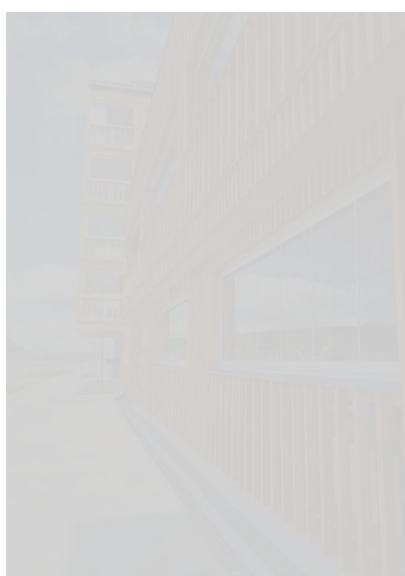


# FTP CALL TOPICS MANUAL HORIZON EUROPE 2021-2022

The complete manual for the Call topics relevant for  
the forestry sector



v2.0 – 21/06/2021

Forest-based Sector  
Technology Platform



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## Introduction

Horizon Europe is the EU's key funding programme for research and innovation for 2021-2027. After more than three years of negotiations, it has finally been approved by the European Parliament on the 27<sup>th</sup> April 2021. The approved budget amount is € 95,5 billion in current prices.

Horizon Europe is structured into three main Pillars. Pillar I focus on the funding of excellent science through the European Research Council and young researchers through the Marie Skłodowska-Curie grants programme. It also funds European research infrastructures.

Pillar II addresses global challenges and increasing the competitiveness of the European industry. Pillar II is divided into 6 thematic sub-budgets that are called Clusters. The third Pillar focus on innovation and acts mainly through the European Innovation Council and the European Institute of Technology.

For the stakeholders of the European Technology Platform for the forest-based sector (FTP), the most relevant funding opportunities are found under Pillar II Clusters 4, 5 and 6.

Cluster 4 is called 'Digital, Industry and Space', Cluster 5 is called 'Climate, Energy and Mobility', and Cluster 6 has the rather long title 'Food, Bioeconomy, Natural Resources, Agriculture and Environment'. Each Cluster has a sub-budget, called Work Programme, that identifies Call Topics for a period of two or three years. **Call Topic Manual covers the relevant Call Topics of the 2021-2022 Work Programmes for Clusters 4, 5 and 6.**

The Horizon Europe budget is distributed by competitive Calls for Proposals. This means that applicants have to submit proposals that will be evaluated and scored by external experts and only the best scoring proposals will be funded under each Call for Proposals.

The proposals, if they are funded, are annexed as part of the contract between the applicants and the European Commission. A proposal could be compared to a business plan of a start-up company. If the proposals are funded or not will depend on how they are ranked in the evaluation by independent experts. The scoring is based on three main criteria; **Excellence** (is the idea sound, is the proposal actually covering the scope of the Call, etc), **Impact** (how will the outcomes of the project contribute to the objectives of the Call and relevant EU objectives), and **Quality and efficiency of the implementation** (is the project well planned in terms of budget, are all the reports and deliverables relevant and well described, Are the project milestones relevant and are there contingency plans prepared if the project run into problems). Although all three criteria are scored equally, the Impact criteria is usually considered the most important of the three.



This FTP Manual showcases a list of the most relevant Call topics for the forest-based sector. Each Call contains topics and each topic describes the specific challenge to be addressed, the scope of the activities to be carried out, and the expected impacts to be achieved by the projects proposed. The relevant topics selected and compiled in this manual are arranged with the link to the corresponding Research and Innovation Areas [of FTP's Strategic Research and Innovation Agenda for 2030 \(SIRA 2030\)](#).

Proposals can be submitted electronically through the European Commission's [Funding and Tenders Portal](#). The complete list and description of Calls and further guidance to submit a proposal are also published on the Portal.

Preparing a proposal takes time and effort. By this version of the FTP Call Topics Manual, we wish to give our stakeholders the advantage of an early start.

The three Work Programme documents we have analysed for this document, together constitute close to 2000 pages text and several hundreds of Call Topics. We have identified approximately 150 of those Call Topics as relevant for stakeholders in the forest-based sector.

Information on the Call Topics in this Manual will also be available on the FTP Database.

Horizon Europe (2021-2027) with its dedicated budget of around €95 billion is the biggest EU Research and Innovation programme ever.



## Budget for 2021–2022: Call topics relevant for the forestry sector

	Number of Calls	Funding (million EUR)
<b>Cluster 4 – Digital, Industry and Space</b>	<b>12</b> (4 indirect)	<b>134,4</b>
Destination 4 - Digital and emerging technologies for competitiveness and fit for the Green Deal	4 (1 indirect)	79,5
Destination 5 - Open strategic autonomy in developing, deploying and using global space-based infrastructures, services, applications and data	2	11
Destination 6 - A human-centred and ethical development of digital and industrial technologies	3 (3 indirect)	11
EUSPA	3	32,9
<b>Cluster 5 – Climate, Energy and Mobility</b>	<b>4</b>	<b>70</b>
Destination 1 - Climate sciences and responses for the transformation towards climate neutrality	3	55
Destination 3 - Sustainable, secure and competitive energy supply	1	15
<b>Cluster 6 – Food, Bioeconomy, Natural Resources, Agriculture and Environment</b>	<b>44</b> (9 indirect)	<b>444,5</b>
Destination 1 - Biodiversity and ecosystem services	19 (9 indirect)	195,5
Destination 2 – Fair, healthy and environment-friendly food systems from primary production to consumption	4	34
Destination 3 - Circular economy and bioeconomy sectors	5	47
Destination 4 - Clean environment and zero pollution	4	27
Destination 5 - Land, ocean and water for climate action	5	53
Destination 6 - Resilient, inclusive, healthy and green rural, coastal and urban communities	3	41
Destination 7 - Innovative governance, environmental observations and digital solutions in support of the Green Deal	4	47
<b>MISSIONS</b>	<b>5</b> (2 indirect)	<b>12</b>
Mission: Adaptation to climate change	1 (1 indirect)	5
Mission: Climate neutral and smart cities	1 (1 indirect)	2
Mission: Soil health and food	1	5
<b>Total all Calls</b>	<b>63 Calls</b> (15 indirect)	<b>660,9 mln EUR</b>
<b>Total (High, Medium, Low)</b>	<b>48 Calls</b>	<b>568,9 mln EUR</b>

## **How to read this manual: The Call Topic Headers**

For each Call Topic, we provide in the header key information such as the Call publication date, application deadline(s), Call budget, recommended EU funding per project, starting TRL and ending TRL (TRL=Technology Readiness Levels).

Further on, to assist the reader to find their way to the Call Topics of highest relevance to them, we have introduced a few concepts in the header of each Call Topic: FTP Subsector, Relevance, Keywords, FTP Comment and FTP SIRA 2030.

### **FTP Subsector: F&F, WW, P&P + Biodiversity, Bioenergy, Policy**

This manual makes a very broad classification of the forest-based sector into three subsectors: forests and forestry, pulp & paper industries, and woodworking industries.

In many cases, the scope of the Call Topic is relevant to actors in more than one subsector and if the scope covers, chain-of custody, life-cycle analysis, circular economy etc, we have included the whole value-chain, i.e., all three subsectors in this identification.

Forests and Forestry (abbreviated F&F): Sustainable forest management, forest-related sciences, remote sensing technologies, plant breeding and much more.

WoodWorking Industries (abbreviated WW) includes sawmilling, building with wood, wood manufacturing, boards, panel industry, carpentry, wood composite products like CLT, construction, reuse and recycling and much more.

Pulp & Paper Industries (abbreviated P&P): packaging, paper, biocomposites, biochemicals, hygiene and healthcare products, nanocellulose, foams, gels, recycling and reuse and much more.

Besides these three subsectors, we sometime use Biodiversity, Bioenergy and Policy to emphasise the scope of the Call Topic.

### **Relevance: High, Medium, Low, Indirect**

High relevance is used when the Call Topic is specifically targeting an area of the forest-based sector, or when it is targeting a broader context but addresses a challenge of very high relevance to the sector.

Medium relevance is used when the Call Topic is relevant but the scope is encompassing for instance agriculture AND forestry, or process industries in general.

Low relevance is used when the topic is either covering a very narrow, special niche of the forest-based sector (e.g. New biocompatible healthcare products), or when the scope is broadly relevant to a much larger group of actors (e.g. a topic on transport and logistics solutions).

Indirect relevance is used when the actors in the forest-based sector should keep an eye of future outcomes, but the Call Topic is unlikely to be addressed by FTP stakeholders. For instance, projects related to standardisation of earth observation data from satellites or studies of climate change effects on biodiversity. Those indirect topics can be found in Annex 1.

**Keywords** are selected from the Call Topic description.

**FTP Comment:** In some cases, we have made some own reflections and recommendations on the call topics that we have collected.

**FTP SIRA 2030:** Here we identify which of the ten Vision Targets and the related Challenges that are described in the FTP Strategic Research and Innovation Agenda 2030 that could be considered addressed by the call topic.

10 Visions Targets and Challenges of SIRA 2030:

1	Sustainable forest management, biodiversity and resilience to climate change
1.A	Capitalizing on the interdependencies between forest management and functional diversity
1.B	Strengthening forest ecosystem resilience and fostering Climate Smart Forestry
1.C	Enhancing the vital role of forests in regional and continental water supply
1.D	Mitigating wildfire risks in forested landscapes
1.E	Improving the partnership with citizens
2	Increased, sustainable wood production and mobilization
2.A	Improving seeds, seedlings and plants to increase productivity and resilience
2.B	Using digital revolution for precision forestry
2.C	Empowering small-scale forest owners
2.D	Harnessing novel technologies and automation in forest operations
2.E	Analysing and foresighting markets and material flows of forest-based products
3	More added value from non-wood ecosystem services
3.A	Improving business opportunities for non-wood forest products
3.B	Enhancing value creation with other ecosystem services
3.C	Providing forest-based benefits for urban and peri-urban societies
3.D	Identifying the benefits of forest expansion as a consequence of land-use change
3.E	Innovation in forest governance to promote forest-based benefits for society
4	Towards a zero-waste, circular society
4.A	Optimizing material recovery through efficient collection, sorting and separation
4.B	Adapting reuse and recycling technologies to complex products
4.C	Defining methods for cost assessment and optimization of recycling

- 4.D Boosting the circularity of forest fibres and wood products
- 5 Efficient use of natural resources
  - 5.A Reducing energy consumption in biorefineries, including pulp and paper mills
  - 5.B Optimizing the use of raw materials by exact control of natural variations
  - 5.C Improving raw material efficiency and production value in wood-based manufacturing
  - 5.D Improving water balance and process water treatment
- 6 Diversification of production technologies and logistics
  - 6.A Developing industrial symbiosis
  - 6.B Creating new biorefinery concepts for the circular and biobased economy
  - 6.C Adopting additive manufacturing technologies and new production methods
  - 6.D Extracting and producing natural compounds with high added value
  - 6.E Improving traceability and chain-of-custody throughout the value chain
  - 6.F Integrating autonomous and/or electrified harvesting and transportation systems
- 7 Purposeful, safe jobs and links between rural and urban regions
  - 7.A Growing the forest-based sector through creative jobs
  - 7.B Creating job opportunities along the value chain through proactive management of small forest ownerships
  - 7.C Developing new marketplaces and jobs in response to changing consumer trends
  - 7.D Adapting job offers in an era of Artificial Intelligence (AI)
  - 7.E Improving operator safety and ergonomics
- 8 Renewable building materials for healthier living
  - 8.A Developing new building systems, including modular and pre-fabricated systems
  - 8.B Improving wood-based products, including engineered wood and composites
  - 8.C Harmonization and standardization research and more intelligent, digital design tools
  - 8.D Exploring the experience of living with wood and its health benefits
- 9 New fibre-based products and 80 per cent lower CO2 emissions
  - 9.A Providing sustainable, fibre-based, high-value consumer products
  - 9.B Developing more sustainable and competitive processes for paper-making and other biobased products
  - 9.C Developing building blocks for biobased materials and chemicals in the circular society
  - 9.D Adding value through digitalization and functionalization
- 10 Renewable energy for society
  - 10.A Developing new, efficient production systems for advanced, clean biofuels and chemicals
  - 10.B Enhancing the valorization of forest residues
  - 10.C Establishing integrated and holistic energy systems (including energy storage and managing demand fluctuations)
  - 10.D Supporting fact-based decision-making on bioenergy-related issues

*DISCLAIMER: Please be aware that only the officially published Work Programme (WP) text, budget and deadlines should be taken as a reference for any proposal preparation. All applicants should consult the Funding and Tenders Portal to find the latest version.*

## Pillar II : Global challenges and European industrial competitiveness Pillar

### Cluster 4: Digital, Industry and Space<sup>1</sup>

#### Destination 4: Digital and emerging technologies for competitiveness and fit for the Green Deal

This destination will directly support the following Key Strategic Orientations, as outlined in the Strategic Plan:

- KSO A, '**Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations.'
- KSO C, '**Making Europe the first digitally led circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems

Proposals for topics under this Destination should set out a credible pathway to contributing to the following expected impact:

- **Open strategic autonomy in digital technologies and in future emerging enabling technologies**, by strengthening European capacities in key parts of digital and future supply chains, allowing agile responses to urgent needs, and by investing in early discovery and industrial uptake of new technologies.

Electronic and photonic components, and the software that defines how they work, are the key digital technologies that underpin all digital systems. As the digitalisation of all sectors accelerates, most industries depend on early access to digital components. Dependence on these technologies represents a clear threat to Europe's autonomy, particularly in periods of geopolitical instability, exposing Europe to risks of vulnerability. Actions under this Destination will build on EU strengths in low-power consumption and ultra-secure components, Europe needs to develop the essential electronic and photonic components for a wide range of applications such as healthcare equipment, electric and autonomous

<sup>1</sup> [Work Programme published by the European Commission on 15 June 2021](#)

vehicles, manufacturing and production plants and equipment, telecom networks, aerospace vehicles, consumer products

R&I initiatives on 6G technologies are now starting in leading regions world-wide, with the first products and infrastructures expected for the end of this decade. 6G systems are expected to offer a new step change in performance from Gigabit towards Terabit capacities and sub-millisecond response times, to enable new critical applications such as real-time automation or eXtended Reality ("Internet of Senses"). Europe must engage now to be among the top influencers of - and competitors in - these technologies and ensure that emerging network technology standards are defined following European values and energy-efficiency requirements. Main actions on 6G technologies will be undertaken in the Smart Networks and Services Joint Undertaking.

Despite a strong European scientific community's on AI and robotics, Europe lags behind in AI diffusion. Actions under this Destination will develop world-class technologies serving the needs of all types of European industries (e.g. manufacturing, healthcare, transport, agriculture, energy, construction), providing top-performing solutions that businesses will trust and adopt to maintain their competitiveness and maximise their contribution to environmental sustainability.

While Europe is strong in many sectors, it must take ownership of its unavoidable future transformations for competitiveness, prosperity and sustainability, by early leadership in new and emerging enabling technologies, e.g. alternative computing models such as bio- and neuro-morphic approaches, use of biological elements as part of technology, and sustainable smart materials. In particular, the far-reaching impact of quantum and graphene technologies on our economy and society cannot be fully estimated yet, but they will be disruptive for many fields. Actions in this Destination will ensure that Europe stays ahead in this global race and is in a position to achieve game-changing breakthroughs.

In line with the vision set out in the Digital Decade Communication (COM(2021)118), in particular its 'secure and performant sustainable digital infrastructures' pillar, actions under this Destination will support Europe's open strategic autonomy, and reinforce and regain European industry's leaderships across the digital supply chain. It will direct investments to activities that will ensure a robust European industrial and technology presence in all key parts of a greener digital supply chain, from low-power components to advanced systems, future networks, new data technologies and platforms. Autonomy will require sustaining first-mover advantage in strategic areas like quantum computing and graphene, and investing early in emerging enabling technologies.

Investments in this Destination contribute substantially to climate change objectives. Energy efficiency is a key design principle in actions, which will lead to new technologies and solutions that are cornerstones for a sustainable economy and society. These solutions range from ultra-low-power processors to AI, Data and Robotics solutions for resource optimisation and reduction of energy consumption and CO2 emissions; from highly efficient optical networking technologies and ultra-low-energy 6G communication networks to robotics that overcome the limitation of energy autonomy. Furthermore, promising emerging avenues are addressed via ultra-low power operations enabled by spintronics and 2D materials-based devices and systems for energy storage and harvesting.

Actions should devote particular attention to openness of the solutions and results, and transparency of the research and innovation process. To ensure trustworthiness and wide adoption by user communities for the benefit of society, actions should promote high standards of transparency and openness. Actions should ensure that the processes and outcomes of research and innovation align with the needs, values and expectations of society, in line with Responsible Research and Innovation.

As a result, this Destination is structured into the following headings, which group topics together with similar outcomes to address a common challenge:

- Ultra-low power processors

Today Europe is not highly present in the microprocessor market. The objective of this heading is to ensure EU open strategic autonomy through the development of low-power, low environmental impact, secure and trusted components and software for strategic value-chains.

Proposals are invited under the topics of this heading in this work programme and under the topics of the 'Key Digital Technologies' Joint Undertaking addressing the electronics value chain (including software technologies).

- European Innovation Leadership in Electronics

Europe currently has a leading position in key digital technologies for the strategic sectors of automotive, industrial manufacturing, aerospace, defence and security and healthcare. In the emerging area of post-Moore components, there is a number of promising technological approaches with no established players or dominant regions.

The objective of this heading is to secure access in Europe to cutting-edge digital technologies, to strengthen current leadership in strategic value-chains, and to seize emerging opportunities addressing existing technological gaps.



Proposals are invited under the topics of this heading in this work programme and under the topics of the 'Key Digital Technologies' Joint Undertaking addressing the electronics value chain (including software technologies).

- European Innovation Leadership in Photonics

The European photonics industry has an excellent position in core segments, far above the average EU market share. The objective of the topics grouped in this heading is to strengthen current leadership in photonic technologies and applications, and to secure access in Europe to cutting-edge photonic technologies.

The topics of this heading are under the co-programmed Partnership 'Photonics'.

- 6G and foundational connectivity technologies

Today European suppliers of connectivity systems are well placed with around 40% of global 5G market share, but with high competitive pressure from Asian and US players. In terms of technology, first 5G standards are available since end of 2017 enabling Gigabit/s speeds and ~millisecond latencies. Trusted industrial services based on 5G technology are at very early stage.

The objective of this heading is to develop a strong supply chain for connectivity, increase European competitiveness and autonomy in Internet infrastructures, and to contribute to a reduction of the growing global energy consumption of the Internet and of the industry vertical users of the Internet, and to other key SDG's such as affordability and accessibility to infrastructures. The topics under this work programme address in particular the need to develop micro electronic components and systems supporting future disaggregated Radio Access Networks and components enabling the advent of all optical networks for ultra low consumption and ultra high security networks.

Proposals are invited under the topics of this heading in this work programme and under the topics of the 'Smart Networks and Services' Joint Undertaking addressing the future connectivity platforms including edge cloud and IoT technologies.

- Innovation in AI, Data and Robotics

Europe has an outstanding track record in key areas of AI research, Europe's scientific community is leading in AI and robotics, but substantial efforts are needed to transform this into (disruptive) European AI technology products that can withstand international competitors. Europe also lags behind in technology diffusion, less than half of European firms have adopted AI technology, with a majority of those still in the pilot stage. 70% of these adopter companies, only capture 10% of full potential use, and only 2% percent of

European firms in healthcare are using those technologies at 80% of potential<sup>124</sup>. Moreover, as demonstrated during the COVID-19 crisis, many AI, Data and Robotics solutions exist today but only a limited number of them reaches the level of maturity and adoption necessary to solve the problems at hand. Therefore, there is room for improved adoption by industry, which requires a drastic increase of industry-driven R&I, from basic research to large-scale piloting. In general, industry acknowledges the potential of AI technologies, but often lacks demonstrable benefits for their particular use cases.

The objective of this heading is to ensure autonomy for Europe in AI, data and robotics in developing world-class technologies serving the needs of all types of European industries, from manufacturing to healthcare, public sector, utilities, retail, finance, insurance, transport, agriculture, energy, telecommunications, environmental monitoring, construction, media, creative and cultural industries, fashion, tourism, etc. providing top-performing solutions that industries will trust and adopt to maintain their competitiveness and maximise their contribution to environmental and resources sustainability.

Several topics of this heading are under the co-programmed Partnership 'AI, Data and Robotics'.

- Tomorrow's deployable Robots: efficient, robust, safe, adaptive and trusted

Europe is leading in robotics industry, with a high intensity of use of robots. Europe is also scientifically leading in robotics' cognition, safety, manipulation, soft robotics, underwater and aerial robotics, with demonstrated impacts in many use-cases in key industrial sectors (e.g.: healthcare, agri-food<sup>125</sup>, forestry, inspection and maintenance, logistics, construction, manufacturing, etc.) and across multiple modalities (aerial, marine, ground, in-vivo and space).

The objective of this heading is to ensure autonomy for Europe in robotics, leading the way in research, development and deployment of world-class technologies.

Several topics of this heading are under the co-programmed Partnership 'AI, Data and Robotics'.

- European leadership in Emerging Enabling Technologies

Europe's leading industry sectors have a solid track-record in constant improvement, but less so for embracing transformative ideas. The pathway from research to industry uptake is often long and staged, with no intertwining of research and industry agendas. In the age of deep-tech, though, this intertwining is essential.

The objective of this heading is to identify early technologies that have the potential to become Europe's future leading technologies in all areas of this cluster and to establish industry leadership in these technologies from the outset. This heading has a unique focus on off-roadmap transformations with a longer time-horizon but profound potential impact.

- Flagship on Quantum Technologies: a Paradigm Shift

Since 2018, the Quantum Technologies Flagship has been consolidating and expanding Europe's scientific leadership and excellence in quantum, in order to foster the development of a competitive quantum industrial and research ecosystem in Europe. The EU's aims for quantum R&I in the next decade are set out in detail in the Quantum Flagship's Strategic Research Agenda (SRA<sup>126</sup>) and its associated main Key Performance Indicators,<sup>127</sup> which drafted and published in 2020 on quantum computing, quantum simulation, quantum communication, and quantum sensing and metrology. Projects in each of these areas are currently supported by the Flagship, by other EU research initiatives and by national programmes.

The objective of this heading is to further develop quantum technologies and their applications in the areas of quantum computing, simulation, sensing and communication, in order to strengthen European technological sovereignty in this strategic field and achieve first-mover industry leadership, capitalising on Europe's established excellence in quantum science and technology maintaining and developing quantum competences and skills available in the EU and raising the capabilities of all Member States in this field.

The aim of the Commission's Digital Decade strategy is for the EU to become digitally sovereign in an interconnected world, and in the coming years quantum technologies will be a key element of this digital sovereignty, as they are of global strategic importance. Quantum technologies will be also used, among others, for sensitive applications in the area of security, and in dual-use applications. Other world regions are already investing heavily in all areas of quantum technologies research. In this context, the EU must take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. This will enable it to safeguard its strategic assets, interests, autonomy and security, while advancing towards its goal of open strategic autonomy.

The Quantum Technologies Flagship conducts research and development activities in the key domains of quantum computing and simulation, quantum communication, and quantum sensing. The Flagship will contribute to world-leading quantum computers and simulators, that will be acquired by the European High Performance Computing Joint Undertaking, and will be crucial to achieving its Digital Decade goal of having its first

computer with quantum acceleration by 2025, with a view to being at the cutting edge of quantum capabilities by 2030. These machines will have a profound impact, with applications in medicine, manufacturing, or new material and new drugs design but also in cryptography, finance and many other sensitive domains.

Moreover, the Flagship's research into quantum communication will support the development of a European quantum communication infrastructure (EuroQCI). This key component of the EU Cybersecurity Strategy will provide an extremely secure form of encryption to shield the EU's government data and critical infrastructures against cyber-attacks. Ensuring that the latest quantum communication technologies remain accessible in the EU is crucial to maintaining European security in the face of future threats.

Research in quantum sensing technologies is also vital to the EU's interests, as it will develop European expertise in quantum clocks for navigation (including for embarkation on Galileo satellites) and precise timing applications, sensors for autonomous vehicles, and the next generation of medical sensors.

It is therefore clearly in the EU's interests to protect European research in these domains, the intellectual property that it generates, and the strategic assets that will be developed as a result, while taking steps to avoid situations of technological dependency on non-EU sources (in line with the call of the October 2020 European Council to reduce Europe's strategic dependencies). With this in mind, the Commission has decided that, in the research areas covered by 12 actions in this work programme in quantum computing and simulation, communication, and sensing, only Associated Countries that meet certain conditions will be eligible to participate in these actions.

As agreements with candidate Associated Countries are not yet in force, the eligibility to participate in such actions is limited for the moment to legal entities established in the EU, Norway and Iceland. However, in view of ensuring maximum excellence of R&I for the EU and to maintain EU's spirit of global openness, before opening these actions for applications, the eligibility to participate in these 12 actions will be extended to include legal entities established in (candidate) Associated Countries which provide assurances concerning the protection of EU's strategic assets, interests, autonomy or security. On the basis of the outcome of the discussions in the relevant configurations of the Horizon Europe Programme Committee, the Commission will reflect the changes in the work programme in full consistency with the decision establishing the Horizon Europe specific programme, especially through comitology procedures as foreseen in articles 13 and 14(4) of it.

- Graphene: Europe in the lead

The starting point is the Graphene Flagship, launched in 2013, which already reached European leadership in graphene and related 2D materials. The work is now coming to a critical point where first simple products are being launched. R&I activities would now need to be pursued and accelerated in order to translate achieved technology advances that are at TRL 3-5 into concrete innovation opportunities and into production capabilities in many industrial sectors (e.g. aviation, automotive, electronics, batteries, healthcare).

The objective of this heading is to strengthen and accelerate the technology developments that support a strong European supply and value chain in graphene and related materials and provide first-mover market advantages of scale.

Activities beyond R&I investments will be needed to realise the expected impacts: testing, experimentation, demonstration, and support for take-up using the capacities, infrastructures, and European Digital Innovation Hubs made available under the Digital Europe Programme; large-scale roll-out of innovative new technologies and solutions (e.g. new energy-efficient connectivity technologies) via the Connecting Europe Facility; further development of skills and competencies via the European Institute of Innovation and Technology, in particular EIT Digital; upscaling of trainings via the European Social Fund +; and use of financial instruments under the InvestEU Fund for further commercialisation of R&I outcomes.

### Expected impact

Proposals for topics under this Destination should set out a credible pathway to contributing to **digital and emerging technologies for competitiveness and fit for the Green Deal**, and more specifically to one or several of the following impacts:

- Europe's open strategic autonomy by sustaining first-mover advantages in strategic areas including AI, data, robotics, quantum computing, and graphene, and by investing early in emerging enabling technologies.
- Reinforced European industry leadership across the digital supply chain.
- Robust European industrial and technology presence in all key parts of a greener digital supply chain, from low-power components to advanced systems, future networks, new data technologies and platforms.

## Call – Digital and emerging technologies for competitiveness and fit for the Green Deal 2021

### Innovation in AI, Data and Robotics

<b>Topic ID and title</b>	<a href="#">HORIZON-CL4-2021-DIGITAL-EMERGING-01-10: AI, Data and Robotics at work (AI, Data and Robotics Partnership) (IA)</a>				
<b>Budget</b>	EUR 22 million	<b>Opening date</b>	22 June 2021	<b>Deadline 1</b>	21 October 2021
<b>Budget per project</b>	EUR 3 to 5 million			<b>Deadline 2</b>	/
<b>Type of action</b>	Innovation Actions (IA)				
<b>FTP subsector</b>	F&F, WW, P&P				
<b>Keywords</b>	Human-centric AI				
<b>FTP comments</b>					
<b>FTP SIRA 2030 Challenges addressed</b>	2B,D - 7	<b>FTP relevance</b>		Low	
		<b>Starting TRL</b>		3-5	
		<b>End TRL</b>		6-7	

#### Expected Outcome:

Project results are expected to contribute to at least one of the following expected outcomes:

- A new human-centred paradigm to keep people away from unsafe and unhealthy jobs via collaborative embodied (physical) AI, engaging and empowering end-users and workers, regardless of their gender, age or background.
- Human-centric AI supporting professionals in trustworthy hybrid decision-making, and optimising their tasks

#### Scope:

Proposals are expected to demonstrate how AI, data, robotics and automation solutions can support workers in their daily tasks, improving working conditions (both physical and social) and work performance/efficiency, while considering safety, security and resilience, as appropriate. The added value to the application field should be demonstrated by qualitative and quantitative industry/production or service relevant KPIs, demonstrators at TRL6-7, benchmarking and progress monitoring processes.

The involvement of the application sector stakeholders, including social partners, workers, managers and decision makers must be a key driver in the proposals, not only to identify the needs and the application scenarios, but to be involved in the co-creation and testing and uptake of the solutions and providing feedback to adapt the solutions to optimise the impact on working conditions and performances.

The selection of the application sector should prioritise sectors and use-cases where the technology can demonstrate maximum impact and added value.

While the focus is on technology, a human-centred approach will be key, with involvement of the workers, professionals, (front-line operators and managers) and other relevant experts, such as experts in human-centred design. They will closely collaborate with the technology providers and integrators. Engagement with SSH140 expertise is also needed to improve interaction design and to provide expertise on trustworthiness and acceptability by workers, as well as ethical perspective of human-machine collaboration. Gender and intersectionality dimension<sup>141</sup> analysis should be a part of the proposals, where relevant.

Each proposal will focus on one of the two following use-cases:

1. Collaborative embodied AI (robotics system), empowering end-users and workers keeping them away from unsafe and unhealthy jobs: the focus will be on demonstrating improved working conditions (health/safety/level of stress, etc.), and worker trust and acceptance. The assistance should also take into account other factors less related with physical assistance like stress level. Meaningful human oversight of autonomy should be addressed.
2. AI and data supporting professionals in trustworthy hybrid decision-making and supporting workers to optimise and facilitate their tasks; the focus will be on demonstrating how AI and data can improve the effectiveness and efficiency as well as management of trade-offs within the decision-making, building on the human and machine complementarities, exploiting the best capability of both for a better outcome. Meaningful human oversight of decision outcomes and explainability should be addressed. Specific effort should be made to develop re-usable decision-support systems or modules.

All proposals should exploit the latest results in AI, data and robotics, as well as multimodal interaction technologies, User interface experience, for natural and seamless interaction between the human and the technology/sources of information, including Augmented/Virtual Reality when appropriate.

Proposals should incorporate skills developments activities or/and connect with existing skills activities in that domain, as appropriate.

Proposals should clearly identify which of the two use-cases listed above they will focus on.

Two types of proposals are expected:



1. Focused projects (EU contribution around EUR 3.00 million), involving the user industry and technology provider(s),
2. Larger projects (EU contribution around EUR 5.00), where a number of companies in a given application sector will identify in the proposal common challenges and use-cases, and organise competitive calls for AI, data and robotics solution providers to address such challenges. Competitive calls will be open to all types of companies, but only SMEs and Start-ups<sup>142</sup> will receive financial support to third parties, with a maximum of EUR 200 000 per third party<sup>143</sup> and 70% funding (100% for start-ups). At least 40% of the requested amount should be dedicated to financial support to third parties. The consortium will provide technical support with expertise in engineering integration, testing and validation to support the selected SMEs and start-ups acting as technology providers to demonstrate the added value of their solutions to address the challenges of the use-cases. Maximum one type of third party project will be funded per use-case.

In all proposals, user industries are expected to play a major role in the requirement and validation phases.

Besides financial support, these SMEs and start-ups successfully demonstrating the potential of their solutions, must receive support from business experts, provided by the action, to further develop their business and develop their market reach, and maximise their business opportunities.

When possible, proposals should build on and reuse public results from relevant previous funded actions. Proposals should make use of connections to the Digital Innovation Hub networks, particularly those in Robotics, Data and AI. Full use should be made of the common resources available in the AI-on-Demand platform<sup>144</sup>, Digital Industrial Platform for Robotics<sup>145</sup>, data platforms<sup>146</sup> and, if necessary other relevant digital resource platforms. Communicable results from projects should be delivered to the most relevant of these platforms in order to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZON-CL4-2021-HUMAN-01-02. Where relevant, synergies with other PPPs are encouraged.

This topic implements the co-programmed European Partnership on Artificial Intelligence, Data and Robotics.

## Call – Digital and emerging technologies for competitiveness and fit for the Green Deal 2022

### Innovation in AI, Data and Robotics

Topic ID and title	<a href="#">HORIZON-CL4-2022-DIGITAL-EMERGING-01-05: AI, Data and Robotics for Industry optimisation (including production and services) (AI, Data and Robotics Partnership)(IA)</a>				
Budget	EUR 19 million	Opening date	23 November 2021	Deadline 1	5 April 2022
Budget per project	EUR 3 to 5 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F, WW, P&P				
Keywords	Artificial Intelligence (AI), production optimisation, competitiveness, environment sustainability, human-robot collaboration				
FTP comments					
FTP SIRA 2030 Challenges addressed	2B,D – cross-sectional			FTP relevance	Low
				Starting TRL	3-5
				End TRL	6-7

#### Expected Outcome:

Proposal results are expected to contribute to at least one of the following expected outcomes:

- Advancing AI, data and robotics, and automation for the optimisation of production and services value-chains, optimisation of products, services, processes, to increase competitiveness, improve working conditions, and environmental sustainability, and supporting the European Economy using AI, data and robotics technologies.
- AI or learning systems (including, but not limited to self-learning, continuous and transfer learning, self-configuring systems) adapting production or services workflows to changing environments, dynamic and unpredictable resource constraints and to the capabilities and restrictions of humans and transferring results from one domain to another.

#### Scope:

Proposals are expected to integrate and optimise AI, data and robotics solutions in order to demonstrate, by addressing use-cases scenarios in actual or highly realistic operating environments, how they optimise production and service use cases.

**Industry-empowering AI, data and robotics:** enable and boost wide spread deployment of European technologies, in demonstrating clear benefits in particular applications coming

from major industrial sectors, in improving processes, products or services, contributing to their competitiveness, quality of services, and strategy for environmental sustainability. Providing industry with more autonomous and more intuitive and easier to operate technologies they can trust and that are tailored for their needs, with the adapted and guaranteed levels of performance, reliability, safety, dependability, security and transparency. Providing trustworthy AI solutions combining various sources of data, sensors, interaction and information to address industrial challenges; combining the power of latest progress in AI, FAIR<sup>183</sup> data, autonomous or interactive robotics, smart devices and next generation networks and computing to increase automation and optimise processes, resources, and services, and addressing new technological challenges removing barriers for industrial deployment, and improving trust through more transparent and explainable AI. Where relevant latest development from low power consuming sensors, actuators and mechanisms, as well as new energy sources and batteries will be exploited to ensure energy autonomy for robotics. Promoting versatile, flexible, scalable, resilient physical and digital architecture that facilitate the future AI, data and robotics based services adoption.

Proposals should demonstrate how major European industries (covering all the sectors, from production<sup>184</sup> to services) can substantially benefit from optimising AI, data and/or robotics to maximise such benefits. Proposals are expecting to focus on specific use-cases to demonstrate such benefits, cross-sector use-cases are encouraged. Added value to the selected use-cases should be demonstrated by qualitative and quantitative industry and service relevant KPIs, demonstrators, benchmarking and progress monitoring.

While the proposals should be application driven, involving problem owners to define needs and validate the proposed solution, the focus is on optimising the enabling of AI, data and robotics technologies to maximise the benefit they bring.

Proposals should focus on demonstrating the added value of AI and/or Data and/or Robotics technologies to optimise value-chains, products, services or associated processes, including knowledge automation (including capturing and elicitation), to increase competitiveness, environmental sustainability, and where relevant, working conditions, for example, through added flexibility, configurability, adaptability, etc.

Digital twin approaches could be considered, where necessary and of added value.

Proposals should also address non-technical issues hampering the adoption of AI, data and robotics in the selected application domain, e.g. ethical aspects for the possible replacement of human operators, trust, human-robots collaboration and cooperation, security and safety.

Proposals will address the production or service sector, where substantial added value of AI, data and/or robotics can be demonstrated. This should be demonstrated with actual or highly realistic operating demonstrators at TRL6-7.

Proposals should clearly identify the sector it will focus on (either production or services).

Two types of proposals are expected:

1. Focused projects (EU contribution around EUR 3.00 million), involving the user industry and technology provider(s),
2. Larger projects (EU contribution around EUR 5.00 million), where a number of companies in a given application sector will identify in the proposal common challenges and use-cases, and organise competitive calls for AI, data and robotics solution providers to address such challenges. Competitive calls will be open to all types of companies, but only SMEs and Start-ups<sup>185</sup> will receive financial support to third parties, with a maximum of EUR 200 000 per third party<sup>186</sup> and 70% funding (100% for start-ups). At least 40% of the requested amount should be dedicated to financial support to third parties. The consortium will provide technical support with expertise in engineering integration, testing and validation to support the selected SMEs and start-ups acting as technology providers to demonstrate the added value of their solutions to address the challenges of the use-cases. Maximum one type of third party project will be funded per focused area (either production or services).

In all proposals user industries are expected to play a major role in the requirement and validation phases.

Besides financial support, these SMEs and start-ups successfully demonstrating the potential of their solutions, must receive support from business experts, provided by the action, to further develop their business and develop their market reach, and maximise their business opportunities.

When possible, proposals should build on and reuse public results from relevant previous funded actions, including public results developed in Member States and Associated Countries. Proposals should make use of connections to the Digital Innovation Hub networks, particularly those in Robotics, Data and AI. Full use should be made of the common resources available in the AI-on-Demand platform<sup>187</sup>, Digital Industrial Platform for Robotics<sup>188</sup>, data platforms<sup>189</sup> and, if necessary other relevant digital resource platforms. Communicable results from projects should be delivered to the most relevant of these platforms so as to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

Where appropriate, issues such as data access, data sovereignty and data protection should be addressed along the whole value chains, respecting all stakeholder interests, particularly SMEs.

The re-use and sharing of data collected and processed for AI and Data innovation should be encouraged to contribute to UN SDGs and the Green Deal (e.g.: sharing private data for the public good, B2G in addition to B2B; G2B data sharing may be identified, in view of helping businesses to increase sustainability and competitiveness).

Proposals should include dissemination activities to increase awareness about the potential value for society and people as well as the business of AI, data and robotics driven innovation.

This topic implements the co-programmed European Partnership on AI, Data and Robotics.

All proposals are expected to allocate tasks to cohesion activities with the co-programmed partnership on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZON-CL4-2021-HUMAN-01-02. Where relevant, synergies with other European partnerships are encouraged.

## Tomorrow's deployable Robots: efficient, robust, safe, adaptative and trusted

Topic ID and title	<a href="#">HORIZON-CL4-2022-DIGITAL-EMERGING-01-07: Increased robotics capabilities demonstrated in key sectors (AI, Data and Robotics Partnership) (IA)</a>				
Budget	EUR 36 million	Opening date	23 November 2021	Deadline 1	5 April 2022
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F, WW, P&P				
Keywords	adaptation and flexibility, human-robot interaction, robot-robot interactions, dull, dirty or strenuous tasks				
FTP comments					
FTP SIRA 2030 Challenges addressed	4A - 5 - 6B,C,F - 10A	FTP relevance		Low	
		Starting TRL		3-5	
		End TRL		6-7	

### Expected Outcome:

Proposals results are expected to contribute to at least one of the following expected outcome:

- Demonstrators able to show the added value of robotics and their performances in addressing challenges in major application sectors, or in dangerous, dull, dirty tasks or those strenuous for humans or in extreme environments.
- Systems able to demonstrate beyond human performance in complex tasks, with high impact in key sectors, that show extended levels of adaptation and flexibility.
- Systems able to show high levels of reactivity and responsiveness and intelligibility when performing human-robot and robot-robot interactions in major application sectors.

### Scope:

Proposals are expected to focus on application oriented use cases that enhance specific sectors in achieving significant improvements functional and economic performance.

Proposals will integrate novel robotics technologies into solutions that are capable of autonomously taking over dangerous, dull and dirty jobs, or that are capable of achieving tasks beyond human capabilities, in a range of innovative applications in key sectors or that are capable of reaching the level of reactivity, flexibility and adaptivity and natural intelligibility required for smooth and beneficial human-robot, as well as robot-robot collaboration and interaction. Engagement with SSH193 expertise is needed to improve

human robot interaction design, behavioural intelligibility of robot interaction and action, especially in novel service applications, and to provide expertise on trustworthiness and acceptability by humans that impact at the design stage.

This topic will support innovation proposals, expected to exploit the latest robotics advances and demonstrate at TRL6-7 use-case scenarios considering end-user needs and expectations, in highly realistic operating environments, how they can directly contribute to the chosen application, supported by quantitative and qualitative industry or service related KPIs. Proposals need to make the case for the added value of such technologies, and demonstrating scalability, and short-term deployment potential. Progress should be demonstrated by appropriate KPIs, demonstrators, benchmarking and progress monitoring.

The proposals should be primarily application driven, with a concrete problem-solving approach, exploiting the most suitable robotics technologies at hand. The focus should be on real-world scenarios which can benefit in short term from the technology and demonstrate substantial impact on the chosen application, also taking into account the maturity of the technologies which can solve the problems at hand.

In case of shared workspaces, safe, dependable efficient and intuitive interaction will be key.

Considering that human factors and socio-economic aspects can limit or lessen efficient use of robots, human-centred and socio-economic approaches in combination with multi-stakeholder co-design activities can contribute to sustainable development of new enabling technologies. Putting people at the forefront will ensure novel transformation pathways, which help utilise existing technology in novel ways, and propose feedback loop systems that engage human users in developing new sociotechnical learning situations and tools. Further, agile sociotechnical learning designs, can remedy e.g., less efficient technologies, by emphasizing human aspects of technologies in any application sector, from service to production, to domestic use. For this, an interdisciplinary approach involving both technical and SSH194, in particular ethics, researchers is needed to improve interaction design and to provide expertise on trustworthiness and acceptability by workers, and address gender equality and intersectionality<sup>195</sup> where relevant.

