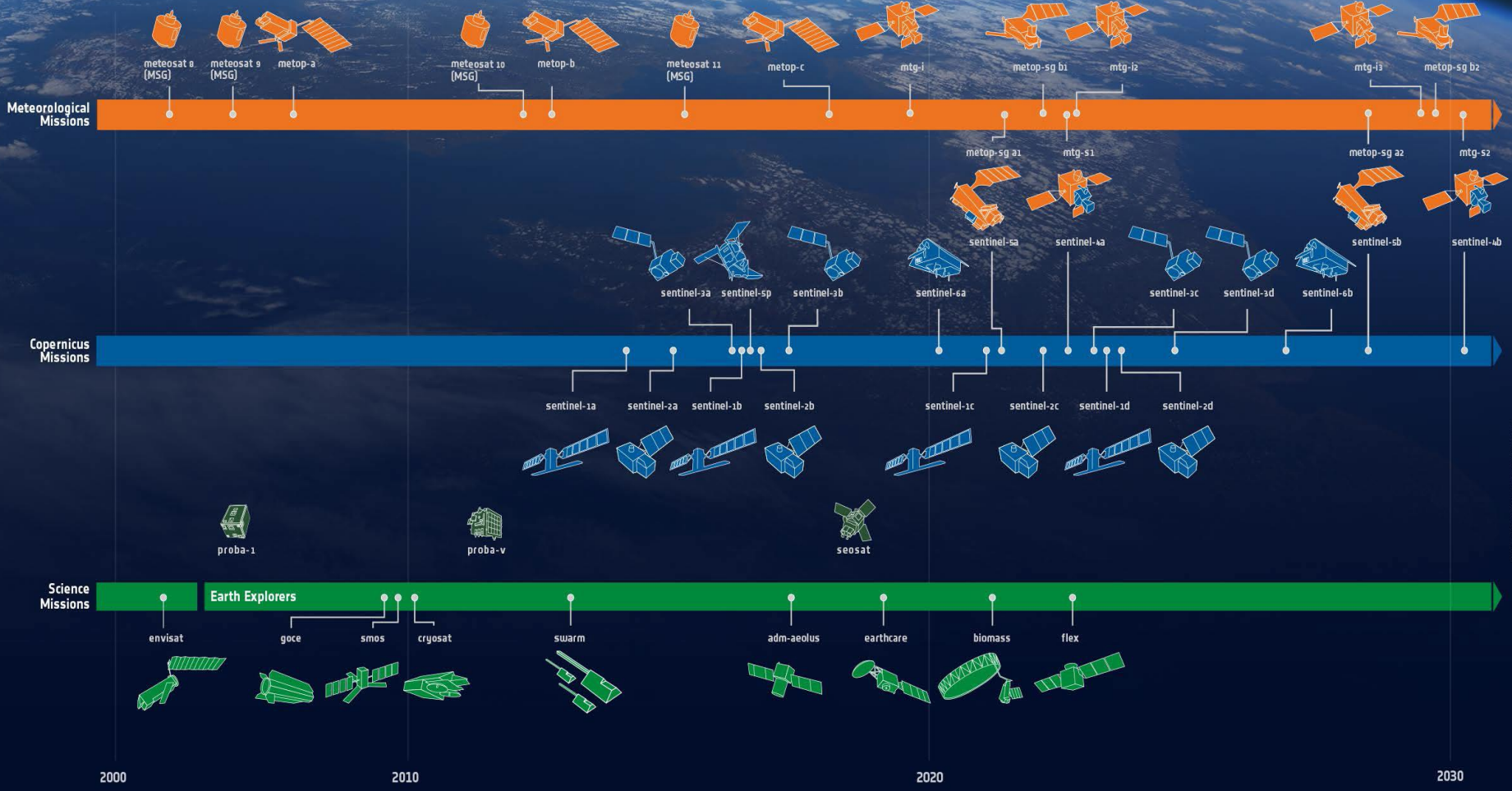
Earth Observation enviromental information in the context of Ecosystems

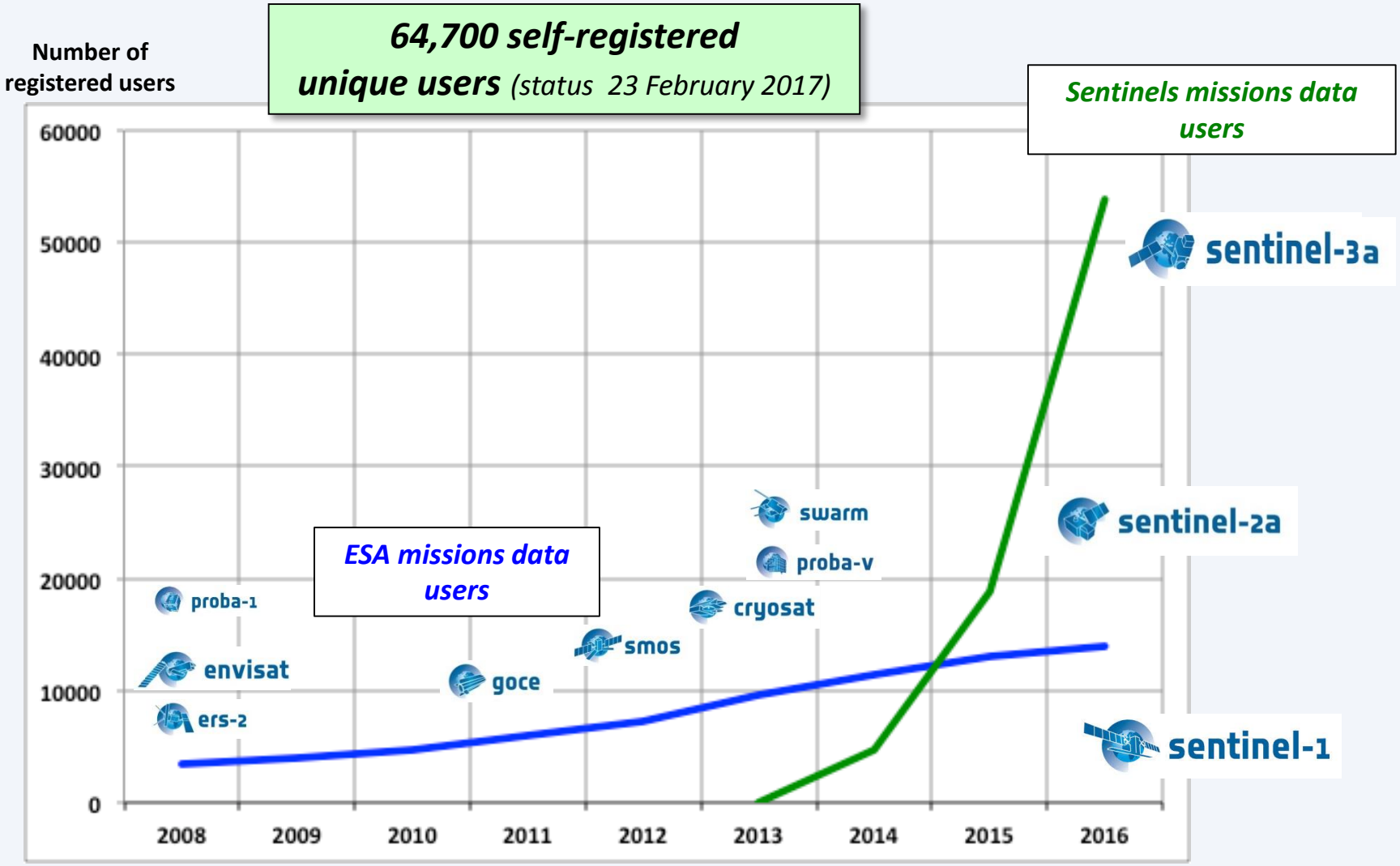
Stephen Coulson
European Space Agency
Directorate of Earth Observation Programmes
ESA/ESRIN

