

ENGAGING DIVERSE GROUPS FOR BETTER POLICYMAKING

*Could using participatory approaches
encourage interaction and build trust
among decision makers?*

EXPLORING THE ECONOMICS OF CLIMATE CHANGE

*A look at how the impacts
of climate change can be
addressed and what it will cost*



THE GENDER DIMENSION OF SUSTAINABLE DEVELOPMENT

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could help find a way forward**

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FROM THE EDITOR

For most of us, 2020 has so far presented a range of unique challenges brought on by the COVID-19 pandemic. We are however grateful that we are able to present our readers with another edition of *Options* magazine despite these difficult circumstances and we hope that you will enjoy reading this issue.

In our cover feature, we take a closer look at the gender dimension of sustainable development, and explore whether a greater focus on women's empowerment could offer a way forward to ensure that we achieve a more sustainable future for all (pages 12-15). As we are fast approaching the institute's 50th anniversary, we also focus on a number of selected research highlights achieved through collaborative efforts between IIASA researchers and colleagues from member countries and partner institutions around the globe (18-19). Researchers at IIASA have embraced citizen science and co-design, not only as an integral part of many research projects, but also as a creative input into advisory processes. In one of our features, we explain how system analysts engage in, or even co-design and implement, processes that provide inclusive, effective, and informed policy guidance (pages 10-11).

If there are topics that you would like to see covered in coming issues of *Options*, or you would like to share your thoughts on an article you read in this issue, please feel free to get in touch with us via email.

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ABOUT OPTIONS

Options magazine features recent IIASA research and activities.

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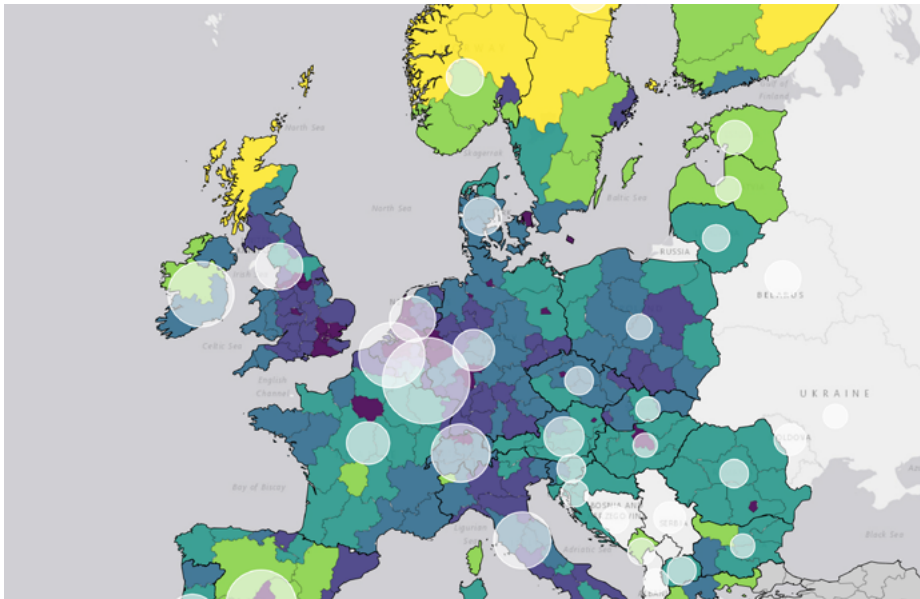
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News in brief



Visualizing regional indicators to help flatten the curve

IIASA researchers have been tracking the progression of the COVID-19 pandemic across Europe and have made available a series of user-friendly maps that visually explore a variety of demographic, socioeconomic, and health-related indicators to help inform decisions by health professionals, governments, and policymakers.

The rapid spread of the corona virus prompted many countries to institute drastic measures like shutting down public spaces, schools, and businesses, in an effort to limit mobility and human interaction. These measures are based on the premise that the less interactions there are among people, the slower the virus spreads, and the better the health care system is capable of handling it – or as this effect is now commonly referred to – “flattening the curve”.

