5th Meeting of the Carbon Removals Expert Group

21 - 23 October 2024

Christian HOLZLEITNER, Head of Unit,
European Commission, DG CLIMA, Unit C3

Objectives

DAY 1

Permanent removals

- Update on policy developments
- DACCS and BioCCS
- Biochar

DAY 2

Carbon farming

- Update on policy developments
- Agriculture
- Peatlands
- Forestry

DAY 3

Carbon storge in buildings & verification rules

- Update on policy developments
- Long-lasting biogenic carbon storage in buildings
- Rules on third-party verification and certification schemes

What’s the state of play?

European Commission

Carbon farming

22 October 2024

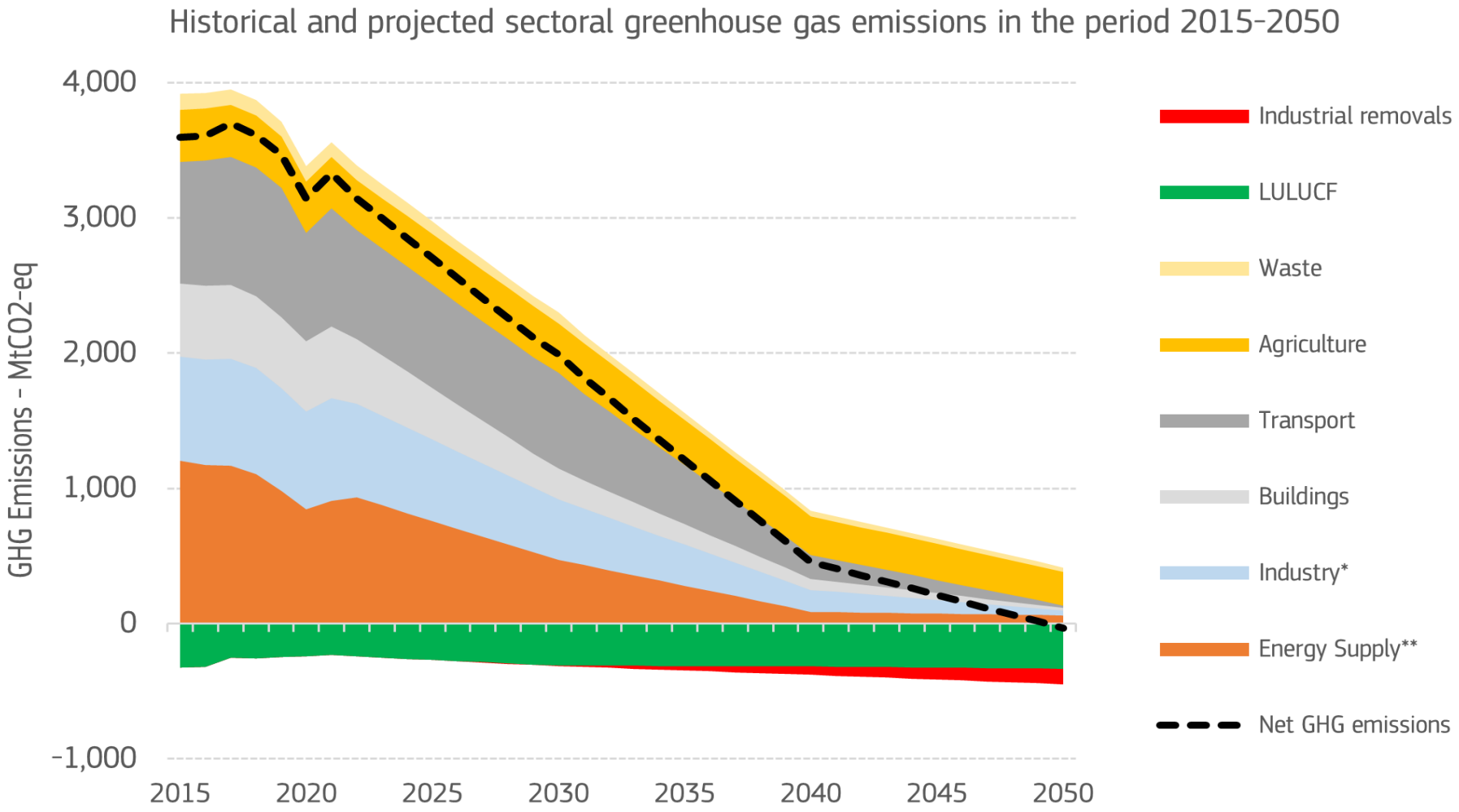
Agenda

CRCF basics

FAQs

Objective of this meeting and timeline

Pathway to climate neutrality



*Excluding non-BECCS industrial removals
**Including bioenergy with carbon capture and storage (BECCS)

European Commission

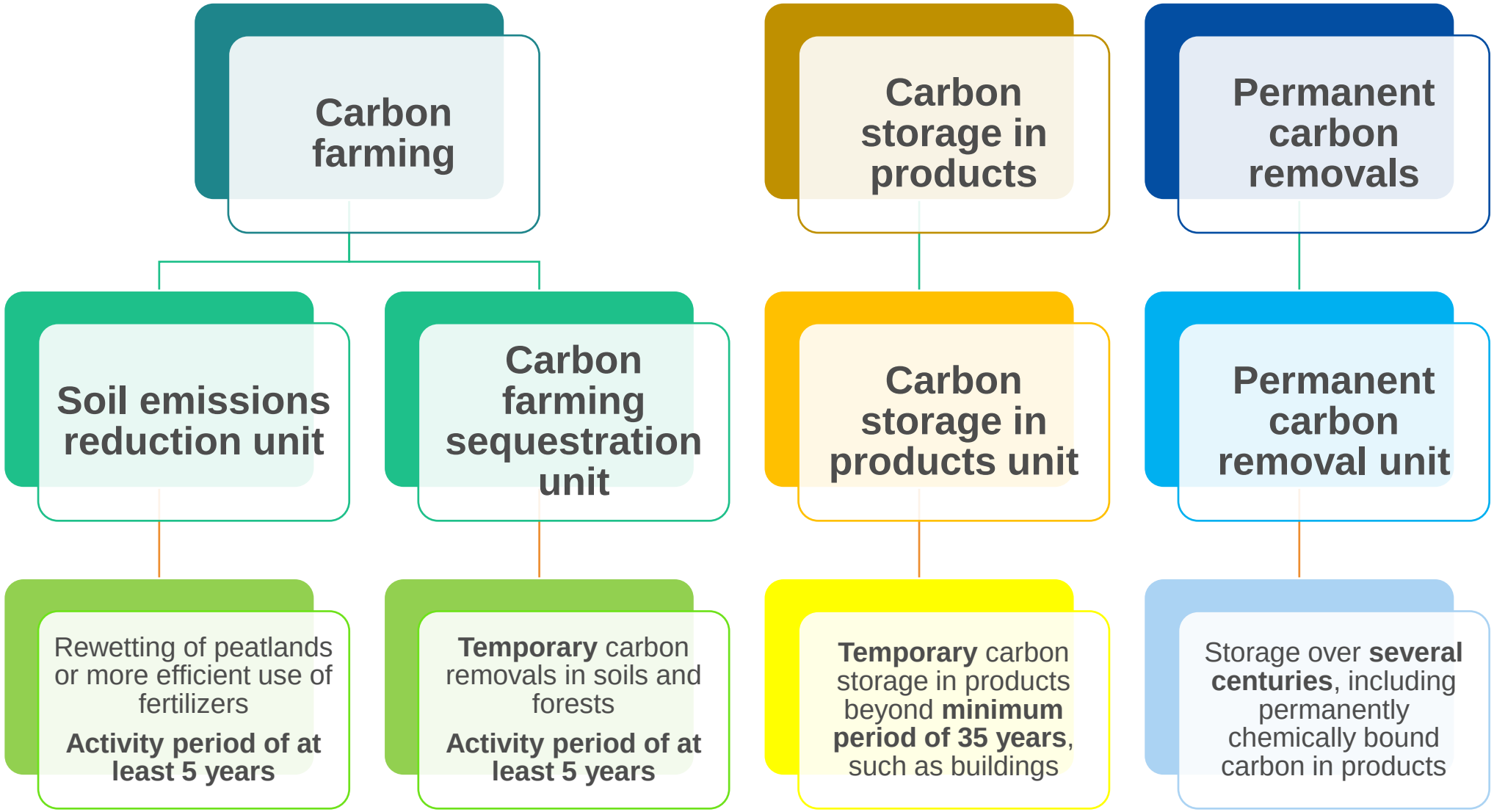
Recommendations from the Strategic Dialogue

Benchmarking system

Markets should drive sustainability

Scope of certification

Article 1 and 2 CRCF Regulation



How does certification work?

CRCF Regulation

EU certification methodology

QUALITY criteria
- Quantification
- Additionality
- Liability
- **Sustainability**

Commission establishes certification methodologies in consultation with **expert group**

Certification process

Private and public certification schemes recognised by the Commission

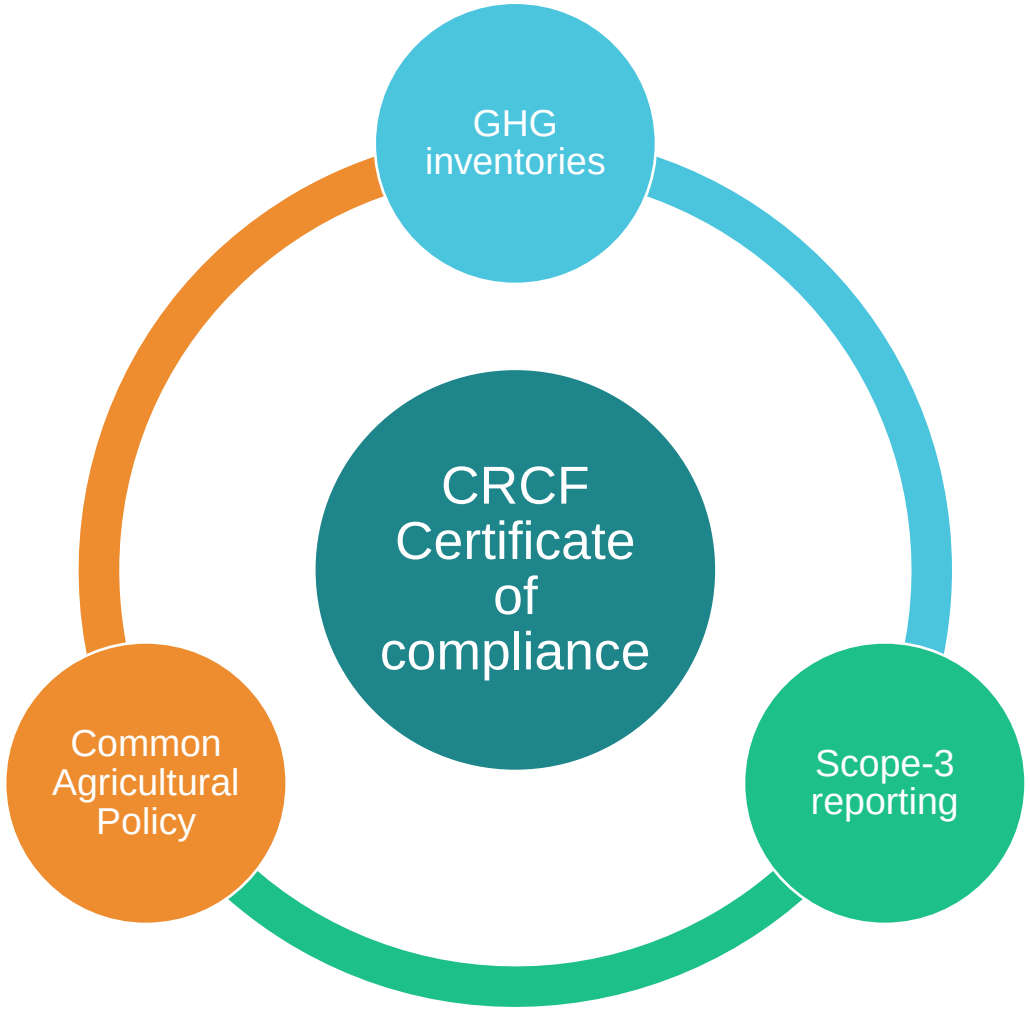
Independent certification bodies to issue
- Audit reports
- Certificate of compliance
- **Group audits possible!**

Certification registries and Union-wide CRCF registry from 2028

Publicly accessible information on activities and operators
- Audit reports
- **Certificates of compliance**

Quantity and status of certified units
- Permanent carbon removals unit
- Carbon farming sequestration unit
- Soil emissions reduction unit
- Carbon storage in products unit

