Food Sustainability

ERASMUS+ Blended Intensive Programme

Contract n.: 2021-1-IT02-KA131-HED-000011267

Description of the programme with course details

- Venue: University of Parma (Italy)
- Online lectures (pre-recorded): from 15th June 2023
  Online final lecture (live): 14th July 2023
- In-presence period: 3rd - 7th JULY 2023
- Language of the programme: ENGLISH
- ECTS: 6

ERASMUS+ blended intensive programme

The University of Parma (Italy), jointly with the University of Angers (France), the University of Extremadura (Spain), the Wroclaw University of Environmental and Life Sciences (Poland), University of Gävle (Sweden) and University of Oradea (Romania), offer their students the opportunity to participate in a Blended Intensive Program (BIPs). The Blended Intensive Program is officially approved by the EU in the framework of the ERAMSUS+ 2021/2027 and is developed in the framework of the EU GREEN Network. BIPs are one of the new and innovative formats of student mobility introduced by the new Erasmus+ 2021-2027 Program. These programs, jointly developed by multiple higher education institutions, feature advanced and innovative pedagogical approaches that combine short-term face-to-face (physical) mobilities with portions of virtual learning. BIPs are inherently transnational and transdisciplinary, as curricula are developed and taught together by partner institutions in different countries. The combination of in-person and virtual learning spaces allows students and professors to experience and exchange highly collaborative, challenge-based, and research-steeped methods of teaching and learning. Through the required virtual part of the programme, students and professors alike have the opportunity to develop and hone their digital knowledge and skills, reflecting the European Commission's priority to harness the potential of digital technologies for teaching and learning and to develop digital skills for all.

Description of the program

The world population has reached the mind-boggling number of 8 billion people. Food production is running into an increasing demand for quantity and quality, but agro-livestock activity and the processing industry have a heavy impact on the environment and on Earth's health. With this BIP we aim at making students conscious of the problems that must be tackled from different perspectives: environment, food production, management, and law. The program will be divided in four sections: the ecological, the food, the management, and the law modules. The **ecological module** supports students in understanding how to produce an inventory of pressures at the watershed scale, organized in a database and connected to a GIS, how to calculate soil system budgets and water pollution risk through real case studies and field trips and how to contrast such risk with nature-based solutions. The **food module** addresses the topics of sustainable food production integrating solutions for wastes recovery, efficiency and sustainability of food production, food safety and food security, while also considering the environmental impact. Key issues of the **management module** will be the concept of transition in terms of potential contribution of innovative policies, localised production and distribution approaches, novel technologies and foods, and alternative consumption scenarios.

The **law module** aims at familiarising participants with the holistic approach the European Union (EU) is undertaking towards food sustainability and novel foods regulation.

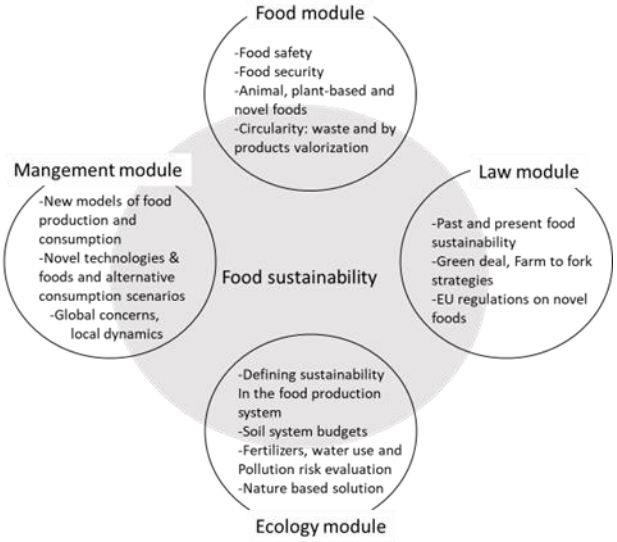
Motivation at the basis of the BIP

The BIP is born with the idea of sharing competences and skills present in the six Universities that participate in this initiative and share them with students coming from four different regions in Europe so that they will take home and possibly adapt to their reality what they will learn in Parma.

