Destination - Land, ocean and water for climate action

Reducing greenhouse gas (GHG) emissions and increasing carbon sinks in primary production and natural systems as well as in harvested wood products and other carbon storage products are key components of the European Green Deal[344]. Achieving sustainable ocean, water and land management, and using natural resources efficiently to help mitigate climate change implies finding the right balance between productivity, climate, biodiversity and environmental goals in the agriculture and forestry sectors, with a long-term perspective. R&I activities will support **solutions for climate and environmentally friendly practices** to reduce emissions of major greenhouse gases, other pollutants and the environmental impact of ocean and land use changes and agricultural activities. R&I will rely on the application of digital technologies where relevant.

The **EU climate law**[345] states that to reach 2030 and 2050 climate targets and to restore biodiversity, the EU needs to immediately and decisively restore and increase its natural carbon sinks. In 2021, the Commission proposed to amend **Regulation (EU) 2018/841 for land use, forestry, and agriculture**[346] by setting an increased EU target for net removals of 310 MtCO2eq by 2030 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 land use, livestock and fertiliser use. At the end of 2021, the Commission published a **communication on sustainable carbon cycles,** including **carbon farming** and **certification of carbon removals**[347]. R&I, new technologies and business models are expected to unlock the full potential of land use, land-use change and forestry (LULUCF) activities in the mitigation of climate change.

Carbon farming will be implemented in line with the communication on sustainable carbon cycles and related documentation. R&I activities under this destination, and in the work programme of the mission 'A Soil Deal for Europe' will **help coordinate** the research community and key stakeholders in **developing, testing and demonstrating carbon farming practices and in certifying carbon removals**. Results of funded activities will help in managing land and forests and in delivering of multiple services provided by agricultural land and forests, such as: i) the provision of goods and long-term carbon storage in harvested wood products, ii) protection of soils, water and biodiversity; and iii) mitigation of and adaptation to climate change.

Specific attention will be given to paludiculture, complementing the activities of Cluster 5 in the 2021/2022 work programme. R&I activities will help increase soil organic carbon, protect carbon-rich soils (e.g. grasslands and peatlands), restore peatlands and wetlands, and improve advisory services for land managers. Together with the work programme for the mission 'A

344 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN
345 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119&from=EN
346 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0554
347 https://ec.europa.eu/clima/system/files/2021-12/com_2021_800_en_0.pdf

Soil Deal for Europe', R&I activities will aim to reduce the financial burden resulting from the costs of management practices in carbon farming and the uncertainty about revenue possibilities. In the livestock sector, R&I on manure management will help **implement the EU methane strategy**[348]. R&I activities will also boost the contribution made by a forest **as a natural and man-made carbon sink** and maintain multiple ecosystem services (e.g., water replenishment, soil protection), as proposed in the **Fit for 55** package with the revised LULUCF Regulation and the new **EU forest strategy**.

Strengthening the **nexus between the ocean and climate change** is a priority for the EU. There is growing political awareness of the importance of ocean and polar regions as integral parts of the Earth's climate system and of the need to ensure the integrity and resilience of these vulnerable ecosystems in the context of climate change. The main outcomes expected are an improved understanding of the ocean's role in the Earth's climate system, resulting in the closing of the research gaps on ocean essential climate variables and improved ocean models for seasonal to decadal forecasting at local and regional scales. This in turn will support decision-making aimed at preserving the integrity of the ocean and aquatic ecosystems and the polar Regions, through a better understanding of the drivers of change and of emerging threats, including tipping points. The ocean is also a large storage system for the global reservoirs of climate-regulating factors, particularly carbon. R&I will advance knowledge innovations to develop ocean-based solutions/mitigation options, helping to close the emissions gap and stop ocean acidification and prevent the consequent biodiversity losses.

The following blue carbon ecosystem developments could be envisaged:

- more knowledge about identifying regions at risk;
- exploring, preserving, restoring or even creating new natural habitats, and providing solutions to strengthen resilience and protection of EU coastal areas against climate change;
- more knowledge and data on blue carbon quantification;
- consider nature-based solutions for carbon farming, e.g. on coastal wetlands, as well as seaweed and mollusc aquaculture.

Biodiversity protection plays an important role in all approaches for mitigation in ecosystems and Nature-based Solutions (NBS)are highly important in this context, providing further environmental, social and economic benefits. Building on the political momentum gained at COP25 where the ocean was identified as a priority, and on the latest developments at COP26, science on the climate and the ocean nexus developed under the Horizon Europe programme will contribute to and inform the dialogue under the United Nations Framework Convention on Climate Change (**UNFCCC)** on the ocean and climate change.

Other major contributions include: i) providing new scientific knowledge on polar regions for the **EU Arctic policy**; ii) supporting the new policy initiative on **sustainable blue economy**

348 https://ec.europa.eu/energy/sites/ener/files/eu_methane_strategy.pdf

and its offshoot initiatives as well as implementing the **Marine Strategy and Water Framework Directives**; and iii) helping to achieve the **clean planet for all's** aim of neutralising all major threats to the health of the planetary ecosystem.

In line with the **climate adaptation strategy**[349], climate action also calls for ecosystems, primary production, food systems and the bioeconomy to adapt to climate change. Climate change is exacerbating existing risks to livelihoods, biodiversity, human and ecosystem health, infrastructure and food systems. Human activities relying on the availability and use of clean water are particularly affected by variable and extreme weather events, which may also lead to desertification. Agriculture and forestry in the EU are vulnerable to climate change. Specifically, there is growing evidence about the effects of climate change and extreme weather events, which need to be mitigated, on agricultural production, crop yields, and also on the forest sector.

In the area of forestry, R&I will improve knowledge on the interactions and interdependencies between biodiversity and climate change, and identify win-win management strategies, also addressing trade-offs in a sustainable manner. Marine and coastal areas are also threatened by the rise in sea level, saline water intrusion, biodiversity loss, ocean acidification, extreme events and a shrinking cryosphere. R&I will, therefore, be critical to stepping up adaptation and building resilience in agriculture, forestry, and activities in marine and coastal areas. They will aim to deliver on the urgent need to step up the adaptation of primary production, notably by providing farmers and other actors in bioeconomy value chains with better-adapted crop varieties and animal breeds with lower impacts on the related ecosystems.

R&I efforts are critical to avoiding, reducing and reversing desertification. They are also critical to delivering sustainable nature-based solutions that will also i) increase carbon sequestration, natural water retention, biodiversity conservation and restoration, ii) strengthen coastal protection, iii) reduce the risks of algal blooms and iv) offer ecotourism opportunities. Water adaptation strategies and approaches will be developed and tested. In this context, the innovation potential for a wide range of alternative water solutions (rainwater harvesting, storm water collection, water reuse and reclamation, brackish and sea water desalination, aquifer recharge, etc.) to be used for avoiding possible negative environmental impacts will be assessed and the European partnership for ensuring water security for the planet will be further supported. Potential trade-offs, and measures to mitigate and avoid them, will be assessed to ensure environmental sustainability and to keep the objectives of improving soil fertility, increasing carbon storage in soils and biomass to support benefitting agricultural productivity and food security and reduce biodiversity loss. R&I will also aim at providing a better understanding of how institutions and behaviour shape vulnerability and offer opportunities for adaptation.

349 https://ec.europa.eu/clima/eu-action/adaptation-climate-change/eu-adaptation-strategy_en

Expected outcomes include, by means of international cooperation, collaborative research on joint adaptation, mitigation and biodiversity reporting and monitoring of land contributing to the overall areas targeted in Cluster 6[350].

Expected impacts

Proposals for topics under this destination should set out credible pathways that contribute to **climate action on land - including forestland, grassland, cropland and wetland - as well as on oceans and water** and more specifically to one or several of the following impacts:

- better understanding and strengthening of the mitigation potential of ecosystems and sectors based on the sustainable management of natural resources;
- advancement of science and technology to support the **adaptation and resilience of natural and managed ecosystems**, on land, in the ocean, in water and soil systems as well as economic sectors in the context of the changing climate, including interaction with drivers of biodiversity change and zero pollution;
- efficient monitoring, assessment, modelling and data-driven decision-making support systems and projections related to **climate change impacts, mitigation and adaptation potential** in order to derive solutions for tackling existing and emerging threats and support decision-making in climate change mitigation and adaptation policies at European and global levels, including through the use of AI and other digital solutions;
- increased **climate change mitigation in the primary sectors**, including by means of reducing their GHG emissions and other pollutants, maintaining **natural and man-made carbon sinks** and increasing uptake and storage of carbon in ecosystems, taking into account trade-offs with regard to ecosystems;
- improved **capacity to climate change** of the ocean, sea, water and soil systems and related sectors to adapt to climate change, including by means of unlocking the potential of nature-based solutions;
- **sustainable management of scarce resources**, in particular soils and water, therefore mitigating climate related risks, especially desertification and erosion, thanks to informed decision-makers and stakeholders and the integration of adaptation measures in relevant EU policies.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL6-2023-CLIMATE-01	86.00	22.00	12 Apr 2023

350 This refers in particular to potential EU-China cooperation under the Climate Change and Biodiversity (CCB) Flagship.

HORIZON-CL6-2024-CLIMATE-01		75.00	22 Feb 2024
Overall indicative budget	86.00	97.00	

Call - Land, ocean and water for climate action

HORIZON-CL6-2023-CLIMATE-01

Conditions for the Call

Indicative budget(s)[351]

Topics	Type of Action	Budgets (EUR million)		Expected EU contribution per project (EUR million)[352]	Indicative number of projects expected to be funded
		2023	2024		
Opening: 22 Dec 2022 Deadline(s): 12 Apr 2023					
HORIZON-CL6-2023-CLIMATE-01-1	COFUND	14.00	22.00	Around 36.00	1
HORIZON-CL6-2023-CLIMATE-01-2	IA	10.00		Around 3.30	3
HORIZON-CL6-2023-CLIMATE-01-3	RIA	10.00		Around 5.00	2
HORIZON-CL6-2023-CLIMATE-01-4	RIA	20.00		Around 20.00	1
HORIZON-CL6-2023-CLIMATE-01-5	CSA	5.00		Around 5.00	1
HORIZON-CL6-2023-CLIMATE-01-6	RIA	5.00		Around 5.00	1
HORIZON-CL6-2023-CLIMATE-01-7	RIA	5.00		Around 5.00	1

351 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

352 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

HORIZON-CL6-2023-CLIMATE-01-8	IA	17.00		5.00 to 6.00	3
Overall indicative budget		86.00	22.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Proposals are invited against the following topic(s):

HORIZON-CL6-2023-CLIMATE-01-1: Additional activities for the European Partnership Water Security for the Planet (Water4All)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 36.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 36.00 million.
Type of Action	Programme Co-fund Action
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The proposal must be submitted by the coordinator of the consortium

	funded under HORIZON-CL6-2021-CLIMATE-01-02: European Partnership Water Security for the Planet (Water4All). This eligibility condition is without prejudice to the possibility to include additional partners. If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
Procedure	The procedure is described in General Annex F. The following exceptions apply: The evaluation committee will be composed partially by representatives of EU institutions. If the proposal is successful, the next stage of the procedure will be grant agreement amendment preparations. If the outcome of amendment preparations is an award decision, the coordinator of the consortium funded under HORIZON-CL6-2021-CLIMATE-01-02: European Partnership Water Security for the Planet (Water4All) will be invited to submit an amendment to the grant agreement, on behalf of the beneficiaries.
Legal and financial set-up of the Grant Agreements	This action is intended to be implemented in the form of an amendment of the grant agreement concluded pursuant to topic HORIZON-CL6-2021-CLIMATE-01-02. For the additional activities covered by this action: • The funding rate is 30% of eligible costs. • Beneficiaries may provide financial support to third parties (FSTP). The support to third parties can only be provided in the form of grants. • Financial support provided by the participants to third parties is one of the primary activities of this action in order to be able to achieve its objectives. The 60 000 EUR threshold provided for in Article 204 (a) of the Financial Regulation No 2018/1046 does not apply. • The maximum amount of FSTP to be granted to an individual third party is EUR 10 000 000. This amount is justified since provision of FSTP is one of the primary activities of this action and it is based on the extensive experience under predecessors of this partnership.