CRCF as part of a benchmarking system



European Commission

Role of CRCF Regulation in voluntary and regulated carbon markets

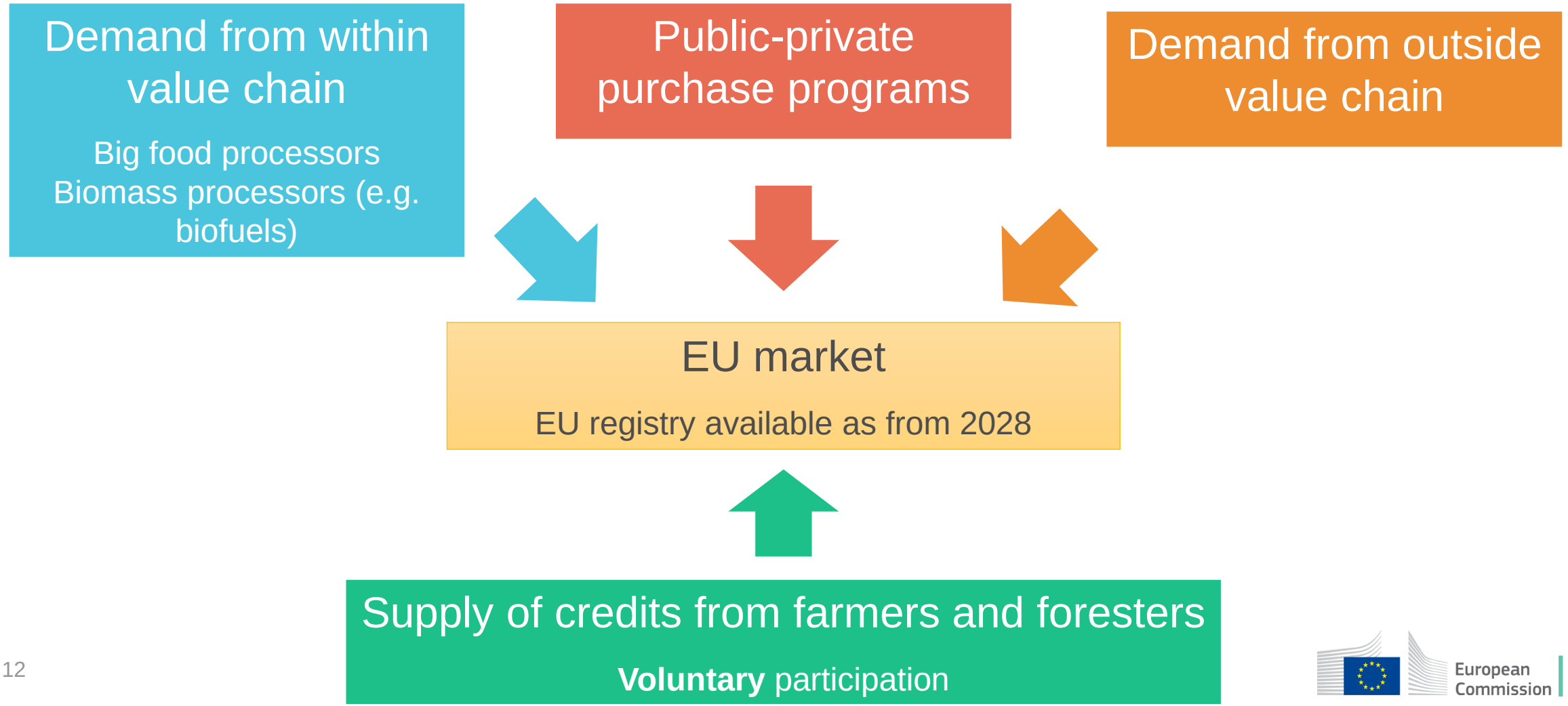
Corporate claims and sustainable finance

- **Corporate Sustainability Reporting Directive**
  - Sustainable Reporting Standards on Climate for non-financial reporting
- **Green Claims**
  - Commission proposal from March 2023 in co-decision

Post-2030 EU climate policy

- **Review of LULUCF and Effort-Sharing Regulation in 2026**
  - Study on market-based approaches in the AGRI-FOOD value chain

EU market for CRCF credits



European Commission

Financing Event on Carbon Farming

Public-private purchasing program

- How could an EU purchasing program be designed?
- Interest of financial institutions, including insurers, to build up a portfolio of carbon farming credits?
- Facilitation of national or regional trading platforms
- Matching investors and suppliers
- **Q2 2025** in Brussels (TBC)

Agenda

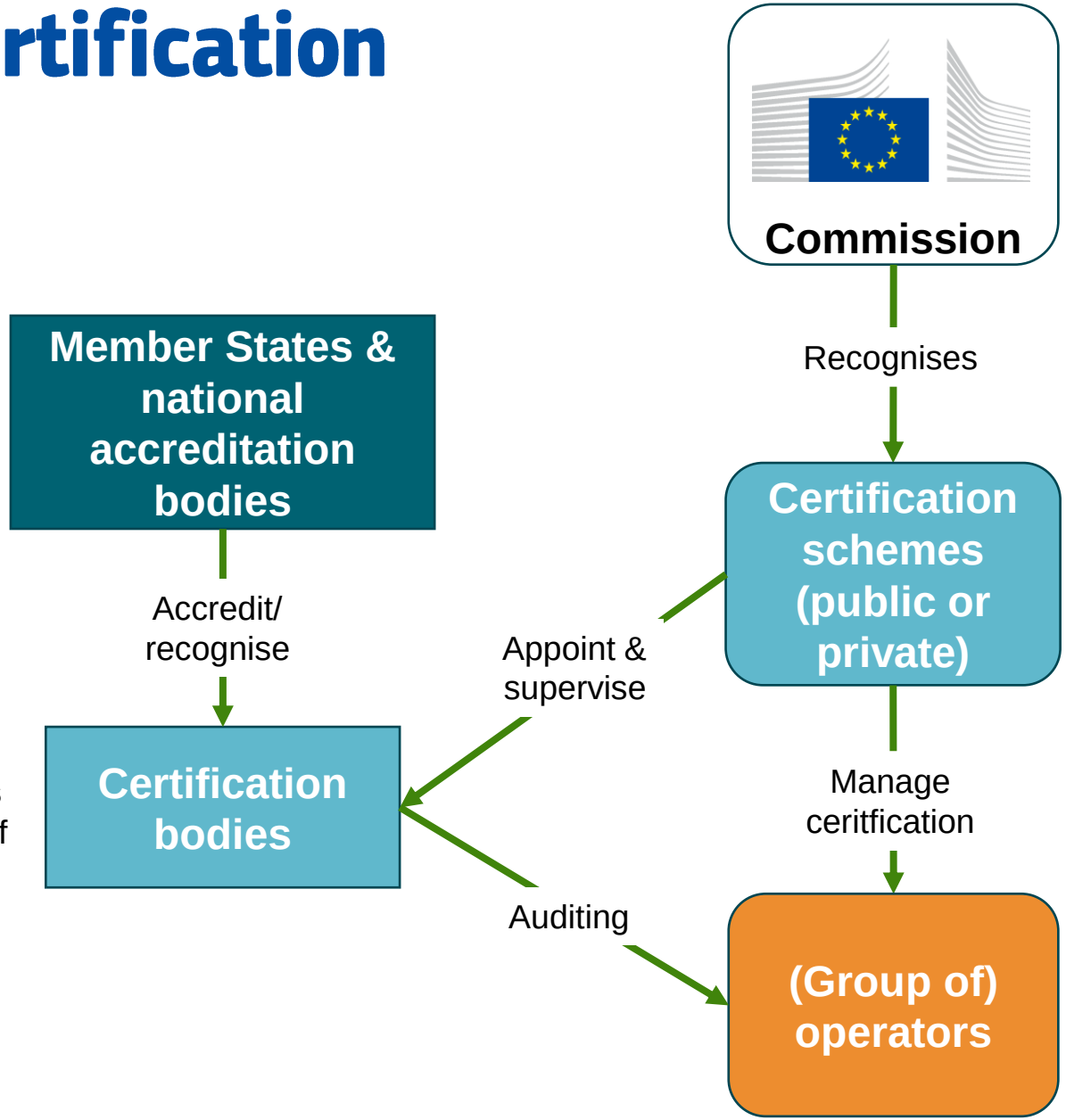
CRCF basics

FAQs

Objective of this meeting and timeline

European Commission

CRCF certification process



- Develops **EU certification methodologies**
- Recognises **certification schemes**
- By 2028: **manages CRCF registry** and issues certified units

- Manage the **scheme** (including internal monitoring)
- Register **activities**
- Appoint, train and supervise **certification bodies**
- Control certification **audits** and **certificates** of compliance
- Manage certification **registry** and issues certified units (until establishment of CRCF registry)

- Carry out **certification & re-certification audits**
- Issue **certificates** of compliance

- Join a **certification scheme**
- Prepare **activity plan** and **monitoring plan** to show compliance with quality criteria and related EU certification methodologies
- Carry out the **activity** and generate **certified units**

Certification audit and regular re-certification audits during activity and monitoring periods

Certification audit (validation)

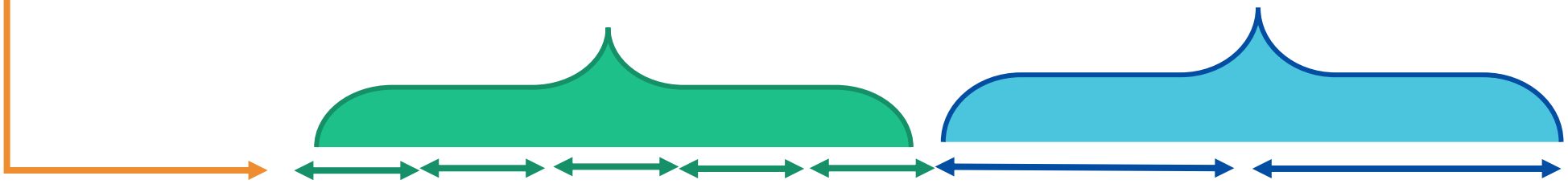
- Before start of activity period
- Issuance of Certificate of Compliance

Re-certification audits (verification)

- Update of Certificate of Compliance
- Issuance of certified units by registry

Monitoring audits (storage verification)

- Update of Certificate of Compliance



Activity period

Monitoring period

FAQs

Can credits be issued ex ante?

- No, CRCF requires certified units to be issued only ex-post on the basis of verified carbon removals or soil emission reductions.
- This does not prejudge procurement agreements with pre-financing.

Can already accumulated carbon in soils and forests be rewarded?

- No, only newly generated carbon removals can be rewarded.

FAQs

Can existing certification schemes and operators join CRCF?

- Yes, all certification schemes can apply for EC recognition if they meet the CRCF verification requirements and apply the EU certification methodologies.
- Operators can join CRCF if their activity is covered by an EU methodology.

Can public funding be combined with CRCF revenues?

- Issues related to double funding and overcompensation fall within the remits of the competition policy for State aid. Therefore, the relevant cumulation rules apply.
- In order to ensure transparency, any public subsidy will be included in the certificate of compliance.

FAQs

What are the liability rules for carbon farming sequestration units and carbon storage in products units?

- An operator or group of operators shall be **liable to address any reversal of the carbon captured and stored** by an activity which occurs during the monitoring period for that activity through appropriate liability mechanisms
- The carbon removed and subsequently stored by a carbon removal activity shall be considered released into the atmosphere at the end of the monitoring period, unless that monitoring period is prolonged through a new certification of the activity

What are the liability rules for soil emissions reduction units?

- Soil emission reduction activities shall be subject to appropriate monitoring rules and liability mechanisms

Agenda

CRCF basics

FAQs

Objective of this meeting and timeline

European Commission

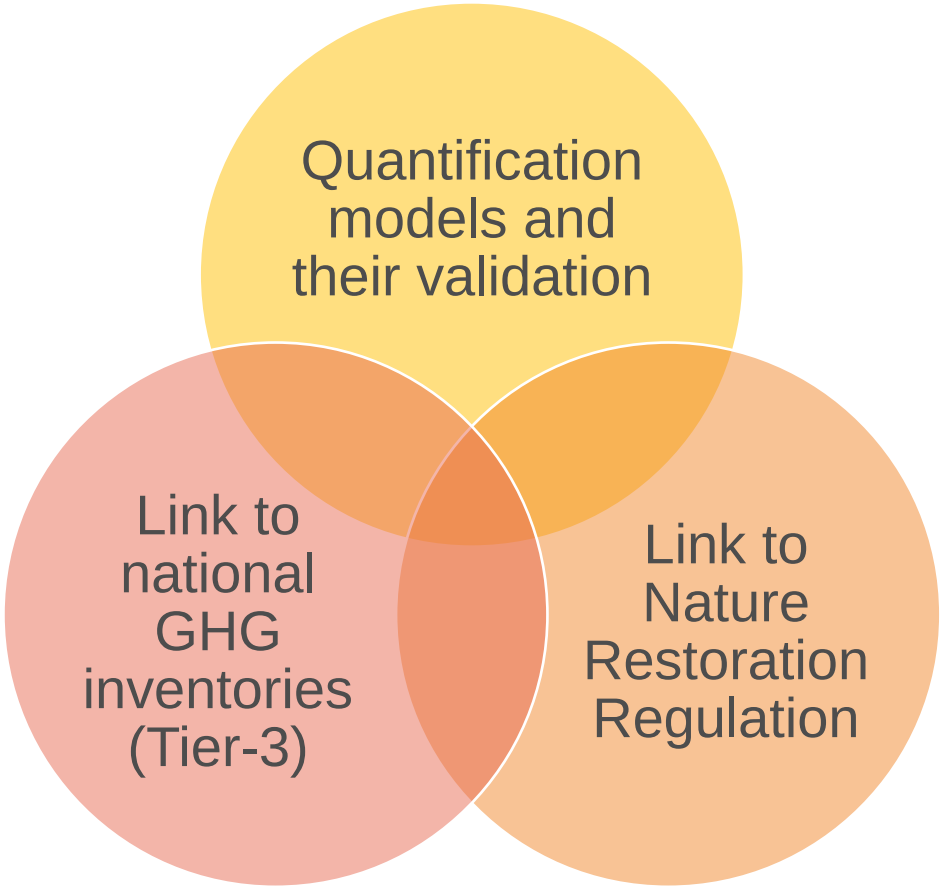
First drafting elements as launchpad for your inputs

Soil management and agroforestry

Rewetting of peatlands

Forestry

- Planting of trees on unused or degraded land



Next steps on carbon farming (tentative)

15 Nov 2024
Deadline for written feedback

- Link here

Nov 2024 to Feb 2025
Online workshops

- **26 Nov**: Soil and Agroforestry
- **28 Nov**: Forestry
- Other workshops TBC

6 to 8 Mar 2025
Carbon Farming Summit

Q2 2025
Expert Group Meeting

- Commission proposal for delegated acts

H2 2025
Livestock methodology

EUROPEAN CARBON FARMING SUMMIT

The 2nd European Carbon Farming Summit

Dublin, Ireland: 4–6 March 2025

Overview:

- We expect the on-site participation of over 500 experts from diverse sectors, including farmers, land managers, scientists, and representatives from various industries, all united around a common ambition: **Putting Carbon Farming to Practice.**
- The summit is envisioned as a space to enable in-depth conversations toward the design and implementation of policy instruments and the deployment of practical solutions.

