Workshop on Land Productivity Indicators in Drylands,

organised by the ESA Diversity II project

| UNCCD secretariat | UN Campus, Bonn | 7-9 July 2014 |

Marc Paganini,
European Space Agency
Directorate of Earth Observations Programs

The European Space Agency

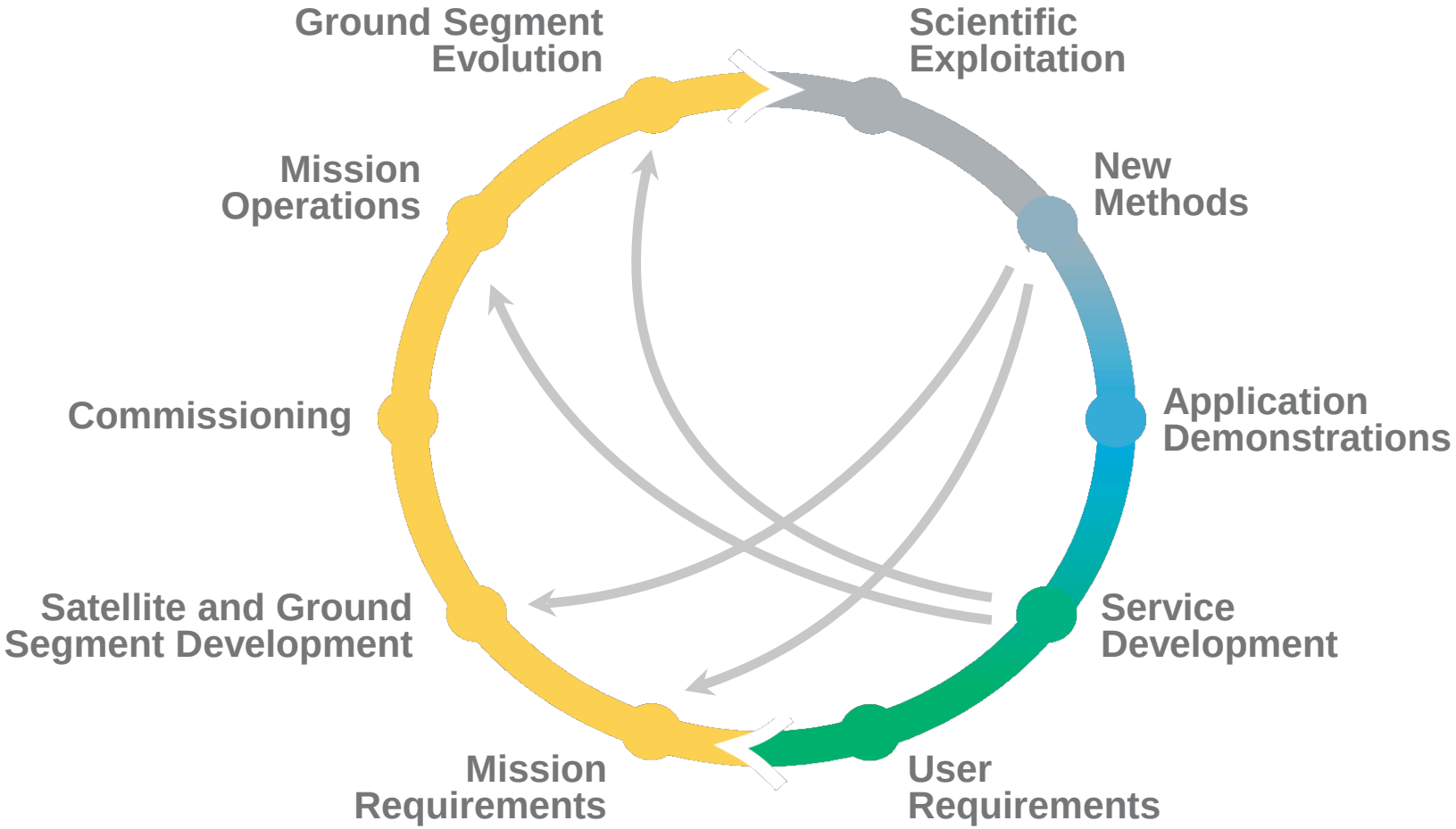
"To provide for and promote, for exclusively peaceful purposes, cooperation among European states in **space research** and **technology** and their **space applications**"

ESA has 20 Member States: 18 states of the EU (AT, BE, CZ, DE, DK, ES, FI, FR, IT, GR, IE, LU, NL, PL, PT, RO, SE, UK) plus Norway and Switzerland.

Seven other EU states have Cooperation Agreements: Estonia, Slovenia, Hungary, Cyprus, Latvia, Lithuania and the Slovak Republic.

Canada takes part in some programmes under a Cooperation Agreement.

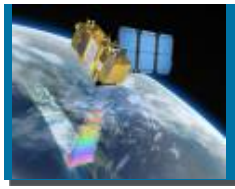
ESA mandate, from satellite mission development to exploitation



| *scientific* excellence | advanced *technologies* | high-quality *global observations* |
| innovative *applications* | sustainable *services* |

The European Copernicus initiative, satellite data access on the long term

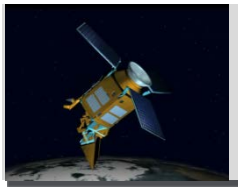
Sentinel 1 – SAR imaging
All weather, day/night applications, interferometry
2014 / 2015



Sentinel 2 – Multi-spectral imaging
Land applications: urban, forest, agriculture,…
Continuity of Landsat, SPOT
2015 / 2016

Sentinel 3 – Ocean and global land monitoring
Wide-swath ocean color, vegetation, sea/land surface temperature, altimetry
2015/ 2016

Sentinel 4 – Geostationary atmospheric
Atmospheric composition monitoring, trans-boundary pollution
2019



Sentinel 5 & precursor – Low-orbit atmospheric
Atmospheric composition monitoring
(S5 Precursor launch in 2016)
2019

Long term EO data to better monitor our Planet

(*)

