6th Asia-Oceania Group on Earth Observations (AOGEO) Workshop

May 29-31, 2023 Macau, China

Near real time global land use/cover change (LUCC) mapping and ecosystem mapping

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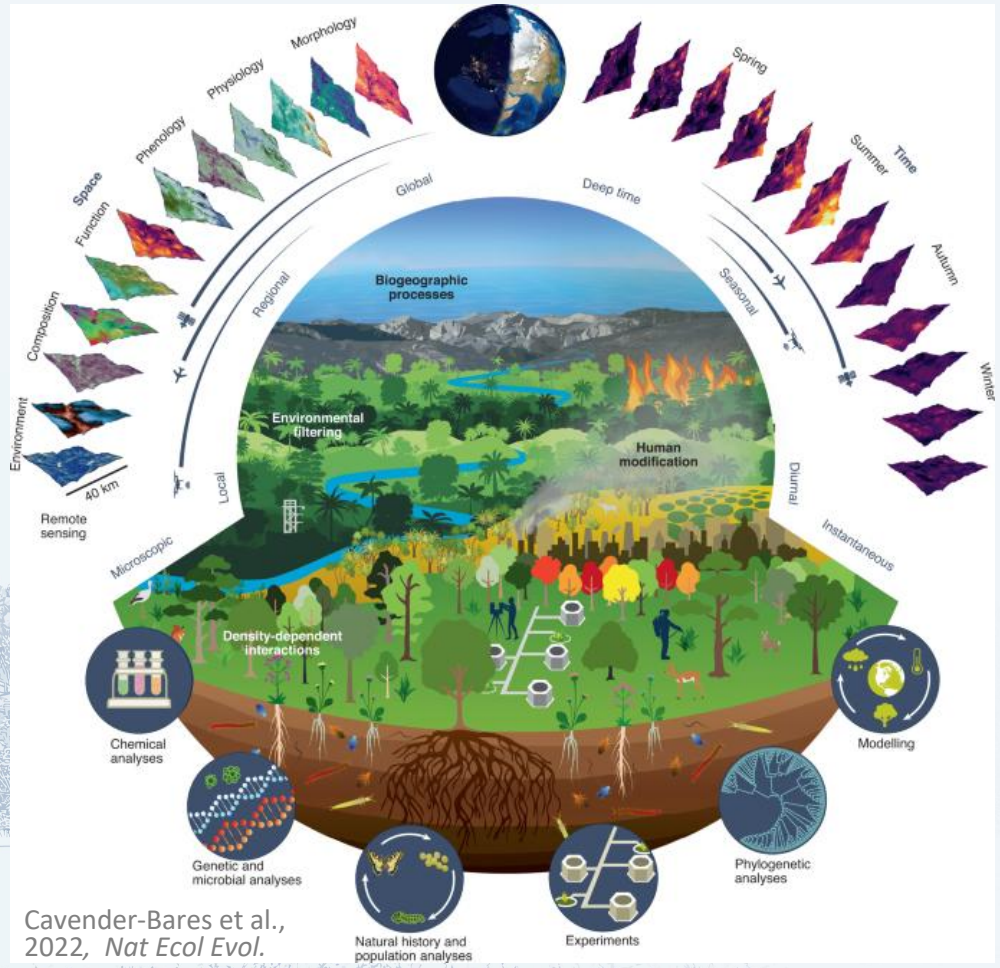
AO GEO
Earth Observations for Asia-Oceania



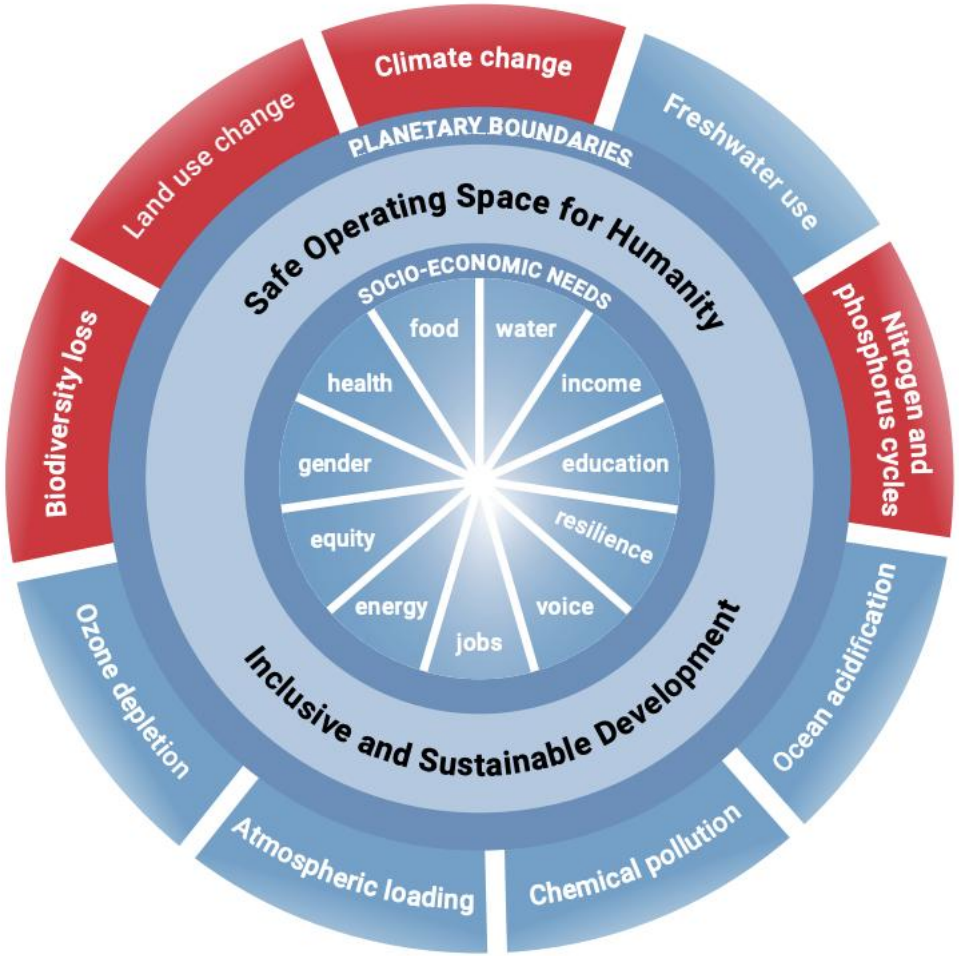
Cavender-Bares et al., 2022, *Nat Ecol Evol.*

Mapping and characterizing ecosystems is crucial to protect and restore ecosystems and their services.

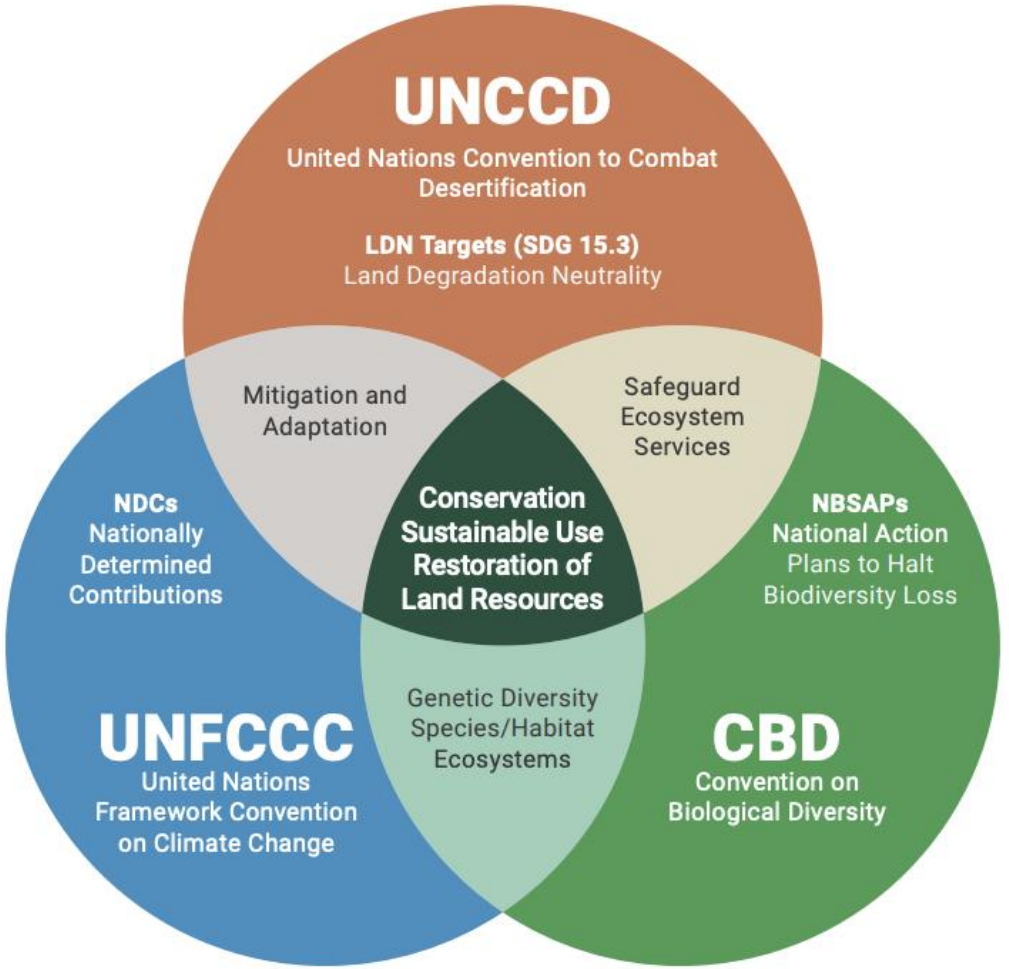
A requirement for managing ecosystems is first knowing **what** they are and **where** they are on the planet.

- **Ecosystem accounting**
- **Ecosystem analysis**
- **Ecosystem conservation**
- **Ecosystem understanding**

...

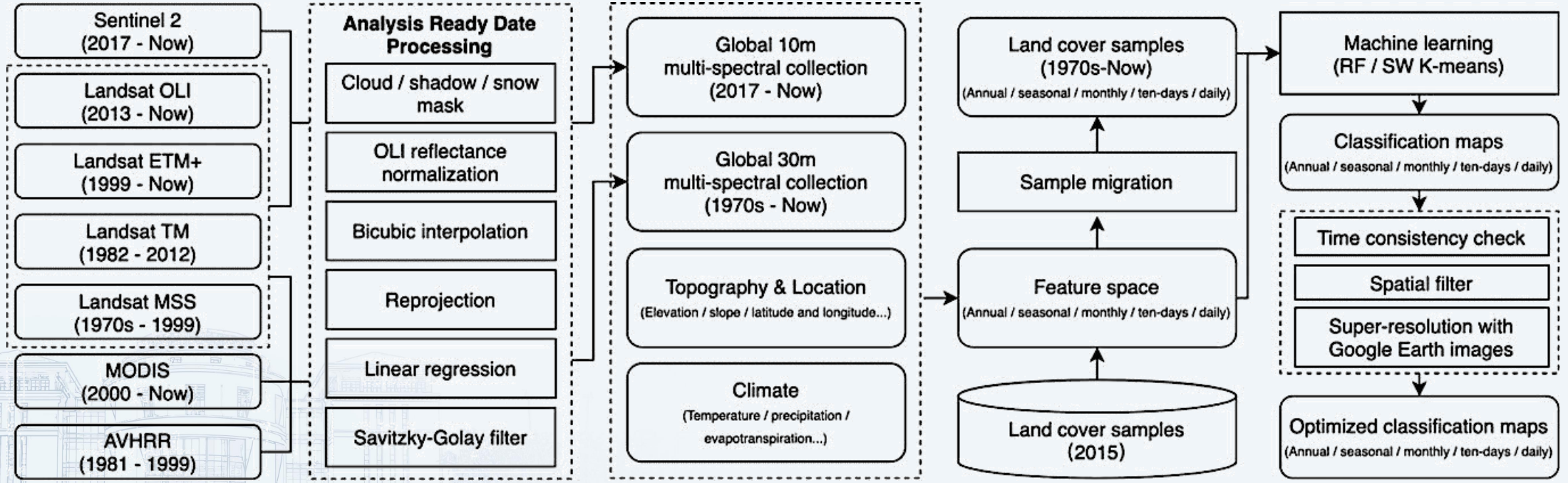


Source: Raworth, 2017.



