

# Future environmental research for a sustainable society and economy

## PEER position paper on FP9

FP9 shall take on global challenges, focus on generating desirable societal impacts and strengthen our ability to renew the European society. FP9 should improve the understanding of boundary conditions of and pathways to sustainable development, embrace the green economy, and reduce environmental risks and ecological scarcities. This will foster a "green shift" towards a more sustainable and responsible economy and society whilst increasing measurable economic benefits.

## Environmental research is fundamental for growth

Europe and the world are facing a growing number of complex global challenges that require transformation in order to move towards the UN Sustainable Development Goals (SDGs)<sup>1</sup>. Europe can choose to lead the way towards the SDG's<sup>2</sup> and benefit from new opportunities and increased resilience that will follow that choice.

The global megatrends that strongly influence also the citizens of Europe are the increasing exploitation of natural resources, demographic change and urbanization, climate change and digital technologies (OECD 2016)<sup>3</sup>. In this context, Europe has the opportunity to become a world leader in the transition to a low carbon economy, sustainable urbanization and new sustainable production and consumption systems. The potential return on the EU investment in environmental research and innovation to promote such holistic solutions is great, whereas failure to move towards the SDGs creates severe risks to society and the economy.

Some of the most pronounced direct economic benefits of sustainable growth and production has been calculated for the oceans, where it has been estimated that they currently represent a gross value of 1,5 trillion US\$ and provide 40 million jobs, projected to double by 2030 provided that ocean ecosystems are healthy and undamaged<sup>2</sup>. Likewise it has been estimated that achieving a circular economy would translate

<sup>1</sup> <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

<sup>2</sup> European Commission 2017: New Horizons: Future Scenarios for Research & Innovation Policies in Europe. A report from the project BOHEMIA. <https://publications.europa.eu/en/publication-detail/-/publication/b2d78a84-3aae-11e7-a08e-01aa75ed71a1/language-en>

<sup>3</sup> OECD 2016: An OECD Horizon Scan of Megatrends and Technology Trends in the Context of Future Research Policy. <https://ufm.dk/en/publications/2016/files/an-oecd-horizon-scan-of-megatrends-and-technology-trends-in-the-context-of-future-research-policy.pdf>

into a European GDP increase of 7 percentage points compared to the current development scenario, with an additional positive employment effect<sup>2</sup>.

In terms of substance, FP9 should focus both on tackling Europe's own sustainability challenges and on finding solutions that can be scaled up to meet the most burning development challenges worldwide.

## Environmental research with impact

Putting research into use and increasing the impact of European research investment is crucial. We therefore support the recommendations of the LAB-FAB-APP report<sup>4</sup>, that FP9 should strengthen its focus on impact and dissemination, enforce open science and open innovation, and involve society as an integral R&I actor.

Addressing the above mentioned megatrends and challenges requires involvement of a broad number of different actors in research, policy, governance, industry and society. No one discipline or sector can solve these problems on their own, but collaboration and inter- and transdisciplinary working is essential.

FP9 environmental research should *concentrate on removing the factors hindering and on the solutions fostering progress* on these critical issues. In order to be funded projects should demonstrate and promote effective uptake of either novel or established research into policies and regulations and/or lead to new private innovations in, for example, cleaner products or novel business models. FP9 should also investigate where and why previous programs did not succeed in the implementation of results. Overall, we support the suggestion to move towards a mission oriented and impact focused approach. . Some important tools for more impactful research include co-design and co-creation processes with key societal actors, transition management and strategic experimenting.

In this document, the Partnership for European Environmental Research (PEER) proposes missions and research topics for the EU's next Framework Programme for Research and Innovation (FP9) and comments on implementing instruments.

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## Three Missions for a sustainable society and economy

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### *Mission 1: Water for Life*

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*To increase Europe's resilience to drought and water shortages in Southern and Central Europe and to increased precipitation and flooding in Northern Europe by 2030*

Today's climate projections predict significant decreases in the availability of natural water resources in Southern as well as Central Europe. Simultaneously, predictions indicate increased precipitation and flooding in Northern Europe.