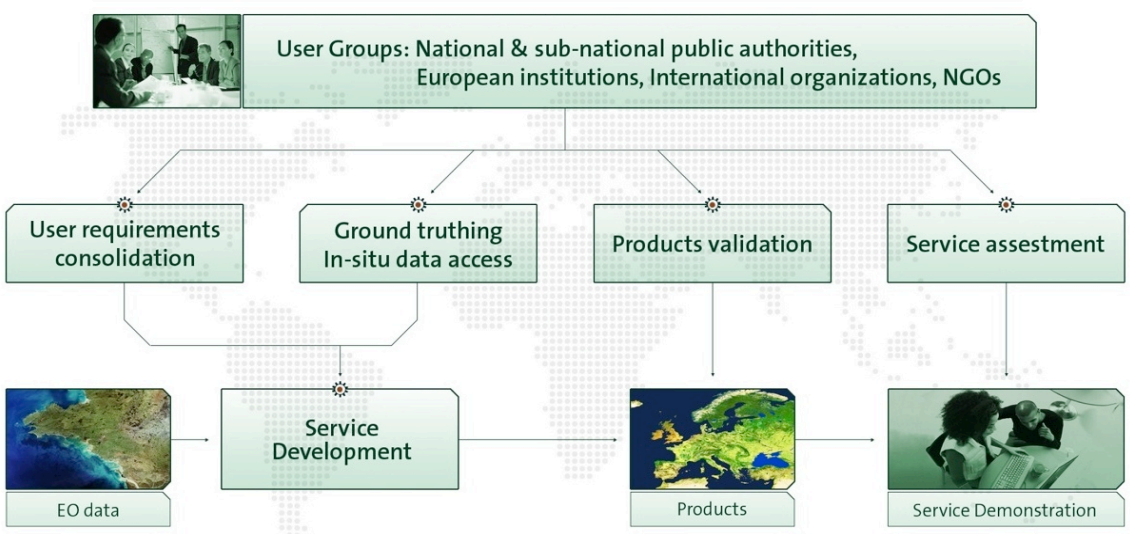
European Space Agency

* Joint EU/ESA Data Policy Principles adopted by ESA Council and by EU Parliament and Council (Nov 2013).

The Data User Element (DUE) of the ESA Earth Observation Envelope Programme (EOEP)

Program Objectives

- Create an environment for the development of **user communities**.
- Develop and demonstrate innovative information **products**.
- Support industry in establishing useful and cost effective **services**.



DUE Workplan 2013-2016

- 2 major axes of activities in EOEP-4 DUE workplan (2013-2016):
  - **Preparing** for the **large-scale production of global data sets**.
  - **Reinforcing** the ESA contribution to the implementation of the **International Environmental Conventions** (UNFCCC, UNCCD, CBD, Ramsar).
- with an **INNOVATION** element, **facilitating** innovative EO-based information services to be developed

http://due.esrin.esa.int/

Diversity II, a DUE project that contributes to the CBD and UNCCD

Contribute to the CBD (and UNCCD) programs of work of respectively inland water and drylands ecosystems,

- global assessment of the **availability of freshwater water and of its quality** with the provision of key observations over 300 large perennial inland waters (lakes and reservoirs).
- assessment of the **status and trends of drylands** with the provision of global indicators on land productivity and land condition, over a large part of the drylands (10 million km2).

diversity inland waters

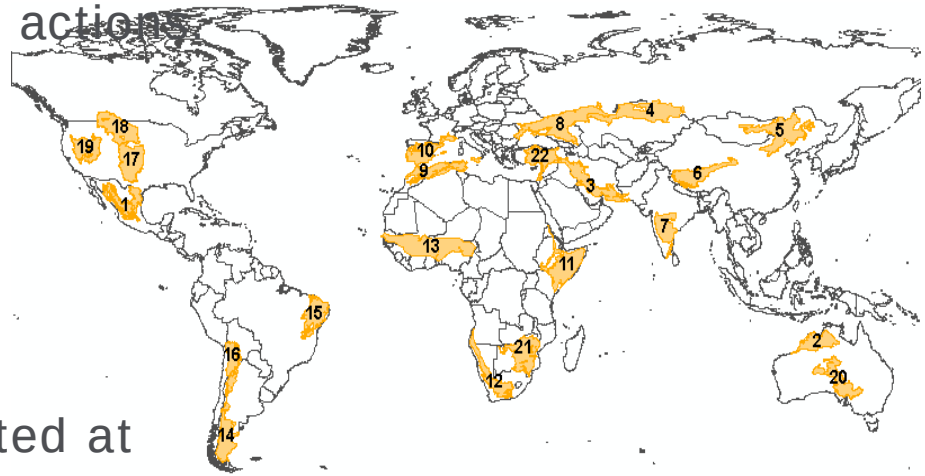
diversity drylands

Make the best use of the 10-year time series (2002-12) of 300m Land biophysical products from MERIS FR on board ENVISAT satellite

2.5 year project, 2012-2015, 1 MEUR

Diversity II, the drylands component

- Provision of key observations over a large part of the Earth drylands:
  - **Net Primary Productivity** (NPP) proxies and related indices on the land/vegetation productivity in dryland ecosystems;
  - **Water Use Efficiency** (WUE) proxies and related indices on the land/vegetation conditions (status and degradation) in dryland ecosystems;
- NPP and WUE are good proxies of the biodiversity in drylands, in particular when used in context with conservation actions
- **20 dryland areas** for a total surface of **10 million Km2**
- on a multi-year basis, for the period **2002-2012**
- **Status and trend indicators** aggregated at different spatial and temporal scales.



- Preparation for a long-term exploitation of **Sentinel 3 OLCI** and **PROBA-V**

Land Productivity Indicators in the context of the CBD

- The AICHI Biodiversity Targets of the CBD Strategic Plan for Biodiversity 2011-2020
- The Biodiversity Indicator Partnership (BIP), tracking global biodiversity
- Remote sensing products to track progress towards the Aichi targets
- The Essential Biodiversity Variables

Earth Observation for Biodiversity monitoring

The issue:

- *Limited use of RS for biodiversity monitoring due to data and analytical constraints but also to a lack of adequate connection between user needs and opportunities provided by RS data.*