Programme learning objectives

Attending this BIP course the students, as well as the teaching staff, will have the chance to exchange experiences and knowledge. In all four modules students will be driven by teachers through a knowledge to action path, where they will learn how to deal with the complexity of the above issues and with the conflicts that they often produce, improving education, awareness-raising and human, professional and institutional efforts. In addition, they will actively participate in work groups in a field sample collection, in the data analysis, and, after the week in Parma, they will also have to collaborate through on-line meetings.

Course content, detailing physical and virtual components



The course will consist of 24 hours in physical presence at the University of Parma, of a one-day field trip in which they will collect data, and a follow-up, on-line, in which the students divided in groups will have work on data elaboration.

Here below, you may find the description of the different modules and their course unit articulation.

Please remember that successful participation includes the attendance of all module, both face-to- face and virtual.

Ecological module (8 hrs.)

The ecological module analyses how the conversion entire natural watersheds into agroecosystems in most Europe has generated a significant amount of waste, liquid and solid, produced by agro-livestock activity and the processing industry. The resulting reduction in biodiversity, functionality and provision of ecosystem services threatens the functional balance of soils, the efficiency of depurative processes, the retention and transformation of nutrients and favours the invasive potential of some species. The dispersion of chemicals and excess nutrients in surface and groundwater has impaired their chemical and biological quality. Water pollution threatens the possibility of use for productive and drinking purposes, the achievement of community conservation objectives and agriculture is in danger of becoming a cause of degradation of the resources on which it depends. Such risk is exacerbated in the present period of climate change, where the timing of precipitation is going to be more and more different and unpredictable as compared to historical records. The ecological module will support students in understanding how to produce an inventory of pressures at the watershed scale, organized in a database and connected to a GIS, how to calculate soil system budgets and water pollution risk through real case studies and field trips and how to contrast such risk with nature-based solutions. Students will be finally driven by teachers through a *knowledge to action* path, where they will learn how to deal with the complexity of the above issues and with the conflicts that they often produce, improving education, awareness-raising and human, professional and institutional efforts.

Lecture 0 – Pre-recorded lesson on "The multiple dimensions of Sustainable Development" **Prof. Antonella Bachiorri**
This lesson is focused on the European approach to Sustainable Development and on its intrinsic interdisciplinarity**.**

Lecture 1 – Too much of a good thing (2 hrs.) **Prof. Antonella Bachiorri/Marco Bartoli**

Freshwater and coastal water cultural eutrophication: causes and effects. Loss of biodiversity and ecosystem functioning in aquatic ecosystems, organic enrichment, anoxia and the collapse of ecosystem services provision. Temporal trends of nutrient loads transported by European Rivers to coastal areas and urgent need of upstream actions.

Lecture 2 – Nature-based solutions (2 hrs.) **Prof. Marco Bartoli**

Biogeochemical services by riparian buffer strips and aquatic vegetation and other practices to contrast diffuse pollution from agriculture and animal farming. How to quantify via laboratory experiments and upscale to real situation the capacity of interacting microbes, aquatic plants and macrofauna to retain/dissipate pollutants. The secondary irrigation network of canal as an opportunity to increase biodiversity and the provision of biogeochemical services.

Lecture 3 – Phosphorus: necessary, but dangerous (2 hrs.) **Prof. Marco Bartoli** (previously Prof. Cezary Kabala)

Apart from nitrogen, phosphorus is the second macronutrient, crucial for plant productivity and efficient use of other nutrients from soils and fertilizers.

Among nutrients, phosphorus is commonly applied in a "natural" form of animal manure that meets the general rules of the sustainable use of potential wastes. However, excessive application of manure creates serious threat for water quality by its huge eutrophication on a watershed scale. Balanced manure application, without negative environmental effects, seems one of challenges for European and national legal systems and environmental policies.

Field trip (6-8 h): Springs, irrigation loop and the dispersion of contaminants.