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<sup>4</sup> European Commission 2017: LAB – FAB – APP. Investing in the European future we want. Report of the Independent High Level Group on maximising the impact of EU Research and Innovation Programmes. [https://ec.europa.eu/research/evaluations/pdf/archive/other\\_reports\\_studies\\_and\\_documents/hlg\\_2017\\_report.pdf](https://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/hlg_2017_report.pdf)

The now expected extremely dry conditions in Southern and Central Europe will have enormous impact on the agro-, the river-management-, the water supply-, the energy- and the industrial sector. This could radically change the business models for all these sectors and subsequent value chains. Urban and rural landscapes are likewise vulnerable to water shortages, flooding and extreme weather events.

New collaborative approaches to water resources planning and management are needed that draw upon hydro-meteorological research and modelling, sectorial impact analyses and infrastructure planning, as well as social and technological innovation. We need to improve regional predictions of water shortages, reduce levels of water abstraction and conserve aquatic life to ensure we maintain a sustainable and productive environment.

[Links to SDG 6: Ensure availability and sustainable management of water and sanitation for all.](#)

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## ***Mission 2: Healthy Environments for All***

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*To ensure a healthy environment for Europe through monitoring, new technologies and education*

Maintaining a healthy living environment is central to human health. An estimated 12.6 million people died as a result of living or working in an unhealthy environment in 2012 (WHO, 2016). Environmental risk factors, such as air, water and soil pollution, chemical exposures and climate change contribute to disease and injury and undermine the quality of our water resources.

These challenges are not new, but population growth, the impacts of new technologies and urban development continue to impact upon air, soil, and surface and ground water quality. It is a continuous challenge to monitor and understand the impacts of i.e. toxic substances, nanoparticles and hazardous wastes. Climate change also exposes human and animal populations to extremes of heat and cold, and the impacts of natural hazards such as flooding and drought. Ensuring environmental health relies on many stakeholders, including national and local governments across multiple domains – environment, agriculture, health, education, transport, and local communities. New methods and greater capacity to measure and respond to environmental risks and impacts on human health and well-being are needed.

[Links to SDGs: 3 Ensure healthy lives and promote well-being for all at all ages, 6 Ensure availability and sustainable management of water and sanitation for all, 11 Make cities and human settlements inclusive, safe, resilient and sustainable, 12 Ensure sustainable consumption and production patterns, 13 Take urgent action to combat climate change and its impacts, 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development, 15 Protect, restore and promote sustainable use of terrestrial ecosystems.](#)

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## ***Mission 3: Moving Towards True Sustainability***

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*To create new sustainable circular economy business and operating models and cut raw material consumption by 30% by 2030.*

Global annual raw material extraction has increased over the 20th century by a factor of eight (UNEP 2011). Between 1970 and 2015, raw material extraction continued to increase strongly, to the extent that since 2000 raw material extraction appears to have grown at a faster rate than GDP (UNEP 2016). This trend is very likely to continue as the world population is projected to reach 9.7 billion in 2050, an increase of 33 per cent from 2015. Unsustainable extraction, production and consumption of natural resources have negative impacts on both human well-being and the environment, and therefore substantial increases in resource efficiency are needed in Europe and beyond.

The circular economy model can bring part of the required resource efficiency improvements by redefining growth, decoupling economic activity from the consumption of finite natural resources, and designing

waste out of the system through reuse and recycling. Europe can lead in the development of new sustainable business and operating models and the innovation needed to help reduce the intake of raw materials and maintain the materials within the economy as long as possible. Raw material consumption (RMC) is a suitable indicator to measure the development of material consumption, as it measures absolute material volumes and includes the overall raw material extraction both domestic and overseas, and thus is less sensitive to the economic structure than the domestic material consumption (DMC) indicator typically used.

Links to SDGs: 6 Ensure availability and sustainable management of water and sanitation for all, 7 Ensure access to affordable, reliable, sustainable and modern energy for all, 12 Ensure sustainable consumption and production patterns, 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development, 15 Protect, restore and promote sustainable use of terrestrial ecosystems.

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## Environmental research themes for a sustainable society and economy

### Theme 1: Managing our natural support systems

Humankind depends on the provision of nature's goods and services, such as water, food, raw materials and energy. This natural capital and the ecosystems services it provides need to be developed in a way that we can guarantee the basis for life for future generations, as well as economic growth.