Timeline:

- The call for sessions is currently open for submissions (Deadline Oct 31, 2024): **please submit proposals here.**
- The call for contributions and summit registration will open soon.
- If you have any questions about the summit, please contact: **team@carbonfarmingsummit.eu** or visit: **www.carbonfarmingsummit.eu** for more information.

CREDIBLE EU carbon farming
eit Climate-KIC Co-funded by the European Union
sae INNOVA
Funded by the European Union

Next steps on verification rules (tentative)

- Vote in Climate Change Committee

Next steps towards certification

December 2024	Publication of CRCF in Official Journal	CRCF Regulation (linguist lawyer version): CO_TA (europa.eu)
2025	Proposal of delegated acts on certification methodologies	Permanent removals Carbon farming Carbon storage in long-lasting buildings
	Proposal of implementing act on verification and registries	
2026	Start of certification	EC recognition of certification schemes
		First issuance of certified units
2028	Start of EU registry	

European Commission

More information:

- DG CLIMA website on Carbon Removals and Carbon Farming
- CRCF Regulation (linguist lawyer version): CO_TA (europa.eu)
- FAQ: a8abe1c4-a3c6-4c94-be0e-4b76f7fd0308_en (europa.eu)
- EU carbon removals newsletter

OVERVIEW

Agriculture

1. Presentation of draft elements of the EU certification methodology, Jan Peter Lesschen, CRETA
2. Comments
   - Greet Ruysschaert, Project Coordinator, Horizon Europe MARVIC project
   - Marta Gómez Giménez , Project Manager, GMV & Coordinator, Horizon Europe project MRV4SOC
   - Gerry Lawson, Policy Analyst, EURAF
   - Andrew Voysey, Climate Agriculture Alliance
3. Open discussion
4. Update on ongoing work on emission reductions from the use of fertilisers, Morgane Henaff, CRETA

European Commission

CONTENT

1. Introduction
2. Scope
3. Quantification

    Discussion and questions

4. Additionality
5. Storage, monitoring and liability
6. Sustainability

    Discussion and questions

INTRODUCTION

- Review of existing methodologies
- Technical assessment papers
- Focus group meetings and feedback Expert Group

→ draft methodology

- Preliminary elements for the first CRCF methodology
- Builds on best practices, aims to incentivise carbon farming
- Finding the balance between accuracy and administrative burden

- Methodology for soil N_2O emission reduction to be added later

ELIGIBLE ACTIVITIES

- Agricultural practices that increase carbon removals or reduce emissions in mineral soils
- Agroforestry practices that increase carbon removals in above- and belowground biomass
  - No predefined list of practices, eligibility based on sustainability criteria and quantification approach
  - Practices generating N_2O emission reductions should be combined with soil/biomass carbon practices
  - Limitation for externally sourced organic amendments

ACTIVITY AND MONITORING PERIOD

- Activity period
  - 5 years
  - For permanent grassland and agroforestry related practices of 10 years

- Monitoring period
  - 10 years
  - For permanent grassland and agroforestry related practices of 15 years

QUANTIFICATION APPROACHES MINERAL SOILS

- Measure – remeasure approach
  - Soil measurements at the start and same locations are resampled at the end of the activity period
  - Model use is optional
- Measure – model approach
  - Soil measurements at the start, which are used as starting stock/initialisation for Tier3 model/model ensemble
  - No prescribed model, validated/accepted model, procedure still to be determined
  - Resampling at 20% of sampling locations for model verification
  - If resampling shows overestimation of more than [20%], corresponding units in the buffer pool will be cancelled

SOIL SAMPLING

- Two approaches
  - Conventional field sampling (composite sample for every 5 ha / field)
  - Sampling protocol making use of other data to optimise sampling design, details to be defined
- Till depth of at least 30 cm
- GNSS coordinates be recorded for resampling
- SOC analysis following ISO approved analysis methods

- Soil dry bulk density
  - Measured in the field using tapping method or hydraulic cylinder
  - Validated pedo-transfer function
  - Same soil bulk density value shall be used throughout the activity period

AGROFORESTRY

- Standardised baseline: zero, i.e. all new carbon removals in the biomass can be certified
- Only trees or woody landscape elements planted less than [5] years before start of activity period can be included

- Monitoring of trees and woody elements every 5 years
- Stock change estimates based on (combination of) Tier 3 approaches:
  - Data from ground measurements
  - Data acquired through remote sensing
  - Modelling (forest growth models)

GHG ASSOCIATED EMISSIONS AND UNCERTAINTY

- Emission related to fossil fuel use and increase/change in fertilizer use
- Only emissions related to on farm emissions sources
- To be calculated in accordance with IPCC guidelines

- ILUC not included, too complex at operator level
- Commission will analyse possible effects as part of the CRCF review

- Uncertainty to be estimated, details of approach and possible discount still to be further elaborated. Uncertainty estimation recommended at project level

GUIDING QUESTIONS FOR DISCUSSION

Quantification

- How to **integrate emission factors, sampling approaches, or models**, including their validation? What governance for this process?*
- Carbon leakage:
  - Internal: field-scale or farm-scale monitoring
  - External: GHG outside of farms; ILUC
- Agro-forestry baseline = 0

Sustainability

- Practical implications for farmer of
  - Minimum Sustainability Criteria (DNSH)
  - Monitoring mandatory co-benefits (NRR indicators)

* To be discussed again during today's last session

ADDITIONALITY FOR ACTIVITY SPECIFIC BASELINE USE

- Regulatory test
  - No legal obligation on the operator to carry out the carbon farming activity, from existing Union or national legislation
- Financial test
  - Additionality is assumed in case of remuneration of private markets
  - Public co-funding is allowed, as long as reported and in line with Cumulation rules under the State aid legal framework
- Possible onboarding of existing certification schemes.

STORAGE, MONITORING AND LIABILITY

- Monitoring rules still to be defined

- Liability mechanisms (only for carbon removals)
  - Insurance policy / guarantee product
  - Buffer pool approach, size based on risk assessment or default value, details still to be developed

SUSTAINABILITY – MINIMUM SUSTAINABILITY CRITERIA

- Based on Taxonomy Do Not Significant Harm principle

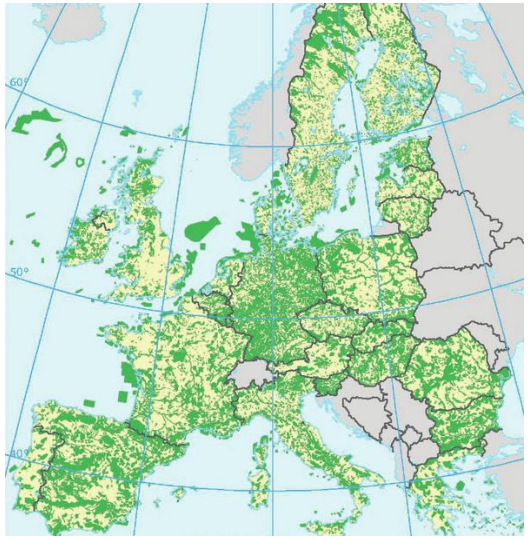
- Climate change mitigation:
  - Maintenance of permanent grassland (GAEC 1)
  - No degradation of land with high carbon stocks (no impact on organic soils or loss of carbon in forest land)
  - No use of peat or peat containing products
- Climate change adaptation:
  - No adverse effect on adaptation efforts and consistent with adaptation strategies
  - No impact expected, carbon farming practices are contributing to climate change adaptation (improved soil structure, water holding capacity)

SUSTAINABILITY – MINIMUM SUSTAINABILITY CRITERIA

- Sustainable use and protection of water and marine resources:
  - Comply with Water Framework Directive
  - No increase in average N input from mineral and organic fertilizers per ha of UAA (exemption for areas with low yields and high NUE)
  - Limitations on use of irrigation in water stressed areas
- Transition to a circular economy
  - Limit waste generation
  - Recycling of non-natural waste materials
- Pollution prevention and control
  - Avoid inputs or release of substances that may harm human health or the environment
  - Follow principles of Integrated Pest Management
  - Limitation on use of plant protection products, no net increase in active substances at farm level

SUSTAINABILITY – MINIMUM SUSTAINABILITY CRITERIA

- Protection and restoration of biodiversity and ecosystems
  - No negative effects on Natura 2000 sites
  - No negative effects on populations and habitats being protected under the Birds and Habitats Directives
  - Protect existing buffer zones and ecological corridors
  - Prevent the introduction of invasive alien species



SUSTAINABILITY – CO-BENEFITS

- Mandatory co-benefits for objective on protection and restoration of biodiversity and ecosystems including soil health and avoidance of land degradation
  - Alignment with indicators from Nature Restoration Regulation
    - Stock of organic carbon in cropland mineral soils
    - Share of agricultural land with high-diversity landscape features
  - Improvement on one of the indicators is considered compliant with mandatory co-benefit

- Monitoring and reporting of other voluntary co-benefits
  - Not possible to identify EU-wide applicable methodologies

GUIDING QUESTIONS FOR DISCUSSION

Quantification

- How to **integrate emission factors, sampling approaches, or models**, including their validation? What governance for this process?*
- Carbon leakage:
  - Internal: field-scale or farm-scale monitoring
  - External: GHG outside of farms; ILUC
- Agro-forestry baseline = 0

Sustainability

- Practical implications for farmer of
  - Minimum Sustainability Criteria (DNSH)
  - Monitoring mandatory co-benefits (NRR indicators)

* To be discussed again during today's last session

Next steps on agriculture methodology

- Link

- 26/11: Quantification & Sustainability
- December: fertiliser emissions
- TBC: baselines, additionality, liability & monitoring rules

- Commission proposal for delegated acts

Thank you

Contact:

janpeter.lesschen@wur.nl

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OVERVIEW

Peatland

1. Presentation of draft elements of the EU certification methodology, Ivan Martinez, DG CLIMA
2. Comments
   - Malte Schneider, Founder, Aeco GmbH, Social Carbon Peatland Restoration Methodology
   - Shane McGuinness, Founder, Director, Peatland Finance
3. Open discussion

European Commission

Draft elements for an EU certification methodology on carbon removals and soil emission reductions through carbon farming under the CRCF Regulation

Peatland restoration through rewetting

5th EU Carbon Removals Expert Group meeting – 22 October 2024

Context

- Wide consensus on the need for upscaling peatland restoration / rewetting ASAP
- Instrument for supporting farmers & landowners in long-term land use decisions and transitions
- Specificities inherent to peatlands to consider (definition, condition, multiple uses, etc.), amplified at EU-scale
- *Constructive feedback at this stage much appreciated!*

Eligible activities

Resulting in:

- Climate benefit -> reduction of GHG emissions
- Protection and restoration of (peatland specific) biodiversity and ecosystems, as well as avoidance of land degradation

Examples:

- Management of drainage structures or pumps
- Re-establishment of peat-forming vegetation
- Paludiculture

Activity period

Minimum 20 yrs, except

- Shorter peat depletion time
- Justification supported by scientific background

Maximum = peat depletion time

Default peat depletion rate:

- [1] cm per year in bogs
- [1.5] cm per year in fens
- A different rate could apply if evidence is presented

Monitoring = activity period

Quantification 1/2

$$\textit{Net soil emission reduction benefit} = LSE_{baseline} - LSE_{total} + ASE_{baseline} - ASE_{total} -$$

$$GHG_{associated} > 0$$

CO_2, CH_4 — N_2O (optional)

- No standarised baseline -- activity specific
- Emissions = Activity (ha) x Emission factor (C eq ha^{-1} yr^{-1})
- $GHG_{associated}$ at farm level. Materiality test

Quantification 2/2

How to determine Emissions Factors (EF)? Prioritization of methods:

1. Methodologies used for the UNFCCC reporting of emissions and removals under Tier 3
2. Process-based biogeochemical GHG flux models, calibrated and validated with direct field measurements
3. Correlative proxy approaches.
4. Direct measurements

Monitoring

Re-certification audits annually (or longer), ex-post issuance of units

What to monitor? Proxies used to determine EFs:

- Water table
- Vegetation (indicator species). How often?
- First recertification audit only in year 5, unless data on initial methane emissions is presented and included

Mitigation of risks

No reversal of emission reductions

Additionality

Regulatory test

No legal obligation derived from Union or national legislation

If new legislation introduced during activity period, still additional

Financial test

Aligned with State aid rules. Possible on-boarding of existing schemes

Assumed in case of schemes that are only financed through remuneration coming from private markets

Sustainability – Protection and restoration of biodiversity and ecosystems, including soil health as well as avoidance of land degradation

Eligible activities imply significant biodiversity co-benefits, in alignment with Nature Restoration Regulation > minimum requirements considered complied with

Protecting and restoring carbon-rich soils such as peatlands enables to avoid land degradation, to preserve soil health and restore natural ecosystems

Co-benefits as a result of eligible activities and peatland-relevant activities listed in NRR if monitored under the methodology > contribution to NRR targets

Sustainability – minimum requirements

Mitigation

- NA

Adaptation

- Identifying and addressing risks and impacts on soils degradation, heat stress and wildfire

Sustainable use and protection of water

- Identifying and addressing environmental degradation risks related to water quality and stress

Circular economy

- Peat extraction and burning of peat prohibited

Pollution prevention

- Prevention mechanisms must be foreseen. Use of pesticides shall be minimised.