GEO Initiative on EO for Ecosystems Accounting (EO4EA), 27-28 March 2017, Copenhagen

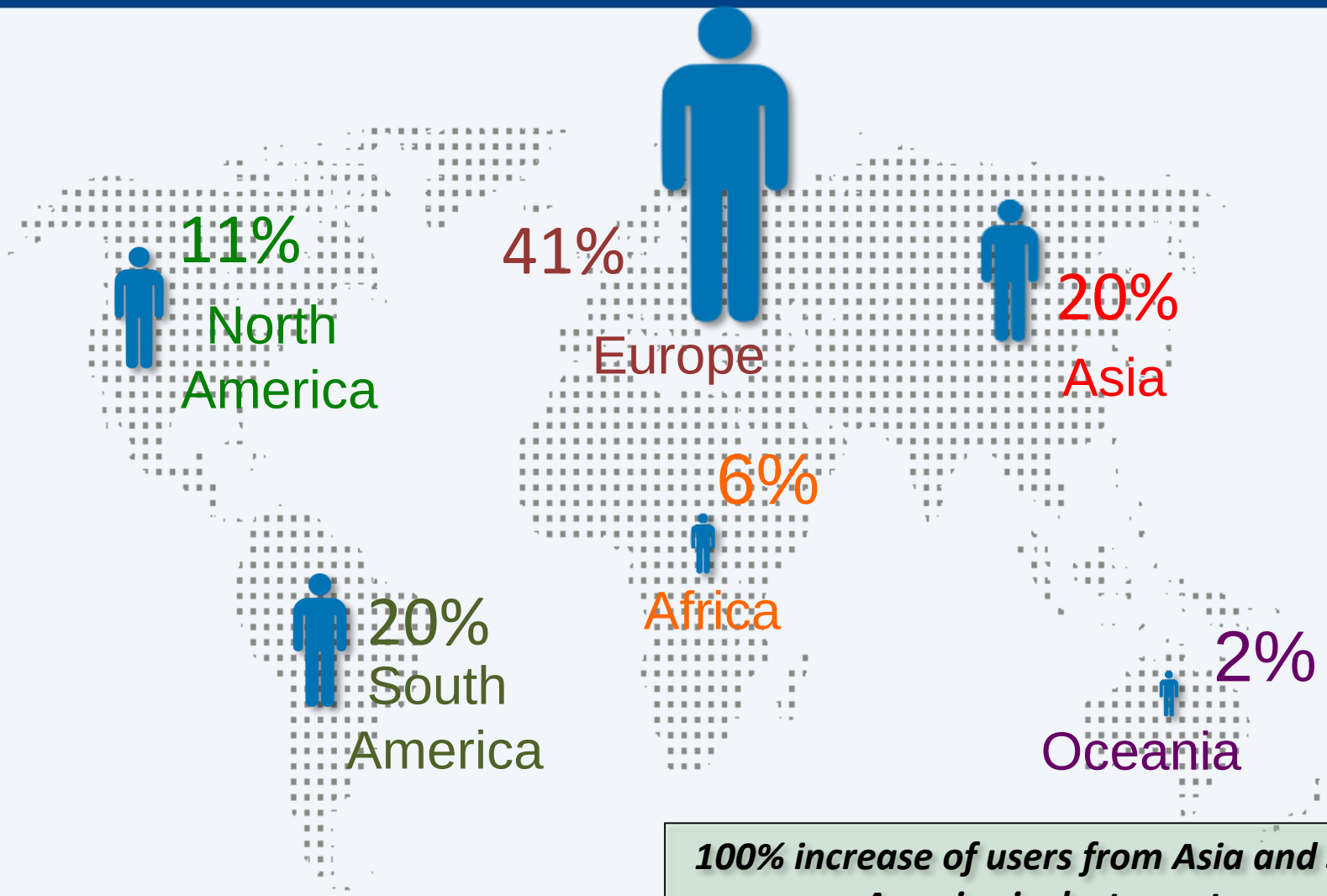
→ ESA DEVELOPED EARTH OBSERVATION MISSIONS



Sentinel data - Users Registration



Sentinels Data Access Statistics – Global View



100% increase of users from Asia and South America in last quarter

Sentinel data – Systematic Production

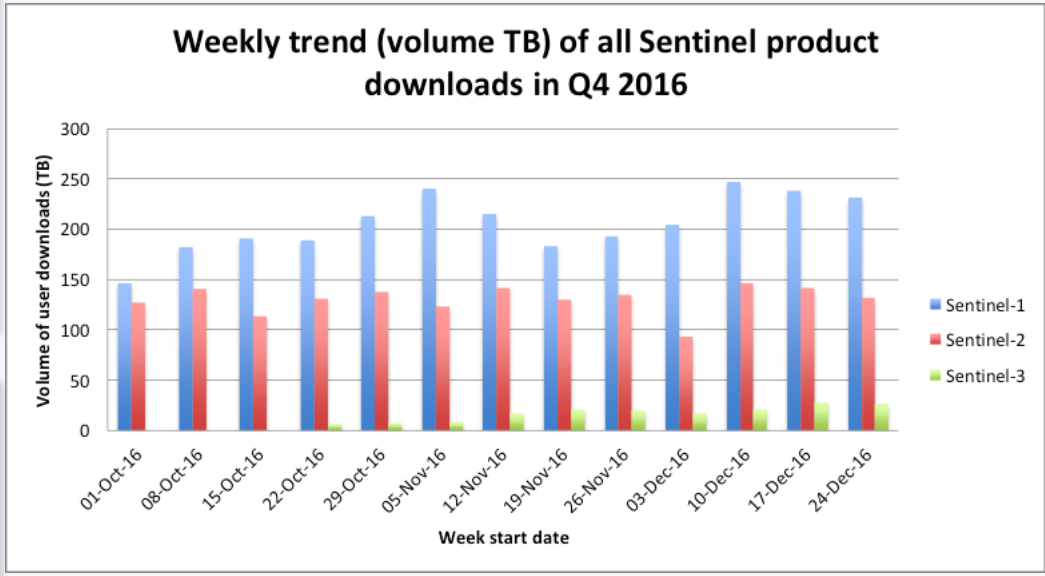
In 2015 an average of 3 TB of core products was generated daily

