

Population and Just Societies Program

Self-Assessment Report 2021-2024

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

The Population and Just Societies (POPJUS) Program was established to bridge applied systems analysis with equity and justice considerations, while also leveraging IIASA's expertise in population and human capital modeling, measuring human wellbeing, and understanding diverse values and behaviors through participatory research. The research in the POPJUS program is people-centered with the goal to support transformative governance and inform evidence-based policy options for creating more just and equitable societies. The program underwent several leadership changes during this period, with Raya Muttarak serving as Program Director in 2020-2021, followed by Samir KC as interim director in 2021-2022, before Anne Goujon took on the leadership in 2022. Similarly, at the research group levels, except for the EQU research group, most groups experienced multiple changes in leadership through the 2021-2024 period. Nevertheless, POPJUS has thrived during this time, accomplishing most of the set goals and developing a solid foundation for relevant future research to foster sustainable societies.

The program has been particularly successful at integrating and cross-fertilizing among the different research groups. Additionally, it has excelled in collaborating with other researchers within the institute, for instance within Strategic Initiatives or institute-wide workshops, facilitating a profitable exchange that serves the purpose of systems analysis. This collaborative environment not only enhances the quality and scope of research but also promotes innovative solutions to complex problems by leveraging diverse expertise and perspectives.

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

- 1. *Advance the empirical inclusion of population, socioeconomic, and spatial heterogeneity in analyses and modeling, as to enable better integration of the social dimension in systems analysis models.***

Understanding heterogeneity is crucial for formulating effective policies and interventions. By examining the multiple layers of heterogeneity, we can gain a comprehensive understanding of the complex interplay between different factors and their cumulative impact on individuals and communities. Heterogeneity in people's behavior, encompasses not only demographic aspects such as fertility, mortality, and migration but also extends beyond demographics to include factors like voting behavior, exposure to and vulnerability from climate change, and conversely, the impact of people on the climate. There are many layers of heterogeneity to be explored across various dimensions, including country, age, sex, education, place of residence (urban/rural), geographical location, income, labor force participation, health status, and more.

The original idea was to include the place of residence in a new round of the Wittgenstein Centre¹ global population projections, following the Shared Socioeconomic Pathways (SSPs), together with the other variables such as age, sex, and education. However, in 2021, the SSP community required an update, whose timeline did not allow for the inclusion of the urban/rural dimension in the projections. However, the [2023 update of the projections](#) (published in 2024) includes the dimension of education

¹ The Wittgenstein Centre for demography and global human capital is a collaboration among the Austrian Academy of Sciences (OeAW), the International Institute for Applied Systems Analysis (IIASA) and the University of Vienna.

which has been shown to correlate with many outcomes. As an example, during the 2021-2024 period, several papers have shown the variability of human-capital mobility by education? at regional level in the context of the economic crisis ([Gonzalez-Leonardo 2023](#)), the importance of maternal education for child survival and the differences existing by place of residence ([Moradhvaj and KC 2023](#)). This is important because education is spatially distributed as shown in the example of China ([Wu and KC 2022](#)). Education was also studied in the context of how it translates into skills and productivity ([Lutz et al. 2021](#); [Marois et al. 2022](#)). Our findings suggest on the one hand that education will be key in reducing the impact of ageing by increasing the productivity of the labor force. On the other hand, we also show that if we adjust education with the skills acquired, we noticed a widening global skill gap between low – and high performing countries.

Spatial heterogeneity, also extending beyond the traditional urban and rural dichotomy, has been a focal point within the program across all research groups, emphasizing the importance of addressing challenges at the local level. This comprehensive approach recognizes the unique characteristics and needs of different localities, ensuring that solutions are tailored to specific contexts. The program's efforts to reinforce spatial heterogeneity involve examining various factors such as geographical (e.g., in the case of [migration](#)), socio-economic conditions and vulnerabilities (e.g., WP3 in the [SPARCCE](#) project in collaboration with the ECE Program, or the [LivWell](#) and [DISCC-AT](#) projects), interaction between natural resources use and human populations (e.g., the [BALANCE](#) project), political (e.g., the [Climate Modernity](#) project) and environmental impacts on populations (e.g., [Li et al. 2022](#) or [Yokomatsu et al. 2024](#)). By doing so, it provides a nuanced understanding of how these elements interact and influence outcomes at the local level. This approach not only enhances the relevance and effectiveness of research findings but also supports the development of more targeted and sustainable interventions.

2. *Strengthen research capacity to apply innovative methods and new data sources to identify sustainable development challenges and explore people-centric systems solutions for sustainable, resilient, equitable, and just societies through empirical and scenario-based analyses.*

The program has embraced cutting-edge methodologies to address sustainable development challenges. This includes the use of advanced statistical techniques such as:

- o Bayesian modeling for estimating [fertility by age and education](#), for understanding [displacement](#) or [environmental concerns](#);
- o Machine learning applied to understand [climate migration](#), [monitor and project hunger](#), or predict the [health status](#) of populations;
- o Microsimulations to project future populations according to several scenarios to assess [labor force participation](#) – in particular depending on different assumptions for migration – and its [productivity](#), [health](#) and [ageing](#) of various populations;
- o Multidimensional population projections including education as a projection parameter (e.g., [global updates of the SSPs](#)).
- o Dynamic macroeconomic modeling of climate-related disaster impacts, considering multidimensional household heterogeneity, for [analyzing changes in growth and inequality in low-income countries](#).

POPJUS also utilizes games and policy simulation scenarios to tackle complex socio-environmental challenges and develop effective strategies. For instance, we explored collaborative governance models to enhance ecosystem resilience and community engagement in the context of the implementation of Nature-based Solutions (NbS) for river basin management ([PHUSICOS](#)). In another project ([ABM2POLICY](#)) in collaboration with the ASA program, a gamified ABM-based policy simulation was developed to understand the multi-party policy process in the context of the arrival of a large

wave of migrants to Austria due to climate extremes in the Middle East and North African region. The [RESPECT](#) role-play simulation aims at closing prevailing science–policy–implementation gaps in Climate Risk Management, which are often a result from insufficiently clear roles and responsibilities, diverging stakeholder interests, priorities and risk perceptions, and inexistent or incipient cooperation mechanisms. Additionally, in the [RECREATE](#) project, policy exercises and elicited shared stakeholder values were used to provide bounds of acceptability of innovative urban mobility solutions to meet ambitious climate targets, in the case of Vienna and Shanghai. These simulations provide valuable insights by integrating diverse stakeholder perspectives, ultimately guiding policymakers toward sustainable and equitable solutions. By leveraging these innovative methods, researchers can uncover patterns and trends that traditional approaches might miss, leading to more accurate and insightful analyses.

One main innovative methodological contribution of POPJUS has been in estimating and projecting migration ([QuantMig](#), [FUME](#), [Global migration flows](#)), involving sophisticated methodologies that integrate both qualitative (Delphi surveys among policymakers and expert surveys) and quantitative analyses.

The program has expanded its research toolkit by incorporating new and diverse data sources. These include non-traditional datasets that provide real-time and granular insights into population dynamics and social behaviors, for instance by exploring [Reddit](#) as a useful data source to analyze public discourse on climate change. Scenario-based analyses allow the program to explore various future possibilities and their implications. Combined high-resolution climatological data with regionally aggregated, harmonized Eurobarometer data and European Parliamentary electoral data allowed us to show a [significant effect of climate change experiences on environmental concern](#) and voting for Green parties.

3. *Engage in applications of methodological tools and concepts in the social sciences using evidence from micro and macro data and scenario-based approaches to inform policy options.*

POPJUS has strived to develop new tools and concepts and this in three main directions:

- o New indicators of well-being to support policymakers and researchers in identifying key areas for improvement and crafting targeted interventions, evaluating progress towards equitable and sustainable societies: The [Empowered Life Years](#) project exemplifies the creation of new well-being indicators. This project developed the "Years of Good Life" (YoGL) indicator, a comprehensive measure that can be applied across various societies, providing the foundation for evaluating transformative policies and progress across countries. The YoGL indicator combines universal components of well-being, including health, literacy, happiness and being out of poverty. To ensure its relevance and applicability, the indicator was tested through focus groups in diverse contexts such as Nepal, South Africa, and Costa Rica, providing valuable insights into its versatility and robustness.
- o Well-being and Loss and Damage from Climate Change: POPJUS researchers have developed [a human well-being based proposal for assessing risk of loss and damage from climate change](#) and suggested to [put multidimensional inequalities in human wellbeing at the centre of transitions](#).
- o Better measurement of ageing by applying new [‘prospective’ measures of aging](#) away from chronological age, using the Remaining Life Expectancy metric, which is relevant for various fields, including insurance, retirement planning, and public health policy. It can help policymakers make informed decisions about health, financial planning, and resource allocation.

- o [Expert views on future demographic trends and their drivers](#): The field of demography is advancing to a point where the predominant theory, the demographic transition, may not adequately explain evolving trends, especially in the global north where fertility rates are concerned. In seeking answers, POPJUS, in collaboration with the European Commission Joint Research Centre and the United Population Division, has conducted an expert demographic survey whose [results](#) are currently under discussion in various [academic circles](#) and with [policymakers](#). The findings of the survey and ensuing dialogues will be key to inform the next round of global population projections.
 - o Operationalizing path dependency for effective climate adaptation: Adaptation pathway approaches (APAs) have become an increasingly popular means of facilitating local and regional anticipatory planning under the influence of climate change. Many studies in this field of research identify path dependencies as a key barrier to adaptation efforts. However, their respective definitions of path dependency are often vague and impede a comprehensive integration of this concept into APAs. We [propose](#) and [test](#) a conceptual framework for or analyzing path dependency in empirical studies using APAs or in decision making processes for [compound climate risk management](#).
- 4. Assume leadership in establishing a framework that enables IIASA researchers to take into account aspects of equity and justice in their projects focusing on grand societal challenges and consider pluralities and heterogeneities both conceptually and empirically (e.g., population, vulnerability, risk perception, values, and norms).**

POPJUS with the Equity and Justice Research Group has emerged as a pioneering force in shaping a framework that empowers researchers to integrate equity and justice considerations into their projects aimed at addressing grand societal challenges across different governance levels. Through their leadership, the group has facilitated a paradigm shift within IIASA, [encouraging scholars](#) to embrace a holistic approach that acknowledges and respects pluralities and heterogeneities. This framework extends beyond mere [conceptual discourse](#) to practical application, for instance in [disaster risk management](#) and more specifically in the case of [wildfire risk management](#), ensuring that aspects such as population dynamics, vulnerabilities, risk perceptions, values, and norms are comprehensively examined both in theory and in empirical studies. By fostering a culture of inclusivity and mindful inquiry, the Equity and Justice Research Group has not only enriched the quality of research at IIASA but has also contributed significantly to fostering sustainable and equitable solutions to the world's most pressing issues.

- 5. Advance applied research toward transforming social, economic, and governance systems such that they contribute to equitable and sustainable societies.**

POPJUS has contributed toward this goal by developing and implementing interdisciplinary frameworks that prioritize equity and sustainability. By conducting comprehensive studies that integrate demographic analysis with social and economic variables, POPJUS has been able to identify and address systemic inequities. This research encompasses a wide range of factors, including population dynamics (and potential futures), socioeconomic disparities, governance structures, and environmental sustainability. POPJUS's initiatives have led to the formulation of policy recommendations and strategies that promote social justice and sustainability, as exemplified by the policy briefs published between 2021-2024 that look for instance in [tackling governance barriers to nature-based solutions](#) and developing innovative [policy and finance schemes](#) to promote them. Supporting governance transformations as a scientific institution requires close collaboration with stakeholders from all parts of society. In the context of our NbS governance and finance focus, we implemented four international policy-business fora, four webinars attended by hundreds of people and a [Finance Innovation Festival](#) with ~100 experts.

Reaching limits to climate adaptation will also require fundamental changes social, economic and governance systems. Our research has shown that also [Global North countries will be subject to constraints and \(soft\) limits to adaptation](#) with progressing climate change and some population groups will be confronted with livelihood transformations. Increasing climate-related risks will therefore require a transformation of current governance structures towards an [adaptive and integrated climate risk management approach](#) to tackle losses and damages from climate change. Similarly in the study of [international migration](#), the research has shown that there is a need to shift the debate on migration towards the mainstreaming of migration uncertainty in the political and policy discourse, and away from either the “illusion of control” of migration or overreacting to specific events, often fueled by availability of higher-frequency data on some migration processes and not on others.