#### *1.1: The water, food, land, and energy nexus is incorporated into policy and industry decision-making by 2030.*

Delivering access to sufficient food, energy and water resources to ensure human wellbeing is a major concern for governments worldwide. However, it is crucial to find better way to account for the 'nexus' of interactions between these natural resources and the consequent implications for human wellbeing. Furthermore, setting limits to sustainable use of scarce resources should become a key part of resource management. The public and private sectors have crucial roles in driving positive change towards the sustainable management of resources. Interdisciplinary collaboration should devise solutions to these challenges, the effective use of regulation and incentives, and the associated trade-offs and risks.

#### *1.2: Payments for ecosystem services (PES) and natural capital accounting are introduced in specific sectors, e.g. drinking water provision by 2030.*

A natural capital approach places emphasis on identifying, quantifying and valuing the costs and benefits associated with different uses of the environment. In order to support policy development and informed decision making by government and industry, research is needed to understand natural capital assets and ecosystems, and how they change with adaptive management. The trade-offs of different management approaches also need to be understood to provide evidence for PES schemes and ultimately the more efficient, equitable and sustainable management of the environment.

#### *1.3: No loss of targeted species of concern by 2030.*

The state of natural environment is complex and variable with some winners (especially generalist species) but more losers (especially specialists). These trends are not reversing despite our growing understanding of drivers and substantial investment in remedies across Europe. Development of new interdisciplinary approaches with a focus on positive outcomes for environmental quality, biodiversity, ecosystem resilience and the flow of ecosystem services is needed to reduce the loss of species of concern.

#### *1.4: European freshwaters will not impact negatively on human and environmental health by 2030.*

Water quality is impacted by multiple pressures ranging from diffuse pollution to climate change and the presence of so-called “emerging pollutants” (which are not yet identified in the Water Framework Directive). Current decision support tools are sub-optimal as they do not embrace the complex interactions of multiple pressures in aquatic ecosystems. Developing a better understanding of the fate and behavior of emerging pollutants, their interactions with one another, the impact on human health, and the resilience of ecosystems to multiple pressure factors will help overcoming this barrier.

### Theme 2: Urban environment

With 73% of its population living in urban areas today, Europe is expected to be over 80% urban by 2050. There are both benefits and costs to urbanization, hence sustainable growth that capitalizes on new technology and participatory processes is needed to grow green cities.

#### *2.1: Advancing towards carbon neutral and zero waste European cities*

Technological advances have given us the opportunity to grow green, sustainable cities – reinvent old ones and build new ones. This could add substantially to a sustainable, healthy living environment for European citizens. It would be an achievable goal to aim for all European cities to become carbon and waste neutral within a few decades.

#### *2.2: Platform based mobility services that reduce the climate impacts of personal transport by 60% by 2040 in an urbanizing world.*

Europe is urbanizing and the emissions of CO<sub>2</sub> from transport will have to be reduced considerably within the next decades. Addressing this challenge will require many technological innovations to be combined into a new system, new service design and changes to existing mobility behavior and lifestyles. New solutions to mobility as a service have to be developed, tested and implemented at a large scale, supported by sustainable urban mobility plans (SUMP). Additional research is required to unravel a variety of technologies, system development transformation into service development, as well as to identify the regulatory barriers and institutional support needed to mitigate the current levels of climate and environmental impacts at different scales. Since transport emissions in the context of urbanization is a global challenge, successful innovations, new business ecosystems and platforms could become a major European export success.

### Theme 3: Rural environments - agriculture, soils and land use

There is increased pressure on land to produce food and energy, but this should not happen at the expense of environmental and social objectives. Research can highlight the current and potential trajectories of land-use change, the values of different benefits of land, and the trade-offs that will be required at strategic points.

A major obstacle to sustainable land management today is the missing integration of the implementation of various regulations and policies e.g. CAP, Pesticide regulation, EU Adaptation Strategy – policies addressing related aims but in different, somehow uncoordinated ways. By linking them in terms of landscape management these actions could be combined and strengthened.

#### *3.1: Soil carbon increased by 0.4% per year across Europe to 2030.*

If we increase the amount of soil carbon by 0.4% per year, we can halt the annual increase in CO<sub>2</sub> in the atmosphere<sup>5</sup>. Research is needed in order to invest in our soils and improve their health, and to further

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<sup>5</sup> <http://4p1000.org/understand>

explore the possibility for adding organic material derived from urban waste streams, thus preserving soil fertility as well as contributing to mitigation of climate change.

