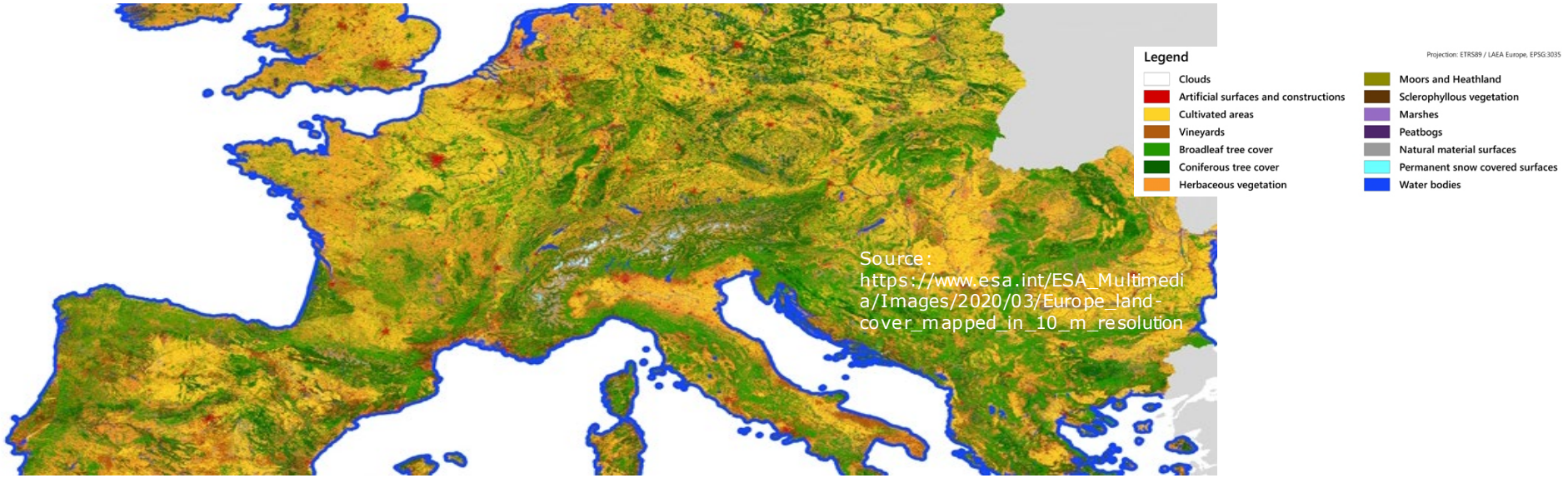
An Overview of European Research Directions in Land-Use Science

by **Ioannis Manakos**, Principal Researcher at the
Centre for Research and Technology Hellas (CERTH), Thessaloniki, Greece

Supported by **Prof. Richard Lucas**, Aberystwyth University, UK

Senior Lecturer Gregory Giuliani, University of Geneva & UNEP GRID
Geneva, CH

(and my colleague at CERTH: **Rizos-Theodoros Chadoulis**, Research Fellow)



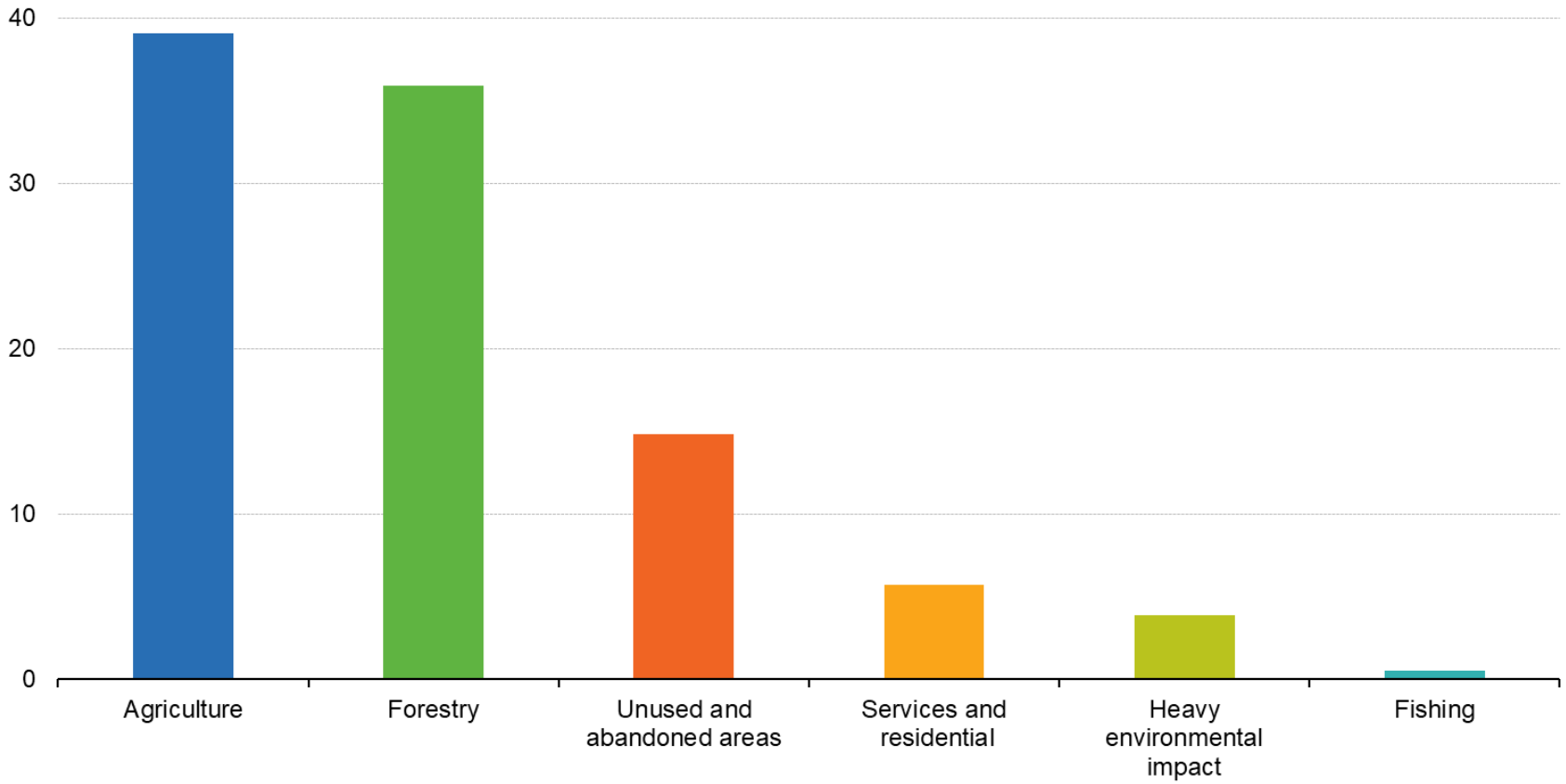
2021 -22 NASA LCLUC Science Team Meeting & Silver Jubilee Celebration

Framework I

The general picture

framework
challenges
enablers
services
outlook

Main land use by land use type, EU 2018
(% of total area)



Source: Eurostat (online data code: lan_use_ovw)

eurostat

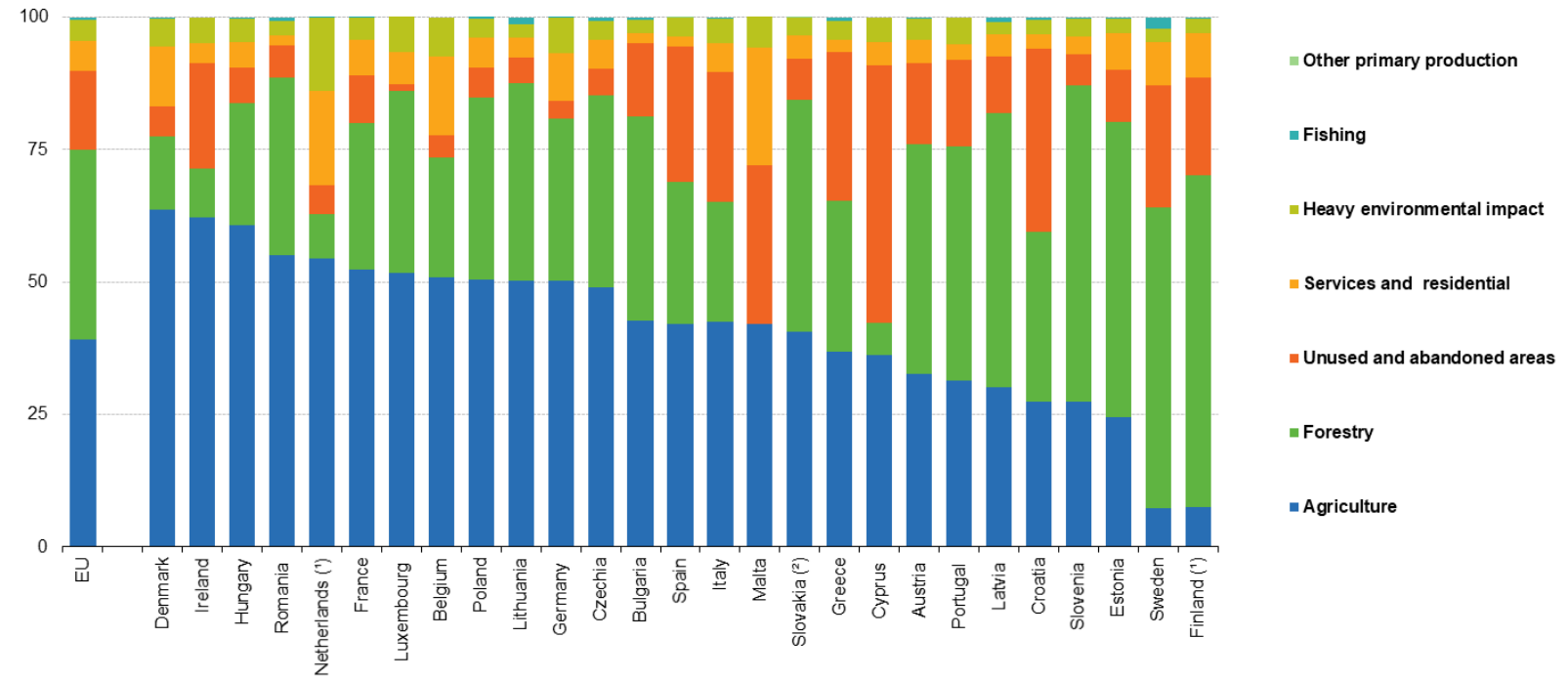
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Land_use_statistics

Framework IIa

A mosaic of nations

A mosaic of land use syntheses

Primary land use by land use type, 2018
(% of total area)