6. Scale up cross-cutting research activities enabling the empirical integration of demographic and social components in IIASA models, both as drivers of sustainable human wellbeing and as a system affected by changes in natural and economic systems.

POPJUS has effectively scaled up cross-cutting research activities at IIASA by integrating demographic and social components into its comprehensive models, thereby enhancing the empirical analysis of sustainable human wellbeing. This integration is achieved through several concrete initiatives and projects:

- o The [Shared Socioeconomic Pathways](#) (SSPs): POPJUS has contributed to the development and refinement of SSPs, which are integrated scenarios used for instance by the IPCC to model the potential impacts of various socioeconomic pathways on climate change and sustainability. By incorporating detailed demographic data, such as population age and sex structures, education, fertility, mortality and migration patterns, POPJUS has enriched these scenarios to better reflect the interplay between demographic factors and environmental and economic systems.
- o Studying and integrating differential Vulnerability in IIASA’s models: This has increased importantly over the research period, and in several directions, for instance developing resilient climate-related health systems, together with the ASA program within the [REACH project](#); mapping and forecasting the EU population vulnerabilities in the context of the [SPARCCE](#) project together with three other research programs: ECE, BNR, and ASA;
- o POPJUS participates in several Strategic Initiatives to push the boundaries of systemic analyses, and particularly aimed at integrating justice and equity issues in system analysis, such as [fairSTREAM](#), [JustTrans4ALL](#), and [TRUST](#).
- o The program has initiated discussions on several cross-cutting topics in the institute's research agenda, including [Justice](#), migration, and health (forthcoming in 2024), to gain momentum on addressing these challenges.

Through these examples, POPJUS demonstrates a robust commitment to incorporating demographic and social dimensions into IIASA’s modeling efforts, thereby providing a more comprehensive and empirically grounded understanding of the pathways to sustainable human wellbeing.

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

Several initiatives collectively highlight the program's success in enhancing policy impact through participatory processes, interdisciplinary research, and effective stakeholder engagement, contributing to the development of sustainable and evidence-based policies. Here are a few highlights:

POPJUS researchers have identified that **participatory and co-design approaches with policy stakeholders** are key to understand collectively the policy process and empower people. It has been implemented in several settings. For instance, in Styria, one of the 9 Austrian provinces, a transdisciplinary group of researchers, practitioners, and policy- and decision makers engaged in 2022 in a participatory process called "[climate modernity](#)" with the aim to co-create courageous and positive visions for a low-carbon and climate resilient future. Our scientific accompanying study assessing the process's effect on participants' self- and response efficacy regarding possible mitigation measures, shows that [participatory processes could raise trust in the democratic process](#) and in the effectiveness of making a green voting decision. Similarly, in the [RECREATE Policy Simulation project](#), Viennese stakeholders in mobility and transport were involved, using a virtual conference setting, to discuss emissions reduction and public space management. The outcomes, which emphasized the importance of compromise and understanding diverse viewpoints, influenced real policy processes. POPJUS are also influencing policy upstream by contributing to the project [makingAchange](#), in which school and university students in Austria can participate in a peer-to-peer training, gaining technical knowledge and developing methodological skills to become a contact person in daily climate change debates and discussions.

Scenario-making and narratives for projections to inform policy: There is a plethora of research projects in POPJUS that implement projections as a tool to understand the consequences of past, present, and future political decisions. For instance, in the [BALANCE project](#) where POPJUS researchers are developing a strategic tool for decision making in Norway that enables policy makers to evaluate alternative strategies for a circular bioeconomy in terms of the goals of value creation and employment, greenhouse gas emission reduction and resource efficiency. Similarly, the [SSPs](#) that are scenarios used in climate research to project and analyze potential futures based on varying socio-economic developments and their impacts on climate change, are central to understanding how different societal choices and policy directions can influence climate outcomes. They are part of the framework used by the Intergovernmental Panel on Climate Change (IPCC), and therefore very influential.

Conveying migration uncertainty to policy makers: Migration is at the core of policy debates, particularly in the European Union but not only. The [White Paper on Migration Uncertainty](#) that was developed in the framework of the QuantMig project provided insights into enhancing foresight and preparedness in migration policy. Similarly, we provided a Science-Policy Interface in Climate Migration with initiatives such as a [TEDx Talk on climate change and population dynamics](#) and a study on bridging the [science-policy gap in climate migration](#) highlighted the importance of translating scientific research into actionable policy.

The transformative potential of Nature-based Solutions: A series of projects and publications focused on the transformative potential of NbS, addressing [policy barriers](#), and proposing governance innovations across multiple scales. Key outputs included comparative case studies, policy briefs, and

deliverables on opportunities, barriers, and governance innovations for NbS, providing comprehensive guidelines for managing climate risks, reinforcing the importance of NbS in policy-making.

Health, health systems and policy reforms: Health policy reforms are essential for building resilient citizens and equitable, and efficient health systems. This vast policy-relevant research is being tackled in the context of several POPJUS projects such as [CHIAS](#), which is looking at the implications of different policies/initiatives that exist in different EU countries/cities that (directly or indirectly) promote healthy cognitive aging. In the context of climate change, we are also studying ways to support health systems that are faced with environmental stresses such as floods and heat extremes. The [REACH](#) project implemented in Zambia and Brazil is in the process of developing models to support local-level decision making regarding climate adaptation. The research involves iterative and ongoing engagement with policy makers to ensure their views and needs are addressed.

During the 2021-2024, the POPJUS program has entered several large networks that have increased our policy impact.

With the **European Commission Joint Research Centre (JRC)**, which is the research arm of the European Commission, we have been engaged in several projects with high policy relevance:

- o Quantifying the [exposed and vulnerable populations to climate change in Africa](#) based on climate, demographic and socio-economic scenarios and analyses past trends, which contributes to the ongoing integration of EU policies on climate change, adaptation and migration. Within the [SPARCCL](#) project, we are also collaborating with the JRC on assessing the socio-economic vulnerabilities of Europeans to climate change, leading (forthcoming) to a story in the [Atlas of Demography](#) which has been initiated by the European Commission Vice-President for Democracy and Demography.
- o Analyzing the [impact of the Russian invasion on the longer-term future of Ukraine's population size and structure](#), by focusing on varying assumptions on the extent of the displacement triggered by the war, the level of return migration, and possible future migration patterns of temporary, circular and permanent movements. This work contributes to forward-looking policymaking supporting the long-term economic and social recovery of Ukraine by anticipating possible consequences of migratory movements on longer-term population trends in Ukraine.
- o [Thinking about future demographic trends beyond the demographic transition](#) and implications for population policies, also in collaboration with the United Nations Population Division, the leading producer of global population projections.

More recently (in 2024), we entered in a partnership with the **Organization for Security and Cooperation in Europe (OSCE)** in the context of migration and climate change which will lead to the design of policy options with experts, stakeholders to strengthen the resilience of population in South-eastern Europe.

Several POPJUS researchers are members of World Health Organization reference groups on [Global health statistics](#) and on the Metric and Life Course, providing advice on population-health related statistics and indicators of relevance to WHO.

POPJUS is participating in the Austrian Panel on Climate Change (APCC) through various activities. Most recently, POPJUS researchers act as Coordinating Lead Authors and Lead Authors in the ongoing process of writing the 2nd Austrian Assessment Report on Climate Change (the national pendant to the IPCC and its Assessment reports).

POPJUS researchers have also been instrumental in incorporating systems analysis elements on grand global challenges in global institutions' teaching and training courses. For example, we have been

involved in co-designing "Climate Change Economics" and "Macroeconomics of Climate Change" courses for the Joint Vienna Institute (JVI) and the International Monetary Fund (IMF). These courses have become part of the most popular trainings that JVI is offering for public sector officials from countries in Central, Eastern and Southeastern Europe, the Caucasus and Central Asia and EQU researchers are frequently lecturing as part of this courses.

POPJUS is part of the steering board of the INQUIMUS Workshop series, which aims to provide exchange, new inspiration and generative dialogues in the context of comprehensive risk management. The specific role of POPJUS lies in strengthening the human dimension (e.g., focusing on subjective risk tolerance) in a field that is historically strongly dominated by quantitative methods and tools. In this capacity, EQU has hosted the INQUIMUS 2022 conference - Transformational risk management and Loss & Damage: What are suitable approaches for assessing climate-related (residual) risks? at IIASA.

Recently, POPJUS has also been instrumental in initiating a new commission on the “defossilisation and carbon neutrality of the European energy system” at the Austrian Academy of Sciences. EQU researcher Thomas Schinko has been nominated as one of the members of this commission and is leading one of the two working groups, again with the aim of establishing real interdisciplinary connections between engineering, natural and social sciences and the humanities.

1.3. Program budget.

Table 1. Overall POPJUS budget over the years (2021-2024) including external/internal, personnel/non-personnel costs, FTEs, and percentage distribution between income sources.

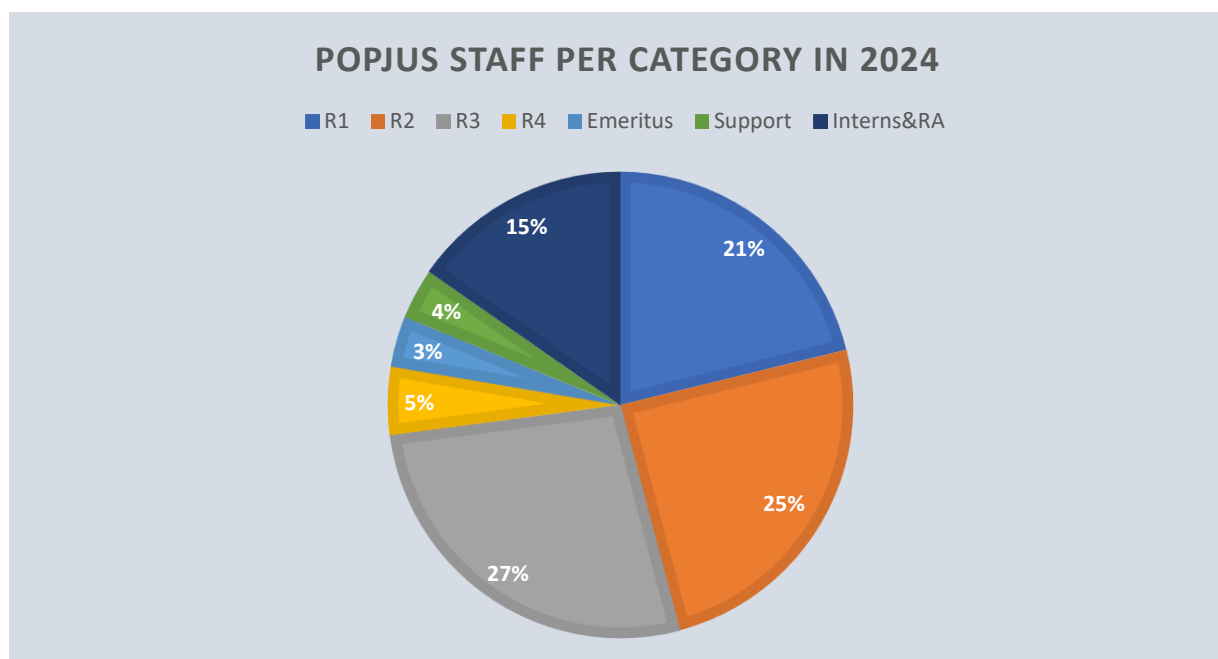
	2021	%	2022	%	2023	%	2024
Total budget	1,508,511		1,859,876		2,075,579		
Income from External Projects	844,885	56	1,064,646	57	1,070,025	52	not available
Income from Internal Projects	30,665	2	93,219	5	141,389	7	not available
Core allocation	632,960	42	702,011	38	864,165	42	875,730
Expenses	1,429,116		1,736,104		1,987,814		not available
Total FTEs	30.29		35.90		41.24		41.48
FTEs scientific	28.48		33.63		38.76		38.88
FTEs non-scientific	1.81		2.26		2.48		2.60

1.4. POPJUS staff.

Table 2. List of staff (per staff category in FTE) working in the research program and RGs over the period 2021-2024.

