European Commission

JRC Session – Concept & Agenda

International joint training workshops for scientists and public stakeholders

"Modelling for change: Which use and impact of modelling to trigger hydro-social transitions?"

13-15/11/2024, Montpellier

UNESCO ICIREWARD - International Centre for Interdisciplinary Research on Water Systems Dynamics

JRC Session: 15/11/2024, 9:00-11:15

Joint Research Centre

UNESCO ICIREWARD

International Centre for Interdisciplinary Research on Water Systems Dynamics, Montpellier

International joint training workshop for scientists and public stakeholders, November 13-15, 2024

"**Modelling for change** -

Which use and impact of modelling to trigger hydro-social transitions?"

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European Commission/Joint Research Centre session on November 15, 9:00-11:15:

"From EU high-level hydro-social transition targets to accountable results on the ground – the case for a comprehensive and effective science-policy interface to build climate and water resilient food systems"

On 18 July 2024, European Commission President Ursula von der Leyen presented to the European Parliament her Political Guidelines[1] for the next European Commission 2024-2029. The Guidelines confirm, notably, the EU Green Deal[2] high-level policy targets towards climate neutrality, embarking on a just transition within planetary boundaries, also striving for food security and water resilience. For the coming years, the Commission's focus lies on implementation, investment and reform to prepare the future, putting research and innovation, science and technology, at the centre of the economy. In 2025, the Commission will propose a new long-term budget for the period 2028-2034. It will be more focused to align with priorities and objectives including promoting economic, social and territorial cohesion, targeted to where EU action is most needed in a flexible way, and geared towards a better use of the budget to leverage further national, private and institutional financing.

The Joint Research Centre (JRC) provides the Commission's Secretariat General and other services with evidence for Better Regulation[3], including on budget policy. The JRC Competence Centre on Modelling (CC-MOD)[4] promotes a collaborative, more comprehensive, geospatially explicit, transparent and inclusive approach to evidence gathering. The application of integrated modelling tools is enriched with additional data and analysis for a robust connection between high-level policy targets, realistic implementation mechanisms including stakeholder dialogue and advisory services, financial incentives and budget support, and monitoring of accountable results on the ground.

Given that food systems are vulnerable and, at the same time, key drivers of climate and environmental outcomes, including water system outcomes, the session gives a priority to the topic of modelling for food system change[5], focusing on a selected segment of the

[1] Towards a new Commission (2024-2029) - European Commission (europa.eu)
[2] The European Green Deal - European Commission (europa.eu)
[3] Better regulation - European Commission (europa.eu)
[4] Corporate Modelling Inventory and Knowledge Management | Knowledge for policy (europa.eu)
[5] Strategic Dialogue on the Future of EU Agriculture (europa.eu)

EU food system in its effort to suggest a better use of modelling to trigger hydro-social change.

The Political Guidelines for the next Commission emphasize the importance of "the principles of the European Pillar of Social Rights to become a reality across the EU". The EU Child Guarantee[6] forms an essential part of the Pillar and will be strengthened under the next Commission. It includes the provision for each vulnerable child in the EU to have access to at least one healthy warm meal per day. The Social Protection Committee, advisory policy committee to the Ministers in the Employment and Social Affairs Council (EPSCO), has entrusted its Indicator Sub-Group with progress monitoring on the implementation of the EU Child Guarantee. EUROSTAT data for 2023 indicate that 20 million, or 25% of all children in the EU are living in households at risk of poverty and social exclusion, and at least 10% of the concerned children do not have access to at least oneealthy warm meal per day.

The session discusses under which conditions and with which implications, notably also EU budget implications, it would be possible for involved actors to fully deliver on the EU Child Guarantee, its nutritional component. It would also elaborate on the concrete contributions that could be made to the achievement of both the binding and non-binding EU high-level policy targets on climate, environment, urban-rural development, poverty reduction, health, farm diversity, organic farming, fertilizer and pesticide use.

