Modelling Ecosystem Services: state of the art and prospects for future development

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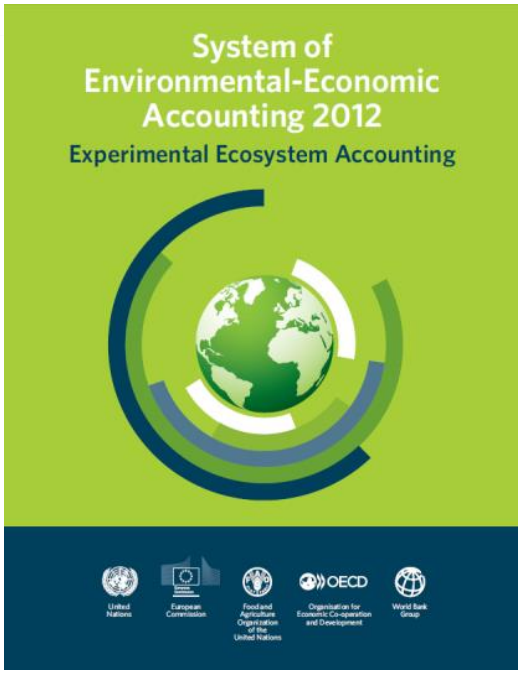
Contents

- The SEEA EEA, illustrated for the Netherlands
- Using advanced models for compiling accounts
- Using remote sensing for compiling accounts
- Using open access datasets for compiling accounts
- Conclusions and future prospects

The ecosystem accounts

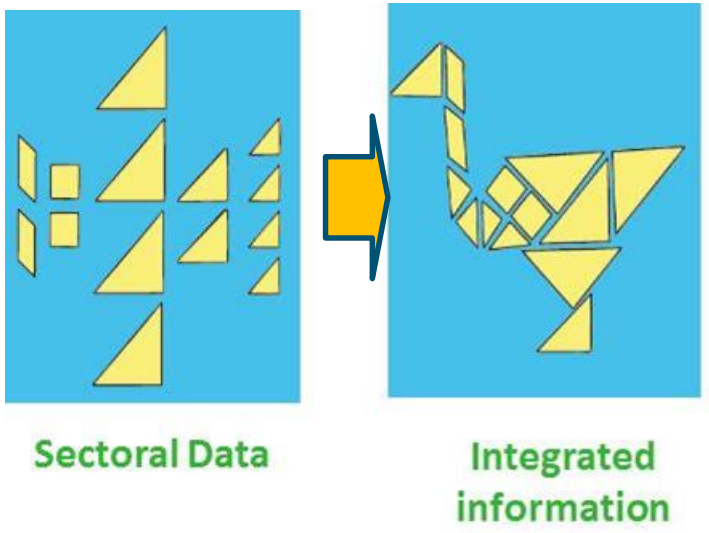


Core accounts

- Ecosystem extent;
- Condition;
- Ecosystem services supply and use;
- Monetary ecosystem assets

