EUROPEAN COMMISSION
DIRECTORATE-GENERAL
JOINT RESEARCH CENTRE

Dir. A – Strategy, Work Programme and Resources
A.5 Scientific Development Unit

JRC

Centre for Advanced Studies

and

Exploratory Research

Annual Workshop 2022

Anticipation and challenges in research

16-18 November 2022, JRC Ispra, Italy with virtual connection to all JRC sites

Hybrid event

Booklet (version 12 Nov. 2022, for the Science Hub portal)

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Registration, Venue and Connection

Registration

JRC staff on all sites and external stakeholders are welcome to participate.

Both attendance in person and online require registration by 7 November 2022

Register here

On site venue

Address: Via Fermi 2749 - 21027 ISPRA (VA), Italy

Detailed location: Building 36 - Conference Centre

Connection parameters

Web Streaming 16.11.2022: **Wednesday connection link**

Web Streaming 17.11.2022: **Thursday connection link**

Web Streaming 18.11.2022: **Friday connection link**

Workshop Rationale

The Joint Research Centre (JRC) of the European Commission carries out research in order to provide independent scientific advice and support to EU policy. The mission of the Scientific Development Unit of the JRC is to provide cutting edge scientific input to help improve and strengthen the interface between science and policy, in order to enhance the JRC's capacity to better inform and influence the regulatory frameworks needed to address new and emerging societal challenges confronting the EU. In this context, the JRC's Centre for Advanced Studies (CAS) was created to give the JRC a leading edge on societal issues that may become relevant for EU policy making. The Exploratory Research (ER) programme is a strategic initiative by the JRC to identify ideas that might lead to novel results that will qualitatively enrich current scientific work.

This year, the CAS and ER programmes have joined forces to build on and harvest the broader sense of community, shared interest and common purpose that each individual CAS and ER research project brings to its respective field of research. In particular, the programmes provide time and space for JRC scientists to experiment with novel ideas in new thematic areas by facilitating collaboration and building synergies across different disciplines and strategic networks, inside and outside the organisation, while developing new methodologies, approaches and technologies.

The workshop will be an opportunity for CAS and ER teams to showcase their ongoing work in their respective scientific fields and discuss their future policy relevance. Importantly, the multi- and transdisciplinary setting will provide fertile ground for participants to come together to identify and investigate, explore and exchange, as well as propose and deliver new ideas and experiences around shared issues, and will explore concrete suggestions to the challenges associated with their different areas of interest.

In particular, the workshop will provide a forum and platform for discussions between stakeholders and policy makers on how we can anticipate upcoming challenges and even shocks, how to be better prepared for them and how to tackle known obstacles and challenges in order to address them. In both plenary and breakout sessions, participants will discuss what we can use from current science, as well as the remaining open scientific questions, and where we go from here.

The Covid crisis has shone a harsh light on how the pandemic has catalysed social and economic change, while exposing the deep rooted challenges facing research methodologies and surmounting the science – policy interface. In addition to wider issues around how we can better prepare for the future, this year's Workshop will open a window on and include keynote speakers and panel discussions covering such diverse issues as pandemic preparedness, social inequality, digital transformation, pollution and global markets and supply chains.

This year, the following three topics will drive presentations and discussions across the event, acting as red lines:

- **Topic 1**: *Understanding and communicating scientific uncertainty in foresight and anticipation for policy makers*
- **Topic 2**: *Interdisciplinarity – how can it be achieved and made successful?*
- **Topic 3**: *Science and Data, from access to data to replication in science.*

Topic 1: Understanding and communicating scientific uncertainty in foresight and anticipation for policy makers

Scientific evidence should put policy makers in a position that will allow them to make evidence-informed decisions in the regulatory process or in the preparation and response to crises. However, the enormous amount of scientific results, as well as the interpretive and intrinsic uncertainties they raise, pose a major issue for the policy makers in understanding them and for scientists in communicating them. A basic understanding of uncertainty quantification is therefore an important component in evidence-based decision making. Further, communication of uncertainty must be done in a way that avoids misinterpretation. Acquiring the corresponding skills can lead to a more informed society and give rise to more consistent decision-making. This is of particular importance when it comes to preparedness for societal crises due to emerging threats. Whereas, anticipation and foresight assessments have useful scientific tools, such as the modelling approaches employed in prediction, their structure and results are characterised by intrinsic uncertainty. Therefore, understanding the uncertainties in model assumptions, structure, and results, as well as communicating them adequately is crucial for effective translation into policy action. A typical example is the climate research community. Despite overwhelming evidence about climate change and its impacts, little and late action has been taken. Further, on some occasions, even the validity of the scientific evidence has been questioned, at least with regard to the magnitude of the impacts. Understanding and communicating risk and uncertainty is therefore key in informing policy-making and the public in a trustworthy manner. Foresight exercise and anticipation should be based on the most robust evidence possible including the description of the uncertainties associated with it.

Topic 2: *Interdisciplinarity – how can it be achieved and made successful*

Multidisciplinarity and interdisciplinarity in science are becoming increasingly indispensable in order to address environmental, societal and policy needs. Whereas "**interdisciplinarity** analyses, synthesises, and harmonizes links between disciplines into a coordinated and coherent whole." (Choi BC, Pak AW. 2006), **multidisciplinarity** is defined as viewing the same object from the viewpoint of different disciplines. And while both are important, a truly holistic approach to policy making would require interdisciplinary research teams. Against this background, the challenges facing scientific researchers are becoming increasingly complex, making the integration of multidisciplinary **competencies** more necessary than ever. The result has been a growing reliance on collaborations between experts from different disciplinary areas, at times from very distant cognitive spheres, but research that crosses disciplinary boundaries is difficult to catalyse and structure, and to finance, evaluate and publish (Viseu, 2015). How far are we in the transition from multi- to transdisciplinary research? How can we facilitate the process? This workshop will exemplify and discuss what we can do to make interdisciplinarity successful.

Topic 3: *Science and Data, from access to data to replication in science*

Reproducibility of scientific research is one of the key factors for increasing the trustworthiness of the scientific literature. Trustworthy scientific results are the basis of evidence-informed decision by policy makers. Over the past decade verification of research has become of major relevance. Recently, major efforts to reproduce scientific results in several scientific areas failed. The reasons are multifaceted and include lack of transparency, e.g. methodological issues, data acquisition and analysis, outcome interpretation, as well as machine learning and the reliability of AI. Accessibility to the research processes of others has also been poor. A lot of published scientific results are not available without subscription, and very often data, and code supporting research outcomes is not accessible, e.g. in public repositories. Policies to promote open science are emerging, however, many aspects remain to be addressed including the disclosure of study descriptions in full and the data collected. Proper evaluation of scientific results needs information about the how they were obtained.

Workshop Agenda

Wednesday 16th November 2022

Session #1 Showcasing exploratory and advanced studies

Day 1: Wednesday 16 November 2022 (09:00 – 17:00)		
09:00	**09:15**	**Social gathering**
09:15	**09:45**	**Opening and introduction of the workshop** *Welcome and short introduction to the workshop* Jutta THIELEN-DEL POZO, Unit Head JRC.A.5 - Scientific Development Thomas HEMMELGARN, Unit Head JRC.I.2 - Foresight, Modelling, Behavioural Insights & Design for Policy *Structure of the workshop and its main topics* Jutta THIELEN-DEL POZO, Unit Head JRC.A.5 - Scientific Development
09:45	**11:10**	**Block 1: A European Green Deal - addressing Environmental Risks** Chair: Shane SUTHERLAND, JRC
09:45	10:10	*Four flash presentations on* ePoster (3' each) • Approaches for the study of plastic particles pollution in the environment, M.A. SERRA BELTRÁN, D. GILLILAND, G. F. SCHIRINZI, M. SÁRRIA PEREIRA PASSOS, A. JONES, F. YUNTA MEZQUITA, P. PANAGOS, J. BARTINICKA, R. CARVALHO, N. SERPETTI, E. GARCIA GORRIZ, S. MILADINOVA, C. PIRODDI, D. MACÍAS MOY • Nanoplastics: towards a technological platform for nanoplastics detection (NANOPLASTICS), M.A. SERRA BELTRÁN, G. F. SCHIRINZI, M. SÁRRIA PEREIRA PASSOS, D. GILLILAND • Can species niche modelling reveal responses of biodiversity to the use of pesticides? X. ROTTLAN PUIG, F. GALIMBERTI; Exploratory Research projects "Flora Fauna Green Rural Corridor Connect - Localizing and modelling wildflower-pollinator interactions in rural landscapes with citizen science and deep learning" (FFGRCC) and "Spatially explicit PESTIcide health RISK indicators based on satellite mapping of crops and human settlements" (PESTIRISK) • Green Modelling - Climate, Agriculture, Forests and Biodiversity, A. HRAST ESSENFELDER, I. AMEZTOY ARAMENDI, G. OTON AZOFRA, E. MASSARO; Exploratory Research projects "AI-enhanced Agro-Climate Service" (AIACS), "Dry Forest Monitoring; monitoring Tropical Dry Forest disturbances with multi-sensor satellite data and machine learning" (DryForM) and "Assessing Forest Biodiversity and Resilience from space; data integration for the prediction of forest structural diversity at continental scales" (ForBioRes)
10:10	10:40	*ePosters* (**showcase available online**)
10:40	11:10	*Plenary discussion*