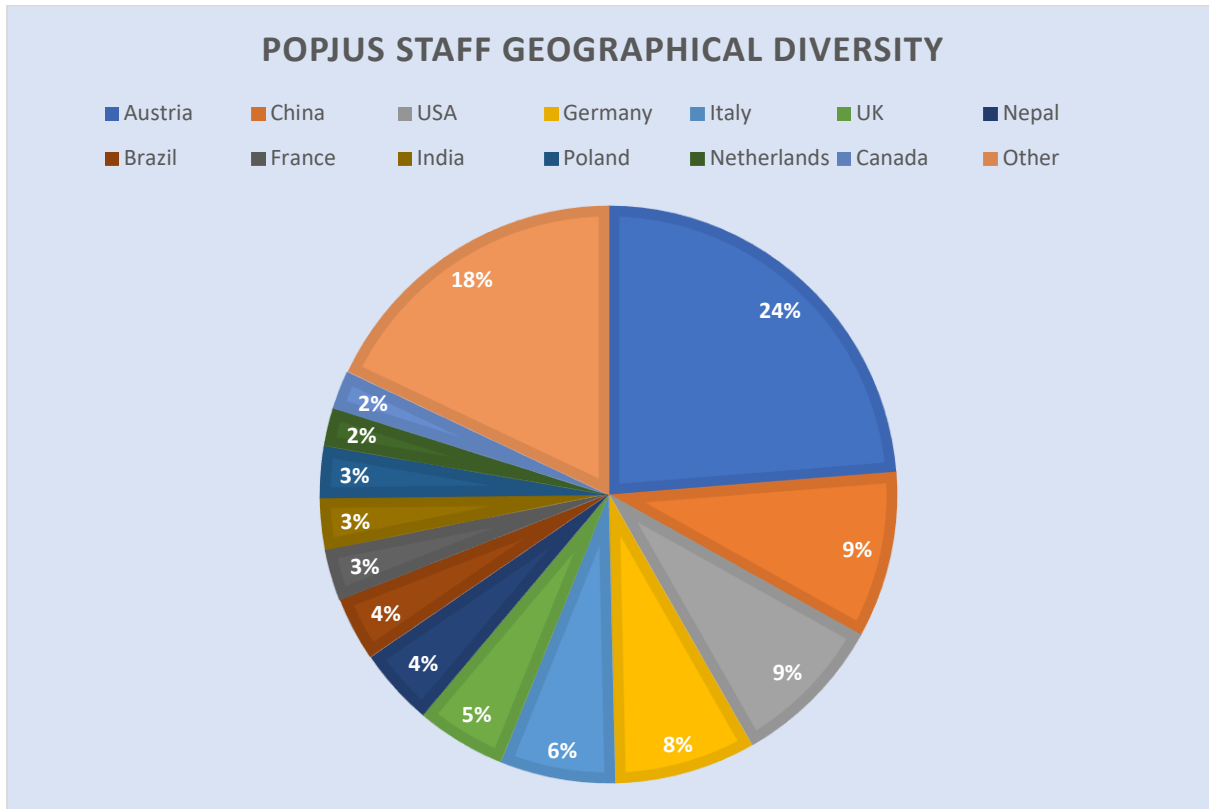
	EQU	MDM	MIG	SHAW	POPJUS	TOTAL
2021						
Scientific Personnel	14.49	3.82	2.34	4.43	3.40	28.48
Non-scientific Personnel					1.81	1.81
2022						
Scientific Personnel	17.83	4.75	3.42	5.93	1.7	33.63
Non-scientific Personnel					2.26	2.26
2023						
Scientific Personnel	19.99	5.86	4.36	7.43	1.13	38.76
Non-scientific Personnel					2.48	2.48
2024						
Scientific Personnel	18.63	6.28	7.36	5.61	1	38.88
Non-scientific Personnel					2.6	2.6

Figure 1. POPJUS staff per category in 2024.



In the period from 2021-2024, the POPJUS staff was represented by 33 nationalities: Austria, France, Netherlands, China, Nepal, Thailand, USA, India, Italy, Germany, Indonesia, Colombia, Romania, Finland, United Kingdom, Brazil, Sweden, Canada, Turkey, Slovakia, Spain, Poland, Russia, Costa Rica, Ukraine, Iran, Bulgaria, Egypt, Australia, Japan, Switzerland, Korea.

. Figure 2. Geographical diversity of POPJUS staff.



2. Research Group 1: Equity and Justice (EQU)

The IIASA Strategy 2021–2030 highlights that human beings are both the cause of dramatic global change and severely impacted by it. This leads to existential risks that are likely to cascade across interconnected socioeconomic systems and impose intolerable burdens, usually borne disproportionately by the most vulnerable who have often contributed little to the crises. At the forefront of global change research, IIASA has put such ethical questions at the heart of its research strategy. As a newly established research group after IIASA’s restructuring in 2021, the Equity and Justice (EQU) Research Group at IIASA sets out to advance the justice debate in global change research and sustainability science using mixed, systems-based, and participatory methods. EQU research aims to contribute to achieving the SDGs by developing and applying conceptual and analytical frameworks for integrating equity and justice into systems analysis. Scientists in EQU bring a valued perspective to major global and local policy issues, including the climate crisis and biodiversity loss, by identifying and co-designing governance reforms and policy options that take account of diverse perceptions of procedural, distributive, and compensatory justice.

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

EQU’s overarching goal is to establish IIASA as an international hub for conceptual, descriptive, normative, and empirical analyses to address equity and justice issues as well as resulting governance challenges in the context of applied systems analysis. To operationalize this overall goal, EQU set the following subgoals for the period 2021-2024:

EQU will take the lead in co-creating a conceptual and analytical justice framework for IIASA

EQU was established in 2021 with the explicit task to create a justice framework for streamlining justice in IIASA’s research. Resting on a three-year process (see Figure 1) across disciplines and research areas, involving a variety of activities, workshops, research projects, researchers from and beyond IIASA including NMO countries, and several key publications ([de Goer de Herve et al., 2023](#); [Schinko et al., 2023](#); [Zimm et al., 2024](#)), EQU has recently synthesized the first version of the IIASA/EQU justice framework (Hanger-Kopp et al., 2024). The resulting IIASA Working Paper is a descriptive framework without normative objectives. The framework is grounded in philosophy and applied and tested in a variety of applications (e.g., designing just biodiversity scenarios, developing guidance material and a tool for just mitigation scenarios, identifying justice challenges in the field of climate risk management), to be useful for research and decision making. It is meant to be accessible (across disciplines), powerful (in terms of capacity to express a variety of justice ideas), and modular (researchers can select and deploy the dimensions that are most appropriate or useful). The current framework serves as a baseline for further refinement, expansion, applications, and evaluation across disciplines, subject areas, and cultural backgrounds over the next research plan period.

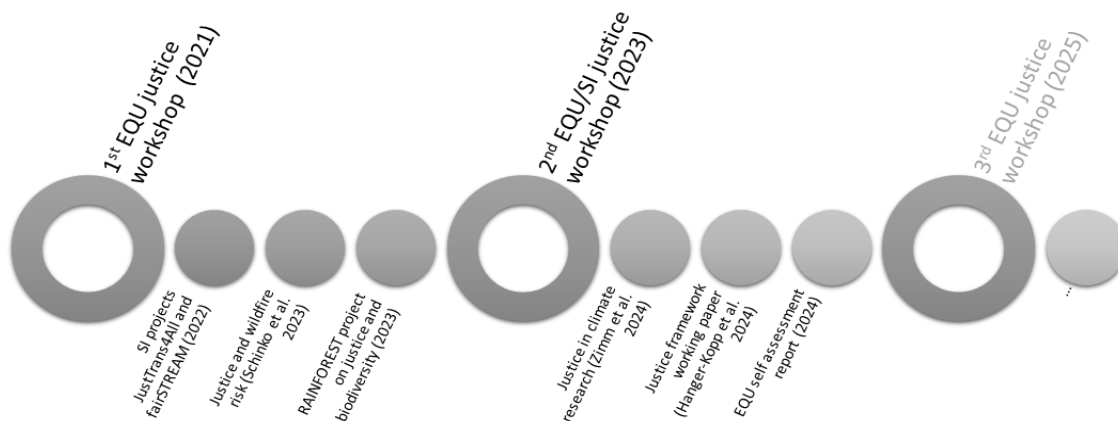


Figure 3: Key activities at the Equity and Justice Research group towards developing a IIASA justice framework.

Strengthen the people-centered and transdisciplinary approach as an analytical framework at IIASA in order to assess the degree of vulnerability and resilience of diverse actors

This goal is linked to the IIASA strategy identifying the need to understand how underlying socioeconomic inequalities and demographic pressures, individual and collective actions (i.e., values, behaviors, norms, and cultures), and the diversity of communities (e.g., rural and urban) affect possible interventions in order to enhance resilience, equity, and the sustainability of human societies. Upon its creation in 2021, the EQU group was building on strong capacities and extensive knowledge gained over the past decade in developing and applying participatory research approaches for assessing and co-designing options for multiple topical policy issues with a past focus on climate-related risks. To better understand how different actors perceive and evaluate risks and their capacity to adapt to changes, EQU engaged in several new research projects that allow us to bring an empirical, people-centered bottom-up element into our conceptual justice framework. For example, based on a broad stakeholder co-design process, we are informing decision makers in Austria about group-specific social vulnerabilities to key climate risks and thereby enabling the implementation of just and cost-effective adaptation measures as well as increasing adaptive capacities of private households where most needed. In another exemplary project, EQU is involved in an inter- and transdisciplinary research process of co-creating and researching essential tools and methodologies towards a drought climate risk service for Austria. Our researchers are thereby leading the development - together with potential end-users at different policy scales in Austria – of a co-creation methodology to identify the requirements of a drought climate risk service.

Advance applied systems analysis research in the context of procedurally just social and institutional arrangements for enabling an equitable and sustainable societal transformation

Building on the long experience of EQU researchers in the field of governance, the group continues to explore options to support transformative governance for just and equitable societies in the context of the grand social, economic, and ecological challenges of our times. For us, procedurally just research means putting people's lived experience at the center to solve real-world policy problems that our societies face. To achieve this goal, EQU carried out various applied and empirical research activities at the interface of science, policy, and society, working at many different levels and with different stakeholders comprising e.g., international organizations like the IMF to local governments, school children, farmers in Ghana and Indian villages. Over the period 2021-2024 EQU conducted multiple transdisciplinary research projects that developed and implemented various participatory methods incorporating our expertise in applied systems analysis, governance, social science and applied empirical ethics. Amongst other, we (1) developed a Climate Peer-to-Peer Training for Austrian school students to raise awareness and increase their self- and collective efficacy in the climate crisis; (2) designed and implemented a participatory visioning workshop

supporting the Styrian Government to co-design a vision for a climate resilient future with a sample of 50 representative citizens; (3) implemented Policy-Business Fora for Nature-based solutions (NBS); (4) assessed the role of insurance in establishing NBS, e.g., in the context of wildfire risk management.

Identify and work on strategies to rigorously attract and engage international experts in the field of applied ethics and social justice

EQU's strategy to achieve this goal in the period 2021-2024 included recruiting ethicists as guest researchers and jointly working with them toward securing internal and external funding to support this effort. Already in 2021, we successfully recruited two established applied ethicists as EQU guest researchers who continue active collaborations with us, [Ivo Wallimann-Helmer \(University of Fribourg, Switzerland\)](#) and [Kian Mintz-Woo \(University College Cork, Ireland\)](#). Together with Kian Mintz-Woo, we successfully applied for an IASA-internal Strategic Initiatives project "JustTrans4All". A proposal together with Ivo Wallimann-Helmer is currently under review with Austria's FWF. Both colleagues were furthermore involved in the development of EQU's Justice Framework for IASA and they have been instrumental in connecting EQU researchers to relevant international ethics networks. In 2024 we hired [Elliott Woodhouse](#) a trained ethicist as PostDoc researcher within the [RAINFOREST](#) research project, who will focus on ethical aspects at the climate-biodiversity nexus and contribute to the further development of our Justice Framework.

2.2. Highlights of scientific output and policy/societal impact

The following five highlights are closely related to our goals described in the previous section and show that EQU research is truly inter- and transdisciplinary, having scientific, policy and societal impact, often at the same time and across different geographical scales. We follow [Belcher and Halliwell's \(2023\)](#) complex systems approach on assessing research impact, who propose a classification of sub-categories of impact that are based on the nature of the change: **Outputs (OP)**, the products and services of research directly generated by EQU; **Outcomes (OC)**, changes in the agency or behavior of other actors, influenced by EQU research outputs; **Realized benefits (RB)**, tangible changes in the social, economic, environmental, or other physical conditions, resulting from a chain of events to which EQU research has contributed. It is important to note that change happens in a complex system of many different actors and dynamics, outside the direct control of a Research Group. Hence, EQU's *sphere of direct control* comprises the Outputs, while the Outcomes are situated in its *sphere of influence*. Eventually, the actions of influenced actors will then contribute to realized benefits in the *sphere of interest*, to which EQU is only indirectly linked.