	• The starting date of grants awarded under this topic may be as of the submission date of the application. Applicants must duly justify the need for a retroactive starting date in their application. Costs incurred from the starting date of the action may be considered eligible (and will be reflected in the entry into force date of the amendment to the grant agreement).
Total indicative budget	The total indicative budget for the duration of this partnership is EUR 126 million.

Expected Outcome: This topic is for the continuation of the European Partnership Water Security for the Planet (Water4All), i.e. EU contribution in WP 2023-2024.

The second instalment of the partnership is expected to contribute to expected outcomes specified in topic HORIZON-CL6-2021-CLIMATE-01-02: European Partnership Water Security for the Planet (Water4All), for continuation and new development of activities.

Scope: The objective of this action is to continue to provide support to the European Partnership Water4All identified in the Horizon Europe Strategic Plan 2021-2024 and first implemented under the topic HORIZON-CL6-2021-CLIMATE-01-02: European Partnership Water Security for the Planet, and in particular to fund additional activities (which may also be undertaken by additional partners) in view of its intended scope and duration, and in accordance with Article 24(2) of the Horizon Europe Regulation.

The consortium which applied to and received funding under HORIZON-CL6-2021-CLIMATE-01-02: European Partnership Water Security for the Planet is uniquely placed to submit a proposal to continue the envisioned partnership. Not only did this consortium submit the proposal leading to the identification of the partnership in the Horizon Europe strategic planning 2021-2024, it has also implemented the partnership through co-funded calls in 2021 and 2022 based on this planning and further to topic HORIZON-CL6-2021-CLIMATE-01-02. In this context, the current consortium has particular expertise in relation to the objectives of the Partnership, the activities to be implemented, in particular FSTP calls or other calls/scope of calls clearly required/envisioned pursuant to initial proposal/partnership, and other relevant aspects of the action. In practice, another consortium could not continue the activities of the Partnership underway without significant disruption to the ongoing activities, if at all.

The scope of the application for this call on the European Partnership Water Security for the Planet should focus on the 2023-27 programmes according to the partnership's co-created strategic research and innovation agenda for seven years, which includes joint calls for research projects, activities to fostering the uptake of R&I results from various stakeholders, living labs and demonstration sites activities to demonstrate the efficiency of innovative solutions, activities to enhance international collaborations and support the achievement of the water related UN SDGs and transfer of in foreign contexts, where specific challenges can be encountered. Actions to ensure coordination and alignment of EU, national and regional

programmes, to strengthen the research/policy interface and all horizontal activities to allow the Partnership to operate and to achieve its specific objectives should be also addressed.

It is expected that the partnership continues to organise joint calls on an annual base and therefore it should factor ample time to run the co-funded projects.

Specific activities to strengthen the synergies of Water4All partnership with the related Missions and Partnerships, identified in the proposal submitted by the coordinator of the consortium funded under HORIZON-CL6-2021-CLIMATE-01-02 should be also described.

While the award of a grant to continue the Partnership in accordance with this call should be based on a proposal submitted by the coordinator of the consortium funded under HORIZON-CL6-2021-CLIMATE-01-02: European Partnership Water Security for the Planet (Water4All) and the additional activities (which may include additional partners) to be funded by the grant should be subject to an evaluation, this evaluation should take into account the existing context and the scope of the initial evaluation as relevant, and related obligations enshrined in the grant agreement.

Taking into account that the present action is a continuation of topic HORIZON-CL6-2021-CLIMATE-01-02 and foresees an amendment to an existing grant agreement, the proposal should also present in a separate document the additional activities and additional partners, if any, to be covered by the award in terms of how they would be reflected in the grant agreement.

The partnership should pool the necessary financial resources from the participating national (or regional) research programmes with a view to implementing joints call for transnational proposals resulting in grants to third parties.

The Commission envisages to include new actions in future work programmes to continue providing support to the partnership for the duration of Horizon Europe.

HORIZON-CL6-2023-CLIMATE-01-2: Improve the reliability and effectiveness of alternative water resources supply systems and technologies

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3.30 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply:

	The Joint Research Centre (JRC) may participate as member of the consortium selected for funding.

Expected Outcome: In support of the European Green Deal and EU water-related policies, successful proposals will contribute to fostering the adaptation of water resources to climate change, in particular the expected impact of the Destination 'Land, ocean and water for climate action' to "Advance understanding and science to support adaptation and resilience of natural and managed ecosystems, ocean, water and soil systems and economic sectors in the context of the changing climate".

Projects results are expected to contribute to all of the following expected outcomes:

- Recommendations on alternative water resources options in water scarce areas to address current and future challenges to water supplies and adapt to climate change, ensuring the water quality for a specific uses;
- Support for decision makers to integrate alternative water resources supply technologies in their strategic plans for water resources management taking into consideration the relevant EU regulatory frameworks (e.g. water and marine related policies, climate change adaptation strategy, Fit for 55);
- Increased societal awareness, acceptance of and trust in of several alternative water supply resources for water use in various societal, environmental and economic contexts;
- Increased market potential of alternative water resources.

Scope: The search for affordable, acceptable and reliable solutions is today a common challenge for water supply planners. A changing climate and increasing water scarcity, population growth, urbanisation and intensifying economic activities have put a strain on traditional water resources, which typically rely on available surface and groundwater resources. Ensuring the availability and sustainability of both surface and groundwater is a key element of the new EU strategy on adaptation to climate change.

According to a recent report on the drivers of and pressures arising from selected key water management challenges (EEA, 2021), water abstraction for public water supply, agriculture and industry is the main significant cause of failure to achieve good quantitative status. Over abstraction of surface water bodies can alter freshwater ecosystems and have adverse ecological effects, including decline of biodiversity. In addition, the over abstraction of groundwater bodies can lower groundwater levels with further impacts on groundwater-dependent aquatic ecosystems and cause salinisation of coastal aquifers, making them unusable for drinking water supply.

To address these problems and in order to improve the security of water supply, alternative water resources, such as rainwater harvesting, storm water, water reuse and reclamation, brackish and sea water desalination, aquifer recharge, are increasingly being used by water managers in rural, coastal and urban areas. However, in many case, the implementation of

several alternative water resources is not sustainable and not embedded in a strategic integrated water management plan at river basin or regional scale. In many cases the negative environmental impacts and associated infrastructure maintenance and investments costs are not properly assessed, nor the costs associated with meeting the EU water policy related requirements (i.e. WFD requirements). Finally, the public/social acceptance of several alternative water resources is lacking and this prevent their further implementation and market uptake. Further research and innovation is needed for making full use of alternative water resources.

Additionally, assessments and recommendations of how alternative water supply sources and infrastructures can relate to existing - mostly centralized - water utility regimes remain unexplored and there is a need to explore how the regulations around these centralized regimes can support infrastructure diversification.

The objective of this action is to improve the sustainability of various alternative water supply resources in the context of climate change and water scarcity adaptation. To achieve this objective the following issues should be addressed:

- Improve the efficiency, reliability and cost-effectiveness and sustainable design of a wide range of alternative water solutions (e.g., rainwater harvesting, storm water, water reclamation and reuse , brackish and sea water desalination, aquifer recharge).
- Assess the interaction between choices of the various alternative water supply technologies with the infrastructure design and development, the scale of operation and the water-energy interactions.
- Assess various alternative water solutions with regards to their potential their innovation, climate mitigation and adaptation and their environmental and health impacts. Explore the potential of digital technologies for appropriate data collection and integration. Attention should be given to reducing the negative impacts of infrastructures to increase water supply in water-scarce areas as well as reducing water demand (rebound effect).
- Develop a comprehensive framework or guidance tool for selecting specific technologies and management strategies for different water scarcity situations that can be adapted on a case-by-case basis and with a view of developing large-scale deployment strategies, in line with the requirements of the Water Framework Directive.
- Assess the critical factors that hinder the public acceptance of alternative water resources and identify measures and actions (e.g., policy actions, marketing interventions) to encourage their acceptance.

The possible participation of the JRC in the selected project would ensure that the approach proposed can be integrated as a scenario in the tool used by the European Commission for the estimation of water availability.

This action should bring together relevant researchers, technology providers, water utilities, business representatives, investors, policy makers and other water users and citizens. The

active participation and engagement of different stakeholders should span the entire project development and implementation to ensure performance and sustainability and maximise the final impact.

Proposals should cover various regions with a balanced coverage reflecting the various biogeographical and climate zones in Europe in a representative way.

The inclusion of relevant SSH expertise would be also needed to ensure the proposed solutions are also socially accepted.

HORIZON-CL6-2023-CLIMATE-01-3: Ocean and coastal waters carbon- and biodiversity-rich ecosystems and habitats in Europe and the Polar Regions

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
Technology Readiness Level	Activities are expected to achieve TRL 2-4 by the end of the project (Option B) – see General Annex B. Activities are expected to achieve TRL 3-5 by the end of the project (Option A) – see General Annex B.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering the topic, grants will be awarded to applications not only in order of ranking but at least also to those that are the highest ranked within each of the two options (A or B) set under 'scope' , provided that the proposals attain all thresholds.
Legal and financial set-up of the Grant	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the

Agreements	Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [353].

Expected Outcome: In line with the European Green Deal and, in particular with the objectives of the European Climate Law [354], the EU climate adaptation and mitigation strategies, the EU biodiversity strategy for 2030, the EU proposal for a nature restoration law[355], the Marine Strategy Framework Directive (MSFD), the Birds and Habitats Directives, the Regulation (EU) n. 734/2008 on the protection of vulnerable marine ecosystems in the high seas from the adverse impacts of bottom fishing gears, successful proposals should further the European efforts in achieving climate-neutrality by maintaining and enhancing natural carbon sinks and stocks in marine and polar ecosystems, while preserving and enhancing their biodiversity, including by unfolding the potential of nature-based solutions, where adaptations to climate change are also being fostered for enhanced resilience.

Successful proposals are expected to contribute to all of the following expected outcomes:

- Better understood and enhanced mitigation potential of ecosystems, based on sustainable management of natural resources and climate change mitigation fostered through the maintenance and enhancement of natural carbon sinks and stocks, while preserving or enhancing biodiversity in ecosystems, in support of a sustained European leadership in ocean–climate–biodiversity nexus science;

- Advanced understanding and science in support of adaptation and resilience of natural and managed marine and polar ecosystems in the context of a changing climate, including its interaction with other natural or anthropogenic stressors such as pollutants, invasive species or marine construction, and better understood impacts of climate change on coastal zones (including the associated ecosystems) and improved adaptive capacity of ocean and marine systems, including by unlocking the potential of nature-based solutions;

- Uncovered mitigation opportunities of newly emerging European and polar blue carbon habitats (novel habitats emerging due to the rising atmospheric CO2 that is intensifying climate change but also driving global and particularly polar greening; polar blue carbon increases with losses of marine ice (sea ice, ice shelf and glacier retreat) that generates a valuable negative feedback on (mitigating) climate change);

353 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

354 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119.

355 Proposal for a Regulation of the European Parliament and of the Council on nature restoration, COM(2022) 304 final, 22.06.2022

- Reduced knowledge gaps for enabling the inclusion of carbon- and biodiversity-rich marine habitats and accounting in nationally determined contributions (NDCs) and associated national climate plans and strategies (NAPs), such as additional national data collection, science and technical capacity, as well as significant contributions made to the implementation of the European Green Deal, particularly the climate and biodiversity objectives, the UNFCCC Ocean and Climate Change Dialogue, the Global Biodiversity Framework, and global scientific assessments.