All major sublacual rivers of the Po watershed alpine sector (Mincio, Chiese, Oglio, Adda and Ticino) is display pollutant anomalies, that are sudden increases of concentrations, sometimes by a factor of 10 or more, over relatively short reaches. Students will visit the area of Soncino, that hosts more than 40 springs, representing simultaneously hot spots of diversity and pollution and that lays in the so-called spring belt. Here, the complex interaction among human regulation of river discharge, local hydrology, pedology and agricultural practices leads to diffuse pollution of the groundwater. Students will be driven through the mechanisms of nitrate trasfer from cultivated soil to groundwater and from groundwater to surface water. Possible solutions to mitigate the impacts of unsustainable practices will be discussed in the field. Outdoor discussion/round table in the "From knowledge to action" topic. Students and teachers form different cultural areas are invited to reflect and discuss on how to deal with the complexity of the above issues and with the conflicts that they often produce (in a period of climate change), improving education, awareness-raising and human, professional and institutional efforts. Shared formulation of take home messages on key issues in the field of knowledge, institutional efforts, conflicts, coherence, education, responsibility.

Module bibliography and reference materials/theoretical framework

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- Erisman, J. W., Sutton, M. A., Galloway, J., Klimont, Z., & Winiwarter, W. (2008). How a century of ammonia synthesis changed the world. Nature geoscience, 1(10), 636-639.
- European Nitrogen Assessment (European Nitrogen Assessment (ENA) | Nitrogen in Europe (nine-esf.org))
- Grizzetti, B., Pistocchi, A., Liquete, C., Udias, A., Bouraoui, F., & Van De Bund, W. (2017). Human pressures and ecological status of European rivers. Scientific reports, 7(1), 1-11.
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175-197.
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- Viaroli, P., Soana, E., Pecora, S., Laini, A., Naldi, M., Fano, E. A., & Nizzoli, D. (2018). Space and time variations of
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(Po river, Northern Italy). Science of the Total Environment, 639, 1574-1587.
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and Possible Escape Technologies: A Review. Resources, 7(2),37.
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Food module (10 hrs.)

All around our planet, food production is running into an increasing demand for quantity and quality, which is partly connected to the increase in population, and - not last - to the continuous change in people's lifestyle. The food module addresses the topics of sustainable food production integrating solutions for wastes recovery, efficiency and sustainability of food production, food safety and food security, while also considering the environmental impact. Key issues of the module will be the understanding of different food production systems (Animal and plant-based foods), the new approaches to possibly reduce the impact of food production on the environment, food waste and food by product recovery and valorisation, and the introduction of Novel Foods in our diet.

Lecture 0: Pre-recorded lessons -Life cycle assessment: introductory aspects (1hr)
Prof. Giuseppe Vignali

The lecture will be focused on the several procedures needed to carry out a Life Cycle Assessment for food products and packaging in line with ISO 14040 and 14044. Definition of scope and goal of the analysis, system boundaries, inventory phases and definition of the assessment methods will be deeply investigated. Finally description of the results will be reported for all the students. Students will be able to apply a LCA to different fields of the food chain.

Lecture 1: Pre-recorded lessons -Introduction to sustainable eating – a public health perspective (1 hr) **Prof. Mikaela Willmer**

What do we mean by sustainable eating? This lecture will provide an overview of basic nutritional science, and present some challenges and possibilities for sustainable eating on the public health level. Common problems and pitfalls will be

addressed, and broader public health issues such as ultra-processed food will also be touched upon.
Objective of the lecture: To give students who may be unfamiliar with the field of public health nutrition an introduction to the topic, and to provide students with a basic understanding of public health nutrition.

Lecture 2: A way to produce sustainable and traditional food products linked to the environment: Iberian dry-cured ham, paprika (¨Pimentón de La Vera¨), cheese (¨Torta¨), Virgin Olive Oil (2 hrs.) **Prof. Marisa Timón Andrada, Prof. María Jesús Petrón Testón**

The lecture will provide an overview of the most significant food products produced in Extremadura, as perfect examples of sustainable management of Mediterranean forests called ¨Dehesa¨. Processing of Iberian dry-cured ham and cheese (¨Torta¨) from Merino sheeps will be presented. Other examples of sustainable and traditional food products will be presented, as paprika (¨Pimentón de La Vera¨) and Virgin Olive Oil. The legislative framework, the nutritional and sensorial quality of these products, the environmental and local social responsibility of this production will be also highlighted.