Note: ranked on the share for agriculture. Malta: forestry, not available. Cyprus, Luxembourg, Ireland, and Malta: fishing, not available. Values for other primary production for countries not listed are almost zero
(1) Fishing: low reliability.
(2) Other primary production: low reliability.
Source: Eurostat (online data code: lan_use_ovw)

eurostat

Geomorphology & Climate

have forged

culture & economic activities

on the acne of

time and evolving mentality

employing land cover to

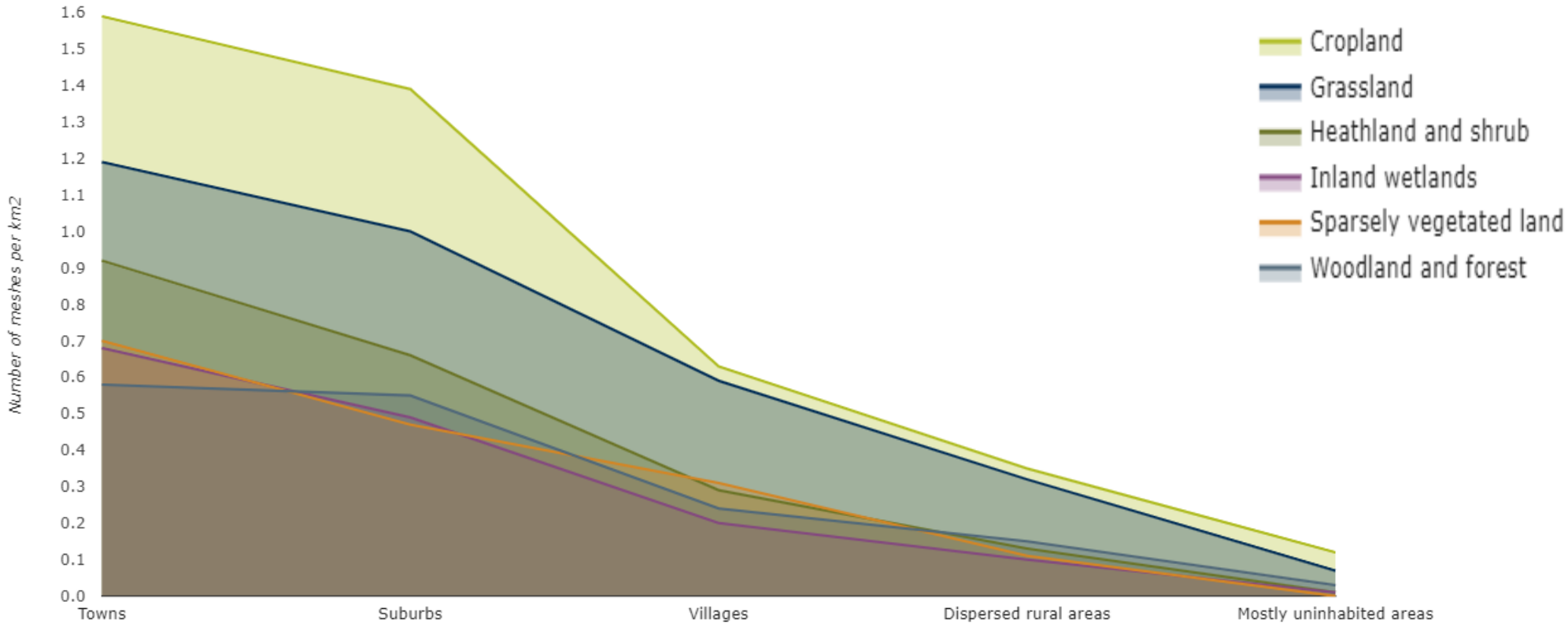
preferred (land) uses

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Land_use_statistics

Framework IIb

Landscape fragmentation

Landscape fragmentation by degree of urbanisation and MAES ecosystem type, 2018, EU-27 and the UK



https://www.eea.europa.eu/ims/landscape-fragmentation-pressure-in-europe

Framework III

Balancing with nature : A variety of ecosystems, land uses & dominating pressures

Macaronésian | Mediterranean | Black Sea | Steppic | Pannonian | Alpinae | Continental | Atlantic | Boreal

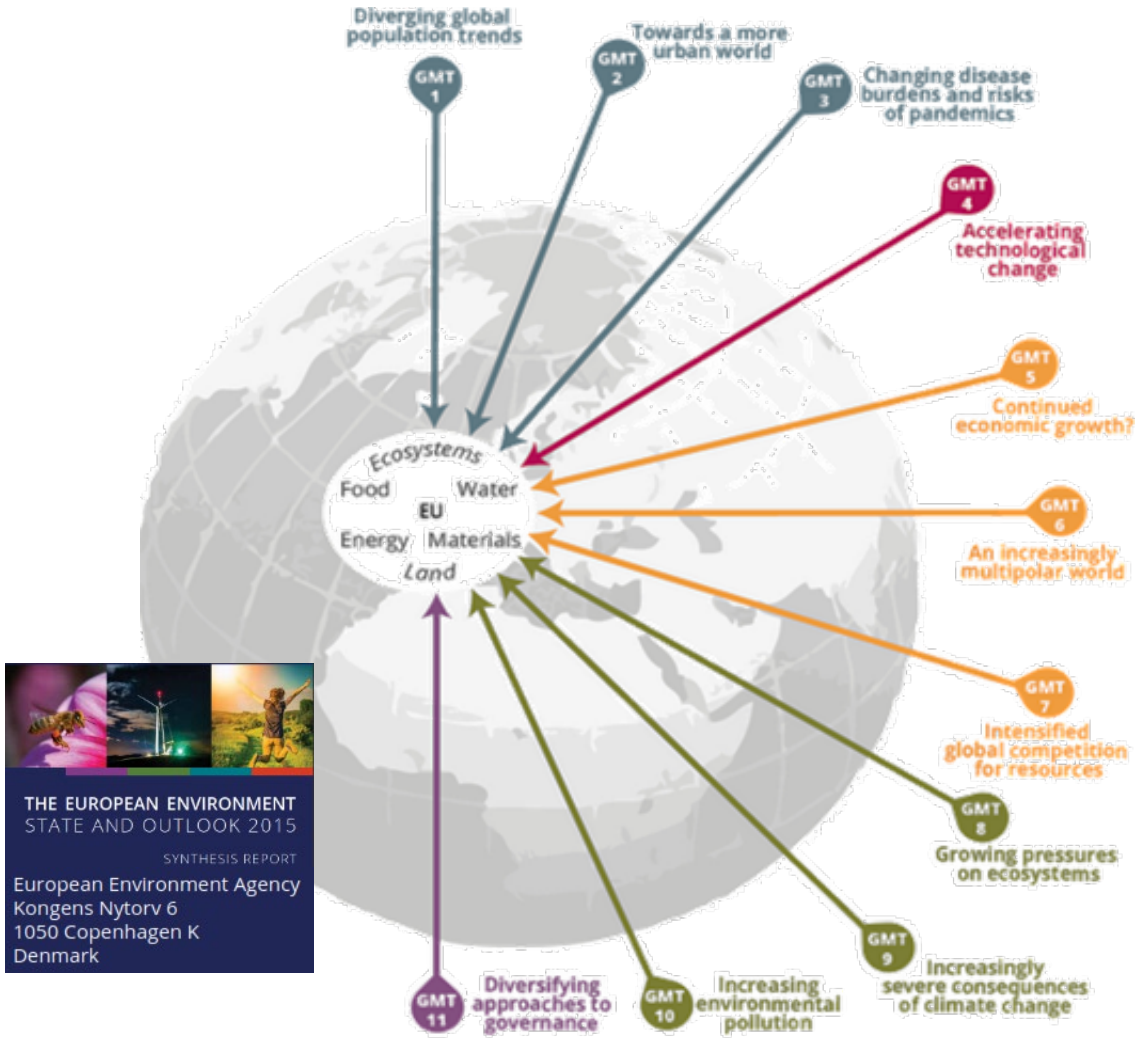
The EU has nine biogeographic regions, each with is own characteristic blend of vegetation, climate topography and geology.

Credit: © European Communities, 2009

Publications Office

Framework IV

One world, a complex environment for growth: telecouplings, globalization & (recently) slow-/ de- globalization?



CREDIT:

1. Population trends
2. Urbanization
3. Diseases
4. Global competition for resources
5. Climate change/ crisis
6. Governance frameworks

Framework V

Reaching to the real needs: how to make best use of the land?
From the society to managers to science to managers to the society

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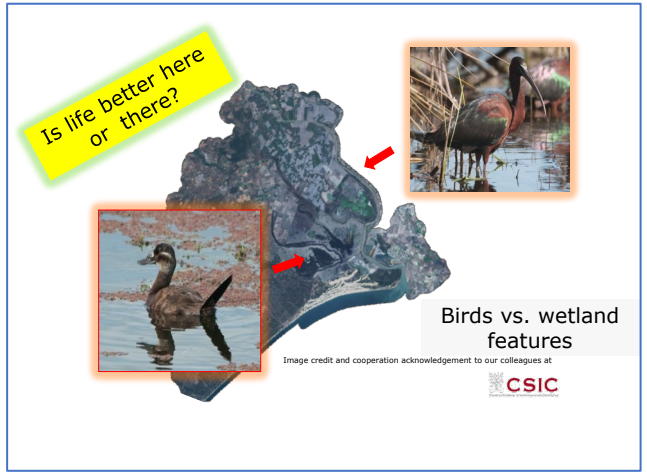
Doñana National Park
Cattle Feeding vs. Bird Nesting



Challenges I

Policies vs. challenges

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Europe's rural land faces many competing demands for the provision of food, energy and timber, as well as environmental and cultural services.

There is scarcely any true wilderness left in the EU, so the ways in which land is managed affects the quality of the environment as well as the character and social fabric of much of rural Europe.

The Common Agricultural Policy (CAP) continues to be a major driver of land use and management decisions.

Other sectoral policies, such as those promoting renewable energy, protecting biodiversity and regulating water quality and usage have an important influence too.

Source: https://ieep.eu/work-areas/agriculture-and-land-management

Challenges II

Climate crisis in deployment vs. Policies

- Globally and within Europe, emissions from agriculture and other land uses contribute about 23% of total greenhouse gas emissions
- Emmissions are likely to continue to rise as agriculture becomes more industrialised, more forests are cleared, and diets shift towards increased meat consumption and processed food.
- Land is a sink for greenhouse gas emissions, but a limited one and difficult to manage.
- Policies that allow industry and other sectors to use land as a sink for emissions to offset emissions from their sectors are beset by accounting, environmental and other risks.
- Europe's efforts to reduce its land use emissions might displace activities outside of Europe, perhaps with an even worse climate outcome.
- Shifting to bioenergy releases emissions which are comparative to, and in some cases worse than, burning fossil fuels – when measured against the short amount of time left to act on climate change.