#1 EQU injects justice expertise into IASA research and beyond (OP, OC)

Within the co-creative process towards an EQU Justice Framework for IASA (and beyond) that we started in 2021 (cf. section 2.1), EQU has not only participated in various collaborative research endeavors within (three SI projects [fairStream](#), [JustTrans4All](#), [TRUST](#)) and outside of IASA, but also published key scientific papers in leading international journals (e.g., [Nature Climate Change a](#), [b](#) and [Risk Analysis](#)). We synthesize the insights from these research endeavors in an accessible IASA Working Paper (Hanger-Kopp et al., 2024), which comprehensively outlines justice in its multiple levels, aspects, and dimensions, facilitating justice assessment across diverse research and policy areas.

#2 EQU spearheads NBS governance and financing research (OP, OC)

EQU established itself as a leader on [NBS governance](#), spearheading research on [financing and policy options](#) that can enable (or hinder) NBS implementation and [transformative adaptation](#). EQU secured funding for four EU-funded projects on this topic ([PHUSICOS](#), [FIRELOQUE](#), [NATURANCE](#),

[HuT](#)). Six case studies were conducted in Europe and China. Particularly relevant are the production of three policy briefs, 10+ scientific publications, five project deliverables and the establishment of an [interdisciplinary working group on wildfire insurance](#). These projects also involved organizing four international policy-business fora, four webinars attended by hundreds of people and a [Finance Innovation Festival](#) with ~100 experts.

#3 EQU empowers the youth amidst the climate crisis (OP, OC, RB)

At the science-society nexus, EQU has developed a climate-peer training for schools within the [makingAchange](#) research project. The training program, which has reached over a hundred Austrian kids so far, aims to provide students not only with solid scientific facts but also soft skills that are needed for building up their own sustainability initiatives. Eventually, we want to empower the participants and provide them with a new sense of self and collective efficacy. Building on the success of the makingAchange climate-peer training and the resulting [handbook](#), IIASA (EQU, CDAT and CER) will continue this endeavor as [IIASA Climate Champions](#).

#4 EQU advances qualitative systems analysis methodologies (OP, OC)

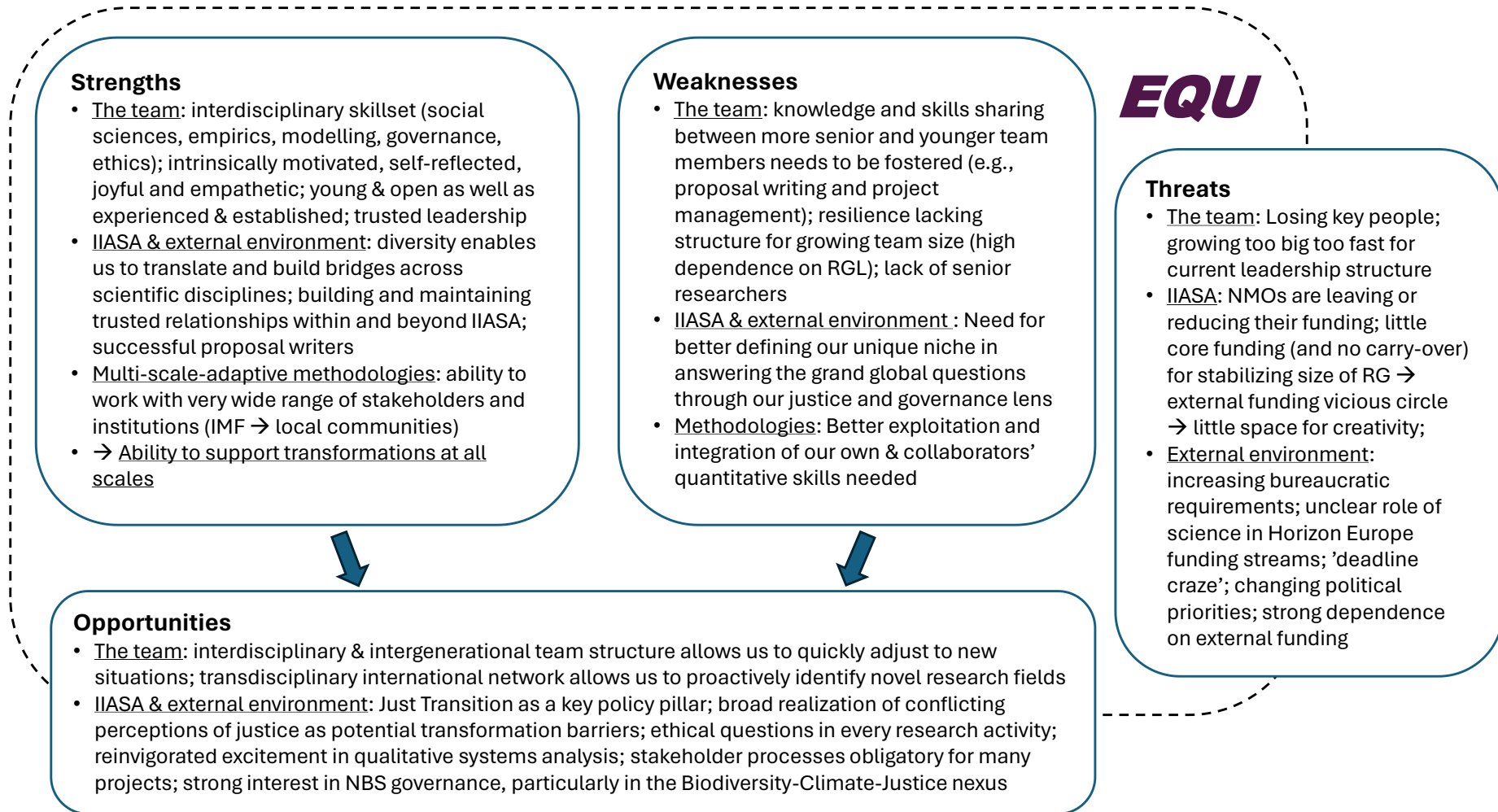
EQU researchers conducted important basic research for the [structured exploration of qualitative systems mapping](#). Systems mapping approaches have been receiving renewed attention both for conducting more transparent and systematic social empirical research as well as supporting policy-making – as they foster systems thinking, co-production of knowledge on complex problems, and communication across disciplines and policy domains. This work will strengthen ongoing methods development across a variety of EQU projects. Indeed, these methodological developments are of importance beyond EQU, as qualitative systems analysis, and system mapping specifically, are nowadays considered essential tools complementing quantitative modeling, for and beyond transdisciplinary research.

#5 EQU highlights the role of path dependencies and leverage points in climate risk governance (OP, OC)

[Conceptual](#) and [applied work on path dependency](#) in the realm of disaster risk management and climate change adaptation, expands systems analytical work that has originated in part at IIASA in the 1980s. This work is receiving international attention – both from the scientific and policy communities as path dependencies are considered a major barrier to increasing societal resilience and enabling sustainability transitions. Equally important for effective climate adaptation practice is the identification of systemic leverage points. EQU has contributed to the emerging field of interlinkages between leverage points, by focusing on food systems in Ghana and assessing [how leverage point interlinkages can be exploited for strengthening adaptive capacity](#).

2.3. EQU SWOT analysis

The following SWOT analysis was conducted jointly by EQU team members at the Annual EQU Team Retreat in May 2024.



3. Research Group 2: Multidimensional Demographic Modeling (MDM)

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

MDM's research closely aligns with the core objectives of the IIASA strategic plan, particularly in developing robust human-centered system models for systems analysis. While the research group was established in 2021, its core activities have long been integral to IIASA's development, drawing from methodological advancements by Andrei Rogers (e.g., [1981](#)), Nathan Keyfitz (e.g., [1980](#)), and applications by Wolfgang Lutz (e.g., [2001](#)) and their teams. A primary focus is on developing population projections that capture the multidimensional aspects of people's characteristics and behavior. This approach aims to provide a more accurate understanding of future world populations, crucial for assessing their exposure to socio-economic, environmental, and geopolitical challenges, their vulnerabilities, capacities, and resilience ([Ghio et al. 2023](#)). Within IIASA, MDM's unique capacity for quantitative assessment and forecasting of population dynamics facilitates this research. MDM has gained international recognition for its multidimensional projections covering 200 countries from 1950 to the end of the 21st century. These projections, encompassing various socioeconomic scenarios with regular updates, utilize a scenario-based approach aligned with frameworks like the Shared Socioeconomic Pathways (SSPs), originally devised for climate change research. Accurate assessment of population dynamics requires understanding the key drivers of change: fertility, mortality, and migration. MDM collaborates closely with MIG and other research groups at the Wittgenstein Centre for Demography and Global Human Capital—a collaborative center of the Austrian Academy of Sciences, IIASA, and the University of Vienna—to derive realistic estimates and assumptions regarding these drivers. MDM's approach involves incorporating significant sources of population heterogeneity beyond age and sex into projections, including education, labor force participation, and place of birth. This explicit focus on heterogeneity allows for realistic estimates and projections, acknowledging demographic behaviors vary across population sub-characteristics and geographical locations.

MDM's overarching goal is to advance demographic modeling methods further, enhancing the assessment and forecasting of population dynamics with particular emphasis on social and spatial heterogeneity across global, national, and subnational levels.

To operationalize this overall goal, MDM set the following subgoals for the period 2021-2024:

Update baseline data used for population projections (when applicable)

The first set of global population projections following the Shared Socioeconomic Pathways (SSPs) was developed in 2013 (WIC2013 as documented in [Lutz et al. 2014](#)). These projections have found widespread use within the environmental and climate change community, among others. In 2018, an SSPs update was generated but not integrated into the SSP database (WIC2018 in [Lutz et al. 2018](#)). The global population projections underwent a major update through the research period 2021-2024, culminating in the release of an updated set in March 2024 (WIC2023). These projections cover 200 countries until the end of the century and include breakdowns by age, sex, and levels of educational attainment (see data sources in Figure 1), following the SSPs narratives ([KC et al. 2024](#)). To achieve this, the baseline data on population by age, sex, and educational levels was revised, alongside updates to base-year fertility data (by age and education), mortality data (by age, sex, and educational attainment), and migration data (by age, sex, and educational levels). Notably, compared to earlier versions, education-specific mortality has been tailored to individual countries and regions.

Furthermore, this version introduces explicit education-specific migration differentials. This version has been validated by the SSP community and will be further as important inputs for the climate models, feeding into the Intergovernmental Panel on Climate Change (IPCC) further assessment reports as WIC2013 entered the 6th round assessment.

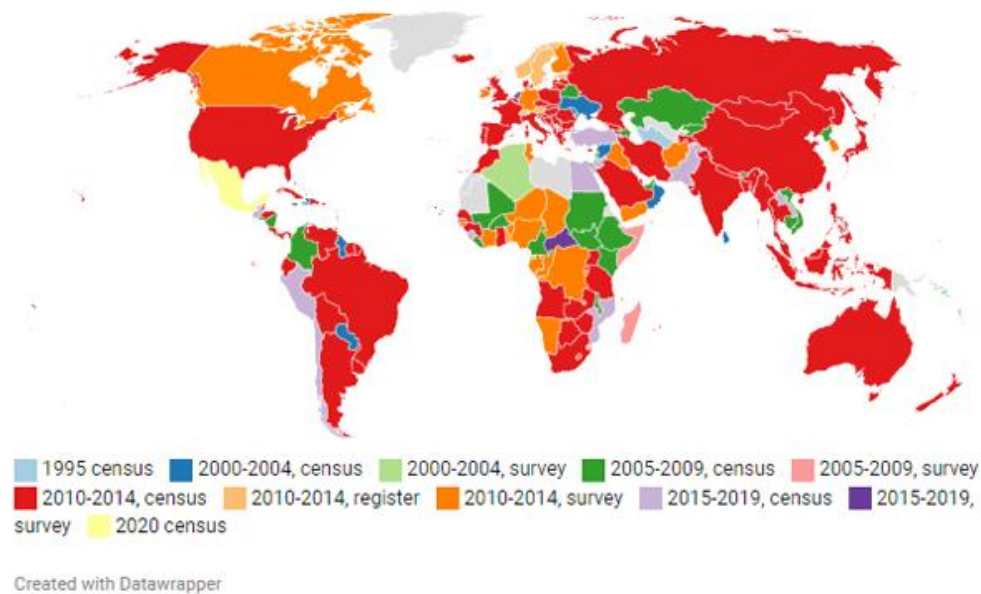


Figure 4: Types of data sources used in the WIC2023 dataset on populations by age, sex and education in 185 countries (for 15 countries, we used regional averages or proxy country for missing education levels).