Based on Taxonomy technical screening criteria for the DNSH principle

Sustainability – voluntary co-benefits

In alignment with Environmental Taxonomy Delegated Regulation 2023/2486

- Measures for flood and drought risk prevention and protection deliver co-benefits on sustainable use and protection of water

Examples of possible co-benefits on other objectives

- Climate adaptation > Evaporative cooling
- Circular economy > Paludiculture
- Pollution prevention > No nitrogen fertilisers, no pesticides, prevention or reduction of harmful phosphorus emissions…

Next steps on peatland methodology

- Link here

- Commission proposal for delegated acts

Thank you

European Commission

Guiding questions for discussion

Quantification*

- How do we **incentivise** the development of new tier 3 emission factors or the update of proxies and models?
- What **governance system** should be established for the necessary validation process?

Sustainability

The draft methodology proposes an approach to co-benefits based on a **positive list of practices**.

- How to integrate **context-specific indicators / metrics** in an EU-wide methodology?

* To be discussed again during today's last session

OVERVIEW

Forestry

1. Presentation of draft elements of the EU certification methodology, Sven van Baren, CRETA
2. Comments
3. Open discussion

European Commission

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Partners for Innovation

Draft elements of forestry certification methodology

5th Expert group meeting
22nd October 2024

Sven van Baren and Eric Arets (WUR)

CLIMATE ACTION

Forestry Certification Methodology

Development of certification methodologies for all forestry activities

- Planting of trees
- Forest Restoration
- Forest Management

Start with planting of trees on degraded and unused land

- Allows focus on quantification and sustainability criteria that will also be relevant for other forestry activities
- Simplified approach for baseline
- Facilitate uptake

Next steps

- Consolidate and integrate contributions into the draft methodology
- Build on best practices, Horizon projects and technical input for development of other forestry methodologies

Content

- Scope and eligibility
- Quantification
- Additionality
- Storage, monitoring and liability
- Sustainability
- Timeline
- Questions for discussion

Scope and eligibility

Planting of trees on unused and/or severely degraded land

No trees for the last 20 years or up to 10% tree cover

Management activities allowed (e.g. thinning)

Peatlands not eligible, no drainage or irrigation of organic soils

Soil disturbance max on 10% of area

Local and climate smart planting

After 5 years, planting density in line with local jurisdiction

No clearcuts exceeding 0.2 ha

Activity period: 30 years. Monitoring period: 40 years

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Quantification

$$\textit{Temporary net carbon removal benefit} = CR_{baseline} - CR_{total} - GHG_{associated} > 0,$$

Pools

- Above-ground biomass
- Below-ground biomass

Sources

- Direct and indirect emissions from fertiliser and machinery → N_2O and CO_2

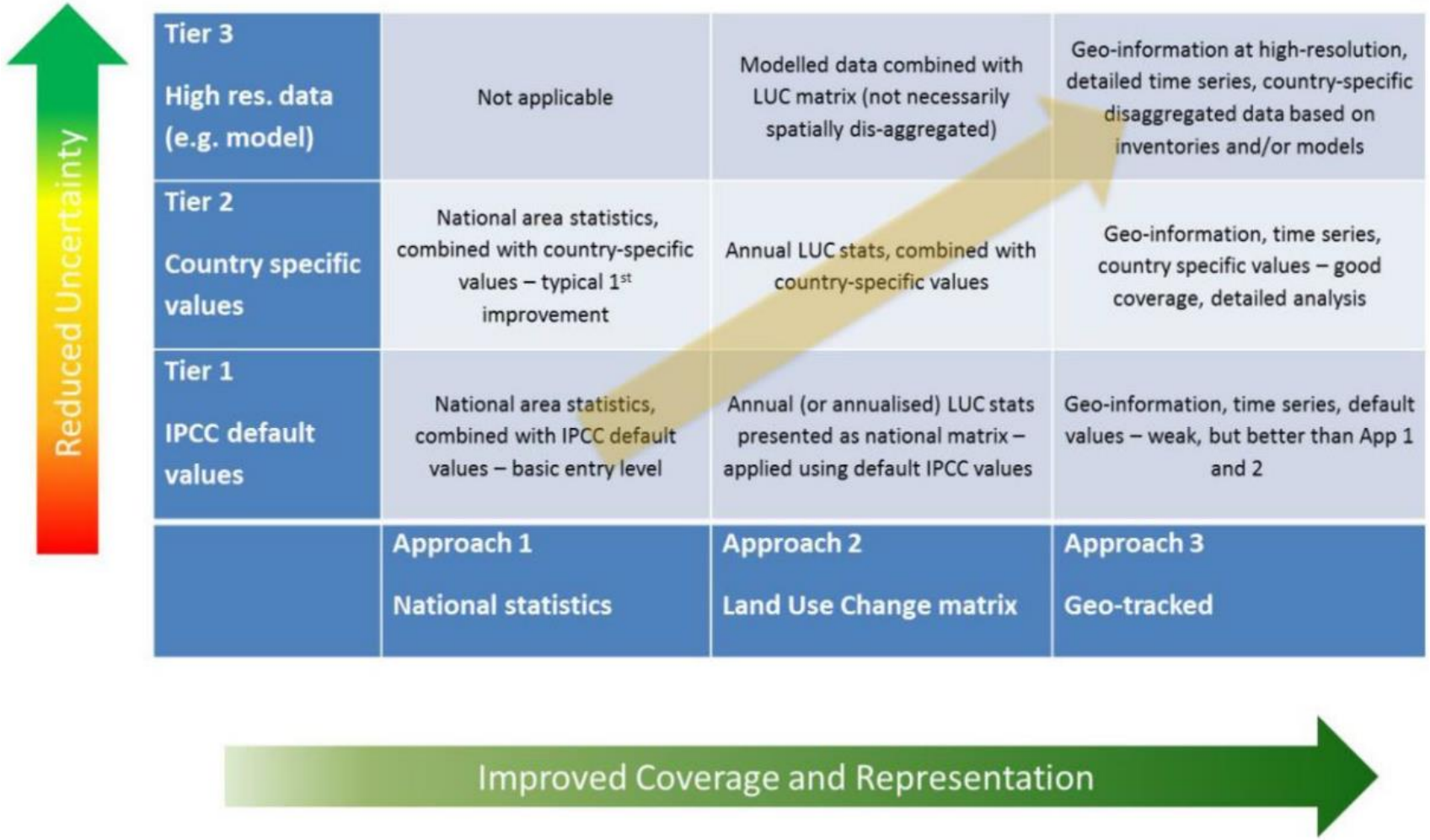
Standardised baseline equal to zero

- Unused and degraded land generally devoid of significant biomass (for the last 20 years).
- New removals from new or existing trees (not more than 10% of activity area) can be certified.
- Not planted more than 5 years before the start of the activity.

Monitoring at least every five years

Quantification – Reflected in GHGI

- Fully in line with the revised **LULUCF & Governance Regulations**
  - Geographically explicit land use data
  - Tier 3 methods, as per the IPCC Guidelines



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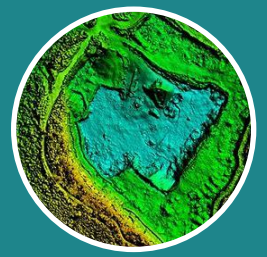
Quantification – Combined approach

On-Ground Measurements

Ground sampling scheme: e. g.
6 trees / plot; 4 plots / ha

Remote Sensing

- Satellite
- LiDAR
- …



Modelling

- Forest Growth Models
- …

→ Soil Monitoring Law

→ Forest Monitoring Law

Quantification – Associated emissions

Direct and indirect

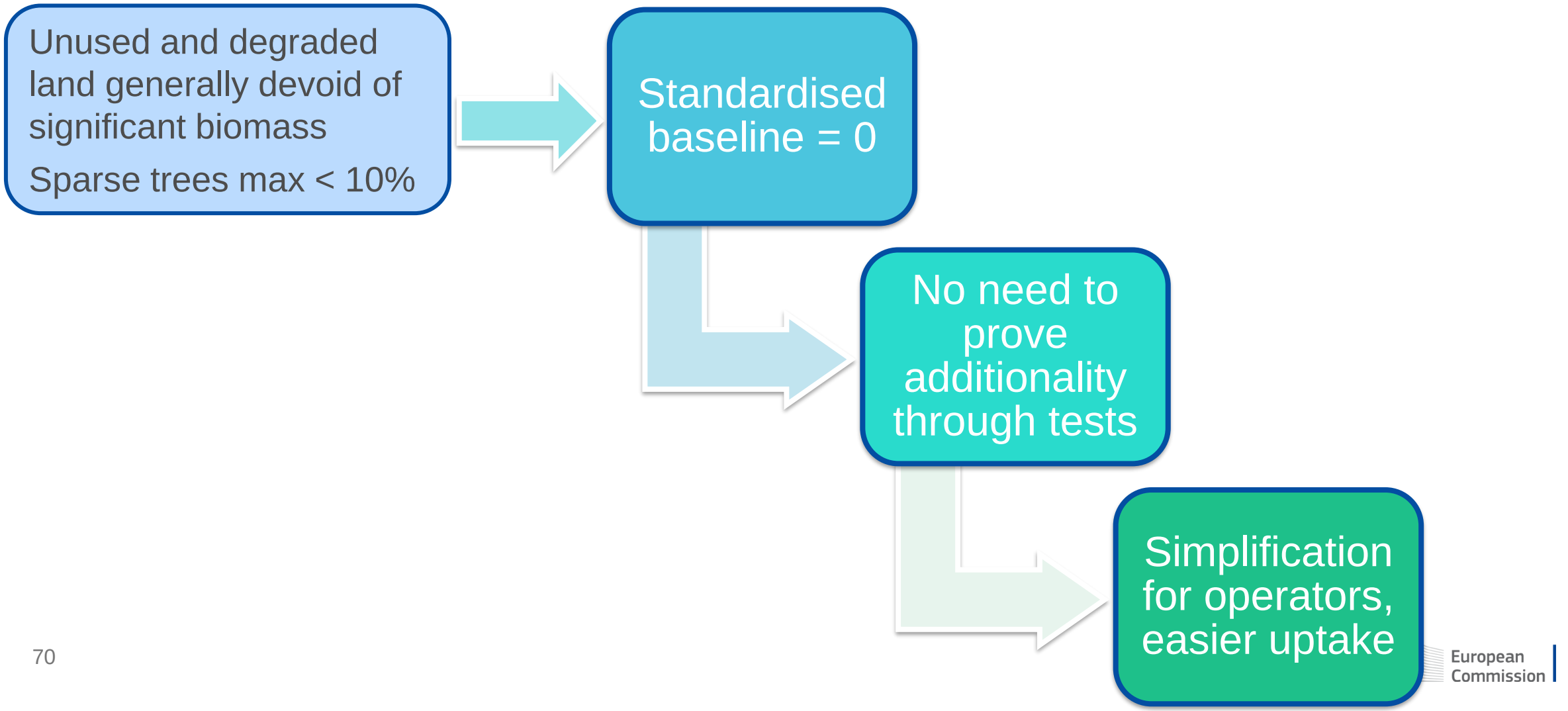
- Increase in fossil fuel use
- Increase in fertiliser use

Materiality rule [*2%*]

