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**COMMUNICATION FROM THE COMMISSION**

**Sustainable Carbon Cycles**

# Draft Communication Sustainable Carbon Cycles

## 1 CARBON CYCLES

Carbon is the atom of life, of our societies and economies. Carbon is in human DNA. Half the weight of the food we eat is carbon. Transforming limestone and iron ore into the cement and steel of our cities involves processing carbon. Organic chemistry exploits the uniqueness of carbon to produce highly complex molecules for the pharmaceuticals, chemicals, plastics and advanced materials of our daily life. Carbon-based fossil fuels have powered our homes, factories and vehicles for more than a century.

Unfortunately, the exploitation of cheap and abundant fossil fuels and land use changes have enabled the development of our economies at the cost of jeopardizing the fragile natural balance of our planet by disturbing the flows of carbon between atmosphere, ocean, vegetation and the earth's crust.

The current carbon cycles destroy the world: emissions from fossil fuel combustion, industrial processes and land use change are cumulating in the atmosphere and are dramatically increasing the concentration of CO<sub>2</sub>. As result, the global climate is warming, biodiversity is disappearing, oceans are getting more acid and extreme weather events are getting more frequent. In turns, short-term carbon cycles between vegetation and atmosphere are disturbed and sea levels are rising due to the impact of climate change on lands, forests, seas and the cryosphere. In some regions, this is amplified by the unsustainable exploitation of natural resources. All these disturbances impact climate and biodiversity.

Responding to the urgency for climate action highlighted in the successive assessments of the Intergovernmental Panel for Climate Change (IPCC), the European Union has set into law its objective of economy-wide Climate Neutrality by 2050. The European Climate Law<sup>1</sup> requires that greenhouse gas (GHG) emissions and removals are balanced within the European Union at the latest by 2050 with the aim to achieve negative emissions thereafter. The European Union has also set the goal that it will be climate resilient by 2050, to withstand the unavoidable impacts of climate change.

To achieve such an ambitious objective, we must establish sustainable and climate-resilient carbon cycles through three key actions:

- First, and foremost, we need to eliminate, and where this is impossible, drastically reduce our reliance on carbon, for instance by improving the efficiency of our buildings, transport modes and industries, by reducing our primary resource consumption and moving to a circular economy, and by replacing carbon-based energy carriers with renewable electricity or hydrogen. Our Climate Law dictates it and our long term analysis indicates that in order to be climate neutral by 2050 we must reduce by 95% the use of fossil carbon energy in the EU final energy consumption. This decarbonisation strategy is at the core of our existing climate,

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<sup>1</sup> [Regulation \(EU\) 2021/1119](#) of 30 June 2021 establishing the framework for achieving climate neutrality ('European Climate Law') (OJ L 243, 9.7.2021, p. 1).

environmental and energy policies to reach the 2030 objective of 55% reduction in EU GHG emissions compared to 1990.

- Second, we need to recycle carbon from waste streams, from sustainable sources of biomass or directly from the atmosphere, to use in place of fossil carbon in the sectors of the economy that will inevitably remain carbon dependent. The circular economy and the bioeconomy address this objective partly and should promote technological solutions for carbon capture and use (CCU) and the production of sustainable synthetic fuels or other non-fossil based carbon products.
- Third, we need to upscale carbon removal solutions that capture CO<sub>2</sub> from the atmosphere and store it for the long term, either in ecosystems through nature based solutions or in other storage forms through industrial solutions. The development and deployment at scale of carbon removal solutions is indispensable to climate-neutrality and requires significant targeted support in the next decade.

The European Green Deal and related policies are therefore aiming to a fast reduction of the use of fossil carbon and to its phase out on the long term. The remaining supply of the carbon required for the functioning of our society will no longer come from fossil fuel extraction, it will be sustainably sourced from our ecosystems and from our industries through innovative technological developments.

At the same time, the IPCC reports indicate that current global climate action is not sufficient to maintain the atmospheric concentration of CO<sub>2</sub> at levels compatible with the objective of the Paris Agreement. This concentration will have to be reduced actively in the future to limit global warming at 1.5°C or even “well below” 2°C. Moreover, climate neutrality by mid-century by all major economies is likely to be only the first step towards restoring the planet’s balance, at least in part, at the end of this century. Carbon removals should play a growing role, and become the main focus of the action needed after climate neutrality has been achieved. The available solutions through natural ecosystems and industrial carbon capture and storage should be both deployed in an efficient and sustainable way that takes into account their specific characteristics. Carbon removals from both ecosystems and industrial solutions should comply with strong requirements on monitoring, reporting and verification to be recognized as action contributing to EU climate and environmental objectives. Irrespectively of their origins, all carbon removals need to be accounted in full transparency and by considering criteria such as the duration of the storage, the risk of reversal, the uncertainty of the measurement or the risk of carbon leakages increasing GHG emissions elsewhere.

Establishing sustainable carbon cycles in European economy and ecosystems is a long-term endeavour that nevertheless requires coordinated action now. This Communication focuses on the short-term action to upscale carbon farming as business model incentivising practices on natural ecosystems that increase carbon sequestration (section 2) and to foster a new industrial value chain for the sustainable capture, recycling, transport, and storage of carbon (section 3). These actions will all contribute to the mitigation effort of the Union either by reducing GHG emissions or by removing carbon from the atmosphere and pave the way for a

policy of negative emissions in the future, with strong co-benefits for the Union's ambition to reverse biodiversity loss.

A fundamental step to make this possible is to put in place a regulatory framework for a clear and transparent identification of the activities that unambiguously remove carbon from the atmosphere and decrease the atmospheric CO<sub>2</sub> concentration, therefore developing a certification mechanism, based on robust accounting rules, for high-quality sustainable carbon removals from both natural ecosystems and industrial solutions (section 4). With a perspective towards climate neutrality in 2050, therefore, this Communication should also start a reflection towards the further integration of carbon removals into the EU regulatory and compliance frameworks, post-2030.