(**UNCCD**, 2022, *Global Land Outlook 2*)

Global land cover change mapping ---- FROM-GLC Plus

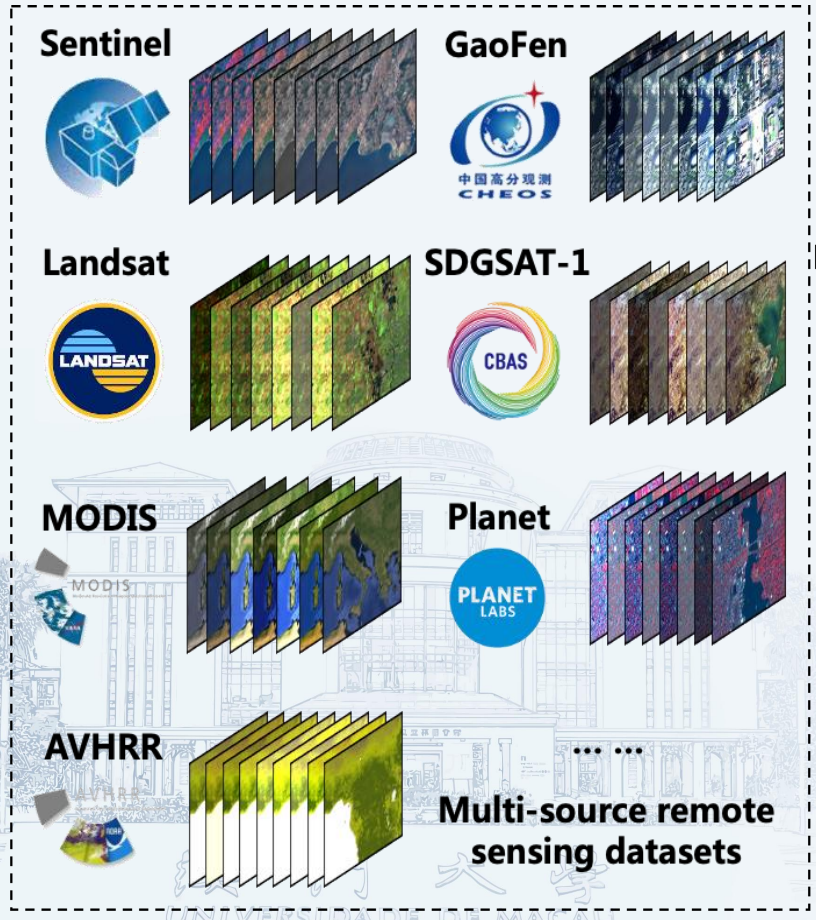


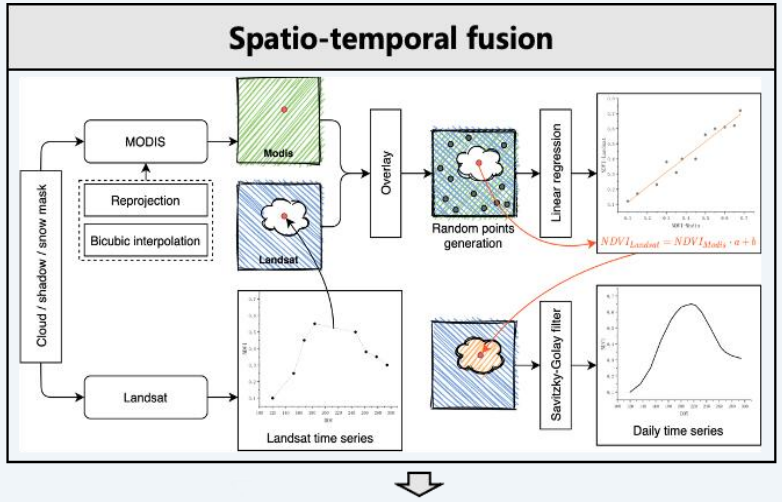
Global land cover maps (30 m)
(long term | annual)

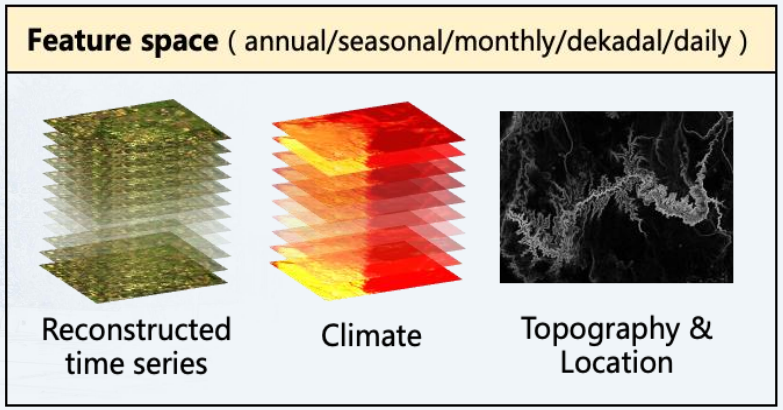
Reginal land cover maps
(multi-scale| near real-time)

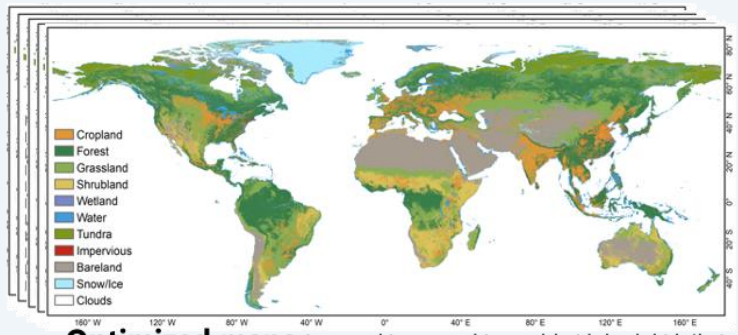
(**Yu*** et al., 2022, *GISci. Remote Sens.*)

Global land cover change mapping ---- FROM-GLC Plus









Optimized maps (annual/seasonal/monthly/dekadal/daily)

Spatial filter | Sup-resolution | Temporal check

Preliminary maps (annual/seasonal/monthly/dekadal/daily)

Machine learning (RF/TaihuLight K-means)

Global land cover samples (1970s-Now)

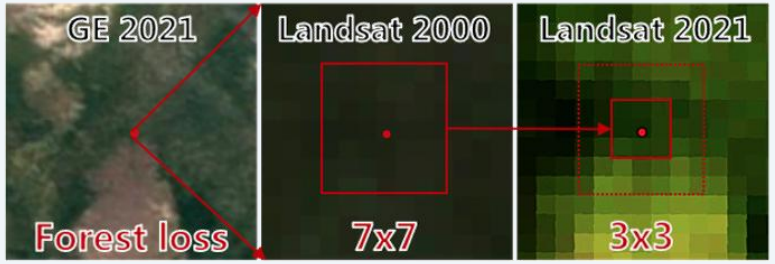
FAST sample set (2015)

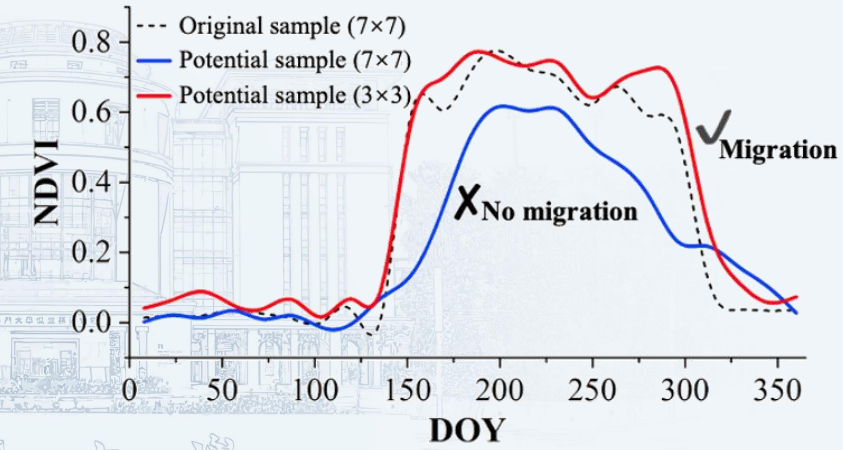
Multi-scale sample migration

(**Yu*** et al., 2022, *GISci. Remote Sens.*)

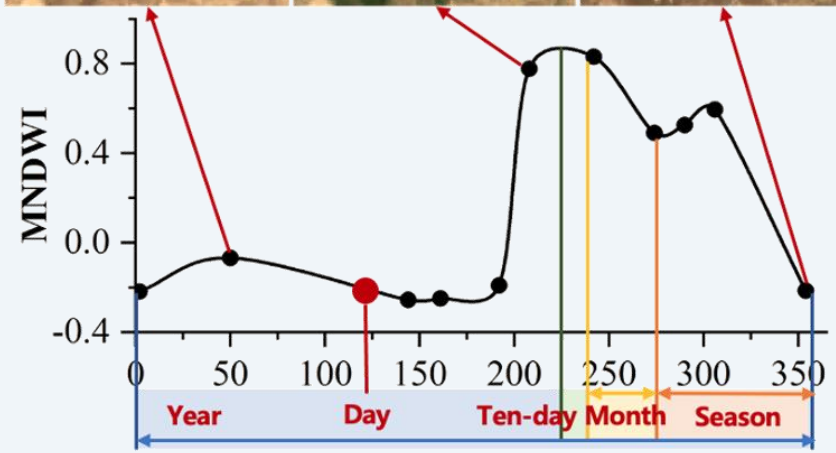
Global land cover change mapping ---- FROM-GLC Plus

Multi-spatial scale sample migration





Multi-temporal frequency sample migration



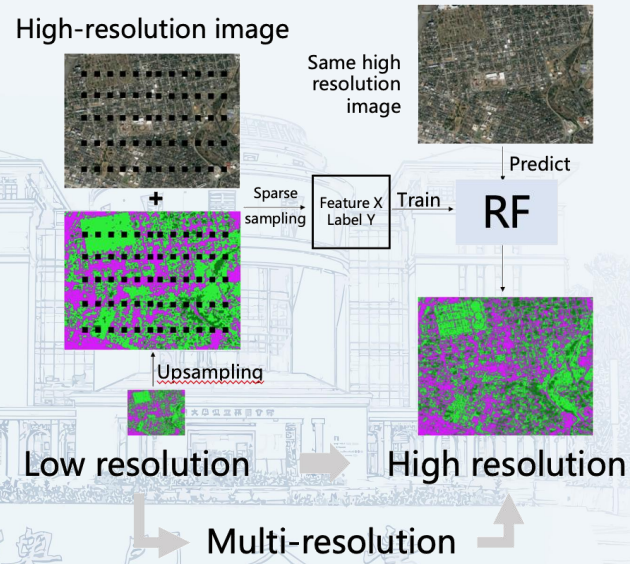
Scale-flexible global land cover sample dataset

(**Yu*** et al., 2022, *GISci. Remote Sens.*)

Higher spatial resolution

500m	300m	30m	10m	1m
MODISLC	GlobalCover / BBI-LC	FROM-GLC/ GLOBELAND30/ GLC_FCS30	FROM-GLC/ ESRI LandCover/ ESA WorldCover	FROM-GLC Plus
Friedl et al., 2002	Bicheron et al.,2008 Defourny et al.,2017	Gong et al., 2013 Chen et al., 2015 Zhang et al., 2020	Gong et al., 2019 Karra et al., 2021 ESA, 2020	Yu et al., 2022

Super-resolution



Product	Spatial resolution	Platform	OA
FROM-GLC 10	10m	Google Earth Engine	72.60±0.57
ESRI LandCover	10m	Microsoft Azure	60.93±0.66
WorldCover	10m	Amazon Web Services	73.11±0.59
Dynamic World	10m	Google Earth Engine	53.55±0.69
FROM-GLC Plus	**30m-1m**	**Google Earth Engine Taihu Light Earthlab**	**74.33±0.69**

Multi-resolution land cover mapping

(**Yu*** et al., 2022, *GISci. Remote Sens.*)

Higher temporal resolution

No update | **5-10years** | **Annual** | **Monthly** | **Dekadal** | **Daily**

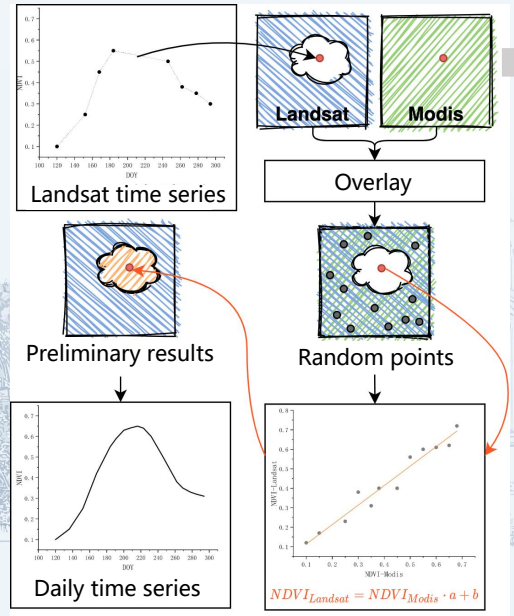
GLC2000, Loveland et al., 2000
UMD 1km, Hansen et al.,2000
IGBPDIScover, Bartholome et al., 2005

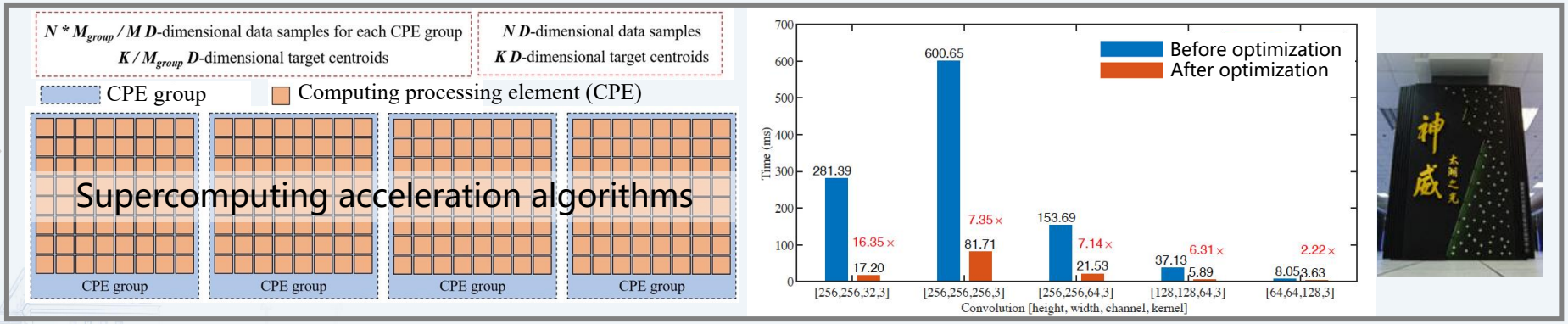
GLOBELAND, Chen et al., 2015
GLC_FCS30, Zhang et al., 2020