By end 2016 this figure has increased to more than 8 TB a day

Full Sentinel-1 production is available online :
> 1 million products (>1.4PB of data)

Full Sentinel-2A production is available online:
> 600,000 products (>500 TB of data)

Sentinel-3A Level-1 products gradual release to all users started in Q4-2016



Approx. 4,6 MILLION products were downloaded during Q4-2016 corresponding to 4,6 PB of data


esa
EO & Ecosystems
European Space Agency
Read more at www.space4ecosystems.com

Natural Capital Accounting : Valuation of Ecosystems Services

Objective

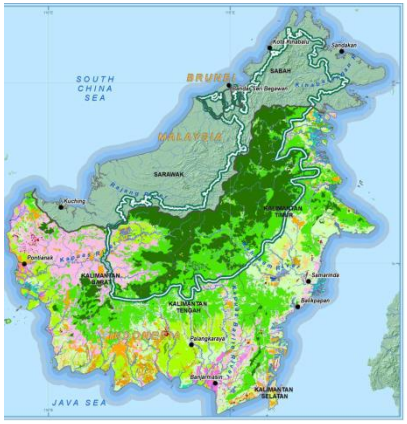
- Large momentum in the international community and on a governmental level for natural capital accounting
- World Business Council for Sustainable Development engage private sector in ecosystems accounting
- WAVES (Wealth Accounting and the Valuation of Ecosystem Services) WB led funded partnership with trust fund of 15M$ to implement natural capital accounting in demonstration countries
- The Economics of Ecosystems and Biodiversity (TEEB) do systematic accounting approaches
- GLOBE World summit of legislators engage in Natural Capital Accounting

ESA is working with the WAVES team at the World Bank on expanding the use of EO. User consultation in May 2013 at WAVES premises in the World Bank.

June 2013 GLOBE Natural Capital Legislation Study

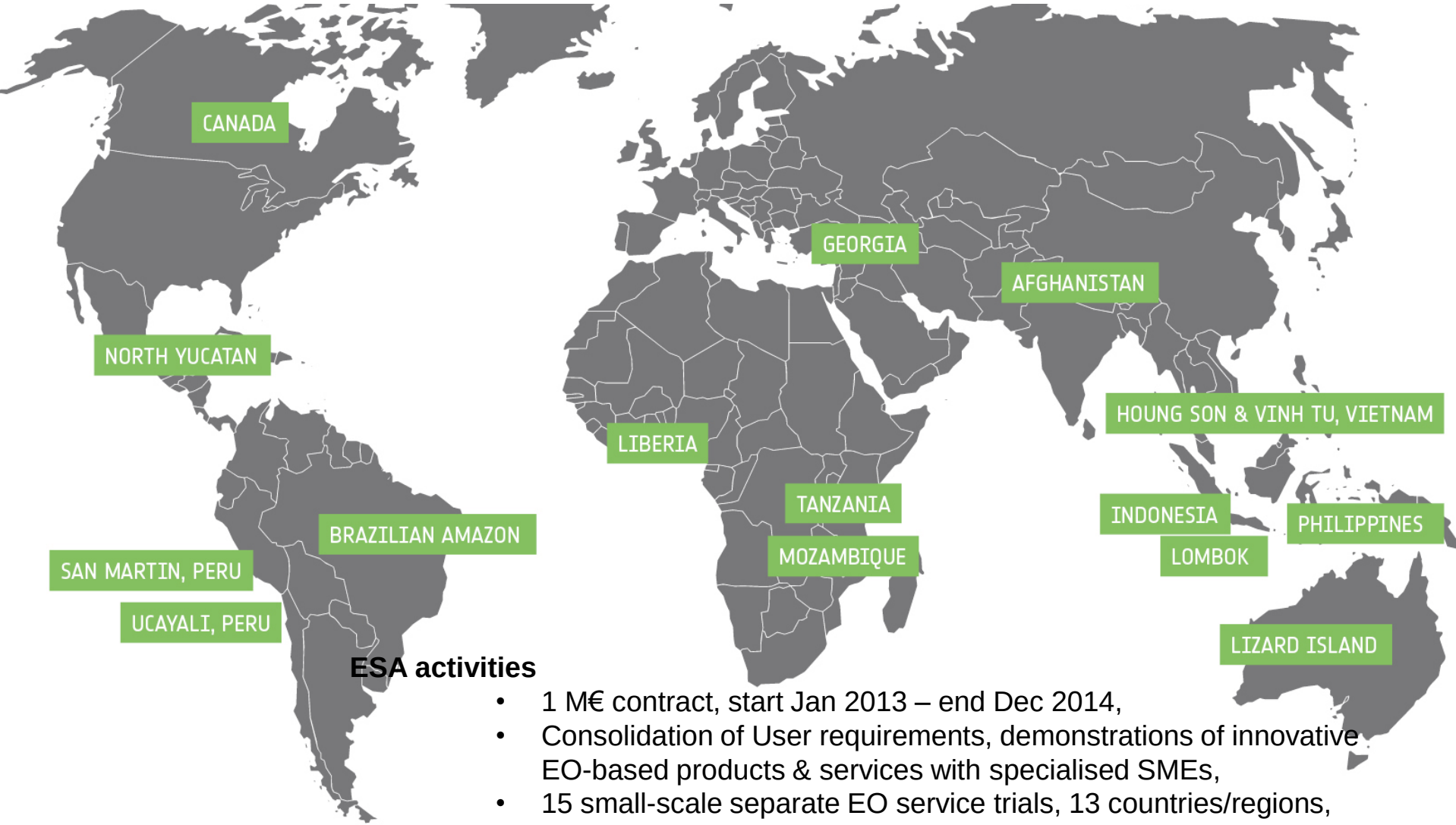
Why EO ?

- Valuation -> objective assessment
- EO independent, validated and unbiased information
- Earth Observation has previously been used in FSC certification, wetlands management, EIA, forestry



ESA working with valuation of ecosystem services on Borneo. Study effective in changing policy makers view on land use.