The session proposes to consider relevant evidence on healthy diets on the one hand, and, on the other hand, survey data[7] on the actual nutritional behaviour of children living in households at risk of poverty and social exclusion, combined with information from the EU Household Budget Survey/Survey on Income and Living Conditions (SILC/ESTAT). The number and location of vulnerable households/children can be mapped in a geospatial information system (ESTAT-GIS). The GIS can also visualize and communicate the persisting gaps to be closed to fulfill the EU Child Guarantee's nutritional component, concretely specifying local opportunities of changed agricultural land parcel use across the EU for the development of additional demand for healthy, notably, organic[8] food for children in need. The Cypriote Organiko LIFE+ project[9] demonstrated the comparative effectiveness of organic agriculture in mitigating greenhouse gas emissions (e.g., N2O) from agricultural fields, and also demonstrated the effectiveness of an organic dietary intervention in lowering the body burden of pesticides and consequently lowering biomarkers of oxidative stress/inflammation in primary school children.

The session further proposes to engage a modelling chain and complementary counterfactual analysis to develop and quantify the benefits, potential EU budget

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[6] The EU Strategy on the Rights of the Child and the European Child Guarantee - European Commission (europa.eu)

[7] Multidisciplinary study of the health and nutritional status of persons living in households at risk of poverty with children in Germany (MEGA_kids): Study design and methods - PubMed (nih.gov)

[8] LIFE+ Programme (organikolife.com) ORGANIKO was a LIFE-co-funded project with duration of 4 years (2015-2019). The ultimate goal of the project was to demonstrate the comparative advantages of organic versus conventional farming and products using indicators of:

- Mitigation efficiency to climate change
- Agronomic and environmental quality
- Decreased children exposures to diet-based pesticides
- Healthy food promotion for better children's health

[9] Organiko Life | Public final report

impacts, differentiated by relevant funding channels, of building a climate resilient food system solution specifically targeted at the needs of the identified vulnerable households/children. The analysis would refer to super-computed climate adaptation needs stemming from the EU DestinationEarth project (DestineE, Climate Adaptation Digital Twin of the Earth) and would consider the encouragement, notably, of typical regional farms as depicted in the EU Farm Accountancy and Sustainability Data Network (FASDN) to climate-adapt and change practices and farm input/output patterns. Using the Common Agricultural Policy Regional Impact (CAPRI) and Individual Farm (IFM-CAP) Models, practice changes could be oriented towards more diversity, also seeking orientation from most diverse existing regional lighthouse FASDN farms, to meet the additional procurement needs for healthy food under the EU Child Guarantee. The models would also allow to assess farm adaptation costs and benefits, necessary incentives for change, the positive climate and environmental impacts of farm conversion on GHG emissions, nutrient balances, pesticide use, soil health, and biodiversity. Highlighting the impact of better nutrient and pesticide management at farm level on the quality of inland and coastal water bodies as depicted by the Geospatial Regression Equation for European Nutrient losses (GREEN) model, the session will also refer to empirical water quality measurement data as generated by the JRC Water Laboratory[10]. The session will also demonstrate sensitivity analysis approaches to study the impact of climate, biotic and abiotic pressures on water model output. It will also present a solution developed by JRC CC-MOD to visualize and access model data and runs, make impact assessment data transparent in support of stakeholder dialogues, political negotiation, and decision-making processes.

Furthermore, the session will present and discuss opportunities to apply counterfactual methods for estimating the environmental and climate impacts of adapted farming practices. This will imply the linking of administrative data on land parcel location and use by farmers (from the Geospatial Aid Applications under the EU Common Agricultural Policy) with soil quality survey and measurement data (ESTAT/JRC Land Use and Coverage Area frame Survey LUCAS, soil module[11]). For example, a healthy food procurement program to fulfill the EU Child Guarantee could also include a payment component that rewards the verified contributions of involved farmers to the EU 2030 legally binding climate target to achieve at least 310 million tons of CO2eq carbon sequestration in the land sector.