The involvement of the user industry and the workers, possibly also the social partners, would be key to drive the proposals, not only to identify the needs and the application scenarios, but to be involved in the testing of the solutions and providing feedback to adapt the solutions to optimise the working conditions and performances. This is also essential for the acceptance of the technology. A human-centred approach will be key in all proposals, with deep involvement of the workers, professionals and other relevant stakeholders including experts in human-centred design, work safety, ergonomics, social partners or work



organisation as appropriate. They will closely collaborate with the technology providers and integrators. The proposals should also take into consideration trustworthy AI principles including respect of human dignity and agency. Special attention will be given to including users of diverse age, gender and background.

Proposals are requested to dedicate at least 20% of their requested amount for FSTP to support SMEs or Start-ups in the development or enhancement of demonstrators, with a maximum of EUR 200 000 per third party<sup>196</sup>, and 70% of the costs (100% for start-ups). The consortium will provide technical support with expertise in engineering integration, testing and validation to support the selected SMEs and start-ups acting as technology providers to demonstrate the added value of their solutions to address the challenges of the use-cases.

The selection of the application sectors should prioritise high impact sectors and use-cases where the technology can demonstrate maximum added value.

Each proposal will focus on one of the following use-cases:

- Demonstrating substantial added value of robotics in major application sectors with high socio-economic and/or environmental potential impact, improving the effectiveness and efficiency of processes or services.
- Demonstrating how robotics can improve human working conditions and satisfaction in taking over dangerous, dull, dirty or strenuous tasks, keeping workers away from unsafe and unhealthy jobs.

Proposals are encouraged, where appropriate, to develop configuration and deployment tools as well as tools for rapid configuration and re-configuration of robotics to improve deployability, reduce time to deployment, increase user driven (re)configuration, including through model-based approaches.

When possible, proposals should build on and reuse public results from relevant previous funded actions. Proposals should make use of connections to the Digital Innovation Hub networks, particularly those in Robotics, Data and AI. Full use should be made of the common resources available in the AI-on-Demand platform<sup>197</sup>, Digital Industrial Platform for Robotics<sup>198</sup>, data platforms<sup>199</sup> and, if necessary other relevant digital resource platforms. Communicable results from projects should be delivered to the most relevant of these platforms so as to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

Proposals are expected to develop synergies with relevant activities in AI, Data and Robotics, primarily in destinations 1, 3, 4 and 6, but also in other destinations and clusters, and share or exploit results with relevant funded actions where appropriate.

This topic implements the co-programmed European Partnership on AI, Data and Robotics.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZON-CL4-2021-HUMAN-01-02. Where relevant, synergies with other PPPs are encouraged.

## Destination 5: Open strategic autonomy in developing, deploying and using global space-based infrastructures, services, applications and data

Today EU citizens enjoy watching satellite TV, increasingly accurate global navigation services for all transport modes and users (e.g. mobile phones and car navigation systems), extended Earth monitoring for land, marine, atmosphere and climate change, global meteorological observation and accurate cartographies of a wide number of variables. Space also makes important contributions to security crisis management and emergency services. These are key assets for the EU policies on climate, environment, transport, agriculture and secure society (e.g. Maritime Strategy, the Arctic Strategy, the Digital Agenda, the Common Security and Defence Policy, the Sustainable Development Strategy, the SGDGs). Finally, the space sector is a source of economic growth, jobs and exports.

This destination will directly support the following Key Strategic Orientations, as outlined in the Strategic Plan:

- KSO A, **'Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations.'
- KSO B, **'Restoring Europe's ecosystems and biodiversity, and managing sustainably natural resources** to ensure food security and a clean and healthy environment.
- KSO C, **'Making Europe the first digitally led circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems.'
- KSO D, **'Creating a more resilient, inclusive and democratic European society**, prepared and responsive to threats and disasters, addressing inequalities and providing high-quality health care, and empowering all citizens to act in the green and digital transitions.'

Proposals for topics under this Destination should set out a credible pathway to contributing to the following expected impact:

**Open strategic autonomy in developing, deploying and using global space-based infrastructures, services applications and data**, including by reinforcing the EU's

independent capacity to access space, securing the autonomy of supply for critical technologies and equipment, and fostering the EU's space sector competitiveness.

This expected impact is fully in line with the Space Strategy for Europe and the proposal for the Space Programme. Horizon Europe R&I funds will contribute to this expected impact along 2 main axes by:

- providing support with R&I funding to the EU space sector at large
- making a specific impact with the EU action with R&I to prepare the future evolutions of the Space programme components

This Destination is therefore structured along the following headings:

1 Foster competitiveness of space systems

2 Reinforce EU capacity to access to space

3 Evolution of Space and ground infrastructures for Galileo/EGNOS

4 Evolution of services: Copernicus

5 Development of applications for Galileo, EGNOS and Copernicus

6 Innovative space capabilities: SSA, GOVSATCOM, Quantum

7 Space entrepreneurship ecosystems (incl. New Space and start-ups) and skills

Targeted and strategic actions supporting the EU space sector

While headings 1, 2, 7 and 8 will support the EU space sector at large and are largely based on the recommendation of the Strategic Research and Innovation Agenda, headings 3), 4), 5), and 6) will be supporting the Space Programme components as well as the emerging quantum initiative.

All headings will contribute to the 'Open strategic autonomy in developing, deploying and using global space-based infrastructures'. This is the underlying goal when investing in R&I to ensure the future of existing space programme component infrastructures, services and applications (Heading 3) and with R&I to investigate new future services (Heading 4) or to develop innovative space capabilities such as SSA, GOVSATCOM and Quantum (Heading 6). This autonomy would however not be complete if we did not have the capacity to access space, to launch these infrastructures (Heading 2) and to propose opportunities for In-Orbit Demonstration and In-Orbit Validation (Heading 8). As the EU space sector relies on a smaller share of institutional investments compared to other regions, this difference needs to be

compensated by a more competitive sector (Heading 1). R&I and a strategy for critical technologies for non-dependence is another important axis of action (Heading 8). A guarantee for such autonomy is also to have a vivid and competitive downstream sector and entrepreneurship eco-systems in the EU (Headings 5 and Heading 7). A description of the headings objectives and targeted achievements is provided below.

### **Foster competitiveness of space systems**

The European space sector and space economy need to improve space-based capabilities, capture new markets, adapt to rapidly changing markets whilst staying competitive in the satellite communication, navigation and Earth observation sectors. This requires the development of new competitive technologies for space and ground systems, such as very high throughput and flexible satellites, very high-resolution sensors, radiation-hardened electronics, on-board and ground Artificial Intelligence (AI), optical communication and quantum technologies, as well as advanced robotics. We also need to prepare the ground for future modular, flexible and intelligent satellites. In the mid to long term, the future space ecosystem should include hybrid, smart and reconfigurable satellites, which can be manufactured, assembled and serviced directly in-orbit, and with a de-orbiting capacity.

Digitalisation and automation will enable advanced design and manufacturing methods (including additive manufacturing) and “Digital Twins”, plug-and-play modularity, as well as model based system engineering. This will yield reductions in mass, cost, emission, energy consumption and development time.

Disruptive technologies and concepts should be further developed to bring breakthrough innovation to the space sector, while at the same time advancing technology maturation in the view of qualification on ground or via In-Orbit Demonstration and Validation activities.

### **Reinforce EU capacity to access to space**

Two specific challenges stand out. Firstly, the highly competitive global market for launch services, which is characterised by an increasing number of competitors, secondly, the emerging opportunities in space transportation that have not been yet seized by European launch actors characterised by new uses of space (e.g. small satellites, larger constellations, payload recovery, payload quick deployment), new services (e.g. direct orbit injection, in-orbit servicing) and in-space transportation. This will require, amongst others, new concepts for reducing the production and operation cost such as reusability (including stage recovery and landing) of launcher and vehicle components, and low cost, high thrust and green propulsion, modular avionics, autonomous systems, micro launchers, re-entry vehicles and modern and flexible test and launch facilities. Both will require urgent activities to enable operational capacities by at the latest 2030.

Disruptive technologies, methodologies and concepts should be developed to bring breakthrough innovation to the launcher systems sector as well as to contribute to cost reduction and contribute to the preparation of a competitive European Space Transportation beyond 2030.

### **Evolution of Space and ground infrastructures for Galileo/EGNOS**

For Galileo/EGNOS, the international context, the competitive environment with emerging actors and novel techniques in the value chain, the increasing threats, and the evolution of the technologies, components and systems, including dual-use technology, call for a constant adaptation of the EU space infrastructure to these changing realities.

To meet these challenges, EU needs sustained investments in R&D for innovative mission concepts, technology and systems. These will ensure the continuity of the EGNSS service, minimise the risks for technology inclusion in the infrastructure, thanks to anticipated development and testing including in-orbit, protect better this infrastructure against modern threats (notably cyber, jamming/spoofing, natural hazards), and increase the strategic autonomy in key technologies. Overall, they will maintain the EU's leadership position in the Global Navigation Satellite Systems.

### **Evolution of services: Copernicus**

Copernicus core services (Climate, Marine environment, Land monitoring, Atmosphere monitoring, Emergency management and Security) must evolve and improve to better respond to new and emerging policy needs, such as anthropogenic CO<sub>2</sub>, green house gas and pollutant monitoring, climate change mitigation and adaptation, EU arctic policy, coastal area, sustainable development goals, environmental compliance, protection of natural resources, ecosystems and biodiversity, food security, agriculture, fisheries, aquaculture, crisis management, safe transport, sustainable and clean energy, border management, preserving cultural heritage, as well as other new domains that could bring key contributions to the European Green Deal and to other EU priorities.

Similarly, the Galileo service portfolio (High precision positioning, navigation and timing, authentication, search and rescue and Public Regulated Service, PRS) must be adapted to the evolution of the user needs and market trends. This requires new services and capabilities to better serve the downstream application sector, so that EGNSS remains at the fore front of the provision of satellite positioning, navigation and timing (PNT) services and keeps the pace with increasing global competition in the sector (USA, China, 5G, etc.). Europe should extend Galileo services to various societal challenges and offer it as a complementary service to emerging markets like 5G, CCAM and AI.

### **Development of applications for Galileo, EGNOS and Copernicus**

EGNSS and Copernicus capacities are unique and world-class and should be fully utilised for EU citizens, companies and society. Research and innovation should therefore foster the development of EGNSS downstream applications and promote their adoption in the EU and worldwide, in particular in markets with a long lead-time (e.g. maritime, rail, aviation), and in areas where Galileo offers unique differentiators (high accuracy, authentication, Search and Rescue, PRS

Copernicus based applications and services can serve, for example, polar research, monitoring of the environment, maritime and coastal monitoring, natural disasters, civil security, migration and agriculture. They and can bring, with EGNSS, a key contribution to the European Green Deal and to the sustainable management of natural resources. The public sector should be supported as customer of space based technologies via innovation procurement. Synergies between Galileo/EGNOS and Copernicus, as well as synergies with non-space programmes, leveraging the combination of space data with non-space data, will open new avenues for the creation of a wealth of new and innovative applications and services. The use of Copernicus and Galileo/EGNOS for the EOSC and DestinE initiatives should equally be taken into account and promoted.

### **Innovative space capabilities: SSA, GOVSATCOM, Quantum**

Space Situational Awareness (SSA) and GOVSATCOM innovative components will be developed in the EU Space programme fostered by Horizon Europe R&I. Quantum Technologies, as an emerging field with great potential to be applied in the EU Space programme, requires foundational research and validation activities for its space component.

**Space Situational Awareness (SSA)** will provide services to European users including spacecraft owners/operators and governmental entities that will reinforce the protection and resilience of European space and ground infrastructures against various hazards and risks (mainly collisions in/from space, Near Earth Objects or space weather events). New challenges are posed by the ever-increasing orbital population of smaller satellites and space debris and the associated increased risk of orbital collisions, fragmentations and re-entries. R&I activities shall address these challenges by developing novel architectures and technical solutions for ground/space sensors, data processing, networking and operation centres (including critical technological elements for the realisation of crucial future space weather applications and services) to ensure safety and sustainability of space operations in Europe as well as by improving current EUSST services and implementing new ones (space debris mitigation and remediation services; space weather services).



The **GOVSATCOM** initiative aims to provide reliable, secured and cost-effective satellite communications services to EU and Member State authorities with an infrastructure supporting secure critical missions and the ability to exchange sensitive information in a environment of worldwide hybrid threats (including the Arctic). Research and innovation activities will foster the development of European satcom security related technologies and increase European independence from foreign critical technologies and exploiting synergies with Copernicus and Galileo and with defence /security assets.

Space will pave the way for **quantum technologies** in EU space infrastructure and for space-based services (e.g. quantum inter-satellite communication, next generation atomic clocks or quantum sensors). It is of the highest strategic importance for the EU and its industry to be competitive and to become a global leader in this area. It will provide enhanced services to EU citizens and allow overcoming limitations and challenges of the current generation of quantum technologies. Therefore, R&I shall foster the development and use of EU sourced space qualified quantum components, including mission design, integration and in-orbit demonstration and validating. The availability of adequate ground segment infrastructure for testing and validating the quantum space mission needs to be ensured too. Synergies with GOVSATCOM will be thought.

#### **Space entrepreneurship ecosystems (incl. New Space and start-ups) and skills**

Business development, acceleration and upscaling of start-ups will be fostered across all space areas under the CASSINI Space Entrepreneurship Initiative.

CASSINI will provide support to business and innovation-friendly ecosystems, including the strengthening business skills in the space market segments and digital services based on space data. The objective is to make start-ups and scale-ups investment-ready and able to secure venture capital funding. Synergies with the InvestEU programme and the Space programme will be established.

#### **Targeted and strategic actions supporting the EU space sector**

Development of associated technologies and actions of key importance to the sections described above will be pursued. These actions will at the same time contribute to foster the competitiveness of the EU space sector, to reinforce our capacity to use and access space and to perform R&I for the Space Programme.

These targeted and strategic actions will include the development of critical technologies for EU non-dependence, the establishment of regular and cost-effective flight opportunities for In-Orbit Demonstration/In-Orbit Validation (IOD/IOV), space science activities, as well as outreach, education and international cooperation activities.

### **Limiting participation in certain actions to Member States (and certain candidate associated countries to Horizon Europe)**

The Space research part of the Horizon Europe Programme is by default open to the world, promoting international cooperation to drive scientific excellence.

However, an important aspect of the Space Programme consists in ensuring security and strengthening strategic autonomy across key technologies and value chains, taking advantage of the possibilities that space offers for the security of the Union and its Member States. This objective requires special rules in specific cases to set the requisite eligibility and participation conditions to ensure the protection of the integrity, security and resilience of the Union and its Member States. Hence, on an exceptional basis and duly justified, the work programme may foresee a limited participation to entities from selected countries. Such exceptional circumstances would relate to prevalent considerations to safeguard the Union's strategic assets, interests, autonomy or security. Possibilities for such limitations are framed by Article 22(5) and by Annex IV(11a) of the Horizon Europe Regulation. Out of 45 actions, 30 remain fully open while 15 are proposed for limited participation

For six space actions, the restrictions to only Member States are justified under Annex IV of the Horizon Europe Regulation which foresees that, where appropriate the eligibility criteria of the Space Programme Regulation shall apply for the Horizon Europe space research topics and actions. In the current work programme this includes SST and GOVSATCOM which relate to sensitive Union space infrastructure.

Nine space actions are open to Member States, Norway and Iceland, under Protocol 31 of the EEA Agreement. Opening to other associated countries is to be assessed and confirmed in a future amendment to the work programme. These nine actions include Copernicus Security R&D and actions involving technologies critical to strategic autonomy/dual-use.

As agreements with candidate Associated Countries are not yet in force, the eligibility to participate in such actions is limited for the moment to legal entities established in the EU, Norway and Iceland. However, in view of ensuring maximum excellence of R&I for the EU and to maintain EU's spirit of global openness, before opening these actions for applications, the eligibility to participate in these 12 actions will be extended to include legal entities established in (candidate) Associated Countries which provide assurances concerning the protection of EU's strategic assets, interests, autonomy or security. On the basis of the outcome of the discussions in the relevant configurations of the Horizon Europe Programme Committee, the Commission will reflect the changes in the work programme in full consistency with the decision establishing the Horizon Europe specific programme, especially through comitology procedures as foreseen in articles 13 and 14(4) of it.

## Call – Strategic autonomy in developing, deploying and using global space-based infrastructures, services, applications and data, 2021

### Foster competitiveness of space systems

Topic ID and title	<a href="#">HORIZON-CL4-2021-SPACE-01-12: Future space ecosystems: on-orbit operations, new system concepts</a>				
Budget	EUR 6 million	Opening date	28 October 2021	Deadline 1	16 February 2022
Budget per project	EUR 1 to 2 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Satellite recycling, sustainable space infrastructure, spacecraft modularity, plug-and-play modules, debris mitigation, construction kit, Artificial Intelligence (AI)				
FTP comments					
FTP SIRA 2030 Challenges addressed	4B - 8B - 9C,D	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

#### Expected Outcome:

Enable the industrialisation and new services in space by intelligent solutions and concepts, exploiting synergies with terrestrial sectors and cultivating an AppStore and Open-Architecture mentality.

Therefore, automation, robotics and artificial intelligence (AI) especially in combination with standardisation, modularisation and digitalisation are key enablers, improving space systems and satellites' flexibility and cost-efficiency, increasing sustainability and accessibility, introducing mass-customisation and cooperative design as well as simplifying operations.

Each project is expected to contribute to one or several of the following outcomes:

- A future space ecosystem, fostering the industrialisation and business in space as well as supporting scientifically meaningful missions by using synergies with terrestrial sectors, building on spacecraft modularity, simplifying operations and make plug-and-play modules more common as well as enabling on-orbit services such as maintenance, assembly, manufacturing, re-configuration, recycling, logistics, warehousing, etc.

- Game-changing technologies, tools and processes enhancing on-orbit servicing applications and contribute to the protection of the in-space future ecosystem (e.g. debris mitigation).
- A paradigm shift towards sustainable, highly automated, flexible and economical viable space infrastructure, to maximise commercial opportunities in space and on Earth.

This will contribute to, in the medium to long term, developing, deploying global space-based services and contribute to fostering the EU's space sector competitiveness, as stated in the expected impact of this destination.

#### Scope:

The areas of R&I, which need to be addressed to tackle the above expected outcomes are:

1) R&I on new scalable satellite platform concepts and building blocks increasing the degree of satellite modularisation. Aiming at intelligent, adaptable and maintainable systems with *plug-and-play* compartmentalised functionalities (modules) that will introduce both, on-orbit re-configuration and re-use/re-cycling of spacecraft parts fostering debris mitigation, as well as increased system redundancy, inherently. The approach should consider an innovative, scalable and adaptive framework concept for a '*European construction kit for satellite systems and applications*', following the *AppStore* approach and fostering development of compartmentalised functionalities (modules) for satellite systems independently from mission. The framework should address the needs from building block developers as well as from end-users. As one result, functional satellite modules (Orbital Replaceable Units to deliver new/enhanced functionality) should be developed (TRL 5-6) to upgrade the satellite platform of the orbital demonstration mission<sup>215</sup> by using pre-existing standard interfaces<sup>216</sup> (*plug-and-play* concept). The module design should support the integration of different pre-existing standard interfaces<sup>113</sup>. Further reference is given in a technical guidance document applicable to this area<sup>217</sup>.

2) R&I on new on-orbit services concepts concentrating on a next generation of potential business cases (e.g. satellite recycling, transfer services, logistics, warehousing, etc.) contributing to a sustainable space infrastructure and in-space ecosystem development. Work should include, but not be limited to, market & trend analyses, design of mission and system architecture, and feasibility studies.

3) R&I to identify, develop and implement AI and industry 4.0 means (e.g. virtual design, digital twins, virtual testing) in order to attain *Rapid Development, Production and Assembly Integration and Testing (AIT)* processes in satellite life cycle.

Proposals should explore relevant and promising solutions derived in Horizon 2020 activities, especially project results from the Strategic Research Clusters *Space Robotics Technologies*<sup>218</sup> and *Electric Propulsion*<sup>219</sup>.

A proposal may address more than one area but must indicate the main area addressed, and is expected to promote cooperation between different actors (industry, SMEs and research institutions) and consider opportunities to quickly turn technological innovation into commercial space usage.

To ensure a balanced portfolio covering the three areas described above, grants will be awarded to applications not only in order of ranking but at least also to one project that is the highest ranked within each area, provided that the applications attain all thresholds.

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

## Call – Strategic autonomy in developing, deploying and using global space-based infrastructures, services, applications and data, 2022

### Evolution of services of the EU space programme components: Copernicus

Topic ID and title	<a href="#">HORIZON-CL4-2022-SPACE-01-43: Copernicus Land Monitoring Service evolution</a>				
Budget	EUR 5 million	Opening date	28 October 2021	Deadline 1	16 February 2022
Budget per project	EUR 4 to 5 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	data combination, Sentinels, land cover, Artificial Intelligence (AI), High-Performance Computing (HPC)				
FTP comments					
FTP SIRA 2030 Challenges addressed	1 - 2 - 3D - 6F			FTP relevance	Low
				Starting TRL	/
				End TRL	5-6

#### Expected Outcome:

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

- Enhanced quality and efficiency of the current service to respond respectively to policy and/or user requirements and to technological developments.
- Development of efficient and reliable new products chains, calling for new paradigms in data fusion, data processing and data visualisation essential for the service to handle more high-volume satellite data sets and product sets. The baseline is to preserve continuity of what has been achieved while keeping the service modern and attractive.
- Development of new algorithms and processing chains preparing for the use of the new types of space observation data (being from new Sentinels or other contributing missions) in order to allow development of new products or the improvement of existing products.

#### Scope:

Since 2013, CLMS has developed core products for the monitoring of natural resources and the assessment of land cover and land use changes, including land cover conditions. At European level, land cover mapping is carried out on a regular basis, every 6 years for

CORINE and every 3 years for the thematic ‘High Resolution Layers’ (HRL). The local component dealing with land cover mapping on specific areas like riparian areas, urban zones and Natura 2000 sites, is following the same approach with a 6 years cycle but at very high resolution. At Global level, an annual land cover mapping has been proposed since 2015 at mid resolution, the evolution to high resolution is also envisaged.

Vegetation, Inland Water and Cryosphere conditions are also monitored but on a regular basis, mainly ten-daily basis at mid-resolution for the Global and European levels.

These mapping and monitoring approaches were partly conditioned by the availability of satellite data. The deployment of the full Earth Observation capacities of Copernicus and the complementarities between the instruments, including outside Copernicus environment, allows to rethink of the approach including for providing a better answer to the policy needs.

The R&I has the main scope to develop new and innovative methods to combine and explore data with different spatial and temporal characteristics using automatic processing for land cover and land cover status change assessment. A more dynamic approach (e.g. annual overviews or early warning or alert systems) and the integration of various sensors will enhance the development of specific automatic processing approaches for real and near real time data processing to respond to emerging European policy needs.

With an integrated modelling approach, the integration of new observational data becomes a driver for further enhancement and improved realism of the already existing production chains, assimilation systems and coupled models. The development of advanced processing (also including AI and HPC) and modelling techniques, as well as the exploitation of new sources of data, will be targeted to create new products or significantly improve the quality and performances of existing elements-components for the benefit of users.

The project should take into account the existing service and clearly define to what extent the service will be improved with new elements or products, including the use of enhanced models, algorithms, tools and techniques to generate new product(s).

Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service within the period 2021-2027. The proposed research and development should be modular and scalable. The project should provide a proof-of-concept (e.g. system element targeting TRL5-6) at least demonstrating the feasibility of the integration in the existing core service. The activities of the project should also contribute to the objectives set by the Group on Earth Observation and outcomes and relevant results of the project should be promoted also at international level through the Global Earth Observation System of Systems (GEOSS). In addition, the project could potentially contribute to the objectives set by the DestinE initiative.



Additionally, the transfer of research results to possible operations should receive active attention during the course of the project to strengthen the readiness for an operational deployment in the future. Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the results (including IPR) by the said entities must be addressed during the project implementation. Software should be open licensed.

Applicants are advised to consult information on the Copernicus programme in general at <https://www.copernicus.eu/en> and further details on the topic in the Guidance document<sup>248</sup>.

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

## Indirectly managed actions delegated to EUSPA

### Development of applications for Galileo, EGNOS and Copernicus

Actions under this area will address downstream R&D activities in the form of calls to proposals to be launched by the European Union Space Programme Agency (EUSPA) in accordance with the specification included in Appendix below.

We need to make the best use of EGNSS and Copernicus capacities for EU citizens, companies and society. Research and innovation should therefore foster the development of EGNSS downstream applications and promote their adoption in the EU and worldwide, in particular in markets with a long lead-time (e.g. maritime, rail, aviation), and in areas where Galileo offers unique differentiators (high accuracy, authentication, Search and Rescue, PRS).

Copernicus based applications and services can serve, for example, polar research, monitoring of the environment, maritime and coastal monitoring, natural disasters, civil security, migration and agriculture. They and can bring, with EGNSS, a key contribution to the European Green Deal and to the sustainable management of natural resources. The public sector should be supported as customer of space based technologies via innovation procurement. Synergies between Galileo/EGNOS and Copernicus, as well as synergies with non-space programmes, leveraging the combination of space data with non-space data, will open new avenues for the creation of a wealth of new and innovative applications and services. The use of Copernicus and Galileo/EGNOS for the EOSC and DestinE initiatives should equally be taken into account and promoted.

Indicative budget for this action: EUR 32.60 million from the 2021 budget and EUR 48.10 million from the 2022 budget

Topic ID and title	HORIZON-EUSPA-2021-SPACE-02-51: EGNSS and Copernicus applications fostering the European Green Deal				
Budget	EUR 14 million	Opening date	2021 (indicative)	Deadline 1	2021-2022 (indicative)
Budget per project	EUR 2 to 3 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F				
Keywords	pollution, renewable energy, building renovation, construction, Building Information Modelling (BIM), biodiversity monitoring, nature restoration, Internet of Things (IoT), Big Data, Artificial Intelligence (AI), drones, 5G				
FTP comments					
FTP SIRA 2030 Challenges addressed	1B – 2B,D			FTP relevance	Low
				Starting TRL	/
				End TRL	7-9

#### Expected Outcome:

Projects are expected to contribute to the following outcomes:

- Development of innovative EGNSS and Copernicus based solutions that contribute to the implementation of the European Green deal<sup>143</sup>. These solutions can play a major role in the transformation of the EUs economy into a climate-neutral economy by 2050, as well as support environmental protection, maintaining biodiversity, etc.

Uptake of Copernicus services and/or Galileo's specific features and differentiators in areas such as zero-pollution, EU methane strategy, clear and renewable energy and circular economy; sustainable and smart mobility; building and renovation, and digital/precision farming supporting the farm to fork strategy.

#### Scope:

Proposals shall focus on the development of innovative EGNSS and Copernicus applications that support the Green Deal objectives and its related policies and they can be submitted in any of the following areas:

- **Increasing the EU's climate ambition for 2030 and 2050:** EGNSS and/or Copernicus based solutions which contribute to CO2 reductions and a toxic free environment, through better monitoring and preventing pollution from the air, water, soil and consumer products as well as natural catastrophes as pollution sources.
- **Supplying clean, affordable and secure energy:** EGNSS and/or Copernicus based solutions which support the supply of clean, affordable and secure renewable energy.

- **Mitigating natural hazards:** EGNSS and/or Copernicus based solutions which limit the damage from fires, floods or other natural hazards.
- **Accelerating the shift to sustainable and smart mobility:** EGNSS and/or Copernicus based solutions which enable or contribute to the development and impact monitoring of new sustainable mobility services and which reduce congestion, emissions and pollution especially in urban areas, while keeping costs at an efficient/reasonable level. Examples of emerging applications include automated and connected multimodal transport, public transport, mobility as a service, autonomous driving, IoT solutions for efficient mobility, road maintenance, air quality monitoring and forecasting.
- **Building and renovating in an energy and resource efficient way:** EGNSS and/or Copernicus based solutions, which contribute to the digitisation, smart monitoring and tracking of building and renovation processes. Examples of emerging applications include EGNSS based augmented or mixed reality for construction, special mapping solutions for making digital twins of buildings, utilities and infrastructure using Building Information Modelling (BIM), location-based applications for governmental processes, e.g. energy labelling of buildings leveraging the authentication feature, sensors for smart monitoring, drones with thermal camera to detect water and thermal leaks.
- **From “Farm to Fork”: a fair, healthy and environmentally friendly food system:** EGNSS and/or Copernicus based solutions which provide for food security and traceability across the entire supply chain and valorisation of the “made in Europe”. Precision or digital EGNSS farming solutions, which reduce significantly the use of chemical pesticides and fertilisers and help saving water for irrigation. Innovative EGNSS and/or Copernicus based tools that support the digitisation of post-2020 Common Agricultural Policy or other agri-environmental policies.
- **Preserving and restoring ecosystems and biodiversity.** EGNSS and/or Copernicus based solutions which enhance biodiversity monitoring and enable data-driven decision tools for policymakers, to stop biodiversity loss and support the EU nature restoration plan. Examples of emerging applications include monitoring and detection of actions which are threatening the functionality of the ecosystem.

The solutions developed for all areas should leverage the Copernicus data or core services products including Copernicus contributing missions and/or EGNSS differentiators, e.g. High Accuracy Service, authentication features or Galileo Open Service with multi-frequency

capability. The developed solutions may integrate technologies like IoT, big data, artificial intelligence, drones, 5G, augmented/mixed reality etc.

The developed applications should have a clearly defined commercial potential and should respond to well identified user needs. The developed solution is expected achieve TRL7-9 by the end of the project

Proposals should deliver new innovative applications, with commercial impact and a clear market uptake.

For proposals under this topic:

- Participation of industry, in particular SMEs and midcaps, is encouraged;
- Participation of, or outreach to, entities based in countries without a space tradition is encouraged;
- Involvement of post-graduate researchers (engineers, scientists, and others) is also encouraged, for example through professional work experience or through fellowships/scholarships when applicable
- A Business Plan and evidence of user engagement is compulsory and must be provided as part of the proposal, to demonstrate the user need and sustainability of the project.

Proposals addressing PRS (Public Regulated Service) related applications are not in the scope of this action.

Proposals under this topic should exploit synergies and be complementary to national activities and activities funded by ESA.

Applicants are welcome to use the European space data infrastructures, e.g. Galileo Service Centre, EGNOS Data Access Service (EDAS) and the EGNOS user support facilities (ASQF).

Applicants are advised to exploit all possible synergies with other specific actions related to the European Green Deal and funded under the work programme of Cluster 5 "Climate, Energy and Mobility" and of Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment'.

Topic ID and title	HORIZON-EUSPA-2021-SPACE-02-53: EGNSS applications for the Digital Age				
Budget	EUR 9,3 million	Opening date	2021 (indicative)	Deadline 1	2021-2022 (indicative)
Budget per project	EUR 2 to 3 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F, WW, P&P				
Keywords	Internet of Things (IoT), Artificial Intelligence (AI), Big Data, geo-tagging, mobile solutions, multiple sensors, cybersecurity, quantum, drones, 5G, Copernicus, augmented reality				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B - 2B - 4 - 6F - 9D	FTP relevance		Low	
		Starting TRL		/	
		End TRL		7-9	

#### Expected Outcome:

Projects are expected to contribute to the following outcomes:

- Foster the adoption of EGNSS in mass markets and professional markets.
- Create applications that will make the best use of EGNSS innovative features such as better multipath resistance, authentication etc.
- Contribute to the competitiveness of the European GNSS industry in the area of mobile applications, with special focus on the innovative role of SMEs and midcaps, and non-space countries.
- maximise public benefits by supporting the development of EGNSS applications that will address major societal challenges in focus areas such as health, citizen safety and security, mobility and the sharing economy.

#### Scope:

Proposals may be submitted in any of the following areas:

- **Internet of Things:** Within Internet of Things solutions, there is a clear trade-off in terms of accuracy and battery life that prevents users to rely on GNSS in any situation. EGNSS solutions should demonstrate how power reduction techniques can effectively deliver GNSS-level accuracy in IoT devices and develop IoT solutions able to demonstrate the EGNSS compositeness in the IoT domain, to be used in application fields such as food geo traceability, blockchain and Artificial Intelligence
- **Mobile solutions.** Development of new EGNSS enabled solutions which exploit the EGNSS differentiators such as High Accuracy Service and authentication features or which leverage the availability of GNSS raw measurements in smartphones.

- **mHealth-solutions for ‘silver economy’, robotics.** With the ageing population growing fast in the EU, governments will be increasingly challenged to meet the needs of older people in a cost-effective manner. EGNSS can support the ‘silver economy’ by satisfying the specific needs of elderly and disabled persons. The innovations brought by EGNSS, together with technologies such as robotics or enhanced home automation – should be exploited to develop innovative solutions.
- **Artificial intelligence- Big Data, geo-tagging, optimisation for multiple sensors.** Advances in AI will improve the capabilities of applications and services, providing improved experiences to all users. AI-enabled machine learning can be used to improve the GNSS data processing to provide greater performance thanks to the optimization of multiple sensors. Proposals shall explore synergies between EGNSS and Artificial Intelligence, in the frame of applications relaying on big data and geo-tagging techniques. Synergies with earth observation data can be also exploited.
- **Cybersecurity- solutions that are stimulating privacy, security of location data, exploiting synergies with quantum.** In a digitalised world, privacy and cybersecurity are of utmost importance for individuals who are increasingly relying on digital applications to perform day-to-day task and activities. EGNSS solutions shall enhance the security of location-based applications. Additionally, synergies with quantum can be leveraged as well.
- **Sharing economy- solutions for logistics, mobility services, goods and food. The** sharing economy covers many different sectors. It is rapidly emerging across Europe. Within this trend, GNSS is a key technology for all services requiring geographic information. Newly developed EGNSS solutions in the field of logistics, mobility services, and food industry should capitalise on the enhanced accuracy and the innovative features provided by EGNSS.
- **Sports and fitness - smart wearables.** Wearables represent the beginning of the separation between smartphones and end users, as an increasing number of smartphone services and apps are now accessible via new interfaces (smartwatches, fitness trackers, smart glasses, clothing, etc.). Currently, wearables are mostly used for fitness, health and entertainment. Proposals should ensure the use of EGNSS innovative features and differentiators in the smart wearables domain, integrating also other non-space technologies.

Synergies with other space components and other non-space technologies are applicable to this topic.



The developed applications should have a clearly defined commercial potential and should respond to user needs. Standardisation of new technologies is also in the scope of the topic and might be considered by the applicant. The solution developed is expected to achieve TRL7-9 by the end of the project.

Proposals should deliver new innovative applications, with commercial and social benefits, impact and a clear market uptake. The standardisation of new technologies is also in the scope of the topic and might be considered by the applicant. The use of other space components such as Copernicus is highly encouraged. The developed solutions may integrate other non-space technologies like IoT, big data, artificial intelligence, drones, 5G, augmented/mixed reality etc.

For proposals under this topic:

- Participation of industry, in particular SMEs and midcaps, is encouraged;
- Participation of, or outreach to, entities based in countries without a space tradition is encouraged;
- Involvement of post-graduate researchers (engineers, scientists, and others) is also encouraged, for example through professional work experience or through fellowships/scholarships when applicable;
- A Business Plan and evidence of user engagement is compulsory and must be provided as part of the proposal, to demonstrate the user need and sustainability of the project.
- Proposals addressing PRS (Public Regulated Service) related applications are not in the scope of this action.

Applicants are advised to exploit all possible synergies with other security specific actions funded under the work programme of Cluster 1 “Health”, other parts of Cluster 4 “Digital, Industry and Space”, and Cluster 5 “Climate, Energy and Mobility” (e.g. destinations 5 and 6).

Proposals under this topic should exploit synergies and be complementary to national activities and activities funded by ESA.

Applicants are welcome to use the European space data infrastructures, e.g. Galileo Service Centre, EGNOS Data Access Service (EDAS) and the EGNOS user support facilities (ASQF).

Topic ID and title	HORIZON-EUSPA-2022-SPACE-02-54: Copernicus downstream applications and the European Data Economy				
Budget	EUR 9,6 million	Opening date	May 2022 (indicative)	Deadline 1	September 2022 (indicative)
Budget per project	EUR 2 to 3 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F				
Keywords	Copernicus uptaking in economy, natural resources, environmental monitoring, insurances,ICT technologies, Big Data, Artificial Intelligence (AI),				
FTP comments					
FTP SIRA 2030 Challenges addressed	2B – cross-sectional	FTP relevance		Low	
		Starting TRL		/	
		End TRL		8	

### Expected Outcome:

Projects are expected to contribute to the following outcomes:

- Europe needs to strengthen its position as provider of products and services based on data, enabling new market opportunities. The EU is promoting the use and uptake of Copernicus, a leading European data provider, as a driver of innovation for the European Data Economy.
- Actions under this Topic will contribute to increase the integration and uptake of Copernicus into the economy, and/or to solve societal challenges.
- The integration of Copernicus data assets with data contributed by other vertical domains into sizeable and scalable applications enabled by modern ICT technologies will greatly enhance Copernicus downstream market. Likewise, many vertical domains (such as, for example, agriculture, food security, health, energy, natural resources, environmental monitoring, insurances, tourism, security etc...) will benefit from the use of Copernicus.

### Scope:

Actions under this Topic will bring to market new or improved applications, products and services by exploiting Copernicus data assets and services products.

To achieve the objectives described above, the project are required to adopt state-of-the-art ICT technologies (such as, for example, Big Data and AI technologies in their wider declinations), and make use of existing European data infrastructures, such as Copernicus DIAS platforms, European open data portals, and industrial data platforms.

The technical solutions to be adopted should be user-friendly and work at the scale of the large quantities of data involved. They should be adopted to contribute to the digitization challenges of the European industry by opening up innovative business avenues opportunities and to support societal challenges.

Copernicus data and services products will be at the core of the projects' data value chains and integration activates activities needed to fulfil the industrial and users requirements that will drive the actions. Whenever relevant, the link with European satellite positioning/navigation/timing technologies should be exploited.

Applicants are required to present initial qualifying items of their business plan in the proposal, which will then have to be fully developed as part of the project's exploitation plan.

Activities are expected to start at TRL 5 and achieve TRL 8 by the end of the project.

## Cluster 5: Climate, Energy and Mobility<sup>2</sup>

### Destination 1: Climate sciences and responses for the transformation towards climate neutrality

Europe has been at the forefront of climate science and should retain its leadership position to support EU policies as well as international efforts for a global uptake of climate action in line with the Paris Agreement and the Sustainable Development Goals (SDGs), including biodiversity objectives. Advancing climate science and further broadening and deepening the knowledge base is essential to inform the societal transition towards a climate neutral and climate resilient society by 2050, as well as towards a more ambitious greenhouse gas reduction target by 2030. It will involve research that furthers our understanding of past, present and expected future changes in climate and its implications on ecosystems and society, closing knowledge gaps, and develops the tools that support policy coherence and the implementation of effective mitigation and adaptation solutions. Due to the inherent international character of this subject, international collaboration is encouraged for topics under this destination.

The activities implemented under this section will enable the transition to a climate-neutral and resilient society and economy through improving the knowledge of the Earth system and the ability to predict and project its changes under different natural and socio-economic drivers, including a better understanding of society's response and behavioural changes, and allowing a better estimation of the impacts of climate change and the design and evaluation of solutions and pathways for climate change mitigation and adaptation and related social transformation.

This Destination contributes directly to the Strategic Plan's **Key Strategic Orientation C** *"Making Europe the first digitally enabled circular, climate-neutral and sustainable economy through the transformation of its mobility, energy, construction and production systems"* and the **impact area** "Climate change mitigation and adaptation".

In line with the Strategic Plan, the overall **expected impact** of this Destination is to contribute to the *"Transition to a climate-neutral and resilient society and economy enabled through advanced climate science, pathways and responses to climate change (mitigation and adaptation) and behavioural transformations"*, notably through:

- a. Advancing knowledge and providing solutions in the any of following areas: Earth system science; pathways to climate neutrality; climate change adaptation including

<sup>2</sup> [Work Programme published by the European Commission on 15 June 2021](#)

climate services; social science for climate action; and better understanding of climate-ecosystems interactions.

- b. Contributing substantially to key international assessments such as those of the Intergovernmental Panel on Climate Change (IPCC) or the European Environment Agency (e.g. European environment state and outlook reports, SOER).
- c. Strengthening the European Research Area on climate change.
- d. Increasing the transparency, robustness, trustworthiness and practical usability of the knowledge base on climate change for use by policy makers, practitioners, other stakeholders and citizens.

Coordination and synergies between activities supported under Destination 1, as well as in other Destinations and Clusters, and in particular complementarities with Cluster 4 and Cluster 6 should be taken into account by planning for adequate resources for co-ordination and clustering activities. Following a systemic approach, Destination 1 concentrates on activities related to climate science and modelling, whereas Cluster 6 supports R&I in the areas covered by Cluster 6, notably on the implementation of climate change mitigation and adaptation solutions.

## Call – Climate sciences and responses 2021

Topic ID and title	<a href="#">HORIZON-CL5-2021-D1-01-09: The contribution of forest management to climate action: pathways, trade-offs and co-benefits</a>				
Budget	EUR 18 million	Opening date	24 June 2021	Deadline 1	14 September 2021
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Climate mitigation, forest-based sector, carbon sequestration change, forest health, substitution, ecosystem services, biodiversity, biomass, bioeconomy, remote sensing, land use change, LULUCF, afforestation				
FTP comments	GHG impact of forest bioeconomy, Renewable Energy Targets, forest-based bioeconomy, climate-oriented forest management				
FTP SIRA 2030 Challenges addressed	1A,B			FTP relevance	High
				Starting TRL	/
				End TRL	/

### Expected Outcome:

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

- A comprehensive assessment of the climate mitigation potential of European forests and forest-based sector through modelling of different policy pathways, taking into account climate change related risks, physiological and biogeochemical responses to environmental change and management practices, adaptation needs, biodiversity goals, and the provision of other ecosystem services. The effects analysed have to include changes in carbon sequestration, forest health, productivity, substitution and biophysical factors, including the causes and time dynamics of these changes. The assessment of the potential and limits of forest-based products and biomass for energy in delivering climate benefits will inform public authorities on the most suitable approach to forest policy and forest bioeconomy.
- Development and improvement of robust and transparent methodologies for high-resolution monitoring and reporting of forest carbon pools and their interactions through a combination of in-situ data collection and remote sensing methods to be used to advance land use, land-use change and forestry (LULUCF) reporting under the UNFCCC and compliance under EU legislation. Methods developed under this action will additionally feed into the development of the Forest Information System for Europe (FISE).

