EARSC Statement

Proposal for a Regulation for a certification framework for carbon removals

The European Association of Remote Sensing Companies (EARSC) is a trade association based in Brussels, representing the European downstream services sector. EARSC counts more than 135 members across 25 countries of Europe.

EARSC welcomes the Commission's initiative to regulate carbon removals via an EU-level certification scheme recognising a unified accounting system for monitoring, reporting and verification processes to ensure the validity of carbon removals.

Satellite-derived data plays an important role in supporting carbon removal certification methodologies by providing valuable information that helps to accurately assess and monitor the amount of carbon that is being stored in various ecosystems. This information is critical in determining the effectiveness of carbon removal efforts and can help to guide future strategies to improve their efficiency.

The carbon cycle[1] keeps a dynamic balance amongst carbon pools. Earth Observation data is wide-scale and globally consistent[2], offering harmonized and comparable information[3]. Hence it enables the monitoring of nature's dynamic cycles with sufficient periodicity and in a cost-effective way. The regulation on carbon removals should address the recommended sequestering practices in the various pools so that Earth Observation shall be adjusted to

[1] The Carbon Cycle and Atmospheric Carbon Dioxide (https://www.ipcc.ch/site/assets/uploads/2018/02/TAR-03.pdf)
[2] Same measurements and methods are used to collect and analyze data across the entire planet.
[3] This can help to ensure that the data used in MRV processes are consistent and accurate, which is important for making informed decisions about climate change policies and actions.

monitoring, measuring and modelling carbon fluxes across pools[4]. This can help construct uniform measurement systems across the board, facilitating harmonization in reporting as well as cooperation and information exchange between stakeholders as required by the proposed certification on carbon removals.

To effectively support such regulation, the framework must be strengthened to deliver its goals, therefore EARSC would like to propose further development and clarification in the following strategic pillars: **technical, financial** and **organizational**:

1- **Technology available:** The regulation should be future-proof and take advantage of the latest available technology. This approach will make use of what is available now but shift towards long-term solutions as more innovation and funding come in to support these new technologies. Being forward-looking will help to ensure that regulations keep pace with advances in technology, promote innovation, and better protect public interests such as net zero emission balance.

Modelling approaches can be complemented by satellite-derived data from public or privately available missions and infrastructures[5] to improve monitoring, reporting, and verification (MRV) of carbon removals. The availability and accessibility of Earth Observation datasets suitable for addressing the information needs of carbon removals have increased. New capabilities in terms of the spatial, temporal and spectral resolution of the data have enabled more efficient and reliable monitoring of the environment over time at global, regional and local scales. Clarity on the variety of geographical dimensions and methodologies[6] are needed to support the certification scheme. Data governance, processing and data policies should also need to be considered:

i) the growing trend towards open and free data policies in the satellite data industry
ii) the availability and accessibility of data and resources

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[4] This letter is not covering atmosphere or ocean pools, i.e., how the ocean ecosystem can absorb and stores a significant amount of carbon. Various techniques such ocean fertilization and ocean alkalinity enhancement are being studied to enhance the ocean's capacity to remove and store carbon.

[5] i.e; High R&D priority missions (Sentinel-5 P, CO2M, CarbonSat), National missions MicroCrab (FR), International (OCO-3, NASA), Public partnership such Carbon Mapper, Commercial missions, Copernicus in-situ component, CEOS Land Product Validation (NASA), GEOSS platform / GEOSS Common Infrastructure / GEONETCast, Modelling approaches…etc

[6] information on the source of data, algorithms used, the assumptions made, data processing or filtering steps, uncertainties, and limitations, overall documenting the adequate validation and accuracy assessments conducted

iii) the improvement of quality, accuracy and resolution

iv) integration of other technologies allowing better processing & interpretation

v) the limitations to accessing and using satellite data due to privacy and security concerns

2- **Financial**: Technology and innovation alone will not be enough to bring the cost of carbon removals down to a level where they can be deployed as widely as they are needed. Adequate funding and policies will also be necessary to underpin them. The increasing availability of satellite data has revolutionized the agroforestry sector and the potential for satellite data and services to inform and improve decision-making will only continue to grow.