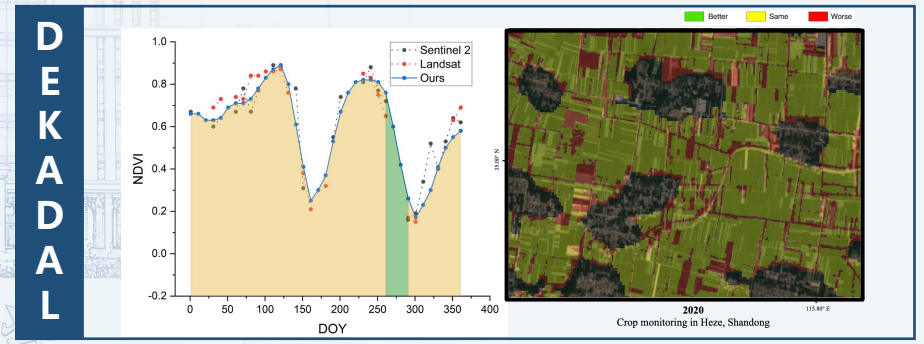
MOD12Q1, Sulla-Menashe et al., 2019
ESA-CCI, ESA, 2017

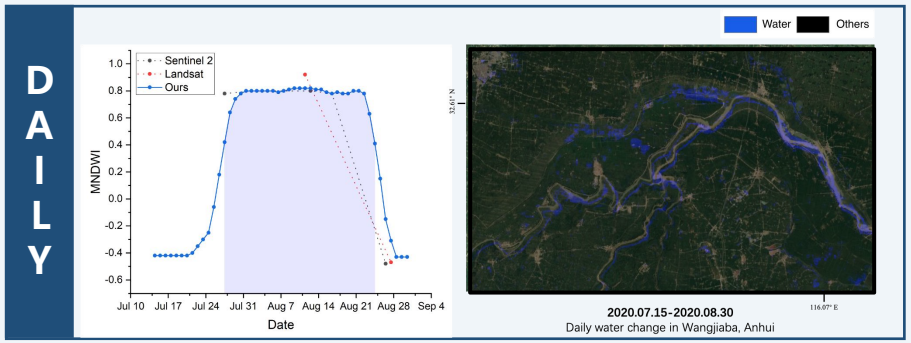
FROM-GLC Plus (Yu et al., 2022)

The construction procedure for time series







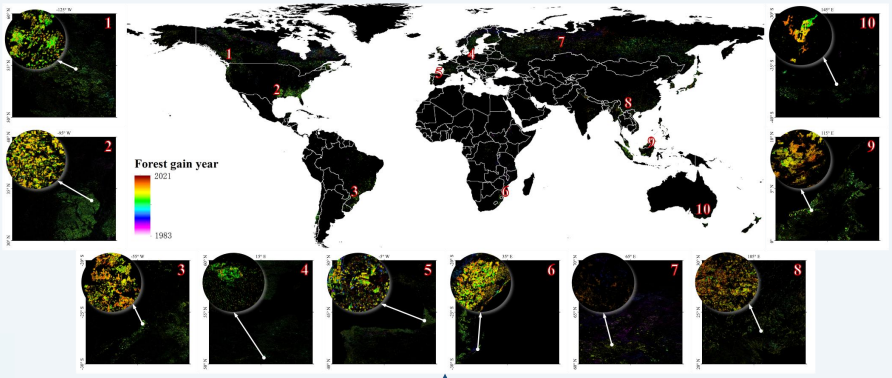


Multi-temporal frequency and near real-time land cover mapping

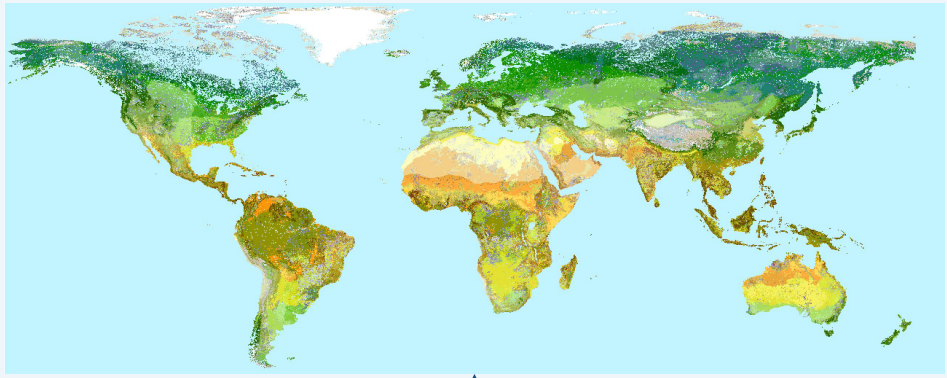
(**Yu*** et al., 2022, *GISci. Remote Sens.*)