Source: https://europeanclimate.org/expertises/land-use/

Challenges III

Bringing rules to natural evolution vs. humanity growth: The Natura 2000 experience

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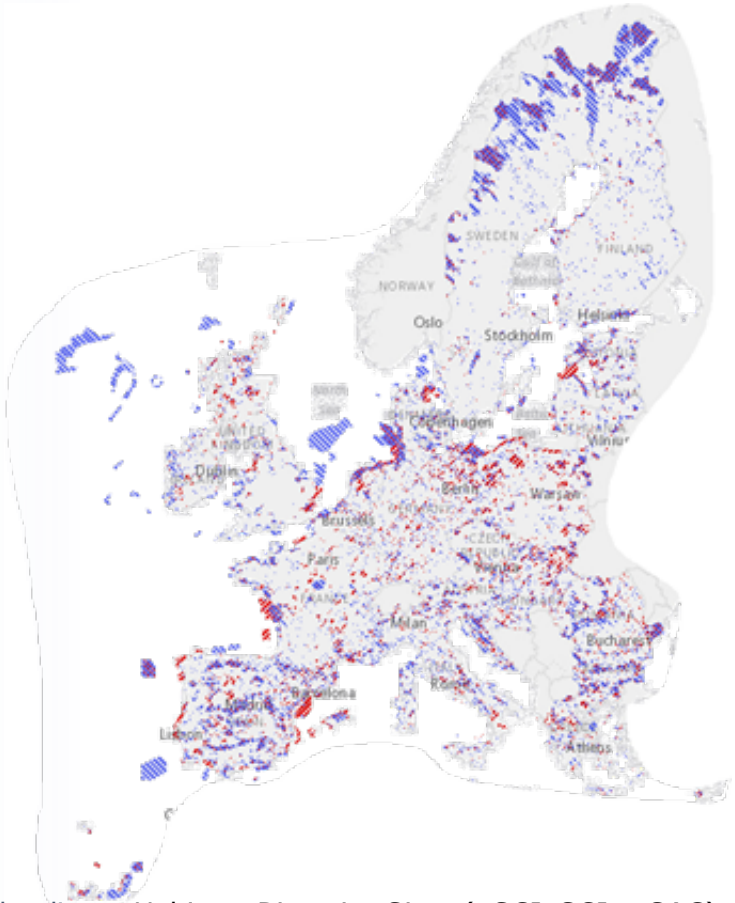


Blue lines: Habitats Directive Sites (pSCI, SCI or SAC)
Red lines: Birds Directive Sites (SPA)
Scale under 1:10.000.000

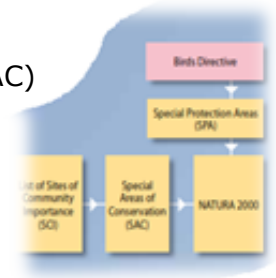
Credit: European Environmental Agency (EEA)

Natura 2000 Network Viewer

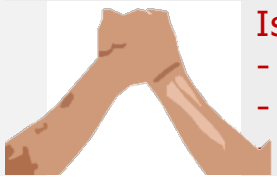
- **Member States identify** sites that are important for the conservation of species and habitats listed in the Habitats Directive occurring naturally in their territory based on purely ecological grounds.

- **European Commission examines** the information provided across the whole biogeographical region and, in cooperation with all relevant actors, selects sites of Community importance.

- **Member States formally protect** these areas and introduce measures to maintain or restore them to a good conservation state.



Joint Strategy:
- Resources Availability
- Top down approach
- EU policy compliant



Issues with local actors:
- Non systematic
- Sparse resources
- EU policy in opposition

Challenges IV

The EU Green New Deal (setting up the scene)

The EU Green New Deal:

- no net emissions of greenhouse gases by 2050
- economic growth decoupled from resource use
- no person and no place left behind

Source: https://ieep.eu/work-areas/agriculture-and-land-management

Challenges V

The new CAP (paving the way forward)

The new CAP harnesses the latest advances in knowledge and innovation and reinforces the role farmers have to play in several of the Green Deal's key policy areas, including:

- building a sustainable food system through the Farm to Fork strategy;
- adding to the new Biodiversity Strategy for 2030 (published in May 2020) by protecting and enhancing the variety of plants and animals in the rural ecosystem;
- contributing to the climate action of the Green Deal to achieve the goal of net-zero emissions in the EU by 2050;
- supporting the updated Forestry Strategy, to be announced in 2021, by maintaining healthy forests;
- contributing to a zero pollution action plan, to be set out in 2021, by safeguarding natural resources such as water, air and soil.

Source: https://croplifeeurope.eu/wp-content/uploads/2021/04/CropLifeEurope_Deloiite_-CAP-Report-Final.pdf

Source: https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/new-cap-2023-27/key-policy-objectives-new-cap_en

Challenges VI

The human factor

Land use is a complex and interconnected sector, in which a vast range of social, cultural and economic issues coalesce and whose activities are, at the same time, associated with deep cultural sensitivities*.

Ecology	Remote Sensing	Geography
Computer Science	Finances	Legislation

Communication amongst scientific communities, governmental actors, economic agents and the society is sought to support policy making and implementing

There is a need for:

- Description of land cover and habitat/ ecosystem classes
- Ensure correspondences between descriptions and land use
- Integration in an operating system
- Field data and local expertise acquisition and incorporation

*Source: https://europeanclimate.org/expertises/land-use/

Challenges VII

The services/ products factor

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RS product reliability and adoptability enhancement for the non-RS society users (experts and simple users)

Cross-scale	Uncertainty	Processes
Standardization	Interface	Copyrights

- Validation
- Framework conditions analysis and reporting
- Metadata quality
- Easy to access products
- Product delivery maintenance

Enablers I

The new LULUC Regulation

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The new EU Regulation on Land Use, Land Use Change and Forestry (LULUCF)

- simplifies and upgrades the current accounting methodology under Decision No 529/2013/EU and the Kyoto Protocol
- establishes a new EU governance process for monitoring how Member States calculate emissions and removals from actions in their forests
- broadens the scope of accounting to cover all managed land within the EU, using more recent benchmarks for performance – and thereby improving accuracy of the accounts.

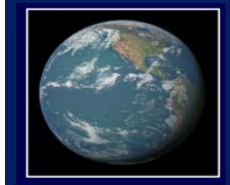
Source: https://climate.ec.europa.eu/eu-action/forests-and-agriculture/land-use-and-forestry-regulation-2021-2030_en

Source: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG

Enablers II

Evaluation approaches: The DPSIR cause and causality example

Drivers



Climate

Economy

Pressures

Abiotic

Biotic

Human-influenced

States

Canopy cover (%)
Canopy height (m)
Biomass (Mg ha^{-1})
Dominant species (cat.)

Canopy cover (%)
Dead material (%)
Leaf Area Index (m^2 m^{-2})
Leaf type (cat.)

Canopy cover (%)
Plant biomass (g cm^{-2})
Leaf Area Index (m^2 m^{-2})
Crop type (cat.)

Impacts

Vegetation damage

Dieback

Vegetation reduction

EVIDENCE BASE

Response ~ DPSIR

Restoration planting

Monitor Removal

Replanting

A globally applicable and widely used policy framework

CHANGE TAXONOMY

impacts (*pressures*)

Vegetation damage (fires)

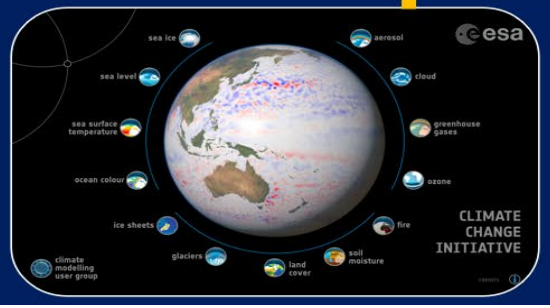
Dieback (*pathogens*)

Vegetation reduction (*harvesting*)

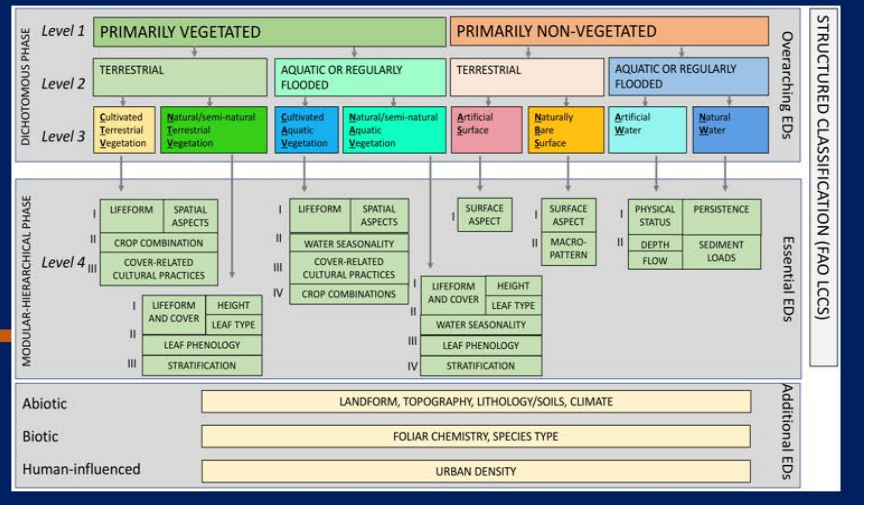
EO (Pressures)
MODIS
SMOS
JASON

EO (Impacts & Pressures)
Landsat
Sentinels

EO (Impacts)
Landsat
Sentinels
GEDI



Food and Agriculture Organisation (FAO) Land Cover Classification System (LCCS)



Enablers III

Evidencing change and attributing to a nomenclature

A3.A10.B2.C1.D1.E1.F1.F9.G7

Trees closed canopy (>70-60 %) tall (14-30 m) continuous needle-leaved evergreen with 2nd layer supporting open canopy 7-3 m in height; Above Ground Biomass of 210 Mg ha^{-1}; dominated by *Pinus sylvestris*)

Structured land cover taxonomies (such as the FAO LCCS) provide a basis for using environmental descriptors for land cover classification.

A3.A10.B2.C1.D1.E1.F1.F9

Trees closed canopy (< 20 %) tall (14-30 m) continuous needle-leaved evergreen (Above Ground Biomass of 157 Mg ha^{-1}; dominated by *Pinus sylvestris (e.g., following wildfires)*

The use of environmental descriptors with defined units (e.g., m, %, Mg ha^{-1}) or categories (e.g. species type) allows scalability in space and time.