As the EU is home to a large aging population, as well as considerable variations across regions with regard to economic development, different regions face different challenges in terms of the spread of the virus. The maps visualize indicators such as migration and population changes, average household income, tourism indicators, and the number of doctors and hospital beds available in each EU country in relation to confirmed cases of COVID-19 infections.

“To know whether measures are working and for how long they need to be kept in place, decision makers need information to help inform their decisions. As we find ourselves in an unprecedented situation, this information is not always readily available. This project aims to help fill this gap,” explains Asjad Naqvi, project lead and a researcher in the IIASA Advanced Systems Analysis Program.

The maps are compiled using selected indicators from the publicly available Eurostat database and are regularly updated to reflect changes in reported cases. The maps are available on a new interactive website that contains all IIASA research related to COVID-19.

By Ansa Heyl Further info: covid19.iiasa.ac.at and pure.iiasa.ac.at/16395

Asjad Naqvi: naqvi@iiasa.ac.at

TOWARDS A NEW ECOLOGY GROUNDED IN SYSTEMS SCIENCE

In their book *A New Ecology*, of which the second edition was just released, IIASA researcher Brian Fath and colleagues take an extended look at the application of ecosystem principles to environmental management. The authors argue that there is a need for a new ecology grounded in the first principles of good science that is also applicable for environmental management.

blog.iiasa.ac.at/Fath-19

FROM AWARENESS TO ACTION

Despite a high level of awareness of climate change and its impacts, people are often hesitant to change their behavior in everyday life. IIASA researchers explored how people’s worldviews affect their perceptions and willingness to act, and how understanding the diversity of worldviews could help policymakers and activists reframe the discussion around climate change mitigation.

www.iiasa.ac.at/news/Action-20

BALANCING THE COST OF AGING IN EUROPE

Europe’s aging population has long been a cause of concern for policymakers, as a large portion of the population above age 65 is assumed to imply an increase in a country’s future economic burden. According to a recent IIASA study, Europe could however largely avoid the expected negative impacts of aging by encouraging better labor force participation among educated migrants and the general population.

www.iiasa.ac.at/news/Ageing-cost-20

The importance and vulnerability of the world's water towers

Mountains and highlands are often called the Earth's natural water towers as they provide almost 1.6 billion people living in low lying areas with essential freshwater for drinking, agriculture, industry, and energy production. High mountain snow peaks and glaciers, and the natural biodiversity of these regions are an irreplaceable part of the global water cycle.

For the first time, 32 scientists from around the world, including IIASA, have assessed the planet's 78 mountain glacier-based water systems, ranked them in order of their importance to nearby lowland communities, and measured their vulnerability to future environmental and socioeconomic changes. The research, published in the journal *Nature*, shows that global water towers are at risk, in many cases critically, due to the threats of climate change, growing populations, mismanagement of water resources, and other geopolitical factors.

"The significance of mountain water supply for drinking water and food production is increasing, which casts a large uncertainty in many regions of the world facing melting glaciers and decreasing snow packs. Some of the vulnerable water towers are especially under pressure due to demands from population growth and alarming increases in downstream water use," explains study coauthor and IIASA Acting Water Program Director, Yoshihide Wada.

This research will help decision makers at the global and local level prioritize where action should be taken to protect mountain systems, the resources they provide, and the people who depend on them.

By Rachel Potter Further info: pure.iiasa.ac.at/16215

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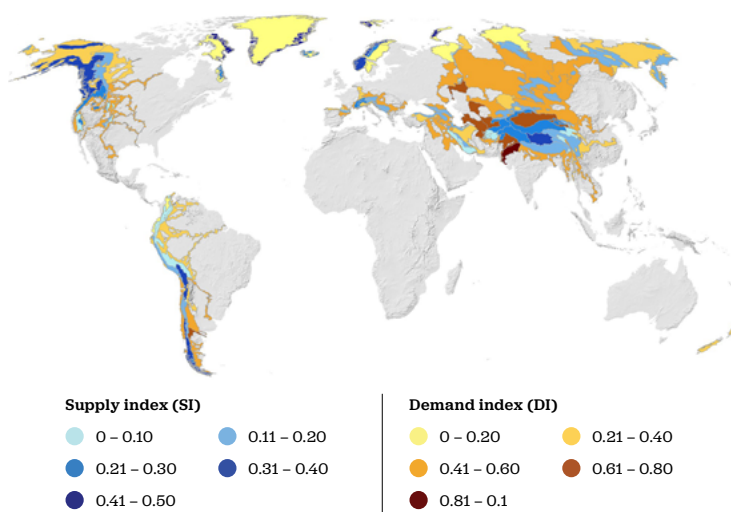