### Scope:

Proposals under this topic should develop a comprehensive assessment of different pathways of the European forest GHG balance in view of the reviewed 2030 and 2050 climate targets and other relevant EU environmental legislation and objectives incorporating:

- Biodiversity goals consistent with the EU Green Deal objectives and Biodiversity Strategy 2030 goals. Issues considered include the use non-native tree species, intensive thinning, transition between intensive and close-to-nature silviculture, and strict protection of forests.
- Uncertainties related to climate change and natural disturbances risks.
- Adaptation needs of existing and future forests, including factors determining their adaptation potential.
- Mitigation potential of afforestation and other forest activities including their opportunity costs.
- GHG impact of forest bioeconomy, including substitution effect of forest-based products and energy against realistic counterfactuals and with appropriate time dynamics.
- Renewable energy targets and the needs of forest-based bioeconomy for sustainable domestically-sourced feedstock.
- Biophysical effects, including changes in air temperature and precipitation associated to changes in surface albedo, land-surface properties, emissions of biogenic volatile organic compounds, transpiration and heat flux
- Assessment of trade-offs and synergies between climate-oriented forest management, and other objectives, for example recreational and amenity values;

Having such models/assessment at their disposal and understanding their time dynamics, uncertainties and system boundaries, policy-makers will be better suited to incorporate forests in the design and evaluation of possible solutions and pathways for climate change mitigation and adaptation.

Monitoring and reporting on changes to forest carbon stocks is essential for policymakers (both national and European) in order to be informed of trends in the forest sink evolution and to develop annual approximated greenhouse gas inventories. Actions should support the use of higher tier (and higher accuracy) methodologies and geographically explicit land-use data in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories<sup>33</sup> and its 2019 Refinement<sup>34</sup>. Especially needed are actions to fill existing gaps



resulting from inventory bias towards the most economically relevant tree species and carbon pools.

Proposals under this topic should therefore aim to develop knowledge, tools, models, databases and country- and region-specific values available to Member States and Associated Countries, where possible integrating with Integrated Assessment Models (IAMs) and climate models to improve monitoring and reporting of forest carbon pools. Remote sensing data sets can be helpful in estimating or verifying forest living biomass gains and losses, forest area changes, forest health status and in identifying carbon-rich old-growth forests or natural disturbances. Sample-based systems, on the other hand, should support mapping changes in other forest carbon pools such as soil organic carbon in mineral and organic soils, and dead organic matter. More robust estimation of fluxes among these forest carbon pools, which are often neglected in greenhouse gas inventories, will assist in estimating their importance as carbon reservoirs and the role that forest management can play in enhancing them, taking into account biodiversity needs and resilience. Considering biophysical effects will improve the understanding of trade-offs among climate objectives and their articulation with forest management practices.

Actions should envisage coordinating activities with other relevant actions, initiatives and programmes, including Horizon 2020 Work Programmes and the LIFE Programme, COPERNICUS and relevant research infrastructures to promote synergies, integration and co-operation. They should make use and contribute to knowledge exchange and networking European platforms and consider devising a novel decision-making platform to ensure effective dissemination of the results to the target stakeholders (i.e. policy-makers and relevant national competent authorities). Cooperation and planning for further exploitation of actions results during and after the project end is strongly encouraged.

## Call – Climate sciences and responses 2022

Topic ID and title	<a href="#">HORIZON-CL5-2022-D1-02-02: Development of high-resolution Earth system models for global and regional climate change projections</a>				
Budget	EUR 20 million	Opening date	12 October 2021	Deadline 1	10 February 2022
Budget per project	EUR 10 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	climate projection improvement, Integrated Assessment Models (IAMs), IPCC Assessment reports, WCRP Coupled Model Intercomparison Programme (CMIP), European cooperation, ICT infrastructures, International cooperation, Copernicus Programme, the ESA science satellite missions in Europe, Group on Earth Observations (GEO), Global Earth Observation System of Systems (GEOSS), Connection to the European Open Science Cloud (EOSC)				
FTP comments					
FTP SIRA 2030 Challenges addressed	1 – 2 - 3			FTP relevance	Low
				Starting TRL	/
				End TRL	/

### Expected Outcome:

Proposals should improve European high-resolution, fully coupled atmosphere-ocean-land Earth System Models, able to robustly simulate key climate processes, their variability and future trends for this and well into the next century in order to enhance the quality, robustness and versatility of climate projections on a range of temporal and spatial scales (global and regional) to (1) support policies implementing the goals of the Paris Agreement and (2) address the societal need to assess and respond to the adverse impacts of climate change.

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

- Improved climate projections with sound uncertainty estimates under different scenarios on different temporal and spatial scales.
- Improved understanding and modelling of tipping points in the climatic systems, such as the ice shields at both poles and ocean circulation.
- Advances in attribution of climate change and its phenomena to anthropogenic forcers.
- Support to the evaluation of mitigation policies through improved linkages with Integrated Assessment Models.
- Pave the way for the next cycle of the IPCC Assessment reports by a leading role in the WCRP Coupled Model Intercomparison Programme (CMIP).

- Sustain and enhance European cooperation and leadership in climate sciences.

#### Scope:

Projects should foster a fully coupled atmosphere-ocean-land-ice Earth-system model approach that contributes to a better understanding and representation of the processes, including for that drive and influence climate change on global and regional scale. Arctic and Antarctic regions should be considered as key elements in global climate changes.

Projects should make efficient use of available and high quality observational data (e.g. space-based and not space based, including in-situ and paleoclimatic data) for the development of robust model validation, verification, and improve uncertainty estimation methodologies.

Where relevant, high-resolution model development and evaluation should be properly connected with major programmes in the domain of Earth Observation such as the Copernicus Programme, the ESA science satellite missions in Europe, as well as the Group on Earth Observations (GEO) and the Global Earth Observation System of Systems (GEOSS) at global level.

They should also strive to reduce uncertainty of key parameters of climate and hydrological systems. Projects should advance methods for assessing and attributing model outputs and climate change impact on regional scales with the support of advanced digital technologies, such as artificial intelligence methodologies.

The advanced climate modelling activities should support the attribution of observed and projected climatic hazards to climate change or climate variability.

The activities should build on the experiences from and results of other European projects contributing to the development of a new generation of climate models<sup>43</sup>.

Beneficiaries are encouraged to take advantage of the emerging ICT infrastructures (e.g. EuroHPC and other high performance computing, cloud-based facilities) that will be made available through the Destination Earth initiative under the Digital Europe Programme<sup>44</sup>.

If adding value to the project outcomes, coordination with the Destination Earth initiative can be proposed to ensure the timely development of “climate replicas” building on the new state-of-the-art IT infrastructure, including access to European high performance computing resources and an operational platform to upload and integrate the models and data developed in the course of the projects. Connection to the European Open Science Cloud (EOSC) should be considered where relevant.

When dealing with models, actions should promote the highest standards of transparency and openness, as much as possible going well beyond documentation and extending to aspects such as assumptions, code and data that is managed in compliance with the FAIR principles<sup>45</sup>. In particular, beneficiaries are strongly encouraged to publish results data in open access databases and/or as annexes to publications. In addition, full openness of any new modules, models or tools developed from scratch or substantially improved with the use of EU funding is expected.

International cooperation is encouraged.

Projects are expected to co-operate with other projects funded under this call, as well as other relevant projects under Destination 1 and Cluster 6, Destination 5.

Topic ID and title	<a href="#">HORIZON-CL5-2022-D1-02-05: Let nature help do the job: Rewilding landscapes for carbon sequestration, climate adaptation and biodiversity support</a>				
Budget	EUR 17 million	Opening date	12 October 2021	Deadline 1	10 February 2022
Budget per project	EUR 8 to 9 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	IPBES, EPCC, rewilding, net zero carbon emissions, EU Biodiversity Strategy, climate change adaptation, societal transformation, ecosystem restoration, carbon sequestration, biodiversity conservation, wildfires risk reduction, land-use management systems, IAMs, ESMS, citizens perception, forestry, interdisciplinary				
FTP comments	Contribution to IPBES and IPCC, Horizon Europe Mission on Adaptation to climate change,				
FTP SIRA 2030 Challenges addressed	1A,B - 2A - 3	FTP relevance		Medium	
		Starting TRL		/	
		End TRL		/	

#### Expected Outcome:

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

- Contribution to IPBES and IPCC, to the achievement of objectives of reaching net zero carbon emissions, enhancing climate change adaptation, and to the EU Biodiversity Strategy.
- Support the implementation of the Horizon Europe Mission on Adaptation to climate change including societal transformation.
- Identify low cost/benefit ratio options to restore natural and semi-natural ecosystems for carbon sequestration and biodiversity conservation.
- Assess the value of restoring ecosystem for adaptation to and/or mitigation of climate change and identify potential rebound effects and trade-offs.
- Demonstrate the degree to which these approaches are affected by climate change itself and if they can still be effective under global warming of 2°C and higher.
- Demonstrate the potential contribution of European abandoned land and protected areas systems for carbon sequestration, adaptation to and/or mitigation of climate change.
- Develop strategies to minimize the increasing risk of wildfires due to the changing climate.

- Provide operational methods for low cost, low human intervention options for ecosystems restoration optimising the contributions to climate and biodiversity objectives and managing trade-offs.
- Help generate FAIR<sup>48</sup> data and well-documented, robust and transparent methodologies for better integration of land-use management systems into IAMs and ESMs.
- Assess the perception and acceptability of citizens and stakeholders on rewilding and rewilding options and identify potential conflicts and trade-offs in governance and decision-making.

#### Scope:

The biodiversity crisis and the climate crisis are intrinsically linked and the contribution of Nature-based Solutions (NBS) to the global climate objectives is pivotal. A better understanding of how the use of ecosystems natural capacity, with minimal help from humans, can contribute to carbon sequestration and biodiversity conservation is urgently needed to make the use of NBS operational.

Actions should foster interdisciplinary research with a focus on the climate-biodiversity nexus, advancing our knowledge to further promote integrated approaches to better address these interdependent challenges.

Actions, taking stock of previous and ongoing experience, including associated uncertainty, should provide a robust assessment of the potential contribution that restoring ecosystems, including trophic chains restoration, with a “let nature do the job”, also called “rewilding”, approach can provide in terms of carbon sequestration and storage, climate change mitigation and adaptation and biodiversity conservation. “Rewilding” is meant here as passive management of ecological succession with the goal of restoring natural ecosystem processes and reducing human control of landscapes, although some intervention may be required in the early restoration stages.

Actions can address specific ecosystems and/or landscapes on land, freshwater, coastal and marine ecosystems while providing a clear contribution to define the potential use of the “rewilding” approach at regional, national and continental levels.

Actions should build on an updated and detailed picture of the status and trends of ecosystems change, (including, where applicable, land abandonment) in Europe to assess where, at which ecological conditions and at what scale the “rewilding” approach can significantly improve carbon sequestration together with habitats reinforcement and biodiversity conservation.

Actions should investigate how “rewilding” can be complemented with other approaches (for example active restoration and conservation, low intensity farming, forestry and pasture management, fishing), taking into account specific regional conditions, to increase carbon sequestration, improve biodiversity conservation and ensure provision of goods and ecosystem services.

Actions should provide scientific insights, tools, methodologies and innovative solutions including social innovations to assist national governments, regions and communities in embedding the “rewilding” approach, as far as feasible, in their own plans to reach carbon neutrality. Actions should also advance the integration of land use options for carbon sequestration into IAMs and ESMs.

Actions should significantly advance knowledge on the role and relevance of restoring fully functional trophic chains, for instance through the conservation, management and reintroduction of apex predators, grazers and scavengers, in the “rewilding” process, with a special focus on the functioning of trophic cascades on landscape processes and the ability of ecosystems to act as carbon sinks. Challenges and barriers to this aim should be analysed and the involvement of Social Sciences and Humanities is recommended.

Actions should ensure appropriate multi-stakeholder collaboration and interdisciplinarity to embed socio-economic aspects, including opportunities for economic development, existing barriers (ecological, social, gender-related...) and potential synergies and drawbacks.

Actions should envisage clustering activities with other relevant actions, initiatives and programmes, including Horizon 2020 and the LIFE Programme to promote synergies, integration and co-operation. They should make use and contribute to knowledge exchange and networking European platforms (e.g. Climate-ADAPT, Network Nature, OPPLA, BiodivERsA). Cooperation and planning for further exploitation of actions results during and after the project end is strongly encouraged.

Synergies should be ensured with projects addressing wildfires (for example under the EU Green Deal call LC-GD-1-1-2020, Horizon 2020 Societal Challenge 5).

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH and gender expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

## Destination 3: Sustainable, secure and competitive energy supply

This Destination includes activities targeting a sustainable, secure and competitive energy supply. In line with the scope of cluster 5, this includes activities in the areas of renewable energy; energy system, grids and storage; as well as Carbon Capture, Utilization and Storage (CCUS).

The transition of the energy system will rely on reducing the overall energy demand and making the energy supply side climate neutral. R&I actions will help to make the energy supply side cleaner, more secure, and competitive by boosting cost performance and reliability of a broad portfolio of renewable energy solutions, in line with societal needs and preferences. Furthermore, R&I activities will underpin the modernisation of the energy networks to support energy system integration, including the progressive electrification of demand side sectors (buildings, mobility, industry) and integration of other climate neutral, renewable energy carriers, such as clean hydrogen. Innovative energy storage solutions (including chemical, mechanical, electrical and thermal storage) are a key element of such energy system and R&I actions will advance their technological readiness for industrial-scale and domestic applications. Carbon Capture, Utilisation and Storage (CCUS) is a CO<sub>2</sub> emission abatement option that holds great potential and R&I actions will accelerate the development of CCUS in electricity generation and industry applications.

This Destination contributes to the following Strategic Plan's **Key Strategic Orientations (KSO)**:

- *C: Making Europe the first digitally enabled circular, climate-neutral and sustainable economy through the transformation of its mobility, energy, construction and production systems;*
- *A: Promoting an open strategic autonomy<sup>69</sup> by leading the development of key digital, enabling and emerging technologies, sectors and value chains to accelerate and steer the digital and green transitions through human-centred technologies and innovations;*

It covers the following **impact areas**:

- Industrial leadership in key and emerging technologies that work for people;
- Affordable and clean energy.

The **expected impact**, in line with the Strategic Plan, is to contribute to “*More efficient, clean, sustainable, secure and competitive energy supply through new solutions for smart grids and energy systems based on more performant renewable energy solutions*”, notably through



- i. Fostering European global leadership in affordable, secure and sustainable **renewable energy technologies** and services by improving their competitiveness in global value chains and their position in growth markets, notably through the diversification of the renewable services and technology portfolio (more detailed information below).
- ii. Ensuring cost-effective uninterrupted and affordable supply of energy to households and industries in a scenario of high penetration of variable renewables and other new low carbon energy supply. This includes more efficient approaches to managing **smart and cyber-secure energy grids** and optimisation the interaction between producers, consumers, networks, infrastructures and vectors (more detailed information below).
- iii. Accelerating the development of **Carbon Capture, Use and Storage (CCUS)** as a CO<sub>2</sub> emission mitigation option in electricity generation and industry applications (including also conversion of CO<sub>2</sub> to products) (more detailed information below).

**Fostering the European global leadership in affordable, secure and sustainable renewable energy technologies**

Renewable energy technologies provide major opportunities to replace or substitute carbon from fossil origin in the power sector and in other economic sectors such as heating/cooling, transportation, agriculture and industry. Their large scale and decentralised deployment is expected to create more jobs than the fossil fuel equivalent. Renewable energy technologies are the baseline on which to build a sustainable European and global climate-neutral future. A strong global European leadership in renewable energy technologies, coupled with circularity and sustainability, will pave the way to increase energy security and reliability.

It is imperative to enhance affordability, security, sustainability and efficiency for more established renewable energy technologies (such as wind energy, photovoltaics or bioenergy), and to further diversify the technology portfolio. Furthermore, advanced renewable fuels, including synthetic and sustainable advanced biofuels, are also needed to provide long-term carbon-neutral solutions for the transport and energy-intensive industrial sectors, in particular for applications where direct electrification is not a technically and cost efficient option.

Synergies with activities in cluster 4 are possible for integrating renewable energy technologies and solutions in energy consuming industries. Complementarities with cluster 6 concern mainly biomass-related activities.

In line with the “do not harm” principle for the environment, actions for all renewable energy technologies aim to also improve the environmental sustainability of the technologies, delivering products with reduced greenhouse gas emissions and improved environmental

performance regarding water use, circularity, pollution and ecosystems. In particular, for biofuels and bioenergy improving the environmental sustainability is associated to the biomass conversion part of the value chain and the quality of the product, while air pollution associated to combustion in engines falls in the scope of other parts of the WP.

The main impacts to be generated by topics targeting the renewable energy technologies and solutions under this Destination are:

- a. Availability of disruptive renewable energy and renewable fuel technologies and systems in 2050 in order to accelerate the replacement of fossil-based energy technologies.
- b. Reduced cost and improved efficiency of renewable energy and renewable fuel technologies and their value chains.
- c. De-risking of renewable energy and fuel technologies with a view to their commercial exploitation and net zero greenhouse gas emissions by 2050.
- d. Better integration of renewable energy and renewable fuel-based solutions in energy consuming sectors.
- e. Reinforced European scientific basis and European export potential for renewable energy technologies through international collaboration (notably with Africa in renewable energy technologies and renewable fuels and enhanced collaboration with Mission Innovation countries).
- f. Enhanced sustainability of renewable energy and renewable fuels value chains, taking fully into account social, economic and environmental aspects in line with the European Green Deal priorities.
- g. More effective market uptake of renewable energy and fuel technologies.

### **Energy systems, grids and storage**

Efficient and effective network management is the key to the integration of renewables in an efficient way that ensures cost-effectiveness and affordability, security of supply and grid stability. Real time monitoring and optimisation are necessary to increase the flexibility, through solutions such as storage, demand response or flexible generation among others, to integrate higher shares of variable renewable energy. Exploiting synergies between electricity, heating and cooling networks, gas networks, transport infrastructure and digital infrastructure will be crucial for enabling the smart, integrated, flexible, green and sustainable operation of the relevant infrastructures. Besides hydrogen and batteries (addressed elsewhere), R&I in other storage technologies, in particular thermal storage but

also electrochemical, chemical, mechanical and electrical storage solutions is necessary to create a set of flexibility options.

Activities on energy systems, grids and storage under this Destination will primarily focus on the systemic aspects to enhance the flexibility and resilience of the system, in particular: integrated energy system planning and operation, engaging consumers and providing new services, electricity system reliability and resilience, storage development and integration and green digitalisation of the energy system.

Moreover, the role of citizens and communities is key when it comes to making the flexibility at appliance level available for the grid. Related to this, the inclusion of social sciences and humanities (SSH) where relevant is essential to build the social acceptance of new energy technologies and increase participation of consumers in energy markets.

All projects will contribute to an increased capacity of the system to integrate renewable energy sources and less curtailment at transmission and distribution level. The main expected impacts are:

- a. Increased resilience of the energy system based on improved and/or new technologies to control the system and maintain system stability under difficult circumstances.
- b. Increased flexibility and resilience of the energy system, based on technologies and tools to plan and operate different networks for different energy carriers simultaneously in a coordinated manner that will also contribute to climate neutrality of hard-to-electrify sectors.
- c. Enhance consumer satisfaction and increased system flexibility thanks to enabling consumers to benefit from data-driven energy services and facilitating their investment and engagement in the energy transition, through self-consumption, demand response or joint investments in renewables (either individually or through energy communities or micro-grids).
- d. Improved energy storage technologies, in particular heat storage but also others such as electrochemical, chemical, mechanical and electrical.
- e. Foster the European market for new energy services and business models as well as tested standardised and open interfaces of energy devices through a higher degree of interoperability, increased data availability and easier data exchange among energy companies as well as companies using energy system data.
- f. More effective and efficient solutions for transporting off-shore energy thanks to new electricity transmission technologies, in particular using superconducting technologies,

power electronics and hybrid Alternate Current – Direct Current grid solutions as well as MT HVDC (Multi Terminal High Voltage Direct Current) solutions.

### **Carbon capture, utilisation and storage (CCUS)**

CCUS will play a crucial role in the EU Green Deal for the transition of energy-intensive industries and the power sector towards climate neutrality. Supporting R&I for CCUS will be particularly important in those industries where other alternatives do not yet exist like the cement industry. This will be highly relevant towards 2050, when most electricity will be coming from renewables, but the need to tackle the process emissions from industry will continue. If CCUS is combined with sustainable biomass, it could create negative emissions.

Low carbon hydrogen from natural gas with CCUS could also play a significant role in industrial climate neutrality, in the transition towards full use of hydrogen from renewable sources, in particular in industries such as steel making, chemicals, or refining where large quantities of hydrogen are needed. CCUS would enable early, clean hydrogen at scale. The hydrogen infrastructure built for clean hydrogen with CCUS could be also shared by hydrogen from renewable sources. It is thus important to develop CCUS for industrial clusters, including aspects of system planning, shared infrastructure solutions such as buffer storage, shared CO<sub>2</sub> and hydrogen transportation and infrastructure optimisation for CCS and CCU.

Demonstration of the full CCUS chain is needed in the EU, with special emphasis on the reduction of the energy penalty and cost of capture and on ascertaining safe storage. Under the EU Strategic Energy Technology Plan (SET Plan) ambitious R&I targets have been set in agreement with the sectorial stakeholders. The focus is on CO<sub>2</sub> storage appraisal, cost-reductions, new technologies and proliferation of pilots and demonstrators.

Synergies with cluster 4 exist on the use of CO<sub>2</sub> (please see topic “HORIZON-CL4-2022-TWIN-TRANSITION-01-11: Valorisation of CO/ CO<sub>2</sub> streams into added-value products of market interest (IA)”).

The main impacts to be generated by topics targeting the renewable energy technologies and solutions under this Destination are:

- a. Accelerated rollout of infrastructure for CCUS hubs and clusters.
- b. Updated authoritative body of knowledge on connecting industrial CO<sub>2</sub> sources with potential ‘bankable storage sites, providing greater confidence for decision makers and investors.

- c. Proven feasibility of integrating CO<sub>2</sub> capture, CO<sub>2</sub> storage and CO<sub>2</sub> use in industrial facilities. Demonstrating these technologies at industrial scale shall pave the way for subsequent first-of-a-kind industrial projects.
- d. Reduced cost of the CCUS value chain, with CO<sub>2</sub> capture being still the most relevant stumbling block for a wider application of CCUS.
- e. Adequate frameworks for Measurement, Monitoring and Verification (MMV) for storage projects, to document safe storage and for public acceptance of the technology.

## Call – Sustainable, secure and competitive energy supply 2022

### Global leadership in renewable energy

Topic ID and title	<a href="#">HORIZON-CL5-2022-D3-02-07: Renewable energy incorporation in agriculture and forestry</a>				
Budget	EUR 15 million	Opening date	26 May 2022	Deadline 1	27 October 2022
Budget per project	EUR 7,5 million			Deadline 2	/
Type of action	Innovations Actions (IA)				
FTP subsector	F&F				
Keywords	carbon footprint, forest waste management, circularity, rural areas, foresters, pyrolysis units				
FTP comments					
FTP SIRA 2030 Challenges addressed	10B	FTP relevance		High	
		Starting TRL		/	
		End TRL		6-7	

#### Expected Outcome:

Meeting local and seasonal energy demands in agriculture and forestry with optimum agricultural and forest waste management and use while reducing the associated emissions is essential. If not managed, agricultural waste is often burnt in the fields and forests suffer from fires, thus increasing the environmental footprint of agriculture and forests. Soil and biodiversity improvement in agriculture could also benefit from renewable energy technologies. Demonstrating incorporation of renewable energy technologies to attain heat, waste and land management needs in agricultural and forestry will contribute to increase the penetration of renewable sources in the energy system and enable transformation of the energy supply across critical energy-consuming sectors, thus accelerating the achievement of the European Green Deal and climate and energy targets for 2030 and of net zero greenhouse gas emissions by 2050, while supporting the EU goals for energy independence and economic growth. Furthermore, it will support achieving the specific objective of the post 2020 Common Agricultural Policy<sup>153</sup> regarding contribution to climate change mitigation and adaptation, as well as sustainable energy.

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

- Promote decentralised renewable energy use and cost-efficient decentralized production of renewable energy carriers.
- Reduce agriculture and forestry carbon footprint from own energy consumption and agricultural/forest waste management.

- Increase sustainability and circularity in agriculture while creating positive effects on biodiversity.
- Increase sustainability and circularity in forestry.
- Foster regional development in rural areas.
- Support farmers' and foresters' engagement as prosumers of renewable energy.

#### Scope:

Proposals should demonstrate incorporation of renewable energy technologies in agriculture or forestry to meet its electricity, heat, cold, waste and land management needs. Solutions should combine innovative renewable, circular and regional value chains from different renewables and adapted storage options to de-fossilize agricultural or forest processes trans-seasonally, taking into account hybridization compatibility. They should also address one of the two options:

- Transformation of agricultural or forest wastes to renewable energy carriers in situ, e.g. by modular slow pyrolysis units, using renewable energy for process energy needs. Solutions should improve the cost-effectiveness and the sustainability of agriculture or forest seasonal energy demand based on renewables.
- Development of renewable-based agricultural protocols for multiple and cover cropping and/ or mixed cropping which increase carbon sequestration and soil organic matter and reduce pesticides, combined with transformation to renewable energy carriers in situ, e.g. by biogas production, in a circular approach for soil nutrients and carbon. Positive effects on soil biodiversity/soil health and soil functionality as regards increasing soil organic matter, phosphorus and other nutrients and reducing the risk on groundwater contamination from nitrogen oxides should be assessed. Solutions should improve the cost-effectiveness and the sustainability (including biodiversity) of agricultural waste and land management through valorisation of wastes and secondary crops based on renewable energy technologies.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities. The effective contribution of renewable energy and agronomy disciplines is also expected.

## Cluster 6 : Food, Bioeconomy, Natural Resources, Agriculture and Environment<sup>3</sup>

### Destination 1: Biodiversity and ecosystem services

The EU biodiversity strategy for 2030 is a cornerstone of the European Green Deal that will put Europe's biodiversity on the path to recovery by 2030, for the benefit of people, the climate and the planet. It will also prepare the EU to take a leading role in the upcoming international negotiations on a new global framework to halt biodiversity loss. With the Green Deal's 'do no significant harm' vision, all EU policies will become more biodiversity-friendly, focusing more on the sustainable use of ecosystems, supporting the recovery in a post-pandemic world<sup>6</sup>. This policy vision is fully supported in the strategic plan of Horizon Europe for 2021-2024 in its first key strategic orientation 'Protecting and restoring ecosystems and biodiversity and managing sustainably natural resources on land and at sea, and achieving climate neutrality and adaptation'. Consequently, Destination 'Biodiversity and ecosystem services' intends to achieve the following expected impact from Cluster 6 **'Biodiversity is back on a path to recovery, and ecosystems and their services are preserved and sustainably restored on land, inland water and at sea through improved knowledge and innovation'**. All actions funded under this destination must therefore help to deliver this main impact.

Research and innovation is key to delivering results that will have an important impact on biodiversity, food, health, water and climate, which are all interconnected, and to achieving the goal of healthy and resilient ecosystems by 2030. It will also enable transformational change engaging European society and economy and their global impacts, making decisions more biodiversity-friendly. R&I will support policy targets, develop nature-based solutions<sup>7</sup> and holistic approaches to address the main causes of biodiversity loss, particularly in connection to production systems, bringing all sectors together to be integrated in ecosystem-based management. Investments in R&I will help to protect and restore the integrity of terrestrial, aquatic and marine ecosystems, currently under multiple pressures, and protect and restore their capacity to deliver a wide range of essential services. Under Horizon Europe, a **long-term strategic research agenda for biodiversity** will also be developed.

The sixth mass extinction is taking place: one million species are at risk of extinction, and the degradation of ecosystems severely affects the fabric of life that enables the survival of humankind<sup>8</sup>. None of the globally agreed targets of the 2011-2020 strategic plan for

<sup>3</sup> [Work Programme published by the European Commission on 15 June 2021](#)



biodiversity has been fully achieved<sup>9</sup>, with the biodiversity crisis even deepening. Our knowledge on biodiversity status, pressures, impacts and responses needs to be improved, requiring even basic taxonomic work in certain ecosystems. **Understanding biodiversity decline** and addressing its main drivers through data-driven science, integrated multidisciplinary knowledge, new tools, models and scenarios, will support Europe's policy needs and boost global biodiversity science. Solutions for preventing and addressing the individual and cumulative effect of direct drivers of biodiversity loss (land use change, overexploitation, climate change, invasive species, pollution) need to be further developed and made available to policy makers and practitioners, such as through the new EC Knowledge Centre for Biodiversity<sup>10</sup>. For more impact on society and economic sectors, citizen science and crowdsourcing also require big data analysis, artificial intelligence, social sciences, communications and policy tools.

**Valuing and restoring biodiversity and ecosystem services** is necessary to develop tools to guide decisions, inform and implement policies on the environment, water, health, climate, disaster risk reduction, agriculture, forests and other land use types, protected areas management, the sustainable bioeconomy, the blue economy, maritime and cross-sectoral spatial planning, and responsible business practices. The continued degradation of the ecosystems and their services affects biodiversity and climate change<sup>11</sup>, and increases the risk of severe ecological disasters and pandemics. The European Green Deal and its biodiversity strategy call for urgent action to restore damaged aquatic and terrestrial ecosystems in order to increase biodiversity and deliver a wide range of ecosystem services.

The contribution of ecosystems to human wellbeing and the economy is not properly accounted for in market transactions, or in planning and investment decisions: the social and economic co-benefits of healthy ecosystems are often disregarded. Natural capital accounts need to be developed and mainstreamed. Investments in R&I will also lay the ground for scaling up and speeding up the implementation of technological, societal and nature-based solutions (NBS). NBS support vital ecosystem services, biodiversity and biomass provision, as well as access to drinking water, clean soil, improved livelihoods, healthy diets and food safety and security from sustainable food systems. NBS deployment will also create green jobs and build resilience to climate change and natural disasters. Citizens, authorities, businesses, social partners and the research community must be engaged at local, regional, national and European levels.

**Managing biodiversity in primary production:** Biodiversity is the basis for sustainable and resilient agriculture, fisheries, aquaculture and forestry, as also recognised in the farm to fork and biodiversity strategies under the Green Deal. With diverse genetic resources, it is possible to use in primary production plants and animals that are adapted to different

environments, ecosystems and meet diverse needs. Furthermore, the interplay between species below and above ground delivers important ecosystem services, such as pollination, soil fertility, pest and risk control. Despite these recognised benefits, current production systems tend to be specialised and rely on a limited number of crops, breeds and forest tree species whose genetic basis is narrow. Reversing this trend and increasing their resilience is critical and of global concern in particular in the current context of accelerated climate change and a growing population whose production and consumption footprint is increasing.

**Enabling transformative change<sup>12</sup> in biodiversity:** Science (IPBES and IPCC) and Policy (the global post-2020 biodiversity framework and the EU biodiversity strategy) clearly underline that biodiversity loss can only be successfully addressed if transformative changes are initiated, accelerated, and up-scaled. There is however hardly any knowledge on potentials and challenges arising from transitions focused on biodiversity. System-level change of this kind starts with social innovation in the form of, for example, regulations, incentives, local and participatory processes, and through the introduction of new technologies, new production processes, or new consumer products, which change how socio-technical and socio-ecological systems operate and impact their environment. Such transformative change must decrease the impacts of indirect drivers of biodiversity loss, which are in turn, underpinned by societal values and behaviours. Indirect drivers of biodiversity loss are understood to mean here: production and consumption patterns, human population dynamics and trends (including their footprints), trade, technological innovations, and local to global governance (including financing). Research and innovation can enable these transformative changes to happen and initiate processes, behaviour changes and actions which are transforming the way we impact biodiversity. Socio-economic and multidisciplinary research, including on the role of education, will develop knowledge and tools to understand the role of transformative change for biodiversity policy making, address the indirect drivers for biodiversity loss, and accelerate transformative changes in our society that are relevant to biodiversity.

**Interconnecting biodiversity research and supporting policies** refers to the establishment of the European Partnership ‘Rescuing biodiversity to safeguard life on Earth’ and to the support to other science-policy interfaces. The European partnership on biodiversity<sup>13</sup> will connect national, local and European research, innovation and environmental programmes, combining resources in support of one goal, i.e. that by 2030 biodiversity in Europe is back on the path to recovery. It will co-develop multidisciplinary research and innovation programmes with stakeholders, set up a European network of coordinated observatories for biodiversity monitoring, and implement a broad range of

activities to increase the relevance, impact and visibility of EU research and innovation in tackling the biodiversity crisis in line with the EU biodiversity strategy for 2030.

Science-policy interfaces on biodiversity and nature-based solutions have made good progress in recent years<sup>14</sup>, and must be stepped up to achieve targeted impacts on biodiversity-relevant policies, that can in turn be used as structured policy input into the research cycle. These interfaces are also key to guiding biodiversity governance, and to implement the EU Green Deal and international conventions<sup>15</sup>. In line with the Commission priority 'A stronger Europe in the world', the EU must take and demonstrate leadership in this field, notably by increasing its support to IPBES<sup>16</sup> -to bring it up to the same level as the IPCC-, and to the Convention on Biological Diversity. Besides economic support, this also includes efforts to create synergies and cooperation between IPBES, regional Multilateral Environmental Agreements and other relevant research communities to ensure a full coverage of all relevant aspects of biodiversity and ecosystem services in order to underpin the full scope of the post 2020 global biodiversity framework.

All topics will directly contribute to the EU biodiversity strategy for 2030 and to the Sustainable Development Goals (SDGs) 13, 14, 15, 17.

Several missions will also help to achieve biodiversity-related impacts, notably in the areas of 'Adaptation to climate change including societal transformation', 'Climate-neutral and smart cities', 'Ocean, seas and waters' and 'Soil health and food'.

### Expected impact

Proposals for topics under this destination should set out a credible pathway contributing to Biodiversity and Ecosystem Services, and more specifically to one or more of the following impacts:

- **Biodiversity decline, its main direct drivers and their interrelations are better understood and addressed** through the production, integration and use of open data, knowledge, education and training, innovative technologies, solutions and control measures, in collaboration with European and international initiatives.
- **Biodiversity and natural capital are integrated into public and business decision-making at all levels for the protection and restoration of ecosystems and their services**; science base is provided for planning and expanding protected areas, and sustainably managing ecosystems.
- **Europe builds competitive sustainability and tackles climate change and natural disasters through the deployment of nature-based solutions**, including

ecosystem-based disaster risk-reduction approaches fully reaping their economic, social and environmental benefits for a green recovery across all European regions.

- **The interrelations between biodiversity, health, food, soil, water, air and climate are better known** and communicated to citizens and policy-makers; in particular, risks associated with microbiomes and biodiversity-friendly prevention/mitigation measures, and opportunities for biodiversity recovery are identified.
- **Practices in agriculture and forestry support biodiversity and the provision of other ecosystems services** based on a) a better understanding of functional biodiversity (above and below ground), b) effective knowledge and innovation systems and c) ready-to use solutions for land managers, adapted to specific conditions.
- **Access to a wider range of crops and breeds with a broadened genetic base is improved in line with global biodiversity commitments** by gaining greater insight into the characteristics of genetic resources and by enhancing capacities for their preservation and use in breeding and in primary production (farming, forestry, fisheries, aquaculture). More (bio)diverse, resilient production systems will have positive knock-on effects on value chains, consumption, healthy diets and the wider, non-managed biodiversity.
- **Approaches for enabling transformative changes in society** for biodiversity and ecosystems recovery are identified, tested and implemented in policy, governance, law business and society; all indirect drivers of biodiversity loss are addressed and 'do not harm' biodiversity policies become a mainstream part of all sectors.
- **Biodiversity research is interconnected** across Europe, supporting and enhancing the ambition of national, EU and international environmental policies and conventions.

When considering the impact of the proposals, their compliance with the 'do no significant harm' principle<sup>17</sup> has to be assessed. Also it has to be ensured that the research and innovation activities do not cause a significant harm to any of the six environmental objectives of the EU Taxonomy Regulation.

The portfolio of actions under this destination will have impacts in the following areas: "Enhancing ecosystems and biodiversity on land and in waters"; "Climate change mitigation and adaptation"; "Clean and healthy air, water and soil"; "Sustainable food systems from farm to fork on land and sea"; and "A resilient EU prepared for emerging threats".

## Call – Biodiversity and Ecosystem Services 2021

### Valuing and restoring biodiversity and ecosystem services

Topic ID and title	<a href="#">HORIZON-CL6-2021-BIODIV-01-07: Ecosystems and their services for an evidence-based policy and decision-making</a>				
Budget	EUR 13 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 13 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Ecosystem services, biodiversity, restoration, forests, soil ecosystems, wetlands, natural capital accounting, MAES, Oppla portal, GEO, GEOSS, Copernicus				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,E - 3B	FTP relevance		Medium	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome

In support to the EU biodiversity strategy for 2030 the successful proposal should provide knowledge to support EU and its Member States as well as relevant Associated Countries in the implementation of its actions and commitments by contributing to the integration of biodiversity and natural capital into public and business decision-making at all levels for the protection and restoration of ecosystems and their services. Successful proposals will contribute to all of the following expected outcomes:

- Inform the policy decisions affecting the environment through a better understanding of the condition of ecosystems and their services in Europe, helping fill the current knowledge gaps.
- Contribute to the evidence and awareness of the importance of biodiversity, healthy ecosystems and the social and economic values that emerge from them through a better understanding of ecosystems services in relation with ecosystems condition.
- Support restoration targets and secure the sustainability of human activities and human well-being through the definition of the minimum criteria for ecosystems to achieve or maintain a healthy state or a good condition.

### Scope

The first EU-wide Ecosystem Assessment report states that Europe's ecosystems, on which we depend for instance for food, timber, clean air, clean water, climate regulation and recreation, suffer from unrelenting pressures caused by intensive use of land or sea, climate

change, pollution, overexploitation of natural resources and invasive alien species. Ensuring that ecosystems achieve or maintain a healthy state or a good condition is a key requirement to secure the sustainability of human activities and human well-being.

The successful proposal should cover the main knowledge gaps identified by the EU Ecosystem assessment<sup>47</sup> report to improve the assessment of the condition of ecosystems while providing uptake of the assessment's outcomes in policy. It should develop and test indicators not yet available for supporting the ecosystem and services assessment. This includes developing the minimum criteria, reference levels and aggregation schemes to define good ecosystem condition. This definition is not restricted to protected areas, but should encompass also forests, agroecosystems, urban areas, soil ecosystems, wetlands, fresh water and marine ecosystems. The proposal should address regional diversity and the corresponding decision level.

The proposal should investigate how good ecosystem condition is related to the capacity of ecosystems to deliver ecosystem services and focus on quantification of ecosystem services and on data derived from biodiversity and ecosystem monitoring in combination with models to study these. The proposal should develop and test methods and tools (in particular methods developed for natural capital accounting) to consistently report harmonised and verified ecosystem data at EU and Member State and Associated Country level that can be used to regularly report or assess the pressures and condition of ecosystems, dynamics, trends and changes over time.

The proposal should bring the individual MAES components 1) map ecosystems, 2) map and assess condition of ecosystems, 3) map and assess ecosystem services delivered by ecosystems together in integrated ecosystem assessments to better understand how the condition of various ecosystem types influences the delivery of different ecosystem services.

The proposal should demonstrate how to apply the MAES<sup>48</sup> outputs and other relevant ecosystem knowledge in practical policy, including its implementation, and other decision-making process (public and private) at various spatial and temporal scales while involving relevant stakeholders and citizens.

The proposal should follow up on European and global projects and networks to facilitate dialogue among the relevant scientific communities, funding bodies, relevant stakeholders and user communities in Europe throughout the duration of Horizon Europe.

The proposal should test and demonstrate the links between biodiversity, ecosystems and macro-economic policies and national policies for instance on agriculture, fisheries, forestry and climate. The proposal should develop and test practical applications seeking to harness the full potential of ecosystem services for evidence-based decision making. Ecosystem

services need to be uptake and better integrated in different sectoral policies including, amongst others, urban and regional development, the common agricultural policy, conservation planning or marine spatial planning.

Applicants should create synergies with relevant projects under this Call. To this end, proposals should include dedicated tasks and appropriate resources for coordination measures, and, where possible, foresee joint activities and joint deliverables. Furthermore, cooperation is expected with the Biodiversity Partnership<sup>49</sup> (HORIZON-CL6-2021-BIODIV-02-01) and the Science Service HORIZON-CL6-2021-BIODIV-01-19. The proposal should set practical policy recommendations for the EU biodiversity strategy for 2030 targets, commitments, and ecosystem services-related policies, thereby contributing to the implementation, monitoring of progress and ratcheting up of the strategy's commitments as part of the European Green Deal.

The successful proposal should show how their results might provide timely information on relevant project outcomes. Cooperation is expected with projects under "HORIZON-CL6-2021-BIODIV-01-20: Support to processes triggered by IPBES and IPCC" and "HORIZON-CL6-2022-BIODIV-01-10: Cooperation with the Convention on Biological Diversity" for major science-policy bodies such as the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), as well as the Convention on Biological Diversity.

The successful proposal should ensure that all evidence, data and information will be accessible through the Oppla portal, and prepare the inclusion of its results, knowledge synthesis and policy briefs to the EC Knowledge Centre for Biodiversity. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement. Where relevant, creating links to and using the information and data of the European Earth observation programme Copernicus, the Group on Earth Observations (GEO) and the Global Earth Observation System of Systems (GEOSS) is expected.



