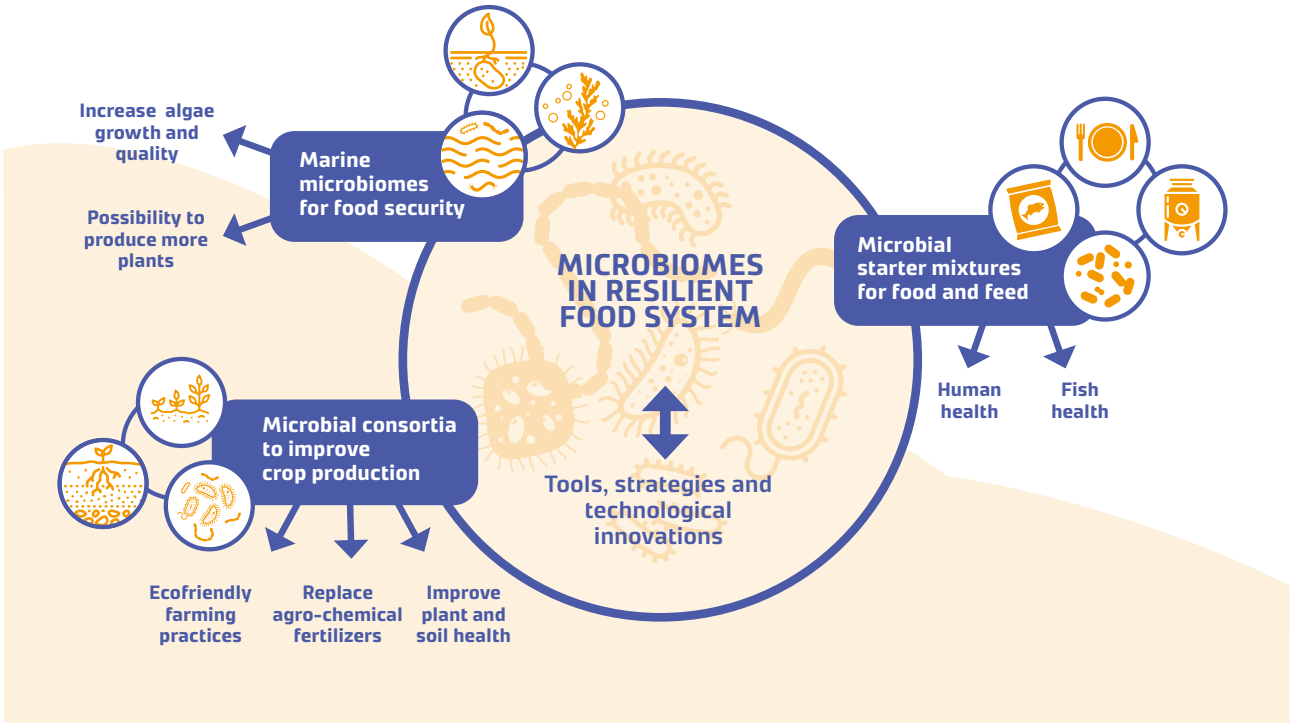
Luke
LUONNONVARAKESKUS

Policy Brief

Soil, marine and food microbiomes for the achievement of the One Health Goals

Our society is facing many challenges, due to change in population demographics and dietary habits, increasing levels of chronic disease and an ageing population. Primary production is vulnerable and dependent on different unsustainable inputs. Without a significant change in current trends, noncommunicable diseases (NCDs) continue to rise as well as decline agro-biodiversity and crop productivity. Therefore, the resilience and sustainability of the European agrifood systems needs to be enhanced in ways that simultaneously increase agricultural production, decrease post-harvest food losses and food waste, protect the climate, environment, and health, and finally preserve biodiversity.



Enabling the use of microbiomes in plant production

A better understanding of the synergies between soil, plants and soil life and their impact on soil processes and ecosystem functions is of key importance for sustainable agriculture that is less dependent on the input of hazardous agrochemicals by well-integrated plant-growth-promoting microorganism applications.

SIMBA has set-up microbial consortia and verified their efficiency in the pot, greenhouse and field tests with/without biostimulants to improve crop production, growth and health by well characterised microbiomes and novel bioactive and biocontrol agents. The microbiome monitoring showed that they do not affect natural microbiomes, therefore showing to be safe and can be recommended to farming practices.