High spatio-temporal accuracy application with FROM-GLC Plus

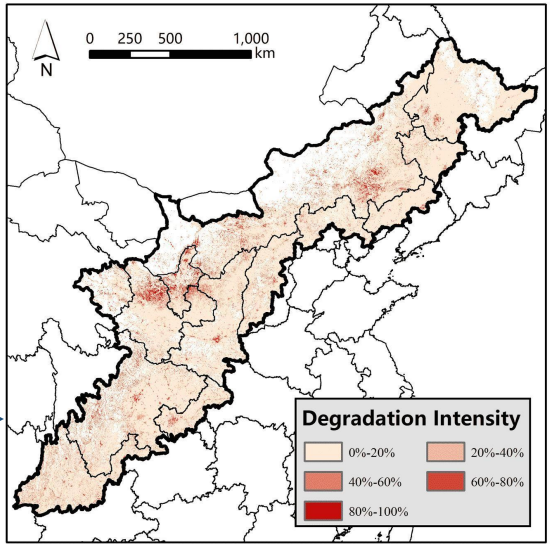
Forest/Plantation monitoring



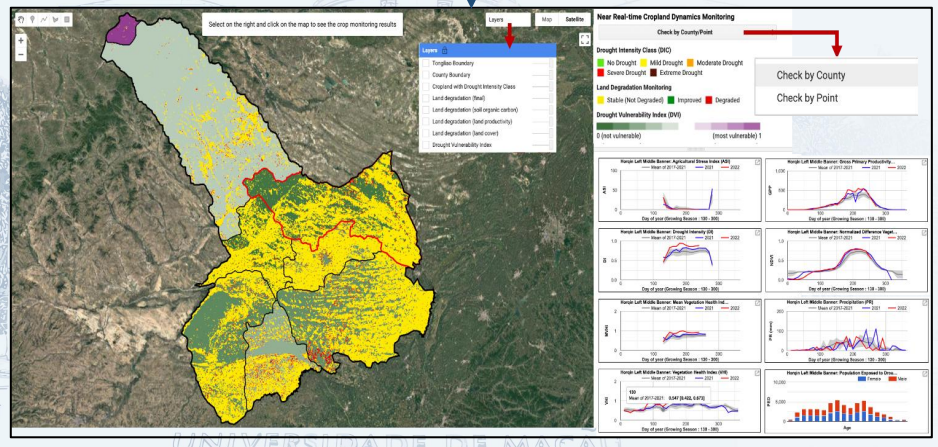
Ecosystem mapping



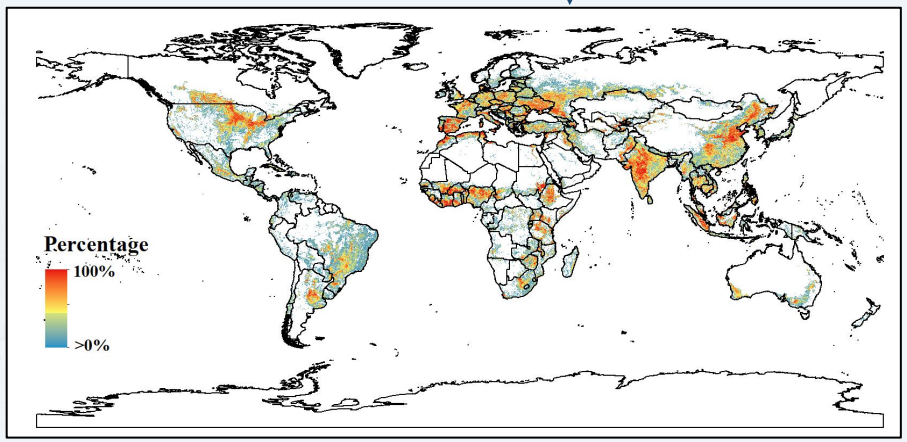
Land degradation monitoring



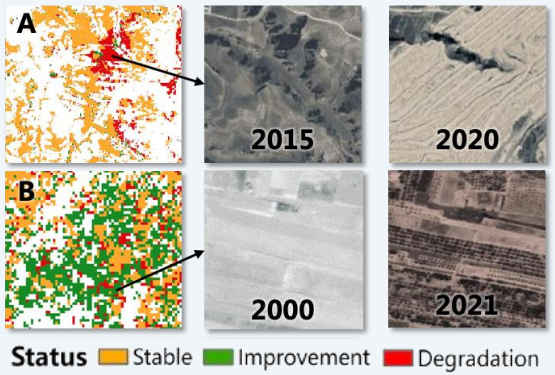
FROM-GLC Plus



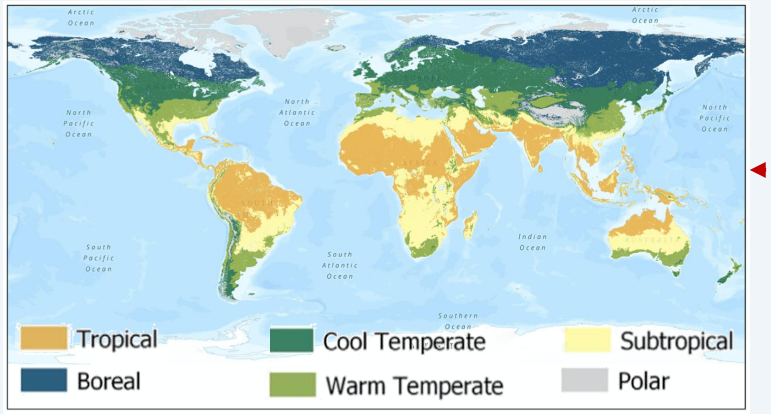
Crop monitoring

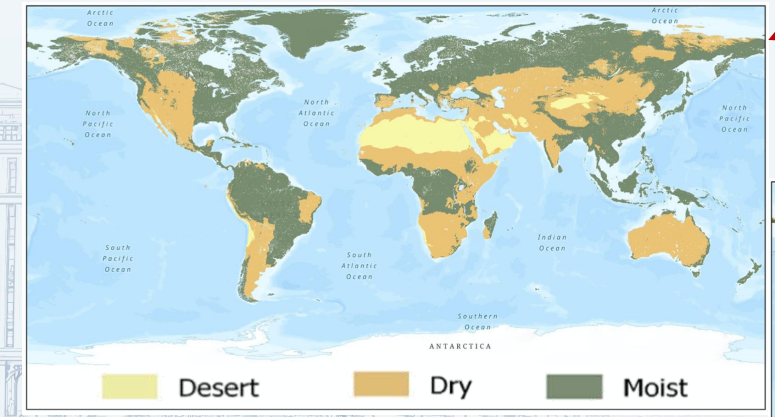


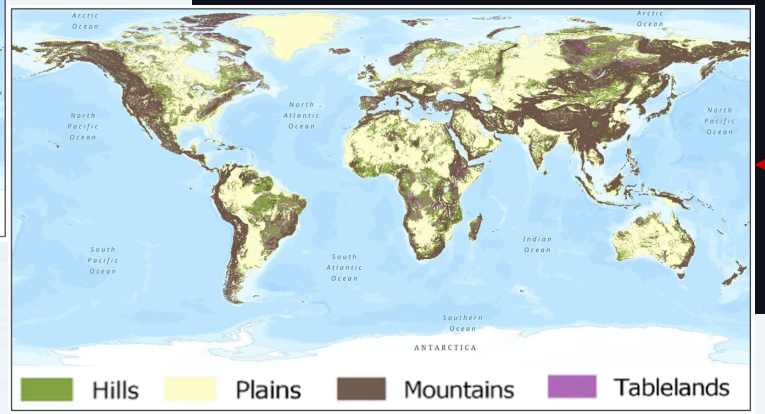
PFT mapping

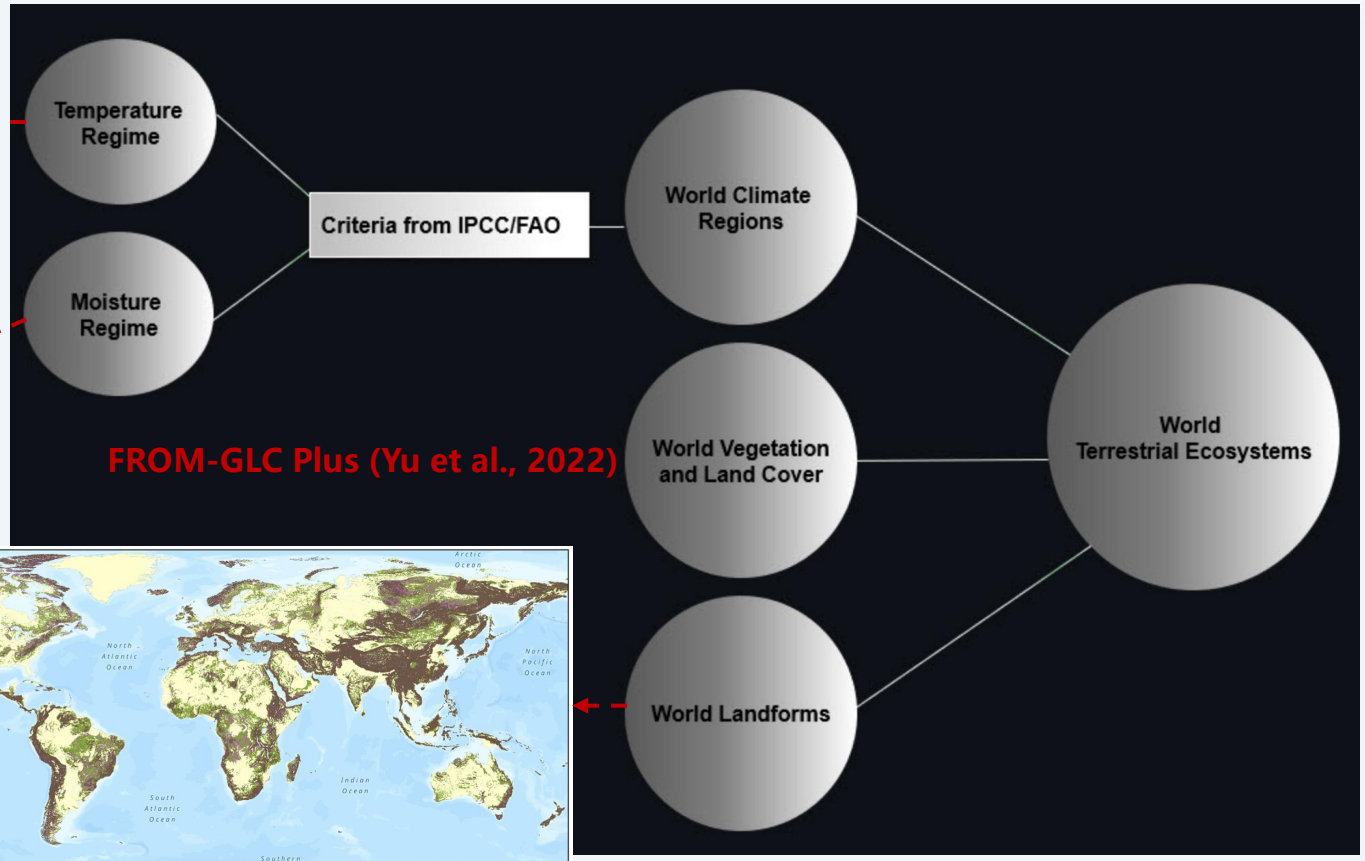


Global ecosystem mapping workflow (Sayre et al, 2020)









Global ecosystem mapping workflow

WorldClim V2 dataset

Global aridity index dataset

Global Temperature Domains

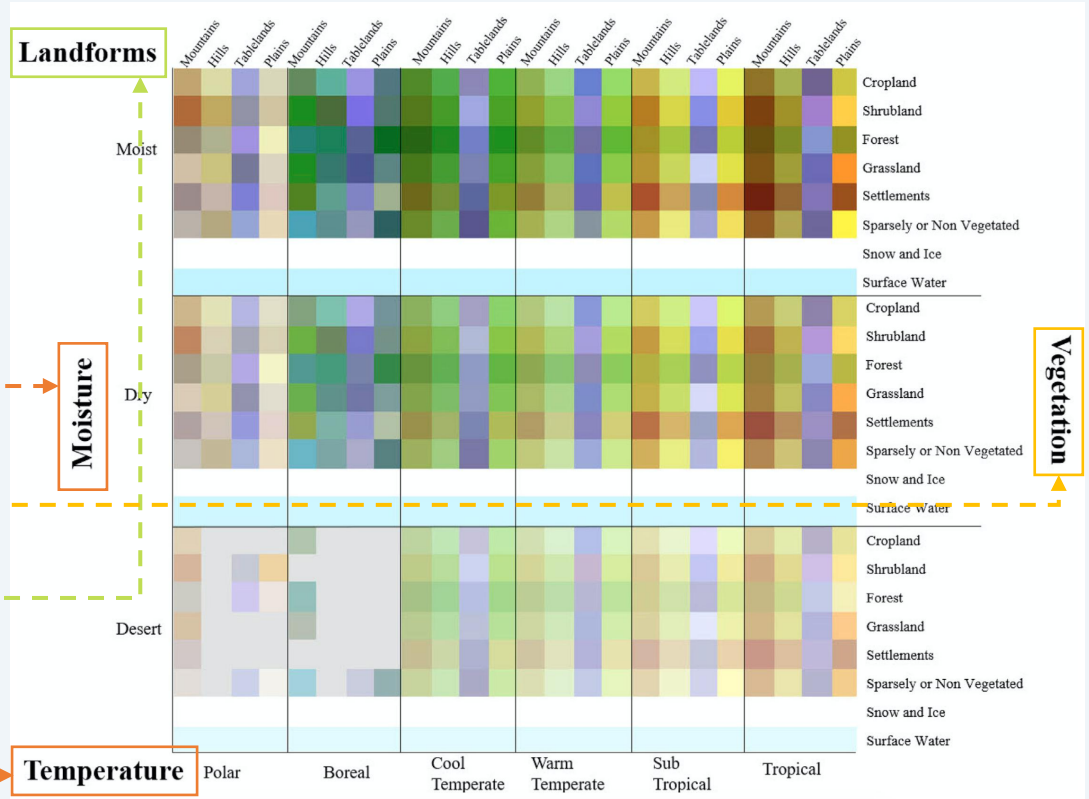
Global Moisture Domains

Global Climate Regions

Global Land Cover (FROM-GLC Plus)

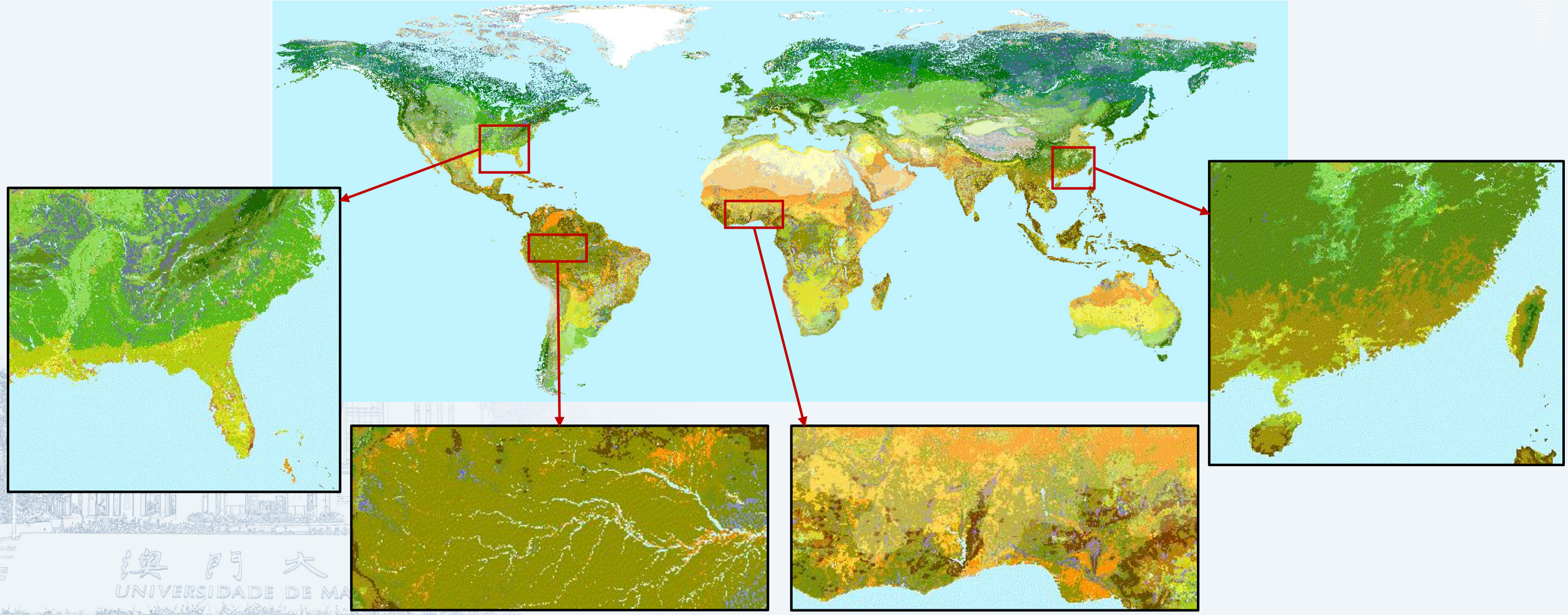
Global Landforms

Global Ecosystem



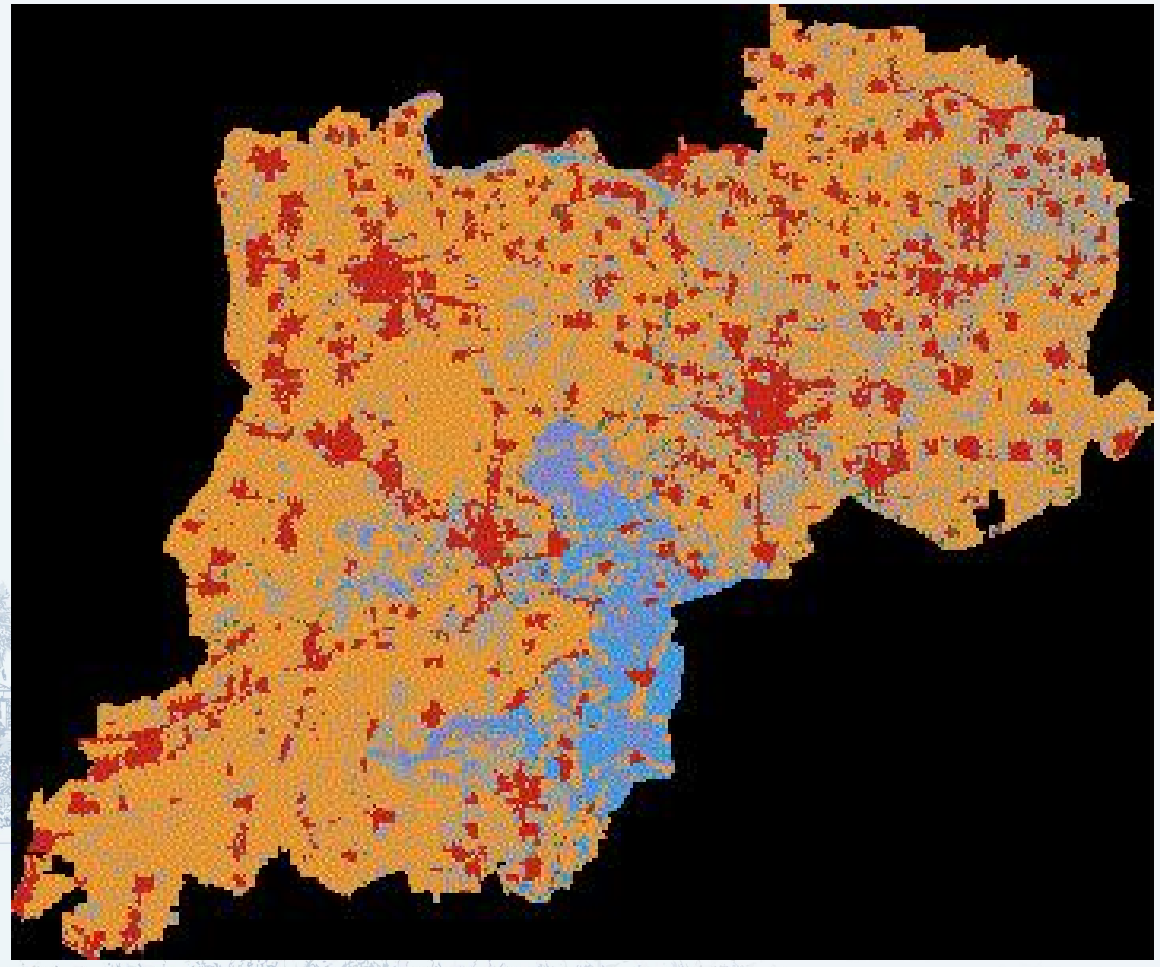
(**Yu*** et al., *in preparation*)

