International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

# *Self-assessment report*

# *Program: Biodiversity and Natural Resources (BNR)*


**Contact**: Petr Havlík
**Email:** havlikpt@iiasa.ac.at

**IIASA**
Schlossplatz 1, A-2361 Laxenburg, Austria

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# Overview of abbreviations

| | |
|---|---|
| AFE | Agriculture, Forestry, and Ecosystem Services |
| AFF | Agroforestry and Forestry |
| AFOLU | Agriculture, Forestry and Other Land Use |
| AI | Artificial Intelligence |
| ANFOS | Analytical Framework for Open Science |
| APCC | Austrian Panel on Climate Change |
| AR6 | Assessment Report 6 |
| ASA | Advancing Systems Analysis Program |
| BEC | Biodiversity, Ecology, and Conservation |
| BNR | Biodiversity and Natural Resources |
| CAEP | Committee on Aviation Environmental Protection |
| CARE | Cooperative for Assistance and Relief Everywhere |
| CBD | Convention on Biological Diversity |
| CC | Cost Centers |
| CDR | Carbon Dioxide Removal |
| CFTA | Comprehensive Framework for Technology Assessment |
| CGLS | Copernicus Global Land Service |
| DG CLIMA | Directorate-General for climate Action |
| CMCC | Centro Euro-Mediterraneo sui Cambiamenti Climatici (Euro-Mediterranean Center on Climate Change) |
| CMIP6 | Coupled Model Intercomparison Project Phase 6 |
| COP | Conference of the Parties |
| CORSIA | Carbon Offsetting and Reduction Scheme for International Aviation |
| COVID | Coronavirus Disease |
| CROMES | Climate Risk and Opportunities Management System |
| CSC | Climate Services Center |
| DESA | United Nations Department of Economic and Social Affairs |
| DG | Directorate-General |
| DG AGRI | Directorate-General for Agriculture and Rural Development |
| DG ENER | Directorate-General for Energy |
| DG ENV | Directorate-General for Environment |
| DGVM | Dynamic Global Vegetation Model |
| DRR | Disaster Risk Reduction |
| EC | European Commission |
| ECA | Eastern and Central Africa |
| ECE | Energy, Climate, and Environment |
| ECR | Early Career Researcher |
| EFI | European Forest Institute |
| EGU | European Geosciences Union |
| EMF | Energy Modeling Forum |
| EO | Earth Observation |
| EPA | Environmental Protection Agency |
| ESA | European Space Agency |
| ET | Evapotranspiration |
| FADN | Farm Accountancy Data Network |
| FAO | Food and Agriculture Organization of the United Nations |
| FAZ | Forestry and Agroforestry Zone |
| FPMF | Forest Product Markets and Forest Management/Forest Policy Modeling Forum |
| FTE | Full Time Equivalents |
| G20 | Group of Twenty |
| G3P | Global Geo-Referenced Database for the Water-Carbon Nexus |
| G4Mm | Global Forest Management Model |
| GAEZ | Global Agro-Ecological Zones model |
| GAINS | Greenhouse Gas and Air Pollution Interactions and Synergies |
| GBF | Global Biodiversity Framework |
| GCB | Global Carbon Budget |
| GEB | Global Environment Bureau |
| GEO | Group on Earth Observations |
| GEOBON | Group on Earth Observations Biodiversity Observation Network |
| GEOGloWS | Group on Earth Observations Global Water Sustainability |
| GEWEX | Global Energy and Water Exchanges Project |

| | |
|---|---|
| GFBI | Global Forest Biodiversity Initiative |
| GGCMI | Global Gridded Crop Model Intercomparison |
| GHG | Greenhouse Gases |
| GIS | Geographic Information System |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation) |
| GLASSNET | Global Lakes Sentinel Services Network |
| GLOBIOM | Global Biosphere Management Model |
| GRACE | Gravity Recovery and Climate Experiment |
| GRBEPM | Global Resources and Biomass Economic Policy Model |
| GRIPP | Groundwater Solutions Initiative for Policy and Practice |
| GS | Graduate Student |
| GTAP | Global Trade Analysis Project - Biofuels |
| GUI | Graphical User Interface |
| H2020 | Horizon 2020 |
| HEU | High Efficiency Utilization |
| HWSD | Harmonized World Soil Database |
| IBF | Integrated Biosphere Futures |
| iBIOM | Integrated Biosphere Management Modeling |
| IBIS | Integrated model for BiodIversity distribution projectionS |
| ICAO | International Civil Aviation Organization |
| ICL | Imperial College London |
| ICRISAT | International Crops Research Institute for the Semi-Arid Tropics |
| IDB | Inter-American Development Bank |
| IEA | International Energy Agency |
| IFPRI | International Food Policy Research Institute |
| IFSA | International Forestry Students' Association |
| IIASA | International Institute for Applied Systems Analysis |
| IISD | International Institute for Sustainable Development |
| ILUC | Indirect Land Use Change |
| INSIGHTS | Integrated Solutions for High-Impact Technologies |
| INSPIRE | INtegrated Spatial PlannIng across REalms for biodiversity conservation and human development in a context of change |
| INTERHYDRO | International Hydropower Association |
| IPBES | Intergovernmental Platform on Biodiversity and Ecosystem Services |
| IPCC | Intergovernmental Panel on Climate Change |
| IRP | International Resource Panel |
| ISC | International Science Council |
| ISI | International Scientific Indexing |
| ISIMIP | Inter-Sectoral Impact Model Intercomparison Project |
| ISIMIP3 | Inter-Sectoral Impact Model Intercomparison Project Phase 3 |
| ITAIPU | Itaipu Binacional (Hydroelectric Dam) |
| IUFRO | International Union of Forest Research Organizations |
| IWMI | International Water Management Institute |
| JRC | Joint Research Centre |
| KTH | KTH Royal Institute of Technology |
| KU | Kyoto University |
| LMS | Land Management System |
| LRIMS | Land Resource Information Management System |
| LTAG | Long-Term Aspirational Goal |
| LU | Land Use |
| LULUCF | Land Use, Land Use Change and Forestry |
| LVBC | Lake Victoria Basin Commission |
| MACROS | Macroeconomic Analysis and Strategy |
| MENTION | Monitoring, Evaluation, and Notification System for Intelligent Organizations |
| MESSAGE | Model for Energy Supply Strategy Alternatives and their General Environmental impact |
| MIP | Model Intercomparison Project |
| MIP3 | Model Intercomparison Project Phase 3 |
| MODFLOW | Modular Groundwater Flow Model |
| MODIS | Moderate Resolution Imaging Spectroradiometer |
| NAEZ | National Agro-Ecological Zones |
| NBS | Nature-Based Solutions |
| NC | National Committee |
| NCS | Nature-Based Solutions |

| | |
|---|---|
| NERC | Natural Environment Research Council |
| NESS | Network for Evaluation, Simulation, and Synthesis |
| NEXUS | Water-Energy-Food Nexus |
| NGO | Non-Governmental Organization |
| NMO | National Member Organizations |
| OeAW | Österreichische Akademie der Wissenschaften (Austrian Academy of Sciences) |
| OECD | Organisation for Economic Co-operation and Development |
| OEMC | Open-Earth-Monitor Cyberinfrastructure |
| OGGM | Open Global Glacier Model |
| OIKOS | OIKOS International (Student Organization for Sustainable Economics and Management) |
| ORF | Operational Research Framework |
| PI | Principal Investigator |
| PIPELINE | Process Integration and Productivity Enhancer |
| PKU | Peking University |
| PNAS | Proceedings of the National Academy of Sciences of the United States of America |
| POLES | Prospective Outlook on Long-term Energy Systems |
| POPJUS | Population and Just Societies |
| POTENCIA | Pathways for the Optimization of Thermal Energy in Cities |
| PR | Public Relations |
| PREDICTS | Projecting Responses of Ecological Diversity In Changing Terrestrial Systems |
| PRIMA | Partnership for Research and Innovation in the Mediterranean Area |
| PROCLIAS | Processes, Climate, and Impacts Assessment in Alpine Regions |
| PROJECTS | Integrated Project Support System |
| R1 | Researcher |
| R2 | Research Scholar |
| R3 | Senior Research Scholar |
| R4 | Principal Research Scholar |
| RENEXPO | Renewable Energy Exhibition |
| RESIST | Resilience of Ecosystem Services provided by Intact and Sustainably managed Terrestrial ecosystems |
| RMO | Regional Member Organization |
| SAC | Scientific Advisory Committee |
| SAFE | Sustainable Agriculture and Food Environment |
| SBTN | Science Based Targets Network |
| SCB | Systematic Conservation Planning |
| SDG | Sustainable Development Goals |
| SDM | Spatial Decision Making |
| SI | Strategic Innitiatives |
| SOIL | Soil Organic Information Link |
| SOLAW | State of the World's Land and Water Resources for Food and Agriculture |
| SOME | Social Media Engagement |
| SOS | Sustainable Oceans Solutions |
| SPIPA | Strategic Partnerships for the Implementation of the Paris Agreement |
| STREAM | Strategy, Analysis and Modeling |
| SWAT | Soil and Water Assessment Tool |
| SWOT | Strengths, Weaknesses, Opportunities, and Threats |
| TM | Task Management |
| UNEP | United Nations Environment Program |
| VERIFY | Verification System for European Ecosystem Monitoring |
| VIACS | Vulnerability, Impacts, Adaptation, and Climate Services |
| WAT | Water Security |
| WAYS | Water, Air, and Soil |
| WCMC | World Conservation Monitoring Centre |
| WG | Working Group |
| WITCH | World Induced Technical Change Hybrid model |
| WP | Work Package |
| WWC | World Water Council |
| WWDR | World Water Development Report |
| WWF | World Wide Fund for Nature |
| WWQA | World Water Quality Assessment |
| YSSP | Young Scientists Summer Program |

# Biodiversity & Natural Resources Program (BNR)

# 1. Program activities to meet goals as set for 2021-24.

## 1.1. Overall program achievements over the evaluation period, research integration within the program and collaboration with other programs

BNR mission is to provide insights and knowledge that promote global and regional systemic transformations toward sustainable integrated biosphere management.

The Program consists of four Research Groups working together towards the BNR mission: **Agriculture, Forestry and Ecosystem Services (AFE)** developing biophysical process-based models for design of resilient and sustainable management strategies in agriculture and forestry, incl. optimal spatial allocation relying on the landscape approach; **Water Security (WAT)** relying on hydrological and hydro-economic models with participatory methods to inform solution-oriented policy assessments of complex water challenges; **Biodiversity, Ecology and Conservation (BEC)** developing biodiversity and protected areas design models to mainstream biodiversity topics into integrated policy assessments; and **Integrated Biosphere Futures (IBF)** combining economic modeling with modeling of ecosystem integrity, land use needs and secure water services in an integrated framework to satisfy human needs while ensuring the sustainable use of natural resources.

BNR relies on its 104 FTE (Full Time Equivalents) employees, composed of 97 FTE scientific staff, including software developers, and 6.75 FTE operational staff, of more than 30 nationalities. The Program capacity is further increased through the cohort of 81 Guest researchers. These numbers are the result of a steady growth since 2021, scientific staff and operational staff increased by 25% FTEs each, and the associated Guest researchers by 11%. The Program regularly hosts large number of PhD students and postdoctoral fellows and promotes the professional growth of its researchers – 18 promotions to Senior Research Scholar and a promotion to Principal Research Scholar.

Next to the dynamic and highly qualified staff, the second pillar of BNR are its world-wide recognized large scale applied models, such as the Global Agro-Ecological Zone model – GAEZ, the global economic model of the agricultural and forest sectors – GLOBIOM, or the global forest management model – G4Mm, and the crop growth model – EPIC-IIASA, as well as the more recent additions, such as the hydrological model – CWatM, the hydro-economic model – ECHO, or the most recent development, the integrated species distribution model for biodiversity assessments – iBIS. In the research period 2021-2024, BNR was striving to continuously develop these models and to bring them into a consistent, modular, and open integrated modeling framework (iBIOM), the progress towards this goal is presented in detail below. The quantitative modeling suite is complemented by state-of-the-art participatory approaches for co-development of future scenarios and co-identification of solution options.

### Spinning the virtuous circle of academic success

The ultimate objective of BNR is to generate positive societal impact and therefore it devotes substantial efforts to directly engaging with policy processes. This ties BNR research to real-world problems driving genuine innovation rather than moving within established paradigms and promotes high-impact scientific publications. Policy relevance together with research excellence are attracting

funders both from the policy arena and from academia, which in turn are spinning the virtuous circle of BNR success (Figure 1).

BNR delivers policy support across different geographical scales and topics. Its policy impact assessments directly support national and regional (EU) governments in designing policy for land-based climate mitigation, sustainable water management, or biodiversity conservation. However, BNR engages also in transboundary issues (e.g., in transboundary river basins) and sub-national policies. Finally, BNR modeling and expertise contribute to international regulatory processes as well as international assessments, such as those by IPCC, IPBES or IRP. This aspect is further detailed in section 1.2 of this report.

BNR researchers published 450 peer-reviewed papers (an average of ~5 per employee, based on an average of 92,5 employees 2021-2024), of which 393 were published in Scopus-listed journals. Of these 393 publications, 18,6% were in the top 1% journals (based on impact factor) and 67,7% were in the top 10% journals. 68 articles published in the Science, Nature, PNAS and related journals. In terms of citations, these 450 papers were cited a total of 8.544 times (average of 19 citations per paper). 8.510 of these citations were from contributions to Scopus-listed journals, of which 42,4% were from papers in the top 1% journals and 92.4% were from papers in the top 10% journals. BNR researchers received also various awards recognizing their scientific excellence: 2 Clarivate Highly Cited Researchers, the rank 6 on the Reuters Hot List, Frontiers Planet Prize 2024 National Champion for Austria, and Early Career Conservation Scientist Award.

Over the research period 2021-2024, BNR was involved in 161 externally funded projects, and the external funding represented about 76% of the Program resources. Part of the BNR funding is provided directly by the policy clients, or their funders, including World Bank or FAO, the largest amount of BNR funding, however, comes from academic research funders, and often in the form of large-scale collaborative research projects, where BNR acts as a coordinator of currently four projects, or as a partner. The external funding also generates about EUR 1 million in overheads contributing to the general IIASA operations.

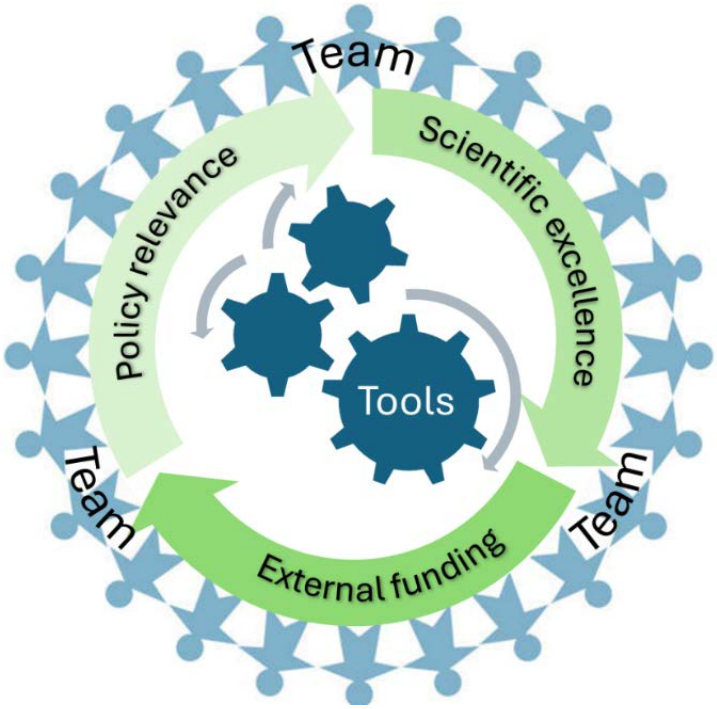


*Figure 1. BNR virtuous circle of academic success*

## Progress towards the 2021-2024 BNR Goals

Biodiversity research has existed at IIASA prior to the launch of the 2021-2030 research strategy, but never before it had a Program and Research Group focused on applied ecology and conservation. One of the 2021-2024 BNR goals is to **comprehensively respond to the major gaps and fully exploit the potential in biodiversity research within integrated systems analysis**. In other words, to fully exploit the potential in biodiversity research within integrated system analysis, address key knowledge gaps and inform global and regional policy assessments.

On the research side, the Program has made incredible strides towards this goal, with 26 projects in the period 2021-2023 that included biodiversity research. Thirteen of these projects involved the newly established Biodiversity Ecology and Conservation (BEC) group, thereby contributing to develop and harness IIASA's internal capacity on applied ecological modelling. These projects involved four research Programs (ASA, BNR, POPJUS, SI): bringing ecological knowledge and addressing biodiversity conservation policies in the context of agriculture (Brightspace), forestry (ForestNavigator, BioConsent), climate change policies (BIOCLIMA), economics (ACCREU), equity and justice (FairStream), water management (FairStream, INSPIRE), earth observations and citizen science (Global Foodscapes, OEMC, NatureMap), land system science (LAMASUS, Global Foodscapes), and earth system science (RESIST).

BNR staff co-authored 108 publications, in applied ecology and conservation from January 2021 to March 2024, 24 of these were led by BNR scientists. The integrative nature of these analyses, was not only pioneering from a scientific perspective, but also enabled the identification of nature-positive pathways that inspired goals and targets of the Kunming-Montreal Global Biodiversity Framework (GBF) and allowed to assess the biodiversity implications of the 2040 climate targets (details in section 1.2).

Another BNR goal was to **establish IIASA as the first international community hub for integrated biosphere research** through **development of an integrated assessment and modeling framework of Earth's biodiversity and natural resources** relying on **innovative tools development to facilitate community-driven efforts for sharing knowledge within the modeling systems**. Although this goal was extremely ambitious within the given time frame, BNR laid solid foundations to achieve it in the medium term. The main two pillars are the Integrated Biosphere management Model (iBIOM) and an innovative underlying IT platform – Accelerator, see Figure 2.

Adequate policy assessment requires a comprehensive understanding of the ecological–economic systems that impact attainment of the SDGs and the consideration of the relevant drivers and levers to bring these systems to a safe and just operating space. iBIOM offers an innovative approach to modeling that is firmly grounded in a nexus approach. It facilitates the integration of multiple sectors, such as land use, water, and biodiversity, in a cohesive manner, enabling a complete analysis of the impacts and interactions on and across sectors in response to biophysical drivers, policies, and adaptation options.

iBIOM leverages the fully fledged suite of models developed by the BNR program at IIASA, which includes detailed biophysical models able to incorporate the effects of climate and management on agriculture (EPIC-IIASA), forestry (G4M), wildfires (FLAM), and hydrology (CWatM), hydroeconomics (ECHO), and water pollution (MARINA and SWAT).

The biophysical information on productivity, water, and nitrogen impacts is explicitly considered in the economic land use model (GLOBIOM) which is linked via a downscaling tool (DownscalR) to the other impact assessment models for forestry (G4Mm), biodiversity impact (IBIS, Hibiiscus) and dynamic vegetation changes (PlantFATE). The iBIOM modeling framework will be hosted in a

cyberinfrastructure dedicated to integrated models and data and efficient interfaces for the iBIOM modeling chains that are established. This will allow for automated data assimilation procedures, the streamlining of inputs and outputs, removal of redundancies in data harmonization efforts, and increases in the scalability of simulation efforts conducted by the iBIOM modeling framework.
Main achievements to date:

- iBIOM kernel composed of GLOBIOM, G4Mm and downscalr has been consolidated through scripted workflows allowing automatized sequential execution of the models on the BNR computational server. The fully operational component is now routinely used for project delivery, for instance to analyze synergies and trade-offs between climate and biodiversity goals in Asia, funded by the Ministry of Environment in Japan. GLOBIOM-G4Mm-downscalr represent also the land use component of the IIASA integrated assessment modeling framework MESSAGEix-GLOBIOM, this development thus opens new opportunities for collaboration with the ECE Program.
- In the context of climate change impacts and adaptation, interfaces were developed also between the crop growth model EPIC-IIASA, the hydrological model CWatM, and GLOBIOM, to analyse the impacts of the CMIP6 scenarios and to provide corresponding land use and management outputs to the ISI-MIP3b project. This coupling has not been fully automatized yet.
- GLOBIOM, G4Mm and downscalr were interfaced also with the biodiversity model ibis.iSDM, and this cluster was used in the BIOCLIMA project to assess the synergies and trade-offs between EU climate and biodiversity conservation and restoration policies to support European Commission. Full integration into iBIOM workflows is envisaged for the next phase of the project.
- 13 newly funded cross-group projects involving at least two, and sometimes all four BNR Research Groups and supporting further integration across the iBIOM candidate models have been started since 2021. Typically four years long, these projects will allow for another quantum leap in iBIOM development.

## Accelerator

So far, iBIOM builds on BNR internal models. However, its IT platform Accelerator is designed to host iBIOM on an open cloud-based computational infrastructure allowing researchers globally to use the models, to collaborate on developing existing modules, and to include additional modules as they see fit. iBIOM and its underlying cyberinfrastructure will thus contribute to boosting the modeling capacity of the global community to support decision-makers in development of sustainable biosphere futures.

Accelerator has four main components, namely the Data Repository, Model Repository, Computing module and Data and Scenario Explorer. These components will host the data, models, and source codes, as well as workflows for data processing and model deployment. This platform will allow BNR researchers and external researchers to interoperate shared data and models, to reduce modelling cycles, and to increase the outreach through visualisation of spatially explicit data and pathways. For more details, see the Accelerator concept note published in the context of the ForestNavigator project, where the ForestNavigator Portal is presented as one particular application of the Accelerator.

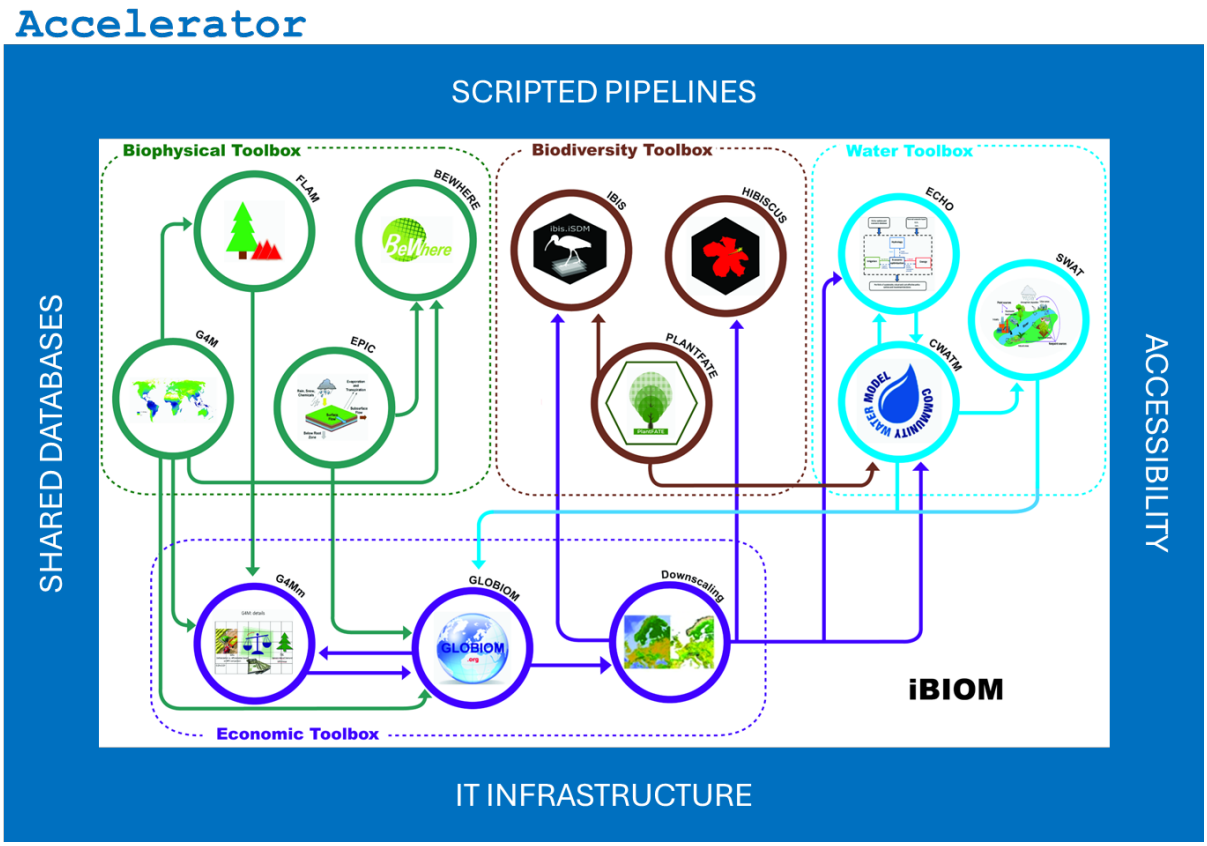


*Figure 2. Selected examples of BNR policy impact work*

Accelerator implementation started only in 2023 when the suitable software engineer was hired. However, remarkable progress was already achieved.

- External funding approaching 1 million euros has been generated through externally funded projects – ACT4CAP27, BrightSpace, ForestNavigator and LAMASUS. These projects provide not only funding but also useful use cases involving a variety of non-IIASA stakeholders from modelers interested in contributing to iBIOM up to the general public that is expecting user-friendly dashboards.
- Data repository has been deployed and successfully stress-tested with external dataflows of multiple terabytes. Data in a data repository can be validated against the user defined rules which makes the dataset features consistent and comparable against other similar datasets. Data access to the public or within the project team can be controlled.
- Availability of several in built and custom data visualization charts and graphs
- Scenario explorer, with several built-in custom data visualization charts and graphs, is operational and used by researchers within the BrightSpace and LAMASUS projects.
- Highly modular computation module has been developed with the capacity of defining the job graph taking parallelism into account and can be dispatched using http protocol. Compute module status and logs can be monitored over http. Computing module is ready for testing
- Two powerful computational servers totaling 384 cores were acquired to allow for intensive internal and external testing

With these innovative and integrative modeling initiatives, BNR aims to further strengthen its role in comprehensive systems analysis of the food security–land–vegetation–livestock–water–biodiversity nexus, including the social, economic, and governance challenges that will become even more relevant over the coming decades.

Another BNR goal was to **lead the integration of biophysical-economic modeling with governance**. Many water management decisions, such as the adoption of more effective irrigation techniques or changing crop types, are made at the farm level by a heterogeneous farmer population. While these decisions are usually advantageous for an individual farmer or their community, aggregate effects of those decisions can have large effects downstream. Similarly, decisions made by other stakeholders, such as governments, often have basin-wide effects and affect each farmer differently.

To fully comprehend how the human–natural water system evolves over time and space and to explore which interventions are suitable to reduce water stress, it is important to consider human behaviour and feedbacks to the hydrological system simultaneously at the local household and large basin scales. Thus, BNR researchers developed the Geographical, Environmental, and Behavioural (GEB) model, a coupled agent-based hydrological model. GEB enables simulating the behaviour and daily bidirectional interaction of more than 10 million individual farm households with the hydrological system on a personal laptop. GEB is dynamically linked with CWatM at a 1km resolution.

The GEB model is currently being used in the SI project fairSTREAM. In this context, the BEC eco-evolutionary plant model PlantFATE uses GEB land-use forcing and CWatM water availability information and returns soil evaporation and plant transpiration, improving the realism of the water cycle simulation (see also section 3.1).

BNR researchers have also advanced the macro-economic model DYNAMMICS for assessment of disaster risk reduction (DRR) policies under multiple hazards. DYNAMMICS can be used to analyze and compare various potential policies in terms of their economic effects. The decomposition of these effects into multiple benefits helps policy makers and other stakeholders better understand the ex-ante and ex-post advantages of DRR investments.

DYNAMMICS has been used for coastal hazard assessment under climate change in the small island economies of Bahamas and Barbados, evaluating the interaction of disaster risk reduction investment options including nature-based solutions and risk financing options, advancing the analytical frontiers on the economic assessment of climate extremes.

As extensively documented in Section 1.2, and indirectly throughout the report, BNR successfully strengthened its **international leadership in applied research of Earth's biosphere management for global and regional policy development.** However, as part of this goal, BNR also intended to launch a new flagship product, the **Global Biosphere Outlook**, relying on a to be built stakeholder community, and this specific goal has not been reached yet although the first necessary steps were made, including *i)* substantial funding has been raised for establishment of iBIOM and the work on iBIOM advances, *ii)* progress has been made also in Accelerator implementation, which will be the backbone of the largely web-based Outlook, *iii)* template has been developed to gather relevant variables from the iBIOM modeling suit in a harmonized way, *iv)* baseline and selected policy scenarios were calibrated and validated in the context of ongoing projects, incl. BrightSpace, LAMASUS, and the IEA World Energy Outlook, *v)* a new generation of scenario thinking has been proposed, and *vi)* a stakeholder platform bringing together large group of policy makers and modelers will have its first meeting as the Forest Policy Modeling Forum in the framework of the ForestNavigator project in September 2024.

WAT modeling tools at BNR took advantage of **advances in Earth Observations (EO), big data and AI** to improve water resource availability and demand assessment. Several EO products are used to evaluate our model simulations. Changes in total water storage simulated with the Community Water Model (CWatM) globally and in different case studies are compared to those derived from GRACE (Gravity Recovery and Climate Experiment) and change in evapotranspiration are compared to those

derived from MODIS (Moderate Resolution Imaging Spectroradiometer). For our large-scale water quality modelling, we are utilizing global EO products to evaluate our model simulations, specifically focusing on sediment and nutrient loadings into lakes and coastal waters. As a proof of concept, we tested this approach in Lake Tana, Ethiopia. We used EO lake turbidity data from the Copernicus Global Land Service (CGLS) to evaluate the simulated seasonal and multiyear trends of river sediment loadings into Lake Tana. Our results demonstrated strong positive correlations between the simulated sediment load from inflow rivers and EO lake turbidity at most river inlets which highlighted the potential of EO turbidity products in characterizing the temporal and spatial patterns of sediment loadings, particularly in data-scarce regions, and contribute to a better understanding of water quality dynamics. In collaboration with the EO workstream within the World Water Quality Alliance (WWQA) and several external partners, we are contributing to the development of a global Earth Observation-based indicator for SDG 6.3.2, which measures the "*Proportion of bodies of water with good ambient water quality*". Utilizing free and open-source satellite data, we are piloting this indicator with Lake Tanganyika and Lake Kivu in cooperation with local stakeholders.

WAT has used a machine learning algorithm to quantify sector-specific drought impacts in the Western Balkan and Eastern Europe region under future climate change scenarios. The assessment followed a risk factor approach, combining several proxy indicators of hazard, exposure and vulnerability. The outcomes of this assessment have completed the recently published European Drought Risk Atlas and supported the development of some of the World Bank Group Country Climate Development reports. Another study analysed streamflow variations as signatures of anthropogenic drivers. It combined global data spanning multiple decades from 5,163 catchments with variables like precipitation, evapotranspiration, water use, and damming, applying machine learning for trend analysis. This approach helps identify archetypal flow regime change classes, linking human activities and climate variables to changes in streamflow, providing insights for better water resource management and mitigation strategies. As part of the SOS-Water project, an effort to derive a dynamic crop coefficient (Kc) for hydrological modelling that relies on a comprehensive range of spatial datasets is ongoing. These data include daily historical meteorological data, such as temperature, wind speed, relative humidity, incoming radiation, and precipitation. Meteorological data are complemented by historical evapotranspiration (ET) data from various sources accessed through Google Earth Engine. The aim is to find the relationships between meteorological variables, ET and Kc using machine learning algorithms.

Last but not least, BNR goal was **promoting IIASA-wide collaborations.** Within the BNR Program, the Research Groups collaborated on 24 externally funded projects, and while this number represents only 15% of all BNR projects, the accumulated budgets of these 24 projects represent 36% of the total BNR externally funded budget (€ 12,5 million vs. a total of € 34,8 million). The total number is thus similar to the collaborative projects with Research Groups outside of BNR, 22 externally funded projects. However, these 22 projects together had a combined IIASA-budget of € 10,4 million (divided over more than just the BNR-groups), of which € 3,8 million was BNR-budget. With regards to Strategic Initiative, BNR is involved in 3 of the 4 projects funded so far and is leading one of them (RESIST). BNR co-authored 119 scientific articles with other IIASA Programs which is more than five times more than the number of publications across Research Groups within BNR, which were on 22. The cross Program collaborations often evolve around cross-model linkages such as the MESSAGEix-GLOBIOM framework or the joint policy impact assessments, such as those for the European Commission.

## 1.2. Overall program achievements over the evaluation period on policy impact and external networks

While scientific innovation is at the core of BNR activities, the ultimate objective is societal impact. The Program thus engages in related activities along several dimensions: *i)* direct participation in

regional and international regulatory processes, *ii)* exploratory studies for national and regional authorities, as well as international organizations, *iii)* participation in international assessments, and *iv)* support to the private sector.

## Direct policy support to National/Regional/International regulatory processes

BNR (IBF) continued to support the European Commission in preparation of key policy and legislative documents related to land-based climate change mitigation policies. The highlight of 2021 was the legislative package for implementation of the European Green Deal, the so-called 'Fit for 55 package', where IBF modeling contributed to the Impact assessment, similarly as to the newly developed EU Forest Strategy 2030. IBF models have also participated in quantification of the EU Reference Scenario 2020: energy, transport and GHG emissions: trends to 2050, and the Reference scenario for EU associate countries. Later, the GLOBIOM/G4M models have underpinned the development of the 2030 Climate Target Plan titled Stepping Up Europe's 2030 Climate Ambition. Most recently, the GLOBIOM/G4M modelling framework was used in an extensive Impact Assessment of the EU 2040 Climate target by EC DG CLIMA, including a biodiversity impacts section that relied on developments done in the BIOCLIMA project.

BNR also provides modelling capacities to Transportation and Climate Division (Office of Transportation and Air Quality) of the U.S. Environmental Protection Agency for the estimation and uncertainty analysis of induced land use change (ILUC) effects of U.S. road biofuels. Based on scenario simulations conducted by BNR, the U.S. EPA announced Final Renewable Fuels Standards Rule for 2023, 2024, and 2025 (link) on June 21, 2023 (IIASA news). The rule establishes biofuel volume requirements and associated percentage standards in view of steady growth of biofuel use in the US's fuel supply and aims to ensure a sustainable and environmentally friendly energy future. IIASA has a longstanding partnership with the EPA, having previously utilized GLOBIOM for similar assessments. The institute maintains an ongoing contract with the EPA to assess the implications of US biofuel policies as part of its commitment to international collaboration and employing systems analysis to address issues of global concern. BNR contributed also to the Greenhouse Gas Mitigation Potential in the U.S. Forestry and Agriculture Sector by the U.S. EPA.

At the international level, BNR (IBF) has continued to support the Carbon Offsetting and the Reduction Scheme for International Aviation (CORSIA), by providing estimates on the Land Use Change impacts of feedstocks for sustainable aviation biofuel production based on the GLOBIOM model, through the successive cycles of Committee on Aviation Environmental Protection (CAEP) for International Civil Aviation Organization (ICAO). The aviation sector has grown at a significant pace in recent years, and despite improvements in aircraft efficiency, the sector's impact on climate change is a growing concern. To address this concern, the International Civil Aviation Organization (ICAO) established the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to help reduce aviation greenhouse gas (GHG) emissions. To estimate ILUC emissions for aviation biofuels, noticing the considerable uncertainty in ILUC simulation results, two different economic models, well-established on this topic, were used: GTAP-BIO (Purdue University) and GLOBIOM (IIASA) as documented in the ICAO Environmental Report 2022 and a related scientific paper. The 41st ICAO Assembly adopted a Long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050.

Finally, BEC and IBF groups provided substantial input to the final steps of the negotiations through a range of policy briefs and papers that were directed at the parties to the Convention on Biological Diversity (CBD) who agreed in December 2022 on a landmark multilateral environmental agreement, the Kunming-Montreal Global Biodiversity Framework (GBF). The Kunming-Montreal Global Biodiversity Framework refers explicitly to IIASA-BNR co-authored work in sections related to the theory of change, as well as in the context of Goals A and B and Targets 1, 2, 3 (on resource

management planning, protection and restoration) as well as targets addressing sustainable production and consumption (10, 16).


*Figure 3. Selected examples of BNR policy impact work*

## Country and regional policy support

BNR is extensively supporting decision makers in Africa. WAT received funding from the Austrian Development Cooperation for the implementation of a research for development project titled '[Accelerating transition towards resilient water and food systems in East Africa. Scaling out resilient water and agricultural systems (scaleWAYS)]'. The project was implemented jointly by IIASA, the Lake Victoria Basin Commission (LVBC) and the International Crops Research Institute for Semi-Arid Tropics (ICRISAT). Through LVBC, member countries in the Lake Victoria Basin covering Burundi, Kenya, Rwanda, Tanzania, and Uganda have been involved in the research project while local universities and other research entities in the region were encouraged to contribute by carrying out specific research activities. In the same region, the [SWAQ-Uganda project] funded by the Austrian Development Cooperation investigates sustainable water quality management through modeling and stakeholders' engagement to support Uganda's development ambitions.

Within an [FAO initiative], a pool of international research institutions, including BNR (IBF), is conducting innovative modelling and analyses supporting Uganda to translate its national priorities for food systems transformation into concrete policies and actions.

BNR was also supporting the Government of Gambia in the framework of the [FACE-Africa project], which looked into the issues of climate impacts, food insecurity, poverty, malnutrition, and its health-related effects, and co-developed scenarios to inform sustainable land-use pathways.

In Asia, WAT conducted a National Agro-Ecological Zones assessment (NAEZ) for Afghanistan which assessed the quality and availability of land resources and identified crop cultivation potentials for current and future agroclimatic conditions. The large database from the NAEZ Afghanistan has been made available via the [LRIMS data portal] and published as an [Agro-Ecological Zones Atlas] together with FAO. To support food systems transformation in Indonesia, FAO also coordinated a [food systems modelling project] involving IFPRI, IIASA, IISD, and Christian-Albrechts-University of Kiel, to inform the

Government of Indonesia's medium- and long-term development planning by identifying technically sound and politically feasible policy interventions to achieve multiple policy objectives related to food systems transformation.

In Europe, the collaboration with the European Commission extends beyond the pure regulatory processes presented above providing model-based assessments for non-EU countries, including Energy Community countries (Albania, Bosnia-Herzegovina, Kosovo, Montenegro, North-Macedonia, Serbia, Ukraine, Georgia, Moldova), and broader topics. Thus, the interdisciplinary BIOCLIMA project led by BNR, in collaboration with UNEP-WCMC and EuroCARE, expands on the established climate mitigation policy impact assessment to also consider the EU Biodiversity Strategy the Farm2Fork Strategy, and provides insights into synergies and trade-offs between climate mitigation, biodiversity conservation and restoration, and sustainable food system.

Members of the BEC group were also invited to coordinate scientific input into the ongoing series of Biogeographical Seminars organized by the Expert Group on the EU Nature Directives including staff of the European Commission and delegations of national authorities responsible for implementing the directives from each Member States.

Moreover, the World Bank commissioned a project led by WAT to develop the so-called One-Water Methodology, which is a methodological framework for rapid assessment of water security, smart planning and development of practical recommendations at country and regional levels. In this context, WAT prepared deep dive assessment reports following the developed methodological framework for several countries in the Danube basin for informing investments and policies to enhance water security.

Finally, WAT worked also with the Inter-American Development Bank (IDB) to advise on the optimal disaster risk reduction and risk transfer investment in Bahamas and Barbados. In Bahamas in particular, the macro-economic modeling framework DYNAMMICS was used by the IDB to advise the incoming presidency on the need for proactive coastal risk assessment under climate change.

## Contribution to international reports/assessments

BNR extensively supported IPCC work on the impactful 6$^{th}$ Assessment Report (AR6) on land and water related issues across the three Working Groups (WG) as Lead authors (1) and Contributing authors (5). Within WG1, The Physical Science Basis, contributions included Chapter 3: Human influence on the climate system, and Chapter 11: Weather and climate extreme events. Within WG2, Impacts, Adaptation and Vulnerability, WAT contributed to evaluating recent efforts in assessing the feasibility and impact of different water adaptation and mitigation measures across Europe in Chapter 13: Impacts, Vulnerability and Adaptation in Europe. WAT further contributed to Chapter 4: Water by highlighting changes and uncertainties in projected water scarcity. In WG3, Mitigation of Climate Change, IBF contributed to Chapter 7: Agriculture, Forestry and Other Land Uses (AFOLU), and Annex III: Scenarios and Modelling Methods. In this context, it is worth mentioning that BNR scientists participated also in the Austrian Panel on Climate Change (APCC) and contributed particularly to the APCC Special Report: Landnutzung und Klimawandel in Österreich.

BEC and IBF have been taking leading roles in the IPBES NatureFutures task force and the IPBES Nexus assessment, with one lead author and one fellow. Both groups were also involved in the GEOBON, bioDISCOVERY and Future Earth joint working-group on post-2020 Global Biodiversity Framework. This led to the production of scientific papers, a report and several policy briefs synthesizing recent scientific evidence on the link between action targets and biodiversity outcomes as featured in the draft of the post-2020 Global Biodiversity Framework, submitted to the CBD as a information document (see also section 7) .IBF has participated in two key community level initiatives at the

biodiversity science-to-policy interface in 2021. IBF also participates in the IPBES Task Force on Scenarios and Models for the 2024-2026 cycle.

BNR developed a new strategic partnership with the International Energy Agency (IEA). The collaboration started with the IEA impactful report *Roadmap to Net Zero by 2050* which combined for the first time the IEA's global energy system modelling with the International Institute for Applied Systems Analysis (IIASA)'s Global Biosphere Management Model (GLOBIOM) to provide insights on bioenergy supply, land use and net emissions. The collaboration continues in the context of the World Energy Outlook, where IIASA contributed to the 2022 and 2023 editions, including the regional deep dive in the Latin America Energy Outlook. The work on the 2024 edition is in progress. BNR/AFE contributed to the IEA Bioenergy comprehensive report on "How bioenergy contributes to a sustainable future".

BNR substantially contributed to numerous other assessment reports by international (UN) agencies. For instance, WAT has significantly contributed to various chapters in the United Nations World Water Development Report (WWDR) 2021 on valuing water, which is UN-Water's flagship report on water and sanitation issues, or the State of the World's Land and Water Resources for Food and Agriculture 2021 (SOLAW) report, which is a 10-year flagship report of the Food and Agriculture Organization of the United Nations (FAO) underlining the essential contribution of appropriate policies, institutions and investments. Moreover, BNR provided the land use modeling component of the UNEP International Resource Panel Global Resource Outlook 2024.

Finally, the BNR model GLOBIOM was used to assess the impacts of agricultural trade and support policy reform on climate change adaptation and environmental performance by the OECD. This analysis was made possible in part through the IIASA-OECD strategic partnership. BNR collaborated with OECD also on a technical paper "Policy strategies and challenges for climate change mitigation in the Agriculture, Forestry and Other Land Use (AFOLU) sector".

## Private sector

Ultimate validation of the usefulness of the analytical tools, and possibly also the most direct impact on the ground, is delivered next to policy impact through the interest of business actors. BNR was approached by several companies and private sector players over the last years. Thus IIASA researchers collaborated with the FAIRR Initiative – a collaborative investor network that raises awareness of the environmental, social and governance risks and opportunities in the global food sector with over 400 members globally representing over $70 trillion in combined assets – on the development of a new IPCC-aligned climate risk analysis tool for investors, the Coller FAIRR Climate Risk Tool which provides investors with company-level data on how climate risks may impact costs and profitability in the meat and dairy sector (IIASA PR).

BNR collaborated also with the Impossible Foods company on a highly impactful study investigating the potential contribution of partial substitution of livestock products by plant-based substitutes to climate mitigation and biodiversity conservation. The resulting article is according to altmetric in the 99th percentile (ranked 194th) of the 357,932 tracked articles of a similar age in all journals and the 99th percentile (ranked 8th) of the 2,221 tracked articles of a similar age in Nature Communications, and the first author was honored as the National Champion for Austria in the prestigious Frontiers Planet Prize.

BNR also supported the BASF company through assessment of biomass availability as substitute for fossil fuels in their material and chemical production processes.

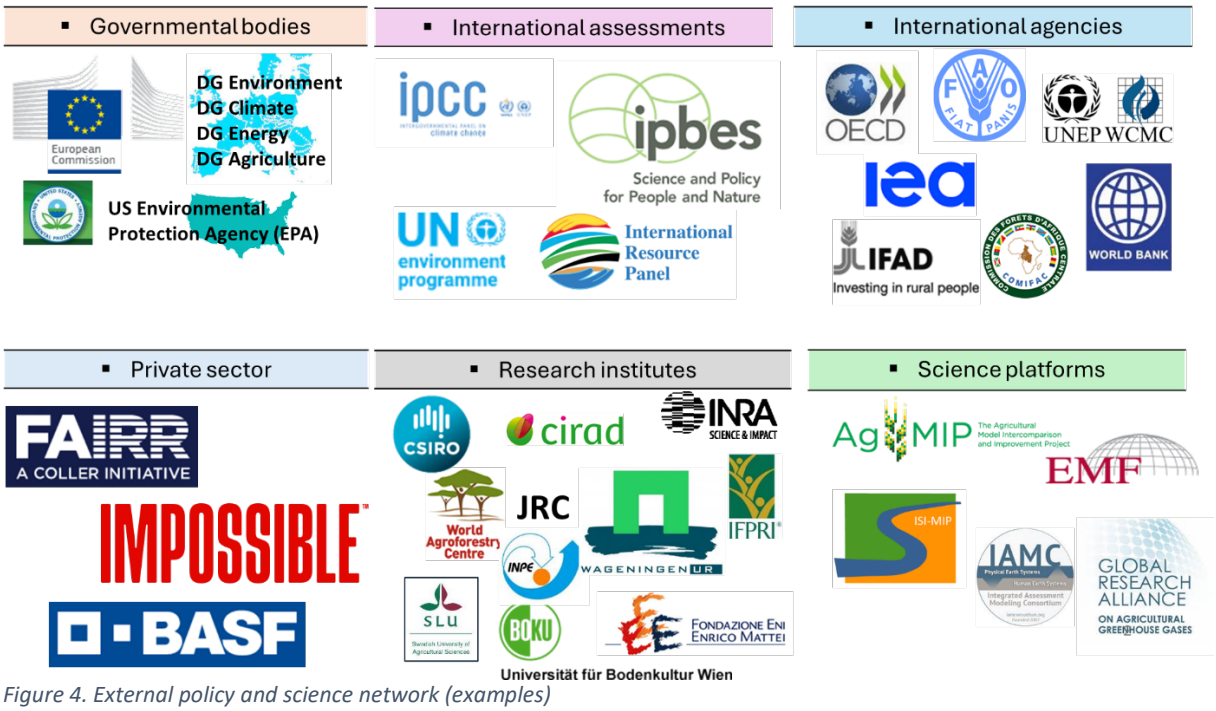


*Figure 4. External policy and science network (examples)*

## External networks

Besides the network of funders and clients presented above, BNR leads or participates in a multitude of networks of scientists and practitioners, which can be clustered in the following four categories: *i)* networks of scientists in large scale collaborative research projects, *ii)* user networks around BNR models and other resources, *iii)* modelers networks, often engaging in multi-model assessments, *iv)* other networks of scientists and practitioners.

BNR researchers are currently coordinating four large-scale collaborative research projects from the EU funding program Horizon Europe – ForestNavigator: Navigating European forests and forest bioeconomy sustainably to EU climate neutrality (24 partners from 12 European countries, China and USA), LAMASUS: Land use and management modelling for sustainable governance (17 partners from 8 European countries), NaturaConnect: Building a resilient ecological network of conserved areas across Europe for nature and people (22 from 15 EU countries and UK), and SOS-Water: Water Resources System Safe Operating Space in a Changing Climate and Society (11 partners from 8 European countries and Vietnam). BNR is involved in other 25 Horizon Europe projects as a partner translating into active collaboration with over 100 research institutions.

BNR developed and hosts several flagship models with a large user community which is typically supported by formalized, as well as hands-on, trainings. The hydrological model CWatM is fully open access on Github with a guiding documentation and YouTube tutorials. 15 researchers from China (3), Ethiopia (1), India (2), Pakistan (3), Switzerland (1), UK (2), and USA (3) are actively using CWatM for their projects. WAT has also provided a training to 25 researchers from the International Water Management Institute (IWMI).

Additionally, WAT hosted a three-day training workshop with 31 participants on *Water Resources Management in Southeast Asia* (review article). This included hands-on learning of CWatM, ECHO and GAEZ. 2 former AFE YSSPs (now Imperial College London (ICL), London/UK, and Royal Technological University (KTH) Stockholm/Sweden) have been trained on BeWhere model with special focus on optimizing aviation e-fuel from Direct Air Capture and electrolysis throughout the entire year in bi-weekly regular meetings.

IBF has also supported with hands-on training and coaching active external GLOBIOM teams around the world. These GLOBIOM teams currently consist of over 60 individual external users, located in 18 different countries, distributed over 6 continents (Asia, North and South America, Europe and Australia). For instance, a hybrid GLOBIOM/GAMS course with 19 participants was organized in 2022. Part of these activities was funded through the EC/GIZ Strategic Partnerships for the Implementation of the Paris Agreement (SPIPA) China project aiming at enhancing modeling capacity building in support to the Paris Agreement implementation, among others through workshops, such as IIASA-China Expert Dialogue on Long-term and Integrated Modeling Analysis. Examples of work by the external teams include Zhao et al., 2021, Wu et al., 2023, Ren et al., 2023, or in US Wu et al., 2023.

Several BNR Research Groups are contributing significantly to the third phase of the Inter-Sectoral Impact Model Intercomparison Project ISIMIP3, which offers a framework for consistently projecting the impacts of climate change across affected sectors and spatial scales to inform policy decision making on climate change mitigation and adaptation.

WAT has delivered to ISIMIP3 results from CWatM global runs and contributed to five ISIMIP high-impact publications (Satoh et al., 2021, Boulange et al., 2021; Telteu et al., 2021, Reinecke et al., 2021, Pokhrel et al., 2021).

IBF contributed future global land-use pattern for impact simulations, especially for ISIMIP3b, within the PROCLIAS project. And is participating in the Regional Forests and Global Biomes sectorial teams.

AFE contributed within Global Gridded Crop Model Intercomparison (GGCMI) EPIC-IIASA projections to a new, CMIP6-based synthesis of climate impacts on global agriculture published by the Agricultural Model Intercomparison and Improvement Project.

IBF participates also in relevant projects of the Energy Modeling Forum (EMF), such as Assessing Large-scale Global Bioenergy Deployment for Managing Climate Change (EMF-33) and various Integrated Assessment Models outside IIASA use GLOBIOM-G4M for their land-use representation such as the WITCH (CMCC), POLES (JRC), and POTENCIA (JRC) models.

## Community leadership

BNR members have been part of leadership and advisory role on various international and European scientific initiatives (e.g., H2020, PRIMA, NEXUS-NESS, H2020 G3P), CMIP6-VIACS (Vulnerability, Impacts, Adaptation and Climate Services, GLASSNET (Global to Local Analysis of Systems Sustainability), International Initiative on Hydrology and Earth System Science for Society, GEWEX, ESA GEO Global Water Sustainability Initiative (GEOGloWS), WWF SBTN (Science Based Targets Network Freshwater and Biodiversity Hub) among others. Y. Wada is also Governors of World Water Council (WWC) which organizes World Water Forum (WWF).

WAT has played an important role in the Groundwater Solutions Initiative for Policy and Practice (GRIPP), which is a global partnership for sustainable groundwater management led by the International Water Management Institute to strengthen, expand, and connect current groundwater research and initiatives.

WAT has been also engaging the Water and Climate Coalition of the World Meteorological Organization, which is a multi-stakeholder initiative to provide tangible action, activities and policy support, for an integrated water and climate agenda with a special focus on data, information, monitoring systems and operational capacity.

WAT is a founding member and co-lead of the Group on River Basin Economic and Policy Modeling (GRBEPM), which aims to significantly improve river basin economic and policy models, and scientific capability, for assessing impacts of water scarcity, droughts, climate change and other driving forces on water-related economic sectors and ecosystems and identifying efficient, sustainable, stable, and implementable water policy interventions. WAT remains an active member of the World Water Quality Alliance led by UNEP and a member of the World Water Council.

AFE continues to be actively involved in the Global Forest Biodiversity Initiative (https://www.gfbinitiative.org/) network, which brings together hundreds of researchers from around the world. In 2022, the GFBI published two papers in leading journals. These articles analyze global tree biodiversity and its ecological drivers (The number of tree species on Earth & Co-limitation towards lower latitudes shapes global forest diversity gradients).

## 1.3. Overall Program budget (2021-2024)

Besides following a set out strategy and fulfilling qualitative targets, the development of a program is also reflected in its quantitative results. In this paragraph, the developments of the budgets, costs, and employees (FTE) of the BNR-program are visualized in 2 tables. This data is reported for the period 2021-2024.

The budget and costs for 2024 are a first, BNR-produced, forecast and should therefore only be treated as a first indication, as the fiscal year is still active. This forecast is based on active and signed projects, employed staff with a cutoff date of the end of March 2024, and expected hires for after this cutoff date.

Starting with the budget, Table 1 shows a stable consolidation phase after the internal restructuring at IIASA in 2020, followed by a clear growth in 2023. The biggest growth took place within the relatively new BEC-group, from 282K in 2021 to 893K in 2023 (mostly driven by external grants), but all groups showed a stable development in this period. This is also in line with the development of the FTEs (Table 2), from which it can be concluded that an increase in scientific employees resulted in an increase in secured external funding.

Based on the first forecast of budget and costs for 2024, this trend of development is expected to continue. For the years beyond 2024 a stable development is expected as well, as the main challenge for all the groups is rather to find the right researchers than to generate additional funding.

*Table 1. Budget distribution and costs BNR-program (2021-2024*)*

| | *2021* | *2022* | *2023* | *2024* |
|---|---|---|---|---|
| *External Projects* | € 3,212,700 | € 3,177,000 | € 3,836,500 | € 5,858,400* |
| *Internal Projects* | € 84,500 | € 155,600 | € 456,300 | € 244,700* |
| *Core budget* | € 1,145,600 | € 1,024,400 | € 1,042,200 | € 1,044,600 |
| ***Total budget*** | **€ 4,442,800** | **€ 4,357,000** | **€ 5,335,000** | **€ 7,148,000*** |
| ***Costs (personnel + non-personnel)*** | **€ 4,519,300** | **€ 4,353,200** | **€ 5,320,300** | **€ 7,072,300*** |
| ***Overhead income*** | **€ 714,500** | **€ 794,500** | **€ 1,011,300** | **€ 1,234,500*** |

*First BNR-produced forecast of 2024 incomes & costs.

*Table 2. FTE distribution BNR-program (2021-2023)*

| | *2021* | *2022* | *2023* |
|---|---|---|---|
| *Scientific FTE within BNR*[1] | 77.38 | 84.00 | 96.93 |
| *Non-scientific FTE within BNR*[2] | 5.40 | 5.38 | 6.75 |
| ***Total FTE within BNR*** | **82.78** | **89.38** | **103.68** |

## 1.4. Overview of staff working in the Research Program (2021-2024)

Elaborating further on the listed FTEs in the previous paragraph, in this section a further analysis of the staff working within BNR over the period 2021-2024 is shown. This overview is based on headcount, and not FTE. Furthermore, some staff members were involved in different roles during this period (e.g. guest and later employee), which means a certain overlap is possible between the types of employment.

### Geographical diversity

Throughout the period 2021-2024, there were on average 30 - 32 different nationalities represented among BNR employees. Furthermore, guests and associates visiting the institute throughout this period represent a similar number of nationalities (28-33). On top of that, the YSSP's visiting BNR represented 10-13 different nationalities. In total, taking the overlap between these different groups into consideration, 50 different nationalities have worked together within the BNR-Program. Following is an illustration summarizing the countries of origin for the 2023 staff (representing the last available full-year data).