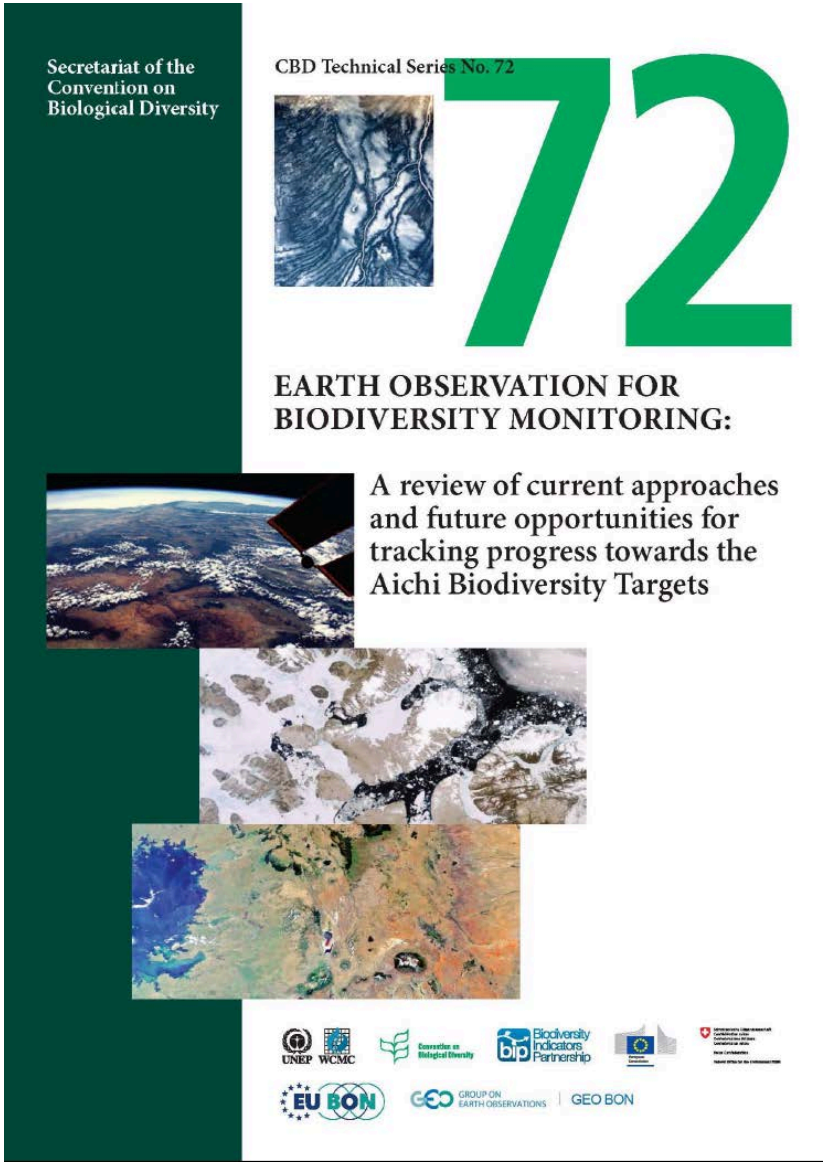
The overarching objectives:

- *Understand main obstacles and identify opportunities for greater use of Remote Sensing in biodiversity monitoring.*

CBD Technical Series No 72

Earth Observation for Biodiversity monitoring,

A review of current approaches and future opportunities for tracking progress towards the Aichi Biodiversity targets



Role of EO to monitor progress towards the Aichi Targets

Strategic Goal	Aichi Biodiversity Target	Current remote sensing adequacy		
A	1. Awareness of biodiversity values	●		
	2. Integration of biodiversity values	●		
	3. Incentives	●		
	4. Sustainable production and consumption		●	
B	5. Habitat loss, fragmentation and degradation			●
	6. Sustainable exploitation of marine resources		●	
	7.Biodiversity-friendly agriculture, forestry and aquaculture		●	
	8. Pollution reduction			●
	9. Control of invasive alien species		●	
	10. Coral reefs and other vulnerable ecosystems		●	
C	11. Protected areas			●
	12. Prevented extinction of threatened species		●	
	13. Genetic diversity of socio-economically and culturally valuable species	●		
D	14. Ecosystem services			●
	15. Ecosystem resilience		●	
	16. Access and benefit sharing	●		
E	17. NBSAPs	●		
	18. Traditional Knowledge and customary use	●		
	19. Biodiversity knowledge improvement and transfer	●		
	20. Resource mobilisation	●		

- 11 out of 20 Aichi Targets could be (partially/largely) derived from RS observations
- 54 out of 99 indicative indicators (CBD decision XI/39) could be partially or largely derived from RS observations

● Currently not observable by EO-based approach but some of the targets under this category maybe technically feasible in the future;

● Could be partially derived from EO-based information or EO-based approaches currently in development;

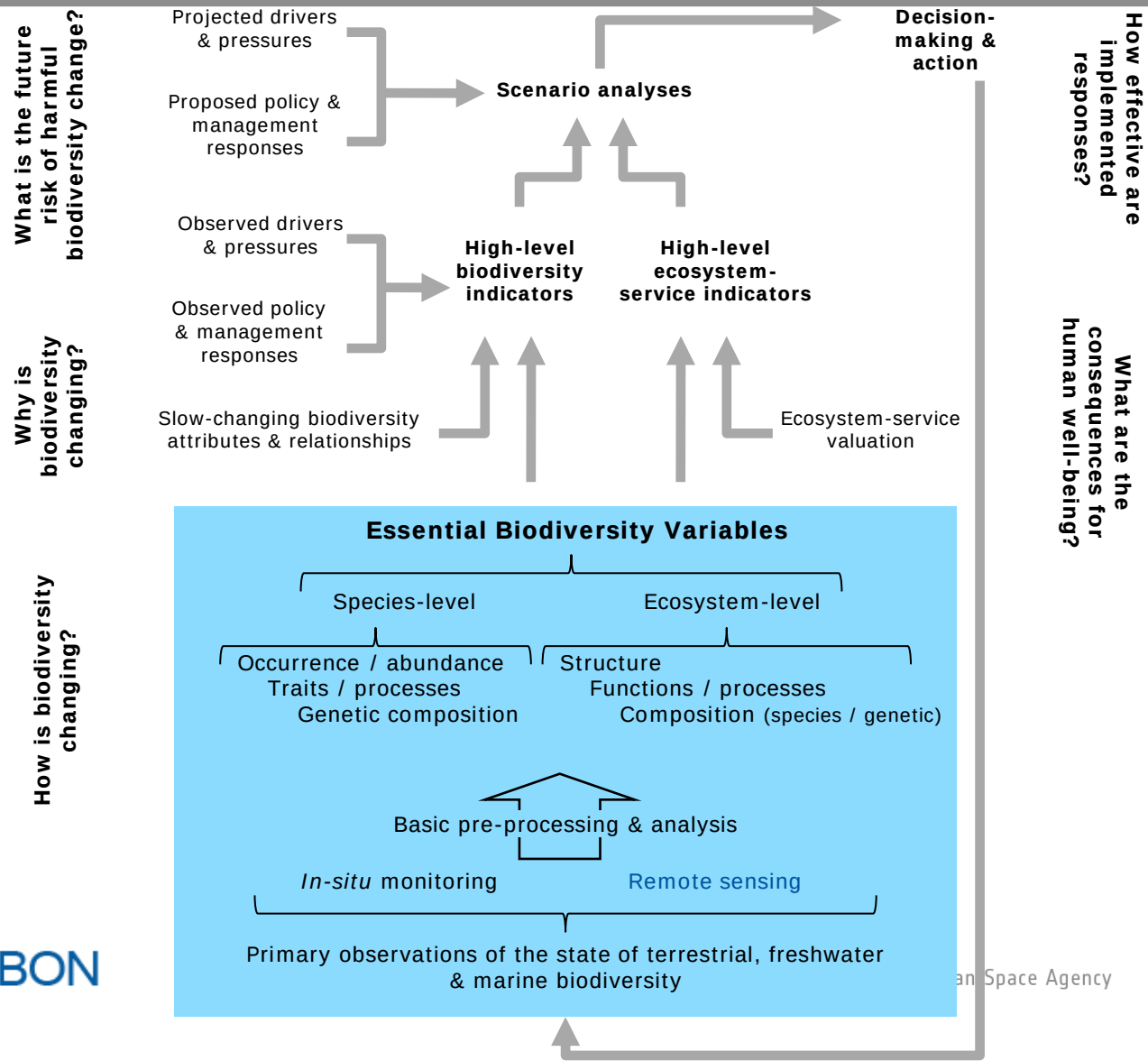
● Can be totally or partially derived from existing EO-based information.