Enablers IV

Evidencing change and attributing to a cause vs. land use

Inputs

	P1Lifeform	P1PLifeform_0	P1PLifeform_3	P1PLifeform_4	P1LeafType	P1PLeafType_0	P1PLeafType_1
0	-1	0.00	0.00	0.00	-1	0.00	0.00
1	3	0.00	0.92	0.08	1	0.25	0.75
2	4	0.02	0.48	0.50	1	0.28	0.72

Environmental Variables

P1AvCanopyco	P1AvCanopyht	P1AvAGB	P1AvChlo	P1AvNitrogen	P1AvLignin	P1AvVegmas
32.39	4.62	0.00	0.00	0.00	0.00	0.00
41.08	5.94	0.00	0.00	0.00	0.00	0.00
26.81	5.57	0.00	0.00	0.00	0.00	0.00

LCCS Classification (P1)

P1_LCCS	P1_LCCSdescription
A24.A3.A20_A21.B2_B6.D1.E1	Broadleaved PhenEvergreen Closed to Open (40-100%) Medium Trees on Flooded land
A24.A3.A20_A21.B2_B6.D1.E1	Broadleaved PhenEvergreen Closed to Open (40-100%) Medium Trees on Flooded land
A24.A3.A20_A21.B2_B6.D1.E1	Broadleaved PhenEvergreen Closed to Open (40-100%) Medium Trees on Flooded land
A24.A3.A20_A21.B2_B6.D1.E1	Broadleaved PhenEvergreen Closed to Open (40-100%) Medium Trees on Flooded land

LCCS Classification (P2)

P2_LCCS	P2_LCCSdescription
A24.A3.A20_A21.B2_B7.D1	Broadleaved Closed to Open (40-100%) Low Trees on Flooded land
A12.A3.A20_A21.B10.D1	Broadleaved Closed to Open (40-100%) Trees
B28.A1.B2	Natural Non-Perennial waterbodies
B26.A1.B2	Natural Non-Perennial waterbodies

Changes in LCCS classes (P1 and P2)

Chg_L3	ul	Cl	C	W	T	Chg_L4_Lifeform	Ul	C	g_L4_MCanopy	Chg_L4_MCanopyht
NAV-NAV						Remained as...			NA	Trees (14-7 m)(B6)to Shrubs (< 0.5 m)(B10)
NAV-NAV						Remained as...			NA	Shrubs (5-3 m)(B8) to Forbs and/or graminoids (3-0.8 ...
NS-NTV						NA			NA	NA
NTV-NTV						Remained as...			NA	Trees (7-3 m)(B7) to Shrubs (< 0.5 m)(B10)

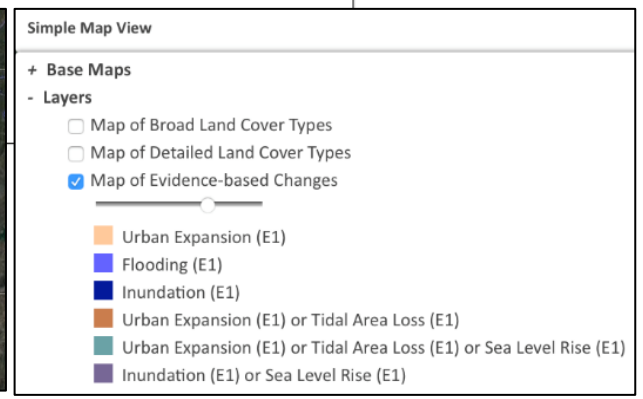
Evidence-based change alerts

TidalLoss	SeaLevelRise	Sedimentation	Erosion
Tidal Area Loss (E1)	Sea Level Rise (E1)	NA	NA
Tidal Area Lo...	...ea Level Rise (E1)	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA

0 Selected

Natural Vegetation	Agriculture	Urban	Water	Bare ground
Deforestation	Herbicide Spraying	Road Abandonment	Flooding	Lava Flows
Degradation	Burning	Greening	Inundation	Sedimentation
SelectLogging	Cutting	Browning	DryingEvent	Erosion
Defoliation	Grazing	Planning	Long Term Drying	Dune Change
Thinning	Growth	Urban Densification	Net Snow Accumulation	
Dieback	Stubble Formation	Urban Renewal	Net Snow Loss	
Growth	Agri. Expansion	Waste Dumps/Extraction	SnowFall	
Thickening	Agri. WaterSupp	Comm. Installation	SnowMelt	
Encroachment	Agri. TimeFactor	Comm. Abandonment	Waterlogging	
Abandonment	Tillage	Rail Conversion	Water OutBurst	
Hedgerow removal	Pasture Degradation	Rail Construction	Dam Creation	
	Pasture Replanting	Urban Expansion	Land Drainage	
	Crop Change	Road Conversion	Freezing	
	Crop Growth	Road Construction	Thawing	
	Crop Sequence change	Road Improvement	Glacial Flow	
	Agri. Homogenisation	Industrialisation	Sea Level Rise	
	Agri. Division	Infilling/levelling	Water Pollution	
	Plantations		Tida lLoss	
	Plantation Growth			
	Grass Fertilization			
	Orchard planting			
	Slurry or sediment spreading			
	Liming			

- Causes and consequences
- Movement of materials and gases
- Implications for policy, society & economy



Change alerts through Ecopotential's Virtual Laboratory, Donana NP, Spain

Enablers Va

Towards evidence-based decision taking

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Global Change Biology

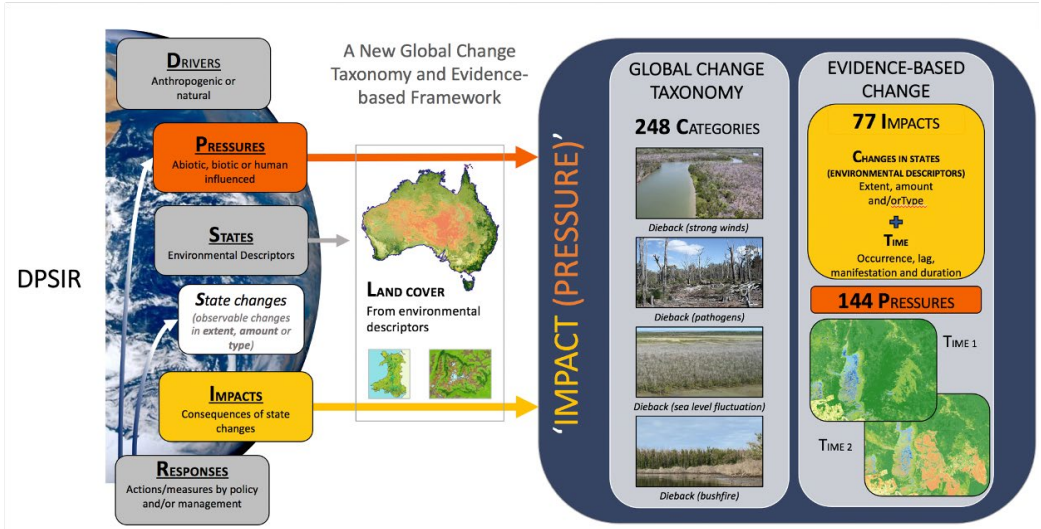
RESEARCH ARTICLE | Open Access

A globally relevant change taxonomy and evidence-based change framework for land monitoring

Richard M. Lucas, Sophia German, Graciela Metternicht, Rebecca K. Schmidt, Christopher J. Owers, Suzanne M. Prober, Anna E. Richards, Sally Tetreault-Campbell, Kristen J. Williams, Norman Mueller, Belle Tissott, Sean M. T. Chua, Alison Cowood, Terry Hills, Dayani Gunawardana, Alexis McIntyre, Sebastien Chognard, Clive Hurford, Carole Planque, Suvarna Punalekar, Daniel Clewley, Ruth Sonnenschein, Nicholas J. Murray, Ioannis Manakos, Palma Blonda, Kate Owers, Stephen Roxburgh, Heather Kay, Peter Bunting, Claire Horton ... See fewer authors

First published: 01 September 2022 | https://doi.org/10.1111/gcb.16346

Term	Definition and associated information
Overarching Environmental Descriptors	Land cover classes that provide the initial broad divisions of the dominant cover (e.g., croplands, urban, water).
Essential Environmental Descriptors	Categorical characteristics that are essential for delivering land cover classifications according to pre-defined taxonomies.
Additional Environmental Descriptors	Categorical or continuous characteristics that are external to a land cover taxonomy, playing no part in its construction but augmenting information.



Enablers Vb

Tracking change in 4D

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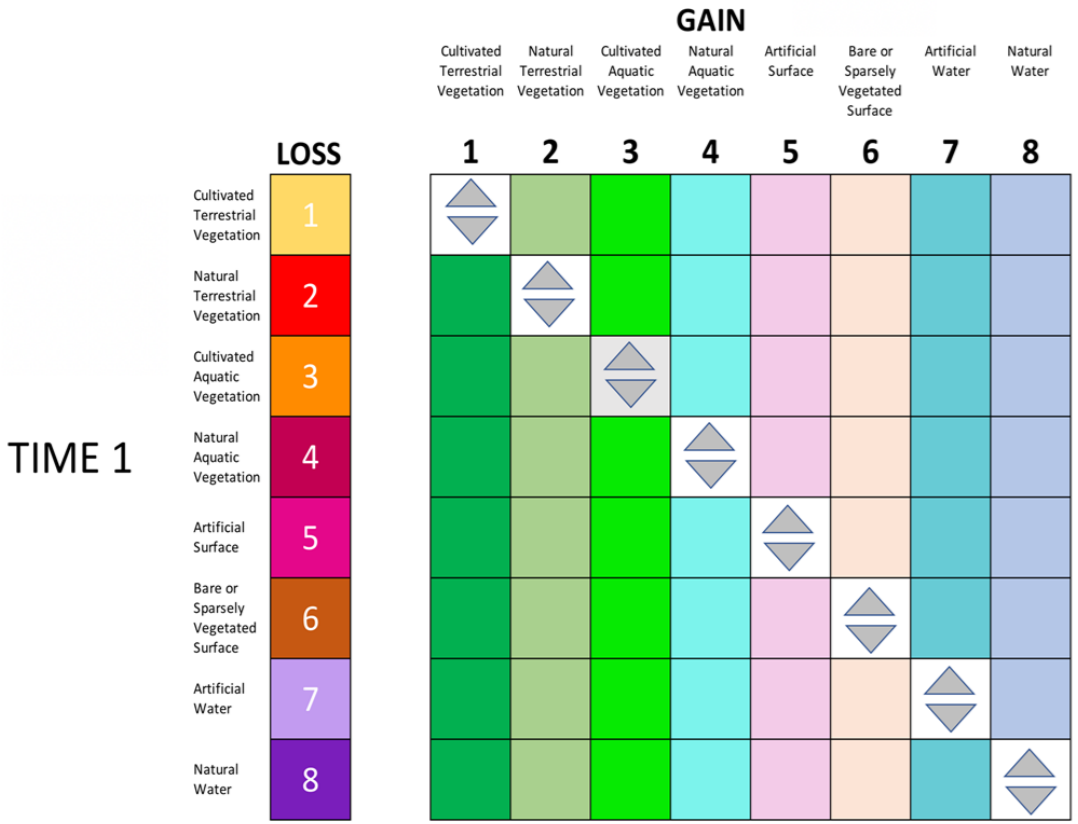
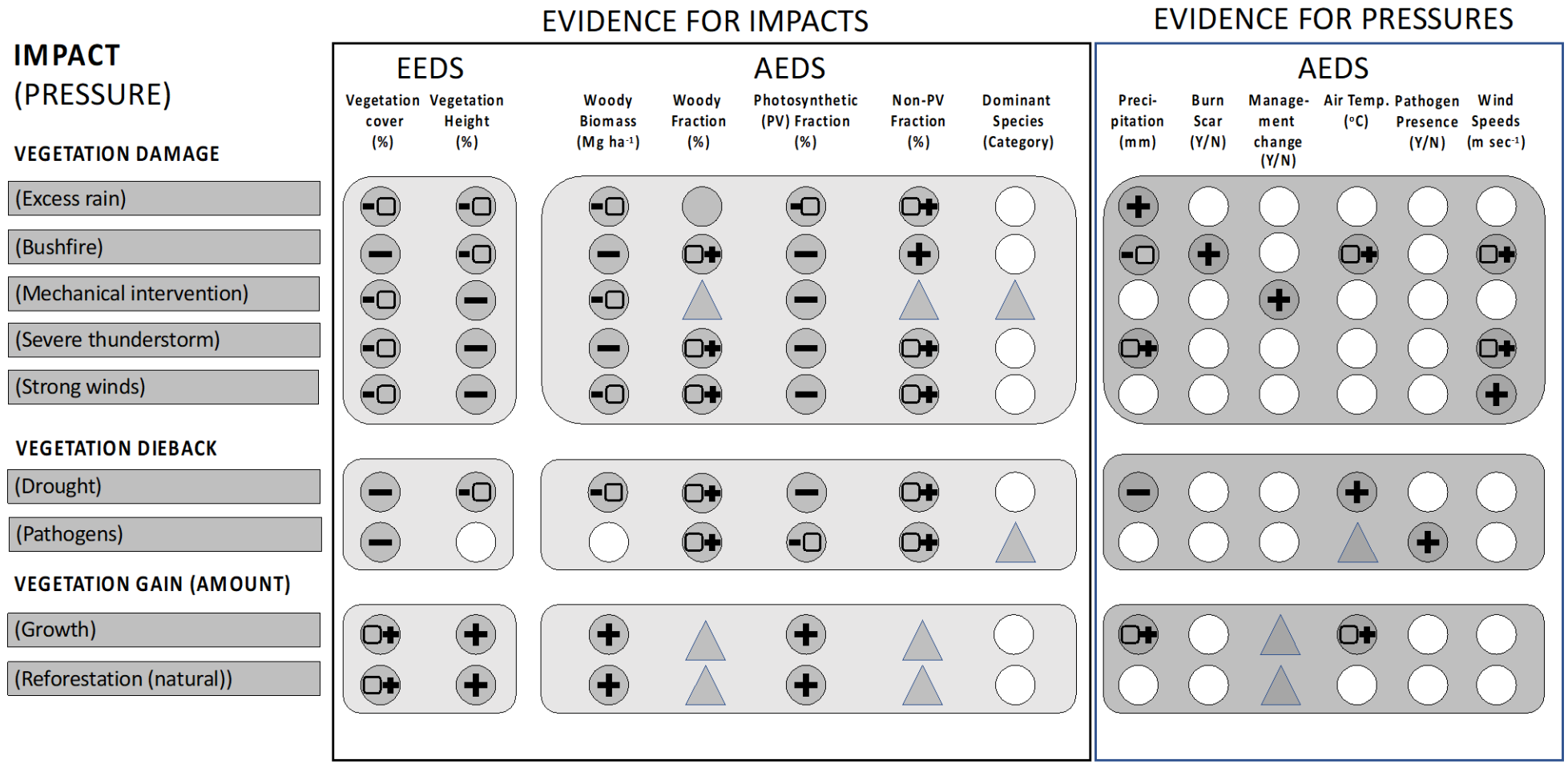
TIME 2