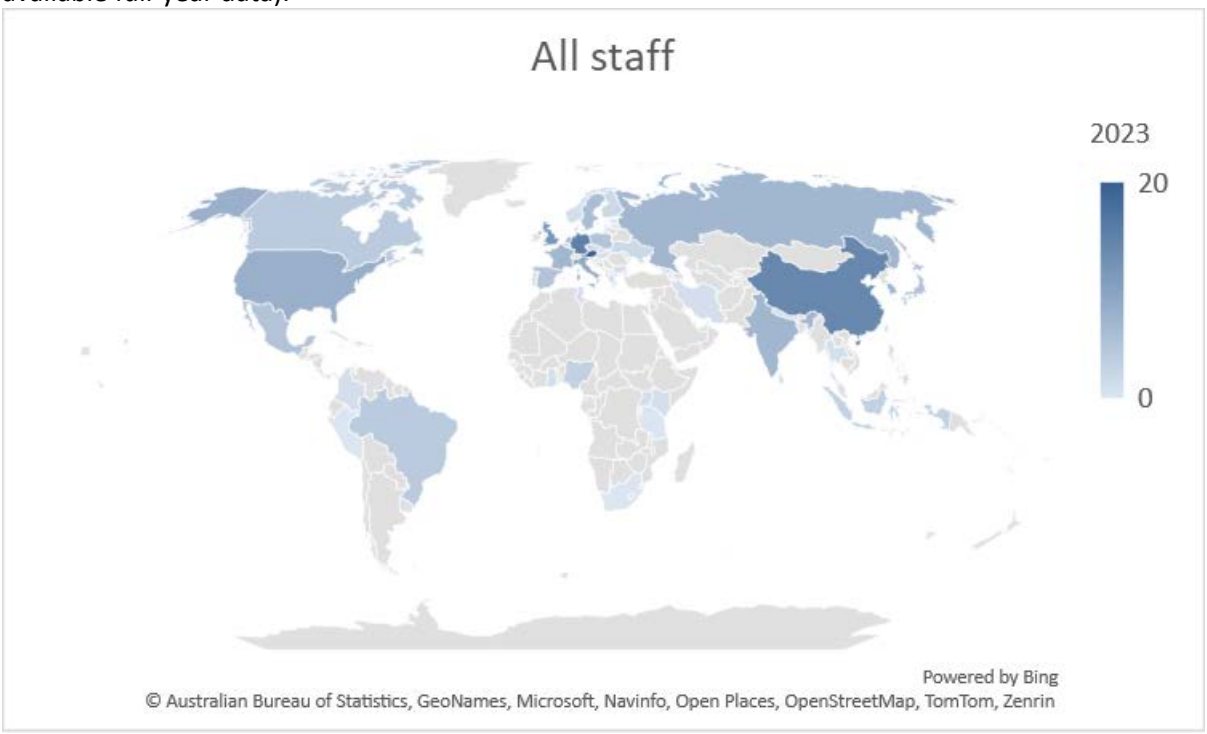


*Figure 5. Countries of origin of all BNR-staff 2023*

[1] Includes the following staff categories: Scientific, Research Scholar, Research Assistant, Software Professional
[2] Includes the following staff categories: General Service, Professional

## Employees

From the overall staff, here we further analyse the employees of the BNR-program. In Figure 6, the employee distribution over the two main categories is visualized. New (expected) hires for 2024, that are not yet present in the data (starting after 31st or March 2024), have been added to the 2024 bar.

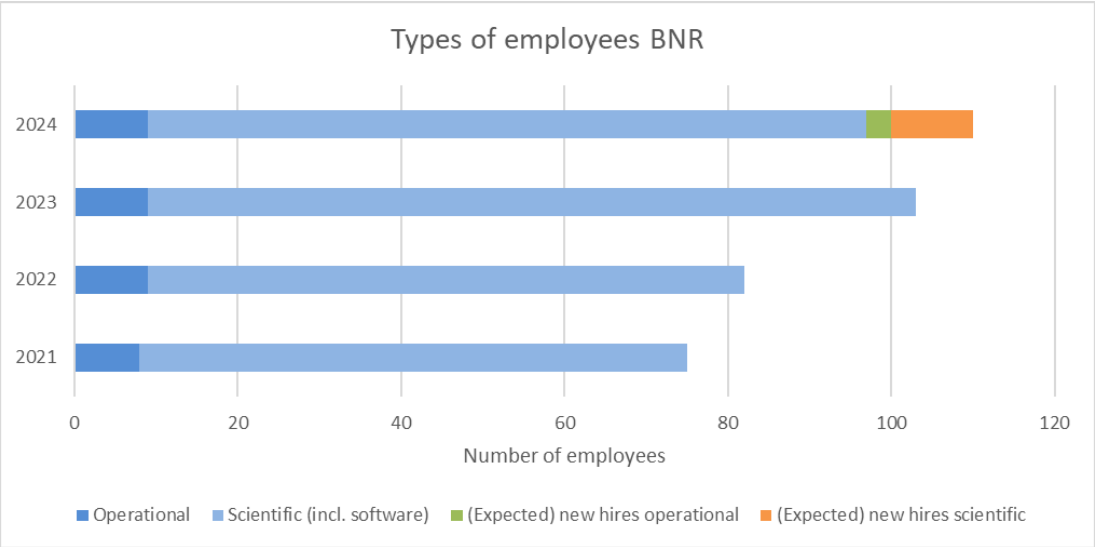


*Figure 6. Visualisation of types of employees within the BNR-program (2021-2024)*

## Scientific profiles

Further focusing on the scientific employees, we look at the level of seniority of the scientific employees of the BNR-program. There are four possible levels, increasing in experience:

R-1 : Researcher
R-2 : Research Scholar
R-3 : Senior Research Scholar
R-4 : Principal Research Scholar

In Figure 7 this analysis is projected. New (expected) scientific hires for 2024, that are not yet present in the data (starting after 31st or March 2024), have been added to the 2024 bar.

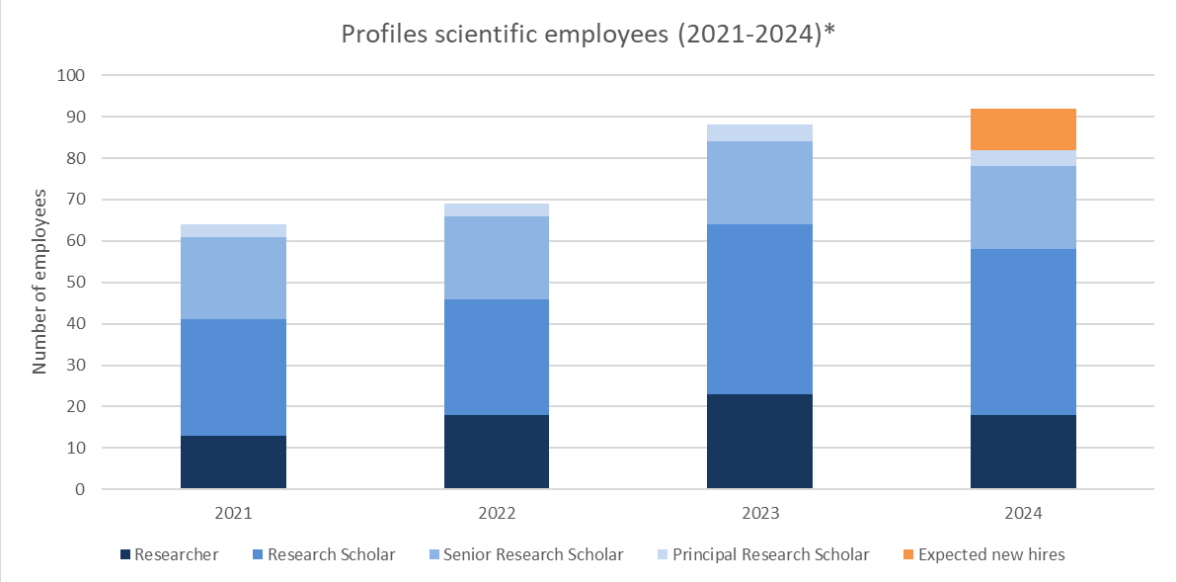


*Figure 7. Visualisation of profiles scientific employees BNR-program (2021-2024). *Expected hires added to 2024 column*

## 1.5. Externally funded projects (approved from January 2021 to March 2024)

In Annex A, a list can be found of all 161 externally funded projects active between January 2021 and March 2024. Of these projects, 24 are collaborations between two or more of the Groups within the BNR-program. This seems like a relatively small number of cross-group projects, the accumulated budget of these projects however represents 36% of the total BNR externally funded budget (€ 12,5 million vs. € 34,8 million).

In the list of Annex A, the project title, active period, funder, involved Research Groups (also known as cost centers, CC), and budget per Research Group can be found for each individual project. In addition, a short description and, if available, informative links have been included for each of the projects.

In Figure 8 the duration of all externally funded approved projects is summarized. Only about a quarter of the projects have a duration of 1 year or less, and about 55% are longer than 2 years. Within the shorter projects, several of them are continuously renewed. This structure of the external funding provides solid financial stability and the possibility to strategically plan substantial innovations.

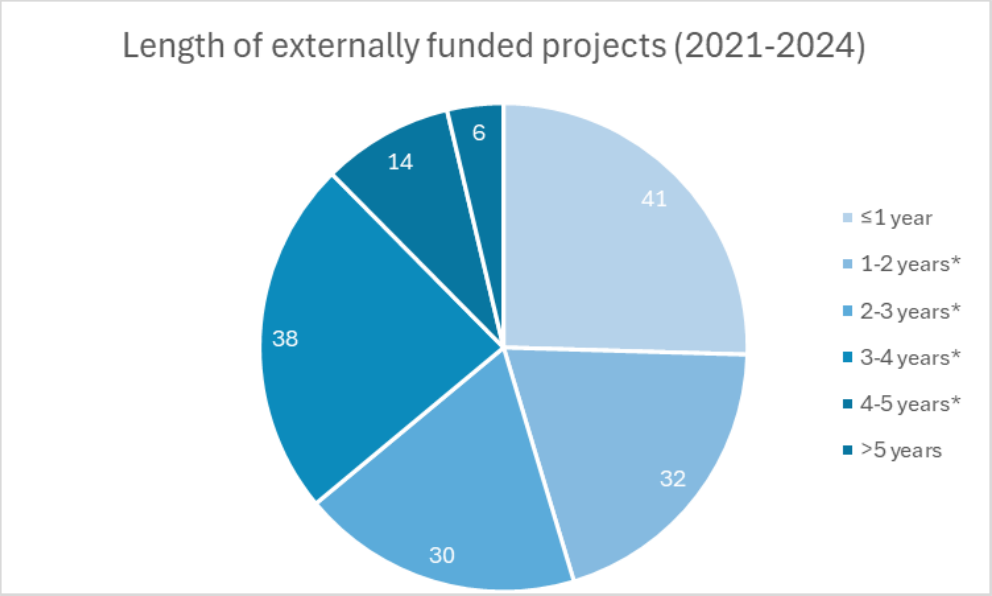


*Figure 8. Duration of externally funded projects BNR-program (active between 2021-2024)*
**Periods from first year until and including last year, e.g. 1-2 years excludes projects running exactly 1 year, but includes projects running exactly 2 years.*

In Figure 9, the overall BNR-related project budgets are grouped to the same project durations, showing that by far the biggest share (60,6%) of the budget comes from the projects active for from 2-4 years. As the duration of the project mainly influences the budget, Figure 9 is fully in line with expectations.

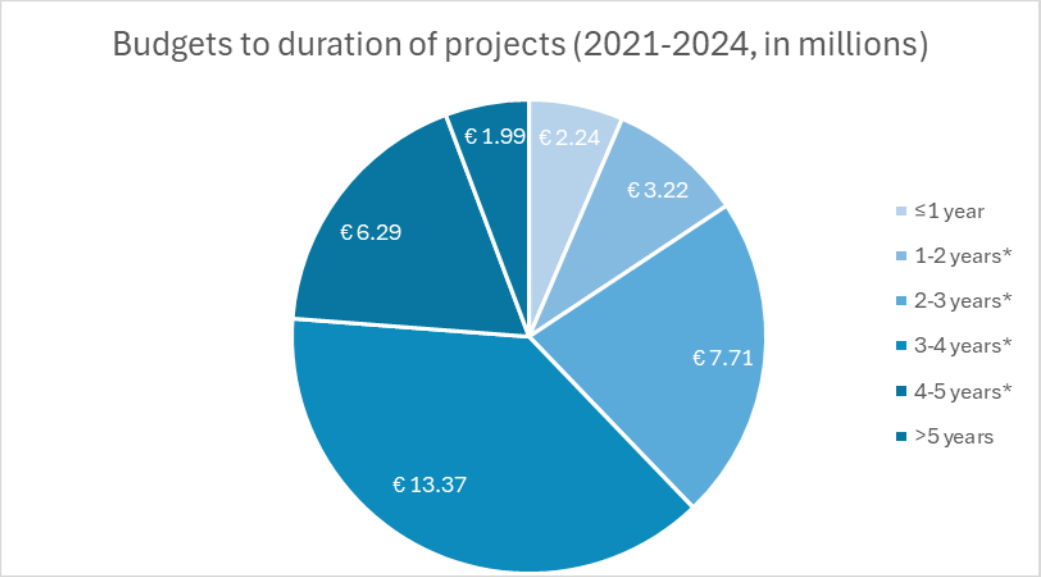


*Figure 9. Total budgets to duration of externally funded projects BNR-program (active between 2021-2024, in millions) *Periods from first year until and including last year, e.g. 1-2 years excludes projects running exactly 1 year, but includes projects running exactly 2 years.*

During the period of 2021-2024, the BNR-program cooperated with 71 different funders from all over the world. For some funders there was a single project, while for others the BNR-program was involved in multiple projects.

# 2. Agriculture, Forestry, and Ecosystem Services Research Group (AFE)

## 2.1. Stated goals for the 4 years and how these goals were met

AFE's research objectives during 2021-2024 focused on both – the further methodological development in order to foster the scientific basis of the group's mostly biophysical modeling, as well as on increasing the group's visibility in terms of participation in or co-organizing of relevant scientific events aiming at policy-relevant national and international processes, and – as a consequence - also on co-authoring of high-level and/or pace setting publications.

Being a critically important component to AFE's goals, the group concentrated on methodological developments aiming at the improvement of our major models including the global crop model EPIC-IIASA, the global forest model G4M, and the natural forest fire and disturbances model FLAM, while also moving further highly innovative approaches including e.g., the linking of forest and DGVM-type modeling with animal population dynamics and techno-economic optimization modeling (BeWhere). Main emphasis has been put on model integration with the ultimate goal of linking LMS to the BNR initiative iBIOM, model acceleration, and model user friendliness, while the respective progress has been published consecutively.

### AFE Land Modeling System – Unique Integration at Landscape Levels

On the model integration side, AFE has been developing an innovative land modeling system (AFE-LMS): an integrated biophysical modelling toolkit designed for advanced assessment of land-based production, ecosystem services, and potentials for nature-based climate and environmental solutions at European and global scales. The AFE-LMS development builds on the existing modelling tools by (a) improving biophysical representation and extending sectoral coverage in the existing AFE's models, (b) deeper integration of the existing models, (c) building common input datasets through harmonization of the most recent and up-to-date European data, and (d) developing data engineering and analytical tools and interfaces enabling linking models and model outputs within AFE-LMS and beyond.

(a) Agricultural model EPIC-IIASA has been extended to consistently simulate ecosystem services across all European cropland and grasslands and reconfigured to incorporate a variety of novel farming options (e.g., crop rotations, crop residue management and other conservation farming practices) and grassland management, which makes it better suited for supporting sustainable agriculture agendas. Agricultural and forest models have been updated to meet harmonized standards for simulating ecosystem C dynamics on mineral and peatland soils.

(b) Sectoral biophysical models have been continuously updated to consistently represent ecosystem services in both time and space, facilitating more straightforward cross-sectoral data fusion and syntheses, starting with C stock and fluxes, commodity productivity, and water balance in Europe. Beyond AFE-LMS, the new-generation model outputs have been included in the integrated biodiversity-land use modelling framework in BIOCLIMA.

(c) AFE-LMS biophysical framework has been updated with the most recent spatio-temporal data on land use and LU management (LAMASUS), European wetlands (ALFAWetlands), and CMIP6 climate change projections (ISIMIP). A novel GIS harmonization interface was developed to increase the interoperability of European, INSPIRE-compliant datasets with the global AFE-LMS modelling framework.

(d) A new AFE team of six experts has been formed to further develop IIASA's Forest Fire and Natural Disturbances Model FLAM focusing on new approaches assess natural disturbances incorporating most recent datasets coupled with technological advancements such as machine learning and neural network (FLAM-Net) approaches. FLAM impact assessments have so far been applied at multiple levels including the Boreal, Tropical, Temperate, Northern Europe and Mediterranean regions, complemented by European and Global future forest fire hotspot identification under climate change and varying forest management scenarios. For precise response modeling of vegetation dynamics to natural disturbances such as fires, droughts, windstorms, and pests/bark beetles, the AFE modeling teams are joining efforts in integrating their models under the AFE-LMS umbrella, using the AFE Integrated Modeling Graphical User Interface (AFE-GUI).

## EPIC-IIASA Hypercube – Emulator and Accelerator

On the model acceleration end, multiple AI algorithms, optimization methods and feature engineering pipelines have been developed and tested, providing AFE-LMS with a Data Analyst tier.

EPIC-IIASA Hypercube - consisting of EPIC-IIASA outputs, available in multiple versions each consisting of millions of data records - provides well-structured training data for learning-machine driven statistical model development replicating EPIC-IIASA. Replacing computationally demanding crop modeling with simple statistical models enables for a dynamic interface for data exchange with integrated land use optimization (or other) models, or EPIC-IIASA emulators could directly serve as dynamic bio-physical modules embedded in more complex modelling tools or services.

## Artificial Intelligence and Machine Learning in AFE Biophysical Modeling

The present EPIC-IIASA Hypercube/-Emulator has been further developed beyond training data towards the Crop Model Machine Learning Emulator Suite (CROMES) - created for fast emulation of global crop impacts and adaptation options throughout the CMIP6 climate change projection ensemble. As part of the AFE-LMS development, the agro-environmental modelling team has assumed a new project MACROS (Machine-learning crop meta-models for climate adaptation) that combines the group's process-based crop modelling platform with machine-learning algorithms to harness synergies of both methods aiming at producing crop model emulators that can be plugged into the AFE-LMS and other integrated modelling platforms to derive crop yield estimates on the fly.

## AFE Enhanced Research Visibility

In the EU project VERIFY, the AFE team engaged with scientific leaders in the global and European carbon cycle modelling, including its biophysical and human dimensions. AFE contributed the first generation of EPIC-IIASA cropland and grassland carbon flux estimates to a new, consolidated European synthesis of $CO_2$ emissions and removals. AFE is WP leader in the HEU project ALFAwetlands that examines the potential and effectiveness of wetland restoration in supporting transition to a climate-neutral and resilient society and economy, through interdisciplinary advancement of environmental, ecosystem, climate and life sciences, social sciences, and economics and aims to contribute to EU policy implementation supporting climate change adaptation and mitigation, as well as achieving biodiversity targets. AI4SoilHealth (Accelerating collection and use of soil health information using AI technology to support the Soil Deal for Europe and EU Soil Observatory (2023-2026)), is a Horizon Europe Mission SOIL project to co-design, create and maintain an open access Europe-wide digital infrastructure founded on advanced AI methods combined with new soil health measures. Within the project, AFE's agro-environmental modelling team is responsible for a pan-European service on soil health indicators employing and developing models for geospatially explicit and fine-grained predictions. Overall, in the domain of biophysical land use modelling with emphasis on forests, agriculture, grassland and techno-economic optimization, AFE has assumed coordinating

or a WP lead in 17+ projects (2021-2024) which tremendously helped to improve its visibility in its particular research field.

### AFE Enhanced Research Impact and Policy Relevance

The AFE agro-environmental modelling team has contributed to a range of model ensemble and intercomparison studies and resulting high level publications coordinated by the Agricultural Model Intercomparison and Improvement Project (AgMIP) and the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). These include among others an update of CMIP6-based climate impact projections for the IPCC AR6, cropping system adaptation studies, and wider food system and land use impacts. Most recently, a new project ANFOS has been approved in which AFE will coordinate an AgMIP crop model ensemble study on potential impacts of nuclear conflict on food security. Finally, multiple policy-and community service-related workshops and conferences have been (co-)organized by AFE during 2021-2024, culminating in a in the IIASA-IUFRO-NuBip Forum on Ukraine Science and Education, a high-level event with broad international participation leading to a fundamental needs assessment for the Ukraine forest sector under war, being circulated widely also within International organizations such as the EC, FAO, EFI, IFSA, and the WWF.

## 2.2. Highlights of scientific output and policy impact

1. **A landmark publication in *Nature*:** Schepaschenko et al. 2021 (*Nature*) demonstrates novel type of analysis including different sources of information (remote sensing, research forest plots, national forest inventory), as well as the involvement of people with various expertise in the analysis: representatives of academic institutes (Russian and international), education, National Forest Inventory and Forestry Agency. The advanced team and analysis ensure the breakthrough findings (the role of boreal forest in the climate system is much more important than previously thought) and policy implementation (advanced methodology of forest inventory and GHG inventory).

2. **AFE and the sustainability of (well done) Bioenergy**: AFE has been invited by the International Energy Agency (IEA)/IEA Bioenergy to contribute to a comprehensive report on "How bioenergy contributes to a sustainable future" published in 2022 https://www.ieabioenergyreview.org/ available as an innovative publishing concept online and tailored towards a broad readership with special emphasis on policy makers.

   The IEA report has built up on work published in a top-10 GCB cited peer review paper in 2022 with IIASA co-authorship titled "Applying a science-based systems perspective to dispel misconceptions about climate effects of forest bioenergy" has been a profound literature basis for the hot topic of bioenergy and its potential contribution to global climate change mitigation (Cowie et al. 2021, *Global Change Biology. Bioenergy*).

3. **Negative emissions and burden sharing:** Carbon dioxide removal (CDR) figures prominently in modelled pathways to achieve the Paris Agreement's goal of limiting global warming to 1.5-2°C compared to pre-industrial levels.

   AFE research shows that competition among nature climate solutions (NCS) and non-NCS CDR options may arise when ambitious CDR quotas are implemented in countries with vast forest areas or large potential for expansion of tree cover. Therefore, it is important to not use CDR quotas to evaluate national climate actions or to inform climate targets that could exacerbate trade-offs between emissions reduction, biodiversity and ecosystem services in these NCS-rich countries. Instead, results from burden-sharing exercises could foster higher ambition if used to inform voluntary cooperation mechanisms (Yuwono et al. 2023, *Nature-Based Solutions*).

4. **Forest Fires threatening nature, climate, and society:** AFF (Austria Fire Futures) is an example of a proactive, forward-thinking approach to combat climate-change induced challenges, in this case the emergence of forest- and wildfires as a serious threat to human and ecosystem health in Austria. The AFE-led project is a positive step to mitigating future climatic disturbances by promoting the improvement of wildfire prediction, detection, and modeling, as well as consideration of novel factors on natural disturbances, namely the impact of touristic activities on wildfire occurrence and spread.

   However, wildland fires need to be considered a global threat which is why AFE is linking national approaches to e.g., boreal wildfires: The boreal zone has already begun to see harmful impacts to its societies and environment as a result of climate change, from melting permafrost, changes in resource availability, and the increasing occurrence and extent of wildfires. The FLAM team is addressing the strong need for a better understanding of wildfires in boreal forests, including their ignition, spread, suppression, and fire-related emissions, with ongoing research and collaboration. This research is setting the stage to tackle the myriad of challenges facing the boreal zone and boreal forests under climate change (Corning et al. 2024, *Fire*)

5. **Prominent AFE position among frontiers in global crop impact modelling:** - contributes to the last generation EPIC-IIASA projections to a new, CMIP6-based synthesis of climate impacts on global agriculture published by the Agricultural Model Intercomparison and Improvement Project.

   In the VERIFY, AFE has engaged with scientific leaders in the global and European carbon cycle modelling, including its biophysical and human dimensions. AFE contributed the first generation of EPIC-IIASA cropland and grassland carbon flux estimates to a new, consolidated European synthesis of CO2 emissions and removals for the EU.

   AFE has contributed with EPIC-IIASA to a series of publications from the Global Gridded Crop Model Intercomparison (GGCMI) initiative, part of the Agricultural Model Intercomparison and Improvement Project (AgMIP) and aligned with the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP), covered by various news outlets: Der Standard, Tagesspiegel, Haaretz, Die Welt, FAZ, India Today, ORF, and USA Today: c.f., Jägermeyr et al., 2021, *NatFood*; Franke et al., 2021, *GCB*; Zabel et al., 2021, *GCB*.

## 2.3. AFE SWOT analysis

| Strengths | Weaknesses |
|---|---|
| • Integration of AFE Models (top priority ongoing process)<br>• Unique expertise strengthening the competitiveness<br>• Specific expertise in biophysical processes<br>• Wide range of models/capacity<br>• Flexibility of models<br>• Attractive/in-demand research topics<br>• We are close to funders, industry, etc... leads to good funding opportunity<br>• Global/multi-level modeling<br>• Computational and infrastructure/platforms<br>• New group formed in 2020 – big strength that we could do a restart<br>• Diversity of academic background of staff members (optimal research/integration/work)<br>• Dynamic group structure<br>• Group structure (sub-groups with team leaders)/dynamic<br>• 1/3 of the group is new – fresh ideas to new concepts etc...<br>• Good coordination within and accross the teams<br>• Cross-program collaboration and external networking<br>• Work as a team and support personal development | • No sustainable income for developing/maintaining long-term models<br>• Lack of institutional support in enabling our work that has the nature of long-term development<br>• Reliance on models (maintenance etc.) makes it difficult for us to address novel and popular research topics (publish high-profile)<br>• Project – reliance is a constraint<br>• We need to use funding from projects in order to live up to our research plan/goals/long-term aims<br>• Competition between groups since each group/program can dive in every topic – no matter if specific expertise or not<br>• Specific expertise (makes it sometimes difficult to find the right experts/expertise)<br>• Limited or no opportunity for capacity development after joining IIASA<br>• Few people per topic - need to further grow<br>• Newcomers need a lot of guidance (to success) - every newcomer needs an experienced supervisor<br>• Difficult integration for newcomers (more systematic and structural approach) |
| **Opportunities** | **Threats** |
| • Inter- and intra-team/group collaboration- enhance collaboration with other (BNR) Research Groups<br>• Project-dependency is an opportunity to go into new topics<br>• Our topics became popular – so we can try and dominate the discussion based on detailed models/-development/our expertise (ex. NbS)<br>• Collaboration with business<br>• Flexibility of models/technologies covered (e.g. BeWhere) that can make us participating in many different proposals etc...<br>• Computational/infrastructure platforms in development to strengthen our activities<br>• Prominently appear in hl journals but also at conferences with sessions and special issues in journals<br>• Internal capacity building (YSSP, Interns, etc.)<br>• Network enhancement (with chances to co-author nice papers)<br>• Potential new staff through YSSP system<br>• Possibility to grow (get higher level)<br>• RGs group name “AFE” could be changed to "SAFE“ - Sustainable Agriculture, Forestry, and Ecosystem Services… to underline the particular focus on integrated sustainability | • Lack of institutional support in enabling our work that has the nature of long-term development --> competitiveness is hindered, management of people is limited, high-level publishing is hindered...<br>• Lacking administration support/lack of computing power<br>• Continuous growth/unsustainable growth (not within our control)<br>• Internal competition<br>• Losing global / multi-level modeling without dedicated institutional support (e.g.,more focus on EU)<br>• Funding needs are threatening internal development<br>• Asymmetric information spread<br>• No space for capacity building<br>• Lose opportunities because of dependence on external funding<br>• Time to write proposals/publications – where to take it from<br>• Intensive work schedule |

# 3. Biodiversity, Ecology, and Conservation Research Group (BEC)

## 3.1. Stated goals for the 4 years and how these goals were met

BEC had 4 research goals for the period 2021-2024,

G1. ***Mainstream ecology and conservation into IIASA work*** *through collaborations with other Research Groups*

G2. ***Lead world-class research in system analysis applied to ecology and biodiversity conservation problems, through the development of novel theory, data, and models***

G3. **Marine ecology and conservation**

G4. ***Generate and attract new talent*** *in macro-ecology, landscape ecology, population ecology, global change biology, biogeography, and conservation science*

Below we report on progress towards each.

### G1) **Mainstream ecology and conservation into IIASA work** through collaborations with other Research Groups.

In the period 2021-2023 BNR had with 26 projects that included biodiversity research. Thirteen of these projects involved the newly established Biodiversity Ecology and Conservation (BEC) group, thereby contributing to develop and harness IIASA's internal capacity on applied ecological modelling. These projects involved four research Programs (ASA, BNR, POPJUS, SI): bringing ecological knowledge and addressing biodiversity conservation policies in the context of agriculture (Brightspace), forestry (ForestNavigator, BioConsent), climate change policies (BIOCLIMA), economics (ACCREU), equity and justice (FairStream), water management (FairStream, INSPIRE), earth observations and citizen science (Global Foodscapes, OEMC, NatureMap), land system science (LAMASUS, Global Foodscapes), and earth system science (RESIST).

### G2) **Lead world-class research in system analysis applied to ecology and biodiversity conservation problems, through the development of novel theory, data, and models.**

The BEC research strategy 2021-2024 included 5 research foci. We break-down progress towards this goal by addressing each research focus below.

***Biodiversity conservation:*** *with the priority topic of* ***designing terrestrial integrated conservation and restoration plans*** *that maximize benefits for species, ecosystems and their services, from sub-national to global levels.*

Between 1/2021 – 3/2024, the group has published 45 papers on conservation science of which 10 first or senior-authored and 13 publications (5 first-authored) specifically on the topic of conservation and restoration priorities. Of particular relevance for integrated spatial planning are Jung et al. 2021 which is described in paragraph 3.2. Fastre et al. 2021, instead provides the first global analyses of integrated spatial planning for biodiversity conservation and food production, effectively providing a first assessment of the feasibility and impacts of implementing together the first 3 targets of the Kunming-Montreal Global Biodiversity Framework. The group has harnessed these advancements to develop an approach for integrated spatial planning in Europe (Chapman et al. 2024) that has been developed by the BEC-IBF co-led BIOCLIMA project. BEC also leads the Horizon Europe NaturaConnect project in a consortium of 22 organizations developing a blueprint for the realization of the EU Biodiversity Strategy targets for protected areas.

***Macroecology, biogeography, and global change biology**: **A priority topic for the next four years will be to study scale-dependent responses** of species' relative abundance, richness, and community intactness to local and regional climate, land cover, and land use.*

**BEC has published 27 papers on these topics, 7 first-authored**. BEC researchers have also been involved in **several world-leading research projects** for example an analysis of Global Trends of Biodiversity and Ecosystem Services from 1900 to 2050, **recently published in *Science***. The group **has also produced an R package** to develop statistical and machine learning models and **repeatable workflows for species distribution models using heterogeneous biodiversity data**. This is currently being applied to identify climate and land-use impacts on biodiversity under alternative policies for agriculture, forestry and nature conservation in the BIOCLIMA, ForestNavigator and Brightspace projects. **Concomitantly, BEC has developed the Hibiiscus model**[3] that allows assessment of the impact of land-use change on ecological communities, making the PREDICTS framework for the first time replicable through an open-source package. The Hibiiscus modelling framework improves on PREDICTS through: 1) Capacity to model a wider range of biodiversity indicator responses; 2) A Bayesian model formulation that better captures and propagates uncertainty – e.g., spatial effects. 3) Possibility to integrate external biodiversity abundance records – e.g., sPlot and eBird – to improve spatial coverage and improve spatial coverage among different land-use classes in the model training data. **BEC is also leading global research (Science paper and BEC-led research project) on the ecological dynamics and conservation implications of land abandonment**, a conspicuous but insufficiently investigated phenomenon which is now attracting international attention thanks to BEC research.

***Bilateral feedbacks between ecosystems and human activities**: in particular the modeling of ecosystem services such as pollination and nature-based solutions (NBS).*

With regards to **ecosystem functioning and associated ecosystem services** BEC has developed and used the PlantFATE model to investigate how phenotypic plasticity, functional diversity and ecological memory can allow forest ecosystems to adapt to elevated $CO_2$ concentration (Joshi et al. 2023), water availability (Rius et al. 2023), and more generally climate change (Joshi et al. 2022). In the RESIST and fairSTREAM projects, the PlantFATE eco-evolutionary vegetation model has been coupled with the Community Water Model (CWatM, from BNR-WAT). PlantFATE uses climatic variables and water-related outputs from CWatM and in turn returns biophysical parameters, such as soil evaporation and plant transpiration to the CWatM model, which uses them to simulate the water cycle. BEC and WAT are using this coupling to assess the effects of tree species composition on downstream water availability, plant $CO_2$ uptake, forest biomass, under different climatic and forest management scenarios (i.e. tree diversification, afforestation, deforestation). This framework can be applied for several case study regions and is currently being conducted in the fairSTREAM project, which investigates the food-water-biodiversity nexus across the Bhima basin, as well as, in the RESIST project, which investigates stakeholder perspectives on biodiversity, and ecosystem services provided by Himalayan Forest ecosystems in India. With regards to **pollination,** the BEC group is currently developing a concept for a mechanistic model of archetypical social and solitary pollinators. A prototype, designed to interact with crop models such as EPIC-IIASA, is expected to be ready by the end of 2024.

***The nexus between conservation, food production, climate change, and disease risks mitigation***

The BEC group has **co-authored 8 publications in the subject, 2 lead or senior-authored** by BEC (Warren-Thomas et al 2022 and Fastre et al 2021). The group also co-leads with IBF the BIOCLIMA project whose aim is to assess the impact of EU land-based climate policies, agricultural policies and biodiversity polices on the achievement of their respective goals, in isolation or combined. The BEC group is also represented in the IPBES Nexus assessment, through Martin Jung who is a young fellow

[3] To be released publicly in the 2nd half of 2024 but available to external reviewers upon request

in the assessment and is co-author in several manuscripts in preparations related to this. With regards to health and biodiversity, BEC co-authored a paper on the nexus between food systems, post-pandemic policies and the environment, one on how mammal community compositions predicts likelihood of emerging infectious disease risk and the recently awarded **Strategic Initiative proposal Eco-Heath**.

### G3) Marine ecology and conservation

**BEC is partner in the INSPIRE Biodiversa+ project where IIASA is involved in developing analytical framework for planning area-based conservation across terrestrial-marine-freshwater realm.** BEC Is testing these approaches through leading a research paper "Protecting the edge of the sea'' (submission by end of 2024) were we identify and compare top priorities for expanding marine and terrestrial protected areas in Europe, with and without land-sea integration, with the objective of reaching 30% of protected area coverage both on land and on sea. This research addresses the current division of scientific and on-the-ground prioritization work that keeps marine and terrestrial planning separate, neglecting the fact that many species and ecosystems are sustained by both realms, e.g. seabirds and seals, for example, reproduce on land, but forage at sea.

### G4) *Generate and attract new talent* *in macro-ecology, landscape ecology, population ecology, global change biology, biogeography, and conservation science.*

**The BEC group has grown from 3.5 to 10.5 FTE of research staff employed at IIASA** (one Research Scholar shared with EQU) in the period 1/2021 – 5/2024. In the same period program and project officers grew from 0.5 to 2.5 FTE and guest researchers from 0 to 6. The expertise the new team hasbrought in terms of research topics and skills has been in line with the expectations set in the research plan, and functional to its realization through the projects that funded these hires (word cloud from abstract BEC team publications at this link). BEC staff turnover has been low, with only three persons leaving, and all key staff (PIs, task and WP leads) still employed at IIASA-BEC. BEC has the highest representation of ECR and women scientists of all IIASA. Two early career researchers successfully applied to reclassifications to higher functional titles. One member of staff received international awards during their employment in BNR-BEC (SCB Early Career Award) and one has become an independent research fellow and continues

## 3.2. Highlights of scientific output and policy impact

1. The parties to the Convention on Biological Diversity (CBD) agreed in 2022 on the Kunming-Montreal Global Biodiversity Framework (GBF). The BEC and IBF groups provided substantial input to the GBF negotiations through a range of policy briefs (here and here) and papers directed at CBD parties. The synthesis papers and policy briefs draw extensively on Leclere et al. (2020), Bolam et al (2021), Strassburg et al. (2020), Jung et al. (2021, next highlight), Adams et al. (2021), Fastre' et al. (2021), and Jetz et al. (2021), led or co-authored by IBF and BEC. The GBF background document refers explicitly to these papers in sections related to the theory of change and several goals and targets of the GBF.

2. The BEC group led a key publication in *Nature Ecology and Evolution*, which presented the first global analysis of synergies between conserving areas for species conservation, carbon storage and water provision as well as providing novel insights to guide area-based conservation measures, this work makes several advancements in spatial conservation prioritization methods, e.g. the introduction of methods to reduce biases in spatial priorities resulting from imbalanced coverage of species distribution and the use of innovative mini-max objective functions that ensure that no biodiversity feature (e.g. species) are "left behind", when planning for maximizing species persistence.

3. The NaturaConnect consortium has been asked by the European Commission DG Environment and the Biogeographical Seminar Series consortium to provide scientific support to the European Commission and the Member States by assessing the sufficiency of countries' pledges towards achieving protected area targets and presenting its prioritization approach to guide new protected area designations towards a more coherent and resilient Trans-European Nature Network. The project has also been invited to submit a proposal for indicators of ecological representativeness of protected areas. NaturaConnect proposal underwent review by the EU Biodiversity Platform and is expected to be adopted as an indicator of progress towards qualitative elements of Target 1 and 2 of the EU Biodiversity Strategy. The project is also feeding into regional policy frameworks and processes. Carpathian Convention CoP Decision COP7/9 (October 2023) specifically welcomed the implementation of NaturaConnect and, encouraging Convention Parties to engage with the project.

4. In Summer 2023, the BEC group was commissioned by the European Commission Directorate-General for Climate a fast assessment of the biodiversity impacts of alternative scenarios for the EU 2040 Climate Targets, which was included in the **Error! Hyperlink reference not valid.**. This short study benefited from BNR engagement with the Commission on long-term service contracts, specifically EUCLIMIT (DG CLIMA, ENER) and BIOCLIMA (DG ENV, CLIMA, AGRI) and marked an important cross-directorate scientific collaboration thanks to IIASA integrated assessment models.

5. The RESIST project hosted within BEC has led a key publication in *Nature Plants*, which highlights how to improve model projections of the global carbon and water cycles under future climate scenarios. By applying a novel modeling framework being based on eco-physiological processes and optimality principles our theory is expected to scale much better to out-of-sample environmental conditions than conventional statistical extrapolations, which therefore allows to capture the synergistic effects of rising CO2 concentrations and rising rainfall variability under projected climate change conditions (Joshi, J., Stocker, B.D., Hofhansl, F. et al. Towards a unified theory of plant photosynthesis and hydraulics. Nat. Plants 8, 1304–1316 (2022).

## 3.3. BEC SWOT analysis

| Strengths | Threats | Opportunities |
|---|---|---|
| BEC provides methods to investigate ecological systems and conservation needs. Coupling it with IIASA's expertise on social and economic systems allows to investigate ecological externalities of human activities as well as ecological feedbacks that affect wellbeing | Communication can be challenging due to epistemic differences with potential collaborators from other fields | Strong demand for including ecology and conservation in many sectors: e.g. the financial sector's interest in improving quality and transparency of biodiversity impacts disclosures |
| | | Topics related to ecology and conservation research are a requirement on an increasing number of funding calls |
| BEC staff has a diverse set of expertise, gender, career stage, background that allows the group to take advantage of more and new research opportunities | Turnover: risk of losing essential staff with critical knowledge | Welcoming and collaborative research environment (more likely to retain people) |
| | | Ability to be PI earlier on in the career than in a University setting |
| | | Competitive benefit package, especially for ECRs |
| Engagement with multilateral environmental agreements, and practical impact in this context: CBD, EU-Green Deal, Carpathian Convention. | Proper engagement at policy level can be time intensive and requires research staff with policy focus | IIASA has an observer status in several international conventions and science-policy platforms |
| | | Most funding agencies provide resources and external support for engagement. |
| Very strong research network | Staff turnover in partner institutions and at IIASA means that connections can be lost | New staff members from diverse background carry their own research network for the benefit of BEC and the rest of IIASA |
| | | The YSSP program and NMO support provide opportunities to continue and further develop professional relationships |
| **Weaknesses** | **Threats** | **Opportunities** |
| Limited capacity to work on the Global South (GS) due to historical limited funding opportunities and research network associated to GS | Most of the funding streams and research connections are from Europe | SI program, SAC and the Directors can support networking outside Europe and diversify funding |
| | | Researchers from India and South Africa with a network of collaborators in those countries have recently joined BEC |
| Junior staff has limited experience in turning ideas into competitive grant proposals | Focus on project deliverables and publications limits time and interest in grant writing | Internal and external capacity development and mentoring on fundraising |
| | | The SI program provides an opportunity for grant writing with less competition and administrative burden than most external grants* |
| Focus on external projects has resulted in fewer interactions among group members than potentially possible | Tight deadlines on project deliverables limits time for brainstorming and collaborating | Creation of thematic groups, e.g. related to methods, can facilitate exchange across people and projects and creative thinking |
| | | **Core budget and some flexibility in delivering on external projects can provide time and resources to develop new ideas |
| | Collaboration across teams is seen as diluting funding, reducing incentives to collaborate | *This opportunity applies here too |
| Marine ecology and One-Health are in the research strategy but have no research outputs yet | Lacking institutional precedence, space and time to address this. | Newly hired researchers have marine ecology and conservation expertise and relevant research networks |
| | | **This opportunity applies here too |

# 4. Water Security Research Group (WAT)

## 4.1. Stated goals for the 4 years and how these goals were met

To accomplish its mission, WAT research has focused on three core research areas over the period 2021-2024, described as follows:

### Leading global efforts on integrated assessment of water resources availability, quality, and demand

WAT has facilitated several integrated assessments of water resource availability and demand across various spatial scales under future socio-economic and climatic change scenarios using the Community Water Model CWatM, which continues to establish itself as a state-of-the-art hydrological model for modelling from global to local scales, focusing on refining human influence and water management at high spatial resolutions.

CWatM is an active member of ISIMIP project, providing projections of the impacts of climate change on water resources globally. CWatM has been set up at various spatial resolutions in many areas around the world (e.g., Austria, Jordan, India, Israel, Norway, North China, Uganda, the Danube Basin, the Lake Victoria basin). These different versions of CWatM necessitated new developments such as reservoir management schemes, wastewater treatment modules, improvement of calibration and validation processes, post-processing tools and visualizations, and coupling with the MODFLOW groundwater model, OGGM glacier model and GEB agent-based model, which allow us to analyze local water challenges and provide meaningful guidance to improve water management.

Given the critical role water quality plays in assessing water availability, WAT embarked on water quality research by synthesizing the main indicators of eutrophication for global freshwater lake basins and developing water quality modules (e.g., sediment and phosphorus) in CWatM.

Another important achievement at WAT was the launch in 2021 of the version 4 platform of the Global Agro-Ecological Zones model GAEZ, providing interactive data access and visualization. GAEZ v4 represents around 600,000 global layers at grids of 5x5 arcminutes (about 9x9 km) on land and water resources, agro-climatic resources, and crop-specific variables, including agro-climatic potential yield, suitability and attainable yield, actual yields and production, and yield and production gaps. A related development was the update of the Harmonized World Soil Database to version 2.0 (HWSD v2.0), a unique global soil inventory providing information on soils' morphological, chemical, and physical properties at a resolution of about 1x1 km.

### Exploring transformation pathways toward a water-secure future

This area of research entails identifying implementable solution options, including technologies, regulatory approaches, and management changes that improve the balance of water supply and demand, ameliorate water quality, and enhance resilience to water-related disasters such as droughts and floods.

Work in this area relies on several modelling tools to support water decision-making and policy at multiple scales. A global version of the ECHO hydro-economic model has been set up and is currently being made open source on GitHub. ECHO has been applied, in combination with different models (e.g., CWatM, GLOBIOM, Input-Output models), to several river basins around the world, including Ebro, Guadalquivir, Lake Victoria, Yangtze, and Zambezi, among others, to assess the cost-

effectiveness of adaptation options to water scarcity, water pollution, and droughts and identify optimal combinations of options to address those issues.

WAT has also advanced the macro-economic model DYNAMMICS for assessing disaster risk reduction policies under multiple hazards. WAT has led a consortium to develop the One-Water Methodology, a methodological framework for systematic yet rapid diagnosis of water security challenges and the development of smart action planning to support governments to move the water security agenda forward. This methodology addresses water security from an integrated perspective, exploring the physical, technological, and governance challenges countries face and opportunities to overcome those challenges. The approach has been tested in 15 countries across Eastern Europe and Central Asia (ECA) and applied to the whole Danube and ECA regions.

WAT also applied state-of-the-art methodologies to assess drought risk in the Western Balkan and Romania, supporting local and regional policymaking and the development of the World Bank Group Country Climate Development Reports.

## Assessing social contexts and governance regimes underlying the management of water resources

Given today's accelerated pace of technological development and the comparatively slower pace of social transition, the biggest constraint to future water security will remain what it is today, namely, the human dimension of water management.

To advance this area, WAT researchers have devoted efforts to developing knowledge and innovative approaches to assess the formal and informal aspects underpinning governance of water resources. WAT researchers recommended in an opinion paper a deeper reflection on beliefs and norms — beyond the mere use of science — as an essential catalyst for advancing the frontiers of knowledge co-production. This reflexivity allows debate on the desired goals, means and necessary trade-offs in the climate transition.

WAT's important achievements in co-development range from local-scale communities to national and transboundary watersheds addressing water security themes. Different methods were developed and applied. At sub-national community level, WAT researchers developed the SDG governance toolkit to explore barriers and opportunities to support the implementation of the SDG agenda at the local level and lift institutional capacities about complex sustainability challenges.

Further efforts to develop participatory (bottom-up) governance approaches have been also tested to explore pathways to water-food-biodiversity sustainability in India. WAT has contributed to the design of the participatory strategy to engage with local communities of the Upper Bhima Basin, that also integrates equity and justice principles to promote sustainable resource allocation. The processes and main innovations have been compiled in the IIASA toolkit on co-production methods to assist other researchers within and beyond IIASA in the development of co-production processes.

WAT researchers have also worked closely with local stakeholders in the transboundary Lake Victoria basin to explore and co-develop regional water scenarios, an essential part of sustainability research, as they help make understandable the long-term and upstream-downstream consequences of near-term water management decisions.

## 4.2. Highlights of scientific output and policy impact

1. WAT researchers contributed to a new international study that tested the extent to which global water models, including CWatM, agree with each other and with observational data. Using a new evaluation approach, the researchers showed which climate regions the models agree on and where they differ. CWatM has also been used together with several other models, to investigate the timing of unprecedented hydrological drought under climate change globally, demonstrating the benefits of the lower-emission pathway in reducing the likelihood of emergence.

2. A study published by WAT researchers synthesizes the main indicators of eutrophication for global freshwater lake basins, including the water quality constituents and sources, biogeochemical pathways, and responses of nutrient emissions. The study also developed a new causal network (i.e., multiple links of indicators) that highlights complex interrelationships among the indicators and provides a holistic perspective of eutrophication dynamics in freshwater lake basins. This study indicates a need for more comprehensive indicators representing the complex mechanisms of eutrophication in lake systems to guide the global expansion of water quality monitoring networks and support integrated assessments to manage eutrophication.

   WAT researchers also contributed to a novel international study, showing that river water quality tends to deteriorate during extreme weather events. As these events become more frequent and severe due to climate change, ecosystem health and human access to safe water may be increasingly threatened.

3. WAT researchers in collaboration with the Lake Victoria Basin Commission (LVBC) worked with local stakeholders from the East African Community to explore and co-develop regional future water scenarios, which are used to identify sustainable water-development pathways to leverage development opportunities and contribute to development and long-term water security. The complete integration of an implementation agency like LVBC into a research project coordinated by IIASA goes beyond common stakeholder involvement. It enhances the joint understanding of the need for resilient water and food systems and brings research results closer to implementation bodies.

4. Development of the Global Agro-Ecological Zones (GAEZ) Data Portal. IIASA and FAO cooperated to develop and implement the Agro-Ecological Zones modelling framework and databases for several decades. A Data Portal has been developed for the most recent version, GAEZv4, making results widely and easily accessible to users.

   The GAEZv4 spatial data includes numerous assessment results relevant to agricultural production under historical, current and future climates. Results are organized by six major themes: Land and Water Resources, Agro-climatic Resources, Agro-climatic Potential Yield, Suitability and Attainable Yield, Actual Yields and Production, and Yield and Production Gaps.

5. WAT has contributed to capacity development activities through providing open access to the modeling tools and data, and organizing several modeling workshops and training courses. CWatM is fully open access on Github with an active forum and video tutorials for using it. WAT also provided a training to 25 researchers from the International Water Management Institute (IWMI) on the use of CWatM through weekly workshops for two months in 2021.

   Additionally, WAT hosted a three-day training Workshop with 31 participants on *Water Resources Management in Southeast Asia*, with hands-on learning of CWatM, ECHO and GAEZ. Lastly, in the summer of 2024, WAT is hosting a 5-day CWatM summer school to guide beginners through learning and applying CWatM.

## 4.3. WAT SWOT analysis

| Strengths | Weaknesses |
|---|---|
| • Diverse and complementary expertise and skills (modeling, data analysis, hydrology, economics, governance and policy, stakeholders' engagement)<br>• Well-established inhouse modeling tools (CWatM, GAEZ, ECHO)<br>• Highly motivated, collaborative, diverse and multi-cultural team<br>• High willingness to collaborate internally and externally<br>• A diverse portfolio of ongoing projects (research and innovation, research for development, policy support), some of them extending over the next few years<br>• Agility in addressing short-term assignments<br>• Extended network of international collaborators and involvement in several collaborative platforms (ISIMIP, UN-Water, WWC, WWQA, etc.) | • Limited time for exploratory research and publication and fewer interactions among group members than potentially possible due to high commitment to external projects<br>• Additional skills are needed to be able to address emerging water challenges (gender, NbS, aquatic biodiversity, water supply and sanitation)<br>• Limited scientific IT support<br>• Lack of professional tools (e.g., financial forecasting, project management) to enable better resource and time allocation |
| **Opportunities** | **Threats** |
| • Advances in AI, EO and big data, enabling better model calibration and validation and application in data-scarce regions<br>• Increasing computing power at IIASA, enabling higher resolution modeling<br>• Growing water management challenges and the need for analytical studies supporting policy formulation and investment decisions<br>• Possibilities to lead projects, especially for Early Career Scientists<br>• Availability of several funding opportunities for Ph.D. and Postdoctoral researchers<br>• Available funding opportunities for water research projects (EU Horizon Program, global donors and foundations)<br>• Potential collaboration opportunities with other Research Groups at BNR and IIASA and other external partners with a strong demand for including water in other sectoral assessments | • Growing external competition in terms of model development and for acquiring funding<br>• Uncertainty in internal and external funding, complicating resource and time allocation and planning<br>• Individualism and knowledge silos<br>• Challenges with staff recruitment and replacement of essential staff with critical knowledge |

# 5. Integrated Biosphere Futures Research Group (IBF)

## 5.1. Stated goals for the 4 years and how these goals were met

IBF Research plan was formulated along *i)* innovations in selected topical areas, *ii)* foresight and policy support, and *iii)* strategic objectives. This section follows the same structure.

### Innovations in selected topical areas

Four topical areas were identified in the Research Plan: Land, water, and oceans management, Bio-based economic sectors, Shocks, adaptation and resilience, and Food, nutrition, and poverty. And four innovation areas: Spatial scales integration, Temporal scales integration, Heterogeneity of economic actors, and Value chains.

In the area of **Land, water, and oceans management**, substantial innovations were achieved along several dimensions.

First, a comprehensive representation of relevant nitrogen flows was implemented in the Global Biosphere Management Model (GLOBIOM) and applied to a study published in Nature Food, which demonstrated that with existing nitrogen surplus mitigation options and international trade, we can reconcile regional nitrogen boundaries with global food security. The model has been also enhanced by new, policy relevant, forest management options – close-to-nature management and set-asides – and used to analyze the impact of European forest management strategies on the global species extinction risk.

The study found that ambitious biodiversity protection action in European forests would, through international trade, lead to the increase of global extinction risk. In order to further enhance our capacity to analyze forest management impacts on biodiversity through better representation of deadwood, a novel model was developed, allowing to project the current deadwood distribution as a function of environmental and socio-economic factors, and its future development in response to management and climate change.

The first step towards integrating the blue economy into our modeling system was made in collaboration with a YSSP student from University of Queensland, who developed a spatially explicit database of the technical and economic potential of marine farming of 34 commercially important seaweed species and in an impactful Nature Sustainability paper, article is in the 99$^{th}$ percentile (ranked 1,990$^{th}$) of the 478,216 tracked articles of a similar age in all journals and the 93$^{rd}$ percentile (ranked 4$^{th}$) of the 60 tracked articles of a similar age in *Nature Sustainability*, studied land related environmental benefits of seaweed substitution in food, feed, and fuel supply chains (cf. Section 5.2, where also achievements in land-based climate mitigation research are summarized).

Under this topic, IBF also started a new era of producers representation in terms of **heterogeneity of economic actors**, when it developed capacity to use the farm accountancy data network (FADN) dataset, which monitors income and business activities of over 80,000 farms across European Union, and thus allows development of production system typology with highly disaggregated cost items, which will in a new AgEnRes project allow also for better integration of the agricultural and energy sectors. Several new developments under this topic are underway in the newly contracted projects, such as ForestNavigator and LAMASUS, both coordinated by IBF, but also ACT4CAP27, ALFAwetlands, AMIGDALA, or BrightSpace.

Forest industry capacity to substitute coniferous, non-coniferous and recycled biomass on the competitiveness of traditional forest industry regions was analyzed under the **Bio-based economic sectors** topic. The economic availability of biomass is a burning question for the industry, as also shows the IBF analysis for BASF, who contracted IIASA to estimate the economic potential of biomass for chemical industry. This study also benefited from an IBF-led international research on benchmarking costs of harvesting from industrial plantations in different global regions.

Under this topic, also the research on international trade was advanced, particularly through the development of a highly disaggregated trade cost representation for Africa to analyze the potential impacts of the African Continental Free Trade Area (AfCFTA) on agricultural markets, food security, and environment, published in Nature Food.

As a recognition of the novelty and policy relevance of our work, a former article on international trade and adaptation was invited by Nature Climate Change to be converted into a Policy Brief in their new series. GLOBIOM was used to assess the impacts of agricultural trade and support policy reform on climate change adaptation and environmental performance by the OECD.

The work on sustainable supply chains for biofuels was pursued in a study on uncertainty in lifecycle greenhouse gas emissions of sustainable aviation fuels, as well as in a Nature Sustainability study on virtual trade flows related to China's growing food demand.

Finally, new projects have been started – CLEVER and RAINFOREST – to further develop the aspects of **value chains**, including actor heterogeneity.

For **Shocks, adaptation, and resilience**, IBF led the contribution to the joint IIASA-ISC (International Science Council) initiative Bouncing Forward Sustainably: Pathways to a post-COVID World on the resilience of food systems. Climate impacts were assessed at global scale under the AgCLIM50-IV project which looked at the potential for irrigated systems to be used as an adaptation strategy for climate change and as part of the ISIMIP3b project. Impacts of climate extremes were assessed as climate storylines under the RECEIPT project, leading to a paper on the impacts of an increase in simultaneous soybean failures. Climate change adaptation pathways for the agricultural sector were also studied for Gambia.

The **temporal scales integration** was then explored in a Nature Food paper focusing on thee rice sector in Africa, which possibly for the first time in a consistent framework analyzed both the impacts of long-term gradual climate change and impact of climate variability on agricultural markets.

Finally, IBF work on the impact of climate extremes and natural disturbances on the forest carbon sink was published in the European Commission Impact Assessment of the 2040 Climate target.

The work on the topic **Food, nutrition, and poverty** was pursued along two intertwined tracks – future diets and consumer heterogeneity. In collaboration with Impossible Foods a highly impactful study about the benefits of partial substitution of livestock product by plant-based equivalents on climate and biodiversity was published in Nature Communications. While the benefits of sustainable healthy diets were extensively discussed in the literature, we also looked at what would be the level of tax necessary to incentivize the shift to healthy diets.

Finally, in a recently published Nature Sustainability study, we demonstrate that dietary change due to urbanization will have in Africa a far larger impact on land use change than the mere expansion of the settlements. Following the Research Plan, and to bring the **heterogeneity of economic actors** also on the consumption side, we have started projects, CHOICE and SWITCH, where we disaggregate food

demand by age and education, to be able to better link with the IIASA disaggregated population projections, and to better assess the health impacts.

## Foresight and policy support

As extensively presented in Section 1.2, IBF further strengthened its position as a **trusted partner in concrete policy and regulatory processes across all continents;** in Europe (European Commission), in North America (US Environmental Protection Agency), Latin America (Governments of Argentina and Colombia), Asia (China, India and Indonesia), Africa (Gambia and Uganda), in Australia, and at the global scale (UN International Civil Aviation Organization). It also reached a new milestone in the foresight area, when it became a strategic partner for the International Energy Agency to collaborate on the authoritative World Energy Outlook by providing the land use component.
Forward-looking scenarios based on the Shared Socio-economic Pathways represented the backbone of a multitude of impactful papers, including more recently Daigneault et al. (2022) or Pereira et al. (2024). IBF is currently working on the new generation of these scenarios.

## Strategic objectives

**Integrated BIOsphere Management modeling framework (iBIOM)** is a truly BNR-wide activity, although led by IBF, and therefore it is extensively elaborated in Section 1.1. Here, we thus focus only on two key elements developed in IBF. First, **spatial scales integration** is one of the challenges when linking BNR models within iBIOM; while the economic model GLOBIOM provides generally country level results, biodiversity or hydrological models, and even the dynamic forest management model (G4Mm) operate at a high spatial resolution, thus downscaling is necessary. The downscaling is done using Bayesian statistical models (Krisztin et al. 2021 and Krisztin and Piribauer 2022). downscalr is an R package which was developed by IBF for downscaling of land-use and management projections, within an EC/GIZ funded Strategic Partnerships for the Implementation of the Paris Agreement (SPIPA) Argentina project aiming at enhancing Argentina's modeling capacity in support to the Paris Agreement implementation. The package was further developed in the context of the European Union Biodiversity and Climate strategies Assessment (EU BIOCLIMA) project. It is fully open source, and has been adapted also for non-BNR models, incl. CAPRI and the FABLE Calculator. Another important step towards the full iBIOM, is the implementation of a fully automatized execution of its "kernel" through a scripted workflow connecting GLOBIOM, G4M, downscalr and several biodiversity models.