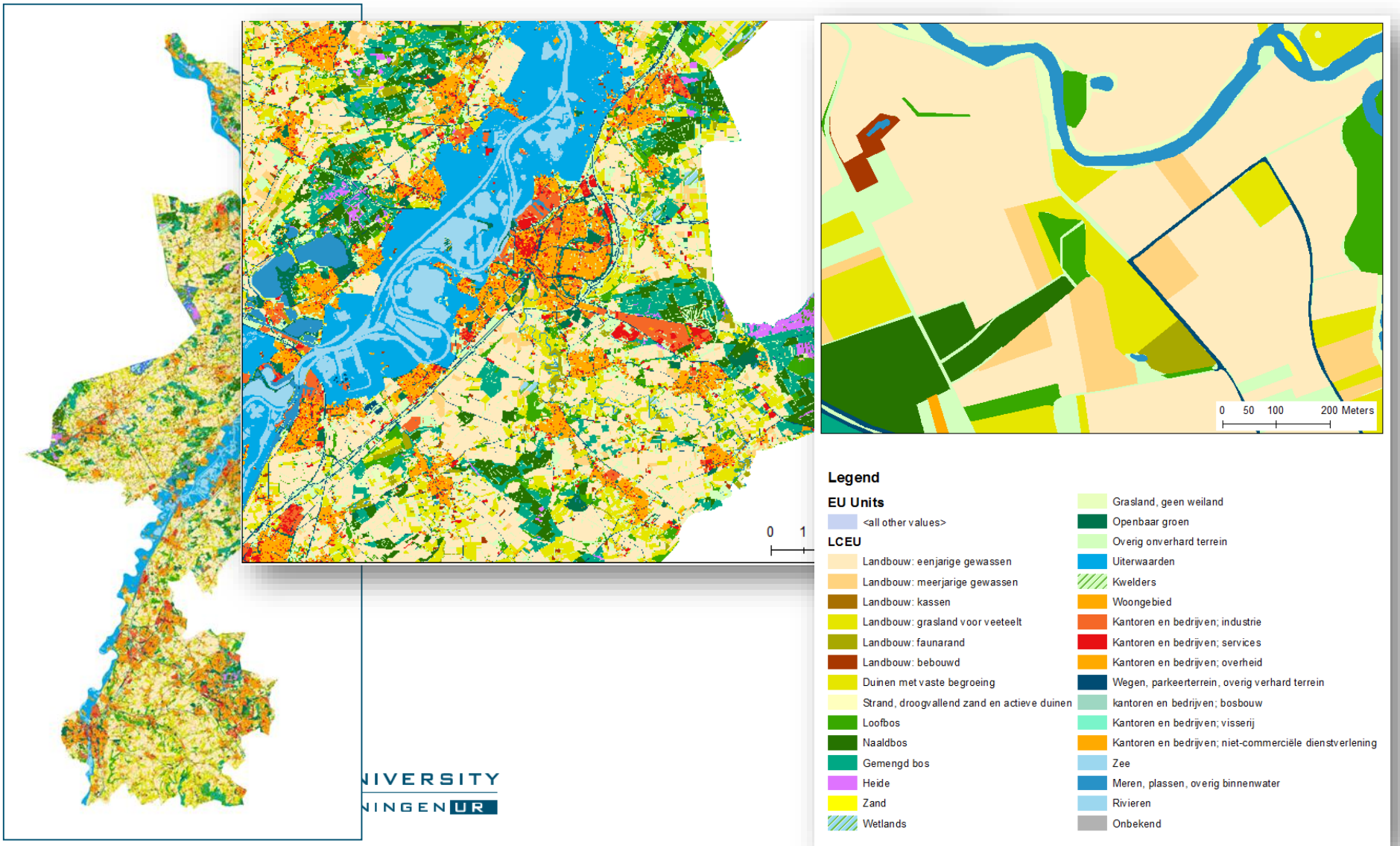
Thematic accounts

- Land
- Water
- Carbon
- Biodiversity



Source figures: UNSD

The extent account for the Netherlands



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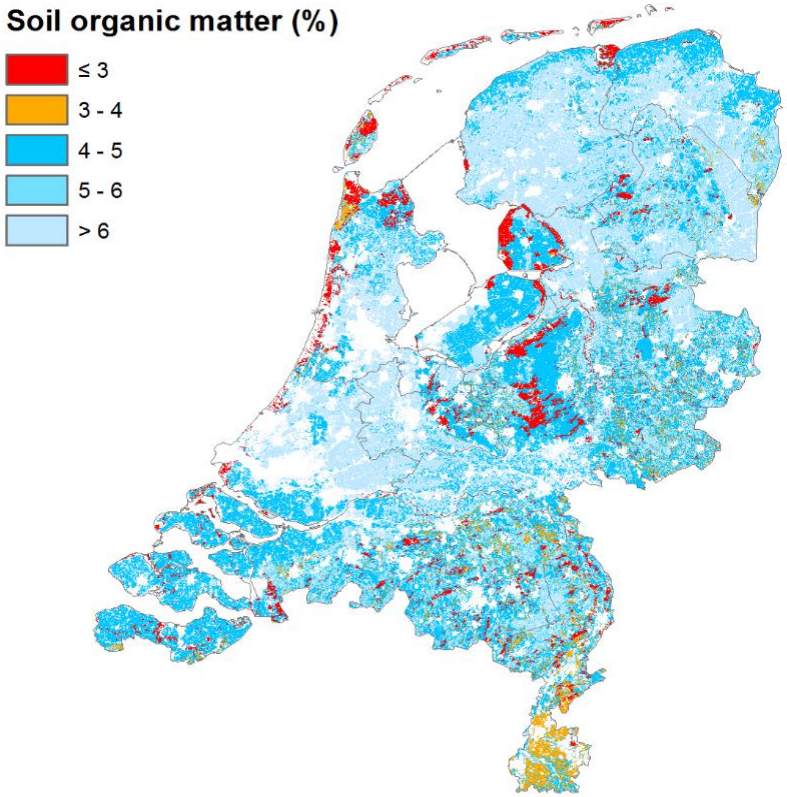
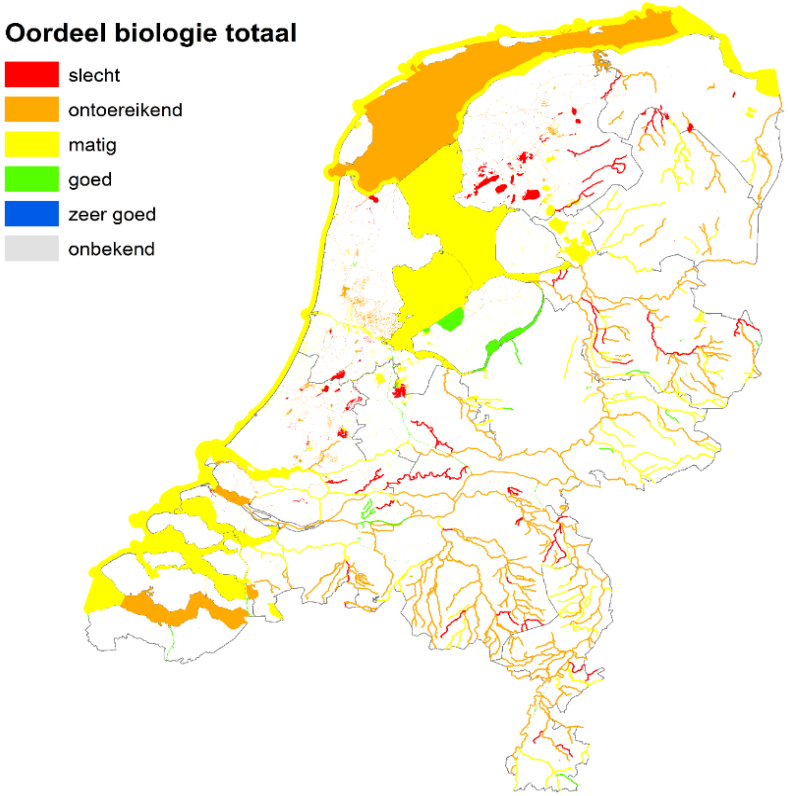
Dutch Condition account: 15 key indicators





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Ecosystem services in NL SEEA account

Provisioning services

- Crop production
- Fodder production
- Timber production
- Other biomass
- Water supply

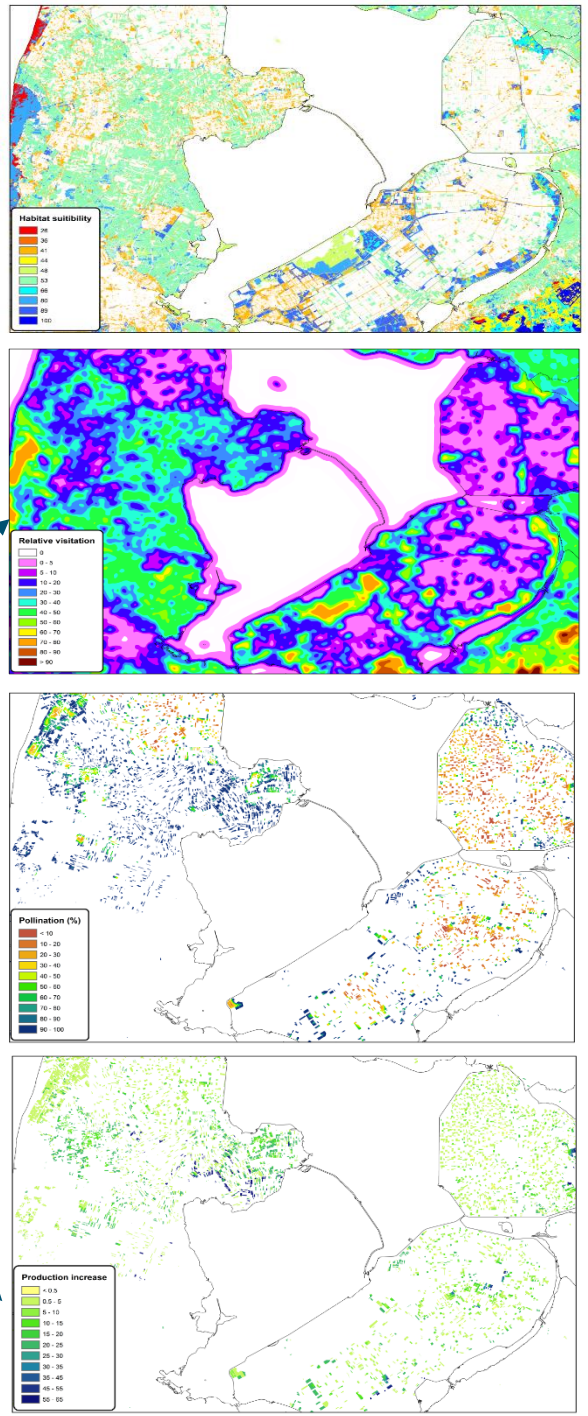
Regulating services

- Carbon sequestration
- Erosion control
- Air filtration
- Water infiltration
- Pollination
- Pest control

Cultural services

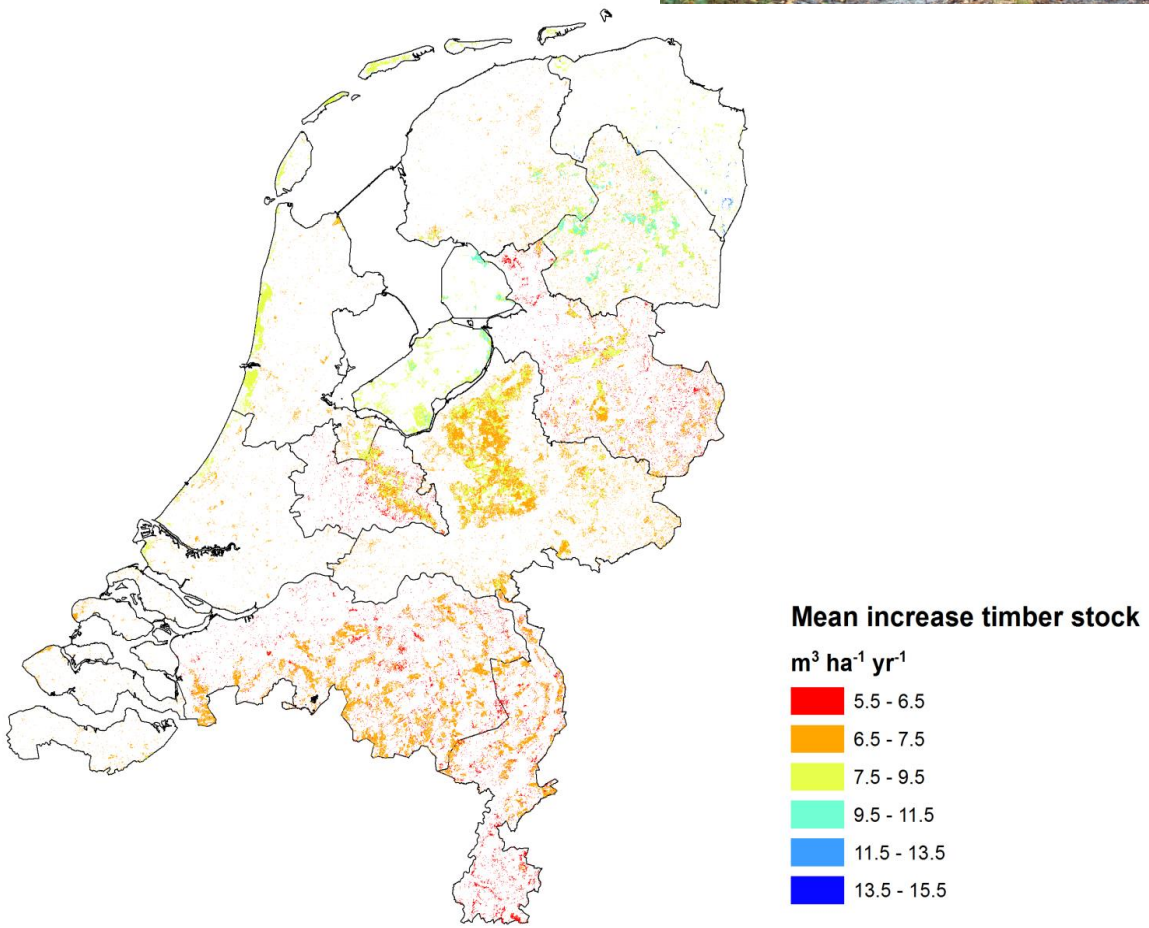
- Nature recreation (hiking)
- Nature tourism