Scope: The ocean and coastal ecosystems and habitats play a significant role in the global carbon cycle, representing the largest long-term carbon sink. Over the past decade, research efforts to understand the ocean and blue carbon sinks and utilize their potential in climate mitigation frameworks has increased. There are remaining research gaps for advancing opportunities to incorporate potential ocean and blue carbon ecosystems into climate frameworks. Evaluating and quantifying the broad range of benefits provided by coastal and marine ecosystems should strengthen the ability to account for them in nationally determined contributions (NDCs) and national adaptation plans (NAPs). Avoiding and reversing the loss and degradation and restoring carbon- and species-rich ecosystems in the ocean and coastal waters is highly effective and of highest importance for combined biodiversity protection and climate change mitigation actions with large adaptation co-benefits. If degraded or lost, these ecosystems are likely to release most of their carbon back into the atmosphere.

Actions should aim at developing innovative approaches to address only one of the following options:

- **Option A:** European and polar blue carbon hotspots and priority areas for climate policy frameworks and effective management (TRL 3-5)

The research actions should map European and polar blue carbon hotspots and priority areas for carbon sequestration and climate change mitigation potential, including an estimate of the area/extent of the habitats. In doing so, the successful proposal should rely on the synergistic use of Earth Observation data (in-situ, airborne, satellite) and models to monitor, evaluate and quantify both carbon fluxes and carbon stocks and stock changes in ocean and coastal reservoirs, to evaluate current trends and improve modelling skills and predictions, including using space and in-situ existing datasets and climate records that can be used as proxy (e.g., Copernicus, EMODnet).

The action should also gather information on organic carbon stocks and accumulation, their characteristics (source, lability, dissolved particulate, living, non-living), and their potential change under pressures from human activities. The action should identify the key characteristics that make the selected ecosystem and habitat a hotspot for blue carbon (i.e. geomorphology, physical-chemical characteristics, anthropogenic manipulation, sea level rise effects, etc.). The action should enable a better understanding of the dynamics of carbon between these reservoirs and the associated timescales involved. A quantification of the approximate amount of carbon (and preferably nutrients) fixed annually by those natural ecosystems in Europe, as well as a quantification of the annual degradation rates of the

ecosystems and consequent reduction in carbon sequestration should also be carried out. This knowledge should then be consolidated into a framework for predictive tools to investigate climate-smart management scenarios at appropriate scales, as well as methodologies, methods, and guidance tailored to the specific EU maritime region. The research action will identify and recommend best suited, fit-for-purpose, climate smart and resilient initiatives and activities that are relevant to local communities in order to protect, sustainably manage, restore, and enhance blue carbon habitats. Particular attention should be given to win-win-win solutions and strategies that have multiple benefits for climate mitigation and adaptation, biodiversity gains and benefit to people, including nature-based solutions, ecosystem-based approaches and technological-ecological synergies (TES) (combining technological and nature-based solutions). Where applicable and desirable, socioeconomic aspect of sustainability should also be part of such solutions, in order to make the projects more socially acceptable; e.g. allowing for eco-tourism, recreational activities and/or extraction activities (for example recreational fishing with permits or mussels farming that does not require any feed inputs) could also allow symbiosis with the communities in the coastal areas in which these ecosystems are situated. Where appropriate, this should include technological-ecological synergies (TES) as an integrated systems approach that recognizes the potential co-benefits that exist in combining technological and nature-based solutions. The action should also assess the synergies and trade-offs of combining nature-based solutions and blue infrastructure with grey infrastructure (i.e. hybrid measures), assess the scalability of nature-based solutions and whether the same benefits and effects achieved on a small scale can be achieved by implementing them across larger spatial scales. Actions should keep in mind and address the challenge that several factors may limit the effectiveness of nature-based solutions applied to coastal areas, making the case for more effective long-term strategies and activities (lack of knowledge of the benefits and limitations of nature-based solutions options, poor planning of measures, impacts of extreme weather- and climate-related hazards, emission of CH4 and N2O, and biogenic calcification, risks of slow-onset events, such as increasing temperature and biodiversity loss, and their interaction with multiple drivers (e.g., land use change) and cascading tipping points related to ecosystem degradation). Many of the approaches are conceptually feasible or have been demonstrated in the laboratory, but their consequences for the ocean, including on its biodiversity are uncertain, especially if applied at scale. Any proposed solutions should have to keep the precautionary approach in mind and demonstrate that they are biodiversity positive and have no negative impacts on the marine environment and ecosystem functioning. Particular attention should be given to maladaptation solutions. For each proposed solution, the action should identify the status, costs, potentials, risk & impacts (including tipping points and irreversibility, as well as the challenges posed by the emissions of blue methane, sea level rise, underwater permafrost thaw, coastal nitrate enrichment, etc.), co-benefits, trade-offs and spill over effects, and role in mitigation pathways. In addition, the economic feasibility should be taken into account, as well as the cost/benefit ratio of natural regeneration (rewilding) vs. assisted (e.g., Posidonia beds restoration/protection against trawling) vs. full restoration.

The action should identify and quantify the impact of anthropogenically induced activities that lead to the disturbance, degradation and destruction of these habitats (with estimation of

the most and least impactful activities, CO2 release in the atmosphere and the cost of no action) (direct or indirect pressure from human activities, such as bottom-contact fisheries, and climate forcing).

Finally, the action should make policy recommendations for advancing the incorporation of potential blue carbon ecosystems into climate frameworks, transforming science into effective policy and management and significantly contribute to the implementation of the European Green Deal and its climate and biodiversity strategies and objectives, including the Communication on Sustainable Carbon Cycles and the EU proposal for a nature restoration law[356] which includes targets.

- **Option B:** Uncover mitigation opportunities of newly emerging European and polar blue carbon habitats (TRL 2-4)

Rising atmospheric CO2 is intensifying climate change but it is also driving global and particularly polar greening. Polar blue carbon increases with losses of marine ice over high latitude continental shelf areas. Marine ice (sea ice, ice shelf and glacier retreat) losses generate a valuable negative feedback on (mitigating) climate change. The research action should conduct exploratory research into potentially new habitats emerging that could yield both mitigation and biodiversity benefits, if appropriately managed. Among the emerging habitats that should be tested in terms of their emerging role in carbon storage and sequestration, with the aim of understanding of carbon sink balances and climate change–feedback variability and reduce uncertainty in model projections, are: blue carbon change with sea ice losses; blue carbon gains from glacier retreat along fjords (fjordic blue carbon, i.e. seabed biological carbon gains as a result of recent rapid glacier retreat along fjords); blue carbon gains from ice shelf losses through opening up of productive new habitat and leaving nutrient-fertilized wakes of enhanced productivity; slight increases in sea temperature may also increase polar blue carbon; blue carbon around Antarctica is increasing with climate change, and the productivity within emerging fjords is likely to further increase with age and seasonal sea ice loss; snow and ice retreat in the subarctic and subantarctic; marine ice losses that create new polar continental shelf habitat across millions of km2 and doubling seabed carbon stocks in 25 years; fjords that have become exposed by glacier retreat (fjords are hotspots for the burial and storage of organic carbon and for their potential to provide an important long-term global climate regulation service); massive coastal embayment emerging as a result of giant iceberg breakout from ice shelves; new and intense phytoplankton blooms around the Southern Ocean which have doubled carbon storage by seafloor organisms in the last 25 years; marine ice loss in the Arctic; macroalgal particulate organic carbon sinks; changes in primary production in open Arctic waters; loss of pagophilic (ice-dependent) species and lower albedo, macroalgae, bivalves; species yet to be discovered in polar and deep-ocean ecosystems; relatively inaccessible habitats; novel approaches to secure carbon stocks in the face of fishing disruption (e.g., through changes in target species, gear, target areas).The action should build on existing and novel datasets (in-situ and satellite) to gather

[356] Proposal for a Regulation of the European Parliament and of the Council on nature restoration, COM(2022) 304 final, 22.06.2022

carbon information on stocks and accumulation, carbon characteristics (source, lability), change under pressures from human activities if not protected, the potential for carbon sequestration and associated timescales, understanding of carbon dynamics, framework and criteria to integrate these considerations and predictive tools to investigate management scenarios at appropriate scales, including displacement and trade-offs. The action should identify the key characteristics that led to the selected ecosystem and habitat to be considered a hotspot for blue carbon (i.e. geomorphology, physical-chemical characteristics, anthropogenic manipulation, sea level rise effects, etc.).

The action should also identify and recommend best suited, fit-for-purpose, climate smart and resilient and locally informed actions, initiatives and activities to protect, sustainably manage, restore, and enhance these newly emerging European and polar blue carbon habitats and assess the impact of anthropogenically induced activities that lead to the disturbance, degradation and destruction of these habitats and assess the synergies and trade-offs of protection vs. no action.

For **both options (A & B)**, international cooperation is strongly encouraged, with a strong linkage with the ongoing activities under the All-Atlantic Ocean Research and Innovation Alliance.

Proposals should include a dedicated task, appropriate resources and a plan on how they will collaborate with the other project funded under this topic, and ensure synergy with relevant activities carried out under other initiatives in Horizon Europe, and the EU Polar Cluster. Actions should build upon and link with Horizon projects (in particular project funded under the calls HORIZON-CL6-2022-CLIMATE-01-02:Understanding the oceanic carbon cycle, HORIZON-CL6-2021-BIODIV-01-03: Understanding and valuing coastal and marine biodiversity and ecosystems services, HORIZON-CL6-2022-BIODIV-01-01: Observing and mapping biodiversity and ecosystems, with particular focus on coastal and marine ecosystems, HORIZON-CL6-2021-CIRCBIO-01-09: Unlocking the potential of algae for a thriving European blue bioeconomy, HORIZON-MISS-2021-OCEAN-02-01: European Blue Parks, HORIZON-MISS-2022-OCEAN-01-07: Integration of biodiversity monitoring data into the Digital Twin Ocean, EU PolarNET2), the Copernicus marine service, Sustaining Arctic Observing Networks (SAON), Scientific Committee on Antarctic Research (SCAR) and Southern Ocean Observing System (SOOS), and international Ocean Observing Initiatives. The R&I needs to be conducted in a multidisciplinary and ecosystem-based approach.

This topic is part of a coordination initiative between the European Space Agency and the European Commission on Earth System Science. Under the initiative, both institutions aim at coordinating efforts to support complementarities between the Horizon Europe and the European Space Agency FutureEO programmes, and their projects. Proposals under this topic should address networking and collaborative research activities with relevant European Space Agency actions. In particular, the European Space Agency will contribute to this topic with existing and planned projects focused on enhancing the observation capacity and understanding from satellite EO technology of carbon sinks and stocks in marine and polar

ecosystems[357]. Relevant European Space Agency activities will be implemented under the A) Ocean Science Clusters (eo4society.esa.int/communities/scientists/esa-ocean-science-cluster), B) the Biodiversity Science Clusters (eo4society.esa.int/) and C) the Polar Science Cluster (eo4society.esa.int/communities/scientists/esa-polar-science-cluster). Proposals should address the collaboration with ongoing or future European Space Agency projects, including those that will be funded through dedicated coordinated invitations to tender, and should towards this end include sufficient means and resources for effective coordination. Applicants are encouraged to contact the European Space Agency to organise the joint European Commission - European Space Agency work. Collaboration with the relevant existing European Research Infrastructures is encouraged.

All in-situ data collected through actions funded from this call should follow INSPIRE principles and be available through open access repositories supported by the European Commission (Copernicus, GEOSS, and EMODnet).

Synergies and complementarities with projects funded under topics: HORIZON-CL5-2024-D1-01-07: Quantification of the role of key terrestrial ecosystems on the carbon cycle and related climate effects; HORIZON-CL5-2023-D1-02-02: EU-China international cooperation on blue carbon; Mission Restore our Ocean and Waters by 2030 (HORIZON-MISS-2021-OCEAN-02-01: European Blue Parks, HORIZON-MISS-2021-OCEAN-02-03: Atlantic and Arctic basin lighthouse - restoration of marine and coastal ecosystems and increased climate resilience, HORIZON-MISS-2022-OCEAN-01-01: European Blue Parks – Protection and restoration solutions for degraded coastal and marine habitats, HORIZON-MISS-2022-OCEANCLIMA-01-01: Mission Climate adaptation and Mission Ocean and waters - Joint demonstration for coastal resilience in the Arctic and Atlantic sea basin).