**Vibrant consortium of GLOBIOM users and developers** is under continuous development. Currently, 86 external users from 18 countries have access to the model code and data through a github repository. 19 researchers participated in a dedicated 1-week GLOBIOM course offered by IBF in 2022. In addition, 25 YSSP students, 1 IIASA-NERC and 4 PKU-IIASA postdocs, 1 CSC scholarship, and several external collaborators, including PhD students and post-Docs from Australia, Canada, China, India, and the U.S., benefited from hands-on training during their IIASA stays or online support. Training activities were also supported by the European Commission GIZ (SPIPA) for India and China. The users are supported also by a recently developed model documentation and a GLOBIOM wiki. External partners led 10 publications since 2021, published among others in Nature Climate Change (1), Nature Food (3), Nature Sustainability (3).

In the framework of the ForestNavigator project, IBF is **convening an international stakeholder community** as the Forest Policy Modeling Forum. The Forum is a platform where policy makers dealing with various facets of forests and of the forest sector meet with modelers in an informal dialogue to better understand each other and to make the modeling work even more relevant for the policy support. Initially, participants from Europe, China, and United States are invited for the first meeting in September 2024. The possibility to expand this Forum to a global platform will be explored.

## 5.2. Highlights of scientific output and policy impact

1. **The new hotspot – Africa: Research and policy impact:** The African continent is the hotspot of sustainability challenges, but analytical tools to accompany the necessary transition to sustainability are badly missing. IBF, in collaboration with PhD students from KU Leuven, developed a regional version of GLOBIOM, with a specific focus on the African continent to address trade-offs between the three dimensions of sustainability and to find solutions in this realm.

   First, the researchers analyzed how continental free trade and agricultural development could ensure sustainable food security for Africa, leading to a publication in Nature Food. Another study published in the same journal investigated climate change impacts, including climate variability, in the context of alternative socio-economic scenarios.

   Finally, the impacts of urbanization and related preference shifts on land use were investigated and published in Nature Sustainability. At a national level, policy engagement took place in the context of an FAO funded project in Uganda, where IBF participated in a modeling consortium to support governance innovation for food system transformation. In The Gambia, IIASA and project partners developed scenarios with stakeholders including the Ministry of Agriculture, Health and Climate Change and The Gambia Bureau of Statistics.

2. **Fundamental contribution to land-based climate mitigation science:** IBF has continued its leadership in the land-based mitigation modeling community, which has led to multiple high-level papers contributing to improved understanding on what land use can contribute to the Paris Agreement target. Studies assessed synergies and trade-offs of ambitious land-based mitigation pathways with other Sustainable Development Goals such as food security or biodiversity, and tried to identify integrated no-regret solutions across targets.

   While climate change is a truly global problem, the implementation of mitigation policies is national, and often even subnational. Here, IBF contributed by assessing Nationally Determined Contributions and identifying the emission gap. IBF also quantified the effectiveness of a unilateral EU climate change mitigation policy in the agricultural sector ("Research Highlights" of Nature Food) and together with JRC investigated policy implications of the short-lived character of methane (Nature Food). Moreover, IBF together with PKU quantified implications of the Chinese climate neutrality target (Nature Food) and its sustainability implications in- and outside China, and assessed the contribution of nature-based solutions for Brazil's net zero target.

3. **Continued support to regulatory processes:** IBF is providing continued support for the estimation of market-mediated impacts and induced land-use change effects of both road and aviation biofuels around the world. For example, GLOBIOM is one of the two models considered by the Carbon Offsetting and the Reduction Scheme for International Aviation (CORSIA) to quantify ILUC factors for alternative aviation biofuels within the International Civil Aviation Organization (ICAO) Fuels Task Group. IBF has continued to support CORSIA process with its GLOBIOM model also in the most current cycle of Committee on Aviation Environmental Protection (CAEP).

   IBF is an integral part of the biofuel modelling community for policy support and is regularly invited to policy workshops (US EPA biofuel and GHG modelling, 3rd Energy Transition Working Group of the G20). Moreover, IBF has also a longstanding partnership with policy makers such as the US Environmental Protection Agency (EPA). Based on GLOBIOM simulations, EPA announced the Final Renewable Fuels Standards Rule for 2023, 2024, and 2025 on June 21, 2023

(IIASA news). The rule establishes biofuel volume requirements and associated percentage standards in view of steady growth of biofuel use in the US's fuel supply and aims to ensure a sustainable and environmentally friendly energy future.

4. **Productive partnerships with the private sector:** IBF researchers (co-)authored more than 130 scientific articles, 28 of them published in the Science/Nature family of journals.

   A highly impactful publication in Nature Communications, article is in the 99th percentile (ranked 195th) of the 358,816 tracked articles of a similar age in all journals and the 99th percentile (ranked 8th) of the 2,220 tracked articles of a similar age in *Nature* Communications, found that replacing 50% of meat and milk products with plant-based alternatives by 2050 can reduce agriculture and land use related greenhouse gas (GHG) emissions by 31% and halt the degradation of forest and natural land. Additional climate and biodiversity benefits would accrue from reforesting the spared land. The restored area could contribute up to 25% of the estimated global land restoration needs under Target 2 of the Kunming Montreal Global Biodiversity Framework by 2030. This is an example of successful collaboration with the private sector, in this case Impossible Foods.

   Another example would be the contribution to the Coller FAIRR Climate Risk Tool which provides investors with company-level data on how climate risks may impact costs and profitability in the meat and dairy sector (IIASA PR).

5. **Fund raising and community leadership:** IBF has been leading the IIASA contribution to 74 externally funded projects with a total IIASA budget of about 16 million euros. IBF was also extremely successful in bringing together large research consortia and developing with them project proposals.

   Currently, IBF coordinates two Horizon Europe projects. The ForestNavigator project (EUR 6.5 million) was launched in 2022 and brings together 24 research institutions from 13 EU countries and China to support the European Commission and national authorities in designing robust sectoral policies addressing forests and the forest sector for achieving climate neutrality in the EU. The LAMASUS project (EUR 5.6 million), also started in 2022, and, with 16 partners, aims at providing a novel governance model, and the tools required to build sound policies for the transition required by the European Green Deal.

## 5.3. IBF SWOT analysis

| Strengths | Weaknesses |
|---|---|
| • IBF modeling framework (GLOBIOM/G4Mm) and team is trusted by clients and partners<br>• The modeling framework is unique in the detailed coverage of both agricultural and forest product (international) markets in a spatially explicit bottom-up setup<br>• The modeling framework is unique in its reputation for both global, often academic, as well as national, often in direct support to policy makers, applications<br>• The modeling framework is linked/integrated not only to BNR models, but also to other IIASA flagship models, as well as leading non-IIASA models<br>• Diversity, expertise and external recognition of IBF staff, incl. track record in high impact journals<br>• Strong network of collaborators and clients<br>• Capacity to attract external funding | • Full integration in the modeling framework of aquaculture, seafood, and blue economy in general is still work in progress<br>• Too much focus on the environmental dimension of sustainability as compared to economics and social aspects although the modeling framework is based on solid economics, and steps towards covering the social dimension are underway<br>• Large reliance on external funding leads to underinvestment in model consolidation and documentation, user community support, publications, and communication in general<br>• Lack of standardization and complexity of the research approaches lead to too high cost, and thus lack of competitiveness for specific opportunities |
| **Opportunities** | **Threats** |
| • Increasing awareness among decision makers about the inseparability of individual development goals, and thus the recognition of the need for formalized integrated approaches<br>• Biomass is gaining on importance as a potential substitute for fossil-based energy and materials, leading to increased interest by decision makers, including industry, into economic availability assessments<br>• Increased interest in Europe in business competitiveness and social impacts of policy decisions will direct funding into novel research areas within IBF reach<br>• Development funding often interested in national level assessment, where competition is smaller than at the global scale or in Europe<br>• New IT technologies to become a modeling community hub<br>• Turbulent geopolitics intensify interest in international trade analysis | • Reduced interest by policy makers in science-based decision support, and in research in general<br>• Funding opportunities tempting to disproportionately focus on Europe at expense on other regions/countries<br>• Not keeping pace with new technologies<br>• Difficulty to attract and maintain key team members because of shrinking pool of qualified candidates on the one hand, and increasing competition for them, on the other hand |

# Annex A: List of externally funded projects BNR (approved from January 2021 to March 2024)

| Title | Abbreviation | Period | Funder | CC | Budget (EUR) |
|---|---|---|---|---|---|
| Coordinated Research in Earth Systems and Climate: Experiments, kNowledge, Dissemination and Outreach | CRESCENDO | 01/11/2015-31/01/2021 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | IBF | € 117,635 |
| | Earth system models (ESMs) are the primary tools available for making future projections of global climate change, linking such projected changes to allowable carbon emissions commensurate with staying below a given warming target. ESMs allow an assessment of the potential response of the full global environment to future climate change, which are important for developing sustainable future development pathways. | | | | |
| Integrated Decision Support System to Address Restoration and Sustainable Agriculture on Degraded Land | RESTORE + | 01/03/2017-31/03/2024 | Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) | AFE<br>IBF | € 1,040,000<br>€ 512,117 |
| | RESTORE+ supports sustainable land use planning in the degraded landscapes of partner countries (Indonesia, Brazil). The project identifies areas that are suitable for restoration and sustainable use. It also analyses the effects on production, biodiversity, greenhouse gas emissions and society. | | | | |
| EU-Brazil Synergistic Cooperation for the Optimization of Advanced Lignocellulosic Biofuels Supply Chains | BECOOL | 01/06/2017-31/05/2022 | European Commission, DG Climate Action | AFE<br>IBF | € 155,081<br>€ 155,081 |
| | Aiming to provide solutions for highly efficient and sustainable value chains encompassing the whole range of activities from biomass production and diversification to logistics, conversion pathways and exploitation. IIASA has participated in the project in two work packages with GLOBIOM and BeWhere models in national evaluations of value chains logistics and EU impact assessment. | | | | |
| Marginal lands for Growing Industrial Crops: Turning a burden into an opportunity | MAGIC | 01/07/2017-31/12/2021 | European Commission, Research Executive Agency (REA) | IBF | € 230,000 |
| | Aims to harness the power of resource-efficient and economically profitable industrial crops cultivated on marginal lands. Specifically, it features the development of an extensive database, as well as the cataloguing of existing resource-efficient industrial crops and their agronomic characteristics. Moreover, marginal lands in Europe will be mapped to identify best practices. | | | | |
| Greenhouse Gas Removal from the Atmosphere | GGR-NERC | 01/07/2017-31/05/2021 | Imperial College of Science, Technology and Medicine | AFE | € 88,317 |
| | This study focuses on the conditions for meeting the Paris Agreement targets, regional variation in the options for greenhouse gas removal, the scope for inter- | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | region cooperation to reduce climate policy costs and how greenhouse gas removal technologies will interact with low carbon energy systems. | | | | |
| Strengthening and facilitating the science-policy dialogue on climate change impacts through stakeholder engagement in ISIMIP 3 | ISIPEDIA | 18/09/2017-18/06/2021 | Austrian Research Promotion Agency (FFG) | WAT | € 199,936 |
| | This project was about making accessible the latest climate impact information to the public. It includes summaries of scientific articles written as stories, interactive and user friendly grraphs. Data is also accessible. https://www.isipedia.org/; https://iiasa.ac.at/projects/isipedia | | | | |
| National Agro-Ecological Zoning Afghanistan | NAEZ Afghanista | 20/09/2017-28/02/2021 | Food and Agriculture Organization of the United Nations (FAO) | WAT | € 169,270 |
| | The project "Development of Land Resources Information Management System (LRIMS) for Afghanistan" aims to strengthen the capacity of Afghanistan Institutions for monitoring and analyzing their agriculture production systems using data from the National Agro-Ecological Zoning (NAEZ) for Afghanistan. More information and data at https://lrimsfaoaf.ait.ac.th/. Further publications: FAO & IIASA (2019). The Islamic Republic of Afghanistan. Agro-Ecological Zoning Atlas. Part 1: Agro-climatic indicators. FAO & IIASA (2022). Afghanistan's Agro-ecological zoning atlas. Part 2: Agro-ecological assessments. | | | | |
| Coordination of International Research Cooperation on soil CArbon Sequestration in Agriculture | CIRCASA | 04/10/2017-28/02/2021 | European Commission, Research Executive Agency (REA) | IBF<br>AFE | € 42,488<br>€ 86,263 |
| | Coordination of International Research Cooperation on soil Carbon Sequestration in Agriculture (CIRCASA). CIRCASA aims to develop international synergies concerning research and knowledge exchange in the field of carbon sequestration in agricultural soils at European Union and global levels, with the active engagement of all relevant stakeholders. | | | | |
| INMS: CWI-UNEP Global Nitrogen Cycle Towards INMS | INMS | 01/07/2017-31/03/2023 | United Nations Environment Programme (UNEP) | IBF | € 38,442 |
| | Developing the International Nitrogen Management System – a process of science evidence gathering and synthesis that can support international nitrogen policy development. It is a way of bringing issues together, of scientists working with governments, business, and civil society to identify the options for change and to help overcome the barriers. | | | | |
| European Climate Prediction System | EUCP | 01/12/2017-31/05/2022 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | WAT | € 225,861 |
| | EUCP is a research project that supports both scientists and climate information providers to produce better climate information for these users, as well as directly producing some of this information. It develops cutting-edge approaches to using climate predictions and projections, as well as providing new climate simulations, never rolled out before on a European level. This lays the foundation for a future regional climate prediction system for Europe. https://www.eucp-project.eu/ | | | | |

| | | | | | |
|---|---|---|---|---|---|
| CO-designing the Assessment of Climate CHange costs | COACCH | 01/12/2017-30/11/2021 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | IBF<br>AFE | € 217,567<br>€ 199,308 |
| | COACCH will develop an innovative science-practice and integrated approach to co-design and co-deliver an improved downscaled assessment of the risks and costs of climate change in Europe, working with end users from research, business, investment, and policy making communities throughout the project. | | | | |
| Co-development of methods to utilize uncertain multi-model based information on fresh water related hazards of climate change | CO-MICC | 01/10/2017-18/06/2021 | Austrian Research Promotion Agency (FFG) | WAT | € 113,264 |
| | CO-MICC provides free access to scientifically-sound data and information on freshwater-related hazards of climate change at multiple spatial scales. The data can be visualized, analysed and downloaded through its interactive data portal. Methods on how to utilize the data, including their uncertainty, can also be consulted on the portal. CO-MICC was co-designed by scientists and stakeholders from the water sector and is hosted by the ICWRGC in Koblenz, Germany. https://www.co-micc.eu/ | | | | |
| The effect of climate change on Arctic permafrost and its socio-economic impact, with a focus on coastal areas | NUNATARYUK | 01/11/2017-31/10/2023 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | IBF | € 7,413 |
| | NUNATARYUK is an international permafrost research project funded by the European Union Horizon 2020 framework programme. In Nunataryuk, 26 partners from 12 countries work together to understand how thawing permafrost on land, along the coast and below the sea changes the global climate and life for people in the Arctic. | | | | |
| Towards a robust and comprehensive greenhouse gas verification system | VERIFY | 01/02/2018-31/07/2022 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | AFE<br>IBF | € 135,563<br>€ 15,063 |
| | Verifying Greenhouse Gas Emissions (VERIFY) develops a system to estimate greenhouse gas emissions (CO2, CH4 and N2O) to support EU countries' emission reporting to the UN Climate Change Convention Secretariat. The emissions are estimated based on land, ocean, and atmospheric observations. | | | | |
| Food-water-energy for Urban Sustainable Environments | FUSE | 01/05/2018-31/05/2022 | Austrian Research Promotion Agency (FFG) | WAT | € 604,916 |
| | FUSE conducted inter- and trans-disciplinary research aimed at innovation through FUSE international teams (Germany, Austria, United States), but involved fundamental (Germany, United States) and applied research (Austria, United States). Fundamental research involving multi-agent model development used to understand urban food-water-energy systems and quantify the impacts of proposed solutions. Such a coupled human-biophysical-engineering urban-FWEs framework and policy analysis tool has never been developed before. | | | | |

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| | The participatory process provided new insights for the formulation and design of further research efforts on FWE and urban development dynamics. https://fuse.stanford.edu/ | | | | |
| Disturbances impact on forest ecosystem services of Chernobyl Exclusion Zone | DIFES-ChEZ | 01/01/2019-31/12/2021 | Austrian Agency for International Cooperation in Education and Research (OeAD-GmbH) | AFE | € 10,000 |
| | Disturbances impact on forest ecosystem services of Chornobyl Exclusion Zone: A partnership between IIASA and prominent Ukranian researchear to assess the dynamics of the main anthropogenic and natural disturbances in forest ecosystems of Chornobyl Exclusion Zone and their impact on productivity of ecosystem services. | | | | |
| WFaS_scaleWAYS: Scaling out resilient water and agricultural systems (scaleWAYS) | WFaS_scaleWAYS | 07/01/2019-31/03/2023 | Austrian Development Agency (ADA) | WAT | € 803,501 |
| | The research and development project analyzes up scaling options for water and land management practices for the resilient and sustainable intensification of rice and fodder production systems in the Lake Victoria Basin. https://www.scaleways-eastafrica.com/ | | | | |
| RLUC: Economic Growth and land-use change in regions | RLUC | 01/04/2019-30/09/2021 | The National Bank of Austria (OeNB) | IBF | € 103,000 |
| | This project focusses on the complex relationship between regional land use change and economic activity, by putting forward a simultaneous modeling framework as a means to capturing the interdependences of the relationship between land use change and economic activity. In addition to the simultaneous treatment of land use change and economic activity, the framework also aims at controlling for spatial dependence in both quantities of interest and potential over-parameterization in a flexible way. | | | | |
| Management for resilience of multifunctionality in European forests in the era of bioeconomy | MultiForest | 01/04/2019-31/10/2022 | Federal Ministry for Sustainability and Tourism of Austria | IBF | € 161,946 |
| | Aiming to provide novel insights into forest policy, forest management and land-use planning by quantitatively analysing impacts of policies, management practices and developing large scale forest. IIASA contributes as WP1 leader to project and quantify realistic future timber demands from forests under alternative EU and national forest-related policies with the GLOBIOM model. | | | | |
| SustES: Adaptive Strategies for Sustainability of Ecosystems Services and Food Security in Harsh Natural Conditions | SustES | 01/04/2019-31/12/2022 | Czech Ministry of Education, Youth and Sports | AFE<br>IBF | € 0<br>€ 238,080 |
| | The aim of the project is to develop a fundamentally new concept for risk identification and adaptation strategies to ensure the sustainability of ecosystem services and, in particular, food security under the conditions of ongoing climate and socio-economic changes. | | | | |
| BioEssHealth: Scenarios for biodiversity and ecosystem services acknowledging health | BioEssHealth | 01/04/2019-31/12/2022 | Austrian Science Fund (FWF) | IBF | € 86,189 |
| | The role of IIASA is to further develop global and national scenarios projection and improve on the modelling and consideration within GLOBIOM of tree species development and its implications for climate mitigation. | | | | |
| MIND STEP: Modelling INdividual Decisions to | MIND STEP | 01/09/2019-31/12/2023 | European Commission, | IBF | € 398,750 |

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| Support The European Policies related to agriculture | | | Research & Innovation (RIA) | | |
| | Modeling individual decisions to support the European policies related to agriculture. MIND STEP uses agricultural statistics, big datasets, and machine learning techniques to include individual decision making (IDM) units in new and existing policy models for impact assessments in the food system. | | | | |
| Air-borne Environment Observation with the Help of a Weather Drone | Coresense-Drone | 29/04/2019-31/12/2021 | Coresense Co., Ltd. | AFE | € 55,983 |
| | The research project is a study on developing an "Air-borne Environment Observation with the Help of a Weather Drone". It foresees a collaboration with Dr. Kim and the Korean funder Coresense to develop, a methodology for the use of a weather drone and further know-how of air-borne environmental measurements/assessments. | | | | |
| Next generation of AdVanced InteGrated Assessment modeling to support climaTE policy making | NAVIGATE | 01/09/2019-31/12/2023 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | IBF | € 150,000 |
| | Aims to develop the Next generation of AdVanced InteGrated Assessment modelling to support climaTE policy making (NAVIGATE), by targeting major advancements in two areas: describing transformative change in the economy and describing distributional impacts of climate change and climate policy. | | | | |
| SPIPA Argentina: Strategic Partnership for the Implementation of the Paris Agreement (SPIPA) | SPIPA Argentina | 01/04/2019-31/10/2021 | European Commission, DG CLIMA | IBF | € 186,894 |
| | To provide the National Cabinet on Climate Change (NCCC) with critical information to inform Argentina's long-term low greenhouse gas emission development strategy in the AFOLU sector. To contribute to the strengthening of the modelling capacities of actors in Argentina, also increasing awareness of how national and global low carbon pathways are interrelated. | | | | |
| REmote Climate Effects and their Impact on European sustainability, Policy and Trade | RECEIPT | 01/09/2019-31/08/2023 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | AFE<br>IBF | € 450,000<br>€ 250,000 |
| | RECEIPT uses innovative storytelling concepts mapping connections between remote climate change impacts and effects on European societies. | | | | |
| ENGAGE: Exploring National and Global Actions to reduce Greenhouse gas Emissions | ENGAGE | 01/09/2019-31/12/2023 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | IBF | € 150,000 |
| | International and multidisciplinary research groups are collaborating to co-produce knowledge for designing cost-effective, technologically sound, socially and politically feasible pathways that can meet the objectives of the Paris Agreement by Integrated Assessment Models (IAMs) applied to inform and guide strategies. IIASA is leading the project and using its IAM MESSAGE with the land use GLOBIOM. | | | | |

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| TRADE Hub_GCRF: Interdisciplinary Research Hubs to Address Intractable Challenges Faced by Developing Countries | TRADE Hub_GCRF | 13/02/2019-31/03/2024 | Research Councils UK (RCUK) | IBF | € 274,286 |
| | Interdisciplinary Research Hubs to Address Intractable Challenges Faced by Developing countries. It is the first research hub of its kind, bringing together over 50 partner organizations from 15 countries. IIASA is involved in WP5: Modelling the implementation of different trade policy and corporate decision-making scenarios. | | | | |
| Support for the China's long-term low greenhouse gas emission development strategy in the AFOLU sector | SPIPA China | 01/10/2019-30/11/2021 | European Commission, DG CLIMA | IBF | € 177,522 |
| | Coordinated by IIASA, the objective of the project is improving the modelling capability and knowledge for designing cost-effective, technologically sound, socially and politically feasible mid-century strategies for China. | | | | |
| Food System Adaptations in Changing Environment in Africa (FACE-Africa) | FACE-Africa | 02/09/2019-30/04/2023 | Wellcome Trust | IBF | € 55,660 |
| | FACE-Africa aims to support researchers who want to explore the links between people's health and a changing climate. IIASA will be involved in WP2 – The future Gambian food system and projected health outcomes and WP3: Future climate change adaptation scenarios. | | | | |
| Study on Disaster Risk Management – A macro perspective cost-benefit analysis for reducing vulnerability. | GFRList | 20/11/2019-30/04/2021 | Inter-American Development Bank | WAT | € 105,363 |
| | GFRList aimed at developing a new dynamic and stochastic macroeconomic framework capable of analysing sustainable growth implications of climate extreme risk management in developing countries. https://iiasa.ac.at/projects/growth-and-fiscal-analysis-of-risk-layering-strategies-gfrlist | | | | |
| Model based Assessment of EU Climate Policies | EUCLIMIT5 | 15/10/2019-14/10/2021 | European Commission, DG Climate Action | IBF | € 176,500 |
| | Development and application of EU economy-wide climate change mitigation modelling capacity. Objective is to perform model-based scenario quantification that supports the European Commission in impact assessments and analyzing policies for the Climate and Energy package and climate-relevant policies in the EU. IIASA provides modelling tools to assess the impact of policies on emissions/removals and mitigation from the land use, land use LULUCF sector including leakage effects outside Europe. | | | | |
| A Transnational Cooperation for Sustainable Use and Management of Non-Native Tree Species in the Alpine Region | ALPTREES | 02/10/2019-30/06/2022 | Interreg Alpine Space | AFE | € 239,730 |
| | ALPTREES developed a transnational strategy for the responsible use and management of non-native trees in the Alpine Space with the help of an integrated Decision Support System. The project fits within the context of national and regional site-derived policy aiming to protect and enhance biodiversity to ensure ecological connectivity and cultural resources while maintaining a high level of resilience and ecosystem services across the region. | | | | |
| Assessment on development of sustainable aviation fuels | ALTERNATE | 01/01/2020-31/12/2022 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | IBF | € 324,688 |

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| | The EU-funded ALTERNATE project is a Chinese-EU proposal that aims to identify the possibilities for extensive sustainable fuel use in aviation considering new technical areas and production procedures. | | | | |
| Fostering development: Agricultural technological change and economic growth | FPROD | 01/11/2020-31/10/2024 | Austrian National Bank, Anniversary Fund (OeNB) | IBF | € 109,000 |
| | This project focusses on the complex relationship between regional agricultural productivity measured both in terms of production and regional farm structure and economic output, by a joint modelling framework as a means to capturing the interdependence of the relationship between agricultural productivity and economic activity. In addition to the simultaneous treatment of agricultural productivity and economic output, the framework also aims at controlling for spatial dependence in all quantities of interest and potential overparameterization in a flexible way. | | | | |
| Climate change and commodity futures market | CROPF | 01/05/2020-30/04/2024 | Austrian National Bank, Anniversary Fund (OeNB) | IBF | € 123,000 |
| | This project focusses on the complex relationship between commodity futures markets and climate change. The impact of unanticipated climate change shocks especially of drought or other extreme events on commodity price formation has not been explored yet. Such interrelations would imply wide-reaching consequences, not only for food security, but also for other commodity markets through spillover effects. | | | | |
| Sustainable aviation fuel potential in South America | SUAVSAM | 13/01/2020-30/06/2023 | WWF South Africa | WAT | € 150,000 |
| | Considering the sustainability criteria aligned with the Roundtable of Sustainable Biomaterials (RSB), the project describes opportunities for current and future sustainable biofuel feedstock production in South America for Aviation Biofuels. | | | | |
| OECD TRADE: The Economic and Environmental Consequences of Confronting Climate Change in the Agricultural Sector through Trade | OECD TRADE | 01/03/2020-28/02/2023 | Organisation for Economic Co-operation and Development (OECD) | IBF | € 62,000 |
| | To evaluate the potential effects of trade and non- tariff measures (NTMs) on climate change adaptation and its associated environmental consequences. It is proposed under the 2019-20 Program of Work and Budget of the Committee of Agriculture, by the OECD Joint Working Party on Agriculture and Environment1 (JWPAE). | | | | |
| Impossible Food: Expansion of plant-based meat (PBM) alternatives and theirimpacts on climate, agriculture and food security in developing countries | Impossible Food | 15/02/2020-30/09/2021 | United States Agency for International Development | IBF | € 69,231 |
| | Identifying plant-based meat or protein investment options in developing countries and their potential impacts on food security and the climate. IIASA will contribute the assessment of potential impacts of a shift toward more plant-based alternative meat production and consumption, with a focus on food security and climate change mitigation. | | | | |
| Analytical Capacity on International Climate Change Mitigation and Tracking Progress of Action | PBL_CLIMA 5 | 19/12/2019-19/12/2021 | European Commission, DG Climate Action | IBF | € 92,500 |
| | To inform the EU's policies on climate change, as well as outreach to 3rd countries and international climate negotiations, IIASA provides the contracting authority with access to state-of-the-art analytical capacity, quantitative analysis and model-derived scenarios on global climate change mitigation action. | | | | |

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| Development of an integral model for assessing carbon emissions and removals by Russian forests | IMGGAR-II | 01/04/2020-31/03/2025 | Joint Stock Company SUEK | AFE | € 196,522 |
| | Improvement of methodology, reference components and development of integral model for carbon accounting in forestry, aiming at their application in national reporting of the Russian Federation to the Secretariat of the UNFCCC | | | | |
| 2020 IIASA-WWF-NL Research Collaboration contract for WWF's Living Planet Report | WNF20 | 15/01/2020-30/06/2021 | WWF Netherlands | IBF | € 61,983 |
| | Planning, identifying authors and coordinating production of the modeling and scenarios chapter of the 2020 Living Planet Report – Chapter 3 - and providing chapter-level comments throughout the review process, from early draft text to final design. Also coordinating modeling, analysis and paper writing on the follow-up Bending The Curve paper. | | | | |
| EPA CCD FC 2020 2023: Analysis and Economic Modeling and Clean Air Act Issues | EPA CCD FC 2020-2023 | 23/06/2020-18/05/2021 | Environmental Protection Agency (EPA) | IBF | € 32,714 |
| | To contribute to multi-model analyses of different socioeconomic drivers, bioenergy policies, GHG policies, and environmental change scenarios to compare model output and publish cross-model comparisons. Continued development of the Global Biosphere Management Model (GLOBIOM). | | | | |
| WaterStressAT: Climate change induced water stress – participatory modelling to identify risks and opportuni-ties in Austrian regions | WaterStressAT | 01/10/2020-30/11/2023 | Austrian Climate Research Program (ACRP) | WAT | € 101,451 |
| | Assessing water availability and demand in Austrian regions considering alternative socio-economic and climate futures. This is to understand the risk of water stress and associated management opportunities. https://iiasa.ac.at/projects/WaterStressAT | | | | |
| Climate change mitigation: How much can achieving biodiversity targets contribute? | ECF_NDC | 01/09/2020-28/02/2022 | European Climate Foundation | IBF<br>BEC | € 9,178<br>€ 37,828 |
| | We quantify the emissions reductions and removals that could result from achieving a range of global biodiversity targets and make the results available in appropriate forms to climate policy leaders, national decision makers and the scientific community. | | | | |
| Development of a European Biodiversity Observation Network (Europa BON) to integrate existing data streams and effectively monitor the status of Europe's ecosystems | EuropaBON | 01/12/2020-31/05/2024 | European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME) | BEC | € 327,500 |
| | EuropaBON will engage stakeholders to identify user and policy needs for biodiversity monitoring, facilitate knowledge exchange, and investigate the feasibility of setting up a biodiversity knowledge center to coordinate monitoring activities across Europe. Together with stakeholders, EuropaBON will assess current monitoring efforts to identify gaps, data and workflow bottlenecks, and analyse cost-effectiveness of the current biodiversity observation capacity across Europe. | | | | |
| SPIPA India: Joint Modelling Initiative for Preparing Low Carbon Development Scenarios for India up to 2050 | SPIPA India | 01/04/2020-28/02/2022 | Deutsche Gesellschaft fuer International Zusammenarbeit (GIZ) GmbH | IBF | € 80,294 |
| | To support EU-India collaboration on the development of modelling capacities to improve the quality of modelling tools, and improving the knowledge of Indian | | | | |

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| | modelling teams on how action in India relates to global and sub-national low carbon development pathways, as well as to selected co-benefits of trade-offs of climate policy. | | | | |
| Science-based silviculture: Ecophysiological modelling for process understanding and improved management | Silviculture II | 01/01/2020-31/12/2021 | Knut and Alice Wallenberg Foundation | AFE | € 78,450 |
| | In the long-term collaboration Science-based silviculture, a key role is played by ecophysiological modeling project, which serves to (i) to explain empirical findings in terms of the underlying mechanisms and (ii) apply these mechanisms in prognostic models, used to evaluate future forest development and optimize forest management. The eco-physiological models will enable foresters to better account for the future consequences of climate change in the long-term adaptation of forest management. The modeling project is led by Oskar Franklin at IIASA and developed in close collaboration with the Co-PIs and the other project members at SLU. | | | | |
| Water and land management trajectories – best bet options for sustainable agricultural intensification | WaterLand_Cap | 01/09/2020-31/12/2021 | International Water Management Institute (IWMI) | WAT | € 141,619 |
| | WaterLand_Cap aimed at assessing water availability, water demand and water stress at the level of major river basins globally using the hydrological model CWatM. The project included also capacity building activities to researchers working on hydrological modeling. | | | | |
| Climate change mitigation: How much can achieving biodiversity targets contribute? | QCF_NDC | 01/09/2020-28/02/2022 | Quadrature Climate Foundation (QCF | BEC | € 71,629 |
| | This project continues the work of the ECF_NDC project by assessing the emission reductions when also accounting for potential leakage of forestry and agriculture resulting from restoration and conservation | | | | |
| Analysis of GHG Impacts of Renewable Fuels and Renewable Fuel Policies Using GLOBIOM | EPA OTAQ4 year5 | 01/08/2020-31/07/2021 | RTI International | IBF | € 57,241 |
| | Running individual shock cases in GLOBIOM around specific biofuels to see what happens to global GHG emissions associated with the increase in biofuels use, analyzing the GHG impacts in the agricultural, land use, and livestock sectors associated with increased use of biofuels replacing petroleum fuel use in the transportation sector. | | | | |
| OECDLand: Develop Part Of The Outlook Model To Better Represent Land Use By Using A Forest And Other Landuse Meta-Model | OECDLand | 01/12/2020-30/06/2021 | Organisation for Economic Co-operation and Development (OECD) | IBF | € 15,000 |
| | To improve the simulation behaviour of Aglink-Cosimo at the land use margin by using a forest and other land use meta-model derived from the Global Biosphere Management Model (GLOBIOM). The project enables OECD to Improve the capacity of in-house modelling related to GHG emission questions. | | | | |
| Assessing DAC Fuel Potentials (ADEPT) | ADEPT | 01/11/2020-01/01/2024 | ClimateWorks Foundation | AFE | € 150,000 |
| | ADEPT project, in collaboration with EDF, aims at identifying the full technical potential of DAC-fuel by creating new demand modeling for the amount needed to meet forecasted global and regional (EU and US) long-haul aviation fuel demand; providing an updated forecast of DAC-fuel costs given the most recent estimates of CO2 from direct air capture; comparing DAC-fuel cost to alternatives such as fuels from concentrated CO2 sources, as well as algae, alcohol to jet, HEFA, and fossil kerosene; estimating the potential saving around land use based on forecasted demand of DAC-fuel in the aviation sector, in the U.S. and the EU, vis-à-vis | | | | |

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| | estimated land demand from aviation biofuels as the sole alternatives to fossil kerosene; identifying the main variables in determining DAC-fuel costs against past literature; providing a realistic assessment of competition with renewable energy demand in the U.S. and the EU, as a stress test of existing DAC analysis. | | | | |
| European Union BIOdiversity and CLIMate strategies Assessment | EU-BIOCLIMA | 23/11/2020-22/11/2024 | European Commission, DG Climate Action | AFE<br>BEC<br>IBF | € 182,415<br>€ 398,276<br>€ 486,785 |
| | Evaluating the potential effects of land-use policies on climate and biodiversity and ecosystem services to 2030 and 2050 as proposed by Member States in their NECPs, NFAPs and NBSAPs. (Coordinated by IIASA) | | | | |
| Global Landscapes: RFS-IIASA Rapid Spatial Analysis | Global Landscape | 16/12/2020-11/07/2022 | The Nature Conservancy | BEC<br>AFE | € 30,897<br>€ 36,813 |
| | The Global LandScapes project is funded by The Nature Conservancy (TNC) in the US and has the overall objective of developing a joint methodology and database to compute a map of global foodscapes and their development potential in view of planning for large-scale deployment of Nature based solutions (NBS). | | | | |
| Klimaschutzwirkung von Naturschutz- und Wirtschaftswäldern | FOR4CLIM | 05/11/2020-31/12/2022 | DBFZ German Biomass Research Center | AFE | € 158,125 |
| | To achieve international and national climate protection targets greenhouse gas emissions in the transport sector have to be reduced, and thus alternative fuels - including fuels on basis of biogenic resources - are an essential building block for the decarbonization of the transport system. By using woody biomass, instead of energy crops, various negative effects can be avoided, but a prerequisite for this benefit is the sustainable management of forests ecosystem services, such as carbon storage, raw material provision and drinking water supply and the preservation of soil fertility and biodiversity. Therefore, the goal of the BIOKRAFT project is to quantify the amount of woody biomass that can be made available for the production of biofuels while accounting for high sustainability requirements that preserve the climate protection effects of nature conservation forests and commercial forests in the EU-27. | | | | |
| Assistance to EFTA Surveillance Authority (ESA) for its upcoming work under Article 8 of Regulation (EU) 2018/841<br><br>(Fixed Price) | FRL_Nor_Ice(FP) | 24/02/2020-24/02/2021 | European Free Trade Association Surveillance Authority | IBF | € 4,140 |
| | ICF, in association with IIASA and Aether Limited, has been requested by the EFTA Surveillance Authority (ESA) to provide assistance and expertise to ESA under Article 8 of the LULUCF Regulation. Tasks require highly technical knowledge in the forestry sector and an understanding of the FRL assessment process undertaken by the EU Commission. | | | | |
| Assistance to EFTA Surveillance Authority (ESA) for its upcoming work under Article 8 of Regulation (EU) 2018/841<br><br>(T&M) | FRL_Nor_Ice(TM) | 24/02/2020-24/02/2021 | European Free Trade Association Surveillance Authority | IBF | € 58,880 |
| | ICF, in association with IIASA and Aether Limited, has been requested by the EFTA Surveillance Authority (ESA) to provide assistance and expertise to ESA under Article 8 of the LULUCF Regulation. Tasks require highly technical knowledge in the forestry sector and an understanding of the FRL assessment process undertaken by the EU Commission. | | | | |

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| Inventive forecasting tools for adapting water quality management to a new climate | inventWater | 01/03/2021-28/02/2025 | European Commission, Research Executive Agency (REA) | WAT | € 264,207 |
| | inventWater is a Marie Sklodowska Curie Action European Training Networks (ETN) project (programme Innovative Training Networks (ITN) of Horizon 2020). Its main objective is to organize a platform providing cutting edge cross disciplinary education of tomorrow's professionals of the water quality sector. https://inventwater.eu/ | | | | |
| Challenges of global agriculture in a climate change context – Focus on water as an agricultural production factor | AgCLIM50 IV | 25/02/2021-16/02/2022 | Commission of the European Communites, Directorate General Joint Research Centre (JRC) | WAT<br>IBF | € 18,200<br>€ 18,155 |
| | AgCLIM50 IV aims to harmonise the introduction of water as a production factor in global agro-economic models, and with that an update of the relevant databases that the models use. It will also include an improved methodological representation of water as a production factor at the global level to allow for an informed inter-comparison model assessment. | | | | |
| DIoD: Monetary and Distributional Implications of Climate-related Disasters - A macroeconomic assessment | DIoD | 01/04/2021-31/03/2023 | Austrian National Bank, Anniversary Fund (OeNB) | WAT | € 14,469 |
| | DIoD studies the feedback effects on macroeconomic aggregates due to changes in income distributions once a disaster has hit. We do so by introducing agent heterogeneity into two state-of-the-art disaster models already used by many researchers as well as policymakers. https://iiasa.ac.at/projects/diod | | | | |
| IEA_S: IEA Service contract | IEA_S | 24/03/2021-31/07/2021 | International Energy Agency (IEA) | IBF | € 30,000 |
| | Calculating land use, land use change and forestry (LULUCF) emissions and related indicators for two scenarios, as input into the project. Assessment of peer reviewer comments on relevant sections of the IEA's Africa work and the Net-Zero Roadmap and related emissions work. Provision of more granular Africa region data and continued result interpretation support to the IEA Secretariat. | | | | |
| Impact of Wildfires on the Carbon Cycle of Forest Ecosystems | IWF-UA | 01/01/2021-31/12/2023 | Austrian Agency for International Cooperation in Education and Research (OeAD-GmbH) | AFE | € 0 |
| | Current wildfire monitoring and analyzing system in Ukraine does not provide a reliable data at the national scale. There is no national assessment system to account for the number and size of wildfires in Ukraine, as well as no state official unit to prepare and unify the reports regarding landscape wildfires. Moreover, a responsibility for fake information about wildfires is absent in Ukraine (Zibtsev et al. 2019; 2020). The collaboration between IIASA and Ukrainian forestry scientists aims at developing the methodology of forest wildfire modelling, burned areas mapping and assessment of carbon emission resulted from this kind of natural disturbances. | | | | |
| | DroughtResilience | | | BEC | € 10,633 |

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| Restoring Ecosystems to Reduce Drought Risk and Increase Resilience | | 06/04/2021-30/09/2022 | Austrian Development Agency (ADA) | WAT | € 50,967 |
| | This project looked at the potential of Nature-based Solutions to reduce drought risks and increase resilience, through literature review of scientific evidences, policy analysis of current policies and enabling environment. | | | | |
| Extension of the EU Energy and Climate Modelling Capacity to include the Energy Community and its Nine Contracting Parties | EUCLIMIT-9EAST | 01/01/2021-31/03/2022 | European Commission, DG Energy | IBF | € 79,500 |
| | Developing data gathering and modelling capacity to cover the energy community and its nine contracting parties in a comparable way and in line with the modelling capacity developed for the EU to assess the 2030 energy and climate targets. Within this process, IBF mainly takes care of the estimation and assessment of emissions from land use, land use change and forestry. | | | | |
| Guiding the pursuit for sustainability by co-developing a Sustainable Agriculture Matrix | SAM co-development | 15/06/2021-14/03/2023 | Austrian Science Fund (FWF) | AFE | € 59,572 |
| | The project is guiding the pursuit for sustainability by co-developing a Sustainable Agriculture Matrixis (SAM) supported by the "Pathways to Sustainability" funding initiative of the Belmont Forum. | | | | |
| Europe and Central Asia Regional Water Security Initiative: Development of an Assessment Methodology and preparation of Diagnostic reports | WB-WatSecAssess | 15/04/2021-30/11/2023 | The World Bank | WAT | € 511,916 |
| | The goal of this project was to develop a methodology for assessing water security challenges and roadmaps to overcome them. The methodology was multi-scale, including country and regional assessments, and also with different levels of depth. For rapid or deep dive assessments. This project has generated 17 reports. 15 country reports (Countries in the Danube, South Caucasus and Central Asia) , and 2 regional reports (Danube and Eastern Europe and Central Asia) https://iiasa.ac.at/projects/world-bank-eca-regional-water-security-initiative-development-of-assessment-and; https://wbwaterdata.org/apps/ | | | | |
| Co-creating climate resilient transformation pathways to meet the SDG Agenda | SDG Pathfinding | 16/06/2021-15/12/2023 | Austrian Science Fund (FWF) | WAT | € 70,746 |
| | This project was intended to support the development of local capacities on SDGs. To this end we develop a frameworks to carry out this process using bottom up approaches and including a toolbox with different participatory methods and simulation games. https://iiasa.ac.at/projects/sdg-pathfinding | | | | |
| BEIS_UK: Global Projections of Emissions From Land Use and Marginal Abatement Cost Curves – RAF009/2122 | BEIS_UK | 20/09/2021-29/04/2022 | Department for Business, Energy & Industrial Strategy (BEIS) | IBF | € 139,227 |
| | Providing up-to-date estimates on emissions and abatement potentials within AFOLU sectors to update the GloCaF model and its applications. Up-to-date estimates on emissions and abatement potentials within AFOLU sectors to be used to model climate scenarios consistent with the Paris Agreement temperature objectives. | | | | |
| Knock-on funding TransNet - Designing a strategic plan for a Trans-European network of protected areas and ecological corridors across the EU | NOE AF HE TransNet | 01/07/2021-06/10/2021 | Office of the Provincial Government of Lower Austria | BEC | € 16,740 |
| | TransNet aims to co-create with key decision-makers and other key stakeholders, a strategic plan for realizing an ecologically representative, well-connected network of conserved areas that contribute to achieving the objectives of the EU Biodiversity Strategy to 2030. | | | | |

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| Knock-on funding NAVIGATING EUROPEAN FORESTS AND FOREST BIOECONOMY SUSTAINABLY TO EU CLIMATE NEUTRALITY | NOE AF HE ForestNavigator | 01/07/2021-14/09/2021 | Office of the Provincial Government of Lower Austria | IBF | € 16,667 |
| | ForestNavigator aims at assessing the climate mitigation potential of European forests and forest-based sectors through modelling of policy pathways, consistent with the best standards of LULUCF reporting, and informing the public authorities on the most suitable approach to forest policy and bioeconomy. | | | | |
| Training_VIET: Regional Training on Approaches Water Resources Management: Climate and Socioeconomic Change adaptation in Transboundary Basins | Training_VIET | 22/09/2021-31/10/2021 | University of Economics Ho Chi Minh City (UEH) | WAT | € 4,950 |
| | This training was provided to several researchers from Vietnam on WAT modeling tools including CWatM, GAEZ and ECHO. | | | | |
| Analysis and Economic Modeling and Clean Air Act Issues | EPA CCD FC 2020-2023 (Option Y1) | 19/05/2021-18/05/2022 | Environmental Protection Agency (EPA) | IBF | € 33,149 |
| | To contribute to multi-model analyses of different socioeconomic drivers, bioenergy policies, GHG policies, and environmental change scenarios to compare model output and publish cross-model comparisons. Continued development of the Global Biosphere Management Model (GLOBIOM). | | | | |
| EPA OTAQ- GLOBIOM Analysis and Support Services for the EPA Office of Transportation and Air Quality | US EPA_OTAQ_RFP_2021 | 08/09/2021-31/07/2024 | Environmental Protection Agency (EPA) | IBF | € 168,754 |
| | To contribute to the analysis of GHG Impacts of Renewable Fuels and Renewable Fuel Policies Using GLOBIOM | | | | |
| World Energy Outlook 2021- Air Pollution and Emissions Analysis & Modelling<br><br>Lot 2 | WEO2021 - Lot 2 | 15/07/2021-30/06/2022 | International Energy Agency (IEA) | IBF | € 48,000 |
| | Lot 2 Services are required for the 2023 edition of the IEA's World Energy Outlook (WEO) publication and potentially other ad hoc special reports in the 2023 WEO series (WEO). These emissions must be specified by source for at least the following sectors: Agriculture and Forestry. | | | | |
| COVID19_Implications: Implications of governmental response stringency and public risk perception for coping<br><br>and building back better from COVID-19: comparison across countries | COVID19_Implications | 31/12/2021-31/12/2022 | Austrian Agency for International Cooperation in Education and Research (OeAD-GmbH) | IBF | € 14,500 |
| | Modeling epidemics, impications of relevant policy interventions and control measures , i.e., lock-downs, self-protection, quarantine, isolation policy, etc. Case studies: China, Germany, Italy, US | | | | |
| Knock-on funding LAMASUS - LAnd MAnagement for SUStainability | NOE AF HE LAMASUS | 01/07/2021-06/10/2021 | Office of the Provincial Government of Lower Austria | IBF | € 15,000 |
| | Developing an integrated framework for eco. and env. modelling of LUM and carbon sequestration that shall enable ex-ante evaluation and monitoring of EU policies related to land use in agriculture and forestry under climate change. | | | | |
| Sustainable water quality management supporting | SWAQ-Uganda | 01/11/2021-31/10/2024 | Austrian Development Agency (ADA) | WAT | € 817,945 |

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| Uganda's development ambitions | The SWAQ-Uganda project aims to contribute to the sustainable management of water resources in Uganda, with the expected outcomes of "improved knowledge and enhanced capacity in water quality management" in support of policy making and effective water resources management. https://iiasa.ac.at/projects/swaq-uganda | | | | |
| Global Agro-Ecological Zoning data version 5 and model documentation | GAEZ_2021 | 20/10/2021-15/12/2022 | Food and Agriculture Organization of the United Nations (FAO) | WAT | € 51,530 |
| | Completion of the version 4 update of the Global Agro-Ecological Zones (GAEZ). Results and data available at: https://gaez.fao.org – Fischer et al. (2021). Global Agro-Ecological Zones v4 – Model Documentation. FAO&IIASA. ISBN 978-92-5-134426-2 | | | | |
| FAO-Indonesia: Indonesia's analysis on agricultural-sector trajectory and global analysis element | FAO-Indonesia | 04/11/2021-28/02/2023 | Food and Agriculture Organization of the United Nations | IBF | € 120,631 |
| | IIASA will use GLOBIOM-Indonesia, a recursive-dynamic economic model tailored to Indonesia, to assess the impact of the growing agriculture-based resource demands along these axes, and how various policies act towards helping achieve the countries objectives for both the agricultural sector and environmental preservation. | | | | |
| ICAO_CLIMA_2021: Further work on the modelling of induced land use change in the context of aviation biofuels at ICAO | ICAO_CLIMA_2021 | 14/06/2021-30/08/2022 | European Commission, DG Climate Action | IBF | € 106,048 |
| | In order to understand the potential impacts of aviation biofuel development, AFTF European members, coordinated by the European Commission, IIASA will provide modelling using the GLOBIOM model thanks to ILUC modelling update and results analysis. | | | | |
| Digital Twin Construction for Forest Environment in Rep. of Korea | DTCFE | 01/01/2021-31/12/2024 | Jeonju University | AFE | € 207,426 |
| | Develop a system to help manage damaged sites from the natural environment. This is one of the tasks within the research project entitled "National Project for Green New Deal in Republic of Korea". We will construct the Digital Twin for the forest and urban area. The necessary algorithm will be developed based on the construction of a forest environment interface that can predict the past, present and future by combining data and information representing the structure, context, and operation of various physical systems, and a powerful digital object that provides future means of solving various problems through improvement of operational performance, business process, and information management. | | | | |
| AGTRADE: Bilateral trade in agricultural commodities: A spatial econometric framework | AGTRADE | 01/12/2021-30/11/2023 | Austrian National Bank, Anniversary Fund (OeNB) | IBF | € 113,000 |
| | This project provides a detailed analysis of agricultural bilateral trade flows in an international context using a spatially augmented gravity model. The expected outcomes of the project consist of substantial innovations in the methodological and empirical aspects. | | | | |
| GFRList II: Study on assessing the long-term macroeconomic (or livelihood) impacts of public investment in disaster risk reduction. | GFRList II - Bahamas | 06/12/2021-30/04/2022 | Inter-American Development Bank | WAT | € 44,188 |
| | This project is the second phase of GFRList project that developed a new dynamic and stochastic macroeconomic framework capable of analysing sustainable growth implications of climate extreme risk | | | | |

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| | management in developing countries. GFRList II applied this framework to Bahamas. | | | | |
| Forests and wildlife under pressure – Systems analysis for sustainable solutions | TaigaClimate | 01/10/2021-30/09/2026 | The Research Council of Norway | AFE | € 588,000 |
| | In the TaigaClimate project researchers develop a simulation-model of forest and wildlife management in the boreal forest ecosystem, which will be used to explore the impacts of climate change and how they can be best managed for the benefit of the stakeholders. | | | | |
| Knock-on funding SOS - Water - Defining water resources supply safe operating space in a changing climate and society | NOe AF HE SOS-Water | 07/08/2021-06/10/2021 | Office of the Provincial Government of Lower Austria | WAT | € 16,667 |
| | This project provided funding to support the coordination of the proposal of the Horizon Europe project SOS-Water that was later on granted to IIASA. | | | | |
| Model based Assessment of EU Climate Policies - Part II | EUCLIMIT VI | 14/10/2021-13/10/2023 | European Commission, DG Climate Action | IBF | € 176,500 |
| | Development and application of EU economy-wide climate change mitigation modelling capacity. Objective is to perform model-based scenario quantification that supports the European Commission in impact assessments and analyzing policies for the Climate and Energy package and climate-relevant policies in the EU. IIASA provides modelling tools to assess the impact of policies on emissions/removals and mitigation from the land use, land use LULUCF sector including leakage effects outside Europe. | | | | |
| Decision Support for Forest Biodiversity Policy | BIOCONSENT | 01/04/2022-31/03/2025 | Austrian Science Fund (FWF) | BEC<br>AFE | € 25,316<br>€ 224,513 |
| | BIOCONSENT provides novel scientific knowledge and policy support by integrating socio-ecological approaches to assess outcomes of alternative conservation and restoration measures on forest biodiversity and ecosystem services provision across spatial and temporal scales at the biodiversity-forest-climate-water nexus. | | | | |
| Analytical Capacity on International Climate Change Mitigation and Tracking Progress of Action | PBL_CLIMA 5b | 01/01/2022-31/12/2023 | European Commission, DG Climate Action | IBF | € 92,500 |
| | To inform the EU's policies on climate change, as well as outreach to 3rd countries and international climate negotiations, IIASA provides the contracting authority with access to state-of-the-art analytical capacity, quantitative analysis and model-derived scenarios on global climate change mitigation action. | | | | |
| Process-based models for climate impact attribution across sectors | PROCLIAS | 01/01/2022-26/10/2024 | COST Association | IBF | € 176,000 |
| | Aiming to develop common protocols, harmonized datasets and a joint understanding of how to conduct cross-sectoral, multi-model climate impact studies at regional and global scales allowing for attribution of impacts of recent climatic changes and robust projections of future climate impacts. | | | | |
| NI: Enhancing global hydrological models with local knowledge | Hydro Knowledge | 01/01/2022-31/07/2023 | National Environment Research Council (NERC) | WAT | € 29,823 |
| | This project is collaboration with UK partners, with the aim to use the large-scale hydrological model in local case studies. | | | | |
| | ALFAwetlands | | | IBF | € 175,219 |

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| Wetland restoration for the future | | 01/06/2022-30/11/2026 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | AFE | € 408,843 |
| | Wetlands have enormous potential for carbon sequestration and adaptation, but gaps in knowledge limit their efficient use and options in the context of land-use (change) and forestry. ALFAwetlands aims to expand the geospatial knowledge base. Its co-creation approach envisions enabling the support of more inclusive and community-based approaches to restoring wetlands. | | | | |
| Navigating European Forests and forest bioeconomy sustainably to EU climate neutrality | ForestNavigator | 01/10/2022-30/09/2026 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | AFE<br>IBF<br>BEC | € 250,000<br>€ 981,799<br>€ 120,000 |
| | ForestNavigator aims at assessing the climate mitigation potential of European forests and forest-based sectors through modelling of policy pathways, consistent with the best standards of LULUCF reporting, and informing the public authorities on the most suitable approach to forest policy and bioeconomy. | | | | |
| Phase II Foodscapes Science Research Program | global_foodscapes | 01/05/2022-01/07/2023 | The Nature Conservancy | BEC<br>AFE | € 18,490<br>€ 54,210 |
| | A project to build a map of the world's diverse food production systems and their dependencies is helping form a better understanding of the crucial elements and necessary transformative actions that govern agricultural systems, now and in the future. | | | | |
| Water Scarcity Clock 2.0 | WSC 2.0 | 01/01/2022-31/07/2022 | World Data Lab | BEC | € 18,700 |
| | This project analysed global changes in extent of surface water ecosystems from 2000 to 2019 and extrapolated to 2030, as well as estimating the number of freshwater species in each hydrological basin vulnerable to water extraction | | | | |
| Giving Rural Actors Novel high-resolution data and Useable tools to Lead public Action in Rural areas | GRANULAR | 01/10/2022-30/09/2026 | European Commission, Research Executive Agency (REA) | IBF | € 80,000 |
| | GRANULAR generates new insights for characterising rural diversity based on a multi-actor and interdisciplinary approach. Based on insights from Multi-Actor Labs, it will generate novel datasets using a wide range of methods and primary data, such as remote sensing, crowd-sourced data, mobile phone data and web-scraping. | | | | |
| Designing a resilient and coherent Trans-European Network for Nature and People | NaturaConnect | 01/07/2022-30/06/2026 | European Commission, Research Executive Agency (REA) | BEC | € 1,524,375 |
| | The project provides data, knowledge and support tools to identify priority areas for establishing a coherent and resilient trans-european network of protected area and ecological corridors that support nature and human wellbeing | | | | |
| Water Resources System Safe Operating Space in a | SOS-WATER | 01/10/2022-30/09/2026 | European Commission, | WAT | € 908,750 |

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| Changing Climate and Society | | | Research Executive Agency (REA) | | |
| | SOS-Water is a EU-funded project, started in October 2022, which aims to define a safe operating space (SOS) for the water resources, accounting concurrently for all relevant water dimensions across multiple sectors and spatial scales under the influence of socio-economic, policy, technological, and climatic changes. https://sos-water.eu/ | | | | |
| LAnd use and MAnagement modelling for SUStainable governance | LAMASUS | 01/09/2022-31/08/2026 | European Commission, Research Executive Agency (REA) | AFE<br>BEC<br>IBF | € 119,352<br>€ 107,417<br>€ 1,033,500 |
| | Developing an integrated framework for eco. and env. modelling of LUM and carbon sequestration that shall enable ex-ante evaluation and monitoring of EU policies related to land use in agriculture and forestry under climate change. | | | | |
| Creating leverage to enhance biodiversity outcomes of global biomass trade | CLEVER | 01/09/2022-31/08/2025 | European Commission, Research Executive Agency (REA) | IBF<br>AFE | € 487,375<br>€ 102,000 |
| | CLEVER identifies new leverage points for sustainable transformation informed by a novel holistic approach to quantify biodiversity and other impacts of trade in major raw and processed non-food biomass value chains. In line with Pillars 3 & 4 of the EU Biodiversity Strategy 2030, we address all outcomes of this topic by adopting perspectives at the system and value chain levels. | | | | |
| Designing a Roadmap for Effective and Sustainable Strategies for Assessing and Addressing the Challenges of EU Agriculture to Navigate within a Safe and Just Operating Space | BrightSpace | 01/11/2022-31/10/2027 | European Commission, Research Executive Agency (REA) | AFE<br>BEC<br>IBF<br>WAT | € 100,000<br>€ 100,000<br>€ 550,000<br>€ 50,000 |
| | Aiming to design effective and sustainable strategies to navigate within a Safe and Just Operating Space (SJOS). BrightSpace provides an analytical toolbox to experiment, analyse, and coordinate the effects of innovative technologies, governance structures, as well as short- and long-term policies related to agriculture. | | | | |
| Integrated Future Wildfire Hot Spot Mapping for Austria | Austria Fire Futures | 15/09/2022-14/09/2025 | Austrian Climate Research Program (ACRP) | AFE | € 110,950 |
| | The Austria Fire Futures project will focus on domestic mountain-dominated forest systems and integrate novel insights on local fuel types into forest and forest fire risk models, including new variables such as morphology and recreational activities. | | | | |
| CSIRO-IRP Global Resource Outlook | IRP Global Resource Outlook | 01/07/2022-01/03/2023 | United Nations Environmental Programme (UNEP) | IBF | € 44,563 |
| | IIASA will contribute to the modelling work for the Global Resources Outlook 2023 for the International Resource Panel of the United Nations Environment Program (UNEP). IIASA will employ its Global Biosphere management Model (GLOBIOM) and will produce a baseline scenario including all 30 GLOBIOM regions. | | | | |
| Human-Tech nexus: Building a safe haven for | The HuT | 01/10/2022-30/09/2026 | European Commission, | AFE | € 132,500 |