Rigorously include new relevant dimensions in population projections (e.g., place of residence).

The WIC2023 population projections mentioned earlier represented a deviation from our 2021 work program. Originally, MDM researchers aimed to incorporate an additional variable into global population projections: place of residence, distinguishing between urban and rural areas or degrees of urbanization. However, in 2021, the SSP community requested an update on the human core of the SSPs, prioritizing factors like age, sex, and education. This demand left insufficient time to develop a new model encompassing place of residence. Nonetheless, significant progress and research have been made in that direction. Particularly, looking at the component that is the game changer in territorial composition that is international/internal migration and labor force participation. For instance, MDM researchers used microsimulation models to project the population of 31 European countries by many characteristics capturing the heterogeneity of their inhabitants: age, sex, country of residence, region of birth, immigrant status (age at migration, duration of residence), educational attainment, labour force participation, and religion, language spoken at home, in the framework of the Horizon 2020 [QuantMig](#) project. Other externally funded projects, such as [FUME](#) (in collaboration with the MIG research group) and more recently [PREMIUM EU](#) model and analyze the socioeconomic and demographic impacts of migration. Microsimulations have also been used to project labor force participation in countries such as India (Marois et al. 2022) and China.

Apply innovative data and methods to produce population projections on smaller geographic scales

Population projections at small geographic scales are pivotal for informing local and regional planning, resource allocation, and policy development. Their significance is amplified by the uneven distribution of climate and environmental change impacts at the national level. Within the IIASA/IACC-led [SPARCCE](#) project, initiated in 2023, MDM researchers are evaluating and projecting multi-dimensional socioeconomic vulnerabilities at NUTS2 and/or NUTS3 levels, utilizing updated Shared

Socioeconomic Pathways (SSPs) and downscaling Bayesian techniques. Similar methodologies have been applied to project the sex ratio at births in Nepal ([Chao et al. 2022](#)). Additionally, microsimulations have been employed to forecast the impact of air pollution on child stunting in India, factoring in state-level and urban/rural characteristics ([Dimitrova et al. 2022](#)). These efforts underscore the critical importance of accurate, localized population projections in addressing complex socio-environmental challenges and fostering targeted interventions for vulnerable communities.

Improve and update assumptions related to future population trends

Global population projections are primarily based on models taking into consideration past trends but also consider expert opinions for the assumptions. The first global population projections developed at IASA (WIC2013) used the result of an expert survey that was conducted in 2010-2011. In 2022-2023, initiated by the European Commission Joint Research Centre and in collaboration with the United Nations Population Division, who is one of the major global projection producers, MDM launched a survey ([Icardi et al. 2023](#)) where experts were asked to assess the validity and relevance of alternative arguments about the forces that could shape future fertility, mortality, and migration trends in the country of their choice. The survey also included a section on the potential consequences of demographic change for policy. It brings interesting results that will be used in the next round of population projections foreseen for 2028. The expert opinions seem to indicate that the demographic challenges of the future may not always have straightforward demographic solutions that make it even more crucial to embed demographic modeling in IASA research. The survey was presented in different settings with dialogues with [policy makers](#) and [researchers](#).

3.2. Highlights of scientific output and policy impact

- **Updating the Shared Socioeconomic Pathways (SSPs) Global Population and Human Capital Projections**

The [SSPs](#) are an important input for the latest climate models, feeding into the Intergovernmental Panel on Climate Change (IPCC). They are also being used to explore how societal choices will affect greenhouse gas emissions and, therefore, how the climate goals of the Paris Agreement could be met. By providing [data on education](#), they provide a valuable input to multiple international policy stakeholders (e.g., World Bank, OECD, Population Council, European Commission) and researchers.

- **Anticipating and responding to emerging issues: Ukraine's population future after the Russian invasion and the impact of COVID-19**

While MDM's plan was outlined in 2020-2021, the research group responded to several challenges that emerge during the last few years. First, studying the global COVID-19 crisis and its impact on migration at different international (e.g., REF) and national levels (e.g., REF), on repercussion of school closure on future skills (REF), and on health (mental and physical) and mortality (REF). The second emergency was linked to the invasion of Ukraine by Russia and the displacement/migration of several millions Ukrainian outside of the country and particularly to Europe, for which modeling was used to [explore the potential futures](#).

- **Better modeling migration and its impact (QUANTMIG and FUME project)**

In collaboration with the MIG research group, the different research streams aimed at better estimating migration flows and stocks, developing scenarios about projections of internal and international migration flows and their impact on population change. These projections provide the migration components of the SSPs but also

- **Demographic Expert Survey on the Drivers and Consequences of Demographic Change**

The result of the 2023 [Demographic Expert Survey](#) lead to rich dialogues around its results at several levels. The expert opinions seem to indicate that demographic challenges of the future do not necessarily have demographic solutions, which was debated from several angles at conferences: Population Association of America ([PAA](#)) and at the European Population Conference ([EPC](#)) in 2024. It was also debated at the [European Commission](#) level in a workshop involving researchers and policy makers. The dialogue is important because we will reflect on how the findings can shape future global population projections.

- **Population exposure and vulnerabilities, and environmental feedback to population change**

There is a growing cluster of projects that link population and climate change, whether looking at the [energy-fertility nexus](#), that is key for population stabilization in Global South countries, exposure and vulnerabilities to climate change ([SPARCCE](#) in the context of Europe, or in the context of [Africa](#)), or on the [consequences for the economy of the arrival of a large wave of climate migrants](#) in the case of Austria. We foresee that the body of research work and projects on the topic of interactions between population and climate change will increase in the MDM group.

3.3. MDM SWOT analysis

The group discussed the SWOT in a retreat on May 13, 2024.



Figure 5. The MDM group at the retreat in the Lainzer Tiergarten Vienna before the SWOT analysis on May 13, 2024

<p>Strength</p> <ul style="list-style-type: none"> • The multidimensional population modeling and projection research in the MDM RG is a niche. • It offers potential for development with the inclusion of more/different socioeconomic variables, at varied spatial level. • The MDM team is committed to common goals. • There is diversity in the team with both specialized and complementary profiles and skills (statistics, qualitative & quantitative researchers, multistate population projections, microsimulations, etc.). • MDM is becoming increasingly visible within IIASA and outside of IIASA. 	<p>Weakness</p> <ul style="list-style-type: none"> • Funding opportunities for standing-alone population projections/modelling do not exist – hence the need to depend on others’ need for population modelling. • While in the plan, the multidimensional model is not set for training and distribution, which still limits its spread. • Small team which would require more modeling expertise. • More work is needed on making the models endogenous with feedback effects.
<p>Opportunities</p> <ul style="list-style-type: none"> • Funding Opportunities emerging from the fact that population modeling is an input for multiple projects, that MDM can provide with heterogeneity (socioeconomic and spatial). • Collaborations within IIASA with ASA and ECE in particular, and outside of IIASA, for instance with the European Commission Joint Research Centre, the World Bank, the UNFPA, Asian Demographic and Research Institute, United Nations Population Division. • High-impact publications are possible with global population projections and other research modeling projects. • Technology Transfer potential: Develop the MDM population projection model to become available online. • MDM attracts early career researchers (YSSP, post-docs) helping in spreading the modeling philosophy. • MDM’s research findings by addressing societal challenges inform policy decisions. MDM has engaged in dialogues with political stakeholders at the international and national level. 	<p>Threats</p> <ul style="list-style-type: none"> • External funding: time needed to apply for more research projects; understaffed; not the capacity to deliver; bad for our reputation. • Professional uncertainties: difficulty keeping the staff; discontinuity in projects. • Growing bureaucratic monster: Taking time away from relevant research, and not receiving enough benefits in return in terms of services. • Institutional memory: person brand more than institution brand: e.g., the MODGEN microsimulation tool. -

4. Research Group 3: Migration and Sustainable Development (MIG)

The MIG research group focuses on applying advanced data collection and estimation methods to quantify and better understand the trends, patterns, drivers, and consequences of different types of migration considering its interactions with the social, economic, and environmental dimensions of sustainable development. A key emphasis has been placed on understanding the heterogeneity of migration, considering demographic, spatial, and other relevant characteristics. The group has focused on achieving four goals over the period 2021-2024 using a combination of advanced migration modeling, novel data sources, and forecasting approaches.

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

Continue to improve migration estimates by employing novel data and innovative methods.

Over the past 4 years, MIG has produced a range of novel data sources that have provided the basis for enhancing the estimation of international and internal migration, including patterns, drivers, and impacts. Whenever possible, data were published open access following FAIR data sharing principles to ensure transparency and to allow other researchers, policymakers, and stakeholders to analyze, validate, and expand the data. Building on previous work on [estimating bilateral international migration flows](#) worldwide (1990-2015), the group has developed [international migration flow estimates broken down by sex](#) and [by age, sex, and educational attainment](#) (in collaboration with MDM research group). These provide valuable information on differentiated patterns of migration of population groups across different world regions. In another study, the group has advanced the [reconstruction of age-specific migration flow estimation](#) using Bayesian modeling to address issues in migration flow estimation related to small sample sizes and demographic heterogeneity (e.g., when estimating age-specific migration flows between small countries). Building on work carried out jointly with the MDM research group as part of the Horizon Europe funded project [Future Migration Scenarios for Europe](#) (FUME), the group has enhanced the estimation of migration stocks and flows to Europe enriching existing estimates using new temporal definitions and integrating various data sources. MIG has also explored the use and applicability of non-traditional data sources in migration estimation, including digital trace data derived from social media (Yildiz et al., paper forthcoming in International Migration Review). In addition to novel international migration estimates, the group has developed [novel comparative datasets estimating internal migration](#), building on census data for 72 countries derived from the Integrated Public Use Microdata Series (IPUMS) International. The latter data provide rich information on migration between subnational regions within countries at administrative level 1 and 2. Even greater detail is provided in two novel migration datasets developed by MIG members which estimate [net-migration between 1990 and 2000](#) and [net-migration between 2000 and 2019](#) at a high spatial resolution combining birth and death rates with overall population growth at the grid level (10km resolution) to estimate net migration. The data reveal complex patterns in net-migration worldwide which are closely linked to socioeconomic developments across regions. The various migration datasets can be combined with other global datasets produced by the group which [map sustainable development processes](#) and changes in livelihood conditions building on harmonized Demographic and Health Survey (DHS) data.

Advance understanding on the changing nature of the drivers of migration

In the past years, global change processes and crises have shaped migration patterns worldwide. These include impacts of the Covid19 Pandemic, geopolitical instability and wars, and different extreme climatic events and disasters. Through its work, MIG has contributed to advancing the evidence on the role of these factors and the changing nature of migration drivers in different parts of the world. A major part of the group's work has been focused on the impacts of climatic changes and environmental hazards on human mobility generating a major scientific and policy impact, including through: (1) [synthesis studies using meta-analysis](#) and [systematic review methods](#), (2) large-scale [global analyses using subnational census](#) and [grid-level data](#), (3) case studies providing in-depth perspectives into climate mobility in local contexts, among others in [Tanzania](#), [India](#), [Indonesia](#), (4) the analysis of [heterogeneity in migration responses to environmental stress](#), (5) the exploration of the role of [migration as an adaptation strategy](#) and [translocal social resilience dimensions](#) of migration as adaptation, (6) the microeconomic [modeling of household mobility decision making](#) in disaster contexts, (7) work on how the [science-policy interface](#) in the field can be strengthened, and (8) issues with [climate resilience of migrant and non-migrant households](#) in migration destination areas. For affected households, migration can lead to improvements in their livelihoods, but there may be [limits to adaptation](#) and in many contexts, [immobility](#) may occur, either because households decide to stay put, or because they are forced to despite difficult circumstances. In addition to emerging environmental drivers, the work of the group has contributed evidence on conflict-driven forced migration and the role of compound risks in shaping mobility, including highly-cited [global analyses on the climate, conflict, and migration nexus](#), and case studies from [Somalia](#) and Columbia (Fenz et al, forthcoming Vienna Yearbook of Population Research). Finally, together with the MDM research group, MIG researchers have quantified the [impact of COVID-19 on immigration](#) in high-income countries, highlighting the important role health crises can play in shaping global mobility patterns.