## **2 CARBON FARMING AS BUSINESS MODEL FOR HEALTHIER ECOSYSTEMS**

### **2.1 Role of carbon farming**

More sustainable land management will be critical in achieving the EU's 2050 climate neutrality objective as it will increase the amount of carbon captured and stored in plants and soils. While forests show annual net carbon removals at EU level, all other land uses such as croplands, grasslands, wetlands and settlements show overall annual net emissions, with significant differences among Member States. Moreover, UNFCCC inventories report that net removals from terrestrial ecosystems in the EU have been on a declining trend over the last decade, largely driven by the deteriorating situation in forest ecosystems. This decline in carbon removals on land is driven by a mix of factors, including an increasing share of forests reaching maturity, increase in natural disturbances such as insect infestations, storms, droughts and forest fires, an increase in wood demand and a decrease of afforestation rates in Europe. Solutions do exist to reverse the decline and return quickly to past levels of terrestrial ecosystem net carbon removals of well above 300 MtCO<sub>2</sub>eq<sup>2</sup>, but their deployment needs to be facilitated.

With this in mind, the Commission proposed to amend Regulation (EU) 2018/841 for Land Use, Forestry, and Agriculture by setting a Union target for net removals of 310 MtCO<sub>2</sub>eq by 2030, a level last seen in 2013, and allocating targets for each Member State. The proposal also includes the aim to reach climate-neutrality in the entire land sector by 2035, namely that carbon removals should balance the greenhouse gas emissions from all land, livestock and fertilizer use. The Commission proposal, however, does not establish direct incentives at the level of the individual land manager to increase carbon removals and protect carbon stocks. A system of incentives at land manager level would nevertheless leverage direct action on the ground. The EU carbon farming initiative announced by the Farm to Fork Strategy<sup>3</sup> and reiterated in the EU Forest Strategy for 2030<sup>4</sup> takes up this challenge and seeks to enable the

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<sup>2</sup> [SWD \(2021\) 609 final](#), Impact Assessment accompanying the Proposal amending the "LULUCF" Regulation (EU) 2018/841

<sup>3</sup> COM(2020) 381 final, A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system.

<sup>4</sup> [COM \(2021\) 572 final](#), New EU Forest Strategy for 2030

key stakeholders in the land sector to play their decisive role in sustainable carbon management, on the pathway to climate neutrality.

### Carbon farming as a business model

Carbon farming can be defined as a green business model that rewards land managers for taking up improved land management practices, resulting in the increase of carbon sequestration in living biomass, dead organic matter and soils by enhancing carbon capture and/or reducing the release of carbon to the atmosphere, in respect of ecological principles favourable to biodiversity. The financial incentives can come from public or private sources and reward land managers for their management practice or the actual amount of carbon sequestered, increasing the storage of atmospheric carbon, taking into account temporal dynamics.

Recently, an increasing number of private carbon farming initiatives have emerged where the land managers sell carbon credits on voluntary carbon markets. The current market size in the EU can be estimated at EUR XX billion in carbon farming credits and XX hectares. The potential is, however, enormous and the demand for such carbon credits is already outweighing the supply. Barriers, described below, prevent a large scale lift off.

On the supply side, the carbon farming credits become an additional “product” that land managers can sell together with their traditional products such as food and biomass. On the demand side, the buyers of these credits could be both economic operators within the bioeconomy, such as food processing companies that want to reduce the carbon footprint in their own value chains, and companies and individuals outside the bio-economy who want to financially contribute to more climate action on the land and to neutralise their own emissions. This is particularly relevant, as food with low carbon footprint will be recognised in the forthcoming framework for sustainable food. This will lead to a competitive advantage of farms using carbon farming practices.

Carbon farming would be a new source of income for land managers, who could in many cases benefit at the same time from the advantages of higher quality land and, to a certain extent, provide better production performance. Furthermore, carbon farming practices often have environmental co-benefits and help land managers to adapt their businesses to withstand the effects of climate change, improve biodiversity and become more resilient.

It is nevertheless crucial to ensure that credits generated through carbon farming do not replace mitigation efforts and are coupled to a net long-term benefit in terms of GHG emission avoidance. This needs to be very clear – climate neutrality in the EU needs to build on reducing GHG emissions and our efforts need to be focused on that. Carbon farming credits can complement those efforts and help address those situations where further reduction of GHG emissions is no longer possible and additional climate action through carbon sequestration is possible. Several food and biomass companies have set themselves climate-neutrality targets for their value chains. This is where carbon farming becomes a very useful tool to contribute to the objective of climate neutrality.

### Carbon farming practices

The potential for carbon removals, emission reductions and protection of existing carbon stocks varies according to bioclimatic conditions and, furthermore, strongly depends on site conditions such as topography, soil type, and past and current land use practices. Although very site-dependent in application, the following are effective examples of improved land management practices that result in the increase of carbon sequestration and in most cases in co-benefits for ecosystems and biodiversity<sup>5</sup>:

- Afforestation and reforestation that respect ecological principles favourable to biodiversity and enhanced sustainable forest management including biodiversity friendly practices and adaptation of forests to climate change
- Agroforestry and other forms of mixed farming combining woody vegetation (trees or shrubs) with crop and/or animal production systems on the same land;
- Use of catch crops, cover crops and conservation tillage: protecting soils, and enhancing soil organic carbon on degraded arable land;
- Targeted conversion of cropland to fallow or of set-aside areas to permanent grassland;
- Restoration of peatlands and wetlands that reduces oxidation of the existing carbon stock and increases the potential for carbon sequestration.

#### Co-benefits of carbon farming

Carbon farming should not only increase carbon sequestration but also have a positive impact on the environment as carbon farming practices can provide important co-benefits for biodiversity and ecosystem services with regard to air, water quality, soil fertility and resilience to climate change.. An illustrative example is the rewetting of peatlands: stopping the agricultural use of drained peatlands and raising their water table has multiple benefits as it contributes to reduce CO<sub>2</sub> emissions, improve biodiversity conservation, provide ecosystem services linked to water purification and help flood control and drought prevention, whereas trade-offs resulting from the loss of agricultural land could be addressed through possibilities for paludiculture. Carbon farming practices should also ensure that EU food security is preserved or enhanced. Carbon farming incentives should then contribute to the financial recognition of these co-benefits. This was also recently highlighted by the Forest Strategy that promoted the setting up of ecosystem services payment schemes and the roll out of carbon farming practices under public funding, as well as the various benefits of a carbon removal certification for private finance of carbon farming.