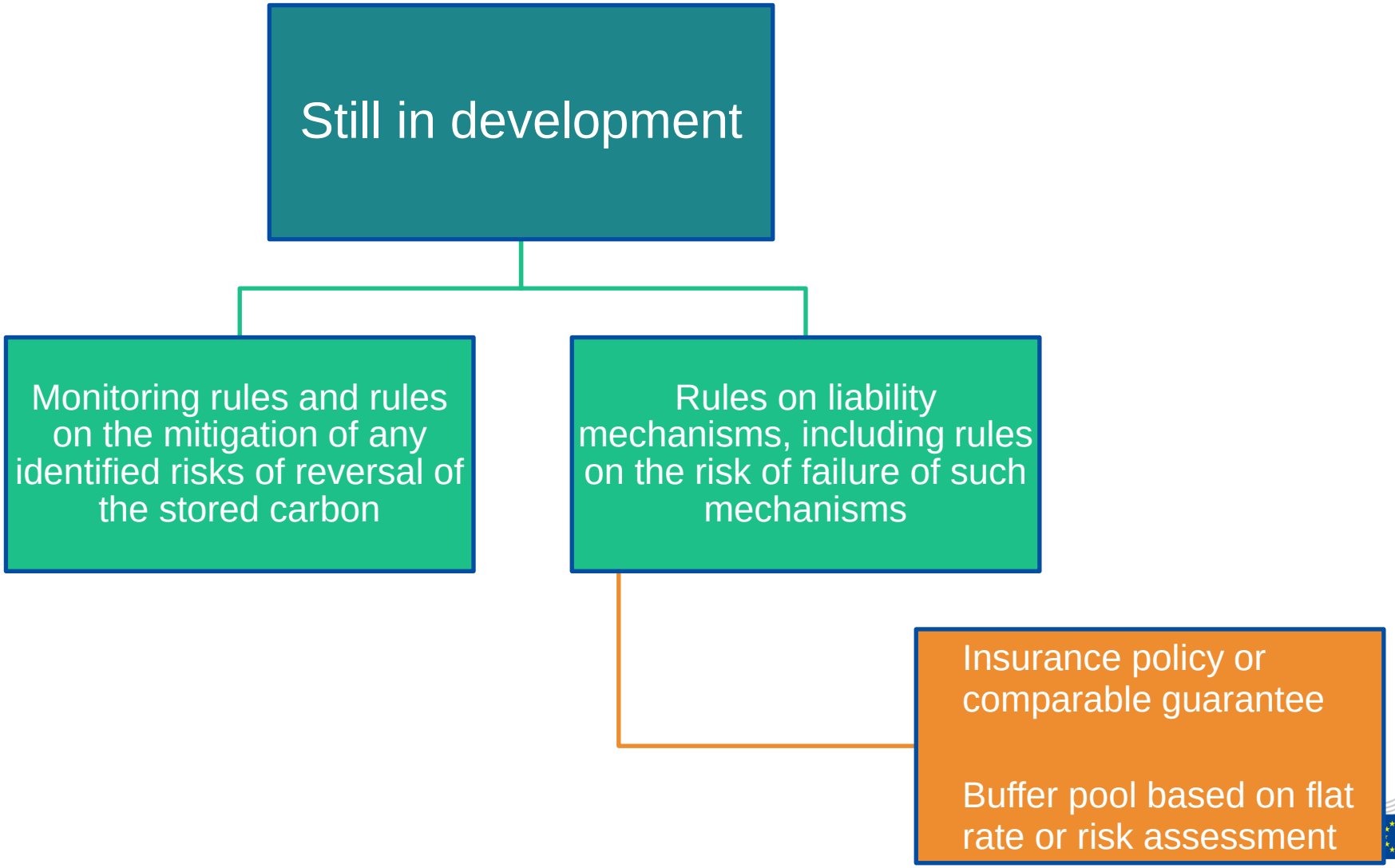
- Emissions with very small impact excluded

Indirect Land Use Change very complex at operator level, not included for now

Additionality



Storage, monitoring and liability

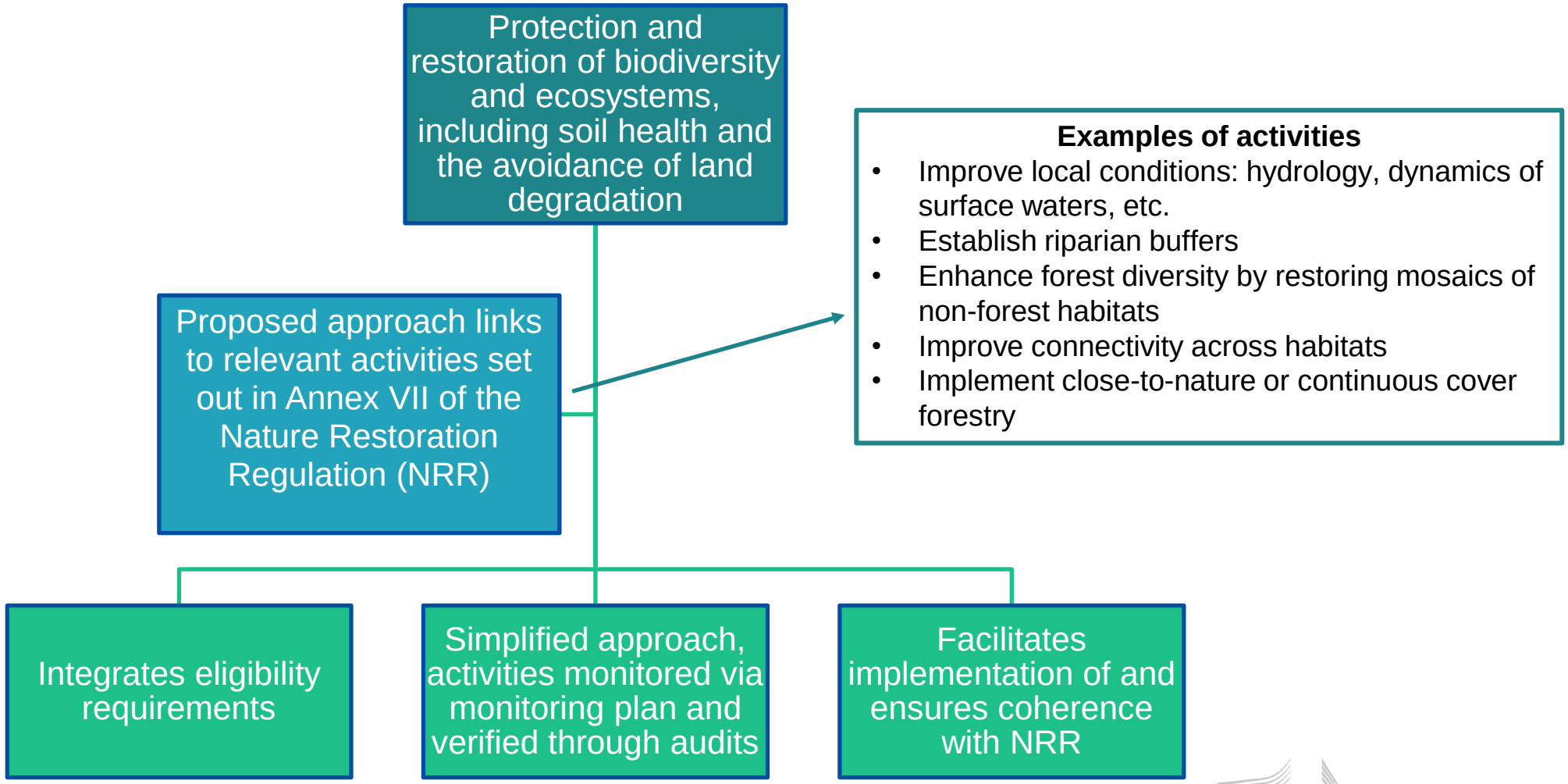


Sustainability – minimum requirements

Based on the Do No Significant Harm (DNSH) criteria set out in the Climate Taxonomy delegated regulation

Climate change mitigation	• respect existing high carbon stocks • no use of soil improvers from peat • volume tree felling < annual increment
Climate change adaptation	• no adverse effects on other adaption efforts • consistent with national adaptation strategies and plans • consider the use of nature-based solutions
Sustainable use and protection of water and marine sources	• avoidance of degradation risks and water stress • respect or help good environmental status of marine waters • maintenance of riparian buffer zones
Transition to a circular economy	• N/A
Pollution prevention and control	• minimise use of pesticides and fertilisers • no release of substances that harm the environment • prevent pollution of water and soil and undertake cleaning meaures
Protection and restoration of biodiversity and ecosystems including soil health, as well as avoidance of land degradation	• no negative effects in relation to Natura 2000 sites • no detrimental effects to recovery/maintenance of populations under birds and habitat dir. • no disturbance of legally protected species • protect existing buffer zones • prevent introduction of invasive alien species • no introduction of non-native species unless demonstrated that this leads to favourable and appropriate ecosystem conditions or improved adaptation to projected climate and pedo-hydrological conditions

Sustainability – mandatory co-benefits



Sustainability – voluntary co-benefits

Climate change mitigation and adaptation, sustainable use and protection of water and marine sources, transition to circular economy, pollution

Not possible to identify EU-wide applicable methodologies

Examples of possible co-benefits for transition to circular economy: limitation of waste generation, collection of non-natural waste material for recycling

Next steps on forestry methodologies

- Link

- 28/11: Forestry
- Further dates TBC Liability and monitoring rules

- Commission proposal for delegated acts

Guiding questions for discussion

Quantification*

- What is the best approach to **integrate remote sensing data and models**, including their validation? What governance for this process?

Sustainability

The draft methodology proposes an approach to co-benefits based on a positive list of practices.

- How to integrate **context-specific indicators/metrics** in an EU-wide methodology?

* To be discussed again during today's last session

Thank you

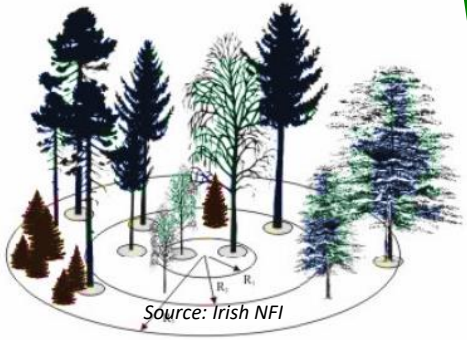
European Commission

International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

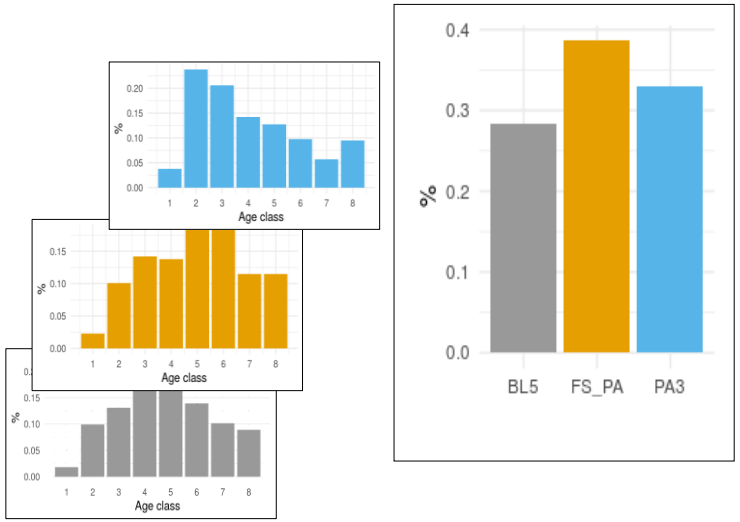
Modelling and remote sensing in support of near-real time monitoring of carbon removals

Fulvio Di Fulvio, IIASA

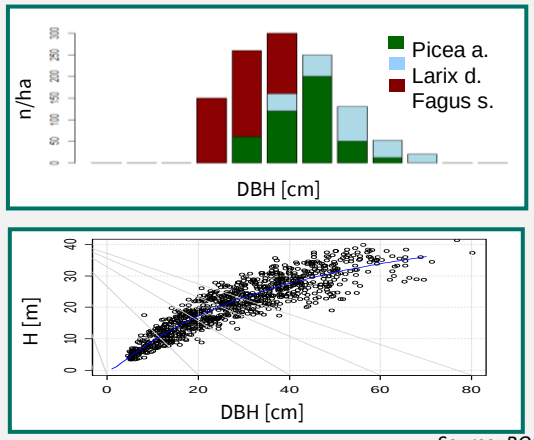
Ground-data based assessment of Carbon sink



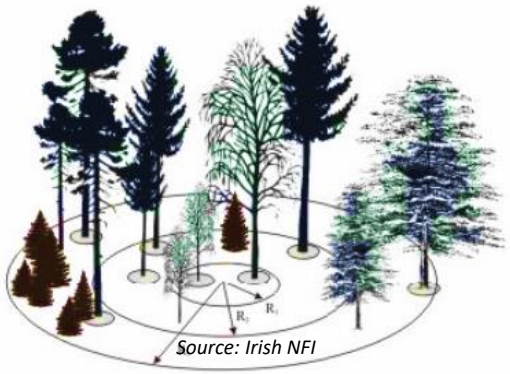
Sample plots Time 1



stand & tree data
for each forest type variant
based on ground plots



Source: BOKU



Sample plots Time 2

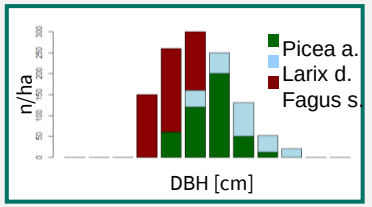
Plot Structure T2- T1 =
Change in C sink

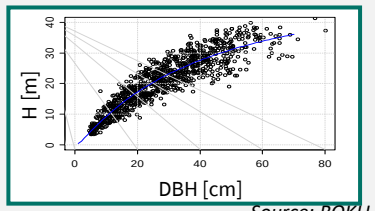
- ✓ *Very reliable*
- ✓ *Relatively expensive*
- ✓ *Non-real time*