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| coping with climate extremes | | | Research Executive Agency (REA) | | |
| | The HuT is an Innovation Action project funded by the Horizon Europe Framework Programme. The project addresses the distributive justice implications of extreme climate event impacts and aims at developing innovative and procedurally just Disaster Risk Reduction (DRR) solutions for dealing with extreme climate events. | | | | |
| Spatial Intelligence for Climate and Nature | SPACES | 01/01/2022-31/12/2022 | World Conservation Monitoring Centre (WCMC) | BEC | € 37,250 |
| | SPACES proposes a two-step process to build a global coalition to advance spatial intelligence for nature and climate working with governments, businesses, and data/technology providers. | | | | |
| Global Land Degradation Impacts on Biodiversity and Agriculture productivity | AgCLIM50 V | 12/08/2022-14/03/2023 | European Commission - Joint Research Centre | IBF | € 26,618 |
| | Co-ordinating update and extension of the global land-use model inputs across three different models (CAPRI, GLOBIOM, and MAGNET-IMAGE). For CAPRI and MAGNET this will mean a link to a gridded database (data harmonization). For GLOBIOM and IMAGE this project will improve the possibilities of comparing spatially explicit data and results. | | | | |
| Assessing the status of groundwater resources and exploring national water management options in Saudi Arabia | GW_KSA | 01/04/2022-31/10/2022 | King Abdullah University of Science and Technology | WAT | € 147,637 |
| | This project aimed to set up the CWatM model for a large aquifer system in Saudi Arabia to assess the impact of future changes on groundwtaer use and aquifer sustainability, and simulating water management options to improve aquifer sustainability under those scenarios. | | | | |
| World Energy Outlook 2022- Air Pollution and Emissions Analysis & Modelling - Lot 2 | WEO2022 - Lot 2 | 11/07/2022-30/06/2023 | International Energy Agency (IEA) | IBF | € 100,000 |
| | Support the IEA's WEO team by providing the absolute amounts of emissions of greenhouse gases including CO2, CH4 and N2O (GHGs) by GEC-M region for the STEPS, APS and NZE scenarios. These emissions must be specified by source for at least the following sectors: Agriculture and Forestry. | | | | |
| Co-produced transformative knowledge to accelerate change for biodiversity | RAINFOREST | 01/11/2022-01/11/2025 | European Commission, Research Executive Agency (REA) | IBF | € 326,563 |
| | Using a combination of integrated assessment modelling, input-output modelling and life cycle assessment, based on case studies addressing the nexus of agricultural production, processing and transport, retail, as well as consumer preferences and diets. The overall aim will be to contribute to reducing biodiversity impacts of major food and biomass value chains by developing and evaluating just and viable transformative change pathways and interventions. | | | | |
| Master Plan for Sustainable Agriculture in the Abu Dhabi Emirate | ADAPT | 01/10/2022-31/08/2023 | Food and Agriculture Organization of the United Nations | WAT | € 128,481 |
| | To develop a 'Master Plan for Sustainable Agriculture in the Abu Dhabi Emirate' (ADAPT), IIASA provides the 'Crop Suitability Mapping of Abu Dhabi' (multi-dimensional agricultural zonation; current and future crop suitability and attainable production potential, estimation of apparent production gaps), a key input to the Decision Support Tool (DST) of the Master Plan. | | | | |

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| ICAO_CLIMA_2022: Performing work on the modelling of induced land use change in the context of sustainable aviation fuels at ICAO | ICAO_CLIMA_2022 | 25/10/2022-31/12/2023 | European Commission DG Mobility and Transport | IBF | € 86,700 |
| | In order to understand the potential impacts of aviation biofuel development, AFTF European members, coordinated by the European Commission, IIASA will provide modelling using the GLOBIOM model thanks to ILUC modelling update and results analysis. | | | | |
| Long-term spillover impacts of financial markets on the environment | PVARGLOBIOM | 01/11/2022-31/10/2024 | Austrian National Bank, Anniversary Fund (OeNB) | IBF | € 164,915 |
| | Aiming to capture the medium to long-term spillover effects of financial markets and related stakeholders such as regulatory institutions on climate relevant emissions from land-use and changes to its pattern. These long-term impacts, in terms of emissions, had not been explored yet in a systematic global manner. | | | | |
| Technical support for coller fair climate risk tool version 3 | FAIRR | 17/11/2022-16/11/2023 | Jeremy Coller Foundation | IBF | € 25,000 |
| | Combination of expert support given by IIASA to FAIRR, in the areas of scenario creation & data and technical consultation for feedback and suggestions on FAIRR's model. It will provide other data linked to IIASA's GLOBIOM model or internal data sources, relevant for filling tool-related technical data gaps, for dairy, beef, poultry, and pork, for different geographies. | | | | |
| Mitigate+ Research for Low-Emission Food Systems | Mitigate+ | 01/01/2022-31/03/2023 | International Center for Tropical Agriculture (CIAT) | IBF | € 96,662 |
| | Building on its extensive experience in the use of modeling tools (especially GLOBIOM) for assessing mitigation-related policies, IIASA will contribute to framing the Mitigate+ frameworks and work plans under WPs 1 and 2 for Colombia and other selected Mitigate+ countries of focus in collaboration with CGIAR Centers and external partners. | | | | |
| Assessing DAC FuEl PotenTials 2 | ADEPT 2 | 01/10/2022-31/12/2023 | ClimateWorks Foundation | AFE | € 264,435 |
| | This project aims to improve and complement the existing ADEPT study (carried out by IIASA and EDF) by harmonizing existing analyses, improving the modeled DAC technologies, and expand the geographic scope of the assessment. It is intended to support policymaking in the United States, China, Europe and United Nations at a crucial moment for aviation. | | | | |
| Analysis and Economic Modeling and Clean Air Act Issues | EPA CCD FC 2020-2023 (Option Y2) | 19/05/2022-18/05/2023 | RTI International | IBF | € 22,533 |
| | To contribute to multi-model analyses of different socioeconomic drivers, bioenergy policies, GHG policies, and environmental change scenarios to compare model output and publish cross-model comparisons. Continued development of the Global Biosphere Management Model (GLOBIOM). | | | | |
| Role of drivers of emissions from agriculture and LULUCF sector in 2040 and beyond | SR7/LULUCF2040 | 26/07/2022-26/07/2023 | ICF Consulting Limited | IBF | € 142,056 |
| | Production of a set of modelling-based scenarios using GLOBIOM/G4M and GAINS models to analyse the impact of different newly implemented mitigation technologies and contrasted drivers on pathways for GHG mitigation of the AFOLU sector for EU member states. | | | | |
| Science-based silviculture: Ecophysiological | SILVICULT_2022 | 01/01/2022-31/12/2023 | Knut and Alice Wallenberg Foundation | AFE | € 160,743 |

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| modelling for process understanding and improved management (2022) | In the long-term collaboration Science-based silviculture, a key role is played by ecophysiological modeling project, which serves to (i) to explain empirical findings in terms of the underlying mechanisms and (ii) apply these mechanisms in prognostic models, used to evaluate future forest development and optimize forest management. The eco-physiological models will enable foresters to better account for the future consequences of climate change in the long-term adaptation of forest management. The modeling project is led by Oskar Franklin at IIASA and developed in close collaboration with the Co-PIs and the other project members at SLU. | | | | |
| Managing prOtective foreSt fAcIng clImate Change compound events | MOSAIC | 01/11/2022-31/10/2025 | Interreg Alpine Space | AFE | € 315,000 |
| | MOSAIC focuses on hazard-resilient and sustainable protective forest management coping with climate changes' multiple dimensions, which is essential for managing climate-related risks. In order to support regional and Alpine climate action plans, the project aims to collect, harmonize and share data, models on Alpine climate-related disasters and trends. The project partners strive to raise awareness among foresters, risk managers, decision makers and the public through an Alpine network of forest living labs. | | | | |
| Modelling of LULUCF emissions and sinks, and of related mitigation options for EU Member States, associated with a POTEnCIA decarbonisation scenario | POTEnCIA | 14/12/2022-13/09/2023 | Commission of the European Communites, Directorate General Joint Research Centre (JRC) | IBF | € 135,875 |
| | Supporting the POTEnCIA model with data and modelling results for the analysis of LULUCF GHG emissions. The main tasks are projection over time of LULUCF emissions, assessment of additional LULUCF emission reduction potential beyond the baseline scenario, development of marginal abatement cost curves, and Provision of sensitivity analyses. | | | | |
| Wind In My Backyard: Using holistic modelling tools to advance social awareness and engagement on large wind power installations in the EU | WIMBY | 01/01/2023-31/12/2025 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | BEC | € 206,250 |
| | The ambition of WIMBY is to deepen knowledge of the and barriers for social acceptance and develop guidelines to raise public understanding and engagement with wind power, especially with new generations of large wind power turbines and farms. | | | | |
| Observation-based approach for vErifYing Emissions of CLIMAte forcers | EYE-CLIMA | 01/01/2023-31/12/2026 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | AFE | € 210,000 |
| | EYE-CLIMA will support National Greenhouse Gas Inventories (NGHGIs), and thus the Paris Agreement, by developing independent observation-based methods for verifying emission estimates of greenhouse gases and the aerosol species, black carbon. Independent verification is much needed and is recognized by the IPCC in their 2019 refinement of the guidelines for NGHGIs. | | | | |

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| Innovative Toolbox empowering effective CAP governance towards EU ambitions | Tools4CAP | 01/03/2023-01/03/2027 | European Commission, Research Executive Agency (REA) | IBF | € 253,312 |
| | Providing a set of methods and tools based on a sound combination of quantitative and qualitative solutions, and the operational capacity, to support policymakers in CAP-governance towards the green transition. IIASA develops a case study with GLOBIOM to support the development of the next CAP strategic plan of the Czech Republic within the Eu Green Deal set-up. | | | | |
| INSPIRE: INtegrated Spatial PlannIng across REalms for biodiversity and human development in a context of change | INSPIRE | 01/04/2023-31/03/2026 | Austrian Science Fund (FWF) | BEC | € 158,452 |
| | The general research question addressed by INSPIRE is how to increase effectiveness of conservation efforts, tackling some of the problems identified in past assessments, from a systematic planning perspective. | | | | |
| Machine-learning crop meta-models for climate adaptation | MACROS | 01/03/2023-01/03/2025 | Austrian Science Fund (FWF) | AFE | € 356,554 |
| | Global gridded crop models (GGCMs) are key tools in agricultural climate change impact assessments. The range of scenarios that can be considered in their application is limited by high computational demand and availability of suitable input data, resulting in narrow boundary conditions and limited comparability of global and regional assessments. Pixel-based crop model emulators can partly overcome these limitations, but have little or no flexibility with respect to spatial scales and crop management. Machine-learning algorithms were recently found highly suitable to downscale GGCM outputs. Advancing this methodology as proposed herein bears potential to provide accurate predictions across a wealth of climate change projections, management trajectories, and spatial scales by training comprehensive machine-learning crop meta-models (MLCMs).<br>The project will address three research questions and associated objectives:<br>1) How reliable are MLCMs with increasing dimensionality and ranges of training data?<br>2) How does the fusion of crop model estimates and observed agronomic data improve or limit the performance of MLCMs?<br>3) How do large ensembles of climate projections and an extensive option space of management adaptation inform on effectiveness and robustness of climate adaptation in cropping systems across scales and time? | | | | |
| Accelerating collection and use of soil health information using AI technology to support the Soil Deal for Europe and EU Soil Observatory | AI4SoilHealth | 01/01/2023-31/12/2026 | European Commission, DG European Research Council Executive Agency (ERCEA) | AFE | € 449,423 |
| | The AI4SoilHealth project aims to create a digital platform using artificial intelligence (AI) to provide a comprehensive assessment of soil health across Europe and support the European Commission's objective of transitioning towards healthy soils by 2030. | | | | |
| Switching european food systems for a just, healthy and sustainable dietary | SWITCH | 01/01/2023-31/12/2026 | European Commission, Research Executive Agency (REA) | AFE<br>IBF | € 170,000<br>€ 430,000 |

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| transition through knowledge and innovation | Improving understanding of knowledge, accessibility and facilitation gaps that limit present large-scale adoption of sustainable and healthy diets among European citizens and to develop and demonstrate appropriate innovative solutions and tools to facilitate a just transition towards healthy and sustainable dietary behavior at all levels of the multi-actor food system in EU. | | | | |
| Support to BASF on biomass availability for Northern America | BASF_USA | 19/01/2023-18/04/2023 | BASF SE | IBF | € 30,000 |
| | Defining biomass availability for the Unites States and Canada (separated by biomass source) from 2020 until 2050 as estimated by the GLOBIOM model. Estimates follow "low", "business as usual" and "high, strong legislative requirements to use biobased raw materials" scenarios. | | | | |
| Modelling the future of sustainable oil crop feedstock production | SusOilCrop | 08/02/2023-31/12/2023 | Roundtable on Sustainable Biomaterials Association (RSB) | WAT | € 78,624 |
| | The project investigates the potential for sustainable oil crop production using the principles of the Roundtable on Sustainable Biomaterials (RSB). Selected oil crops and regions include i) coconut (as single crop and in two intercropping systems) in Southeast Asia and tropical regions of Latin America and ii) carinata as winter cover crop in Europe, South and North America. | | | | |
| European Topic Centre for Biodiversity and Ecosystem | ETC-BE | 15/11/2022-15/11/2026 | European Environment Agency | IBF<br>BEC | € 26,784<br>€ 127,120 |
| | The European Topic Centre Biodiversity and Ecosystems (ETC BE) supports European Environment Agency (EEA) with the implementation of the range of EU directives, strategies and policies constituting the environmental acquis, including integrated systemic assessments of terrestrial, freshwater and marine ecosystems focusing on effects under climate change and to mitigate climate change, on cumulative drivers and pressures on these ecosystems, as well as socio-economic implications of solutions. | | | | |
| Robust Food Supply Chains in Austria | ROBVEK | 01/01/2023-15/06/2023 | Federal Ministry of Agriculture, Forestry, Regions and Water Management | AFE | € 20,150 |
| | The reliable supply of affordable, high-quality food is one of the greatest successes of a social market economy based on the division of labour, innovation, competition and entrepreneurship. In the research project presented, the robustness of the food supply in Austria is to be examined with a view to current market developments. The quantitative supply, the affordability of goods and the aspects of supply security, have been examined along the value chain. | | | | |
| Development and verification of model systems of long-term carbon sequestration in the Czech Republic | Sequestration - CZ | 01/05/2023-30/11/2025 | Ministry of Agriculture of the Czech Republic | AFE | € 90,000 |
| | The project reflects the call of the Ministry of Agriculture of the Czech Republic to create conceptual and legislative documents, schemes and manuals for the national implementation of carbon agriculture, in order to define procedures for the binding, long-term storage and reporting of carbon in agricultural land. Project is aimed to design model systems of long-term carbon sequestration from greenhouse gases in agricultural land. The systems will be regionally specific and applicable to enterprises with different structure of the agricultural system, while they will be practically usable for at least 25 % of Czech agricultural enterprises. Within the | | | | |

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| | project the effectiveness of model systems will be predicted using a regional simulation model EPIC-IIASA Cz for scenarios of future climate development. | | | | |
| EU Climate Dialogues | EUCDs/SPIPA | 22/05/2023-30/06/2024 | Deutsche Gesellschaft fuer International Zusammenarbeit (GIZ) GmbH | IBF | € 23,450 |
| | Aiming to support technical exchange on the development and implementation of strategies, policies and measures in India for transition to climate neutrality by exchange of best practices and know-how on greenhouse gas (GHG) emissions modelling between Indian and EU modellers working closely with government. | | | | |
| Transformations, Resilience, and Adaptation to Climate Change in Europe | SPARCCLE | 01/09/2023-28/02/2027 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | IBF | € 150,250 |
| | SPARCCLE is a research project dedicated to understanding the risks of climate change to the society and economy of Europe. The project will support people, organizations and government to make better decisions to reduce risks and build resilience to climate change. | | | | |
| Assessing Climate Change Risk in EUrope | ACCREU | 01/06/2023-30/11/2026 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | IBF | € 207,750 |
| | | | | BEC | € 140,950 |
| | | | | WAT | € 105,050 |
| | Contributing to the just transition towards climate resilience in the EU, its Member States, and regions, by co-creating and co-delivering with a wide array of stakeholders, new knowledge and actionable insights that connect the challenges of adaptation and mitigation with the multiple and new challenges our society is facing. | | | | |
| Digital platform for hydro-economic basin modelling for water policy and climate change analysis (Plataforma digital de modelización hidro-económica de cuencas para el análisis de políticas de agua y cambio climático) | e-MOHICAN | 01/01/2023-31/08/2024 | Spanish Ministry of Science and Innovation | WAT | € 20,000 |
| | This project aims to develop a digital platform for hydro-economic modeling of river basins to analyze water and climate change policies. | | | | |
| Groundwater for Deep Reslience in Africa (G4DR) (Pre-project phase) | G4DR_PreProject | 01/04/2023-15/06/2023 | International Water Management Institute (IWMI) | WAT | € 16,500 |
| | This pre-project aimed at supproting the preparation of the project document of the G4DR project aiming at looking at the potential of groundwater resources to enhance resilience and water security in Africa. | | | | |
| Bridging current knowledge gaps to enable the UPTAKE of carbon dioxide removal methods | UPTAKE | 01/09/2023-31/08/2027 | European Commission, European Climate, Infrastructure and | IBF | € 97,813 |
| | | | | AFE | € 97,813 |

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| | | | Environment Executive Agency (CINEA) | | |
| | UPTAKE aims to develop resilient CDR strategies based on strengthened scientific evidence on the social, technological, economic, and environmental characteristics of CDR technologies and their interplay. IIASA is providing the MESSAGEix-GLOBIOM framework and it will host the Scenario Explorer for all pathway-related data products of the UPTAKE project. | | | | |
| World Energy Outlook 2023- Air Pollution and Emissions Analysis & Modelling | WEO2023 - Lot 2 | 23/06/2023-23/05/2024 | Organisation for Economic Co-operation and Development (OECD) | IBF | € 100,000 |
| | Support the IEA's WEO team by providing the absolute amounts of emissions of greenhouse gases including CO2, CH4 and N2O (GHGs) by GEC-M region for the STEPS, APS and NZE scenarios. These emissions must be specified by source for at least the following sectors: Agriculture and Forestry. | | | | |
| "Global Agro-Ecological Zoning data version 5 datasets and model documentation" | GAEZ v5 data portal | 01/09/2023-31/05/2024 | Food and Agriculture Organization of the United Nations (FAO) | WAT | € 56,201 |
| | Update of Global Agro-Ecological Zones (GAEZ) to version 5 including input of novel land use data, Harmonized World Soil Data (HWSDv2), and climate model results of the CMIP6 experiments. Further, the project supports the development of PyAEZ, and develops National/Sub-national AEZ assessments for Tunisia, Mozambique and Pakistan. | | | | |
| BioFlex: Integrative energy infrastructure planning tool for cross-sector resilience and flexibility concepts | BioFlex | 01/12/2023-30/11/2024 | Austrian Research Promotion Agency (FFG) | AFE | € 59,992 |
| | The BioFlex exploratory project serves to prepare research, development and innovation projects that aim to proactively avoid future risks of climate change on the energy infrastructure as far as possible and to exploit opportunities that arise. Opportunities arise primarily from the joint planning of measures to increase infrastructure resilience in relation to extreme weather events and measures to increase flexibility in relation to regular fluctuations. Additional opportunities arise from strategic coupling between infrastructure systems to compensate for bottlenecks and deficits through the targeted transformation of different resources. | | | | |
| Mainstreaming Integrated Assessment Models by embedding behavioural change and actor heterogeneity, and increasing their outreach to citizens, communities and industrial actors | CHOICE | 01/11/2023-31/10/2026 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | IBF | € 617,000 |
| | Mitigation options traditionally focused on in Integrated Assessment Models (IAMs) pay less attention to the demand-side and food system representation, due to the inherent complexity and actor heterogeneity. The IAM-generated impacts from highly influential 1.5oC-compatible mitigation actions shall highlight, besides emissions, the co-benefits of their changes in behaviour or practice in terms of health, biodiversity and food security aspects, in familiar scales. | | | | |
| Support to BASF on global biomass availability | BASF_GLOBAL | 06/11/2023-06/09/2024 | BASF SE | IBF | € 70,000 |
| | Evaluating the global potential supply and demand of renewable raw material using the GLOBIOM model. Employing this economic model to simulate potential biomass | | | | |

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| | supply response to market demands, the project evaluates potential availability and demand of biomass feedstocks 2020-2050. | | | | |
| Coupling of AEZ and CWatM models that will support FAO's understanding of sustainable crop and irrigation patterns under extreme climate conditions | CWatM-PyAEZ | 21/12/2023-21/06/2024 | Food and Agriculture Organization of the United Nations (FAO) | WAT | € 48,636 |
| | This project funded by FAO aimed at linking CWatM with the newly developed Py-AEZ model to assess the impact of sustainable agricultural water management under extreme climate conditions. | | | | |
| Advanced ensemble projections for indirect impacts of nuclear winter in global food systems | ANFOS | 01/09/2023-01/09/2026 | Future of Life Institute | AFE | € 421,602 |
| | ANFOS leads a community effort of global crop modelers to develop new projections of potential impacts of a nuclear winter on global food production. These will be combined with scenarios of supply chain disruptions to develop a comprehensive picture of potential impacts on global food security. | | | | |
| A water-energy-food nexus assessment of climate change impacts on biomass and hydropower resources | WATNEX | 01/08/2021-31/07/2025 | The Research Council of Norway | WAT | € 118,932 |
| | WatNEX aims to develop methods to assess impacts of climate change on water resources in river basins by jointly considering energy and biomass sectors. | | | | |
| Development of a Harmonized Water Balance Modelling System for the Danube River Basin | considering energy and biomass sectors. | 01/01/2024-30/06/2026 | Interreg Programme Danube Region co-funded by the European Commission | WAT | € 450,911 |
| | The Danube Water Balance project aims to contribute to the sustainable, integrated and transnational water management in the Danube River Basin (DRB) ensuring good quantity of waters. The overall objective of the project is to develop a harmonized water balance modelling system in the DRB. | | | | |
| iMproving the cOpeRnicus Flood forecast with Earth Observations in data scarce areas | water management in the Danube River Basin (DRB) ensuring good quantity of waters. | 01/01/2024-31/12/2026 | European Commission,European Health And Digital Executive Agency (HADEA) | WAT | € 391,815 |
| | SEED-FD aims to improve the quality and portfolio of CEMS flood and droughts forecasts by capitalising on the yet untapped potential offered by Copernicus Space data and enhancing its hydrological modelling performance. | | | | |
| Advancing analytical capacity and tools to support EU agri-food policies post 2027 | DRB. | 01/03/2024-28/02/2029 | European Commission, European Research Council Executive Agency (ERCEA) | IBF | € 650,000 |
| | | | | WAT | € 200,000 |
| | ACT4CAP27 responses to this challenge by enhancing the analytical capacity of the key policy tools (CAPRI,GLOBIOM,MAGNET,AGMEMOD) used by the European Commission to assess short-term and long-term policy impacts on EU's agri-food systems and providing evidence-based knowledge supporting analysis for the design of agri-food policies post 2027. | | | | |
| Alliance for Modelling Industries Towards The | AMIGDALA | 01/01/2024-31/12/2027 | European Commission, European Health And | IBF | € 419,531 |

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| Green Deal's Objectives and Circularity | | | Digital Executive Agency (HADEA) | | |
| | Facilitating decision makers in governments and EU's industries to define and evaluate pathways towards climate neutrality, circularity and sustainability. In this project we combine insights in decision-making with integrated modelling of scenarios to analyze transformation pathways. | | | | |
| Farm Energy Transition | AgEnRes | 01/01/2024-31/12/2027 | European Commission, Research Executive Agency (REA) | IBF | € 497,250 |
| | Designing sustainable pathways for policy making to reduce direct and indirect dependence of farmers and the agricultural sector on fossil fuels and fertilisers, and increase the resilience to volatile energy prices, considering farmers' behaviour and the synergies and trade-offs between European economic and environmental objectives at micro- and macro-level. | | | | |
| European Topic Centre on Biodiversity and Ecosystems 2024 | ETC BE 2024 | 01/01/2024-31/12/2024 | European Environment Agency | BEC | € 73,795 |
| | The European Topic Centre Biodiversity and Ecosystems (ETC BE) supports European Environment Agency (EEA) with the implementation of the range of EU directives, strategies and policies constituting the environmental acquis, including integrated systemic assessments of terrestrial, freshwater and marine ecosystems focusing on effects under climate change and to mitigate climate change, on cumulative drivers and pressures on these ecosystems, as well as socio-economic implications of solutions. | | | | |
| Science-based silviculture: Ecophysiological modelling for process understanding and improved management (2024) | Silvicult_2024 | 01/01/2024-31/12/2024 | Knut and Alice Wallenberg Foundation | AFE | € 68,290 |
| | In the long-term collaboration Science-based silviculture, a key role is played by ecophysiological modeling project, which serves to (i) to explain empirical findings in terms of the underlying mechanisms and (ii) apply these mechanisms in prognostic models, used to evaluate future forest development and optimize forest management. The eco-physiological models will enable foresters to better account for the future consequences of climate change in the long-term adaptation of forest management. The modeling project is led by Oskar Franklin at IIASA and developed in close collaboration with the Co-PIs and the other project members at SLU. | | | | |
| EU GHG modelling for beyond 2030 | EUCLIMIT 7 | 30/10/2023-14/11/2025 | European Commission, DG Climate Action | IBF | € 189,536 |
| | Development and application of EU economy-wide climate change mitigation modelling capacity. Objective is to perform model-based scenario quantification that supports the European Commission in impact assessments and analyzing policies for the Climate and Energy package and climate-relevant policies in the EU. IIASA provides modelling tools to assess the impact of policies on emissions/removals and mitigation from the land use, land use LULUCF sector including leakage effects outside Europe. | | | | |
| Building Roadmaps to Industrial Decarbonisation and Green Economy through Sino-European cooperation | EU-CHINA-BRIDGE | 01/04/2024-31/03/2027 | European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA) | IBF | € 342,907 |

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| | Supporting transition to a climate-neutral and resilient society in both Europe and China by jointly advancing knowledge on technology innovations and roadmaps for decarbonising energy intensive industries, co-creating innovative bottom-up and integrated assessment modelling to quantify net-zero sustainable pathways, and develop updated and comprehensive emissions data. | | | | |
| Contract to perform work on the modelling of induced land use change in the context of sustainable aviation fuels at ICAO | ICAO_CLIMA_2023 | 01/01/2024-30/12/2024 | European Commission DG Mobility and Transport | IBF | € 89,020 |
| | In order to understand the potential impacts of aviation biofuel development, AFTF European members, coordinated by the European Commission, IIASA will provide modelling using the GLOBIOM model thanks to ILUC modelling update and results analysis. | | | | |
| Modeling Climate Policy Implementation and Development in the Agriculture and LULUCF Sector Under Framework contract CLIMA.A4/FRA/2019/0011 | AFOLU Modelling 2023 | 08/03/2024-30/12/2024 | European Commission, DG Climate Action | IBF | € 114,345 |
| | Expanding the two existing (and in previous projects interlinked) models, CAPRI and GLOBIOM/G4M, to then provide an analysis of trends in the EU AFOLU sectors, aiming to improve DG CLIMA's ability to capture new relevant legislative and economic developments. | | | | |
| Analytical capacity for international climate action (renewable | PBL Clima 7 | 01/05/2024-31/12/2025 | European Commission, DG Climate Action | IBF | € 76,750 |
| | To inform the EU's policies on climate change, as well as outreach to 3rd countries and international climate negotiations, IIASA provides the contracting authority with access to state-of-the-art analytical capacity, quantitative analysis and model-derived scenarios on global climate change mitigation action. | | | | |

# Annex B: Complete list of publications BNR

## Peer-reviewed publications

### Journal articles


1. **Tiwari, S.**, Singh, J.G., & Garg, A. (2024). **A static robust energy management approach for modelling low emission multi-vectored energy hub including emission markets and power-to-gas units.** *Energy* 294 e130827. **10.1016/j.energy.2024.130827**.
2. **Wang, X**., Wang, S., **Folberth, C.**, **Skalský, R.,** Li, H., Liu, Y., & **Balkovič, J.** (2024). ***Limiting global warming to 2 °C benefits building climate resilience in rice-wheat systems in India through crop calendar management.*** *Agricultural Systems* 213 e103806. **10.1016/j.agsy.2023.103806**.
3. **Skalský, R.,** Barančíková, G., Makovníková, J., Koco, Š., Halas, J., & Kobza, J. (2024). **Regional topsoil organic carbon content in the agricultural soils of Slovakia and its drivers, as revealed by the most recent national soil monitoring data**. *Environmental Challenges* 14 **e100816. 10.1016/j.envc.2023.100816**.
4. **Awais, M.**, **Vinca, A., Byers, E.**, **Frank, S., Fricko, O.**, **Boere, E., Burek, P.**, **Poblete Cazenave, M.**, et al. (2024). **MESSAGEix-GLOBIOM nexus module: integrating water sector and climate impacts**. *Geoscientific Model Development* 17 (6) 2447-2469. **10.5194/gmd-17-2447-2024**.
5. **Nkwasa, A.,** Getachew, R.E., Lekarkar, K., Yimer, E.A., Martínez, A.B., Tang, T., & van Griensven, A. (2024). **Can Turbidity Data from Remote Sensing Explain Modelled Spatial and Temporal Sediment Loading Patterns? An Application in the Lake Tana Basin**. *Environmental Modeling & Assessment* **10.1007/s10666-024-09972-y**.
6. Haddad, S., **Escobar Lanzuela, N.** , Bruckner, M., & Britz, W. (2024). **Subsidizing extensive cattle production in the European Union has major implications for global agricultural trade and climate change.** *Journal of Cleaner Production* 448 e141074. **10.1016/j.jclepro.2024.141074**.
7. Bhalla, S., Baggio, J.A., **Sahu, R.K.** , **Kahil, T.** , Tarhouni, J., Brini, R., & **Wildemeersch, M.** (2024). **The role of interacting social and institutional norms in stressed groundwater systems.** *Journal of Environmental Management* 356 e120389. **10.1016/j.jenvman.2024.120389**.
8. Mandal, S., Mondal, C., **Ghosh, S.**, Saha, S., Ray, M.S., & Lyndem, L.M. (2024). **Efficacy of Lactobacillus taiwanensis S29 and Lactiplantibacillus plantarum S27 against tapeworm Artificial Intelligence, Machine Learning, and Intelligent Decision infection in Swiss Albino rats.** *Experimental Parasitology* 259 e108715. **10.1016/j.exppara.2024.108715**.
9. **O'Connor, L.**, Cosentino, F., Harfoot, M., Maiorano, L., Mancino, C., Pollock, L., & Thuiller, W. (2024). **Vulnerability of terrestrial vertebrate food webs to anthropogenic threats in Europe.** *Global Change Biology* 30 (3) e17253. **10.1111/gcb.17253**.
10. Hackländer, J., Parente, L., Ho, Y.-F., Hengl, T., Simoes, R., Consoli, D., Şahin, M., Tian, X., **Jung, M.**, Herold, M., Duveiller, G., Weynants, M., & Wheeler, I. (2024). **Land potential assessment and trend-analysis using 2000–2021 FAPAR monthly time-series at 250 m spatial resolution.** *PeerJ* 12 e16972. **10.7717/peerj.16972**.
11. Müller, C., Jägermeyr, J., Franke, J.A., Ruane, A.C., **Balkovič, J.** , Ciais, P., Dury, M., Falloon, P., **Folberth, C.** , Hank, T., Hoffmann, M., Izaurralde, R.C., Jacquemin, I., **Khabarov, N.** , Liu, W., Olin, S., Pugh, T.A.M., Wang, X., Williams, K., Zabel, F., & Elliott, J.W. (2024). **Substantial Differences in Crop Yield Sensitivities Between Models Call for Functionality-Based Model Evaluation.** *Earth's Future* 12 (3) e2023EF003773. **10.1029/2023EF003773**.
12. **Folberth, C.** , Wood, S., Wironen, M., **Jung, M.**, Boucher, T., Bossio, D., & **Obersteiner, M.** (2024). **Exploring the potential for nitrogen fertilizer use mitigation with bundles of management interventions.** *Environmental Research Letters* 19 (4) e044027. **10.1088/1748-9326/ad31d8**.
13. Burian, A., Kremen, C., Wu, J.S.-T., Beckmann, M., Bulling, M., Garibaldi, L.A., **Krisztin, T.** , Mehrabi, Z., Ramankutty, N., & Seppelt, R. (2024). **Biodiversity–production feedback effects lead to**

**intensification traps in agricultural landscapes.** *Nature Ecology & Evolution* **10.1038/s41559-024-02349-0**. (In Press)

14. **Hesselbarth, M.** & Wiegand, K. (2024). **A simulation study comparing common methods for analyzing species–habitat associations of plants.** *Journal of Vegetation Science* 35 (2) e13243. **10.1111/jvs.13243**.
15. Yang, H., Wang, S., Son, R., Lee, H., Benson, V., Zhang, W., Zhang, Y., Zhang, Y., Kattge, J., Boenisch, G., **Shchepashchenko, D.** , Karaszewski, Z., Stereńczak, K., Moreno-Martínez, Á., Nabais, C., Birnbaum, P., Vieilledent, G., Weber, U., & Carvalhais, N. (2024). **Global patterns of tree wood density.** *Global Change Biology* 30 (3) e17224. **10.1111/gcb.17224**.
16. **Nkwasa, A.**, Chawanda, C., Schlemm, A., Ekolu, J., Frieler, K., & van Griensven, A. (2024). **Historical climate impact attribution of changes in river flow and sediment loads at selected gauging stations in the Nile basin.** *Climatic Change* 177 (3) e42. **10.1007/s10584-024-03702-9**.
17. **Avidar, O.** (2024). **A holistic framework for evaluating and planning sustainable rural drinking water projects in sub-Saharan Africa.** *Journal of Rural Studies* 107 e103243. **10.1016/j.jrurstud.2024.103243**.
18. **Nakhavali, A.**, Lauerwald, R., Regnier, P., & Friedlingstein, P. (2024). **Historical trends and drivers of the laterally transported terrestrial dissolved organic carbon to river systems.** *Science of the Total Environment* 917 e170560. **10.1016/j.scitotenv.2024.170560**.
19. **Derci Augustynczik, A.L.**, **Gusti, M.**, **Di Fulvio, F.** , **Lauri, P.**, **Forsell, N.**, & **Havlik, P.** (2024). **Modelling the effects of climate and management on the distribution of deadwood in European forests.** *Journal of Environmental Management* 354 e120382. **10.1016/j.jenvman.2024.120382**.
20. Lewis, C.H.M., Little, K., **Graham, L.**, Kettridge, N., & Ivison, K. (2024). **Diurnal fuel moisture content variations of live and dead Calluna vegetation in a temperate peatland.** *Scientific Reports* 14 (1) **10.1038/s41598-024-55322-z**.
21. Matsala, M., Odruzhenko, A., Hinchuk, T., Myroniuk, V., Drobyshev, I., Sydorenko, S., Zibtsev, S., Milakovsky, B., **Shchepashchenko, D.** , **Kraxner, F.**, & Bilous, A. (2024). **War drives forest fire risks and highlights the need for more ecologically-sound forest management in post-war Ukraine.** *Scientific Reports* 14 (1) e4131. **10.1038/s41598-024-54811-5**.
22. **Jung, M.**, Boucher, T.M., Wood, S.A., **Folberth, C.** , Wironen, M., Thornton, P., Bossio, D., & **Obersteiner, M.** (2024). **A global clustering of terrestrial food production systems.** *PLoS ONE* 19 (2) e0296846. **10.1371/journal.pone.0296846**.
23. **Hunt, J.** , Jurasz, J., **Zakeri, B.** , Tong, W., Nascimento, A., **Guo, F.** , Đurin, B., Dąbek, P., **Wada, Y.** , **van Ruijven, B.** , & **Riahi, K.** (2024). **Electric truck gravity energy storage: An alternative to seasonal energy storage.** *Energy Storage* 6 (1) e575. **10.1002/est2.575**.
24. Bouchard, E., Searle, E.B., Drapeau, P., Liang, J., Gamarra, J.G.P., Abegg, M., Alberti, G., Zambrano, A.A., Alvarez-Davila, E., Alves, L.F., Avitabile, V., Aymard, G., Bastin, J.-F., Birnbaum, P., Bongers, F., Bouriaud, O., Brancalion, P., Broadbent, E., Bussotti, F., Gatti, R.C., Češljar, G., Chisholm, C., Cienciala, E., Clark, C. J., Corral-Rivas, J.J., Crowther, T.W., Dayanandan, S., Decuyper, M., de Gasper, A.L., de-Miguel, S., Derroire, G., DeVries, B., Djordjević, I., Van Do, T., Dolezal, J., Fayle, T.M., Fridman, J., Frizzera, L., Gianelle, D., Hemp, A., Hérault, B., Herold, M., Imai, N., Jagodziński, A.M., Jaroszewicz, B., Jucker, T., Kepfer-Rojas, S., Keppel, G., Khan, M.L., Kim, H..S., Korjus, H., **Kraxner, Fl.**, Laarmann, D., Lewis, S., Lu, H., Maitner, B.S., Marcon, E., Marshall, A.R., Mukul, S.A., Nabuurs, G.-J., Nava-Miranda, M.G., Parfenova, E.I., Park, M., Peri, P.L., Pfautsch, S., Phillips, O.L., Piedade, M.T.F., Piotto, D., Poulsen, J.R., Poulsen, A.D., Pretzsch, H., Reich, P.B., Rodeghiero, M., Rolim, S., Rovero, F., Saikia, P., Salas-Eljatib, C., Schall, P., **Shchepashchenko, D.** , Schöngart, J., Šebeň, V., Sist, P., Slik, F., Souza, A.F., Stereńczak, K., Svoboda, M., Tchebakova, N.M., ter Steege, H., Tikhonova, E.V., Usoltsev, V.A., Valladares, F., Viana, H., Vibrans, A.C., Wang, H.-F.., Westerlund, B., Wiser, S.K., Wittmann, F., Wortel, V., Zawiła-Niedźwiecki, T., Zhou, M., Zhu, Z.-X., Zo-Bi, I.C., & Paquette, A. (2024). **Global patterns and environmental drivers of forest functional composition.** *Global Ecology and Biogeography* 33 (2) 303-324. **10.1111/geb.13790**.

25. **Smilovic, M.** , **Burek, P.** , **Fridman, D.** , Guillaumot, L., **de Bruijn, J.** , Greve, P., **Wada, Y.** , **Tang, T.** , Kronfuss, M., Hanus, S., **Tramberend, S.** , & **Kahil, T.** (2024). **Water circles—a tool to assess and communicate the water cycle.** *Environmental Research Letters* 19 (2) e021003. **10.1088/1748-9326/ad18de**.
26. **Di Fulvio, F.** , Acuna, M., Ackerman, P.., Ackerman, S., Spinelli, R., Abbas, D., Kaakkurivaara, N., Sánchez-García, S., & Guerra, S.P.S. (2024). **Benchmarking operational conditions, productivity, and costs of harvesting from industrial plantations in different global regions.** *International Journal of Forest Engineering* 1-26. **10.1080/14942119.2023.2296789**.
27. Lu, H., Wang, X., Zhang, H., Xie, X., **Nakhavali, A.**, Quine, T.A., Xu, W., Xia, J., He, B., Hao, Z., Geng, X., & Yuan, W. (2024). **Soil Organic Carbon Lateral Movement Processes Integrated Into a Terrestrial Ecosystem Model.** *Journal of Advances in Modeling Earth Systems* 16 (1) e2023MS003916. **10.1029/2023MS003916**.
28. Henry, E.G., Santini, L., Butchart, S.H.M., González-Suárez, M., Lucas, P.M., Benítez-López, A., Mancini, G., **Jung, M.**, Cardoso, P., Zizka, A., Meyer, C., Akçakaya, H.R., Berryman, A.J., Cazalis, V., & Di Marco, M. (2024). **Modelling the probability of meeting IUCN Red List criteria to support reassessments.** *Global Change Biology* 30 (1) e17119. **10.1111/gcb.17119**.
29. Saed, B., **Elshorbagy, A.**, & Razavi, S. (2024). **Quantifying interactions in the water-energy-food nexus: data-driven analysis utilizing a causal inference method.** *Frontiers in Environmental Science* 11 **10.3389/fenvs.2023.1328009**.
30. **Burek, P.** & **Smilovic, M.** (2023). **The use of GRDC gauging stations for calibrating large-scale hydrological models.** *Earth System Science Data* 15 (12) 5617-5629. **10.5194/essd-15-5617-2023**.
31. Dou, Y., Zagaria, C., **O'Connor, L.**, Thuiller, W., & Verburg, P.H. (2023). **Using the Nature Futures Framework as a lens for developing plural land use scenarios for Europe for 2050.** *Global Environmental Change* 83 e102766. **10.1016/j.gloenvcha.2023.102766**.
32. Gvein, M.H., Hu, X., Næss, J.S., Watanabe, M.D.B., Cavalett, O., Malbranque, M., **Kindermann, G.** , & Cherubini, F. (2023). **Potential of land-based climate change mitigation strategies on abandoned cropland.** *Communications Earth & Environment* 4 (1) e39. **10.1038/s43247-023-00696-7**.
33. Jones, C.D., Ziehn, T., Anand, J., Bastos, A., Burke, E., Canadell, J.G., Cardoso, M., Ernst, Y., Jain, A.K., Jeong, S., Keller, E.D., Kondo, M., Lauerwald, R., Lin, T.-S., Murray-Tortarolo, G., Nabuurs, G.-J., O'Sullivan, M., Poulter, B., Qin, X., von Randow, C., Sanches, M., **Shchepashchenko, D.** , **Shvidenko, A.**, Smallman, T.L., Tian, H., Villalobos, Y., Wang, X., & Yun, J. (2023). **RECCAP2 Future Component: Consistency and Potential for Regional Assessment to Constrain Global Projections.** *AGU Advances* 4 (6) e2023AV001024. **10.1029/2023AV001024**.
34. Martins, N.P., Valverde-Barrantes, O., Fuchslueger, L., Lugli, L.F., Grandis, A., **Hofhansl, F.** , Takeshi, B., Ushida, G., & Quesada, C.A. (2023). **Fine root presence and increased phosphorus availability stimulate wood decay in a central Amazonian rainforest.** *Oikos* 2 e09996. **10.1111/oik.09996**.
35. Toraño Caicoya, A., Vergarechea, M., Blattert, C., Klein, J., Eyvindson, K., Burgas, D., Snäll, T., Mönkkönen, M., Astrup, R., **Di Fulvio, F.** , **Forsell, N.**, Hartikainen, M., Uhl, E., Poschenrieder, W., & Antón-Fernández, C. (2023). **What drives forest multifunctionality in central and northern Europe? Exploring the interplay of management, climate, and policies.** *Ecosystem Services* 64 e101575. **10.1016/j.ecoser.2023.101575**.
36. **Yuwono, B.**, **Yowargana, P.**, Fuss, S., Griscom, B.W., Smith, P., & **Kraxner, F.** (2023). **Doing burden-sharing right to deliver natural climate solutions for carbon dioxide removal.** *Nature-Based Solutions* 3 e100048. **10.1016/j.nbsj.2022.100048**.
37. Gnann, S., Reinecke, R., Stein, L., **Wada, Y.** , Thiery, W., Müller Schmied, H., Satoh, Y., Pokhrel, Y., Ostberg, S., Koutroulis, A., Hanasaki, N., Grillakis, M., Gosling, S. N., **Burek, P.** , Bierkens, M.F.P., & Wagener, T. (2023). **Functional relationships reveal differences in the water cycle representation of global water models.** *Nature Water* 1 1079-1090. **10.1038/s44221-023-00160-y**.

38. **Gidden, M.** , **Gasser, T.** , Grassi, G., **Forsell, N.**, **Janssens, I.**, Lamb, W., Minx, J., **Nicholls, Z.** , **Steinhauser, J.** , & **Riahi, K.** (2023). **Aligning climate scenarios to emissions inventories shifts global benchmarks.** *Nature* 624 102-108. **10.1038/s41586-023-06724-y**.
39. Gaüzère, Pierre, Botella, Christophe, Poggiato, Giovanni, O'Connor, Louise, Di Marco, Moreno, Dragonetti, Chiara, Maiorano, Luigi, Renaud, Julien, & Thuiller, Wilfried (2023). **Dissimilarity of vertebrate trophic interactions reveals spatial uniqueness but functional redundancy across Europe.** *Current Biology* 33 (23) 5263-\-5271.e3. **10.1016/j.cub.2023.10.069**.
40. Mo, L., Zohner, C., Reich, P., Liang, J., de Miguel, S., Nabuurs, G., Renner, S., van den Hoogen, J., Araza, A., Herold, M., Mirzagholi, L., Ma, H., Averill, C., Phillips, O., Gamarra, J., Hordijk, I., Routh, D., Abegg, M., Adou Yao, Y., Alberti, G., Almeyda Zambrano, A., Alvarado, B., Alvarez-Dávila, E., Alvarez-Loayza, P., Alves, L., Amaral, I., Ammer, C., Antón-Fernández, C., Araujo-Murakami, A., Arroyo, L., Avitabile, V., Aymard, G., Baker, T., Bałazy, R., Banki, O., Barroso, J., Bastian, M., Bastin, J., Birigazzi, L., Birnbaum, P., Bitariho, R., Boeckx, P., Bongers, F., Bouriaud, O., Brancalion, P., Brandl, S., Brearley, F., Brienen, R., Broadbent, E., Bruelheide, H., Bussotti, F., Cazzolla Gatti, R., César, R., Cesljar, G., Chazdon, R., Chen, H., Chisholm, C., Cho, H., Cienciala, E., Clark, C., Clark, D., Colletta, G., Coomes, D., Cornejo Valverde, F., Corral-Rivas, J., Crim, P., Cumming, J., Dayanandan, S., de Gasper, A., Decuyper, M., Derroire, G., DeVries, B., Djordjevic, I., Dolezal, J., Dourdain, A., Engone Obiang, N., Enquist, B., Eyre, T., Fandohan, A., Fayle, T., Feldpausch, T., Ferreira, L., Finér, L., Fischer, M., Fletcher, C., Frizzera, L., Gianelle, D., Glick, H., Harris, D., Hector, A., Hemp, A., Hengeveld, G., Hérault, B., Herbohn, J., Hillers, A., Honorio Coronado, E., Hui, C., Ibanez, T., Imai, N., Jagodziński, A., Jaroszewicz, B., Johannsen, V., Joly, C., Jucker, T., Jung, I., Karminov, V., Kartawinata, K., Kearsley, E., Kenfack, D., Kennard, D., Kepfer-Rojas, S., Keppel, G., Khan, M., Killeen, T., Kim, H., Kitayama, K., Köhl, M., Korjus, H., **Kraxner, F.**, Kucher, D., Laarmann, D., Lang, M., Lu, H., Lukina, N., Maitner, B., Malhi, Y., Marcon, E., Marimon, B., Marimon-Junior, B., Marshall, A., Martin, E., Meave, J., Melo-Cruz, O., Mendoza, C., Mendoza-Polo, I., Miscicki, S., Merow, C., Monteagudo Mendoza, A., Moreno, V., Mukul, S., Mundhenk, P., Nava-Miranda, M., Neill, D., Neldner, V., Nevenic, R., Ngugi, M., Niklaus, P., Oleksyn, J., Ontikov, P., Ortiz-Malavasi, E., Pan, Y., Paquette, A., Parada-Gutierrez, A., Parfenova, E., Park, M., Parren, M., Parthasarathy, N., Peri, P., Pfautsch, S., Picard, N., Piedade, M., Piotto, D., Pitman, N., Poulsen, A., Poulsen, J., Pretzsch, H., Ramirez Arevalo, F., Restrepo-Correa, Z., Rodeghiero, M., Rolim, S., Roopsind, A., Rovero, F., Rutishauser, E., Saikia, P., Salas-Eljatib, C., Saner, P., Schall, P., Schelhaas, M., **Shchepashchenko, D.** , Scherer-Lorenzen, M., Schmid, B., Schöngart, J., Searle, E., Seben, V., Serra-Diaz, J., Sheil, D., **Shvidenko, A.**, Silva-Espejo, J., Silveira, M., Singh, J., Sist, P., Slik, F., Sonké, B., Souza, A., Stereńczak, K., Svenning, J., Svoboda, M., Swanepoel, B., Targhetta, N., Tchebakova, N., ter Steege, H., Thomas, R., Tikhonova, E., Umunay, P., Usoltsev, V., Valencia, R., Valladares, F., van der Plas, F., Van Do, T., van Nuland, M., Vasquez, R., Verbeeck, H., Viana, H., Vibrans, A., Vieira, S., von Gadow, K., Wang, H., Watson, J., Werner, G., Wiser, S., Wittmann, F., Woell, H., Wortel, V., Zagt, R., Zawiła-Niedźwiecki, T., Zhang, C., Zhao, X., Zhou, M., Zhu, Z., Zo-Bi, I., Gann, G., & Crowther, T. (2023). **Integrated global assessment of the natural forest carbon potential.** *Nature* 624 (7990) 92-101. **10.1038/s41586-023-06723-z**.
41. **Maxwell, T.**, Rovai, A., Adame, M., Adams, J., Álvarez-Rogel, J., Austin, W., Beasy, K., Boscutti, F., Böttcher, M., Bouma, T., Bulmer, R., Burden, A., Burke, S., Camacho, S., Chaudhary, D., Chmura, G., Copertino, M., Cott, G., Craft, C., Day, J., de los Santos, C., Denis, L., Ding, W., Ellison, J., Ewers Lewis, C., Giani, L., Gispert, M., Gontharet, S., González-Pérez, J., González-Alcaraz, M., Gorham, Co., Graversen, A., Grey, A., Guerra, R., He, Q., Holmquist, J., Jones, A., Juanes, J., Kelleher, B., Kohfeld, K., Krause-Jensen, D., Lafratta, A., Lavery, P., Laws, E., Leiva-Dueñas, C., Loh, P., Lovelock, C., Lundquist, C., Macreadie, P., Mazarrasa, I., Megonigal, J., Neto, J., Nogueira, J., Osland, M., Pagès, J., Perera, N., Pfeiffer, E.-M., Pollmann, T., Raw, J., Recio, M., Ruiz-Fernández, A., Russell, S., Rybczyk, J., Sammul, M., Sanders, C., Santos, R., Serrano, O., Siewert, M., Smeaton, C., Song, Z., Trasar-Cepeda, C., Twilley, R., Van de Broek, M., Vitti, S., Antisari, L., Voltz, B., Wails, C., Ward, R., Ward, M., Wolfe, J., Yang, R., Zubrzycki, S., Landis, E., Smart, L., Spalding, M., & Worthington, T.

(2023). **Global dataset of soil organic carbon in tidal marshes.** *Scientific Data* 10 (1) **10.1038/s41597-023-02633-x**.

42. Sykes, R.E., O'Neill, H.M.K., Juffe-Bignoli, D., Metcalfe, K., Stephenson, P.J., Struebig, M.J., **Visconti, P.**, Burgess, N.D., Kingston, N., Davies, Z.G., & Smith, R.J. (2023). **Developing a framework to improve global estimates of conservation area coverage.** *Oryx* 1-10. **10.1017/S0030605323000625**.
43. **Soterroni, A.**, Império, M., Scarabello, M., Seddon, N., **Obersteiner, M.** , Rochedo, P., Schaeffer, R., Andrade, P., Ramos, F., Azevedo, T., Ometto, J., **Havlik, P.** , & Alencar, A. (2023). **Nature-based solutions are critical for putting Brazil on track towards net-zero emissions by 2050.** *Global Change Biology* 29 7085-7101. **10.1111/gcb.16984**.
44. Ma, H., Crowther, T., Mo, L., Maynard, D., Renner, S., van den Hoogen, J., Zou, Y., Liang, J., de-Miguel, S., Nabuurs, G.-J., Reich, P., Niinemets, Ü., Abegg, M., Adou Yao, Y., Alberti, G., Almeyda Zambrano, A., Alvarado, B., Alvarez-Dávila, E., Alvarez-Loayza, P., Alves, L., Ammer, C., Antón-Fernández, C., Araujo-Murakami, A., Arroyo, L., Avitabile, V., Aymard, G., Baker, T., Bałazy, R., Banki, O., Barroso, J., Bastian, M., Bastin, J.-F., Birigazzi, L., Birnbaum, P., Bitariho, R., Boeckx, P., Bongers, F., Bouriaud, O., Brancalion, P., Brandl, S., Brearley, F., Brienen, R., Broadbent, E., Bruelheide, H., Bussotti, F., Cazzolla Gatti, R., César, R., Cesljar, G., Chazdon, R., Chen, H., Chisholm, C., Cho, H., Cienciala, E., Clark, C., Clark, D., Colletta, G., Coomes, D., Valverde, F., Corral-Rivas, J., Crim, P., Cumming, J., Dayanandan, S., de Gasper, A., Decuyper, M., Derroire, G., DeVries, B., Djordjevic, I., Dolezal, J., Dourdain, A., Engone Obiang, N., Enquist, B., Eyre, T., Fandohan, A., Fayle, T., Feldpausch, T., Ferreira, L., Finér, L., Fischer, M., Fletcher, C., Fridman, J., Frizzera, L., Gamarra, J., Gianelle, D., Glick, H., Harris, D., Hector, A., Hemp, A., Hengeveld, G., Hérault, B., Herbohn, J., Herold, M., Hillers, A., Honorio Coronado, E., Hui, C., Ibanez, T., Amaral, I., Imai, N., Jagodziński, A., Jaroszewicz, B., Johannsen, V., Joly, C., Jucker, T., Jung, I., Karminov, V., Kartawinata, K., Kearsley, E., Kenfack, D., Kennard, D., Kepfer-Rojas, S., Keppel, G., Khan, M., Killeen, T., Kim, H., Kitayama, K., Köhl, M., Korjus, H., **Kraxner, F.**, Kucher, D., Laarmann, D., Lang, M., Lewis, S., Lu, H., Lukina, N., Maitner, B., Malhi, Y., Marcon, E., Marimon, B., Marimon-Junior, B., Marshall, A., Martin, E., Meave, J., Melo-Cruz, O., Mendoza, C., Merow, C., Monteagudo Mendoza, A., Moreno, V., Mukul, S., Mundhenk, P., Nava-Miranda, M., Neill, D., Neldner, V., Nevenic, R., Ngugi, M., Niklaus, P., Oleksyn, J., Ontikov, P., Ortiz-Malavasi, E., Pan, Y., Paquette, A., Parada-Gutierrez, A., Parfenova, E., Park, M., Parren, M., Parthasarathy, N., Peri, P., Pfautsch, S., Phillips, O., Picard, N., Piedade, M., Piotto, D., Pitman, N., Mendoza-Polo, I., Poulsen, A., Poulsen, J., Pretzsch, H., Ramirez Arevalo, F., Restrepo-Correa, Z., Rodeghiero, M., Rolim, S., Roopsind, A., Rovero, F., Rutishauser, E., Saikia, P., Salas-Eljatib, C., Saner, P., Schall, P., Schelhaas, M.-J., **Shchepashchenko, D.** , Scherer-Lorenzen, M., Schmid, B., Schöngart, J., Searle, E., Seben, V., Serra-Diaz, J., Sheil, D., **Shvidenko, A.**, Silva-Espejo, J., Silveira, M., Singh, J., Sist, P., Slik, F., Sonké, B., Souza, A., Miścicki, S., Stereńczak, K., Svenning, J.-C., Svoboda, M., Swanepoel, B., Targhetta, N., Tchebakova, N., ter Steege, H., Thomas, R., Tikhonova, E., Umunay, P., Usoltsev, V., Valencia, R., Valladares, F., van der Plas, F., Van Do, T., van Nuland, M., Vasquez, R., Verbeeck, H., Viana, H., Vibrans, A., Vieira, S., von Gadow, K., Wang, H.-F., Watson, J., Werner, G., Westerlund, B., Wiser, S., Wittmann, F., Woell, H., Wortel, V., Zagt, R., Zawiła-Niedźwiecki, T., Zhang, C., Zhao, X., Zhou, M., Zhu, Z.-X., Zo-Bi, I., & Zohner, C. (2023). **The global biogeography of tree leaf form and habit.** *Nature Plants* 9 (11) 1795-1809. **10.1038/s41477-023-01543-5**.
45. **Singh, S.**, Verma, A., & **Hofhansl, F.** (2023). **Topographical heterogeneity governs species distribution and regeneration potential by mediating soil attributes in Western Himalayan forests.** *Research Square* **10.21203/rs.3.rs-3462205/v1**. (Submitted)
46. **Etard, A.** & Newbold, T. (2023). **Species-level correlates of land-use responses and climate-change sensitivity in terrestrial vertebrates.** *Conservation Biology* e14208. **10.1111/cobi.14208**.
47. Wang, Y., Hollingsworth, P.M., Zhai, D., West, C., Green, J., Chen, H., Hurni, K., Su, Y., **Warren-Thomas, E.**, Xu, J., & Ahrends, A. (2023). **High-resolution maps show that rubber causes substantial deforestation.** *Nature* **10.1038/s41586-023-06642-z**.