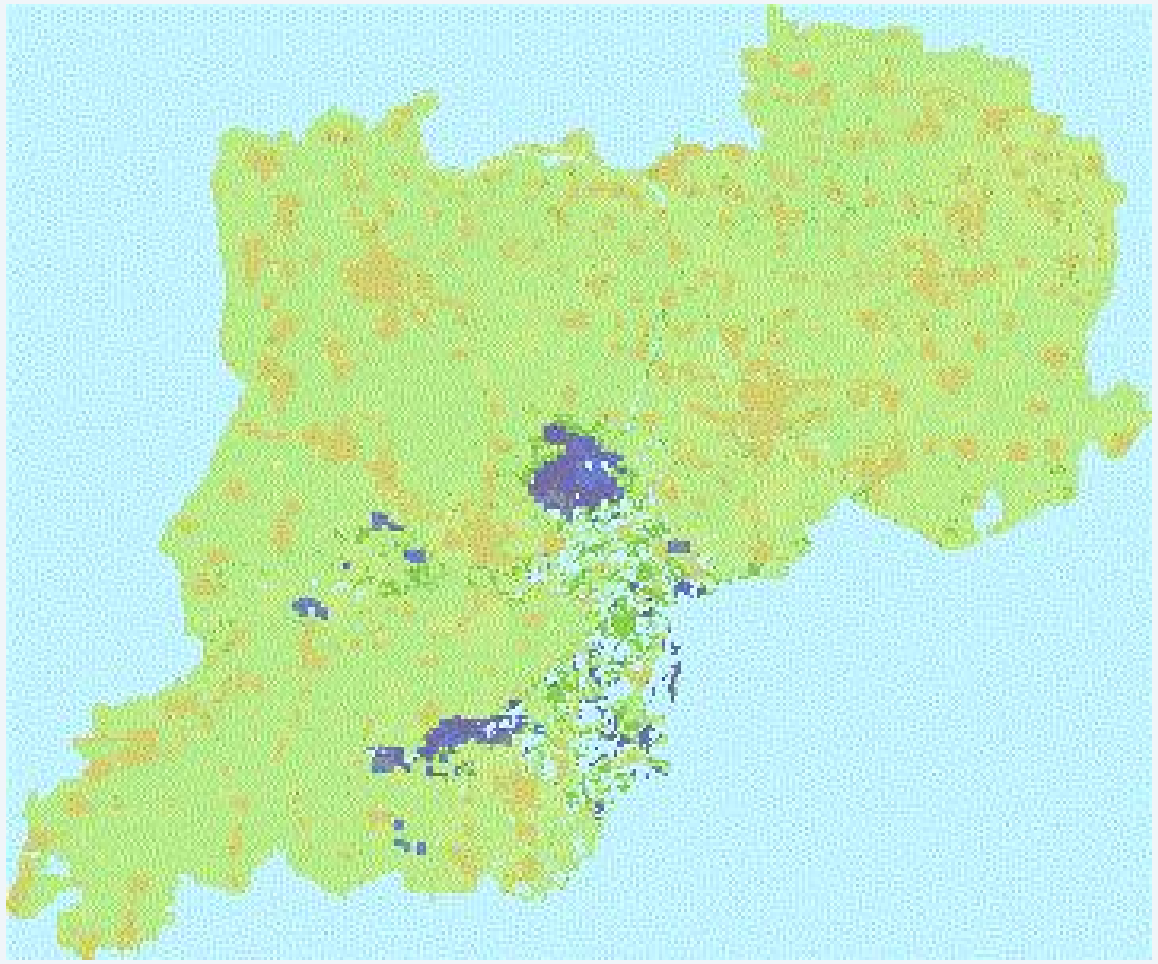
Annual global ecosystem mapping (1982-2021, 30m)



(**Yu*** et al., *in preparation*)

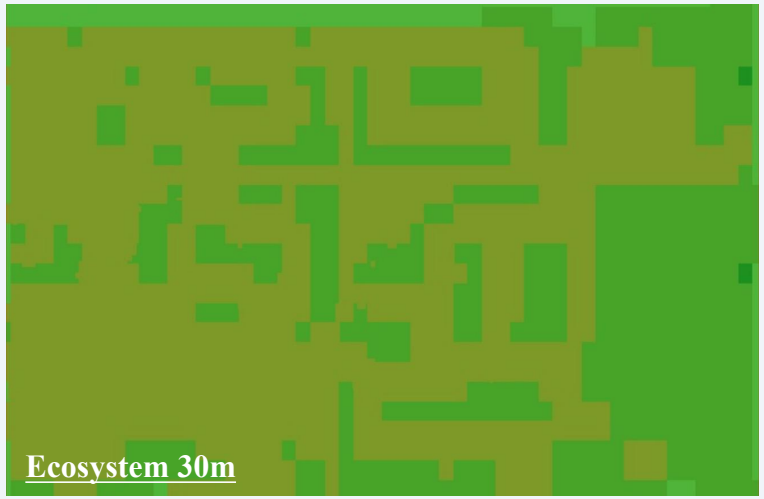
Multi-temporal frequency and near real-time ecosystem mapping (Monthly, Xiong'an, 10m)

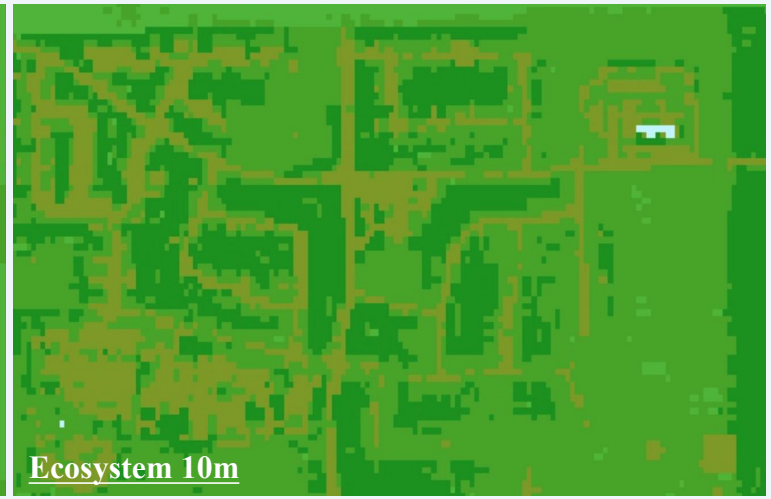


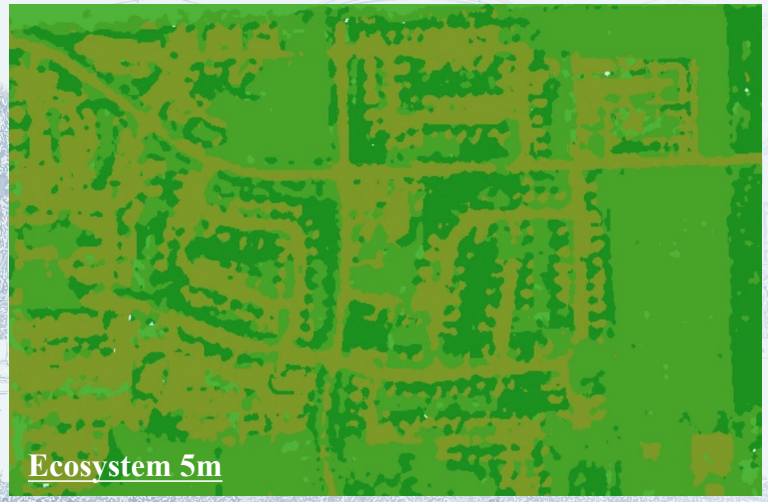


(**Yu*** et al., *in preparation*)

Multi-resolution ecosystem mapping



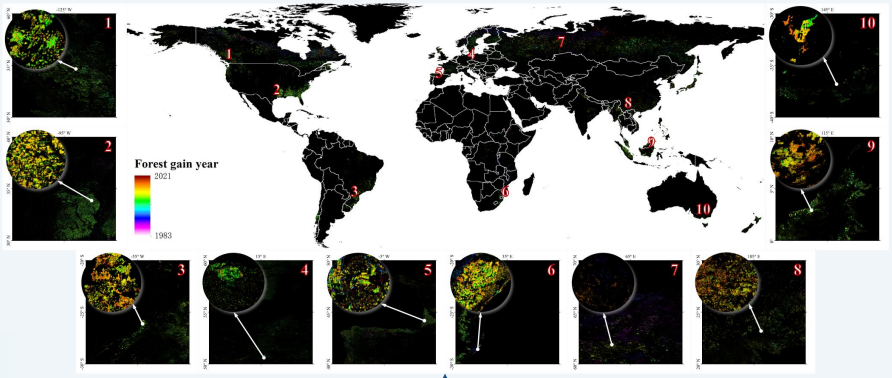




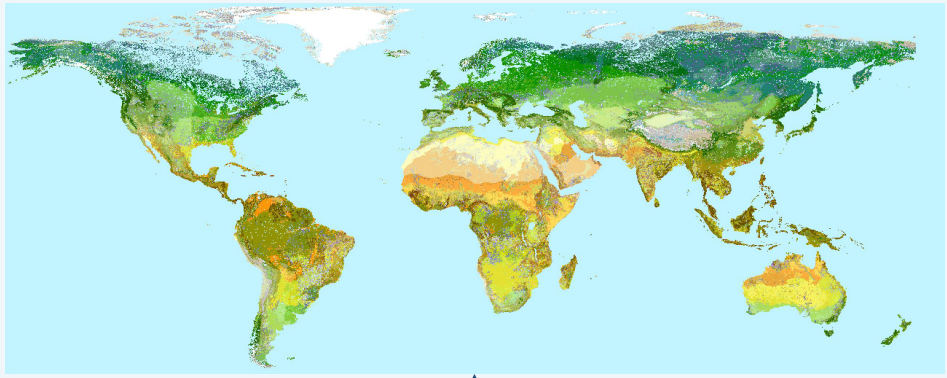
(**Yu*** et al., *in preparation*)