In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL6-2023-CLIMATE-01-4: Demonstration network on climate-smart farming – linking research stations

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 20.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 20.00 million.
Type of Action	Research and Innovation Actions
Eligibility	The conditions are described in General Annex B. The following

[357] Dedicated ESA invitation to tenders to be launched in 2023 and 2024 for each of the clusters will be published in the ESA-STAR Tender publication system (https://esastar-publication-ext.sso.esa.int).

conditions	exceptions apply: The following additional eligibility criteria apply: the proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.

Expected Outcome: Project results are expected to contribute to all of the following expected outcomes:

- The knowledge base of climate-related farming practices is expanded, resulting in increased application of climate-neutral approaches;
- Different methods of climate-smart agriculture in plant and animal production are assessed and evaluated with all relevant actors involved; with all relevant actors involved;
- The involvement of and adoption by farmers of innovative / smart farming practices that mitigate emissions of greenhouse gases (GHGs) and that foster adaptation of the sector to climate change is accelerated. In the long-term, this will support a more substantial contribution of the farming sector to mitigation of GHG emissions and to carbon storage;
- Implementation of the EU carbon farming initiative, as presented in the communication on "Sustainable Carbon Cycles" [358] is supported;
- The involvement of Member States' and Associated Countries' agricultural knowledge and innovation systems (AKIS) in climate-related farming issues is increased, including through linking to national, regional and local projects under the European Innovation Partnership "Agricultural productivity and sustainability" (EIP-AGRI) and to research stations, with a view to wider dissemination and enhanced interaction within and across the Member States and Associated Countries.

Scope: The conservation and enhancement of Earth's natural terrestrial carbon sinks such as soils and plants, forests, farmed lands and wetlands is crucial. The European Green Deal gives research and innovation (R&I) a significant role to play in supporting the design and implementation of policies that will ensure the achievement of the EU's climate objectives. Project implementation is expected to contribute to mitigation of and adaptation to climate change and help achieve climate-neutrality.

A wide adoption of practices contributing to mitigation of climate change and enhanced carbon storage by farmers is a priority to ensure that the EU reaches GHG mitigation objectives by 2030 and climate-neutrality for land use by 2035 and for the overall economy by 2050. Farming is also vulnerable to impacts of climate change; hence adaptation is of utmost importance. Mainstreaming the use of climate-smart practices has been recognised as a priority at the global level, including by the G-20.

[358] COM(2021) 800, 15.12.2021, https://ec.europa.eu/clima/eu-action/forests-and-agriculture/sustainable-carbon-cycles_en

The overall aim is to establish a three-level network in a phased manner over Cluster 6 work programmes 2021/2022 and 2023/2024. The first level is a network which engages front-runner farmers introducing on-farm trials and demonstration of innovations, using existing knowledge both in the EU and in Associated Countries (project "Climate Farm Demo"). The second level is a network to connect to all advisors on the subject in the Member States, building on achievements of Horizon 2020 projects and EIP-AGRI operational groups and the development of Member States' AKIS, to ensure the provision of targeted advice. The third level of the network – the present topic – will engage and strengthen the capacity of experimental research stations on climate issues.

Proposals should:

- Network existing research stations involved in adaptation to or mitigation of climate change in agriculture, to create an EU network including all Member States and where possible Associated Countries and to stimulate effective cross-fertilisation among them;

- Exploit existing solutions and develop new ones through practice-oriented on-farm testing and demonstration in a co-creative approach with pilot farmers and their advisors;

- Collect and compare tool-kits for assessing GHG balances at farm level, monitoring of performance in reducing emission, decision-support tools, climate services, etc. for possible use also on average farms;

- Explore carbon farming techniques (as defined in the Communication on "Sustainable Carbon Cycles") and their outcomes, also in terms of better farm management; analyse costs of carbon farming management practices and revenue possibilities as well as related risk and challenges; develop and/or test monitoring, reporting and verification systems; facilitate knowledge exchange and support tailored training and advisory services;

- Foster knowledge exchange within and among Member States and regions and establish links with the EIP-AGRI and Member States' AKIS networks and coordination bodies;

- Include a task to collaborate with the project "Climate Farm Demo" funded under topic HORIZON-CL6-2021-CLIMATE-01-04 and with the project funded under topic HORIZON-CL6-2022-CLIMATE-01-03 "Demonstration network on climate-smart farming – boosting the role of advisory services".

The project should operate for at least five years and build on the outcomes of the climate-related projects from various funding sources. The project must implement the multi-actor approach and may involve social innovation.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL6-2023-CLIMATE-01-5: Pilot network of climate-positive organic farms

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 5.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The following additional eligibility criteria apply: the proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [359].

Expected Outcome: This topic should contribute to mitigation of and adaptation to climate change and help achieve climate-neutrality by 2035 (in the land-use sector) and 2050 (across the EU economy). It will also contribute to meeting the target of the farm to fork strategy of having 25% of the EU's agricultural land under organic farming by 2030, as well as to implementing concrete actions of the action plan for the development of organic production[360].

Project results are expected to contribute to all of the following expected outcomes:

- The capacity of organic holdings to mitigate and adapt to climate change is enhanced, with co-benefits for biodiversity, water, soil and air;

[359] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[360] COM(2021) 141, 10.4.2021, https://agriculture.ec.europa.eu/farming/organic-farming/organic-action-plan_en

- Qualitative and quantitative data on the climate-related and other (co-)benefits and impacts of organic production are made more easily accessible, contributing to building the knowledge base for EU policy design and implementation and to increasing consumer awareness of the benefits of organic production;

- Carbon farming practices (as described in the Communication on "Sustainable Carbon Cycles" [361]) are further developed in the organic farming sector;

- Agricultural knowledge and innovation systems (AKIS) and decision-support systems in the organic sector are strengthened, in particular with regard to climate adaptation and mitigation.

Scope: The conservation and enhancement of Earth's natural terrestrial carbon sinks such as soils and plants, forests, farmed lands and wetlands is crucial. The European Green Deal gives research and innovation (R&I) a significant role to play in supporting the design and implementation of policies that will ensure the achievement of the EU's climate objectives. Organic farming relies on management practices that contribute to climate change mitigation, with additional benefits for the environment and biodiversity. The organic sector also has a role to play in the implementation of the EU carbon farming initiative as developed in the 2021 Communication on "Sustainable Carbon Cycles".

Proposals should:

- Establish a pilot network of existing and newly converted commercial certified organic farms and research stations representative of the main organic farming production systems (both plant and animal production) and regions in the EU.

- Provide for the collection at farm and landscape level of data relevant to organic farming and to climate change and other environmental objectives;

- Implement carbon farming techniques and analyse their outcomes, also in terms of better farm management; analyse costs of carbon farming management practices and revenue possibilities as well as related risk and challenges; develop and/or test monitoring, reporting and verification systems;

- Enhance sharing of knowledge and best practice on adaptation to and mitigation of climate change in the organic sector, including with regard to carbon farming, with attention also to regions where the organic sector is less developed, and support tailored training and advisory services;

- Ensure that project outcomes are made available also beyond the organic farming sector, including to other farmers who focus on low-input farming, circular agriculture and agroecology;

[361] COM(2021) 800, 15.12.2021, https://ec.europa.eu/clima/eu-action/forests-and-agriculture/sustainable-carbon-cycles_en

- Establish links with projects under the topics on a demonstration network for climate-smart farming (HORIZON-CL6-2021-CLIMATE-01-04 – project "Climate Farm Demo", and HORIZON-CL6-2022-CLIMATE-01-03), on agroecological approaches for climate change mitigation, resilient agricultural production and enhanced biodiversity (HORIZON-CL6-2021-CLIMATE-01-05), and on improving yields in organic cropping systems (HORIZON-CL6-2023-FARM2FORK-01-3), as well as with the planned partnership on agro-ecology living labs and the Mission "A Soil Deal for Europe".

This topic should involve the effective contribution of SSH disciplines.

HORIZON-CL6-2023-CLIMATE-01-6: Analysing fossil-energy dependence in agriculture to increase resilience against input price fluctuations

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 5.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The Joint Research Centre (JRC) may participate as member of the consortium selected for funding.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [362].

Expected Outcome: In supporting the implementation of the European Green Deal, in particular the European Climate Law, the farm to fork strategy and the common agricultural policy, R&I is expected to support agriculture pathways towards reduced greenhouse gas emissions and better use of inputs, while improving the incomes of primary producers.

[362] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Relevant inputs include in particular fossil fuels and fertilisers produced from non-renewable resources. The topic will contribute to the Destination's expected impact of "foster[ing] climate change mitigation in the primary sectors, including by the reduction of their GHG emissions and other pollutants".

Successful proposals are expected to contribute to all of the following expected outcomes:

- Better analytical tools and capacity to integrate the use of fossil energy and energy-intensive inputs in modelling and in socio-economic analysis more broadly;
- Improved decision-making by farmers in relation to the consumption of energy and energy-intensive inputs, in particular mineral fertilisers;
- Better capacity of the farming sector to cope with variations in the price of energy and energy-intensive inputs;
- Direct and indirect dependence of the sector on hydrocarbons is reduced.

Scope: Proposals should:

- Use foresight methods to elaborate scenarios of fossil energy and mineral fertiliser use evolution and dependence. Where available, reference scenarios of the European Commission (DG ENER) should be used to advance the state of the art;
- Improve the capacity of models to take into account direct and indirect energy uses and prices;
- Cover both macro and micro levels in the analysis. At the micro-economic level linkages should be established with the Farm Sustainability Data Network (FSDN) under development by the European Commission;
- Develop tools to support farmers' decision-making for optimal use of energy and mineral fertiliser, to improve economic, environmental and climate performance of farming systems.

This topic should involve the effective contribution of SSH disciplines.

Projects shall leverage the data and services available through European Research Infrastructures federated under the European Open Science Cloud, as well as data from relevant Data Spaces in the data-driven analyses.

The possible participation of the JRC in the project would ensure that the approach proposed is compatible with and improves the tools used at the European Commission**.**

HORIZON-CL6-2023-CLIMATE-01-7: Enhancing the sustainable production of renewable energy at farm-level

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 5.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The following additional eligibility criteria apply: the proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.

Expected Outcome: This topic supports the implementation of the EU bioeconomy strategy by creating opportunities for new cooperation in production, sales and distribution of renewable energy, which can provide agricultural communities (conventional and organic sectors) with an extra source of income, while contributing to clean energy supply for society without harming the environment.

Project results are expected to contribute to all of the following outcomes:

- Development of sustainable solutions and business models to reduce greenhouse gas emissions by at least 55% by 2030 in the EU and ultimately achieve net-zero greenhouse gas emissions by 2050.
- Identification of technical, economic, societal, environmental and regulatory barriers hampering further scale-up of renewable energy at farm-level
- Development of suitable and sustainable solutions to produce co-benefits (e.g. energy production, higher productivity, less water use, further pollination) and increase their up-take in practice.
- Recommendations for improved and targeted guidance, incentives and policies at regional, national and EU-level to reduce environmental impacts and financial risks for farmers.
- Diversification and enhancement of agricultural incomes (organic and conventional farming).

Scope: Many different forms of renewable energy are produced in rural areas, ranging from wind, solar (including agri-voltaics) and geothermal sources to different forms of bioenergy. Between these renewable energy sources and the environment, there can be trade-offs (e.g. land use change, biodiversity loss, air pollution) but also synergies. Small and medium scale installations can provide opportunities for new cooperation in production, sales and distribution of renewable energy, and thus, can provide agricultural communities

(conventional and organic sectors) with an extra source of income, while contributing to clean energy supply for society. If well planned and implemented, such installations can be deployed without harming the environment, or even with positive impacts, for example preserving soils quality, contributing to water retention, avoiding methane emissions or supporting pollination.

However, the variety of options also result in complex considerations, as the potential, performance and impacts of renewable energy technologies depend on natural conditions, size and type of farm, approaches designed and implemented, management techniques, degree of mechanization, geographic location, and socio-economic factors, such as awareness ,about technologies and their implementation, investment and advice support for farmers, as well as the surrounding energy system and energy infrastructure.