48. **Ippolito, T.**, **Balkovič, J.** , **Skalský, R.** , **Folberth, C.** , **Krisztin, T.** , & Neff, J. (2023). **Predicting spatiotemporal soil organic carbon responses to management using EPIC-IIASA meta-models.** *Journal of Environmental Management* 344 e118532. **10.1016/j.jenvman.2023.118532**.
49. Rinke Dias de Souza, N., Palma Petrielli, G., Dourado Hernandes, T., **Leduc, S.**, **Di Fulvio, F.** , de Souza Henzler, D., Ferreira Chagas, M., Lopes Junqueira, T., & Cavalett, O. (2023). **Bioenergy-livestock integration in Brazil: Unraveling potentials for energy production and climate change mitigation.** *Journal of Cleaner Production* 422 e138586. **10.1016/j.jclepro.2023.138586**.
50. Ermolieva, T., **Havlik, P.** , **Derci Augustynczik, A.L.**, **Boere, E.**, **Frank, S.** , **Kahil, T.** , Wang, G., **Balkovič, J.** , **Skalský, R.** , **Folberth, C.** , **Komendantova, N.** , & Knopov, P. S. (2023). **A Novel Robust Meta-Model Framework for Predicting Crop Yield Probability Distributions Using Multisource Data.** *Cybernetics and Systems Analysis* **10.1007/s10559-023-00620-z**.
51. Thuiller, W., Calderón-Sanou, I., Chalmandrier, L., Gaüzère, P., **O'Connor, L.**, Ohlmann, M., Poggiato, G., & Münkemüller, T. (2023). **Navigating the integration of biotic interactions in biogeography.** *Journal of Biogeography* **10.1111/jbi.14734**. (In Press)
52. **Khabarov, N.** , **Smirnov, A.** , & **Obersteiner, M.** (2023). **A note on the logical inconsistency of the Hotelling Rule: A Revisit from the System's Analysis Perspective.** *arXiv* (Submitted)
53. McGrath, M.J., Petrescu, A.M.R., Peylin, P., Andrew, R.M., Matthews, B., Dentener, F., **Balkovič, J.** , Bastrikov, V., Becker, M., Broquet, G., Ciais, P., Fortems-Cheiney, A., Ganzenmüller, R., Grassi, G., Harris, I., Jones, M., Knauer, J., Kuhnert, M., Monteil, G., Munassar, S., Palmer, P.I., Peters, G.P., Qiu, C., Schelhaas, M.-J., Tarasova, O., Vizzarri, M., Winkler, K., Balsamo, G., Berchet, A., Briggs, P., Brockmann, P., Chevallier, F., Conchedda, G., Crippa, M., Dellaert, S.N.C., Denier van der Gon, H.A.C., Filipek, S., Friedlingstein, P., Fuchs, R., Gauss, M., Gerbig, C., Guizzardi, D., Günther, D., Houghton, R.A., Janssens-Maenhout, G., Lauerwald, R., Lerink, B., Luijkx, I.T., Moulas, G., Muntean, M., Nabuurs, G.-J., Paquirissamy, A., Perugini, L., Peters, W., Pilli, R., Pongratz, J., Regnier, P., Scholze, M., Serengil, Y., Smith, P., Solazzo, E., Thompson, R.L., Tubiello, F.N., Vesala, T., & Walther, S. (2023). **The consolidated European synthesis of CO2 emissions and removals for the European Union and United Kingdom: 1990–2020.** *Earth System Science Data* 15 (10) 4295-4370. **10.5194/essd-15-4295-2023**.
54. Gavasso-Rita, Y.L., Papalexiou, S.M., Li, Y., **Elshorbagy, A.**, Li, Z., & Schuster-Wallace, C. (2023). **Crop models and their use in assessing crop production and food security: A review.** *Food and Energy Security* 13 e503. **10.1002/fes3.503**.
55. van Vliet, M. T. H., Thorslund, J., Strokal, M., Hofstra, N., Flörke, M., Ehalt Macedo, H., Nkwasa, A., **Tang, T.** , Kaushal, S.S., Kumar, R., van Griensven, A., Bouwman, L., & Mosley, L. M. (2023). **Global river water quality under climate change and hydroclimatic extremes.** *Nature Reviews Earth & Environment* 4 687-702. **10.1038/s43017-023-00472-3**.
56. Lapin, K., Bindewald, A., Brundu, G., Marinšek, A., Chakraborty, D., Oettel, J., Konrad, H., Porta, N., Alagić, A., Berger, F., Detry, P., **Shchepashchenko, D.** , **Kraxner, F.**, Hazarika, R., Wohlgemuth, T., & Braun, M. (2023). **Transnational strategy on the sustainable management and responsible use of non-native trees in the Alpine Space.** *Central European Forestry Journal* 69 (3) 142-151. **10.2478/forj-2023-0001**.
57. Martins, I., Schrodt, F., Blowes, S., Bates, A., Bjorkman, A., Brambilla, V., Carvajal-Quintero, J., Chow, C., **Daskalova, G.** , Edwards, K., Eisenhauer, N., Field, R., Fontrodona-Eslava, A., Henn, J., van Klink, R., Madin, J., Magurran, A., McWilliam, M., Moyes, F., Pugh, B., Sagouis, A., Trindade-Santos, I., McGill, B., Chase, J., & Dornelas, M. (2023). **Widespread shifts in body size within populations and assemblages.** *Science* 381 (6662) 1067-1071. **10.1126/science.adg6006**.
58. **Jung, M.** (2023). **An integrated species distribution modelling framework for heterogeneous biodiversity data.** *Ecological Informatics* 76 e102127. **10.1016/j.ecoinf.2023.102127**.
59. Kim, H., Peterson, G., Cheung, W., Ferrier, S., Alkemade, R., Arneth, A., Kuiper, J., Okayasu, S., Pereira, L., Acosta, L., Chaplin-Kramer, R., den Belder, E., Eddy, T., Johnson, J., Karlsson-Vinkhuyzen, S., Kok, M., Leadley, P., **Leclere, D.**, Lundquist, C., Rondinini, C., Scholes, R., Schoolenberg, M., Shin, Y.-J., Stehfest, E., Stephenson, F., **Visconti, P.**, van Vuuren, D., Wabnitz,

C., José Alava, J., Cuadros-Casanova, I., Davies, K., Gasalla, M., Halouani, G., Harfoot, M., Hashimoto, S., Hickler, T., Hirsch, T., Kolomytsev, G., Miller, B., Ohashi, H., Gabriela Palomo, M., Popp, A., Paco Remme, R., Saito, O., Rashid Sumalia, U., Willcock, S., & Pereira, H. (2023). **Towards a better future for biodiversity and people: Modelling Nature Futures.** *Global Environmental Change* 82 e102681. **10.1016/j.gloenvcha.2023.102681**.

60. **Ringwald, L.** & Zörner, T.O. (2023). **The money-inflation nexus revisited.** *Journal of Empirical Finance* 73 293-333. **10.1016/j.jempfin.2023.07.002**.
61. **Warren-Thomas, E.**, Ahrends, A., Wang, Y., Wang, M., & Jones, J. (2023). **Rubber's inclusion in zero-deforestation legislation is necessary but not sufficient to reduce impacts on biodiversity.** *Conservation Letters* e12967. **10.1111/conl.12967**.
62. Delavaux, C., Crowther, T., Zohner, C., Robmann, N., Lauber, T., van den Hoogen, J., Kuebbing, S., Liang, J., de-Miguel, S., Nabuurs, G.-J., Reich, P.B., Abegg, M., Adou Yao, Y.C., Alberti, G., Almeyda Zambrano, A.M., Alvarado, B.V., Alvarez-Dávila, E., Alvarez-Loayza, P., Alves, L.F., Ammer, C., Antón-Fernández, C., Araujo-Murakami, A., Arroyo, L., Avitabile, V., Aymard, G.A., Baker, T.R., Bałazy, R., Banki, O., Barroso, J.G., Bastian, M.L., Bastin, J.-F., Birigazzi, L., Birnbaum, P., Bitariho, R., Boeckx, P., Bongers, F., Bouriaud, O., Brancalion, P.H.S., Brandl, S., Brienen, R., Broadbent, E.N., Bruelheide, H., Bussotti, F., Gatti, R.C., César, R.G., Cesljar, G., Chazdon, R., Chen, H.Y.H., Chisholm, C., Cho, H., Cienciala, E., Clark, C., Clark, D., Colletta, G.D., Coomes, D.A., Cornejo Valverde, F., Corral-Rivas, J.J., Crim, P.M., Cumming, J.R., Dayanandan, S., de Gasper, A.L., Decuyper, M., Derroire, G., DeVries, B., Djordjevic, I., Dolezal, J., Dourdain, A., Engone Obiang, N.L., Enquist, B.J., Eyre, T.J., Fandohan, A.B., Fayle, T.M., Feldpausch, T.R., Ferreira, L.V., Fischer, M., Fletcher, C., Frizzera, L., Gamarra, J.G.P., Gianelle, D., Glick, H.B., Harris, D.J., Hector, A., Hemp, A., Hengeveld, G., Hérault, B., Herbohn, J.L., Herold, M., Hillers, A., Honorio Coronado, E.N., Hui, C., Ibanez, T.T., Amaral, I., Imai, N., Jagodziński, A.M., Jaroszewicz, B., Johannsen, V.K., Joly, C.A., Jucker, T., Jung, I., Karminov, V., Kartawinata, K., Kearsley, E., Kenfack, D., Kennard, D.K., Kepfer-Rojas, S., Keppel, G., Khan, M.L., Killeen, T.J., Kim, H.S., Kitayama, K., Köhl, M., Korjus, H., **Kraxner, F.**, Laarmann, D., Lang, M., Lewis, S.L., Lu, H., Lukina, N.V., Maitner, B.S., Malhi, Y., Marcon, E., Marimon, B.S., Marimon-Junior, B.H., Marshall, A.R., Martin, E.H., Martynenko, O., Meave, J.A., Melo-Cruz, O., Mendoza, C., Merow, C., Mendoza, A.M., Moreno, V.S., Mukul, S.A., Mundhenk, P., Nava-Miranda, M.G., Neill, D., Neldner, V., Nevenic, R., Ngugi, M., Niklaus, P., Oleksyn, J., Ontikov, P., Ortiz-Malavasi, E., Pan, Y., Paquette, A., Parada-Gutierrez, A., Parfenova, E., Park, M., Parren, M., Parthasarathy, N., Peri, P., Pfautsch, S., Phillips, O., Picard, N., Piedade, M., Piotto, D., Pitman, N., Polo, I., Poorter, L., Poulsen, A., Pretzsch, H., Ramirez Arevalo, F., Restrepo-Correa, Z., Rodeghiero, M., Rolim, S., Roopsind, A., Rovero, F., Rutishauser, E., Saikia, P., Salas-Eljatib, C., Saner, P., Schall, P., **Shchepashchenko, D.** , Scherer-Lorenzen, M., Schmid, B., Schöngart, J., Searle, E., Seben, V., Serra-Diaz, J., Sheil, D., **Shvidenko, A.**, Silva-Espejo, J., Silveira, M., Singh, J., Sist, P., Slik, F., Sonké, B., Souza, A., Stanislaw, M., Stereńczak, K., Svenning, J.-C., Svoboda, M., Swanepoel, B., Targhetta, N., Tchebakova, N., ter Steege, H., Thomas, R., Tikhonova, E., Umunay, P., Usoltsev, V., Valencia, R., Valladares, F., van der Plas, F., Do, T.V., van Nuland, M., Vasquez, R., Verbeeck, H., Viana, H., Vibrans, A., Vieira, S., von Gadow, K., Wang, H.-F., Watson, J., Werner, G., Wiser, S.K., Wittmann, F., Woell, H., Wortel, V., Zagt, R., Zawiła-Niedźwiecki, T., Zhang, C., Zhao, X., Zhou, M., Zhu, Z.-X., Zo-Bi, I., & Maynard, D. (2023). **Native diversity buffers against severity of non-native tree invasions.** *Nature* 621 773-781. **10.1038/s41586-023-06440-7**.
63. Armas Vargas, F., **Nava, L.F.** , Gómez Reyes, E., Olea-Olea, S., Rojas Serna, C., Sandoval Solís, S., & Meza-Rodríguez, D. (2023). **Water and Environmental Resources: A Multi-Criteria Assessment of Management Approaches.** *Water* 15 (16) e2991. **10.3390/w15162991**.
64. **Greve, P.**, **Burek, P.** , **Guillaumot, L.** , van Meijgaard, E., Aalbers, E., **Smilovic, M.** , Sperna-Weiland, F., **Kahil, T.** , & Wada, Y. (2023). **Low flow sensitivity to water withdrawals in Central and Southwestern Europe under 2 K global warming.** *Environmental Research Letters* 18 (9) e094020. **10.1088/1748-9326/acec60**.

65. **Jung, M.**, **Lesiv, M.** , **Warren-Thomas, E.**, **Shchepashchenko, D.** , **See, L.** , & **Fritz, S.** (2023). **The importance of capturing management in forest restoration targets.** *Nature Sustainability* 6 1321-1325. **10.1038/s41893-023-01192-8**.
66. Molina Bacca, E.J., Stevanović, M., Bodirsky, B.L., Karstens, K., Chen, D.M.-C., Leip, D., Müller, C., Minoli, S., Heinke, J., Jägermeyr, J., **Folberth, C.** , Iizumi, T., Jain, A.K., Liu, W., Okada, M., Smerald, A., Zabel, F., Lotze-Campen, H., & Popp, A. (2023). **Uncertainty in land-use adaptation persists despite crop model projections showing lower impacts under high warming.** *Communications Earth & Environment* 4 (1) e284. **10.1038/s43247-023-00941-z**.
67. Harahap, F., Nurdiawati, A., Conti, D., **Leduc, S.**, & Urban, F. (2023). **Renewable marine fuel production for decarbonised maritime shipping: Pathways, policy measures and transition dynamics.** *Journal of Cleaner Production* 415 e137906. **10.1016/j.jclepro.2023.137906**.
68. Johnson, T.F., **Cornford, R.** , Dove, S., Freeman, R., & Millard, J. (2023). **Achieving a real-time online monitoring system for conservation culturomics.** *Conservation Biology* 37 (4) e14096. **10.1111/cobi.14096**.
69. Sonter, L.J., Maron, M., Bull, J., Giljum, S., Luckeneder, S., **Maus, V.** , McDonald-Madden, E., Northey, S.A., Sánchez, L.E., Valenta, R., **Visconti, P.**, Werner, T.T., & Watson, J. (2023). **How to fuel an energy transition with ecologically responsible mining.** *Proceedings of the National Academy of Sciences* 120 (35) e2307006120. **10.1073/pnas.2307006120**.
70. **Teixeira, E.** , Guo, J., Liu, J., Cichota, R., Brown, H., Sood, A., Yang, X., Hannaway, D., & Moot, D. (2023). **Assessing land suitability and spatial variability in lucerne yields across New Zealand.** *European Journal of Agronomy* 148 e126853. **10.1016/j.eja.2023.126853**.
71. Theron, S.N., Midgley, S., **Hochrainer-Stigler, S.**, Archer, E., **Tramberend, S.** , & Walker, S. (2023). **Agricultural resilience and adaptive capacity during severe drought in the Western Cape, South Africa.** *Regional Environmental Change* 23 (3) e98. **10.1007/s10113-023-02091-6**.
72. Cornu, S., Keesstra, S., Bispo, A., Fantappie, M., van Egmond, F., Smreczak, B., Wawer, R., Pavlů, L., Sobocká, J., Bakacsi, Z., Farkas-Iványi, K., Molnár, S., Møller, A.B., Madenoglu, S., Feiziene, D., Oorts, K., Schneider, F., Gonçalves, M.C., Mano, R., Garland, G., **Skalský, R.** , O'Sullivan, L., Kasparinskis, R., & Chenu, C. (2023). **National soil data in EU countries, where do we stand?** *European Journal of Soil Science* 74 (4) e13398. **10.1111/ejss.13398**.
73. Matsala, M., Myroniuk, V., Borsuk, O., Vishnevskiy, D., **Shchepashchenko, D.** , **Shvidenko, A.**, **Kraxner, F.**, & Bilous, A. (2023). **Wall-to-wall mapping of carbon loss within the Chornobyl Exclusion Zone after the 2020 catastrophic wildfire.** *Annals of Forest Science* 80 (1) e26. **10.1186/s13595-023-01192-w**.
74. Cazalis, V., Santini, L., Lucas, P., González-Suárez, M., Hoffmann, M., Benítez-López, A., Pacifici, M., Schipper, A.M., Böhm, M., Zizka, A., Clausnitzer, V., Meyer, C., **Jung, M.**, Butchart, S.H.M., Cardoso, P., Mancini, G., Reşit Akçakaya, H., Young, B.E., Patoine, G., & Di Marco, M. (2023). **Prioritizing the reassessment of data deficient species on the IUCN Red List.** *Conservation Biology* 37 e14139. **10.1111/cobi.14139**.
75. **Joshi, J.**, **Hofhansl, F.** , **Singh, S.**, Stocker, B., **Brännström, Å.**, **Franklin, O.** , Blanco, C.C., Aleixo, I., Lapola, D.M., Prentice, I.C., & **Dieckmann, U.** (2023). **Competition for light can drive adverse species-composition shifts in the Amazon Forest under elevated CO2.** *BioRxiv* **10.1101/2023.07.03.547575**. (Submitted)
76. **Ren, M.**, Huang, C., **Wu, Y.**, **Deppermann, A.**, **Frank, S.** , **Havlik, P.** , Zhu, Y., Fang, C., Ma, X., Liu, Y., Zhao, H., Chang, J., Ma, L., Bai, Z., **Xu, S.**, & Dai, H. (2023). **Enhanced food system efficiency is the key to China's 2060 carbon neutrality target.** *Nature Food* 4 552-564. **10.1038/s43016-023-00790-1**.
77. Winkler, K., Yang, H., Ganzenmüller, R., Fuchs, R., Ceccherini, G., Duveiller, G., Grassi, G., Pongratz, J., Bastos, A., **Shvidenko, A.**, Araza, A., Herold, M., Wigneron, J.-P., & Ciais, P. (2023). **Changes in land use and management led to a decline in Eastern Europe's terrestrial carbon sink.** *Communications Earth & Environment* 4 (1) e237. **10.1038/s43247-023-00893-4**.

78. Rius, B.F., Filho, J.P.D., Fleischer, K., **Hofhansl, F.** , Blanco Casagrande, C., Rammig, A., Domingues Ferreira, T., & Lapola Montenegro, D. (2023). **Higher functional diversity improves modeling of Amazon forest carbon storage.** *Ecological Modelling* 481 e110323. **10.1016/j.ecolmodel.2023.110323**.
79. Expósito, A., **Kahil, T.** , & Berbel, J. (2023). **Editorial — Advances in Hydro-Economic Modeling for Sustainable Basin Management in a Context of Climate Change.** *Water Economics and Policy* 09 (01) e2302001. **10.1142/S2382624X23020010**.
80. Wu, L., **Elshorbagy, A.**, & Helgason, W. (2023). **Assessment of agricultural adaptations to climate change from a water-energy-food nexus perspective.** *Agricultural Water Management* 284 e108343. **10.1016/j.agwat.2023.108343**.
81. Buchadas, A., **Jung, M.**, Bustamante, M., Fernández-Llamazares, Á., Garnett, S.T., Nanni, A.S., Ribeiro, N., Meyfroidt, P., & Kuemmerle, T. (2023). **Tropical dry woodland loss occurs disproportionately in areas of highest conservation value.** *Global Change Biology* 29 4880-4897. **10.1111/gcb.16832**.
82. Riva, F., Graco-Roza, C., **Daskalova, G.** , Hudgins, E.J., Lewthwaite, J.M.M., Newman, E.A., Ryo, M., & Mammola, S. (2023). **Toward a cohesive understanding of ecological complexity.** *Science Advances* 9 (25) eabq4207. **10.1126/sciadv.abq4207**.
83. **De Vos, K.**, **Janssens, C.**, Jacobs, L., Campforts, B., **Boere, E.**, **Kozicka, M.** , **Havlik, P.** , **Folberth, C.** , **Balkovič, J.** , Maertens, M., & Govers, G. (2023). **Rice availability and stability in Africa under future socio-economic development and climatic change.** *Nature Food* **10.1038/s43016-023-00770-5**.
84. **Franklin, O.** , Fransson, P., **Hofhansl, F.** , Jansen, S., & **Joshi, J.** (2023). **Optimal balancing of xylem efficiency and safety explains plant vulnerability to drought.** *Ecology Letters* 26 1485-1496. **10.1111/ele.14270**.
85. **Suresh, K.**, **Tang, T.** , van Vliet, M.T.H., Bierkens, M.F.P., Strokal, M., **Sorger-Domenigg, F.**, & **Wada, Y.** (2023). **Recent advancement in water quality indicators for eutrophication in global freshwater lakes.** *Environmental Research Letters* 18 (6) e063004. **10.1088/1748-9326/acd071**.
86. Martínez-Dalmau, J., Gutiérrez-Martín, C., **Kahil, T.** , & Berbel, J. (2023). **Impact of alternative water policies for drought adaptation in the Guadalquivir Mediterranean river basin, southern Spain.** *Journal of Hydrology: Regional Studies* 47 e101444. **10.1016/j.ejrh.2023.101444**.
87. Potopová, V., Musiolková, M., Gaviria, J.A., Trnka, M., **Havlik, P.** , **Boere, E.**, Trifan, T., Muntean, N., & Chawdhery, M.R.A. (2023). **Water Consumption by Livestock Systems from 2002–2020 and Predictions for 2030–2050 under Climate Changes in the Czech Republic.** *Agriculture* 13 (7) e1291. **10.3390/agriculture13071291**.
88. Xu, L., Ferris, D., **Huggins, X.**, Wong, J.S., Mohan, C., Sadri, S., Chandanpurkar, H.A., Sanyal, P., & Famiglietti, J.S. (2023). **From coarse resolution to practical solution: GRACE as a science communication and policymaking tool for sustainable groundwater management.** *Journal of Hydrology* 623 e129845. **10.1016/j.jhydrol.2023.129845**.
89. Schulze, K., Malek, Ž., **Shchepashchenko, D.** , **Lesiv, M.** , **Fritz, S.** , & Verburg, P.H. (2023). **Pantropical distribution of short-rotation woody plantations: spatial probabilities under current and future climate.** *Mitigation and Adaptation Strategies for Global Change* 28 (5) **10.1007/s11027-023-10066-5**.
90. Williams, N.G., Lucash, M.S., Ouellette, M.R., Brussel, T., Gustafson, E.., Weiss, S.A., Sturtevant, B.R., **Shchepashchenko, D.** , & **Shvidenko, A.Z.** (2023). **Simulating dynamic fire regime and vegetation change in a warming Siberia.** *Fire Ecology* 19 (1) e33. **10.1186/s42408-023-00188-1**.
91. Yao, F., Livneh, B., Rajagopalan, B., Wang, J., Crétaux, J.-F., **Wada, Y.** , & Berge-Nguyen, M. (2023). **Satellites reveal widespread decline in global lake water storage.** *Science* 380 (6646) 743-749. **10.1126/science.abo2812**.
92. Smolka, G., Kosatica, E., Berger, M., Kissinger, M., **Fridman, D.** , & Koellner, T. (2023). **Domestic water versus imported virtual blue water for agricultural production: A comparison based on**

**energy consumption and related greenhouse gas emissions.** *Journal of Industrial Ecology* 27 1123-1136. **10.1111/jiec.13403**.

93. **Daskalova, G.** & Kamp, J. (2023). **Abandoning land transforms biodiversity.** *Science* 380 (6645) 581-583. **10.1126/science.adf1099**.
94. **Kortz, A.** , Moyes, F., Pivello, V.R., Pyšek, P., Dornelas, M., **Visconti, P.**, & Magurran, A.E. (2023). **Elevated compositional change in plant assemblages linked to invasion.** *Proceedings of the Royal Society B: Biological Sciences* 290 (1998) **10.1098/rspb.2022.2450**.
95. **de Bruijn, J.** , **Smilovic, M.** , **Burek, P.** , **Guillaumot, L.** , **Wada, Y.** , & Aerts, J.C.J.H. (2023). **GEB v0.1: a large-scale agent-based socio-hydrological model – simulating 10 million individual farming households in a fully distributed hydrological model.** *Geoscientific Model Development* 16 (9) 2437-2454. **10.5194/gmd-16-2437-2023**.
96. Henriksson, N., Marshall, J., Högberg, M.N., Högberg, P., Polle, A., **Franklin, O.** , & Näsholm, T. (2023). **Re-examining the evidence for the mother tree hypothesis – resource sharing among trees via ectomycorrhizal networks.** *New Phytologist* 239 19-28. **10.1111/nph.18935**.
97. **Valencia, R.**, **Guillaumot, L.** , **Sahu, R.K.** , Nam, C., Lierhammer, L., & Máñez Costa, M. (2023). **An assessment of water management measures for climate change adaptation of agriculture in Seewinkel.** *Science of the Total Environment* 885 e163906. **10.1016/j.scitotenv.2023.163906**.
98. Hordijk, I., Maynard, D.S., Hart, S.P., Lidong, M., ter Steege, H., Liang, J., de-Miguel, S., Nabuurs, G.-J., Reich, P., Abegg, M., Adou Yao, C., Alberti, G., Almeyda Zambrano, A., Alvarado, B., Esteban, A.-D., Alvarez-Loayza, P., Alves, L., Ammer, C., Antón-Fernández, C., Araujo-Murakami, A., Arroyo, L., Avitabile, V., Aymard C, G., Baker, T., Bałazy, R., Banki, O., Barroso, J., Bastian, M., Bastin, J.-F., Birigazzi, L., Birnbaum, P., Bitariho, R., Boeckx, P., Bongers, F., Bouriaud, O., Brancalion, P., Brandl, S., Brienen, R., Broadbent, E., Bruelheide, H., Bussotti, F., Cazzolla Gatti, R., César, R., Cesljar, G., Chazdon, R., Chen, H., Chisholm, C., Cienciala, E., Clark, C., Clark, D., Colletta, G., Coomes, D., Cornejo Valverde, F., Corral-Rivas, J., Crim, P., Cumming, J., Dayanandan, S., de Gasper, A., Decuyper, M., Derroire, G., DeVries, B., Djordjevic, I., Iêda, A., Dourdain, A., Nestor Laurier, E., Enquist, B., Eyre, T., Fandohan, A., Fayle, T., Ferreira, L., Feldpausch, T., Finér, L., Fischer, M., Fletcher, C., Frizzera, L., Gamarra, J., Gianelle, D., Glick, H., Harris, D., Hector, A., Hemp, A., Hengeveld, G., Hérault, B., Herbohn, J., Hillers, A., Honorio Coronado, E., Hui, C., Cho, H., Ibanez, T., Bin Jung, I., Imai, N., Jagodzinski, A., Jaroszewicz, B., Johanssen, V., Joly, C., Jucker, T., Karminov, V., Kartawinata, K., Kearsley, E., Kenfack, D., Kennard, D., Kepfer-Rojas, S., Keppel, G., Khan, M., Killeen, T., Kim, H., Kitayama, K., Köhl, M., Korjus, H., **Kraxner, F.**, Laarmann, D., Lang, M., Lewis, S., Lu, H., Lukina, N., Maitner, B., Malhi, Y., Marcon, E., Marimon, B., Marimon-Junior, B., Marshall, A., Martin, E., Martynenko, O., Meave, J., Melo-Cruz, O., Mendoza, C., Merow, C., Stanislaw, M., Mendoza, A., Moreno, V., Mukul, S., Mundhenk, P., Nava-Miranda, M., Neill, D., Neldner, V., Nevenic, R., Ngugi, M., Niklaus, P., Oleksyn, J., Ontikov, P., Ortiz-Malavasi, E., Pan, Y., Paquette, A., Parada-Gutierrez, A., Parfenova, E., Park, M., Parren, M., Parthasarathy, N., Peri, P., Pfautsch, S., Phillips, O., Picard, N., Piedade, M., Piotto, D., Pitman, N., Polo, I., Poorter, L., Poulsen, A., Poulsen, J., Pretzsch, H., Ramirez Arevalo, F., Restrepo-Correa, Z., Rodeghiero, M., Rolim, S., Roopsind, A., Rovero, F., Rutishauser, E., Saikia, P., Salas-Eljatib, C., Schall, P., **Shchepashchenko, D.** , Scherer-Lorenzen, M., Schmid, B., Schöngart, J., Searle, E., Šebeň, V., Serra-Diaz, J., Sheil, D., **Shvidenko, A.**, Silva-Espejo, J., Silveira, M., Singh, J., Sist, P., Slik, F., Sonké, B., Souza, A., Stereńczak, K., Svenning, J.-C., Svoboda, M., Swanepoel, B., Targhetta, N., Tchebakova, N., Thomas, R., Tikhonova, E., Umunay, P., Usoltsev, V., Valencia, R., Valladares, F., van der Plas, F., Tran, D., Van Nuland, M., Vasquez Martinez, R., Verbeeck, H., Viana, H., Vibrans, A., Vieira, S., von Gadow, K., Wang, H.-F., Watson, J., Werner, G., Wiser, S., Wittmann, F., Wortel, V., Zagt, R., Zawila-Niedzwiecki, T., Zhang, C., Zhao, X., Zhou, M., Zhu, Z.-X., Zo-Bi, I., & Crowther, T. (2023). **Evenness mediates the global relationship between forest productivity and richness.** *Journal of Ecology* 111 (6) 1308-1326. **10.1111/1365-2745.14098**.
99. **Scolobig, A.**, **Linnerooth-Bayer, J.**, Pelling, M., **Martin, J.** , **Deubelli, T.** , **Liu, W.** , & Oen, A. (2023). **Transformative adaptation through nature-based solutions: a comparative case study analysis**

**in China, Italy, and Germany.** *Regional Environmental Change* 23 (2) e69. **10.1007/s10113-023-02066-7**.

100. **Huber, F.**, **Krisztin, T.** , & **Pfarrhofer, M.** (2023). **A Bayesian panel vector autoregression to analyze the impact of climate shocks on high-income economies.** *The Annals of Applied Statistics* 17 (2) 1543-1573. **10.1214/22-AOAS1681**.
101. Ahlström, J., Jafri, Y., **Wetterlund, E.**, & Furusjö, E. (2023). **Sustainable aviation fuels – Options for negative emissions and high carbon efficiency.** *International Journal of Greenhouse Gas Control* 125 e103886. **10.1016/j.ijggc.2023.103886**.
102. **van Dijk, M.** & Geurtsen, S. (2023). **Mapping Irrigated Areas in China Using a Synergy Approach.** *Water* 15 (9) e1666. **10.3390/w15091666**.
103. **Hunt, J.D.** , Montanari, P.M., Hummes, D.N., Taghavi, M., **Zakeri, B.** , Romero, O.J., Zhou, W., Vasconcelos de Freitas, M.A., José de Castro, N., Schneider, P.S., & **Wada, Y.** (2023). **Solid air hydrogen liquefaction, the missing link of the hydrogen economy.** *International Journal of Hydrogen Energy* 48 (75) 29198-29208. **10.1016/j.ijhydene.2023.03.405**.
104. **Kozicka, M.** , Gotor, E., Pagnani, T., Occelli, M., & Caracciolo, F. (2023). **Examining linkages among multiple sustainable development outcomes: does the productive safety net program increase on-farm agrobiodiversity?** *Environment, Development and Sustainability* **10.1007/s10668-023-03257-2**.
105. **Wu, Y.**, **Deppermann, A.**, **Havlik, P.** , **Frank, S.** , **Ren, M.**, Zhao, H., Ma, L., Fang, C., Chen, Q., & Dai, H. (2023). **Global land-use and sustainability implications of enhanced bioenergy import of China.** *Applied Energy* 336 e120769. **10.1016/j.apenergy.2023.120769**.
106. Willcock, S., Hooftman, D., Neugarten, R., Chaplin-Kramer, R., Barredo, J., Hickler, T., **Kindermann, G.** , Lewis, A., Lindeskog, M., Martínez-López, J., & Bullock, J. (2023). **Model ensembles of ecosystem services fill global certainty and capacity gaps.** *Science Advances* 9 (14) **10.1126/sciadv.adf5492**.
107. Goulart, H.M.D., van der Wiel, K., **Folberth, C.** , **Boere, E.**, & van den Hurk, B. (2023). **Increase of Simultaneous Soybean Failures Due To Climate Change.** *Earth's Future* 11 (4) e2022EF003106. **10.1029/2022EF003106**.
108. Hong, M., Song, C., **Kim, M.**, Kim, J., Roh, M., Ko, Y., Cho, K., Son, Y., Jeon, S., **Kraxner, F.**, & Lee, W.-K. (2023). **Modeling-Based Risks Assessment and Management of Climate Change in South Korean Forests.** *Forests* 14 (4) e745. **10.3390/f14040745**.
109. Araza, A., Herold, M., de Bruin, S., Ciais, P., Gibbs, D.A., Harris, N., Santoro, M., Wigneron, J.-P., Yang, H., MÃ¡laga, N., Nesha, K., Rodriguez-Veiga, P., Brovkina, O., Brown, H.C.A., Chanev, M., Dimitrov, Z., Filchev, L., Fridman, J., GarcÃa, M., Gikov, A., Govaere, L., Dimitrov, P., Moradi, F., Muelbert, A.E., NovotnÃ½, J., Pugh, T.A.M., Schelhaas, M.-J., **Shchepashchenko, D.** , Stereńczak, K., & Hein, L. (2023). **Past decade above-ground biomass change comparisons from four multi-temporal global maps.** *International Journal of Applied Earth Observation and Geoinformation* 118 e103274. **10.1016/j.jag.2023.103274**.
110. **Hunt, J.** , **Zakeri, B.** , Nascimento, A., Gazoli, J.R., Bindemann, F.T., **Wada, Y.** , **van Ruijven, B.** , & **Riahi, K.** (2023). **Compressed air seesaw energy storage: A solution for long-term electricity storage.** *Journal of Energy Storage* 60 e106638. **10.1016/j.est.2023.106638**.
111. **Huggins, X.**, Gleeson, T., Serrano, D., Zipper, S., Jehn, F., Rohde, M.M., Abell, R., Vigerstol, K., & Hartmann, A. (2023). **Overlooked risks and opportunities in groundwatersheds of the world's protected areas.** *Nature Sustainability* 6 (7) 855-864. **10.1038/s41893-023-01086-9**.
112. Mosnier, A., **Javalera-Rincón, V.** , Jones, S.K., Andrew, R., Bai, Z., Baker, J., Basnet, S., Boer, R., Chavarro, J., Costa, W., Daloz, A.S., DeClerck, F.A., Diaz, M., Douzal, C., Howe Fan, A.C., Fetzer, I., Frank, F., Gonzalez-Abraham, C.E., Habiburrachman, A.H.F., Immanuel, G., Harrison, P.A., Imanirareba, D., Jha, C., Jin, X., Ghosh, R.K., Leach, N., Lehtonen, H., Lotze-Campen, H., Low, W.S., Marcos-Martinez, R., McCord, G.C., Molla, K.G., Monjeau, A., Navarro-Garcia, J., **Neubauer, R.**, **Obersteiner, M.** , Olguín, M., **Orduña-Cabrera, F.** , Pena, A., **Pérez Guzmán, K.** , Potashnikov, V., Rämö, Ja., Ramos, F.M., Rasche, L., Gallardo, R.R., Schmidt-Traub, G., Selomane, O., Singh, V.,

Smith, A., Soterroni, A.C., **Sperling, F.**, **Steinhauser, J.** , Stevanovic, M., Strokov, A., Thomson, M., van Oort, B., **Vittis, Y.**, Wade, C., Winarni, N.L., Woldeyes, F.B., Wu, G.C., & Zerriffi, H. (2023). **A decentralized approach to model national and global food and land use systems.** *Environmental Research Letters* 18 (4) e045001. **10.1088/1748-9326/acc044**.

113. Ghoreishi, M., **Elshorbagy, A.**, Razavi, S., Blöschl, G., Sivapalan, M., & Abdelkader, A. (2023). **Cooperation in a transboundary river basin: a large-scale socio-hydrological model of the Eastern Nile.** *Hydrology and Earth System Sciences* 27 (5) 1201-1219. **10.5194/hess-27-1201-2023**.
114. **Huggins, X.**, Gleeson, T., Castilla-Rho, J., Holley, C., Re, V., & Famiglietti, J.S. (2023). **Groundwater connections and sustainability in social-ecological systems.** *Groundwater* 61 (4) 463-478. **10.1111/gwat.13305**.
115. Tierolf, L., Haer, T., Botzen, W.J.W., **de Bruijn, J.** , Ton, M., Reimann, L., & Aerts, J. (2023). **A coupled agent-based model for France for simulating adaptation and migration decisions under future coastal flood risk.** *Scientific Reports* 13 (1) e4176. **10.1038/s41598-023-31351-y**.
116. **Jo, H.-W.**, **Krasovskiy, A.** , Hong, M., **Corning, S.**, Kim, W., **Kraxner, F.**, & Lee, W.-K. (2023). **Modeling Historical and Future Forest Fires in South Korea: The FLAM Optimization Approach.** *Remote Sensing* 15 (5) e1446. **10.3390/rs15051446**.
117. Enahoro, D., **Kozicka, M.** , Pfeifer, C., Jones, S.K., Tran, N., Chan, C.Y., Sulser, T.B., Gotor, E., & Rich, K.M. (2023). **Linking ecosystem services provisioning with demand for animal-sourced food: an integrated modeling study for Tanzania.** *Regional Environmental Change* 23 (1) e48. **10.1007/s10113-023-02038-x**.
118. Liang, Z., Sun, L., Tian, Z., **Fischer, G.**, & Yan, H. (2023). **Increase in grain production potential of China under climate change.** *PNAS Nexus* 2 (3) pgad057. **10.1093/pnasnexus/pgad057**.
119. Gallardo Zavaleta, V., **Nava, L.F.** , Kauffer, E., & Gonzalez Santana, O. (2023). **Local Knowledge of Sediment Exploitation in the Usumacinta River Basin: A Theoretical–Methodological Framework Proposal.** *Sustainability* 15 (5) e4182. **10.3390/su15054182**.
120. **Krisztin, T.** & Piribauer, P. (2023). **A joint spatial econometric model for regional FDI and output growth.** *Papers in Regional Science* 102 (1) 87-106. **10.1111/pirs.12714**.
121. Armas Vargas, F., Escolero, O., Sandoval Solis, S., **Nava, L.F.** , Mazari Hiriart, M., Rojas Serna, C., & Lopez-Corona, O. (2023). **A Quantitative Approach to the Watershed Governance Prism: The Duero River Basin, Mexico.** *Water* 15 (4) e743. **10.3390/w15040743**.
122. Johnson, J.A., Brown, M.E., Corong, E., Dietrich, J.P., C Henry, R., von Jeetze, P.J., **Leclere, D.**, Popp, A., Thakrar, S.K., & Williams, D.R (2023). **The meso scale as a frontier in interdisciplinary modeling of sustainability from local to global scales.** *Environmental Research Letters* 18 (2) e025007. **10.1088/1748-9326/acb503**.
123. Wright, G., Salk, C., **Magnuszewski, P.**, Stefanska, J., Andersson, K., Benavides, J.P., & Chazdon, R. (2023). **Conformity and tradition are more important than environmental values in constraining resource overharvest.** *PLoS ONE* 18 (2) e0272366. **10.1371/journal.pone.0272366**.
124. Labrière, N., Davies, S.J., Disney, M.I., Duncanson, L.I., Herold, M., Lewis, S.L., Phillips, O.L., Quegan, S., Saatchi, S.S., **Shchepashchenko, D.** , Scipal, K., Sist, P., & Chave, J. (2023). **Toward a forest biomass reference measurement system for remote sensing applications.** *Global Change Biology* 29 (3) 827-840. **10.1111/gcb.16497**.
125. Ostadzadeh, E., **Elshorbagy, A.**, Tuninetti, M., Laio, F., & Abdelkader, A. (2023). **Who will dominate the global fossil fuel trade?** *Economic Systems Research* 1-22. **10.1080/09535314.2023.2174002**.
126. Vergarechea, M., Astrup, R., Fischer, C., Øistad, K., Blattert, C., Hartikainen, M., Eyvindson, K., Di Fulvio, F., **Forsell, N.**, Burgas, D., Toraño-Caicoya, A., Mönkkönen, M., & Antón-Fernández, C. (2023). **Future wood demands and ecosystem services trade-offs: A policy analysis in Norway.** *Forest Policy and Economics* 147 e102899. **10.1016/j.forpol.2022.102899**.
127. Rosa, F., **Di Fulvio, F.** , **Lauri, P.**, Felton, A., **Forsell, N.**, Pfister, S., & Hellweg, S. (2023). **Can Forest Management Practices Counteract Species Loss Arising from Increasing European Demand for**

**Forest Biomass under Climate Mitigation Scenarios?** *Environmental Science & Technology* 57 (5) 2149-2161. **10.1021/acs.est.2c07867**.

128. **Spillias, S.**, **Valin, H.** , **Batka, M.** , **Sperling, F.**, **Havlik, P.** , **Leclere, D.**, Cottrell, R.S., O'Brien, K.R., & McDonald-Madden, E. (2023). **Reducing global land-use pressures with seaweed farming.** *Nature Sustainability* 6 380-390. **10.1038/s41893-022-01043-y**.
129. Schaap, K.J., Fuchslueger, L., Quesada, C.A., **Hofhansl, F.** , Valverde-Barrantes, O., Camargo, P.B., & Hoosbeek, M.R. (2023). **Seasonal fluctuations of extracellular enzyme activities are related to the biogeochemical cycling of C, N and P in a tropical terra-firme forest.** *Biogeochemistry* **10.1007/s10533-022-01009-4**.
130. Howlett, K., Lee, H.-Y., Jaffé, A., **Lewis, M.** , & Turner, E.C. (2023). **Wildlife documentaries present a diverse, but biased, portrayal of the natural world.** *People and Nature* 5 633-644. **10.1002/pan3.10431**.
131. Streefkerk, I.N., **de Bruijn, J.** , Haer, T., Van Loon, A.F., Quichimbo, E.A., Wens, M., Hassaballah, K., & Aerts, J.C.J.H. (2023). **A coupled agent-based model to analyse human-drought feedbacks for agropastoralists in dryland regions.** *Frontiers in Water* 4 e1037971. **10.3389/frwa.2022.1037971**.
132. **Hunt, J.** , **Zakeri, B.** , Jurasz, J., Tong, W., Dabek, P., Brandao, R., Patro, E.R., Durin, B., Filho, W.L., **Wada, Y.** , **van Ruijven, B.** , & **Riahi, K.** (2023). **Underground Gravity Energy Storage: A Solution for Long-Term Energy Storage.** *Energies* 16 (2) e825. **10.3390/en16020825**.
133. **Joseph, J.**, **van Dijk, M.**, & **Krisztin, T.** (2023). **Do Large Estates Benefit Smallholder Neighbours? Evidence from Malawi.** *The Journal of Development Studies* 1-23. **10.1080/00220388.2022.2147831**.
134. **Ren, M.**, Ma, T., Fang, C., Liu, X., Guo, C., Zhang, S., Zhou, Z., Zhu, Y., Dai, H., & Huang, C. (2023). **Negative emission technology is key to decarbonizing China's cement industry.** *Applied Energy* 329 e120254. **10.1016/j.apenergy.2022.120254**.
135. Jellesmark, S., Ausden, M., Blackburn, T.M., Hoffmann, M., McRae, L., **Visconti, P.**, & Gregory, R.D. (2023). **The effect of conservation interventions on the abundance of breeding waders within nature reserves in the United Kingdom.** *Ibis* 165 (1) 69-81. **10.1111/ibi.13106**.
136. McCrea, R., King, R., **Graham, L.**, & Börger, L. (2023). **Realising the promise of large data and complex models.** *Methods in Ecology and Evolution* 14 (1) 4-11. **10.1111/2041-210X.14050**.
137. Ureta, C., Ramírez-Barrón, M., Sánchez-García, E.A., Cuervo-Robayo, A.P., Munguía-Carrara, M., **Mendoza Ponce, A.** , Gay, C., & Sánchez-Cordero, V. (2023). **Species, taxonomic and functional group diversities of terrestrial mammals at risk under climate change and land use/cover change scenarios in Mexico.** *Global Change Biology* 28 (23) 6992-7008. **10.1111/gcb.16411**.
138. Blattert, C., Mönkkönen, M., Burgas, D., **Di Fulvio, F.** , Toraño Caicoya, A., Vergarechea, M., Klein, J., Hartikainen, M., Antón-Fernández, C., Astrup, R., Emmerich, M., **Forsell, N.**, Lukkarinen, J., Lundström, J., Pitzén, S., Poschenrieder, W., Primmer, E., Snäll, T., & Eyvindson, K. (2023). **Climate targets in European timber-producing countries conflict with goals on forest ecosystem services and biodiversity.** *Communications Earth & Environment* 4 (1) e119. **10.1038/s43247-023-00771-z**.
139. **Cornford, R.** , Spooner, F., McRae, L., Purvis, A., & Freeman, R. (2023). **Ongoing over-exploitation and delayed responses to environmental change highlight the urgency for action to promote vertebrate recoveries by 2030.** *Proceedings of the Royal Society B: Biological Sciences* 290 (1997) e20230464. **10.1098/rspb.2023.0464**.
140. Dornelas, M., Chase, J.M., Gotelli, N.J., Magurran, A.E., McGill, B.J., Antão, L.H., Blowes, S.A., **Daskalova, G.** , Leung, B., Martins, I.S., Moyes, F., Myers-Smith, I.H., Thomas, C.D., & Vellend, M. (2023). **Looking back on biodiversity change: lessons for the road ahead.** *Philosophical Transactions of the Royal Society B: Biological Sciences* 378 (1881) e20220199. **10.1098/rstb.2022.0199**.
141. **Ermolieva, T.**, **Ermoliev, Y.**, **Havlik, P.** , **Derci Augustynczik, A.L.**, **Komendantova, N.** , **Kahil, T.** , **Balkovič, J.** , **Skalský, R.** , **Folberth, C.** , Knopov, P.S., & Wang, G. (2023). **Connections between**

**robust statistical estimation, robust decision making with two-stage stochastic optimization, and robust machine learning problems.** *Cybernetics and systems analysis* 59 (3) 33-47.

142. Fan, L., Wigneron, J.-P., Ciais, P., Chave, J., Brandt, M., Sitch, S., Yue, C., Bastos, A., Li, X., Qin, Y., Yuan, W., **Shchepashchenko, D.** , Mukhortova, L., Li, X., Liu, X., Wang, M., Frappart, F., Xiao, X., Chen, J., Ma, M., Wen, J., Chen, X., Yang, H., van Wees, D., & Fensholt, R. (2023). **Siberian carbon sink reduced by forest disturbances.** *Nature Geoscience* 16 56-62. **10.1038/s41561-022-01087-x**.
143. **Haniotis, A.** (2023). **Down (my) Memory Lane: Has Economic Analysis Impacted CAP Reforms?** *EuroChoices* 22 (2) 38-44. **10.1111/1746-692X.12401**.
144. **Kozicka, M.** , **Havlik, P.** , **Valin, H.** , Wollenberg, E., **Deppermann, A.**, **Leclère, D.**, **Lauri, P.**, Moses, R., **Boere, E.**, **Frank, S.** , **Davis, C.**, **Park, E.**, & Gurwich, N. (2023). **Feeding climate and biodiversity goals with novel plant-based meat and milk alternatives.** *Nature Communications* 14 e5316. **10.1038/s41467-023-40899-2**.
145. Ortiz-Partida, J.P., Fernandez-Bou, A.S., Maskey, M., Rodríguez-Flores, J.M., Medellín-Azuara, J., Sandoval-Solis, S., **Ermolieva, T.**, Kanavas, Z., **Sahu, R.K.** , **Wada, Y.** , & **Kahil, T.** (2023). **Hydro-Economic Modeling of Water Resources Management Challenges: Current Applications and Future Directions.** *Water Economics and Policy* 09 (01) e2340003. **10.1142/S2382624X23400039**.
146. Petsakos, A., **Kozicka, M.** , Blomme, G., Nakakawa, J.N., Ocimati, W., & Gotor, E. (2023). **The potential impact of banana Xanthomonas wilt on food systems in Africa: modeling scenarios of policy response and disease control measures.** *Frontiers in Sustainable Food Systems* 7 e1207913. **10.3389/fsufs.2023.1207913**.
147. **Shchepashchenko, D.** , Mukhortova, L.V., Martynenko, O.V., Korotkov, V.N., & Karminov, V.N. (2023). **Application of Mineral Fertilizers in Forests with Respect to Forest Carbon Budget.** *Agrochemistry* 9 81-96. **10.31857/S0002188123090107**.
148. **Shvidenko, A.**, Mukhortova, L., Kapitsa, E., **Kraxner, F.**, **See, L.** , Pyzhev, A., Gordeev, R., Fedorov, S., Korotkov, V., Bartalev, S., & **Shchepashchenko, D.** (2023). **A Modelling System for Dead Wood Assessment in the Forests of Northern Eurasia.** *Forests* 14 (1) p. 45. **10.3390/f14010045**.
149. Soula, R., Chebil, A., Majdoub, R., Crespo, D., Albiac, J., & **Kahil, T.** (2023). **Evaluation of the Impact of Groundwater Management Policies Under Climate and Economic Changes in Tunisia.** *Water Economics and Policy* 09 (01) e2340005. **10.1142/S2382624X23400052**.
150. Wolff, N.H., **Visconti, P.**, Kujala, H., Santini, L., Hilbers, J.P., Possingham, H.P., Oakleaf, J.R., Kennedy, C.M., Kiesecker, J., Fargione, J., & Game, E.T. (2023). **Prioritizing global land protection for population persistence can double the efficiency of habitat protection for reducing mammal extinction risk.** *One Earth* 6 (11) 1564-1575. **10.1016/j.oneear.2023.10.001**.
151. **Yokomatsu, M.**, **Mochizuki, J.** , **Joseph, J.**, **Burek, P.** , & **Kahil, T.** (2023). **Macroeconomic co-benefits of DRR investment: assessment using the Dynamic Model of Multi-hazard Mitigation CoBenefits (DYNAMMICs) model.** *Disaster Prevention and Management: An International Journal* 32 (1) 139-162. **10.1108/DPM-07-2022-0154**.
152. **Yokomatsu, M.**, **Schinko, T.** , **Mochizuki, J.** , & Rezai, A. (2023). **Climate-related Disaster and Human Capital Investment in the Global South — Household Heterogeneity and Growth.** *Economics of Disasters and Climate Change* **10.21203/rs.3.rs-3532426/v1**. (Submitted)
153. Park, J., Müller, J., Arora, B., Faybishenko, B., Pastorello, G., Varadharajan, C., **Sahu, R.** , & Agarwal, D. (2022). **Long-term missing value imputation for time series data using deep neural networks.** *Neural Computing and Applications* 35 9071-9091. **10.1007/s00521-022-08165-6**.
154. **Mochizuki, J.** & **Wada, Y.** (2022). **Closing the loop of reflexivity.** *Nature Climate Change* **10.1038/s41558-022-01569-1**.
155. Kokemohr, L., **Escobar Lanzuela, N.** , Mertens, A., Mosnier, C., Pirlo, G., Veysset, P., & Kuhn, T. (2022). **Life Cycle Sustainability Assessment of European beef production systems based on a farm-level optimization model.** *Journal of Cleaner Production* 379 e134552. **10.1016/j.jclepro.2022.134552**.

156. **Sperling, F.**, **Havlik, P.** , Denis, M., **Valin, H.** , **Palazzo, A.** , **Gaupp, F.**, & **Visconti, P.** (2022). **Toward resilient food systems after COVID-19.** *Current Research in Environmental Sustainability* 4 e100110. **10.1016/j.crsust.2021.100110**.
157. **Awais, M.** , **Vinca, A.** , Parkinson, S., McPherson, M., **Byers, E.** , **Willaarts, B.** , Muhamma, A., & **Riahi, K.** (2022). **Replenishing the Indus Delta through multi-sector transformation.** *Frontiers in Environmental Science* 10 e958101. **10.3389/fenvs.2022.958101**.
158. **van Dijk, M.**, de Lange, T., van Leeuwen, P., & Debie, P. (2022). **Occupations on the map: Using a super learner algorithm to downscale labor statistics.** *PLoS ONE* 17 (12) e0278120. **10.1371/journal.pone.0278120**.
159. Leadley, P., Obura, D., Archer, E., Costello, M.J., Dávalos, L.M., Essl, F., Hansen, A., Hashimoto, S., **Leclere, D.**, Mori, A.S., Nicholson, E., Purvis, A., Rondinini, C., Shannon, L., Shen, X., Turak, E., Verburg, P.H., & **Visconti, P.** (2022). **Actions needed to achieve ambitious objectives of net gains in natural ecosystem area by 2030 and beyond.** *PLOS Sustainability and Transformation* 1 (12) e0000040. **10.1371/journal.pstr.0000040**.
160. Noll, L., Zhang, S., Zheng, Q., Hu, Y., **Hofhansl, F.** , & Wanek, W. (2022). **Climate and geology overwrite land use effects on soil organic nitrogen cycling on a continental scale.** *Biogeosciences* 19 (23) 5419-5433. **10.5194/bg-2022-41**.
161. **Ermolieva, T.**, **Ermoliev, Y.**, Zagorodny, A., Bogdanov, V., Borodina, O., **Havlik, P.** , **Komendantova, N.** , Knopov, P., Gorbacuk, V., & Zaslavskyi, V. (2022). **Artificial Intelligence, Machine Learning, and Intelligent Decision Support Systems: Iterative "Learning" SQG-based procedures for Distributed Models' Linkage.** *Artificial Intelligence Journal* 94 (2) **10.15407/jai2022.02.092**.
162. Mahnken, M., Cailleret, M., Collalti, A., Trotta, C., Biondo, C., D'Andrea, E., Dalmonech, D., Marano, G., Mäkelä, A., Minunno, F., Peltoniemi, M., Trotsiuk, V., Nadal-Sala, D., Sabaté, S., Vallet, P., Aussenac, R., Cameron, D.R., Bohn, F.J., Grote, R., **Derci Augustynczik, A.L.**, Yousefpour, R., Huber, N., Bugmann, H., Merganičová, K., Merganic, J., Valent, P., Lasch-Born, P., Hartig, F., Vega del Valle, I.D., Volkholz, J., Gutsch, M., Matteucci, G., Krejza, J., Ibrom, A., Meesenburg, H., Rötzer, T., van der Maaten-Theunissen, M., van der Maaten, E., & Reyer, C.P.O. (2022). **Accuracy, realism and general applicability of European forest models.** *Global Change Biology* 28 (23) 6921-6943. **10.1111/gcb.16384**.
163. Wu, G.C., Baker, J.S., Wade, C.M., McCord, G.C., Fargione, J.E., & **Havlik, P.** (2022). **Contributions of healthier diets and agricultural productivity toward sustainability and climate goals in the United States.** *Sustainability Science* 18 (1) 539-556. **10.1007/s11625-022-01232-w**.
164. Cimdins, R., **Krasovskiy, A.** , & **Kraxner, F.** (2022). **Regional Variability and Driving Forces behind Forest Fires in Sweden.** *Remote Sensing* 14 (22) e5826. **10.3390/rs14225826**.
165. Li, J., Chen, Y., Cai, K., Fu, J., **Tang, T.** , Chen, Y., **Folberth, C.** , & Liu, Y. (2022). **A high-resolution nutrient emission inventory for hotspot identification in the Yangtze River Basin.** *Journal of Environmental Management* 321 e115847. **10.1016/j.jenvman.2022.115847**.
166. Bonner, M.TL., **Franklin, O.** , Hasegawa, S., & Näsholm, T. (2022). **Those who can don't want to, and those who want to can't: An eco-evolutionary mechanism of soil carbon persistence.** *Soil Biology and Biochemistry* 174 e108813. **10.1016/j.soilbio.2022.108813**.
167. **Kallio, M.**, Guillaume, J.H.A., **Burek, P.** , **Tramberend, S.** , **Smilovic, M.** , Horton, A.J., & Virrantaus, K. (2022). **Unpacking dasymetric modelling to correct spatial bias in environmental model outputs.** *Environmental Modelling & Software* 157 e105511. **10.1016/j.envsoft.2022.105511**.
168. **Khabarov, N.** , **Smirnov, A.** , & **Obersteiner, M.** (2022). **Shadow prices and optimal cost in economic applications.** *arXiv* (Submitted)
169. Wang, Z., Hu, B., Zhang, C., Atkinson, P.M., Wang, Z., Xu, K., **Chang, J.** , Fang, X., Jiang, Y., & Shi, Z. (2022). **How the Air Clean Plan and carbon mitigation measures co-benefited China in PM2.5 reduction and health from 2014 to 2020.** *Environment International* 169 e107510. **10.1016/j.envint.2022.107510**.