2020 Aichi Targets, a framework for actions on biodiversity

The Essential Biodiversity Variables

EBV characteristics

- Ability to detect change
- Quantifiable
- Repeatable
- Allow aggregation and disaggregation
- Biological
- Emphasis on State



GROUP ON EARTH OBSERVATIONS | GEO BON

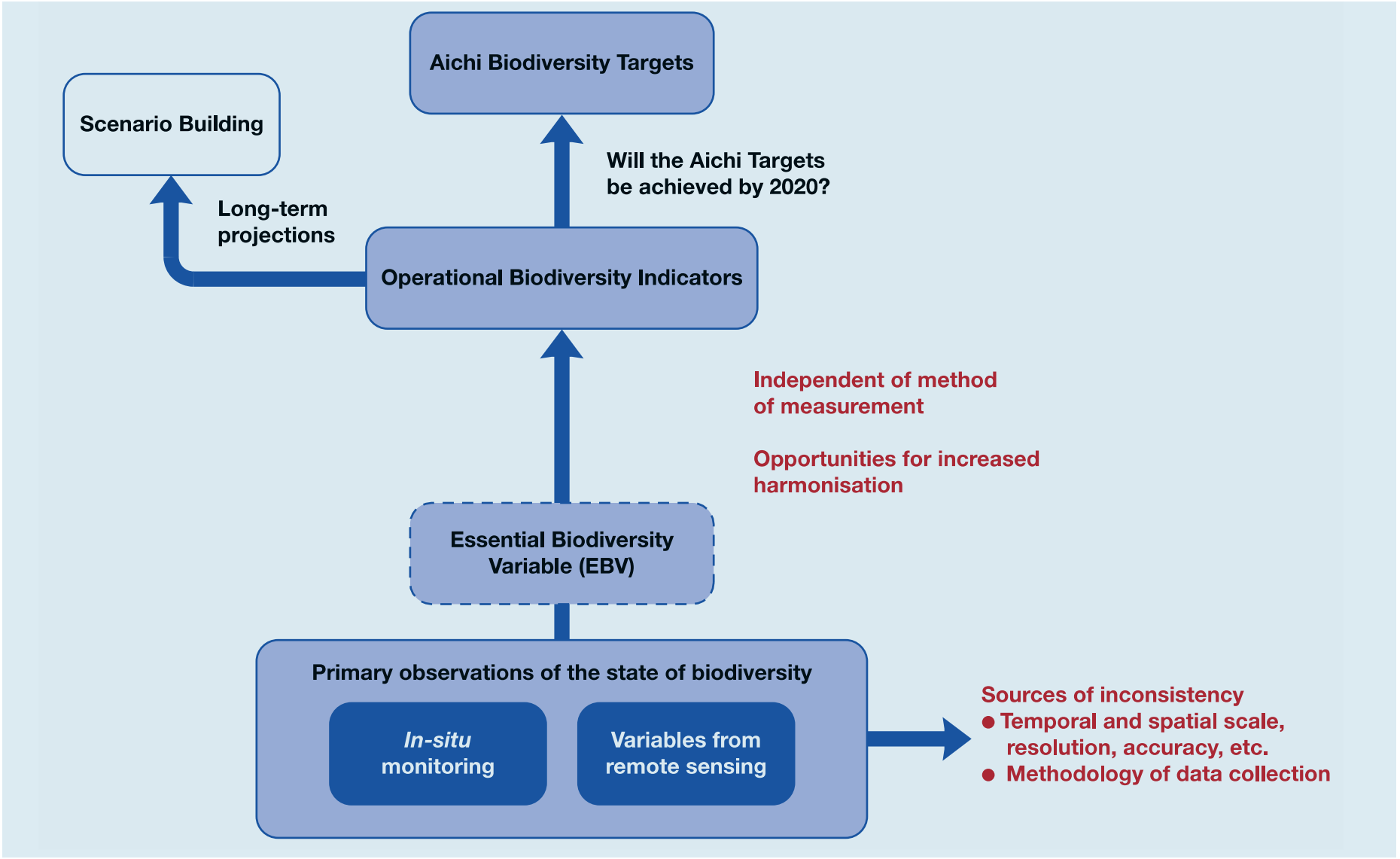
an Space Agency

Net Primary Productivity, an essential EBV

EBV Class	EBV	Measurement & scalability	Temporal Sensitivity	Feasibility	Relevance & related CBD 2020 targets
Ecosystem Function	**Net primary productivity**	Global mapping with modelling from remote sensing observations (fAPAR, ocean greenness) and selected *in situ* locations (eddy covariance).	<=1 year	A network of regional networks of *in situ* measurements exists (FLUXNET), and some global maps based on models and remote sensing are available. GCOS is also addressing this EBV.	Indicator of the energy flow through ecosystems and a **measure of health/degradation; ecosystem states;** Targets: 5, 8, 14.

(*) Extract from GEO-BON candidate EBVs, www.earthobservations.org/geobon_ebv

Pathway from EO to indicators for the Aichi Targets, the role of EBVs



Land Productivity Indicators in the context of the UNCCD

- The Strategic Objectives of the UNCCD 10-year Strategic Plan (2008-2018)
- The Progress indicators for the monitoring and assessment of impacts