Proposals will:

- Analyse the different options to deploy renewable energy installations on farms, thereby assessing their environmental impacts (on climate change, biodiversity loss, pollution and natural resources depletion) and identifying the best options to mitigate trade-offs and supporting synergies in light of the sustainable management of agricultural land coupled with production of food and feed.

- Assess the opportunities for and barriers (e.g., financial risks and incentives/policies to overcome them) to combine agricultural production and different sustainable renewable energy technologies.

- Engage with relevant stakeholders and develop innovative business models for farmers producing sustainable renewable energy, including self-consumption, energy communities or direct feed into the electricity or gas grid or collective sales approaches that could potentially enhance profitability for farms.

- Analyse the potential of smart energy systems in rural areas and consider economically viable energy storage and transformation solutions for combined production of biogas/ biomethane, solar and wind as well as smart battery and energy solutions, including power to gas (hydrogen), thermal energy storage for self-use and grid stabilisation.

- Address the nutrient recovery and minimisation of negative environmental impacts, or even co-benefits, in the context of good agricultural practices and possible sanitary implications.

- Promote bioeconomy-related interventions in the new CAP and provide advice and technical guidance for Member States.

Proposals are expected to cooperate with other relevant EU-funded research projects, in particular ongoing projects under Cluster 5 of Horizon Europe.

Proposals must apply the concept of the 'multi-actor approach’ and ensure adequate involvement of the farming sector, and actors active in rural areas.

HORIZON-CL6-2023-CLIMATE-01-8: Closing the research gaps on Essential Ocean Variables (EOVs) in support of global assessments

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 6.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 17.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project (Option C) – see General Annex B. Activities are expected to achieve TRL 7-8 by the end of the project (Option B) – see General Annex B. Activities are expected to achieve TRL 7-8 by the end of the project (Option A) – see General Annex B.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering the Essential Ocean Variables (EOVs), grants will be awarded to applications not only in order of ranking but at least also to those that are the highest ranked within each of the three options (A, B or C) set under "scope", provided that the applications attain all thresholds.

Expected Outcome: In line with the European Green Deal and, in particular with the objectives of the European Climate Law, the EU climate adaptation and mitigation strategies, the EU biodiversity strategy for 2030, the EU proposal for a nature restoration law[363], the Marine Strategy Framework Directive (MSFD), successful proposals should further the European efforts in achieving climate–neutrality by advancing the understanding and science to support adaptation and resilience of natural and managed ecosystems in the context of a

[363] Proposal for a Regulation of the European Parliament and of the Council on nature restoration, COM(2022) 304 final, 22.06.2022

changing climate and biodiversity loss and by efficiently monitoring, assessment and projections related to climate change impacts, mitigation, and adaptation potential to deliver solutions for tackling emerging threats and support decision-making at regional, European and global levels.

Successful proposal results are expected to contribute to all of the following expected outcomes:

- Further developed key ocean monitoring indicators, Essential Climate Variables (ECVs from GCOS), Essential Ocean Variables (EOVs from GOOS) in compliance with international programmes (IPCC, WOA, IPBES, CMIP, CLIVAR, Ocean Health Index, UN Decade, ARGO) that support international global assessments and foster the development of a regional approach to ocean climate monitoring and reporting, overcoming current limitations and gaps;

- Further improved Earth System Models (ESMs) representing key physical, biogeochemical and biological processes in the ocean with reduced uncertainty of climate change projections at regional scales, and reduced biases (i.e. in the WCRP Coupled Model Intercomparison Project (CMIP7) models for ocean and polar regions);

- Better understood links between ocean physical, biogeochemical and biodiversity (including microbes and macro-organisms) variability over time, and the impacts of environmental stressors (e.g., warming, extreme events, ocean deoxygenation, and acidification) on ocean health, GHG sources and sinks, biology and ecosystems, as well as advanced understanding and science in support of adaptation and resilience of natural and managed marine and polar ecosystems in the context of a changing climate, including its interaction with other natural or anthropogenic stressors like pollutants;

- Strengthened development of common, agreed standards for climate records content, format, quality and validation methodology;

- Enabled evidence-based decision–making (e.g., developing early warning ocean climate indicators); Sustained European leadership in ocean–climate–biodiversity science nexus supporting EU programmes e.g., the Copernicus climate service, marine service, EEA / JRC reporting and complementing other relevant European programmes (e.g., science programme of the European Space Agency); Significant contribution to the implementation of the European Green Deal and its climate and biodiversity objectives, the EU maritime strategy, to the development of the European Digital Twin of the Ocean[364] (both data and models components), and to global scientific assessments, such as the IPCC, IPBES and WOA, as well as to the UNFCCC Ocean and Climate Change Dialogue, UN Decade of Ocean Science and UN SDGs 13 and 14.

Scope: To be able to deliver ocean forecasts and early warnings, climate projections and assessments and protect ocean health and its benefits, it is vital to measure Essential Ocean

[364] European Digital Twin of the Ocean (European DTO) | European Commission (europa.eu).

Variables (EOVs). The Essential Climate Variables and Essential Ocean Variables form the basis of the Global Climate Indicators that contain key information for the most relevant areas of climate change. The physics, chemistry, biology and biodiversity (including microbes and macro-organisms) of the ocean system are irrevocably interlinked. Ocean ecosystems are subject to a multitude of stressors, including changes in ocean physics and biogeochemistry, and direct anthropogenic influences. Implementation of protective and adaptive measures for ocean ecosystems sustainable management and conservation requires a combination of ocean observations with analysis and prediction tools that can guide assessments of the current state of ocean ecosystems, elucidate ongoing trends and shifts, anticipate impacts of climate change and management policies and provide decision makers and the public with the necessary information to assess the impact of policy decisions. In physical oceanography, essential variables have been collected globally in a standardized manner providing valuable input to the IPCC. Expansion of biogeochemical and ecological observation systems should allow for significant advances in the development and application of analysis and prediction tools for ocean biogeochemistry and ecosystems, production of biodiversity essential variables and associated climate records, with multiple societal benefits. This requires further standardisation and improved utilisation of existing sensors, as well as exploration and development of new sensor technology, suitable for ships, mooring and autonomous platforms, increased use of emerging remote sensing technologies at higher resolution.

One of the major roles of the research conducted under this topic should be to deliver integrated multidisciplinary ocean science by means of the physical, biogeochemical and biological/ecosystem research communities coming together and joining forces for development of Essential Ocean Variables, integration of observations from the different oceanographic disciplines into models for multidisciplinary analysis and reporting.

Actions should aim at developing innovative approaches to address only one following options:

- **Option A:** Improving the monitoring, understanding, reporting (Essential Variables) and projections of essential **physical** oceanic processes related to climate and changes over time, and production of related Essential Ocean Variables and indicators, at regional or sea basin scale (sea state, ocean surface stress, sea ice, ocean surface heat fluxes, sea surface and subsurface salinity, sea surface height, sea surface and subsurface temperature, ocean circulation and surface and subsurface currents, ocean layering and density gradient, upwelling) (including GHG fluxes) (TRL 7-8).

The research action is expected to further develop essential physical ocean monitoring indicators, EOVs, ECVs, improve their performances (e.g. resolution, uncertainties) and support their integration in climate models in order to improve the understanding of important feedbacks (e.g., cryosphere–ocean interactions such as: permafrost thawing–ocean feedbacks, ocean–ice sheet coupling, wind– and wave–ice coupling and sea ice formation, carbon–climate feedbacks). The activity should improve monitoring and reporting in specific ocean areas such as at depth and in marginal areas, over the continental shelf slopes, coastal zones and polar areas. The action should combine observation analyses and models over different

time scales (by making use of instrumental and proxy data), benefiting from latest advances in satellite measurements and in-situ, to improve the scientific understanding of the change and variability of ocean circulation and ocean heat content change, sea surface and subsurface conditions (temperature, salinity, sea ice, currents, deep convection), and the short- and long-term variability, as well as improve projections at regional scales.

The action should advance the scientific understanding of the projected decrease of Antarctic ice and Arctic sea ice and contribute to improving model projections of future changes, particularly at the regional level; of the potential connections between Arctic polar warming and sea ice loss and mid-latitude atmospheric variability; and the understanding and sea level long term prediction better considering the response of the ice sheets on multi-decadal to centennial timescales.

The action should advance in improving the characterisation of ice sheets and glaciers contribution in sea level monitoring, and projections, and advance our understanding and prediction of the multi-decadal reversibility. The action should contribute to the development of a more quantitative understanding and predictability of the processes that cause and maintain ocean extremes, and the conditions that are conducive for the generation of extremes.

- **Option B:** Improving the monitoring, understanding, reporting (Essential Variables) and projections of essential **biogeochemical** oceanic processes related to climate and changes over time at regional or sea basin scale (oxygen, nutrients, inorganic carbon, transient tracers, nitrous oxide, ocean colour, particulate matter, dissolved organic carbon, elemental and isotopic tracers, stable carbon isotopes, marine debris) (TRL 7-8).

The action should further develop essential biogeochemical ocean monitoring indicators, EOVs and ocean ECVs. The action should support the development of the ocean component of climate models through a better representation of essential biogeochemical processes, microbe biomass and diversity and enable a better understanding of the links between ocean physical and biogeochemical variability. The action should combine GHG measurements in regions especially critical for GHG fluxes (the polar oceans, main open-ocean convection areas like the North Atlantic, southern hemisphere, coastal and marginal seas, or coastal upwelling zones) with relevant biogeochemical measurements (e.g., oxygen, nutrients, carbon) to support GHG data analyses and model simulations. The action should improve the understanding of ocean biogeochemical fluxes and turnover of carbon and nitrogen in the ocean using state of the art autonomous observation technology combined with remote-sensing. This includes quantifying fluxes between basins/regimes (e.g. Arctic to North Atlantic, or coastal to oceanic) and across boundaries (air-sea, water-sediment), as well as between chemical phases (such as inorganic to organic, particulate to dissolved). Focus should be on quantifying GHG reservoir size and change, and potential subsequent impact on GHG fluxes, ocean productivity, carbon sequestration, oxygen demand and carbonate system.

The action should further inform models and improve predictions of the Earth system response to ocean acidification and to the ocean biological pump, including the long-term trends in ocean chemistry, beyond the observational record (paleo-ocean acidification), for a

better understanding of the multi-decadal reversibility or the hysteresis of ocean processes (like the AMOC). Links should be made with ocean stratification that acts as barrier for water mixing or carbon sequestration.

The action should improve observations for the interplay between carbonate chemistry and a variety of biogeochemical and physical processes, including eutrophication and freshwater inflow and outflow in coastal zones, and increase the robustness of future assessments of ocean acidification. The action should improve our understanding of changes in water mass ventilation associated with climate change and variability to gain further insights into future trends in ocean acidification.

The action should further research the net response of natural ocean CH4 and N2O sources to future warming, including permafrost, and predict the magnitude and timing of the responses of each individual process.

The action should make use of the recent developments, such as the Biogeochemical ARGO, to investigate extreme conditions, and extreme or compound events below the surface of the ocean, and their link to biogeochemical processes.

The action should further contribute towards the integration of more biogeochemical parameters, assimilation techniques, models and assessment strategies into ESMs.

- **Option C:** Improving the monitoring, understanding, reporting (Essential Variables) and projections of essential **biological and ecosystem** oceanic processes related to climate and changes over time at regional or sea basin scale (marine habitat properties, calcifying organisms, phytoplankton, zooplankton, fish, nekton migration, marine turtles, birds and mammals, hard coral, seagrass, mangrove, macroalgal canopy, microbe, invertebrate, ocean sound) (TRL 5-6).

The research action should further develop the essential biological and ecosystem ocean monitoring variables and indicators, and the development of early warning systems based on biological indicators (like marine calcifying organisms, coral reefs or plankton lifecycle).