Model-based assessment and projection of Carbon sink

Ground data

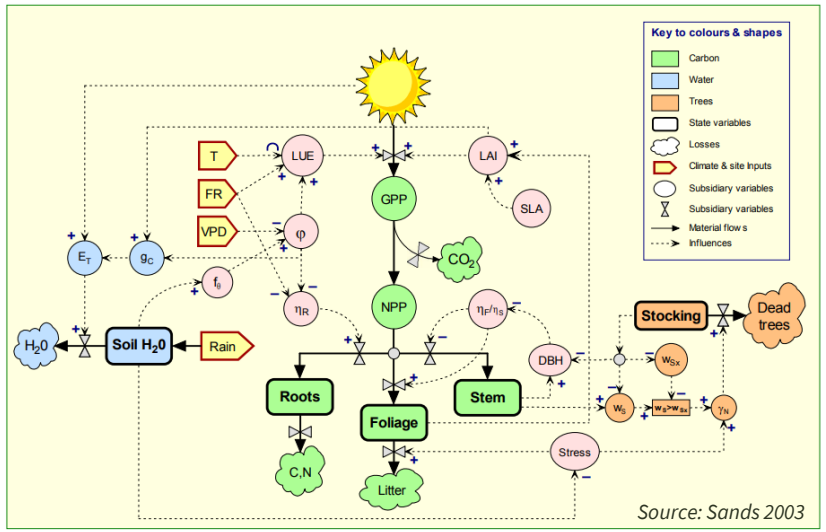
stand & tree data
for each forest type variant
based on ground plots





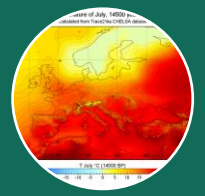
Source: BOKU

Biophysical model calibrated to ground data



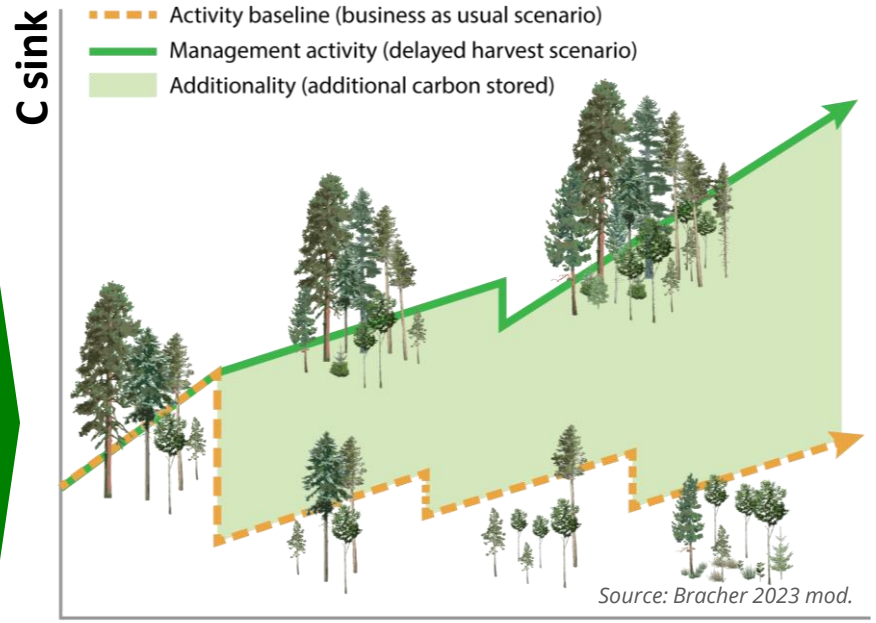
Source: Sands 2003

Disturbances



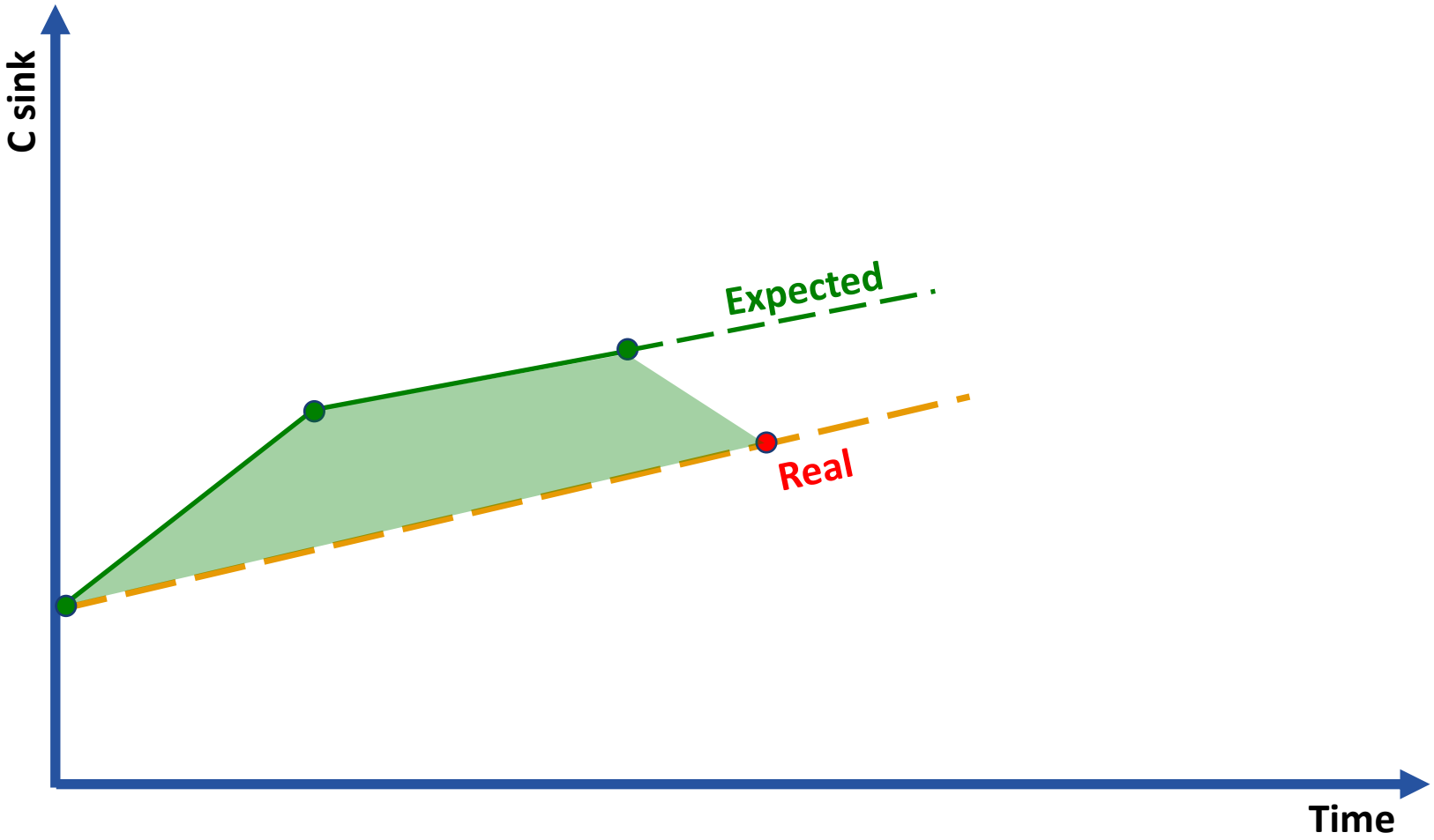
Climate interactions

Projections of carbon sink



- ✓ *Based on biophysical processes*
- ✓ *Calibrated to measured data*
- ✓ *Monthly/Yearly projection*

Importance of timely observations



Activity Baseline

Management Activity

Additional Carbon Stored

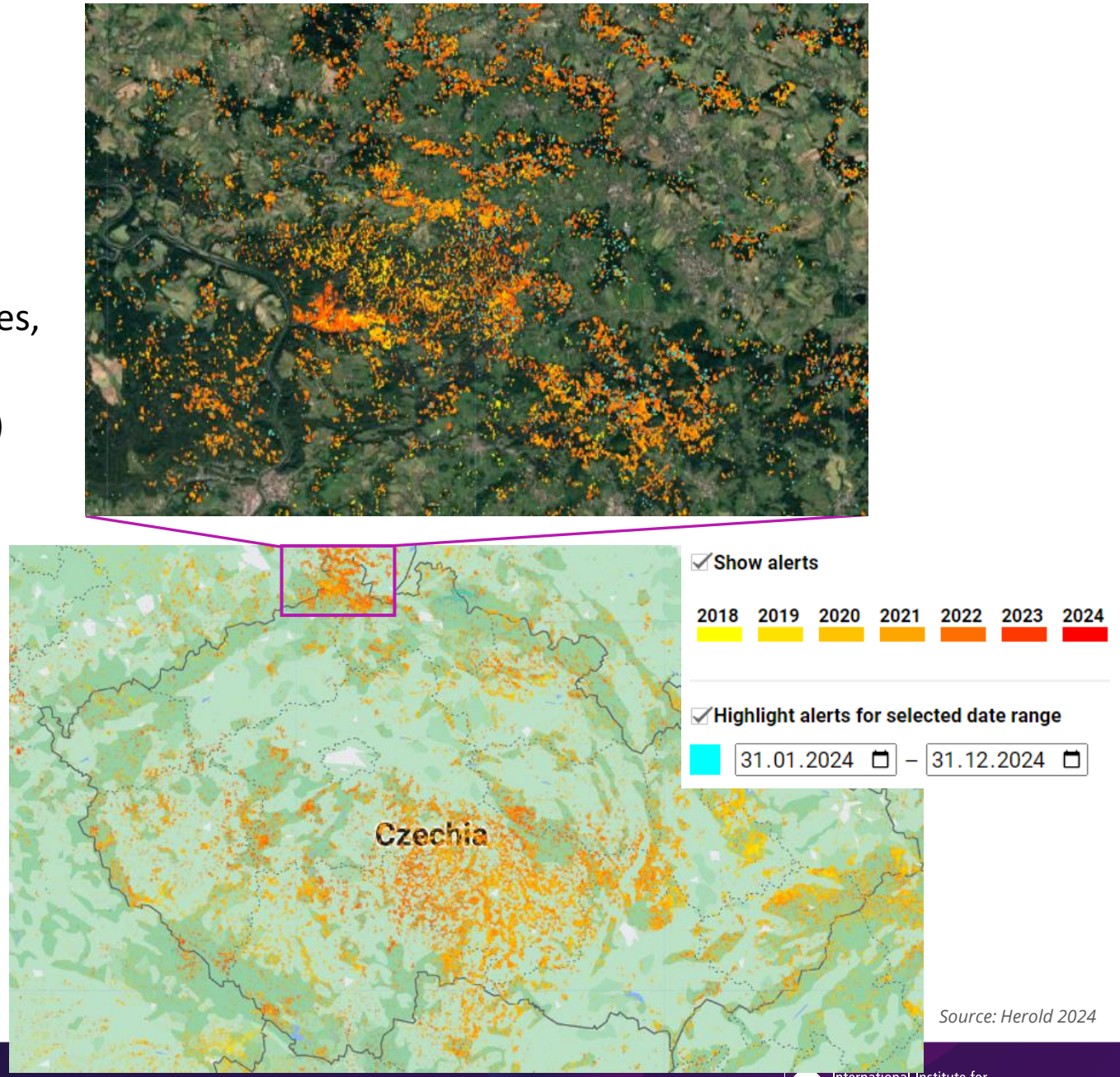
✓ *Information for timely management corrections*

Remote Sensing Data

“Quick changes” are usually those related to C-stock losses

- Spotting consistency or anomalies: climate extremes, fires, defoliation, bark beetles' attacks
- Forest disturbance data (RADD-Europe, GLAD-DD, LUCA)

✓ *Near-real time: Weekly/Monthly updates*
✓ *Need of calibration to ground data*



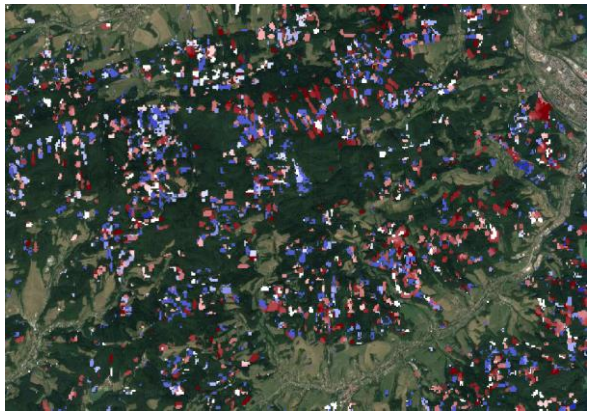
Source: Herold 2024

Model-data fusion for near-real time monitoring of C sink

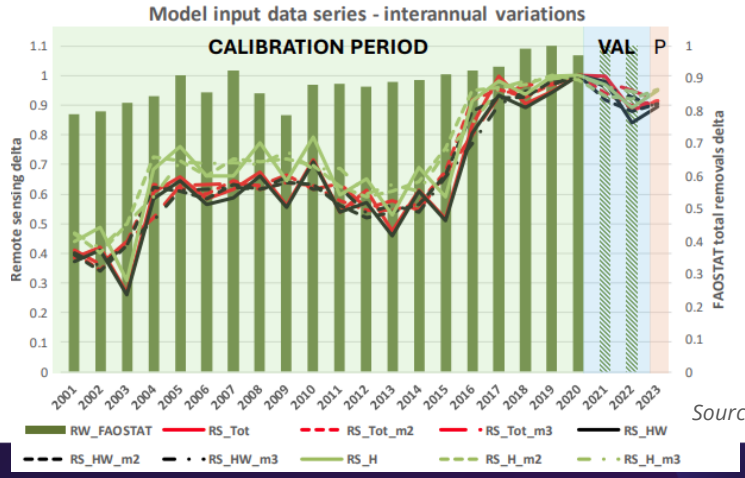
Updated climate data records

Projection of growth from ground calibrated biophysical forest model

Updated forest disturbance area from forest RS monitoring data (e.g. Copernicus services) and other sources



Calibration and validation of RS records vs observed data



Source: Pilli et al.