Earth Observation services can provide economic, reliable, and frequent validation for carbon storage projects. In general, satellite-derived data can be more cost-effective than ground surveys covering large areas quickly and providing a broad overview of the landscape, making them useful for monitoring changes over time and identifying trends or patterns. Currently, the methods for carbon verification require extensive in-field measurements such as data from the Land Use/Cover Area frame statistical Survey (LUCAS database)[7]. This information requires significant financial and human resources to collect and maintain it while satellite-derived data is an excellent source to complement it thanks to its accessibility and cost efficiency[8]. EO can improve the efficiency of monitoring activities by automatically highlighting areas of interest, reducing the cost of launching projects by using satellite data to map and model the carbon captured. This can be done by using a set of ground truth data to train models that use satellite data to predict biomass[9]. International calibration and validation partnerships are crucial to build on existing plot networks and inventory methods[10].

There are several cost-effective management practices and tools that can contribute to long-lasting carbon storage in agriculture and forestry[11]. The table below represents some examples of operational practices which should be analysed in the local, regional, national and European

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[7] Based on ground surveys, where trained professionals collect data from sample sites.

[8] Ref EARSC statement on Carbon removals

[9] Ground truth data is collected through direct measurements of biomass in the field, and can include information on vegetation type, density, and height. This information can be used to validate and calibrate satellite data, which can then be used to create predictive models

[10] Committee on Earth Observation Satellites: Land Product Validation Subgroup: https://lpvs.gsfc.nasa.gov/AGB/AGB_home.html

[11] not taking into this consideration on air or ocean sequestration, i.e., how the ocean ecosystem can absorb and stores a significant amount of carbon. Various techniques such ocean fertilization and ocean alkalinity enhancement are being studied to enhance the ocean's capacity to remove and store carbon.

dimensions and for which Earth Observation can provide a cost-effective solution by strongly reducing ground surveys and measures.

Management practices	Cost-effectiveness of EO contribution
Conservation agriculture which emphasizes minimal soil disturbance, maintaining soil cover, and diversifying crop rotations. By reducing soil erosion and improving soil health, conservation agriculture can help store more carbon in the soil.	Satellite imagery can be used to map and monitor land use patterns (crop types, soil moisture, vegetation cover, etc) helping to identify areas that are suitable for conservation agriculture practices or that are carrying them out successfully.
Agroforestry in alignment with LULUCF[12] and integrating forest practices into agricultural landscapes can provide multiple benefits including carbon sequestration, soil improvement, and improved biodiversity.	Estimating carbon stocks and emissions in agroforestry systems can help support carbon credits. By using remote sensing techniques, satellite data can be used to monitor forests and other vegetation, including changes in the extent, type, and condition of these ecosystems.
Restoration and conservation of peatlands[13] can contribute significantly to global efforts to reduce carbon emissions and mitigate climate change. Peatlands cover about 3% of the Earth's surface, but overall, store almost a third of the world's carbon. This is double the carbon stored in all the world's forests[14] therefore, plays an important role in carbon removal, as they store large amounts of carbon in their peat soils. However, if peatlands are damaged or	Satellite data can be used to monitor changes in peatlands over time, such as changes in water levels, vegetation cover, and land use. This information can be used to assess the effectiveness of restoration efforts and identify areas where further action is needed (i.e., changes due to drought or improper use could be documented and reported in order to initiate the appropriate countermeasures to protect

