

Proposal for a Horizon Europe mission on nutrients

(Grand challenge: Healthy people and planet)

Mission: To halve the nutrient footprint of food by 2030, for more resilient farms, healthier diets and a better environment

Explanation: Nutrients such as **phosphorus and nitrogen** are essential to life. But much of the nutrients that farmers apply to their land are ultimately lost into the atmosphere or water bodies. There, they wreak environmental havoc, notably **eutrophication** or algal blooms that can wipe out other aquatic life.

Phosphorus is the main reason why **over a third of European water bodies are failing to meet quality standards** under the EU's water framework directive. Agricultural ammonia emissions are a major contributor to **particulate matter**, an air pollutant that causes more deaths than road traffic accidents every year. Nutrient pollution is one reason why governments are struggling to comply with EU laws on clean air and water.

Only about 20%ⁱ of the nutrients used in agriculture in agriculture actually reach our plates. We propose a Mission to improve nutrient efficiency and recycling throughout the food chain. In other words, a **circular economy for nutrients**. We want to **halve nutrient losses to water and air**, and halve the number of water bodies failing water quality objectives because of nutrient run-off. For the most polluted areas (e.g. the Baltic Sea), we propose to research **remediation options** including nutrient removal technologies and practices (e.g. targeted fishing).

This Mission is also about making European agriculture more competitive. In line with the Common Agricultural Policy's proposal for nutrient management plans, we propose to study how to **optimise mineral and recycled organic fertiliser inputs** - for maximum yields and minimum impact on the environment - through **soil analysis** and **precision farming**. What new forms of fertiliser delivery could make a difference? Is there scope for a shift from **product- to service-based business models** in agriculture?

We want to recycle more nutrients. Today, the EU depends on imports for 90% of its phosphorus (phosphate rock is an **EU Critical Raw Material**) and most of its nitrogen (because it is made from natural gas). We want to halve this dependency, both for food production and for strategic industries that rely on phosphorus (e.g. pharmaceuticals, fire safety and lubricants).

This requires research into **nutrient recovery from biowaste streams** (e.g. manure, sewage, animal by-products and forestry). It also requires research into **how to build a market** for such secondary raw materials and how to use them better. The EU's revised fertiliser regulation takes a first step in this direction, by introducing standards for waste-based fertilisers.

We have to better understand the **opportunities and challenges of recycled fertilisers**. What is their life cycle **impact on yield and the environment** versus mineral fertilisers? What are the socio-economic implications of using recycled fertilisers? What kinds of **contaminants** do we need to worry about, and how can we best manage them? How do we get farmers and consumers to **accept** recycled nutrients as sensible and safe? By 2030, we want to double the use efficiency of nutrients through recycling.

Part of this Mission is also about **climate change**. We propose to research the **interactions between nutrient recycling and organic carbon recycling** (e.g. via digestate or compost). Our goal is to turn European agriculture from a net carbon emitter to a **net carbon sink by 2050** (in line

with the "**4 per 1000**" **soil carbon initiative** launched by France at COP21). Recycling nutrient-rich organic matter can increase the soil's fertility and make it more resilient to climate change. Nutrient recovery from waste can also support the energy transition through the concomitant production of **biogas**.

The biggest reduction in food's nutrient footprint however, could come from **eating less, and less meat in particular**. Phosphorus and nitrogen levels in diet in Europe are more than twice dietary requirements, which raises health questions as well as causing environmental problems. We are not proposing to ban meat, but to explore **dietary choice and communication** with consumers, also via supermarkets and the food industry. We believe this can contribute to our goal of halving the total nutrients consumed to produce Europe's food.

We propose to investigate how nutrients can be included in **Product Environmental Footprints** for example; half of the European Commission's PEF pilots have been carried out by food and drink manufacturers. We want to study the nutrient footprint of **food waste**, and halve that too.

There is a lot of work to do to better understand nutrient flows in Europe. We need to collect **quantitative data on nutrient flows** in agriculture, waste streams and the environment. We need to model the impact of relevant policies. We can develop **regional strategies** for nutrient recycling, energy production and waste valorisation. At the end of the day, **big data** on nutrient flows can help support the development of the EU's bioeconomy.

The **Paris Climate Agreement** and **Sustainable Development Goals (SDGs)** both require a more circular, low-carbon food system. The aim of this Mission is to contribute to the production and consumption of safe, affordable food and healthier diets, while cleaning up the environment and creating local jobs. As the agri-food sector re-orientates towards supplying value rather than materials, recycling, precision farming and agricultural services will support **job growth** in the EU.

Relevant actors: Farmers, agro-food industry (food and beverage processors), animal feed industry, slaughterhouses, distributors and retailers (supermarkets), consumers (incl. citizens and cities), water, wastewater and waste/recycling companies, environment and health NGOs, mineral and organic fertilisers and soil improvers, chemicals and forestry industries (biorefineries), fisheries, aquaculture, technology suppliers, energy (biogas production), climate community (soil carbon), researchers and policymakers at national, regional and local level.

Recap of proposals to halve the nutrient footprint of food by 2030:

1. Halve nutrient losses to water and air by 2030.
2. Halve the number of water bodies failing water quality objectives because of nutrients by 2030.
3. Halve the EU's dependency on imported phosphorus and nitrogen by 2030.
4. Double the use efficiency of nutrients through recycling by 2030.
5. Turn European agriculture from a net carbon emitter to a net carbon sink by 2050.
6. Halve the total nutrients consumed to produce Europe's food by 2030 (also through diet change).
7. Halve nutrient losses through food waste.

Prepared for ESPP (European Sustainable Phosphorus Platform) based on the input received from stakeholders, including via the SYSTEMIC – Biorefine meeting 30th May and ESPP3 Helsinki 11th June 2018.

ⁱ From Cordell et al. "The story of phosphorus: Global food security and food for thought", Global Environmental Change, 2009 <http://dx.doi.org/10.1016/j.gloenvcha.2008.10.009> updated in "Life's Bottleneck: Sustaining the World's Phosphorus for a Food Secure Future", Annual Reviews 2014 <http://dx.doi.org/10.1146/annurev-environ-010213-113300>