The transition matrix provides
the first line of evidence for change

Enablers Vc

Coupling monitored change with impact and pressure



Many change (impact (pressure)) categories can be mapped using Earth observation data.

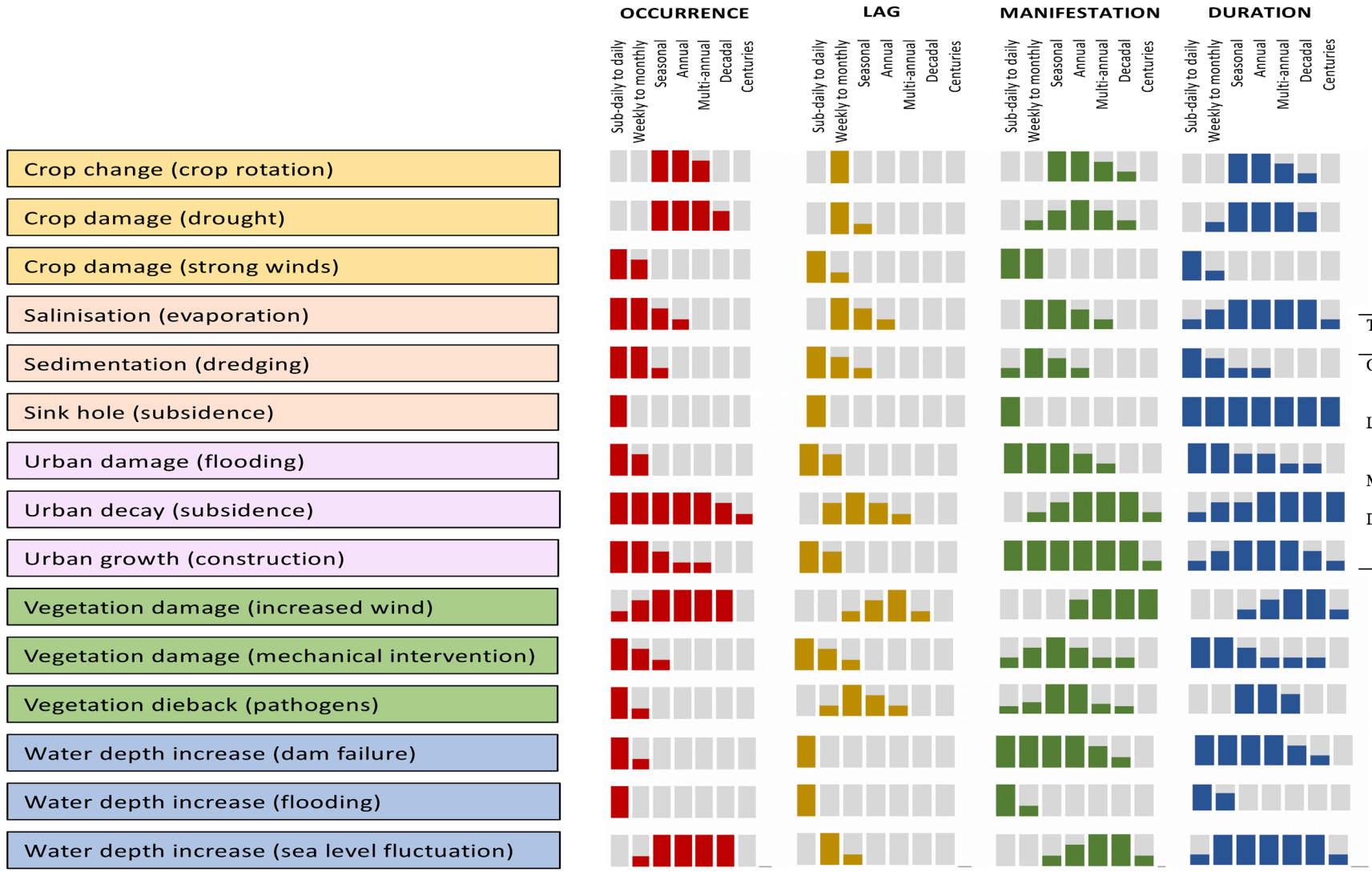
* EEDs : Environmental Descriptors (Acknowledged Essential Variables)
AEDs: Additional Environmental Descriptors

No change | Likely loss | Probable to possible loss | Likely gain | Probable to possible gain | Categorical or uncertain

Enablers Vd

Paying attention to the time factor

framework
challenges
enablers
services
outlook

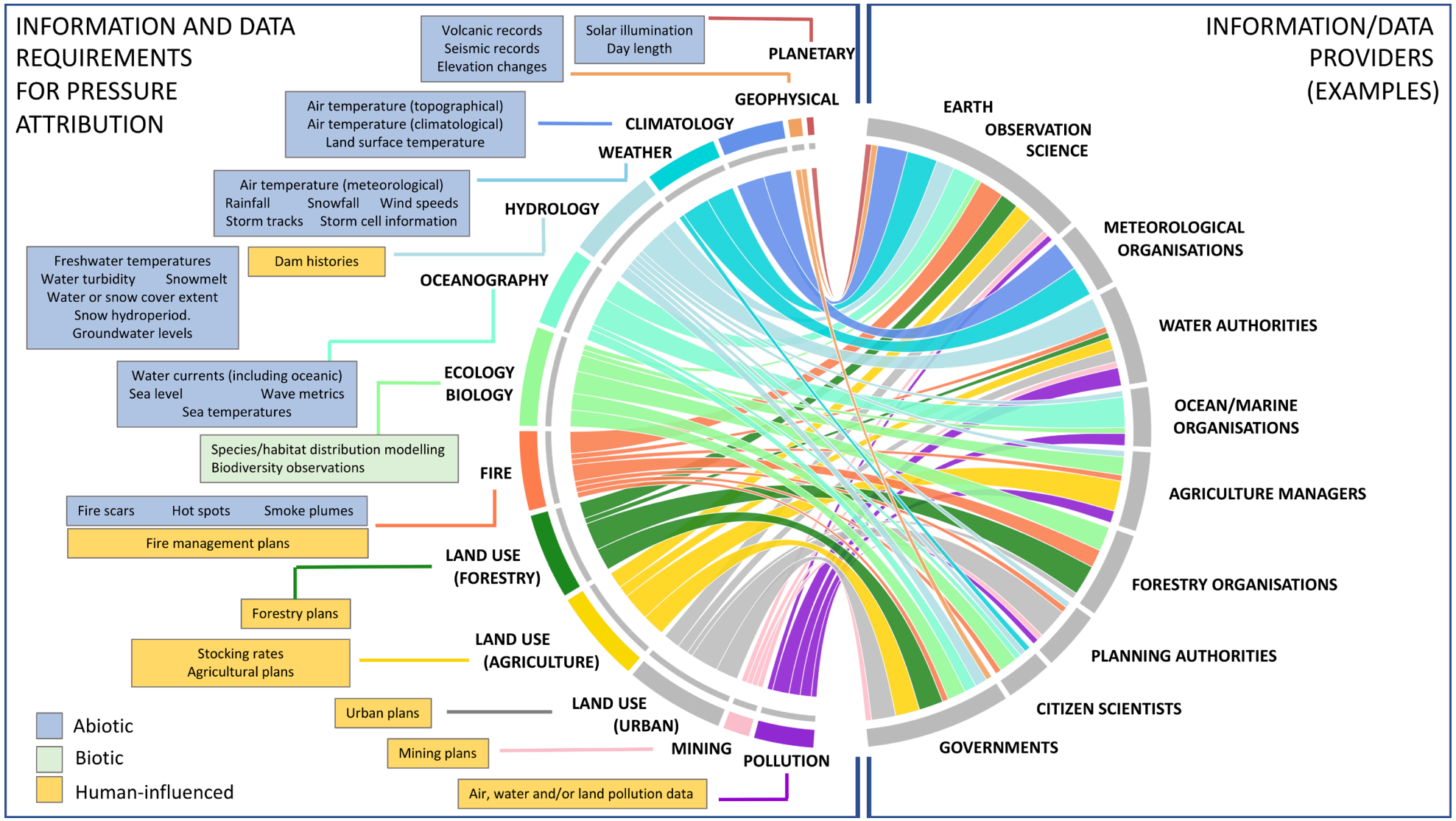


Sub-daily to daily
Weekly to monthly
Seasonal
Annual
Multi-annual
Decadal
Centuries

Term	Definition and associated information
Occurrence	The time span of the actual natural event or process or human activity
Lag	The time between commencement and detection
Manifestation	The time period of detectability
Duration	The time from commencement to completion of a natural event or process or human activity.

