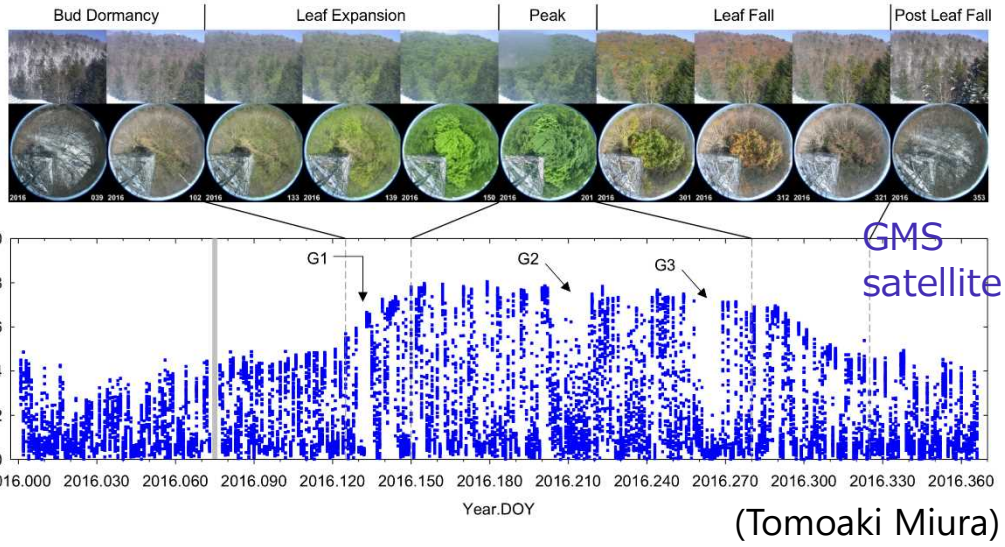
(Shin Nagai)

Satellite

UAV



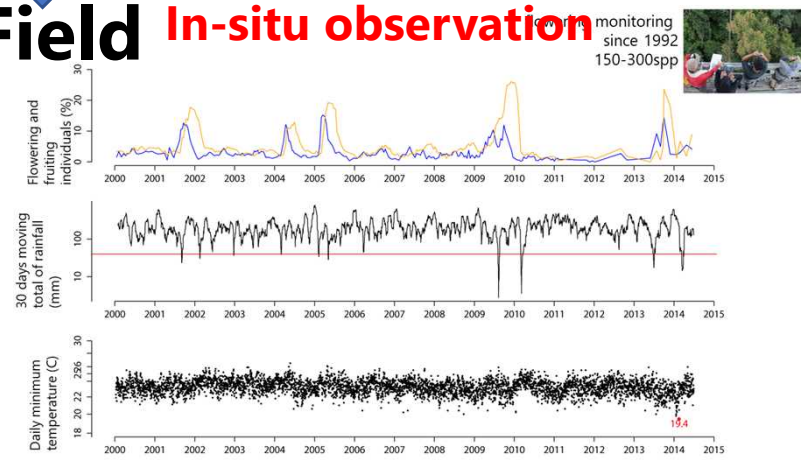
Time-lapse camera



(Tomoaki Miura)

Field

In-situ observation



Conclusions: Expectations from APBON

1. Filling the observational gaps **through collaboration with Remote sensing team**
   - Geographical gaps, Temporal gaps
   - Scaling-up monitoring of Ecosystem processes/functions

2. Understanding relationships between species diversity and ecosystem functions **through collaboration with Carbon/GHGs TG**
   - Species diversity vs Biomass
   - Species diversity's contribution to mitigation of Climate change

Expected outcomes

Integrated earth observations will provide the insight for interaction among Essential Variables