Topic ID and title	<a href="#">HORIZON-CL6-2021-BIODIV-01-08: Supporting the development of a coherent and resilient Trans-European Nature Network</a>				
Budget	EUR 10 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 10 million			Deadline 2	/
Type of action	Innovations Actions (IA)				
FTP subsector	F&F				
Keywords	Protected areas selection, ecological corridors, ecosystem services, nature-based solutions (NBS), green infrastructure (GI), Copernicus, GEO, GEOS				
FTP comments					
FTP SIRA 2030 Challenges addressed	1E - 3E	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome:

Contributing to the implementation of the EU Biodiversity Strategy for 2030, this topic aims to give support to building a coherent and resilient trans-European nature network (TEN-N) of protected areas, including through the set-up of ecological corridors, thereby contributing to the protection and restoration of ecosystems and their services in Europe.

Successful proposals will contribute to all of the following outcomes:

- Development of a coherent and resilient trans-European nature network of protected areas, by supporting Member States on the key commitments for protecting at least 30% of EU land area, and strictly protecting at least 10% of EU land area.
- Setting up of ecological corridors – within and outside the network - to prevent genetic isolation, allowing for species migration including the response to climate change, and maintaining and enhancing healthy ecosystems, and delivering multiple ecosystem services.
- Promote, support and demonstrate innovative and replicable financing solutions for the upscaling investments in green and blue infrastructure<sup>43</sup> (GI) and nature-based solutions (NBS)

### Scope:

The first EU-wide Ecosystem Assessment report states that Europe's ecosystems, on which we depend for instance for food, timber, clean air, clean water, climate regulation and recreation, suffer from unrelenting pressures caused by intensive use of land or sea, climate change, pollution, overexploitation of natural resources and invasive alien species. Ensuring that ecosystems achieve or maintain a healthy state or a good condition is a key requirement to secure the sustainability of human activities and human well-being.



The successful proposal should cover the main knowledge gaps identified by the EU Ecosystem assessment<sup>47</sup> report to improve the assessment of the condition of ecosystems while providing uptake of the assessment's outcomes in policy. It should develop and test indicators not yet available for supporting the ecosystem and services assessment. This includes developing the minimum criteria, reference levels and aggregation schemes to define good ecosystem condition. This definition is not restricted to protected areas, but should encompass also forests, agroecosystems, urban areas, soil ecosystems, wetlands, fresh water and marine ecosystems. The proposal should address regional diversity and the corresponding decision level.

The proposal should investigate how good ecosystem condition is related to the capacity of ecosystems to deliver ecosystem services and focus on quantification of ecosystem services and on data derived from biodiversity and ecosystem monitoring in combination with models to study these. The proposal should develop and test methods and tools (in particular methods developed for natural capital accounting) to consistently report harmonised and verified ecosystem data at EU and Member State and Associated Country level that can be used to regularly report or assess the pressures and condition of ecosystems, dynamics, trends and changes over time.

The proposal should bring the individual MAES components 1) map ecosystems, 2) map and assess condition of ecosystems, 3) map and assess ecosystem services delivered by ecosystems together in integrated ecosystem assessments to better understand how the condition of various ecosystem types influences the delivery of different ecosystem services.

The proposal should demonstrate how to apply the MAES<sup>48</sup> outputs and other relevant ecosystem knowledge in practical policy, including its implementation, and other decision-making process (public and private) at various spatial and temporal scales while involving relevant stakeholders and citizens.

The proposal should follow up on European and global projects and networks to facilitate dialogue among the relevant scientific communities, funding bodies, relevant stakeholders and user communities in Europe throughout the duration of Horizon Europe.

The proposal should test and demonstrate the links between biodiversity, ecosystems and macro-economic policies and national policies for instance on agriculture, fisheries, forestry and climate. The proposal should develop and test practical applications seeking to harness the full potential of ecosystem services for evidence-based decision making. Ecosystem services need to be uptake and better integrated in different sectoral policies including, amongst others, urban and regional development, the common agricultural policy, conservation planning or marine spatial planning.

Applicants should create synergies with relevant projects under this Call. To this end, proposals should include dedicated tasks and appropriate resources for coordination measures, and, where possible, foresee joint activities and joint deliverables. Furthermore, cooperation is expected with the Biodiversity Partnership<sup>49</sup> (HORIZON-CL6-2021-BIODIV-02-01) and the Science Service HORIZON-CL6-2021-BIODIV-01-19. The proposal should set practical policy recommendations for the EU biodiversity strategy for 2030 targets, commitments, and ecosystem services-related policies, thereby contributing to the implementation, monitoring of progress and ratcheting up of the strategy's commitments as part of the European Green Deal.

The successful proposal should show how their results might provide timely information on relevant project outcomes. Cooperation is expected with projects under "HORIZON-CL6-2021-BIODIV-01-20: Support to processes triggered by IPBES and IPCC" and "HORIZON-CL6-2022-BIODIV-01-10: Cooperation with the Convention on Biological Diversity" for major science-policy bodies such as the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), as well as the Convention on Biological Diversity.

The successful proposal should ensure that all evidence, data and information will be accessible through the Oppla portal, and prepare the inclusion of its results, knowledge synthesis and policy briefs to the EC Knowledge Centre for Biodiversity. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement. Where relevant, creating links to and using the information and data of the European Earth observation programme Copernicus, the Group on Earth Observations (GEO) and the Global Earth Observation System of Systems (GEOSS) is expected.

## Managing biodiversity in primary production

Topic ID and title	<a href="#">HORIZON-CL6-2021-BIODIV-01-13: Breeding for resilience: focus on root-based traits</a>				
Budget	EUR 16 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 8 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Root phenotyping, genotypic variability, genetic resources, abiotic stress, breeding, resource efficiency, agriculture				
FTP comments					
FTP SIRA 2030 Challenges addressed	2A	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome

In line with the objectives of the biodiversity and farm to fork strategies, a successful proposal will support the transition to more sustainable practices in agriculture by reducing the need for external inputs and supporting biodiversity in agroecosystems.

The project results are expected to contribute to all of the following expected outcomes:

- A better understanding of root-based traits (including the capacity to establish beneficial interactions with soil biota) and their genotypic variability as well as increased insight into the (adaptive) phenotypic plasticity of roots;
- Enhanced capacities for root phenotyping under controlled and on-field conditions;
- The delivery of strategies for breeding for below-ground traits capitalising on more effective interactions between plants and microorganisms in the rhizosphere;
- An increased use and valorisation of genetic resources (in situ and ex situ) for root based traits.

On the longer term projects will contribute to: the development of crops (annual and perennial) and forest trees that are more tolerant to abiotic stress conditions, require less external inputs (e.g. fertilisers and pesticides) and show an increased capacity for carbon sequestration, thereby contributing to adaptation of agriculture and forestry to climate change.

### Scope

With increasing effects of climate change and a shift towards low(er) input production systems, there is the need for crops that are capable of capturing resources more efficiently and are resilient to abiotic stresses.

The root system and its interaction with soil biota is crucial for nutrient and water acquisition as well as for the capacity of plants to adapt to changing environments and to be more tolerant against pests and diseases. Phenotypic plasticity is key for plants to respond to varying soil conditions and highly dynamic distribution of soil resources. The size and architecture of the root system also determine the allocation of carbon in the soil. Breeding for root traits is therefore a promising strategy to increase plant stress resilience while also enhancing soil carbon sequestration.

Proposals should:

- Identify root traits that increase resource efficiency of plants in different environments, taking into account beneficial plant – microbe interactions and the restitution of plant-fixed carbon to the soil;
- Increase our knowledge on the (molecular and biochemical) plasticity of root responses and their metabolic mechanisms to environmental cues;
- Improve existing and/or develop new root phenotyping tools (including image analysis protocols) to be used in controlled and on-field conditions, thereby overcoming the root data bottleneck;
- Develop strategies to implement “root breeding”, i.e. select for desirable root characteristics and exploit the genetic variation in root traits.

Activities should be carried out in a range of agronomically relevant soil conditions.

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

## Enabling transformative change on biodiversity

Topic ID and title	<a href="#">HORIZON-CL6-2021-BIODIV-01-18: Understanding the impacts of and the opportunities offered by digital transformation, new emerging technologies and social innovation with respect to biodiversity</a>				
Budget	EUR 5 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 2 to 3 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F, WW, P&P				
Keywords	Digital technologies, Artificial Intelligence (AI), biodiversity loss, ecosystem services, policy making, governance, Copernicus, GEO, GEOSS				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome

In line with the EU biodiversity strategy, successful proposals will develop knowledge and tools to understand the role of transformative change for biodiversity, tackle indirect drivers of biodiversity loss, and initiate, accelerate and upscale biodiversity-relevant transformative change in our society.

Digital technologies are transforming all sectors of society, from food production to mobility, energy, climate mitigation and adaptation measures, construction, infrastructure, technology use, human behaviour and societal organisation, with different impacts on and perceptions of biodiversity, due to the speed, scale and level of connectivity of these transformations. Projects should help identify a safe operating space, in which digitalisation and new emerging technologies generate no unsustainable rebound effects, but instead can be a vehicle for accelerating and amplifying the transition to a safe and just world for humankind whilst protecting, restoring and sustainably using biodiversity and ecosystem services.

Project should address all following outcomes:

- A better understanding, today and for the future, of the impacts on, risks and opportunities for biodiversity of digital transformation (for example smart technologies, artificial intelligence, automation, miniaturised sensors, citizen science applications, crowdsourcing), new materials (e.g. for biomimicry), and new and emerging technologies.
- Identification and an assessment of how system-level change affecting biodiversity through social innovation happens. This should cover bringing in new technologies,

new production processes, consumer products, regulations, incentives, or participatory processes, and changes how socio-technical and socio-ecological systems operate.

- Making proposals for safeguards to build public understanding of the range of diverse values held by members of the public (i.e. indigenous communities, youth, women, vulnerable groups in society, socially or economically marginalised groups), to promote democracy and a socially just transition taking action on biodiversity. Proposals should promote incorporating these safeguards in transformative processes linked to the digital sector and technology, which can have positive or negative impacts on biodiversity and on the wide range of services ecosystems can provide.
- Demonstrating the potential of social innovation to tackle biodiversity loss, as well as using biodiversity and the ecosystem services it provides, with nature-based solutions as case studies. Demonstrating how nature-based solutions, enabled by social innovation, tackle poverty, low resilience and social inequality to achieve a just transition.
- Testing active intervention by R&I policy and sector policies (niche creation, reformulation of governance, 'exnovation'), also by empowering and endowing communities.
- Approaches, tools and knowledge influence policies provided at the right level on transformative change for biodiversity. The key elements for this change are to be delivered by the portfolio of cooperating projects (of which these projects form part).

Outcomes should be formulated in such a way that enables their potential users (policy makers, institutions, businesses, engineers, civil society) to understand and concretely apply them, including for monitoring, accounting and reporting purposes. The outcomes should be translated into options to ratchet up the targets and enabling mechanisms of the EU biodiversity strategy for 2030, the global post-2020 biodiversity framework, and to feed input into the processes on the Paris Agreement, the Sustainable Development Goals and IPBES. With the focus on the impacts and opportunities of digital transformation, new emerging technologies and social innovation on biodiversity for the EU and associated countries, projects are strongly encouraged to engage in international cooperation, in particular with African countries, Brazil, Latin American and Caribbean countries or the Mediterranean region, in order to understand differences between the EU/AC and other world regions.

### Scope

- Proposals should generate, collect and distribute knowledge on how to tackle the indirect drivers of biodiversity loss linked to technological and social innovation, which includes digitalisation. They should also assess the impacts on biodiversity of the digital divide between urban, peri-urban and rural areas. Proposals should explain how changes in our societies are fostered by technological and social innovation impacting biodiversity – for example by bringing in new and emerging technologies, new production processes, consumer products, regulations, incentives, or participatory processes, which change how socio-technical and socio-ecological systems operate.
- Proposals are expected to contribute to informing stakeholders and users on the social and technological impacts of new and emerging technologies that are not covered by existing procedures for biodiversity-related risk assessments<sup>79</sup>. This includes the wider positive and negative impacts on societal values, behaviour, institutional, financial and business frameworks, which in turn are having an impact on biodiversity and the capacity of ecosystems to provide a wide range of services.
- Proposals should assess which tools further mainstream biodiversity into policy making, and governance (including financing, the promotion of innovation, and bringing in new and emerging technologies) to achieve transformative action that benefits biodiversity, to avoid, mitigate or manage conflicts linked to these transformational changes<sup>80</sup>. In doing this, proposals should engage with civil society, policy makers, finance and business leaders, to create a toolbox for transformative change via action on biodiversity.
- Proposals should build their analysis on the synergies between multiple Sustainable Development Goals to deliver both direct and indirect biodiversity benefits, staying within planetary boundaries, and on the role of biodiversity in reaching the set of Sustainable Development Goals. Proposals should factor in impacts and opportunities of digital transformation, new emerging technologies and social innovation on biodiversity. This explicitly includes the interdependence of biodiversity loss and climate change, and the impacts on biodiversity of digital, technological or social approaches on action to mitigate and adapt to climate change – and vice versa.
- Proposals should develop pathways for digital developments to achieve a successful twin digital and biodiversity transition. They should develop methodologies to assess their impacts (including the impacts from energy/electricity infrastructure, or on democracy and on trust in science) on environmental, social and economic systems. Such assessments should focus on the direct and indirect effects of digital developments on biodiversity, intertwined with climate change and health.

- Proposals should provide case studies and a collection of good and failed examples, including current relevant business models, the role of citizen science, and scenarios that could provide useful impact to these transformations and inform and inspire transformative change through learning, co-creation and dialogue.
- Proposals should include specific tasks and allocate sufficient resources to develop joint deliverables (e.g. activities, workshops, and joint communication and dissemination) with all projects on transformative change related to biodiversity funded under this destination. They should use existing platforms and information sharing mechanisms relevant to transformational change and to biodiversity knowledge<sup>81</sup>. Furthermore, projects are expected to cooperate with the Biodiversity Partnership and the Science Service. Proposals should show how their results and outcomes can provide timely information to major science-policy bodies such as the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), and to the Convention on Biological Diversity. They are expected to cooperate with projects 'HORIZON-CL6-2021-BIODIV-01-20: Support to processes triggered by IPBES and IPCC' and 'HORIZON-CL6-2021-BIODIV-2022-01-10: Cooperation with the Convention on Biological Diversity'.
- Where relevant, projects are expected to create links to and use information, data and impact-related knowledge from the European Earth observation programme Copernicus, the Group on Earth Observations (GEO) and the Global Earth Observation System of Systems (GEOSS).



## Interconnecting biodiversity and supporting policies

<b>Topic ID and title</b>	<a href="#">HORIZON-CL6-2021-BIODIV-01-21: Impact and dependence of business on biodiversity</a>				
<b>Budget</b>	EUR 5 million	<b>Opening date</b>	22 June 2021	<b>Deadline 1</b>	06 October 2021
<b>Budget per project</b>	EUR 2 to 3 million			<b>Deadline 2</b>	/
<b>Type of action</b>	Research and Innovation Actions (RIA)				
<b>FTP subsector</b>	F&F, WW, P&P				
<b>Keywords</b>	Ecosystem services, corporate decision making, business resilience, investment risks, interdisciplinary				
<b>FTP comments</b>					
<b>FTP SIRA 2030 Challenges addressed</b>	1A - 2E	<b>FTP relevance</b>	Low/Medium		
		<b>Starting TRL</b>	/		
		<b>End TRL</b>	/		

### Expected Outcome

In line with the EU biodiversity strategy for 2030<sup>95</sup>, the topic aims to support the development of policies, business decisions and knowledge generation, to tackle the indirect drivers of biodiversity loss, and accelerate biodiversity-relevant transformative changes in businesses and our society.

Successful proposals will help integrate biodiversity into business decisions to improve:

- public health and well-being and to tackle inequalities, create new jobs and sustainable growth in rural, post-industrial and coastal areas; strengthen resilience against environmental and climate stressors; minimise the risks of future diseases linked to business activities, with disastrous health, economic and social impacts, and
- corporate decision making and business resilience and to minimise investment risk and thereby play a key role in the sustainable transition of the economy.

Projects should produce all following outcomes:

- A better understanding and awareness of how businesses depend, and impact upon, biodiversity and ecosystem services, based on past and ongoing knowledge, also from practical business experience (by private companies), to feed into business decision making.
- Making available knowledge (e.g. meta-studies, publications) for the production of the IPBES methodological assessment on business and biodiversity, which is planned to be adopted in 2024-25, following a fast-track approach. Putting in place capacity building, policy support, and science brokerage of the projects, including after the

release dates of the IPBES assessment, through effective and impactful dissemination.

Making accessible scientific evidence that is directly relevant to multiple Sustainable Development Goals, in particular closely related to Goals 9 (build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation), 12 (ensure sustainable consumption and production patterns, i.e., issues of production and efficient use of natural resources), 13 (climate change), 14 (life below water) and 15 (life on land).

### Scope

Key economic sectors depend on and have a direct and indirect, positive or negative impact on biodiversity. Biodiversity is directly at the centre of many economic activities, and a healthy biodiverse planet is a precondition for humankind to exist – and thus for businesses to grow and for the economy to recover following a crisis such as the COVID-19 pandemic.

Keeping nature healthy is critical for the economy, both directly and indirectly. The World Economic Forum ranks biodiversity loss and ecosystem collapse as one of the top five threats humankind will face in the next ten years. Businesses rely on biodiversity as inputs into their production processes, with over half of global GDP – some €40 trillion – dependent on nature and the services it provides.

Conversely, if we continue doing business as usual, and contribute to destroying ecosystems, the continued degradation of our natural capital will considerably limit business opportunities and socio-economic development potential. Internalising biodiversity into business decisions can enhance the health and well-being of all people and tackle inequalities, create new jobs and sustainable growth in rural, post-industrial and coastal areas; strengthen resilience against environmental and climate stressors; and minimise the risks of future outbreaks of infectious diseases with disastrous health, economic and social impacts. From the perspective of the private sector companies, integrating natural capital and biodiversity impacts and dependencies will enhance corporate decision making and business resilience as well as minimise investment risks. It will better inform, transform and improve their companies' sustainable decision-making processes, including by removing key blind spots in company risk assessments.

This means putting together a highly interdisciplinary team of experts, including biodiversity and corporate practitioners. It needs to cover biophysical and socio-economic aspects related to multiple sectors that have different impacts and ways of managing and accounting. Key expertise is needed in accounting, ecology, business management and organisation, social, political and environmental economics. This topic does not cover developing natural capital accounts or measuring biodiversity footprints.

The proposals should cover all of the following points:

- identifying criteria and indicators for measuring dependence, impact and contribution to the recovery of biodiversity and ecosystem services;
- developing methods to reduce adverse impacts and related material and reputational risks, and to develop the business case for long-term sustainability, for business sectors in addition to forestry, agriculture and fisheries, tourism, energy and mining, infrastructure and manufacturing and processing, that are directly dependent upon ecosystem services;
- developing a tool box to measure, assess and monitor the dependence and impact of the business sector on biodiversity, improved risk management linked to biodiversity, and the contribution of business to biodiversity recovery<sup>96</sup>;
- assessing the broader impact of businesses on biodiversity, the cumulative impact and the indirect impact from supply chains, trade or substitution effects (such as tele-coupling);
- collating targets and regulations (at any level within the EU and in associated countries) that stimulate innovation generating a positive impact on biodiversity and on the decoupling of environmental pressures from increased output;
- promoting (1) business cases that contribute to the conservation, restoration and sustainable use of biodiversity and the wide range of ecosystem services and (2) public accountability, informing regulatory agencies and guiding financial investments and influencing producer, retailer and consumer behaviour. Analysing the added value of creating a Horizon Europe prize<sup>97</sup> for innovative businesses that improve biodiversity and its wide range of ecosystem services, focused on nature-based solutions<sup>98</sup>. Delivering timely input to IPBES assessment on business, and the processes on IPBES objectives for building capacity, strengthening the knowledge basis, supporting policy, and communicating and engaging, on impact and dependence of business on biodiversity, and the relevant IPBES task forces.

Proposals should also show how their results could provide timely information on project outcomes to the Intergovernmental Panel on Climate Change (IPCC), and to the Convention on Biological Diversity. Projects are expected to cooperate with projects HORIZON-CL6-2021-BIODIV-01-20: Support to processes triggered by IPBES and IPCC, HORIZON-CL6-2022-BIODIV-01-10: Cooperation with the Convention on Biological Diversity and HORIZON-CL6-2022-BIODIV-01-04: Natural capital accounting: Measuring the biodiversity footprint of products and organizations.

Proposals should make available the relevant evidence, data and information via the Oppla portal, and prepare to feed in the uptake of its results according to an agreed format to the EC Knowledge Centre for Biodiversity. Collaboration with the Knowledge Centre should also include its stakeholders forum.

The project should set out a clear plan on how it will collaborate with other projects selected under this and any other relevant topics, such as HORIZON-CL6-2021-BIODIV-01-16: Biodiversity, water, food, energy, transport, climate and health nexus in the context of transformative change, and with the European partnership on biodiversity HORIZON-CL6-2021-BIODIV-02-0199, by participating in joint activities such as workshops or communication and dissemination activities. The project should also set out a clear plan on how it will collaborate with key business-related networks that promote the integration of biodiversity into corporate decision making. Proposals should include specific tasks and allocate sufficient resources for these coordination measures.

This topic should involve the contributions from the social science and humanities disciplines.

## Call – Biodiversity and Ecosystem Services 2021

<b>Topic ID and title</b>	<a href="#">HORIZON-CL6-2021-BIODIV-02-01: European partnership Rescuing Biodiversity to Safeguard Life on Earth</a>				
<b>Budget</b>	EUR 40 million	<b>Opening date</b>	22 June 2021	<b>Deadline 1</b>	22 July 2021
<b>Budget per project</b>	EUR 40 <b>to 165 million</b>			<b>Deadline 2</b>	/
<b>Type of action</b>	Programme Co-fund Action (COFUND)				
<b>FTP subsector</b>	F&F				
<b>Keywords</b>	Birds and Habitats Directives, biodiversity monitoring, strategic research agenda, European partnership, natural capital accounting, Nature-based solutions (NBS)				
<b>FTP comments</b>					
<b>FTP SIRA 2030 Challenges addressed</b>	1A	<b>FTP relevance</b>	Medium		
		<b>Starting TRL</b>	/		
		<b>End TRL</b>	/		

### Expected Outcome

The partnership is expected to contribute to all the following expected outcomes:

In line with the European Green Deal and the Convention on Biological Diversity, this partnership will contribute to the objectives and targets of the EU biodiversity strategy for 2030 under the overarching objective that, by 2030, biodiversity in Europe is back on the path to recovery. A successful proposal will contribute to the EU Green Deal priorities, the Birds and Habitats Directives, and to EU climate and agricultural policies. It will help connect biodiversity research across Europe, supporting and raising the ambition of national, EU and international environmental policies and conventions<sup>103</sup>. The expected outcomes of the topic will also contribute to other impacts of Destination 'Biodiversity and ecosystem services', as well as to the Commission priority 'A stronger Europe in the world', and to the Sustainable Development Goals (SDGs) 13, 14, 15, 17.

- Biodiversity research and environmental policy institutions build up coherent initiatives through a co-funded European partnership.
- National/local and EU research & innovation programmes share information between programmes and with environmental ministries and agencies, combining in-cash and in-kind resources. EU and national/regional biodiversity research agendas from EU Member States and associated countries- are complementary; a long-term pan-European strategic research agenda is co-created and implemented.
- Biodiversity monitoring in Europe is structured in the form of a network of coordinated observatories providing accessible knowledge on biodiversity and ecosystem services to users via the EC Knowledge Centre for Biodiversity.

- The partnership increases the relevance, impact and visibility of R&I and European leadership in tackling the biodiversity crisis.
- Biodiversity is mainstreamed across sectors and policies across Europe by using tools such as natural capital accounting and by rolling out nature-based solutions, including traditional and new technologies, which provide multifunctional and resilient solutions to complex societal challenges.

### Scope

The European partnership on biodiversity 'Rescuing biodiversity to safeguard life on Earth' is one of the actions included in the EU biodiversity strategy for 2030. It should coordinate research programmes between EU and its Member States and associated countries and trigger combined action. For the first time, it should mobilise environmental authorities as key partners in carrying out biodiversity research and innovation, along with ministries of research, funding agencies, and environmental protection agencies. The partnership's co-created strategic research and innovation agenda for seven years should include calls for research projects, biodiversity- and ecosystems monitoring and science-based policy advisory activities.

The partnership and its members should be committed to the Global 2050 Vision of 'Living in harmony with nature' adopted under the Convention on Biological Diversity - by 2050, biodiversity and its benefits to people should be protected, valued and restored. The long-term goals in the zero-draft of the post-2020 global biodiversity framework, adding up to this 2050 Vision include:

- net zero ecosystem loss by 2030, with a decreased risk of species extinction risks decreasing, and an increase in abundance of endangered species and their genetic diversity;
- rolling out of nature-based solutions at sufficient scale to contribute to people's and environmental needs across Europe;
- good biodiversity status fully acknowledged as one of the basis for sustainable development and a green economy, and EU/AC leadership is recognised in this context.

To reach these long-term goals, the Biodiversity Partnership should support the contribution of R&I to the EU biodiversity strategy to 2030 to enable transformative change that puts biodiversity on the path to recovery by 2030, for the benefit of the climate and people.

The partnership should aim to achieve five overarching objectives:

1. Produce actionable knowledge to tackle both the direct and indirect drivers of biodiversity loss; produce knowledge on biodiversity status, trends and dynamics, and in integrating drivers, pressures, impacts and responses; produce knowledge on the trade-offs and synergies between multiple drivers of biodiversity change; and an assessment of new tools and approaches to biodiversity/ecosystem conservation and restoration;
2. Expand and improve the evidence base, accelerate the development and wide deployment of nature-based solutions to meet societal challenges across Europe in a sustainable and resilient way, contributing to protecting biodiversity while tackling multiple challenges such as the climate crisis while improving food and nutrition security, the water supply, addressing flooding and water scarcity, and tackling other societal priorities.
3. Making the business case for the conservation and restoration of ecosystems, by contributing science-based methodologies to account for and possibly value ecosystem services and the natural capital, and to assess the dependency and impact of businesses on biodiversity.
4. Improved monitoring of biodiversity and ecosystem services across Europe (status and trends), building on existing national/regional monitoring schemes, building new capacity for setting up new schemes, promoting new and efficient technologies and experience from processes related to mapping and assessing ecosystems and their services (MAES) with regard to enhancing and standardising tools for mapping and assessment.
5. Science-based support for EU, Member States and associated countries policy-making, including for strengthening and implementing environmental policies and laws, and improving cross-sectoral links synergies with other European sectoral policies. More generally, R&I programmes should be better linked to the policy arena, providing greater input to policy making and improving the assessment of policy efficiency. The European partnership for biodiversity should be implemented through a joint programme of activities ranging from research to coordination and networking, including training, demonstration and dissemination, to be structured along the following main work streams:
6. Actions to promote and support R&I programs and projects across the European Research Area, including launching ambitious joint calls to fund transnational R&I projects and run mobility schemes, for example for young scientists or between academia and business;
7. Actions to build R&I capacity and increase the impact of R&I programmes and projects, including science-based policy support;
8. Actions to support, harmonise and carry out biodiversity monitoring;



9. Measures to improve the uptake, demonstration and rollout of solutions to tackle the above-mentioned objectives of the partnership;
10. Measures to enhance the excellence, visibility and impact of European R&I at international level.
11. Measures to regularly update the partnership vision and strategy.

The composition of the partnership should include at least a geographically representative distribution of national and regional research and innovation authorities and funding agencies, environmental authorities, and environmental agencies from EU Member States, associated countries and their regions. The number of partners and their contribution should be sufficient to attain a critical mass in the field. Partners are expected to provide financial and/or in-kind contribution, in line with the level of ambition of the proposed measures. The partnership should be open to including new partners over the lifetime of the partnership. Its governance should create a clear and transparent process for engaging with a broad range of stakeholders, together with the full members of the partnership, to ensure that the work strategically covers a wide range of views in the field of biodiversity, nature-based solutions and ecosystem services throughout the lifetime of the partnership. To ensure that all work streams are coherent and complementary, and to leverage knowledge investment potential, the partnership is expected to foster close cooperation and synergies with the Horizon Missions on Soils; Ocean, seas and waters; Climate Adaptation and Cities; and with the future European Partnerships Agroecology, Urban Transitions, Agriculture of Data, Water, Blue Economy, and Circular/Bio-based economy. The partnership should collaborate closely with the EC 'Knowledge Centre for Biodiversity'<sup>104</sup> recently launched by the EC to build the expertise in Europe to inform, track and assess progress in implementing the EU 2030 biodiversity strategy and to underpin further biodiversity policy developments. It should also cooperate with the Science Service project under Horizon Europe<sup>105</sup>, which is embedded into the EC 'Knowledge Centre for Biodiversity' and aims to facilitate the inclusion of research results into action to implement biodiversity policies.

The partnership should allocate resources to cooperate with existing projects, initiatives, platforms, science-policy interfaces, institutional processes at EU level, and at other levels where relevant to the partnership's goals. Proposals should pool the necessary financial resources from participating national (or regional) research programmes with a view to implementing joint calls for transnational proposals that provide grants to third parties.

Applicants are expected to describe in detail how they would carry out this collaborative work in practice. Given the global dimension of biodiversity, membership and other modalities of participation from institutions in non-EU countries is encouraged. In particular,



the participation of legal entities from international countries and/or regions including those not automatically eligible for funding is encouraged in the joint calls.

Proposals should pool the necessary financial resources from participating national (or regional) research programmes with a view to implementing joint calls for transnational proposals that provide grants to third parties.

Financial support provided by the participants to third parties is one of the primary channels under this action to enable the partnership to achieve its objectives. The maximum amount to be granted to each third party is EUR 7 million for the whole duration of Horizon Europe. It is expected that the partnership organises joint calls on an annual base from 2022-2027 and therefore it should factor ample time to run the co-funded projects.

This topic should involve contributions from the social sciences and humanities disciplines.

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

## Call – Biodiversity and Ecosystem Services 2022

### Valuing and restoring biodiversity and ecosystem services

Topic ID and title	<a href="#">HORIZON-CL6-2022-BIODIV-01-03: Network for nature: multi-stakeholder dialogue platform to promote nature-based solutions</a>				
Budget	EUR 6 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Coordination and Support Action (CSA)				
FTP subsector	F&F				
Keywords	Nature-based solutions (NBS), ecosystem services				
FTP comments	Might be interesting for State Forest Organisations				
FTP SIRA 2030 Challenges addressed	1E - 3	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome

This topic aims to support the development of policies, business models and market conditions to scale up and speed up the implementation of nature-based solutions (NBS)<sup>112</sup>. It will contribute to deploying NBS more widely and to fully reaping their economic, social and environmental benefits in order to build a competitive sustainability in Europe and to tackle climate change. NBS contribute to the EU biodiversity strategy for 2030 and other Green Deal priorities, by supporting biodiversity and vital ecosystem services: climate change mitigation and improving carbon sinks, biomass provision, access to fresh water, clean soil, healthy diets and lifestyles and sustainable food systems. Deploying NBS will also create green jobs and build resilience to climate change and natural disasters.

Successful proposals must contribute to all following expected outcomes:

- Broad and effective community of innovators in the EU and associated countries, practitioners and developers of NBS – including but not limited to Horizon 2020/Horizon Europe projects – engaged across communities of science, business, policy and practice, and from local to global level;
- Better engagement, with public authorities, private sector and society at large for implementing and investing in NBS;
- Establish European NBS “quality brand” with an underlying, comprehensive and agreed vision and agenda, to position and promote EU excellence in NBS innovation;

- Improve cooperation and synergies with key strategic international partners and collaboration with CEN/CENELEC to develop European and international standards and foster the emergence of a global market for NBS;
- Consolidate NBS knowledge across sectors and disciplines through regional and Europe-wide transdisciplinary collaboration, advisory services, awareness raising, knowledge transfer and skills development.

### Scope

Nature-based solutions (NBS) deliver multiple ecosystem services to address diverse societal challenges with a systemic and innovative approach. An effective multi-stakeholder platform is needed to support and consolidate the understanding of NBS and to promote their use and speed up market up-take and wider implementation.

Such a platform enables: a) dialogue, interactions, knowledge and information sharing; b) integration of EU project results and platforms; and c) collaboration and think-and-do-tanks among relevant stakeholders (science, public administration, professional organizations, businesses and investors, civil society).

NetworkNature<sup>113</sup>, a CSA funded under Horizon 2020's Societal Challenge 5 (WP 2019) that is due to end in 2022, is in the process of creating this platform. The Oppla<sup>114</sup> portal is developing the underlying EU NBS knowledge repository, supporting access, sharing NBS knowledge more widely, including from EU-funded NBS projects, to already engaged and new target audiences, such as the finance and investment sector and the wider public.

This topic aims to maintain and build upon the achievements of NetworkNature and Oppla. The successful proposal should further develop and consolidate an engaged, broad and effective European community of innovators, practitioners and developers to promote the design, deployment, out- and up-scaling of NBS at the European and global scale, while recognising regional and national specificities, contexts and needs.

The successful proposal should undertake continuous and strategically driven stakeholder dialogue and facilitate sharing of practice, experience and expertise related to all NBS-relevant aspects, across multiple scales and sectors. Actions should cover social, economic, financial, environmental, educational, institutional, regulatory and cultural aspects; in particular:

- Improve engagement, strengthened ties and new partnerships with public authorities, the private and financing sector and society at large to implement and invest in NBS, based on a high level of awareness about their advantages in order to widen the uptake of these solutions;

- Maintain and further develop an online open source stakeholder platform that facilitates the interactions within and between NBS knowledge holders and implementers;
- Identify, evaluate, standardise and gather tools, mechanisms and advisory services that support different actors in NBS in a one-stop-shop, aiming at supplying offers to match the needs which are brought forward;
- Build on NetworkNature's business plan, to make such a platform financially self-sustainable by the end of the project, and emphasise payback models and payable advisory services;
- Maintain and support established NBS hubs and establish new ones; support and advise on communication and outreach campaigns and regular events in all Member States, involving international networks and environmental communicators and targeting all relevant stakeholders involved in the NBS value chain, including the scientific community;
- Develop a ready-to-use communication toolbox in all EU official languages for regional and local authorities to better communicate about NBS and their benefits, namely in terms of economic growth and job creation;
- Facilitate the clustering of current and upcoming EU-funded NBS relevant research and innovation projects and promote the uptake of their results in further EU or national initiatives (e.g. in projects resulting from the LIFE programme or cohesion policy);
- Assist the Commission in organising science-policy workshops and assessing the contribution of NBS to global and EU policies, notably related to the EU Green Deal. These include biodiversity, pollution, climate adaptation and mitigation, water, agriculture and forestry, as well as urban and regional development, health, transformative change and just transitions;
- Facilitate the development of guidelines for practitioners with state-of-the-art NBS design practices and protocols; Collaborate with CEN/CENELEC to develop European standards, making sure these guidelines are accessible to all users;
- Help to the develop and mainstream NBS-related professional training and include it in primary, secondary and higher-education curricula<sup>115</sup>;
- Develop mechanisms for capacity building and knowledge sharing across disciplines, the involving EU and MS/AC-wide professional organisations. Include partner

organisations across EU Member States to ease dissemination of NBS knowledge at local and Europe-wide level ;

- Promote international cooperation with key strategic partners and sharing best practice, in particular with – but not limited to – Latin American and Caribbean countries, the USA and Africa;
- Support a dialogue between cities implementing NBS (e.g. through twinning, peer exchanges, etc.) to encourage NBS knowledge sharing, experience exchange and access to best practices in the Member States; and establish links with other networking initiatives such as ICLEI, or the Covenant of Mayors;
- Further develop and maintain existing databases of facts and figures on NBS cost-effectiveness, including in monetised form, and according to NBS typology and challenges addressed by NBS, for improved communication and outreach;
- Identify specific areas and priorities where further research and innovation and educational development are needed to more widely implement, exploit benefits and market acceptance of NBS.

The proposals must address all of the above points and should ensure that all evidence and information will be accessible through the Oppla portal (the EU repository for NBS)<sup>116</sup>.

Applicants should create links with projects under the same topic and other relevant ongoing or up-coming projects, notably the Horizon 2020 NBS project portfolio and its task forces; 'HORIZON-CL6-2021-BIODIV-01-05: The economics of nature-based solutions: cost-benefit analysis, market development and funding'; 'HORIZON-CL6-2021-BIODIV-01-06: Nature-based solutions, prevention and reduction of risks and the insurance sector'; 'HORIZON-CL6-2022-COMMUNITIES-01-05: Assessing the socio-politics of nature-based solutions for more inclusive and resilient communities'; 'HORIZON-CL6-2022-COMMUNITIES-02-02-two-stage: Developing nature-based therapy for health and well-being'; 'HORIZON-CL6-2021-COMMUNITIES-01-06: Inside and outside: educational innovation with nature-based solutions'. To this end, proposals should include specific tasks and sufficient resources for coordination measures, envisage joint activities and joint deliverables.

Collaboration with the Biodiversity Partnership (HORIZON-CL6-2021-BIODIV-02-01) is expected in the context of strengthening the knowledge base for assessing, developing and deploying nature-based solutions.

This topic should involve the effective contribution of social sciences and humanities disciplines.

Topic ID and title	<a href="#">HORIZON-CL6-2022-BIODIV-01-04: Natural capital accounting: Measuring the biodiversity footprint of products and organizations</a>				
Budget	EUR 10 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 10 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F, WW, P&P				
Keywords	Biodiversity, corporate natural capital accounting, Product Environmental Footprint (PEF)				
FTP comments					
FTP SIRA 2030 Challenges addressed	1E - 3	FTP relevance		Medium	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome

In keeping with the EU biodiversity strategy for 2030 the successful proposal is expected to contribute to measuring and integrating the value of nature into public and business decision making at all levels for the protection and restoration of ecosystems and their services.

Successful proposals will contribute to all the following expected outcomes:

- Change the way in which EU and associated countries organizations and companies allocate capital or influence their activities to promote a sustainable management by mainstreaming the use of corporate natural capital accounting.
- Integrate biodiversity and ecosystem considerations into business decision-making at different levels by measuring the biodiversity footprint of products and organisations through improving, developing and implementing standardised methods, criteria and standards that focus on essential features of biodiversity, ecosystems services, values, and sustainable use.
- Improve corporate biodiversity disclosure through innovative approaches to foster principles of biodiversity data transparency to accurately report on biodiversity, ecosystems and services.
- Demonstrate innovative solutions for valuing business impacts and dependencies in biodiversity and ecosystem and how this ends up in risks and opportunities for businesses private decision-making.
- Explore solutions to decrease the biodiversity footprint of retailers in global value chains.

## Scope

The EU biodiversity strategy for 2030 recognises that biodiversity considerations need to be better integrated into public and business decision-making at all levels. This should include measuring the environmental footprint of products and organisations on the environment, through life-cycle approaches complemented and eventually integrated by natural capital accounting. In this context, the Commission will support the establishment of an international natural capital accounting initiative.

Natural capital accounting has potential in providing a meaningful basis for business performance reporting by explicitly mapping out impacts and/or dependencies on natural resources and placing a monetary value on them. Specific examples include business accounting and reporting and the disclosure of non-financial reporting and accounting directives.

The successful proposal should develop, take up or demonstrate in real settings standardised natural capital accounting practices to support companies to measure, value and synthesise biodiversity and ecosystem risks assessment, notably in a way that is suitable for routine consideration in business and economy decision-making (including at executive level). It should also mainstream environmental footprints methods for instance through quantifying the environmental impacts of products, or supply and value chains, business models or organisations based the Commission Organisation Environmental Footprint (OEF) and the Product Environmental Footprint (PEF).

The successful proposal should contribute to the alignment of natural capital accounting between the public and private sectors and to explore how the links to link the collection and use of statistics and data for natural capital accounting. It should also address the obstacles businesses are facing, in particular on data collection and improving the access and utility of European environmental data sets at different levels (i.e.: national statistical offices, environmental agencies, corporate reports) allowing better corporate and national data integration for economic and financial decision making.

The successful proposal should work on methodologies for companies to set science-based biodiversity targets. It should also address the specific decision-making needs of corporates and financial service provider to allow a specific and meaningful linkage with the macro-economic perspective and the ecological concept of planetary boundaries at the scale of decision to be taken at corporate level enabling to assess and understand to corporate safe operating space.

The successful proposal should develop and test concrete natural capital accounting and reporting frameworks for business performance with respect to biodiversity and ecosystem

services reporting. This should include explicit mapping of the impacts and/or dependencies on natural resources and placing a monetary value on them. Specific examples should include business accounting, reporting, and the disclosure of non-financial reporting.

The successful proposal should explore to which extent the System of Environmental-Economic Accounting / Experimental Ecosystem Accounting (SEEA EEA) framework in its current form is useful for natural capital assessment and natural capital accounting by businesses. This should be done both in terms of methodological approach and data collection o the opportunities for adapting the SEEA EEA framework to make it more tailored to the business needs or the extent to which national statistical offices can benefit from data collection by businesses.

The successful proposal should develop and test concrete natural capital accounting basis for business performance on biodiversity and ecosystem services reporting by explicitly mapping out impacts and/or dependencies on natural resources and placing a monetary value on them. Specific examples should include business accounting, reporting, and the disclosure of non-financial reporting.

The successful proposal should support the European contribution to a globally consistent approach to account for ecosystems and their value. The proposal should ensure that the EU continues to play a lead role in international environmental affairs through its support for effective measures, international standards and accounting relating to natural capital.

The successful proposal should improve the access and utility of European environmental data sets at different levels (i.e: national statistical offices, environmental agencies, corporate reports) allowing better corporate and national data integration for economic and financial decision making.