The session will close with a statement from the Director of the Organic Cities Network Europe on the potential usefulness of the stronger science-policy interface as presented in the session to support the achievement of the EU high-level policy target of 25% organic farming area share in total agricultural area by 2030.

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Agenda of the session - moderated by Christine MÜLLER, Head of JRC CC-MOD

"From EU high-level hydro-social transition targets to accountable results on the ground – the case for a comprehensive and effective science-policy interface to build climate and water resilient food systems"

[10] Water Laboratory - European Commission (europa.eu)
[11] LUCAS - ESDAC - European Commission (europa.eu)

9:00-9:05 **Welcome and introduction** (by the moderator)

9:05-9:10 **Better Regulation**: the role of JRC CC-MOD/Model Inventory and Data Access System (MIDAS) in the new Commission (**Antonina CIPOLLONA**, Head of Evaluation and Impact Assessment Unit A.2, Secretariat General of the European Commission)

9:10-9:15 **The EU Multi-Annual Financial Framework (MFF) 2028-2034**: towards a policy (target) driven and performance-based EU budget (**Kai WEYNANDS**, Head of MFF & Annual Management Cycle Unit A.3, Secretariat General of the European Commission)

9:15-9:30 **Hydro-social transition in the EU towards 2030**: Direction and instruments in the areas of natural resource management/water and food/better nutrition – policy statements (5 min each)

- **High level policy targets** on climate adaptation, emission reduction and carbon sequestration, biodiversity and water, key policy instruments (**Christian HOLZLEITNER**, Head of Low Carbon Solutions: Land Economy and Carbon Removals Unit C.3, Directorate General for Climate Action of the European Commission; **Claudia OLAZABAL**, Head of Sustainable Freshwater Management Unit C.1, Directorate General for the Environment of the European Commission)

- **High level policy targets** on organic farming, fertilizers, pesticides, key policy instruments (**Gijs SCHILTHUIS**, Head of Policy Perspectives Unit A.1, Directorate General for Agriculture and Rural Development of the European Commission)

- **High level policy targets** on poverty reduction/EU Child Guarantee – healthy food component, key policy instruments (**Czaba ANDOR** – Vice-Chair of the Indicator Sub-Group of the Social Protection Committee, advisory policy committee to the Ministers in the Employment and Social Affairs Council (EPSCO))

  9:30-11:00 **Science for transition planning, performance monitoring and reward programs**

- 9:30-9:50 **Evidence from the Organiko LIFE+ project** that set a **multi-faceted action plan** in place in **Cyprus** to demonstrate the generation of **high quality field data on greenhouse gas emissions** related to **organic farming and children's health indicators**, while **interacting** with policy makers and **communicating the science to the public** and **private sector** (**Konstantinos C. Makris**, Assistant Professor of Environmental Health, Cyprus University of Technology, Cyprus International Institute for Environmental and Public Health)

- 9:50-11:00 **Delivering the EU Child Guarantee**, nutritional component, **and co-benefits** at local level under the conditions of **climate change and agricultural/food sector adaptation**

  - 9:50-10:00 Outlook on changing weather patterns/agricultural growing conditions across Europe (and beyond) from **Destination Earth, Climate Change Adaptation Digital Twin** (**Grazyna PIESIEWICZ**, Head of High Performance Computing and Applications Unit C.1, Communications Networks, Content & Technology Directorate General of the European Commission)

- 10:00-10:30 Challenges to better represent **water in micro-economic models**: the case of **IFM-CAP** (Individual Farm Model for Common Agricultural Policy Analysis) – Opportunities to assess the **impact of climate and farming practice change** with **IFM-CAP and CAPRI** (**Lola REY**, Economics of the Food System Unit D.4 of the Joint Research Centre of the European Commission)