Finally, carbon farming can be a key tool to implement other EU strategies, as:

- it would support, among other things, the reforestation, afforestation and forest restoration activities set out in the EU Forest Strategy for 2030, including the planting of three billion additional trees;
- it would stimulate the benefits for climate adaptation of nature-based solutions highlighted in the Adaptation Strategy;

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<sup>5</sup> XX REF SWD 1

- it would support the goals of protecting and restoring many carbon-rich natural and semi-natural ecosystems set out under the EU Biodiversity Strategy for 2030;
- it would support the restoration, rewetting and conservation of peatlands as included in the action plan of the Long-Term Vision for Rural Areas.
- [Placeholder Soil Strategy and Nature Restoration Law]

## 2.2 Upscaling carbon farming

Given the clear benefits of carbon farming, the Commission wants to accelerate its upscaling across the Union. However, several barriers still exist for a widespread uptake of carbon farming initiatives across the EU:

- financial burden resulting from the costs of carbon farming management practices and uncertainty about revenue possibilities;
- uncertainty or lack of public trust in the reliability of standards in voluntary carbon markets, in conjunction with questions around environmental integrity and additionality or permanence concerns
- complexity and high costs of robust monitoring, reporting and verification systems;
- insufficiently tailored advisory services;

This Communication aims to address these barriers. The existing policies have already several tools in place to better support carbon farming practices and to create win-win-win situations for climate actions, biodiversity and the bioeconomy. Nonetheless, knowledge and access to these opportunities should be facilitated and brought at land manager level. To that end, the Commission also published a technical handbook<sup>6</sup> that explored key issues, challenges, trade-offs and design options of this business model. The new Common Agricultural Policy (CAP) especially will have an important role to play to stimulate action on emission reductions, particularly from cultivated drained organic soils as well as to support better farming practices. It should also provide funding for improving knowledge exchange and cooperation among land managers.

### 2.2.1 Public funding to kick-start carbon farming

Public funding under the CAP and other EU programs – LIFE, the cohesion funds, Horizon Europe<sup>7</sup> - can support the upscaling of carbon farming by funding the roll out of the practices, as well as for example by covering additional costs related to monitoring, reporting and verification aspects, or by financing projects that improve the understanding of carbon farming practices and fulfil the existing knowledge gaps. Essential to the uptake of carbon farming, advisory services, knowledge exchange or information actions for farmers and foresters can also be financed under the CAP or through State aid.

By relieving the financial burden of the several costs inherent to carbon farming schemes, EU or national public funding significantly reduces the risk for land managers to enter into such schemes. Public funding is therefore key to securing land managers' interest in this business

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<sup>6</sup> [Technical guidance handbook](#) - Setting up and implementing result-based carbon farming mechanisms in the EU

<sup>7</sup> See section 2.2.3 for funding opportunities under Horizon Europe

model and to contributing to build confidence in carbon farming schemes, by complementing revenue possibilities from private markets. The Commission will mainstream carbon farming in EU public support, especially promoting it in the national CAP strategic plans.

Public funding opportunities for carbon farming	
Source of public funding	Type of funding
CAP	<ul style="list-style-type: none"> <li>● Ecoschemes and rural development agri-environment-climate measures or investments can directly support carbon farming schemes</li> <li>● The European Innovation Partnership for agricultural productivity and sustainability (EIP-AGRI) helps land managers cooperate and test new approaches</li> <li>● Support to advisory services brings knowledge to land managers</li> </ul>
LIFE Programme	Focus on pilot projects for the upscaling of carbon farming elements (e.g. three new projects to start in 2021 on better monitoring tools; Carbon Farming Scheme that is testing incentives to enable the trading of removal certificates).
Cohesion Policy	Investments into e.g. restoration and conservation of peatland (also Just Transition Fund) Cooperation across regions (INTERREG)
State aid	Proposal of aid for carbon farming as new category of aid

### 2.2.2 Standardisation of monitoring, reporting and verification methodologies for carbon farming

The success of carbon farming in Europe will be judged on the quantity and longevity of the carbon that will be sequestered in plants and soils by enhancing carbon capture and/or reducing the release of carbon to the atmosphere. To upscale carbon farming successfully, it will be essential to standardise the methodologies and rules for monitoring, reporting and verifying (MRV) the gains, or losses, in carbon sequestered. Currently, private schemes apply very different benchmarks and rules to the carbon credits placed on the voluntary markets. Without a high degree of transparency, environmental integrity, and methodology standardisation, buyers will be hesitant about the quality of the offered carbon farming credits, land managers will find it difficult to estimate their potential revenues, policy makers will hesitate to allow the use of such credits for compliance into the regulatory framework and it will be challenging to develop a successful market.

The Commission will therefore set up an expert group on carbon farming where Member State authorities and stakeholders can share their experiences from existing initiatives with a view to establishing best practices on carbon farming, in particular on improving the quality

of carbon farming credits and to foster peer-to-peer knowledge exchange. The expert group would support the Commission in monitoring the development of carbon farming initiatives implemented by private or public bodies and their impact on emissions reductions and carbon removals as well as on the environment, in particular biodiversity.

<b>Carbon farming challenge</b>	
Carbon farming can support the achievement of the proposed 2030 climate target of net removals of 310 Mt CO <sub>2</sub> eq in the land sector. To that end:	
●	every land manager should have access to verified emission and removal data by 2028 to enable a wide uptake of carbon farming
●	carbon farming initiatives should contribute to the increase by 42 Mt CO <sub>2</sub> eq of the land sink that is required to fill the gap with the objective of 310 Mt CO <sub>2</sub> eq net removals by 2030.

Furthermore, the expert group would discuss how to better link the carbon farming initiatives with the existing and proposed policy framework at the level of the Member States. The proposed Regulation (EU) 2018/841 for Land Use, Forestry, and Agriculture already sets a governance and incentive framework for Member States, thereby encouraging the design of national policies for carbon farming. More consideration needs to be given to the reflection of carbon farming initiatives in the reporting of Member States. The progress of these initiatives needs to be recognised to give value to the carbon farming efforts but also to avoid double-claiming in the national inventories and other reports. Synergies with the reporting under [placeholder for Nature Restoration Law reporting] will be ensured.