High spatio-temporal accuracy application with FROM-GLC Plus

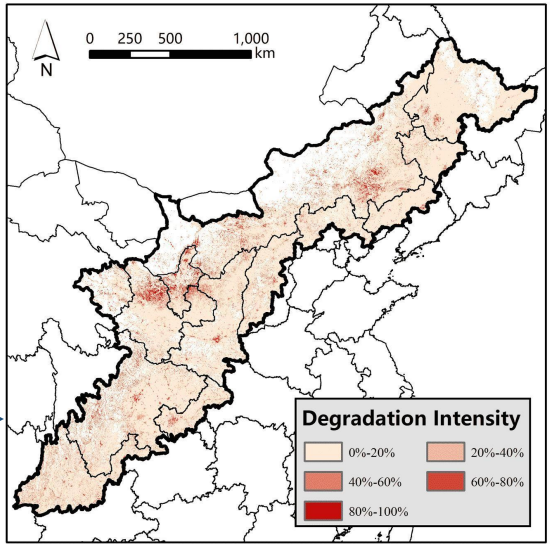
Forest/Plantation monitoring



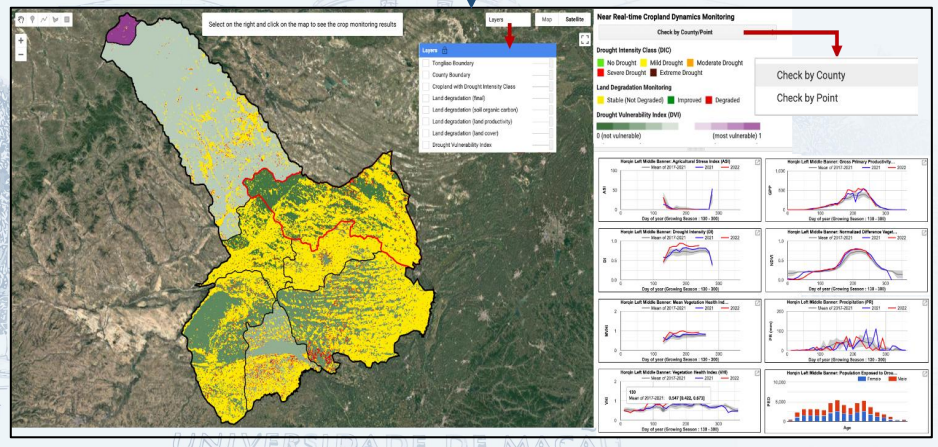
Ecosystem mapping



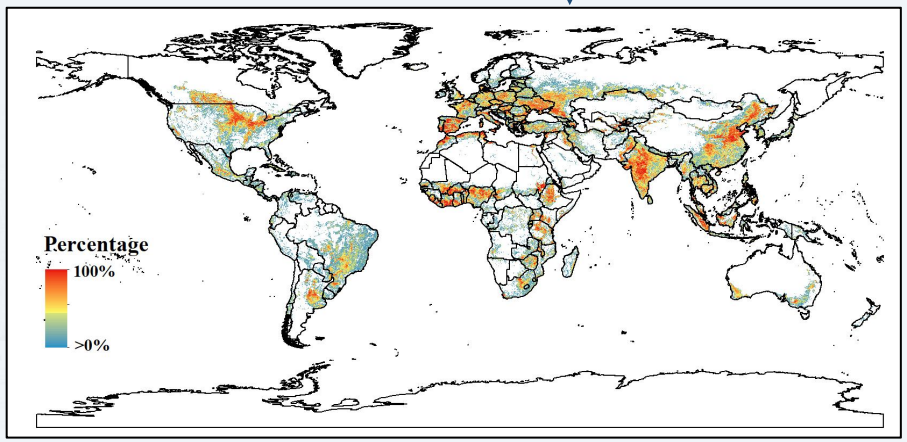
Land degradation monitoring



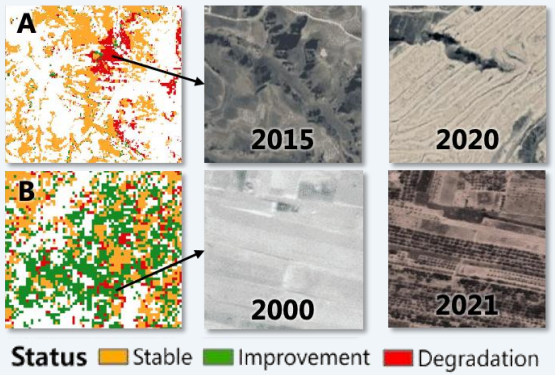
FROM-GLC Plus



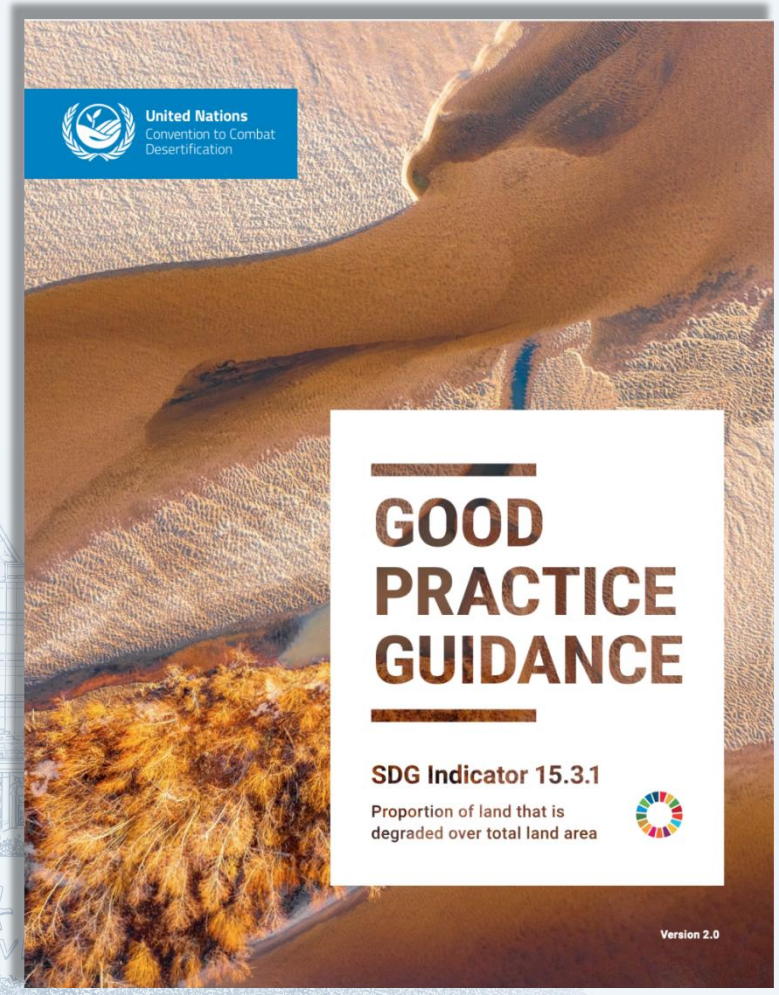
Crop monitoring



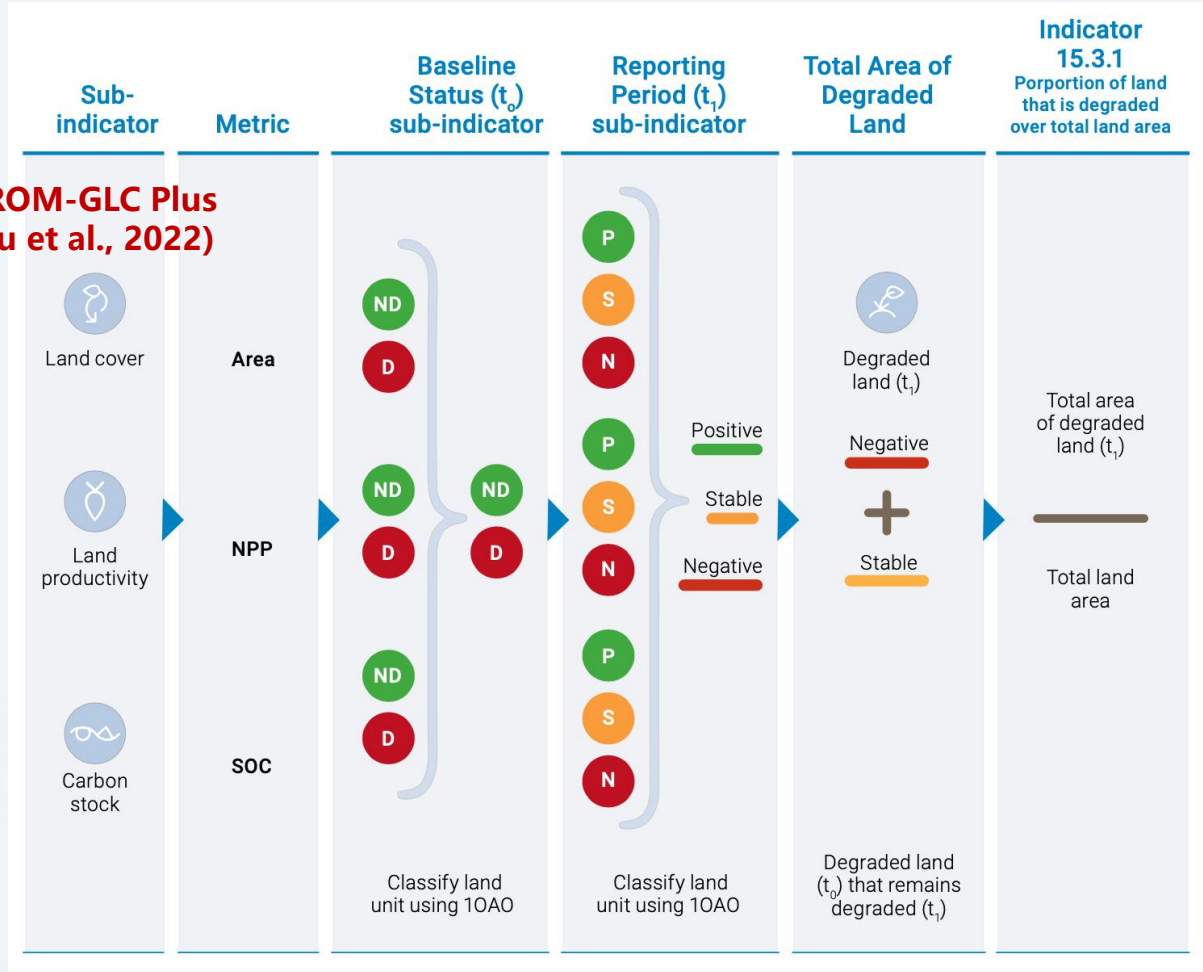
PFT mapping



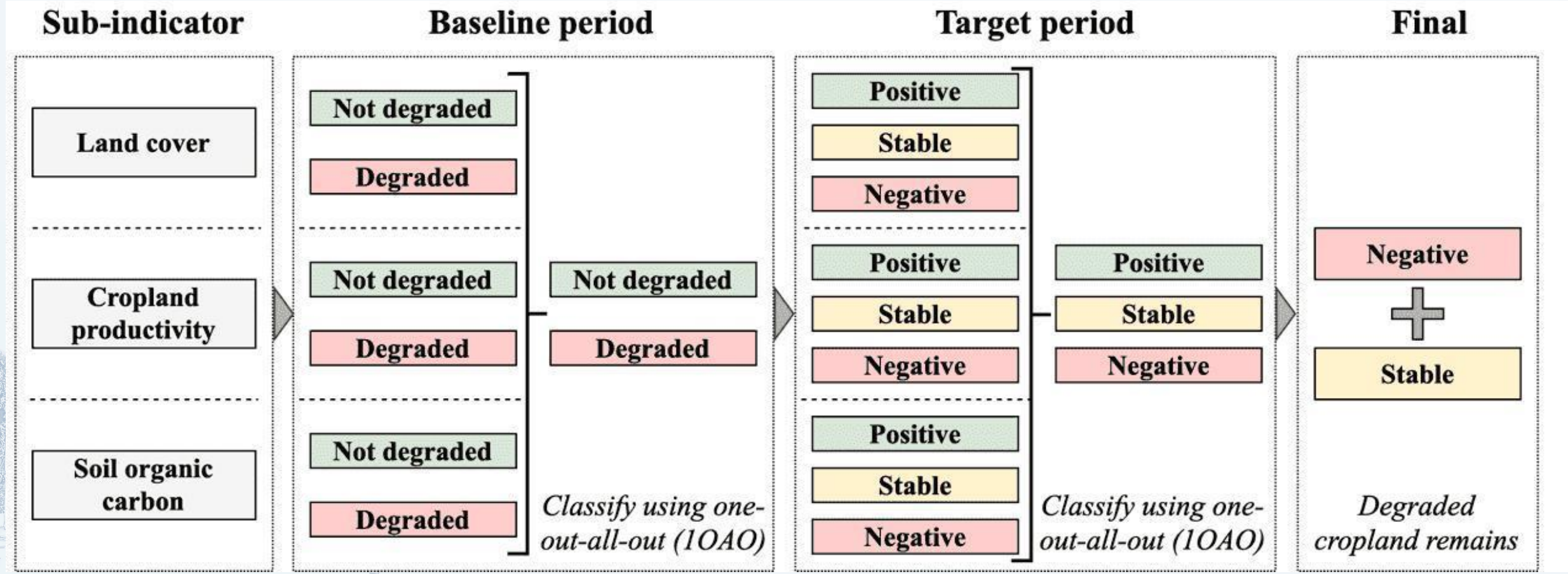
Land degradation monitoring framework (UNCCD, 2021)



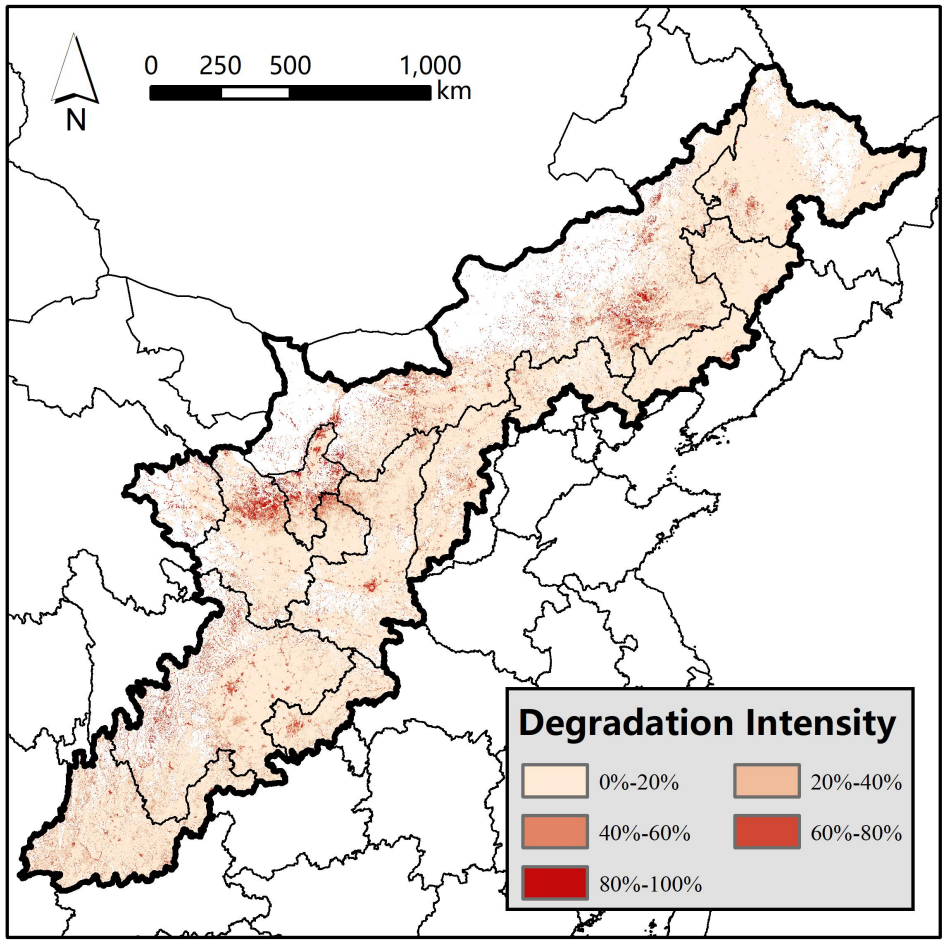
FROM-GLC Plus (Yu et al., 2022)

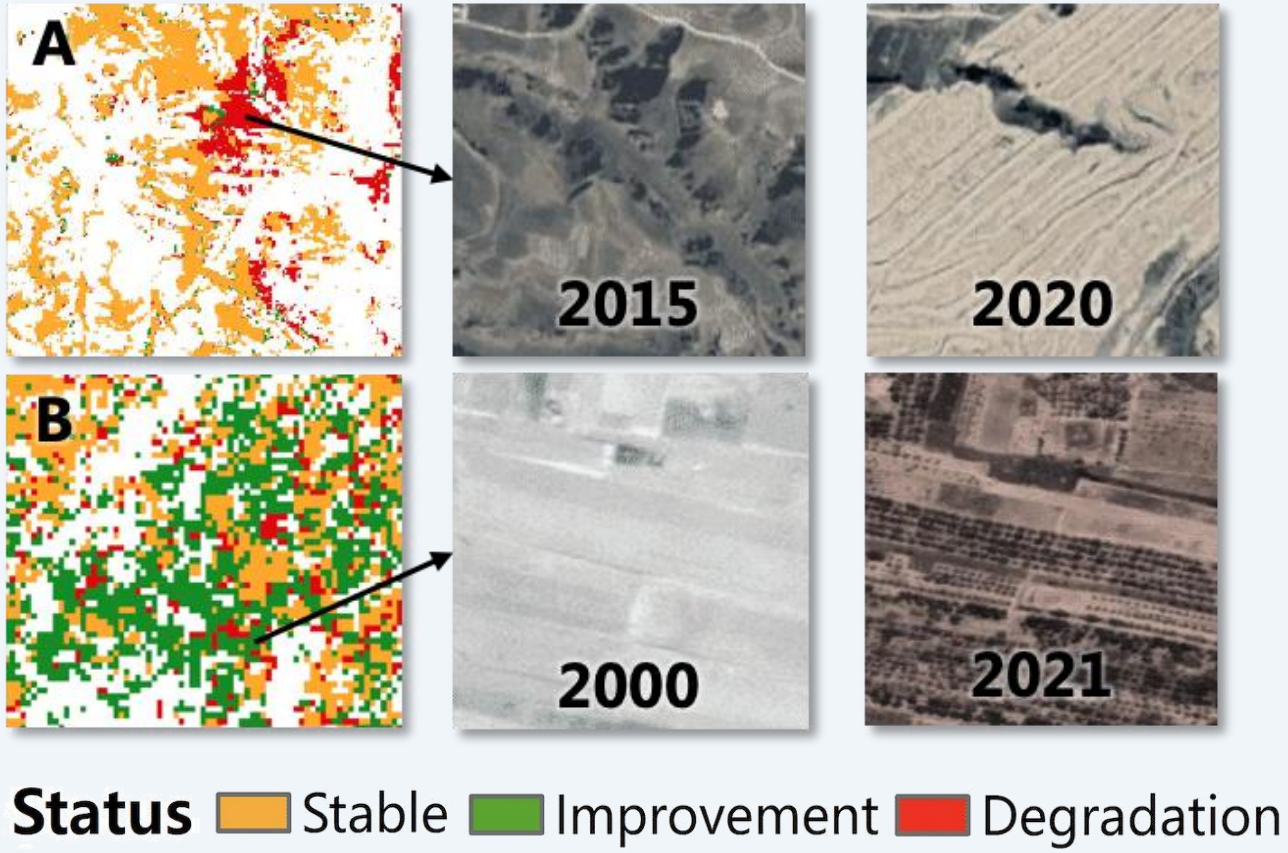


NRT Land degradation monitoring



NRT Land degradation monitoring in China





(Du, **Yu*** et al., 2023, *Accepted*)