- 10:30-10:50 Opportunities to follow the impact of adapted regional agriculture, its improved nutrient balances, pesticide application on inland and coastal water using the **Geospatial Regression Equation for European Nutrient (GREEN) losses model** (**Alberto PISTOCCHI**, Ocean and Water Unit D.2, Joint Research Centre of the European Commission) and **demonstration of sensitivity analysis approaches** to study the impact of climate, biotic and abiotic pressures on water model output (**Elena BASTIANON**, Science for Modelling, Monitoring and Evaluation Unit S.3 of the Joint Research Centre of the European Commission)

- 10:50-11:00 Opportunities to apply **counterfactual methods** for estimating the environmental and climate impacts of adapted farming practices linking administrative data on land parcel use and soil quality survey data (**Zelda BRUTTI**, Science for Modelling, Monitoring and Evaluation Unit S.3 of the Joint Research Centre of the European Commission)

11:00-11:15 **Concluding statement and discussion** (**Eric GALL**, Deputy Director, IFOAM Organics Europe/all participants)

Annex:

Background information on models, surveys, and analysis involved

- https://knowledge4policy.ec.europa.eu/modelling/topic/corporate-modelling-inventory-knowledge-management_en **Corporate Modelling Inventory and Knowledge Management** CC-MOD develops and runs MIDAS, the Modelling Inventory and Knowledge Management System of the European Commission

- Multidisciplinary study of the health and nutritional status of persons living in households at risk of poverty with children in Germany (MEGA_kids): Study design and methods - PubMed (nih.gov) **Background:** In Germany, the nutritional situation of adults and children living in households at risk of poverty has been insufficiently studied so far. **Aim:** The aim of the mixed-methods study MEGA_kids is to gain a deeper understanding of the nutritional situation including socioeconomic, behavioural, and attitudinal factors and health characteristics among persons living in families at risk of poverty. **Method:** MEGA_kids is a mixed-methods cross-sectional study consisting of four modules combining quantitative and qualitative methods. The first module (A) applies self-administered questionnaires to assess the individual's diet, household food insecurity, and several other factors among adults and children of 500 households. Cash receipts are used to assess household's food expenses. For the second module (B), a semistructured interview guide is used to identify factors influencing food security and nutritional quality from the perspective of a subsample of module A (n = 20). The third module (C) applies the participatory World Café technique to explore experiences and generate ideas for tailored support measures for a healthy diet from the perspective of 40 parents participating in module A. Finally, the fourth module (D) investigates the knowledge and usage of existing nutrition-related preventive measures among 200 parents at risk of poverty by using an online questionnaire. **Conclusion:** By providing a

comprehensive picture of nutritional aspects of families living at risk of poverty, MEGA_kids will guide officials to target and prioritize public health nutrition measures, inform policy makers to implement and improve healthy policies and, finally, identify research gaps to be prioritized.