APBON's main target

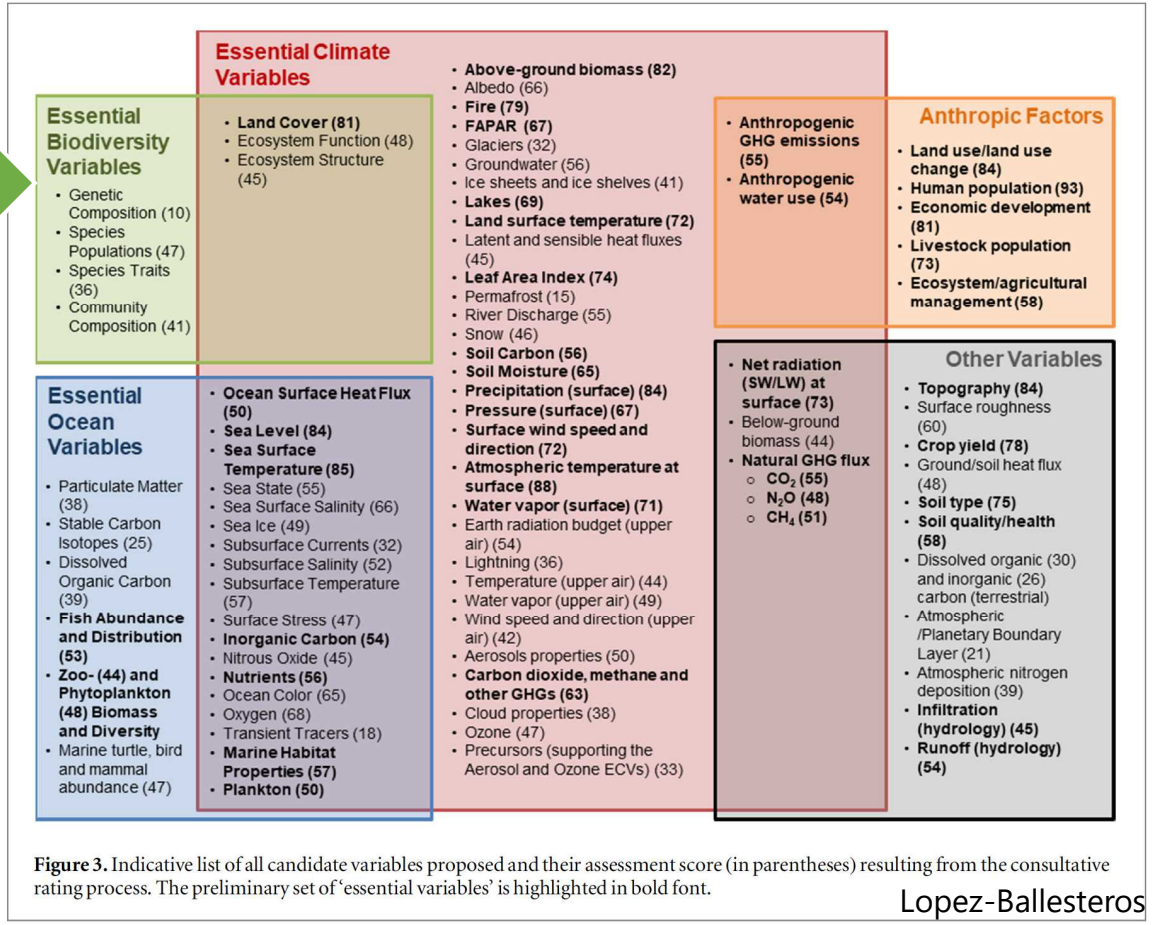
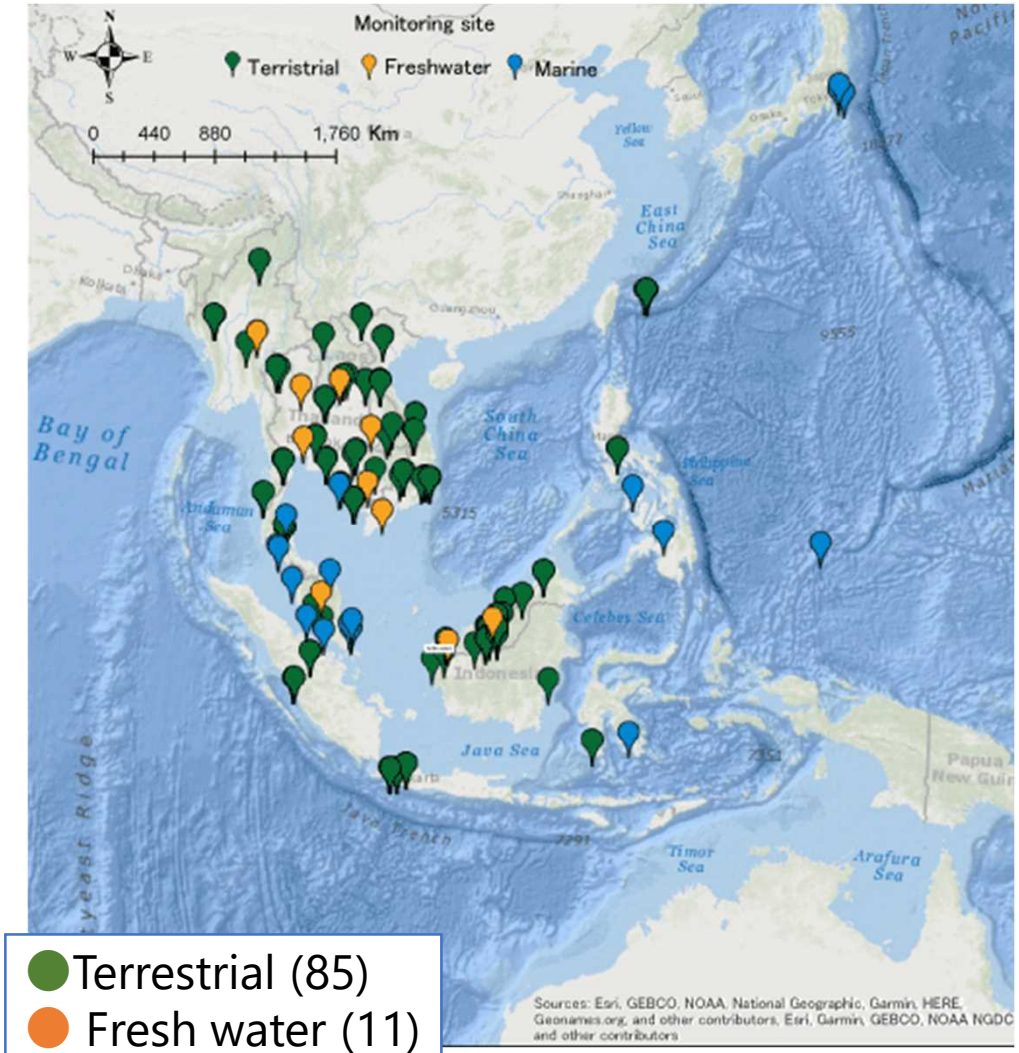


