Research Plan
2021–2024

HIGHLIGHTS

International Institute for
Applied Systems Analysis

IIASA   www.iiasa.ac.at

About the Research Plan 2021-2024

The research plan operationalizes the IIASA Strategy 2021-2030 by presenting the new IIASA research structure along with the research foci of the research programs and groups over the next four years. It is strictly aimed at an internal IIASA audience including Council, the Science Advisory Committee, National Member Organizations, IIASA management, and researchers. The plan outlines the objectives, approach, and expected impact of each research program and group. It is developed to facilitate groups and programs in aligning their research agendas and objectives as well as to enhance cross-IIASA collaboration. The plan also provides Council and IIASA management with the means to oversee the next four years of research at IIASA, a plan against which progress can be assessed in the coming years, and the research areas that future IIASA research projects must be aligned with—although the detailed research projects and resource allocations that are greatly determined by external fundraising success are beyond the scope of this plan.

info@iiasa.ac.at

Research Plan 2021-2024

Highlights

Climate change, habitat loss, pollution, disease, and deprivation form a dense thicket of challenges whose roots are tangled in interconnected systems: a changing climate, the eco-web of plants and animals, a rapidly changing global economy, and increasingly unequal human societies.

With its core strengths in interdisciplinary applied systems analysis targeted at informing policy, IIASA has moved to address this complexity, helping nations to balance the often competing goals of environment, economy, and wellbeing—how to cut pollution but not growth; protect forests while providing enough food; ensure water security without depriving ecosystems; and achieve a sustainable future for all (Agenda 2030) that also limits human-induced climate change in accordance with the Paris Agreement.

As the impact of humanity grows, global challenges become more acute, interconnected, and urgent; IIASA must itself evolve to keep up with this changing landscape. With its new ten-year strategy "Reducing Footprints, Enhancing Resilience", IIASA aims to become the primary destination for integrated systems solutions and policy insights into the emergent challenges and threats to global sustainability and also to the opportunities that they can uncover. To put that strategy into action IIASA has developed a new Research Plan for 2021–2024.
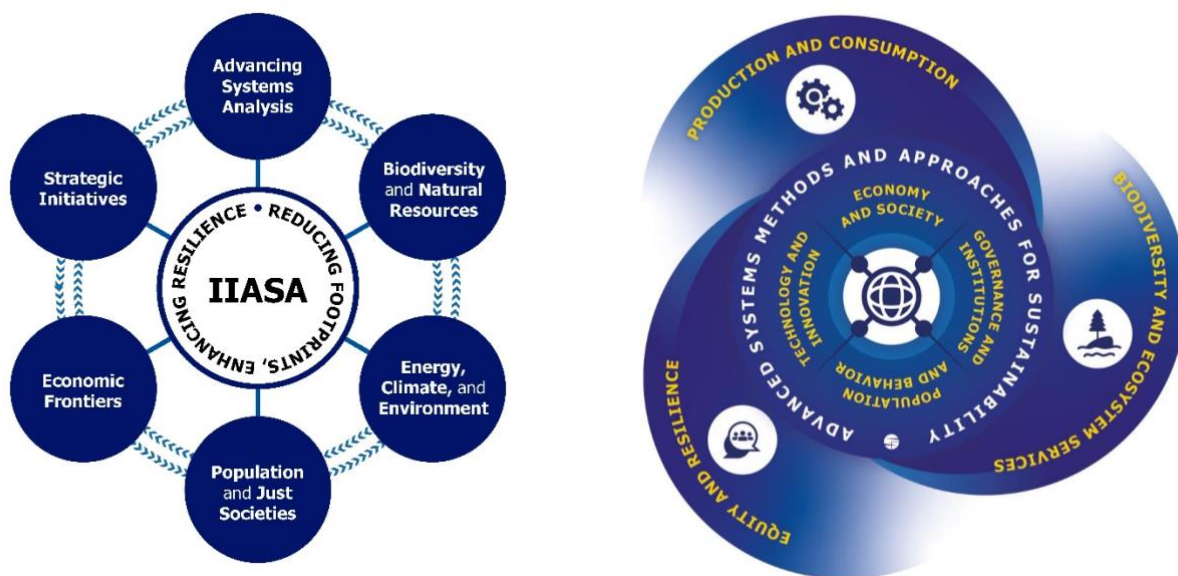

Figure 1: The six new research programs (left) will address the seven research themes (right) of the IIASA strategy 2021-2030 "Reducing Footprints, Enhancing Resilience".