- LUCAS - ESDAC - European Commission (europa.eu) LUCAS 2018 topsoil data - This report summarises the soil dataset collected as part of the 2018 Land Use/Cover Area frame statistical Survey' (generally referred to as LUCAS Soil Module). It presents an overview of the various laboratory analysis and describes the spatial variability of soil properties by land cover (LC) class and a comparative analysis of the soil properties for NUTS 2 regions. The LUCAS Soil Module is the only mechanism that currently provides a harmonised and regular collection of soil data for the entire territory of the European Union, addressing all major land cover types simultaneously, in a single sampling period (April – October). At the same time, the LUCAS Soil module can support further policy needs through a flexibility that permits both the collection of new field data, if required, from new sampling sites. In turn, this can be complemented with additional laboratory analysis (e.g. micronutrients, specific pollutants). This capacity addresses the needs of a diverse policy user base and an evolving policy landscape. Several new developments were put in place for the 2018 LUCAS Soil module. These included: • Assessment of bulk density for a subset of locations. • Trial to extend sampling depth to 30 cm (only in Portugal). • An assessment of different types of soil erosion (sheet, rill, gully, wind). • Measuring the depth of organic soils. • The collection of fresh samples in order to extract DNA from the soil fabric to assess soil biodiversity and detect the presence of antibiotic resistance genes. • Selected measurements of metals, and a pilot to assess residues of plant protection products and veterinary antibiotics in a subset of samples. Initially, 27,069 locations were identified for soil sampling, incorporating locations visited in 2015. At the close of the survey, a soil related activity (i.e. assessing type of erosion, organic soil check sample collection) was made at 19,345 locations (i.e. LUCAS Grid Points). After the removal of samples that could not be identified or were mislabelled or lost in transit, the LUCAS 2018 Soil Module dataset contains data for 18,984 locations. As in the previous exercises, a common sampling procedure, single laboratory, standard analytical methods were applied. Additional soil parameters that were collected from all LUCAS field points primarily to support soil erosion modelling (e.g. signs of ploughing, presence of crop residues, percentage of stones) are not presented here but are included in the LUCAS 2018 microdata, which is made available by EUROSTAT. A parallel report will present an assessment of changes in soil properties between 2009, 2015 and 2018. The results of analysis into metals, biodiversity assessment, antimicrobial resistance genes, antibiotics, residues of plant protection products, and microplastics, as well as changes between 2009 and 2018, will be presented as separate reports. Data can be downloaded from https://esdac.jrc.ec.europa.eu/content/lucas2018-topsoil-data

- Water Laboratory - European Commission (europa.eu) The Water Laboratory provides an assessment of the chemical status of water bodies, it also offers a technology for water purification. The Water Laboratory hosts specialized analytical equipment for environmental chemical analysis of priority pollutants and compounds of emerging concern with special focus on the natural and urban water cycles.

- Destination Earth (destination-earth.eu) Destination Earth is a flagship initiative of the European Commission to develop a highly-accurate digital model of the Earth (a digital twin of the Earth) to model, monitor and simulate natural phenomena, hazards and the related human activities. These groundbreaking features assist users in designing

accurate and actionable adaptation strategies and mitigation measures. DestinE unlocks the potential of digital modelling of the Earth system at a level that represents a real breakthrough in terms of accuracy, local detail, access-to-information speed and interactivity. By pushing the limits of computing and climate sciences, DestinE is an essential pillar of the European Commission's efforts towards the Green Deal and Digital Strategy.

- model CAPRI - Common Agricultural Policy Regional Impact Analysis | Modelling Inventory and Knowledge Management System of the European Commission (MIDAS) (europa.eu) The CAPRI modelling system is a global agro-economic model, operational since 1999, designed for assessing economic and environmental impacts on agriculture at regional level. CAPRI is a partial equilibrium model, which iteratively links a supply module, focusing on the EU, Norway, Turkey and Western Balkans, with a global multi-commodity market module. It consists of specific databases, generated among others from two major sources: EUROSTAT and FAOSTAT. Specific modules ensure that the data used in CAPRI are mutually compatible and complete in time and space. They cover about 50 agricultural primary and processed products for the EU, from regional level to global scale including input and output coefficients. CAPRI offers projections and scenario work on economic and environmental outcomes for medium and long run perspectives, so far up to 2085. The focus is often on linkages of environmental issues, including emissions of greenhouse gases, ammonia, nutrient balances and biodiversity indicators to the EU's Common Agricultural Policy and trade policies. The model is frequently used in various Commission services (such as DG AGRI, DG ENV, DG CLIMA, and the JRC) reporting on agricultural, environmental and climate policies at the regional dimension in the EU.