[12] Land use and forestry regulation for 2021-2030 (https://climate.ec.europa.eu/eu-action/forests-and-agriculture/land-use-and-forestry-regulation-2021-2030_en)
[13] Restoration and conservation of peatlands (https://www.weforum.org/agenda/2021/08/peatlands-store-carbon-climate-change/)
[14] Peatlands store twice as much carbon as all the world's forests (https://www.unep.org/news-and-stories/story/peatlands-store-twice-much-carbon-all-worlds-forests)

degraded, they can become significant sources of carbon emissions instead[15] (highest potential to sequester carbon, if we restore it and the highest potential of carbon losses if those ecosystems are not conserved).	and conserve these valuable ecosystems).
Managing wetlands to improve carbon sequestration occurring belowground. Wetlands can take up atmospheric carbon and restricting subsequent carbon loss to facilitate long-term storage.	Earth observation can support the monitoring and mapping of land cover and land uses, the identification of the location, extent, and characteristics of wetlands (frequency and time).
Sustainable forest management helps to create long-term carbon sinks, provided the forests are not clear-cut or degraded. Activities such as reducing waste, planting new trees, and protecting forests from fires and pests can help ensure long-term carbon storage in forests.	Earth observation can provide valuable information about the health, extent, and structure of forests, including information on vegetation cover, tree height, and biomass. This information can be then used to track the progress of conservation and restoration efforts and assess their impact on carbon sequestration.
Precision agriculture optimizes agricultural practices and reduce waste, fertilizers and water applications which will improve the efficiency	Earth observation allows monitoring changes in land use and vegetation cover, as well as the carbon content of the soil, which

[15] 60% of European peatlands have been altered by agricultural use (grassland and arable land), forestry and peat extraction (Joosten, 1997) (Joosten, H. (1997). European mires: A preliminary status report. International Mire Cons. Group Members Newsletter, 3m, 10 – 13). Today, peatlands still cover more than 593,727 km^2, i.e., 5.5% of the land surface of Europe (Tanneberger et al., 2021) (Tanneberger, F., Appulo, L., Ewert, S., Lakner, S., Ó Brolcháin, N., Peters, J., & Wichtmann, W. (2021). The Power of Nature-Based Solutions: How peatlands can help us to achieve key EU sustainability objectives. Advanced Sustainable Systems, 5(1), 2000146. https://doi.org/10.1002/adsu.202000146.). European peatlands are estimated to store 42 Gt C (Byrne et al., 2004) (Byrne, K. A., Chojnicki, B., & Christensen, T. R. (2004). EU peatlands: Current carbon stocks and trace gas fluxes. Carbo- Europe- GHG Concerted Action— Synthesis of the European Greenhouse Gas Budget. Report 4/2004, 58 pp.) which represents a significant proportion of the terrestrial soil carbon stock (>20%). The degradation of Europe's remaining peatlands not only impacts these carbon stocks, but it may also induce land subsidence (Dawson et al., 2010) (Dawson, Q., Kechavarzi, C., Leeds- Harrison, P. B., & Burton, R. G. O. (2010). Subsidence and degradation of agricultural peatlands in the Fenlands of Norfolk, UK. Geoderma, 154(3– 4), 181– 187. https://doi.org/10.1016/j.geoderma.2009.09.017), increase greenhouse gas emissions (Humpenöder et al., 2020) (Humpenöder, F., Karstens, K., Lotze- Campen, H., Leifeld, J., Menichetti, L., Bar thelmes, A ., & Popp, A. (2 020). Peatland protection and restoration are key for climate change mitigation. Environmental Research Letter s, 15(10), 104093.https://www.researcher-app.com/paper/6051961a), contribute to downstream water quality impacts (Worrall et al., 2007)# and compromise biodiversity (Fraixedas et al., 2017) (Fraixedas, S., Lindén, A., Meller, K., Lindström, Å., Keišs, O., Kålås, J. A., Husby, M., Leivits, A., Leivits, M., & Lehikoinen, A. (2017). Substantial decline of Northern European peatland bird populations: Consequences of drainage. Biological Conservation, 214, 223– 232.https://www.sciencedirect.com/science/article/abs/pii/S0006320717305037)

of farming by reducing the carbon footprint of agricultural operations.	can provide valuable insights into the effectiveness of carbon sequestration practices.
Green urban areas can help to absorb and store carbon in cities	Earth Observation is currently helping different municipalities in reporting accurately the capacity of their green urban spaces (e.g., trees, parks, forests, green roofs, residential gardens, etc) to remove carbon and improve the air quality.
Monitoring biodiversity can provide important information on the health and functioning of ecosystems (monitor plant biodiversity at different scales, and it can also be used to derived proxies for animal biodiversity), which can inform carbon removal efforts.	Earth Observation is an efficient tool to monitor above-ground biomass and vegetation cover, which can be used to estimate the carbon storage capacity of different ecosystems at different scales.