Update baseline migration data for population projections

MIG has provided critical inputs to the updates of the global population projections carried out as a joint effort by the Wittgenstein Centre for Demography and Global Human Capital of which IIASA's Population and Just Societies Program is one pillar institution. For this, MIG has produced updated global migration data and estimates, including [updated international migration flow estimates](#). In addition, more refined datasets by relevant population characteristics were produced that allow for a more granular perspective on international migration, distinguishing [migration flows by sex](#), and by [age, sex, and educational attainment](#). These data inputs have been used, among others, for the development of novel migration scenarios to update the [population and human capital components of the Shared Socio-Economic Pathways \(SSPs\)](#) projections, which also form the basis of the Wittgenstein Centre global population projections.

Improve and update assumptions related to future migration trends

In addition to empirical analyses of past migration and relevant drivers, the development of enhanced migration forecasts and projections represents one of the key achievements of the group. For this, the MIG team has collaborated with the MDM research group to improve and update the assumptions related to future migration trends and to develop [novel migration projections based on different socioeconomic scenarios](#), which were used as an input to the [update of the Shared Socioeconomic Pathways \(SSPs\)](#) and [Wittgenstein Centre population projections](#). As part of the collaborative FUME project, [new migration scenario narratives for Europe](#) were developed, and the narratives were quantified in form of novel migration scenarios taking into account changing drivers and their relevance for migration to Europe (Yildiz et al, forthcoming in Demographic Research). Further work of the group has focused on improving the estimation and forecasting of bilateral migration between South America and Europe (in review). As part of the [PREMIUM-EU project](#), led by the MDM research group, members of the MIG group have further contributed to providing evidence and scenarios on

migration to Europe and the role of policy for turning the individual benefits of mobility into societal benefits. At the global level, the group has contributed to the development, implementation, and analysis of the [Global Demography Expert Survey](#) as part of which 237 experts were interviewed to gain informed insights into the future of the world population and population dynamics, including migration. Insights from the survey will be used to further enrich MIG's migration scenarios in the future and to advise policy. Further work of the group has focused on the role of [information campaigns in shaping local perceptions and discourses](#) of migration, and in [influencing migration aspirations](#). Such information campaigns have been increasingly used in migration policy, and may be a relevant factor in shaping future migration trends. Also societal transformations and change processes can have a major impact on future migration, which is the focus of MIG's [Sustainability Performances, Evidence, and Scenarios](#) (SPES) project funded by the European Union.

4.2. Highlights of scientific output and policy impact

(1) Migration in times of global environmental changes and crises

MIG's work has significantly contributed to improving the understanding of the climate-environment-migration nexus. The group has carried out large-scale empirical analyses at the global and regional level to explore the complex interplay between climatic risks, moderating influences and mechanisms, and migration (e.g. studies in [Global Environmental Change](#), [Nature Communications](#), [Nature Human Behavior](#), [Nature Climate Change](#)). By integrating georeferenced migration and environmental data across multiple scales, MIG has provided valuable insights into the spatial and temporal dynamics of climate migration, highlighting its [potential for adaptation processes](#) as well as [pertinent risks and challenges](#) for affected households and communities.

(2) Advancing migration data and estimation

Advances in data represent one of the key scientific outputs of MIG's work in the past years. In addition to providing updates on existing datasets on [international migration](#), the group has produced a series of novel datasets allowing to distinguish [migration flows by demographic subgroups](#). The data on international migration are complemented with novel datasets capturing [internal migration](#) sub-nationally as well as [migration at a high spatial resolution](#) at the grid level. Digital traces have been used to enrich traditional sources for migration estimation. Integrative methodologies (e.g., [Bayesian modeling](#) or [machine learning](#)) were used for estimation, including in data scarce contexts.

(3) Migration forecasting and population projections

The novel migration data and evidence produced by MIG have formed the basis for the development of [new migration scenarios](#) providing valuable insights into future migration of relevance for policy and strategic planning. To further enrich the scenario formulation and to gain a comprehensive perspective on future trends, a [Global Demographic Expert Survey](#) was carried out and analyzed under the leadership of the MDM team. Scenarios on future migration were used as an integral input to the updates of the [population and human capital components of the Shared Socio-Economic Pathways \(SSPs\)](#), which are widely used by the scientific community.

(4) Generating policy impact

MIG has achieved lasting policy impacts through its involvement in different policy fora and events, including a [migration conference organized by the European Commission](#), a policy [workshop on understanding migration drivers](#) for policy development, and a [G20 task force on migration](#). In addition, the group has contributed to various reports, including on [environmental change, conflict, and human migration](#) by the Mediterranean Experts on Climate Change (MedECC) and on [human migration and natural resources: global assessment of an adaptive complex system](#)" by the

International Resource Panel (IRP). The group has also been collaborating with various policy actors and international organizations, including the World Bank, OSCE, OECD, UNFPA, IOM, and UNICEF.

(5) Public outreach, capacity building, and awareness raising

In addition to an academic audience, MIG has also actively engaged with the general public to broaden its impacts and to raise societal awareness and knowledge on migration. Relevant highlights from our work in this area include the organization of a [IIASA Voices Webinar](#) (2024) on emerging migration drivers, the co-organization of the [Wittgenstein Centre conference](#) (2022) on “population and climate change”, and a [TEDx talk](#) (2023) on climate change and population dynamics. Several members of the group are also actively involved in capacity building activities and teaching, among others at the University of Vienna, different summer and winter schools, and community colleges in Austria.

4.3. MIG SWOT analysis

<p>Strengths</p> <ul style="list-style-type: none"> ▪ Expertise in empirical, quantitative migration research and modeling. ▪ Strong methodological background and rigor ▪ Access and expertise to unique and innovative migration data ▪ Reputation in the analysis of migration in response to (global or local) changes and disruptive events ▪ International networks and connections to scientists in various disciplines ▪ Highly qualified group of researchers with diverse background and experiences combining multiple perspectives (bottom-up interdisciplinarity) ▪ Good research ethics ▪ Good atmosphere, management, and support in the group ▪ Supportive environment at IIASA. Institute infrastructure for publishing data and dissemination of research outputs 	<p>Weaknesses</p> <ul style="list-style-type: none"> ▪ Dependency on external funding and budgetary uncertainty ▪ Lacking theoretical work and contributions to the broader migration literature that go beyond empirical results and modeling ▪ Lack of group cohesion given that many group members also work in other institutions, including on topics other than migration and sustainable development ▪ Group could more strongly use qualitative research and think more about political narratives on migration ▪ Lack of visibility and "brand name" given that MIG is relatively young, there is limited recognition of IIASA and MIG as a hub for migration research. ▪ Lack of exposure to on-going migration research outside of our personal network and research topic "bubbles" beyond conferences
<p>Opportunities</p> <ul style="list-style-type: none"> ▪ Increasing importance and salience of migration as a research topic. ▪ Strong international networks to cooperate with researchers from research groups with a stronger theory and/or policy focus. ▪ Creating a distinct group profile / niche, pursuing more focused research and hiring, targeted projects, and strategic collaborations. ▪ Potential of developing a broader group profile that goes beyond individual 	<p>Threats</p> <ul style="list-style-type: none"> ▪ In the long run, maintaining a consistent research focus and high group cohesion is challenging in a research environment where most contracts are short-term and temporary in nature. ▪ Migration is a popular topic and many other researchers are working on it as well. ▪ Budgetary uncertainty within IIASA. Challenges related to “normatively-directed science funding”.

<p>contributions and establishing MIG as a prominent hub for migration research both within IIASA and in the wider academic community worldwide.</p> <ul style="list-style-type: none"> ▪ Strategic collaborations with partners from policy and practice. ▪ Novel data sources, including Austrian micro data, could open new research possibilities. ▪ Further embracing supportive management through retreats, seminars, workshops etc. 	<ul style="list-style-type: none"> ▪ Maintaining a clear research focus of the group while at the same time integrating the diverse interests of the group members.
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5. Research Group 4: Social Cohesion, Health and Well-being (SHAW)

The SHAW group (hereafter SHAW), dedicated to advancing human wellbeing with a particular emphasis on health, identified three goals guiding its research over the period 2021-2024, pursued through interdisciplinary approaches: 1) developing new methods for wellbeing measurement and healthy aging; 2) examining the relationship between the environment and health outcomes; 3) understanding the drivers of health and wellbeing across contexts and population subgroups.

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

1. Continue to **improve the measurement of human wellbeing** accounting for population heterogeneities

A key achievement was the development and testing of a novel measure of wellbeing, [the Years of Good Life \(YOGL\) indicator](#). YOGL integrates life expectancy with subjective and objective wellbeing measures, enabling the assessment of wellbeing, and progress towards sustainable development, across nations and timeframes. Extensive cultural acceptability testing in Nepal, South Africa, and Costa Rica underscored its adaptability across diverse contexts. A further example of SHAW's contribution to holistic wellbeing measurement was its input into defining universal [decent living standards](#) to achieve basic human wellbeing, in collaboration with other IIASA research groups.

SHAW has also undertaken research to define globally relevant measures of healthy aging. An example is SHAW-led research showing that [hand grip strength](#) can be used as a predictor of mortality risk in clinical practice; and participation in a research collaboration which developed the [ATHLOS scale for measuring healthy ageing](#), combining intrinsic capacity and functional ability items. SHAW research on an alternative way of conceptualizing and measuring individual and population level aging, based on [prospective longevity](#) is also noteworthy, resulting in the introduction of new [UN measures](#) of aging.

2. **Consider socioeconomic and environmental impacts and feedback on health and wellbeing**, focusing particularly on both short- and longer-term impacts of such emerging challenges and threats differentiated by population subgroups and geographical locations.

In collaboration with other IIASA research groups and external institutions, SHAW has contributed evidence quantifying the association between environmental factors and population

health and wellbeing over the life course, facilitated by linking environmental and health-related data. Examples of this include a study (in collaboration with Vrije Universiteit Amsterdam) exploring the relationship between air pollution and population cognitive health. This demonstrated how PM10 exposure is associated with worsened episodic memory among older Europeans.

SHAW research also examined how climate exposures affect access to modern amenities, education, and fertility rates across 52 countries. Together with IIASA's Economic Frontiers Program, research is underway to examine health effects across a range of conditions using the Global Burden of Disease data. Research in Brazil and Zambia, in collaboration with IIASA's SYRR group, is quantifying the relationship between floods and heatwaves and maternal and child health care use.

Analyses of the relationship between the environment and health are facilitated by linking environmental and health-related data, and SHAW has contributed to this by generating, and making publicly accessible, the [LivWell](#) database combining Demographic and Health Survey data with climate-related data (on temperature extremes, humidity, precipitation and drought), enabling national and subnational level analysis over the period 1990-2019 for 52 countries. Health and wellbeing, in addition to being impacted by environmental change, can also mediate the impacts of these changes, as shown in a study of the [interactions](#) between environment, mortality, and economic activity, that SHAW contributed to.

In addition to considering how environmental factors affect health and wellbeing, SHAW is also examining how social factors affect health. The *Cognitive Health in Aging Society* (CHIAS) project, co-led by SHAW researchers, is exploring how labour force participation, retirement, grandparenting and social network affect cognitive health and ageing in Europe, and how this varies by gender and education. Initial findings suggest that social network positively moderates the association between non-employment and episodic memory scores.

Beyond examining historical drivers of health and wellbeing it is also important to look forward and explore future scenarios on health and wellbeing. As an input into the [IIASA 50-year Flagship report](#), the YoGL wellbeing measure was integrated into the Full of Economics and Environmental linkages and Integration (FeliX) system dynamics model to map out the impact of alternative development pathways on wellbeing.

- 3. employ relevant and innovative methods** to investigate trends, determinants, and mechanisms of good health and wellbeing over time and over a life course for differentiated subgroups of populations around the world, including the effect of policies and prevention strategies.

The final area of SHAW work was centered around the exploration of trends and determinants of health and wellbeing overtime, and exploring population heterogeneities, policy, and Covid-19 impacts. In relation to understanding drivers of wellbeing, SHAW used "[Years of Good Life](#)" (YoGL), to describe wellbeing heterogeneities by country and by gender for the population aged 50+ in 26 European countries. Further work is currently underway to explore trends in cognitive abilities by age and overtime. SHAW researchers also undertook a study on [health and well-being among older adults](#), illustrating how healthy life expectancy relates to working life expectancy in Europe, and heterogeneities by education.

SHAW has also been evaluating the effect of policy reforms on health and wellbeing, including the redistributive effects of pension reforms ([Sanchez-Romero et al 2023](#)); the impacts of social security reforms in heterogeneous aging populations ([Sanchez-Romero and Fürnkranz -Prskawetz 2023](#)); and the role of financial incentives in antibiotic prescription patterns in Austria ([Stacherl et al 2023](#)).

