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FairCarboN, an exploratory Priority Research Programme and Infrastructure (PEPR) with sights set on carbon neutrality

Jointly steered by the CNRS and the INRAE, the FairCarboN exploratory Priority Research Programme and Infrastructure (Programme et Équipement Prioritaire de Recherche, or PEPR)¹ aims to develop the role of continental ecosystems in climate change mitigation and the attainment of carbon neutrality. Inaugurated on 11 April 2022, this PEPR has a six-year budget of €40 million, financed through France's Programme d'Investissements d'Avenir 4 (PIA4) funding mechanism. It is issuing an initial call for proposals this month and will back five target projects, to foster greater dialogue between the disciplines, locations, and parties involved.

To meet the Paris Agreement's goal of limiting global warming by 2050 to well under 2° C, carbon neutrality must be achieved. Here terrestrial ecosystems play a pivotal role by helping to reduce emissions and, through carbon sequestration, offset those that are unavoidable. Both functions must be performed while preserving natural ecosystems and ensuring the sustainability of managed and seminatural ones. Their capacity to provide other ecosystem services—supplying biomass, providing adequate water of sufficient quality, and preserving biodiversity—needs to be maintained or enhanced. This requires substantial multidisciplinary advances in our understanding of carbon dynamics in terrestrial ecosystems, of carbon sinks and flows at different spatiotemporal scales, and of interactions between the carbon cycle and other biogeochemical cycles, including the water cycle—all within the context of global changes. The **FairCarboN** exploratory PEPR should make it possible to precisely determine the contribution of continental ecosystems—including natural, forest, agricultural, freshwater, coastal, urban, and rural environments—to climate change mitigation, and to identify the ecological, agronomic, and socioeconomic mechanisms that can be activated for the transition to carbon neutrality.

To that end, **FairCarboN** will capitalize on French research teams and infrastructures² in mainland France, French overseas departments and territories, and other countries, including those of the Global South, thereby consolidating French leadership in the area of carbon management within continental ecosystems.

The PEPR's two steering bodies are flanked by six partners from the world of academia and research,³ with recognized, complementary expertise, that will sit on the strategic committee. Its two co-directors, Sylvie Recous (INRAE) and Pierre Barré (CNRS), lead with assistance from a team of 14 scientists specialized in the main fields concerned by the PEPR. This team will benefit from the insights of an international scientific committee and a stakeholders' committee, which will also help coordinate **FairCarboN** activity with ongoing international initiatives and ensure broad mobilization of all parties around the PEPR.



FairCarboN will have a meaningful, direct, and concrete impact on:

- (1) **science**—by expanding knowledge, enhancing expertise within research infrastructures, creating databases and a new generation of shared and open computer models, authoring more international scientific publications, and building a worldwide reputation;
- (2) **environment**—through solutions to reduce greenhouse gas emissions and increase carbon sequestration while maintaining ecosystem sustainability;
- (3) **societal engagement and economic strategy**—charting courses to carbon neutrality with the various stakeholders (e.g. farmers, foresters, industrial firms, environmental agencies, civil society, NGOs, and policymakers), assisting authorities as they pursue these courses on national and subnational levels, and implementing indicators and decision-making tools to help parties involved contribute to the carbon neutrality transition; and
- (4) **policy**—transmitting essential programme data via summaries and indicators for use by government officials, and helping to draft and evaluate public policies.

An initial call for proposals from the whole community, to be issued in mid-April, will seek to spur progress in our understanding of key processes governing the carbon cycle (e.g. links with other cycles, plant biomass production and recycling, latitudinal and longitudinal flows, greenhouse gas volumes, carbon sequestration and emissions, and public policy effects). Engagement with the scientific community during the project definition phase will create conditions for the emergence of broad, coordinative multidisciplinary consortia needed to deepen our knowledge of these complex systems.

Five target projects, with a budget ranging from €1.5 million to €7 million, will be launched by 2023. One will create an unprecedented database to track changes in soil and plant biomass carbon pools. Its use by the modelling community, through PEPR stimulus, will give rise to a new generation of models simulating carbon dynamics within continental ecosystems with greater precision. Another project will develop a multi-agent modelling platform for the integrated evaluation of regional bioeconomic systems. The platform will be a key vehicle for the coordination of 'scenario labs' bringing together scientists and stakeholders in five pilot regions—reflecting diverse bioeconomic priorities—in mainland France, overseas French departments and territories, and countries of the Global South. The three remaining projects will provide targeted support for existing research infrastructures, to increase and harmonize monitoring of continental ecosystems with state-of-the-art instrumentation.

Finally, research-based educational initiatives (e.g. workshops, instructional modules, and online resources) and international exchanges will be organized to train tomorrow's men and women researchers, engineers, and technicians committed to following the path to carbon neutrality.

Notes

¹Exploratory PEPRs target emerging fields of science or technology to receive French government coordination and support. They are financed through the research component of the PIA4 programme and the France Relance economic recovery plan. Projects that become exploratory PEPRs are selected by an international jury through a rigorous process.

²The extensive reach and collaborative network of the French research ecosystem ensures coverage of an immense range of soil climate conditions and sociotechnical systems in temperate, Mediterranean, tropical, arctic, and subarctic zones. This is evident in the wealth of networks, research infrastructures (e.g. AnaEE France, eLTER-France RZA and OZCAR, ICOS France, and SNO observation networks), and scientific as well as economic partnerships in France and abroad.



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