Multiple datasets and models per service



Timber production

	Total area	stock	Harvest
	(1000ha)	(1000m3)	(1000m3/yr)
Groningen	6	1,221	19
Friesland	14	2,918	40
Drenthe	31	6,633	129
Overijssel	34	7,723	106
Flevoland	14	2,910	73
Gelderland	88	20,411	308
Utrecht	17	3,526	53
Noord-Holland	17	4,478	38
Zuid-Holland	8	1,420	18
Zeeland	4	553	11
Noord-Brabant	65	12,358	215
Limburg	24	5,147	73
Zuid-Limburg	5	1,436	13
Netherlands	326	70,726	1,097

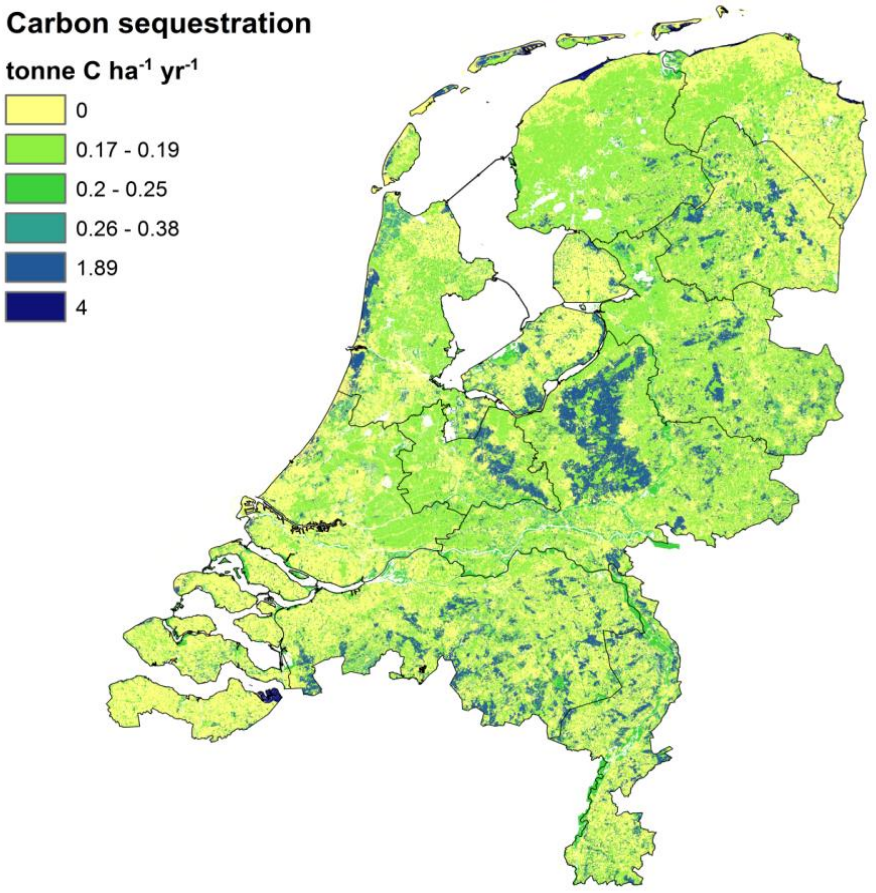


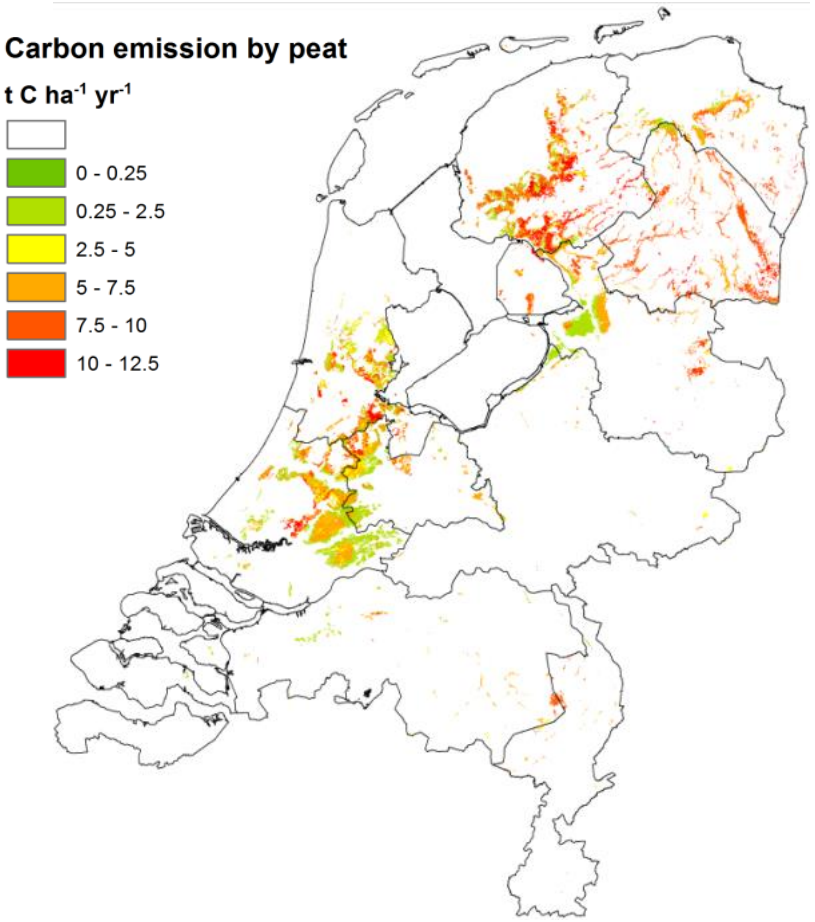
Ecosystem asset account

- Monetary indicators only, based on NPV of expected flow of ecosystem services
- To be finalised December 2018
- Ecosystem services valued based on actual use patterns, corrections made in case of unsustainable use patterns.