Lastly, SHAW has contributed evidence on the health and wellbeing impact of Covid-19, including: measuring excess mortality from Covid-19 in Russia and Italy; demonstrating the limitations of tracking [the case fatality rate](#) as an indicator of pandemic impact; determining optimal [lockdown intensity](#); and proposing [a novel method](#) to assess the impact of the Covid-19 pandemic on life expectancy.

Conclusion: In summary, SHAW's endeavors over the past four years have not only advanced our understanding of human wellbeing and healthy aging but also provided actionable insights for policy and practice. By integrating interdisciplinary approaches and fostering collaborations within IIASA and beyond, SHAW has made significant strides towards its overarching goal of promoting holistic health and wellbeing worldwide. Going forward, the group aims to expand its research on climate change and health, wellbeing and healthy aging in collaboration with other groups at IIASA. It also seeks to undertake further research in, and in collaboration with, the Global South.

5.2. Highlights of scientific output and policy impact

- (1) **YOGL** - Attempts at comprehensive quantitative assessments of sustainable development can focus on either determinants or constituents of long-term human well-being. While much research on determinants has relied on economic concepts of capital and inclusive wealth, this study focused on the constituents of well-being using a demographic approach. The Years of Good Life (YOGL) based on life expectancy and indicators of objective and subjective well-being enables comparisons across countries and over time, enabling the assessment of cross-sectoral policy impacts towards achieving the sustainable development goals. It has also been combined with scenarios addressing future changes including feedback from environmental change ([Lutz et al. 2021](#))
- (2) **Hand grip and health** - The paper's contributions in defining low handgrip strength related to mortality risk, providing cut-off points, and estimating remaining life expectancy have significant implications for informing healthcare policies aimed at **improving early risk detection and patient outcomes. The findings suggest that medical** practitioners should be concerned about mortality risks even when hand grip strength is slightly below the reference group, indicating the need for early interventions and monitoring for patients with lower hand grip strength levels ([Scherbov et al. 2022](#)).
- (3) **Working life expectancy** - This study investigated whether there is health potential for working longer given the rise of retirement ages across Europe. The study compared working life expectancy (WLE) with health specific life expectancy relevant for active labour market participation such as good cognitive and physical functioning. While life expectancy in good physical health is at a high level for 60–69-year-old, WLE and life expectancy in good cognitive health were found to increase over time. However, substantial disparities based on educational levels were identified, along with the potential to extend working lives for different educational strata ([Weber et al. 2022](#)).
- (4) **Demographic change and urban health** – This study aims at highlighting key linkages between demographic changes and urban health from a multifaced perspective. For instance, demographic change has a strong impact on urban health. Further, demographic processes contribute to (intra)urban inequities in health, but they could also present opportunities to address those inequities. The paper also sheds light on research gaps as well as data gaps relevant for future strategies ([Duminy et al. 2023](#))

(5) **Optimal lockdown strategies for Covid-19** - This paper examines the optimal intensity and timing of lockdown measures during an epidemic, using an optimal control model, considering the epidemic intensity and healthcare system capacity. It identifies four main lockdown strategies, from short-term lockdowns to sustained measures preventing health system overload. The model suggests returning to lockdown after lifting restrictions can be effective. The findings underscore the complexity of COVID-19 policy-making ([Caulkins et al. 2021](#)).

5.3. SHAW SWOT analysis

<p>Strengths</p> <ul style="list-style-type: none"> • Ability to attract funding from excellent funders • Interdisciplinary • International collaborations/network • Excellent quantitative skills • Strong publication record in high impact journals • Forward looking research • Outcome focused, hence a connector to all IIASA research • Policy engagement and impact • Subject matter expertise on aging, cognitive research, YOGI/wellbeing measurement, health systems- from a global perspective 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Diverse group focusing on many topics, lacking a unique brand/focus • SHAW needs to position itself within the institution and beyond • Limited research on the climate and health/wellbeing interface • Could do more to pull out the policy impact/implications of the work • Potential for wider use of mixed methods, co-production, systems thinking tools which are in high demand by funders • Small team size, young members
<p>Opportunities</p> <ul style="list-style-type: none"> • Young team, room for growth • Gain more visibility within IIASA and beyond by becoming the go-to group for health/wellbeing/health systems-related research • Consider potential re-branding of SHAW, to emphasize health/wellbeing focus • Leverage growth in funding for interdisciplinary climate and health research • Expand work on climate and health to capitalize on funding opportunities and IIASA's core strengths • Take advantage of capacity building training in CDAT • Greater use of NMOs for policy impact and outreach • Enhance cross group/programme collaborations within IIASA 	<p>Threats</p> <ul style="list-style-type: none"> • Institutional constraints to cross group/programme collaboration • Staff turnover due to breaks in funding • More competition for funding from the global south

6. 20 selected participations in global efforts, lectures, courses, other capacity building efforts

Event	Year	Place	Person/RG	Role	NMO relation (if any)
INQUIMUS 2022 conference - Transformational risk management and Loss & Damage: What are suitable approaches for assessing climate-related (residual) risks?	2022	Laxenburg, IIASA	Thomas Schinko/EQU	Main organizer, session chair, presenter	Participants from different NMO countries were present
"Climate Change Economics" and "Macroeconomics of Climate Change" courses with Joint Vienna Institute (JVI) and the International Monetary Fund (IMF)	2022-ongoing	Vienna, Austria and Washington DC, USA	Thomas Schinko/EQU	Co-developer of the weeklong training course; regular invited speaker	JVI is funded by the Austrian Ministry of Finance, the Austrian National Bank and the International Monetary Fund
World Science Forum 2022 - Science for Social Justice	2022	Capetown, South Africa	Thomas Schinko/EQU	Invited speaker	South African NMO (now SSARMO) involved in the event organization
NATURANCE Finance Innovation Festival: Insurance and Investment Opportunities for Nature-based Solutions	2024	Laxenburg, IIASA	JoAnne Linnerooth-Bayer, Jenan Irshaid, Tim Foreman, Juliette Martin/EQU	Host & co-organizers, keynote speaker (JoAnne), World Cafe table host (Tim)	Participants from different NMO countries were present (Austria, Germany, Norway, USA, UK...)
2022 Annual Meeting of the Society for	2022	Mexico City, Mexico	Susanne Hanger-Kopp/EQU	Invited speaker	Mexico currently not a NMO but this

Decision Making Under Deep Uncertainty (DMDU): "Transformative Recovery and Forging Anew"					could hopefully change after the upcoming elections. Participants from different NMO countries were present
Training workshop on multidimensional and multiscale demographic modeling for environmental and climate change scenario development organized by the Asian Demographic Research Institute, Shanghai University.	2023	Shanghai, China	Anne Goujon, Samir KC, Guillaume Marois, Dilek Yildiz, Moradvaj Dhakad / MDM	Co-organizer and teachers	China and several trainees from NMO countries were present (China, Egypt, Brazil, South Korea)
IIASA at the conference on Future Migration to Europe / Policy Day at the EU Parliament	2023	Brussels, Belgium	Dilek Yildiz, Michaela Potancokova, Samir KC / MDM	Participants	Parliamentarians from EU NMO
Demography and climate change: Panel discussion with Vice-President Dubravka Šuica	2023	Ispra, Italy	Anne Goujon / MDM Raya Muttarak / MIG	Panelists	NA
Session Multi-Dimensional Demography for Sustainable Development: 50 Years of IIASA Contributions at the 2023 Population Association of America Conference	2023	New Orleans, USA	Anne Goujon / MDM Wolfgang Lutz / SHAW	Organizer Chair Presenter	USA NMO organizational and funding involvement

Wittgenstein Centre Conference “Exploring Population Heterogeneities”	2023	Vienna, Austria	Anne Goujon /MDM	Co-organizer and Coordinator	Austria
Wittgenstein Centre Conference “Climate Change and Population: The Defining Relationship of the 21st Century”	2022	Vienna, Austria	Roman Hoffmann /MIG	Co-organizer and Coordinator	Austria
TEDx talk on "How climate change affects population dynamics"	2023	Vicenza, Italy	Raya Muttarak /MIG	Speaker	
IIASA Voices Webinar: Understanding emerging migration drivers and their implications	2024	online	Jesus Crespo Cuaresma, Gregor Zens, Raya Muttarak, Roman Hoffmann /MIG	Organizers and presenters	
IUSSP Workshop on “Data and modeling approaches to assessing climate-conflict impact on population dynamics” at the Annual Meeting of the Population Association of America (PAA)	2023	New Orleans, USA	Raya Muttarak, Roman Hoffmann /MIG	Conveners	US
UN DESA Global Policy Dialogues Series: The Future of Population Growth	2022	New York, USA	Raya Muttarak /MIG	Expert	
Healthy ageing and longevity in Europe: How do	2024	Brussels, Belgium	Daniela Weber/SHAW	Invited panelist	

we prepare for the 100-year life? Event organized by International Longevity Centre, UK					
Training course on “Advanced demographic analysis with applications to ageing population and sustainable wellbeing”	2023	Chulalongkorn University, Bangkok, Thailand	Sergei Scherbov/SHAW	Sole trainer and co-organizer	
Annual Meeting of the Population Association of America (PAA)	2022	Atlanta, USA	Wolfgang Lutz/SHAW	Organizer, chair, and discussant of session 610 on 'Human Capital and Inequality in Low- and Middle-Income Countries'	
The 7th Global Symposium on Low Fertility and Population Ageing: “Standardization of age-disaggregated data and definition of being 'old'”	2023	Seoul, South Korea	Sergei Scherbov/SHAW	Invited speaker	In presence of participants from NMO countries in East Asia.
Invited lecture on “Working life and health expectancies” at the Aging Research Center (ARC)	2021	Stockholm, Sweden	Daniela Weber/SHAW	Invited speaker	

Annex 1. List of externally funded projects in the period from 2021 to May 2024.

Project title	Research Group	Funder	Duration	Budget (EUR)
Exploring Low Carbon Futures: Achieving Zero Emissions From Agriculture, Forestry and Other Land Use in Eisenwurzen And Beyond (ZEAFOU)	EQU	Austrian Academy of Sciences (ÖAW)	2017-2021	25 002
Citizen science for landslide risk reduction and disaster resilience building in mountain regions (Landslide EVO)	EQU	National Environment Research Council (NERC)	2016-2021	283 985
PHUSICOS – 'According to Nature'	EQU	European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME)	2018-2023	547 456
Embedding climate policies into deep economic transformations (EconTrans)	EQU	Austrian Climate Research Program (ACRP)	2018-2021	39 148
Agent-based models to inform economic policies towards migration (ABM2Policy)	EQU	Austrian Science Fund (FWF)	2019-2023	177 357
Resource nexus for transformation to circular, resilient, and liveable cities in the context of climate change (RECREATE)	EQU	Austrian Research Promotion Agency (FFG)	2019-2022	108 240
Strategic decision-making in climate risk management: designing local adaptation pathways (pathways)	EQU	Austrian Climate Research Program (ACRP)	2019-2022	78 660
Transformational risk management to tackle climate Loss and Damage in Austria and beyond (TransLoss)	EQU	Austrian Climate Research Program (ACRP)	2019-2022	139 975
Promoting methods for analyzing the effectiveness of educational measures in the areas of climate change and sustainability in Austria (makingAchange/TEACH)	EQU	Federal Ministry for Education, Science and Research (BMBWF)	2020-2023	120 000
Climate change induced water stress – participatory modelling to identify	EQU	Austrian Climate Research Program (ACRP)	2020-2023	122 816

