

## Research development and innovation joint call on Sargassum seaweed:

The ongoing large influxes of Sargassum seaweed currently impacting the Caribbean and American coastlines are the worst since 2011. Their economic impact can be counted in millions of euros, especially in the tourism industry and the associated emissions of hydrogen sulphide (H<sub>2</sub>S) and ammonia (NH<sub>3</sub>) having a significant effect on the health of coastal residents. Marine ecological impacts have not yet been evaluated.

In order to improve the management of Sargassum influxes, there is a compelling need to increase our knowledge of bloom ecology as a basis for developing reliable forecasts and alert systems, and for finding operational and economically reliable solutions for the collection, use and valorization of Sargassum. These requirements are central to the present joint call.

The aim of the joint call is to support collaborative research, development and innovation projects that will:

- improve knowledge of Sargassum ecology as a basis for environmental decision making;
- foster the design of both short and long-term management strategies, and;
- provide innovative, cost-effective solutions capable of mitigating the impact of Sargassum strandings.

Joint initiatives from different countries and regional authorities from Caribbean islands and American regions are expected through this joint call. They are designed to create and support international research teams with the aim of gaining a better understanding of the phenomenon and find effective solutions for managing these harmful events.

### Background:

Before 2010, brown algae only bloomed in the tropical North Atlantic, the Sargasso Sea. However, they have recently been observed off the Brazilian coast and those of Western Africa, from Sierra Leone to Ghana. The reasons for the increasing incidence of blooms need further elucidation, but in the case of those affecting the Caribbean and American coastlines, Amazon nutrients in relation with deforestation and agricultural intensification have been implicated, along with shifts in hydrodynamic and wind drift patterns associated with climate change.

### Content of the call:

The main goal is to provide research and innovation grants for projects led by consortia of scientists and companies from the Caribbean region in conjunction with research teams from mainland France, Brazil and other countries (USA, Mexico...). The results will be expected to increase our knowledge of bloom events, explain their causes and origin, and provide insight into effective techniques for dealing with them over different time scales, including the development of innovative technologies for reducing the impact of strandings, and where practicable, their use as a resource for industrial processes.

The call focusses on 4 interrelated thematic areas. Proposals will need to identify their main themes and, it is recommended, submit transversal projects covering several items. Ideally, outputs from themes 1 and 2 will fuel reflections and works for themes 3 and 4. Funders are expecting concrete results, ready and easy to use tools to optimize the use of the different

operational solutions and technologies which will come out from theme 3, in order to deploy pragmatic strategies to cope with these sargassum issues, as expected in theme 4.

### **Theme 1. Characterization of Sargassum**

This theme will focus on identifying the different species and determining their origin, behavioural traits, reproductive and demographic patterns and the associated ecological interactions. This process should involve modelling growth rate and population dynamics in relation to relevant biotic and abiotic factors using the appropriate physiological, genetic, biochemical, morphological, demographic techniques. Bloom-increasing factors, such as the influence of Amazon and African rivers will also need to be identified together with the associated chemical input, including that of contaminants such as Cadmium, Arsenic and Chlordecon etc. Against this background, consortia will also be required to:

- provide results capable of supporting Call themes dealing with the forecasting of sargassum events (theme 2), the impacts of sargassum blooms on the environment and human health (theme 4) and ways of valorising the associated strandings (theme 3);
- propose or develop ecological patterns that could predictively link volume of influxes with key and easy to evaluate indicators (Theme 2).

### **Theme 2. Forecasting sargassum events**

This theme will examine the accumulation of sargassum banks, their trajectory in the open seas and options for the development of operational alert systems for algae stranding and their likely site effects. These models and operational systems must be based on hydrodynamic and remote sensing observations and be capable of being integrated into mechanistic models informed by input from theme 1.

Applicants must develop research strategies that can improve the reliability and precision of existing sargassum forecast tools. This will involve the extension of databases, analytical techniques, the exploration of new image sources, as well as ground truthing investigations that cross-check forecasts with real stranding and local knowledge. It will also involve considering the work of ongoing modelling projects (such as CaribCoast) that examine possible influences of climate change and the impact on hydrodynamics and wind conditions on the banking and drift of algae blooms.