The action should develop the integration (e.g., forcing, assimilation of boundary conditions, coupling, etc.) between climate models (physics and biogeochemistry) and ecosystem/marine habitat models to support ocean biodiversity variables and ECV development, in particular, quantifying the sensitivity of regional ecosystems responses to poorly-resolved, global, physical & biogeochemical inputs at model boundaries. The action should also identify & quantify the propagation of non-linear errors through the ecosystem models (from physics through biogeochemistry and to the highest trophic levels), including through better integration of numerical & statistical approaches allowing improved forecasting.

The action should further develop observation processing for biological and ecosystem EOVs and ECVs production, and assess needs for additional observations in support of biological EOVs and ECV development and validation. The action should support the development of common approaches and standards for the development of biological and ecosystem variables and ECVs for the oceans by strengthening the use of observation networks and relevant

biogeochemistry, biological and ecological measurements; an increase use of high-resolution remote sensing technologies, and the development of inter-calibrated protocols, notably for macroalgae, coral reefs, mangroves, tidal marshes, saltmarshes and seagrass. Particularly, it should extend the physical, biogeochemical, and ecological data records needed to develop, initialize, and validate marine ecosystem forecasts.

The action should assess the integration of the whole model chain (ESM + biology) on some specific test cases to evaluate uncertainties and potential use of such a modelling capacity for climate scenarios development and policy - management: e.g., evaluation of impacts of overshoot on ecosystems due to extreme climate change scenarios, perturbation of the biological carbon pump in a changing ocean or tipping point effect, surpassing the physiological tolerance limits beyond which the resilience of the ecosystem is compromised.

Particular attention should be paid to impacts of warming and acidity, or changes in the frequency and intensity of disturbance regimes, as they may lead to the collapse or transition of ecosystems to a new ecological state, with a loss or altered biodiversity and ecosystem services. The action should advance our scientific understanding of how extremes affect organisms and ecosystems, in particular for the effect of dual- or triple-compound events, by better understanding the cumulative effects on biota of the multifaceted characteristics—from abruptness to recurrence—associated with individual extremes; and the role of the compounding effect of the different hazards, leading to a complex matrix of often new conditions. Furthermore, advances should be made with regard to closing gaps in our understanding of the factors controlling biological, genetic and functional diversity, food-web interactions and relationships between different ecosystem constituents (trophic links, symbiosis, parasitism, etc.), and, also with regard to the physiological states and trophic modes (mixotrophy) of populations, before these models can be made operational in future forecasting and impact projection applications.

The action should establish protocols for the scientific validation of forecasts to validate results and build trust in forecasts, and ensure forecasts have the necessary spatiotemporal resolution for analysis and application to marine resource management, or to force downscaled regional forecasts.

The action should contribute towards the integration of more ecosystem parameters, assimilation techniques, models and assessment strategies into ESMs.

For **all three options (A, B & C)**, actions should result in better scientific understanding and quantification of tipping points and abrupt system changes, and associated impacts, including aspects of irreversibility and compound events. Actions should support a regional approach to ECVs, EOVs, ocean monitoring indicators and climate change / ocean health assessment, taking into account sea basin specificities. The action should result in spatially and temporally explicit information about physical, biological, and chemical properties of the ocean. Actions should also advance the understanding of the impacts caused by the crossing of tipping elements and develop early warning indicators. Where appropriate, the combination of multiple drivers and/or hazards that contribute to societal and/or environmental risk should be assessed. Actions should identify safe operating spaces for the ocean to provide life-support

systems for humanity, accompanied – where relevant – with long-term strategies for preventing or mitigating impacts. To better monitor significant changes in physical and biogeochemical environments and their impacts on ecosystems and society, actions should enable further integration of multidisciplinary observation systems (in-situ, airborne, satellite) and improved models. The assessments of cumulative effects should look at existing and past activities in the marine environment but should also allow for foresight in order to inform planning of future activities and support management that is adaptive to future conditions and sustains ecosystems and human well-being.

The actions funded under this topic should have a strong collaboration element and mechanism in order to ensure that the topic delivers on its key research priorities and help characterize the interplay and dependence between the biological, chemical, and physical properties of the ocean environment. The actions should build on existing observing platforms, Copernicus, and strengthen and expand the current capacities in a multidisciplinary and ecosystem-based approach. This multidisciplinary approach is key to comprehensively understand the variety of effects of global change on the ocean and its ecosystems. This topic provides for the opportunity to strengthen the interaction between biological and physical and biogeochemical platforms and research communities. To this end, proposals should include a dedicated task, appropriate resources and a plan on how they will collaborate with the other projects funded under this topic, and ensure synergy with relevant activities carried out under other initiatives in Horizon Europe. Relevant activities of the plan will be set out and carried out in close cooperation with relevant Commission services, ensuring coherence with related policy initiatives.

International cooperation will be essential in integrating and coordinating these different scaled approaches. A strong linkage should be ensured with the ongoing activities under the All-Atlantic Ocean Research and Innovation Alliance, UN Decade of Ocean Science, and GOOS bio-eco panel. Actions under this topic will build upon and link with Horizon projects (COMFORT, PolarRES, CrIceS, EuroSea, AtlantOS, EPOC, OCEAN ICE, OceanICU, Jetzon, DOOS, etc.), the Copernicus marine service, GOOS, the Ocean Biogeographic Information System (OBIS), MBON of GEOBON, ICOS, GCOS, and other relevant international Ocean Observing Initiatives. All in-situ data collected through actions funded from this call should follow INSPIRE principles and be available through open access repositories supported by the European Commission (Copernicus, GEOSS, and EMODnet).

This topic is part of a coordination initiative between the European Space Agency and the European Commission on Earth System Science. Under the initiative, both institutions aim at coordinating efforts to support complementarities between the Horizon Europe and the European Space Agency FutureEO programmes, and their projects. Proposals under this topic should address networking and collaborative research activities with relevant European Space Agency actions. In particular, the European Space Agency will contribute to this topic with existing and planned projects focused on enhancing the observation capacity and

understanding from satellite EO technology of the relevant ocean processes[365]. Relevant European Space Agency activities will be implemented under the A) Ocean Science Clusters (eo4society.esa.int/communities/scientists/esa-ocean-science-cluster), B) the Biodiversity Science Clusters (eo4society.esa.int/) and C) the Polar Science Cluster (eo4society.esa.int/communities/scientists/esa-polar-science-cluster). Proposals should address the collaboration with ongoing or future ESA projects, including those that will be funded through dedicated coordinated invitations to tender, and should towards this end include sufficient means and resources for effective coordination. Applicants are encouraged to contact ESA to organise the joint European Commission-European Space Agency work.

Projects shall leverage the data and services available through European Research Infrastructures federated under the European Open Science Cloud, Copernicus, as well as data from relevant Data Spaces in the data-driven analyses. Projects could additionally benefit from access to infrastructure and relevant FAIR data by collaborating with projects funded under the topics HORIZON-INFRA-2022-EOSC-01-03: FAIR and open data sharing in support of healthy oceans, seas, coastal and inland waters and HORIZON-INFRA-2024-EOSC-01-01: FAIR and open data sharing in support of the mission adaptation to climate change.

Collaboration with the relevant existing European Research Infrastructures is encouraged.

Synergies and complementarities: HORIZON-CL6-2024-CLIMATE-01-6: Ocean models for seasonal to decadal and local to regional climate predictions, and Cluster 5 topics: HORIZON-CL5-2024-D1-01-02: Inland ice, including snow cover, glaciers, ice sheets and permafrost, and their interaction with climate change, HORIZON-CL5-2024-D1-01-01: Enhanced quantification and understanding of natural and anthropogenic methane emissions and sinks, and HORIZON-CL5-2023-D1-01-02: Climate-related tipping points.

Call - Land, oceans and water for climate action

HORIZON-CL6-2024-CLIMATE-01

Conditions for the Call

Indicative budget(s)[366]

Topics	Type of	Budgets (EUR	Expected EU contribution per	Indicative number

[365] Dedicated ESA invitation to tenders to be launched in 2023 and 2024 for each of the clusters will be published in the ESA-STAR Tender publication system (https://esastar-publication-ext.sso.esa.int).

[366] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

	Action	million) 2024	project (EUR million)[367]	of projects expected to be funded
Opening: 17 Oct 2023 Deadline(s): 22 Feb 2024				
HORIZON-CL6-2024-CLIMATE-01-1	IA	10.00	Around 5.00	2
HORIZON-CL6-2024-CLIMATE-01-2	RIA	5.00	Around 5.00	1
HORIZON-CL6-2024-CLIMATE-01-3	IA	20.00	Around 10.00	2
HORIZON-CL6-2024-CLIMATE-01-4	RIA	12.00	Around 6.00	2
HORIZON-CL6-2024-CLIMATE-01-5	RIA	14.00	Around 7.00	2
HORIZON-CL6-2024-CLIMATE-01-6	RIA	9.00	Around 4.50	2
HORIZON-CL6-2024-CLIMATE-01-7	RIA	5.00	Around 5.00	1
Overall indicative budget		75.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant	The rules are described in General Annex G.

[367] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Agreements	

Proposals are invited against the following topic(s):

HORIZON-CL6-2024-CLIMATE-01-1: Improving irrigation practices and technologies in agriculture

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The Joint Research Centre (JRC) may participate as member of the consortium selected for funding. The following additional eligibility criteria apply: The proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.
Technology Readiness Level	Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [368].

Expected Outcome: In line with the European Green Deal's farm to fork strategy, EU water-related policies (notably the Water Framework Directive), and the work done and data made available by the European Environmental Agency (EEA), successful proposals will contribute

[368] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

to increasing the resilience of agriculture to drought with innovative irrigation systems that increase efficiency in water management.

Projects results are expected to contribute to the following expected outcomes:

- Solutions and prevention tools for improving water management in particular in areas experiencing recurrent or permanent water scarcity to anticipate solutions for current and future challenges in water management.
- Support available for end-users seeking to take up innovative solutions in irrigation technologies.
- Unlocking the potential of recycled sewage sludge and other biowaste streams as alternative, safe water and nutrient supply resources for agriculture.
- Increased socio-economic and environmental potential of alternative irrigation practices such as fog harvesting.
- Reduced agricultural water demand, as a result of optimized irrigation systems, including new opportunities for alternative water supplies, and expected innovations from the transition towards more sustainable farming systems, including agroecology.

Scope: Proposals should address the following:

- Improve the understanding of the composition, potential for irrigation in terms of efficiency, reliability and cost-effectiveness of sewage sludge and other biowaste streams, on condition that a safe use of these recycled products is possible, without a negative impact on the environment, ensuring high agronomic efficiency of the nutrients they contain.
- Integration and upscaling of the on-farm water management practices and results at the catchment level by quantifying the impacts of water recycling in the whole basin water balance, optimizing catchment-based agriculture production, reducing runoff patterns and possible changes in hydrological cycles linked to climate conditions.
- New or improved tools for an efficient combined use of water and fertilizers via irrigation for different agricultural systems, including agroecology, organic production, as well as conventional, intensive or urban agriculture.
- New, innovative forms of alternative water for agriculture (e.g., superabsorbent polymers/‘solid water’), including evaluation of their socio-economic, environmental and health impacts.
- Improve practices and solutions in small and large-scale farms to deal with the effects of water abundance (rapid showers, floods) and/or water scarcity.
- Identification of societal and regulatory barriers hampering upscaling of recycled water-use and development of suitable solutions to increase the uptake in practice.

- Recommendations for improved and targeted incentives and policies at regional, national and EU-level to reduce financial risks for early adopters of practices developed in the project.

Proposals must implement the 'multi-actor approach' and ensure adequate participation of the main stakeholders involved in irrigation practices and technologies in agriculture. Proposals should build and expand on the achievements of past and current Horizon 2020 and Horizon Europe research and innovation projects, including as part of the Horizon 2020 art. 185 PRIMA partnership. Proposals should include a dedicated task, appropriate resources and a plan on how they will collaborate with other projects funded under this topic as well under HORIZON-CL6-2023-ZEROPOLLUTION-01-01: Knowledge and innovative solutions in agriculture for water availability and quality and HORIZON-CL6-2024-BIODIV-02-01-two-stage: Demonstrating Nature-based Solutions for the sustainable management of water resources in a changing climate, with special attention to reducing the impacts of extreme droughts.