risks and opportunities in Austrian regions (WaterStressAT)				
Monetary and Distributional Implications of Climate-related Disasters - A macroeconomic assessment (DioD)	EQU	Austrian National Bank, Anniversary Fund (OeNB)	2021-2024	206 392
Guiding the pursuit for sustainability by co-developing a Sustainable Agriculture Matrix (SAM co-development)	EQU	Austrian Science Fund (FWF)	2021-2023	14 893
Cross-sector Wildfire Risk Management Dialogue (FIRELOGUE)	EQU	European Commission, Research Executive Agency (REA)	2021-2025	395 563
Nature for insurance, and insurance for nature (NATURANCE)	EQU	European Commission, Research Executive Agency (REA)	2022-2026	558 750
Assessing the distributional effects of climate change impacts and adaptation in Austria (DISCC-AT)	EQU	Austrian Climate Research Program (ACRP)	2022-2024	55 686
The Human-Tech Nexus - Building a Safe Haven to cope with Climate Extremes (HuT)	EQU	European Commission, Research Executive Agency (REA)	2022-2026	308 200
Identifying tools and methods to co-create a climate service for managing drought risk in Austria (CRiSDA)	EQU	Austrian Climate Research Program (ACRP)	2022-2024	86 944
Co-produced transformative knowledge to accelerate change for biodiversity (RAINFORREST)	EQU	European Commission, Research Executive Agency (REA)	2022-2025	355 000
INtegrated Spatial Planning across REalms for biodiversity and human development in a context of change (INSPIRE)	EQU	Austrian Science Fund (FWF)	2023-2026	53 719
Multi-hazards in Biosphere Reserves - Management of multiple hydro-climatic risks to improve the social-ecological resilience (MultiBios)	EQU	Austrian Academy of Sciences (ÖAW)	2023-2025	60 203
Major levers in climate change adaptation (A-LEVERS)	EQU	Austrian Climate Research Program (ACRP)	2023-2025	65 075
Distributional implications of carbon pricing (DICaP)	EQU	Austrian National Bank, Anniversary Fund (OeNB)	2024-2026	239 000
FUture Migration scenarios for Europe (FUME)	MDM/MIG	European Commission, DG Executive Agency for Small and Medium-	2019-2023	340 884

		sized Enterprises (EASME)		
Quantifying Migration Scenarios for Better Policy (QuantMig)	MDM	European Commission, DG Executive Agency for Small and Medium-sized Enterprises (EASME)	2020-2023	316 353
Policy REcommendations to Maximise the beneficial Impact of Unexplored Mobilities in and beyond the European Union (PREMIUM EU)	MDM	European Commission, Research Executive Agency (REA)	2023-2026	373 569
Transformations, Resilience, and Adaptation to Climate Change in Europe (SPARCCE)	MDM	European Commission, European Climate, Infrastructure and Environment Executive Agency (CINEA)	2023-2027	175 000
Link4Skills	MDM	European Commission, Research Executive Agency (REA)	2024-2026	510 625
People-Centered Economic Modelling for Climate Policy (PEOPLE)	MDM	Vienna Science and Technology Fund (WWTF)	2024-2027	45 000
BALancing humAn and Natural resource use in a Circular bioeconomy (BALANCE)	MIG	The Research Council of Norway	2021-2025	364 971
Development of a Modelling Technique for Human Mobility in the Context of Climate Change and Capacity Development in the IGAD Region- Horn of Africa (ClimMob). Final Report	MIG	Deutsche Gesellschaft fuer International Zusammenarbeit (GIZ) GmbH	2021-2022	16 700
Sustainability Performances, Evidence and Scenarios (SPES)	MIG	European Commission, DG European Research Council Executive Agency (ERCEA)	2023-2026	275 720
Demographic Trends and Implications for Children (CHILDFUTURE). The project aims to develop further data analysis and projections on demographic trends and generate content and cutting-edge data for 2024 edition of The State of the World's Children (SOWC)	MIG	United Nations Children's Fund (UNICEF)	2024-2025	111 305
The Demography of Sustainable Human Wellbeing (EmpoweredLifeYears)	SHAW	European Commission, DG European Research	2017-2023	980 117

		Council Executive Agency (ERCEA)		
Fair Pensions and Population Ageing (PenAgeing)	SHAW	European Commission, DG European Research Council Executive Agency (ERCEA)	2021-2022	150 000
Cognitive health in aging society – The role of context for cognitive functioning and related policy implications in Europe (CHIAS)	SHAW	Vienna Science and Technology Fund (WWTF)	2023-2027	209 540

Annex 2. Complete list of publications from January 2021 to May 2024

List of publications generated by PURE, total number of publications: 306.

1. Vashold, L. & [Crespo Cuaresma, J.](#) (2024). [A unified modelling framework for projecting sectoral greenhouse gas emissions](#). *Communications Earth & Environment* 5 (1), e139. [10.1038/s43247-024-01288-9](#).
2. Fu, X. & [Zimm, C.](#) (2024). [Towards a decent transport for all: The transport dimension of decent living standards for just transitions to net-zero carbon emission](#). *Multimodal Transportation* 3 (2), e100136. [10.1016/j.multra.2024.100136](#).
3. Szenkurök, V., [Weber, D.](#), & Bilger, M. (2024). [Informal and formal long-term care utilization and unmet needs in Europe: examining socioeconomic disparities and the role of social policies for older adults](#). *International Journal of Health Economics and Management* [10.1007/s10754-024-09378-z](#).
4. [Crespo Cuaresma, J.](#), Fortin, I., Hlouskova, J., & [Obersteiner, M.](#) (2024). [Regime-dependent commodity price dynamics: A predictive analysis](#). *Journal of Forecasting* [10.1002/for.3152](#).
5. [Yokomatsu, M.](#), [Schinko, T.](#), [Mochizuki, J.](#), & Rezai, A. (2024). [Climate-related Disaster and Human Capital Investment in the Global South — Household Heterogeneity and Growth](#). *Economics of Disasters and Climate Change* [10.1007/s41885-024-00150-8](#).
6. [Freiberger, M.](#), [Hoffmann, R.](#), & [Fürnkranz-Prskawetz, A.](#) (2024). [Should I stay or should I go: Modelling disaster risk behaviour using a dynamic household level approach](#). IIASA Working Paper. Laxenburg, Austria: WP-24-010
7. [González-Leonardo, M.](#), Neville, R., Gil-Clavel, S., & Rowe, F. (2024). [Where have Ukrainian refugees gone? Identifying potential settlement areas across European regions integrating digital and traditional geographic data](#). *Population, Space and Place*, e2790. [10.1002/psp.2790](#).
8. [Mintz-Woo, K.](#) (2024). [A directional dilemma in climate innovation](#). *Journal of Responsible Innovation* 11 (1), e2346972. [10.1080/23299460.2024.2346972](#).
9. Eusse-Villa, L., Bonardi Pellizzari, C., Franceschinis, C., Thiene, M., Borga, M., & [Scolobig, A.](#) (2024). [Identification of maladaptive behavioural patterns in response to extreme weather events](#). *Scientific Reports* 14 (1), e10563. [10.1038/s41598-024-60632-3](#).
10. [Hanger-Kopp, S.](#), Lemke, L., & [Beier, J.](#) (2024). [What qualitative systems mapping is and what it could be: integrating and visualizing diverse knowledge of complex problems](#). *Sustainability Science* [10.1007/s11625-024-01497-3](#).
11. Belfiori, E. & [Rezai, A.](#) (2024). [Implicit carbon prices: Making do with the taxes we have](#). *Journal of Environmental Economics and Management* 125, e102950. [10.1016/j.jeem.2024.102950](#).
12. [Yokomatsu, M.](#) & Hori, M. (2024). [Dynamic Programming of Firms' Activities and Market Interactions After a Disaster](#). In: *Application of High Performance Computing to Earthquake Related Problems*. Eds. Hori, M., pp. 449-478 World Scientific Publishing. [10.1142/q0432](#).
13. [Gaupp, F.](#) & [Eker, S.](#) (2024). [Climate Activism, Social Media and Behavioural Change: A Literature Review](#). IIASA Working Paper. Laxenburg, Austria: WP-24-007
14. McNaught, R., Nalau, J., Hales, R., Pittaway, E., [Handmer, J.](#), & Renouf, J. (2024). [Innovation and deadlock in governing disasters and climate change collaboratively - Lessons from the Northern Rivers region of New South Wales, Australia](#). *International Journal of Disaster Risk Reduction* 105, e104366. [10.1016/j.ijdr.2024.104366](#).

15. Caballero Reina, J., [Crespo Cuaresma, J.](#), Fenz, K., Zellmann, J., Yankov, T., & Taha, A. (2024). [Gravity Models for Global Migration Flows: A Predictive Evaluation](#). *Population Research and Policy Review* 43 (2), e29. [10.1007/s11113-024-09867-6](#).
16. Fenz, K., Mitterling, T., [Crespo Cuaresma, J.](#), & Roitner-Fransecky, I. (2024). [Climate, conflict and internal migration in Colombia](#). In: *Vienna Yearbook of Population Research*. pp. 1-22 Vienna, Austria: Vienna Institute of Demography. ISBN 978-3-7001-9476-7 [10.1553/p-8kaj-g8kb](#).
17. [González-Leonardo, M.](#), Rowe, F., [Potančoková, M.](#), & [Goujon, A.](#) (2024). [Assessing the Differentiated Impacts of COVID-19 on the Immigration Flows to Europe](#). *International Migration Review*, e01979183241242445. [10.1177/01979183241242445](#).
18. [Grass, D.](#), [Wrzaczek, S.](#), Caulkins, J.P., Feichtinger, G., Hartl, R.F., Kort, P.M., [Kuhn, M.](#), [Fürnkranz-Prskawetz, A.](#), Sanchez-Romero, M., & Seidl, A. (2024). [Riding the waves from epidemic to endemic: Viral mutations, immunological change and policy responses](#). *Theoretical Population Biology* 156, 46-65. [10.1016/j.tpb.2024.02.002](#).
19. Steel, D., Phillips, C., Giang, A., & [Mintz-Woo, K.](#) (2024). [A forward-looking approach to climate change and the risk of societal collapse](#). *Futures* 158, e103361. [10.1016/j.futures.2024.103361](#).
20. [Poledna, S.](#), [Strelkovskii, N.](#), Conte, A., [Goujon, A.](#), [Linnerooth-Bayer, J.](#), [Catalano, M.](#), & [Rovenskaya, E.](#) (2024). [Economic and labour market impacts of migration in Austria: an agent-based modelling approach](#). *Comparative Migration Studies* 12 (1), e18. [10.1186/s40878-024-00374-3](#).
21. [Link, A.-C.](#), [Hoffmann, R.](#), & Brenner, T. (2024). [The Tail End of Migration: Assessing the Climate Resilience of Migrant Households in Ethiopia](#). IIASA Working Paper. Laxenburg, Austria: WP-24-006
22. [Freiberger, M.](#), [Kuhn, M.](#), [Fürnkranz-Prskawetz, A.](#), [Sanchez-Romero, M.](#), & [Wrzaczek, S.](#) (2024). [Optimization in age-structured dynamic economic models](#). IIASA Working Paper. Laxenburg, Austria: WP-24-004
23. [Marois, G.](#), Gietel-Basten, S., [Crespo Cuaresma, J.](#), Zellmann, J.G., [Reiter, C.](#), & [Lutz, W.](#) (2024). [Measuring Human Capital with Productivity-Weighted Labor Force: Methodology and Projections for China, India, the United States, and the European Union](#). IIASA Working Paper. Laxenburg, Austria: WP-24-005
24. Bijak, J., Czaika, M., [Potančoková, M.](#), & de Vilhena, D.V. (2024). [New perspectives for migration foresight and preparedness: Insights from the QuantMig Project](#). *Migration Policy Practice* XIII (1), 34-40.
25. [Schinko, T.](#), [Karabaczek, V.](#), Menk, L., & Kienberger, S. (2024). [Identifying constraints and limits to climate change adaptation in Austria under deep uncertainty](#). *Frontiers in Climate* 6 [10.3389/fclim.2024.1303767](#).
26. Bento, N., [Grubler, A.](#), [Boza-Kiss, B.](#), De Stercke, S., [Krey, V.](#), [McCollum, D.](#), [Zimm, C.](#), & Alves, T. (2024). [Leverage demand-side policies for energy security](#). *Science* 383 (6686), 946-949. [10.1126/science.adj6150](#).
27. Blocher, J.M., [Hoffmann, R.](#), & Weisz, H. (2024). [The effects of environmental and non-environmental shocks on livelihoods and migration in Tanzania](#). *Population and Environment* 46 (1) [10.1007/s11111-024-00449-4](#).
28. Weber, K., Damyanovic, D., & [Thaler, T.](#) (2024). [Impacts of social contracts for citizens in the austrian flood risk management system](#). *International Journal of Disaster Risk Reduction* 102, e104266. [10.1016/j.ijdr.2024.104266](#).
29. [K.C., S.](#), [Dhakad, M.](#), [Potančoková, M.](#), [Adhikari, S.](#), [Yildiz, D.](#), [Mamolo, M.](#), Sobotka, T., Zeman, K., [Abel, G.](#), [Lutz, W.](#), & [Goujon, A.](#) (2024). [Updating the Shared Socioeconomic Pathways](#)

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