✓ Monthly/Yearly update of C sink

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Thank you

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Monitoring Forest Carbon with Earth Observation

grega.milcinski@sinergise.com

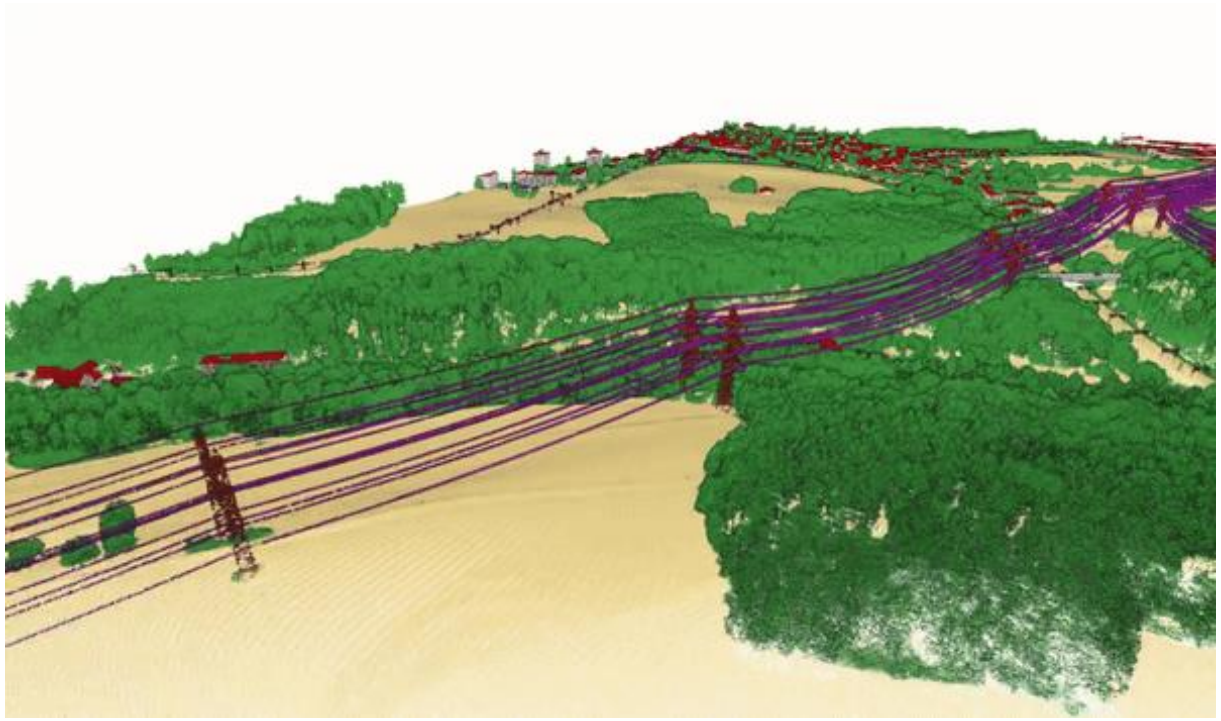
Sinergise, a Planet company

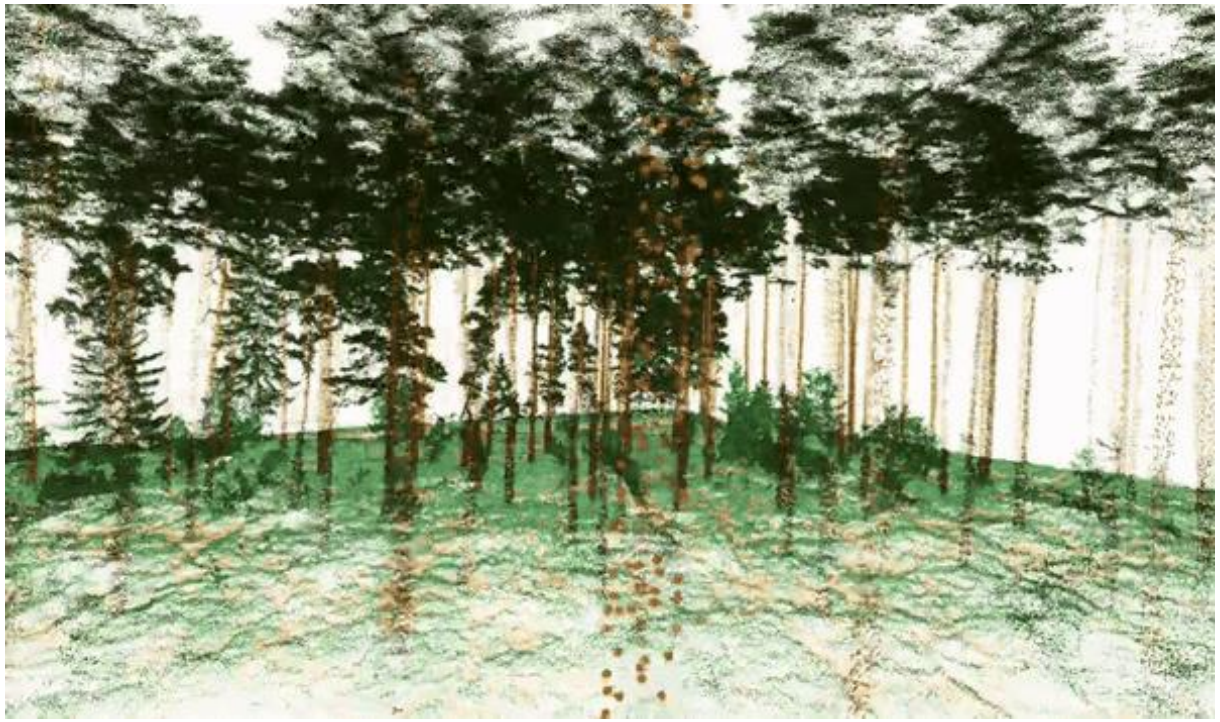
SINERGISE

Historic data

Source: Copernicus Data Space Ecosystem

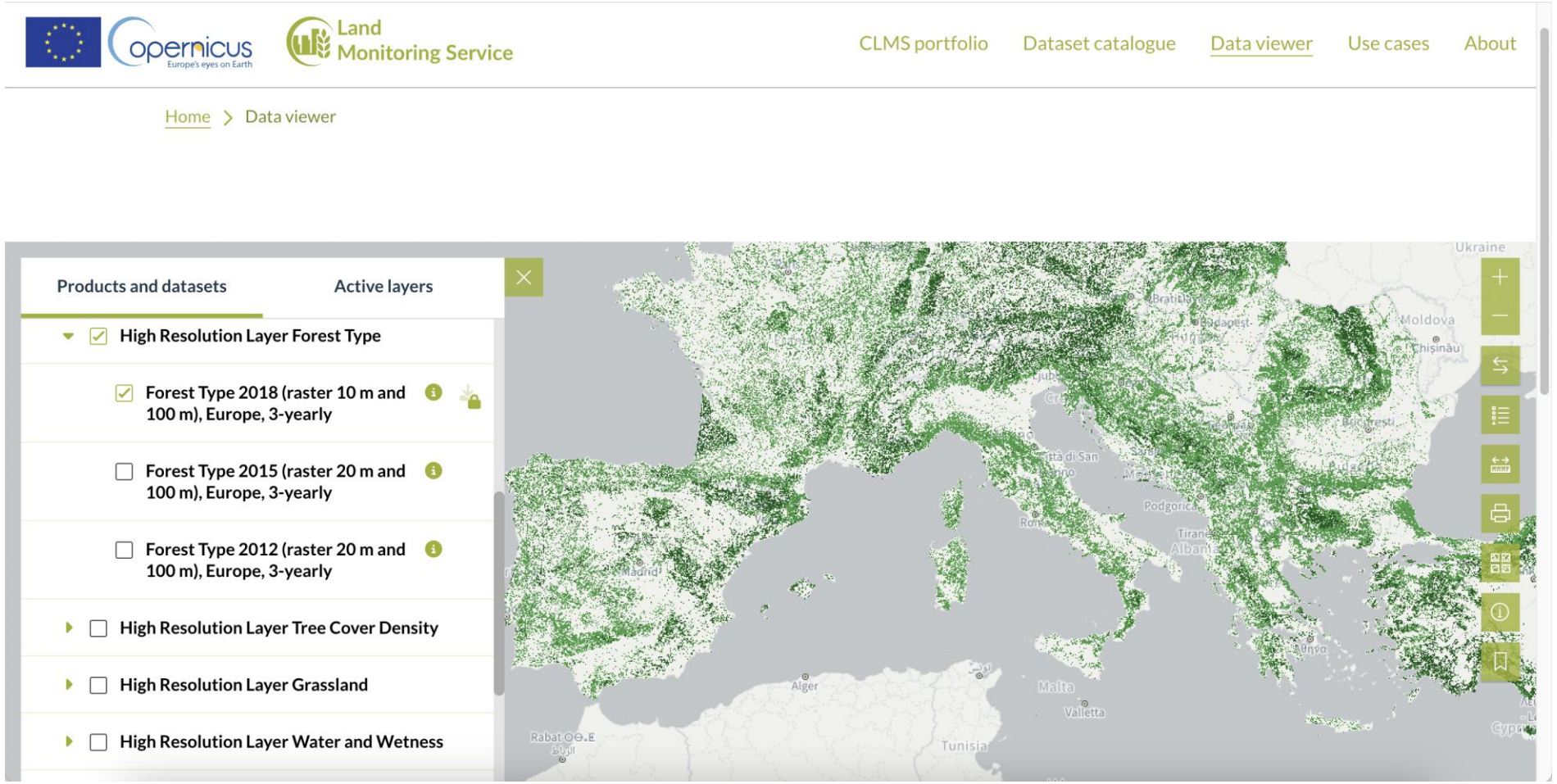
Inventory monitoring





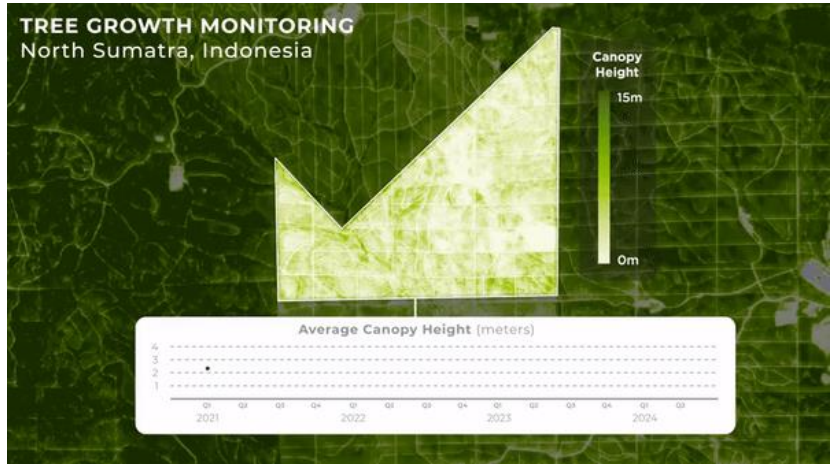
Source: FLAI Single Tree Inventory

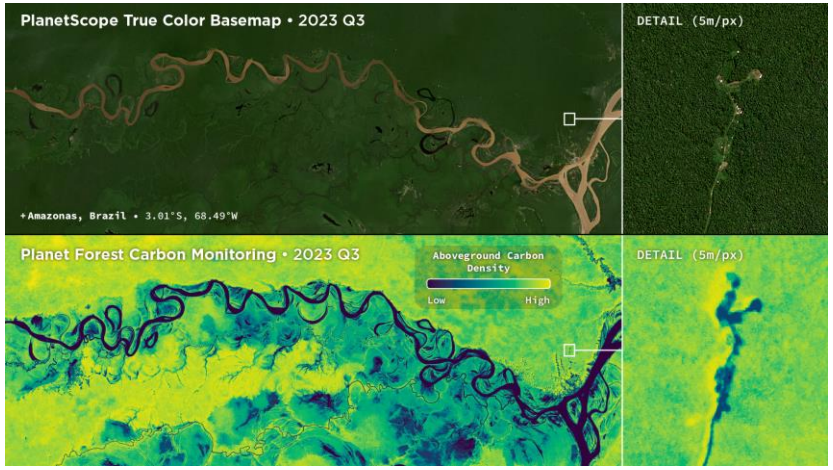
Forest type



Source: [Copernicus Land Monitoring Service]