Lecture 3: Green extraction methods for the recovery of bioactive compounds from agri-food by-products (2 hrs.) **Prof. Ana Isabel Andrés Nieto**

The lecture will provide an overview of the extraction methods for the recovery of bioactive compounds (phenolic, carotenoid, fiber) from agri-food by-products with special attention to those considered as ¨green extraction methods¨, their advantages and drawbacks as compared to more traditional but environmentally unfriendly methods. The possible applications of these high-value compounds in food, cosmetic and nutraceutical industry will be discussed. The difficulties of the application of this method at an industrial scale will be also explained.

Group activities

Prof. María Jesús Petrón Testón, Prof. Marisa Timón Andrada; Prof. Ana Isabel Andrés Nieto

1.Identification of bioactive compounds from agri-food by-products in the labels of cosmetic, nutraceutical and food products found in the market. Search and discussion of the agri-food sources and flow charts.
2.Identification of traditional food products from students' own countries. Are they produced in a sustainable way?
3.How can the Sustainable Development Goals (SDG) be implemented in a specific food industry? Search for case examples

Lecture 4 Possibilities and challenges for sustainable eating and public health (1hour) **Prof. Mikaela Willmer**

This lecture will address the question of protein intake and quality in a sustainable diet, from a public health perspective. It will also address socioeconomic aspects of sustainable eating and look at ways of promoting sustainable nutrition to under-

privileged groups. The objective of the lecture is to provide the student with basic knowledge about protein intake and quality in sustainable diets, and to give the student the necessary background knowledge to be able to reflect on socioeconomic challenges in sustainable eating.

Lecture 5 Industrial symbiosis (1 hour) **Prof. Malgorzata Korzeniowska**

The lecture will focus on an industrial symbiosis concept with the selected aspects of food side streams valoriozation. Industrial symbiosis can be defined as the process or chain/set of processes in which wastes or side-streams of one industry or one industrial process become the raw materials for another. Implementation of this concept in food sector develops a circular economy and makes the use of raw materials more sustainable and efficient. One of the examples can be an industrial symbiosis based on eggs processing industry.

At the end of the lecture, the student will obtain knowledge about the industrial symbiosis concept with a practical approach and importance to circular economy and sustainable use of resources.

Lecture 6 Microplastic fibres presence in foodstuff (1 hour) **Prof. Adrian Timar**

Course content will present the sources and type of microplastic fibres. In this way there will be presented the classification and type of plastic materials from which they are produced. The methods of evaluation and incidence in some foodstuff and also in the environment will be also shown. The effects of microplastic presence will be also highlighted on consumers health trough case studies all over the world. There will be presented two case studies in Europe related with this topic.

The lecture is focused on the awareness of the trainees about the importance of microplastic assessment in foodstuff from the sustainability point of view. Another objective of the course is to acquire knowledge about microplastic fibres cycle in the environment and assessment methods. Also, the awareness of establishing maximum allowed limits and new regulation related with microplastic fibres presence in the foodstuff and environmental is another objective of the course. Not in the last the course wants to induce the critical thinking of developing new packaging materials for foodstuff to reduce the microplastic fibres presence.

Working Group (1 h)

Prof. Giuseppe Vignali

LCA calculations on several case studies.

Module bibliography and reference materials/theoretical framework

- Madhura Rao, Aalt Bast and Alie de Boer. Valorized Food Processing By-Products in the EU: Finding the Balance between Safety, Nutrition, and Sustainability. Sustainability 2021, 13, 4428. https://doi.org/10.3390/Su13084428.
- Lucas Cantao Freitas, Jhonatas Rodrigues Barbosa, Ana Laura Caldas da Costa, Fernanda Wariss Figueiredo Bezerra, Rafael Henrique Holanda Pinto, Raul Nunes de Carvalho Junior. From waste to sustainable industry: How can agro- industrial wastes help in the development of new products? Resources, Conservation & Recycling, 2021, 169, 105466.