11:10	**11:30**	**Coffee Break**
11:30	**12:45**	**Block 2: A European Green Deal - addressing Smart & Sustainable Resource Management** Chair*:* Carina HENRIKSSON, JRC
11:30	11:45	*3 flash presentations on* ePoster (3' each*)* • Circular Economy: a recipe for more strategic autonomy? (bounCE4ward), B. BALDASSARRE, A. BUESA, A. ALBIZZATI • Integrating Innovative Photovoltaics into Complex Energy Systems, L. CIAMMARUCHI, A. MEZZETTI, A. DIAZ RINCON; Exploratory Research projects "Evaluation, assessment and improvement of Process for Recycling and Reusing Innovative Photovoltaic Solar Cells" (RECYCLE-PSC) and "Sectoral Integration Assessment of Complex Energy System" (SIACES) • Sustainable buildings and cities, A. VELJKOVIC, G. TESTORI, S. IODICE, P. SULIS; Exploratory Research project "Physics-Informed Neural Networks for Foresight on LOsses and Energy Demand of buildings" (PINN FLOED) and ER activity "Space matters: How to develop a common methodology for CityLabs" (CityLabs)
11:45	12:15	*ePosters* **(showcase available online)**
12:15	12:45	*Plenary discussion*
12:45	**13:45**	**Lunch Break**
13:45	**15:15**	**Block 3: A new push for European Democracy and a Europe fit for the Digital Age** Chair: Ingrid PUILLAT, JRC
13:45	14:10	*5 flash presentations* on ePoster (3' each) • Social classes in the digital age: Technological Change, Social Inequalities and the Social Contract (DIGCLASS), C. GIL-HERNÁNDEZ, L. SALAZAR, G. VIDAL, D. VILLANI • Misinformation, data, and values in the EU, A. BERNINI, H. BRUNS, M. SCHARFBILLIG; Exploratory Research projects "IMpact assessment of PAndemics through big data analytics ReseArch" (IMPARA) and "Countering the negative effects of misinformation during global crises through targeted behavioural interventions" (COCOMI), ER activity "Understanding EU Identity in Member States through Media Analysis of Narratives, Emotions and Values in Reporting" (EUdentity). • Demand-driven policy relevant research - a case study on real estate market, E. BERTONI, M. FONTANA, L. GABRIELLI, S. SIGNORELLI, M. VESPE • Toward explainable, robust and fair Artificial Intelligence in automated and autonomous vehicles: challenges and opportunities for safety and security; Exploratory Research activity "extrAIsafe", A. KRISTON, R. HAMON • A revolution in time precision for the digital age, C. A. DE ALMEIDA CARRAPIÇO; Exploratory Research project "Thorium nuclear clock half-life measurement" (THC ½)
14:10	14:40	*ePosters* **(showcase available online)**
14:40	15:10	*Plenary discussion*

15:10	**15:30**	**Coffee Break**
15:30	**16:50**	**Block 4: Promoting our European way of life - addressing Material Science and Human Health** Chair: Sonia LAHOREAU, JRC
15:30	15:50	*4 flash presentations on ePoster (3' each)* • Replication from modelling to experimental, J. MANAUD; Exploratory Research project "Investigation of Ultra-High Temperature Ceramics" (ULTIMATE) • Getting ready for the next pandemic, D. SCACCABAROZZI, G. GUERRINI, T. LISCHETTI, A. NAVARRO CUENCA, L. A. CLERBAUX, A. BARBAGLIA; Exploratory Research projects "Corona Virus Decontamination" (COVIDEC), "Future Response Strategies Against Coronaviruses" (FutuRe), "Coronaviruses and Environment: One health approach" (COV & ENV for ONEH), "Modelling the pathogenesis of Covid-19 based on the Adverse Outcome Pathway paradigm" (CIAO), "SENsitive pepTIdes for aNomalous Epidemic Level" (SENTINEL) • Human and Environmental Action Plans (HEAPS), J. BARTNICKA, F. YUNTA MEZQUITA, E. VAN RIJN, F. MARANDO, M. ALT, D. LIPSA; Exploratory Research projects "Understanding the links between SOiL pollution and CancEr" (SOLACE), "A healthy mind in a healthy ecosystem" (HELIOS), "Policy mix and behavioural Spillovers" (PoliSpill) and "Detection of hazardous environmental POLLUtants using eXosomes" (POLLUX) • Epidemics dynamics and control (EPICO) project - state of the art and future developments, N. I. STILIANAKIS, A. FASANO, F. FERRACCIOLI, N. RICCETTI
15:50	16:20	*ePosters* **(showcase available online)**
16:20	16:50	*Plenary discussion*
16:50	**17:00**	**One word take away (Slido Word Cloud), presentation of the next day agenda**
19:00	**22:00**	**CAS and ER Social Dinner at JRC Club House**

Thursday 17th November 2022

Session #2: How do we design the future?

Understanding and communicating scientific uncertainty in foresight is essential to help improve policy design and develop future proof strategies, but too often the message gets lost in the telling. In the first panel discussion we examine ways to make the message clearer.

How far are we in the transition from multi- to transdisciplinary research? How can we facilitate the process? In this second panel discussion we examine what more can be done to make interdisciplinary successful.

Day 2: Thursday, 17 November 2022 (09:00 – 16:15)		
09:00	**09:15**	**Social gathering**
09:15	**09:30**	**Introduction to day 2 and topic 1 (Slido Word Cloud)**
09:30	**10:30**	**Topic 1: Understanding and communicating scientific uncertainty in foresight and anticipation for policy makers** Chair: Prof. Nikolaos STILIANAKIS, JRC
09:30	10:00	*Keynote # 1: Communicating scientific uncertainty – experience from EU food safety assessments* Anthony SMITH, EFSA
10:00	10:30	*Panel discussion # 1: Dealing with scientific uncertainty* Anthony SMITH, EFSA; Nikolaos KASTRINOS, RTD; Prof. Gema REVUELTA DE LA POZA, University Pompeu Fabra; Anne Katrin BOCK, Head of the JRC Foresight Competence Centre; Prof. Nikolaos STILIANAKIS, JRC
10:30	**11:00**	**Coffee Break**
11:00	**12:15**	**Topic 1 Cont':** *Joint Panel and Plenary discussion with CAS and ER examples*
12:15	**13:45**	**Lunch Break**
13:45	**14:00**	**Introduction to topic 2 (Slido Word Cloud)**
14:00	**15:00**	**Topic 2: Interdisciplinarity – how can it be achieved and made successful** Chair: Jutta THIELEN-DEL POZO, JRC
14:00	14:30	*Keynote # 2: Imagining the future through the complexity crystal ball* Prof. Peter SLOOT, Scientific Director of the Institute for Advanced Study (IAS) in Amsterdam and Professor at the University of Amsterdam
14:30	15:00	*Panel discussion # 2: Interdisciplinarity* Prof. Peter SLOOT, IAS; Prof. Auxi PRIETO, CSIC-CIB; Prof. Ulrich SCHWANEBERG, Aachen University; Michele VESPE, JRC; Prof. Koen JONKERS, JRC; Jutta THIELEN-DEL POZO, JRC
15:00	**15:30**	**Coffee Break**
15:30	**16:15**	**Topic 2 Cont':** *Joint Panel and Plenary discussion with CAS and ER examples*

Friday18th November 2022

Session #3: How to face common (methodology) challenges?

The reproducibility of scientific research goes towards the trustworthiness of science literature. Nevertheless, recent efforts to reproduce scientific research results in several fields have failed. Proper evaluation of scientific results needs information about the how they were obtained. The third and final panel of this year's joint CAS and ER workshop will examine how these issues will be addressed.

Day 3: Friday 18 November 2022 (09:00 – 14:00)		
09:00	**09:15**	**Social gathering**
09:15	**09:30**	**Introduction of day 3 topic (Slido Word Cloud)**
09:30	**11:15**	**Topic 3: Science and Data, from access to data to replication in science** Chair: Goeran LOEVESTAM, JRC
09:30	10:00	*Keynote #3: On the importance of replicability in science* Jana BERKESSEL, Mannheim Centre for European Social Research, University of Mannheim
10:00	10:30	*Panel discussion # 3: Reproducibility in science* Prof. Arnout VAN DER RIJT, European University Institute; Prof. Livia PULJAK, Catholic University of Croatia; Jana BERKESSEL, University of Mannheim; Dr. Danny KINGSLEY, Australian National Centre for the Public Awareness of Science; Miguel-Angel SERRA BELTRAN, JRC; Leire SALAZAR, JRC; Hendrik BRUNS, JRC
10:30	11:15	*Joint Panel and Plenary discussion with CAS and ER examples*
11:15	**11:30**	**Coffee Break**
11:30	**12:00**	**Defining a Neuro security research agenda – protecting citizens from cognitive and effective manipulation** Aleksander VALJAMAE, associate professor in Physiological Computing at Tallinn University
12:00	**12:30**	**Best Poster Award and conclusions (Slido Word Cloud)**
12:30	**14:00**	**Lunch and Lecture on the special book on Humanities and Artificial Intelligence** *Panel members*: Emilia GOMEZ, JRC; Max CRAGLIA, JRC; Freddy Paul GRUNERT, International Curator; FAY ESZTER, European Parliament, Science and Technology Options Assessment; Lorenzo GERBI, Curator / BaltanLab, Directory; Prof. Gabriele ROMEO, Albertina Academy; Christina GRAMMATIKOPOULOU, University of Macedonia

Abstracts book and short biographies

1. Abstracts of Flash Presentations (day 1: Wed. 16 Nov.)

Block 1: A European Green Deal – Addressing Environmental Risks

Flash presentation and poster 1.1

Approaches for the study of plastic particles pollution in the environment

Miguel-Ángel Serra Beltrán[1], Douglas Gilliland[1], Gabriella F. Schirinzi[1], Marisa Sárria Pereira Passos[1], Arwyn Jones[2], Felipe Yunta Mezquita[2], Panos Panagos[2], Joanna Bartinicka[2], Raquel Carvalho[2], Natalia Serpetti[3], Elisa Garcia Gorriz[3], Svetla Miladinova[3], Chiara Piroddi[3], Diego Macías Moy[3] .