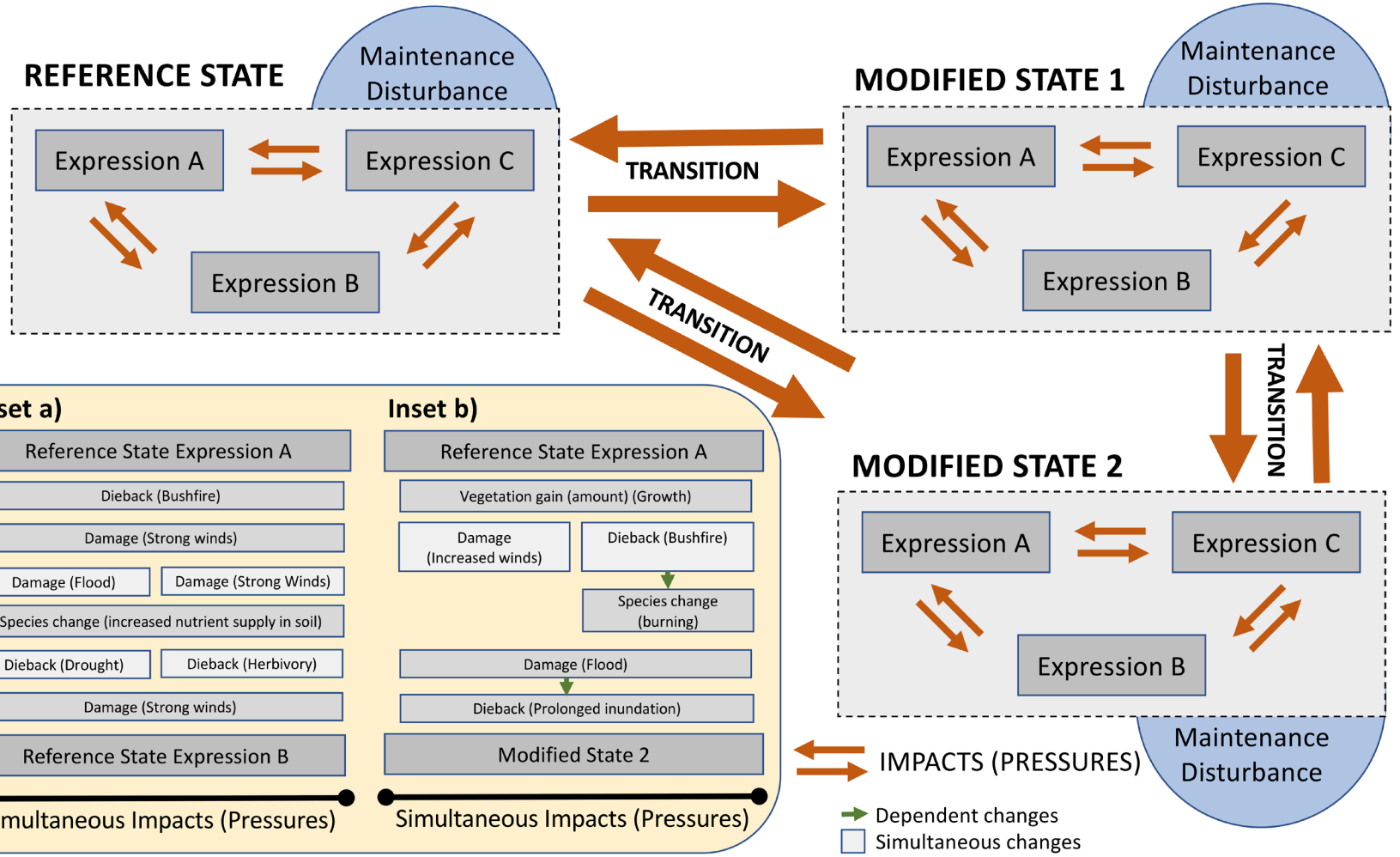
Enablers Ve

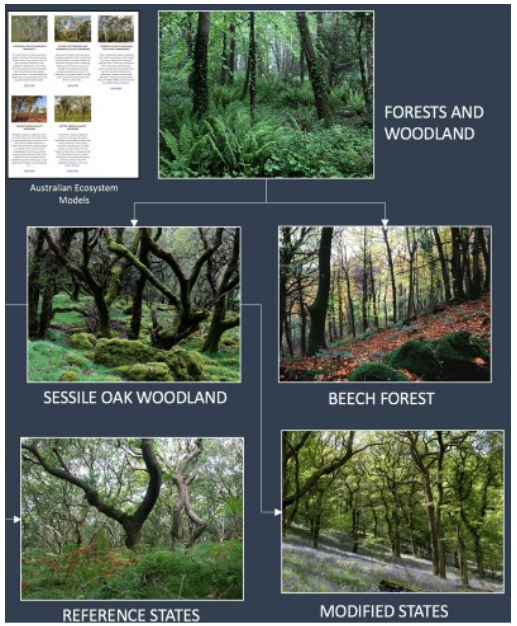
Land Use – Descriptors – Service and Data providers: interconnections and flows



Enablers Vf

Registering change & managing uses based on scenarios: towards the future landscapes





Services I

Analysis Ready Data are gaining pace in the big data era (The Swiss example)

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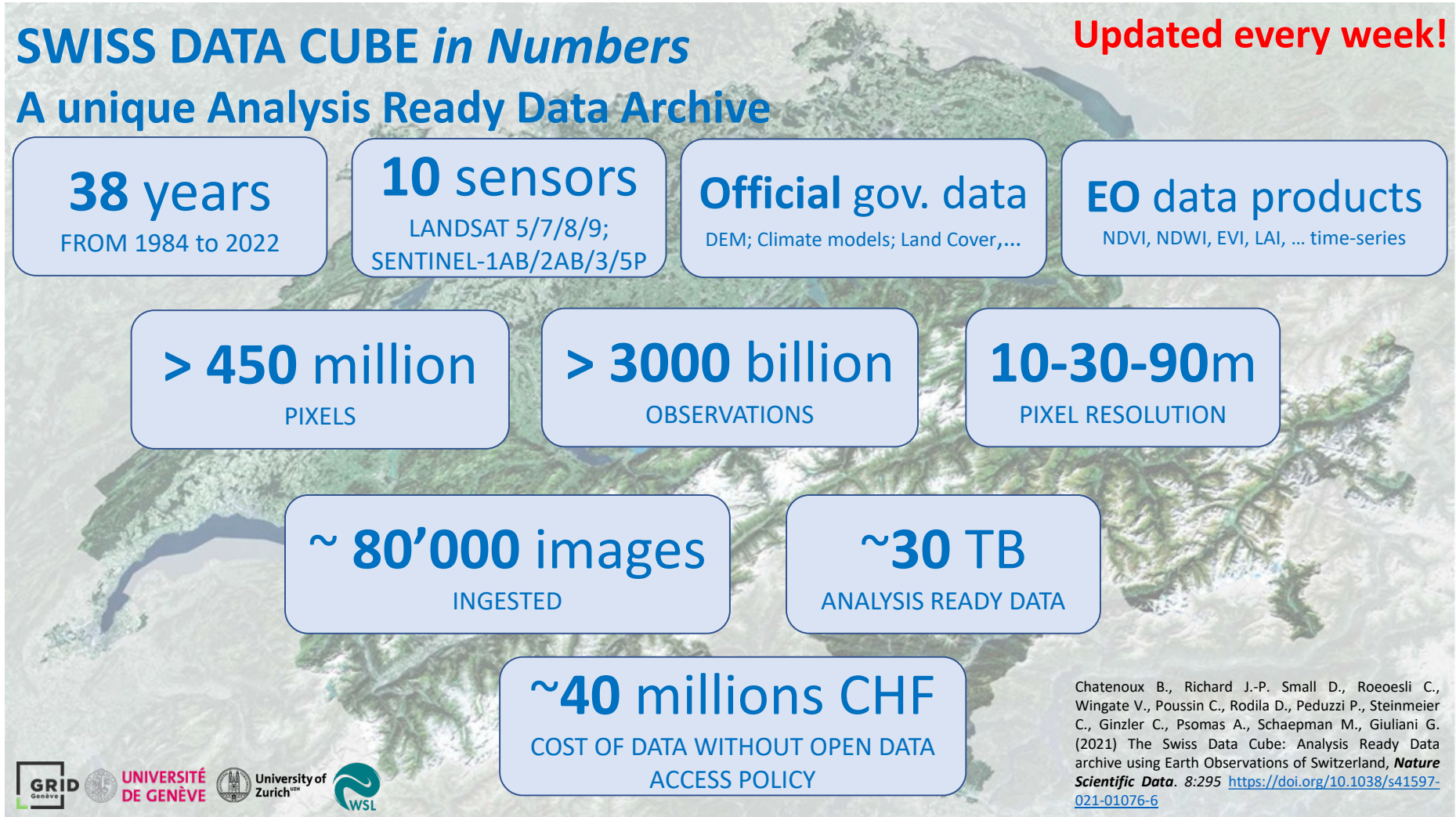


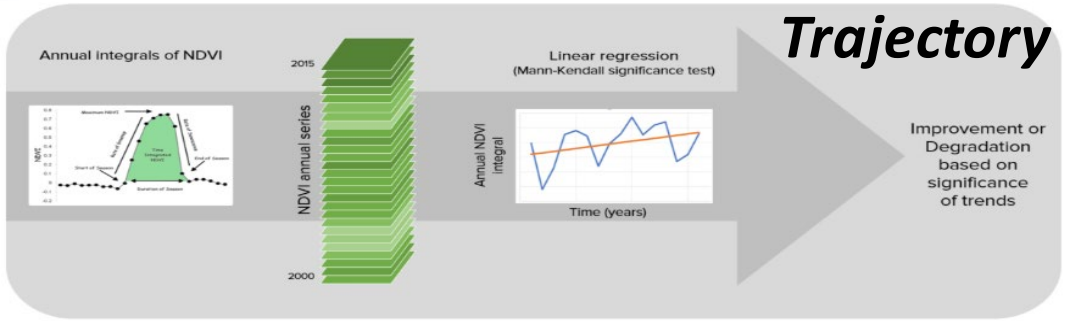
Stores more than 2TB of enviromental descriptors time-series (35+ years) such as snow cover, NDVI, EVI, LAI,GCI… and more!