The carbon account

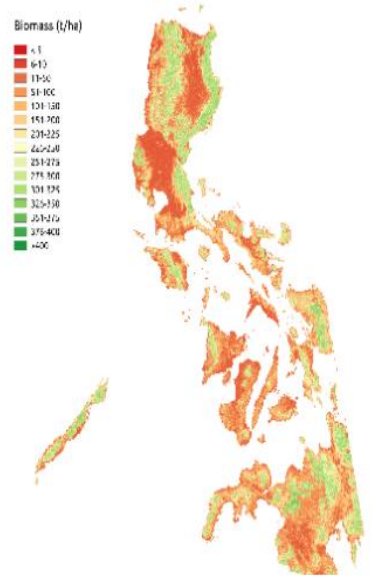
- Stocks, emissions and sequestration of CO_2



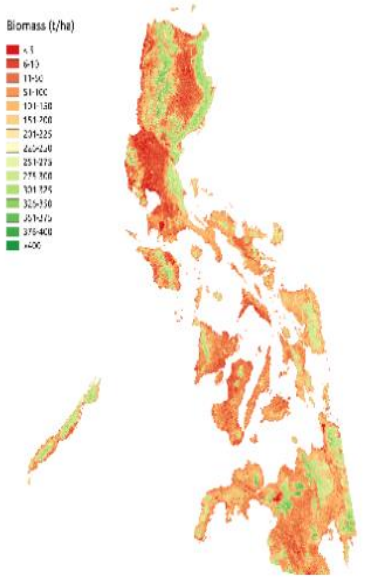


Using machine learning for mapping carbon

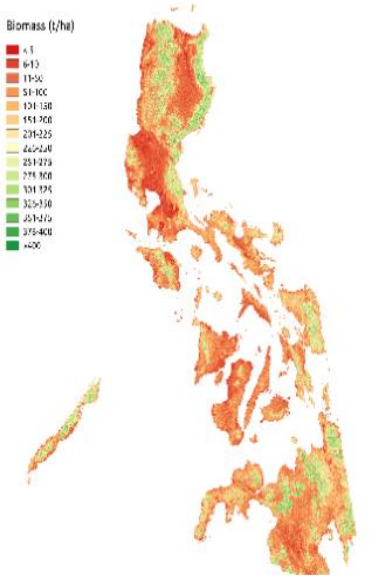
- Philippines
- Costa Rica



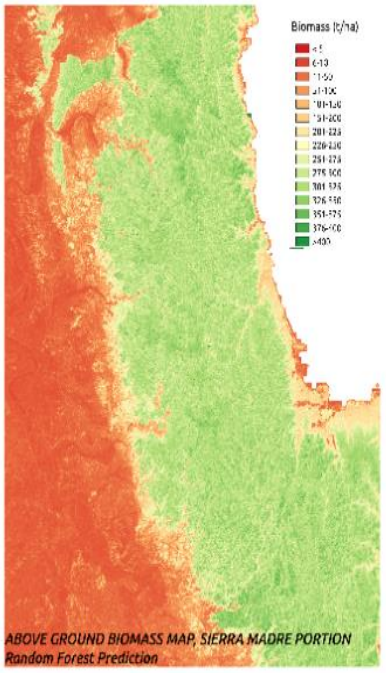
ABOVE GROUND BIOMASS MAP, PHILIPPINES
RANDOM FOREST PREDICTION

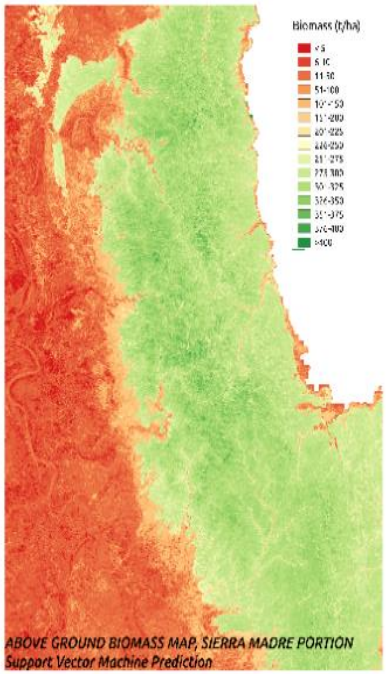


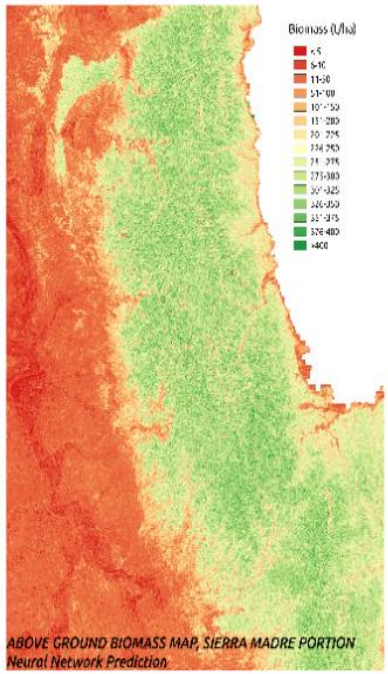
ABOVE GROUND BIOMASS MAP, PHILIPPINES
SUPPORT VECTOR MACHINE PREDICTION



ABOVE GROUND BIOMASS MAP, PHILIPPINES
NEURAL NETWORK PREDICTION







Biomass maps predicted by random forest, support vector machine, and neural networks

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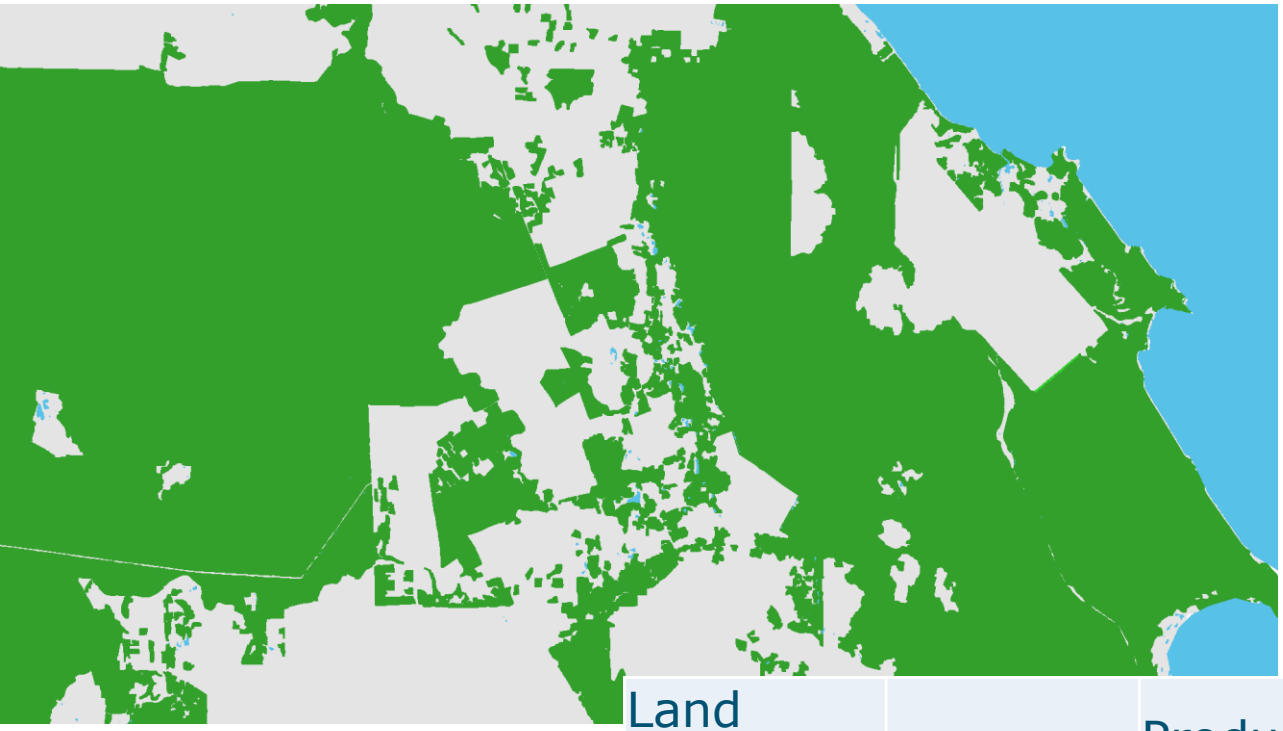
Using remote sensing to compile accounts