Figure 3. Indicative list of all candidate variables proposed and their assessment score (in parentheses) resulting from the consultative rating process. The preliminary set of 'essential variables' is highlighted in bold font.

Lopez-Ballesteros et al. (2018) Env Re Let

Use our biodiversity observation network



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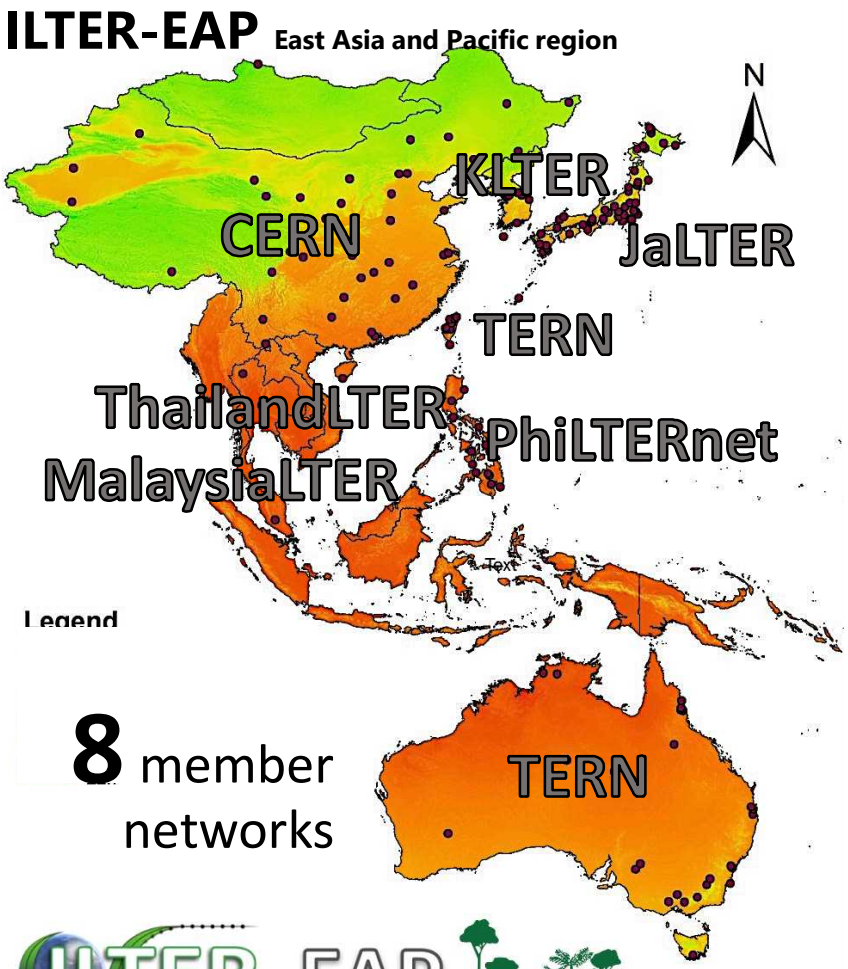

8 member networks

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From 11th APBON (June, 2019)

BON in “master sites”

Synonyms: “top sites”, “super sites”, “LTER hubs”, “sentinel sites” etc.

	UNESCO BR	Forest GEO
Japan	Yakushima	
Korea	Jeju Island	
China	Xishuangbanna	Xishuangbanna
Taiwan		Lienhuachih
Vietnam	Langbian	Bidoup
Laos		
Cambodia	Tonle Sap	
Thailand	Mae Sa-Kog Ma	Doi Inthanon
Myanmar	Inlay Lake	
Malaysia	Crocker Range	Pasoh, Lambir
Brunei		Kuala Belalong
Singapore		Bukit Timah
Indonesia	Cibodas	
Phillipines	Pallawan	Palanan

Yahara


Thank you for
your attention!