The wide adoption by farmers and foresters of standardised monitoring and reporting methodologies is a necessary condition to establish long-term business perspectives for carbon farming and to consider options for creating an EU regulated market for the period after 2030. Taking into account the recommendation by the European Court of Auditors to assess the application of the polluter-pays principle in agriculture, the Commission will carry out a study to assess the potential to apply the polluter-pays principle to emissions from agricultural activities by December 2023.

### **2.2.3 Improving knowledge, data management and tailored advisory services to land managers**

Providing land managers with improved knowledge, tools and methods for a better implementation, assessment and optimisation of the carbon benefits is key to securing their engagement in carbon farming. This is particularly relevant for European small farmers or forest holders – and critical to scaling up action across the Union.

Several key datasets and tools are available through current systems and legislation. The CAP already requires geographically explicit monitoring of agricultural parcels, through its well established integrated system (IACS). The new CAP provides for regular and systematic observation, tracking and assessment of agricultural activities and practices through IACS (notably the geospatial aid application used by the CAP beneficiaries) and the monitoring using by Copernicus Sentinels (or other, equivalent) satellite data. Peatlands and wetland areas are good examples of where progress is being made rapidly using remote sensing

methods. The Commission will continue exploring with Member States new ways to leverage the use of these tools and help address interoperability issues that may emerge.

The Agricultural Knowledge and Innovation System (AKIS) will underpin CAP Strategic Plan implementation through support to advisory services, knowledge exchange, training, information actions or interactive innovation projects for farmers and foresters. Through AKIS, Member States will ensure advice and knowledge transfer on environmental aspects, thereby potentially facilitating carbon farming.

On-farm calculations, moreover, will enable land managers – or their advisors – to access carbon farming schemes more easily, to assess carbon sequestration potentials of an individual land holding and to optimise strategy. The reformed CAP includes the Farm Sustainability Tool for nutrients (FaST) - a digital application for farmers to better tailor the use of nutrient inputs – within their AKIS. The Commission is working on the integration of a module for the calculation of GHG balance at holding level, complementing the assessment of the nutrient balance.

Today's forest monitoring builds heavily on field observations acquired in national forest inventories and in a few cases also national forest soil inventories. While some Member States explore or have already integrate Earth observation in their forest monitoring, its capacity to retrieve coherent and harmonized forest-related information across the EU has not yet been explored.

The key to accurate and cost-efficient monitoring of EU forests is to effectively link bottom up approaches of ground-based sample plots to top down measurements by Earth observation. Detailed information in the spatial and temporal domain will be essential for carbon farming to assess the carbon sequestration at parcel level. In addition, the monitoring should be harmonized across the EU to ensure the same standards, and thus the value of carbon removals, in all Member States. To this end, the Commission announced its intentions to propose a legally-binding instrument for forest monitoring in the Forest Strategy<sup>8</sup>.

Under the proposal to amend the LULUCF Regulation, Member States would also need to upgrade their geographically explicit datasets relating to carbon baselines. These improvements will also firmly underpin the implementation of MRV in carbon farming schemes.

### European Climate Pact

The European Climate Pact can also help promote carbon farming initiatives. The Climate Pact can enable a direct exchange of experiences among land managers that can become Climate Pact ambassadors, to lead by example and raise awareness on carbon farming in their neighbourhoods and further, also via a dedicated social platform. By committing to a pledge, they can showcase to their peers that moving from conventional to carbon farming is feasible

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<sup>8</sup> New EU Forest Strategy for 2030 (COM/2021/572 final of 16.7.2021, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0572>)

within a short period of time. Land managers may also like to commit to a joint pledge, for example with their municipality, on initiatives going beyond their plot of land.

### Fostering research and innovation

Horizon Europe will continue to foster innovative approaches, in particular through a major R&I mission to promote soil health: “A Soil Deal for Europe”, its thematic Clusters<sup>9</sup> and the European Innovation Council:

- The Horizon Europe mission “A Soil Deal for Europe” aims to spur the transition to healthy soils by 2030, in line with Green Deal commitments for climate, biodiversity, zero pollution and sustainable food systems. Together with the recently launched European Soil Observatory and the new Soil Strategy, the mission will be part of a comprehensive framework to address soil and land stewardship at large scale across land uses. Under the mission, carbon farming has been identified as a “hotspot” area for research and innovation. Furthermore, a network of 100 living laboratories and lighthouses planned under the mission, will serve to test, demonstrate and upscale solutions for carbon farming. The soil monitoring component of the mission will support efforts for harmonized soil monitoring in Europe.
- As part of the first work programs of Horizon Europe, a demonstration network on climate-smart farming is being established which will provide support to the implementation of carbon farming.
- For the Horizon Europe’s next programming periods, the Commission will increase the focus on carbon farming and on several other related elements across calls for projects. A particular attention will be given to the potential of digital technologies and data technologies for more accurate, cost effective and efficient estimates of carbon emissions, removals from plants and soils and carbon farming practices. Coupled with in-field instruments and experience from the ground, those technologies will also help to adjust carbon farming practices for an optimization of environmental benefits.
- The European Innovation Council (EIC) supports research in breakthrough technologies and game-changing innovations. The EIC Accelerator Challenge “Technologies for ‘Fit for 55’ support the development and scale up of sustainable agriculture to increase climate resilience, abate nitrogen and methane emissions and increase carbon stock in the soil.
- In the new EU Forest Strategy for 2030 the Commission announced, inter alia, the intention to develop together with Member States and stakeholders a “Planning our Future Forests” research and innovation agenda and to support the evidence-based design and implementation of forest restoration strategies, including through the planned research and innovation mission on soil health for forest soils.
- The contribution of up to EUR 1 billion of Horizon Europe will be combined with the complementary private investment in the future Circular Bio-based Europe Partnership to boost innovative and resource efficient bio-based materials and products that have strong potential to substitute their fossil based counterparts.

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<sup>9</sup> Cluster 6 ‘Food, Bioeconomy, Natural Resources, Agriculture and Environment’ and Cluster 5 ‘Climate, Energy and Mobility’.

### 2.3 Blue carbon economy

Blue ecosystems cover 71% of the planet and have higher carbon sequestration and storage potential than terrestrial ecosystems through algae aquaculture<sup>10</sup> and marine permaculture<sup>11</sup>. Seaweed and mollusk farming plays an important role in blue carbon fixation.