### *3.2: Reduce Europe's reliance on chemical inputs in agriculture by 25% by 2030 and by 40% by 2040.*

The indiscriminate and excessive use of chemical inputs represents a threat for the good state of ecosystems and human health. Many Member States have introduced specific plans in order to reduce the use of chemical inputs. This policy action needs to be coupled with research and innovation actions aimed at a better understanding of the impacts and transfer rates of chemical inputs into other parts of the environment, in particular water. Knowledge on this area can pave the way towards better agricultural land and water management.

## Theme 4: Climate change adaptation

Increasing temperatures and increasing occurrence of extreme events increase pressures on the habitats, biodiversity and ecosystems on which we all depend,. Research is needed to investigate what might be the combined effect of these trends alongside others, such as population growth, and how to adapt.

### *4.1: Strategies to adapt to climate change in rural and urban environments developed by 2025.*

Research and innovation are needed to develop measures aimed at enhancing the adaptation of European society and ecosystems to climate change.

Under a context of climate change and growing population, water supply will become a challenge in many regions of Europe and the rest of the world. Higher water demand for different uses (agriculture, industry, etc) as a result of growing population coupled with water scarcity in certain areas due to more frequent and long periods of drought are expected to exacerbate pressure on current water resources and ecosystems. The unequal distribution of water resources all over the planet is likely to bring about social and even political conflicts. Innovative ideas around monitoring tools, decision support tools based on adaptative integrated water management, the evaluation of the state and vulnerability of hydrosystems, and governance models are still needed.

Climate change is also expected to impact upon the emergence of vector-borne diseases, or the frequency of extreme events (floods and droughts). The effects of flood events on aquatic ecosystems include the consequences of increased sediment and pollutant transport, with likely impacts on aquaculture and benthic quality and potential for eutrophication, and more generally on fresh water quality and availability. These events also pose risks to population living along rivers. Research is needed to understand and manage such events and their consequences for ecosystems, the water cycle and housing areas and to construct and validate models to confidently predict and mitigate them.

The devastating forest fires in many regions of Europe in 2017 have resulted in a high number of deaths, habitats destruction and financial losses. Climate change is likely to exacerbate the effects of forest fires in European ecosystems. A better understanding of ecosystem and human vulnerability to fire and of fire prevention and fire suppression strategies could help prepare European society for these events. This includes developing multirisk approaches in response to multiple hazards and analysing the efficiency of different vegetation management scenarios for increasing forest resistance and resilience; as part of integrated land management.

## Theme 5: An equitable economy for limited living space

In an economy in which the value of natural resources and services is poorly incorporated, the benefits and costs of economic development are unequally distributed between societal groups and generations. Europe

should pioneer in bringing key environmental boundaries to the political agenda and in co-creating effective and acceptable solutions.

In this respect, human behaviour is an important factor: human behaviour strongly influences economic and environmental developments. A thorough understanding of human preferences and the analysis of acceptability of new technological and social solutions are therefore required for sustainable development.

*5.1: Valuing the benefits of the environment to human well-being and health across all levels of the European society, by citizen involvement.*

Human behaviour, choices and preferences in relation to the environment need to be better understood in order to manage the transition to a more sustainable, environmental friendly society. The importance of environmental services for human health need to be better assessed and valued. Environmental research can invest the importance of early life interventions on e.g. human tolerance against autoimmune illnesses, brain development, mental and physical resilience as well as how to increase the economic benefits for society and the economy.

*5.2: The bioeconomy as a tool to enhance ecological transition to be explored through new innovation by 2030.*

A considerable proportion of renewable natural resources are today underexploited and wasted, e.g. it has been estimated that 30% of food leftovers are lost. The bioeconomy, which is partially inscribed in the circular economy, offers a new paradigm based upon the recycling, reuse and valorisation of resources so that they can be transformed into, and used, in food and materials production systems. From an economic perspective, bioeconomy will open up opportunities for job creation and regional development. Future research needs to be directed at:

- Overcoming disciplinary silos and building a system approach beyond sectors through the development of scenario-based foresight studies in order to get a better insight into contrasting options and their compatibility. More multidisciplinary research is needed to help to analyse co-benefits and trade-offs in bioeconomy.
- Accompanying and involving all players and actors of society on the paths of transition.
- Identifying relevant territorial scales for organizing value creation through the mapping of sustainable regional biomass potentials and the launch of living labs to test in real conditions the coherence of technological and organizational innovations.
- Measuring, analyzing and improving the implementation of bioeconomy through life cycle assessment models, risk and uncertainty assessments.