The successful proposal should support developing and testing natural capital and biodiversity based business models. These are expected to invest in nature for the benefit of biodiversity, ecosystems functioning and ecosystem services and address the challenge to turn the value of ecosystem into a revenue stream. The successful proposal should help making natural capital and biodiversity based business models bankable, thereby enabling private investments in nature conservation. In other words, 'how to facilitate making money with nature by enhancing ecosystem conditions but not by exploiting it to the detriment of nature'.

The successful proposal should therefore take stock and establish links with the work undertaken by ongoing initiatives, European and national platforms on business and biodiversity, the Natural Capital Protocol, Value balancing alliance, the Knowledge Innovation Project KIP INCA and other Horizon 2020 related projects<sup>117</sup>.



The successful proposal should support the practical implementation of corporate reporting obligations such as under the EU Non-Financial Reporting Directive (2014/95/EU)<sup>118</sup> or of the EU Taxonomy on Sustainable Finance.

Applicants should create synergies with relevant projects under this call ('HORIZON-CL6-2021-BIODIV-01-07: Ecosystems and their services for an evidence-based policy and decision-making'; 'HORIZON-CL6-2021-BIODIV-01-17: Policy mixes, governance (including financing) and decision-making tools for transformative action for biodiversity' the EU Biodiversity Partnership and the Science Service. To this end, proposals should include specific tasks and appropriate resources for coordination measures, and, where possible, envisage joint activities and joint deliverables.

The proposal should set practical policy recommendations for the EU biodiversity strategy for 2030 targets and commitments. Proposals should contribute to strategic dialogue with the EC Knowledge Centre for Biodiversity forum and ensure that all evidence, results, data and information will be accessible and interoperable with the KCBD<sup>119</sup>.

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

This topic should include the effective contribution of social sciences and humanities disciplines.

## Managing biodiversity in primary production

Topic ID and title	<a href="#">HORIZON-CL6-2022-BIODIV-01-07: Protection and sustainable management of forest genetic resources of high interest for biodiversity, climate change adaptation, and forest reproductive materials</a>				
Budget	EUR 8 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 8 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Genetic resources, nurseries, ecosystem restoration, phenotypic traits, reproductive materials, ecosystem management, genetic diversity, ecosystem services, breeding, traceability, EU Forest Reproductive Material Information System (FOREMATIS)				
FTP comments					
FTP SIRA 2030 Challenges addressed	1 - 2			FTP relevance	High
				Starting TRL	/
				End TRL	/

### Expected Outcome

In line with the EU biodiversity and climate change objectives, successful proposals will support the protection and sustainable use of forest genetic resources by contributing to a better insight into the characteristics of genetic resources in the climate change context, adaptive and biodiversity supporting practices in forestry and the enhancement of Europe's ambition in the international biodiversity agenda and international conventions.

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

- Improved cooperation and knowledge sharing on deploying and conserving forest genetic resources in Europe;
- Better conservation of unique tree lineages for forest ecosystem restoration and management;
- Sustainable use of genetic resources within the forest community in a climate change context;
- Efficient implementation of the Access and Benefit Sharing Regulation in the EU.

### Scope

Diversity of forest genetic resources provides the adaptive potential for tree species and populations to cope with climatic changes and future challenges. The adaptive potential of forests depends on their demographic history and the forces of natural selection. It also depends on forestry activities and the choice of species and populations that show better

potential for adaptation to climate change or to subsequent effects of climate change. Provenance trials and common garden trials allow for the assessment of phenotypic responses in various environmental conditions and genomic backgrounds and therefore, genotype X environment interactions. New provenance trials in new environments including populations from range and habitat margins, coupled with genomic analysis of the provenances should provide insights to improve adaptive forest management.

Proposals should:

- Conduct research and networking on provenance trials or common gardens, with new trials and reassessment of older provenance tests using phenotypic traits related to climate change adaptation. This analysis should guide adaptive forest management to choose appropriate forest reproductive material, including its use through assisted migration. This may also lead to a requirement for research into adaptive silvicultural management of stands to support the efficient and sustainable deployment of forest genetic resources.
- Evaluate the impact of forestry activities on forest genetic diversity, develop new cultural trajectories to protect and sustainably use forest genetic resources in naturally regenerated forests, and quantify the ecosystem services provided by forest genetic resources.
- Focus on methods and strategies to breed forest reproductive material with a higher genetic diversity, to diversify tree species composition when establishing new forests and regenerating existing forests. Biomass properties, essential for wood-based products as well as properties related to resilience to climate change induced disturbances, need to be safeguarded or enhanced in the new reproductive material.
- Develop methods and tools to expand the production capacity of nurseries and the diversity of forest reproductive material produced to anticipate and mitigate the impact of extreme weather events, stimulate the development of nurseries in regions where forest reproductive material with useful characteristics is available, establish an EU network of forest nurseries assisting each other with the provision of forest reproductive material, and ensure the traceability of the material from the nursery to the final planting site.
- Expand the EU Forest Reproductive Material Information System (FOREMATIS) and link it with existing information systems to provide information on genetic conservation units with useful properties, to serve as a decision-support tool on where to best source and/or plant forest reproductive material. This would take into account current/future climatic conditions, and create an archive for future

generations that should allow the tracking of exact planting site and performance of forest reproductive material.

- Cover different climate/biogeographical regions in Europe.

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

## Enabling transformative change on biodiversity

Topic ID and title	<a href="#">HORIZON-CL6-2022-BIODIV-01-08: Assessing the nexus of extraction, production, consumption, trade and behaviour patterns and of climate change action on biodiversity in the context of transformative change</a>				
Budget	EUR 12 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 3 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F, WW, P&P				
Keywords	Biodiversity loss, human impacts, primary production, ecosystem services, bioeconomy, multi-actor approach, nature-based solutions (NBS), environmental footprint, GIS-mapping, Bid data, Copernicus, GEO, GEOSS				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A			FTP relevance	Medium
				Starting TRL	/
				End TRL	/

### Expected Outcome

In line with the EU biodiversity strategy, a successful proposal must develop knowledge and tools to understand the role of transformative change for biodiversity policy making, address the indirect drivers of biodiversity loss, and initiate, accelerate and upscale biodiversity-relevant transformative changes in our society.

Projects must address all of the following outcomes:

- Economically, socially, ethically and institutionally viable and sustainable pathways are designed to minimise biodiversity loss or to enhance biodiversity. These pathways should consider mutually influencing extraction, production, consumption, trade patterns in the medium- and long-term (beyond 2030).
- Improve understanding of the human dimensions impacting biodiversity i.e. ethics, social context, institutions, organisation, behaviour will provide policy makers, industrial stakeholders and civil society the tools needed to reframe their actions, by highlighting the synergies of mainstreaming biodiversity with climate transitions, including on how to avoid or minimise trade-offs.
- Better understand social norms and behaviours, linked to socio-economic values (e.g. ethics, social context of individuals, consumers, institutions, organisations, industry) affecting biodiversity.
- Inform and motivate transformational change through learning, co-creation and dialogue based on case studies. The understanding of the biodiversity inter-

dependencies of the SDGs has improved; IPBES and IPCC are strengthened through European research and innovation. Provide a set of approaches, tools and knowledge influence policies at the appropriate level on transformative change for biodiversity – the key elements for this change are delivered by the portfolio of cooperating projects (of which these projects form part).

With focus on assessing the nexus of extraction, production (including processing), consumption, trade and behaviour patterns, including transformative changes for climate change on biodiversity for the EU and Associated Countries, international cooperation in particular with African countries, Brazil, Latin American and Caribbean countries or the Mediterranean region is strongly encouraged.

### Scope

Proposals should address all the following points:

- Assess how extraction, production, processing, consumption, trade, behaviour patterns, especially linked to primary production (e.g. livestock with/or energy crops, etc. including through tele-coupling from consumption and all along supply chains), integrated food systems, and transformative changes towards climate neutrality, affect biodiversity and ecosystem services.
- Develop pathways together with key industries and key stakeholders to minimise loss of, and enhance biodiversity, whilst increasing the delivery of a wide range of ecosystem services. These industries cover food, feed, fibre, energy production and the wider food chain (related to bio-economy, renewable energies, infrastructure, technologies)<sup>122</sup>, and the deployment of climate mitigation and adaptation measures potentially harmful for biodiversity (e.g. concrete walls in coastal areas, replacement of biodiversity rich ecosystems for energy crops, etc.).
- Identify and address leverage points for transformational change in trade, triggering changes in established and new production and consumption patterns for new business models.
- Highlight the potential of (1) public procurement for delivering biodiversity benefits and (2) nature-based solutions for enabling and accelerating the relevant aspects of transformative change.
- Quantify investments into infrastructure and labour that could be shifted from impacting biodiversity negatively towards benefits for biodiversity, including the anticipation, mitigation and management of social, institutional and economic conflicts this may trigger (or decrease), to achieve a just transition process.

- Understand and engage communities and other social actors, including through citizens science, and initiate behavioural changes leading to production and consumption patterns preventing further biodiversity loss.
- Cooperate with ongoing activities to include biodiversity into integrated assessment models<sup>123</sup> and analyse the usability of existing and emerging concepts such as 'Planetary Boundaries', 'Doughnut Economy', 'Environmental Footprints'.
- Explain the relevance of transition pathways for biodiversity for competitive sustainability, towards a just transition in the full range of SDGs and climate neutrality.

Unsustainable production and consumption, including the role of trade for linking both, are pushing many of the direct drivers of biodiversity loss: land use change, overexploitation, climate change and pollution. Proposals should, based on a clear understanding of these relationships<sup>124</sup> address how leverage points and levers can be identified and used for generating benefits for biodiversity, e.g. through revision of regulation, standards, funding practices or governance processes.

They should highlight how the primary production sectors (in particular in agriculture, forestry, fisheries, raw material extraction, and also the construction sector) and the related infrastructure and energy provision and use impacts biodiversity directly. They should show effects on the direction of economic development, which leads to lock-in effects, inequalities, lack of capacities of institutions at every level to shift towards sustainable use, the protection and restoration of biodiversity and ecosystem services. On patterns of consumption, proposals should show how their impacts such as uneven use and exploitation of resources, generation of waste and pollution, value setting, power setting in societies, institutions and financial streams could be addressed in business, institutional and consumer agendas to achieve positive outcomes for biodiversity.

Proposals should assess the cultural diversity that influences these compromises and people's engagement, and lead the way to further mainstream biodiversity in socio-economic and environmental agendas, from the transformative aspect of changing extraction, production and processing, consumption, trade and behaviour patterns, including on actions for addressing climate change on biodiversity. They should also analyse and test the use of nature-based solutions as tool in this regard. Optimal and cost-effective use of behavioural games, networks of sensors, GIS-mapping, big data and observational programmes such as the European Earth observation programme Copernicus, through the Group on Earth Observations (GEO) and the Global Earth Observation System of Systems

(GEOSS) as well as citizens' observatories, should be used as appropriate to enable the integration and visualisation of data.

Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

Proposals should build their analysis upon the links between multiple Sustainable Development Goals, to deliver direct and indirect biodiversity benefits, and of the role of biodiversity in reaching the set of Sustainable Development Goals, when related to extraction, production, consumption, trade and behaviour patterns.

Proposals should produce case studies and collect good and bad examples that could inform these transformations and inform and inspire transformative change through learning, co-creation and dialogue.

Proposals should include specific tasks and ensure sufficient resources to develop joint deliverables (e.g. activities, workshops, as well as joint communication and dissemination) with all projects on transformative change related to biodiversity. This concerns projects funded under this destination, or under calls included in Destination 'Fair, healthy and environmentally-friendly food systems from primary production to consumption' related to transformational change (Fair, healthy and environmentally-friendly food systems from primary production to consumption) that aim to deliver various co-benefits, including on the reduction of biodiversity loss. Projects should use existing platforms and information sharing mechanisms relevant for transformational change and on biodiversity knowledge<sup>125</sup>. Cooperation and possibly synergies with relevant topics in Cluster 5 should be explored and established as relevant. Furthermore, cooperation is expected with the European partnership on biodiversity and with the Science Service.

Proposals should show how their results might provide timely information for major science-policy bodies such as the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), as well as the Convention on Biological Diversity on project outcomes. Cooperation is requested with projects under 'HORIZON-CL6-2021-BIODIV-01-20: Support to processes triggered by IPBES and IPCC' and 'HORIZON-CL6-2022-BIODIV-01-10: Cooperation with the Convention on Biological Diversity'.

This topic should involve the effective contribution of social science and humanities disciplines.



## Destination 2 : Fair, healthy and environmentally-friendly food systems from primary production to consumption

National, EU and global food systems are facing sustainability challenges, from primary production to consumption, that could jeopardise food and nutrition security. The farm to fork strategy, which is key to the success of the European Green Deal and achievement of the UN sustainable development goals (SDGs), aims to address these challenges and to deliver co-benefits for environment, health, society and the economy, ensuring that actions leading to recovery from the COVID-19 crisis also put us onto a sustainable path going forward. Research and innovation (R&I) are key drivers steering and accelerating the transition to sustainable, safe, healthy and inclusive food systems, from farm to fork, thereby ensuring food and nutrition security for all.

**Sustainable farming** systems provide a number of economic, environmental, social and health benefits, and are the main prerequisite for food and nutrition security. For farmers, who are the backbone of food systems and the immediate managers of natural resources, the Green Deal sets ambitious targets with respect to the sustainability and safety of feed and food production. These targets are included in the core Green Deal policy initiatives, in particular the farm to fork strategy, the biodiversity strategy, zero pollution efforts and climate action. R&I in line with the strategic approach to EU agricultural research and innovation<sup>142</sup> will be key enablers if these challenging targets are to be achieved. They will speed up the transition to sustainable and competitive agriculture by unlocking the potential of agroecology<sup>143</sup>, including improving organic farming as part of the agroecological transition, boosting production of EU-grown plant proteins and advancing digital and data technologies (Destination 'Innovative governance, environmental observations and digital solutions in support of the Green Deal'). R&I will support farmers to manage land, soil, water and nutrients in new, sustainable ways, in particular through the Horizon Europe mission in the area of 'soil health and food'. New knowledge and innovative solutions will improve plant and animal health and welfare, prevent interspecies disease transmission through food production and trade systems, and reduce farmers' dependency on pesticides, antimicrobials and other external inputs. Thanks to R&I, farming systems will maximise provision of a wide range of ecosystem services from more sustainably managed EU agro-ecosystems and landscapes, and help to reverse the loss of biodiversity and soil fertility while ensuring resilient primary production (Destination 'Biodiversity and ecosystem services'). Farmers will be better equipped to make a significant contribution to climate neutrality and become more resilient to climate change (Destination 'Land, ocean and water for climate action'). Also, R&I will support the development of policy (in particular the common agricultural policy (CAP)), business models and market conditions enabling transition to sustainable food and farming systems. Effective agricultural knowledge and

innovation systems (AKISs) will speed up innovation and the uptake of R&I results from farm to fork (Destination 'Innovative governance, environmental observations and digital solutions in support of the Green Deal'). As a result, farmers will be able to transform their production methods and move to climate- and environment-friendly, and resilient farming systems, thereby contributing to sustainable food value chains that provide producers with fair economic returns and consumers with affordable, safe, healthy and sustainable food (Destinations 'Biodiversity and ecosystem services' and 'Land, ocean and water for climate action').

**Sustainable fisheries and aquaculture** contribute directly to environment-friendly, inclusive, safe and healthy food production by providing highly nutritional proteins, lipids and micronutrients for a healthy diet. Sustainably produced food from marine and freshwater bodies can and should account for a much bigger proportion of our overall food consumption. The farm to fork strategy seeks to help fishers and aquaculture producers to achieve better climate and environmental results and to strengthen their position in the supply chain. R&I will directly support the common fisheries policy (CFP) and deliver inclusive, diversified approaches to allow fisheries management to adapt to different realities, including in the international context. Sustainable and resilient aquaculture systems, including the use of low trophic species (e.g. algae and herbivores), high animal welfare standards and alternative sources of protein for food and feed, will increase seafood production and reduce its environmental impact while adding economic value to the chain. Seafood security will benefit from a drastic reduction in the current massive pre- and post-harvest losses in seafood biomass. Producers' and consumers' awareness, trust and behaviour with respect to the responsible production, consumption and disposal of seafood will contribute directly to the competitiveness and sustainability of the sector. An overarching partnership for a climate-neutral, sustainable and productive blue economy will contribute to food security, added value, blue growth and jobs in Europe through a jointly supported R&I programme in the European seas, coastal and inland waters.

**Transforming food systems for health, sustainability and inclusion** requires robust, system-wide changes at all governance levels (from local to global and vice versa) as food systems are intertwined with all other sectors and are among the key drivers of climate change and environmental degradation. Food systems are to be understood as covering all the sectors, actors, stakeholders, organisations and disciplines relevant to and connecting primary production from land and sea, food processing, food distribution and retailing, food services, food consumption, food safety, nutrition and public health, and food waste streams. The European Green Deal and, in particular, the farm to fork strategy support a shift to more resilient and environmentally, socially and economically sustainable food systems, as required to deliver safe, healthy, accessible and affordable food and diets for all

sourced from land and sea, while respecting planetary boundaries. This will involve a better understanding of the multiple interactions between the components of current food systems, to foster solutions that maximise co-benefits with respect to the four priorities of the Commission's 'Food 2030' R&I initiative:

- nutrition and health, including food safety;
- climate and environmental sustainability;
- circularity and resource efficiency; and
- innovation and empowering communities.

R&I will accelerate the transition to sustainable, healthy and inclusive food systems by delivering in various areas: dietary shifts towards sustainable and healthy nutrition; supply of alternative and plant-based proteins; prevention and reduction of food loss and waste; microbiome applications; improving food safety and traceability; fighting food fraud; behavioural change; personalised nutrition; urban food systems (Destination 'Resilient, inclusive, healthy and green rural, coastal and urban communities'); food systems governance and systems science; and digital and data-driven innovation (Destination 'Innovative governance, environmental observations and digital solutions in support of the Green Deal').

R&I activities supporting the partnership for safe and sustainable food systems for people, planet and climate will help identify and deliver innovative solutions providing co-benefits for nutrition, food quality, the climate, circularity and communities.

The EU also aims to promote a **global transition to sustainable food systems**. Targeted R&I activities, in particular under the EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA) and global initiatives involving international research consortia, will contribute to this ambition.

#### Expected impacts:

Proposals for topics under this destination should set out credible pathways to **fair, healthy, safe, climate- and environment-friendly, resilient food systems from primary production to consumption, ensuring food and nutrition security for all within planetary boundaries in the EU and globally**.

More specifically, proposals should contribute to one or more of the following impacts:

- sustainable, productive, climate-neutral and resilient farming systems providing consumers with affordable, safe, traceable healthy and sustainable food, while

minimising pressure on ecosystems, restoring and enhancing biodiversity, improving public health and generating fair economic returns for farmers;

- sustainable fisheries and aquaculture increasing aquatic biomass production, diversification and consumption of seafood products for fair, healthy, climate-resilient and environment-friendly food systems with low impact on aquatic ecosystems and high animal welfare; and
- sustainable, healthy and inclusive food systems delivering co-benefits for climate mitigation and adaptation, environmental sustainability and circularity, sustainable healthy nutrition, safe food consumption, food poverty reduction, the inclusion of marginalised people, the empowerment of communities, and flourishing businesses.

When considering their impact, proposals also need to assess their compliance with the 'do no significant harm' principle<sup>144</sup>, whereby R&I projects should not support or involve activities that significantly undermine any of the six environmental objectives of the EU Taxonomy Regulation.

To unlock the full potential of R&I and maximise impacts, participatory approaches, e.g. multi-actor approach, involving input from industry, technology providers, primary producers, the food, drink and hospitality industry, consumers, citizens, local authorities, etc. should be promoted with a view to co-creating innovative systemic solutions in support of food systems' sustainability.

Topics under this destination should have impacts in the following impact areas of the Horizon Europe strategic plan for 2021-2024:

- sustainable food systems from farm to fork on land and sea
- climate change mitigation and adaptation;
- enhancing ecosystems and biodiversity on land and in waters;
- good health and high-quality accessible healthcare;
- clean and healthy air, water and soil;
- a resilient EU prepared for emerging threats; and
- inclusive growth and new job opportunities.

## Call - Fair, healthy and environmentally-friendly food systems from primary production to consumption 2021

### Enabling sustainable farming

<b>Topic ID and title</b>	<a href="#">HORIZON-CL6-2021-FARM2FORK-01-04: Tackling outbreaks of plant pests</a>				
<b>Budget</b>	EUR 14 million	<b>Opening date</b>	22 June 2021	<b>Deadline 1</b>	06 October 2021
<b>Budget per project</b>	EUR 7 million			<b>Deadline 2</b>	/
<b>Type of action</b>	Research and Innovation Actions (RIA)				
<b>FTP subsector</b>	F&F				
<b>Keywords</b>	Plant pest spread, pest surveillance, pest biocontrol, pest management, international cooperation, multi-actor approach, foresters				
<b>FTP comments</b>					
<b>FTP SIRA 2030 Challenges addressed</b>	1B - 2A	<b>FTP relevance</b>		High	
		<b>Starting TRL</b>		/	
		<b>End TRL</b>		/	

#### Expected Outcome:

In line with the farm to fork strategy, for a transition to fair, healthy and resilient EU agriculture and forestry, including an ambitious target for the reduced use of plant protection products<sup>150</sup>, proposals will support research and innovation (R&I) to help the agricultural / forestry sectors to remain productive and contribute to sustainable agriculture and/or forest health.

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

- Find adequate responses to EU quarantine plant pests;
- Enhance capacities to prevent, monitor and (bio)control important plant pests;
- Support to relevant EU and Associated Countries' plant health policies.

#### Scope:

Proposals should target one or more plant pest(s)<sup>151</sup> that are either Union quarantine plant pests<sup>152</sup> present in the EU or Union quarantine pests which are priority pests <sup>153</sup> in the EU, and that are of concern for agriculture and/or forestry. They should improve methods and strategies for surveillance and control, and extend the range of tools for integrated and effective pest management.

Proposals should:

- Contribute to the understanding of the drivers of plant pest spread and establishment including the influence of climate change, ecosystem degradation, and globalisation.
- Develop efficient surveillance methods and strategies for early-detection and (bio)control of the pest(s).
- Extend the range of tools and technologies available for the development of economically and environmentally sound solutions for effective pest management in farming and forestry in line with the principles of integrated pest management.
- Analyse the social and economic implications for farmers affected by the plant pest(s) and developing approaches whereby those affected can best cope with the situation.
- Analyse the ecological impact of plant pest(s) spread and establishment.

International cooperation with countries affected or threatened by the same pest(s) is strongly encouraged. Proposals should consider both the conventional and the organic sectors. Proposals must implement the “multi-actor approach” including a range of actors to ensure that knowledge and needs from various sectors such as research, plant health services and farmers/foresters are brought together.

The possible participation of the JRC in the project will consist of supporting the analysis of social and economic implications for farmers affected by the plant pest(s) and developing approaches on how to best cope with the situation when affected.

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

## Call - Fair, healthy and environmentally-friendly food systems from primary production to consumption 2022

### Enabling sustainable farming

Topic ID and title	<a href="#">HORIZON-CL6-2022-FARM2FORK-01-01: Risk assessment of new low risk pesticides</a>				
Budget	EUR 7 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 7 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	agriculture, forestry, pesticides, forest health				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B - 2A	FTP relevance		Low/Medium	
		Starting TRL		/	
		End TRL		/	

#### Expected Outcome:

In line with the farm to fork strategy, for a transition to fair, healthy and resilient EU agriculture and forestry, including an ambitious target of the reduced use of plant protection products, the successful proposal will support research and innovation (R&I) to help agriculture / forestry sectors to remain productive and contribute to sustainable agriculture and forest health.

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

- improve risk assessment of new so-called low-risk substances and plant protection products with the use of relevant methods;
- foster EU regulatory science and risk assessment of new low-risk pesticides for agriculture;
- ensure the safety of new low-risk pesticides used in agriculture through robust and transparent risk assessment;
- increase the availability of safe and environmentally friendly methods for plant protection and weed control to reduce risks to the environment, non-target organisms and human health.

#### Scope:

Topic ID and title	<a href="#">HORIZON-CL6-2022-FARM2FORK-01-02: Socio-economics of pesticide use in agriculture</a>				
Budget	EUR 6 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	agriculture, forestry, pesticides, forest health				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B,E - 2A	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome:

In line with the Farm to Fork Strategy, the successful proposal will support integrated pest management practices facilitating the progress towards the ambitious target of reduced use of plant protection products while supporting the agricultural / forestry sector to remain productive and contribute to sustainable and biodiversity friendly agriculture and/or forest health.

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

- Identify opportunities and barriers to increase the uptake of integrated pest management and low-pesticide-input pest management across the diversity of EU and Associated Countries farming systems.
- Increase the capacity to understand the impact of current pesticide use practices and proposed alternatives on the agricultural sector.
- Thorough understanding of farmers' decision-making, governance aspects and consumption patterns behind integrated pest management and low pesticide use practices.
- Support the design of relevant related policies to achieve the targets of the Farm to Fork and Biodiversity Strategies.
- Strengthened transdisciplinary research and integrated scientific support for relevant EU policies and priorities (Sustainable Use Directive<sup>198</sup>, Common Agricultural Policy, Green Deal objectives, etc.).

### Scope:



Concerns are mounting over the effects of pesticides on the environment, non-target organisms and human health. Member States and EU policies seek to reduce the reliance on chemical pesticides for crop protection through the design and implementation of approaches that are more integrated and include restrictions on the use of several active substances. To ensure the lowest risk to human health and the environment, the development of so-called low-risk substances<sup>175</sup> is encouraged by several regulatory incentives in the EU. However, the changing nature of low-risk plant protection products requires increased capacities in risk assessment. The plant protection products approval and authorization process has to keep pace with scientific and technological developments aiming to advance assessment methods of new low-risk plant protection products.

New products may seek EU market regulatory approval, thus proposals should need to consider and address relevant EU regulatory requirements as well as relevant guidance documents that are to be followed for the specific hazard characterisation and exposure assessment to achieve an appropriate risk assessment.

Proposals should contribute to:

- improve the risk assessment of newly proposed or specifically adapted low-risk pesticides such as new species/strains of microorganisms, ds-RNA-based pesticides, pheromones, plant extracts, and/or microbiome solutions or a new mode of application with the use of relevant methods;
- develop and advance the integration of different tools, technologies and methodologies to support the comprehensive and consistent risk assessments of new low-risk pesticides to ensure safety and sustainability;
- contribute to understanding the biological effects of these new substances and/or products;
- assess the impacts and risks of these new substances and/or products;
- assess and improve the level of certainty in risk assessments of new low-risk pesticides;
- identify the relevant additional studies required for assessing these new low-risk pesticides in order to establish that they have a hazard profile compatible with their classification as low-risk substances and plant protection products;
- contribute to the standardisation and validation of the developed tools, technologies and methods for risk assessments.

## Call - Fair, healthy and environmentally-friendly food systems from primary production to consumption 2022 two-stage

### Enabling sustainable farming

Topic ID and title	<a href="#">HORIZON-CL6-2022-FARM2FORK-02-02-two-stage: Emerging and future risks to plant health</a>				
Budget	EUR 7 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 7 million			Deadline 2	6 September 2022
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Emerging plant pests, integrated pest management, early detection, prevention, biocontrol, multi-actor approach				
FTP comments					
FTP SIRA 2030 Challenges addressed	1B - 2A	FTP relevance		High	
		Starting TRL		/	
		End TRL		/	

#### Expected Outcome:

In line with the farm to fork strategy for a transition to fair, healthy and resilient European agriculture and forestry, including an ambitious target of reduced use of plant protection products<sup>188</sup>, the successful proposal will support research and innovation (R&I) to help the agricultural / forestry sector to remain productive and contribute to sustainable agriculture and/or forest health.

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

- Find adequate responses to new and/or emerging plant pests;
- Improve the understanding of drivers of plant pest emergence including the influence of climate change, ecosystem degradation and globalisation;
- Develop economic and environmentally sound solutions for effective pest management in farming and forestry in line with the principles of integrated pest management;
- Support to relevant plant health policies in the EU and Associated Countries.

#### Scope:

Proposals should target one or more new or emerging<sup>189</sup> plant pests<sup>190</sup> (regulated, non-regulated, introduced or native) that are causing or likely to cause, significant (socio)

economic and/or environmental losses to agriculture and/or forestry in the EU and/or Associated Countries. Within the scope of this topic are pests exhibiting an altered and higher probability of entry and spread in a new area that might be the result of changes in their biology or changes in agriculture or forestry pest management practice or rapid spread in new areas<sup>191</sup>. The choice of target pest(s) should consider the potential threat in terms of development and spread, its potential exacerbation under climate change as well as the potential impact on agricultural production, forestry, trade and the wider environment (including soil and water). Activities should consider both the conventional and the organic sectors.

Proposals should:

- Increase knowledge of the biology, pathways of entry, behaviour in the plant-soil system where relevant, and drivers of spread including the influence of climate change and globalization of pest(s);
- Improve methods and strategies for prevention, early detection and surveillance;
- Develop and uptake rapid and effective tools for the prevention of entry, spread and establishment, early detection, surveillance, treatment and (bio) control of plant pests for a sustainable and integrated pest management;
- Identify and introduce resistance traits to support the long term sustainability of agriculture and forestry in the EU and/or Associated Countries;
- Assess the social and economic implications for farmers and ecological impacts of the plant pest(s) and the development of approaches on how to best cope with these situations;
- Integrate citizen science as a tool to monitor emerging pests.

International cooperation with countries affected or threatened by the same pest(s) is strongly encouraged. Proposals must implement the “multi-actor approach” including a range of actors to ensure that knowledge and needs from various sectors such as research, plant health services and the farming/forestry sector are brought together. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

The possible participation of the JRC in the project will consist of support on the analysis of the potential impact of the studied pests and the development of economic and environmentally sound solutions for effective pest management in farming and forestry in

line with the principles of integrated pest management in particular their acceptance by farmers.

## Destination 3: Circular economy and bioeconomy sectors

This destination and its topics target climate-neutral **circular and bioeconomy transitions**, covering safe **integrated circular solutions at territorial and sectoral levels**, for important material flows and product value chains, such as the textile, electronics, plastics and construction sectors, as well as **key bioeconomy sectors** such as **sustainable bio-based systems, sustainable forestry, small-scale rural bio-based solutions**, and **aquatic value chains**. With this approach, the destination supports the European Green Deal, and other European initiatives such as the Industrial Strategy, SME Strategy, Circular Economy Action Plan, Bioeconomy Strategy, Biodiversity Strategy, Farm to Fork Strategy, Textile Strategy, Plastics Strategy, the Action Plan on Critical Raw Materials, and the Forest Strategy.

More specifically, the focus on **circularity**<sup>197</sup> aims at less waste and more value by extending the lifetime and retaining the value of products and materials. It supports a sharing, reusing, and material-efficient economy, in a safe way, and minimises the non-sustainable use of natural resources. The cascading use of materials and innovative upcycling of waste to new applications is encouraged. The safe and sustainable use of biomass and waste<sup>198</sup> for the production of materials and products, including nutrients, can reduce Europe's dependence on non-renewable resources, cut GHG emissions, offer long-term circular carbon sinks and substitutes to fossil-based and carbon-intensive products, and reduce pressures on biodiversity and its wide range of ecosystem services. The potential of biological resources goes beyond biomass processing into renewable products. It includes the use of organisms and their parts in "green" (i.e. more environmentally friendly) bio-based industrial processes. Marine and land-based biotechnology can provide new sustainable and safe food and feed production methods, greener industrial products and processes, new health-related products, and can help characterise, monitor and sustain the health of marine and terrestrial ecosystems. The potential of marine resources and biotechnology will contribute to the coming "blue economy", accelerating the transition towards a circular and climate-neutral economy that is sustainable and inclusive. The concepts of the circular economy, bioeconomy and blue economy converge and altogether provide an opportunity to balance environmental, social and economic goals, with their sustainability ensured by the life cycle assessment approaches.

Acknowledging the multiple benefits of circularized material/substance and energy flows, such circularity however has to be achieved in a safe, non-hazardous way without (re-)connecting epidemiological pathways or introducing pathogen/toxin enrichment cycles when involving biogenic materials. Established circularized material/substance flows have to be complemented with accompanying research in their safety and non-hazardous to health, society, economy and nature. In addition, a **local and regional focus**<sup>199</sup> is crucial for a

circular economy and bioeconomy that is sustainable, regenerative, inclusive and just. Innovative urban and regional solutions and value chains can create more and better quality jobs and help our economies rebound from the COVID-19 crisis.

A systemic and science-based circular transition with the help of research, innovation and investments will address all issues from material selection and product design via resource efficiency along the value chain to an optimised after-use system, incorporating reuse, repair and upgrade, refurbishment, remanufacturing, collection, sorting and new forms of recycling and upcycling also to improve the waste cycle management. It will tackle all barriers and mobilise all key stakeholders. The development of definitions, taxonomies, indicators and targets will inform and support policy and decision making. The use of advanced life cycle methods such as the European Commission Product Environmental Footprint (PEF), data and information will enable economic actors, including consumers, to make sustainable choices. The development and deployment of specific technological and non-technological circular solutions, including new business models, will cover intra- and inter-value chain collaboration between economic actors. The development of a working after-use system for plastic-based products, incorporating reuse, collection, sorting, and recycling technologies will provide insights into the transition towards a circular economy for key material flows including plastics. The Circular Cities and Regions Initiative (CCRI)<sup>200</sup> under the European Circular Economy Action Plan will expand the circular economy concept beyond traditional resource recovery in waste and water sectors and support the implementation, demonstration and replication of systemic circular solutions for the transition towards a sustainable, regenerative, inclusive and just circular economy at local and regional scale. Water use will be tackled from a circularity perspective, aiming at pollution prevention, resource efficiency and business opportunities.

**Bio-based innovation** lays the foundations for the transition away from a fossil-based carbon-intensive economy by encompassing the sustainable sourcing, industrial<sup>201</sup><sup>202</sup> and small scale processing and conversion of biomass from land and sea into circular bio-based materials and products with reduced carbon and environmental footprint including lower impacts on biodiversity and long-term circular carbon sinks in sustainable products substituting carbon-intensive ones, with improved end-of-life including biodegradability in specific natural as well as controlled environments. It also capitalises on the potential of living resources, life sciences and industrial biotechnology for new discoveries, products, services and processes, both terrestrial and marine. Bio-based innovation can bring new and competitive economic activities and employment to regions and cities in the recovery from the COVID-19 crisis, revitalising urban, rural and coastal economies and strengthening the long-term circularity of the bioeconomy, including through small non-food bio-based

solutions. Furthermore, targeted and well-tailored investments can increase and diversify the income of primary producers and other rural actors (e.g. SMEs).

To enable the bio-based innovation, environmental objectives and climate neutrality will build on a robust understanding of environmental impacts and trade-offs of bio-based systems at the European and regional scale, including the comparisons to similar aspects on the fossil and carbon-intensive counterparts. Systemic impacts of bio-based systems on biodiversity and its wide range of ecosystem services as well as how we restore and use them, need to be assessed, and negative impacts avoided in line with the “do no harm” principle of the European Green Deal. Implementing sustainable and just bio-based value chain requires symbiosis across primary production and industrial ecosystems in regions, Member States and Associated Countries and improved environmental performance of products, processes, materials and services along value chains and life cycles.

The **multifunctional and sustainable management of European forests** as well as the environmentally sustainable use of wood and woody biomass as a raw material have a crucial role to play in the achievement of the EU’s climate and energy policies, the transition to a circular and sustainable bioeconomy as well as the preservation of biodiversity and the provision of ecosystem services such as climate regulation, recreation, clean air, water resources and erosion control among many others. Furthermore, forestry and the forest-based sector offer important opportunities for wealth and job creation in rural, peripheral and urban areas. The condition of European forests is increasingly threatened by a growing number of social, economic and environmental and climatic pressures. The European Green Deal and the EU Biodiversity Strategy for 2030 recognise that the EU’s forested area needs to improve, both in quality and quantity, for the EU to reach climate neutrality and a healthy environment. The multifunctionality and the sustainable forest management under rapid climate change will be enabled through a variety of approaches, including the use of intelligent digital solutions, enhanced cooperation in forestry and the forest-based sector as well as the establishment of an open-innovation ecosystem with relevant stakeholders.

**Aquatic biological resources and blue biotechnology** are crucial to delivering on the Green Deal’s ambition of a ‘blue economy’, which alleviates the multiple demands on the EU’s and the Associated Countries’ land resources and tackles climate change.

The immense marine and freshwater biodiversity both faces and offers solutions to multiple challenges such as climate, biodiversity loss, pollution, food security, green products, and health but remains largely unexplored. Unprecedented advances in the biotechnology toolbox (e.g. -omics, bioinformatics, synthetic biology) have triggered an increased interest in the potential of aquatic bioresources. Further research and innovation will be key to unlocking the value of the marine and freshwater biological resources available in Europe,

including its outermost regions by learning from the functioning and processes of aquatic living organisms to provide a sustainable products and services to the society, whilst avoiding systemic impacts on biodiversity. Algae biomass is becoming increasingly important not only as food but also as a sustainable source of blue bioeconomy products such as pharmaceuticals, cosmetics, and speciality chemicals. Although only a small fraction of marine microbial diversity has been characterised to date, advances in genetic and sequencing technologies are opening new avenues for the understanding and harnessing marine microbiomes such as for the biodiscovery of new products and services for the environment and society.

### Expected impacts

Proposals for topics under this destination should set out a credible pathway to developing circular economy and bioeconomy sectors, achieving sustainable and circular management and use of natural resources, as well as prevention and removal of pollution, unlocking the full potential and benefits of the circular economy and the bioeconomy, ensuring competitiveness and guaranteeing healthy soil, air, fresh and marine water for all, through better understanding of planetary boundaries and wide deployment and market uptake of innovative technologies and other solutions, notably in primary production (forestry) and bio-based systems.

Specifically, the topics will target one or several of the following impacts, for circular economy, bio-based sectors, forestry and aquatic value chains:

- **Regional, rural, local/urban and consumer-based transitions** towards a sustainable, regenerative, inclusive and just circular economy and bioeconomy across all regions of Europe based on **enhanced knowledge and understanding of science**, in particular regarding biotechnology-based value chains, for all actors, including policy makers, to design, implement and monitor policies and instruments for a circular and bio-based transitions.
- **European industrial sustainability, competitiveness and resource independence** by lowering the use of primary non-renewable raw materials and reducing greenhouse gas emissions and other negative environmental footprint (including on biodiversity), enabling climate-neutrality and higher resource efficiency (e.g. by circular design, improved waste management, cascading use of biomass) along and across value chains, developing innovative and sustainable value-chains in the bio-based sectors, substituting fossil-based ones, increasing circular practices in textiles, plastics, electronics and construction, developing recycling technologies and industrial symbiosis, increasing circular bio-based systems from sustainably sourced



biological resources replacing carbon-intensive and fossil-based systems, with inclusive engagement of all stakeholders;

- **Improved consumer and citizen benefits**, including in the rural settings by establishing circular and bio-based systems based on sustainability, inclusiveness, health and safety; reaching a significantly higher level of involvement of all actors (manufacturers, retailers, consumers, public administration, primary biomass producers etc.);
- **Multi-functionality and management of forests** in Europe based on the three pillars of sustainability (economic, environmental and social);
- **Enlarged potential of marine and freshwater biological resources and blue biotechnology** to deliver greener (climate-neutral circular) industrial products and processes, and to help characterise, monitor and sustain the health of aquatic ecosystems for a healthy planet and people.

When considering their impact, proposals also need to assess their compliance with the “Do No Significant Harm” principle<sup>203</sup> according to which the research and innovation activities of the project should not be supporting or carrying out activities that make a significant harm to any of the six environmental objectives of the EU Taxonomy Regulation.

In addition to the impacts listed above, topics under this destination will address the following impact areas of the Horizon Europe Strategic Plan for 2021-2024: “Climate change mitigation and adaptation”, “Enhancing ecosystems and biodiversity on land and in waters”, “A resilient EU prepared for emerging threats”, “Inclusive growth and new job opportunities”, “Industrial leadership in key and emerging technologies that work for people”.

## Call – Circular economy and bioeconomy sectors 2022

### Innovating sustainable bio-based systems and the bioeconomy

Topic ID and title	<a href="#">HORIZON-CL6-2022-CircBio-01-02: Marginal lands and climate-resilient and biodiversity-friendly crops for sustainable industrial feedstocks and related value chains</a>				
Budget	EUR 14 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 7 million			Deadline 2	/
Type of action	Innovation Actions (IA)				
FTP subsector	F&F				
Keywords	Biomass production, Indirect Land Use Change (ILUC), biorefineries, water stress, soil erosion, ecosystem services, Key Performance Indicators (KPI), Life Cycle Assessment (LCA), bio-based sector				
FTP comments					
FTP SIRA 2030 Challenges addressed	2			FTP relevance	Medium
				Starting TRL	/
				End TRL	7

### Expected Outcome

Successful proposals will contribute to the impacts of this destination and the European policies it supports, in particular the European Green Deal, the circular economy action plan and the bioeconomy strategy, and engage all stakeholders. They should help improve European industrial<sup>236</sup> sustainability, competitiveness and resource independence by lowering the environmental footprint (including on biodiversity), enabling climate neutrality and higher resource efficiency (in particular upcycling and cascading use of biomass) along value chains, and developing innovative bio-based products.

Projects results should contribute to all following expected outcomes:

- Identification of the co-benefits potential risks and upscaling potential of sustainable biomass production with a low potential for Indirect Land Use Change (ILUC) with focus on marginal lands<sup>237</sup>. This should include non-edible (industrial) biomass use (such as in biorefineries of various scale and types for climate-neutral circular materials and products); introducing new industrial cropping systems (such as perennial crops).
- An improved understanding of the actual available land in the EU Member States and associated countries that could be used for biomass production that can be certified as 'low ILUC' for use in bio-based sectors; taking into account increasing resilience to

environmental climate change effects such as soil erosion and water stress of the identified crops.