The development of blue carbon initiatives will lead to multiple co-benefits, for instance increased carbon removals, and improvement of ocean health and ecosystem services. The development of regenerative seaweed aquaculture will bring to the market healthy food alternatives, low-carbon feed and other algae-origin products.

The main challenge is the degradation of blue carbon ecosystems leading to the release of stored carbon into the atmosphere and the reduction of the potential for future carbon removals.

Currently, there are no blue carbon farming initiatives in the EU. However, several projects such as the network of operational marine farms for regenerative ocean cultivation<sup>12</sup> or the EU project MEDSEA<sup>13</sup> that estimated the economic value of marine carbon sequestration could contribute to the development of such initiatives. The Commission is also looking at monitoring and accounting possibilities for carbon and nitrogen uptake, and their trade on voluntary carbon markets<sup>14</sup>.

The following developments on blue carbon ecosystems could be envisaged:

- Enhanced knowledge on identification of regions at risk;
- Investments to preserve, restore or create new habitats, and to provide solutions to enhance resilience and protection of EU coastal areas against climate change;
- Increased knowledge and data on blue carbon quantification
- Carbon farming through nature-based solutions, for example on coastal wetlands as well as seaweed and mollusk aquaculture.

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<sup>10</sup> Blue farming, Sustainable blue economy strategy

<sup>11</sup> Marine Permaculture is a form of [mariculture](#) that reflects the principles of [permaculture](#) by recreating seaweed forest habitat and other ecosystems in nearshore and offshore ocean environments

<sup>12</sup> Coordinated by the Danish NGO Havhost.

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[https://ec.europa.eu/environment/integration/research/newsalert/pdf/economic\\_benefits\\_carbon\\_storage\\_in\\_mediterranean\\_sea\\_422na3\\_en.pdf](https://ec.europa.eu/environment/integration/research/newsalert/pdf/economic_benefits_carbon_storage_in_mediterranean_sea_422na3_en.pdf)

<sup>14</sup> Two studies funded by the European Maritime and Fisheries Fund (EMFF) to be started end 2021, i) Algae and Climate, and ii) Shellfish and Algae. These studies will look at blue carbon price, potential production areas, chemical properties of European Seas etc.

### **Box 1: Key actions to support carbon farming**

In order to upscale carbon farming up to 2030, the Commission will undertake the following actions:

- create an expert group on carbon farming where Member State authorities and stakeholders can share their experiences from existing initiatives with a view to establish best practices on carbon farming and to assess the functioning and robustness of monitoring, reporting and verification for the certification of carbon removals;
- provide guidance and mainstream dedicated carbon farming funding in most relevant EU policies and related tools, such as the CAP, LIFE, cohesions funds to contribute to address the relevant implementation challenges;
- support the coordination of the research community and key stakeholders on developing, testing and demonstrating carbon farming practices through Horizon Europe cluster 6;
- provide a digital carbon navigator template and guidelines on common pathways for the quantitative calculation of GHG emissions and removals for holdings;
- carry out a study to assess the potential to apply the polluter-pays principle in to emissions from agricultural activities;
- create a carbon farming group within the Climate Pact social platform to bring land managers together who want to become Climate Pact ambassadors and feed the exchange on direct experiences;

### **3 INDUSTRIAL CAPTURE, USE AND STORAGE OF CARBON**

The EU consumed approximately one billion tonnes of biogenic (45%) and fossil (55%) carbon for the functioning of its economy in 2018<sup>15</sup>. The carbon is used to provide food (25%), energy (56%) and materials (19%) and only a very small fraction of the carbon used today is from recycled origin. Beyond decarbonising its energy system to be climate neutral by 2050, the EU will also need to rethink its sourcing of carbon as feedstock for industrial production.

The EU economy will still require some carbon for its functioning in 2050 and beyond, for instance for the production of synthetic fuels, plastics, rubbers, chemicals and other advanced materials requiring carbon as a feedstock even when a complete and well-functioning circular economy will minimize the end of life impact of these products by promoting their reuse and recycling. The bioeconomy will also have an important role to play in the construction sector by providing substitutes for conventional building materials which are able to store carbon for long periods of time. Fossil carbon will be replaced by more sustainable streams of recycled carbon from waste, biomass and directly from the atmosphere to supply the organic chemistry processes for the synthesis of sustainable products and fuels.

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<sup>15</sup> Carbon Economy - Studies on support to research and innovation policy in the area of bio-based products and services. DOI: [10.2777/004098](https://doi.org/10.2777/004098)

### 3.1 Capturing and recycling carbon in the bioeconomy

A sustainable EU bioeconomy has an important role to play as it provides the carbon for food, feed, fibre, energy and materials. Various studies identified biomass potentials in the EU, considering resource efficiency, sustainability (incl. biodiversity, ecosystem services, GHG emissions, soil protection and water) and demand for non-energy uses.

The bioeconomy reduces fossil emissions through the replacement of GHG-intensive materials and of fossil fuels with bio-based materials and bioenergy, respectively. The climate mitigation benefit of bio-based products can be optimized by increasing the proportion of material use (especially for long-lived products) in total biomass uses through the application of the cascading principle while ensuring that the land sink is maintained or enhanced. Increased sustainable storage of carbon in bio-based products contributes to reach the net carbon removal target of -310 MtCO<sub>2</sub>eq by 2030, as proposed in the Regulation (EU) 2018/841 for Land Use, Forestry, and Agriculture. To incentivise the development of more innovative and long-lasting bio-products, the Regulation (EU) 2018/841 proposes to enlarge the category of Harvested Wood Products and to also cover innovative carbon storage products, such as bio-plastics or material from lignocellulosic biomass and natural fibres like flax, hemp and others.

Improving the climate performance of buildings is an opportunity for the bioeconomy, including to turn the construction sector from a source of emissions into a carbon sink, as set out in the Renovation Wave Strategy<sup>16</sup> and the new European Bauhaus initiative<sup>17</sup>.