## Instruments for implementing FP9

### Collaborative research and innovation actions

We agree with the recommendations in the LAB-FAB-APP4<sup>4</sup> report that:

- EU research funding should be prioritised in EU and national budgets.
- EU R&I programmes should be designed for greater impact and improved dissemination.
- Research should be based on openness in science and innovation and open to broader participation.
- Further simplification, harmonisation, rationalisation and alignment of programmes and mechanisms are needed.

Following these recommendations, PEER would also like to highlight that:

- A mission oriented approach is dependent on a strong European Research Area as a platform for strategic, interdisciplinary collaborative research. Thus the whole chain of R&I from blue skies bottom-up research through strategic thematic research to innovation actions should be funded, and the interdisciplinary collaborative research instrument should be a leading element in FP9 in order to bring knowledge from the research community into public and private innovation.
- Innovation generated by European research must be introduced into the market. So called “regional living labs” that bring together different stakeholders from industry, administration and science on a regional level have proven that they can provide a suitable approach for bridging the gap between science and the market uptake of research results and should be further explored in the future.
- FP9 shall put more emphasis on cross-cutting issues than before. This can be done through the mission-oriented approach and launching truly cross-cutting calls.
- State-of-the-art research infrastructure is vital for cutting edge science, and European added value requires more coordination between national and international funding decisions on infrastructure to maximize benefits.
- The current ERC definition of ‘Excellent Science’ largely follows a traditional, single discipline approach, and potentially hampers excellent proposals in more interdisciplinary areas such as environmental science. The funding and evaluation criteria of the ERC grants should be further developed to better support excellent cross-cutting and interdisciplinary science.
- In the future bottom-up, cutting edge research should also be aimed at fundamental research on basic, but multi- and interdisciplinary questions such as (i) how to transform developed societies to a circular economy, (ii) how to change the flows between developed and developing countries towards a sustainable mode and (iii) how to address policy and behaviour change to advance a more sustainable world. This would be another way to overcome the traditional disciplinary understanding of excellent science and increasing the European added value of the ERC.

In addition, PEER would like to recommend that measures are taken to avoid oversubscription and its associated waste of resources. In order to achieve this we recommend:

- Calls includes a clear description of requirements, scoring criteria and expected impacts and are should be two staged.
- Call budgets should allow for more than one project to be funded and be open in successive years.
- Project budgets should enable coverage of costs for use and collaborative development of research infrastructures.
- The commission issues a “**Seal of Excellence**” for high ranked project proposals that do not receive funding (as done by the Structural Funds). Even if national budgets are tight and not adapted to financing European consortia, such a seal may in a few cases help in attracting funding from national or other sources.
- FP9 provides more detailed evaluation reports so that researchers will have transparent information on reasons why a proposal failed.



## About PEER

PEER is a partnership of the eight largest environmental research centres in Europe ([www.peer.eu](http://www.peer.eu)), combining forces to follow a joint strategy in environmental sciences and to further develop the European Environmental Research Area.

Given its 16 year long experience in joint European cooperation and participation in the Framework Programmes, PEER wishes to contribute to current discussions on FP9. This paper contains PEER's views on what could be the main environmental objectives of the future Framework Programme, possible instruments to achieve those objectives, as well as a list of missions that should be addressed.

Environmental issues require and will continue to require a broad, European and international approach. PEER embodies cooperation in environmental research both amongst its constituent institutes and more widely with research and educational institutes across Europe and beyond. As we go into a new Framework programme, there is considerable uncertainty from a geopolitical perspective, however continued cooperation with our partners in the United Kingdom will remain essential for the development of the European Research Area.

PEER members are partially publically funded national and European competence centres characterised by scientific autonomy and interdisciplinary expertise. PEER conducts basic and applied research combining different disciplines from natural and social sciences and addressing the needs of stakeholders from industry and society. Our research covers all fields of the environment, particularly addressing the interactions between mankind and nature.

With a combined budget of €630 million and approximately 6,100 staff members, PEER brings a wealth of experience from participation in major international networks and programmes, and all members have been actively involved in numerous projects funded by the EU's Framework Programmes for Research and Development.

### The PEER members are:




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