Case studies covering aspects of
EO Products for Ecosystem Assessment & Valuation



ESA activities

- 1 M€ contract, start Jan 2013 – end Dec 2014,
- Consolidation of User requirements, demonstrations of innovative EO-based products & services with specialised SMEs,
- 15 small-scale separate EO service trials, 13 countries/regions,
- Use of standard tools (INVEST) for economic valuation.

Users covering aspects of

Product & Production management, Ecosystem management & policy, Payment for ecosystem services, Impact assessment

User consultations : (70+ organizations and companies):

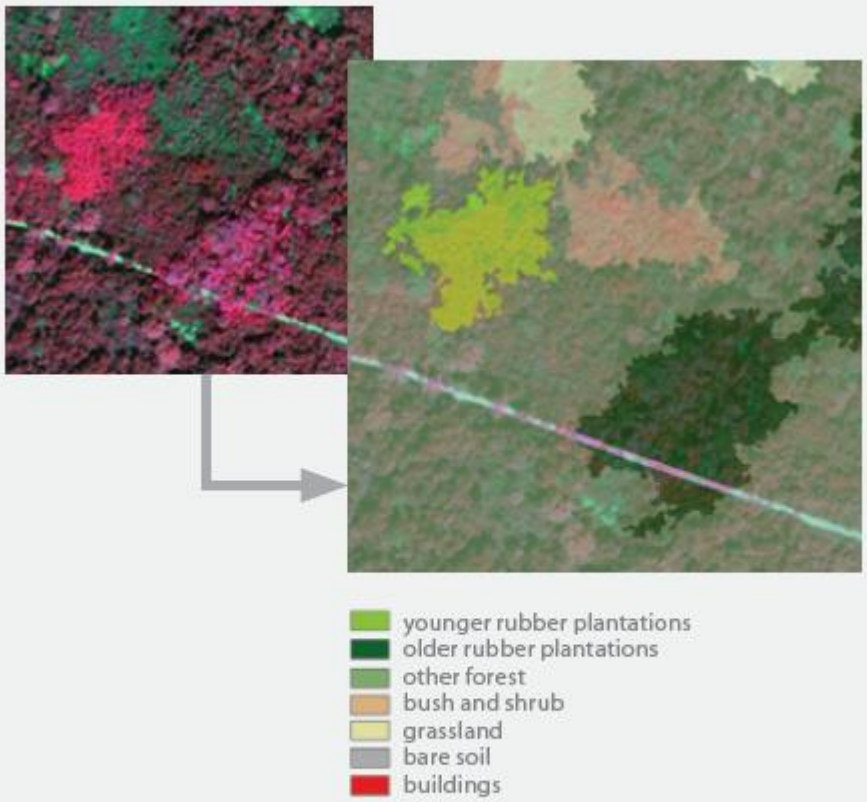
- Althelia, Unilever, ESPA, FSC, Shell, BP, EIB, WBSCD, Carbon Neutral Co, Forum for the Future, World Bank,

Product & Production Management

Forest Plantation; Liberia

Rubber trees : EO based estimation of location, health and age.

Can be used for plywood? wood fuel?



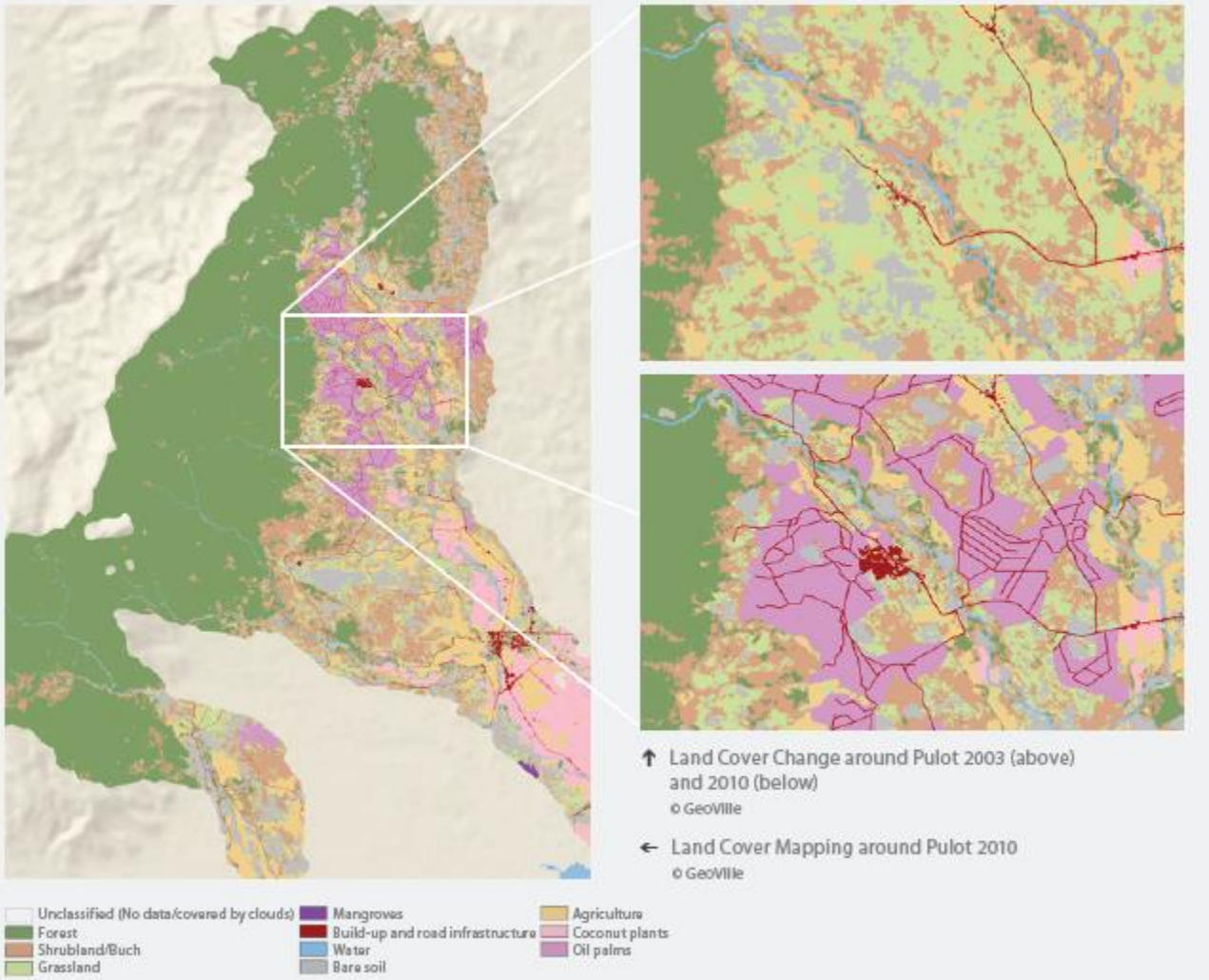
↑ Detailed mapping of rubber trees and their relative age for the year 2012. Based on this biomass estimates can be calculated.