The possible participation of the JRC in the selected project would ensure that the approach proposed can be integrated as a scenario in the tool used at the European Commission for the estimation of water availability.

HORIZON-CL6-2024-CLIMATE-01-2: Socio-economic, climate and environmental aspects of paludiculture

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 5.00 million.
Type of Action	Research and Innovation Actions
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [369].

[369] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Expected Outcome: This topic will support the European Green Deal, notably its climate objectives and the EU proposal for a nature restoration law[370] of the EU biodiversity strategy for 2030. Earth's natural terrestrial carbon sinks, in particular peatlands and wetlands, are expected to play a crucial role in reaching EU climate objectives thanks to the conservation and restoration of ecosystems with large potential for carbon sequestration. To reach climate goals, rewetting of 500 000 hectares will be necessary in Europe. By looking into the potential of such areas when used for paludiculture, the topic will contribute to the following impact of the Destination: "Efficient monitoring, assessment, modelling, data-driven decision-making support systems and projections related to climate change impacts, mitigation and adaptation potential in order to derive solutions for tackling emerging threats and support decision-making in climate change mitigation and adaptation policies at European and global levels, including the use of AI and other digital solutions."

Project results are expected to contribute to all of the following expected outcomes:

- Paludiculture systems and their potential to provide jobs and income, while addressing climate mitigation, environmental objectives (notably water quality) and nature conservation, are better understood;
- The EU approach to carbon farming regarding wetlands and peatlands and their restoration, with the aim of reducing oxidation of the existing carbon stock and increasing the potential for carbon sequestration, is supported[371];
- Innovative solutions to facilitate the development of paludiculture are explored.

Scope: Proposals should:

- Take stock of the main socio-economic variables relevant for the paludiculture sector, including options for marketing of its products, and carry out socio-economic analyses, including projections and foresight;
- Estimate the potential for degraded peatlands and wetlands, currently used for conventional agriculture or forestry (with drainage), to be converted to paludiculture;
- Establish an observatory and databases for analytical purposes, covering the whole supply chain;
- Analyse positive and negative incentives and trade-offs, including with regard to carbon farming, in particular those that relate to the policy environment and to the attitudes and values of farmers and other actors;
- Explore solutions to lift possible lock-ins and speed up the development of paludiculture including with social innovation;

370 Proposal for a Regulation of the European Parliament and of the Council on nature restoration, COM(2022) 304 final, 22.06.2022

371 The approach is described in the Communication on "Sustainable Carbon Cycles", COM(2021) 800, 15.12.2021, https://ec.europa.eu/clima/eu-action/forests-and-agriculture/sustainable-carbon-cycles_en.

- Support the establishment of a network of researchers and practitioners involved in paludiculture at European and global level;

- Include a dedicated task, appropriate resources and a plan on how the project(s) will collaborate with project(s) supported through topic "HORIZON-CL6-2024-CLIMATE-01-3: Paludiculture: large-scale demonstrations".

Proposals under this topic should build on the results of the project(s) funded under the topic "HORIZON-CL5-2021-D1-01-08: Restoration of natural wetlands, peatlands and floodplains as a strategy for fast mitigation benefits; pathways, trade-offs and co-benefit". They should also build links with relevant projects funded under Mission 'Restore our ocean and waters by 2030' Horizon Europe Work Programme, in particular topics HORIZON-MISS-OCEAN-2022-01-02 "Danube river basin lighthouse: Protection and restoration of wetlands, flood plains, coastal wetlands and salt marshes and their biodiversity", and under HORIZON-MISS-OCEAN-2021-02-04 "Danube river basin lighthouse – coordination activities" as well as with the Mission implementation monitoring system that will be part of the Mission Implementation Support Platform for reporting, monitoring and coordination of all relevant implementation activities.

This topic should involve the effective contribution of SSH disciplines.

HORIZON-CL6-2024-CLIMATE-01-3: Paludiculture: large-scale demonstrations

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 10.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 20.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The following additional eligibility criteria apply: The proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.

Expected Outcome: This topic will support the European Green Deal, notably its climate objectives and the EU proposal for a nature restoration law[372] of the EU biodiversity strategy for 2030. Earth's natural terrestrial carbon sinks, in particular peatlands and wetlands, are

[372] Proposal for a Regulation of the European Parliament and of the Council on nature restoration, COM(2022) 304 final, 22.06.2022

expected to play a crucial role in reaching EU climate objectives thanks to the conservation and restoration of ecosystems with large potential for carbon sequestration.

Projects results are expected to contribute to all of the following expected outcomes:

- Practical options for the development of paludiculture and pathways for the conversion of degraded organic agricultural and forest soils to paludiculture are demonstrated.
- Recommendations for the approach to be taken towards large-scale deployment of paludiculture are developed.
- The carbon sequestration potential of paludiculture is quantified, including an assessment of its potential contribution to the achievement of EU targets.

Scope: Project activities should:

- Establish large-scale paludiculture demonstration in three areas of at least 50 hectares each;
- Involve all relevant actors (farmers/foresters, scientists, advisors, local/regional public authorities, industry, etc.) throughout the different stages of project development and implementation;
- Consider the potential for activities demonstrated in the project(s) to be replicated and scaled up, and to this end develop recommendations for policymakers and land managers;
- Include a dedicated task, appropriate resources and a plan on how the project(s) will collaborate with other projects funded under this topic and with project(s) supported through topic "HORIZON-CL6-2024-CLIMATE-01-2: Socio-economic aspects of paludiculture".
- Where relevant, build links with projects funded under Horizon Europe Missions, in particular the Missions "A Soil Deal for Europe", "Adaptation to Climate Change", and "Restore our ocean and waters by 2030". Relevant topics from the Mission work programmes include HORIZON-MISS-OCEAN-2022-01-02 "Danube river basin lighthouse: Protection and restoration of wetlands, flood plains, coastal wetlands and salt marshes and their biodiversity" and HORIZON-MISS-OCEAN-2021-02-04 "Danube river basin lighthouse – coordination activities", as well as the Mission implementation monitoring system that will be part of the Mission Implementation Support Platform for reporting, monitoring and coordination of all relevant implementation activities.

HORIZON-CL6-2024-CLIMATE-01-4: Land use change and local / regional climate

Specific conditions	
Expected EU	The Commission estimates that an EU contribution of around EUR 6.00

contribution per project	million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 12.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used). The following additional eligibility criteria apply: The proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.

Expected Outcome: Project implementation is expected to contribute to mitigation of and adaptation to climate change and to help achieve climate-neutrality in the land-use sector by 2035 (combining net removals from Land Use, Land Use Change and Forestry with biogenic emissions from agriculture) and climate neutrality of all sectors by 2050.

Projects results are expected to contribute to all of the following expected outcomes:

- Solutions are made available for understanding, modelling and optimising the relationships between net removals from Land Use, Land Use Change and Forestry (LULUCF) and biogenic emissions from the agriculture sector at local / regional level;
- Strategies are developed at local and regional level to deal with impacts of climate change and to maximise co-benefits for other objectives, including biodiversity protection.

Scope: The conservation and enhancement of Earth's natural terrestrial carbon sinks such as soils and plants in forests, on farmed lands as well as peatlands and wetlands is crucial. The European Green Deal and EU sectoral policies such as the common agricultural policy give research and innovation (R&I) a significant role to play in supporting the design and implementation of policies that will ensure the achievement of the EU's climate objectives.

Project activities should:

- Analyse, model and project impact of past, present and future land use and land use change on the local and regional evolution of the climate, including as appropriate the use of remote sensing technologies (Copernicus) combined with innovative processing and AI;

- Develop strategies for policy-making to mitigate adverse evolutions of climate at the regional/landscape level, including with regard to trade-offs between different objectives (climate change mitigation and adaptation, food and biomass production, biodiversity protection);

- Propose solutions for improved land management, making use of afforestation, integrated land use change and management practices (e.g. hedges, agro-forestry), extensivation and rewetting of organic soils, improved forest management and better use of biomass for long-lasting wood products, more efficient use of fertilisers, dietary changes, etc.;

- Include dedicated tasks and appropriate resources to collaborate with other projects financed under this topic as well as with projects under Destination 1, "Climate sciences and responses for the transformation towards climate neutrality", of Horizon Europe Cluster 5, "Climate, Energy and Mobility", and with relevant projects under the Missions "Adaptation to Climate Change" and "A Soil Deal for Europe".

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL6-2024-CLIMATE-01-5: Climate-smart use of wood in the construction sector to support the New European Bauhaus

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 7.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 14.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The following additional eligibility criteria apply: The proposals must use the multi-actor approach. See definition of the multi-actor approach in the introduction to this work programme part.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 60 000. Eligible costs will take the form of a lump sum as defined in the

	Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [373].

Expected Outcome: This topic will support the New European Bauhaus initiative and the implementation of the new EU forest strategy by making the construction sector more renewable and circular especially for existing buildings, which includes the use of currently underused timber such as hardwoods, salvage wood and post-consumer wood for traditional and newly emerging innovative woody biomass-based applications, while including circularity as part of a broader system and design loop.

Projects results are expected to contribute to all of the following outcomes:

- Enhanced contribution of the forest-based sector with respect to climate change mitigation and adaptation, a toxic-free environment and rural development objectives.
- Pathways for an efficient conversion of solid biomass into forms of long-term carbon storage.
- Enhanced contribution of the forest-based sector to decarbonisation strategies for buildings, both in terms of operational emissions, embodied emissions, and carbon removals, in relation to the Energy Performance of Buildings Directive, the renovation wave strategy, the Construction Products Regulation and other EU policies on buildings.
- Contribute to a robust and transparent methodology to quantify the climate benefits of wood construction products and other building materials, reflecting the most advanced dynamic life-cycle analyses and in view of contributing to the carbon farming initiative and carbon removal certification.
- Increased resource efficiency and minimisation of environmental footprint of wood products used in construction works.
- Better knowledge about the quantitative limits of global wood supply and the limits of wood as a resource.

Scope: Wood materials remain considerably under-utilised in the construction sector despite their durability and appreciation by end users. At the same time, there is a need for making the construction sector more renewable and circular, which includes the use of currently underused timber such as hardwoods, damage wood and post-consumer wood, while including circularity as part of a broader system and design loop. This requires new raw

[373] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

material sources and secondary material, technologies, and designs for wood components, specified products and for wooden buildings. Buildings need also to be adapted to climate change, including as regards summer and winter thermic performance.

Proposals will:

- Analyse the potential market and new technologies (such as the use of AI, IoT sensors or robotics) as well as processes for the utilisation of hardwoods, low quality, damage, and post-consumer wood in the construction sector, including for the refurbishment of buildings.
- Explore the potential of zero-waste concepts by developing solutions for each source type to turn into viable products as elements and as whole buildings in the wood construction sector.
- Design wood building blueprints based on these products and other underutilised bio-based materials, taking into account the reuse, adaptability and healthy living environment (e.g. avoidance of hazardous substances) into the design.
- Study and integrate human health and wellbeing aspects, as well as the cultural traditions of local crafts and design languages, as integral elements of the built space.
- Analyse and propose systems to overcome technical, logistical, legal, business, political, economic, knowledge and social barriers, challenges and opportunities and derive integrated policy recommendations and business strategies for enlarging the wood construction sector in Europe.
- Include the reuse, recycling, renovation and deconstructivity into product and building design concepts.
- Develop robust, transparent and cost-effective methodologies to quantify the carbon removal benefits of key wood construction products and other building materials.
- Develop roadmaps to mainstreaming multi-story wood buildings in Europe, which are the main market segment in living and commercial/office spaces in cities.
- Engage with relevant stakeholder in co-creation processes (e.g., the New European Bauhaus Community of Partners, policy, architects, business, insurance, investment, society, public and private sector).
- Link with other selected proposals and the NEB Lab and establish an open-access wood construction observatory in Europe, to monitor and update progress, statistics, good practice guidelines and solutions on wood construction.
- Address policy frameworks and standards that are still hindering innovation and further market development, as well international production norms and standards for assessing the ecological effects, climate adaptation and climate footprint of buildings which do not account for all benefits of wood.