Integrated, innovative, collaborative, agile

The institute's re-engineered research structure has two tiers: six research programs (below) are split into research groups, with the option to activate or deactivate groups as priorities change. These programs will

- Apply novel methods, approaches, and technologies;
- Plug gaps in existing IIASA research, placing more emphasis on just societies, resilience, biodiversity, and how human behavior drives production and consumption;
- Integrate research across IIASA, for example, by combining models to link human society with the biosphere and atmosphere, and by realistically representing the global system of systems;
- Partner with research collaborators in member countries and elsewhere in areas of common research interest to jointly deliver both policy insights and new research frontiers; and
- Become more agile, with horizon-scanning to identify urgent new challenges and tackle them with cross-cutting research initiatives.

1. The **Biodiversity and Natural Resources (BNR)** Program addresses the nexus of food production, biodiversity conservation, water, climate, and ecosystem health. It will provide integrated tools to analyze the biosphere's behavior in the face of climate change, deforestation, and pollution; and it will assess policies to provide food security and protect and restore ecosystems. BNR will:

- Develop a new Biosphere Model, iBIOM, an integrated global framework encompassing farmland and forest, as well as freshwater and coastal waters, that will analyze how species and ecosystems will respond to changes in climate, land and water use, and vice versa;
- Use iBIOM to identify practical solutions, such as how to design sustainable transformations in land, water, and ecosystems management that simultaneously satisfy human needs while ensuring sustainable use of natural resources;
- Exploit advances in Earth observation, big data, and AI to assess sources of water and the demand for it on fine scales and to discover how to improve water quality and resilience, for example, through smart irrigation and demand management;
- Promote IIASA-wide collaborations on key cross-cutting themes, including climate change, adaptation and mitigation, the green economy, resilient food systems, transboundary governance, resource depletion and migration, and digital transformation; and
- Build an international community to jointly develop sustainable biosphere solutions, involving regular dialogue with partners in IIASA National Member Organization (NMO) countries, through a new foresight product, the Global Biosphere Outlook.

2. The **Energy, Climate, and Environment (ECE)** Program aims to find feasible systems transformations to address challenges at the intersection of energy, environment, and climate change that will put the world on track to meeting the goals of the Paris Agreement and the United Nations 2030 Agenda for Sustainable Development. ECE will:

- Foster integration of research across ECE (and IIASA) to allow a comprehensive representation of the entire socioeconomic and environmental system, as well as identify local, short-term policies that will position the world to successfully achieve long-term targets;

- Extend the scope of pollution analysis by developing multi-sectoral policy interventions to manage pollution across different media at various scales;
- Place a new emphasis on the social dimensions of the required changes to achieve a greenhouse gas neutral and resilient society. These include: demand-side systems that can decouple consumption from economic development; behavioral changes and governance; and equity and poverty;
- Use these new methods and perspectives to widen the range of policy options and to identify novel solutions that can be used simultaneously to achieve multiple Sustainable Development Goals including ambitious climate targets; and
- Open up access to the new framework, by establishing a community of users in NMO countries and elsewhere that can co-design research with IIASA and form international partnerships, not only with the wider social and political science community, but also with key policy and decision-making groups, thereby helping to ensure that research plugs into policy.

3. The **Population and Just Societies (POPJUS)** Program connects applied systems analysis to equity and justice dimensions. The program builds on IIASA expertise in population and human capital modeling, empirical social sciences, quantitative economics, social organization, and governance. It will focus on heterogeneity in the modeling of changing populations, devise more inclusive measures of human wellbeing, and provide insights into differing values and behavior through participatory research, all with a view to supporting transformative governance and informing evidence-based policy options for more just and equitable societies. POPJUS will:

- Update demographic models with new approaches, including Bayesian methods, machine learning, and micro simulation, to capture the heterogeneity of the real world. The resulting predictions of population sizes, structures, and distributions will be an essential element of future policy decisions;
- Explore how to better measure wellbeing. Comprehensive indicators, with a focus on health and social cohesion, can contribute to a more broadly shared vision of sustainable development;
- Understand socioeconomic inequalities and heterogeneity in values and norms around the world using stakeholder-driven participatory approaches, and thereby inform ethical questions and explore policy options for more just societies;
- Expand today's sparse data on, and estimates of, human migration, for example, by enlisting non-traditional data sources such as social media and by applying novel methods;
- Enable other IIASA programs to address equity and justice concerns in their research on major challenges such as climate change and biodiversity loss; and
- Reach out to policymakers and civil society with open-access data and user-friendly web-based interactive tools.

4. The **Economic Frontiers (EF)** Program is a brand-new program that studies how to shift production and consumption to patterns that are sustainable, resilient, and fair. It will:

- Examine the impact on economies of disruptive shocks, including environmental tipping points, pandemics, and political upheaval, as well as of long-term change, such as climate change and digitalization;
- Explore how opportunities and incentives for investments in health and education as sources of sustained wellbeing and resilience can be provided and maintained in an equitable way for all; and

- Design policy to guide economic behavior toward sustained human wellbeing and advise the policies of global institutions and individual countries, especially IIASA NMO countries, with respect to those insights.