- An increased understanding of the biodiversity challenges and potentials, and the ecosystem services, with due attention to protection measures, coupled with end-user adoption and implementation of environmentally sound practices by all operators (farmers, researchers, and bio-based industry active in rural areas). This should include the replication of such practices across Europe.
- Improved functional performance of the specific value chains and products, and improved resource efficiency thanks to a better application of the cascading use of biomass.

### Scope

Sustainable biomass provision by primary land sectors (agriculture and forestry), supporting climate change mitigation and adaptation. This will require finding a balance between productivity and ecosystem services, notably biodiversity and social sustainability goals.

The topic explores two main aspects. First, enhancing ecosystem services to prepare for increased water stress and water scarcity due to climate change (including the increasing desertification of large parts of the EU, especially of the Mediterranean and Central European Member States). Secondly, serving multi-purpose and optimised<sup>238</sup> biomass production, with a specific focus on improving biodiversity-related benefits, with opportunities for European rural development and improved industrial competitiveness.

The scope includes identifying and developing environmentally and economically viable sources of pollinator-supporting industrial crops (e.g. by exploring the traits supporting the pollinators such as nectar provision, or resistance to pests and diseases, as well as the optimisation of a related agronomic practice). It also includes identifying and optimising crops (e.g. non-edible oil and fibre crops, dryland shrubs and woody crops) that could be adapted through modern biotechnology tools to require low-water/low-input use, and upscaling them in related value chains, e.g. in industrial sectors such as biochemicals, composites or elastomers, with the aim of replacing their fossil-based counterparts.

The topic aims to engage all relevant actors, especially the farming community, but also bio-based industry and academia, and civil society, calling for working together and co-creation, to develop solutions involving end users and taking into account a comprehensive business case at farm/production level.

Proposals should help to increase farming systems' resilience to climate change and boost the sustainability of biomass provision through sound agronomic practices, with particular

focus on high resource efficiency (including water, and nutrients e.g. via nature-based solutions and biodiversity-friendly solutions) and circular use of biomass and other natural resources.

Proposals may develop key performance indicators and life cycle assessment (LCA) criteria for operators, or identify biodiversity hotspots along the value chains and test them against established benchmarks as part of the overall recommendations.

Where relevant, proposals should seek links with and capitalise on the results of past and ongoing EU Member States and associated countries research projects (especially under the Bio-based Industries Joint Undertaking and the future Circular Bio-based Europe partnership).

Proposals should:

- a. Identify and evaluate the most suitable feedstock options for different farming systems and pedo-climatic conditions. The agricultural diversity of EU and associated countries should be considered, and the selected options should contribute efficiently to climate change mitigation/adaptation (with a focus on water scarcity and water stress) and biodiversity preservation and enhancement (with special attention to marginal lands under high risk of desertification), while ensuring overall business case viability.
- b. Develop sustainable diversification strategies that can help optimise the production of agricultural feedstock in the emerging bio-based economy (e.g. through intercropping systems, logistics and storage). Identify and produce crops suited to marginal lands. Optimise intermediary/catch crops to increase biomass production sustainably, or optimise perennial crops and short-rotation coppice plantations in annual crops-dominated agricultural production systems.
- c. Identify and implement the best mix of appropriate technical solutions and practices for specific industrial value chains (a proposal should select and justify the choice). The scale-dependent effects on farms and landscapes should be analysed, as well as the barriers and drivers arising from governance and market issues. Make an effort to inform and engage all actors.
- d. Develop and communicate the methods to monitor and measure the qualitative and quantitative impacts of these solutions and practices for different farming systems, the climate neutrality/negativity potential and trade-offs, including for biodiversity, and the associated improvement in farm/business socio-economic resilience.
- e. Develop and test mechanisms with all actors, notably the research community and bio-based industry. Exchange knowledge on and demonstrate solutions for climate change

mitigation and adaptation, water stress and biodiversity loss (including biotechnology approaches) to rural stakeholders (farmers, foresters) and the broader public, and help them implement them.

f. International cooperation is encouraged to allow the exchange of best practice while ensuring win-win scenarios and contributing to European competitiveness.

For this topic, it is not mandatory to integrate the gender dimension (sex and gender analysis) into research and innovation.

Topic ID and title	<a href="#">HORIZON-CL6-2022-CircBio-01-03: Benefits of the transition towards sustainable circular bio-based systems from linear fossil-based</a>				
Budget	EUR 4 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 2 million			Deadline 2	/
Type of action	Coordination and Support Action (CSA)				
FTP subsector	F&F, WW, P&P				
Keywords	Environmental impact, social impact, economic impact, waste production, non-renewable resources, biodiversity loss, land use, ecosystem services, scenarios comparison, nature-based solutions (NBS), bio-based solutions				
FTP comments					
FTP SIRA 2030 Challenges addressed	4			FTP relevance	Low
				Starting TRL	/
				End TRL	/

### Expected Outcome

Successful proposals will support policy makers in their efforts to develop sustainable pathways to replace fossil and carbon-intensive systems with circular bio-based systems at the EU and regional scale, in line with the 2030 climate targets and European Green Deal objectives. Project outcomes will contribute to foster European industrial sustainability, competitiveness and resource independence.

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

- Policies are designed to enable the transition from linear fossil-based systems to circular bio-based systems, setting priorities.

### Scope

Abandoning the current linear fossil-based economy is a prerequisite for European Green Deal objectives and, in general, for preserving life on our planet. Biogenic resources are key means of mitigating climate change as they can strengthen natural and anthropogenic carbon sinks. Circular bio-based systems are part of the solution to achieving climate neutrality, where they replace carbon-intensive and fossil-based systems and are based on sustainably sourced biological resources. Policies must ensure that this transition from linear fossil-based to circular bio-based systems is sustainable and aims at i) climate change mitigation and adaptation; ii) increasing resource efficiency and circularity; iii) preserving and restoring natural resources, their ecosystem services and biodiversity; and i) ensuring a just transition for everyone. Policies and priorities should be comprehensive and underpinned by a critical assessment of the environmental/social/economic impacts of the current linear fossil-based economy. That assessment should help individuating policy priorities, as well.

To support designing policies to transition away from linear fossil-based systems towards sustainable circular bio-based ones, proposals should:

- a. Consolidate knowledge on current trends in terms of the environmental, economic and social limits of a linear carbon-intensive and fossil-based economy. By limits, we mean technical and structural barriers and/or inability to reach local and global Sustainable Development Goals (e.g. SDGs, climate change mitigation targets, European Green Deal objectives). Cultural and social limits should also be considered, including barriers related to gender and age.
- b. Develop new/improve existing methodologies to assess environmental/social/economic impacts of linearity vs circularity in the economy, including on waste production and disposal, non-renewable resources exploitation and loss, geographically (and socially) unbalanced distribution of resources and growth, biodiversity loss at global and local scale. The methodologies should consider circular economy indicators, methods and concepts developed or under development in existing initiatives, including Commission's ongoing work on the circular economy monitoring framework and R&I activities.
- c. Assess the environmental/social/economic impacts of the EU's current linear fossil-based economy. This should include aspects related to the geographical distribution of oil origins and global trade, direct and indirect environmental impacts of fossil-based value chains on a life cycle base, including on, but not limited to, climate change, resource use including land, water and marine space, air/water/soil quality, ecosystems services and biodiversity. Costs arising from environmental and social impacts should be internalised in the economic impacts assessment.
- d. Develop and compare multiple scenarios of transitioning from fossil-based to circular bio-based systems, modelling the replacement of the fossil-based activities, with a focus on the most carbon-intensive ones, with bio-based systems, including innovative solutions, at EU and global scale. Environmental/social/economic impacts of bio-based systems should be assessed with validated methodology, considering also the benefits of applying a circular approach to the bio-based systems. Biogenic carbon capture utilization (BCCU) solutions for bio-based systems via nature-based solutions (e.g. in soils or long-term circular bio-based materials) should be part of the assessment. Scenarios should compare the impacts of fossil-based and bio-based solutions, and include social aspects and social innovation, especially at the socio-technical interfaces of innovative solutions.
- e. Identify knowledge gaps in the assessment of the sustainability of the transition from fossil-based to circular bio-based systems and in the comparison between alternative scenarios as described under point d).

f. Identify priorities in the transition from fossil-based to circular bio-based systems, according to scenarios analysed in the project and develop guidelines and policy recommendations.

Proposals should include a task dedicated to sharing methodologies and findings with projects funded within this topic.

This topic should involve the effective contribution of social sciences and humanities (SSH) disciplines.



## Safeguarding the multiple functions of EU forests

Topic ID and title	<a href="#">HORIZON-CL6-2022-CircBio-01-06: Strengthening the European forest-based research and innovation ecosystem</a>				
Budget	EUR 4 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 4 million			Deadline 2	/
Type of action	Research and Innovations Actions (RIA)				
FTP subsector	F&F, WW, P&P				
Keywords	EU Forest Strategy, open-innovation ecosystem, funding possibilities, trans-national R&I cooperation, R&I roadmap, multifunctionality of forest, forest management, multi-actor approach				
FTP comments					
FTP SIRA 2030 Challenges addressed				FTP relevance	High
				Starting TRL	/
				End TRL	/

### Expected Outcome

To support the new EU forest strategy, successful proposals will assess research needs and funding possibilities for forestry and the forest-based sector, notably for the multifunctionality and management of forests in Europe based on the three pillars of sustainability (economic, environmental and social). Project results are expected to contribute to all of the following expected outcomes:

- Better insights into existing funding sources (including Horizon Europe, rural and regional development funds) and streamlining of research and innovation (R&I) actions in Europe.
- Establishment of a co-creative environment allowing stakeholders to identify jointly existing research gaps and future priorities to coordinate research efforts at regional, national and European level.
- Intensified trans-national R&I cooperation in forestry and the forest-based sector on research priorities, critical and key technologies.
- Creation of an open-innovation ecosystem with relevant stakeholders in the EU and associated countries to support the evolution of the forest-based sector.

### Scope

A key R&I challenge for the coming years is to address the complexity of the forest-based sector in environmental terms (long life cycle, ecosystem functioning and diversity, spatial variability, interface between the soil and the atmosphere, in the middle between cultivated and natural assets), economic terms (multiple forest owners and SMEs, competitiveness on

global markets) and policy terms (many forest-related policies including biological diversity, climate and energy, bioeconomy, rural development, trade, agriculture, etc.).

A successful transition of the forest-based sector towards greater sustainability needs to be underpinned by a comprehensive scientific assessment. Better coordination of research activities is also required to overcome fragmentation of public research efforts, to strengthen the link between forest managers, industries and society and to streamline the activities of European, national and regional stakeholders.

Proposals will:

- Analyse the forest-based sector in an integrated way, considering different biodiversity and bioeconomy issues, societal expectations and climate change risks that call for an intensified European and international collaboration.
- Design a suitable method for conducting foresight analysis on issues that are likely to have an impact on forests in European regions and globally.
- Consider the future availability of and demands for different forest resources, and assess their sustainability within the changing global economic, social and environmental conditions.
- Provide evidence and knowledge on how existing funding sources at EU (including Horizon Europe, rural and regional development funds), Member State, associated countries' and regional levels are mobilised to support research and innovation initiatives in the forest-based sector.
- Address the necessity for new knowledge to support major transitions and innovations in forestry and the forest-based sector in view of the new EU forest strategy and other major policy initiatives.
- Develop a structured framework for a European network of research funding and research policy organisations across the different parts of the forest-based and related sectors to increase cross-fertilisation between different areas of knowledge generation and innovation activities.
- Develop an R&I roadmap at EU-level and prepare for a possible European partnership or other appropriate comprehensive actions under Horizon Europe.
- Provide scenarios and information on how to maximise synergies and minimise trade-offs between the different funding instruments and research needs (environmental, economic and social dimensions)

- Assess the potential of flagship projects in selected key strategic areas in the forest-based sector (e.g. integrated forest research across several dimensions of sustainable forest management; landscape-level integration of forest research at the interface with other sectors (agriculture, cities, water); increased, sustainable wood production and mobilisation; renewable building materials for healthier living; role of new wood-based products to reach climate neutrality by substitution effects; contributions of the forest-based sector in the green recovery).

Proposals must implement the ‘multi-actor approach’ and ensure a value chain approach, with adequate involvement of the forestry and forest-based sector.

Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

## Call – Circular economy and bioeconomy sectors 2022 two-stage

### Enabling a circular economy transition

#### Innovating sustainable bio-based systems and the bioeconomy

Topic ID and title	<a href="#">HORIZON-CL6-2022-CircBio-02-02-two-stage : Exploring extreme environments: novel adaptation strategies at molecular level for bio-based innovation</a>				
Budget	EUR 10 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 5 million			Deadline 2	01 September 2022
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	biochemical, ecological adaptation, climate change mitigation, biotechnology, bio-based products, environmental footprint, biomass resources, biodiversity preservation				
FTP comments					
FTP SIRA 2030 Challenges addressed	2A			FTP relevance	Low
				Starting TRL	/
				End TRL	4-5

#### Expected Outcome

Projects will contribute to the expected impacts identified for Destination ‘Circular economy and bioeconomy sectors’, and to the European policies it supports, in particular the European Green Deal, the circular economy action plan and the Bioeconomy and biodiversity strategies. Their results will help to improve the European industrial sustainability, competitiveness and resource independence by lowering the environmental footprint (including on biodiversity), enabling climate-neutrality and higher resource efficiency (in particular upcycling and cascading use of biomass) along and across value chains, developing innovative bio-based products. They will engage all stakeholders and improve their knowledge and understanding of science, in particular biotechnology-based value chains

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

Deeper understanding of the molecular, biochemical and cellular mechanisms of ecological adaptation of terrestrial and aquatic organisms in response to life under extreme or changing environments, while strengthening the remediation options at macro level for the studied populations, including by their interactions, thus contributing to expanding the range of potential climate change mitigation strategies.

- Stronger innovation capacity by applying the discovered principles (including via biotechnology routes) to the development of more resilient innovative feedstocks needed for sustainable bio-based products<sup>247</sup>
- A significantly improved environmental footprint of novel feedstocks based on discovered principles<sup>248</sup>, and a wider range of sustainable biomass resources available to European industry, that are important for industrial competitiveness and SMEs participation, thus helping to create skilled jobs and boost the economy.
- Increased public understanding in Europe of biotechnology, the conservation of biodiversity, and EU biodiversity strategy goals. Respect of the principles of access and benefit sharing (UN Biodiversity Convention), via clear, inclusive and transparent communication strategies.

### Scope

The topic covers R&D needed to advance and potentially exploit knowledge on the ways terrestrial and aquatic organisms and their populations adapt, on molecular, physiological, and ecological levels, to the effects of climate change, such as by tolerance to extreme temperatures, drought/water stress, salinity or increased biotic pressures (new pests), as observed at macro-scale (e.g. shifting ecological niches). The scope covers understanding the complex interactions between the affected populations (e.g. molecular signalling), and broader outcomes on an ecological level. International cooperation is strongly encouraged to maximise the impact.

Where relevant, proposals should seek synergies and capitalise on the results of past and ongoing research projects. Proposals should:

- Identify and justify the choice of the selected organism or system under investigation, specifying the level and characteristics of the environmental stimuli covered (i.e. extreme or changing environment linked to climatic conditions).
- Consider the broader level of climate adaptation in the systems identified, in order to shed light on the possibility and magnitude of applying the discovered principles as part of a mitigation strategy.
- Engage with industrial actors including SMEs to identify and implement the best combination of appropriate technical solutions and in particular biotechnology for specific industrial value chains, for sustainable biomass generation, taking into account the barriers and drivers derived from governance and market aspects, while seeking engagement and understanding of all actors.

d. Develop and communicate the key methods to monitor and measure the qualitative and quantitative impacts of these solutions and practices for different biomass sourcing, optimization, processing and production systems, the potential of replacing available traditional alternatives, if relevant, and trade-offs, including for biodiversity, and potential benefits in terms of the socioeconomic resilience of businesses, job creation and industrial competitiveness.

e. Develop and test mechanisms with all actors, notably the research community and bio-based industry. Exchange knowledge on and demonstrate solutions for improved bio-based products and processes and for addressing other environmental impacts such as on biodiversity to agricultural operators, farmers, fishers, foresters, SMEs and the broader public, and help them implement them.

For this topic, it is not mandatory to integrate the gender dimension (sex and gender analysis) into research and innovation.

## Safeguarding the multiple functions of EU forests

Topic ID and title	<a href="#">HORIZON-CL6-2022-CircBio-02-06-two-stage: Harnessing the digital revolution in the forest-based sector</a>				
Budget	EUR 15 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 6 to 8 million			Deadline 2	1 September 2022
Type of action	Innovations Actions (IA)				
FTP subsector	F&F, WW, P&P				
Keywords	EU Forest Strategy, digital solutions, ICT innovations, ecosystem services, forest resources, wood value chain, precision forestry, harvesting systems, nurseries, harvest planning, operations management, timber transport, Copernicus, Galileo/EGNOS pests, forest fires, multi-actor approach				
FTP comments					
FTP SIRA 2030 Challenges addressed	2B,D - 8C - 9D - 10C,D	FTP relevance		High	
		Starting TRL		/	
		End TRL		6-7	

### Expected Outcome

line with the EU forest strategy and the European digital strategy, successful proposals will demonstrate the potential of digital solutions in forestry and forest-based value chains contributing to the multifunctionality and management of forests in Europe based on the three pillars of sustainability (economic, environmental and social). Project results are expected to contribute to all of the following expected outcomes:

- Deployment of information and communication technology (ICT) innovations in forestry to optimise productivity as well as the delivery of ecosystem services.
- Application of innovative approaches along the forest-based value chain by more accurate tracing methodologies of forest resources.
- A greater competitive advantage for European industries that utilise forest resources more efficiently.

### Scope

The improved use of information flows and intelligent digital solutions that are increasingly available in forest monitoring, management and forestry operations, could help to significantly improve and unlock the efficiency of wood supply chain activities. Modern digital applications also provide promising possibilities to improve forest managers' decision making in a precious and complex forest environment and to improve ecosystem monitoring.

This topic addresses innovations in information systems for forest managers, forest-based industries and policy makers as well as advances in precision forestry, harvesting systems and forest nursery operation, optimised harvest planning, operations management, timber transport and logistics, as well as safety, ergonomics and smart assistance for human workers. The synergetic use of geo-spatial, statistical, and modelling technologies together with information and communication technologies such as aerial and satellite retrievals, (in particular from the Copernicus programme) and the 'web of things' combined with big-data analytics is highly encouraged.

The aim is to harness the potential of ICT and new technologies to improve the sustainability of forest management and logging operations with a view to sharing data throughout the wood value chain, thereby driving greater sustainability, to offer new business models along the value chain and to improve the traceability of forest resources for optimised and transparent supply chains. The integration in the new technologies of climate change impacts on these wood chains should be an essential component. Activities may also include robust and transparent methods and tools for high resolution forest and ecosystems services assessments, natural disturbance risk monitoring and analysis (including pests and forest fires) and disaster response systems.

Besides activities such as prototyping, testing, demonstrating and piloting in a near to operational environment, proposals may include limited research activities. Assessing and deepening the understanding of economic, social and environmental impacts through an enhanced application of digital technologies for foresters, small and medium-sized enterprises (SMEs) and industries, as well as end-consumers will be of special interest, including the assessment of risks and opportunities for jobs in forestry, the wider forest-based sector and rural communities.

Proposals must implement the 'multi-actor approach' and ensure adequate involvement of the primary sector and the wider forest-based value chain. Cooperation with other selected projects under this topic and other relevant projects is strongly encouraged.

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



## Destination 4: Clean environment and zero pollution

Anthropogenic pollution undermines the integrity of Earth ecosystems and severely affects natural resources essential for human life. Keeping our planet clean and our ecosystems healthy will not only contribute to addressing the climate crisis but also help regenerate biodiversity, ensure the sustainability of primary production activities and safeguard the well-being of humankind. In line with the objectives of the European Green Deal, particularly its zero pollution ambition, and the 2030 Climate Target Plan, and other relevant EU legislation<sup>260</sup>, this destination seeks to halt and prevent pollution by focussing the work programme 2021-2022 on fresh and marine waters, soils, air, including from nitrogen and phosphorus emissions, as well as on the environmental performance and sustainability of processes in the bio-based systems. Synergies with other clusters (notably 1 and 5), relevant destinations as well as missions and partnerships will be exploited.

Halting emissions of pollutants to soils and waters is of fundamental significance for the planet. Diffuse emissions of pollutants from land and urban sources, including atmospheric depositions, are a major stress factor for terrestrial and aquatic ecosystems, threatening the quality of surface waters and aquifers, and affecting soil quality and all water-dependent sectors that require a holistic understanding of the pollution sources, key vectors and pathways. Projected impacts of climate change will alter, and notably reduce, the hydrological flows in many parts of Europe, while eutrophication could be exacerbated by increasing temperatures. Climate change and increasing water demand will exert significant pressures on surface and groundwater quality<sup>261</sup>, notably where the combined effect of water table depletion and sea level rise will endanger the integrity of coastal aquifers and groundwater quality. This is due to saline water intrusion or extreme events (e.g. higher tides, storm surges or inland flooding events), which will put coastal wetlands and reservoirs, estuaries and ecosystems at risk. While recognising its essential role in aquatic ecosystems functioning and services, the sediments originating mostly from run-off and erosion are likely the major source of physical pollution of water bodies (excessive turbidity, impacts of deposition, accumulation of litter and debris) and contribute to a large extent to chemical and biological pollution of receiving waters. Beside land use practises, the increasing intensity and variability of precipitation will exacerbate erosion risks, affect the deposition and transport of sediments and could lead to a remobilisation of legacy contaminants and further deteriorate the quality of soils, sediments and water bodies, including aquifers, estuaries and coastal areas, and of their ecosystem function and services.

Keeping nitrogen (N) and phosphorus (P) cycles in balance is another crucial challenge. N and P flows from anthropogenic sources, mostly from excessive or inefficient input of fertilisers (including manure, sewage sludge, etc.) in agriculture, currently exceed

planetary boundaries. Their leaching and run-off negatively affect soil biodiversity, pH, organic matter concentration and carbon sequestration capacity, and cause the eutrophication of water bodies while ammonia and nitrous oxide emissions affect air quality and climate. As all environmental media are concerned, a systemic approach is necessary to limit N/P emissions from different sources, for example through the deployment of alternative fertilising products, and considering regional conditions (geography, climate zones, economy activities, soil properties, eco-system condition, agricultural practices, governance structures etc.), and to bring N/P flows back within safe ecological boundaries

Protecting drinking water and managing water pollution in rural settlements, and in increasingly dense urban areas requires innovative and holistic approaches at city/catchment level to ensure water quality, resilient to the impacts of climate and global change, by considering different spatial and temporal scales and contexts, aging water infrastructures, as well as pollution derived from point and non-point sources, and natural/human-made disasters. Protective measures should consider current and future land use, environmental needs and socioeconomic interests as essential elements for improving water quality and its management and governance. Re-emerging pollutants, such as polychlorinated biphenyls (PCB) or mercury, and contaminants of emerging concern (CECs) in water bodies may have impacts on ecological and human health, and some are not well regulated under existing environmental legislation. Sources of these pollutants include e.g. industry, agriculture, urban runoff, household products, coatings, paints and pharmaceuticals that are normally disposed of to sewage treatment plants and subsequently discharged into water bodies. Micro-pollutants, plastics, pathogens and CECs, individually or combined, represent a concern for a safe and good quality drinking water supply. Increasing water temperatures, notably due to climate change could deteriorate the quality of aquatic ecosystems and drinking water sources by favouring the conditions for enhanced eutrophication as well as pathogen development or the spread of invasive species. Emerging concerns are also growing at the level of drinking water treatment and distribution, notably in relation with disinfection operations and possible harmful effects of by-products and metabolites.

Addressing pollution on seas and ocean is a prerequisite for a healthy planet. The ocean is being polluted and destroyed due to the release of substances or energy in marine waters which initiate a range of subsequent effects. According to a new European Environment Agency report, all four regional seas in Europe have a large-scale contamination problem, ranging from 96% of the assessed area in the Baltic Sea and 91% in the Black Sea, to 87% in the Mediterranean and 75% in the North-East Atlantic Ocean. The main sources of pollution include industrial, agricultural and municipal waste runoff, other human activities (e.g. transport), underwater noise, light, atmospheric deposition, etc. into marine waters.

Increasing the environmental performance and sustainability of processes and products plays a significant role in keeping our planet clean. Environmental pollution resulting from human activity is detrimental to ecosystems at different functional levels, representing, also, an important economic burden for society. Circular bio-based systems, including biotechnology, have the potential to substantially contribute to the European Green Deal objectives, provided that they are developed sustainably and systemically aiming at mitigating the climate change and its impacts, increasing resource efficiency and circularity, preserving and restoring ecosystems services, natural resources, air/water/soil quality and biodiversity. Indicators of such sustainability are needed, building on dynamic perspectives at scales ranging, in space, from planetary to local ecosystems and, in time, from next decade to the end of century and beyond. Environmental impacts should be traced along value chains and trades to enable responsible production and consumption.

### **Expected impacts**

Pollution must be halted and eliminated to guarantee clean and healthy soils, air, fresh and marine water for all. To reach this objective, it will be paramount to advance the knowledge of pollution sources and pathways to enable preventive measures, improve monitoring and control, apply planetary boundaries in practice and introduce effective remediation methods.

Proposals for topics under this destination should set out a credible pathway to contribute to the aforementioned goal to achieve a clean environment and zero pollution, and more specifically to one or several of the following impacts:

- Advanced understanding of diffuse and point sources of water pollution in a global and climate change context, enabling novel solutions to protect water bodies, aquatic ecosystems and soil functionality, and further enhancing water quality and its management for safe human and ecological use, while fostering the EU's and Associated Countries' position and role in the global water scene.
- Balanced N/P flows well within safe ecological boundaries at EU and Associated Countries, regional and local scale, contribute to restoring ecosystems.
- Clean, unpolluted seas in the EU and Associated Countries as a result of successful behavioural, social-economic, demographic, governance and green-blue transitions.
- Circular bio-based systems reversing climate change, restoring biodiversity and protecting air, water and soil quality along supply chain of biological feedstock and industrial value chains, within the EU and Associated Countries and across borders.
- Innovative biotechnology creating zero-pollution bio-based solutions.

When considering their impact, proposals also need to assess their compliance with the “Do No Significant Harm” principle<sup>262</sup> according to which the research and innovation activities of the project should not be supporting or carrying out activities that make a significant harm to any of the six environmental objectives of the EU Taxonomy Regulation.

Actions should develop scientifically robust and transparent approaches and methodologies, building on achievements from previous research activities, where possible and appropriate. To ensure deployment, trustworthiness, swift and wide adoption by user communities, and to support EU and national policy-makers, they should adopt high standards of transparency and openness, going beyond ex-post documentation of results and extending to aspects such as assumptions, models and data quality during the life of projects.

Topics under this destination will address the following impact areas of the Horizon Europe strategic plan for 2021-2024: “Climate change mitigation and adaptation”; “Enhancing ecosystems and biodiversity on land and in waters”; “Good health and high-quality accessible healthcare”; “Clean and healthy air, water and soil”; “A resilient EU prepared for emerging threats”; and “Inclusive growth and new job opportunities”.

## Call – Clean environment and zero pollution 2021

### Increasing environmental performances and sustainability of processes and products

Topic ID and title	<a href="#">HORIZON-CL6-2021-ZEROPOLLUTION-01-05: Environmental sustainability criteria for biological resources production and trade in bio-based systems: impacts and trade-offs</a>				
Budget	EUR 6 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Innovations Actions (IA)				
FTP subsector	F&F, WW, P&P				
Keywords	Certification, international trade, bio-based systems, primary biomass resources production, biological feedstock, secondary raw materials, environmental impacts, land use, GHG emissions, ecosystem services, biodiversity, energy consumption, life cycle, traceability				
FTP comments					
FTP SIRA 2030 Challenges addressed	1 - 2E	FTP relevance		Medium	
		Starting TRL		/	
		End TRL		7-8	

#### Expected Outcome

The successful proposal will support tracing environmental impacts of biological resources production and trade by primary producers, traders and certification companies to enable responsible production in the industrial bio-based systems, in line with the 2030 Climate Target Plan and the zero pollution ambition. Project outcomes will contribute to establish circular bio-based systems reversing climate change, restoring biodiversity and protecting air, soil and water quality along supply chain of biological resources and industrial value chains, within the EU and across borders. Project results are expected to contribute to the following expected outcome:

- Certification schemes for international trade at EU and global scale of biological resources for bio-based systems include the environmental impacts and trade-offs along the bio-based supply chains.

#### Scope

Assessment of environmental sustainability of biological resources production and trades in the bio-based systems is still a challenge. Indicators of such sustainability should build on dynamic perspectives at scales ranging, in space, from planetary to local ecosystems and, in time, from next decade to the end of century and beyond.

Proposals should:

- a. Identify the range of biological resources intended for industrial bio-based systems at EU and local (regional/rural/urban/coastal) scale, including primary biomass resources production and biological secondary raw materials from rural/urban/industrial activities. Industrial bio-based systems do not include food/feed, biofuels, bioenergy and cultural/recreation sectors. However, relevant initiatives in the field of assessment and certification of environmental sustainability of biological resources arising from EU policies in the bioeconomy sectors should be taken into account. Aspects of trade of biological resources within the EU and at global level should be part of the analysis.
- b. Collect data and figures on volumes of biological resources identified under a) in global trade flows and imports into the EU and their geographic distribution. The data collection should be based on existing and consolidated statistics and market databases.
- c. Improve existing and/or develop new methodology for the assessment of the environmental impacts and trade-offs of biological resources in the scope addressing, but not limiting to, the following environmental categories: i) GHG emissions/savings and carbon footprint; ii) emissions from nitrogen and phosphorous based fertilisers; iii) land use and land use change and its related impact on land carbon sink capacity; iv) marine space use and marine space use change; v) water use; vi) biodiversity and ecosystem services; vii) energy consumption, viii) any other aspects of air/water/soil environmental quality. Assessments should consider the life cycle perspective and relevant regulatory requirements in terms of trade (across and within the EU), to the extent possible. Trade-offs and synergies with food production, nature-based solution to protect biodiversity or other resources use and ecosystem services (e.g. recreation, urban creep) should be included in the assessment;
- d. Align methodology in c) with indicators (e.g. environmental, demographic, geophysics indicators) provided by consolidated and available database, including networks of environmental observations, efficiently.
- e. Adapt methodology in c) to be suitable to definition/identification of environmental sustainability criteria compliant with the format of certification schemes in terms of either adopting existing certification schemes or developing of ad hoc ones. Criteria should be aligned with the Commission's Taxonomy Regulation<sup>271</sup>. Traceability of biological resources at European and global scale should be essential part of certification.
- f. Demonstrate the developed methodologies for the assessment of environmental impacts and trade-offs, sustainability criteria and certification schemes to a range of biological resources intended for industrial bio-based systems in an operational environment and deliver guidelines.

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

Proposals' consortia should involve primary producers of biological resources, trade bodies, bio-based industries, agencies/companies developing certification, consumers' organisations and any stakeholder along the supply chain of biological resources for bio-based industries.

Topic ID and title	<a href="#">HORIZON-CL6-2021-ZEROPOLLUTION-01-07: International and EU sustainability certification schemes for bio-based systems</a>				
Budget	EUR 6 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 2 million			Deadline 2	/
Type of action	Coordination and Support Action (CSA)				
FTP subsector	F&F, WW, P&P				
Keywords	Business-to-business (B2B), certification schemes, LCA, Labels for biobased materials, bio-based value chain transparency, circular bio-based systems, biodiversity restoration, bio-waste, secondary raw materials				
FTP comments					
FTP SIRA 2030 Challenges addressed				FTP relevance	Medium
				Starting TRL	/
				End TRL	/

### Expected Outcome:

The successful proposals will support tracing environmental impacts along value chains and trades in the bio-based systems for business-to-business communication to enable responsible production and consumption, in line with the 2030 Climate Target Plan and the zero pollution ambition. Project outcomes will contribute to establish circular bio-based systems reversing climate change, restoring biodiversity and protecting air, soil and water quality along supply chain of biological resources and industrial value chains, within the EU and across borders.

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

- Bio-based value chains transparency in international and EU trade is enhanced through business-to-business labels of biological resources and bio-based materials and products.
- Harmonization of existing international and EU certification scheme and the monitoring system and indicators of their effectiveness and robustness.

### Scope:

Climate neutral circular bio-based systems have the potential to establish a zero-pollution economy provided that they are developed sustainably. Environmental, social and economic impacts and trade-offs should be traced along value chains and trades to enable responsible production and consumption. Activities under this topic should assess scope, potential and requirements of international and EU sustainability certification schemes and business-to-business labels applicable to biological resources including primary biomass resources and bio-waste and residues intended for bio-based industrial value-chains and to bio-based materials and products, also in complementarity with actions on bio-based innovation and



market measures. Industrial bio-based systems do not include food/feed, biofuels, bioenergy and cultural/recreation sectors. However, relevant initiatives in the field of assessment and certification of environmental sustainability arising from EU policies in the bioeconomy sectors should be taken into account. Traceability of biological resources and bio-based materials and products on a business-to-business level, at the EU and the global scale, should be part of certification, including aspects on primary and secondary biomass and bio-based intermediates in global trade flows and imports into the EU.

Proposals should:

- a. Review and analyse existing international and EU sustainability certification schemes and business-to-business labels for biological resources. The analysis should encompass schemes applied/applicable to biological resources intended for industrial bio-based value chains. Certified environmental, social and economic impacts and trade-offs should be analysed. Bio-waste and any biological secondary raw materials from rural/urban/industrial activities are included in the definition of biological resources.
- b. Collect data and figures on volumes of biological resources and bio-based materials and products in global trade flows and imports into (exports from) the EU and their geographic distribution, distinguishing between certified and uncertified resources and materials/products. The data collection should be based on existing and consolidated market databases.
- c. Review and analyse existing international and EU sustainability certification schemes and business-to-business labels for bio-based materials and products with the same level of detail apply to the analysis of resources (point a).
- d. Assess existing/develop new monitoring system and indicators of effectiveness and robustness of existing certification schemes and labels reviewed in point a) and c). The task should consider the life cycle analysis perspective and identify minimum requirements of a certification scheme to ensure its completeness covering environmental, social and economic aspects.
- e. Demonstrate/test effectiveness of existing (voluntary) certification schemes and labels and monitor their robustness; this action includes testing the monitoring system and indicators assessed/developed within the project, point d, on the reviewed schemes, point a) and c). The results should consolidate the optimal monitoring system and indicators and provide a preliminary selection of (parts of) the certification schemes covering the minimum requirements identified in point d). The same for labels.

f. Assess costs from the adoption of certification schemes and labels in selected industrial bio-based value-chains. The assessment includes selecting a range of value-chains in the EU and Associated Countries and the corresponding biological resources and flows of materials and products among those certified and reviewed in point a and c and collecting data and figures on the known costs: actual economic and internalised environmental and social ones. The evaluation of the externalised environmental and social costs should be part of the overall assessment, based either on primary data or/and on models taken from peer-reviewed literature in the related fields of economy, social and environmental sciences.

g. Evaluate the feasibility of business-to-business labels that award best performances either of resources or material or products from either environmental or social aspects. The feasibility should include modelled economic costs and benefits.

h. Analyse and develop recommendations on how to promote the best practices in the adoption of effective and robust certification schemes and business-to-business labels. Promoting actions may include deployment and take-up by industrial sectors of certification schemes, building trust between business stakeholders, deploying corporate responsibility, engagement with and awareness of bio-based sectors.

i. Engage in cooperation with international partners and organisations, to increase impact and outreach, while ensuring sufficient focus on the EU's situation.

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

Proposals should include a task dedicated to sharing methodologies and findings with projects funded within this topic. Proposals' consortia may include, but not be limited to, experts in certification schemes and stakeholders of the international and EU trade of biomass resources and bio-based materials and products.

This topic should involve the effective contribution of SSH disciplines.

Topic ID and title	<a href="#">HORIZON-CL6-2021-ZEROPOLLUTION-01-09: Environmental impacts and trade-offs of alternative fertilising products at global/local scale</a>				
Budget	EUR 4 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 2 million			Deadline 2	/
Type of action	Coordination and Support Action (CSA)				
FTP subsector	F&F				
Keywords	alternative fertilising products				
FTP comments					
FTP SIRA 2030 Challenges addressed	2A,D	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome:

The successful proposals will support awareness of environmental performances of alternative fertilising products and their uptake by stakeholders and local administrators, in line with the zero pollution ambition. Projects outcomes will contribute to maintaining nitrogen and phosphorus flows well within safe ecological boundaries at the EU, regional and local scale and to restoring ecosystems.

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

- Orienting the production and the application of alternative fertilising products according with the best environmental performances and practices.
- Local administrations formulate policies to support the development of sustainable local value chains deploying alternative fertilising products.

### Scope:

The scope of this topic is the assessment of environmental impacts and trade-offs of the production and application of a range of fertilising products derived from secondary raw materials which could replace nitrogen- and phosphorus-based fertilisers produced from conventional processes (including mining and fossil-based processes) in a life cycle perspective. Examples of alternative fertilising products within the scope include products made from secondary raw materials such as, for example: recycled nutrients from urban and industrial waste water and sewage sludge, organic fertilising products from bio-waste, from any biological residue or by-products, from digestate and from treated manure.

Proposals should:

- a. Collect all relevant data and figures on a range of fertilising products derived from secondary raw materials. Information should include all phases of their life cycle:

production, distribution/trade, storage, application on lands and consequent transformation/diffusion into the different environments. The range of alternative fertilising products should be selected in order to cover at least one product from each main waste/residue raw material, i.e. at least one from each of: urban waste water, industrial waste water, sewage sludge, bio-waste, biological by-products, digestate and treated manure.

- b. Apply and/or improve existing methodologies to assess the environmental impacts and trade-offs of the alternative fertilising products selected at point a) on a life cycle base, building on and complementing existing assessment results published by European Commission (project SAFEMANURE279). In particular, methodology and assessment should include the territorial and practical factors in terms of local vs global production and trade, local management procedures (storage, spreading on soils) also depending on specific agricultural applications and practices (e.g. agro-ecological vs traditional approach, current legislation at national level, within the consortium). Impacts and trade-offs should include categories on: climate change mitigation, including in terms of restoring the carbon sink capacity of soils, biodiversity and ecosystems protection, including soil biodiversity and below-ground ecosystems, land use and land use change, water consumption, energy use, nitrogen and phosphorus flows into the environment and any other pollutants' emission that affect air/water/soil, including microplastics. Methodology and assessment should rely on existing procedures, e.g. Product Environmental Footprint method<sup>280</sup> and other validated/certified modelling and objective techniques, experimental tests, consultation of peer-reviewed scientific literature;
- c. Relevant data may feed into the European Platform on Life Cycle Assessment<sup>281</sup> if feasible;
- d. Analyse technical aspects of the environmental impacts prevention and control operations during all phases of life cycle of the selected alternative fertilising products and their effectiveness. Include preliminary assessment of costs of installation/maintenance and social benefits of such operations. Alternative fertilising products under this proposal seeking market regulatory approval, should consider relevant regulatory requirements.

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

Activities should include a thorough analysis of past research projects and studies developed under the EU funding programmes. Proposals should include a task dedicated to sharing

methodologies and findings with projects funded within this topic. Proposals' consortia should include stakeholders from the whole value chain such as producers of fertilisers and farmers, as well as scientists and experts in the analysis of environmental impacts of agricultural products.

Topic ID and title	<a href="#">HORIZON-CL6-2021-ZEROPOLLUTION-01-10: Environmental services: improved bioremediation and revitalization strategies for soil, sediments and water</a>				
Budget	EUR 11 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 5,5 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	bioremediation, biotechnology, resource recycling, nature-based solutions (NBS)				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B	FTP relevance		Low	
		Starting TRL		/	
		End TRL		4-5	

### Expected Outcome:

In line with the European Green Deal and its zero pollution ambition and Climate Pact, the successful proposal should support circular bio-based systems reversing climate change, restoring biodiversity and protecting soil and water quality along the supply chain of biological feedstock and industrial value chains, within Europe and globally, as well as deliver innovative “zero-pollution” bio-based biotechnology solutions and advanced bioremediation methods for environmental protection.

Project results should contribute to all of the following outcomes:

- Improved bioremediation and revitalization strategies for contaminated environments, including soil, sediment, surface water and groundwater using recent advances in biotechnology;
- New approaches for efficient bioremediation and resource recycling;
- Provide science-based evidence and bio-based solutions enabling a better assessment of pollution threats from pollutants’ remobilisation to soil, sediment, surface water and groundwater;
- Reduce the main negative impacts of pollution in terms of loss of biodiversity and ecosystem services;
- Validated newly developed and effective bioremediation methods in different environmental conditions, also based on microbiome exploitation potential;
- Improved overall environmental performance (soil and sediment health, water quality, reduction of emissions, etc.);

- Improved environmental footprint and lower toxicity of processes, products and services by means of biotechnologies;
- Advanced assessment of effective methods of bioremediation with improved environmental, economic and social sustainability.

#### Scope:

Environmental pollution has been a major concern over the past few decades influencing the quality of life. Contamination of soils, sediments and water remains a major ecological problem. This pollution contains dangerous and persistent toxic substances that have adverse effects on human health and the environment. Pollutants resulting from human activity are detrimental to ecosystems at different functional levels, representing an important economic burden for society.

Remediation strategies, such as chemical and physical approaches, are not enough to mitigate pollution problems. Bioremediation using microbes is a sustainable, eco-friendly and socially acceptable alternative to conventional remediation approaches and helps improve the environment. It plays a significant role in monitoring “Zero-pollution”. Many microbes with bioremediation potential have been isolated and characterised but, in many cases, cannot completely degrade the targeted environmental pollutant or are ineffective in situations with complex contamination such as mixed waste.

The topic aims at improving bioremediation and revitalization strategies for soils, sediments, surface water and groundwater while respecting the EU legislation and regulations applicable in this area, including the use of naturally occurring and optimised organisms.