[1]CAS6 NANOPLASTICS (A.5, F.2), [2]ER SOLACE (D.3, F.1) and [3]ER PLASTIC-WEB (D.2)

Abstract:
There are currently three projects on the impact of plastics pollution in environmental and human health, namely, the CAS project NANOPLASTICS and the ER projects SOLACE and PLASTIC-WEB.
These projects share a common interest in the set-up and availability of reliable analytical techniques to quantify and discriminate plastic particles of different chemical nature and size (micro/nano-plastics) and their impact on different ecosystems, particularly in aqueous (freshwater and marine) and soil compartments. For that purpose, there is an urgent need for environmentally realistic reference micro/nanoplastics and to develop specific methods for the different matrices.
Moreover, the uptake, accumulation and translocation of micro/nanoplastic particles in different environmental compartments, including relevant organisms (microalgae, zooplankton, mussels and fish species) and adsorption in soil, will allow a better assessment of the effects of these pollutants at individual and population levels.
Access to and generation of specific databases of plastic particles in soil and aquatic ecosystem will also facilitate a more accurate modelling of their environmental fate and effects, and pave the way for future measures, including policy actions.

Flash presentation and poster 1.2

Nanoplastics: towards a technological platform for nanoplastics detection (NANOPLASTICS)

Miguel-Ángel Serra Beltrán, Gabriella F. Schirinzi, Marisa Sárria Pereira Passos, Douglas Gilliland

Abstract:
The main aim of the CAS6 NANOPLASTICS project is overcoming the lack of analytical methods for detecting nanoplastics, which is of relevance to a range of EC health and environmental policies. It assembles a dedicated multidisciplinary research team comprising external experts and JRC researchers to develop novel methods and strategies to detect and quantify nanoplastic particulates at a cost and/or scale relevant for widespread environmental monitoring.
The approach considers primarily novel biological (bioaccumulation, sentinel species) and biotechnological (tailored anchor peptides) solutions but, where possible, will be extending the capabilities of conventional analytical methods. The project has first focused on freshwater and marine environments.
The ultimate objective is to provide the JRC and the international scientific community with novel, cost-effective analytical methods and strategies for the widespread detection and environmental monitoring of

nanoplastic pollution, necessary to understand the distribution and effects of what are already one of the most widely spread human-made environmental pollutants.
This input to the policy makers will allow a better definition of actions to safeguard the environmental and human health, through a better understanding of whatever threats this emergent pollutant may present.

Flash presentation and poster 1.3

Can species niche modelling reveal responses of biodiversity to the use of pesticides?

ER project FFGRCC - Flora Fauna Green Rural Corridor Connect - Localizing and modelling wildflower-pollinator interactions in rural landscapes with citizen science and deep learning

Xavier Rotllan Puig, project leader Marijn Van der Velde

Abstract:
In FFGRCC we are developing novel methodologies to characterize agricultural intensification using species occurrence data and species distribution modelling. Relevant biogeographical and landscape information is extracted from several geo-localized databases including LUCAS, Pl@ntNet and GBIF. With this and other ancillary information we apply modelling techniques (e.g. deep learning) for assessments relevant in the context of different EU policies, such as the Common Agricultural Policy (CAP) and the EU Biodiversity Strategy.
The research carried out, together with researchers within and outside the JRC, can be divided into data-driven and modelling-based activities. For example, we are harmonizing the LUCAS grassland module data sets for 2018 (and 2022). This data, besides helping to assess habitat condition, can be used to validate and benchmark distribution models built with species occurrence data from sources such as GBIF, which is partly fed by crowdsourced data (e.g. from Pl@ntNet). GBIF species occurrences should also help us to enrich existing European peatland maps in terms of type (e.g. bog, fen) and condition. The inclusion of ancillary data should allow informing a spatial prioritization framework regarding peatland restoration. Finally, also using GBIF data, in combination with farmer's crop declarations, we present a data-driven proof of concept to select meaningful species that could become useful indicators of agricultural intensification.
The FFGRCC research and approaches humbly aspire to contribute to actions that can ultimately reverse the decline of pollinators in EU and increase biodiversity in rural landscapes.

ER project PESTIRISK - Spatially explicit PESTIcide health RISK indicators based on satellite mapping of crops and human settlements

Francesco Galimberti, project leader Raphael D'Andrimont

Abstract:
In the last 20 years, pesticide use has continuously increased in the European Union. To address this, the goal of the Exploratory Research project PESTIRISK is to develop new spatially explicit PESTIcide health RISK indicators based on satellite mapping of crops and human settlements. The Commission is currently working on improving the harmonised risk indicators or developing new ones. In this project, two key datasets developed at the JRC, should prototype a spatially explicit indicator based on satellite observations: (1) the EU Crop map which provides a detailed parcel-level crop type mapping and (2) the Global human settlement layer providing spatial data about human settlements. By combining these two datasets with available information on pesticides, the PESTIRISK project presumes to define pan EU scenarios of time series of potential/real pesticide applications on EU crops. These prospective results would pave the way to develop new indicators to monitor population pesticide exposure risk in close proximity to agricultural areas. The same approach will also be potentially used for monitoring biodiversity into different environmental compartments as well as for developing economic scenarios.

Flash presentation and poster 1.4

Green Modelling - Climate, Agriculture, Forests and Biodiversity

ER project AIACS - AI-enhanced Agro-Climate Service

Arthur Hrast Essenfelder, project leader Andrea Toreti

Abstract:
AIACS (AI-enhanced Agro-Climate Service) is an exploratory research project that aims at developing an innovative AI-enhanced climate service prototype capable of digesting, analysing and interpreting data and information from various sources to monitor and forecast unfavourable climate conditions and climate extremes. Leveraging on the increasing availability of high-resolution data, AIACS combines the use of machine learning and big data, being set in the broader context of disaster risk management and climate extremes, particularly in the context of droughts and agriculture. The project builds from the JRC expertise in providing reliable information on sectoral climate services (such as the JRC crop monitoring and forecasting system) to better determine the spatio-temporal characteristics of drought events and to provide useful information to promote the reduction of the potential negative impacts on agriculture. The main objectives of the project are: i) drought events characterisation; ii) ai-enhanced drought events (seasonal) forecasting, and; iii) attribution of factors that lead to drought events. A concluding objective of AIACS is to consolidate the developed knowledge into a first-of-its-kind farm digital twin to promote a better understanding and predictive skill on the effects of unfavourable climate conditions and the role of risk-reduction strategies in agriculture. The prototype will be tested and applied in the agro-climatic context and evaluated against the JRC crop monitoring and forecasting system especially with respect to the Areas-of-Concern as currently issued in JRC MARS' bulletins.

ER project DryForM - Dry Forest Monitoring; monitoring Tropical Dry Forest disturbances with multi-sensor satellite data and machine learning

Iban Ameztoy Aramendi, project leader René Beuchle

Abstract:
The mapping of dry forest ecosystems, covering large parts of tropical and sub-tropical Central and South America, Africa and Asia, remains technically highly challenging. Most optical images with no or low cloud coverage are acquired during the dry season, thus during a time when dry forest trees have shed their leaves, exposing the vegetation cover at ground level in optical satellite imagery. Consequently, the spectral properties of dry forests are often similar to the signal of the ground coverage, which imposes challenges for monitoring and requires time-series analyses of satellite imagery. The DryForM project builds on the advantage of having access to Synthetic Aperture Radar (SAR) data from the Copernicus Sentinel-1 satellites, which can fill the gap when no cloud-free optical imagery (e.g. from Sentinel-2 or Landsat-8) is available during the leaf-on status of the trees. The project focuses in 1) producing a base-line map of pan-tropical dry forests, 2) testing a set of time-series analysis algorithms, including those built in-house or already established methods with the objective to monitor changes in forest cover and 3) supporting the establishment of an EU Observatory on deforestation, forest degradation, changes in the world's forest cover (EUFO) and its associated drivers; a key action of the EU communication on the Stepping Up EU Action to Protect and Restore the World's Forests.