170. **Joshi, J.**, Stocker, B.D., **Hofhansl, F.** , Zhou, S., **Dieckmann, U** , & Prentice, I.C. (2022). **Towards a unified theory of plant photosynthesis and hydraulics.** *Nature Plants* **10.1038/s41477-022-01244-5**.
171. **Gidden, M.** , **Gasser, T.** , Grassi, G., **Forsell, N.**, Janssens, I., Lamb, W., Minx, J., **Nicholls, Z.** , **Steinhauser, J.** , & **Riahi, K.** (2022). **Policy guidance and pitfalls aligning IPCC scenarios to national land emissions inventories.** *Earth and Space Science Open Archive* **10.1002/essoar.10512676.2**.
172. Estrada, F., **Mendoza Ponce, A.** , Calderón-Bustamante, O., & Botzen, W. (2022). **Impacts and economic costs of climate change on Mexican agriculture.** *Regional Environmental Change* 22 (4) e126. **10.1007/s10113-022-01986-0**.
173. Nwachukwu, C.M., Olofsson, E., Lundmark, R., & **Wetterlund, E.** (2022). **Evaluating fuel switching options in the Swedish iron and steel industry under increased competition for forest biomass.** *Applied Energy* 324 e119878. **10.1016/j.apenergy.2022.119878**.
174. **Khabarov, N.** , **Smirnov, A.** , & **Obersteiner, M.** (2022). **Social cost of carbon: A revisit from a systems analysis perspective.** *Frontiers in Environmental Science* 10 **10.3389/fenvs.2022.923631**.
175. Ali, Z., Scheelbeek, P.F.D., Felix, J., Jallow, B., **Palazzo, A.** , Segnon, A.C., **Havlík, P.** , Prentice, A.M., & Green, R. (2022). **Adherence to EAT-Lancet dietary recommendations for health and sustainability in the Gambia.** *Environmental Research Letters* 17 (10) e104043. **10.1088/1748-9326/ac9326**.
176. Mosnier, A., Schmidt-Traub, G., **Obersteiner, M.** , Jones, S., **Javalera Rincón, V.** , DeClerck, F., Thomson, M., **Sperling, F.**, Harrison, P., **Pérez Guzmán, K.** , McCord, G.C., Navarro-Garcia, J., Marcos-Martinez, R., Wu, G.C., Poncet, J., Douzal, C., **Steinhauser, J.** , Monjeau, A., Frank, F., Lehtonen, H., Rämö, J., Leach, N., Gonzalez-Abraham, C.E., Ghosh, R.K., Jha, C., Singh, V., Bai, Z., Jin, X., Ma, L., Strokov, A., Potashnikov, V., **Orduña-Cabrera, F.** , **Neubauer, R.**, Diaz, M., Penescu, L., Domínguez, E.A., Chavarro, J., Pena, A., Basnet, S., Fetzer, I., Baker, J., Zerriffi, H., Reyes Gallardo, R., Bryan, B.A., Hadjikakou, M., Lotze-Campen, H., Stevanovic, M., Smith, A., Costa, W., Habiburrachman, A.H.F., Immanuel, G., Selomane, O., Daloz, A.-S., Andrew, R., van Oort, B., Imanirareba, D., Molla, K.G., Woldeyes, F.B., Soterroni, A.C., Scarabello, M., Ramos, F.M., Boer, R., Winarni, N.L., Supriatna, J., Low, W.S., Fan, A.C.H., Naramabuye, F.X., Niyitanga, F., Olguín, M., Popp, A., Rasche, L., Godfray, C., Hall, J.W., Grundy, M.J., & Wang, X. (2022). **How can diverse national food and land-use priorities be reconciled with global sustainability targets? Lessons from the FABLE initiative.** *Sustainability Science* 18 (1) 335-345. **10.1007/s11625-022-01227-7**.
177. Nogué, S., de Nascimento, L., **Graham, L.**, Brown, L.A., González, L.A.G., Castilla-Beltrán, A., Peñuelas, J., Fernández-Palacios, J.M., & Willis, K.J. (2022). **The spatiotemporal distribution of pollen traits related to dispersal and desiccation tolerance in Canarian laurel forest.** *Journal of Vegetation Science* 33 (5) e13147. **10.1111/jvs.13147**.
178. Bai, M., Zhou, S., & **Tang, T.** (2022). **A Reconstruction of Irrigated Cropland Extent in China from 2000 to 2019 Using the Synergy of Statistics and Satellite-Based Datasets.** *Land* 11 (10) e1686. **10.3390/land11101686**.
179. **Su, H.**, **Willaarts, B.** , **Luna Gonzalez, D.**, Krol, M.S., & Hogeboom, R.J. (2022). **Gridded 5 arcmin datasets for simultaneously farm-size-specific and crop-specific harvested areas in 56 countries.** *Earth System Science Data* 14 (9) 4397-4418. **10.5194/essd-14-4397-2022**.
180. Klauer, B., Küblböck, K., Omann, I., Karutz, R., Klassert, C., Zhu, Y., Zozmann, H., **Smilovic, M.** , Talozi, S., Figueroa, A.J., Grohs, H., Heilemann, J., & Gorelick, S. (2022). **Stakeholder Workshops Informing System Modeling—Analyzing the Urban Food–Water–Energy Nexus in Amman, Jordan.** *Sustainability* 14 (19) e11984. **10.3390/su141911984**.
181. Mukhortova, L., Krivobokov, L., & **Shchepashchenko, D.** (2022). **Postfire dynamics of standing dead tree stock in northern boreal forests.** *BIO Web of Conferences* 52 e00038. **10.1051/bioconf/20225200038**.
182. **Guillaumot, L.** , **Smilovic, M.** , **Burek, P.** , **de Bruijn, J.** , **Greve, P.**, **Kahil, T.** , & **Wada, Y.** (2022). **Coupling a large-scale hydrological model (CWatM v1.1) with a high-resolution groundwater**

**flow model (MODFLOW 6) to assess the impact of irrigation at regional scale.** *Geoscientific Model Development* 15 (18) 7099-7120. **10.5194/gmd-15-7099-2022**.

183. **Hadi, H.**, **Yowargana, P.**, Zulkarnain, M.T., Mohamad, F., Goib, B.K., Hultera, P., **Sturn, T.**, **Karner, M.**, **Dürauer, M.**, **See, L.** , **Fritz, S.** , Hendriatna, A., Nursafingi, Afi, Melati, D.N., Prasetya, F.V.A.S., Carolita, I., Kiswanto, Firdaus, M.I., Rosidi, M., & **Kraxner, F.** (2022). **A national-scale land cover reference dataset from local crowdsourcing initiatives in Indonesia.** *Scientific Data* 9 (1) **10.1038/s41597-022-01689-5**.
184. Daigneault, A., Baker, J.S., Guo, J., **Lauri, P.**, Favero, A., **Forsell, N.**, Johnston, C., Ohrel, S.B., & Sohngen, B. (2022). **How the future of the global forest sink depends on timber demand, forest management, and carbon policies.** *Global Environmental Change* 76 e102582. **10.1016/j.gloenvcha.2022.102582**.
185. Dockendorff, C., Fuss, S., Agra, R., Guye, V., Herrera, D., & **Kraxner, F.** (2022). **Committed to restoring tropical forests: an overview of Brazil's and Indonesia's restoration targets and policies.** *Environmental Research Letters* 17 (9) 093002. **10.1088/1748-9326/ac8ab2**.
186. Ilyas, A., **Parkinson, S.** , **Vinca, A.** , **Byers, E.** , Manzoor, T., **Riahi, K.** , **Willaarts, B.** , Siddiqi, A., & Muhammad, A. (2022). **Balancing smart irrigation and hydropower investments for sustainable water conservation in the Indus basin.** *Environmental Science & Policy* 135 147-161. **10.1016/j.envsci.2022.04.012**.
187. McCallister, M., **Krasovskiy, A.** , Platov, A., Pietracci, B., Golub, A., Lubowski, R., & Leslie, G. (2022). **Forest protection and permanence of reduced emissions.** *Frontiers in Forests and Global Change* 5 **10.3389/ffgc.2022.928518**.
188. **Jung, M.** (2022). **Predictability and transferability of local biodiversity environment relationships.** *PeerJ* 10 e13872. **10.7717/peerj.13872**.
189. Chrysafi, A., Virkki, V., Jalava, M., Sandström, V., Piipponen, J., Porkka, M., Lade, S.J., La Mere, K., Wang-Erlandsson, L., Scherer, L., Andersen, L.S., Bennett, E., Brauman, K.A., Cooper, G.S., De Palma, A., Döll, P., Downing, A.S., DuBois, T.C., Fetzer, I., Fulton, E.A., Gerten, D., Jaafar, H., Jägermeyr, J., Jaramillo, F., **Jung, M.**, Kahiluoto, H., Lassaletta, L., Mackay, A.W., Mason-D'Croz, D., Mekonnen, M.M., Nash, K.L., Pastor, A.V., Ramankutty, N., Ridoutt, B., Siebert, S., Simmons, B.I., Staal, A., Sun, Z., Tobian, A., Usubiaga-Liaño, A., van der Ent, R.J., van Soesbergen, A., Verburg, P.H., **Wada, Y.** , Zipper, S., & Kummu, M. (2022). **Quantifying Earth system interactions for sustainable food production via expert elicitation.** *Nature Sustainability* 5 830-842. **10.1038/s41893-022-00940-6**.
190. Liang, J., Gamarra, J.G.P., Picard, N., Zhou, M., Pijanowski, B., Jacobs, D.F., Reich, P.B., Crowther, T.W., Nabuurs, G.-J., de-Miguel, S., Fang, J., Woodall, C.W., Svenning, J.-C., Jucker, T., Bastin, J.-F., Wiser, S.K., Slik, F., Hérault, B., Alberti, G., Keppel, G., Hengeveld, G.M., Ibisch, P.L., Silva, C.A., ter Steege, H., Peri, P.L., Coomes, D.A., Searle, E.B., von Gadow, K., Jaroszewicz, B., Abbasi, A.O., Abegg, M., Yao, Y.C. A., Aguirre-Gutiérrez, J., Zambrano, A.M.A., Altman, J., Alvarez-Dávila, E., Álvarez-González, J.G., Alves, L.F., Amani, B.H.K., Amani, C.A., Ammer, C., Ilondea, B.A., Antón-Fernández, C., Avitabile, V., Aymard, G.A., Azihou, A.F., Baard, J.A., Baker, T.R., Balazy, R., Bastian, M.L., Batumike, R., Bauters, M., Beeckman, H., Benu, N.M.H., Bitariho, R., Boeckx, P., Bogaert, J., Bongers, F., Bouriaud, O., Brancalion, P.H.S., Brandl, S., Brearley, F. Q., Briseno-Reyes, J., Broadbent, E.N., Bruelheide, H., Bulte, E., Catlin, A.C., Cazzolla Gatti, R., César, R.G., Chen, H.Y. H., Chisholm, C., Cienciala, E., Colletta, G.D., Corral-Rivas, J.J., Cuchietti, A., Cuni-Sanchez, A., Dar, J.A., Dayanandan, S., de Haulleville, T., Decuyper, M., Delabye, S., Derroire, G., DeVries, B., Diisi, J., Do, T.V., Dolezal, J., Dourdain, A., Durrheim, G.P., Obiang, N.L.E., Ewango, C.E.N., Eyre, T.J., Fayle, T.M., Feunang, L.F.N., Finér, L., Fischer, M., Fridman, J., Frizzera, Lorenzo., de Gasper, A.L., Gianelle, D., Glick, H.B., Gonzalez-Elizondo, M.S., Gorenstein, Lev., Habonayo, R., Hardy, O.J., Harris, D.J., Hector, A., Hemp, A., Herold, M., Hillers, A., Hubau, W., Ibanez, T., Imai, N., Imani, G., Jagodzinski, A.M., Janecek, S., Johannsen, V.K., Joly, C.A., Jumbam, B., Kabelong, B. L. P. R., Kahsay, G.A., Karminov, V., Kartawinata, K., Kassi, J.ustin N., Kearsley, E., Kennard, D.K., Kepfer-Rojas, S., Khan, M. L., Kigomo, J.N., Kim, H.S., Klauberg, C., Klomberg, Y., Korjus, H., Kothandaraman, S., **Kraxner,**

**F.**, Kumar, A., Kuswandi, R., Lang, M., Lawes, M.J., Leite, R.V., Lentner, G., Lewis, S.L., Libalah, M.B., Lisingo, Janvier, López-Serrano, P.M., Lu, H., Lukina, N.V., Lykke, A.M., Maicher, V., Maitner, B.S., Marcon, E., Marshall, A.R., Martin, E. H., Martynenko, O., Mbayu, F.M., Mbuvi, M. T. E., Meave, J. A., Merow, C., Miscicki, S., Moreno, V. S., Morera, A., Mukul, S.A., Müller, J.C., Murdjoko, A., Nava-Miranda, M.G., Ndive, L.E., Neldner, V.J., Nevenic, R.V., Nforbelie, L.N., Ngoh, M.L., N'Guessan, A.E., Ngugi, M.R., Ngute, A. S. K., Njila, E. N. N., Nyako, M.C., Ochuodho, T.O., Oleksyn, J., Paquette, A., Parfenova, E.I., Park, M., Parren, M., Parthasarathy, N., Pfautsch, S., Phillips, O. L., Piedade, M.T. F., Piotto, D., Pollastrini, M., Poorter, L., Poulsen, J. R., Poulsen, A.D., Pretzsch, H., Rodeghiero, M., Rolim, S.G., Rovero, F., Rutishauser, E., Sagheb-Talebi, K., Saikia, P., Sainge, M.N., Salas-Eljatib, C., Salis, A., Schall, P., **Shchepashchenko, D.** , Scherer-Lorenzen, M., Schmid, B., Schöngart, J., Šebeň, V., Sellan, G., Selvi, F., Serra-Diaz, J.M., Sheil, D., **Shvidenko, A.**, Sist, P., Souza, A.F., Stereńczak, K.J., Sullivan, M. J. P., Sundarapandian, S., Svoboda, M., Swaine, M.D., Targhetta, N., Tchebakova, N., Trethowan, L.A., Tropek, R., Mukendi, J.T., Umunay, P.M., Usoltsev, V.A., Vaglio Laurin, G., Valentini, R., Valladares, F., van der Plas, F., Vega-Nieva, D.J., Verbeeck, H., Viana, H., Vibrans, A.C., Vieira, S.A., Vleminckx, J., Waite, C.E., Wang, H.-F., Wasingya, E.K., Wekesa, C., Westerlund, B., Wittmann, F., Wortel, V., Zawiła-Niedźwiecki, T., Zhang, C., Zhao, X., Zhu, J., Zhu, X., Zhu, Z.-X., Zo-Bi, I.C., & Hui, C. (2022). **Co-limitation towards lower latitudes shapes global forest diversity gradients.** *Nature Ecology & Evolution* 6 1423-1437. **10.1038/s41559-022-01831-x**.

191. Jaramillo, F., Piemontese, L., Berghuijs, W.R., Wang-Erlandsson, L., **Greve, P.**, & Wang, Z. (2022). **Fewer Basins Will Follow Their Budyko Curves Under Global Warming and Fossil-Fueled Development.** *Water Resources Research* 58 (8) e2021WR031825. **10.1029/2021WR031825**.
192. Mazziotta, A., Lundström, J., **Forsell, N.**, Moor, Helen, Eggers, J., Subramanian, N., Aquilué, N., Morán-Ordóñez, A., Brotons, L., & Snäll, T. (2022). **More future synergies and less trade-offs between forest ecosystem services with natural climate solutions instead of bioeconomy solutions.** *Global Change Biology* 28 (21) 6333-6348. **10.1111/gcb.16364**.
193. Bradter, U., Johnston, A., Hochachka, W.M., Soultan, A., Brommer, J.E., **Gaget, E.**, Kålås, J.A., Lehikoinen, A., Lindström, Å., Piirainen, S., Pavón-Jordán, D., Pärt, T., Øien, I.J., & Sandercock, B.K. (2022). **Decomposing the spatial and temporal effects of climate on bird populations in northern European mountains.** *Global Change Biology* 28 (1) 6209-6227. **10.1111/gcb.16355**.
194. **Laurien, F.** , **Martin, J.G.C.** , & Mehryar, S. (2022). **Climate and disaster resilience measurement: Persistent gaps in multiple hazards, methods, and practicability.** *Climate Risk Management* 37 e100443. **10.1016/j.crm.2022.100443**.
195. Blowes, S.A., **Daskalova, G.** , Dornelas, M., Engel, T., Gotelli, N.J., Magurran, A.E., Martins, I.S., McGill, B., McGlinn, D.J., Sagouis, A., Shimadzu, H., Supp, S.R., & Chase, J.M. (2022). **Local biodiversity change reflects interactions among changing abundance, evenness, and richness.** *Ecology* e3820. **10.1002/ecy.3820**.
196. **Krisztin, T.** & Piribauer, P. (2022). **A Bayesian approach for the estimation of weight matrices in spatial autoregressive models.** *Spatial Economic Analysis* 1-20. **10.1080/17421772.2022.2095426**.
197. Zetterholm, J., Mossberg, J., Jafri, Y., & **Wetterlund, E.** (2022). **We need stable, long-term policy support! — Evaluating the economic rationale behind the prevalent investor lament for forest-based biofuel production.** *Applied Energy* 318 e119044. **10.1016/j.apenergy.2022.119044**.
198. Cinner, J., Caldwell, I., Thiault, L., Ben, J., Blanchard, J., Coll, M., Diedrich, A., Eddy, T., Everett, J., **Folberth, C.** , Gascuel, D., Guiet, J., Gurney, G., Heneghan, R., Jägermeyr, J., Jiddawi, N., Lahari, R., Kuange, J., Liu, W., Maury, O., Müller, C., Novaglio, C., Palacios-Abrantes, J., Petrik, C., Rabearisoa, A., Tittensor, D., Wamukota, A., & Pollnac, R. (2022). **Potential impacts of climate change on agriculture and fisheries production in 72 tropical coastal communities.** *Nature Communications* 13 (1) e3530. **10.1038/s41467-022-30991-4**.
199. **Satoh, Y.**, Yoshimura, K., Pokhrel, Y., Kim, H., Shiogama, H., Yokohata, T., Hanasaki, N., **Wada, Y.** , **Burek, P.** , **Byers, E.** , Müller Schmied, H., Gerten, D., Ostberg, S., Gosling, S.N., Boulange, J.E.S., &

Oki, T. (2022). **The timing of unprecedented hydrological drought under climate change.** *Nature Communications* 13 (1) e3287. **10.1038/s41467-022-30729-2**.

200. Paris Minetto Gellert, J., Falkenberg, T., Nöthlings, U., Heinzel, C., Borgemeister, C., & **Escobar, N.** (2022). **Corrigendum to "Changing dietary patterns is necessary to improve the sustainability of Western diets from a One Health perspective" [Sci. Total Environ. 811 (2022)/151437].** *Science of The Total Environment* 840 e156616. **10.1016/j.scitotenv.2022.156616**.
201. den Elzen, M.G.J., Dafnomilis, I., **Forsell, N.**, Fragkos, P., Fragkiadakis, K., Höhne, N., Kuramochi, T., Nascimento, L., Roelfsema, M., van Soest, H., & **Sperling, F.** (2022). **Updated nationally determined contributions collectively raise ambition levels but need strengthening further to keep Paris goals within reach.** *Mitigation and Adaptation Strategies for Global Change* 27 (6) e33. **10.1007/s11027-022-10008-7**.
202. **Hunt, J.** , Nascimento, A., Guzman, O.J.R., Furtado, G.C.D.A., ten Caten, C.S., Tomé, F.M.C., Leal Filho, W., Đurin, B., Lopes, M., & **Wada, Y.** (2022). **Sedimentary Basin Water and Energy Storage: A Low Environmental Impact Option for the Bananal Basin.** *Energies* 15 (12) e4498.
203. Leadley, P., Gonzalez, A., Obura, D., Krug, C.B., Londoño-Murcia, M.C., Millette, K.L., Radulovici, A., Rankovic, A., Shannon, L.J., Archer, E., Armah, F.A., Bax, N., Chaudhari, K., Costello, M.J., Dávalos, L.M., Roque, F., DeClerck, F., Dee, L.E., Essl, F., Ferrier, S., Genovesi, P., Guariguata, M.R., Hashimoto, S., Ifejika Speranza, C., Isbell, F., Kok, M., Lavery, S.D., **Leclere, D.**, Loyola, R., Lwasa, S., McGeoch, M., Mori, A.S., Nicholson, E., Ochoa, J.M., Öllerer, K., Polasky, S., Rondinini, C., Schroer, S., Selomane, O., Shen, X., Strassburg, B., Sumaila, U.R., Tittensor, D.P., Turak, E., Urbina, L., Vallejos, M., Vázquez-Domínguez, E., Verburg, P.H., **Visconti, P.**, Woodley, S., & Xu, J. (2022). **Achieving global biodiversity goals by 2050 requires urgent and integrated actions.** *One Earth* 5 (6) 597-603. **10.1016/j.oneear.2022.05.009**.
204. **Jung, M.**, **Lewis, M.** , **Lesiv, M.** , Arnell, A., **Fritz, S.** , & **Visconti, P.** (2022). **The global exposure of species ranges and protected areas to forest management.** *Diversity and Distributions* 28 (7) 1487-1496. **10.1111/ddi.13582**.
205. Ramirez Camargo, L., Castro, G., Gruber, K., **Jewell, J.** , Klingler, M., Turkovska, O., **Wetterlund, E.**, & Schmidt, J. (2022). **Pathway to a land-neutral expansion of Brazilian renewable fuel production.** *Nature Communications* 13 (1) e3157. **10.1038/s41467-022-30850-2**.
206. Yao, T., Bolch, T., Chen, D., Gao, J., Immerzeel, W., Piao, S., Su, F., Thompson, L., **Wada, Y.** , Wang, L., Wang, T., Wu, G., Xu, B., Yang, W., Zhang, G., & Zhao, P. (2022). **The imbalance of the Asian water tower.** *Nature Reviews Earth & Environment* **10.1038/s43017-022-00299-4**.
207. Chiang, F., **Greve, P.**, Mazdiyasni, O., **Wada, Y.** , & AghaKouchak, A. (2022). **Intensified Likelihood of Concurrent Warm and Dry Months Attributed to Anthropogenic Climate Change.** *Water Resources Research* 58 (6) e2021WR030411. **10.1029/2021WR030411**.
208. Elkouk, A., Pokhrel, Y., **Satoh, Y.**, & Bouchaou, L. (2022). **Implications of changes in climate and human development on 21st-century global drought risk.** *Journal of Environmental Management* 317 e115378. **10.1016/j.jenvman.2022.115378**.
209. **Franklin, O.** , Fransson, P., **Hofhansl, F.** , & **Joshi, J.** (2022). **Optimal balancing of xylem efficiency and safety explains plant vulnerability to drought.** *bioRxiv (preprint)* **10.1101/2022.05.16.491812**.
210. **Escobar Lanzuela, N.** , Bautista, I., Peña, N., Fenollosa, M.L., Osca, J.M., & Sanjuán, N. (2022). **Life Cycle Thinking for the environmental and financial assessment of rice management systems in the Senegal River Valley.** *Journal of Environmental Management* 310 e114722. **10.1016/j.jenvman.2022.114722**.
211. **Lesiv, M.** , **Shchepashchenko, D.** , Buchhorn, M., **See, L.** , **Dürauer, M.**, **Georgieva, I.** , **Jung, M.**, **Hofhansl, F.** , Schulze, K., Bilous, A., Blyshchyk, V., Mukhortova, L., Brenes, C., Krivobokov, L., Ntie, S., Tsogt, K., **Pietsch, S.** , Tikhonova, E., **Kim, M.**, **Di Fulvio, F.** , Su, Y.-F., Zadorozhniuk, R., Sirbu, F., Panging, K., Bilous, S., Kovalevskii, S., **Kraxner, F.**, Rabia, A.H., Vasylyshyn, R., Ahmed, R., Diachuk, P., Kovalevskyi, S., Bungnamei, K., Bordoloi, K., Churilov, A., Vasylyshyn, O., Sahariah, D., Tertyshnyi, A., Saikia, A., Malek, Å., Singha, K., Feshchenko, R., Prestele, R., Akhtar, I., Sharma, K.,

Domashovets, G., Spawn-Lee, S., Blyshchyk, O., Slyva, O., Ilkiv, M., Melnyk, O., Sliusarchuk, V., Karpuk, A., Terentiev, A., Bilous, V., Blyshchyk, K., Bilous, M., Bogovyk, N., Blyshchyk, I., Bartalev, S., Yatskov, M., Smets, B., **Visconti, P.**, **McCallum, I.** , **Obersteiner, M.** , & **Fritz, S.** (2022). **Global forest management data for 2015 at a 100 m resolution.** *Scientific Data* 9 (1) e199. **10.1038/s41597-022-01332-3**.

212. Guivarch, C., Le Gallic, T., Bauer, N., Fragkos, P., **Huppmann, D.** , Jaxa-Rozen, M., Keppo, I., Kriegler, E., **Krisztin, T.** , Marangoni, G., Pye, S., **Riahi, K.** , Schaeffer, R., Tavoni, M., Trutnevyte, E., van Vuuren, D., & **Wagner, F.** (2022). **Using large ensembles of climate change mitigation scenarios for robust insights.** *Nature Climate Change* **10.1038/s41558-022-01349-x**.
213. Crespo, D., **Albiac Murillo, J.**, Dinar, A., Esteban, E., & **Kahil, T.** (2022). **Integrating ecosystem benefits for sustainable water allocation in hydroeconomic modeling.** *PLoS ONE* 17 (5) e0267439. **10.1371/journal.pone.0267439**.
214. Rose, S., Popp, A., **Fujimori, S.** , **Havlik, P.** , Weyant, J., Wise, M., van Vuuren, D., Brunelle, T., Cui, R., Daioglou, V., **Frank, S.** , Hasegawa, T., Humpenöder, F., Kato, E., Sands, R., Sano, F., Tsutsui, J., Doelman, J., Muratori, M., Prudhomme, R., Wada, K., & Yamamoto, H. (2022). **Global biomass supply modeling for long-run management of the climate system.** *Climatic Change* 172 (1-2) **10.1007/s10584-022-03336-9**.
215. Karutz, R., Omann, I., Gorelick, S.M., Klassert, C.J.A., Zozmann, H., Zhu, Y., Kabisch, S., Kindler, A., Figueroa, A.J., Wang, A., Küblböck, K., Grohs, H., **Burek, P.** , **Smilovic, M.** , & Klauer, B. (2022). **Capturing Stakeholders' Challenges of the Food–Water–Energy Nexus—A Participatory Approach for Pune and the Bhima Basin, India.** *Sustainability* 14 (9) e5323. **10.3390/su14095323**.
216. Wang-Erlandsson, Lan, Tobian, Arne, van der Ent, Ruud J., Fetzer, Ingo, te Wierik, Sofie, Porkka, Miina, Staal, Arie, Jaramillo, Fernando, Dahlmann, Heindriken, Singh, Chandrakant, **Greve, Peter**, Gerten, Dieter, Keys, Patrick W., Gleeson, Tom, Cornell, Sarah E., Steffen, Will, Bai, Xuemei, & Rockström, Johan (2022). **A planetary boundary for green water.** *Nature Reviews Earth & Environment* 3 380-392. **10.1038/s43017-022-00287-8**.
217. Liu, X., Liu, W., Tang, Q., Liu, B., **Wada, Y.** , & Yang, H. (2022). **Global Agricultural Water Scarcity Assessment Incorporating Blue and Green Water Availability Under Future Climate Change.** *Earth's Future* 10 (4) **10.1029/2021EF002567**.
218. Wang, J., Walter, B.A., Yao, F., Song, C., Ding, M., Maroof, A.S., Zhu, J., Fan, C., McAlister, J.M., Sikder, S., Sheng, Y., Allen, G.H., Crétaux, J.-F., & **Wada, Y.** (2022). **GeoDAR: georeferenced global dams and reservoirs dataset for bridging attributes and geolocations.** *Earth System Science Data* 14 (4) 1869-1899. **10.5194/essd-14-1869-2022**.
219. Medrano-Pérez, O.R., **Nava, L.F.** , & Cáñez-Cota, A. (2022). **The Visibility of Citizen Participation and the Invisibility of Groundwater in Mexico.** *Water* 14 (9) e1321. **10.3390/w14091321**.
220. Cha, S., Jo, H.-W., Kim, M., Song, C., Lee, H., Park, E., Lim, J., **Shchepashchenko, D.** , **Shvidenko, A.**, & Lee, W.-K. (2022). **Application of deep learning algorithm for estimating stand volume in South Korea.** *Journal of Applied Remote Sensing* 16 (02) e024503. **10.1117/1.JRS.16.024503**.
221. Araza, A., de Bruin, S., Herold, M., Quegan, S., Labriere, N., Rodriguez-Veiga, P., Avitabile, V., Santoro, M., Mitchard, E.T.A., Ryan, C.M., Phillips, O.L., Willcock, S., Verbeeck, H., Carreiras, J., Hein, L., Schelhaas, M.-J., Pacheco-Pascagaza, A.M., da Conceição Bispo, P., Laurin, G.V., Vieilledent, G., Slik, F., Wijaya, A., Lewis, S.L., Morel, A., Liang, J., Sukhdeo, H., **Shchepashchenko, D.** , Cavlovic, J., Gilani, H., & Lucas, R. (2022). **A comprehensive framework for assessing the accuracy and uncertainty of global above-ground biomass maps.** *Remote Sensing of Environment* 272 e112917. **10.1016/j.rse.2022.112917**.
222. Chico, D., Pahlow, M., **Willaarts, B.** , Sinisgalli, P., & Garrido, A. (2022). **An Integrated Approach to Assess the Water Efficiency of Introducing Best Management Practices: An Application to Sugarcane Mechanisation in Brazil.** *Water* 14 (7) e1072. **10.3390/w14071072**.

223. Chandrasekar, R., **Sahu, R.K.** , & Balaji, C. (2022). **Assimilation of multi-channel radiances in mesoscale models with an ensemble technique to improve track forecasts of Tropical cyclones.** *Journal of Earth System Science* 131 (2) e83. **10.1007/s12040-021-01798-6**.
224. **Żebrowski, P.** , **Dieckmann, U.** , **Brännström, Å.**, **Franklin, O.** , & **Rovenskaya, E.** (2022). **Sharing the Burdens of Climate Mitigation and Adaptation: Incorporating Fairness Perspectives into Policy Optimization Models.** *Sustainability* 14 (7) e3737. **10.3390/su14073737**.
225. Meier, H.E.M., Kniebusch, M., Dieterich, C., Gröger, M., Zorita, E., Elmgren, R., Myrberg, K., Ahola, M.P., Bartosova, A., Bonsdorff, E., Börgel, F., Capell, R., Carlén, I., Carlund, T., Carstensen, J., Christensen, O.B., Dierschke, V., Frauen, C., Frederiksen, M., **Gaget, E.**, Galatius, A., Haapala, J.J., Halkka, A., Hugelius, G., Hünicke, B., Jaagus, J., Jüssi, M., Käyhkö, J., Kirchner, N., Kjellström, E., Kulinski, K., Lehmann, A., Lindström, G., May, W., Miller, P.A., Mohrholz, V., Müller-Karulis, B., Pavón-Jordán, D., Quante, M., Reckermann, M., Rutgersson, A., Savchuk, O.P., Stendel, M., Tuomi, L., Viitasalo, M., Weisse, R., & Zhang, W. (2022). **Climate change in the Baltic Sea region: a summary.** *Earth System Dynamics* 13 (1) 457-593. **10.5194/esd-13-457-2022**.
226. **Wang, X.**, **Folberth, C.** , **Skalský, R.** , Wang, S., Chen, B., Liu, Y., Chen, J., & **Balkovič, J.** (2022). **Crop calendar optimization for climate change adaptation in rice-based multiple cropping systems of India and Bangladesh.** *Agricultural and Forest Meteorology* 315 e108830. **10.1016/j.agrformet.2022.108830**.
227. **Warren-Thomas, E.**, Agus, F., Akbar, P.G., Crowson, M., Hamer, K.C., Hariyadi, B., Hodgson, J.A., Kartika, W.D., Lopes, M., Lucey, J.M., Mustaqim, D., Pettorelli, N., Saad, A., Sari, W., Sukma, G., Stringer, L.C., Ward, C., & Hill, J.K. (2022). **No evidence for trade-offs between bird diversity, yield and water table depth on oil palm smallholdings: Implications for tropical peatland landscape restoration.** *Journal of Applied Ecology* 59 (5) 1231-1247. **10.1111/1365-2664.14135**.
228. Gustavsson, L., Sathre, R., Leskinen, P., Nabuurs, G.-J., & **Kraxner, F.** (2022). **Comment on 'Climate mitigation forestry—temporal trade-offs'.** *Environmental Research Letters* 17 (4) e048001. **10.1088/1748-9326/ac57e3**.
229. Paris, J.M.G., Falkenberg, T., Nöthlings, U., Heinzel, C., Borgemeister, C., & **Escobar Lanzuela, N.** (2022). **Changing dietary patterns is necessary to improve the sustainability of Western diets from a One Health perspective.** *Science of the Total Environment* 811 e151437. **10.1016/j.scitotenv.2021.151437**.
230. **Addo, F.** & Salhofer, K. (2022). **Transient and persistent technical efficiency and its determinants: the case of crop farms in Austria.** *Applied Economics* 54 (25) 2916-2932. **10.1080/00036846.2021.2000580**.
231. Choi, Y., Lim, C.-H., **Krasovskiy, A.** , Platov, A., Kim, Y., Chung, H.I., **Kim, M.**, Lee, W.-K., Shvidenko, A., **Kraxner, F.**, **Shchepashchenko, D.** , Biging, G.S., Chon, J., & Jeon, S.W. (2022). **Can a national afforestation plan achieve simultaneous goals of biodiversity and carbon enhancement? Exploring optimal decision making using multi-spatial modeling.** *Biological Conservation* 267 e109474. **10.1016/j.biocon.2022.109474**.
232. García-Velásquez, C., **Leduc, S.**, & van der Meer, Y. (2022). **Design of biobased supply chains on a life cycle basis: A bi-objective optimization model and a case study of biobased polyethylene terephthalate (PET).** *Sustainable Production and Consumption* 30 706-719. **10.1016/j.spc.2022.01.003**.
233. Zhuo, L., Li, M., Zhang, G., Mekonnen, M.M., Hoekstra, A., **Wada, Y.** , & Wu, P. (2022). **Volume versus value of crop-related water footprints and virtual water flows: A case study for the Yellow River Basin.** *Journal of Hydrology* 608 e127674. **10.1016/j.jhydrol.2022.127674**.
234. **Fujimori, S.** , Wu, W,, Doelman, J,, **Frank, S,** , Hristov, J,, Kyle, P,, Sands, R,, van Zeist, W,-J,, **Havlik, P,** , Domínguez, I, P,, Sahoo, A,, Stehfest, E,, Tabeau, A,, **Valin, H,** , van Meijl, H,, **Hasegawa, T,**, & Takahashi, K. (2022). **Land-based climate change mitigation measures can affect agricultural markets and food security.** *Nature Food* 3 (2) 110-121. **10.1038/s43016-022-00464-4**.
235. **Fritz, S.** , **Laso Bayas, J.C.** , **See, L.** , **Shchepashchenko, D.** , **Hofhansl, F.** , **Jung, M.**, **Dürauer, M.**, **Georgieva, I.** , **Danylo, O.**, **Lesiv, M.** , & **McCallum, I.** (2022). **A Continental Assessment of the**

**Drivers of Tropical Deforestation with a Focus on Protected Areas.** *Frontiers in Conservation Science* 3 e830248. **10.3389/fcosc.2022.830248**.

236. Fox, N., **Graham, L.**, Eigenbrod, F., Bullock, J.M., & Parks, K.E. (2022). **Geodiversity Supports Cultural Ecosystem Services: an Assessment Using Social Media.** *Geoheritage* 14 (1) e27. **10.1007/s12371-022-00665-0**.
237. Liu, X., Dai, H., **Wada, Y.** , **Kahil, T.** , Ni, J., Chen, B., Chen, Y., Guo, C., Pan, C., Liu, X., & Liu, Y. (2022). **Achieving carbon neutrality enables China to attain its industrial water-use target.** *One Earth* 5 (2) 188-200. **10.1016/j.oneear.2022.01.007**.
238. Henry, R.C., Arneth, A., **Jung, M.**, Rabin, S.S., Rounsevell, M.D., Warren, F., & Alexander, P. (2022). **Global and regional health and food security under strict conservation scenarios.** *Nature Sustainability* **10.1038/s41893-021-00844-x**.
239. **Wildemeersch, M.** , Tang, S., **Ermolieva, T.**, **Ermoliev, Y.**, **Rovenskaya, E.** , & **Obersteiner, M.** (2022). **Containing the Risk of Phosphorus Pollution in Agricultural Watersheds.** *Sustainability* 14 (3) e1717. **10.3390/su14031717**.
240. van Vuuren, D., **Zimm, C.** , Busch, S., Kriegler, E., Leininger, J., Messner, D., **Nakicenovic, N.** , Rockstrom, J., **Riahi, K.** , **Sperling, F.**, Bosetti, V., Cornell, S., Gaffney, O., Lucas, P., Popp, A., Ruhe, C., von Schiller, A., Schmidt, J., & Soergel, B. (2022). **Defining a Sustainable Development Target Space for 2030 and 2050.** *One Earth* 5 (2) 142-156. **10.31223/X5B62B**.
241. **Addo, F.** & Salhofer, K. (2022). **Part-Time Farming and Scale Efficiency.** *German Journal of Agricultural Economics* 71 (1) 16-35. **10.30430/gjae.2022.0195**.
242. Hooftman, D.A.P., Bullock, J.M., Jones, L., Eigenbrod, F., Barredo, J.I., Forrest, M., **Kindermann, G.** , Thomas, A., & Willcock, S. (2022). **Reducing uncertainty in ecosystem service modelling through weighted ensembles.** *Ecosystem Services* 53 e101398. **10.1016/j.ecoser.2021.101398**.
243. Yang, W., Long, D., Scanlon, B., **Burek, P.** , Zhang, C., Han, Z., Butler, J., Pan, Y., Lei, X., & **Wada, Y.** (2022). **Human Intervention Will Stabilize Groundwater Storage Across the North China Plain.** *Water Resources Research* 58 (2) e2021WR030884. **10.1029/2021WR030884**.
244. Cazzolla Gatti, R., Reich, P., Gamarra, J., Crowther, T., Hui, C., Morera, A., Bastin, J.-F., de-Miguel, S., Nabuurs, G.-J., Svenning, J.-C., Serra-Diaz, J., Merow, C., Enquist, B., Kamenetsky, M., Lee, J., Zhu, J., Fang, J., Jacobs, D., Pijanowski, B., Banerjee, A., Giaquinto, R., Alberti, G., Almeyda Zambrano, A., Alvarez-Davila, E., Araujo-Murakami, A., Avitabile, V., Aymard, G., Balazy, R., Baraloto, C., Barroso, J., Bastian, M., Birnbaum, P., Bitariho, R., Bogaert, J., Bongers, F., Bouriaud, O., Brancalion, P., Brearley, F., Broadbent, E., Bussotti, F., Castro da Silva, W., César, R., Češljar, G., Chama Moscoso, V., Chen, H., Cienciala, E., Clark, C., Coomes, D., Dayanandan, S., Decuyper, M., Dee, L., Del Aguila Pasquel, J., Derroire, G., Djuikouo, M., Van Do, T., Dolezal, J., Đorđević, I., Engel, J., Fayle, T., Feldpausch, T., Fridman, J., Harris, D., Hemp, A., Hengeveld, G., Herault, B., Herold, M., Ibanez, T., Jagodzinski, A., Jaroszewicz, B., Jeffery, K., Johannsen, V., Jucker, T., Kangur, A., Karminov, V., Kartawinata, K., Kennard, D., Kepfer-Rojas, S., Keppel, G., Khan, M., Khare, P., Kileen, T., Kim, H., Korjus, H., Kumar, A., Kumar, A., Laarmann, D., Labrière, N., Lang, M., Lewis, S., Lukina, N., Maitner, B., Malhi, Y., Marshall, A., Martynenko, O., Monteagudo Mendoza, A., Ontikov, P., Ortiz-Malavasi, E., Pallqui Camacho, N., Paquette, A., Park, M., Parthasarathy, N., Peri, P., Petronelli, P., Pfautsch, S., Phillips, O., Picard, N., Piotto, D., Poorter, L., Poulsen, J., Pretzsch, H., Ramírez-Angulo, H., Restrepo Correa, Z., Rodeghiero, M., Rojas Gonzáles, R., Rolim, S., Rovero, F., Rutishauser, E., Saikia, P., Salas-Eljatib, C., **Shchepashchenko, D.** , Scherer-Lorenzen, M., Šebeň, V., Silveira, M., Slik, F., Sonké, B., Souza, A., Stereńczak, K., Svoboda, M., Taedoumg, H., Tchebakova, N., Terborgh, J., Tikhonova, E., Torres-Lezama, A., van der Plas, F., Vásquez, R., Viana, H., Vibrans, A., Vilanova, E., Vos, V., Wang, H.-F., Westerlund, B., White, L., Wiser, S., Zawiła-Niedźwiecki, T., Zemagho, L., Zhu, Z., Zo-Bi, I., & Liang, J. (2022). **The number of tree species on Earth.** *Proceedings of the National Academy of Sciences* 119 (6) e2115329119. **10.1073/pnas.2115329119**.
245. **Ermoliev, Y.**, Zagorodny, A.G., Bogdanov, V. L., **Ermolieva, T.**, **Havlik, P.** , **Rovenskaya, E.** , **Komendantova, N.** , & **Obersteiner, M.** (2022). **Robust Food–Energy–Water–Environmental**

**Security Management: Stochastic Quasigradient Procedure for Linkage of Distributed Optimization Models under Asymmetric Information and Uncertainty.** *Cybernetics and Systems Analysis* 58 (1) 45-57. **10.1007/s10559-022-00434-5**.

246. **Ermolieva, T.**, **Havlik, P.** , **Frank, S.** , **Kahil, T.** , **Balkovič, J.** , **Skalský, R.** , **Ermoliev, Y.**, Knopov, P.S., Borodina, O.M., & Gorbachuk, V.M. (2022). **A Risk-Informed Decision-Making Framework for Climate Change Adaptation through Robust Land Use and Irrigation Planning.** *Sustainability* 14 (3) p. 1430. **10.3390/su14031430**.
247. Soultan, A., Pavón-Jordán, D., Bradter, U., Sandercock, B., Hochachka, W., Johnston, A., Brommer, J., **Gaget, E.**, Keller, V., Knaus, P., Aghababyan, K., Maxhuni, Q., Vintchevski, A., Nagy, K., Raudonikis, L., Balmer, D., Noble, D., Leitão, D., Øien, I.J., Shimmings, P., Sultanov, E., Caffrey, B., Boyla, K., Radišić, D., Lindström, Å., Velevski, M., Pladevall, C., Brotons, L., Karel, Š., Rajković, D.Z., Chodkiewicz, T., Wilk, T., Tibor, S., van Turnhout, C., Foppen, R., Burfield, I., Vikstrøm, T., Mazal, V.D., Eaton, M., Vorisek, P., Lehikoinen, A., Herrando, S., Kuzmenko, T., Bauer, H.-G., Kalyakin, M., Voltzit, O., Sjeničić, J., & Pärt, T. (2022). **The future distribution of wetland birds breeding in Europe validated against observed changes in distribution.** *Environmental Research Letters* 17 (2) e024025. **10.1088/1748-9326/ac4ebe**.
248. **Ermoliev, Y.**, Zagorodny, A.G., Bogdanov, V.L., **Ermolieva, T.**, **Havlik, P.** , **Rovenskaya, E.** , **Komendantova, N.** , & **Obersteiner, M.** (2022). **Linking Distributed Optimization Models for Food, Water, and Energy Security Nexus Management.** *Sustainability* 14 (3) e1255. **10.3390/su14031255**.
249. Huggins, X., Gleeson, T., Kummu, M., Zipper, S.C., **Wada, Y.** , Troy, T.J., & Famiglietti, J.S. (2022). **Hotspots for social and ecological impacts from freshwater stress and storage loss.** *Nature Communications* 13 (1) **10.1038/s41467-022-28029-w**.
250. **Krasovskiy, A.** & Platov, A.S. (2022). **Algorithm for Solving a Problem of Optimal Control of Structured Populations Interacting at Stationary States.** *Proceedings of the Steklov Institute of Mathematics* 315 (1) 140-148. **10.1134/S0081543821050102**.
251. Cazalis, V., Di Marco, M., Butchart, S.H.M., Akçakaya, H., González-Suárez, M., Meyer, C., Clausnitzer, V., Böhm, M., Zizka, A., Cardoso, P., Schipper, A.M., Bachman, S.P., Young, B.E., Hoffmann, M., Benítez-López, A., Lucas, P.M., Pettorelli, N., Patoine, G., Pacifici, M., Jörger-Hickfang, T., Brooks, T.M., Rondinini, C., Hill, S.L.L., **Visconti, P.**, & Santini, L. (2022). **Bridging the research-implementation gap in IUCN Red List assessments.** *Trends in Ecology & Evolution* 37 (4) 359-370. **10.1016/j.tree.2021.12.002**.
252. Ringsmuth, A.K., Otto, I.M., van den Hurk, B., Lahn, G., Reyer, C.P.O., Carter, T.R., **Magnuszewski, P.**, Monasterolo, I., Aerts, J.C.J.H., Benzie, M., Campiglio, E., Fronzek, S., **Gaupp, F.**, Jarzabek, L., Klein, R.J.T., Knaepen, H., **Mechler, R.** , Mysiak, J., Sillmann, J., Stuparu, D., & West, C. (2022). **Lessons from COVID-19 for managing transboundary climate risks and building resilience.** *Climate Risk Management* 35 e100395. **10.1016/j.crm.2022.100395**.
253. Rivas-Tabares, D., Tarquis, A.M., De Miguel, Á., Gobin, A., & **Willaarts, B.** (2022). **Enhancing LULC scenarios impact assessment in hydrological dynamics using participatory mapping protocols in semiarid regions.** *Science of the Total Environment* 803 e149906. **10.1016/j.scitotenv.2021.149906**.
254. Funk, J., **Forsell, N.**, Gunn, J., & Burns, D. (2022). **Assessing the potential for unaccounted emissions from bioenergy and the implications for forests: The United States and global.** *GCB Bioenergy* 14 (3) 322-345. **10.1111/gcbb.12912**.
255. Liu, W., Liu, X., Yang, H., Ciais, P., & **Wada, Y.** (2022). **Global Water Scarcity Assessment Incorporating Green Water in Crop Production.** *Water Resources Research* 58 (1) e2020WR028570. **10.1029/2020WR028570**.
256. Schaap, K.J., Fuchslueger, L., Quesada, C.A., **Hofhansl, F.** , Valverde-Barrantes, O., Camargo, P., & Hoosbeek, M.R. (2022). **Extracellular enzyme activities in tropical soils are driven by seasonal litter input.** *Biogeochemistry* 163 1-15. **10.1007/s10533-022-01009-4**.

257. Stark, S., Biber-Freudenberger, L., Dietz, T., **Escobar Lanzuela, N.** , Förster, J.J., Henderson, J., Laibach, N., & Börner, J. (2022). **Sustainability implications of transformation pathways for the bioeconomy.** *Sustainable Production and Consumption* 29 215-225. **10.1016/j.spc.2021.10.011**.
258. Trnka, M., Bartošová, L., Grammatikopoulou, I., **Havlik, P.** , Olesen, J.E., Hlavinka, P., Marek, M.V., Vačkářová, D., Skjelvåg, A., & Žalud, Z. (2022). **The Possibility of Consensus Regarding Climate Change Adaptation Policies in Agriculture and Forestry among Stakeholder Groups in the Czech Republic.** *Environmental Management* 69 128-139. **10.1007/s00267-021-01499-2**.
259. Calliari, E., Castellari, S., Davis, M., **Linnerooth-Bayer, J.**, **Martin, J.G.C.** , Mysiak, J., Pastor, T., Ramieri, E., Scolobig, A., Sterk, M., Veerkamp, C., Wendling, L., & Zandersen, M. (2022). **Building climate resilience through nature-based solutions in Europe: A review of enabling knowledge, finance and governance frameworks.** *Climate Risk Management* 37 e100450. **10.1016/j.crm.2022.100450**.
260. Chen, M., Cui, Y., Jiang, S., & **Forsell, N.** (2022). **Toward carbon neutrality before 2060: Trajectory and technical mitigation potential of non-CO2 greenhouse gas emissions from Chinese agriculture.** *Journal of Cleaner Production* 368 e133186. **10.1016/j.jclepro.2022.133186**.
261. Cimdins, R., **Krasovskiy, A.** , & **Kraxner, F.** (2022). **Regional Variability and Driving Forces behind Forest Fires in Sweden.** *Environmental Sciences Proceedings* 17 (1) e23. **10.3390/environsciproc2022017023**.
262. Guo, Q., Zhou, X., **Satoh, Y.**, & Oki, T. (2022). **Irrigated cropland expansion exacerbates the urban moist heat stress in northern India.** *Environmental Research Letters* 17 (5) e054013. **10.1088/1748-9326/ac64b6**.
263. **Janssens, C.**, **Havlik, P.** , **Boere, E.**, **Palazzo, A.** , **Mosnier, A.**, **Leclère, D.**, **Balkovic, J.** , & Maertens, M. (2022). **A sustainable future for Africa through continental free trade and agricultural development.** *Nature Food* 3 (8) 608-618. **10.1038/s43016-022-00572-1**.
264. **Kozicka, M.** , Jones, S.K., Gotor, E., & Enahoro, D. (2022). **Cross-scale trade-off analysis for sustainable development: linking future demand for animal source foods and ecosystem services provision to the SDGs.** *Sustainability Science* **10.1007/s11625-021-01082-y**.
265. **Laso Bayas, J.C.** , **See, L.** , **Georgieva, I.** , **Shchepashchenko, D.** , **Danylo, O.**, **Dürauer, M.**, **Bartl, H.**, **Hofhansl, F.** , Zadorozhniuk, R., Burianchuk, M., Sirbu, F., Magori, B., Blyshchyk, K., Blyshchyk, V., Rabia, A.H., Pawe, C.K., Su, Y.-F., Ahmed, M., Panging, K., Melnyk, O., Vasylyshyn, O., Vasylyshyn, R., Bilous, A., Bilous, S., Das, K., Prestele, R., Pérez-Hoyos, A., Bungnamei, K., Lashchenko, A., Lakyda, Maryna., Lakyda, I., Serediuk, O., Domashovets, G., Yurchuk, Y., Koper, M., & **Fritz, S.** (2022). **Drivers of tropical forest loss between 2008 and 2019.** *Scientific Data* 9 (1) e146. **10.1038/s41597-022-01227-3**.
266. Lees, T., Reece, S., Kratzert, F., Klotz, D., Gauch, M., De Bruijn, J., **Sahu, R.K.** , **Greve, P.**, Slater, L., & Dadson, S.J. (2022). **Hydrological concept formation inside long short-term memory (LSTM) networks.** *Hydrology and Earth System Sciences* 26 (12) 3079-3101. **10.5194/hess-26-3079-2022**.
267. **Mukhortova, L.** & **Shchepashchenko, D.** (2022). **ОЦЕНКА ЗАПАСОВ УГЛЕРОДА В ПОЧВАХ ЛЕСНЫХ ЭКОСИСТЕМ САХАЛИНСКОЙ ОБЛАСТИ [Estimation of carbon stock in forest soils of Sakhalin region].** *Processes in GeoMedia* 4 (34) 1841-1847.
268. Sandoval-Solis, S., Paladino, S., Garza-Diaz, L.E., **Nava, L.F.** , Friedman, J.R., Ortiz-Partida, J.P., Plassin, S., Gomez-Quiroga, G., Koch, J., Fleming, J., Lane, B.A., Wineland, S., Mirchi, A., Saiz-Rodriguez, R., & Neeson, T.M. (2022). **Environmental flows in the Rio Grande - Rio Bravo basin.** *Ecology and Society* 27 (1) e20. **10.5751/ES-12944-270120**.
269. Seber, G., **Escobar Lanzuela, N.** , **Valin, H.** , & Malina, R. (2022). **Uncertainty in life cycle greenhouse gas emissions of sustainable aviation fuels from vegetable oils.** *Renewable and Sustainable Energy Reviews* 170 e112945. **10.1016/j.rser.2022.112945**.
270. **Kozicka, M.** , Enahoro, D., Groot, J.CJ., Rich, K.M., & Gotor, E. (2021). **The Future of Sustainable Development and Agrobiodiversity in Tanzania and Uganda.** *SocArXiv Papers* **10.31235/osf.io/d2rgx**.