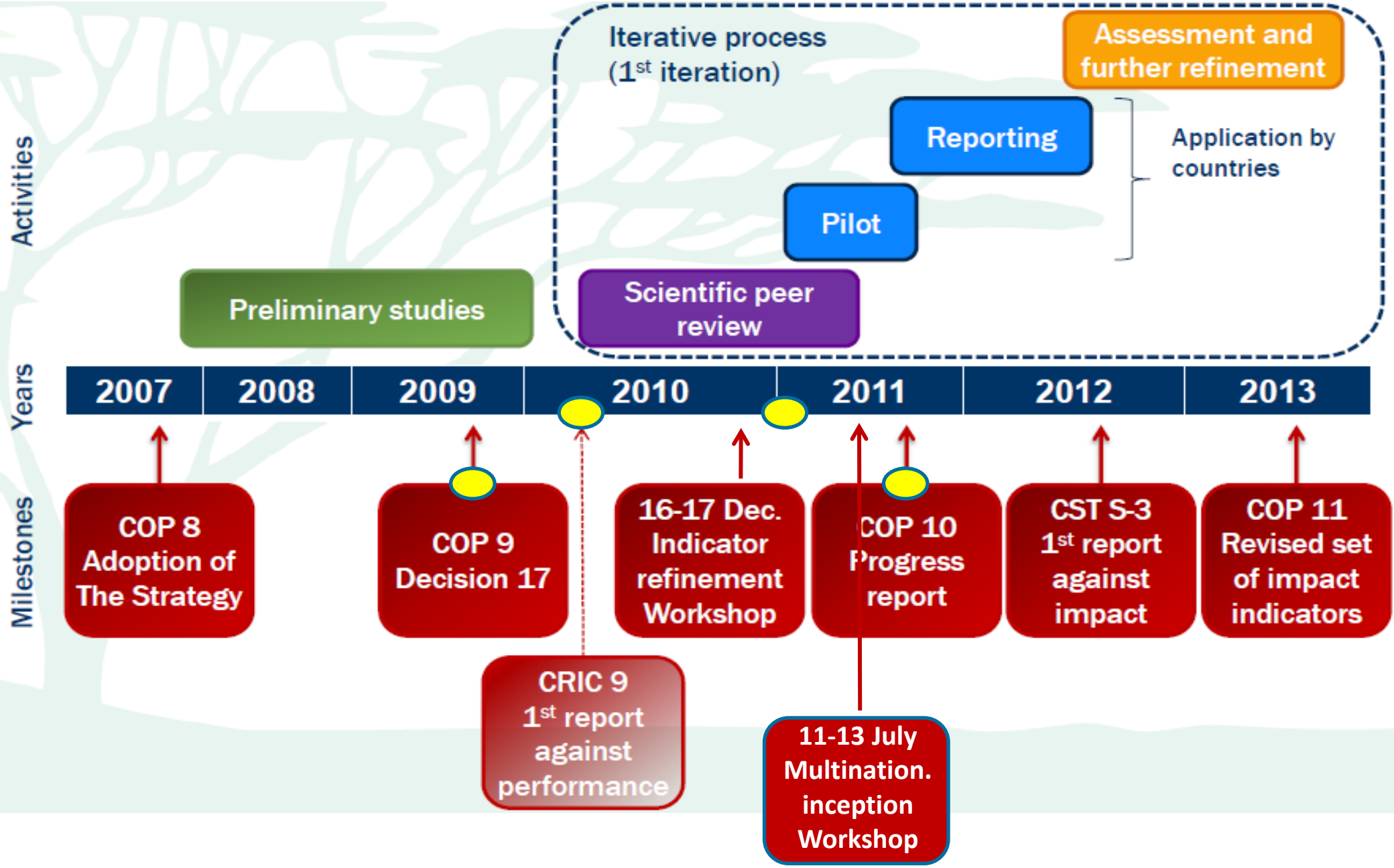
UNCCD 10-year Strategic Plan (2008-2018)

Strategic Objective 1: To improve **living conditions** of affected populations.

Strategic Objective 2: To improve the **conditions of the ecosystems**.

Strategic Objective 3: To generate **global benefits** through effective implementation of the Convention.

Progress indicators (metrics/proxies) for the monitoring and assessment of impact


Activities
Years
Milestones
Iterative process
(1st iteration)
Assessment and further refinement
Reporting
Application by countries
Pilot
Scientific peer review
Preliminary studies
2007
2008
2009
2010
2011
2012
2013
COP 8 Adoption of The Strategy
COP 9 Decision 17
16-17 Dec. Indicator refinement Workshop
COP 10 Progress report
CST S-3 1st report against impact
COP 11 Revised set of impact indicators
CRIC 9 1st report against performance
11-13 July Multination. inception Workshop

Strategic objective 1: To improve the living conditions of affected populations				
Core indicator S-(1/2/3): Improvement in the livelihoods of people potentially impacted by the process of DLDD	**III Proportion of the population living above the relative poverty line**	Rural poverty rate**	High	Green
	I Water availability per capita	Percentage of population with access to (safe) drinking water	Medium	Yellow
		Water availability and use	Low***	Yellow
	IV Food consumption per capita	Proportion of chronically undernourished children under the age of 5 in rural areas**	High	Yellow
Strategic objective 2: To improve the condition of ecosystems				
Core indicator S-4: Reduction in the total area affected by DLDD	VI Degree of land degradation	A less complex version of Level of land degradation + Trends in seasonal precipitation	High	Yellow
	VIII Drought index	Trends in WMO Standardized Precipitation Index (SPI) (a meteorological drought index)	(new)	Green
	V Capacity of soils to sustain agro-pastoral use	GLADIS "Soil Health Status"	(new)	Green
	II Change in land use	Land use (in support of deriving (a) VI Land degradation and (b) XI Land under SLM, and also in interpreting (c) IX Land cover status)	Low***	Yellow
Core indicator S-5: Maintenance of or increases in ecosystem function, including net primary productivity	**IX Land cover status**	Land cover**	High	Green
		Land productivity	Medium	Green
	VII Plant and animal biodiversity****	Crop and livestock diversity (agro-biodiversity)	High	Yellow
		Trends in abundance and distribution of selected species	High	Yellow
		Soil biodiversity	(new)	Red
Strategic objective 3: To generate global benefits through effective implementation of the UNCCD				
Core indicator S-6: Increases in carbon stocks (soil and plant biomass)	X Carbon stocks above and below ground	Above ground organic carbon stocks	High	Yellow
		Below ground organic carbon stocks	High	Red
Core indicator S-7: Areas of forest, agricultural and aquaculture ecosystems under sustainable management	XI Land under SLM	Land under SLM + general indicator VII Plant and animal biodiversity (secondary role) + II Change in land use	High	Yellow
	V Capacity of soils to sustain agro-pastoral use	GLADIS "Soil Health Status"	(new)	Yellow

COP-11 decision: from 11 impact indicators to 6 progress indicators indicators

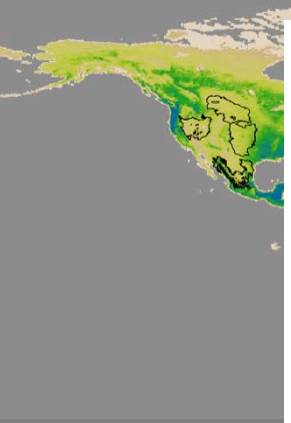
Indicator	*Metrics/Proxies*	*Description*	*Potential data source/Reference methodology*
Strategic objective 1: To improve the living conditions of affected populations			
Trends in population living below the relative poverty line and/or income inequality in affected areas	**Poverty severity (or squared poverty gap)** *or* **Income inequality**	Takes account of both the distance separating the poor from the poverty line and the inequality among the poor Alternative to the poverty severity metric for those countries where poverty is no longer an issue; strategic objective 1 has in this sense already been reached	World Bank methodology[a, b] OECD* methodology[c]
Trends in access to safe drinking water in affected areas	**Proportion of population using an improved drinking water source**	An improved drinking water source is defined as one that is protected from outside contamination through household connection, public standpipe, borehole, protected dug well, protected spring, rainwater, etc.	WHO/UNICEF* Joint Monitoring Programme for Water Supply and Sanitation methodology[d]