ER project ForBioRes - Assessing Forest Biodiversity and Resilience from space; data integration for the prediction of forest structural diversity at continental scales (Data integration for the prediction of forest structural diversity at continental scales)

Gonzalo Oton Azofra, Emanuele Massaro, project leader Alessandro Cescatti

Abstract:
The three-dimensional structure of forests is of utmost importance to ecosystem functioning. Structurally diverse forests provide a greater diversity of microhabitats, harbouring more species, which in turn influence tree maximum productivity and water use efficiency. Additionally, a higher diversity in forest structure can moderate air temperature extremes, water stress, and contribute to a more thorough mixing of the atmospheric boundary layer, thus enabling greater heat exchange.
Efforts directed at monitoring forest structure over large scales via earth observation have gone a long way thanks to the recent deployment of novel spaceborne Light Detection And Ranging (LiDAR) sensors. However, the data produced by these sensors are sparse. Continuous products on forest structural diversity are needed in order to develop operational frameworks for monitoring changes in ecosystem functioning at continental and global scales.
In this study we combine different earth observation products, within a machine learning framework, to predict forest structural diversity over Europe. Specifically, we use a suite of structural parameters produced as a part of a novel spaceborne LiDAR mission, the Global Ecosystem Dynamics Investigation (GEDI), together with data from two Copernicus missions i.e. Sentinel 1 and Sentinel 2. Our results show that a combination of radar (Sentinel 1) and passive optical data (Sentinel 2) are able to predict forest structural diversity with relatively high accuracy. Overall, our study paves the way for the development of a cost-effective framework for monitoring changes in forest structural diversity at unprecedented spatial scales. Our results find application in a number of fields, ranging from biodiversity monitoring to effects of large-scale disturbances on ecosystem functioning.

Block 2: A European Green Deal – Addressing Smart & Sustainable Resource Management

Flash presentation and poster 2.1

Circular Economy: a recipe for more strategic autonomy? (bounCE4ward)

Brian Baldassarre, Alejandro Buesa Olavarrieta, Paola Albizzati

Abstract:
The EU is dependent upon raw materials and products for strategic technologies largely imported from overseas. Recent events, such as COVID-19 and the Russian invasion of Ukraine, exposed the EU's vulnerability to supply chain shocks. Core to the EU Green Deal, the transition to a Circular Economy (reduce, reuse, recycle) is an important contributor to achieve climate ambitions and prevent future supply chain disruptions. All of the former calls for analysis on the technical and financial viability of circularity in these critical value chains.
Bounce4ward is a 3-year research project focusing on Circular Economy and Strategic Autonomy. The project investigates how the Circular Economy might foster strategic autonomy within priority supply chains in the EU, by reducing consumption, reusing products and recycling resources imported from overseas. The objectives of BounCE4ward are: (1) to identify critical supply chains for the EU economy; (2) to analyse them from a technical, economic and geopolitical standpoint, while pinpointing drivers and barriers to their circularity, by combining quantitative and qualitative methods; and (3) to define actions to leverage drivers and overcome barriers, including new business models, inter-firm collaborations, EU policies and relations with non-EU countries.

So far, the BounCE4ward project enhances ongoing JRC research on critical supply chains (Report "Critical Raw Materials for Strategic Technologies and Sectors in the EU") by including circularity-specific considerations. Moreover, the project team is pursuing a detailed analysis of the titanium supply chain, owing to its relevance for EU industry and the stark dependence from Russia and Ukraine.

Flash presentation and poster 2.2

Integrating Innovative Photovoltaics into Complex Energy Systems

ER project RECYCLE-PSC - Evaluation, assessment and improvement of Process for Recycling and Reusing Innovative Photovoltaic Solar Cells

Alessandro Mezzetti, Laura Ciammaruchi, project leader Ewan Dunlop

Abstract:
Photovoltaic energy production (830 TWh worldwide in 2021) is currently dominated by first-generation silicon-based solar cells, due to their high efficiency and long-term stability. In the last decade a new generation of materials and technologies has emerged and has rapidly gained interest thanks to simplified processes and low cost, the missing ingredients for a feasible large-scale solar energy economy. In particular, perovskite solar cells (PSC) stand as one of the most promising and fast-improving technology, with record efficiencies (25.8%) already approaching the values of silicon solar cells (26.7%) and significant investments on industrial scale-up.
Since these new materials perform differently from their first- and second-generation predecessors, extensive research is required to properly understand and characterise their behaviour. Additionally, perovskite solar cells contain lead, thus raising the issue of recyclability and environmental impact. To this end, this project will focus on the assessment and improvement of recycling processes for perovskite solar cells, in an attempt to develop a safe and sustainable protocol to handle these devices and to reduce the environmental footprint of their hazardous components; the project results could help developing future policies in the perspective of a large-scale implementation of perovskite solar cells as high-efficiency, low-cost photovoltaics.

ER project SIACES - Sectoral Integration Assessment of Complex Energy System

Andrea Diaz Rincon, project leader Florian Fosse

Abstract:
In the energy arena, the transition towards a cleaner use of energy has led to a series of changes in how we consume energy, the energy vectors we use to satisfy our needs and, in general, the configuration of our energy systems. These developments add complexity to our systems as the production and consumption configurations evolve. The scientific landscape reveals the existence of a variety of tools that could be improved and used to explore such issues, based on complex systems analysis. SIACES proposes a series of new approaches to study complex energy systems by measuring the actual complexity of energy systems, conducting intensive numerical exploratory experiments and providing adapted data visualization. All these areas might contribute to better policy design for energy and climate, through complexity-based policy support. Robustness enhancements of the policy assessments performed with JRC in-house models are also expected.

Flash presentation and poster 2.3

Sustainable buildings and cities

ER project PINN FLOED - Physics-Informed Neural Networks for Foresight on LOsses and Energy Demand of buildings

Ana Veljkovic, project leader Daniel Pohoryles

Abstract:
PINN FLOED aims to harness the potential of data-driven machine learning approaches to provide foresight on the effect of building renovation. Given that the EU building stock is ageing, the Commission's Renovation Wave initiative promotes increasing building renovation rates to ensure that climate-neutrality targets for 2050 can be achieved. To inform policy-making processes, modelling approaches that are applicable at large-scale, yet adequately consider building physics parameters, are needed. Detailed building energy models are valuable, but too computationally intensive to be applied at EU-level. Instead, PINN FLOED explores for the first time a novel physics-informed neural network (PINN) approach for the EU building stock, with the aim of carrying out foresight studies on the renovation of the EU building stock. This will allow exploring future scenarios, such as the effect of climate change, changes in energy-carrier mix and different renovation rates. This novel bottom-up approach will allow to integrate results with the effect of applying seismic retrofitting to existing vulnerable buildings and hence include insights in terms of reductions in energy consumption, CO_2 emissions and potential monetary losses from seismic damage.

ER activity CityLabs – Space matters: How to develop a common methodology for CityLabs

Giulia Testori

Abstract:
This Exploratory Research Activity (ERA) 'Space matters: How to develop a common methodology for CityLabs' has been developed by the Territorial Development Unit of the Joint Research Centre (JRC) between October 2021 and September 2022. The main aim of the ERA was to develop an up-to-date, robust and flexible methodology that could be applied when running future CityLabs.
A CityLab is a participatory research format whereby the JRC works in close contact with a specific European municipality to collectively gather quantitative and qualitative data of a specific trend or discuss and spatialise the impact of a specific urban policy. The topics under observation are place-based and vary according to the urban context being analysed.
The ERA activities included one workshop with internal experts from the European Commission (EC) highlighting knowledge and current projects in the JRC and one workshop with experts from academia, planning practices and policy networks highlighting the state-of-the-art, good practices and successful examples of urban labs across different countries.
All contributions fed the development of a methodology that is modular, flexible and adaptable to future CityLabs organised among partners (i.e. the JRC and a city administration). The methodology and best practices presented in the report contribute to evaluating the impact of European policy at the urban level and to informing cities of their policy coherence with European frameworks and priorities, as well as of funding opportunities that support cities.

Block 3: A new push for European Democracy and a Europe fit for the Digital Age

Flash presentation and poster 3.1

Social classes in the digital age: Technological Change, Social Inequalities and the Social Contract (DIGCLASS)

Carlos Gil-Hernández, Leire Salazar, Guillem Vidal, Davide Villani

Abstract:
The DIGCLASS project addresses both opportunities and challenges related to the impact of technological change—automation, digitalisation and platformisation—on socioeconomic inequalities.
The main objectives of DIGCLASS are: (1) To identify how digital technology may fuel social and economic inequalities and transform societal needs; (2) To revise existing theoretical and empirical approaches to social class analysis and update them to address the challenges posed by technological transformations; (3) To assess whether the traditional links between social position and life chances are altered by technological changes; (4) To identify whether new socioeconomic vulnerabilities are emerging and whether new forms of social protection are required.
The way in which social rewards are distributed in the society is altered by technological change. This is an empirical matter that needs to be addressed rigorously. The distributional consequences of such transformations might require novel and evidence-based approaches to social protection. To that end, we are conducting empirical work using existing cross-sectional datasets that are comparable across EU countries, existing cross-sectional and longitudinal data for specific single European countries, and collecting our own data. We host (a) a Seminar Series on interdisciplinary approaches to social inequalities, (b) the Real Utopias for a Social Europe series, discussing bold policy initiatives to tackle emerging needs for social protection, (c) a Working Papers series with the scientific outputs of the project.