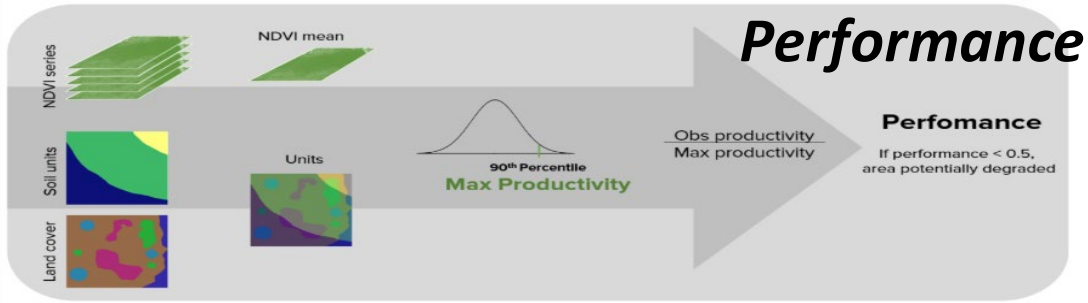
Services II

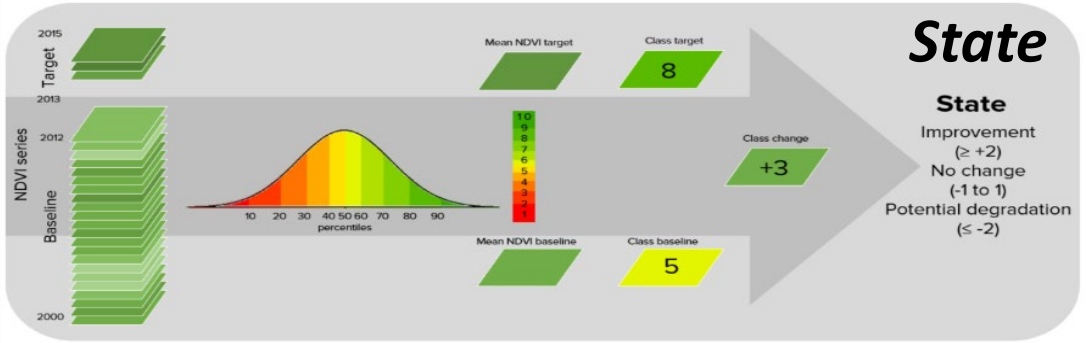
From Data to Information to Knowledge

Environmental Descriptors in support of the land use management

documentation: http://trends.earth/docs/en/background/understanding_indicators.html#productivity
code: https://github.com/ConservationInternational/landdegradation/blob/master/landdegradation/productivity.py



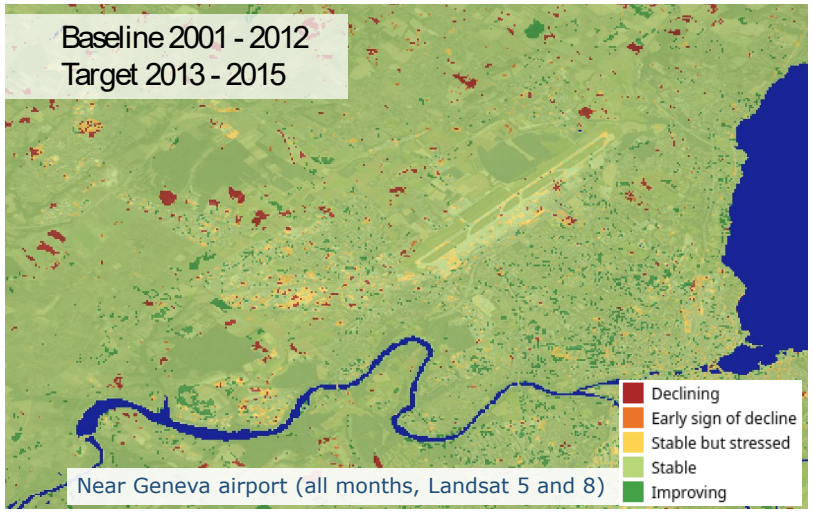




Aggregating the productivity sub-indicators

Trajectory	State	Performance
Improvement	Improvement	Stable
Improvement	Improvement	Degradation
Improvement	Stable	Stable
Improvement	Stable	Degradation
Improvement	Degradation	Stable
Improvement	Degradation	Degradation
Stable	Improvement	Stable
Stable	Improvement	Degradation
Stable	Stable	Stable
Stable	Stable	Degradation
Stable	Degradation	Stable
Stable	Degradation	Degradation
Degradation	Improvement	Stable
Degradation	Improvement	Degradation
Degradation	Stable	Stable
Degradation	Stable	Degradation
Degradation	Degradation	Stable
Degradation	Degradation	Degradation

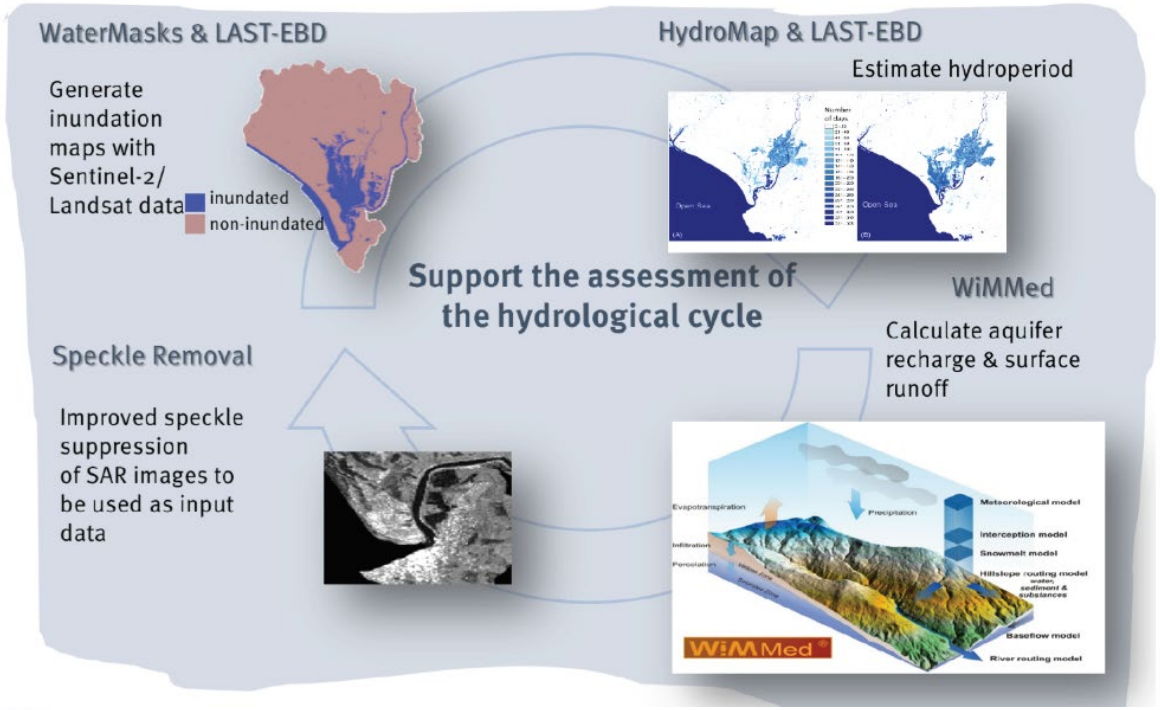
3 Classes	5 Classes
Improvement	Improving
Improvement	Improving
Improvement	Improving
Improvement	Improving
Improvement	Improving
Degradation	Stable
Stable	Stable
Stable	Stable
Stable	Stable
Degradation	Stable but stressed
Degradation	Early signs of decline
Degradation	Declining
Degradation	Declining
Degradation	Declining
Degradation	Declining
Degradation	Declining
Degradation	Declining
Degradation	Declining

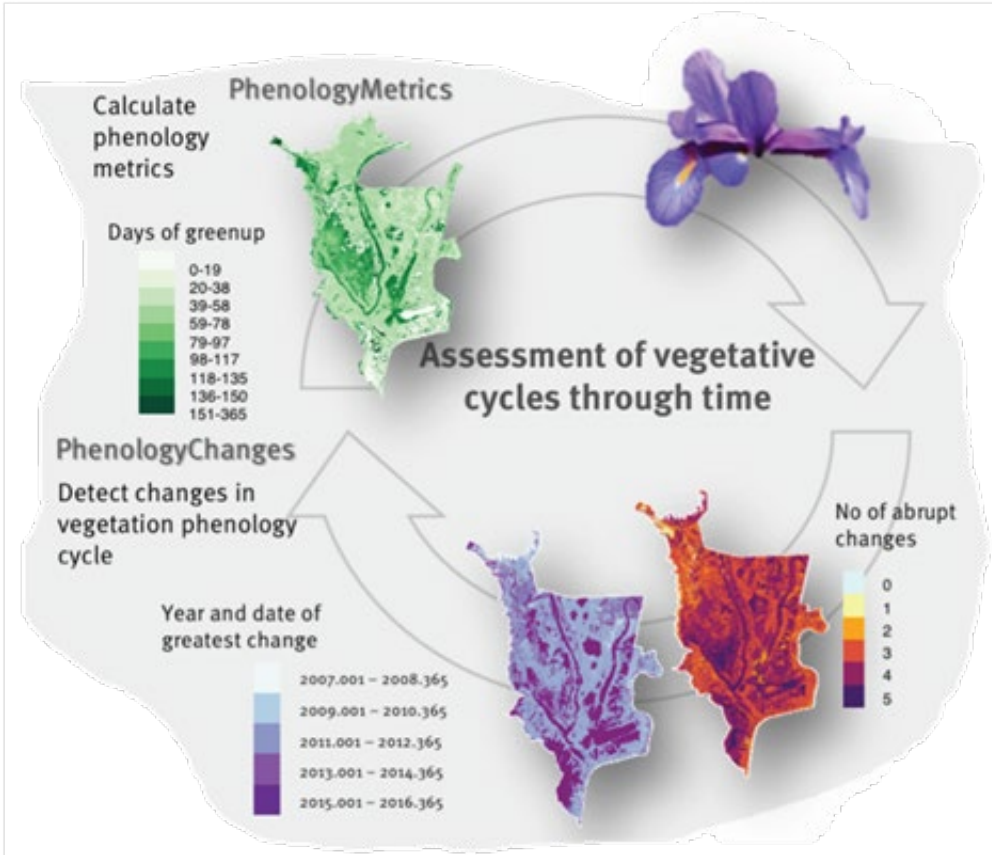


Services III

From Information to Knowledge and Modeling

Land use management based on evidence and scenario building





Services IV

Copernicus Land Monitoring Service & beyond

Copernicus Land Monitoring Service (CLMS) provides geographical information on land cover to a broad range of users in the field of environmental terrestrial applications.

This includes land use, land cover characteristics and changes, vegetation state, water cycle and earth surface energy variables.

CLMS products are divided into five categories:

- Systematic biophysical monitoring
- Land cover & land use mapping (e.g. CLC)
- Thematic hotspot mapping
- Reference data
- Ground motion service

Further products, like Urban Atlas, have been developed to complement Corine Land Cover time series data and are used for further assessments such as land recycling and landscape fragmentation.

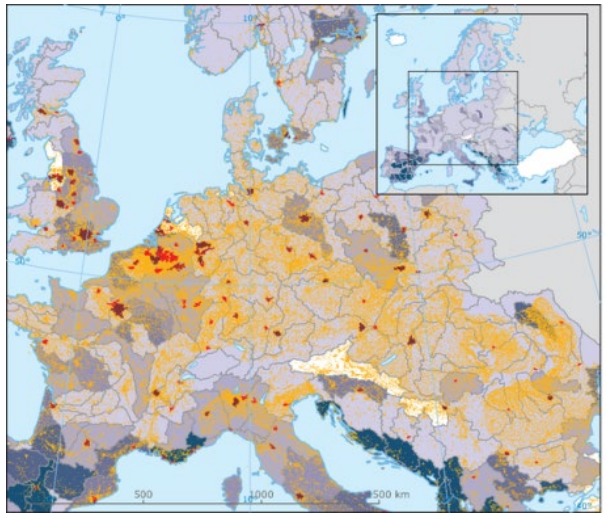
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=LUCAS_-_Land_use_and_land_cover_survey

Services Va

EEA available Land Cover and Land Use products

Ecosystem type map

European ecosystem map covering spatially explicit ecosystem types for land and freshwater at 1 ha spatial resolution. Ecosystems are mapped by interpreting available land cover data on the basis of the European habitat classification (EUNIS).