- model IFM-CAP - Individual Farm Model for Common Agricultural Policy Analysis | Modelling Inventory and Knowledge Management System of the European Commission (MIDAS) (europa.eu) IFM-CAP is a micro model designed for the ex-ante economic and environmental assessment of the medium-term adaptation of individual farmers to policy and market changes. IFM-CAP was developed by JRC in close cooperation with DG AGRI starting from 2013 for the purpose to improve the quality of agricultural policy assessment upon existing aggregate (regional, farm-group) models and to assess distributional effects of policies over the EU farm population. Rather than providing forecasts or projections, the model aims to generate policy scenarios, or 'what if' analyses. It simulates how a given scenario, for example, a change in prices, farm resources or environmental and agricultural policy, might affect a set of performance indicators important to decision makers and stakeholders. IFM-CAP is a comparative static positive mathematical programming model applied to each individual farm from the Farm Accountancy Data Network (FADN) to guarantee the highest possible representativeness of the EU agricultural sector. Farmers are assumed maximizing their expected utility at given yields, product prices and CAP subsidies, subject to resource endowments and policy constraints. The main strengths and capabilities of the model include the possibility to conduct a flexible assessment of a wide range of farm-specific policies and to capture the full heterogeneity of EU commercial farms in terms of policy representation and impacts (e.g. small versus big farms). IFM-CAP can be applied for ex-ante economic and environmental impact assessment of agricultural and environmental policies at micro (farm) level. For example, IFM-CAP was applied to support the DG AGRI Impact Assessment accompanying the proposal for the CAP post 2020 (SWD/2018/301).

- model GREEN - Geospatial Regression Equation for European Nutrient losses | Modelling Inventory and Knowledge Management System of the European Commission (MIDAS)

(europa.eu) GREEN is a statistical model used to assess the impact of agricultural fertilizers and other sources of nutrients on the environment. The GREEN model estimates the mass discharge of total nitrogen (N) and total phosphorus (P) through the stream network down to marine coastal areas, the concentration of N and P, and the relative contribution of diffuse and point sources to the total mass discharge/concentration. GREEN is a simplified conceptual model, which distinguishes between two different pathways in nutrient transfer from sources to catchment outlet (Grizzetti et al., 2006, 2005a, 2005b). Diffuse sources (DS), which include applied synthetic and manure fertilisers, atmospheric deposition and emissions with wastewater from scattered dwellings (i.e. homesteads that are disconnected from sewerage systems), first undergo degradation in the soil via various processes including crop uptake, atmospheric losses and soil storage, before reaching the stream network. Point sources (PS), which include discharges from sewers, waste water treatment plants, industries and paved areas are directly emitted to the stream network. Once in the stream network, nutrients are partially retained in the streams due to algae growth, atmospheric losses etc. The calculation is performed on a catchment of interest, which is subdivided into a number of sub-basins (n) based on a topographic discretisation. A routing structure is then elaborated and serves to establish an emitting-receiving sub-basins relationship, i.e. an up-stream nutrient load is considered as an additional point source to the receiving down-stream sub-basin. With this representation, the emissions of N and P from upstream are transferred downstream taking into account the mass fraction lost in the basin and in the stream network.

- https://publications.jrc.ec.europa.eu/repository/handle/JRC135190 Counterfactual analysis on the climate and environmental impacts of policy measures under the EU Common Agricultural Policy. The Common Agricultural Policy (CAP) has been one of the main pillars in the construction of the European project. While its fundamental goals remained the same, the policy over the time adapted to evolving needs: since 2014 specifically with an ever-increasing regard also towards environmental objectives. This Report aims to assess the feasibility of estimating a causal relationship between the CAP and environmental outcomes. It offers an assessment of the present state of both data availability and associated obstacles and deficiencies. Different counterfactual impact assessment scenarios based on the FADN survey at the European level are summarised in a set of concise documents, referred to as fiches, which provide details about the databases and variables to be used, the methods to be applied, and give a judgement on the current feasibility at different geographical levels within the EU territory. Where applicable, references to further complementary data sources containing potentially useful information are outlined.

Science for policy

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