Proposals should:

- Identify and analyse optimised proteins, microorganisms, microbiomes, plants, and animals (specifically fish and molluscs/bivalves including mussels) for sediment, watershed and wastewater remediation and revitalization (e.g. novel enzymes to degrade xenobiotic small molecules such as toxins, antibiotics and microplastics, selective uptake of non-degradable metal toxins, bioadsorption);
- Identify and characterise plant platforms, microorganisms and microbiomes that can be optimised for efficient remediation of a range of contaminated environments (e.g. enzymes optimised for efficient bioconversion and/or biosequestration of environmental contaminants, biological tools/systems for land-based bioremediation, phytoremediation for contaminated industrial sites);

- c. Identify and characterise plants transformed with pathways and metabolisms that enable the uptake of targeted contaminants and that have clearly visible 'markers' for public surveillance (for example, colours that clearly mark the plant as being genetically modified, so as to prevent people from eating these plants);
- d. Develop strategies for efficient metabolic pathways of naturally-occurring species to be re-introduced into the environment;
- e. Develop sustainable and cost-effective technologies for bioremediation of water resources used for water production and effective in situations with mixed waste (e.g. nature-based solutions)<sup>282, 283</sup>; and/or develop sustainable and cost-effective technologies for bioremediation of soil resources, including those effective in situations with mixed waste;
- f. Enable new microbial approaches, such as combinations of synthetic auxotrophies, that increase the safety and reduce the risk of deploying optimised microbes in the field;
- g. Develop and analyse the ability of defined consortia of bacteria, fungi algae and/or other organisms to most productively revitalise soil, sediment and water sources (for example, by researching functioning of ecosystems in the hyporheic zone, which plays a crucial role in the purification of bank filtered water and thus in ensuring a safe supply of drinking water in several countries);
- h. Identify and assess (with quantification) the key environmental, economic, social and safety benefits of bioremediation and revitalization strategies for soils, sediments, surface water and groundwater compared to standard physicochemical remediation approaches;
- i. Where relevant, proposals should seek synergies and capitalise on the results of past and ongoing research projects <sup>284, 285</sup>

For this topic, it is not mandatory to integrate the gender dimension (sex and gender analysis) into research and innovation.



## Destination 5: Land, ocean and water for climate action

Assessing the impacts of climate change on our land and marine environments, natural resources, agriculture and food systems, and identifying mitigation options and adaptation pathways, requires interdisciplinary and multidisciplinary research and investments across a broad range of activities. Research is needed to better understand who or what is exposed and sensitive to these changes, their underlying vulnerability, the associated costs and adaptive capacity. Research is also required to provide mitigation options that reduce the risk of long-term climate change

The conservation and enhancement of Earth's natural carbon sinks such as soils and plants, forests, farmed lands, wetlands and the oceans is crucial. The European Green Deal green oath to "do no harm", requires a careful examination of the trade-offs and synergies among the sustainability goals, including health protection, food and nutrition security, ecosystem services and biodiversity preservation both on land and at sea. R&I has a significant role to play to support the design and implementation of policies that will ensure the achievement of EU climate objectives.

Agriculture has a significant role to play to reduce and mitigate GHG emissions and to enhance carbon sinks. It also needs to strengthen its capacity to adapt to climate change and its resilience. The forestry sector faces similar challenges.

Freshwater resources are increasingly under stress as a consequence of overuse and climate change with wide-ranging consequences for human societies and ecosystems. It is therefore necessary to define the safe operating space in terms of water quantity and availability, reduce the vulnerability to change and enhance our adaptive capacity.

Strengthening the ocean and climate nexus is another priority for the EU. There is growing political awareness of the importance of ocean and polar regions as an integral part of the Earth's climate system and of the need to ensure the integrity and resilience of these ecosystems.

While new knowledge leading to a better understanding of the impacts of climate change is necessary, a strong priority needs to be granted to the large-scale deployment and uptake of solutions for climate adaptation and mitigation. Environmental observations and related solutions will be necessary throughout, from understanding to deployment.

Understanding the impacts of climate change on primary production and natural systems is a pre-requisite for policy and societal action on climate change adaptation and mitigation. At present, our understanding of the interactions between climate change and ecosystem management, protection and restoration is limited, yet it is crucial to enabling sound

decision making for mitigation and adaptation measures. Monitoring and evaluation of the impacts of climate change, land use change and associated biodiversity loss on a range of key issues related to agriculture and forestry are crucial with respect to the transition to net-zero emissions in the EU. R&I are also needed to close knowledge gaps in support of decision-making aimed at preserving the integrity of ocean and aquatic ecosystems through a better understanding of the drivers of change and of emerging threats. Moreover, since water availability is vulnerable to climate change, it is necessary to improve the projections of changes to the water cycle at different relevant scales and projections of the frequency and intensity of extreme events. We also require improved long-term observations and assessment of the effects of climate change on diverse water uses and on the state of ecosystems and their services.

Reducing GHG emissions and enhancing carbon sinks in primary production and natural systems are key elements of the European Green Deal. Achieving sustainable land management and efficient use of natural resources that foster climate change mitigation 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 and the environmental footprint of land use changes and agricultural activities. R&I, new technologies and business models are expected to unlock the full potential of LULUCF293 activities in the mitigation of climate change. Results of funded activities will benefit land and forest management and the delivery of multiple services provided by land and forests, such as the provision of goods as long-term carbon stocks in harvested wood products, peatlands and wetlands, the protection of soils, water and biodiversity and finally climate change adaptation and mitigation. Ocean is also a large storage system for the global reservoirs of climate-regulating factors. R&I will advance knowledge innovations to foster ocean-based solutions/mitigation options, helping to close the emissions gap.

Climate action calls also for fostering adaptation to climate change of ecosystems, primary production, food systems and the bioeconomy. Climate change is exacerbating existing risks to livelihoods, biodiversity, human and ecosystem health, infrastructure and food systems. There are growing concerns regarding the role of climate change in the spreading of new plant and terrestrial and aquatic animal diseases, which can jeopardise food safety and security. Human activities relying on the availability and use of water are particularly impacted by variable and extreme weather events, which may at the same time lead to desertification. Agriculture and forestry in the EU are vulnerable to climate change. There is in particular growing evidence about the effects of climate change, and of extreme weather events, on agricultural production and crop yields, which need to be mitigated, and also on

the forest sector. Coastal areas are also threatened by sea level rise, saline water intrusion, biodiversity loss, ocean acidification, extreme events and a shrinking cryosphere. R&I will, therefore, be critical to foster adaptation and build resilience in agriculture, forestry and coastal areas. They will aim to deliver on the urgent need to foster 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. Water adaptation strategies and approaches will be developed and tested. Appropriate solutions including water allocation schemes will be developed for businesses, farmers and ecosystems. Potential trade-offs, and measures to mitigate and avoid them, will be assessed to ensure environmental sustainability and to keep the objectives of enhancing soil fertility, increasing carbon storage in soils and biomass, benefitting agricultural productivity and food security and reducing biodiversity loss. R&I will also aim at better understanding how institutions and behaviour shape vulnerability and offer opportunities for adaptation.

#### Expected impact

Proposals for topics under this destination should set out a credible pathway to contributing to climate action on land, oceans and water and more specifically to one or several of the following impacts:

- Better understanding and enhancing the mitigation potential of ecosystems and sectors based on the sustainable management of natural resources;
- Advanced understanding and science to support adaptation and resilience of natural and managed ecosystems, water and soil systems and economic sectors in the context of the changing climate;
- Efficient monitoring, assessment and projections related to climate change impacts, mitigation and adaptation potential in order to bring out solutions for tackling emerging threats and support decision-making in climate change mitigation and adaptation policies at European and global levels;
- Fostered climate change mitigation in the primary sector , including by the reduction of GHG emissions, maintenance of natural carbon sinks and enhancement of sequestration and storage of carbon in ecosystems
- Improved adaptive capacity of water and soil systems and sectors including by unlocking the potential of nature-based solutions;
- Better managed scarce resources, in particular soils and water, thus mitigating climate related risks, in particular desertification and erosion, thanks to informed

decision-makers and stakeholders and integration of adaptation measures in relevant EU policies.

When considering their impact, proposals also need to assess their compliance with the “Do No Significant Harm” principle<sup>294</sup> according to which the research and innovation activities of the project should not be supporting or carrying out activities that make a significant harm to any of the six environmental objectives of the EU Taxonomy Regulation.

This destination contributes to support R&I on climate for areas covered by Cluster 6 notably on the implementation of climate change mitigation and adaptation solutions while Destination “Climate sciences and responses for the transformation towards climate neutrality” in Cluster 5 concentrates on activities related to climate science and modelling.

Topics under this destination will have impacts in the following impact areas of the Horizon Europe strategic plan for 2021-2024<sup>295</sup>: “Climate change mitigation and adaptation”; “Enhancing ecosystems and biodiversity on land and in water”; “Clean and healthy air, water and soil”; “Sustainable food systems from farm to fork on land and sea”; “A resilient EU prepared for emerging threats”; “A secure and open EU society”; and “Inclusive growth and new job opportunities”.

## Call – Land, ocean and water for climate action 2021

Topic ID and title	<a href="#">HORIZON-CL6-2021-CLIMATE-01-01: Improved understanding, observation and monitoring of water resources availability</a>				
Budget	EUR 10 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 3 to 5 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	sustainable water management, floods, droughts, ecological flows, Artificial Intelligence (AI), Internet of Things (IoT), computation technologies, GEOSS, Copernicus, multidisciplinary, multi-institutional				
FTP comments					
FTP SIRA 2030 Challenges addressed	1C			FTP relevance	Low
				Starting TRL	/
				End TRL	5

### Expected Outcome:

In support of the European Green Deal and EU water-related policies, successful proposals will contribute to foster the adaptation of water resources to climate change, in particular Destination ‘Land, ocean and water for climate action’ impacts “Advance the understanding and science, and support adaptation and resilience of natural and managed ecosystems, water and soil systems and economic sectors in the context of the changing climate” and “Improve tools and technologies for efficient monitoring, assessment and projections related to climate change impact”

Projects results are expected to contribute to several of the following expected outcomes

- Enhanced knowledge base regarding water related climate change impacts, vulnerability, risk and adaptation assessments in Europe and abroad.
- Provide a more complete picture of future water vulnerabilities, including both water quantity and quality aspects, by better considering the interactions among climate change and variability, land surface and groundwater hydrology, water engineering, and human systems, including societal adaptations to water scarcity
- Support decision makers defining the safe operating space in terms of water quantity and availability, i.e., defining sustainable water management and climate change adaptation measures, meeting growing water supply, food, and energy needs, and controlling the high inter-annual variability in water availability

- Improve Member States' preparedness for climate change impacts with respect to floods and droughts and support more accurate decision making for flood and drought risk reduction and response.
- Improve knowledge of ecological flows in the context of the Water Framework Directive and especially of the impacts of management, infrastructure and climate on ecological flows; improve prediction of drought events and water scarcity and enhance the assessment of the impacts of drought on water quality and biodiversity.
- Minimise the disparities associated with data collection and reporting between researchers and data agencies, enhance the interoperability, in particular through the mainstreaming of community-accepted standards, metadata schemas and data management best practices in line with the FAIR principles, between data providers and data users and strengthen coordination among various monitoring services
- Foster commitments between climate change and water scientists, monitoring services, industry, water utilities and other socioeconomic communities to collect, standardise, and widely disseminate information on water use in different sectors.

#### Scope:

Freshwater resources are under increasing stress as a consequence of overuse and climate change with wide-ranging consequences for human societies and ecosystems. To reduce the vulnerability of ecosystems, society and water consuming economic sectors (agriculture, energy, industry) to climate change, it is necessary to enhance the knowledge on water resource availability and use, on future changes to climate and hydrological systems and on risks of extreme weather events.

Actions should address one or more of the following issues:

- A comparative assessment of the state-of-the-art integrated river basin models that are currently used for assessing water availability and vulnerability in the context of climate change. Models should be capable of simulating both surface and groundwater quantity and quality issues, as well as water supply and use and land use changes. They should be also able to take into account the socio-economic impacts of future climate change scenarios, as well as the costs and benefits associated with the adaptation strategies defined in response to those. In assessing water availability, an estimation should be made of the environmental flows necessary to sustain the health of both terrestrial and aquatic ecosystems. The impacts of various management and hydraulic infrastructure systems on the ecological flows of water and sediments should also be considered in this estimation.

Assessments should be carried out in several river basins within and outside Europe, which are particularly vulnerable to climate change impacts and are facing significant water related problems, with a view to providing policy recommendations for long term infrastructure investments and management strategies beyond the river basins addressed.

- Improve accuracy and spatiotemporal resolution of regional scale projections of changes in precipitation, soil moisture, runoff and groundwater availability for management purposes, and quantification of the related uncertainties. Projections of changes in the frequency and intensity of extreme events such as severe storms, heat waves, floods, including flash floods and droughts should be also made. The potential of recent global observation studies and data collections, in cooperation with relevant EU earth observation initiatives, such as ESA, should be considered.
- Development of techniques, monitoring tools and innovative sensors for advance measurement and calculation of current available water balances and future needs and monitoring, leveraging on advanced computation technologies (e.g. high performance computing, edge analytics, cloud computing, and grid computing), artificial intelligence and Internet of Things
- Development of a long-term observation framework and capacity, in collaboration with the Copernicus programme and GEOSS and any other relevant global observation initiatives, to support integrated analysis of water resource availability in Europe, including the development of community-driven, open access, end-to-end data infrastructures. This framework should be linked the European Open Science Cloud, as a pan-European cross-sectoral data space for research and innovation, and should include all relevant in situ and earth observations needed to monitor and assess the impacts of climate change on water resource availability and to support integrated model developments and adaptation planning responses. Both surface and groundwater resources as well as water quantity and water quality issues should be considered. Particular attention should be given to ensuring availability of data to measure and/or assess relevant water use. In developing this framework, a thorough review of existing observational systems and initiatives at both EU and global level developed over recent years should be undertaken, and experiences and lessons learnt from previous long term water related research studies across a wide range of river basins within and outside Europe should be considered. Cooperation with relevant European water observation institutions and initiatives, such as ESA, EEA and JRC, is important.

Actions should bring together a multidisciplinary and multi-institutional team of researchers to pursue a combination of field data collection, innovative data analysis methods, artificial intelligence and the development of data-driven reduced-complexity models for scientific understanding and to guide management decisions, and to support relevant stakeholders and policy makers.

All in-situ data collected through actions funded from this call should follow INSPIRE298 principles.

In general, the participation of academia, research organisations, utilities, industry and regulators is strongly advised, as well as civil society engagement whenever necessary, also aiming to broaden the dissemination and exploitation routes and to better assess the innovation potential of developed solutions and strategies.

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



Topic ID and title	<a href="#">HORIZON-CL6-2021-CLIMATE-01-08: Agroforestry to meet climate, biodiversity and farming sustainability goals</a>				
Budget	EUR 8 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 4 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	biodiversity, soil conservation, carbon sequestration, soil erosion, pest and disease, biomass, ecosystem services				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B	FTP relevance		Medium	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome

A successful proposal should contribute to the European Green Deal and international objectives to foster climate change mitigation and adaptation in agriculture. It should in particular support the farm to fork's strategy objective of a transition to a fair, healthy and resilient European agriculture, notably its objective to promote agroforestry as a sustainable farming practice that can foster climate change mitigation and carbon sinks in the primary sector, by optimising and deploying agroforestry for climate neutrality and mobilising its mitigation potential as a farming system based on the sustainable management of natural resources. Activities should improve the knowledge base to inform decision-makers and other relevant stakeholders on how agroforestry can contribute to better manage scarce resources such as soil and water in a changing climate. As such, activities should deliver dependable and transparent knowledge base for EU policy design and implementation (common agricultural policy (CAP), European Green Deal objectives, farm to fork and biodiversity strategies, etc.).

Project results are expected to contribute to at least two of the following expected outcomes (depending on the activities covered):

- Improved qualitative and quantitative data availability of the contribution of agroforestry to climate change (mitigation and adaptation), soil conservation and (agro-)biodiversity (including genetic diversity within species) and to greater economic, environmental and social sustainability of farming;
- Improved configuration and management of agroforestry systems, including systems involving animal production, through models and tools;
- Enhanced capacities of various actors to measure the economic, environmental and social performance of agroforestry, in particular at farm level and in relation with the

support scheme designed under the CAP as regards environment and climate objectives, through appropriate methods and indicators;

- A strengthened and more robust agroforestry innovation ecosystem and increased end-user acceptance and implementation of agroforestry in the EU and Associated Countries.

### Scope

Achieving sustainable agricultural production that fosters both climate change mitigation and adaptation and biodiversity preservation and enhancement is a policy objective that implies finding a balance with farm productivity, socio-economic viability and wider sustainability goals. Agroforestry systems include both traditional and modern land-use systems where trees are managed together with crops and/or animal production systems in agricultural settings. These systems have the potential to increase ecosystem services - including soil carbon sequestration, water retention, erosion control, soil nutrients, pollination, pest- and disease-control - and biodiversity, while improving farming productivity, profitability and sustainability of farmers' incomes. Implementation of agroforestry in the EU and Associated Countries needs to be boosted in order to maximise this potential. The management of agroforestry systems is critical for their positive impact on climate and the environment as well as to ensure a balance with productivity and profitability for farmers. This is essential to promote the uptake and long-term sustainability of agroforestry.

Proposals should increase knowledge of the contribution of agroforestry to ecosystem services underpinning climate change mitigation and adaptation, increased biodiversity and farming resilience and boost the implementation of this type of farming systems in different pedo-climatic zones across the EU and Associated Countries. Proposals must implement the 'multi-actor approach' and ensure involvement of farmers and all other relevant actors in the value chain. Proposals should cover the conventional, agroecological and organic sectors. Proposals should build on and expand existing knowledge, tools and initiatives developed by Horizon 2020 projects, and where relevant ensure coordination with those projects/initiatives. Proposals should include a clear plan to collaborate with other projects selected under this topic. In order to achieve the expected outcomes, international cooperation is strongly encouraged. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Proposals should address at least five of the following activities:

- Design agroforestry systems for climate change (mitigation and adaptation) and increased (agro-)biodiversity that also ensure farming resilience to fluctuating climate, environmental and socio-economic conditions, farm income stability and enhanced ecosystem services, in different regions and pedo-climatic conditions;
- Develop methods and indicators that allow the identification of newly established agroforestry systems and monitor their performance over time. Analysis of trade-offs and synergies (e.g. between ecosystem services and between the environmental and socio-economic benefits) should be included;
- Develop models and tools adapted to real farm conditions and considering the full amount of food, feed (for systems including livestock), timber or biomass and ecosystem services produced, to allow the configuration and efficient management of agroforestry systems that take into account aspects such as tree renewal, adaptation to biotic and abiotic stresses, selection and improvement of agricultural varieties and animals most suited for agroforestry, recovery and improvement of biodiversity, soil water related aspects, and erosion control, in different regions and pedo-climatic zones;
- Building on existing tools and methods where available, enhance quantification of the contribution of agroforestry to ecosystem services underpinning climate change (mitigation and adaptation) in relation to aspects such as carbon sequestration potential, stability of organic carbon in the soil (top- and sub-soil), reduction of greenhouse gas emissions, soil erosion control, pest and disease control, increased organic matter in (top- and sub-) soil, and nutrient recycling, and develop indicators. When animals are present, animal production, health and welfare aspects should be considered;
- Enhance quantification of the contribution of agroforestry to increased (agro)biodiversity, including on pollinators, and the linkages with soil quality and water quality and quantity, and develop indicators, as well as guidance for species selection;
- Improve knowledge of the economic, environmental and social performance of agroforestry systems and their contribution to sustainable food and feed / non-food biomass production, analysing their productivity and profitability for farmers and factors influencing farmers' decision-making, and considering aspects such as crop / tree and livestock / tree combinations, factors explaining yield response variability, tree size, animal production, a mix of traditional and new systems and applications, etc. Identify needs for new equipment, machinery and management tools;

- Building on existing tools where relevant, develop a model to measure the impact of policies on agroforestry, both in terms of barriers or incentives to maintain existing agroforestry systems and to establish new ones. Sharing of experience among stakeholders as regards relevant common agricultural policy (CAP) support to agroforestry should be promoted. The potential of labelling of products linked to agroforestry in support of and complying with the current relevant legal framework and, when the scope of activities would cover the food system, the future EU framework for sustainability food labelling, should be investigated;
- Design and implement a plan to boost networking and research and innovation (R&I) support to agroforestry at regional level, building on and expanding existing networks and initiatives where available and relevant, and involving policy makers, regional authorities, institutions, researchers, consumers and other key stakeholders;
- Develop a training package and guidelines to support farmers in designing business plans linked to value chain development to put in place and manage agroforestry systems in different regions.

Topic ID and title	<a href="#">HORIZON-CL6-2021-CLIMATE-01-09: Enhancing science-based knowledge on EU forests', including old-growth forests, capacities to mitigate climate change</a>				
Budget	EUR 10 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 5 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	EU Forest Strategy, forest-based sector, carbon sequestration, biodiversity, bioeconomy, sustainable forest management, remote sensing, wood products, wood harvest, GHG emissions, forest protection, afforestation, reforestation, restoration, social acceptability				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B			FTP relevance	High
				Starting TRL	/
				End TRL	/

### Expected Outcome

In line with the EU Green Deal objectives and the EU forest strategy, successful proposals will support the preservation and enhancement of carbon stocks and sinks while supporting biodiversity, genetic diversity within and among tree species, and providing renewable resources for a circular and sustainable bioeconomy contributing to fostering climate change mitigation in the primary sector and carbon sinks and optimising and deploying nature-based solutions for climate neutrality.

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

- Forest managers adapting to sustainable management practices in view of climate change, bioeconomy, genetic diversity and biodiversity objectives;
- Improved knowledge on scenarios and sustainable pathways for forestry and the forest-based sector including measures and management strategies taking into account regional differences in Europe and changes in species composition;
- Increased forest-based carbon removals through forest management practices and uses of long-lived wood products;
- Better understanding on how forest management impacts carbon sequestration in comparison to non-managed forests;
- Pathways to achieve the ambition of the Paris Agreement ambition to limit climate warming;
- Transfer of knowledge from science to practice (good practice).

## Scope

Carbon sequestration by forest ecosystems has attracted much interest as a mitigation approach, as it can be considered as a relatively inexpensive option to address climate change in the short- medium- and long term. Forest lands, covered by the regulation on land use, land-use changes and forestry, are expected to contribute to the achievement of Europe's climate ambition for 2030. As shown in the in-depth analysis in support of the “Clean Planet for all” communication, this contribution needs to be increasing to achieve climate neutrality by 2050.

This topic aims to increase the science-based knowledge for an efficient implementation of good management practices that ensure the multiple functions of various forest types in Europe and to increase forest carbon stocks in the short-, medium-, and long-term.

Proposals will:

- Contribute to a better understanding of favourable management practices for both soil and vegetation, within-species genetic diversity upon, species selection and rotations to enhance and climate-proof forest carbon stocks (considering both in situ carbon sequestration and carbon storage in long-lived wood products) and sinks, while considering the broad range of other forest values and ecosystem services.
- Consider the dynamics of the carbon stored in the different pools (above-ground biomass, below-ground biomass, deadwood, litter, soil organic carbon fractions, harvested wood products) under different forest management regimes and at different scales (EU-wide, national, local) to identify possible adaptations to current European models of sustainable forest management, so that the forest-based sector can optimise climate action, and to facilitate the monitoring and reporting of GHG emissions.
- Improve the integration of European forests, including forest practices, in global and regional climate modelling.
- Contribute to progress in the certification and authenticity verification of carbon removals that are nature-based (i.e. through forest protection, afforestation and sustainable forest management) or through the forest biomass used for longer-lived and higher-substitution products.
- Design and monitor the efficacy of forest-based mitigation plans, combining the growing potential of satellite-based remote sensing with surface monitoring.

- Develop recommendations for up-take in practice, including specifying which silvicultural measures to apply to which types of forest in order to maximise their mitigation potential while ensuring the provision of other ecosystem services, under the current and future climate, while fully respecting ecological principles favourable to biodiversity and soil conservation.
- Analyse socio-economic aspects of forest-based mitigation strategies, including forest managers' and users' perception and factors influencing their decision making such as consumer choices, sectorial integration and international/domestic competition.
- Improve knowledge on the environmental integrity, the social acceptability and the economic feasibility of forest-based mitigation actions such as afforestation, reforestation, forest restoration, forest protection, sustainable forest management and enhanced wood harvest and use, especially for long-lived products.

Proposals must implement the 'multi-actor approach' and should include a task to collaborate with other projects financed under the topic HORIZON-CL6-2022-CLIMATE-01-05: Forestry - European observatory of climate change impacts and demonstration network of climate smart restoration pilots.

This topic should involve effective contribution of SSH disciplines.

Topic ID and title	<a href="#">HORIZON-CL6-2021-CLIMATE-01-10: EU-China international cooperation on increasing the resilience of forests</a>				
Budget	EUR 10 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 10 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	EU Forest Strategy, international cooperation, forest adaptation, sustainable forest management, afforestation, reforestation, regeneration, assisted species migration, ecosystem services, multi-actor approach				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B			FTP relevance	High
				Starting TRL	/
				End TRL	/

### Expected Outcome

In line with the European Green Deal objectives and the EU forest strategy, successful proposals will support the resilience and adaptation of forests and the forest-based sector contributing to advance the understanding and science, and support adaptation and resilience of natural and managed ecosystems, water and soil systems and economic sectors in the context of the changing climate.

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

- Strengthened international cooperation with actors from China in the areas of forest adaptation to climate change
- Comprehensive knowledge base on the impact of climate change on forests and their capacity to adapt
- Increased adaptation efforts in climate change hotspots in the EU/associated countries (mountains, Mediterranean, Northern Scandinavian Peninsula, Central and Eastern Europe, outermost regions) and China
- Informed decision-making by forest managers adopting sustainable forest management practices
- Knowledge transfer and capacity building at science-policy-practice interface.

### Scope

Adaptation and increased resilience of forests is essential for the forests to maintain their function as carbon sinks, to protect existing stocks and to ensure that forests will continue to provide important ecosystem services and to support the forest-based bioeconomy. Due to the high variation of European and Chinese forests, diversity of landscapes as well as



governance and ownership structures, adaptation strategies need to be adapted to regional conditions and circumstances, with focus on the most vulnerable forests in climate change hotspots.

Proposals will:

- Develop and refine projections at regional scale, improve the modelling of effects on natural vegetation, both at individual and ecosystem level and support science-based decisions with a view to the sustainable management of forests, including activities related to afforestation, reforestation and regeneration.
- Design adaptation plans to increase the resilience of forests by active management of the species composition and the genetic diversity within these species (including through assisted species migration, and forest regeneration and afforestation with species already adapted and / or further improved to tolerate or even benefit from future climate conditions) while supporting forest production and ecosystem services under climate change in the various regions and forest types of Europe.
- Analyse socio-economic aspects of forest adaptation, including forest managers' and users' perception and factors influencing their decision making such as consumer choices, sectorial integration and international/domestic competition and analyse the potential of incentives and tools to reach forest managers and to encourage changes towards preventive strategies/measures by taking into account the different forms of forest governance and ownership.

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.

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

Proposals should include a task to collaborate with projects financed under the topic HORIZON-CL6-2022-CLIMATE-01-05: Forestry: European observatory of climate change impacts and demonstration network of climate smart restoration pilots. Actions will contribute to implementing the EU-China Food, Agriculture and Biotechnology (FAB) flagship initiative, which aims to ensure sustainability of agri-food systems, catering for the needs of a growing population, the reduction of food and agricultural losses and waste, and the provision of safe and healthy foodstuffs.

Due to the scope of this topic, international cooperation is strongly encouraged, in particular with China. This topic is envisaged to be implemented as a coordinated call but if no agreement is reached with the Ministry of Science and Technology China (MOST) on the co-

funding of Chinese partners, it will be implemented as a normal call. Updates will be published on the Funding & Tenders Portal.

This topic should involve the effective contribution of SSH disciplines.

## Call – Land, ocean and water for climate action 2022

Topic ID and title	<a href="#">HORIZON-CL6-2022-CLIMATE-01-05: Forestry - European observatory of climate change impacts and demonstration network of climate smart restoration pilots</a>				
Budget	EUR 15 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 15 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	EU Forest Strategy, remote sensing, demo sites, restoration, afforestation, reforestation, forest protection, forest composition, forest management, biodiversity management, soil carbon, climate change adaptation, climate-smart forestry				
FTP comments					
FTP SIRA 2030 Challenges addressed	1A,B,C,D			FTP relevance	High
				Starting TRL	/
				End TRL	/

### Expected Outcome

In line with the European Green Deal objectives and the EU forest strategy, successful proposals will increase the knowledge on climate change impacts and enhance the practical knowledge on adaptive management practices contributing to efficient monitoring, assessment and projections related to climate change impacts, mitigation and adaptation potential in order to bring out solutions for tackling emerging threats and support decision-making in climate change mitigation and adaptation policies at European and global levels. Project results are expected to contribute to all of the following expected outcomes:

- Better knowledge on impacts and effects of drivers and pressures on Europe's forests in the context of climate change.
- Combination of modern monitoring tools (remote sensing) and traditional approaches (demo sites) in European forests.
- Enhanced practical knowledge on restoration, afforestation, reforestation and forest protection addressing forest composition and forest management practices that support mitigation, adaptation, optimal use of genetic diversity within and among tree species, and (biodiversity), maximising the synergies and minimising trade-offs.
- Better knowledge on best practices for effective adaptation and mitigation strategies, including synergies with biodiversity management goals and soil carbon impacts.
- Increased capacity and exchange of scientific knowledge, proven experience and know-how, tools and practices.

- Engagement of the society in forest restoration through information, participation and merging of societal engagement with scientific evidence and professional expertise.

### Scope

A holistic approach is needed to ensure that climate, biodiversity and bioeconomy goals can be integrated at different scales in practice and with the engagement of local communities, forest owners and industries. Intensive monitoring of impacts and sharing of experiences in the context of climate change is an important decision support at the science-practice interface to implement adapted forest management practices successfully.

Proposals will:

- Establish a European network to gather information on current developments in demo and long-term observation sites;
- Reinitiate EU participation in the International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) for long-term observations of forest ecosystems;
- Develop an evidence-based overview on current and planned forest restoration activities across Europe and their socio-economic and environmental impacts;
- Quantify possible synergies and trade-offs between contrasting forest management objectives at different spatial, temporal scales in different social environmental contexts in Europe;
- Analyse typical restoration cases to systematise knowledge on implementation successes and failures in specific regional settings, and distil best practices cases and business models for upscaling;
- Engage with key stakeholders and citizens to develop regionalised restoration trajectories through assessment of regional restoration pathways;
- Consider forward-looking forest conversion through adaptive forest management to mitigate/prevent future adverse effects;
- Improve communication and network/capacity building and exchange of experience, engagement with key stakeholders including national and regional policymakers and enable knowledge exchange beyond the forest community;

- Pilot climate-smart forestry measures and support forest restoration of damaged areas and degraded ecosystems in view of the diverse forest conditions, value chains and societal needs found across Europe.

Proposals may involve financial support to third parties, particularly for setting up of the observatory and for supporting the implementation and scaling-up of climate-smart restoration pilots. All European climate/biogeographical regions should be covered.

In order to achieve the expected outcomes, international cooperation is strongly encouraged.

The involvement of citizens and civil society in co-creating solutions (e.g. as part of user-led innovation or citizen science), alongside other actors, is encouraged as part of the project's methodology / approach.

Proposals should include a task to collaborate with other projects financed under the topics HORIZON-CL6-2021-CLIMATE-01-09: Enhancing science-based knowledge on EU forests', including old-growth forests, capacities to mitigate climate change and associated risks and HORIZON-CL6-2021-CLIMATE-01-10: EU-China international cooperation on increasing the resilience of forests.

Projects should consider to collaborate with the EU Observatory on Deforestation and Forest Degradation, managed by the Joint Research Centre (JRC) of the European Commission.

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

## Destination 6: Resilient, inclusive, healthy and green rural, coastal and urban communities

Places and people matter to the achievement of a more sustainable Europe. The Sustainable Development Goals and the ecological and digital transitions brought forward by the European Green Deal<sup>304</sup> and digital strategy<sup>305</sup>, alongside the recent pandemic, bring challenges and opportunities that differ for different places and people. Rural (including mountains and sparsely populated areas) and coastal areas, play a key role in managing, protecting and using natural resources. The provision of both private and public goods from these areas depends on the resilience and attractiveness of rural and coastal communities and the capacity of people who live and work there to access a sufficient level of well-being. The COVID-19 pandemic has highlighted deficiencies in digital infrastructures and economic opportunities that hamper resilience. Urban communities generally offer better access to many services but are also more vulnerable to supply-chain disruptions, as shown during the COVID-19 pandemic. Furthermore, they have a key role to play in fostering sustainable production and consumption as major demand drivers. In all communities, social and behavioural drivers play an important role in enabling or slowing down transitions. Knowledge and innovative solutions need to be developed to enhance every community's resilience and capacity to contribute to and benefit from the upcoming transitions in an economy that works for all territories and ensures a fair and just transition leaving no one behind.

Under this destination, transdisciplinary R&I with a strong social and behavioural sciences dimension, and attention to gender aspects, will foster a sustainable, balanced and inclusive development of rural<sup>306</sup>, coastal and urban areas in three different ways. Firstly, it will aim to increase our understanding of the differential impacts of climate, environmental, socio-economic and demographic changes on rural, coastal and urban areas in order to identify ways to turn these changes into equal opportunities for people wherever they live, enhancing territorial cohesion and enabling a just transition. Secondly, it will explore innovative ways to tailor policy responses to the place-based challenges identified at various levels of governance. Thirdly, it will support bottom-up community-led innovation to empower communities to develop, test and upscale solutions that answer global challenges in locally adapted ways. Achieving policy goals require providing people with more equitable access to the knowledge and skills required to make informed choices and be actively engaged in the sustainable and circular management of natural resources, from production or service provision to consumption. Rural, coastal and urban communities, in particular women, youth, the most vulnerable groups like indigenous people and those hit the hardest by the COVID-19 pandemic, need to see their labour conditions, quality of life and long-term socio-economic prospects improved in the context of major transitions and rising threats to

climate, resources and health. Their capacity to drive community-led innovations must be enhanced and their resilience increased across the diversity of European territories including remote places such as mountains and sparsely populated areas. Mobilising the forces of digital transformation, start-up ecosystems, nature-based solutions, as well as social and policy innovation will facilitate necessary changes and support smart, environment and climate friendly and resilient lifestyles.

Activities under this destination are complementary to Cluster 2 activities with attention to spatial differences and specifics in relation with democracy (Destination 'Innovative research on democracy and governance'), socio-economic transformations (Destination 'Innovative research on social and economic transformation') and cultural heritage (Destination 'Innovative research on the European cultural heritage and the cultural and creative industries'). They are also complementary to Cluster 5's Destination 'Cross-sectoral solutions for the climate transition' on cities and communities that should explore place-based approaches to climate, energy and mobility specifically for all places.

To maximise the intended impacts and to ensure uptake by the communities, actions in the cluster should aim for high standards of transparency and openness for the solutions developed, going beyond ex-post documentation of results and extending to aspects such as assumptions, processes, models and data during the life of projects.

### **Expected impacts**

Proposals for topics under this destination should set out a credible pathway to contributing to resilient, inclusive, healthy and green rural, coastal and urban communities and more specifically one or several of the following expected impacts:

- Rural, coastal and urban areas are developed in a sustainable, balanced and inclusive manner thanks to a better understanding of the environmental, socio-economic, behavioural, cultural and demographic drivers of change as well as deployment of digital, nature-based, social and community-led innovations.
- Rural, coastal and urban communities are empowered to act for change, better prepared to achieve climate neutrality, adapt to climate change, and turn digital and ecological transitions into increased resilience to various types of shocks, good health and positive long-term prospects, including jobs, for all including women, young people and vulnerable groups.
- Rural communities are equipped with innovative and smarter solutions that increase access to services, opportunities and adequate innovation ecosystems, including for

women, youth and the most vulnerable groups, improve attractiveness and reduce the feeling of being left behind, even in the most remote locations like mountains.

- The sustainable development of coastal areas including coastal protection and resilience reaps the benefits of social, digital and community-led innovations, to deliver nature-based and scientifically validated solutions to existing coastal socio-economic and environmental threats. In this way, applications of new social, economic and governance frameworks are enabled.
- Tourism, recreational and leisure activity development in natural and coastal areas respects long-term environmental carrying capacity, and social goals.
- Urban and peri-urban communities – including the most vulnerable individuals and families – can access, afford and choose healthier, nutritious and environmental-friendly food.

When considering their impact, proposals also need to assess their compliance with the “Do No Significant Harm” principle<sup>307</sup> according to which the research and innovation activities of the project should not be supporting or carrying out activities that make a significant harm to any of the six environmental objectives of the EU Taxonomy Regulation.

Topics under this destination will have impacts in the following impact areas of the Horizon Europe strategic plan for 2021-2024<sup>[308]</sup>: “Climate change mitigation and adaptation”; “Enhancing ecosystems and biodiversity on land and in water”; “Sustainable food systems from farm to fork”; “Good health and high-quality accessible healthcare”; “A resilient EU prepared for emerging threats”; “A competitive and secure data-economy”; and “Inclusive growth and new job opportunities”.



## Call – Resilient, inclusive, healthy and green rural, coastal and urban communities 2021

<b>Topic ID and title</b>	<a href="#">HORIZON-CL6-2021-COMMUNITIES-01-03: Smart XG, last-mile and edge solutions for remote farming, forestry and rural areas</a>				
<b>Budget</b>	EUR 10 million	<b>Opening date</b>	22 June 2021	<b>Deadline 1</b>	06 October 2021
<b>Budget per project</b>	EUR 5 million			<b>Deadline 2</b>	/
<b>Type of action</b>	Research and Innovation Actions (RIA)				
<b>FTP subsector</b>	F&F				
<b>Keywords</b>	5G, 6G, internet connectivity, remote areas, energy efficiency, cross-sectoral approaches				
<b>FTP comments</b>					
<b>FTP SIRA 2030 Challenges addressed</b>	2B - 7			<b>FTP relevance</b>	Medium
				<b>Starting TRL</b>	/
				<b>End TRL</b>	4-5

### Expected Outcome

In line with the ambitions of the Green Deal, the Digital Age and an Economy that works for people, leaving no one behind, the farm to fork strategy and the European strategy for data in particular, successful proposals will strengthen the capacities of farmers, foresters and rural community through connectivity gains. They will therefore contribute to i) fostering a sustainable, balanced and inclusive development of rural areas thanks to the deployment of digital, nature-based, social and community-led innovations; ii) empowering people to act for change and get prepared to achieve climate neutrality by 2050, adapt to climate change, and turn digital and ecological transitions into increased resilience; and iii) equipping rural communities with innovative and smarter solutions that increase access to services, opportunities and adequate innovation ecosystems.

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

- Reduce (the risk of) digital divides between different types of farms, sectors and regions.
- Contribute to increase the competitiveness and social and environmental sustainability of the agricultural and forestry sectors and rural areas through innovative 5G, last-mile and edge solutions.
- Facilitate decision-making, in particular for municipalities, farmers, foresters and their associations, in the selection of internet connectivity solutions under consideration of technical, economic and environmental aspects.

- Increase energy efficiency through analysing and developing connectivity options and contributing to climate mitigation.

### Scope

Missing access to fast broadband still presents a development challenge to many rural and remote areas. Frequently, the investments costs appear to be too high in comparison to the final number of end users in certain regions. Sometimes only investing in the “last-mile” presents a bottleneck to the connectivity. End-user needs vary not only between communities, but also between individual businesses and households, making it more challenging to find a common solution.

5G connectivity is a prerequisite for the running of several real-time applications, including of applications in the agricultural and forestry sectors, and has thus theoretically the potential to increase the economic and environmental performance of the sectors.

Overall, a range of possibilities to establish different types of broadband access at e.g. community-, farm- or field level are available going along with different investment and running costs.

Edge technologies allow under certain conditions the processing and analysis of data in remote systems, independently from larger data centres, which are frequently far away from rural communities. Edge technologies have the potential to reduce energy consumption.<sup>335</sup>

Communities and businesses in rural areas considering upgrading their internet connectivity are confronted with decision-making challenges regarding the choice of technologies in which they should invest in to achieve best outcomes at system level under consideration of technical, economic, environmental and social aspects and the location-specific requirements and systemic resilience.

Proposals should cover all of the following aspects:

- Assessing the socio-economic and environmental effects of innovative and existing 5G/4G/3G provision options (at regional-, community-, and farm-level) and making them feasible for non-scientists).
- Developing innovative cost-effective and environmentally friendly solutions to 5G- and last-mile provision in remote areas tailored to the needs of communities, farms and forestry.

- Assessing the socio-economic and environmental effects of innovative and existing edge technology options (at regional-, community-, and farm-level) and making them feasible for non-scientists.
- Developing innovative cost-effective and environmental friendly edge solutions tailored to the needs of communities, farms and forestry, including an energy balance at system level.
- Developing innovative business models (including at systemic level and cross-sectoral approaches).

Proposals are expected to undertake a comprehensive stocktaking exercise of solutions towards 5G, last-mile and edge solutions existing in the EU and globally (including satellite-based solutions<sup>336</sup> and other solutions, such as drones-assisted broadband provision), and of related studies and assessments. This review may also cover connectivity solutions developed in other domains, such as expedition, emergency or military services.

The aspects of regional and/or systemic resilience and energy efficiency should be elaborated, including the contribution to climate mitigation. Different regional contexts in the EU and Associated Countries as it regards environmental framing conditions, as well as the structure of the society and economy are to be reflected. To tailor solutions to practitioners' and citizens' needs, proposals must implement the multi-actor approach.

Project results are to be made feasible to rural communities, farmers and foresters associations, and policy-makers. A decision-making support tool, which includes assistance in business model development, is to be provided. – Practitioner-orientation has to form a key element of the project(s).

Proposals are not expected to develop innovative technology solutions for the general use of 5G, but should reflect and build – as far as possible – on the (interim) results of relevant projects funded under Horizon 2020, Horizon Europe Cluster 4, the Digital Europe Programme, the Connecting Europe Facility and other research and innovation projects, to develop innovative solutions tailored to the needs of remote farming, forestry and rural communities.