Crop monitoring

FAO ASIS

MOD13A1 (NDVI)

MOD17A2H (GPP)

GSMaP (Precipitation)

Agricultural Stress Index (ASI)

Drought Intensity (DI)

Vegetation Health Index (VHI)

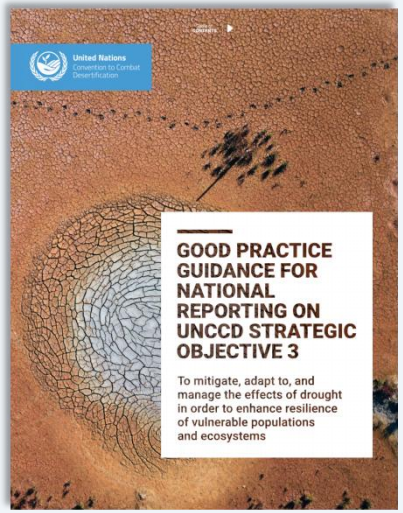
Mean Vegetation Health Index (MVHI)

Index anomaly method

Crop monitoring results (Dekadal)

FROM-GLC Plus Cropland dynamic (10-days)

UNCCD



Standardized Precipitation Index (SPI)

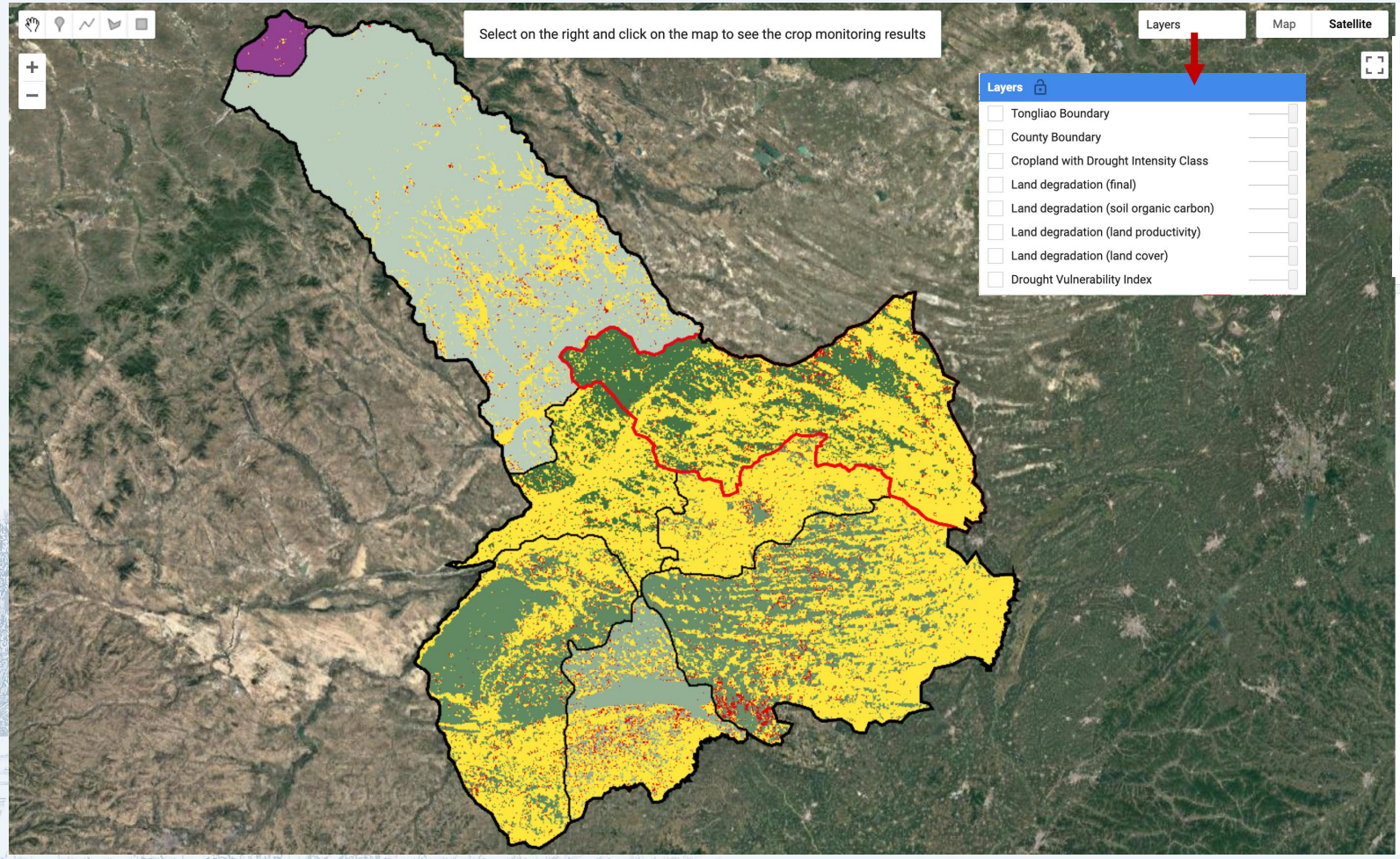
Drought Intensity Class (DIC)

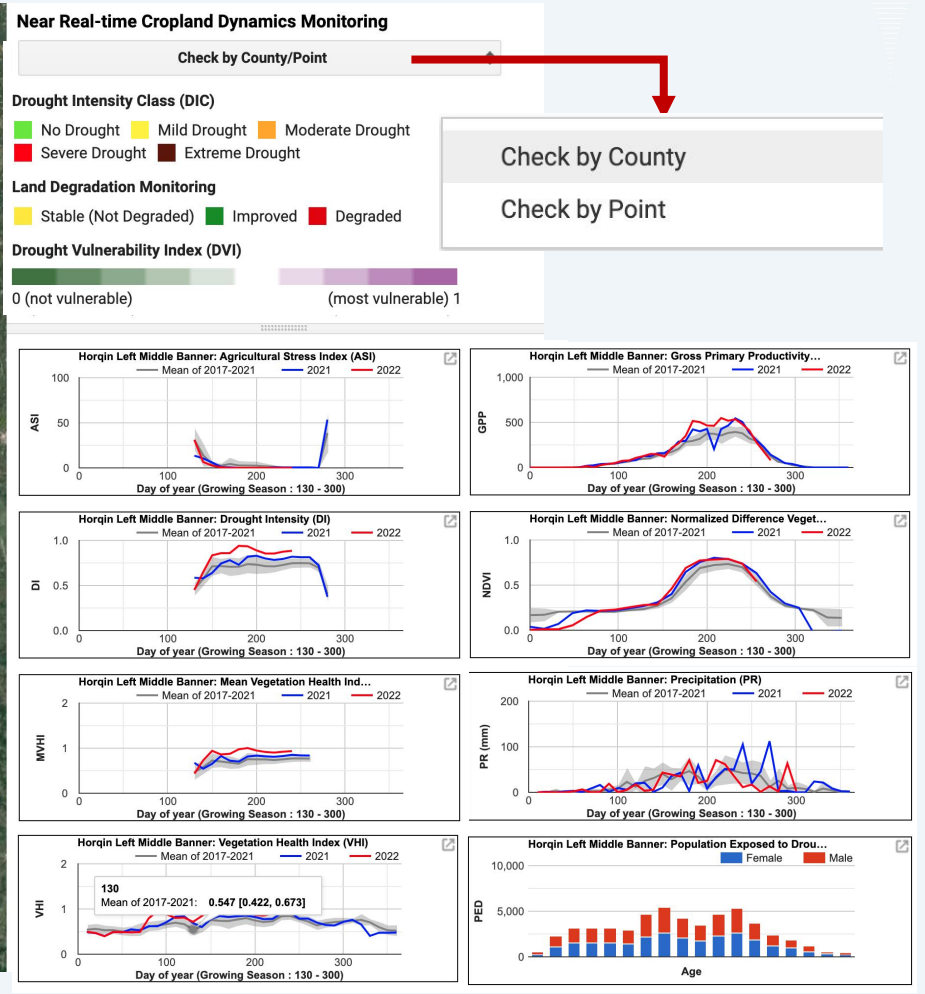
Social, economic and infrastructure factors

Drought Vulnerability Index (DVI)

(Du, **Yu*** et al., 2023, *Accepted*)

NRT land degradation and crop monitoring platform

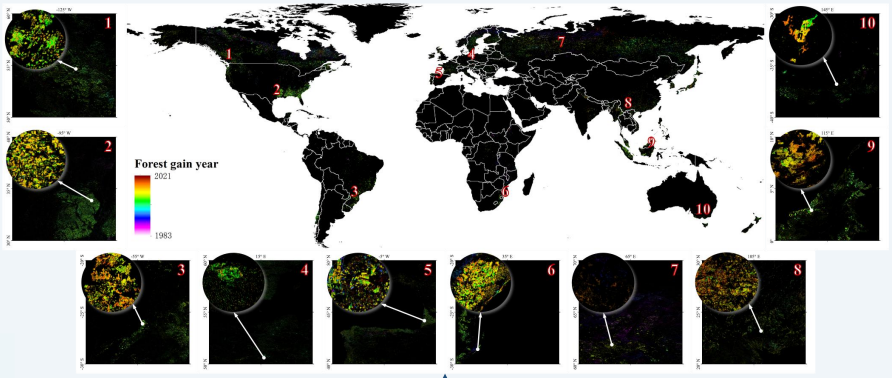




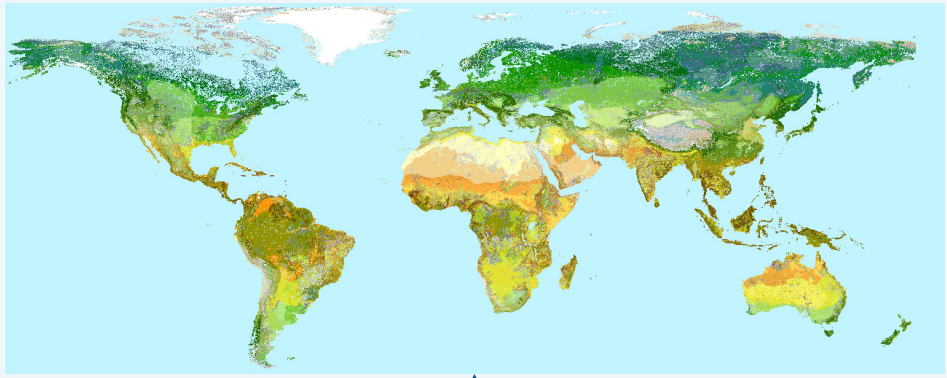
(Du, **Yu*** et al., 2023, *Accepted*)