Flash presentation and poster 3.2

Misinformation, data, and values in the EU

ER project IMPARA - IMpact assessment of PAndemics through big data analytics ReseArch

Alba Bernini, project leader Pieter Kempeneers

Abstract:
Since early 2020, the COVID-19 pandemic has taken over the world. During the first months, when vaccines were not available yet, the only way to limit its spread was through non-pharmaceutical interventions (NPIs), i.e. measures that aim at interrupting infection chains. NPIs include travel bans, events cancellation, social distancing, curfews, and lockdowns. These measures are effective in limiting the direct impacts of an outbreak on human health and the health system but may cause serious indirect impacts on several socio-economic sectors. Examples of these impacts are loneliness during the quarantine period, lack of income due to professional inactivity, effects on mental health, and the postponement of cancer treatments or surgeries, to name a few. The heterogeneity across space and time of the measures adopted by the different countries, as well as the magnitude of the changes they induced offer an unprecedented opportunity to investigate their effectiveness.
The goal of the Exploratory Research project IMPARA is to learn (or *imparare* in Italian) from the COVID-19 experience, in order to provide scientific evidence on how to find a balance between imposing strict measures to mitigate the spread of the pathogen and limiting their collateral damage.

ER project COCOMI - Countering the negative effects of misinformation during global crises through targeted behavioural interventions

Hendrik Bruns

Abstract:
The COCOMI (Countering Covid Misinformation) project's main goal is to assess the effectiveness of strategies to fight misinformation on Covid-19, as well as on climate change, for specific groups of individuals. More specifically, the project focuses on ways to target behaviourally informed strategies against misinformation to specific groups of individuals. These strategies aim at reducing the effect and spread of misinformation. The fight against misinformation relies on many interventions that are behaviourally informed. Some strategies focus on the problematic content, rhetoric, or source of misinformation. Some strategies use small doses of misinformation to train people in identifying it. Other strategies rely on pledges against sharing misinformation or use reminders before sharing. Most of these interventions are implemented in a “one-size-fits-all” manner. Yet, for example, some people might profit more from debunking, others more from pre-bunking. This project explores why people share and believe misinformation and how this information can be used to make interventions more effective. Based on this, we assess experimentally investigate the effectiveness of specific interventions for specific groups. If applied responsibly, targeting could increase the effectiveness of existing strategies and thus strengthen the fight against misinformation. The generated insights should be interesting for other Directorate-Generals and benefit the overall fight of the Commission against disinformation.

ER activity EUdentity - Understanding EU Identity in Member States through Media Analysis of Narratives, Emotions and Values in Reporting

Mario Scharfbillig

Abstract:
The way people identify themselves with groups is essential to human nature. We are hard-wired to care more for people who we perceive to be closer to, which strongly depends on our social identities. Everyone has a multitude of potential identities like family, social class, nationality or even global identities like being European. While research has shown the relevance of these identities for our decision making e.g. in solidarity, cooperation, pro-social behaviour or on the flip side discrimination, prejudice and inter-group conflict, not much is known how this reflected in the media landscape, especially in Europe.
The aim of this activity is to set up a framework and a methodology to study various social identities reflected in the media in the EU. Several concepts for measuring identities in text data and more specifically in news media have been developed with various experts. Those concepts are tested on a sample dataset from the European Media Monitoring system of the JRC for the topics of migration and sustainable energy production. Furthermore, connections between values and emotion text analysis are explored.
The results enrich the JRC tool kit on political intelligence, and will help to understand polarisation between groups, and inform policies for appropriate responses. Understanding group identities and narratives thereof expressed in the media can also help to predict potential conflicts and help provide early warning or help enhance cooperation and solidarity.

Flash presentation and poster 3.3

Demand-driven policy relevant research - a case study on real estate market

E. Bertoni, M. Fontana, l. Gabrielli, S. Signorelli, M. Vespe

Abstract:
One of the first activities of CSS4P has been to find policy relevant questions with a scientific interest. The process that we envisioned is composed of three steps: collecting demand side needs, involving expertise and operationalizing a case study in order to tackle the policy question. The first step has resulted in a Science for Policy report "Mapping the demand side of Computational Social Science for Policy" (https://publications.jrc.ec.europa.eu/repository/handle/JRC126781), that collects a set of policy questions that could be potentially tackled using CSS methods.

The second has yielded the "Handbook of Computational Social Science for Policy", a collection of chapters from experts in the field that show the methods and the already available experiences using CSS in the different domains. The third step is a hands-on experiment where the demand side and the expertise could be used to practically apply methods and data to address the proposed issues.

Our proposal consists in starting from one of the collected policy questions named "The Short and Long Term Impacts of COVID-19 on Residential Patterns" (https://trello.com/c/8NmJNxSH) and try to come up with research strategy to address it, given also the expertise provided on the topic into the handbook chapters written by Recchi & Tittel and Medeiros. Through the case study we highlight perspectives and limitations of Computational Social Science in regional analysis in terms of data quality and availability.

Flash presentation and poster 3.4

ER activity extrAIsafe - Toward explainable, robust and fair AI in automated and autonomous vehicles

Akos Kriston, Ronan Hamon

Abstract:
In March 2022 the JRC (Units B.6, C.4, E.3) organized an Exploratory Workshop entitled "Toward explainable, robust, and fair AI in automated and autonomous vehicles", bringing together experts in fields such as Trustworthy AI, autonomous driving, and vehicle testing. This report summarizes the steps that followed the organization of the workshop, including the definition of the scientific objectives, the list of invited presenters and participants, and the conditions under which the workshop took place.
The report also presents the main findings of each talk that occurred during the workshop and an analysis of the discussions that occurred during collaborative working sessions. Topics of interest included, among others, current regulations and standards regarding automated and autonomous road vehicles and analysis of their limitations; explainability of artificial intelligence; accuracy, robustness, security, and fairness of AI systems.
These insights are used to provide concluding remarks on the outlook of the Workshop, in particular how the findings of the Workshop can help to promote further research within and outside of the JRC on this topic, with the goal of making safer transport through innovative ecosystems and effective regulations.

Flash presentation and poster 3.5

A revolution in time precision for the digital age

ER project THC ½ - Thorium nuclear clock half-life measurement

Carlos De Almeida Carrapico, project leader Alban Kellerbauer

Abstract:
The Joint Research Centre Karlsruhe is conducting scientific research to investigate the feasibility of the Nuclear Optical Clock concept with the support of the Exploratory Research program. The project supports the following European Commission Priorities: Europe fit for the digital age, European industrial strategy and Synergies between industries. A nuclear clock will provide a significantly higher level of precision in the definition of the second as defined by the SI system. In this way, it will increase GPS accuracy, provide the means for further advance of General Relativity studies and improve the financial system's resilience to illegal trading ahead of time, among many other benefits. To demonstrate the nuclear clock concept, it is necessary to measure the half-life of the thorium-229 metastable state (Th-229m). To do so, a setup dedicated to the production of suitable thorium thin film samples has been constructed and is being commissioned. Additionally, a second setup dedicated to the excitation of the Th-229m state using vacuum ultraviolet (VUV) light and the measurement of its half-life is in the final construction phase. The successful measurement of the Th-229m half-life using VUV light as excitation method is a key component of nuclear clock technology and provides a clear path for its quick adoption.

Block 4: Promoting our European way of life – Addressing Material Science and Human Health

Flash presentation and poster 4.1

Replication from modelling to experimental

ER Project ULTIMATE - Investigation of Ultra-High Temperature Ceramics

Jérémie Manaud, project leader Luka Vlahovic

Abstract:
Ultra-high temperature ceramics (UHTCs) are of interest for the development of new applications working under extreme conditions, such as space vehicles, nuclear reactor or high temperature turbines. Indeed, UHTC show excellent performances to withstand high temperatures, thermal shocks and corrosive environments. Among them, tantalum carbide (TaC) and hafnium carbide (HfC) exhibit very interesting mechanical properties and one of the highest melting points (>3500K). Recently, the sub-stoichiometric hafnium carbo-nitride $HfC_{0.56}N_{0.38}$ was predicted by Hong and van de Walle to be the compound with the highest melting point reported among all materials (>4000K). In this framework, we studied tantalum and hafnium carbo-nitride systems in order to characterise experimentally their mechanical properties and melting point, as they are key properties to know the limits of the use of these materials. Dense samples were prepared by spark plasma sintering under argon atmosphere to avoid oxidation. The final composition, morphology and structure were confirmed by various characterization techniques (XRD, SEM, C/N analysers…). The mechanical properties, *e.g.* hardness and Young's modulus, were determined by nano and macro indentation experiments. The melting point was determined by a laser heating facility that allows us to reach a temperature high enough to melt ultra-high temperature ceramics.