The results from the models are expected to help the design of the strategies of mitigation in theme 4 and improve the use of the innovative solutions of theme 3. In order to accomplish this, the models will need to:

- be tested for several months in order to fine tune the process and ensure the delivery of adequate services.
- provide accurate information on expected quantity, location and time of sargassum stranding and possible site effects.
- be supported by reliability indexes and indicators in order to express the reliability of the system, and;
- made available as effective, ready to use open sourced web-based tools.

## Theme 3. Collection and valorisation of sargassum strandings

### 1. Collection

This element of theme 3 will involve both industrial research and experimental development. Its aim will be to propose innovative low-cost methods and technologies for protecting the beaches from massive inputs of algae by collect them at sea close to the shore, from coastal sediment as well as from beaches. Added value will be attached to proposals that balance the costs of collection (1) with the revenues of valorization (2).

In pursuing theme aims, applicants should:

- review the latest experiments<sup>1</sup> to avoid duplication and to capitalise on developing ideas
- adopt an agile and creative approach to the development, adaptation and testing of innovative solutions.
- Ensure that proposed collection methods are cost effective, efficient and comply with current environmental and health and safety regulations.
- Provide technical drawings along with data on methods and technologies and simulations. Novel solutions, like mobile dams to improve algae collection at sea, among others, will be welcomed.

Tests will need to be conducted on real strandings and evaluated in the field across the key operations. In order to reduce transport costs, they should also assess the practicability of cost-cutting measures (pre-treatment) such as drying, compaction.

### 1. Valorisation

This element of theme 3 will use fundamental and applied research to explore ways of valorisation sargassum. Potential options include its use in energy production, agriculture (excluding direct spreading), the development of biomaterials and the extraction of high-value bioactive molecules (including phyto-pharmaceutical). In presenting options, applicants must mention other potential raw materials included in the process.

Proposals must take into account of stranding-irregularity as well as results from theme 1, contamination in particular. And since one solution is unlikely to fit all circumstances, funders will expect a range of solutions that could be used depending on the volume of influxes and the expected stranding sites.

Proposed methods must also be adapted to local conditions and show a viable business model. Moreover, territorial feasibility studies will be needed to prepare technology transfers (market, source and co-products availability...). In support of this aim, the participation of private partners is highly recommended.

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<sup>1</sup> Data of experiments will be accessible (in French only)

#### Theme 4. Impacts of strandings and coping strategies

The focus of theme 4 is to precise the impacts of Sargassum and define solutions and coping strategies that can mitigate adverse effects. In this context, impacts studies will be required in relation to:

- Human healthcare, diseases (exposure to H<sub>2</sub>S, NH<sub>3</sub>, sensor strategies and warning thresholds), kinetic of sargassum degradation and gas released, epidemiological issues
- Environmental health, with a focus on coral reefs, mangroves, wetlands, seagrass beds, emblematic species, turtles and fishing species;
- Socio-economic influences, including tourism, fisheries and economic consequences on businesses due to illnesses of the workforce. (ie chikungunia in Reunion islands)<sup>2</sup> and the concomitant impacts on the insurance industry.

Based on the results of theme 2 and solutions arising from theme 3, applicants are invited to submit tools and methods to mitigate the adverse effects of sargassum strandings on the population, the environment and the economy. These should have a territory planning approach as existing planning maps which not only record land uses but also identify critical locations where environmental issues may arise, including landslides.

In attempting to mitigate the impact of sargassum blooms, theme 4 actions will need to draw on a wide range of stakeholder interests, including government, non-government, sectoral, business and academic organisations. Many of these have decision-making capabilities and the potential to resource initiatives, and some have experience in dealing with sargassum crises and the implementation of sargassum action plans. The project should use this stakeholder resource to access local knowledge, avoid duplication, promote engagement, and, at a broader scale, use the network to adapt the policy framework and the associated regulations at local, Caribbean and international level.

Operational tools are expected from applicants.

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<sup>2</sup> Some populations as well as schools have been relocated (town of Goyave in Guadeloupe)