Encouraging the use of marine microbiomes for microbiomes for food production

A better utilization of marine microbiomes can underpin food security. The coastal agriculture relies on a healthy microbiome, but salinification of the groundwater and soils may negatively impact the plant root associated microbiome and hinder growth of crops. In addition, fresh water is becoming more scarce worldwide, threatening traditional agriculture based food production. Moreover, the marine microbiomes play a significant role in influencing the growth and biochemical composition of algae cultures. It is important to study how microbes react to these influences and whether can be used to facilitate growth of salt tolerant crops or algae.

In **SIMBA** we have characterized isolates, enrichments, and natural microbiomes derived from the rhizosphere of a natural salt marsh vegetation. The experiments showed that growth of potatoes under saline conditions was stimulated by adding natural salt tolerant microbiomes, but the identification of the beneficial bacterial species require more and larger scale testing.

The marine microbiomes can also increase the micro-algae growth and vitamin B12 production in closed system. Moreover, in **SIMBA** we formulated the potential candidate bacteria to seaweed growth in an open system.

Recommend microbial consortia for food and feed

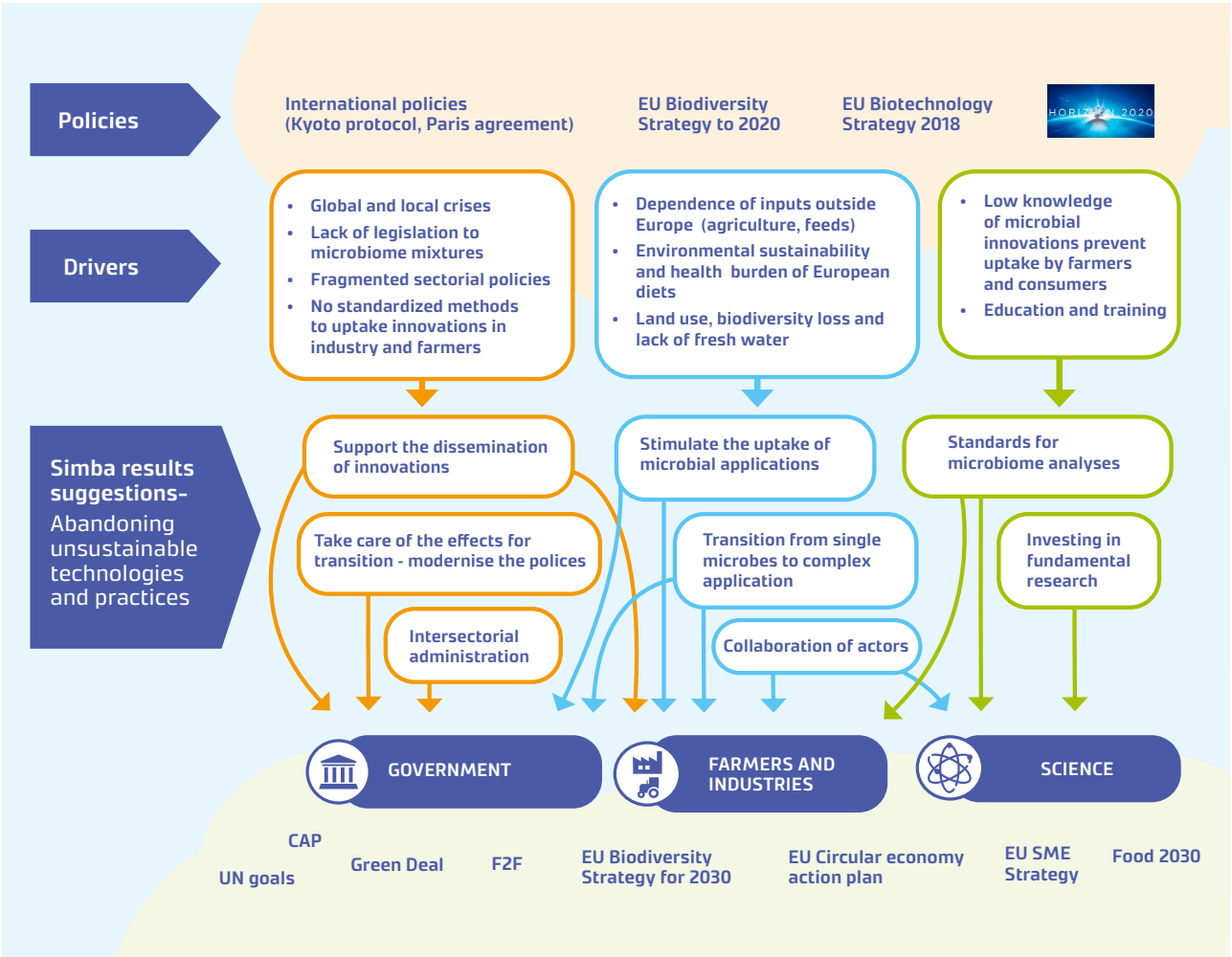
The use of plant proteins is limited by the presence of several anti-nutrients that reduce digestibility and nutrient utilization. Fermentation is a cost-effective way to reduce the above-mentioned undesirable substances and to obtain good quality foods and feeds. Diverse plant-based food is recommended to improve the human health. In fish feed, it is important to find new feeds to replace the fishmeal. Fermented products have enhanced nutritional properties due to transformation of raw materials and formation of beneficial compounds to the end products.