Flash presentation and poster 4.2

Getting ready for the next pandemic

Giuditta Guerrini (FutuRe), Diletta Scaccabarozzi (COVIDEC), Andrea Barbaglia (SENTINEL), Tiziana Lischetti (COV&ENV for ONEH) and Laure-Alix Clerbaux (CIAO)

Abstract:
COVID-19 pandemics underlined the need to respond quickly to the viral threats and the importance of prevention. The five ER projects (FUTURE, COVIDEC, SENTINEL, COV&ENV for ONEH and CIAO) focused on COVID-19, cooperate to detect and characterise known pathogens and unforeseen possible threats. Social distancing and face masks are the main counter measurements against airborne pathogens. Thanks to the decontamination of face masks, COVIDEC ER project provides solution to their shortage (as experienced during the last pandemic) and to the environmental impact of single-use face masks. As additional countermeasures, SENTINEL ER project studies the early detection of pathogens in the environment by sampling aerosol in confined indoor spaces such as occupational, social or schooling environment. Similarly, COV&ENV for ONEH ER project implements a novel and fast molecular technique based on the CRISPR/Cas system, to monitor the presence of coronaviruses in environmental samples. Both SENTINEL and COV&ENV for ONEH ER projects thus, aim at detecting early warning signs of potential new epidemic outbreaks. FUTURE ER project aims at understanding the molecular mechanism of interaction between the host and the pathogen, and to study the interaction of the viral proteins with antibodies effective against new COVID-19 variants. Finally, CIAO ER project aims at modelling the pathogenesis of COVID-19 from the molecular level, through cellular, tissue, organ up to an adverse outcome at the organism level. A mechanistic understanding of the disease permits to combine data from in vitro models for virus characterization with data from animal and human studies depicting the inflammatory response and various adverse outcomes. This approach also helps to capture how diverse factors modulate the clinical outcomes, increasing our understanding of why some populations are more vulnerable than others.

ER Project FutuRe - Future Response Strategies Against Coronaviruses

Giuditta Guerrini, project leader Luigi Calzolai

ER Project COVIDEC - Corona Virus Decontamination

Diletta Scaccabarozzi, project leader Francesco Fumagalli

ER Project SENTINEL - SENsitive pepTIdes for aNomalous Epidemic Level

Andrea Barbaglia, project leader Andrea Valsesia

ER Project COV & ENV for ONEH - Coronaviruses and Environment: One health approach

Tiziana Lischetti, Anna Navarro Cuenca, project leader Teresa Lettieri

Abstract:
The coronavirus disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, deeply affected the global health and welfare since the early 2020. SARS-CoV-2 belongs to the *Coronaviridae* family, which comprises strains able to infect either mammals, birds or both. Cross-infection among species gave rise to COVID-19 as well as to other diseases over the last two decades, as for the severe acute respiratory syndrome (SARS) in 2003, and the Middle East respiratory syndrome (MERS) in 2012. SARS-CoV-2 has a high mutation rate and several new viral variants have emerged over the pandemic. These variants may have increased transmissibility,

present severe symptoms, or even decrease the effectiveness of public health measures such as vaccines and diagnostic tools.
The project "Coronaviruses and environment: One health approach (COV&ENV for ONEH)" aims to develop a fast detection system based on the CRISPR/Cas approach to enable the detection of SARS-CoV-2 or other Coronaviruses in environmental samples. By identifying unique genomic regions characteristic of every single variant of concern (VOC) this method allows to characterize and monitor the diffusion of the diverse SARS-CoV-2 variants over time and thus potentially foresee when new variants are emerging and raising. Likewise, by exploiting genetic regions highly conserved among the coronaviruses, the system can turn into a surveillance method to early monitor emerging outbreaks in animals or humans.
So far the specific regions identified by bioinformatics analysis were used to develop two multiplexes reverse transcription quantitative PCR (RT-qPCR)-based methods for the simultaneous detection of three different SARS-CoV-2 variants: alpha, delta and omicron. The multiplexes were used to analysed environmental samples collected once a month in a local wastewater treatment plant (WWTP). With the validation of specificity of the regions by RT-qPCR, the sequences are used to design the guide to develop the CRISPR/Cas system, which will allow the detection of viral RNA in natural sample.

ER Project CIAO - Modelling the pathogenesis of Covid-19 based on the Adverse Outcome Pathway paradigm

Laure-Alix Clerbaux, project leader Clemens Wittwehr

Abstract:
Since the onset of the COVID-19 pandemic, researchers have intensively investigated the pathological mechanisms of the disease which results in a tsunami of publications. The ER CIAO project (Modelling the Pathogenesis of COVID-19 using the Adverse Outcome Pathway) aims to make sense of the available knowledge on COVID-19 pathogenesis by applying the Adverse Outcome Pathway (AOP) framework, well-established in toxicology but never exploited so far for a viral disease. An AOP depicts the causal relationships that link an initial event (here the binding of the virus to the ACE2 receptor) over a series of biological key events toward an adverse outcome, such as respiratory distress or anosmia. The modular aspect of the AOPs allows the development of networks where biological events common between various pathways become evident and knowledge gaps can be identified. Such mechanistic organization of the knowledge also helps to understand how factors influence the underlying mechanisms to ultimately modulate the outcomes. Addressing modulating factors is essential since abundant clinical evidence shows that COVID-19 outcomes are markedly heterogeneous. Developing COVID-19 related AOPs relies on interdisciplinary collaborative effort, synergizing exchange between experts from different fields. CIAO has attracted more than 75 scientists from 40 different organisations across the world who have been collaborating in the project since 2 years. Based on this hands-on on a successful interdisciplinary and crowdsourced collaboration, JRC.F.3 plans to apply lessons learned from CIAO in its institutional work program.

Flash presentation and poster 4.3

Human and Environmental Action Plans (HEAPS)

ER Project SOLACE - Understanding the links between SOiL pollution and CancEr

Joanna Bartnicka, Felipe Yunta Mezquita, project leaders Raquel Negrao Carvalho and Arwyn Jones

Abstract:
The main objective of the ER project SOLACE is to investigate the potential links between soil pollution and cancer occurrence. This includes assessing the spatial correlations between soil pollution with carcinogenic metals and cancer burden indicators, using harmonised databases curated by the JRC (LUCAS, IPCHEM, ECIS),

combined with the analysis of soil properties affecting heavy metals distribution and accumulation in the food chain.
To this end, the availability of data on cancer burden indicators and cancer risk factors prevalence was mapped; these datasets were linked on the regional level with databases reporting environmental occurrence of carcinogenic metals. Correlations between soil pollution with carcinogenic metals and cancer occurrence, after adjustment for main cancer risk factors, were assessed by ecological regression. Comprehensive analysis of the effect of soil properties on heavy metal distribution from LUCAS 2009 database (for As, Cd, Cu, Cr, Ni, Hg, Pb and Zn) was carried out. Crops growing on contaminated sites were identified as starting point for further analysis by using bioaccumulation factors. Pollution indices were determined for risk assessment of heavy-metal accumulation in soils. Spatial distribution of pollutants were represented at NUST2 level to support policy-making. Arsenic threshold values were calculated and mapped for Cropland, Grassland and Woodlands. Impact assessment of the cumulative application of Sewage sludge in agricultural soils was carried out. The further aims of the project are to develop a methodology for assessment of potential exposure pathways to soil pollutants by resident populations and for risk analysis.

ER Project HELIOS - A healthy mind in a healthy ecosystem

Federica Marando, Elaine Van Rijn, project leader Jan Wollgast

Abstract:
HELIOS (a healthy mind in a healthy ecosystem) explores how the presence of nearby nature and green spaces, as well as the quality of the living environment, impact our mental health and well-being. This relationship is studied within the context of the Covid-19 pandemic, aiming to offer insights in times of a health crisis and beyond. The project uses an interdisciplinary approach to measure and analyse the environmental quality of residential areas (JRC D.3, D.1, C.5), mental health (JRC F.1, University of Verona), and the relationship between the two. Additionally, a citizens' engagement dimension of the project (JRC H.1) examines whether neighbourhood places can contribute to well-being, through discussions around photos taken by the residents themselves.
The environmental characterization in terms of urban stressors and green infrastructure is close to completion, and their relationship with mental health of a cohort of psychiatric patients from Verona is being analysed. A scoping review on green space, mental health and the pandemic is currently underway, while a survey to analyse well-being is about to be launched. The workshops with citizens have been concluded and the photos are to be displayed in an exhibition at the end of this year. The knowledge emerging from the HELIOS project is planned to be reported in a final workshop, scientific publications and a science for policy brief.

ER Project PoliSpill - Policy mix and behavioural Spillovers

Marius Alt, project leader Nives Della Valle

Abstract:
Drastic behavioural changes are required to mitigate and confine the environmental and societal damages caused by climate change. These changes require effective policy interventions. In many cases, an environmentally-relevant behaviour is regulated by multiple interventions at the same time. Such policy mixes can appeal to policymakers as they might contain complementarities in their effectiveness and could be preferred over the implementation of a single intervention. In this context, PoliSpill investigates possible synergies between different interventions when being applied jointly. Hereby, the focus lies not only on targeted environmental behaviour, but also on how these interventions spill over on individuals' motivation to engage in other related environmental behaviour. These unintended effects of interventions can both be positive or negative. Neglecting spillover effects might result in incomplete evidence on the degree to which a policy contributes to environmental well-being. By providing these additional information about spillovers

of policy mixes to tackle climate change through experimental methods, the findings in PoliSpill aim at equipping policymakers with the adequate tools to address climate change.