- In West Africa extensive rubber tree plantations are considered a sustainable source of wood products and fuel.
- Using rubber trees at the end of their productive life to improve energy access (ie. wood chips produced from unproductive rubber trees are used for electricity power plants instead of healthy and productive forests)

Figure : Credit Geoville

Ecosystem Management & Policy

Oil Palm Plantation mapping with Wealth Accounting and Valuation of Ecosystem Services (WAVES); Philippines



Wealth Accounting and the Valuation of Ecosystem Services

"The Earth Observation-based maps have filled information gaps needed to model key ecosystem services as well as validate and improve upon existing data".

Stefanie Sieber, World Bank - WAVES

Transformation of natural vegetation into oil palm plantations

↓

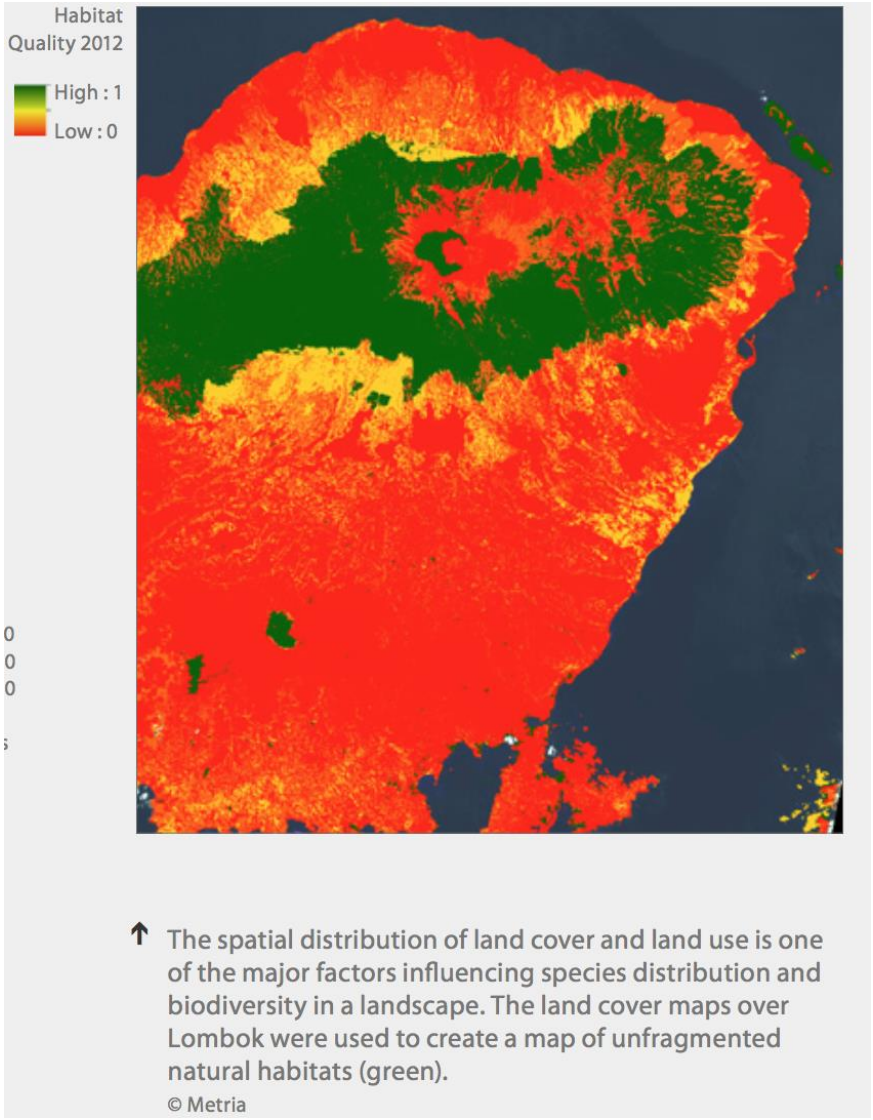
Increased sedimentation

Payments for Ecosystems Services (PES)

Forest preservation Mapping in order to protect potable water resources; Lombok Island, Indonesia

Lombok Island is dominated by Mount Rinjani, with moist cloud forest on the higher slopes and agricultural land mixed with forest patches on the low land. The climate is seasonal and large areas experience dry seasons, sometimes with droughts. The water capturing capacity of the moist forest is hence of great importance.

Earth observation supported the effort to identify and map indicators for the payment of services related to forest and water provision and purification.