Following the EU Forest Strategy<sup>18</sup>, the Commission has committed to developing a standard, robust and transparent methodology to quantify the climate benefit of sustainably-produced wood construction products and other building materials, including those associated with carbon capture and utilisation (e.g. replacing gravel and sand in concrete with synthetic aggregate that stores CO<sub>2</sub>). In this prospect, the Commission has explored the relevance of dynamic life cycle analysis methodologies for a reliable and verifiable quantification of the net carbon removals of construction products. Such methodologies can support the elaboration of market-based schemes to reward construction actors for their carbon removals, as well as other policy frameworks, in particular those related to the climate performance of products. The Commission will ensure that the ability to remove carbon is acknowledged in all European frameworks related to the climate performance of products, including through the update of the EU Product and Organisation Environmental Footprint (OEF/PEF)<sup>19</sup>, the review of the Construction Products Regulation (CPR)<sup>20</sup>, as well as the Sustainable Product Initiative<sup>21</sup>.

Beyond the issue of regulatory measures, Horizon Europe provides funding for research on the benefits of the transition away from linear fossil-based systems to sustainable circular

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<sup>16</sup> COM (2020) 662 final

<sup>17</sup> [https://europa.eu/new-european-bauhaus/index\\_en](https://europa.eu/new-european-bauhaus/index_en).

<sup>18</sup> COM (2021) 572 final

<sup>19</sup> <https://ec.europa.eu/environment/eussd/smgp/index.htm>

<sup>20</sup> [https://ec.europa.eu/growth/sectors/construction/product-regulation/review\\_en](https://ec.europa.eu/growth/sectors/construction/product-regulation/review_en)

<sup>21</sup> [https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en)

bio-based systems, novel feedstocks for biorefineries, and the design of bio-based products and processes<sup>22</sup>. Horizon Europe will also offer opportunities for research on carbon removals in buildings, including under the European Partnership for People-centric Sustainable Built Environment (Built4People<sup>23</sup>). Going beyond the research stage, the Innovation Fund, which is financed by the revenues from the EU Emissions Trading System, can support innovative projects that replace energy-intensive materials, such as cement and steel, with bio-based materials.

### 3.2 Creating an internal market for capture, use, and storage of CO<sub>2</sub>

Besides a sustainable bioeconomy, it is pivotal that the EU supports today the development of emerging technologies, which are needed to achieve climate neutrality in 2050. Industrial projects have long lead times and project developers are often faced with scale-up challenges and fierce global competition, in particular in the energy-intensive industries, where large amounts of products will have to be produced through new processes.

Since natural resources are limited and the bioeconomy cannot provide all the carbon to fulfil the energy and material needs of a climate neutral EU economy in 2050, other streams of carbon should be developed to replace fossil carbon, including capturing CO<sub>2</sub> directly from the atmosphere, also called Direct Air Capture (DAC). Another promising route is to turn the CO<sub>2</sub> from a waste to a resource and use it as feedstock for the production of chemicals, plastics or fuels. Carbon dioxide as feedstock is today mainly used in the production of urea for fertiliser application and in marginal volumes in some specialised applications. Mastering the production of methanol from CO<sub>2</sub> at reasonable costs would pave the road to the production of a large range of chemicals such as ethylene or propylene used for the production of plastics, coolants, and resins.

The permanent storage of CO<sub>2</sub> in geological formations is an option to mitigate industrial emissions and to remove carbon from the atmosphere when the CO<sub>2</sub> is captured directly from the atmosphere – Direct Air Carbon Capture and Storage (DACCS) – or from the combustion or fermentation of biogenic carbon, also called Bio-Energy Carbon Capture and Storage (BECCS). Depleted oil and gas reservoirs and saline aquifers have the potential to store billion tonnes of CO<sub>2</sub> in offshore sites, the binding of CO<sub>2</sub> to basalt rocks being another option potentially deployable at large scale. The Directive on the geological storage of CO<sub>2</sub>, the so called CCS Directive, establishes a legal framework for the environmentally safe geological storage of CO<sub>2</sub> by covering all CO<sub>2</sub> storage in geological formations in the European Economic Area, and the entire lifetime of storage sites, while the EU ETS Directive already gives a price incentive for geological storage of fossil CO<sub>2</sub><sup>24</sup> to take place.

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[https://ec.europa.eu/info/research-and-innovation/research-area/environment/bioeconomy/bio-based-products-and-processes\\_en](https://ec.europa.eu/info/research-and-innovation/research-area/environment/bioeconomy/bio-based-products-and-processes_en)

<sup>23</sup>[https://ec.europa.eu/info/events/sustainable-built-environment-research-and-innovation-partnership-under-horizon-europe-2019-dec-12\\_en](https://ec.europa.eu/info/events/sustainable-built-environment-research-and-innovation-partnership-under-horizon-europe-2019-dec-12_en)

<sup>24</sup> CCS-biomass projects with a clear and verifiable climate benefit could potentially benefit from recognition pursuant to Article 24a of the revised EU ETS Directive, <https://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2009-1622&language=EN>

The EU has been supporting the development and deployment of Carbon Capture Use and Storage (CCUS) technologies for many years. In the past, Horizon 2020 has supported completing the industrial carbon cycle with funding for research on carbon capture, use and storage. Horizon Europe has launched calls on the integration of CCUS in industrial hubs and clusters, on decarbonising industry with CCUS, on the cost reduction of CO<sub>2</sub> capture, carbon negative sustainable biofuel production and direct atmospheric carbon capture and conversion. Future calls of Horizon Europe will cover CO<sub>2</sub> transport and storage, CCU and BECCS. The European Innovation Council Pathfinder Challenge “Carbon and Nitrogen management and valorisation” focuses on new biological, chemical, physical routes that integrate the capture, sequestration and/or recovery of carbon and nitrogen species and their conversion into value-added and decarbonized commodities, chemicals, fuels and energy vectors.

### **Industrial Sustainable Carbon challenge**

Reaching climate neutrality requires capturing carbon from the atmosphere for storage and for use as substitute to fossil carbon:

By 2028, any ton of CO<sub>2</sub> captured, transported, used and stored by industries should be reported and accounted by its fossil, biogenic or atmospheric origin;

At least 20% of the carbon used in the chemical and plastic industry should be from non-fossil sources by 2030

5Mt of CO<sub>2</sub> should be annually removed from the atmosphere and permanently stored through technological solutions by 2030

The Innovation Fund is the world’s largest funding programmes for the deployment at scale of innovative low-carbon technologies. It is financed by the EU ETS and is currently expected to provide financial support of around EUR 25 billion over the period 2021-2030 (based on a carbon price of EUR 50/tCO<sub>2</sub>). The goal is to help businesses invest in innovative clean technologies, including CCUS and carbon removals, and reinforce European leadership on a global scale. The proposed new Climate, Energy, and Environment State aid guidelines further enable Member States to provide support to close the financial gap for CCUS and carbon removal projects.