3- **Organizational**: The EU would have to enact rules that define the requirements for sustainable land management for the individual agro-ecological zones. Sustainable management refers to the site requirements of the respective cultural landscape. These measures can vary greatly from region to region and must be defined. Remote sensing can be very useful in monitoring these measures if the relevant catalogue and timing of these measures is known.

The use of satellite-derived data in quantifying carbon removals can help improve the accuracy and reliability of carbon accounting, as it provides a more comprehensive and consistent view of changes in land use and vegetation cover over time and across large areas. Collaboration and active discussion with other stakeholders' networks can be a powerful tool for driving progress and achieving the common QU.A.L.ITY criteria and credible certification from the regulation, but it requires careful planning and coordination to be successful. Satellite-derived data can be used to validate ground-based measurements and observations and to estimate above-ground carbon[16], which can improve confidence and transparency in carbon accounting estimations. This will lead to standardized reporting metrics and verified sustainable practices.

Earth observation is one component of the solutions to provide information for monitoring, reporting and verification of carbon removals. It is important to establish clear communication channels and agreements on roles, responsibilities, and expectations between all partners involved in the collaboration to establish methodologies for carbon removals. This can help to ensure that the collaboration is productive, efficient, and sustainable.

4- **Definitions**: The Proposal is written in generic terms. While certain definitions are nowadays debated by the community, we consider that a robust definition of "**carbon removal**" will be beneficial for the understanding of the regulation establishing a certification framework.

The suggested definitions below would help give clarity and enhance understanding of the proposed regulation to improve implementation[17]. Some other definitions may be considered and based on the IPCC bibliography[18].

- Baseline: Baseline is the amount of CO2 emitted in a point reference time before any intervention in an area, which should be constantly updated.
- Carbon removal: Human activities that remove CO2 from the atmosphere and durably store it in geological, terrestrial or ocean reservoirs.
- Carbon sequestration: Retention of carbon in ways that prevent or delay its emission to the atmosphere as carbon dioxide. This may help mitigate climate change by reducing the amount in the atmosphere.
- Carbon farming: A variety of agricultural methods aimed at sequestering atmospheric carbon into the soil and in crop roots, wood, and leaves.

[16] validation of ground-based measurements (Benchmark map of forest carbon stocks in tropical regions across three continents: https://www.pnas.org/doi/10.1073/pnas.1019576108 and Nation-wide mapping of tree-level aboveground carbon stocks in Rwanda:https://www.nature.com/articles/s41558-022-01544-w)
[17]Carbon dioxide removal (https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/689336/EPRS_BRI(2021)689336_EN.pdf)
[18] From IPCC glossary (https://www.ipcc.ch/sr15/chapter/glossary/)

- Carbon storage in products: Carbon that is stored in a material or product as a result of its manufacturing or production process. The carbon remains stored in the product until it is eventually released back into the atmosphere through processes such as combustion or decomposition.
- Durability of the removal: the planned duration of carbon storage or the risk of reversal before that time is up (mid-term, long lasting, permanent, etc).
- Permanent carbon storage: Refers to carbon storage that remains in a long-term, stable, and secure reservoir.

Earth observation data plays a key role in the development of carbon capture, storage, and sequestration services. Consequently, EARSC believes that the regulation on certifying carbon removals should specify that services complemented by Earth Observation data publicly or privately are operational solutions, which shall be used for carbon reduction and capture practices to upscale this green business model that rewards companies for carbon storage. EARSC remains at your disposal to work together on this objective.