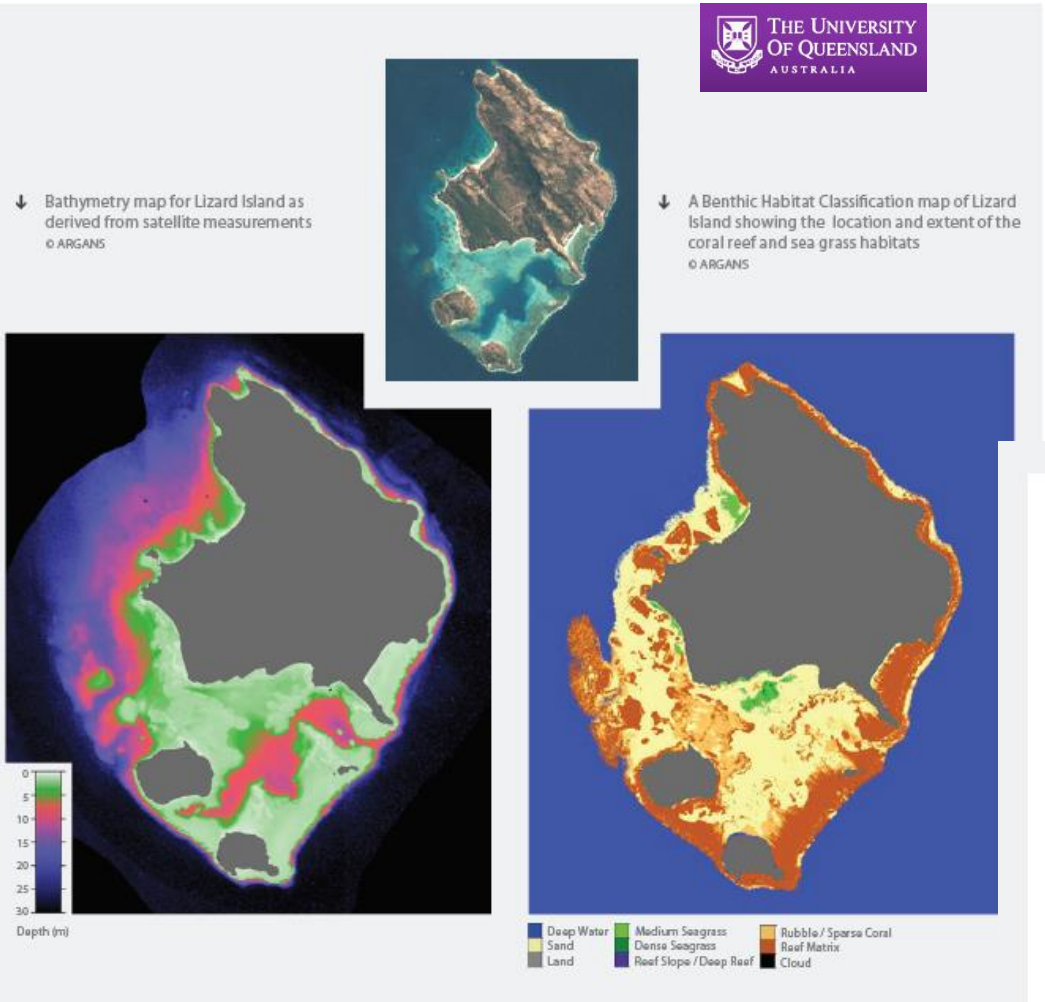


The spatial distribution of land cover and land use is one of the major factors influencing species distribution and biodiversity in a landscape. The land cover maps over Lombok were used to create a map of unfragmented natural habitats (green).

© Metria

Impact Assessment

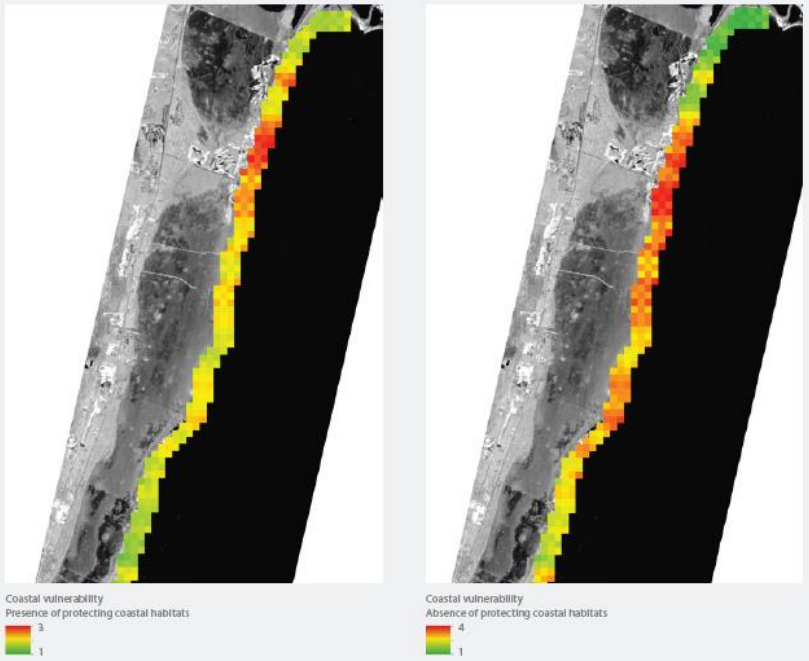
Coral Reefs Mapping; Australia, Caribbean



Tourism and natural pressures endanger sea grass beds and coral reefs

↓

Using the **Invest Model** for wave energy and coastal erosion assessment

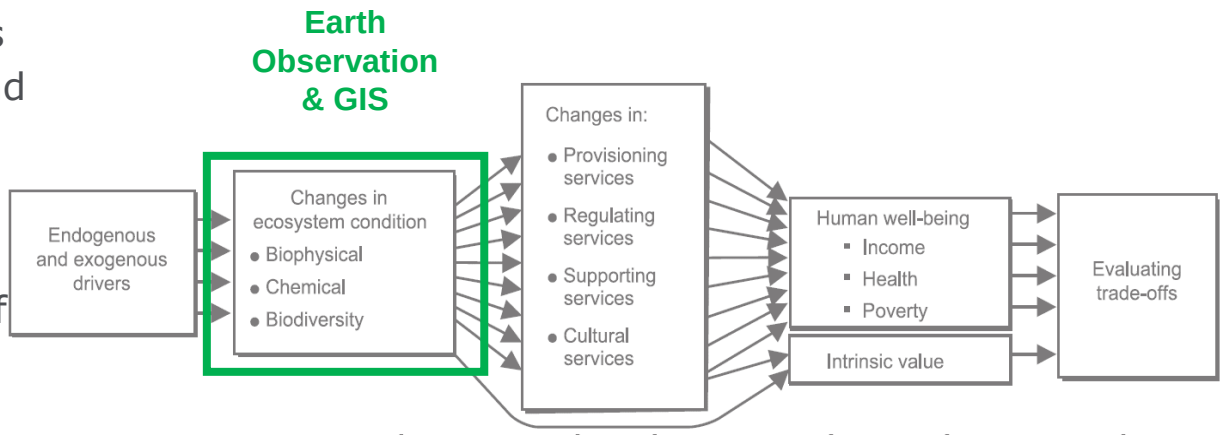


The input data was EO-derived data on benthic habitats and depths and the results were compared with a scenario without these habitats.