In order to speed up commercialisation of innovative technologies, the Commission has proposed to increase the size of the Innovation Fund and to include the possibility of carbon contracts for difference (CCD) in the revised EU ETS Directive. The next practical step while awaiting the agreement on the proposal will be an in-depth analysis of the possible design options and implementation modes.

The upcoming proposal for the certification of carbon removals will provide the framework to develop the appropriate rules so that industrial carbon removals solutions are accounted in full transparency, duly considering the existing legal framework of the EU ETS and its rules for the monitoring and reporting of emissions. This framework should ensure environmental integrity and prevent negative impacts on biodiversity. Biomass used for removals solutions such as BECCS will have to comply with the sustainability requirements of the Renewable

Energy Directive. Energy intensive approaches such as DACCS will have to use predominantly renewable energy to ensure that the effect on the climate remains positive, also when considering upstream and downstream emissions in a Life Cycle Assessment.

Industrial installations capturing CO<sub>2</sub> for utilisation or storage must also properly monitor, report and account the quantity and origin of the CO<sub>2</sub> they process. The EU needs an efficient system for the traceability of captured CO<sub>2</sub> that can track how much fossil, biogenic or atmospheric CO<sub>2</sub>, respectively, is transported, processed, stored and potentially re-emitted to the atmosphere each year. This will allow a differentiation between industrial solutions that permanently remove carbon dioxide and those that store the carbon for shorter periods or without a net decrease of the CO<sub>2</sub> concentration in the atmosphere.

The certification framework will facilitate the purchase of carbon removal credits by private or public buyers. Provided double counting is avoided, carbon removal projects can increase their viability by combining the grants from the Innovation Fund with the revenues from the sale of carbon removal credits, whereby any double funding has to be duly avoided. The experience with carbon removal projects under the Innovation Fund will provide important feedback for the development of the certification of industrial carbon removals and their possible further regulatory treatment in the longer term.

**Box 2: Example of projects financed by the Innovation Fund**

The Silverstone project is a full-scale CO<sub>2</sub> capture and basalt rock mineral storage at the Hellisheidi power station in Iceland.

The AGGREGACO2 project is a factory for aggregates based on accelerated carbonation processes fed by carbon captured at a refinery in Spain.

The FirstBio2Shipping project will produce bio-LNG for marine shipping and capture biogenic CO<sub>2</sub> in the Netherlands.

[XXX placeholder for relevant large-scale innovation fund projects XXX]

Regulatory changes in the near future will further benefit first movers who deploy CCU technologies. The Commission proposal for ReFuelEU Aviation should ensure demand for synthetic fuels based on CCU and advanced biofuels and complement the proposal for a revised Renewable Energy Directive, which sets a sub-target for renewable fuels from non-biological origin. The Commission proposal for a revised EU ETS Directive sets out the basis to avoid the double counting of emissions when synthetic fuels based on CCU are both produced and consumed in activities covered by the EU ETS. In addition, the revised EU ETS Directive creates an incentive for capturing and utilising emissions to become permanently chemically bound in a product so that they do not enter the atmosphere under normal use.

However, the lack of sufficient capacity for transport and storage of CO<sub>2</sub> can become an important bottleneck in the use of these technologies as infrastructure needs to undergo lengthy permitting processes and may not advance due to uncertainties related to cross value chain risks. The transport network needs to connect the future CO<sub>2</sub> sources with the available CO<sub>2</sub> storage sites and production sites consuming CO<sub>2</sub>, to track the carbon flows, and to acknowledge possible local public concerns. An open-access infrastructure ensures competition between different transport and storage operators and will thereby help drive down cost and allow CO<sub>2</sub> capture operators to choose between different options for the transport, use or storage of CO<sub>2</sub>. The development of CCUS hubs, where many CO<sub>2</sub> emitters can benefit from a common infrastructure, and an open-access transport network for CO<sub>2</sub> across national borders will be critical because not all Member States have access to suitable storage sites. The Commission will study the cross-border CO<sub>2</sub> infrastructure deployment needs at EU, regional and national level until 2030 and beyond, involving all relevant public and private stakeholders.

The Connecting Europe Facility (CEF) under the TEN-E Regulation provides funding for targeted infrastructure investment of European importance, including CO<sub>2</sub> transport infrastructure. In the 2020 call for proposals, several CO<sub>2</sub> transport projects were successful. The CEF will also be a key funding instrument for CO<sub>2</sub> infrastructure in the future.

The Commission will facilitate the development of a competitive CCUS market by taking stock of the existing knowledge base and engaging with all the relevant industrial, public and civil society stakeholders. The CCUS Forum in October 2021 has already been a first successful step and will be held each year from now on. To facilitate further the uptake of CCS, the Commission will, on the basis of technological progress and stakeholder feedback, update the four Guidance Documents from 2011 that assist stakeholders to implement the CCS Directive<sup>25</sup>.

**Box 3: Key actions to support industrial capture, use and storage of CO<sub>2</sub>**

In order to upscale industrial solutions for the capture use and storage of CO<sub>2</sub>, the Commission will undertake the following actions:

develop a standard, robust and transparent methodology to quantify the climate benefit of sustainably-produced wood construction products and other building materials;

better support industrial carbon removals with the Innovation Fund;

propose dedicated Horizon Europe calls on industrial CO<sub>2</sub> capture, use, and storage in its next work program (2023/24);

launch a study on the development of the CO<sub>2</sub> transport network;

update the guidance documents for the CCS Directive, covering risk management, monitoring, and financing;

organise an annual CCUS forum.