- Ana Sofia Brandao, Artur Gonçalves, Jose M.R.C.A. Santos. Circular bioeconomy strategies: From scientific research to commercially viable products. Journal of Cleaner Production, 2021, 295, 126407.
- Mónica Moreno-González & Marcel Ottens. A Structured Approach to Recover Valuable Compounds from Agri-food Side Streams. Food and Bioprocess Technology, 2021, https://doi.org/10.1007/s11947-021-02647-6.
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- Sonel E, Gür Ş, Eren T. Analysis of factors affecting industrial symbiosis collaboration. Environ Sci Pollut Res Int. 2022 Feb;29(6):8479-8486. doi: 10.1007/s11356-021-16213-2. Epub 2021 Sep 6
- Yazıcı E, Alakaş HM, Eren T.Analysis of operations research methods for decision problems in the industrial symbiosis: a literature review. Environ Sci Pollut Res Int. 2022 Oct;29(47):70658-70673. doi: 10.1007/s11356-022-22507-w. Epub 2022
- Shan H, Yang J, Wei G.Industrial Symbiosis Systems: Promoting Carbon Emission Reduction Activities. Int J Environ Res Public Health. 2019 Mar 27;16(7):1093. doi: 10.3390/ijerph16071093.
- Borghesi, G., Stefanini, R., & Vignali, G. (2022). Life cycle assessment of packaged organic dairy product: A comparison of different methods for the environmental assessment of alternative scenarios. Journal of Food Engineering, 318 doi:10.1016/j.jfoodeng.2021.110902
- Borghesi, G., Stefanini, R., & Vignali, G. (2022). Are consumers aware of products' environmental impacts? different results between life cycle assessment data and consumers' opinions: The case study of organic parmigiano reggiano and its packaging. International Journal of Food Engineering, 18(3), 185-192. doi:10.1515/ijfe-2021-0025
- Stefanini, R., & Vignali, G. (2022). The environmental, economic and social impact of industry 4.0 in the food sector: A descriptive literature review. Paper presented at the IFAC-PapersOnLine, , 55(10) 1497-1502. doi:10.1016/j.ifacol.2022.09.602
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Management module (6 hours)

Sustainable food systems are needed to ensure appropriate food production and reduce waste, while also safeguarding human and environmental health. The management module addresses the topics of sustainable food production and consumption models in contexts of high population density and socio-economic heterogeneity where concerns are growing around the economic and political dimensions of food systems, including concentration in the industry and retail sectors, power imbalances, lack of transparency, and issues concerning access to and control over natural resources, including land, water, energy and genetic resources. Innovative approaches are thus increasingly called upon to play a greater role to connect environmental sustainability and social innovation, production and consumption, global concerns, and local dynamics. Key issues of the module will be the concept of transition in terms of potential contribution of innovative policies, localized production and distribution approaches, novel technologies and foods, and alternative consumption scenarios.

Lecture 0: Pre-recorded lesson - The agri-food system of Emilia-Romagna Region between conventional and alternative models (2 hrs.)

Prof. Mario Venezian

The lecture aims at providing the students with a broad overview of the socio-economic features of the agri-food system in the Emilia-Romagna Region. This will enable the students to get an understanding of the main issues concerning the triple bottom line of sustainability and the potential scenarios to improve sustainability, as well as the background knowledge to deal with the case-studies. On the one hand, conventional agriculture and intensive livestock production that use large-scale technologies in Emilia-Romagna Region will be described. The processing sector and the main distribution channels will be also considered. On the other hand, some alternative production systems for the transition towards more sustainable agri-food models will be shown (e.g. organic districts, typical productions short supply chains).

Lecture 1 – Insects as a sustainable alternative source of animal protein (2 hrs.)

Prof. Gaelle Pantin-Sohier

The lecture will provide an overview of edible insect consumption in Western countries. This alternative food could become part of a healthy and sustainable food source aimed at meeting a growing food demand while at the same time preserving the environment. This lecture will provide knowledge on nutritional transitions linked to global changes already underway (exhaustion of natural resources, changes in lifestyle, changes in the supply of food). Introducing really new food products implies an evolution of behaviors and requires a better comprehension of the social, cultural, psychological, and sensory determinants, and dietary preferences and practices. This lecture proposes an analysis of these preferences and practices in order to identify possible innovations for food companies seeking to offer healthy, sensory, nutritional and functional food, and strategies for public policies and regulations to accompany these changes in consumption patterns.

Working Group: Initiation to Food sensory experiment through a participation of the students to an experiment (2 h)

An experiment is a method of data collection designed to test hypotheses under controlled conditions (often in a laboratory), with the goal to eliminate threats to internal validity. This experiment involves the tasting of a novel product and delves into the effect of auditory cues on sensory perception and appreciation. The goal of this session is to explain the experimental design, the data collection, the role of controlled conditions and the difference between experimental group and control groups in a food sensory experiment.