Conclusions

What we showed…

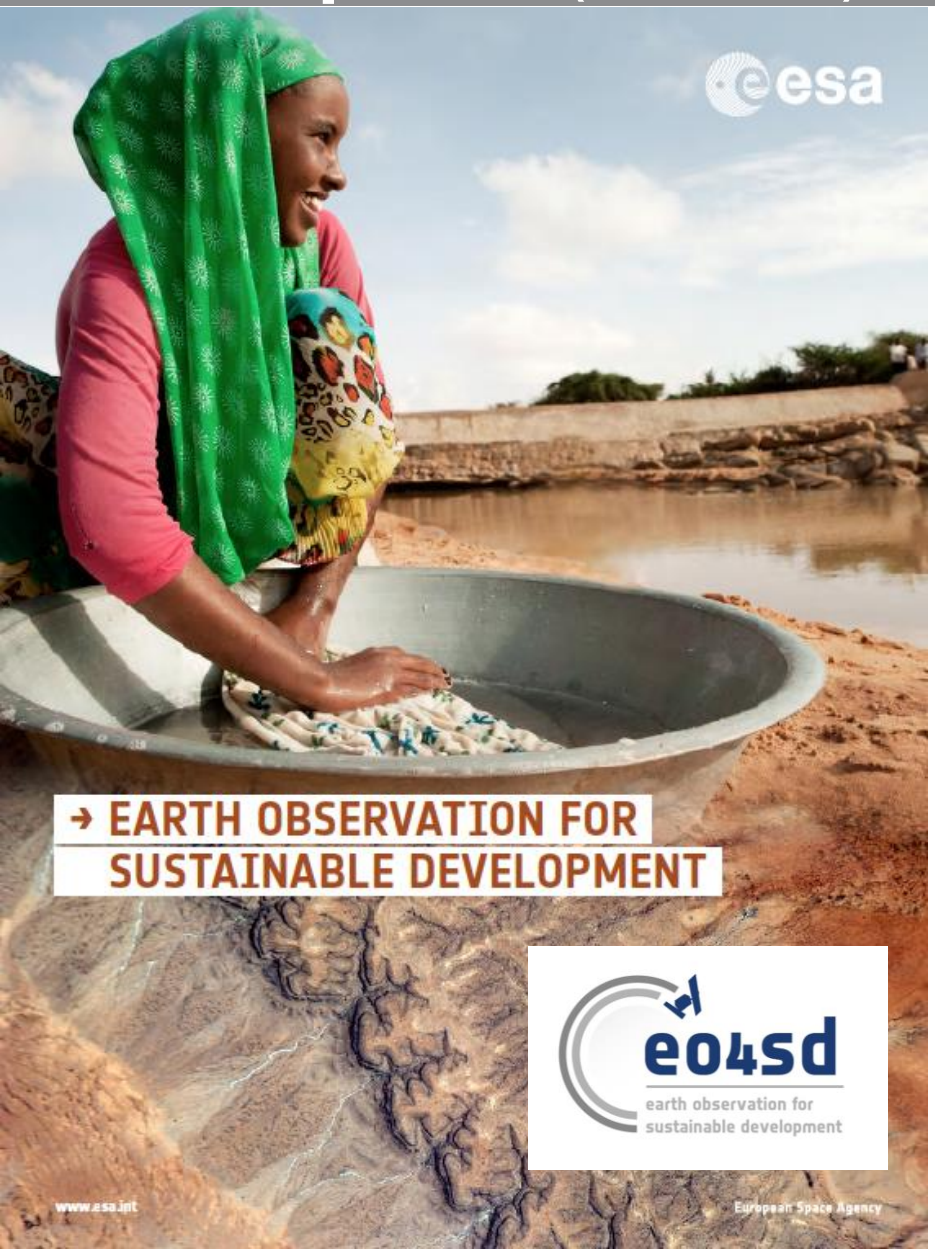
- EO based information services provide objective baselines and are key for the monitoring of terrestrial & marine environmental systems,
- EO facilitates a deeper level of understanding of the stocks and flows of ecosystems and interactions with human environment.



What we learnt…

- Very limited local EO expertise, potential to build capacity of **national EO and GIS providers in developing countries,**
- **Open source customised GIS tools** improve access and reduce costs, free Sentinel-1 and Sentinel-2 data is game-changing,
- The **complexity of data, products and tools** a barrier even for experienced users => high interest but more awareness/training needed,
- **Statistical offices** emerge as new user community.

Longer-Term Vision : EO for Sustainable Development *(next 5-8 years)*



- **Phase 1** (3 years**) : Consolidate Requirements,** engage stakeholders (IFIs & Client States) via regional demonstrations of EO.
- **Phase 2** (5 years**) : Mainstream & Transfer EO** into operational working processes & financing of ODA as 'best-practice' source of environmental information in Environmental Safeguards Systems (ESS) and Monitoring & Evaluation (M&E) methodologies.
- **Priority thematic areas :**

  Urban, Marine & Coastal, Agriculture, Risk Management, Energy & Extractives, Water Resources, Forest, Ecosystems Services, Fragile & Conflict States, Climate Resilience & Proofing.

EO4SD : Ecosystems Activity

Planning & Way Forward

Timeframe

- Q2 2018 – Q2021

Main Thematic Issues

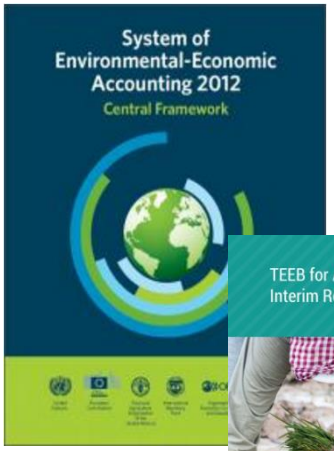
- Ecosystems services
- Natural Capital Accounting

Geographical focus areas

- 3 regions, TBD

Main target stakeholders

- The IFIs (WBG, ADB, IADB, IFAD,…)
- The GEF Programs and Agencies (CI, IUCN, WWF…)
- Existing initiatives and platforms (WAVES, SEEA, …)



Thank You for your Attention !

Earth Observation
A Necessity

Product & Production Management

Forest Mapping for REDD in Liberia: 2013 - 2015

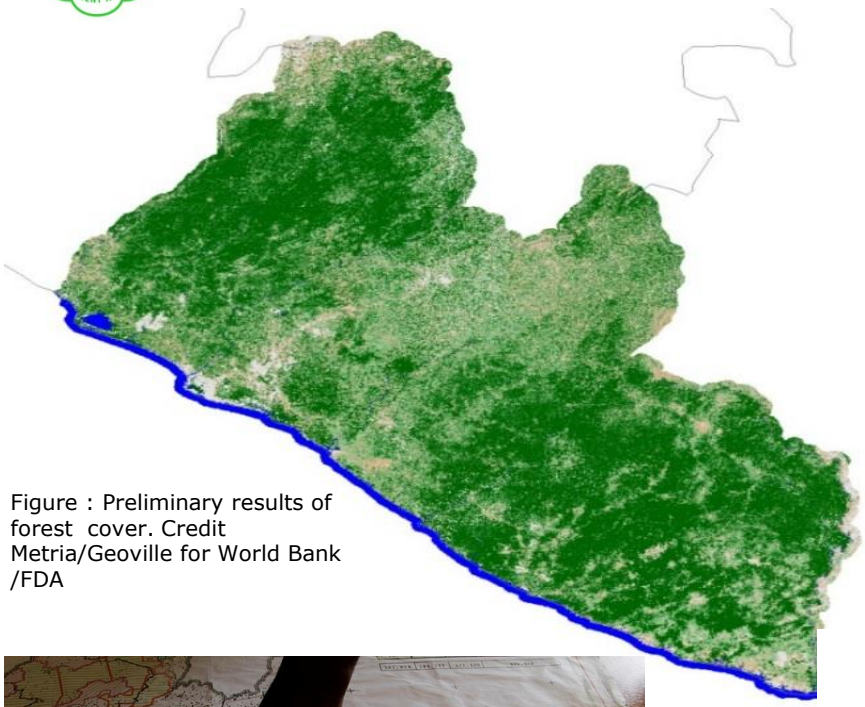
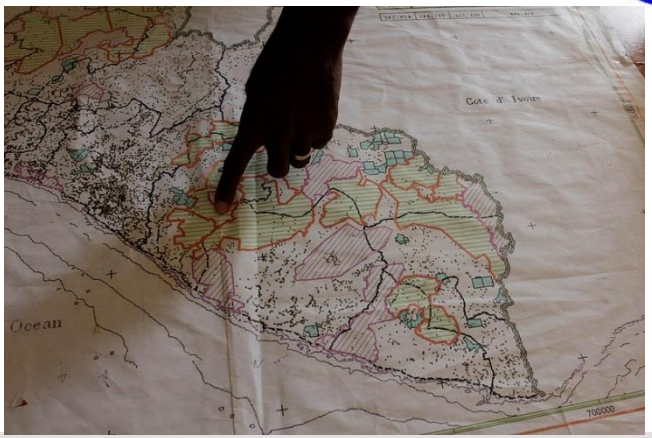