- Ecosystem extent / land use
  - Conversion of forest in plantations
  - Smallholders versus plantations
- Condition
  - Fire
  - Water/flooding
- Carbon
  - Stocks and flows
- Supply and use account
  - Rice production

Compiling extent accounts with satellite data



Detail of map

Plantation

Forest

Case study showing expansion of oil palm plantations in Johor, Malaysia 2016-2018

Land cover (ha)		Production	(ton)
Forest	109,000	Timber	981,000
		Carbon sequestration	654,000
Plantation	91,000	Oilpalm fruit	1,820,000
Annual crops	85,000	Paddy rice	1,020,000
Urban	25,000	-	
Total	310,000		

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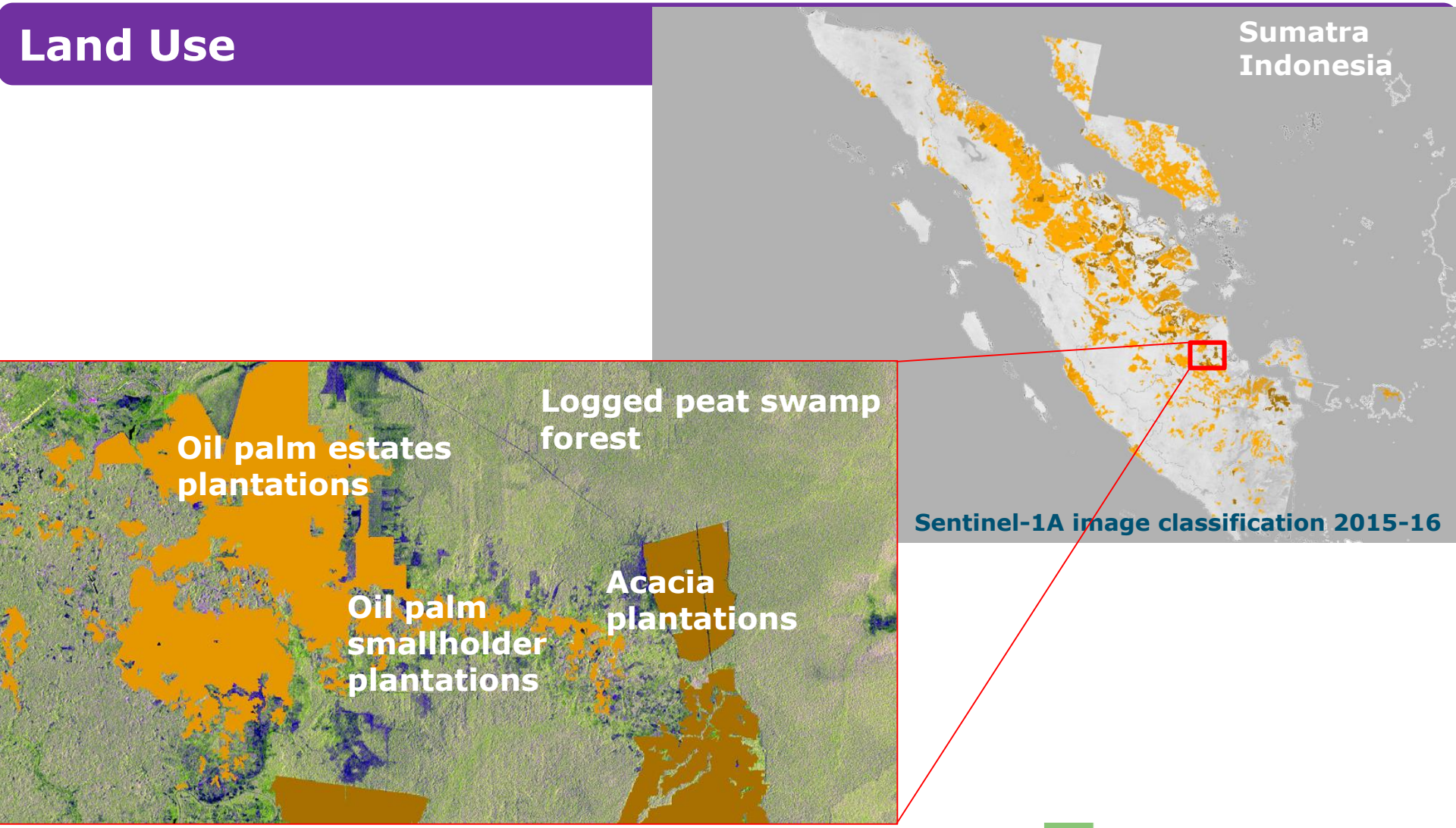
Applications in remote sensing

Mapping estates and smallholder plantations

Land Use



Mapping smallholders and estates

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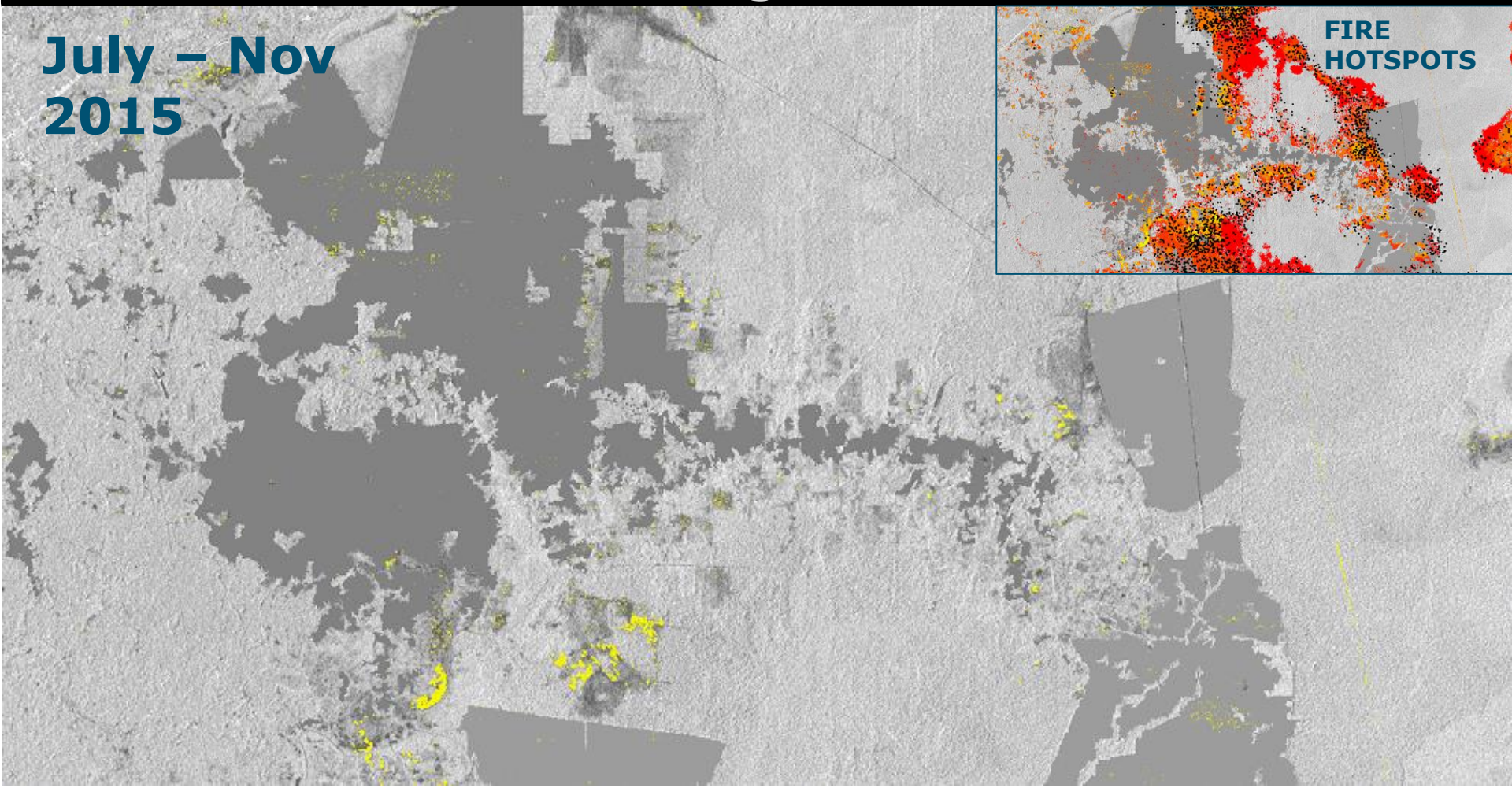
Mapping burned areas, 12 days interval