#### **4 A REGULATORY FRAMEWORK FOR THE CERTIFICATION OF CARBON REMOVALS**

<sup>25</sup> [https://ec.europa.eu/clima/policies/innovation-fund/ccs/implementation\\_en#tab-0-1](https://ec.europa.eu/clima/policies/innovation-fund/ccs/implementation_en#tab-0-1)

To reach the climate neutrality objective of the EU Climate Law, carbon removals will have to be fully integrated into the EU climate policy. To be climate neutral, in 2050 each single tonne of CO<sub>2eq</sub> allowed under the policy framework to be emitted to the atmosphere will have to be neutralized by a certified tonne of CO<sub>2</sub> removed from the atmosphere. The establishment of the legal framework suggested in this Communication will be an essential stepping stone towards the recognition of carbon removals in the EU climate policy. It will define the type of carbon removals that could be accounted in the period after 2030 to neutralize emissions in EU compliance frameworks. The Union carbon removal certification mechanism should focus on solutions taking place in the Union and removing CO<sub>2</sub> from the atmosphere with sufficient guarantees on the duration of the storage, the risk of reversal, the quality of the measurement or the risk of carbon leakages increasing GHG emissions elsewhere. This is important to ensure the EU can claim domestic climate neutrality. The question of the “validity” of carbon removals taking place outside the Union is also important, but not only presents greater complexity, in particular with regard to monitoring and verification issues: it can only be effectively addressed once the Union has a domestic regulatory framework for carbon removals against which to benchmark activities taking place elsewhere.

To scale up carbon farming and industrial solutions removing carbon from the atmosphere, the European Commission is working towards a legislative proposal in 2022 for an EU regulatory framework for the accounting and certification of carbon removals<sup>26</sup>. In light of the previous policy discussion on carbon farming and industrial capture, use, and storage of carbon, several considerations can already be identified for the design of this framework.

The development of this framework should ensure the transparent recognition of activities that unambiguously remove carbon from the atmosphere in a sustainable way. The accounting and certification rules should therefore set scientifically robust requirements in terms of quality of measurement, monitoring, reporting and verification of the carbon removed from the atmosphere, as well as regarding the environmental sustainability, impact on biodiversity, and the amount and type of energy used for the carbon removal process.

Carbon removal accounting and certification faces a number of challenging technical issues because carbon removals are at risk of uncontrolled re-emission (non-permanence) and measurement difficulties (uncertainty of estimates). In particular with regard to carbon farming, existing certification frameworks use a wide variety of approaches to quantify the amount of carbon removals which are generated compared to standard land management practices (additionality), and for the determination of co-benefits for bio-diversity. This lack of standardisation is a major barrier to the expansion of the voluntary carbon market.

Finally, the credibility of the accounting and certification framework will depend on its effective implementation. Preference should be given to a transparent process for the definition and updating of the accounting and certification rules. Various options exist for a governance framework involving public authorities and private bodies to support its implementation, ranging from a single, centralised EU system through to a more

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<sup>26</sup>[https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13172-Certification-of-carbon-removals-EU-rules\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13172-Certification-of-carbon-removals-EU-rules_en), announced in the Circular Economy Action Plan COM(2020)98

decentralised structure. Robust monitoring, reporting and verification of carbon removals at the level of individual land holdings (section 2) and through the industrial capture, transport and storage of CO<sub>2</sub> (section 3) is a necessary prerequisite to ensure their authenticity, as well as to minimize the risk of fraud and errors, and is therefore a pre-condition for regulatory mandates or incentives for the medium-term market uptake of carbon removal solutions. Nevertheless, the administrative costs, including those related to the monitoring, reporting, and verification of carbon removals, need to be kept manageable. The use of state-of-the-art digital solutions should allow for a cost-efficient and user-friendly implementation.

The Commission will be particularly attentive to the involvement of stakeholders in the preparation of the legislative proposal and the accompanying impact assessment. Among other actions, the Commission will launch a call for evidence to strengthen the Commission's understanding of carbon removals and key issues for their accounting and certification, and will organise a conference to bring together representatives from academia, business sectors, public organizations, NGOs and civil society to exchange views on the EU-wide certification concept.

#### Implementing the regulatory framework

In the near-term up to 2030, it is envisaged that the accounting and certification framework will be applied on a voluntary basis. A key objective over the next years will be to scale up carbon removals – be it in the land sector or in industry – and at the same time gain regulatory experience, in particular with regard to improving the monitoring, reporting and verification of carbon removals. Carbon farming and industrial projects, who invest now in carbon removals, should benefit from a robust accounting and certification framework to ensure comparability and environmental integrity. Carbon Farming should not be prejudicial to food security.

The Commission, in consultation with experts and stakeholders, will have to assess the functioning and robustness of the monitoring, reporting and verification system to be established, before further steps can be taken towards a better integration of certified carbon removals into EU regulatory framework. To that end, it will be crucial to address the risk of non-permanence and ensure the very long term benefit of carbon removals.

The objective of the accounting and certification framework is in the first place to establish high-quality standards for carbon removals taking place in the Union. The lessons learnt with their implementation can hopefully contribute towards the development of international standards. The Commission will organise an exchange with other interested jurisdictions to share experiences. This can also provide inspiration for third parties of how to use high quality credits in the context of the potential use for offsetting and ongoing discussion related to Article 6 of the Paris Agreement on the accounting framework and credit trading mechanism of an international carbon market.

The accounting and certification framework should also be consistent with other EU policy initiatives, such as the future Directives on Sustainable Corporate Governance and on Corporate Sustainability Reporting, where the framework could contribute towards more transparency for the reporting by companies on their climate-neutrality targets, as well as the

Sustainable Product legislative Initiative, where the framework could help to transparently demonstrate and encourage temporary carbon storage in products.

**Box 4: Key actions towards the certification of carbon removals**

On the way towards an integration of carbon removals in EU climate policy, the Commission will undertake the following actions:

launch a Call for Evidence to strengthen the Commission's understanding of carbon removals and key issues for their accounting and certification;

organise a conference to exchange views on the EU-wide accounting and certification concept;

establish, as a pre-condition for an effective accounting and certification framework, an EU standard in monitoring, reporting and verifying GHG emissions and carbon removals at farm and forest holding level as well as for captured fossil, biogenic or atmospheric CO<sub>2</sub> that is transported, processed, stored and potentially re-emitted to the atmosphere each year ;

propose an EU regulatory framework for the accounting and certification of carbon removals.

organise regular exchanges with other jurisdictions on carbon removal accounting and certification.