Water Exploitation Index plus (WEI+)

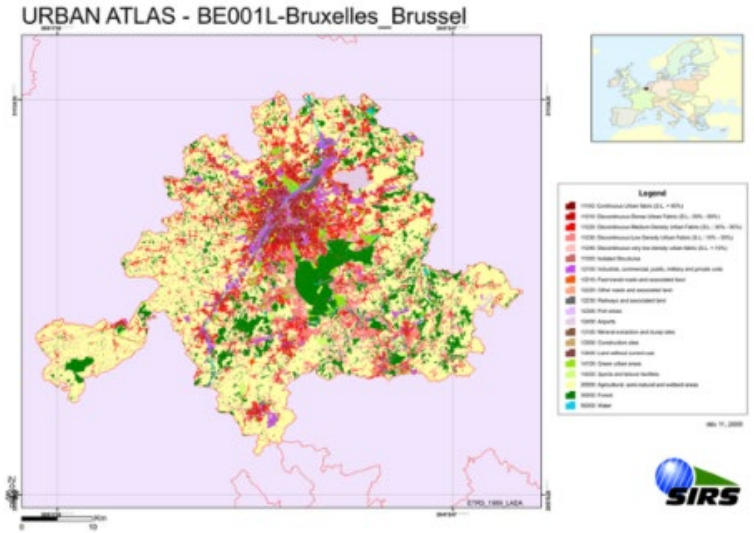
The water exploitation index plus (WEI+) compares water use against renewable water resources. The map illustrates the relation between Urban Morphological Zone and the WEI+ at the sub-basin scale for summer months (July, August and September) defined in calendar year.

Average annual increase in soil sealing

The map shows the yearly average imperviousness density change, relative to 10 km grid cells. The unit is the average percentage of newly sealed 10 km cells between 2006 and 2009.

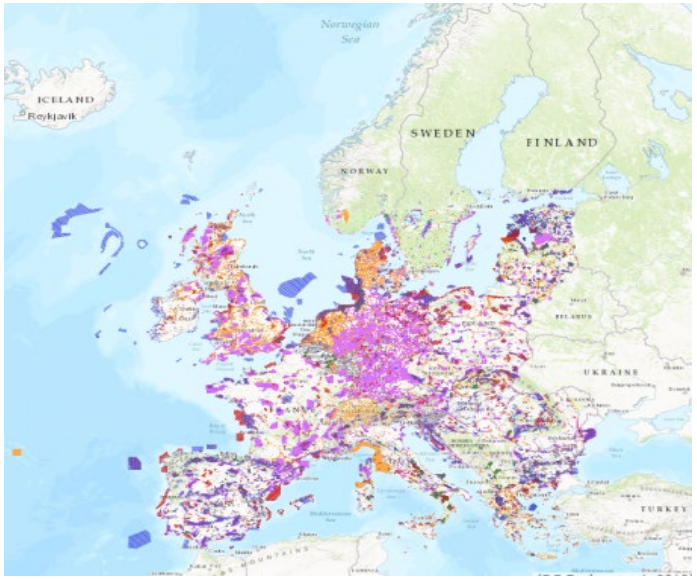
Services Vb

EEA available Land Cover and Land Use products



Urban Atlas

The Urban Atlas is providing pan-European comparable land use and land cover data for Large Urban Zones with more than 100.000 inhabitants as defined by the Urban Audit.



European protected sites

The map shows an overview of protected sites in Europe, including Natura 2000 sites and nationally designated areas (CDDA).

List is much longer. Please visit the site of EEA.

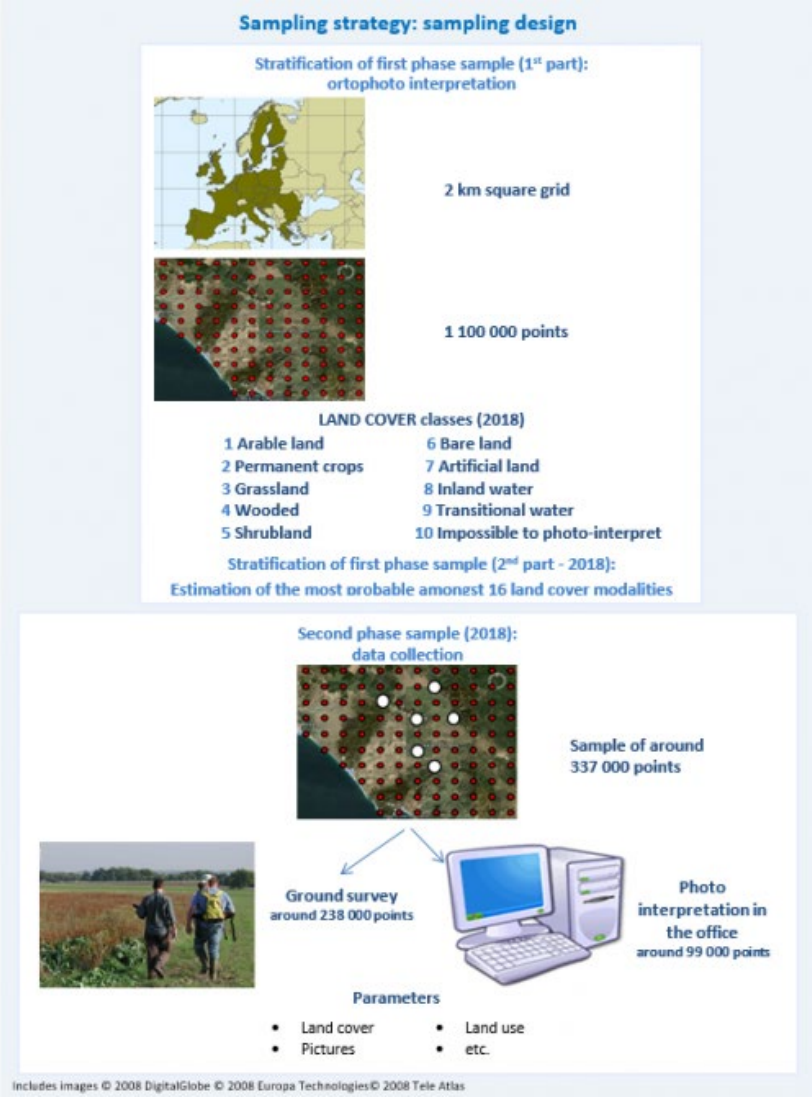
Services VI

The LUCAS in situ monitoring campaign

The LUCAS source of data is obtained via an Area Frame survey. In fact, LUCAS is the acronym of Land Use and Cover Area frame Survey.

The LUCAS field survey is conceived and designed by Eurostat. It is carried out on a sample of points spread over the entire territory of the European Union.

The LUCAS points are selected from a standard 2 km grid which comprises around 1 million points all over the EU. Only a sample of the LUCAS points is visited in each campaign.



Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=LUCAS_-_Land_use_and_land_cover_survey#The_LUCAS_survey

Outlook I

The LUCAS in situ monitoring campaign

LUCAS Survey 2009

- · 234 561 points visited in-situ
- · 23 countries (25 with soil data, since Cyprus and Malta collected soil on a voluntary basis)
- · 500 field surveyors on the spot
- · Beginning of survey by early April in Lithuania and Poland
- · End of survey by end October in Sweden

LUCAS Survey 2012

- · 270 389 points visited in-situ
- · 27 countries (of which Bulgaria and Romania collected also soil data)
- · 594 field surveyors on the spot
- · Beginning of the survey by mid-March in Spain
- · End of the survey by early November in Poland and Romania

LUCAS Survey 2015

- · 273 401 points visited in-situ
- · 28 countries (soil data collected in all)
- · 700 field surveyors on the spot
- · Beginning of the survey by mid-March in Spain
- · End of the survey in October in Sweden
- · A complementary sample of around 66.000 points was photo-interpreted in the office and used for surveys 2012 and 2009

LUCAS Survey 2018

- · 238 077 field points + 99 777 (Photo–interpreted points in the office)
- · 28 countries (soil data collected in all)
- · 700 field surveyors on the spot
- · Beginning of the survey by mid-March in Spain
- · End of the survey in December in Sweden

The frequency of the survey until 2018 has been of 3 years

- · 2006 (pilot)
- · 2009
- · 2012
- · 2015
- · 2018
- · 2022 (in preparation)

Source: https://ec.europa.eu/eurostat/cache/metadata/en/lan_esms.htm

Outlook II

By the EEA and by the upcoming H Europe funding framework

Several environmental and territorial policies, such as the EU Biodiversity Strategy to 2020, the EU Forest Strategy or the European Commission's Thematic Strategy for Soil protection rely on sound land-use information as a fundamental reference.

The EEA will also support the implementation by EU institutions and EEA countries of the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals, which aim, among other things, to reduce the land degradation trend in Europe and promote the interdisciplinary approach for the land system.

The EEA will continue to implement the pan-European and local components of the Copernicus land monitoring service with regards to continental and specific issues of interest such as urban areas, riparian zones and natural grasslands.

Source: https://www.eea.europa.eu/themes/landuse/intro

Horizon Europe - Work Programme 2023-2024 Digital, Industry and Space

Expected Relative Calls:

- Copernicus for Land and Water
- Copernicus-based applications for businesses and policy-making

Outlook III

Research activities ongoing and upcoming focus

(in respect to all colleagues' work that we might have missed,
only some projects are referenced, and the list is not exhaustive neither the topics are)

Computer modeling for assessing the impact of potential land based mitigation technologies (fluxes of carbon and nitrogen between the atmosphere, vegetation, and soil), (changes in landscape composition and related indicators in response to drivers, such as natural disturbances and climate change), (interactions of socio-economic drivers and the biophysical environment determining land use and land use changes(, (assessment of the impacts of changes on human society and the environment)

Decision Support via multi-level policy co-design platforms (integration of agricultural and land use sectors), (perform land use policy assessments), (access to land use based adaptation and mitigation solutions linking various scales), (development and implementation of land use policies in Europe)

Crowdsourcing/ citizen science (mobile apps so that citizens may collect ground-based data), (citizens collect information on land cover and land use), (simplified protocols)

Participatory schemas promotion (evaluation of trade-offs between different land uses), (collate, review, map and synthesize the state-of-the-art, existing knowledge gaps and priority areas in soil and land management), (co-design strategy identifying relevant forms of co-design actions at different time horizons) (Rigorous protocols to conduct co-design actions ensuring the growth of the EO ecosystem in a resilient perspective)

Accelerating Digital Transformation towards CAP implementation (making efficient use of digital solutions and e-tools), (creating reliable methodologies and harmonised data sets for monitoring agricultural performance while reducing administrative burden for farmers, paying agencies and other stakeholders)

Policy support (create knowledge repositories for land use policy making), (strengthen transparent land use practices), (foster networking among stakeholders)

Modelling and data fusion (digital soil mapping), (farm management information systems), (tools for the continuous, large scale and uninterrupted monitoring of farm management activities), (compliance with the CAP's agri-environmental objectives)

with a smile, vision, and collaborative spirit

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

framework
challenges
enablers
services
outlook

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At your disposal for questions/clarifications

Dr. ioannis Manakos
imanakos@iti.gr
http://eos.iti.gr/