271. **Gaget, E.**, Johnston, A., Pavón-Jordán, D., Lehikoinen, A., Sandercock, B., Soultan, A., Božič, L., Clausen, P., Devos, K., Domsa, C., Encarnação, V., Faragó, S., Fitzgerald, N., Frost, T., Gaudard, C., Gosztonyi, L., Haas, F., Hornman, M., Langendoen, T., Ieronymidou, C., Luigujõe, L., Meissner, W., Mikuska, T., Molina, B., Musilová, Z., Paquet, J.-Y., Petkov, N., Portolou, D., Ridzoň, J., Sniauksta, L., Stīpniece, A., Teufelbauer, N., Wahl, J., Zenatello, M., & Brommer, J. (2021). **Protected area characteristics that help waterbirds respond to climate warming.** *Conservation Biology* 1-9. **10.1111/cobi.13877**.
272. Chan, C.Y., Prager, S., Balie, J., **Kozicka, M.** , Hareau, G., Valera, H.G., Tran, N., Wiebe, K., Diagne, M., Alene, A., & Mausch, K. (2021). **The Future of Food Security, Nutrition and Health for Agri-food Systems Transformation.** *SocArxiv Papers* **10.31235/osf.io/qgn9u**.
273. **Guillaumot, L.** , Marçais, J., Vautier, C., Guillou, A., Vergnaud, V., Bouchez, C., Dupas, R., Durand, P., de Dreuzy, J.-R., & Aquilina, L. (2021). **A hillslope-scale aquifer-model to determine past agricultural legacy and future nitrate concentrations in rivers.** *Science of the Total Environment* 800 e149216. **10.1016/j.scitotenv.2021.149216**.
274. **Mendoza Ponce, A.** , Corona-Núñez, R.O., **Nava, L.F.** , Estrada, F., Calderón-Bustamante, O., Martínez-Meyer, E., Carabias, J., Larralde-Corona, A.H., Barrios, M., & Pardo-Villegas, P.D. (2021). **Impacts of land management and climate change in a developing and socioenvironmental challenging transboundary region.** *Journal of Environmental Management* 300 e113748. **10.1016/j.jenvman.2021.113748**.
275. Gleeson, T., Wagener, T., Döll, P., Zipper, S.C., West, C., **Wada, Y.** , Taylor, R., Scanlon, B., Rosolem, R., Rahman, S., Oshinlaja, N., Maxwell, R., Lo, M.-H., Kim, H., Hill, M., Hartmann, A., Fogg, G., Famiglietti, J.S., Ducharne, A., de Graaf, I., Cuthbert, M., Condon, L., Bresciani, E., & Bierkens, M.F.P. (2021). **GMD perspective: The quest to improve the evaluation of groundwater representation in continental- to global-scale models.** *Geoscientific Model Development* 14 (12) 7545-7571. **10.5194/gmd-14-7545-2021**.
276. Pérez-Domínguez, I., del Prado, A., Mittenzwei, K., Hristov, J., **Frank, S.** , Tabeau, A., Witzke, P., **Havlik, P.** , van Meijl, H., Lynch, J., Stehfest, E., Pardo, G., Barreiro-Hurle, J., Koopman, J.F.L., & Sanz-Sánchez, M.J. (2021). **Short- and long-term warming effects of methane may affect the cost-effectiveness of mitigation policies and benefits of low-meat diets.** *Nature Food* **10.1038/s43016-021-00385-8**.
277. Baccour, S., **Albiac Murillo, J.**, **Kahil, T.** , Esteban, E., Crespo, D., & Dinar, A. (2021). **Hydroeconomic modeling for assessing water scarcity and agricultural pollution abatement policies in the Ebro River Basin, Spain.** *Journal of Cleaner Production* 327 e129459. **10.1016/j.jclepro.2021.129459**.
278. Hlásny, T., **Augustynczik, A.**, & Dobor, L. (2021). **Time matters: Resilience of a post-disturbance forest landscape.** *Science of the Total Environment* 799 e149377. **10.1016/j.scitotenv.2021.149377**.
279. Jetz, W., McGowan, J., Rinnan, D.S., Possingham, H.P., **Visconti, P.**, O'Donnell, B., & Londoño-Murcia, M.C. (2021). **Include biodiversity representation indicators in area-based conservation targets.** *Nature Ecology & Evolution* **10.1038/s41559-021-01620-y**.
280. Goulart, H., van der Wiel, K., **Folberth, C.** , **Balkovič, J.** , & van den Hurk, B. (2021). **Storylines of weather-induced crop failure events under climate change.** *Earth System Dynamics* 12 (4) 1503-1527. **10.5194/esd-12-1503-2021**.
281. Carr, T.W., **Balkovič, J.** , Dodds, P.E., **Folberth, C.** , & **Skalský, R.** (2021). **The impact of water erosion on global maize and wheat productivity.** *Agriculture, Ecosystems & Environment* 322 e107655. **10.1016/j.agee.2021.107655**.
282. **Riahi, K.** , Bertram, C., **Huppmann, D.** , **Rogelj, J.** , Bosetti, V., Cabardos, A.-M., **Deppermann, A.**, Drouet, L., **Frank, S.** , **Fricko, O.** , **Fujimori, S.** , Harmsen, M., Hasegawa, T., **Krey, V.** , Luderer, G., Paroussos, L., Schaeffer, R., Weitzel, M., van der Zwaan, B., Vrontisi, Z., Longa, F.D., Després, J., Fosse, F., Fragkiadakis, K., **Gusti, M.**, Humpenöder, F., Keramidas, K., **Kishimoto, P.** , Kriegler, E., Meinshausen, M., Nogueira, L.P., Oshiro, K., Popp, A., Rochedo, P.R.R., **Ünlü, G.** , **van Ruijven, B.** , Takakura, J., Tavoni, M., van Vuuren, D., & **Zakeri, B.** (2021). **Cost and attainability of meeting**

**stringent climate targets without overshoot.** *Nature Climate Change* 11 1063-1069. **10.1038/s41558-021-01215-2**.

283. Chaplin-Kramer, R., Brauman, K.A., Cavender-Bares, J., Díaz, S., Duarte, G.T., Enquist, B.J., Garibaldi, L.A., Geldmann, J., Halpern, B.S., Hertel, T.W., Khoury, C.K., Krieger, J.M., Lavorel, S., Mueller, T., Neugarten, R.A., Pinto-Ledezma, J., Polasky, S., Purvis, A., Reyes-García, V., Roehrdanz, P.R., Shannon, L.J., Shaw, M.R., Strassburg, Bernardo B. N., Tylianakis, J.M., Verburg, P.H., **Visconti, P.**, & Zafra-Calvo, N. (2021). **Conservation needs to integrate knowledge across scales.** *Nature Ecology & Evolution* 6 118-119. **10.1038/s41559-021-01605-x**.
284. **Sahu, R.K.** & McLaughlin, D.B. (2021). **The Multi-Scale Dynamics of Groundwater Depletion.** *Water Resources Research* 57 (12) e2020WR029402. **10.1029/2020WR029402**.
285. An, L., Wang, J., Huang, J., Pokhrel, Y., Hugonnet, R., **Wada, Y.** , Cáceres, D., Müller Schmied, H., Song, C., Berthier, E., Yu, H., & Zhang, G. (2021). **Divergent Causes of Terrestrial Water Storage Decline Between Drylands and Humid Regions Globally.** *Geophysical Research Letters* 48 (23) e2021GL095035. **10.1029/2021GL095035**.
286. Fastré, C., van Zeist, W.-J., Watson, J.E.M., & **Visconti, P.** (2021). **Integrated spatial planning for biodiversity conservation and food production.** *One Earth* 4 (11) 1635-1644. **10.1016/j.oneear.2021.10.014**.
287. **Yokomatsu, M.**, Park, H., Kotani, H., & Ito, H. (2021). **Designing the building space of a shopping street to use as a disaster evacuation shelter during the COVID-19 pandemic: A case study in Kobe, Japan.** *International Journal of Disaster Risk Reduction* 67 e102680. **10.1016/j.ijdrr.2021.102680**.
288. Sperna Weiland, F.C., Visser, R.D., **Greve, P.**, Bisselink, B., Brunner, L., & Weerts, A.H. (2021). **Estimating Regionalized Hydrological Impacts of Climate Change Over Europe by Performance-Based Weighting of CORDEX Projections.** *Frontiers in Water* 3 **10.3389/frwa.2021.713537**.
289. Kuschnig, N., **Crespo Cuaresma, J.**, **Krisztin, T.** , & Giljum, S. (2021). **Spatial spillover effects from agriculture drive deforestation in Mato Grosso, Brazil.** *Scientific Reports* 11 (1) **10.1038/s41598-021-00861-y**.
290. **Janssens, C.**, **Havlík, P.** , **Krisztin, T.** , Baker, J., **Frank, S.** , **Hasegawa, T.**, **Leclère, D.**, Ohrel, S., Ragnauth, S., Schmid, E., **Valin, H.** , Van Lipzig, N., & Maertens, M. (2021). **International trade is a key component of climate change adaptation.** *Nature Climate Change* 11 (11) 915-916. **10.1038/s41558-021-01201-8**.
291. Jägermeyr, J., Müller, C., Ruane, A.C., Elliott, J., **Balkovič, J.** , Castillo, O., Faye, B., Foster, I., **Folberth, C.** , Franke, J.A., Fuchs, K., Guarin, J.R., Heinke, J., Hoogenboom, G., Iizumi, T., Jain, A.K., Kelly, D., **Khabarov, N.** , Lange, S., Lin, T.-S., Liu, W., Mialyk, O., Minoli, S., Moyer, El.J., Okada, M., Phillips, M., Porter, C., Rabin, S.S., Scheer, C., Schneider, J.M., Schyns, J.F., **Skalský, R.** , Smerald, A., Stella, T., Stephens, H., Webber, H., Zabel, F., & Rosenzweig, C. (2021). **Climate impacts on global agriculture emerge earlier in new generation of climate and crop models.** *Nature Food* 2 873-885. **10.1038/s43016-021-00400-y**.
292. Wineland, S.M., Başağaoğlu, H., Fleming, J., Friedman, J., Garza-Diaz, L., Kellogg, W., Koch, J., Lane, B.A., Mirchi, A., **Nava, L. F.** , Neeson, T.M., Ortiz-Partida, J.P., Paladino, S., Plassin, S., Gomez-Quiroga, G., Saiz-Rodriguez, R., Sandoval-Solis, S., Wagner, K., Weber, N., Winterle, J., & Wootten, A.M. (2021). **The environmental flows implementation challenge: Insights and recommendations across water-limited systems.** *WIREs Water* e1565. **10.1002/wat2.1565**.
293. Drouet, L., Bosetti, V., Padoan, S.A., Aleluia Reis, L., Bertram, C., Dalla Longa, F., Després, J., Emmerling, J., Fosse, F., Fragkiadakis, K., **Frank, S.** , **Fricko, O.** , **Fujimori, S.** , Harmsen, M., **Krey, V.** , Oshiro, K., Nogueira, L.P., Paroussos, L., Piontek, F., **Riahi, K.** , Rochedo, P.R.R., Schaeffer, R., Takakura, J., van der Wijst, K.-I., van der Zwaan, B., van Vuuren, D., Vrontisi, Z., Weitzel, M., **Zakeri, B.** , & Tavoni, M. (2021). **Net zero-emission pathways reduce the physical and economic risks of climate change.** *Nature Climate Change* 11 1070-1076. **10.1038/s41558-021-01218-z**.
294. **Lauri, P.**, **Forsell, N.**, **Di Fulvio, F.** , Snäll, T., & **Havlik, P.** (2021). **Material substitution between coniferous, non-coniferous and recycled biomass – Impacts on forest industry raw material use**

**and regional competitiveness.** *Forest Policy and Economics* e132 e102588. **10.1016/j.forpol.2021.102588**.

295. West, C.D., Stokeld, E., Campiglio, E., Croft, S., Detges, A., Duranovic, A., von Jagow, A., Jarząbek, Ł., König, C., Knaepen, H., **Magnuszewski, P.**, Monasterolo, I., & Reyer, C.P.O. (2021). **Europe's cross-border trade, human security and financial connections: A climate risk perspective.** *Climate Risk Management* 34 e100382. **10.1016/j.crm.2021.100382**.
296. Schaap, K.J., Fuchslueger, L., Hoosbeek, M.R., **Hofhansl, F.** , Martins, N.P., Valverde-Barrantes, O.J., Hartley, I.P., Lugli, L.F., & Quesada, C.A. (2021). **Litter inputs and phosphatase activity affect the temporal variability of organic phosphorus in a tropical forest soil in the Central Amazon.** *Plant and Soil* **10.1007/s11104-021-05146-x**.
297. **Zhao, H.**, **Chang, J.** , **Havlik, P.** , **van Dijk, M.**, **Valin, H.** , **Janssens, C.**, Ma, L., Bai, Z., Herrero, M., Smith, P., & **Obersteiner, M.** (2021). **China's future food demand and its implications for trade and environment.** *Nature Sustainability* 4 1042-1051. **10.1038/s41893-021-00784-6**.
298. Roe, S., Streck, C., Beach, R., Bush, J., Chapman, M., Daioglou, V., **Deppermann, A.**, Doelman, J., Emmet-Booth, J., Engelmann, J., **Fricko, O.** , Frischmann, C., Funk, J., Grassi, G., Griscom, B., **Havlik, P.** , Hanssen, S., Humpenöder, F., Landholm, D., Lomax, G., Lehmann, J., Mesnildrey, L., Naburs, G-J., Popp, A., Rivard, C., Sanderman, J., Sohngen, B., Smith, P., Stehfest, E., Wolff, D., & Lawrence, D. (2021). **Land-based measures to mitigate climate change: Potential and feasibility by country.** *Global Change Biology* 27 6025- 6058. **10.1111/gcb.15873**.
299. **Frank, S.** , **Havlik, P** , Tabeau, A., Witzke, P., **Boere, E.**, Bogonos, M., **Deppermann, A.**, **van Dijk, M.**, **Höglund-Isaksson, L.** , Janssens, C., Kesting, M., van Meijl, H., Pérez-Domínguez, I., & **Valin, H.** (2021). **How much multilateralism do we need? Effectiveness of unilateral agricultural mitigation efforts in the global context.** *Environmental Research Letters* 16 (10) e104038. **10.1088/1748-9326/ac2967**.
300. Hasegawa, T., **Fujimori, S.** , **Frank, S.** , Humpenöder, F., Bertram, C., Després, J., Drouet, L., Emmerling, J., **Gusti, M.**, Harmsen, M., Keramidas, K., Ochi, Y., Oshiro, K., Rochedo, P., **van Ruijven, B.** , **Cabardos, A.-M.**, **Deppermann, A.**, Fosse, F., **Havlik, P.** , **Krey, V.** , Popp, A., Schaeffer, R., van Vuuren, D., & **Riahi, K.** (2021). **Land-based implications of early climate actions without global net-negative emissions.** *Nature Sustainability* **10.1038/s41893-021-00772-w**.
301. Gallardo-Cruz, J.A., Peralta-Carreta, C., Solórzano, J.V., Fernández-Montes de Oca, A.I., **Nava, L.F.** , Kauffer, E., & Carabias, J. (2021). **Deforestation and trends of change in protected areas of the Usumacinta River basin (2000–2018), Mexico and Guatemala.** *Regional Environmental Change* 21 (4) e97. **10.1007/s10113-021-01833-8**.
302. Martins, N.P., Fuchslueger, L., Fleischer, K., Andersen, K.M., Assis, R.L., Baccaro, F. B., Camargo, P.B., Cordeiro, A.L., Grandis, A., Hartley, I. P., **Hofhansl, F.** , Lugli, L.F., Lapola, D.M., Menezes, J.G., Norby, R.J.., Rammig, A., Rosa, J.S., Schaap, K.J., Takeshi, B., Valverde-Barrantes, O.J., & Quesada, C. A. (2021). **Fine roots stimulate nutrient release during early stages of leaf litter decomposition in a Central Amazon rainforest.** *Plant and Soil* 469 287-303. **10.1007/s11104-021-05148-9**.
303. Mohd Idris, M.N., Hashim, H., **Leduc, S.**, **Yowargana, P.**, **Kraxner, F.**, & Woon, K.S. (2021). **Deploying Bioenergy for Decarbonizing Malaysian Energy Sectors and Alleviating Renewable Energy Poverty.** *Energy* 232 e120967. **10.1016/j.energy.2021.120967**.
304. Flach, R., Abrahão, G., Bryant, B., Scarabello, M., **Soterroni, A.**, Ramos, F.M., **Valin, H.** , **Obersteiner, M.** , & Cohn, A.S. (2021). **Conserving the Cerrado and Amazon biomes of Brazil protects the soy economy from damaging warming.** *World Development* 146 e105582. **10.1016/j.worlddev.2021.105582**.
305. Okaali, D.A., Kroeze, C., Medema, G., **Burek, P.** , Murphy, H., Tumwebaze, I.K., Rose, J.B., Verbyla, M.E., Sewagudde, S., & Hofstra, N. (2021). **Modelling rotavirus concentrations in rivers: Assessing Uganda's present and future microbial water quality.** *Water Research* 204 e117615. **10.1016/j.watres.2021.117615**.
306. Prussi, M., Lee, U., Wang, M., Malina, R., **Valin, H.** , Taheripour, F., Velarde, C., Staples, M.D., Lonza, L., & Hileman, J. (2021). **CORSIA: The first internationally adopted approach to calculate**

**life-cycle GHG emissions for aviation fuels.** *Renewable and Sustainable Energy Reviews* 150 e111398. **10.1016/j.rser.2021.111398**.

307. Thiery, B.W., Lange, S., **Rogelj, J.** , Schleussner, C.-F., Gudmundsson, L., Seneviratne, S.I., Andrijevic, M., Frieler, K., Emanuel, K., Geiger, T., Bresch, D.N., **Zhao, F.**, Willner, S.N., Büchner, Ma., Volkholz, J., Bauer, N., **Chang, J.** , Ciais, P., Dury, M., François, L., Grillakis, M., Gosling, S.N., Hanasaki, N., Hickler, T., Huber, V., Ito, A., Jägermeyr, J., **Khabarov, N.** , Koutroulis, A., Liu, W., **Lutz, W.** , Mengel, M., Müller, C., Ostberg, S., Reyer, C., Stacke, T., & **Wada, Y.** (2021). **Intergenerational inequities in exposure to climate extremes.** *Science* 374 (6564) 158-160. **10.1126/science.abi7339**.
308. **Chang, J.** , **Havlik, P.** , **Leclere, D.**, de Vries, W., **Valin, H.** , **Deppermann, A.**, Hasegawa, T., & **Obersteiner, M.** (2021). **Reconciling regional nitrogen boundaries with global food security.** *Nature Food* **10.1038/s43016-021-00366-x**.
309. Zhang, X., Yao, G., Vishwakarma, S., Dalin, C., Komarek, A.M., Kanter, D.R., Davis, K.F., Pfeifer, K., Zhao, J., Zou, T., D'Odorico, P., **Folberth, C.** , Rodriguez, F.G., Fanzo, J., Rosa, L., Dennison, W., Musumba, M., Heyman, A., & Davidson, E.A. (2021). **Quantitative assessment of agricultural sustainability reveals divergent priorities among nations.** *One Earth* 4 (9) 1262-1277. **10.1016/j.oneear.2021.08.015**.
310. Franke, J.A., Müller, C., Minoli, S., Elliott, J., **Folberth, C.** , Gardner, C., Hank, T., Izaurralde, R.C., Jägermeyr, J., Jones, C.D., Liu, W., Olin, S., Pugh, T.A.M., Ruane, A.C., Stephens, H., Zabel, F., & Moyer, E.J. (2021). **Agricultural breadbaskets shift poleward given adaptive farmer behavior under climate change.** *Global Change Biology* 28 167-181. **10.1111/gcb.15868**.
311. Makungwe, M., Chabala, L.M., **van Dijk, M.**, Chishala, B.H., & Lark, R.M. (2021). **Assessing land suitability for rainfed paddy rice production in Zambia.** *Geoderma Regional* 27 e00438. **10.1016/j.geodrs.2021.e00438**.
312. **Mukhortova, L.**, **Shchepashchenko, D.** , Moltchanova, E., **Shvidenko, A.**, **Khabarov, N.** , & **See, L.** (2021). **Respiration of Russian soils: climatic drivers and response to climate change.** *Science of the Total Environment* 785 e147314. **10.1016/j.scitotenv.2021.147314**.
313. Harrison, S.P., Cramer, W., **Franklin, O.** , Prentice, I.C., Wang, H., **Brännström, Å.**, de Boer, H., **Dieckmann, U.** , **Joshi, J.**, Keenan, T.F., Lavergne, A., Manzoni, S., Mengoli, G., Morfopoulos, C., Peñuelas, J., **Pietsch, S.** , Rebel, K.T., Ryu, Y., Smith, N.G., Stocker, B.D., & Wright, I.J. (2021). **Eco-evolutionary optimality as a means to improve vegetation and land-surface models.** *New Phytologist* 231 (6) 2125-2141. **10.1111/nph.17558**.
314. **Hunt, J.** , Falchetta, G., **Parkinson, S.** , **Vinca, A.** , **Zakeri, B.** , **Byers, E.** , Jurasz, J., Quaranta, E., Grenier, E., Pereira Junior, A., Barbosa, P., Brandão, R., de Castro, N., Schneider, P., Vieira, L., Nascimento, A., & **Wada, Y.** (2021). **Hydropower and seasonal pumped hydropower storage in the Indus basin:pros and cons.** *Journal of Energy Storage* 41 e102916. **10.1016/j.est.2021.102916**.
315. Kuramochi, T., Nascimento, L., Moisio, M., den Elzen, M., **Forsell, N.**, van Soest, H., Tanguy, P., Gonzales, S., Hans, F., Jeffery, M.L., Fekete, H., Schiefer, T., de Villafranca Casas, M.J., De Vivero-Serrano, G., Dafnomilis, I., Roelfsema, M., & Höhne, N. (2021). **Greenhouse gas emission scenarios in nine key non-G20 countries: An assessment of progress toward 2030 climate targets.** *Environmental Science & Policy* 123 67-81. **10.1016/j.envsci.2021.04.015**.
316. Pressey, R.L., **Visconti, P.**, McKinnon, M.C., Gurney, G.G., Barnes, M.D., Glew, L., & Maron, M. (2021). **The mismeasure of conservation.** *Trends in Ecology & Evolution* 36 (9) 808-821. **10.1016/j.tree.2021.06.008**.
317. Vörösmarty, C.J., Stewart-Koster, B., Green, P.A., Boone, E.L., Flörke, M., **Fischer, G.**, Wiberg, D.A., Bunn, S.E., Bhaduri, A., McIntyre, P.B., Sadoff, C., Liu, H., & Stifel, D. (2021). **A green-gray path to global water security and sustainable infrastructure.** *Global Environmental Change* 70 e102344. **10.1016/j.gloenvcha.2021.102344**.

318. Huang, Y., Ciais, P., Santoro, M., Makowski, D., Chave, J., **Shchepashchenko, D.** , Abramoff, R.Z., Goll, D.S., Yang, H., Chen, Y., Wei, Wei, & Piao, Shilong (2021). **A global map of root biomass across the world's forests.** *Earth System Science Data* 13 (9) 4263-4274. **10.5194/essd-13-4263-2021**.
319. Harfoot, M.B.J., Johnston, A., Balmford, A., Burgess, N.D., Butchart, S.H.M., Dias, M.P., Hazin, C., Hilton-Taylor, C., Hoffmann, M., Isaac, N.B.J., Iversen, L.L., Outhwaite, C.L., **Visconti, P.**, & Geldmann, J. (2021). **Using the IUCN Red List to map threats to terrestrial vertebrates at global scale.** *Nature Ecology & Evolution* 5 1510-1519. **10.1038/s41559-021-01542-9**.
320. St John Glew, K., Espinasse, B., Hunt, B.P.V., Pakhomov, E.A., Bury, S.J., Pinkerton, M., Nodder, S.D., Gutiérrez-Rodríguez, A., Safi, K., Brown, J.C.S., **Graham, L.**, Dunbar, R.B., Mucciarone, D.A., Magozzi, S., Somes, C., & Trueman, C.N. (2021). **Isoscape Models of the Southern Ocean: Predicting Spatial and Temporal Variability in Carbon and Nitrogen Isotope Compositions of Particulate Organic Matter.** *Global Biogeochemical Cycles* 35 (9) e2020GB006901. **10.1029/2020GB006901**.
321. **Jung, M.**, Arnell, A., de Lamo, X., García-Rangel, S., **Lewis, M.** , Mark, J., Merow, C., Miles, L., Ondo, I., Pironon, S., Ravilious, C., Rivers, M., **Shchepashchenko, D.** , Tallowin, O., van Soesbergen, A., Govaerts, R., Boyle, B.L., Enquist, B.J., Feng, X., Gallagher, R., Maitner, B., Meiri, S., Mulligan, M., Ofer, G., Roll, U., Hanson, J.O., Jetz, W., Di Marco, M., McGowan, J., Rinnan, D.S., Sachs, J.D., **Lesiv, M.** , Adams, V.M., Andrew, S.C., Burger, J.R., Hannah, L., Marquet, P.A., McCarthy, J.K., Morueta-Holme, N., Newman, E.A., Park, D.S., Roehrdanz, P.R., Svenning, J.-C., Violle, C., Wieringa, J.J., Wynne, G., **Fritz, S.** , Strassburg, B.B. ., **Obersteiner, M.** , Kapos, V., Burgess, N., Schmidt-Traub, G., & **Visconti, P.** (2021). **Areas of global importance for conserving terrestrial biodiversity, carbon and water.** *Nature Ecology & Evolution* 5 1499-1509. **10.1038/s41559-021-01528-7**.
322. Santoro, M., Cartus, O., Carvalhais, N., Rozendaal, D.M.A., Avitabile, V., Araza, A., de Bruin, S., Herold, M., Quegan, S., Rodríguez-Veiga, P., Balzter, H., Carreiras, J., **Shchepashchenko, D.** , Korets, M., Shimada, M., Itoh, T., Moreno Martínez, Á., Cavlovic, J., Cazzolla Gatti, R., da Conceição Bispo, P., Dewnath, N., Labrière, N., Liang, J., Lindsell, J., Mitchard, E.T.A., Morel, A., Pacheco Pascagaza, A.M., Ryan, C.M., Slik, F., Vaglio Laurin, G., Verbeeck, H., Wijaya, A., & Willcock, S. (2021). **The global forest above-ground biomass pool for 2010 estimated from high-resolution satellite observations.** *Earth System Science Data* 13 (8) 3927-3950. **10.5194/essd-13-3927-2021**.
323. Starnes, T., Beresford, A.E., Buchanan, G.M., **Lewis, M.** , Hughes, A., & Gregory, R.D. (2021). **The extent and effectiveness of protected areas in the UK.** *Global Ecology and Conservation* 30 e01745. **10.1016/j.gecco.2021.e01745**.
324. Choruma, D.J., **Balkovič, J.** , **Pietsch, S.** , & Odume, O.N. (2021). **Using EPIC to simulate the effects of different irrigation and fertilizer levels on maize yield in the Eastern Cape, South Africa.** *Agricultural Water Management* 254 e106974. **10.1016/j.agwat.2021.106974**.
325. Chiang, F., **Greve, P.**, Mazdiyasni, O., **Wada, Y.** , & AghaKouchak, A. (2021). **A Multivariate Conditional Probability Ratio Framework for the Detection and Attribution of Compound Climate Extremes.** *Geophysical Research Letters* 48 (15) e2021GL094361. **10.1029/2021GL094361**.
326. Fox, N., **Graham, L.**, Eigenbrod, F., Bullock, J.M., & Parks, K.E. (2021). **Enriching social media data allows a more robust representation of cultural ecosystem services.** *Ecosystem Services* 50 e101328. **10.1016/j.ecoser.2021.101328**.
327. Fox, N., **Graham, L.**, Eigenbrod, F., Bullock, J.M., & Parks, K.E. (2021). **Reddit: A novel data source for cultural ecosystem service studies.** *Ecosystem Services* 50 e101331. **10.1016/j.ecoser.2021.101331**.
328. Matsala, M., Bilous, A., Myroniuk, V., Holiaka, D., **Shchepashchenko, D.** , **See, L.** , & **Kraxner, F.** (2021). **The Return of Nature to the Chernobyl Exclusion Zone: Increases in Forest Cover of 1.5 Times since the 1986 Disaster.** *Forests* 12 (8) e1024. **10.3390/f12081024**.
329. Janssen, T., van der Velde, Y., **Hofhansl, F.** , Luyssaert, S., Naudts, K., Driessen, B., Fleischer, K., & Dolman, H. (2021). **Drought effects on leaf fall, leaf flushing and stem growth in Neotropical**

**forest; reconciling remote sensing data and field observations.** *Biogeosciences Discussions* 18 (14) 4445-4472. **10.5194/bg-2021-30**.

330. Janssen, T., van der Velde, Y., **Hofhansl, F.** , Luyssaert, S., Naudts, K., Driessen, B., Fleischer, K., & Dolman, H. (2021). **Drought effects on leaf fall, leaf flushing and stem growth in the Amazon forest: reconciling remote sensing data and field observations.** *Biogeosciences* 18 (14) 4445-4472. **10.5194/bg-18-4445-2021**.
331. Macharia, P., Wirth, M., **Yillia, P.**, & Kreuzinger, N. (2021). **Examining the Relative Impact of Drivers on Energy Input for Municipal Water Supply in Africa.** *Sustainability* 13 (15) e8480. **10.3390/su13158480**.
332. Novella-Fernandez, R., Juste, J., Ibáñez, C., Rebelo, H., Russo, D., Alberdi, A., Kiefer, A., **Graham, L.**, Paul, H., Doncaster, C.P., Razgour, O., & Capinha, C. (2021). **Broad-scale patterns of geographic avoidance between species emerge in the absence of fine-scale mechanisms of coexistence.** *Diversity and Distributions* 27 (9) 1606-1618. **10.1111/ddi.13375**.
333. Adams, V.M., **Visconti, P.**, Graham, V., & Possingham, H.P. (2021). **Indicators keep progress honest: A call to track both the quantity and quality of protected areas.** *One Earth* 4 (7) 901-906. **10.1016/j.oneear.2021.06.014**.
334. Fernandez-Anez, N., **Krasovskiy, A.** , Müller, M., Vacik, H., Baetens, J., Hukić, E., Kapovic Solomun, M., Atanassova, I., Glushkova, M., Bogunović, I., Fajković, H., Djuma, H., Boustras, G., Adámek, M., Devetter, M., Hrabalikova, M., Huska, D., Martínez Barroso, P., Vaverková, M.D., Zumr, D., Jõgiste, K., Metslaid, M., Koster, K., Köster, E., Pumpanen, J., Ribeiro-Kumara, C., Di Prima, S., Pastor, A., Rumpel, C., Seeger, M., Daliakopoulos, I., Daskalakou, E., Koutroulis, A., Papadopoulou, M.P., Stampoulidis, K., Xanthopoulos, G., Aszalós, R., Balázs, D., Kertész, M., Valkó, O., Finger, D.C., Thorsteinsson, T., Till, J., Bajocco, S., Gelsomino, A., Amodio, A.M., Novara, A., Salvati, L., Telesca, L., Ursino, N., Jansons, A., Kitenberga, M., Stivrins, N., Brazaitis, G., Marozas, V., Cojocaru, O., Gumeniuc, I., Sfecla, V., Imeson, A., Veraverbeke, S., Mikalsen, R.F., Koda, Eu., Osinski, P., Castro, A.C. M., Nunes, J.P., Oom, D., Vieira, D., Rusu, T., Bojović, S., Djordjevic, D., Popovic, Z., Protic, M., Sakan, S., Glasa, J., Kacikova, D., Lichner, L., Majlingova, A., Vido, J., Ferk, M., Tičar, J., Zorn, M., Zupanc, V., Hinojosa, M., Knicker, H., Lucas-Borja, M.E., Pausas, J., Prat-Guitart, N., Ubeda, X., Vilar, L., Destouni, G., Ghajarnia, N., Kalantari, Z., Seifollahi-Aghmiuni, S., Dindaroglu, T., Yakupoglu, T., Smith, T., Doerr, S., & Cerda, A. (2021). **Current Wildland Fire Patterns and Challenges in Europe: A Synthesis of National Perspectives.** *Air, Soil and Water Research* 14 e117862212110281. **10.1177/11786221211028185**.
335. **Shennan Farpon, Y.**, **Visconti, P.**, & Norris, K. (2021). **Detecting ecological thresholds for biodiversity in tropical forests: Knowledge gaps and future directions.** *Biotropica* 53 1276- 1289. **10.1111/btp.12999**.
336. Zhang, X., Zou, T., Lassaletta, L., Mueller, N.D., Tubiello, F.N., Lisk, M.D., Lu, C., Conant, R.T., Dorich, C.D., Gerber, J., Tian, H., Bruulsema, T., McClellan Maaz, T., Nishina, K., Bodirsky, B.L., Popp, A., Bouwman, L., Beusen, A., **Chang, J.** , **Havlik, P.** , **Leclere, D.**, Canadell, J.G., Jackson, R.B., Heffer, P., Wanner, N., Zhang, W., & Davidson, E.A. (2021). **Quantification of global and national nitrogen budgets for crop production.** *Nature Food* **10.1038/s43016-021-00318-5**.
337. Onuchin, A., Burenina, T., **Shvidenko, A.**, Prysov, D., & Musokhranova, A. (2021). **Zonal aspects of the influence of forest cover change on runoff in northern river basins of Central Siberia.** *Forest Ecosystems* 8 (1) e45. **10.1186/s40663-021-00316-w**.
338. Popoff, N., **Gaget, E.**, Béchet, A., Dami, L., du Rau, P.D., Geijzendorffer, I., Guelmami, A., Mondain-Monval, J.-Y., Perennou, C., Suet, M., Verniest, F., Deschamps, C., Taylor, N.G., Azafzaf, H., Bendjedda, N., Bino, T., Borg, J.J., Božič, L., Dakki, M., Encarnação, V., Erciyas-Yavuz, K., Etayeb, K., Gaudard, C., Hatzofe, O., Langendoen, T., Ieronymidou, C., Mikuska, T., Molina, B., Petkov, N., Portolou, D., Qaneer, T., Sayoud, S., Šćiban, M., Topić, G., Uzunova, D., Vine, G., Vizi, A., Zenatello, M., Abdou, W., & Galewski, T. (2021). **Gap analysis of the Ramsar site network at 50: over 150 important Mediterranean sites for wintering waterbirds omitted.** *Biodiversity and Conservation* **10.1007/s10531-021-02236-1**.

339. Viegas, D.X., Oliveira, R., Almeida, M., & **Kim, D.H.** (2021). **Ignition of Fuel Beds by Cigarettes: A Conceptual Model to Assess Fuel Bed Moisture Content and Wind Velocity Effect on the Ignition Time and Probability.** *Fire* 4 (3) e35. **10.3390/fire4030035**.
340. Wang, Y.X.G., Matson, K.D., Santini, L., **Visconti, P.**, Hilbers, J.P., Huijbregts, M.A.J., Xu, Y., Prins, H.H.T., Allen, T., Huang, Z.Y.X., & Boer, W.F. (2021). **Mammal assemblage composition predicts global patterns in emerging infectious disease risk.** *Global Change Biology* 27 4995-5007. **10.1111/gcb.15784**.
341. Liu, S., **Ermolieva, T.**, **Cao, G.-Y.**, Chen, G., & Zheng, X. (2021). **Analyzing the Effectiveness of COVID-19 Lockdown Policies Using the Time-Dependent Reproduction Number and the Regression Discontinuity Framework: Comparison between Countries.** *Engineering Proceedings* 5 (1) e8. **10.3390/engproc2021005008**.
342. Henriksson, N., Lim, H., Marshall, J., **Franklin, O.** , McMurtrie, R.E., Lutter, R., Magh, R., Lundmark, T., & Näsholm, T. (2021). **Tree water uptake enhances nitrogen acquisition in a fertilized boreal forest – but not under nitrogen poor conditions.** *New Phytologist* 232 113-122. **10.1111/nph.17578**.
343. Telteu, C.-E., Müller Schmied, H., Thiery, W., Leng, G., **Burek, P.** , Liu, D., Boulange, J., Andersen, L., Grillakis, M., Gosling, S., Satoh, Y., Rakovec, O., Stacke, T., Chang, J., Wanders, N., Shah, H., Trautmann, T., Mao, G., Hanasaki, N., Koutroulis, A., Pokhrel, Y., Samaniego, L., **Wada, Y.** , Mishra, V., Liu, J., Döll, P., Zhao, F., Gädeke, A., Rabin, S., & Herz, F. (2021). **Understanding each other's models: an introduction and a standard representation of 16 global water models to support intercomparison, improvement, and communication.** *Geoscientific Model Development* 14 (6) 3843-3878. **10.5194/gmd-14-3843-2021**.
344. **Krisztin, T.** , Piribauer, P., & **Wögerer, M.** (2021). **A spatial multinomial logit model for analysing urban expansion.** *Spatial Economic Analysis* 1-22. **10.1080/17421772.2021.1933579**.
345. Zhong, H., Feng, K., Sun, L., Tian, Z., **Fischer, G.**, Cheng, L., & Munoz Castillo, R. (2021). **Water-land tradeoffs to meet future demands for sugar crops in Latin America and the Caribbean: A bio-physical and socio-economic nexus perspective.** *Resources, Conservation and Recycling* 169 e105510. **10.1016/j.resconrec.2021.105510**.
346. **Shchepashchenko, D.** , Moltchanova, E., Fedorov, S., Karminov, V., Ontikov, P., Santoro, M., **See, L.** , Kositsyn, V., **Shvidenko, A.**, Romanovskaya, A., Korotkov, V., **Lesiv, M.** , Bartalev, S., **Fritz, S.** , Shchepashchenko, M., & **Kraxner, F.** (2021). **Russian forest sequesters substantially more carbon than previously reported.** *Scientific Reports* 11 (1) e12825. **10.1038/s41598-021-92152-9**.
347. Haro, A., **Mendoza Ponce, A.** , Calderón-Bustamante, Ó., Velasco, J.A., & Estrada, F. (2021). **Evaluating Risk and Possible Adaptations to Climate Change Under a Socio-Ecological System Approach.** *Frontiers in Climate* 3 **10.3389/fclim.2021.674693**.
348. Esteban, E., Calvo, E., & **Albiac Murillo, J.** (2021). **Ecosystem Shifts: Implications for Groundwater Management.** *Environmental and Resource Economics* **10.1007/s10640-021-00569-7**.
349. Kostková, M., Hlavinka, P., Pohanková, E., Kersebaum, K. C., Nendel, C., Gobin, A., Olesen, J. E., Ferrise, R., Dibari, C., Takáč, J., Topaj, A., Medvedev, S., Hoffmann, M. P., Stella, T., Balek, J., Ruiz-Ramos, M., Rodríguez, A., Hoogenboom, G., Shelia, V., Ventrella, D., Giglio, L., Sharif, B., Oztürk, I., Rötter, R. P., **Balkovič, J.** , **Skalský, R.** , Moriondo, M., Thaler, S., Žalud, Z., & Trnka, M. (2021). **Performance of 13 crop simulation models and their ensemble for simulating four field crops in Central Europe.** *The Journal of Agricultural Science* 159 (1-2) 69-89. **10.1017/S0021859621000216**.
350. Jost, E., Schönhart, M., **Skalský, R.** , **Balkovič, J.** , Schmid, E., & Mitter, H. (2021). **Dynamic soil functions assessment employing land use and climate scenarios at regional scale.** *Journal of Environmental Management* 287 e112318. **10.1016/j.jenvman.2021.112318**.
351. **Chang, J.** , Peng, S., Yin, Y., Ciais, P., **Havlik, P.** , & Herrero, M. (2021). **The Key Role of Production Efficiency Changes in Livestock Methane Emission Mitigation.** *AGU Advances* 2 (2) e2021AV000391. **10.1029/2021AV000391**.

352. **Lessa Derci Augustynczik, A.** & Yousefpour, R. (2021). **Assessing the synergistic value of ecosystem services in European beech forests.** *Ecosystem Services* 49 e101264. **10.1016/j.ecoser.2021.101264**.
353. Lo, M.-H., Wey, H.-W., Im, E.-S., Tang, L.I., Anderson, R.G., Wu, R.-J., Chien, R.-Y., Wei, J., AghaKouchak, A., & **Wada, Y.** (2021). **Intense agricultural irrigation induced contrasting precipitation changes in Saudi Arabia.** *Environmental Research Letters* 16 (6) e064049. **10.1088/1748-9326/ac002e**.
354. **Irshaid, J.**, **Mochizuki, J.** , & **Schinko, T.** (2021). **Challenges to local innovation and implementation of low-carbon energy-transition measures: A tale of two Austrian regions.** *Energy Policy* 156 p. 112432. **10.1016/j.enpol.2021.112432**.
355. Vittis, Y., **Folberth, C.** , **Bundle, S.-C.**, & **Obersteiner, M.** (2021). **Restoring Nature at Lower Food Production Costs.** *Frontiers in Environmental Science* 9 **10.3389/fenvs.2021.672663**.
356. Hartmann, A., Jasechko, S., Gleeson, T., **Wada, Y.** , Andreo, B., Barberá, J.A., Brielmann, H., Bouchaou, L., Charlier, J.-B., Darling, W.G., Filippini, M., Garvelmann, J., Goldscheider, N., Kralik, M., Kunstmann, H., Ladouche, B., Lange, J., Lucianetti, G., Martín, J.F., Mudarra, M., Sánchez, D., Stumpp, C., Zagana, E., & Wagener, T. (2021). **Risk of groundwater contamination widely underestimated because of fast flow into aquifers.** *Proceedings of the National Academy of Sciences* 118 (20) e2024492118. **10.1073/pnas.2024492118**.
357. Zabel, F., Müller, C., Elliott, J., Minoli, S., Jägermeyr, J., Schneider, J.M., Franke, J.A., Moyer, E., Dury, M., Francois, L., **Folberth, C.** , Liu, W., Pugh, T.A.M., Olin, S., Rabin, S.S., Mauser, W., Hank, T., Ruane, A.C., & Asseng, S. (2021). **Large potential for crop production adaptation depends on available future varieties.** *Global Change Biology* 27 (16) 3870-3882. **10.1111/gcb.15649**.
358. **Kortz, A.** & Magurran, A. (2021). **Complex community responses underpin biodiversity change following invasion.** *Biological Invasions* **10.1007/s10530-021-02559-8**.
359. **Hofhansl, F.** , Chacón-Madrigal, E., **Brännström, Å.**, **Dieckmann, U.** , & **Franklin, O.** (2021). **Mechanisms driving plant functional trait variation in a tropical forest.** *Ecology and Evolution* 11 3856- 3870. **10.1002/ece3.7256**.
360. Cowie, A.L., Berndes, G., Bentsen, N.S., Brandão, M., Cherubini, F., Egnell, G., George, B., Gustavsson, L., Hanewinkel, M., Harris, Z.M., Johnsson, F., Junginger, M., Kline, K.L., Koponen, K., Koppejan, J., **Kraxner, F.**, Lamers, P., Majer, S., Marland, E., Nabuurs, G.-J., Pelkmans, L., Sathre, R., Schaub, M., Smith, C.T., Soimakallio, S., Van Der Hilst, F., Woods, J., & Ximenes, F.A. (2021). **Applying a science-based systems perspective to dispel misconceptions about climate effects of forest bioenergy.** *GCB Bioenergy* 13 1210-1231. **10.1111/gcbb.12844**.
361. Jayathilake, H.M., **Warren-Thomas, E.**, Nelson, L., Dolman, P., Bumrungsri, S., Juthong, W., Carrasco, L.R., & Edwards, D.P. (2021). **Fruit trees and herbaceous plants increase functional and phylogenetic diversity of birds in smallholder rubber plantations.** *Biological Conservation* 257 e109140. **10.1016/j.biocon.2021.109140**.
362. Jonas, H. D., Ahmadia, G. N., Bingham, H. C., Briggs, J., Butchart, D. H. M., Cariño, J., Chassot, O., Chaudhary, S., Darling, E., DeGemmis, A., Dudley, N., Fa, Julia, Fitzsimons, J., Garnett, S. T., Geldmann, J., Kroner, R. G., Gurney, G. G., Harrington, A. R., Himes-Cornell, A., Hockings, M., Jonas, H. C., Jupiter, S., Kingston, N., Lee, E., Lieberman, S., Mangubhai, S., Marnewick, D., Matallana-Tobón, C. L., Maxwell, S. L., Nelson, F., Parrish, J., Ranaivoson, R., Rao, M., Santamaría, M., Venter, O., **Visconti, P.**, Waithaka, J., Walker Painemilla, K., Watson, J. E. M., & von Weizsäcker, C. (2021). **Equitable and effective area-based conservation: towards the conserved areas paradigm.** *PARKS: The International Journal of Protected Areas and Conservation* 27 **10.2305/IUCN.CH.2021.PARKS-27-1HJ.en**.
363. Sheil, D., Nabuurs, G.-J., & **Shvidenko, A.** (2021). **Hopes for Russia's new forest code.** *Science* 372 (6541) 472-473. **10.1126/science.abi9095**.
364. Dinar, A., Esteban, E., Calvo, E., Herrera, G., Teatini, P., Tomás, R., Li, Y., Ezquerro, P., & **Albiac Murillo, J.** (2021). **We lose ground: Global assessment of land subsidence impact extent.** *Science of the Total Environment* 786 e147415. **10.1016/j.scitotenv.2021.147415**.

365. Grassi, G., Stehfest, E., **Rogelj, J.** , van Vuuren, D., Cescatti, A., House, J., Nabuurs, G.-J., Rossi, S., Alkama, R., Viñas, R.A., Calvin, K., Ceccherini, G., Federici, S., **Fujimori, S.** , **Gusti, M.**, Hasegawa, T., **Havlik, P.** , Humpenöder, F., Korosuo, A., Perugini, L., Tubiello, F.N., & Popp, A. (2021). **Critical adjustment of land mitigation pathways for assessing countries' climate progress.** *Nature Climate Change* **10.1038/s41558-021-01033-6**.
366. Chernova, O.V., Golozubov, O.M., Alyabina, I.O., & **Shchepashchenko, D** (2021). **Integrated Approach to Spatial Assessment of Soil Organic Carbon in the Russian Federation.** *Eurasian Soil Science* 54 (3) 325-336. **10.1134/S1064229321030042**.
367. Sun, Y., Goll, D.S., **Chang, J.** , Ciais, P., Guenet, B., Helfenstein, J., Huang, Y., Lauerwald, R., Maignan, F., Naipal, V., Wang, Y., Yang, H., & Zhang, H. (2021). **Global evaluation of the nutrient-enabled version of the land surface model ORCHIDEE-CNP v1.2 (r5986).** *Geoscientific Model Development* 14 (4) 1987-2010. **10.5194/gmd-14-1987-2021**.
368. Macharia, P., Kitaka, N., **Yillia, P.**, & Kreuzinger, N. (2021). **Assessing Future Water Demand and Associated Energy Input with Plausible Scenarios for Water Service Providers (WSPs) in Sub-Saharan Africa.** *Energies* 14 (8) e2169.
369. Macharia, P., Kitaka, N., **Yillia, P.**, & Kreuzinger, N. (2021). **Assessing Future Water Demand and Associated Energy Input with Plausible Scenarios for Water Service Providers (WSPs) in Sub-Saharan Africa.** *Energies* 14 (8) e2169. **10.3390/en14082169**.
370. Gao, J., Xu, X., **Cao, G.-Y.**, **Ermoliev, Y.**, **Ermolieva, T.**, & **Rovenskaya, E.** (2021). **Strategic decision-support modeling for robust management of the food–energy–water nexus under uncertainty.** *Journal of Cleaner Production* 292 e125995. **10.1016/j.jclepro.2021.125995**.
371. Dakki, M., Robin, G., Suet, M., Qninba, A., El Agbani, M.A., Ouassou, A., El Hamoumi, R., Azafzaf, H., Rebah, S., Feltrup-Azafzaf, C., Hamouda, N., Ibrahim, W.A.L., Asran, H.H., Elhady, A.A., Ibrahim, H., Etayeb, K., Bouras, E., Saied, A., Glidan, A., Habib, B.M., Sayoud, M.S., Bendjedda, N., Dami, L., Deschamps, C., **Gaget, E.**, Mondain-Monval, J.-Y., Defos du Rau, P., & Hodgson, D. (2021). **Imputation of incomplete large-scale monitoring count data via penalized estimation.** *Methods in Ecology and Evolution* 12 1031-1039. **10.1111/2041-210X.13594**.
372. Brock, R.C., Arnell, A., Simonson, W., **Soterroni, A.**, **Mosnier, A.**, Ramos, F., Ywata de Carvalho, A.X., Camara, G., **Pirker, J.**, **Obersteiner, M.** , & Kapos, V. (2021). **Implementing Brazil's Forest Code: a vital contribution to securing forests and conserving biodiversity.** *Biodiversity and Conservation* 30 (6) 1621-1635. **10.1007/s10531-021-02159-x**.
373. **Krisztin, T.** & Piribauer, P. (2021). **Modelling European regional FDI flows using a Bayesian spatial Poisson interaction model.** *The Annals of Regional Science* 67 593-616. **10.1007/s00168-021-01058-x**.
374. **Escobar Lanzuela, N.** & Britz, W. (2021). **Metrics on the sustainability of region-specific bioplastics production, considering global land use change effects.** *Resources, Conservation and Recycling* 167 e105345. **10.1016/j.resconrec.2020.105345**.
375. Lian, X., Piao, S., Chen, A., Huntingford, C., Fu, B., Li, L.Z.X., Huang, J., Sheffield, J., Berg, A.M., Keenan, T.F., McVicar, T.R., **Wada, Y.** , Wang, X., Wang, T., Yang, Y., & Roderick, M.L. (2021). **Multifaceted characteristics of dryland aridity changes in a warming world.** *Nature Reviews Earth & Environment* 2 (4) 232-250. **10.1038/s43017-021-00144-0**.
376. Ruane, A.C., Phillips, M., Müller, C., Elliott, J., Jägermeyr, J., Arneth, A., **Balkovič, J.** , Deryng, D., **Folberth, C.** , Iizumi, T., Izaurralde, R.C., **Khabarov, N.** , Lawrence, P., Liu, W., Olin, S., Pugh, T., Rosenzweig, C., Sakurai, G., Schmid, E., Sultan, B., Wang, X., de Wit, A., & Yang, H. (2021). **Strong regional influence of climatic forcing datasets on global crop model ensembles.** *Agricultural and Forest Meteorology* 300 e108313. **10.1016/j.agrformet.2020.108313**.
377. Choi, Y., Lim, C.-H., Chung, H.I., Kim, Y., Cho, H.J., Hwang, J., **Kraxner, F.**, Biging, G.S., Lee, W.-K., Chon, J., & Jeon, S.W. (2021). **Forest management can mitigate negative impacts of climate and land-use change on plant biodiversity: Insights from the Republic of Korea.** *Journal of Environmental Management* 288 e112400. **10.1016/j.jenvman.2021.112400**.

378. **Danylo, O.**, **Pirker, J.**, Lemoine, G., Ceccherini, G., **See, L.** , **McCallum, I.** , **Hadi, H.**, **Kraxner, F.**, Achard, F., & **Fritz, S.** (2021). **A map of the extent and year of detection of oil palm plantations in Indonesia, Malaysia and Thailand.** *Scientific Data* 8 art. 96. **10.1038/s41597-021-00867-1**.
379. Ringeval, B., Müller, C., Pugh, T.A.M., Mueller, N.D., Ciais, P., **Folberth, C.** , Liu, W., Debaeke, P., & Pellerin, S. (2021). **Potential yield simulated by global gridded crop models: using a process-based emulator to explain their differences.** *Geoscientific Model Development* 14 (3) 1639-1656. **10.5194/gmd-14-1639-2021**.
380. Henriksson, N., **Franklin, O.** , Tarvainen, L., Marshall, J., Lundberg-Felten, J., Eilertsen, L., Näsholm, T., & Selosse, M.-A. (2021). **The mycorrhizal tragedy of the commons.** *Ecology Letters* **10.1111/ele.13737**.
381. **Tramberend, S.** , **Burtscher, R.** , **Burek, P.** , **Kahil, T.** , **Fischer, G.**, **Mochizuki, J.** , **Greve, P.**, Kimwaga, R., Nyenje, P., Ondiek, R., Nakawuka, P., Hyandye, C., Sibomana, C., Luoga, H.P., Matano, A.S., **Langan, S.** , & **Wada, Y.** (2021). **Co-development of East African regional water scenarios for 2050.** *One Earth* 4 (3) 434-447. **10.1016/j.oneear.2021.02.012**.
382. Stenzel, F., **Greve, P.**, Lucht, W., **Tramberend, S.** , **Wada, Y.** , & Gerten, D. (2021). **Irrigation of biomass plantations may globally increase water stress more than climate change.** *Nature Communications* 12 (1) e1512. **10.1038/s41467-021-21640-3**.
383. Donde, O.O., Atoni, E., Muia, A.W., & **Yillia, P.** (2021). **COVID-19 pandemic: Water, sanitation and hygiene (WASH) as a critical control measure remains a major challenge in low-income countries.** *Water Research* 191 e116793. **10.1016/j.watres.2020.116793**.
384. Fekete, H., Kuramochi, T., Roelfsema, M., den Elzen, M., **Forsell, N.**, Höhne, N., Luna, L., Hans, F., Sterl, S., Olivier, J., van Soest, H., **Frank, S.** , & **Gusti, M.** (2021). **A review of successful climate change mitigation policies in major emitting economies and the potential of global replication.** *Renewable and Sustainable Energy Reviews* 137 e110602. **10.1016/j.rser.2020.110602**.
385. Gudmundsson, L., Boulange, J., Do, H.X., Gosling, S.N., Grillakis, M.G., Koutroulis, A.G., Leonard, M., Liu, J., Müller Schmied, H., Papadimitriou, L., Pokhrel, Y., Seneviratne, S.I., **Satoh, Y.**, Thiery, W., Westra, S., Zhang, X., & Zhao, F. (2021). **Globally observed trends in mean and extreme river flow attributed to climate change.** *Science* 371 (6534) 1159-1162. **10.1126/science.aba3996**.
386. Latka, C., Kuiper, M., **Frank, S.** , Heckelei, T., **Havlik, P.** , Witzke, H.-P., Leip, A., Cui, H.D., Kuijsten, A., Geleijnse, J.M., & **van Dijk, M.** (2021). **Paying the price for environmentally sustainable and healthy EU diets.** *Global Food Security* 28 e100437. **10.1016/j.gfs.2020.100437**.
387. **Mohd Idris, M.N.**, **Leduc, S.**, **Yowargana, P.**, Hashim, H., & **Kraxner, F.** (2021). **Spatio-temporal assessment of the impact of intensive palm oil-based bioenergy deployment on cross-sectoral energy decarbonization.** *Applied Energy* 285 E116460. **10.1016/j.apenergy.2021.116460**.
388. Müller, C., Franke, J., Jägermeyr, J., Ruane, A.C., Elliott, J., Moyer, E., Heinke, J., Falloon, P.D., **Folberth, C.** , Francois, L., Hank, T., Izaurralde, R.C., Jacquemin, I., Liu, W., Olin, S., Pugh, T.A.M., Williams, K., & Zabel, F. (2021). **Exploring uncertainties in global crop yield projections in a large ensemble of crop models and CMIP5 and CMIP6 climate scenarios.** *Environmental Research Letters* 16 (3) e034040. **10.1088/1748-9326/abd8fc**.
389. Nandintsetseg, B., Boldgiv, B., **Chang, J.** , Ciais, P., Davaanyam, E., Batbold, A., Bat-Oyun, T., & Stenseth, N.C. (2021). **Risk and vulnerability of Mongolian grasslands under climate change.** *Environmental Research Letters* 16 (3) e034035. **10.1088/1748-9326/abdb5b**.
390. Gyamfi-Ampadu, E., Gebreslasie, M., & **Mendoza Ponce, A.** (2021). **Multi-Decadal Spatial and Temporal Forest Cover Change Analysis of Nkandla Natural Reserve, South Africa.** *Journal of Sustainable Forestry* 1-24. **10.1080/10549811.2021.1891441**.
391. Stepanyan, D., Grethe, H., Zimmermann, G., Siddig, K., **Deppermann, A.**, Feuerbacher, A., Luckmann, J., **Valin, H.** , Nishizawa, T., Ermolieva, T., & **Havlik, P.** (2021). **Multiple Rotations of Gaussian Quadratures: An Efficient Method for Uncertainty Analyses in Large-Scale Simulation Models.** *Environmental Modelling & Software* 281 e104929. **10.1016/j.envsoft.2020.104929**.

392. **Martin, J.G.C.** , **Scolobig, A.**, **Linnerooth-Bayer, J.**, **Liu, W.** , & Balsiger, J. (2021). **Catalyzing Innovation: Governance Enablers of Nature-Based Solutions.** *Sustainability* 13 (4) e1971. **10.3390/su13041971**.
393. Miashike, R.L., **Kortz, A.** , Zarate do Couto, H.T., & Pivello, V.R. (2021). **Can demographic rates of early development stages justify invasion success among three pine species in the Cerrado biodiversity hotspot?** *Austral Ecology* 46 722-736. **10.1111/aec.12987**.
394. Bolam, F.C., Mair, L., Angelico, M., Brooks, T.M., Burgman, M., Hermes, C., Hoffmann, M., Martin, R.W., McGowan, P.L.K., Rodrigues, A.S.L., Rondinini, C., Westrip, J.R.S., Wheatley, H., Bedolla-Guzmán, Y., Calzada, J., Child, M.F., Cranswick, P.A., Dickman, C.R., Fessl, B., Fisher, D.O., Garnett, S.T., Groombridge, J.J., Johnson, C.N., Kennerley, R.J., King, S.R.B., Lamoreux, J.F., Lees, A.C., Lens, L., Mahood, S.P., Mallon, D.P., Meijaard, E., Méndez-Sánchez, F., Percequillo, A.R., Regan, T.J., Renjifo, L.M., Rivers, M.C., Roach, N.S., Roxburgh, L., Safford, R.J., Salaman, P., Squires, T., Vázquez-Domínguez, E., **Visconti, P.**, Woinarski, J.C.Z., Young, R.P., & Butchart, S.H.M. (2021). **How many bird and mammal extinctions has recent conservation action prevented?** *Conservation Letters* e12762. **10.1111/conl.12762**.
395. Ciais, P., Yao, Y., **Gasser, T.** , Baccini, A., Wang, Y., Lauerwald, R., Peng, S., Bastos, A., Li, W., Raymond, P.A., Canadell, J., Peters, G., Andres, R., Chang, J., Yue, C., Dolman, A.J., Haverd, V., Hartmann, J., Laruelle, G., Konings, A.G., King, A.W., Liu, Y., Luyssaert, S., Maignan, F., Patra, P.K., Peregon, A., Regnier, P., Pongratz, J., Poulter, B., **Shvidenko, A.**, Valentini, R., Wang, R., Broquet, G., Yin, Y., Zscheischler, J., Guenet, B., Goll, D.S., Ballantyne, A., Yang, H., Qiu, C., & Zhu, D. (2021). **Empirical estimates of regional carbon budgets imply reduced global soil heterotrophic respiration.** *National Science Review* nwaa145. **10.1093/nsr/nwaa145**.
396. van Vliet, M.T.H., Jones, E.R, Flörke, M., Franssen, W.H.P., Hanasaki, N., **Wada, Y.** , & Yearsley, J.R. (2021). **Global water scarcity including surface water quality and expansions of clean water technologies.** *Environmental Research Letters* 16 (2) e024020. **10.1088/1748-9326/abbfc3**.
397. Baccour, S., **Albiac Murillo, J.M.S.**, & **Kahil, T.** (2021). **Cost-Effective Mitigation of Greenhouse Gas Emissions in the Agriculture of Aragon, Spain.** *International Journal of Environmental Research and Public Health* 18 (3) e1084. **10.3390/ijerph18031084**.
398. Turkovska, O., Castro, G., Klingler, M., Nitsch, F., Regner, P., **Soterroni, A.**, & Schmidt, J. (2021). **Land-use impacts of Brazilian wind power expansion.** *Environmental Research Letters* 16 (2) e024010. **10.1088/1748-9326/abd12f**.
399. **Frank, S.** , **Gusti, M.** , **Havlík, P.** , **Lauri, P.**, **Di Fulvio, F.** , **Forsell, N.**, **Hasegawa, T.**, **Krisztin, T.** , **Palazzo, A.** , & **Valin, H.** (2021). **Land-based climate change mitigation potentials within the agenda for sustainable development.** *Environmental Research Letters* 16 (2) e024006. **10.1088/1748-9326/abc58a**.
400. Mikovits, C., **Wetterlund, E.**, Wehrle, S., Baumgartner, J., & Schmidt, J. (2021). **Stronger together: Multi-annual variability of hydrogen production supported by wind power in Sweden.** *Applied Energy* 282 e116082. **10.1016/j.apenergy.2020.116082**.
401. Tang, D.H.Y. & **Visconti, P.** (2021). **Biases of Odonata in Habitats Directive: Trends, trend drivers, and conservation status of European threatened Odonata.** *Insect Conservation and Diversity* 14 (1) 1-14. **10.1111/icad.12450**.
402. Pokhrel, Y., Felfelani, F., **Satoh, Y.**, Boulange, J., **Burek, P.** , Gädeke, A., Gerten, D., Gosling, S.N., Grillakis, M., Gudmundsson, L., Hanasaki, N., Kim, H., Koutroulis, A., Liu, J., Papadimitriou, L., Schewe, J., Müller Schmied, H., Stacke, T., Telteu, C.-E., Thiery, W., **Veldkamp, T.**, Zhao, F., & **Wada, Y.** (2021). **Global terrestrial water storage and drought severity under climate change.** *Nature Climate Change* 11 226-233. **10.1038/s41558-020-00972-w**.
403. Marques, A., Robuchon, M., Hellweg, S., Newbold, T., Beher, J., Bekker, S., Essl, F., Ehrlich, D., Hill, S., **Jung, M.**, Marquardt, S., Rosa, F., Rugani, B., Suárez-Castro, A.F., Silva, A.P., Williams, D.R., Dubois, G., & Sala, S. (2021). **A research perspective towards a more complete biodiversity footprint: a report from the World Biodiversity Forum.** *The International Journal of Life Cycle Assessment* **10.1007/s11367-020-01846-1**.