Condition account: Fire damage detection



Mapping burned areas (fire scars),
12 day interval

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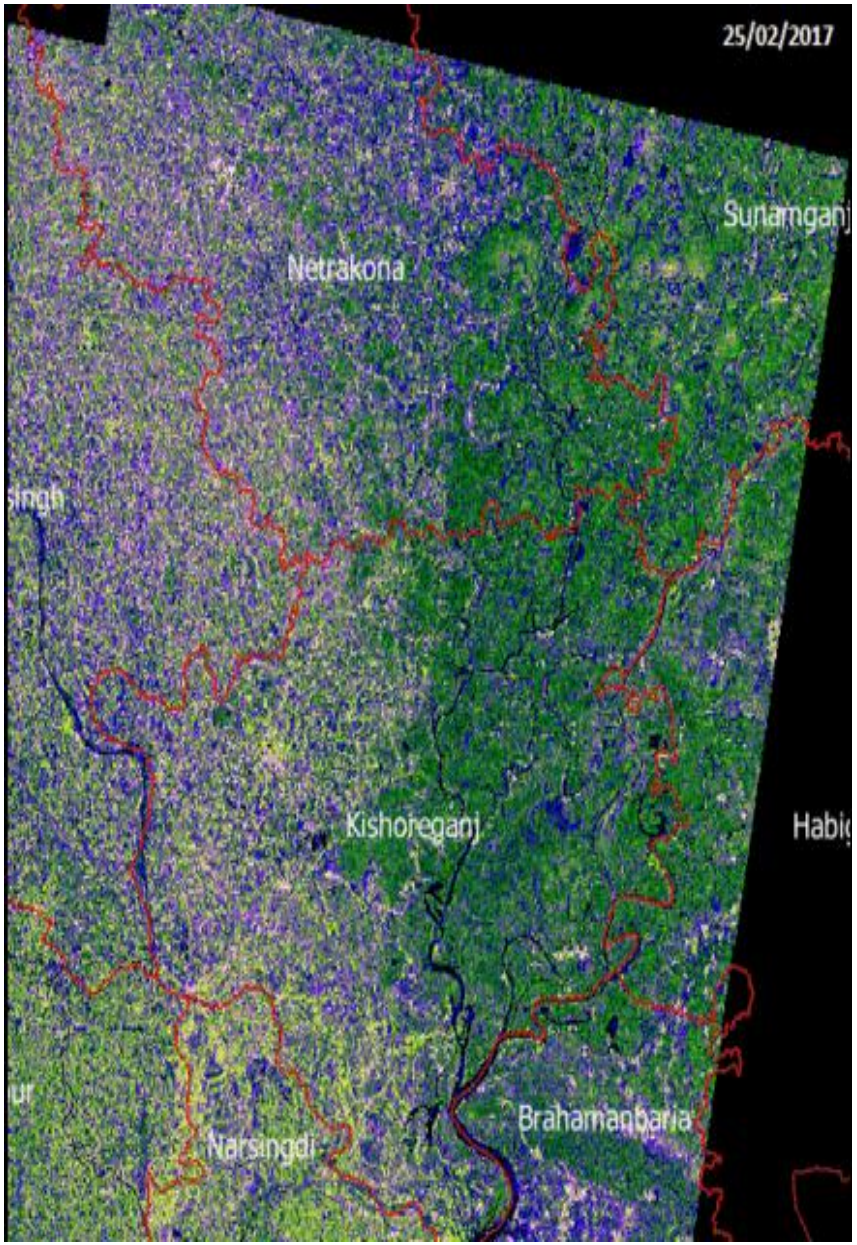
Condition account: Monitoring and recording flooding