ER Project POLLUX - Detection of hazardous environmental POLLUtants using eXosomes

Dorelia Lipsa, project leader Susanne Bremer-Hoffmann

Abstract:
Health effects of a repeated exposure to environmental pollutants in humans can be difficult to detect in particular when the non-degradable contaminants occur in low concentration and accumulate in tissues/cells overtime. A robust and accurate understanding of long-term effects is often challenging due to limitations of animal studies and existing toxicological in vitro tests.
Recently, there is growing scientific interest in exosomes – tiny vesicles involved in intercellular communications through the exchange of proteins, nucleic acids and lipid molecules. Their dynamic role in immune activation and oncogenesis is currently the focus of biomedical research and recent studies suggest also their relevance in toxicological applications.
The main aim of Pollux project is to explore the capacity of exosomes as an in vitro biomarker indicating early phases of the pathological development after repeated dosing of persistent and accumulating pollutants in the food chain. The selection and establishment of a series of methodologies for the isolation of exosomes from the pool of extracellular vesicles as well as their characterisation is required. The poster will highlight relevant analytical and imaging techniques to identify and characterise exosomes deriving from intestinal cells.

Flash presentation and poster 4.4

Epidemics dynamics and control (EPICO) project - state of the art and future developments

Nikolaos I. Stilianakis, Augusto Fasano, Federico Ferraccioli, Nicola Riccetti

Abstract:
The Epidemics: dynamics and control (EPICO) project aimed to disentangle and model transmission dynamics of infectious pathogens with pandemic potential, using as case study West Nile virus (WNV) – for vector borne-diseases – and COVID-19 – for diseases transmitted via direct contact between humans.
The process comprised two tasks: on one hand identify state of the art knowledge and research gaps in the specific fields, and on the other use this acquired knowledge to develop modelling approaches for health risk assessment including early warning in an effort to develop optimal control strategies in support of public health policy making.
For the case of vector-borne diseases this two-track approach has resulted so far in a review of literature on host selection and the ratio between the blood meals and availability of potential hosts of WNV-transmitting mosquitoes (accepted for publication in the journal PLoS Neglected Tropical Diseases) and a WNV transmission model (paper currently under review), which is an extension of a previously developed model by the lead scientist of the EPICO project and his collaborators.
To date, the populations of WNV-transmitting mosquitoes and host competent birds, as well as their specific impact in the transmission cycle of WNV, are yet unclear. For this reason, we were faced with the challenge to model the transmission dynamics of a pathogen with a highly complex transmission cycle. In our aforementioned work, and the one we are developing, we are trying to disentangle and quantify the impact of these populations on incidence and prevalence of the infections. The ultimate goal is to further develop an early warning system for WNV infections in humans and improve health risk assessment.

Furthermore, with our work we hope to motivate the development of further Exploratory Research (ER) research questions and provide appropriate tools for approaches such as quantitative health risk assessment. To that end joint research projects with ER may emerge.

2. Abstract of keynote speeches and brief speaker's biography (day 2 & 3: 17-18 Nov. 2022)

2.1. Keynote #1: Communicating scientific uncertainty – experience from EU food safety assessments

Communicating scientific uncertainty – experience from EU food safety assessments

Anthony SMITH, EFSA

Abstract:
Scientific advisory bodies need to provide advice that satisfies both substantive and normative imperatives: respectively, enhance policymaking/decision-making and maintain public confidence in the system as a whole. Transparency of assessment conclusions, of the strengths and weaknesses of the evidence base, and of the scientific process followed, is critical in providing "actionable advice" that can satisfy these imperatives; addressing and communicating scientific uncertainty is one element that lies at the heart of such transparency initiatives. The European Food Safety Authority (EFSA) provides scientific advice to EU and national risk managers in the form of risk assessments and technical assistance in relation to the food chain. As part of EFSA's approach to the transparency of its scientific assessments, it has developed a comprehensive approach to uncertainty analysis and uncertainty communication to support and harmonise the work of its expert panels, scientists and risk communicators. This intervention will outline EFSA's overall approach, focus on its guidance on communication of uncertainty with examples, and flag supporting findings from social research conducted by EFSA in support of this work.

Short bio:
Anthony Smith works in the Department of Partnership and Cooperation, at the European Food Safety Authority (EFSA). Anthony studied political science, economics and anthropology at university and has over 20 years of experience as a professional communicator in the public, private and non-profit sectors. He has an eclectic track record of communications management and operational content production involving print and online media, multilingual news copy and public information, audiovisual formats, web and social media channels; on topics ranging from sport, leisure and finance to policy analysis, scientific food safety risk assessment and communication methodologies. His current role at EFSA is risk communication scientist, in which he uses social research insights to develop communications approaches and to contribute to strategic communication planning and operations. Anthony's research and contributions to EFSA outputs deal with topics on food safety risk communication, communication of scientific uncertainty and, in the future, risk/benefit communication.

2.2. Keynote #2: Imagining the future through the complexity crystal ball

Imagining the future through the complexity crystal ball

Peter SLOOT, Institute for Advanced Study, University of Amsterdam

Abstract:
We are changing the world much faster than we can reason about it: we need new ways to imagine the future and the impact our interventions will have on that future.

We live in a complex world and are surrounded by complex systems. From a biological cell, made of thousands of different molecules that work together seamlessly, to our global society; a collection of seven billion individuals that try to work and live together. These complex systems display endless signatures of order, disorder, self-organisation and self-annihilation. Understanding this complexity is one of the biggest scientific challenges of our time.

In this talk I will discuss how the science and language of complexity can help us to imagine realistic scenarios and the emerging consequences of the feedback processes that result from our interventions in complex adaptive systems such as crime and health.

Short bio:
Peter Sloot is a full-time professor of Complex Adaptive Systems at the University of Amsterdam, he is the founding scientific director of the Institute for Advanced Study in Amsterdam. He was trained as a chemical physicist and obtained a PhD from the Dutch Cancer Institute and the UvA. Over the past decades worked in Singapore, Australia, the Russian Federation and The Netherlands where he developed new computational methods that allow researchers of various disciplines to work together on complex wicked problems. He is associated to UNESCO where he works on bringing together scientists from all walks of life to understand the dynamics of social transitions in a world under stress.
https://peter-sloot.com
Curiosity, Serendipity and Complexity - Institute for Advanced Study IAS

2.3. Keynote #3: On the importance of replicability in science

On the importance of replicability in science

Jana BERKESSEL, Mannheim Centre for European Social Research, University of Mannheim

Abstract:
One of the pathways by which the scientific community examines the validity of a scientific discovery is by repeating the research that produced it – by reproducing the results from the original data or by replicating the study. Over the past decade, large efforts to estimate the replicability of scientific findings have repeatedly reported shockingly low replication rates: Only 39% of psychological studies (Reproducibility Project: Psychology, 2015) and 46% of cancer biology studies (Reproducibility Project: Cancer Biology, 2021) were successfully replicated. In this talk, I will discuss why these findings are troubling, which factors might have led to low replication rates, and what we, as researchers, can do to increase the reproducibility and replicability of our results.

Short bio
Jana Berkessel is a PhD candidate in Cross-Cultural Social and Personality Psychology at the University of Mannheim in Germany. She earned a bachelor's and a research master's degree in psychology from the University of Cologne. During her studies, she focused on social psychology and worked as a student assistant at the Social Cognition Center Cologne. From October 2017 to July 2018, she was a research assistant at the

Psychological Methods lab at the University of Mannheim. In her PhD research, she focuses on socioeconomic and sociocultural antecedents of psychological well-being, including socioeconomic status and cultural religiosity. She is also passionate about improving research practices and has co-founded the Mannheim Open Science Meetup.

CAS and ER programmes: a short description

1. Summary of the Centre for Advanced Studies

The JRC Centre for Advanced Studies (hereafter "CAS" or "the Centre") opened in 2016 with the vision of creating a stimulating, trans-disciplinary environment where the JRC could work together with external researchers and scientists to explore new and emerging scientific and societal challenges facing the EU.
As an incubator for new scientific ideas, outside the policy support activities undertaken by the JRC, the research in CAS contributes to the knowledge base of the JRC, enabling it to elaborate on policy options and their impact well ahead of time.
Deliberately chosen without a thematic focus, CAS projects contribute to various Commission priorities and enable transdisciplinary thinking and exchanges across a wide range of topics, thus reflecting on the complexity of the challenges Europe is facing.
Projects are typically led by a senior scientist or external experts with an established reputation in the research area concerned and have a limited duration not exceeding a maximum of 3 years. For more information, CAS Projects are summarized in Annex I.

Towards a technological platform for nanoplastics detection NANOPLASTICS (2020 – 2023)

The project studies novel ways to detect nanoplastics by combining instrumental analytics with novel biological and biotechnological approaches in order to overcome the major limitations of existing analytical methods. The project's aim is to provide the scientific community with analytical tools which can allow the quantification of nanoplastics in a range of key matrices and thus help to reduce the knowledge gaps surrounding what may already be one of the most widely spread yet poorly understood man-made environmental pollutants. This better understanding will provide input to the policy makers who may have to define appropriate actions to safeguard both environmental and human health by tackling whatever potential risks may be presented by this ubiquitous pollutant.