In **SIMBA** fermentation protocols were applied to plant-based materials. Four distinct microbial consortia featuring lactic acid bacteria, or a combination of lactic acid bacteria and propionic acid bacteria were developed for food fermentations. The studies proved that fermentation could improve the nutritional quality, reduce unwanted compounds, produce vitamin B12, and enhance sensorial properties in the development of plant-based food products.

The fish-feeding results of **SIMBA** showed that fermented ingredients are potentially sustainable in the diets of different fish species. Our results showed that the replacement of 50% of fish meal with the fermented compounds had no negative effects on growth and feed conversion in salmon and only a very slight reduction for sea bream and sea bass. No effects of the diets were observed on the gut microbiome, which can be seen as a positive outcome. In addition, diets with fermented compounds showed an increase of polyunsaturated fatty acids in the fish fillets, which is interesting from a human nutritional perspective.

EU needs sustainable food system

We suggest including **the policy coherence** among many and fragmented sectorial policies affecting food production and consumption. This actually is the most important policy deficiency identified by UN as well as by EU-level policy think-tanks in connection to the **UN Sustainable Development Goals (SDGs)** and respective **Policy Agendas 2030**. In our opinion it is a cross-cutting policy issue connected to SIMBA results. SIMBA supported the European Green Deal, incl. **Farm to Fork Strategy:** circular economy and sustainable consumption patterns through conversion of not tradable vegetables into fermented added value foods. SIMBA was in line of the **Food 2030** priorities establishing the value chains for plant-based materials and side-streams and conduct chemical analyses to assess the suitability and safety of the products for potential applications. New plant-based food innovations will also support the competitiveness of European agriculture and thus, in addition to health, address environmental and social challenges. Innovations created through research supported SMEs to adopt sustainable production methods complying with environmental and social standards and empower growth, economic development and job creation in the EU **(SME strategy.**)



Recommendations

- **To take care of the effects of the transition.** To modernize existing policies (e.g. Common Agricultural Policy) to support the transition towards a fully sustainable agricultural sector integrating the principles of circular economy, stimulating the microbiome research and innovation, and contributing to the UN SDGs.

- **To improve intersectional administration.** The intersectional administration will provide the capacity to develop and apply the farming practices to improve the agro-ecological biodiversity.

- **To support the dissemination of innovation.** To facilitate the development of innovative microbiome-based products to the market by amending the authorisation procedures in a way that they do not hamper their access to the market.

- **To eliminate unsustainable practices and technologies.** To integrate the know-how on the study of microbiomes in different environments & increase awareness in scientists and society that microbiomes should be applied by industry and farmers.

- **To facilitate the transition** from single microbes or simple consortia applications to complex microbiome applications in the biotech and food industry

- **To facilitate the collaboration** of all actors so the results of research activities are in line with the values, needs and expectations expressed by society / consumers

- **To establish international standards** in agri-food microbiome analyses (from sample collection to technology implementation). This is critical and must be a main priority to improve plant production and processing. This is also critical for agro-industry: industry will not implement methods & protocols if they are not standardized. If data and drivers used to formulate legislative policies are deriving only from a top-down analysis there is a concrete risk to not allow farmers to reach the envisaged targets.

- **To keep investing in fundamental research** for the search of novel beneficial genes, enzymes, and microbial consortia that will drive novel applied research opportunities

Authors:

Anne Pihlanto (Coordinator)
anne.pihlanto@luke.fi

Annamaria Bevivino (Soil)
annamaria.bevivino@enea.it

Henk Bolhuis (Marine)
henk.bolhuis@nioz.nl

Minna Kahala (Food)
minna.kahala@luke.fi

Sarah Sarsfield (Communications)
sarah@aquatt.ie

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SIMBA
SUSTAINABLE INNOVATION OF MICROBIOME APPLICATIONS IN THE FOOD SYSTEM

Luke
NATURAL RESOURCES INSTITUTE FINLAND