Flood monitoring – Haor region, Bangladesh
Sentinel-1 images
02/2017 – 05/2017

DhakaTribune

HOME NEWSPAPER BANGLADESH BUSINESS WORLD SPORTS FEAT

Flash flood in the Haors may worsen rice price hike

Abu Siddique Published at 01:04 AM April 08, 2017

Fresh areas flooded in Netrakona

Situation unchanged in Kishoreganj

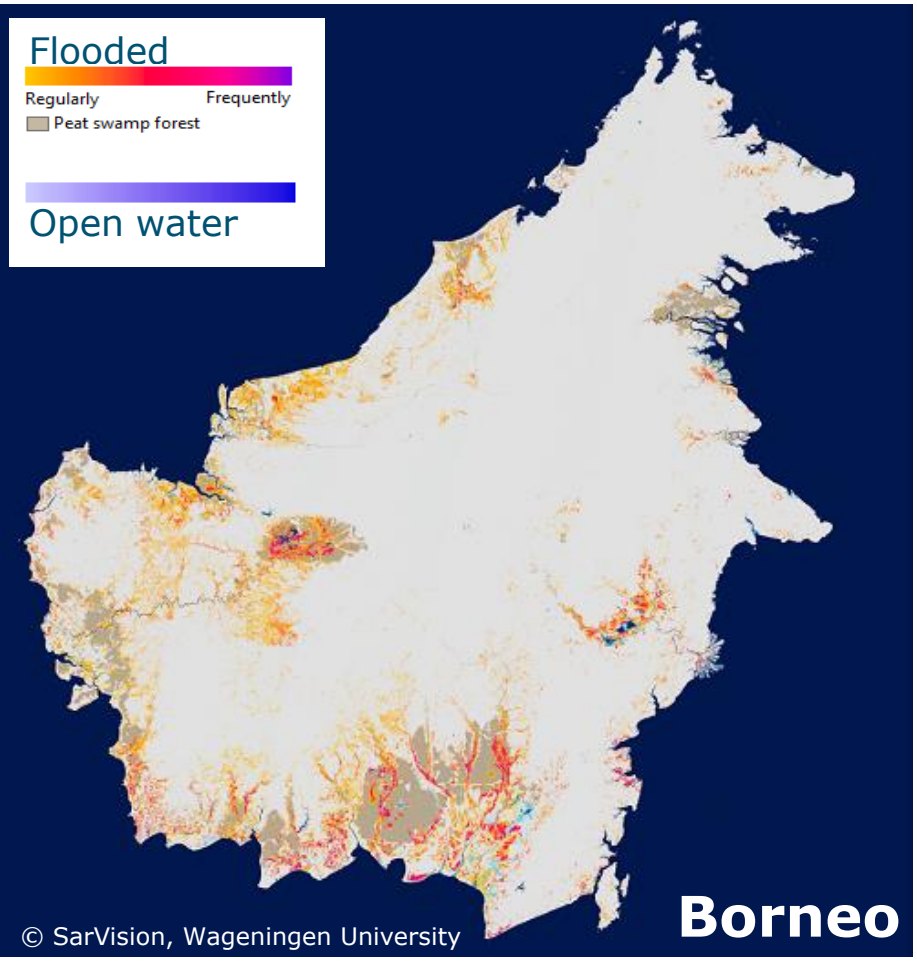
Our Correspondent, Mymensingh

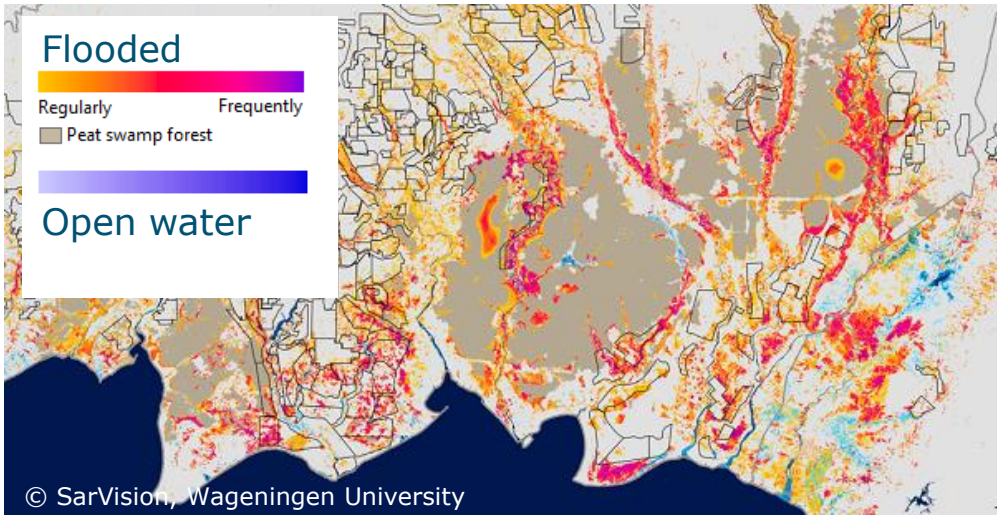
Flood situation in Netrakona continues to deteriorate as fresh areas of farmland were inundated yesterday, causing immense sufferings to thousands of farmers.

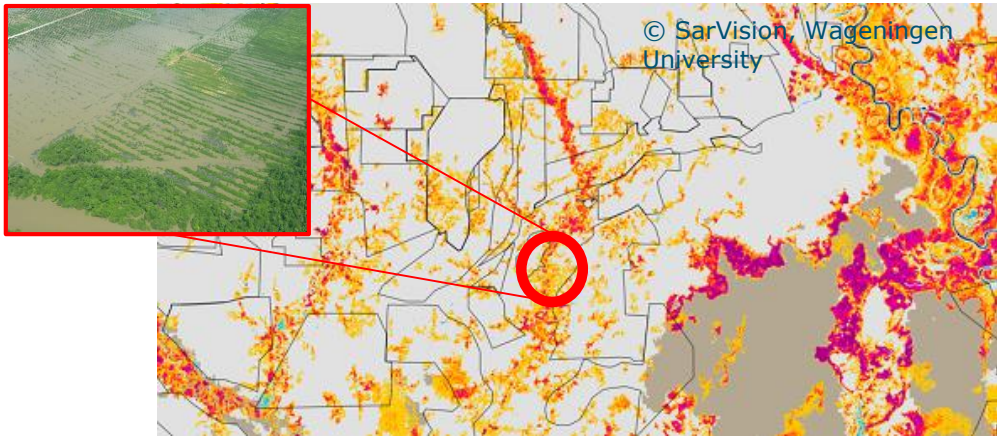
Due to washing away of two more embankments- 'Gachikhai' and 'Joypur' embankments in Khaliajury upazila, over 90 percent area of the upazila has gone under water, said Mohammed

More haor areas of Khaliajury upazila in Netrakona have been flooded. Photo: Collected

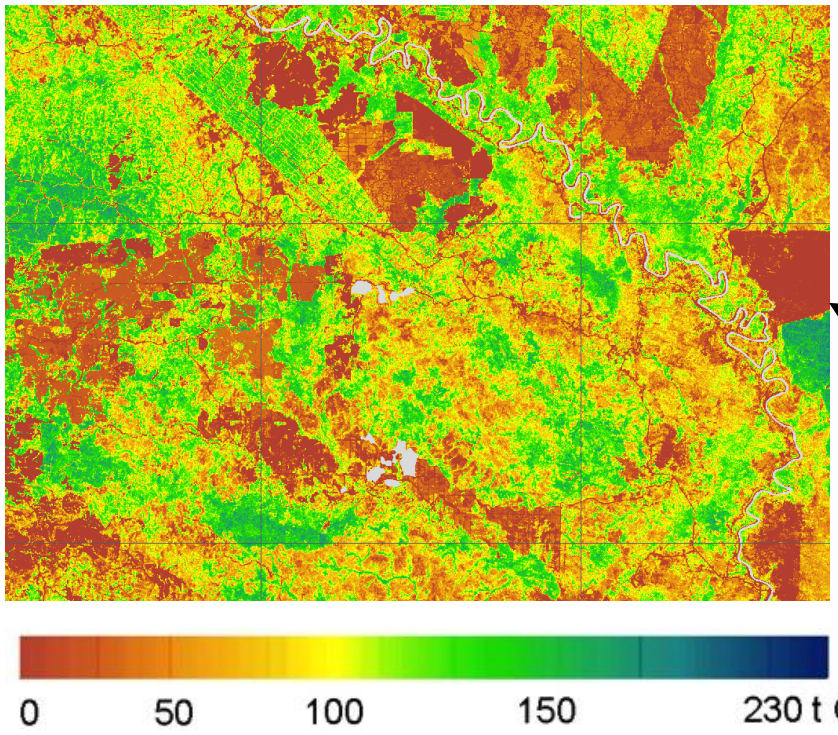
From accounts to policy support: flooding frequency





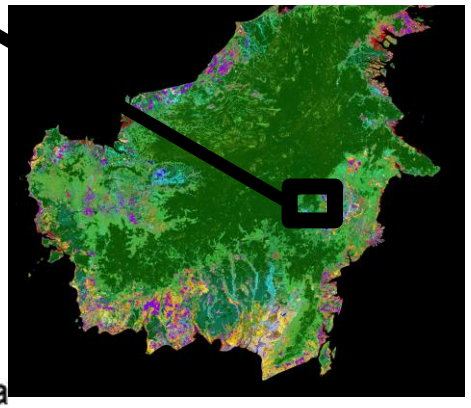


Carbon account: Mapping carbon stocks and flows (above ground vegetation)
In new, European space agency funded project also emissions from peat drainage will be included



Biomass time series over the years 2000-2012

Small section of the East Kalimantan map (50 km wide).