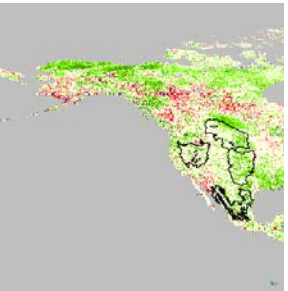
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Strategic objective 2: To improve the condition of ecosystems			
Trends in land cover structure	**Vegetative land cover structure**	Intended as the distribution of land cover types of greatest concern for land degradation (excluding artificial surfaces) by characterizing the spatial structure of vegetative land cover; it should include and specify natural habitat classes	Sourced from products like GlobCover[e, f] or finer-resolution products under development (Gong et al., 2013); and following established land cover classifications (e.g. FAO/ UNEP LCCS*[g])
Trends in land productivity or functioning of the land	**Land productivity dynamics**	Based on long-term fluctuations and current efficiency levels of phenology and productivity factors affecting standing biomass conditions	New World Atlas of Desertification methodology;[h] update foreseen every five years

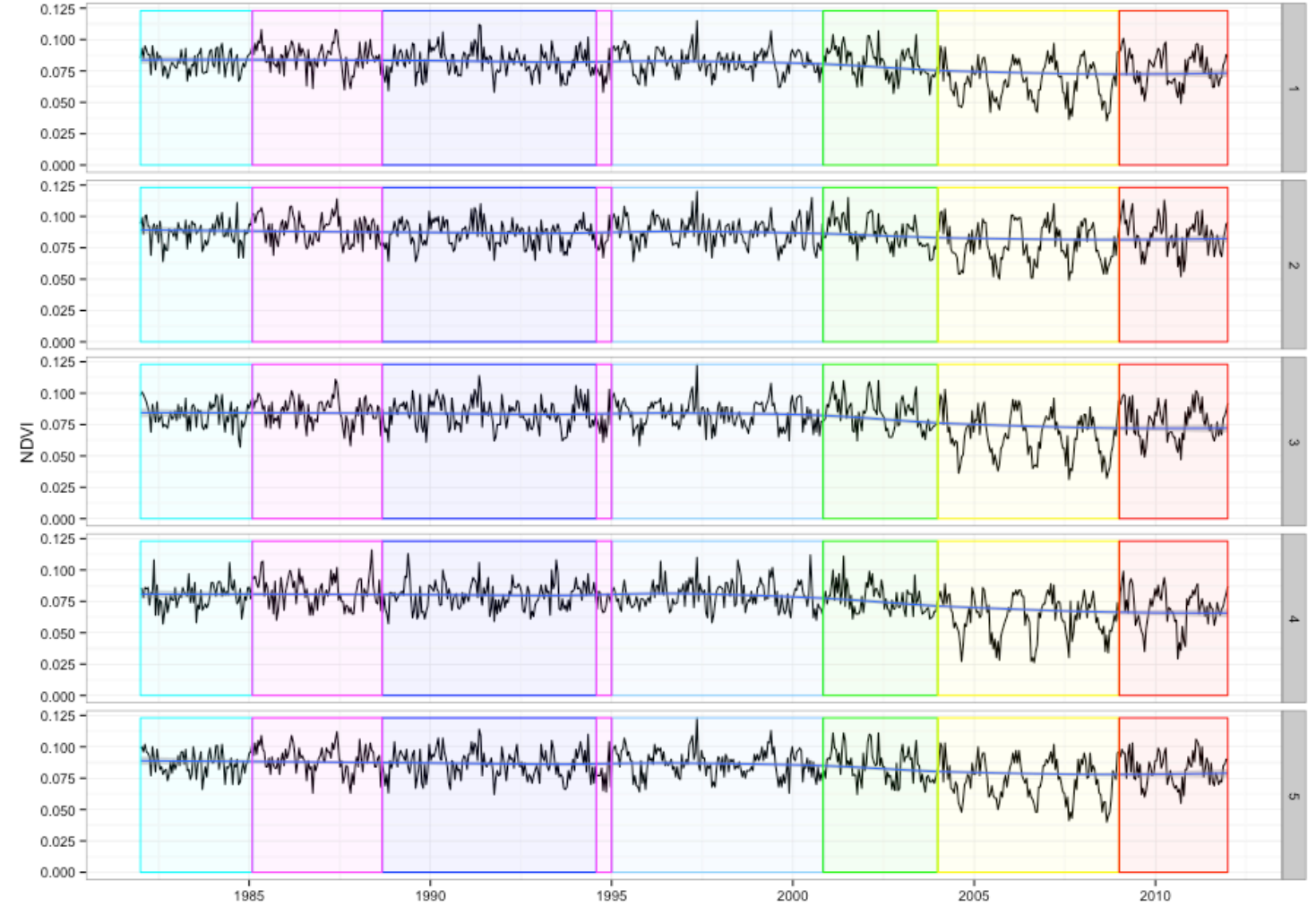
The Diversity II approach to Land Productivity Indicators

- NPP proxies derived from phenological indices of long-time series of fAPAR from the 300m ENVISAT MERIS FR