404. Jellesmark, S., Ausden, M., Blackburn, T.M., Gregory, R.D., Hoffmann, M., Massimino, D., McRae, L., & **Visconti, P.** (2021). **A counterfactual approach to measure the impact of wet grassland conservation on UK breeding bird populations.** *Conservation Biology* 35 (5) 1575-1585. **10.1111/cobi.13692**.
405. **Chang, J.** , **Gasser, T.** , Smith, P., Herrero, M., **Havlik, P.** , **Obersteiner, M.** , Guenet, B., Goll, D.S., Li, W., Naipal, V., Peng, S., Qiu, C., Tian, H., Viovy, N., Yue, C., & Zhu, D. (2021). **Climate warming from managed grasslands cancels the cooling effect of carbon sinks in sparsely grazed and natural grasslands.** *Nature Communications* **10.1038/s41467-020-20406-7**.
406. **Kim, M.**, **Kraxner, F.**, **Forsell, N.**, Song, C., & Lee, W.-K. (2021). **Enhancing the provisioning of ecosystem services in South Korea under climate change: The benefits and pitfalls of current forest management strategies.** *Regional Environmental Change* 21 (1) e6. **10.1007/s10113-020-01728-0**.
407. **Ermolieva, T.**, **Havlik, P.** , **Ermoliev, Y.**, **Khabarov, N.** , & **Obersteiner, M.** (2021). **Robust Management of Systemic Risks and Food-Water-Energy-Environmental Security: Two-Stage Strategic-Adaptive GLOBIOM Model.** *Sustainability* 13 (2) e857. **10.3390/su13020857**.
408. Fransson, P., **Brännström, Å.**, & **Franklin, O.** (2021). **A tree's quest for light—Optimal height and diameter growth under a shading canopy.** *Tree Physiology* 41 (1) 1-11. **10.1093/treephys/tpaa110**.
409. Grantham, H. S., Duncan, A., Evans, T. D., Jones, K. R., Beyer, H. L., Schuster, R., Walston, J., Ray, J. C., Robinson, J. G., Callow, M., Clements, T., Costa, H. M., DeGemmis, A., Elsen, P. R., Ervin, J., Franco, P., Goldman, E., Goetz, S., Hansen, A., Hofsvang, E., Jantz, P., Jupiter, S., Kang, A., Langhammer, P., Laurance, W. F., Lieberman, S., Linkie, M., Malhi, Y., Maxwell, S., Mendez, M., Mittermeier, R., Murray, N. J., Possingham, H., Radachowsky, J., Saatchi, S., Samper, C., Silverman, J., Shapiro, A., Strassburg, B., Stevens, T., Stokes, E., Taylor, R., Tear, T., Tizard, R., Venter, O., **Visconti, P.**, Wang, S., & Watson, J. E. M. (2021). **Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity.** *Nature Communications* 11 (1) **10.1038/s41467-020-19493-3**.
410. Guenet, B., Gabrielle, B., Chenu, C., Arrouays, D., Balesdent, J., Bernoux, M., Bruni, E, Caliman, J.-P., Cardinael, R., Chen, S., Ciais, P., Desbois, D., Fouche, J., **Frank, S.** , Henault, C., Lugato, E., Naipal, V., Nesme, T., **Obersteiner, M.** , Pellerin, S., Powlson, D.S., Rasse, D., Rees, F., Soussana, J.-F., Su, Y., Tian, H., **Valin, H.** , & Zhou, F. (2021). **Can N2 O emissions offset the benefits from soil organic carbon storage?** *Global Change Biology* 27 (2) 237-256. **10.1111/gcb.15342**.
411. **Mochizuki, J.** , **Magnuszewski, P.**, Pajak, M., Krolikowska, K., Jarzabek, L., & Kulakowska, M. (2021). **Simulation games as a catalyst for social learning: The case of the water-food-energy nexus game.** *Global Environmental Change* 66 e102204. **10.1016/j.gloenvcha.2020.102204**.
412. Almazán-Gómez, M.A., **Kahil, T.** , Duarte, R., & Sánchez-Chóliz, J. (2021). **A Multiregional Input–Output Hydro-Economic Modeling Framework: An Application to the Ebro River Basin.** *Water Economics and Policy* **10.1142/S2382624X21400026**.
413. Alpuche Álvarez, Y.A., **Nava, L.F.** , Carpio Candelero, M.A., & Contreras Chablé, D.I. (2021). **Vinculando ciencia y política pública La Ley de Aguas Nacionales desde las perspectivas sistémica y de servicios ecosistémicos [Linking science and public policy: The national waters law under the perspectives of systems thinking and ecosystem services].** *Gestión y Política Pública* 30 (2) e133. **10.29265/gypp.v30i2.881**.
414. Boulange, J., Hanasaki, N., Satoh, Y., Yokohata, T., Shiogama, H., **Burek, P.** , Thiery, W., Gerten, D., Müller Schmied, H., **Wada, Y.** , Gosling, S.N., Pokhrel, Y., & Wanders, N. (2021). **Validity of estimating flood and drought characteristics under equilibrium climates from transient simulations.** *Environmental Research Letters* 16 (10) e104028. **10.1088/1748-9326/ac27cc**.
415. **Eker, S.** , Garcia, D., **Valin, H.** , & **van Ruijven, B.** (2021). **Using social media audience data to analyse the drivers of low-carbon diets.** *Environmental Research Letters* 16 (7) 074001. **10.1088/1748-9326/abf770**.

416. **Martin, J.G.C.** , **Khadka, P.**, **Linnerooth-Bayer, J.**, **Velev, S.**, Russell, C., Parajuli, B., Shaky, P., Vij, S., & **Liu, W.** (2021). **Living with Landslides: Perceptions of Risk and Resilience in Far West Nepal.** *IDRiM Journal* 11 (2) 138-167. **10.5595/001C.31187**.
417. Mukhortova, L.V., Krivobokov, L.V., **Shchepashchenko, D.** , Knorre, A.A., & Sobachkin, D.S. (2021). **Stock of standing dead trees in boreal forests of Central Siberia.** *IOP Conference Series: Earth and Environmental Science* 875 (1) e012059. **10.1088/1755-1315/875/1/012059**.
418. Müller, J., Park, J., **Sahu, R.K.** , Varadharajan, C., Arora, B., Faybishenko, B., & Agarwal, D. (2021). **Surrogate optimization of deep neural networks for groundwater predictions.** *Journal of Global Optimization* 81 (1) 203-231. **10.1007/s10898-020-00912-0**.
419. Reinecke, R., Müller Schmied, H., Trautmann, T., Andersen, L.S., **Burek, P.** , Flörke, M., Gosling, S.N., Grillakis, M., Hanasaki, N., Koutroulis, A., Pokhrel, Y., Thiery, W., **Wada, Y.** , **Satoh, Y.**, & Döll, P. (2021). **Uncertainty of simulated groundwater recharge at different global warming levels: a global-scale multi-model ensemble study.** *Hydrology and Earth System Sciences* 25 (2) 787-810. **10.5194/hess-25-787-2021**.
420. Santini, L., Antão, L.H., **Jung, M.**, Benítez-López, A., Rapacciuolo, G., Di Marco, M., Jones, F.A.M., Haghkerdar, Je.M., & González-Suárez, M. (2021). **The interface between Macroecology and Conservation: existing links and untapped opportunities.** *Frontiers of Biogeography* 13 (4) e53025. **10.21425/F5FBG53025**.
421. **Satoh, Y.**, Shiogama, H., Hanasaki, N., Pokhrel, Y., Boulange, J.E.S., **Burek, P.** , Gosling, S.N., Grillakis, M., Koutroulis, A., Müller Schmied, H., Thiery, W., & Yokohata, T. (2021). **A quantitative evaluation of the issue of drought definition: a source of disagreement in future drought assessments.** *Environmental Research Letters* 16 (10) e104001. **10.1088/1748-9326/ac2348**.
422. **van Dijk, M.**, Morley, T., Rau, M.L., & Saghai, Y. (2021). **A meta-analysis of projected global food demand and population at risk of hunger for the period 2010–2050.** *Nature Food* 2 (7) 494-501. **10.1038/s43016-021-00322-9**.

## Books and book chapters

1. Soula, R., Chebil, A., Majdoub, R., Crespo, D., **Kahil, T.** , & **Albiac Murillo, J.M.S.** (2023). **Policy Interventions to Improve Groundwater Management: Case of a Depleted Aquifer in Mahdia (Tunisia).** In: *Selected Studies in Environmental Geosciences and Hydrogeosciences.* pp. 245-248 Springer. **10.1007/978-3-031-43803-5$_{52}$**.
2. **Nava, L.F.** , Torres Bernardino, L., & Orozco, I. (2023). **Crisis Water Management in Mexico.** In: *The Palgrave Encyclopedia of Sustainable Resources and Ecosystem Resilience.* pp. 1-21 Cham: Springer International Publishing. ISBN 978-3-030-67776-3 **10.1007/978-3-030-67776-3$_{56-1}$**.
3. Gauthier, S., Kuuluvainen, T., Macdonald, S.E., Shorohova, E., **Shvidenko, A.**, Bélisle, A.-C., Vaillancourt, M.-A., Leduc, A., Grosbois, G., Bergeron, Y., Morin, H., & Girona, M.M. (2023). **Ecosystem Management of the Boreal Forest in the Era of Global Change.** In: *Boreal Forests in the Face of Climate Change.* Eds. Girona, M.M., Morin, H., Gauthier, S., & Bergeron, Y., pp. 3-49 Springer. ISBN 978-3-031-15990-9 **10.1007/978-3-031-15988-6_1**.
4. **Avidar, O.** (2023). **Israel: From Water Scarcity to Water Surplus.** In: *The Palgrave International Handbook of Israel.* Eds. Kumaraswamy, P.R., pp. 1-14 Singapore: Palgrave Macmillan. **10.1007/978-981-16-2717-0_94-1**.
5. **Ermoliev, Y.**, **Komendantova, N.** , & **Ermolieva, T.** (2023). **Energy Production and Storage Investments and Operation Planning Involving Variable Renewable Energy Sources A Two-stage Stochastic Optimization Model with Rolling Time Horizon and Random Stopping Time.** In: *Modern Optimization Methods for Decision Making Under Risk and*

*Uncertainty.* Eds. Gaivoronski, A., Knopov, P., & Zaslavskyi, V., Taylor & Francis. ISBN 9781003260196 **10.1201/9781003260196-13**.

6. **Ermolieva, T.**, **Ermoliev, Y.**, **Komendantova, N.** , Norkin, V., Knopov, P., & Gorbachuk, V. (2023). **Linking Catastrophe Modeling and Stochastic Optimization Techniques for Integrated Catastrophe Risk Analysis and Management.** In: *Modern Optimization Methods for Decision Making Under Risk and Uncertainty.* Eds. **Gaivoronski, A.**, Knopov, P., & Zaslavskyi, V., pp. 15-50 Taylor & Francis. ISBN 9781003260196 **10.1201/9781003260196-2**.
7. Mukhortova, L. V. & **Shchepashchenko, D.G.** (2023). **Estimation of Carbon Stock in Forest Soils of Sakhalin Region.** In: *Physical and Mathematical Modeling of Earth and Environment Processes—2022. PMMEEP 2022.* Eds. Karev, V.I., pp. 295-304 Cham: Springer. **10.1007/978-3-031-25962-3_30**.
8. Armas Vargas, F., **Nava, L.F.** , Escolero, O., Gómez Reyes, E., & Sandoval Solis, S. (2022). **Watershed Sustainability: An Integrated River Basin Perspective.** In: *The Palgrave Encyclopedia of Urban and Regional Futures.* pp. 1-15 Cham, Switzerland: Palgrave Macmillan. ISBN 978-3-030-51812-7 **10.1007/978-3-030-51812-7_353-1**.
9. Bednar-Friedl, B., Biesbroek, R., Schmidt, D.N., Alexander, P., Børsheim, K.Y., Carnicer, J, Georgopoulou, E., Haasnoot, M., Le Cozzanet, G., Lionello, P., Lipka, O., Möllmann, C., Muccione, V., Mustonen, T., Piepenburg, D., & Whitmarsh, L. (2022). **Europe (Chapter 13).** In: *IPCC 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Eds. Pörtner, H.-O., Roberts, D.C., Tignor, M., Poloczanska, E.S., Mintenbeck, K, Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A., & Rama, B., pp. 1817-1927 Cambridge, UK and New York, NY, USA: Cambridge University Press. **10.1017/9781009325844.015**.
10. Chacón-Madrigal, E., Avalos, G., **Hofhansl, F.** , Coronado, I., Ferrufino-Acosta, L., MacVean, A., & Rodríguez, D. (2022). **Biological invasions by plants in continental Central America.** In: *Global Plant Invasions.* Eds. Clements, D., Upadhyaya, M., Joshi, S., & Ahrestha, A., Springer. ISBN 978-3-030-89684-3 **10.1007/978-3-030-89684-3**.
11. **Ermoliev, Y.**, **Komendantova, N.** , & **Ermolieva, T.** (2022). **Strategic DSS for robust energy production and storage investments and operation planning involving variable renewable energy sources: A two-stage stochastic optimization model s with stopping time and rolling horizon.** In: *Mathematical modeling, optimization and information technologies", international scientific conference.* pp. 57-59 CEP USM. ISBN 978-9975-159-03-6
12. **Ermolieva, T.**, **Havlik, P.** , **Kahil, T.** , **Balkovič, J.** , **Skalský, R.** , **Ermoliev, Y.**, Knopov, P., **Borodina, O.**, & Gorbachuk, V. (2022). **Climate change adaptation through robust land use planning: two-stage stochastic optimization for risk-informed decision making.** In: *Mathematical modeling, optimization and information technologies", international scientific conference.* pp. 52-56 CEP USM. ISBN 978-9975-159-03-6
13. FAO & IIASA (2022). **Afghanistan's Agro-ecological zoning atlas. Part 2: Agro-ecological assessments. First revision.** Rome, Italy: FAO and IIASA. ISBN 978-92-5-135628-9 **10.4060/cb8302en**.
14. Guivarch, C., Kriegler, E., Portugal-Pereira, J., Bosetti, V., Edmonds, J., Fischedick, M., **Havlík, P.** , Jaramillo, P., **Krey, V.** , Lecocq, F., Lucena, A., Meinshausen, M., Mirasgedis, S., O'Neill, B., Peters, G.P., **Rogelj, J.** , Rose, S., Saheb, Y., Strbac, G., Hammer Strømman, A., van Vuuren, D.P., & Zhou, N. (2022). **Annex III: Scenarios and modelling methods.** In: *IPCC*

*2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Eds. Shukla, A.R., Skea, J., Slade, R., Al Khourdajie, A., van Diemen, R., McCollum, D., Pathak, M., Some, S., Vyas, P., Fradera, R., Belkacemi, M., Hasija, A., Lisboa, G., Luz, S., & Malley, J., pp. 1842-1908 Cambridge, UK and New York, NY, USA: Cambridge University Press. **10.1017/9781009157926.022**.

15. Nabuurs, G-J., Mrabet, R., Abu Hatab, A., Bustamante, M., Clark, H., **Havlík, P.** , House, J., Mbow, C., Ninan, K.N., Popp, A., Roe, S., Sohngen, B., & Towprayoon, S. (2022). **Agriculture, Forestry and Other Land Uses (Chapter 7).** In: *IPCC 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Eds. Shukla, A.R., Skea, J., Slade, R., Al Khourdajie, A., van Diemen, R., McCollum, D., Pathak, M., Some, S., Vyas, P., Fradera, R., Belkacemi, M., Hasija, A., Lisboa, G., Luz, S., & Malley, J., pp. 747-860 Cambridge, UK and New York, NY, USA: Cambridge University Press. **10.1017/9781009157926.009**.
16. **Nava, L.F.** & Medrano Pérez, O.R. (2022). **Water Policy in the State of Tabasco.** In: *The Palgrave Encyclopedia of Urban and Regional Futures.* Eds. Brears, R., pp. 1-13 Palgrave Macmillan. **10.1007/978-3-030-51812-7_355-1**.
17. **Nava, L.F.** & Nava Jiménez, C. (2022). **Sustainable Development And Responsible Tourism: The Grijalva-Usumacinta Lower River Basin.** In: *The Palgrave Encyclopedia of Urban and Regional Futures.* Eds. Brears, R., pp. 1-9 Palgrave Macmillan. **10.1007/978-3-030-51812-7_148-1**.
18. **Albiac Murillo, J.M.S.**, **Kahil, T.** , & Encarna, E. (2021). **The Jucar River Basin.** In: *Sustainability of Engineered Rivers In Arid Lands: CHallenge and Response.* Eds. Schmandt, J., Kibaroglu, A., Buono, R., & Thomas, S., pp. 220-232 Cambridge, UK: Cambridge University Press. ISBN 978-1-108-41703-7 **10.1017/9781108261142.015**.
19. IPCC (2021). **Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.** Cambridge, UK: Cambridge University Press.
20. **Ermolieva, T.**, **Ermoliev, Y.**, **Obersteiner, M.** , & **Rovenskaya, E.** (2021). **Chapter 4 Two-Stage Nonsmooth Stochastic Optimization and Iterative Stochastic Quasigradient Procedure for Robust Estimation, Machine Learning and Decision Making.** In: *Resilience in the Digital Age.* pp. 45-74 Springer. ISBN 978-3-030-70369-1 **10.1007/978-3-030-70370-7_4**.
21. European Commission (2021). **EU reference scenario 2020: energy, transport and GHG emissions : trends to 2050.** Luxembourg: Publications Office. ISBN 978-92-76-39356-6
22. Eyring, V., Gillett, N.P., Achuta Rao, K.M., Barimalala, R., Barreiro Parrillo, M., Bellouin, N., Cassou, C., Durack, P.J., Kosaka, Y., McGregor, S., Min, S., Morgenstern, O., & Sun, Y. (2021). **Human Influence on the Climate System (Chapter 3).** In: *IPCC 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Eds. Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S.L., Péan, C., Berger, S., Caud, N., Chen, Y., Goldfarb, L., Gomis, M.I, Huang, M., Leitzell, K., Lonnoy, E., Matthews, J.B.R., Maycock, T.K., Waterfield, T., Yelekçi, K., Yu, R., & Zhu, B., pp. 423-552 Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. **10.1017/9781009157896.005**.

23. Figueroa, A.J. & **Smilovic, M.** (2021). **Groundwater irrigation and implication in the Nile river basin.** In: *Global Groundwater.* pp. 81-95 Amsterdam, Netherlands: Elsevier. ISBN 978-0-12-818172-0 **10.1016/B978-0-12-818172-0.00007-4**.
24. Nava Jiménez, C., **Nava, L.F.** , Barbosa Granados, A.A., & Flores Agapito, S.E. (2021). **Conflictividad asociada a grandes obras hidráulicas: el pantano de Jánovas, España y la presa Tenosique, México.** In: *El turismo desde las ciencias sociales. Reflexiones, apropiaciones y diálogos con América Latina.* Eds. Pimentel, T.D., César Dachary, A.A., & Korstanje, M., pp. 213-236 Motres Académicos. ISBN 978-65-5513-078-2
25. Ottolini, I., **Nava, L.F.** , & Bernardino, L.T. (2021). **Conflictividad asociada a grandes obras hidráulicas el pantano de Jánovas, España y Lapresa Tenosique, México.** In: *Globalización neoliberal, extractivismos y conflictividad ambiental y territorial en América Latina y Europa.* pp. 249-297 Tirant Lo Blanch. ISBN 9788418534218
26. Seneviratne, S.I., Zhang, X., Adnan, M., Badi, W., Dereczynski, C., Di Luca, A., Ghosh, S., Iskander, I., Kossin, J., Lewis, S., Otto, F., Pinto, I., Satoh, M., Vicente-Serrano, S.M., Wehner, M., & Zhou, B. (2021). **Weather and Climate Extreme Events in a Changing Climate (Chapter 11).** In: *IPCC 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Eds. Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S.L., Péan, C., Berger, S., Caud, N., Chen, Y., Goldfarb, L., Gomis, M.I, Huang, M., Leitzell, K., Lonnoy, E., Matthews, J.B.R., Maycock, T.K., Waterfield, T., Yelekçi, K., Yu, R., & Zhu, B., pp. 1513-1766 Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. **10.1017/9781009157896.013**.
27. Tansel, B., Keyes, C.G., **Nava, L.F.** , & Lander, A.J. (2021). **Concentrate Management in Desalination: Case Studies.** American Society of Civil Engineers. ISBN 9780784415696 **10.1061/9780784415696**.
28. de Souza, M., Koo-Oshima, S., **Kahil, T.** , **Wada, Y.** , Qadir, M., Jewitt, G., Cudennec, C., Uhlenbrook, S., & Zhang, L. (2021). **Food and agriculture.** In: *The United Nations World Water Development Report 2021: Valuing Water.* pp. 67-78 Paris: UNESCO. ISBN 978-92-3-100434-6

# Non-refereed publications

## IIASA working papers, reports and policy briefs

1. **Magnuszewski, P.**, Campo, P., **Strelkovskii, N.** , **Fresolone-Caparrós, A.** , **Linnerooth-Bayer, J.**, **Poledna, S.**, **Rovenskaya, E.** , Pajak, M., **Goujon, A.** , Conte, A., Szewczyk, K., & Wegschaider, K. (2023). **The Migration Policy Simulation: Engaging stakeholders in Austria's migration future by linking an agent-based model with a policy exercise.** IIASA Report. Laxenburg, Austria: IIASA
2. **Lutz, W.** & **Pachauri, S.** (2023). **Systems Analysis for Sustainable Wellbeing. 50 years of IIASA research, 40 years after the Brundtland Commission, contributing to the post-2030 Global Agenda.** IIASA Report. Laxenburg, Austria: International Institute for Applied Systems Analysis (IIASA) **10.5281/zenodo.8214208**.
3. **Martin, J.** , **Scolobig, A.**, **Linnerooth-Bayer, J.**, Aguilera Rodríguez, J.J., Balsiger, J., Del Seppia, N., **Fresolone-Caparrós, A.** , Garcia, E., Kraushaar, S., Verges, D., Wulff Knusten, T., & Zingraff-Hamed, A. (2023). **Policy and finance innovation for nature-based solutions.** IIASA Policy Brief. Laxenburg, Austria: PB-38
4. Moersberger, H., **Martin, J.G.C.** , Valdez, J., Junker, J., **Georgieva, I.** , Bauer, S., Beja, P., Breeze, T., Brotons, L., Bruelheide, H., Fernández, N., Fernandez, M., Jandt, U., Langer, C., Solheim, A.L., Maes, J., Moreira, F., Pe'er, G., Santana, J., Shamoun-Baranes, J., Smets, B., **McCallum, I.** , Pereira,

H.M., & Bonn, A. (2023). **The future of biodiversity monitoring in Europe.** IIASA Policy Brief. Laxenburg, Austria: PB-37

5. **Boere, E.**, **Derci Augustynczik, A.L.**, **Kozicka, M.** , & **Havlik, P.** (2023). **Food systems transformation in Indonesia: Results on baseline and stylized scenarios from GLOBIOM.** IIASA Report. Laxenburg, Austria: IIASA
6. Kariuki, P., Edel, I., Hauser, M., **Irshaid, J.**, **Joseph, J.**, **Kahil, T.** , **Luna Gonzalez, D.**, **Smilovic, M.** , **Tramberend, S.** , & **Yillia, P.** (2023). **Report: scaleWAYS Final Workshop.** IIASA Report. Laxenburg: IIASA
7. **Addo, F.** & **Palazzo, A.** (2023). **Securing sustainable and resilient food systems for The Gambia.** IIASA Policy Brief. Laxenburg, Austria: PB-36
8. **Leclere, D.**, **Visconti, P.**, & **Heyl, A.** (2022). **Integrated solutions for biodiversity.** IIASA Policy Brief. Laxenburg, Austria: PB-33
9. **Willaarts, B.** , **Palazzo, A.** , **Kahil, T.** , **Tang, T.** , & **Heyl, A.** (2021). **Sustainable development pathways to water, food, and energy security in the Zambezi basin.** IIASA Policy Brief. Laxenburg, Austria: PB-27
10. **Willaarts, B.** , **Vinca, A.** , **Parkinson, S.** , **Riahi, K.** , **Byers, E.** , & **Heyl, A.** (2021). **Cooperation and joint investments are key to sustainable development in the Indus basin.** IIASA Policy Brief. Laxenburg, Austria: PB-28
11. **Mechler, R.** , Stevance, A.-S., **Deubelli, T.** , **Scolobig, A.**, **Linnerooth-Bayer, J.**, **Handmer, J.**, **Irshaid, J.**, McBean, G., Zapata-Marti, R., Gordon, M., Ivanova, M., **Srivastava, L.**, **Gomez Echeverri, L.**, **Hochrainer-Stigler, S.**, **Schinko, T.** , & Olukoshi, A. (2021). **Transformations within reach: Pathways to a sustainable and resilient world - Enhancing Governance for Sustainability.** IIASA Report. IIASA-ISC
12. **Srivastava, L.**, **Gomez Echeverri, L.**, Schlegel, F., Denis, M., **Deubelli, T.** , **Havlik, P.** , Kaplan, D., **Mechler, R.** , Paulavets, K., **Rovenskaya, E.** , **Sizov, S.** , **Sperling, F.**, Stevance, A.-S., & **Zakeri, B.** (2021). **Transformations within reach: Pathways to a sustainable and resilient world - Synthesis Report.** IIASA Report. IIASA-ISC

## Other external publications

1. Sotirov, M., Jonsson, R., Kleinschmit von Lengefeld, A.N., **Krasovskiy, A.** , **Kraxner, F.**, Lexer, M.J., Malovrh, Š.P., & Ritschkoff, A.-C. (2024). **Europe's wood supply in disruptive times. An evidence-based synthesis report.** International Union of Forest Research Organizations (IUFRO) , Vienna, Austria.
2. **Hofhansl, F.** (2023). **Conservation and reforestation of biodiversity in the biological corridor La Gamba, Costa Rica.** IIASA , Laxenburg, Austria.
3. Campo, P., **Willaarts, B.** , **Magnuszewski, P.**, Giger, T., Ksiazczak, A.M., Brychczynski, H., & Kułakowska, M. (2023). **Collaborative Design of Pathways to Sustainability. Guidebook for designing and running in-person workshops.** Zenodo **10.5281/zenodo.8345513**.
4. van Westen, C., Naz, I., Atun, F., Hassinger, L., van den Bout, B., Flacke, J., Manzella, I., Marr, P., Agmon, G., Ottow, B., Hurlimann, M., Kumar, P., Cocuccioni, S., Schollerer, L., Kulakowska, M., Koelle, B., Jaime, C., **Komendantova, N.** , **Ermolieva, T.**, & Twayana, R. (2023). **The web-based simulation and information service for multi-hazard impact chains. Design document.** University of Twente
5. Kanade, R., Lohakare, K., Bhadbhade, N., Joy, K.J., Thomas, B.K., **Martin, J.** , & **Willaarts, B.** (2023). **Situational Analysis of the Upper Bhima sub-basin in the context of the Water-Food-Biodiversity Nexus.** Zenodo **10.5281/zenodo.8255959**.
6. Moersberger, H., **Martin, J.G.C.** , Junker, J., **Georgieva, I.** , Maes, J., **McCallum, I.** , Pereira, H.M., & Bonn, A. (2023). **National survey to co-design the Europa Biodiversity Observation Network (EuropaBON).** ARPHA Preprints **10.3897/arphapreprints.e104251**.

7. **Linnerooth-Bayer, J.**, **Martin, J.** , **Fresolone-Caparrós, A.** , **Scolobig, A.**, Rodriguez, J.A., Solheim, A., Olsen, S.G., & Reutz, E.H. (2023). **Learning from NBS implementation barriers.** Deliverable 5.4 of the PHUSICOS project
8. **Martin, J.** , **Irshaid, J.**, **Linnerooth-Bayer, J.**, **Scolobig, A.**, Rodriguez, J.A., & **Fresolone-Caparrós, A.** (2023). **Opportunities and barriers to NBS at the EU, national, regional and local scales, with suggested reforms and innovations.** Deliverable 5.2 of the PHUSICOS project
9. **Scolobig, A.**, Rodriguez, J.A., **Martin, J.** , & **Linnerooth-Bayer, J.** (2023). **Governance innovation for the design, financing and implementation of NBS, and their application to the concept and demonstration projects.** Deliverable 5.3 of the PHUSICOS project
10. Moersberger, H., **Martin, J.G.C.** , Junker, J., **Georgieva, I.** , Maes, J., **McCallum, I.** , Pereira, H.M., & Bonn, A. (2023). **European survey to co-design the Europa Biodiversity Observation Network (EuropaBON).** ARPHA Preprints **10.3897/arphapreprints.e104168**.
11. Thambi, S., Chandrasekharan, T., Chiu, C., Susanto, E., **Palazzo, A.** , **Frank, S.** , & **Havlik, P.** (2023). **The Financial Impact of Climate Change on the Livestock Sector. New Insights For Investors and Policymakers.** The FAIRR Initiative , London, UK.
12. FABLE (2023). **Ecological restoration and deforestation control: Implications for Colombia's agriculture and climate goals. FABLE Policy Brief.** Sustainable Development Solutions Network (SDSN) and International Institute for Applied Systems Analysis (IIASA) , Paris, France/Laxenburg, Austria.
13. FAO & IIASA (2023). **Harmonized World Soil Database version 2.0.** FAO; IIASA **10.4060/cc3823en**.
14. IBF-IIASA (2023). **Global Biosphere Management Model (GLOBIOM) Documentation 2023 - Version 1.0.** International Institute for Applied Systems Analysis , Laxenburg, Austria.
15. IEA (2023). **Bioenergy Review 2023: How bioenergy contributes to a sustainable future.** IEA Bioenergy
16. UNESCO (2023). **Partnerships and cooperation for water**. The United Nations World Water Development Report 2023
17. UNEP-WCMC (2023). **Mapping nature-based solutions for societal challenges. A product of the SPACES coalition.** United Nations Environment Programme , Cambridge.
18. UNEP-WCMC (2023). **Remote Sensing for monitoring impacts of land-use change on biodiversity and carbon stocks: the role in the spatial planning process. A product of the SPACES coalition.** United Nations Environment Programme , Cambridge.
19. FABLE (2022). **National food and land mitigation pathways for net zero.** Alliance of Bioversity International and the International Center for Tropical Agriculture & Sustainable Development Solutions Network (SDSN) , Montpellier/Paris, France.
20. Nascimento, L., Kuramochi, T., Wollands, S., de Villafranca Casa, M.J., Hans, F., de Vivero, G., Fekete, H., Pelekh, N., Lui, S., Wong, J., Höhne, N., Dafnomilis, I., Hooijschuur, E., den Elzen, M., Roelfsema, M., **Forsell, N.**, **Araujo Gutierrez, Z.**, & **Gusti, M.** (2022). **Greenhouse gas mitigation scenarios for major emitting countries Analysis of current climate policies and mitigation commitments: 2022 update.** NewClimate Institute , Cologne, Germany.
21. United Nations Environment Programme (2022). **Strengthening Synergies: Climate change mitigation benefits from achieving global biodiversity targets.** United Nations Environment Programme World Conservation Monitoring Centre , Cambridge.
22. Guerrero, S., Henderson, B., Valin, H., **Janssens, C.**, **Havlik, P.** , & **Palazzo, A.** (2022). **The impacts of agricultural trade and support policy reform on climate change adaptation and environmental performance.** OECD https://doi.org/https://doi.org/10.1787/520dd70d-en.
23. Moersberger, H., **Martin, J.G.C.** , Junker, J., **Georgieva, I.** , Bauer, S., Beja, P., Breeze, T., Brotons, L., Bruelheide, H., Fernández, N., Fernandez, M., Jandt, U., Langer, C., Lyche Solheim, A., Maes, J., Moreira, F., Pe'er, G., Santana, J., Shamoun-Baranes, J., Smets, B., Valdez, J., **McCallum, I.** , Pereira, H.M., & Bonn, A. (2022). **Europa Biodiversity Observation Network: User and Policy Needs**

**Assessment.** EuropaBON/German Centre of Biodiversity Research (iDiv) , Leipzig. **10.3897/arphapreprints.e84517**.

24. FABLE (2022). **Pathways for food and land use systems to contribute to global biodiversity targets. FABLE Policy Brief.** Alliance of Bioversity International and the International Center for Tropical Agriculture & Sustainable Development Solutions Network (SDSN) , Montpellier/Paris, France.
25. Krieger, J., Duarte, G., Boakes, E., Capellao, R., Chaplin-Kramer, R., Enquist, B., Feng, X., Gomes, F., Hill, S., Iribarrem, A., Lacerda, E., **Leclere, D.**, Merow, C., Mortara, S., Newbold, T., Oliveira, L., Rocha, D., Roehrdanz, P., Watson, J., & Strassburg, B. (2022). **Ambitious goals require inclusive and integrated spatial planning: Recommendations for the post-2020 Global Biodiversity Framework.** International Institute for Sustainability
26. Expert Input to the Post-2020 Global Biodiversity Framework (2022). **Transformative actions on all drivers of biodiversity loss are urgently required to achieve the global goals by 2050.** Convention on Biological Diversity
27. **Sperling, F.**, Rumbaitis del Rio, C., & **Laurien, F.** (2022). **Resilience and the Transformation of Food and Land Use Systems. Discussion paper prepared for the Food and Land Use Coalition (FOLU).** International Institute for Applied Systems Analysis (IIASA) and Concept Resilience
28. Systemiq (2022). **Tech to Track: Harnessing the potential of spatial data & digital technologies to prioritise nature and climate action. A product of the SPACES coalition.** United Nations Environment Programme
29. UNDRR (2022). **Prospects and challenges of transdisciplinary research approaches for managing and communicating climate-related risks.** United Nations Office for Disaster Risk Reduction
30. **Yokomatsu, M.**, **Mochizuki, J.** , **Tellez Leon, E.**, & **Burek, P.** (2022). **Macroeconomic co-benefits of DRR investment: Assessment using the Dynamic Model of Multi-hazard Mitigation CoBenefits (DYNAMMICs) model.** United Nations Office for Disaster Risk Reduction
31. Dunz, N., Tanaka, H., Shiiba, N., **Mochizuki, J.** , & **Naqvi, A.** (2021). **Building Back Better in Small Island Developing States in the Pacific: Initial Insights from the BinD Model of Disaster Risk Management Policy Options in Fiji. ADBI Working Paper 1290.** Asian Development Bank Institute , Tokyo, Japan.
32. Högberg, P., Ceder, L.A., Astrup, R., Binkley, D., Dalsgaard, L., Egnell, G., Filipchuk, A., Genet, H., Ilintsev, A., Kurz, W.A., Laganière, J., Lemprière, T., Lundblad, M., Lundmark, T., Mäkipää, R., Malysheva, N., Mohr, C.W., Nordin, A., Petersson, H., Repo, A., **Shchepashchenko, D.** , **Shvidenko, A.**, Soegaard, G., & **Kraxner, F.** (2021). **Sustainable boreal forest management challenges and opportunities for climate change mitigation.** Swedish Forest Agency
33. McCallister, M., **Krasovskiy, A.** , Platov, A., Golub, A.A., Pietracci, B., & Leslie, G. (2021). **Forest Protection and Permanence of Reduced Emissions.** Environmental Defense Fund Economics Discussion Paper Series, EDF EDP 21-08 **10.2139/ssrn.3964985**.
34. Nascimento, L., Kuramochi, T., Moisio, M., Hans, F., de Vivero, G., Gonzales-Zuñiga, S., Smit, S., Lui, S., Schiefer, T., Mooldijk, S., Wong, J., de Castro Dias, E., Höhne, N., van Soest, H., Dafnomilis, I., Chen, H.H., den Elzen, M., **Forsell, N.**, **Batka, M.** , & **Gusti, M.** (2021). **Greenhouse gas mitigation scenarios for major emitting countries – Analysis of current climate policies and mitigation commitments: 2021 Update.** NewClimate Institute , Cologne, Germany.
35. FABLE (2021). **Environmental and agricultural impacts of dietary shifts at global and national scales. FABLE Policy Brief.** Alliance of Bioversity International and the International Center for Tropical Agriculture & Sustainable Development Solutions Network (SDSN) , Montpellier/Paris, France.
36. **Valin, H.** , Hertel, T., Bodirsky, B., Hasegawa, T., & Stehfest, E. (2021). **Achieving Zero Hunger by 2030 A Review of Quantitative Assessments of Synergies and Tradeoffs amongst the UN Sustainable Development Goals.** Center for Development Research (ZEF) , Bonn, Switzerland. **10.48565/scgr2021-2337**.

37. Bossio, D., **Obersteiner, M.** , Wironen, M., **Jung, M.**, Wood, S., **Folberth, C.** , Boucher, T., Alleway, H., Simons, R., Bucien, K., Dowell, L., Cleary, D., & Jones, R. (2021). **Foodscapes: Toward Food System Transition.** The Nature Conservancy, International Institute for Applied Systems Analysis, and SYTEMIQ
38. Duncanson, L., Armston, J., Disney, M., Avitabile, V., Barbier, N., Calders, K., Carter, S., Chave, J., Herold, M., MacBean, N., McRoberts, R., Minor, D., Paul, K., Réjou Méchain, M., Roxburgh, S., Williams, M., Albinet, C., Baker, T., Bartholomeus, H., Bastin, J. F., Coomes, D., Crowther, T., Davies, S., de Bruin, S., De Kauwe, M., Domke, G., Dubayah, R., Falkowski, M., Fatoyinbo, L., Goetz, S., Jantz, P., Jonckheere, I., Jucker, T., Kay, H., Kellner, J., Labriere, N., Lucas, R., Mitchard, E., Morsdorf, F., Naesset, E., Park, T., Phillips, O. L., Ploton, P., Quegan, S., Saatchi, S., Schaaf, C., **Shchepashchenko, D.** , Scipal, K., Stovall, A., Thiel, C., Wulder, M. A., Camacho, F., Nickeson, J., Román, M., & Margolis, H. (2021). **Aboveground Woody Biomass Product Validation Good Practices Protocol.** Land Product Validation Subgroup (WGCV/CEOS **10.5067/doc/ceoswgcv/lpv/agb.001**.
39. **Fischer, G.**, Nachtergaele, F.O., **van Velthuizen, H.**, Chiozza, F., Francheschini, G., Henry, M., Muchoney, D., & **Tramberend, S.** (2021). **Global Agro-ecological Zones (GAEZ v4)- Model Documentation.** FAO & IIASA , Laxenburg, Austria; Rome, Italy. **10.4060/cb4744en**.
40. IEA (2021). **Net Zero by 2050: A Roadmap for the Global Energy Sector.** International Energy Agency
41. **Yokomatsu, M.,** Joseph, J., Williges, K., **Mochizuki, J., Kahil, T**. (2021). **Public Investment Profile for Climate Risk Reduction in Barbados: A Macroeconomic Cost-Benefit Analysis for Reducing the Socio-Economic Risk of Coastal Erosion.** Inter-American Development Bank (IDB) , Technical Note No. IDB-TN-2393. **10.18235/0003915**.
42. Kim, H., Peterson, G., Cheung, W., Ferrier, S., Alkemade, R., Arneth, A., Kuiper, J., Okayasu, S., Pereira, L., Acosta, L., Chaplin-Kramer, R, den Belder, E., Eddy, T., Johnson, J., Karlsson-Vinkhuysen, S., Kok, M., Leadley, P., **Leclere, D.**, Lundquist, C., Rondinini, C., Scholes, R., Schoolenberg, M., Shin, Y., Stehfest, E., Stephenson, F., **Visconti, P.**, van Vuuren, D., Wabnitz, C., Alava, J., Cuadros-Casanova, Ivon, Davies, K., Gasalla, M., Halouani, G., Harfoot, M., Hashimoto, S., Hickler, T., Hirsch, T., Kolomytsev, G., Miller, B., Ohashi, H., Palomo, M., Popp, A., Remme, R., Saito, O., Sumaila, R., Willcock, S., & Pereira, H. (2021). **Towards a better future for biodiversity and people: modelling Nature Futures.** Utrecht University **10.31235/osf.io/93sqp**. (Submitted)
43. Miles, L., **Visconti, P.**, Strassburg, B., **Jung, M.**, **Lewis, M.** , Iribarrem, A., Ribeiro Lacerda, E., Ribeiro Mortara, S., Silva de Oliveira, L.G., Souza Bezerra Rocha, D., Toledo Capellao, R., Mills, J., Telhado, C., Tshwene-Mauchaza, B., & Kapos, V. (2021). **Methods for estimating potential greenhouse gas emissions reductions from achieving global biodiversity targets.** UNEP-WCMC , Cambridge.
44. Nascimento, L., **Forsell, N.**, **Batka, M.** , Kuramochi, T., Illenseer, N., Subtil, C., & Lancesseur, N. (2021). **Tracking climate mitigation efforts in 30 major emitters: Economy-wide projections and progress on key sectoral policies.** NewClimate Institute, IIASA and FTSE Russell
45. Wilcox, J., Kolosz, B., & Freeman, J. (2021). **CDR Primer.** Carbon Dioxide Removal Primer
46. World Water Quality Alliance (2021). **World Water Quality Assessment: First Global Display of a Water Quality Baseline.** United Nations Environment Assembly , Nairobi.

# Annex C. List of participation in global efforts, lectures, courses, other capacity building efforts BNR

## Global efforts

1. **Convention on Biological Diversity 15th conference of the parties**, Montreal, December 2022. David Leclère gave a keynote presentation on ''Bending the curve of biodiversity'' (>1000 in the plenary) and Piero Visconti presented results from the BIOCLIMA project at the Science-Policy dialogue side-event of the CBD COP (>100 in the side events). Both presentations raised awareness among world leaders (~200 countries delegation attending the COP) about IIASA's work to identify pathways to achieve global and regional biodiversity scenarios through simulating conservation actions and policies addressing direct and indirect drivers of biodiversity loss.
2. **Contribution to the IPCC 6th Assessment Report**. Petr Havlík (Lead author) & Andre Deppermann (contributing author) of WG3 Chapter 7 - Agriculture, Forestry and Other Land Uses (AFOLU). Stefan Frank (contributing author) Annex III: Scenarios and Modelling Methods. Peter Greve (contributing author) of WG1 chapters 3 and 11 and WG2 chapter 13.
3. **IPBES**, Petr Havlík, Member of the Task Force on Scenarios and Models for 2024-2026
4. **NaturaConnect 1st Stakeholder event 28 February 2022**. More than 70 leading EU policy and governmental decision-makers came together to lay the foundation for a bold new vision for Europe's nature protection in the first NaturaConnect Stakeholder Event this year. Organized by the Horizon Europe NaturaConnect project, the event welcomed a diverse range of influential stakeholders, from country representatives to European Union delegates and international and European conservation organizations. The event increased the awareness of the project, and its goals to key stakeholders, specifically the European Commission Directorate General for the Environment, key international NGOs, sectorial organizations and national environmental agencies and ministries important outputs. It also offered important feedback on key knowledge gaps and policy-support needs to implement area-based conservation targets, that, according to participants, the project should be addressing.
5. **First Global Symposium on Sustainable Water and Energy Solutions.** Short info on event: The main objective of this global symposium was to enhance capacities of relevant stakeholders including governmental institutions to effectively manage the water-energy nexus and interlinkages with other SDGs covering the social, economic and environmental dimensions of sustainable development. The event provided a global platform for all stakeholders to disseminate knowledge, exchange experiences and showcase best practices on integrated approaches that support sustainable water and energy solutions. The symposium was organized by UN-DESA and ITAIPU in Brazil on 13-15 June, 2022. Goals/important outputs: WAT Group participated in the special event "Global crop mapping" providing a presentation on yield and production gap in agroecological zoning based on ongoing collaboration between IIASA and FAO.
6. **FAO Science and Innovation Forum 2022.** Short info on event: This event was organized by FAO on 17-21 October 2022 with the focus on highlighting the centrality of science, technology, and innovation for agrifood systems transformation. Goals/important outputs: WAT Group participated in the special event "Global crop mapping" providing a presentation on yield and production gap in agroecological zoning based on ongoing collaboration between IIASA and FAO.
7. **All-IUFRO Conference: Forests in a Volatile World – Global Collaboration to Sustain Forests and Their Societal Benefits**, Vienna, Austria, 21-23 September 2022**:** https://www.iufro.org/events/all-iufro-conference-2022/#c34368
   International Conference with broad participation of global Forest Research Organizations on behalf of invitation by leading structures and regional representatives of the International Union of Forest Research Organizations (IUFRO). Several AFE staff members participated and gave lectures. Florian Kraxner has been invited to provide a keynote on "Our Future Forests - Global Challenges and Local Opportunities".

The All-IUFRO event provided the opportunity to meet with members of IUFRO Directors Board and the IUFRO President and have discussions with national representatives on a planned Special IUFRO Conference to be jointly organized with IIASA on the forest under war in Ukraine.

8. **ARC Conference 2022 - Water-Food-Energy Nexus in (Terrestrial) Ecosystems,** Seoul, Republic of Korea, 3-4 November 2022: www.asiaresilience.org
   The ARC Conference was held for the fourth time following 2018, 2019, and 2020.The Asia Resilience Center (ARC) is a scientific opinion board with a bottom-up approach to long-term sustainable social-ecological systems in Asia. Beyond Asia, the ARC serves as a bridge between resilience research institutes from a national scale to an international scale. The center is a joint initiative among the OJeong Eco-Resilience Institute at Korea University (KU-OJERI), the Institute of Urban Environment at the Chinese Academy of Sciences, the Education University of Hong Kong, the National University of Ireland, the University of East Anglia, and the University of Newcastle.
   Florian Kraxner serves on the Scientific Advisory Board of the ARC and has been invited to provide a keynote on "The Challenge of Afforestation - Emphasis on the Northern Hemisphere and Mid-Latitude Region".
   The event provided the opportunity to hold meetings with South Korean leaders of ongoing IIASA/-AFE collaboration with Korea University, ARC, UNOSD-Ojeri, MLRN on joint research in the Mid-Latitude Region.
9. **Forum on Ukraine Forest Science and Education: Needs and Priorities for Collaboration**, IIASA, Laxenburg, Austria, 21-22 November 2023: https://iiasa.ac.at/events/nov-2023/forum-on-ukraine-forest-science-and-education-needs-and-priorities-for
   This round table forum, jointly hosted by the International Institute for Applied Systems Analysis (IIASA), the International Union of Forest Research Organizations (IUFRO), and the National University of Life and Environmental Sciences of Ukraine (NUBiP) with support from the Austrian Federal Ministry for Agriculture, Forestry, Regions, and Water Management (BML), will bring together global experts to explore pathways toward catalyzing coordinated and impactful international action to address Ukrainian forest research and education needs and priorities.
   The Ukrainian forestry and forest sector is suffering unprecedent challenges – not only due to the ongoing war and resulting research capacity drain, contamination, and devastation - but also due to factors like climate change, forest health dynamics, wildfires, and a decrease in productivity.
   This two-day forum, coordinated and hosted by AFE / Florian Kraxner aimed to convene the scientific expertise necessary to catalyze coordinated and impactful international action addressing forest research needs and priorities of Ukraine.
10. **The 20th Brazilian Remote Sensing Symposium**, Florianopolis, Brazil, 2-5 April 2022:, https://2023.sbsr.com.br/en/
    The 20th Brazilian Remote Sensing Symposium aimed at bringing together the technical-scientific and business communities, and end-users in general, from Remote Sensing, Geoinformatics and applications areas, to present papers and discuss about their research, technological development, teaching and science policy being carried out in Brazil and abroad for the past two years. AFE FLAM Team Leader Andrey Krasovskiy has been invited to provide a keynote address on "'Latest Advances in Remote Sensing-Based Environmental Dynamic Models".
    The event provided the opportunity of having discussions with the conference host and scientific board and plan further steps of applying IIASA's wildfire and disturbance model FLAM to Latin America/the tropical Amazon Basin.
11. **International Symposium on the 50th Anniversary of national reforestation in the Republic of Korea,** Seoul, Republic of Korea, 13-15 September 2023: https://eng-nifos.forest.go.kr/kfsweb/kfs/subIdx/Index.do?mn=UEFR
    2023 marked the 50th anniversary of the inception of the Republic of Korea's national reforestation effort. The event has been planned to prepare a 100-year forestry vision that links the past 50 years and the future 50 years to help the Republic of Korea prosper through forests.

This 100-year forestry vision has been planned to go beyond simply establishing and managing forests, but as a start of a future where humanity and forests can sustainably coexist. The symposium was held to foster greater exchanges of experiences and to maximize the economic, environmental and social benefits of forests through the 100-year forestry vision as well as to ensure the happiness of the Korean people and those of the world. Florian Kraxner has been invited to provide a keynote address on "High-Tech meets Tradition to Mitigate Climate Change - New Tools and Technologies in Forest Management". Further to scientific exchange, the event has been used as a platform to hold meetings with Korean leaders of ongoing and planned collaborations with AFE, to represent IIASA/AFE at the International Reforestation Symposium and wrt. Korean NMO; to represent IBFRA; to participate in the development of an implementing plan for the 100-year forest vision in the Republic of Korea with special emphasis on forest ICT, climate change, forest fires, and carbon neutrality.

## Lectures

12. **5th Conference of Nordic Society OIKOS 2022 -June 2022**, Aarhus, Denmark. Gergana Daskalova gave a plenary keynote talk on '' Expected and surprising drivers of biodiversity in a changing world'' (>200 participants). This keynote talk put Dr Daskalova on the international stage of young leading ecologists, and helped her promoting her research on land abandonment and its ecological implications.
13. **Biodiversa+ Science-Policy Forum** and Kick-off meeting of the successful projects of the Biodiversa+ call on ''Supporting the protection of biodiversity and ecosystems across land and sea'' Prague April 2023. Piero Visconti gave a key-note at the kick-off meeting of the project, on the policy relevance of these projects for evidence-based support to achieving the EU Biodiversity Strategy and the Kunming-Montreal Global Biodiversity Framework. Martin Jung gave a keynote presentation presenting the NaturaConnect project (>100 people), mostly project leads from Biodiversa+ funded projects and Horizon 2020 projects on ecology and conservation. The meeting's aim was to allow all projects leads to make contact and create a network of project performing research on area-based conservation and species-action plans. The NaturaConnect project made connection with several relevant projects which have resulted in knowledge exchange afterwards.
14. **Global Perspectives on Women in Science: Challenges, Opportunities and Realities**, Amanda Palazzo spoke on this event organized by the five embassies and the Austrian Academy of Sciences in 2023. The first panel discussed the realities faced by women working in STEM careers, including the links between gender and career advancement, the impacts of unconscious bias, and how more women in science equals greater scientific advancement for humanity. The second panel explored how governments, organizations, and academic institutions are supporting women in scientific careers and how these efforts are helping to propel women toward greater professional and scientific achievement.
15. **25th International River Symposium.** Short info on event: The International River Symposium is a unique global congress for those in the water sector, managed by the International River Foundation, which works in partnerships around the world to facilitate the sustainable management of the world's rivers. The 25th International River Symposium was organized in Vienna, 27-30 November 2022. Goals/important outputs: WAT Group Leader provided a keynote presentation at the session "Water security Diagnostics – Informing Policy and Investments" about the water security assessment methodology that was developed by the WAT team.
16. **75th anniversary event "Austria and the World Bank Group: Greening the Cooperation".** Short info on event: This event was organized by the World Bank in Vienna on June 19, 2023 on the occasion of the 75th anniversary of Austria joining the World Bank. Goals/important outputs: WAT Group Leader provided a keynote presentation at the session "Climate Change Resilience in the Danube Region, Cities, and the Western Balkans" about the water security assessment in the Danube region that was conducted by the WAT team.

17. **Regional Policy Dialogue on Disaster Risk Management** "Towards a Climate-Resilient and Sustainable Blue Economy". Short info on event: This virtual event was organized by Inter-American Development Bank on February 23-24, 2023. Goals/important outputs: In this section, IDB representatives and international experts involved in IDB-related projects outlined technical approaches and models that may be effective in implementing climate resilient and sustainable blue economy public policies in the region. WAT Group Leader provided a presentation on the DYNAMMICS model and its application to Barbados for the design of disaster risk reduction measures.
18. **Biogeographical seminar series of EU Member States** The BEC group has been invited to attend each of the 4 in-person meetings held by the European Commission from September 2023 to June 2024 to align member states in their interpretation and implementation of the EU Birds and Habitats Directives, and in ratcheting up efforts towards achievement of the EU Biodiversity Strategy targets. The focus of these meetings has been particularly on achievement of the 3 targets related to protected areas establishment, and the NaturaConnect project has been invited (among very few) to present their work, seen as very relevant evidence-base to support countries strategies towards achieving protected area targets. More info on one of the seminars here. 50-100 people at each meeting. The meetings served to refine NaturaConnect's methods and scenario assumptions, to align closely with each countries ambitions and knowledge needs, e.g. with regards to achievement of strict protection targets effectively and efficiently. It also created several opportunities for further bilateral engagement, e.g. with the representatives of Italy.
19. **IIASA-OeAW "Systems Analysis for Reducing Footprints and Enhancing Resilience" Conference**. Short info on event: This event was organized jointly by IIASA and OeAW in Vienna on November 16-17, 2022 to celebrate IIASA 50th Anniversary. Goals/important outputs: IBF and WAT group members organized the Session "Sustainable Management of Water-Energy-Food-Land-Ecosystem Nexus", involving several external experts (from the World Bank, OECD, IFPRI, etc.) working on nexus issues.
20. **Refreshing H2O policy: An EU socio-economic workshop**. The workshop provided a space for policy makers, practitioners and environmental socio-economists to get together and identify the disruptive breakthroughs in social and economic thinking required to support European Blue policy transition in facing present and future challenges, including climate change. It took place in Rotterdam from January 30th to February 1st, 2023. Goals/important outputs: WAT Group members co-organized and participated in the workshop. The results of this workshop provide an insight on the state of the art of social and economic thinking, methods and tools to support blue policy in Europe and beyond. Lively discussions among participants identified opportunities and challenges for mainstreaming their use in water and marine decision making, strengthening European blue policy in the face of the challenges ahead of us.
21. **RENEXPO INTERHYDRO.** Short info on event: The Renexpo Interhydro is regarded as the European industry meeting place for hydropower. It acts as a hub between Eastern and Western Europe. This is where the experts meet and offers a necessary European platform for future-oriented products, projects and services of the clean energy source and creates a unique space for practice-oriented exchange and successful networking. Goals/important outputs: WAT Group members provided a presentation on the work done in the WaterstressAT project on water resources modeling in Austria.
22. **European Geosciences Union (EGU) annual meeting (2021, 2022, 2023, 2024).** The EGU aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of Earth, planetary and space science research. BNR members participate regularly in the EGU annual meeting, by presenting work and organizing sessions.
23. **Forestry and Agriculture Greenhouse Gas Modeling Forum 2024**, conference organized by US EPA at NC State University, Raleigh. The Forum provides an important and unique venue for bringing together agriculture and forestry modelers from U.S. and Canadian government agencies,

universities, and research institutions to share ideas and foster collaboration. Nicklas Forsell gave a keynote on the "Role of AFOLU in meeting Decarbonization Goals" and Niklas Hinkel presented work on US biofuel assessment using GLOBIOM "Understanding uncertainty in market-mediated responses to US oilseed biodiesel demand"

24. **Workshop on Biofuel Greenhouse Gas Modeling organized by US EPA**, 28th February 2022. Stefan Frank presented the GLOBIOM model and its application for ILUC assessments in session 5 "Overview of Modeling Frameworks of Crop-Based Biofuels"
25. **Different EU climate policy stakeholder workshops with EU member state representatives,** organized by the EC to support the development of European climate policies, e.g., the EU's Climate Target Plan 2040 and the EU Reference scenario. IBF participates as member of the Reference Scenario Expert Group and presented the methodology to calculate LULUCF emission pathways and mitigation potentials.
26. IBF participated in **bilateral meetings with Energy Community States** (Ukraine, Moldova, Georgia, Noth-Macedonia, Albania, Kosovo, Bosnia-Herzegovina, Montenegro, Serbia) which have been organized by the EC (DG ENER) to discuss the extension of the modelling suite to Energy Community countries.
27. **Sustainability Research & Innovation Congress 2023**, Panama City, Panama, 25-29 June 2023: www.belmontforum.org; https://sricongress.org/
    A Congress on transdisciplinary sustainability research organized by project funder Belmont Forum and simultaneously used as a venue for a consortium meeting of the 'SAM project' – AFE's sustainable agriculture modeling project. Christian Folberth represented the Austrian partner team at the congress within two sessions organized by the SAM consortium. Christian – in his role of the Austrian SAM representative and a co-organizer of the Congress - provided two lectures: (1) Get the Grade (SAM Edition)! A Board Game for Sustainable Agriculture; (2) Co-evaluating and -designing a Sustainable Agriculture Matrix for Austria in an international context. Furthermore, the event has been used to synthesize Congress outcomes and plan for potential follow-up activities.
28. **European Geosciences Union General Assembly 2021 - Modeling agricultural systems under global change**, Göttingen, Germany (online event): https://egu21.eu
    An event attended by a wide range of IIASA colleagues where Christian Folbert co-convened the virtual scientific session BG3.21 'Modeling agricultural systems under global change' together with Christoph Müller and Sara Minoli from PIK (Germany). This allowed for exchanging on most recent developments within the international agricultural modelling community and foster IIASA's visibility within the community. Furthermore, Christian Folberth co-authored three presentations within this and other sessions.

## Courses

29. **GLOBIOM/GAMS course.** June 27 – July 1, 2022. Hybrid. 19 participants
30. **Bridging the gap between fire ecology and fire behaviour**:– 2022 FireLinks Summer school in Barcelona, Spain, 13-16 June 2022: https://firelinks.eu/event/bridging-the-gap-between-fire-ecology-and-fire-behaviour-2022-summer-school-in-barcelona/
    The event has been organized to bring together fire ecologists and experts in fire behaviour, to cover the basics and to put a platform together where discussion and understanding integrated. The Summer School has been designed for early career researchers in the field of wildfire research with interest in the present and future of the relation between fire ecology and fire behaviour fields, motivation to deepen on both, meeting other students and experts working on the same problem.
    IIASA FLAM Team leader Andrey Krasovskiy has been invited to provide a talk and give fire modeling lectures global forest fires hotspots.