This topic should involve the effective contribution of SSH disciplines.

## Call – Resilient, inclusive, healthy and green rural, coastal and urban communities 2022

Topic ID and title	<a href="#">HORIZON-CL6-2022-COMMUNITIES-01-05: Assessing the socio-politics of nature-based solutions for more inclusive and resilient communities</a>				
Budget	EUR 12 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	nature-based solutions (NBS), vulnerable communities, NBS governance models, co-creation tools, ecologic benefits, economic benefits, social benefits, land-use conflicts solutions, citizens perceptions, citizens expectations				
FTP comments					
FTP SIRA 2030 Challenges addressed	1E - 3D	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome:

A successful proposal will contribute to the EU's goal of leading just digital, economic and ecological transitions that will leave no one behind, supporting in particular European Green Deal priorities such as the biodiversity strategy for 2030. R&I will contribute to develop rural, coastal and urban areas in a sustainable, balanced and inclusive manner thanks to the deployment of nature-based solutions (NBS)<sup>359</sup> and to a better understanding of the environmental, socio-economic, behavioural and cultural drivers of change. R&I will also further support the empowerment of communities to deploy NBS to adapt to climate change and turn digital and ecological transitions into increased resilience, well-being and positive long-term prospects, such as jobs for all (including for women, young people and vulnerable groups).

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

- Enhanced contribution of nature-based solutions (NBS) to social and economic targets, especially in vulnerable communities and notably regarding the transformative change needed to address the biodiversity and climate crises.
- New NBS governance models and co-creation approaches and tools, as well as NBS design and technologies that enhance social benefits while providing ecological and economic benefits.
- NBS are better suited to respond to different socio-political contexts and have higher replicability in the diverse environmental, economic and social conditions across Europe.

### Scope:

Nature-based solutions (NBS) are already being delivered with increasing evidence on their effectiveness, but implementation issues persist, hindering NBS uptake and upscale. There is a need to move beyond seeing the implementation challenge as primarily a technical issue, to develop our understanding of the economic, social, political, moral and cultural dimensions of designing and implementing NBS<sup>360</sup>.

Most of the available approaches seem inadequate to fully take into consideration synergies and trade-offs among different actions, notably in what concerns the social and cultural benefits of NBS. They often also fail to understand the social, political and institutional contexts and the material and discursive elements that shape NBS implementation. This, in turn, affects the long-term success of NBS, notably in contributing to the transformative change needed to address the biodiversity and climate crises. This understanding is particularly crucial when implementing NBS to support vulnerable communities and regions to cope with transformative change in old-industrialised, low-income, outermost or disaster-hit areas. NBS can also contribute to addressing inequities and well-being in communities and regions who need it most, especially in terms of the post-COVID19 recovery. Additionally, our understanding of how diverse actors – who may operate at different scales and through multiple networks – are engaged in the development and implementation of NBS is still limited, especially when the deployment of NBS implies collaboration across different regions, administrative areas or simply different types of land owners.

The successful proposals should:

- Gain a wider understanding of the role of actors involved in NBS, considering: a) particular groups of actors that have been under-researched (e.g. land holders such as churches, charitable organizations, educational establishments, utilities, etc.); b) sectors of the economy (e.g. agriculture, forestry, tourism, finance, etc.) and c) landscapes (e.g. coastal areas, river catchments, wetlands, etc.);
- Investigate how different NBS designs and governance can contribute to environmental justice, prevent environmental racism and gentrification, insure the inclusion and active participation of women, youth, minority groups, immigrant communities, etc.;
- Develop innovative governance models: a) exploring different forms of engagement, inclusion and stewardship; b) enabling the breaking of silos in public administration and between different administrative domains; and c) tackling other legal, management and administrative issues;

- Propose ways in which NBS governance and design can contribute to transformative change and to a just transition in support of the Sustainable Development Goals;
- Understand and propose solutions to functional conflicts in land-use for better and more integration between NBS, land-use planning and other (possibly conflicting) sectors, their policies and planning processes;
- Explore governance techniques (e.g. standards, certification, incentives, subsidies, etc.) that develop private and voluntary governance alongside formal regulatory and planning powers, with a view to mainstreaming NBS in the public and private sectors.
- Identify the possibilities for, and limits to, the full co-creation approach in NBS (including co-design, co-implementation, co-maintenance and co-monitoring), their underlying governance arrangements and instruments;
- Provide approaches based on citizen science, big data or artificial intelligence tools to better communicate the science of NBS and promote citizen engagement in the co-creation, co-implementation and co-monitoring of NBS;
- Understand how the meanings and values attached to nature in urban, rural, coastal, periurban or post-industrial areas affect the long-term success of NBS. To this end, investigate what counts as nature, what is valued and why this varies amongst individuals and communities as well as how this can be taken into account in the development of NBS.
- Investigate the impact of citizens' perceptions and expectations towards NBS on management decisions and delivery of ecosystem services, while considering also the role of NBSs in generating new kinds of connections and values for nature and with what consequences.

Proposals should address all of the above points.

Proposals should bring together from the start multiple types of scientific expertise in both natural sciences and social sciences and humanities (e.g. geography, sociology, political ecology, behavioural sciences, anthropology, philosophy, etc). In particular, this topic should involve the effective contribution of SSH disciplines.

Projects should seek to contribute to the New European Bauhaus initiative by supporting the green and digital transitions in communities' living environments through merging sustainability, inclusiveness and quality of experience. Small-scale pilots could be envisaged to explore NBS which are innovative either in their functional scope, socio-economic reach, integrative approaches or application in new settings.

Applicants should create synergies with projects under the same topic and other relevant ongoing or up-coming projects, notably the Horizon 2020 NBS project portfolio and its task forces; HORIZON-CL6-2021-BIODIV-01-05: The economics of nature-based solutions: cost-benefit analysis, market development and funding; HORIZON-CL6-2021-BIODIV-01-06: Nature-based solutions, prevention and reduction of risks and the insurance sector; HORIZON-CL6-2022-BIODIV-01-03: Network for nature: multi-stakeholder dialogue platform to promote nature-based solutions; HORIZON-CL6-2022-COMMUNITIES-02-02-two-stage: Developing nature-based therapy for health and well-being; HORIZON-CL6-2021-COMMUNITIES-01-06: Inside and outside: educational innovation with nature-based solutions. To this end, proposals should include dedicated tasks and appropriate resources for coordination measures, foresee joint activities and joint deliverables.

Proposals should ensure that all evidence, information and project outputs will be accessible through the Oppla portal (the EU repository for NBS)<sup>361</sup>.

Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

In order to achieve the expected outcomes, international cooperation is strongly encouraged, in particular with the Latin American and Caribbean region and the USA.

## Call – Resilient, inclusive, healthy and green rural, coastal and urban communities 2022 two-stage

Topic ID and title	<a href="#">HORIZON-CL6-2022-COMMUNITIES-02-02-two-stage: Developing nature-based therapy for health and well-being</a>				
Budget	EUR 19 million	Opening date	28 October 2021	Deadline 1	15 February 2022
Budget per project	EUR 6 million			Deadline 2	06 September 2022
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	healthcare, social, educational, citizen and policy-maker awareness, positive benefits, cross-sectoral approach, land owners, green space management sector, causal relationships				
FTP comments	Non-wood forest services				
FTP SIRA 2030 Challenges addressed	3B,C	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome:

A successful proposal will contribute to the EU's goal of leading just, digital, economic and ecological transitions that will leave no one behind, supporting in particular European Green Deal priorities such as the biodiversity strategy for 2030. R&I will support the development of nature-based therapy to help communities turn the ecological transition into opportunities for good health and well-being, increased resilience, and positive long-term prospects such as the creation of green jobs.

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

- Sharper view of green space management, nature protection, agriculture and forestry sectors as care providers and their possible linkages with the healthcare, social and educational sectors;
- Stronger evidence base for the causal relationships between nature and health and well-being for more effective nature therapy prescriptions;
- Cost-effective nature therapy prescriptions are more widely used in the health care sector;
- Greater citizen and policy-maker awareness of the positive benefits of nature for health and well-being;
- Wider utilization by healthcare professionals and citizens of nature therapy as a form of preventive medicine.



### Scope:

Nature affects human health in different ways. In particular, urban environments can have a negative impact on physical and mental health. This is due to urban stressors such as increased noise levels, higher crime rates and higher levels of pollution. The total global burden of disease attributable to mental illness has recently been estimated to be as high as 32% of total years lived with disability and 13% of disability-adjusted life-years, on par with cardiovascular and circulatory diseases. It is important, therefore, to determine the degree to which nature experience might lessen and address this burden. Even more so in view of the fact that the opportunities and time spent in nature are decreasing.

However, despite many putative positive correlations identified between nature and health and well-being, the causal understanding of relationships between health and nature exposure are not well understood. The long-term effects are also less well studied and recognised in policies. Social, economic and cultural factors strongly mediate the strength and direction of linkages between health and nature. Age, gender and especially socio-economic status may modify the association between greenness and health behaviours and outcomes and need to be better understood to create more effective nature therapy. Additionally, mental health benefits may vary with the type of interaction with nature and the form of sensory input. Furthermore, the health and well-being benefits of exposure to nature are affected by cultural perspectives and experiences relating to social interaction and contact with the natural environment.

A successful proposal should:

- Develop a common framework to increasingly recognise and promote contact with nature, including protected areas and other green and blue spaces, as a cost-effective response for the prevention and treatment of human health and well-being;
- Propose an interdisciplinary and cross-sectoral approach, including the involvement of the health care sector, land owners, as well as green space management and nature protection sectors;
- Improve schemes monitoring nature-health linkages to enhance the evidence base and tools for the health care sector, green space management, nature protection, urban planning and landscape architecture;
- Develop longitudinal prospective methods, (quasi-) experiments or well-controlled interventions, to provide more evidence of the causal relationships between nature and health and well-being;

- Understanding of when people explicitly choose to go to an urban green space and what experiences they have there (e.g., active versus passive activities).
- Determining the type of interactions and dose of interactions necessary for long-term health and well-being benefits.
- Understanding the mediators of the health-nature relationship, such as age, gender, socio-economic status or culture.
- Considering the difference between greenness quantity and quality and determining which aspects of natural features are relevant to mental health.
- Understanding how different geographical locations and factors such as population density affect the health-nature relationships;
- Test nature therapy sessions, identify best-practices and develop the necessary tools and guidelines for integration of nature-based care in the public health sector;
- Identify legal and administrative arrangements, partnerships, and financial mechanisms for implementation of nature therapy sessions.

The proposals should address all of the above points.

Proposals should bring together from the start multiple types of scientific expertise in both health and natural sciences, as well as social sciences and humanities, together with a variety of community and health sector representatives, businesses, civil society organisations and citizens.

Proposals should ensure that all evidence, information and project outputs will be accessible through the Oppla portal (the EU repository for nature-based solutions)<sup>381</sup>.

Applicants should create synergies with projects under the same topic and other relevant ongoing or up-coming projects, notably the Horizon 2020 NBS project portfolio and its task forces; HORIZON-CL6-2021-BIODIV-01-05: The economics of nature-based solutions: cost-benefit analysis, market development and funding; HORIZON-CL6-2022-BIODIV-01-03: Network for nature: multi-stakeholder dialogue platform to promote nature-based solutions; HORIZON-CL6-2022-COMMUNITIES-01-05: Assessing the socio-politics of nature-based solutions for more inclusive and resilient communities; HORIZON-CL6-2021-COMMUNITIES-01-06: Inside and outside: educational innovation with nature-based solutions. To this end, proposals should include dedicated tasks and appropriate resources for coordination measures, foresee joint activities and joint deliverables.

Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

In order to achieve the expected outcomes, international cooperation is strongly encouraged, in particular with the USA, Japan and the LAC region.

This topic should involve the effective contribution of SSH disciplines.

## Destination 7: Innovative governance, environmental observations and digital solutions in support of the Green Deal

Transformative changes such as the ones required within the Green Deal are dynamic processes that require appropriate governance. At the same time, to ensure coordination and for collaborative decision-making, governance requires multiple channels and networks that provide readily available data and information coming from different sources.

R&I activities under this destination aim at both: experimenting with new ways to govern the transition process and modernising the governance, in particular by making information and knowledge available and accessible. R&I for governance to support the Green Deal shall provide insights into institutional barriers such as lock-ins, path dependency, political and cultural inertia power imbalances and regulatory inconsistencies or weaknesses.

Innovative governance supporting the Green Deal objectives needs to recognise, cope with and promote resilience in the face of on-going shocks and disruptions both globally and across Europe, whether these be climatic, ecological, economic, social, geo-political or related to health. Critical risk assessment and reduction strategies need to be incorporated, including the diversification of infrastructures, resources and knowledge through more self-sufficiency and autonomy.

Taking advantage of the use, uptake, deployment and exploitation of environmental observations<sup>382</sup> as well as digital solutions, assessed through the “do not harm” principle of the Green Deal, is key for innovative governance models and a more science-based policy design, implementation and monitoring. To maximise impacts of R&I on the ground and spark behavioural and socio-economic change, the knowledge and innovation produced throughout the whole cluster should be widely disseminated to key stakeholders of the relevant sectors of the cluster. In particular, the Agricultural Knowledge and Innovation Systems (AKIS) needs to be reinforced to accelerate the required transformative changes.

Data and information obtained through Environmental Observation is of great value when assessing the state of the planet and is delivering crucial information to support the Green Deal and the climate and ecological transition. Integration of this information from different sources (space-based, airborne including drones, in-situ and citizens observations) with other relevant data and knowledge while ensuring (better) accessible, interoperable or deployable information, delivers information necessary for shaping the direction of the development of policies in the broad context of Cluster 6 of Horizon Europe. A strong link to the European Earth observations programme Copernicus (in Cluster 4) and the European Space Agency’s (ESA) Earth observation programme, as well as support to the Group on Earth Observations (GEO), its European regional initiative (EuroGEO) and the Global Earth

Observation System of Systems (GEOSS) is foreseen for topics on environmental observations under this destination. R&I activities relevant to ocean, seas and coastal waters will complement and support the UN Decade of Ocean Science for Sustainable Development and UN Decade on Restoration, the G7 Future of the Seas and Oceans Initiative, the pan-Commission Destination Earth initiative, the European Global Ocean Observing System (EOOS) and the GOOS 2030 strategy.

Digital innovation, in complementarity with Cluster 4 and Digital Europe Programmes activities, should bring benefits for citizens, businesses, researchers, the environment, society at large and policy-makers. The potential of the ongoing digital transformation, and its wider impacts, positive and negative, need to be better understood and monitored in view of future policy design and implementation, governance, and solution development

This destination will develop innovative digital and data based solutions to support communities and society at large, and economic sectors relevant for this cluster to achieve sustainability objectives. R&I activities will add value to the knowledge and cost-effectiveness of innovative technologies in and across primary production sectors, food systems, bioeconomy, ocean and biodiversity.

Knowledge and advice to all actors relevant to this cluster are key to improve sustainability. For instance, primary producers have a particular need for impartial and tailored advice on sustainable management choices. Knowledge and Innovation Systems are key drivers to enhance co-creation and thus speed up innovation and the take-up of results needed to achieve the Green Deal objectives and targets. This will include promoting interactive innovation and co-ownership of results by users, as well as strengthening synergies with other EU Funds in particular the CAP, reinforcing the multi-actor approach and setting up structural networking within national/regional/local AKISs. AKIS goes beyond agriculture, farming and rural activities and covers environment, climate, biodiversity, landscape, bio-based economy, consumers and citizens, i.e., all food and bio-based systems including transformation and distribution chains up until the consumer.

#### Expected impact

Proposals for topics under this destination should set out a credible pathway to contributing to innovative governance and sound decision making in policy for the green transition, and more specifically to one or several of the following impacts:

- Innovative governance models enabling sustainability and resilience notably to achieve better informed decision-making processes, societal engagement and innovation;

- Green Deal related domains benefit from further deployment and exploitation of Environmental Observation data and products ;
- A strengthened Global Earth Observation System of Systems (GEOSS)<sup>383</sup>;
- Sustainability performance and competitiveness in the domains covered by Cluster 6 are enhanced through further deployment of digital and data technologies as key enablers;
- More informed and engaged stakeholders and end users including primary producers and consumers thanks to effective platforms such as Agriculture Knowledge and Innovation Systems (AKIS)
- Strengthened EU and international science-policy interfaces to achieve the Sustainable Development Goals

When considering their impact, proposals also need to assess their compliance with the “Do No Significant Harm” principle<sup>384</sup> according to which the research and innovation activities of the project should not be supporting or carrying out activities that make a significant harm to any of the six environmental objectives of the EU Taxonomy Regulation.

Topics under this destination will have impacts in the following areas: “Climate change mitigation and adaptation”; “Clean and healthy air, water and soil”; “Enhancing ecosystems and biodiversity on land and in water”; “Sustainable food systems from farm to fork on land and sea”; “High quality digital services for all”; and “A Competitive and secure data-economy”.

Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

## Call – Innovative governance, environmental observations and digital solutions in support of the Green Deal 2021

### Innovating with governance models and supporting policies

Topic ID and title	<a href="#">HORIZON-CL6-2021-GOVERNANCE-01-09: Revitalisation of European local communities with innovative bio-based business models and social innovation</a>				
Budget	EUR 5 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 2,5 million			Deadline 2	/
Type of action	Coordination and Support Actions (CSA)				
FTP subsector	F&F, WW, P&P				
Keywords	local communities revitalisation, local bio-based economy, ecosystem services, recreation, sustainable biomass production				
FTP comments					
FTP SIRA 2030 Challenges addressed	3	FTP relevance		Low	
		Starting TRL		/	
		End TRL		/	

#### Expected Outcome:

Successful proposal(s) will contribute to the expected impacts of Destination ‘Innovative governance, environmental observations and digital solutions in support of the Green Deal’, and the European policies it supports, in particular the European Green Deal, and EU bioeconomy strategy, by supporting the establishment of the innovative governance models notably to achieve better-informed decision-making processes, social engagement and innovation. In addition, the topic supports the strengthened EU and international science-policy interfaces to achieve the Sustainable Development Goals.

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

- Higher awareness of stakeholders (e.g. by development of a programme that focuses on helping local stakeholders, including primary biomass producers, civil society organisations including NGOs and SMEs to be integrated in and benefit from bio-based value chains) – identifying local actors and improve communication between them, showing opportunities for collaboration along the bio-based value chain.
- Increased opportunities to develop skilled jobs and small-scale establishments in the bioeconomy, thus helping to revitalise local communities (by supporting the local and regional rural development, economic and implementing authorities, to raise awareness of bio-based options)

- Advancement of the role of 'social enterprise' model for local communities, including the low-income populations, benefiting from creativity linked to bio-based solutions and promoting inclusiveness and cooperation at all levels.
- Increased opportunities created by the local bio-based economy within broader bioeconomy transition, e.g. by linking valorisation of ecosystem/nature services' (e.g. recreation) with sustainable biomass production, processing, product design and manufacture, circular use and upcycling to new applications.
- Supporting the development of for small businesses and for business-to-consumers communication of innovation, climate-neutrality and low environmental footprint/benefits/trade-offs and performances of bio-based products and services (e.g. by development of best practice guidelines);
- Supporting novel business models and related social measures to enable consumers, industry and public bodies to switch to socially and environmentally responsible behaviour within their choices (e.g. guidelines on regulatory measures, corporate responsibility initiatives, education); ensuring synergies, transparency and inclusiveness of all actors)

#### Scope:

The action advances the role and impact of bio-based innovation to accelerate the transition from a linear fossil-based economy, which leads to overuse and depletion of natural resources, into a resource-efficient and circular bio-based systems operating safely within planetary boundaries. Improved and informed governance and especially social innovation contributes to reducing resource consumption and results in an increased innovation capacity of all actors, while reducing the risk of leaving anyone behind, particularly in the areas and communities in need of revitalisation. This also helps to advance innovation at local scale and engage all actors (especially the 'social enterprise' model relevant for vulnerable populations).

Proposals should benefit from social creativity and opportunities at regional scale unleashed for bio-based systems, ensuring their low environmental footprint, in terms of feedstock, resources, processes, materials and products. Impacts and trade-offs, such as the carbon footprint and environmental footprint of the whole value chains should be part of the assessment of the bio-based systems. The proposals should seek complementarities with related actions<sup>392</sup>, under rural development programs on the governance of bio-based innovation and ensure inclusiveness and engagement of all actors.



Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake. Proposal could explore intersectionality approaches and consider aspects like gender, ethnicity, migrant or refugee status, social class, sexual orientation and disability to ensure inclusion of marginalised groups in citizen engagement and the development of tools and guidelines.

Proposals should:

- a. select a range of bio-based systems where value chains can be tailored to specific needs in respect to the revitalisation of local communities (understood both in territorial and social sense), to their environmental and social impacts (benefits and trade-offs) from trade in the primary materials to the final products;
- b. focus on relevant new or updated business models and local capacities (feedstocks, infrastructure, human skills, etc), and innovation actors (including community knowledge and marginalised groups), to enable sufficient impacts/benefits/positive trade-offs and performances of the specific value chains;
- c. assess existing/develop new monitoring system and indicators of the effectiveness and robustness of existing governance schemes, to allow replication across Europe (e.g. income generation for all stakeholders, labour conditions, environmental indicators, social engagement, innovation parameters etc);
- d. ensure efficient engagement of all actors (public authorities, SMEs, NGOs, knowledge providers) via robust and transparent communication and awareness-rising campaigns;
- e. analyse social and economic barriers and potentialities to enable the transition towards socially and environmentally responsible behaviour within all ranges (e.g. regulatory measures, corporate responsibility initiatives, education), ensuring inclusiveness of all actors (NGOs, civil society etc).

Topic ID and title	<a href="#">HORIZON-CL6-2021-GOVERNANCE-01-13: Modelling land use and land management in the context of climate change</a>				
Budget	EUR 10 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 5 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Carbon sequestration, climate policy, land use policy, forest land cover, simulations, projections, Copernicus, Galileo/EGNOS				
FTP comments					
FTP SIRA 2030 Challenges addressed	3D,E	FTP relevance		Medium	
		Starting TRL		/	
		End TRL		/	

### Expected Outcome:

Successful proposals will set out a credible pathway to contributing to innovative governance and sound decision making in policy for the transition required by the European Green Deal.

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

- Boosting of economic and environmental modelling of land use and management and carbon sequestration in Europe and use of modelling for policy purposes (mainly climate policy, agricultural policy, land use policy).
- Contribution to the formulation, implementation and monitoring of land-related issues of agriculture and forestry policies, in particular linked to climate change.

### Scope:

To ensure the sustainable management of land resources in the long term there is a need for an integrated framework that addresses society's objectives appropriately by understanding the trade-offs between uses and by incentivising actions / behaviours / investments contributing to desirable targets. Land use and management has a key role to play in Europe in terms of boosting carbon storage, producing biomass for the bioeconomy, reducing urban sprawl and attaining the objective of climate neutrality by 2050 while ensuring food and nutrition security, biodiversity commitments and well-being in general. There are however substantial knowledge gaps regarding, in particular, the understanding of the impacts of farming / forestry practices at various scales, from local to global, and the capacity to model these impacts (economic and environmental). Work should include the analysis of land use dynamics and trends between arable land, permanent grassland, land abandonment / marginal lands, forest areas, for which quantifications and an identification of drivers and impacts should be done in an integrated manner.

Projects should:

- work on land use dynamics and explore the effects of policy measures that can influence such dynamics, in particular agricultural, land use and climate policies.
- focus activities mainly on agriculture and forest land use/cover and should extend to interactions of the former with other main land uses/covers and drivers. This should ensure usability of the results in larger contexts. While focusing on Europe, proposals are encouraged to draw on good examples from elsewhere.
- work at various spatial scales – farm level, regional to EU levels - and simulations and projections should range from medium-term to long-term policy scenarios and should cover the whole of the EU and its Member States and possibly Associated Countries.
- The possible participation of the JRC in the projects will ensure that the proposed approach will be compatible with and/or improve existing databases and tools used at the European Commission and ensure open access to data.
- include a task to collaborate with other projects financed under this topic and under topic HORIZON-CL6-2021-GOVERNANCE-01-12 “EU agriculture within a safe and just operating space and planetary boundaries”. They should also liaise with relevant Horizon 2020 modelling projects (including LandSupport399).

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

## Deploying and adding value to Environmental Observations

<b>Topic ID and title</b>	<a href="#">HORIZON-CL6-2021-GOVERNANCE-01-14: User-oriented solutions building on environmental observation to monitor critical ecosystems and biodiversity loss and vulnerability in the European Union</a>				
<b>Budget</b>	EUR 20 million	<b>Opening date</b>	22 June 2021	<b>Deadline 1</b>	06 October 2021
<b>Budget per project</b>	EUR 3 to 5 million			<b>Deadline 2</b>	/
<b>Type of action</b>	Research and Innovation Actions (RIA)				
<b>FTP subsector</b>	F&F				
<b>Keywords</b>	Ecosystem services, mitigation actions, anthropogenic activities, support decision-making, Copernicus, Galileo/EGNOS ??				
<b>FTP comments</b>					
<b>FTP SIRA 2030 Challenges addressed</b>	1A,B	<b>FTP relevance</b>	High		
		<b>Starting TRL</b>	/		
		<b>End TRL</b>	/		

### Expected Outcome:

A successful proposal will support the delivery of services and solutions for the implementation of the European Green Deal and the biodiversity strategy, through the deployment and exploitation of environmental observations<sup>400</sup>, benefiting a broad range of end users and helping them restore biodiversity and ecosystems under threat, thus contributing to the global observation and monitoring of the living realm.

Proposals are expected to contribute to at least four of the following outcomes:

- Better informed policy formulation for biodiversity & ecosystem services on European/national and regional level, built on enhanced understanding of better quantified and characterised changes in biodiversity and ecosystem services and the prediction of their trajectories;
- Enhanced understanding of the adverse cumulative impacts of climate change and anthropogenic activities on biodiversity and ecosystem functioning and in particular on habitats and key species at risk of extinction in sensitive ecosystems to define enhanced management, adaptation and mitigation actions;
- Enhanced planning and ecosystem-based management of land and sea with the objectives to minimise the adverse effects of climate change and anthropogenic activities on ecosystems and biodiversity;
- Dependable data, information and knowledge to support adaptation and mitigation of biodiversity loss resulting from climate change and anthropogenic activities, through maximised exploitation of information and data from European data

infrastructures, European programmes (such as EMODnet<sup>401</sup> and European research infrastructures<sup>402</sup>) and GEO<sup>403</sup> initiatives;

- Support to the development of the European service sector regarding end-user climate services related to biodiversity and ecosystems and deliver usable results to the monitoring framework of the EU biodiversity strategy for 2030;
- A contribution to the EC-ESA joint Earth system science initiative<sup>404</sup> (in particular to the flagship action on biodiversity and ocean health);
- Improved governance of biodiversity monitoring and reporting, in particular together with the 'Rescuing biodiversity to safeguard life on Earth' partnership<sup>405</sup>, the EC Knowledge Centre for Biodiversity and GEOBON<sup>406</sup>

#### Scope:

The projects are expected to further the harmonisation, mobilisation, and uptake of monitoring and environmental data to better characterise and understand the natural and anthropogenic pressures on biodiversity, the extent of the destruction of natural biological resources and its connection with ecosystem conditions within safe planetary boundaries. There is a need for knowledge of both better quantified and more precisely characterised changes in biodiversity and related ecosystem services (in coastal, marine, terrestrial and freshwater ecosystems), and of ecosystem status and quantified impacts of the main direct drivers of changes (i.e. land and sea use changes, pollutions, climate change, invasive alien species and exploitation of natural resources) on European natural capital.

The projects should deliver new Earth observation (EO) data services building on the potential of EO capabilities in order to address end-user needs facing the deterioration and destruction of their living environment and ecosystems. The projects under this topic should tackle issues raised within the European Green Deal calls<sup>407</sup> and provide solutions to halt biodiversity loss and protect vulnerable ecosystems, and ensuring ecosystem capacity to continue to provide services to society and the environment. The projects should make mapping tools and information solutions available, which are needed by a wide variety of end users in order to meet targets for conservation and restoration of diverse terrestrial, coastal and marine ecosystems. Hence, the development of tools to support decision-making and participatory management are crucial in this context. Solutions related to improving ecosystem health and resilience should be integrated into best practice monitoring activities within respective monitoring governance schemes. This should enable stakeholders and policy makers to take the right conservation and restoration measures, in particular with the use of a holistic ecosystem-based management in response to the urgent

need for halting biodiversity loss and, consequently, alterations to ecosystem functions and sustain the delivery of precious ecosystem services.

Building on existing services and frameworks provided through GEO, EuroGEO408, European research infrastructures, European Ocean Observing Systems, EMODnet, Copernicus, ESA409 Earth Observation programmes and EGNSS, this topic should address the downstream part of the value chain to support mitigation and adaptation to climate change impact on biodiversity and ecosystems. The consortia should engage with end users and stakeholders, contribute to customising of data and exploitation platforms, deliver scaling-up and replication of existing service models, and brokerage of knowledge and dissemination to the public. The successful proposals should build on outcomes of EU funded projects such as Horizon 2020 projects like ECOPOTENTIAL410, initiatives like EuropaBON411 and programmes like LIFE412, and should feed into the EC Knowledge Centre for Biodiversity, and deliver usable results to the monitoring framework of the EU biodiversity strategy for 2030.

## Digital and data technologies as key enablers

Topic ID and title	<a href="#">HORIZON-CL6-2021-GOVERNANCE-01-21: Potential of drones as multi-purpose vehicle – risks and added values</a>				
Budget	EUR 12 million	Opening date	22 June 2021	Deadline 1	06 October 2021
Budget per project	EUR 6 million			Deadline 2	/
Type of action	Research and Innovation Actions (RIA)				
FTP subsector	F&F				
Keywords	Drones, forestry, agriculture, Sustainable smart forestry, production assessment, pest and disease detection, harvesting planning				
FTP comments					
FTP SIRA 2030 Challenges addressed	1B - 2B,D	FTP relevance		High	
		Starting TRL		/	
		End TRL		4-5	

### Expected Outcome

In line with the farm to fork strategy and the Headline ambitions of a Digital Age and an Economy that works for people, that works for all, leaving no one behind, the biodiversity strategy, the successful proposals will support the effective and efficient deployment of drones, including in the field of environmental monitoring. They will therefore contribute a) to the enhancement of the sustainability performance and competitiveness in agriculture, forestry and rural areas through further deployment of digital and data technologies as key enablers, and b) to the development of innovative governance models enabling sustainability and resilience, notably to achieve better informed decision-making processes through research and innovation in the field of drones.

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

- Strengthened capacities for sustainable smart farming, forestry and rural communities through exploiting the potential of drones and other remotely piloted aircraft systems.
- Strengthened the capacities for plant, plant-health, livestock, livestock-health, and agri-environmental monitoring (including tree health) through the use of drones and other remotely piloted aircraft systems.
- Reduced risk of the use of drones and other remotely piloted aircraft systems.

### Scope

The increased use of drones for sectoral and societal purposes can be observed in the EU. Also in the field of agricultural production, drones are used in the EU, whereby to different extents across Member States because of environmental, socio-economic and also

regulatory framing conditions. While the use of drones can bring advantages to agricultural production, e.g. to collect data on crop conditions, it also goes along with risks emanating from the use of the unmanned vehicle itself, or the activity it is carrying out. For several reasons, e.g. a lack of cost-effectiveness, the potential of drones is not fully exploited by the agricultural sector in the EU. When exploring the opportunities to increase the use of drones, the consideration of aspects related to the safe use and the interests of the society at large, which might be negatively affected by the use of drones, is of outermost importance. To the same time, drones can also deliver services of common interests, which have the potential to be well linked to the agricultural use of drones, for instance, the collection of environmental information in agricultural landscapes, such as about landscape features, water quality or soil quality, and biodiversity in and around utilised agricultural areas. Exploring possibilities to use drones as multi-purpose vehicle in rural areas, e.g. for reasons of cost-effectiveness is of interest.

Proposals should cover all of the following aspects:

- Stock-taking of innovation in the use of drones as multi-purpose vehicle in agricultural production, forestry and the development of rural communities globally, the advantage and disadvantages of different approaches, and perform comparative analyses with the situation of the use of drones in the EU.
- Development of innovative approaches to use drones and other remotely piloted aircraft systems as multi-purpose vehicle in agriculture, e.g. for production assessment, cover-crop seeding, pest and disease detection, harvesting planning as well as innovative approaches to use drones as multi-purpose vehicle linking agricultural and wider environmental observation interests (including the assessment of landscape features, forests, water quality, and soil carbon) and for rural services.
- Assessment of the potential of the use of drones and other remotely piloted aircraft systems in the agricultural sector and socio-economic and environmental effects under consideration of different regulatory scenarios.
- Development of business models to the use of drones and other remotely piloted aircraft systems in agriculture, which may include agriculture / forestry / community development interlinkages.
- Development of innovative approaches to assess and reduce the risks related to the use of drones in the agricultural sector, especially in the context of spraying.



Projects are expected to take into consideration the results of other related Horizon 2020/ Europe projects, such as AW-Drones<sup>435</sup> and ROMI<sup>436</sup>, as well as of other relevant projects and initiatives.

Proposals may involve financial support to third parties e.g. to academic researchers, hi-tech startups, SMEs, rural communities and other multidisciplinary actors, to, for instance, develop, test or validate developed assessment approaches or collect or prepare data sets or provide other contributions to achieve the project objectives. A maximum of € 60 000 per third party might be granted. Conditions for third parties support are set out in Part B of the General Annexes. 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. The financial support to third parties can only be provided in the form of grants.

## Missions

Missions aim to address some of the greatest challenges facing our society. They are bold and inspirational with clear objectives that are time-bound, realistic, measurable and targeted.

Rooted in research and innovation, missions aim to tackle societal challenges with systemic solutions, leading to societal transformations and social impact.

Missions will help deliver key EU policy priorities such as the European Green Deal, Europe's Beating Cancer Plan, NextGenerationEU, the EU Industrial Strategy and A Europe fit for the Digital Age, amongst others.

To achieve their goals and promote societal change, missions will implement the reuse and reproducibility of research results such as FAIR research data and open access to scientific publications. Also, the missions will closely involve citizens in their preparation, implementation and monitoring throughout their duration, also showcasing the added value of the EU.

Missions are a novel instrument in Horizon Europe - the Framework Programme for Research and Innovation. For their successful implementation they will work in synergy and coordination with other missions, parts of Horizon Europe, in particular with European Partnerships and Clusters, as well as with other EU funding instruments and policies. Furthermore, they will need to be implemented in close synergy with funding, programmes and strategies both at Member State / Associated Country and regional level, as well as with civil society and the private sector.

Five mission areas have been included in the Horizon Europe Regulation (Adaptation to Climate Change, including Societal Transformation; Cancer; Healthy Ocean, Seas, Coastal and Inland Waters; Climate-Neutral and Smart Cities; Soil Health and Food). Mission boards, comprised of external experts with a wide variety of backgrounds, have been established to advise the Commission on possible missions within the scope of these areas. On the basis of reports from the five mission boards, the Commission has identified the following titles for missions in the Horizon Europe Strategic Plan, subject to further refinement:

- Adaptation to Climate Change;
- Cancer;
- Climate-Neutral and Smart Cities;
- Ocean, Seas and Waters;
- Soil Health and Food.

Each of the five identified missions is now in a preparatory phase, during which implementation plans will be developed, which will include the detailed objectives, specific interventions, investment strategy and performance indicators for each mission. When finalised, within a period of maximum one year, these implementation plans will be assessed against objective criteria 1 . This assessment will form the basis for a decision on which missions will enter full implementation.

This work programme part for the moment contains actions for each of the five missions during their preparatory phase, and will be updated with the full R&I agenda when the implementation phase is launched. The actions included in this work programme are to establish foundations for the missions' implementation phase and thus support rapid development of the R&I actions when these are launched.

Critical to the success of the missions will be the extent of wide engagement across the EU and Associated Countries and beyond. To facilitate this, an action to develop a network coordinating complementary actions for missions is proposed, with the possibility that this might be extended at a later date with national hubs.

The introduction to this work programme will be updated for the implementation phase, including a more detailed presentation of the relationship between missions and the expected impacts of the Strategic Plan.

## Mission: Soil, health and food

### Call – Preparing the ground for healthy soils: building capacities for engagement, outreach and knowledge

Topic ID and title	HORIZON-MISS-2021-SOIL-01-01: Preparing the ground for healthy soils: building capacities for engagement, outreach and knowledge				
Budget	EUR 5 million	Opening date	22 June 2021	Deadline 1	20 October 2021
Budget per project	EUR 5 million			Deadline 2	/
Type of action	Coordination and Support Actions (CSA)				
FTP subsector	F&F				
Keywords					
FTP comments					
FTP SIRA 2030 Challenges addressed				FTP relevance	Low
				Starting TRL	/
				End TRL	/

#### Expected Outcome:

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

- Enhanced capacities for effective mission deployment in close co-operation with the Mission Core Network and eventual national mission hubs supported through the topic ‘Coordination of complementary actions for missions’
- Increased networking and knowledge exchange between communities across Europe at regional/local level on soil health taking into account various types of land uses and based on the work undertaken in existing and new living labs and lighthouses;
- Decision-makers from policy and the private sector are better equipped to answer to questions on soil quality across land uses due to increased insight into the status of soil health in European regions as well as improved capabilities for assessment and analyses and soil monitoring;
- All sectors of society are informed and/or can make informed decisions regarding soil management through integrated on-line resources in all Member States and Associated Countries and improved access to evidence-based information, data as well as resources and examples of best practices in education and training;
- Virtual, cross-disciplinary communities on soil stewardship are created using social media and making full use of the potential of digital tools.

### Scope:

Life on Earth depends on healthy soils. Soil provides food, clean water and habitats for biodiversity while contributing to climate resilience including an increased preparedness to extreme weather events (both droughts and floods). As the largest terrestrial habitat, soil is a unique ecosystem that is critical to aboveground and belowground biodiversity yet it is the least studied. Partly as a result of an increasing urban lifestyle, there is very little awareness in society on the importance of soils, their functions, the threats to soil health and what can be done to preserve this valuable resource. A lack of education and understanding often underpins land degradation and a loss of soil capacity to provide the functions on which we depend. Both land managers in rural areas and urban planners need improved access to ready-to-use knowledge and to advisory services that can support them in their efforts to manage soils in sustainable ways.

Living labs (LLs) and lighthouses (LHs) <sup>80</sup> are emerging as places for engagement of communities to co-create, test and upscale solutions in various domains. However, LLs and LHs working on soil management are not yet widespread and information on existing experiences is scattered.

Proposed activities will lay the ground for rapid take-up of mission activities following its formal approval. Proposals should therefore:

- identify in close cooperation with regional authorities, stakeholders and communities existing “soil needs” (e.g. status, main problems and priority areas for improvement) in a number of contrasting regions in each Member State and Associated Country so that different land use systems are addressed. Insight on the status of soils and the main challenges to soil health should be a starting point for recommendations on priority actions and activities to be implemented in living labs and lighthouses;
- develop tools to support networking and knowledge exchange of communities working at regional/local level on soil health and create Communities of Practice (CoP) in the respective regions. This should include a mapping of current and emerging Living Labs and Lighthouses targeting various types of land uses (e.g. in agriculture, forestry, urban and natural areas). The mapping of living labs and lighthouses shall ensure that a variety of locations are represented reflecting the diversity of soils, land uses as well as socio-economic and demographic conditions. Results of the mapping should be displayed through an interactive map showing relevant information, for example on context (land use type, funding sources, etc.), activities and partners involved;

- develop “model business plans” for Living Labs and Lighthouses (e.g. specifying ownership, funding, goals and activities) taking into account different regions at NUTS 2 level and different land uses.
- improve the knowledge base required to assess progress in monitoring soils and meeting the targets proposed by the Mission Board Soil Health and Food. Activities should be undertaken in close collaboration with Member States Associated Countries and the EU Soil Observatory<sup>81</sup>. They will depend amongst others on harmonised and regular soil data collection, common definitions and possibly thresholds identified for each Member States and Associated Countries for the mission’s proposed soil health indicators;
- connect existing on-line resources on soil information to provide a single point for access to this information (a one-stop shop for soil literacy) in each Member State and Associated Country. In view of taking a systemic approach to soil health, the information should extend to sectors/activities that have an impact on soils (e.g. sources of pollution) as well as information on wider impacts of unhealthy soils (e.g. on water bodies). This one stop shop or platform should connect diverse organisations, projects and people that contribute to the sustainable management of soils by promoting soil advocates in different fields/roles/regions. It should also help identifying “agents of transition”, i.e. people supporting changes in perception, values, attitudes and behaviour towards more sustainable practices and management of soils while promoting the economic benefits from restoration opportunities;
- link this one-stop shop in each Member State and Associated Country to “best of” online material to inspire and connect citizens to the topics of soil health (e.g. films, websites, apps, games, educational tools). The material should target different groups and be displayed in local official languages. Links should also be established with good examples for online material in Europe and internationally;
- promote and reward on-going or recent examples of soil education and social innovation in the area of soil health to increase understanding of soils by the public at large.

In carrying out the tasks the project should tap into the expertise of partners from various sectors (e.g. research, land managers including farmers and foresters, education, communication, citizens and civil society, food and non-food industries, spatial planners, public authorities) and address soil health in the context of various land uses. This is in line with the approach taken by the proposed mission Caring for Soil is Caring for Life.

Proposals should demonstrate a route towards open access, longevity, sustainability and interoperability of knowledge and outputs, also through close collaboration with the JRC's EU Soil Observatory.

They should build on existing activities and ensure cooperation with relevant projects under Horizon 2020 such as the SMS project and the European Joint Partnership EJP Soil. Activities should also take into account the implementation of living labs under a possible future partnership on agroecology which is under preparation. This should ensure compatibility and cooperation between living labs associated to the mission and the future partnership.

Activities should also support the objectives of the upcoming EU Soil Strategy, and other major initiatives in the area of soil health.

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 be used in addition.