GIMMS NDVI time series 1982 - 2010







GIMMS

GIMMS NDVI vegetation Year Trends
1982 - 2010

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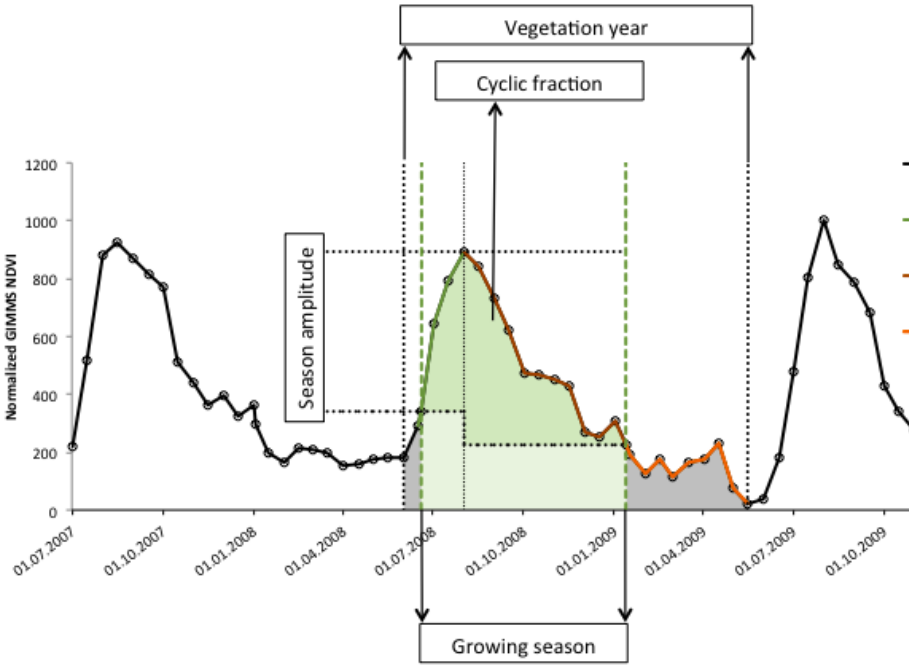
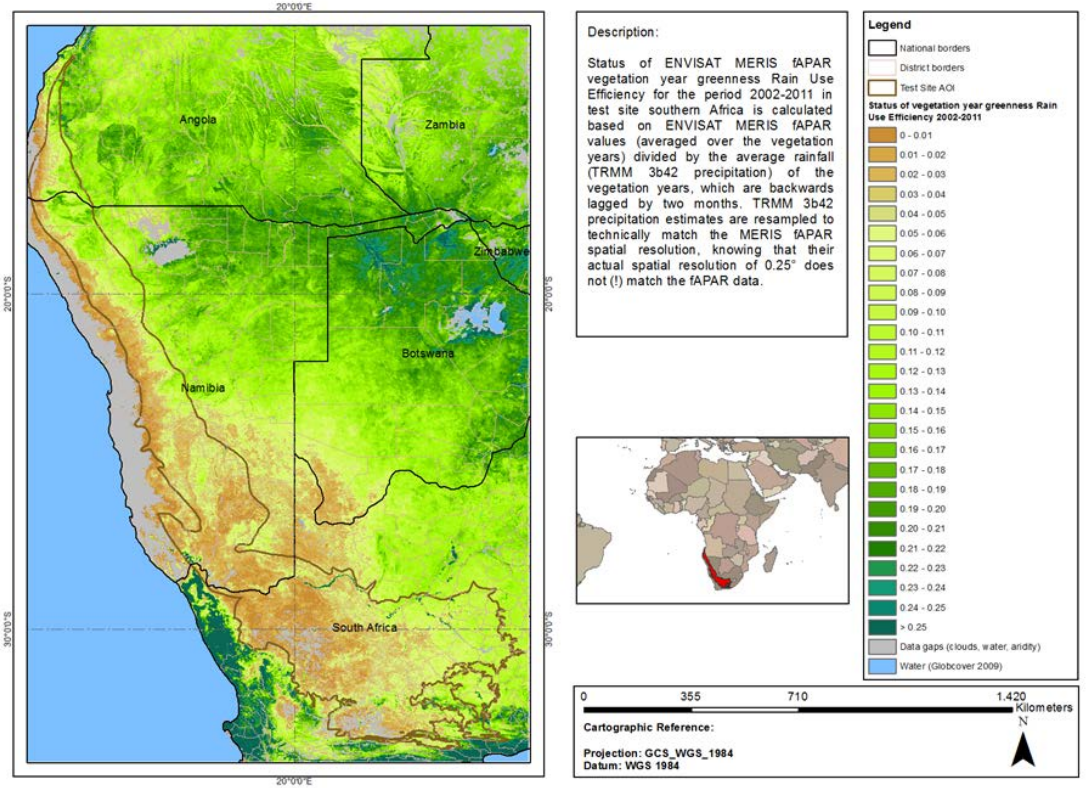
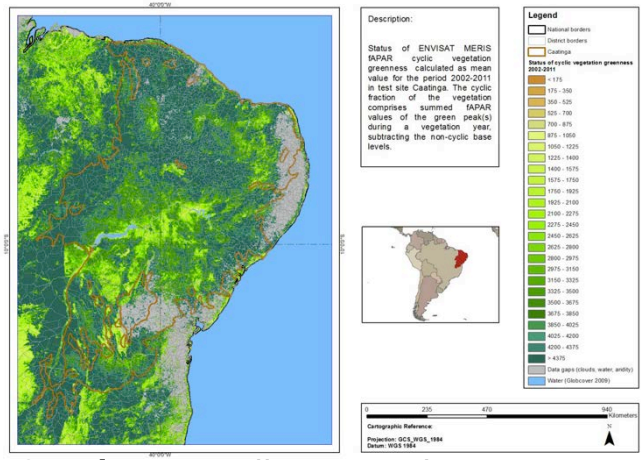
Phenological approaches to NPP proxies



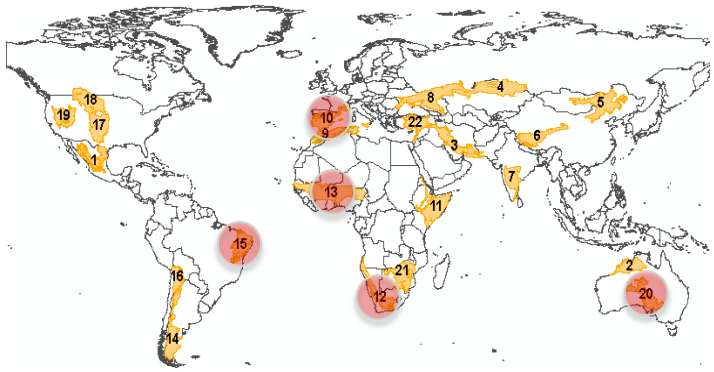


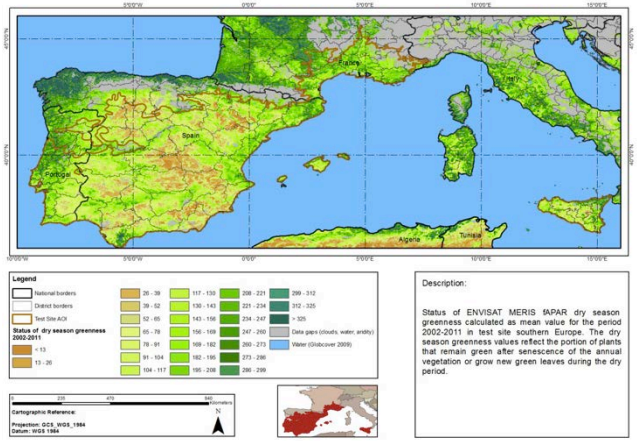
Extraction of phenological descriptors and periods of NPP proxies (fAPAR)

Preliminary Dryland Products Booklets on 5 test sites.