While collaborations across research programs are strongly encouraged, the following two programs are specifically designed to be cross-cutting and have been established to accomplish systematic integration across IIASA programs:

5. The **Strategic Initiatives (SI)** Program will scan for new challenges that demand major IIASA research efforts. This will bring exceptional focus and agility to the institute's entire research platform. This program will:

- Undertake active horizon scanning, engaging with IIASA NMOs through yearly workshops, to identify urgent challenges where a new cutting-edge research initiative can have a high impact for policy and society;
- Respond to the collective challenges faced by NMO countries, to bring the most pressing regional and global research interests of IIASA and its NMOs into greater alignment; and
- Launch major innovative IIASA strategic initiatives that aim to break new ground and be cross-cutting in terms of involving several different disciplines and research programs.

6. Advancing Systems Analysis (ASA) is the institute's laboratory for innovative systems analysis. This explicitly cross-cutting program will produce new data, develop innovative methods, and create new insights for use in other programs and the broader research community, while acting as a hub to promote transdisciplinary research. It will bring together method-oriented and application-oriented researchers to match IIASA analytical tools to the realities of decision making in society. The program will:

- Improve the realism of socioeconomic–environmental modeling, for example, by following the behavior and interaction of individual agents;
- Develop new mathematical tools in optimization, complexity science, dynamical systems, game theory, advanced statistical modeling, and multi-criteria analysis;
- Explore new data sources and approaches to create data, such as machine learning, Citizen Science, and improved Earth observation technologies;
- Advance understanding of systemic, existential, and compound risks, and develop feasible policy options to help deal with them and improve resilience; and
- Demonstrate these novel approaches with proof-of-concept projects.

Complementing the work of the research programs, the **Capacity Development and Academic Training Unit (CDAT)** will educate young and experienced researchers, both within and outside IIASA, to develop capacity in systems analysis and to sensitize current and future decision makers to systems thinking. Building on almost fifty years' experience in developing methods in systems analysis and applying them to global and regional challenges, IIASA through CDAT will:

- Strengthen and expand the development opportunities in systems analysis for early career researchers at IIASA;

- Develop and roll out an innovative and modular teaching platform on systems analysis and science-to-policy; and
- Foster an internal community of researchers to become some of the best and most effective teachers of systems analysis in the world.

For the Earth and for its people

At the forefront of this research plan lies the IIASA vision of a sustainable and equitable future—one that strikes a balance between human needs and the health of ecosystems, and between the drive for efficiency and the requirement to build resilience.

Although IIASA cannot resolve all the world's problems, it can help to inform many of them. As a result of the new Research Plan 2021–2024, the institute's experience in systems thinking and in developing science for policy needs will be scaled up to a broad range of sustainability challenges at different scales, providing evidence-based policy options to governments, international organizations, and other stakeholders, including society in general.

The independence and commitment of IIASA to open science, through the support of its NMO countries, can help to build trust and shared understanding around the world that are essential to the deep transformations needed for the wellbeing of societies and for the future of the Earth.

IIASA Research Plan
2021-2024

National Member Organizations (*01 June 2021***)**

AUSTRIA The Austrian Academy of Sciences

BRAZIL The Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES)

CHINA The National Natural Science Foundation of China (NSFC)

EGYPT Academy of Scientific Research and Technology (ASRT)

FINLAND The Finnish Committee for IIASA

GERMANY Association for the Advancement of IIASA

INDIA The Technology Information, Forecasting and Assessment Council (TIFAC)

INDONESIA Indonesian National Committee for IIASA

IRAN Iran National Science Foundation (INSF)

ISRAEL The Israel Committee for IIASA

JAPAN The Japan Committee for IIASA

JORDAN *(Prospective Member)* **The Royal Scientific Society (RSS) of Jordan**

KOREA, REPUBLIC OF National Research Foundation of Korea (NRF)

MALAYSIA *(Observer)* **Academy of Sciences Malaysia (ASM)**

MEXICO *(Observer)* **Mexican National Committee for IIASA**

NORWAY The Research Council of Norway (RCN)

RUSSIA The Russian Academy of Sciences (RAS)

SLOVAKIA Ministry of Education, Science, Research and Sport

SOUTH AFRICA The National Research Foundation (NRF)

SWEDEN The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS)

UKRAINE The National Academy of Sciences of Ukraine (NASU)

UNITED KINGDOM United Kingdom Research and Innovation (UKRI)

USA The National Academy of Sciences (NAS)

VIETNAM Vietnam Academy of Science and Technology (VAST)

International Institute for
Applied Systems Analysis
I I A S A www.iiasa.ac.at

twitter.com/**iiasavienna**

facebook.com/**iiasa**

blog.iiasa.ac.at

linkedin.com/company/**iiasa-vienna**

youtube.com/**iiasalive**

flickr.com/**iiasa**