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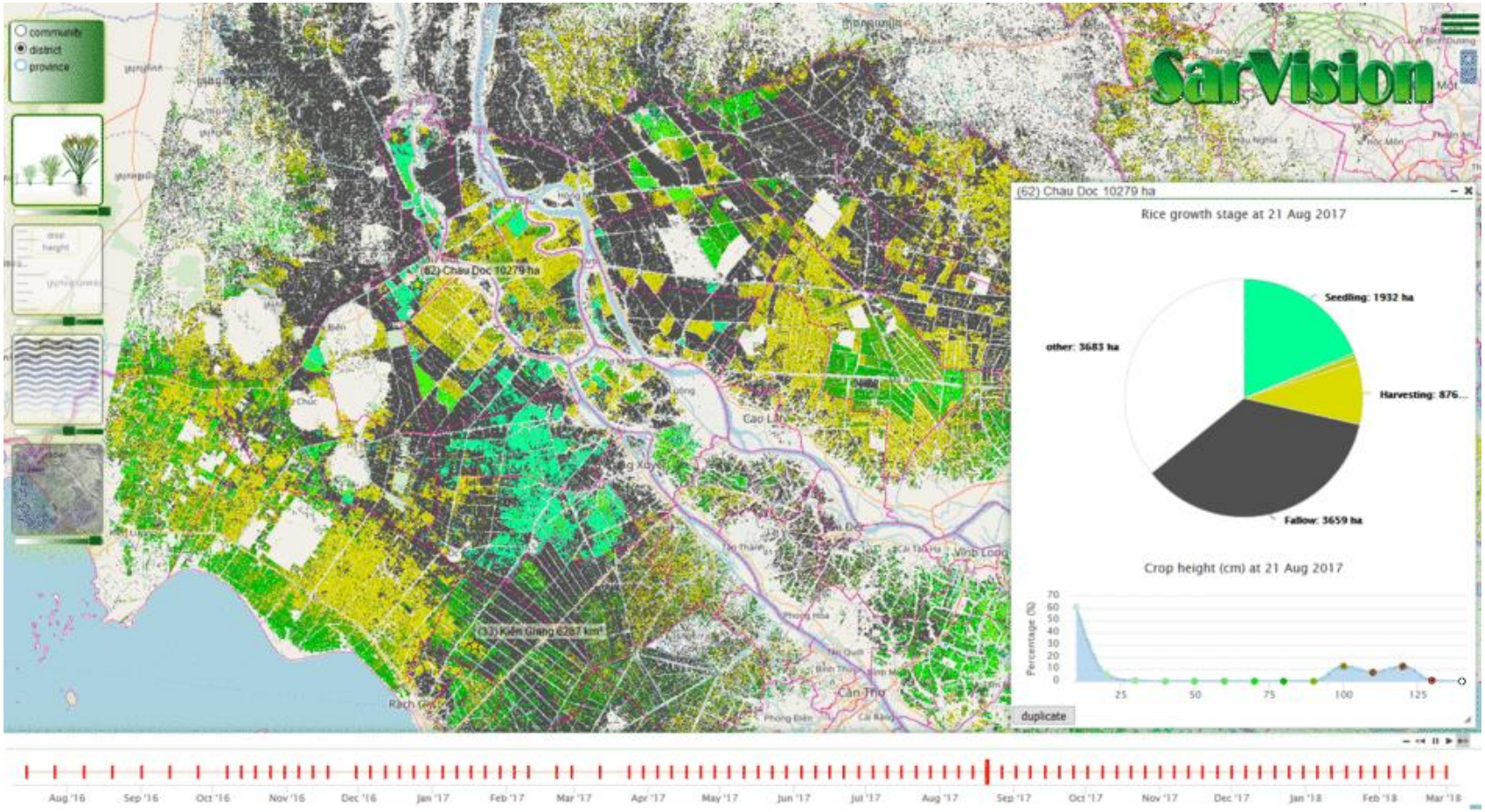
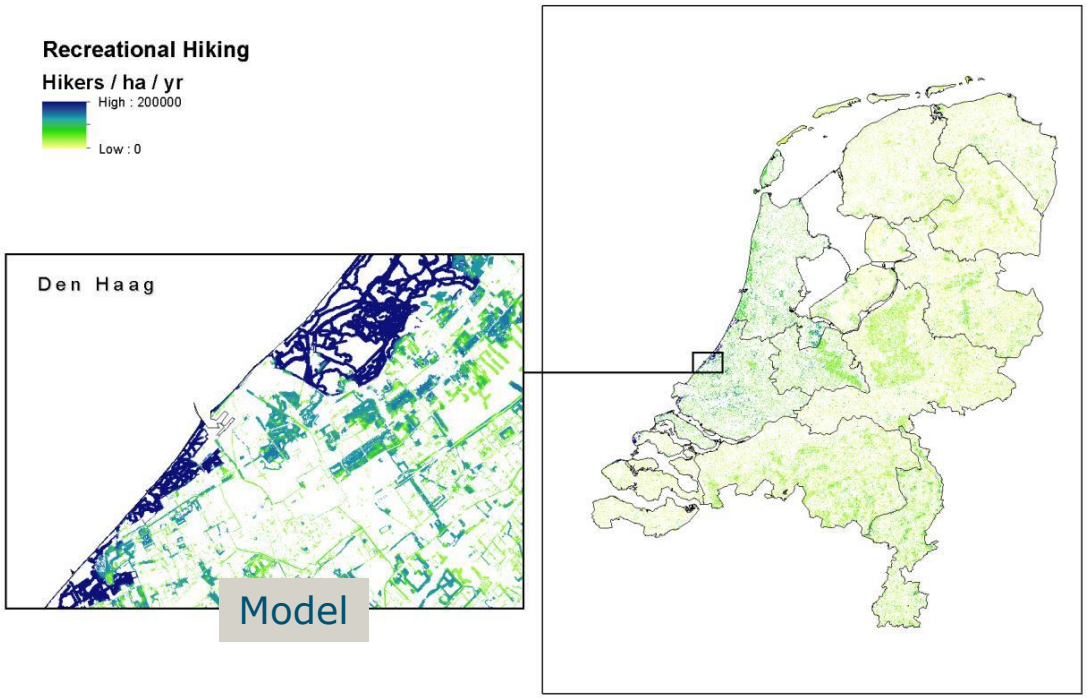
Supply and use account: crop (rice) production

Rice growth stage monitoring, Mekong Delta, Vietnam



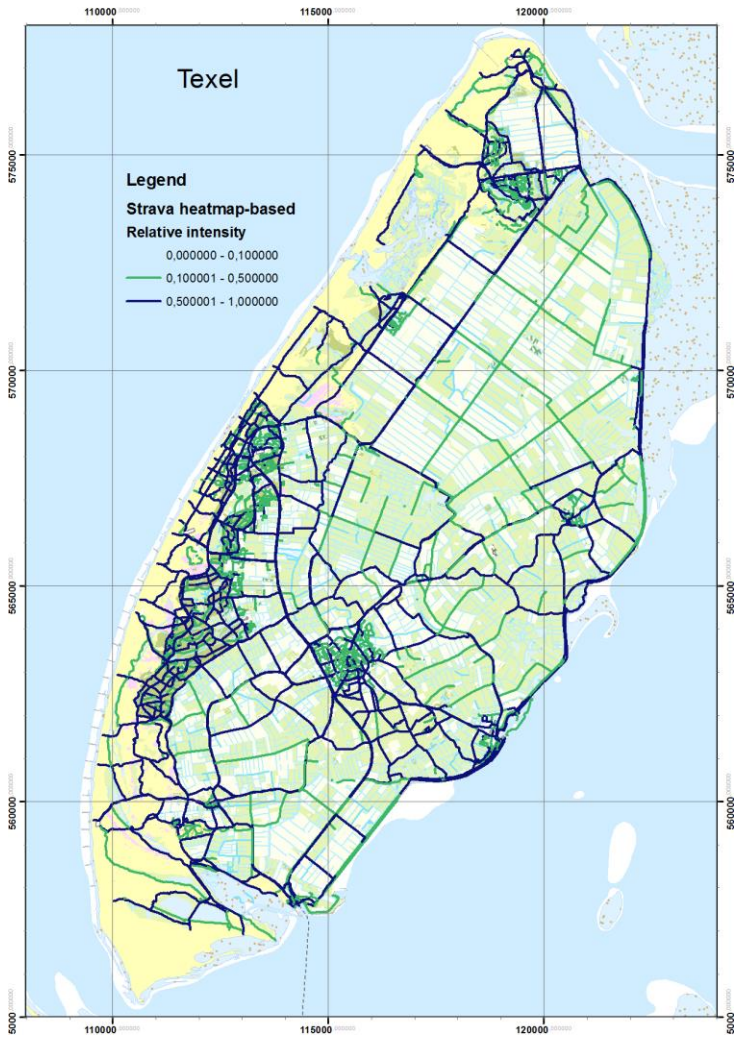
Using open-access, 'big data' for mapping ES



Model

Mapping recreation

Statistics Netherlands



Strava

Using 'big data' to produce accounts, cultural services modelling based on strava, flickr, and other apps

Conclusions and look into the future

- Technology for using models, earth observation and open data for informing natural resource management and compiling accounts is developing **VERY** rapidly
- Machine learning will replace existing earth system modelling approaches. In five to 10 years?
- Level of detail, in time and in space, and high accuracy **already** present multiple policy use options
- Need for further development:
    - Developing new approaches, testing in new areas, scaling up, connecting to users
- Question: should every individual country develop these models and connect them to accounts and environmental information management system? Or should this be done by global / regional centres? If so which ones? and how to connect to national and **sub-national** policy makers?