High spatio-temporal accuracy application with FROM-GLC Plus

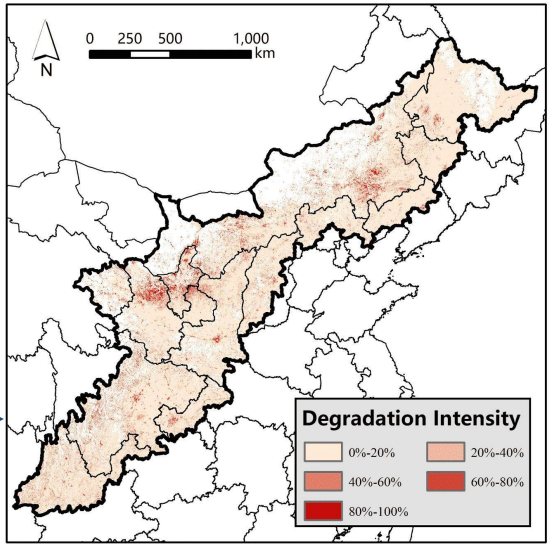
Forest/Plantation monitoring



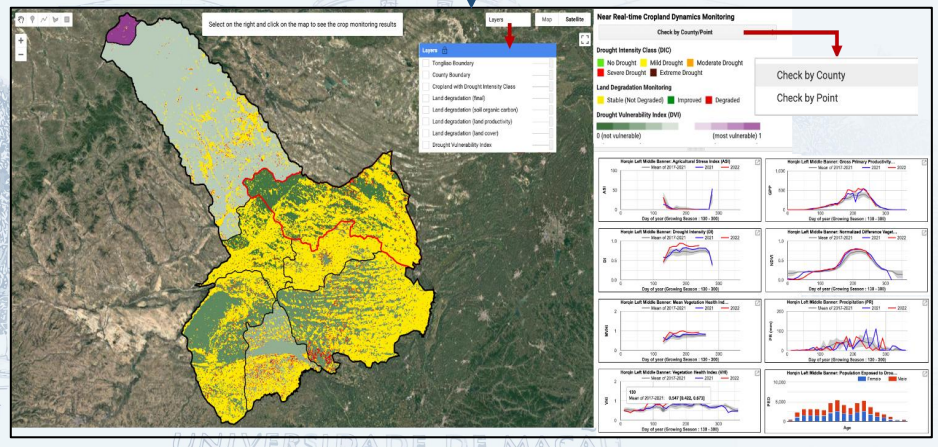
Ecosystem mapping



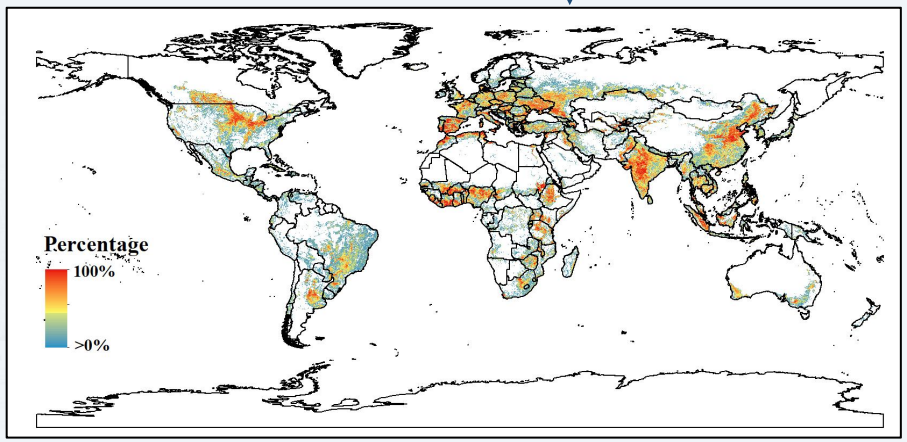
Land degradation monitoring



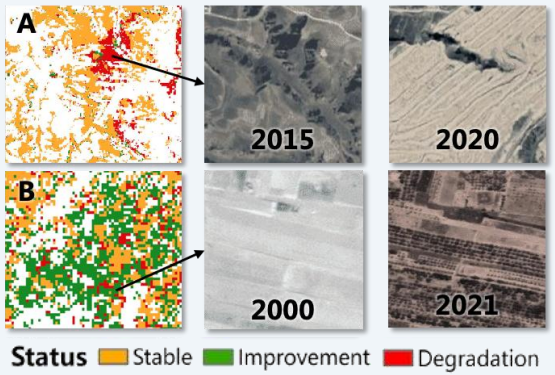
FROM-GLC Plus



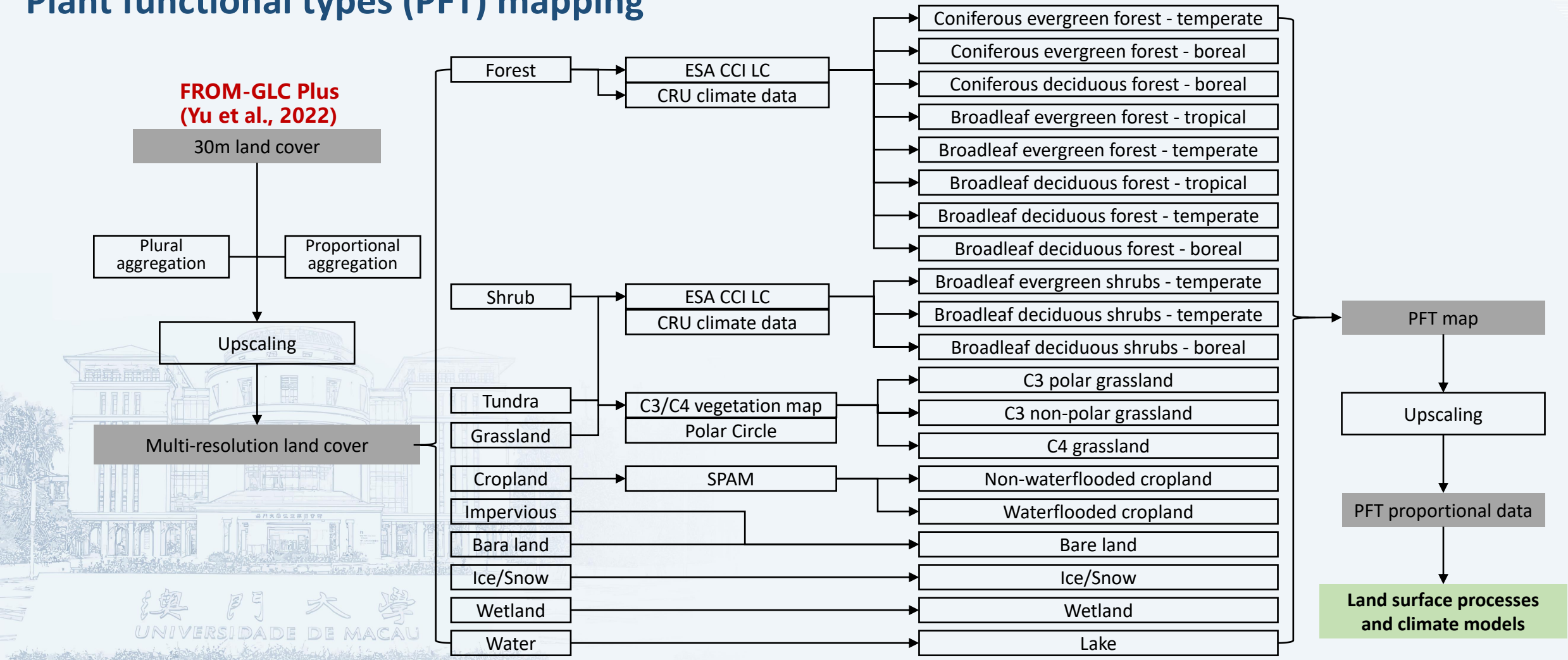
Crop monitoring



PFT mapping

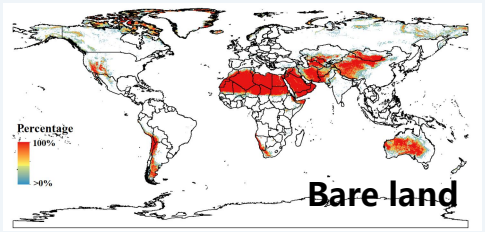


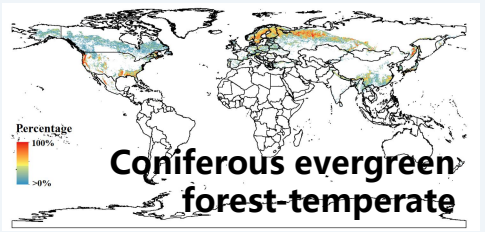
Plant functional types (PFT) mapping

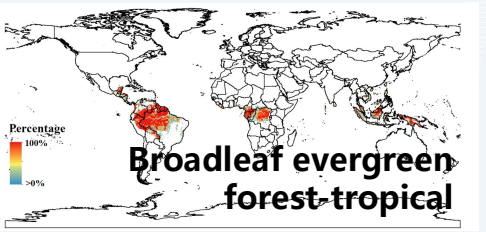


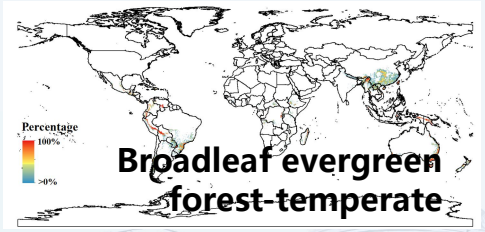
(**Yu*** et al., *in preparation*)

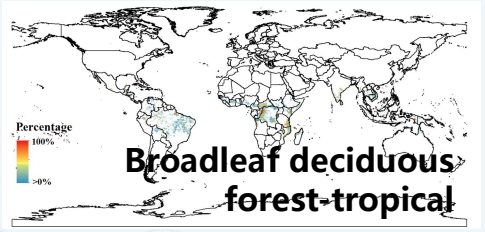
Plant functional types (PFT) mapping

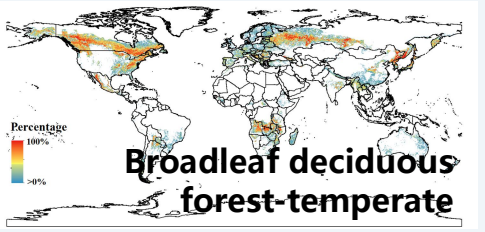


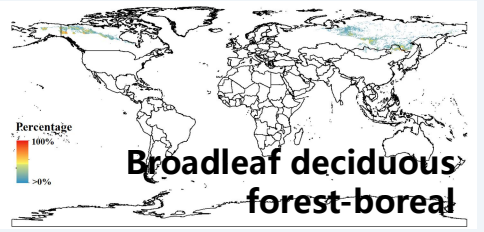


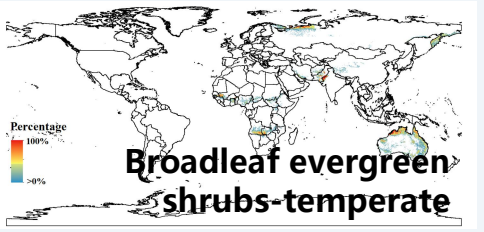


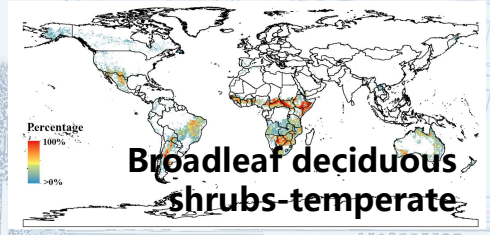


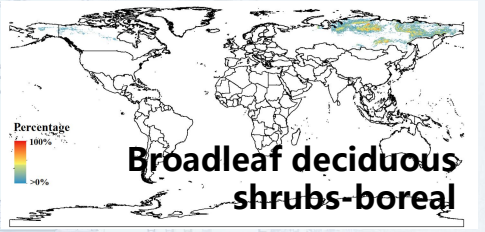


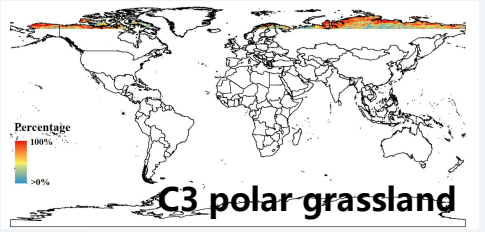


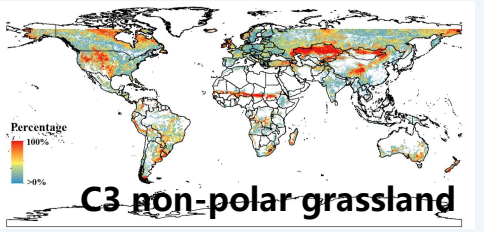


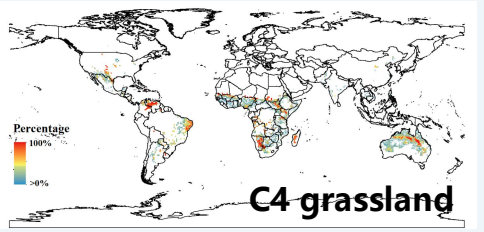


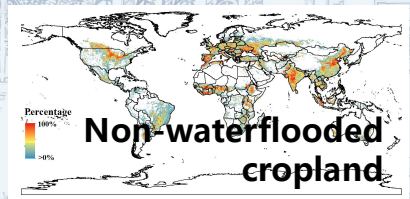


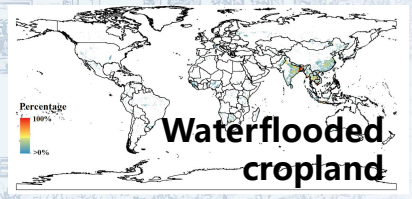


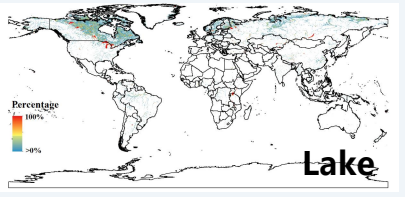


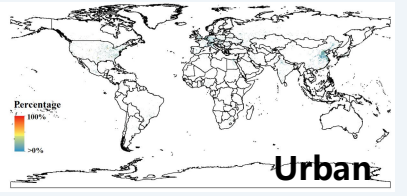












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5th Asia- Oceania Group on Earth Observations (AOGEO) Workshop

https://aogeo-workshop-2022.casconf.cn/

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· Short Bio of Speaker:

Dr. Le Yu is an Associate Professor at the Department of Earth System Science, Tsinghua University. His research has been on the use of geographical information techniques to monitor and model global land use change, especially cropland and to facilitate many applications, e.g., food security, biodiversity conservation, and land system modelling. He particularly focuses on satellite-based methods to quantify the spatiotemporal change of land cover/use and understand their ecological, environmental, and socioeconomic impacts on sustainable development.