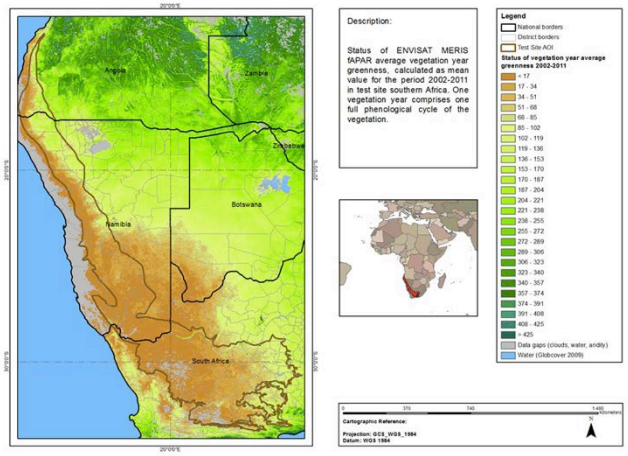


Caatinga, Cyclic Vegetation Greenness, 2002-2012

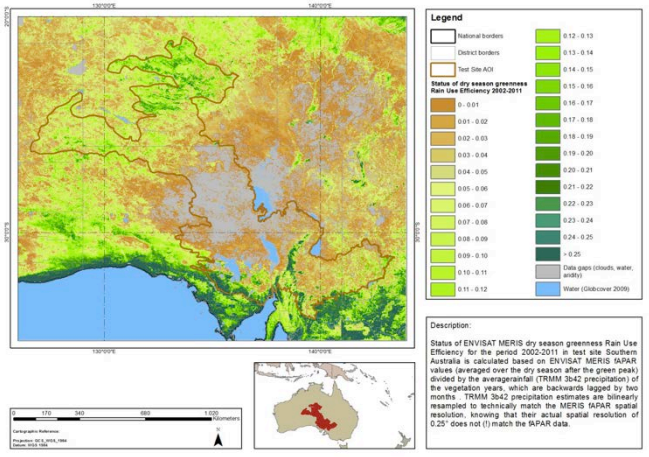




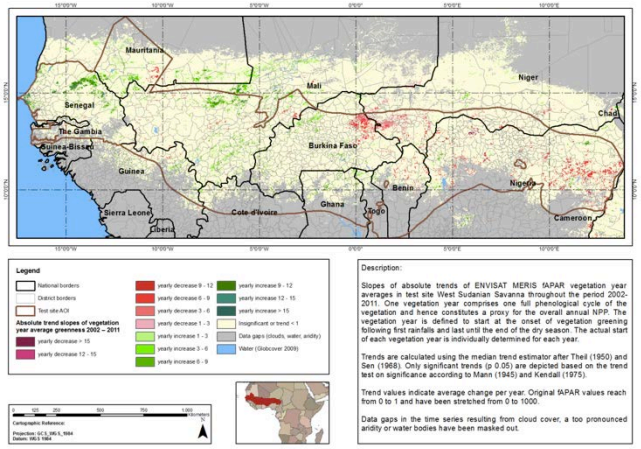
Iberian Peninsula, Dry Season Greenness, 2002-2012



South Western Africa, Average Vegetation Year Greenness, 2002-2012



Central Southern Australia, Dry Season Rain Use Efficiency Status, 2002-2012



Western Sahel, Vegetation Year Greenness Trend, 2002-2012

Objectives of the workshop on land productivity indicators in drylands

The **workshop** is an opportunity for stakeholders in drylands to:

- **Get detailed insights** into the **approaches and results** of Diversity II dryland products;
- **Express suggestions and concerns** for further elaboration of the Diversity II dryland products' specifications;
- **Align product properties** with UNCCD and CBD requirements (2nd order indicators);
- **Share scientific experiences** "across borders" both geographically and thematically;
- **Build synergies** amongst on-going and up-coming initiatives;
- **Learn** about **future opportunities** (including future sensors and data policies);
- **Establish partnerships** and **coordinated approaches** on further developments and future work (in particular in relation to the new sensors);

Monday, July 7, afternoon (part 1) **Welcome, Workshop Objectives, Diversity II project overview**		
14:00 – 14:20	Introduction, welcome, objectives of the meeting	Marc Paganini, *European Space Agency*
14:20 – 14:35	Short tour through the agenda and logistics	Carsten Brockmann, *Brockmann Consult* Ute Gangkofner, *Geoville*
14:35 – 14:45	Tour de table	all
14:45 – 15:45	DIVERSITY II project overview Work of CIBIO on validation approaches using large scale species modelling and in situ data	Carsten Brockmann, *Brockmann Consult,* João Carlos Campos, *CIBIO*
15:45 - 16:00	Coffee Break	
Monday, July 7, afternoon (part 2) **EO information needs related to Land Productivity Indicators of UNCCD and CBD**		
16:00 - 16:20	The use of Land productivity as an indicator for the UNCCD reporting process and to monitor Land Degradation Neutrality	Victor Castillo, *UNCCD secretariat*
16:20 - 16:40	CBD information needs with a focus on dry and sub-humid lands	Ms. Sakhile KOKETSO, *CBD secretariat*
16:40 - 17:00	Overview about the role and work of GEOBON	Martin Wegmann, *University of Würzburg*
17:00 - 17:30	Wrap up of common UNCCD and CBD information needs	General discussion
17:30	End of Day 1	

Tuesday, July 8, morning **Existing EO approaches for drylands, Diversity II methods/indicators**		
08:45 - 09:00	Warm up	Whoever is there
09:00 - 09:30	Modelling NPP and NPP Proxies	Kurt Günther, *DLR*
09:30 - 10:00	Desertification; what can we learn from time series of Earth Observation data?	Rasmus Fensholt, *University of Copenhagen*
10:00 - 10:30	Non-linearities between rainfall and vegetation in drylands	Gregor Ratzmann, *Geoville*
10:30 - 10:45	Coffee Break	
11:00 - 12:30	Methods and products of Diversity II	Ute Gangkofner, *Geoville*
12:30 - 14:00	Lunch Break	
Tuesday, July 8, afternoon **Dryland productivity indicators and their potential , User/expert presentations & Discussions**		
14:00 - 16:00	The World Atlas of Desertification (WAD)	Michael Cherlet, *JRC, European Commission*
	Experience from South Africa in mapping land degradation	Graham von Maltitz, *CSIR, South Africa*
	Indicators of land degradation and desertification: a Southern African perspective	Patrik Klintenberg, *Mälardalen University*
	Discussions	all
16:00 - 16:15	Coffee Break	
16:15 - 17:30	UNCCD Indicators. Application on the Portuguese NAPCD	Lúcio Pires do Rosário, *National Focal Point for UNCCD, Portugal*
	Experiencia Proyecto ASA-INSA: Monitoramiento de sistemas agricolas familiares en el semiárido del Brazil	Aldrin Perez-Marin, *INSA, Brazil*
17:30	End of Day 2	

Wednesday, July 9, morning **Towards EO indicators serving UNCCD and CBD needs**		
08:45 - 09:00	Logistics, departure, lunch	Carsten Brockmann
09:00 - 10:00	Proposed “second order” indicators of Diversity II Discussions	Ute Gangkofner all
10:00 - 10:15	Coffee Break	
10:15 - 10:30	Near Future: EO sensors, other developments and their impacts on dryland monitoring	Marc Paganini
10:30 - 11:45	Final Discussions, suggestions continued	all
11:45 - 12:00	Concluding remarks	Marc, Ute, Carsten, whoever wants to say something
12:00	Official end of meeting, social lunch at convenience	Marc Paganini to conclude