The project must implement the multi-actor approach and ensure an adequate involvement of the primary production sector and the wider forest-based value chain

This topic should involve the effective contribution of SSH disciplines and capitalise on previous research results (e.g., BASAJAUN[374], Build-in-Wood[375], etc.), as well as the results of the LIFE Strategic Projects from the LIFE Circular Economy and LIFE Quality and Climate Action Sub-programmes.

Proposals are encouraged to/should consider social innovation when the solutions is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

Proposals may involve financial support to third parties e.g. to primary producers, academic researchers, start-ups, SMEs, and other multidisciplinary actors, to, for instance, develop, test or validate developed applications. Consortia need to define the selection process of organisations, for which financial support may be granted. Maximum 20% of the EU funding can be allocated to this purpose.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL6-2024-CLIMATE-01-6: Ocean models for seasonal to decadal regional climate impacts and feedbacks

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 4.50 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 9.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
Technology Readiness Level	Activities are expected to achieve TRL 3-5 by the end of the project – see General Annex B.

374 https://cordis.europa.eu/project/id/862942
375 https://cordis.europa.eu/project/id/862820

Expected Outcome: Successful proposals will contribute to the European Green Deal, addressing resilience to climate change (mitigation and adaptation) in coastal areas. Improved ocean models for 21st century climate projections, from regional to coastal scales, and from seasonal to decadal timeframes, will support the sustainability of the blue economy and the protection of ocean health and coastal landscapes.

The proposals will support the Digital and Green Transitions and will directly support Destination Earth[376] and the development of the Digital Twins, and the Digital Twin Ocean[377] in particular. They should contribute to the improvement of marine information services provided by European programmes like Copernicus, and their uptake at local, coastal and EU regional levels.

Project results are expected to contribute to all the following expected outcomes:

- Demonstration of the fit for purpose and configuration of ocean models, for climate change impact assessment in European sea basins and coastal areas, in particular on marine ecosystems;
- Demonstration of EU basin scale to coastal ocean climate services that support policy implementation and the development of climate adaptation strategies and of a carbon-neutral blue economy (e.g., ocean climate risk services);
- Development and publication of indicators on ocean status and health, targeted towards territorial decision-makers, complementary to current Global Climate Observing System (GCOS) Essential Climate Variables[378] or Copernicus Ocean State Reports[379];
- Integration of the developments in the digital perspective, interoperable and/or integrable with Destination Earth and the Digital Twin Ocean;
- Fostered collaboration between the climate science community and operational oceanography communities (operating ocean services on a sustained way).

Scope: A current limitation to climate change projections for EU-basin scale to coastal use comes from an insufficient representation and resolution of basin and coastal ocean dynamics and from an unsatisfactory understanding of the oceanic biogeochemical cycle. Most climate models include the ocean dimension that stops at the regional scale as defined by meteorology and climatology like in CORDEX In parallel, operational oceanography centres develop and operate ocean models (physics, biogeochemistry, sea-ice) for daily ocean forecasting and reanalysis that represent more exhaustively the full ocean dynamics. Methods should help close the gap between current climate projections (global, centennial) on the one hand and existing Copernicus Marine physics and biogeochemical models used for daily ocean forecasting.

376 Destination Earth | Shaping Europe's digital future (europa.eu)
377 European Digital Twin of the Ocean (European DTO) | European Commission (europa.eu)
378 GCOS | WMO
379 Ocean State Reports | CMEMS (copernicus.eu)

Proposals are expected to focus on:

- Developing capabilities for producing decadal to long-term (multi-decadal to centennial) refined predictions of the ocean state, at the scale of European regional seas including the coastal zones, where climate change risk is considered to be particularly high;
- Improving the representation of ocean processes (and dynamics, especially at regional to coastal scale) that can be integrated in in climate models;
- Developing capabilities for producing decadal to long-term EU basin scale predictions of biogeochemistry models to support feedback into global/regional marine ecosystem models and climate models;
- Validating the approach by performing historical runs and comparing corresponding model results to observations, proxy information, and / or reanalyses over an instrumental multi-decadal period, up to centennial scales, with characterized uncertainties;
- Investigating and assessing the quality of coastal models or ecosystem models of the low to mid trophic food web levels, over European seas and their coastal zones, with characterized uncertainties.

Methodology and developments should be benchmarked with two relevant use cases, to be showcased in three different European regional seas and coastal areas involving both scientists and end users:

- Development and demonstration of regional ocean climate risk services in coastal areas, due to sea level rise, waves, surges, or any other extreme event;
- Development and demonstration of regional ocean climate services in coastal areas supporting the blue economy (e.g. aquaculture, marine renewal energies, tourism).

Proposals shall demonstrate that the targeted scientific framework, ocean models integrated into EU basin scale climate models and resulting in basin scale ocean services for the marine and maritime sectors can be replicable to all EU regional seas. Proposals should plan resources for coordination and networking activities with related projects, in particular those funded under the Missions “Restore our Ocean and waters by 2030” and “Adaptation to Climate Change”, as well as with relevant projects funded under Cluster 4 – Space addressing Copernicus services (marine, land, emergency, climate), Cluster 5 Destination “Climate sciences and responses for the transformation towards climate neutrality”, and Cluster 6, as appropriate. These networking and joint activities could, for example, involve the participation in joint workshops, the exchange of knowledge, the development and adoption of best practices, or joint communication activities to break the silos between science communities.

The proposal should favour open data, open source, and public-use models and algorithms with open source licensing and integrable in the Digital Twin of the Ocean. Proposals should

leverage the data and services available through European Research Infrastructures federated under the European Open Science Cloud, as well as data from relevant Data Spaces in the data-driven analyses. Projects could additionally benefit from access to infrastructure and relevant FAIR data by collaborating with projects funded under the topics HORIZON-INFRA-2022-EOSC-01-03: FAIR and open data sharing in support of healthy oceans, seas, coastal and inland waters and HORIZON-INFRA-2024-EOSC-01-01: FAIR and open data sharing in support of the mission adaptation to climate change.

Synergies and complementarities: HORIZON-CL6-2023-CLIMATE-01-08: Closing the research gaps on ocean Essential Climate Variables (ECVs) in support of global assessments, relevant EU Research Infrastructures.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL6-2024-CLIMATE-01-7: EU-China international cooperation on improving monitoring for better integrated climate and biodiversity approaches, using environmental and Earth observation

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 5.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: In order to achieve the expected outcomes and to implement the Climate Change and Biodiversity Flagship in compliance with the provisions of the Administrative Arrangement between the European Commission and the Ministry of Science and Technology of the People's Republic of China (MOST), on a Co-funding Mechanism for the period 2021-2024 to support Collaborative Research and Innovation projects under the "Food, Agriculture and Biotechnologies", and the "Climate Change and Biodiversity" Joint Flagship Initiatives", and in accordance with the requirements of the Inter-governmental Science and Technology Innovation (STI) Cooperation Special Programme of MOST: 1. Consortia must also include as associated partners at least three independent legal entities established in China; and 2. Legal entities established in China can only participate as

	associated partners; and 3. Chinese participants must be awarded co-funding by MOST* *This condition will not be fulfilled if, at the time of grant agreement signature, the Chinese participants have not concluded a grant agreement with MOST. If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Grants awarded under this topic will be linked to the specific grants awarded by the Ministry of Science and Technology, China (MOST) to the Chinese partners. The respective options of the Model Grant Agreement will be applied.

Expected Outcome: The successful proposal is aiming to improve terrestrial monitoring as well as maximising synergies with biodiversity conservation and climate mitigation and adaptation, by using or acquiring environmental data, particularly geographically explicit data such as ground-based observation and remote sensed Earth observation data. This with a view to contribute to the objectives of climate-neutrality, adaptation to climate change and reversing biodiversity loss at global levels, with a focus on the EU and China. Synergetic solutions, including nature-based solutions such as the protection, the restoration and the sustainable management of terrestrial land, can contribute to enhancing carbon dioxide removals from the atmosphere, while reducing vulnerability and increasing resilience to climate change impacts, and contributing to biodiversity conservation and restoration.

The successful proposal will furthermore contribute to an advanced understanding of science to support integrated climate and biodiversity actions on natural and managed ecosystems and associated economic sectors. It will do so by advancing solutions for monitoring, assessment and projections to support decision-making in better integrated climate and biodiversity policies in terrestrial ecosystems generally.

The successful proposal is expected to contribute to all of the following outcomes:

- Protect biodiversity and maximize synergetic benefits of biodiversity conservation, climate mitigation and adaptation based on both remote sensing and ground-based observation;
- Development and exchange of best practices in using ground-based observation and Earth observation data and information, and establish standard and indicator system for biodiversity measurement for better integrated approaches in order to deliver increased synergies between mitigation, adaptation and conservation.

- Geographically-explicit monitoring on regions that has been identified high biodiversity value and/or subject to biodiversity protection and restoration provisions due to high climate risk;

- Strengthen scientific research in supporting of the synergies between the monitoring and reporting frameworks under the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention on Biological Diversity (CBD), including on the impacts of climate change on biodiversity, for better implementation and progress assessment of the post-2020 global biodiversity framework.

Scope: The EU and China face similar challenges as a result of climate change where it comes to biodiversity related aspects, while reaching climate neutrality will require critical contributions from terrestrial land, including through enhancing net carbon dioxide removals. Similar challenges could benefit from similar actions and defining best practices in improving monitoring of terrestrial ecosystems in order to design better approaches integrating climate change adaptation and mitigation, and biodiversity conservation.

The successful project should provide improvements in biodiversity monitoring infrastructures in support of integrated approaches able to deliver better synergies between mitigation, adaptation and conservation. Such integrated approaches can include a wide range of mitigation options, such as protection and restoring natural ecosystems, sustainable land management practices, sustainable forest and grassland management. Such options, based on a smart use of natural ecological processes and improved technologies, contribute to improving the quality, diversity and resilience of ecosystems, all of which have substantial benefits for biodiversity.

Most monitoring instruments for climate and biodiversity indicators on terrestrial land are carried out in a non-integrated manner and are based on statistical inventories without explicit geographical resolution. Earth observation (including satellite and near surface remote sensing as well as ground based methods), alongside analysis tools such as Geographic Information Systems, can be combined as multiple geographically-explicit data sets. Data acquisition, processing, cross-referencing and coherent integration on terrestrial land require substantial research and innovation investments.

Improving ground-based monitoring for better integrated approaches should assess or set up a strategy to assess the potential of natural and managed terrestrial ecosystems to contribute to:

- climate mitigation, including enhancing net carbon removals,

- climate adaptation, including resilience and disaster risk prevention, and

- protection, conservation and restoration of biodiversity.

Improving existing monitoring, including through designing new datasets and methods to set up a geographically-explicit monitoring of climate and biodiversity aspects fits within the scope of this topic.

The successful proposal should contribute to a strengthened cooperation between the EU and China, also in the context of a better cooperation under the Group on Earth Observations initiatives, building on the climate and biodiversity monitoring networks in China and the EU.

This topic is part of the EU-China flagship initiative on Climate Change and Biodiversity, which will promote substantial coordinated and balanced cooperation between the EU and China and is within the scope of the Administrative Arrangement between the European Commission and the Ministry of Science and Technology of the People's Republic of China on a Co-funding Mechanism for the period 2021-2024 to support collaborative research projects under the Food, Agriculture and Biotechnologies (FAB) and the Climate Change and Biodiversity (CCB) flagship initiatives.

The use of existing data and information coming from e.g. Copernicus and GEOSS is encouraged. Interaction with other actions developed under the EU-China Climate Change and Biodiversity (CCB) Research Flagship and/or the Flagship on Food, Agriculture and Biotechnologies is encouraged, as well as related topics within Cluster 5 and 6 and existing cooperation between the EU and China on land, including soils.