Team members: Miguel-Angel Serran-Beltran (Project Coordinator), Douglas Gilliland (scientific coordination), Gabriella Schirinzi, Marisa Passos.

External experts: Julien Gigault (CNRS, FR), Ulrich Schwaneberg (RWTH Aachen University, DE), Miren Cajaraville (UPV/EHU, ES), Nicoletta Riccardi (CNR-IRSA, IT), Denis Mitrano (ETH Zürich, CH), Jennifer Lynch (NIST, USA).

Computational Social Science CSS4P (2020 – 2023)

The project envisages identifying how our digital footprint is used to describe and anticipate societal trends.
This research aims to unlock the potential of Computational Social Science for EU policy support through a balanced capacity of data scientists, statisticians, social scientists and data stewards with legal background to build partnerships with key players in the private sector while addressing legal privacy, ethical and security concerns as well as data transparency, accountability and governance challenges. Thanks to the possibility to channel research findings to policymakers, the European Commission Joint Research Centre has already

successfully demonstrated its ability to attract the academic community and this research will draw on collaborations with prominent scholars in the field of Computational Social Science.

Team members: Michele Vespe (Project Coordinator), Eleonora Bertoni, Matteo Fontana, Lorenzo Gabrielli and Serena Signorelli.

External experts: Ettore Recchi (Sciences Po, EUI/MPC & Institut Convergences Migrations, Paris, France), Rada Mihalcea (University of Michigan, Ann Arbor, USA), Jin Zhijing (Max Planck Institute for Intelligent Systems, Tübingen, Germany & ETH Zürich, Zürich, Switzerland), Massimo Tavoni (Politecnico di Milano & RFF-CMCC European Institute on Economics and the Environment, Milan, Italy), Stefaan Verhulst (Data Program, The GovLab, New York University, New York, NY, U.S.A.), Linnet Taylor (Global Data Justice Project, TILT, Tilburg University, Tilburg, The Netherlands), Ridhi Kashyap (Leverhulme Centre for Demographic Science & Nuffield College, University of Oxford, Oxford, UK), Giuseppe Veltri (University of Trento, Trento, Italy), Kristof de Witte (Leuven Economics of Education Research (LEER), KU Leuven, Leuven, Belgium & United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT), Maastricht, the Netherlands), Marc-André Chénier (Leuven Economics of Education Research (LEER), KU Leuven, Leuven, Belgium), Caroline Rizza (Institut Polytechnique de Paris, Paris, France), Helen Margetts (The Alan Turing Institute for Data Science and AI, London, United Kingdom & Oxford Internet Institute, University of Oxford, Oxford, United Kingdom), Yelena Mejova (ISI Foundation, Turin, Italy), David Leslie (The Alan Turing Institute, London, United Kingdom), T. S Amjath Babu (International Maize and Wheat Improvement Center (CIMMYT), Dhaka, Bangladesh), Francesco Rampazzo (Saïd Business School, Leverhulme Centre for Demographic Science, Nuffield College, University of Oxford, Oxford, UK), Sebastiano Manzan (Zicklin School of Business, Baruch College, CUNY, New York, USA), Joshua Tucker (New York University, New York, NY, U.S.A.), Johannes Stroebel (NYU Stern, NBER, CEPR, CESifo, New York, NY, U.S.A.), Nuno Crato (ISEG, Cemapre, University of Lisbon, Lisbon, Portugal), Fabiano Pallonetto (Maynooth University, Maynooth, Ireland), Magda Fontana (University of Turin, Turin, Italy), Eduardo Medeiros (Instituto Universitário de Lisboa (ISCTE-IUL), DINÂMIA'CET - IUL, Lisbon, Portugal), Gustavo Romanillos Arroyo (tGIS, Department of Geography, Universidad Complutense de Madrid, Spain), Borja Moya-Gómez (Universidad Complutense de Madrid, Spain).

Social classes in the digital age DIGCLASS (2021 – 2024)

The project aims to identify how digital technology may play a role in fuelling inequality and transforming society. Researchers to revise existing theoretical and empirical approaches to social class analysis in the social sciences and update them to address the challenges posed by technological transformations. Our work will propose new taxonomies and analytical tools, it will assess whether the traditional links between social position and life chances are altered by digitalization and whether new needs in terms of social protection are required in current societies.

DIGCLASS aims to apply them to contemporary phenomena such as:

- The decline of the middle class
- Job polarisation
- Effects of digital technologies on inequalities
- Life chances
- The emergence of new types of economic relations

Team members: Leire Salazar (Project Leader and Lead Scientist), Carlos J.Gil, Guillem Vidal, Davide Villani.

External experts: Pablo Beramendi (Duke University), David Rueda (University of Oxford)Marco Cozzani (EUI), Tatiana Eremenko (UNED), Peter Fallesen (Stockholm University), Alice Goisis (UCL), Jad Moawad (University of Lausanne), José Antonio Noguera (UAB), Daniel Oesch (University of Lausanne), Juan J. Fernández (UC3M), Antonio M. Jaime-Castillo (UNED), Natalia Mora-Sitja (University of Cambridge), Reto Burgisser (University of Zurich), Aina Gallego (UB and IBEI), Thomas Kurer (University of Zurich), Alexander Kuo (University of Oxford), Nicolas Bicchi (IBEI), Luca Giangregorio (UPF), Rafael Muñoz de Bustillo (University of Salamanca).

Circular Economy: a recipe for more strategic autonomy bounCE4ward (2021 – 2024)

The project aims to investigate to which extent Circular Economy can mitigate what the COVID-19 crisis has already exposed: the EU's vulnerability to sudden shocks in the global supply chain.
Core to the EU Green Deal and NextGenerationEU, the transition to a Circular Economy with less waste and better resource use will help achieve the EU climate ambitions and reduce susceptibility to supply disruptions. The project will assess and optimise the EU's strategic autonomy for priority supply chains to build such resilience. It plans to show how circular the EU economy currently is and what actions are most urgently needed.

Team members: Brian Baldasserre (Project Leader and Lead Scientist), Alejandro Buesa Olavarrieta, Paola Albizzati

Epidemics and Control EPICO (2021 – 2024)

The project addresses fundamental issues in prevention, preparedness, and response of epidemics.
The focus is on the dynamics and control of vector-borne and respiratory infectious diseases, both posing a major global health threat. The aim is to develop a framework based on mathematical and statistical methods, and on data derived from routine and modern space surveillance systems.
EPICO will study aspects of spatiotemporal dynamics, early warning, seasonality, the One-Health approach, transmission modes, waning immunity, pathogenesis, the immuno-epidemiology of the disease and the assessment of pharmaceutical interventions that may inform the public health decision process.

Team members: Nikolaos Stilianakis (Project Coordinator and Primary Researcher), Augusto Fasano, Nicola Roccetti, Jamie Gomez-Ramirez**External experts**: Ioannis Kioutsioukis (University of Patras), Vladimir Veliov (Technical University of Vienna), Simona Bignami (University of Montreal)

2. Summary of the Exploratory Research Programme

Exploratory Research (hereafter ER) has a long tradition in the JRC. It has been an integral part of the JRC's nuclear research since the establishment of the JRC and was formally introduced as a programme to the wider JRC in the late 80's. ER in the JRC has its legal base in the framework programmes for research and is integrated in the Horizon Europe Programme[1], section 7.2.4.

The JRC Strategy 2030 states that 5% of the JRC's research should be exploratory research. Despite the fact that ER projects should link to EU policy, no pre-defined topics are set. Instead, ER is defined as a "bottom-up process" for JRC scientists to propose projects with the ambition to build up new scientific competences on emerging research fields and possible upcoming policy demands.

ER is a systematic scientific approach to verify whether an idea is worthwhile studying or not and does not aim to provide a final and conclusive answer to a certain scientific question but rather to explore a research topic with varying levels of depth. Hence, exploratory research is considered "initial phase" research, which, if successful, may contribute to novel research methods and findings enriching the current scientific community and advancing science. The exploratory character of an ER project proposal is thus an important criterion in the evaluation process.

Keeping the JRC's ongoing institutional research up to date and at cutting edge, allowing for blue-sky thinking and strengthening scientific networking and publishing, ER projects contribute to the JRC's ambitious research. The continuation of ER projects as part of the institutional work programme demonstrates the benefit for the JRC.

In 2016, the Exploratory Research Programme was centralised to the Unit A.5 Scientific Development. While ER scientists are hosted in operational scientific units and execute their research under the lead of ER project leaders, they are hierarchically allocated to Unit A.5 Scientific Development, responsible for the administrative management, coordination and monitoring of the Exploratory Research Programme. Unit A.5 manages the ER project and ER activity calls, reviews all projects and activities, establishes regular events such as ER workshops and ER seminars, stimulates the JRC ER Community and fosters knowledge exchange and cross-unit collaboration.

[1] Council Decision 2021/764 of 10 May 2021 repealing Decision 2013/743/EU, The EU 2014-2020 Framework Programme for Research and Innovation