Module bibliography and reference materials/theoretical framework

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Law module (8 hours)

The *Law module* aims at familiarising participants with the holistic approach the European Union (EU) is undertaking towards food sustainability and climate change. In this respect, classes (sub-divided into two lessons of two hours) will delve into the most recent non-legislative and legislative acts the EU Commission is proposing. Regarding the former, specific attention is devoted to an overall analysis of the EU Green Deal alongside the Farm to Fork Strategy as the cornerstones of forthcoming EU actions, linking together sustainable development, climate change, food sustainability and health protection. Regarding the latter, a critical assessment of the recently adopted regulation on climate neutrality is proposed to understand how this piece of legislation fit within the broader scheme of international obligations the EU commits to respect.

Reading materials (e.g., legal acts, judgments, literature etc.) will be circulated in advance to allow meaningful and informed dialogue between the instructor and the students.

Lecture 0 Pre-recorded lesson- Introduction to International Law and European Union Law (2 hrs.)-pre-recorded lesson **Prof. Marco Inglese**

Lecture 1 – Food in Ancient Rome: A Possible Sustainability?(2 hrs.) **Prof. Salvatore Puliatti**

The lesson aims to provide a historical overview of the social and legal implications of food. Literary and legal sources show how central food was in Roman life. Thanks to these testimonies, it is therefore possible to reconstruct eating habits and their change over time, but also to discover the variety and multiplicity of food. In the Roman legal experience, food was also both the subject of specific legislative interventions and the reflection of classical jurists. For instance, numerous provisions regulate the distribution of food through the annona, just as the Roman civil law reflected about preserving the integrity of the food supply. Building on the testimonies of the past, an attempt will then be made to ascertain whether there are examples or practices that are precursors of the modern concept of sustainability.

Lecture 2 – Food Sustainability in the European Union (2 hrs.)
Dr. Marco Inglese
This lesson delves into the most recent non-legislative and legislative acts the EU Commission is proposing on food sustainability. Regarding the former, specific attention is devoted to an overall analysis of the EU Green Deal alongside the Farm to Fork Strategy as the cornerstones of forthcoming EU actions, linking together sustainable development, climate change, food sustainability and health protection. Regarding the latter, a critical assessment of the recently adopted regulation on climate neutrality is proposed in order to understand how this piece of legislation fits within the broader scheme of international obligations the EU commits to respect.

Lecture 3: Food Sustainability, Innovation and Law: Novel Foods and Edible Insects in the EU (2hr) **Prof. Lucia Scaffardi**

Food sustainability is one of the most debated challenges of our times: although this concept still lacks a shared definition, the promotion of sustainable food systems has become central in national and supranational policies and legislations. In this context innovative solutions and technological progress play a pivotal role: the EU Regulation on Novel Foods and, amongst them, edible insects represent an interesting example of the difficulties policy-makers and legislators have to face while disciplining innovative foods, considering the need to guarantee food safety but also food security and food sustainability. The frontal lesson intends to provide knowledge on food sustainability challenges and on the legislative process that brought to the current Novel Foods legislation, having regard also to the political and regulatory issues met at the EU as well as at the national level. The lesson aims at prompting a debate on how food sustainability must be boosted together with the protection of human health, the guarantee of animal welfare and the protection of the environment.

Module bibliography and reference materials/theoretical

- Communication from the Commission to the European Parliament, the European Council, the Council, the
- European Economic and Social Committee and the Committee of the Regions – The European Green Deal,
- COM/2019/640 final.

- Communication from the Commission to the European Parliament, the Council, the European Economic and Social
- Committee and the Committee of the Regions – A Farm to Fork Strategy for a fair, healthy and environmentally-
- friendly food system, COM/2020/381 final.
- Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the
- framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243, 9.7.2021, p. 1–17

On-line module

Three meetings concerning "Soil system budget: source of data. Realization of the input and output database.", "Calculation of Nitrogen budget at the municipality scale" and "Evaluation of nitrogen use efficiency in arable land and of the risk of water pollution".

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