Figure : Preliminary results of forest cover. Credit Metria/Geoville for World Bank /FDA

Forest domain	• **Forest >80%** • **Forest 30-80%** • **Forest <30%**

Rural, agricultural and particular domain	• Mangrove & swamps
	• Settlements
	  • Urban (>2500 inhabitants)
	  • Rural (< 2500 inhabitants)
	• Surface Water Bodies
	• Grassland (Savannah) & Shrubs
	• Bare soil
	• Ecosystem complex (rocks & sand)
	• Slope classes (<10%, 10-20 %, 20-30 %, >30 %)
	• Elevation classes

Infrastructure	• Road and railway network
	  • Primary road (paved)
	  • Secondary road (unpaved)
	  • Tracks (backroads)
	  • Railways



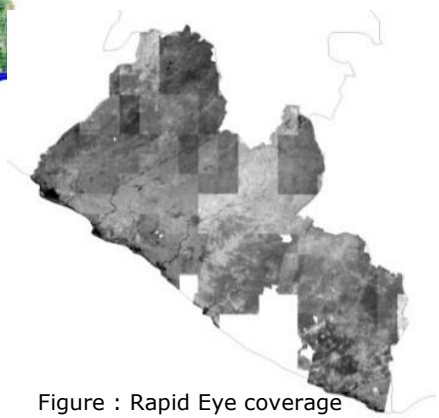


Figure : Rapid Eye coverage 2011-2013

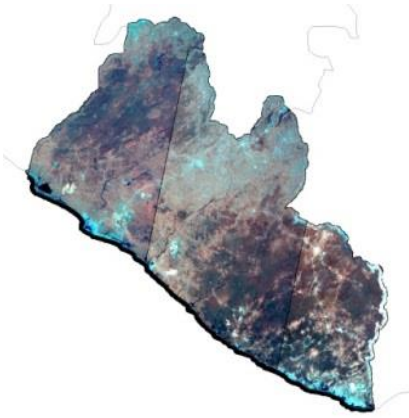
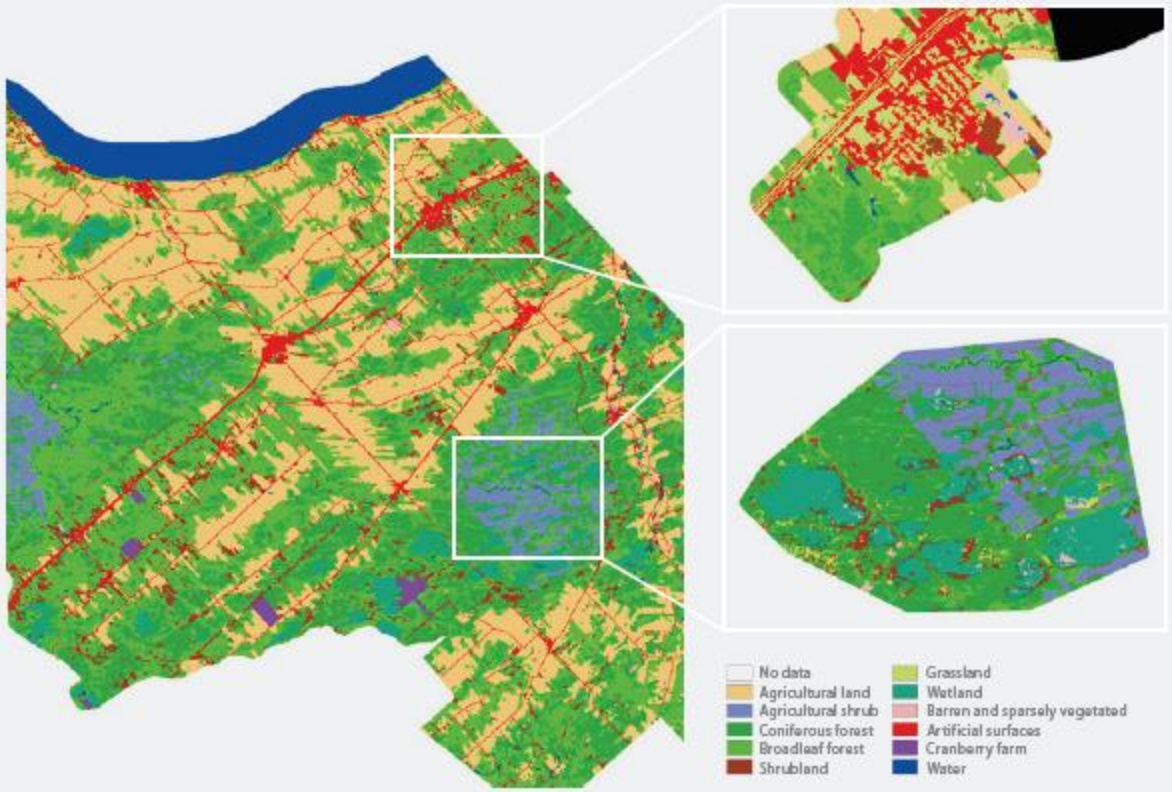


Figure : Landsat 8 coverage Dec 2014-Jan 2015

Ecosystem Assessment To Support The Québec Land Account Statistical Infrastructure, Canada



↑ Medium resolution land cover mapping of the year 2011 for the entire Chaudière-Appalaches region (left) and detailed high resolution land cover mapping for the Wetland complex of Saint-Gilles and Saint-Agathe (right) and the buffer zone around the urban perimeter of Saint-Apollinaire.
© GeoVille

The Chaudière-Appalaches region in Québec is a highly diverse region covered with mixed land cover types

↓

EO methods were used in one of the SEEA Experimental Ecosystem Accounting to give inputs to future ecosystem services assessment, including assessment models