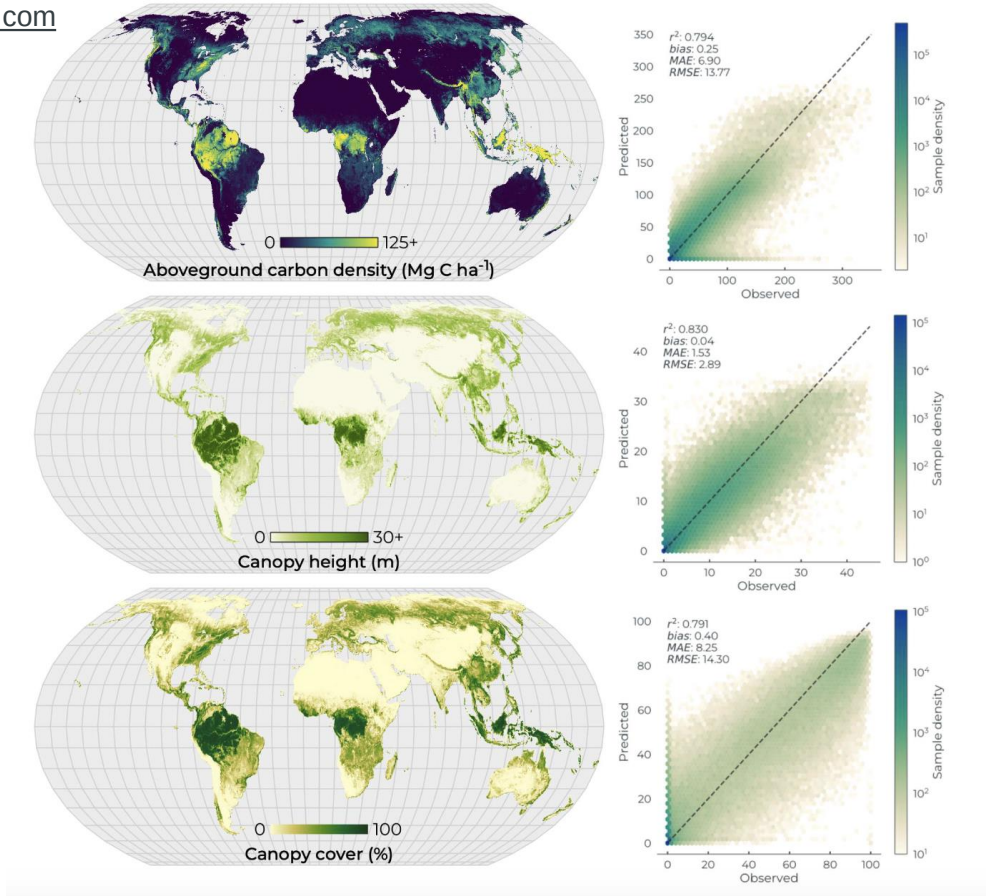
Forest and Forest Carbon monitoring with satellites





Source: Planet.com

Source: Planet.com



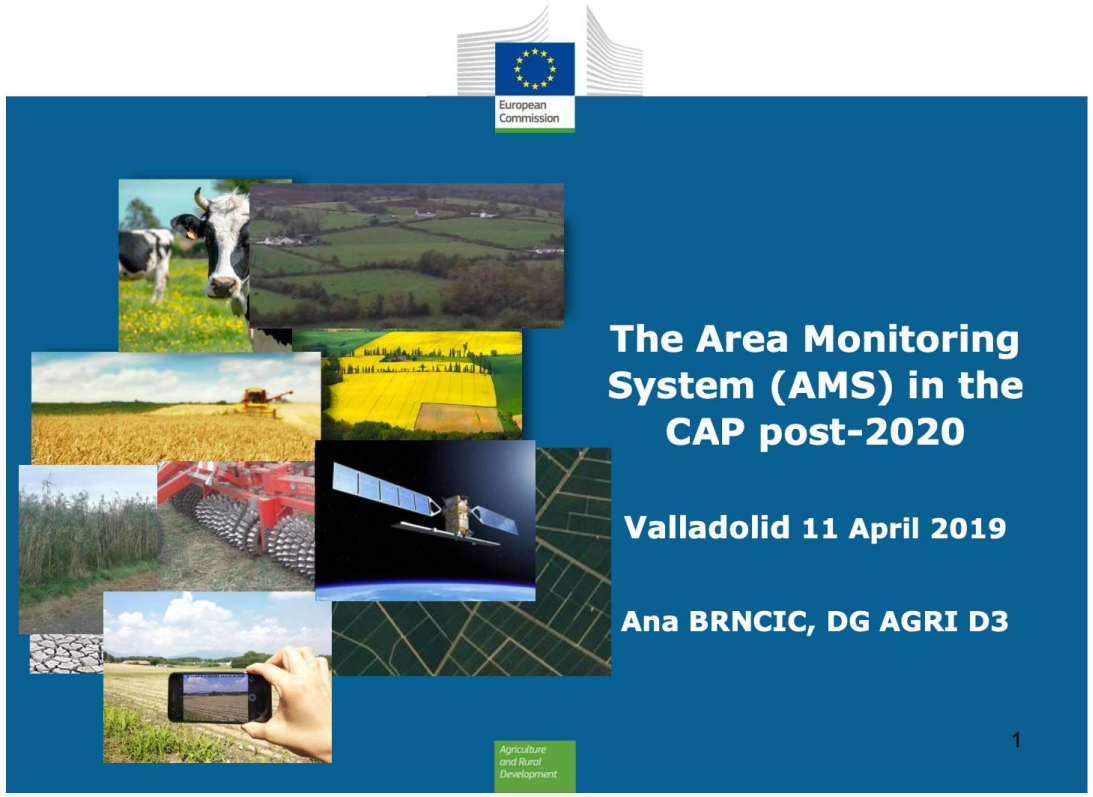
[Technical documentation]
[Validation and Intercomparison report]

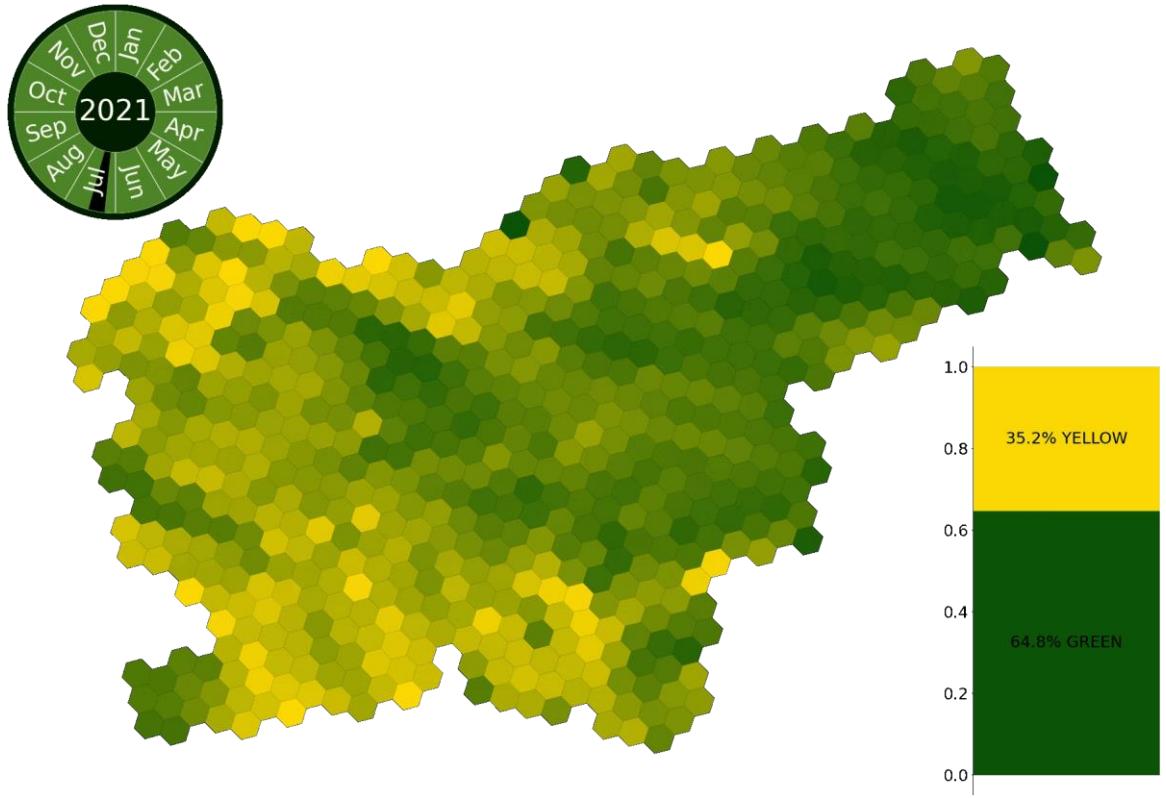
Disclosure: presenter is working with Planet Labs

Don’t let the perfect be the enemy of the good.

(Voltaire)

Existing experience in EU – CAP Area Monitoring System





Certification methodology for planting of trees on unused and severely degraded land: *sustainability and quantification*

Clara Antón Fernández

Senior Researcher

NIBIO, Norway

Sustainability in planted areas on unused and severely degraded land

- **Species adapted to current and future climate** (resilience)
- **Genetic species variability** (adaptation and resilience)
- **Diversified forest structure**:
  - species composition (stand and landscape),
  - mosaic landscapes/stands.

Foto: John Yngvar Larsson, NIBIO

Sustainability: **measures and monitoring**

- Improved connectivity (remote sensing)
- Diversified forest structure at **landscape level** (remote sensing)
- Resilience (current and future species suitability maps)
- Ensure intra-specific genetic variability
- Introduce not-so-common species

Foto: John Dan Aamlid, NIBIO

Monitoring biodiversity: Environmental DNA (eDNA)

<u>eDNA</u>: Genetic material obtained directly from environmental samples: soil, water, air..

- No direct observation needed
- Easy and fast to take
- Easy to train people to take the samples
- Easy to store

Metabarcoding

identify multiple species within an environmental sample

Phylogenetic diversity captures the differences in evolutionary history among species.

Functional diversity considers species traits which are relevant to ecosystem functioning.

Genetic diversity is a key for species survival, evolutionary potential and ability to respond to environmental changes.

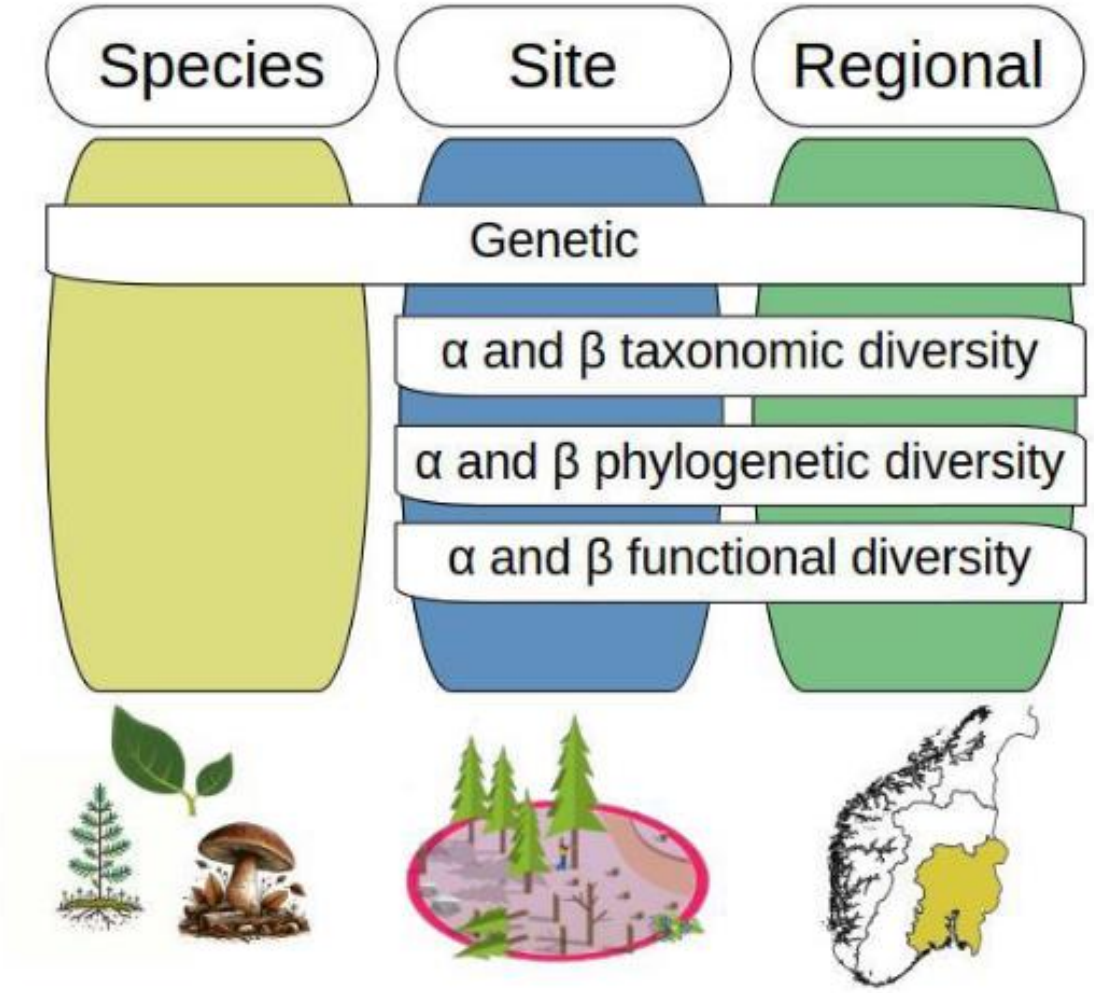


Figure 1. Integrative biodiversity approach