Figure: The Water Tower Units (WTU) SI (blue colourscale) and downstream DI (brown colourscale) for all 78 WTUs and WTU basins.



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Increasing opportunities for sustainable behavior

Every day we make choices in our lives that affect the environment. Understanding how human behavior is influenced by our habits, skills, attitudes, and environments is vital, given that we need radical change in human behaviors and cultures to alleviate climate change and protect our ecosystems.

Using a new computational method for simulating interactions between individuals and environments, an IIASA study explored how collective behavior patterns emerge systemically as a product of personal, social, and environmental factors. Researchers used Copenhagen, a city known for its well-developed cycling culture, as a case study to examine how changes in opportunities to behave sustainably – such as increasing the number of bicycle lanes in a city – affects the collective adoption of sustainable behaviors.

"The drastic effect that the physical environment, for instance, cycling infrastructure, has on our collective behavior patterns is surprising. The results show that even minor changes in the structure of the environment can trigger so-called "tipping points" or "phase transitions" in the collective adoption of sustainable behaviors like cycling. Reaching such tipping points is precisely what is needed to enact society-wide behavior change. We have to start designing our everyday environments in ways that make sustainable behaviors the default option and as easy as possible," says study lead author Roope Kaaronen, who worked on the research as a participant of the 2019 IIASA Young Scientists Summer Program. Kaaronen is currently a PhD student at the University of Helsinki's Institute of Sustainability Science.



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EXPLORING TROPICAL FORESTS' POTENTIAL AS GLOBAL CARBON SINKS

Tropical forest ecosystems are crucial players in the global carbon cycle as they take up and store large amounts of CO₂. IIASA research however shows that we will only be capable of providing accurate projections of future carbon sink-strength if we account for the complexity within ecological systems and what this means for atmospheric feedbacks, such as emissions of greenhouse gases further increasing global warming.

www.iiasa.ac.at/news/Carbon-sinks-20

THINKING SMALL FOR FASTER DECARBONIZATION

An international team of researchers collected data on a variety of energy technologies at different scales and tested how well they performed against nine characteristics of accelerated low-carbon transformation including cost, innovation, and accessibility. They found that low-carbon technologies that are smaller scale, more affordable, and can be mass deployed are more likely to enable a faster transition to net-zero emissions.

www.iiasa.ac.at/news/Granular-tech-20

MAPPING MALNUTRITION IN INDIA

Malnutrition remains a humanitarian crisis in India. Children growing up under such detrimental living conditions are more likely to perform poorly at school and be less productive later in life, thus hampering the country's future developmental outlook. IIASA research shows that the problem is concentrated in specific geographic areas, which could help policymakers working to address the issue.

www.iiasa.ac.at/news/malnutrition-20

Empowering the crowd to restore Indonesia's forests

For the tropical archipelago of Indonesia, which is home to some of the world's largest tropical forests, combining forest and landscape restoration with economic development that still heavily relies on agricultural expansion, poses a unique challenge. Addressing these issues requires vast amounts of high-quality data and analyses, as well as collective action to implement them. Systems analysis can provide an inclusive response by crowdsourcing the data required and thus empower the public to participate in identifying forest and landscape restoration potential.

To help model the impact of different restoration scenarios, IIASA teamed up with Indonesian partners under the RESTORE+ project to establish a national platform for participatory data collection campaigns in Indonesia. Urundata (in English, donate data) is a tailor-made crowdsourcing platform that allows communities to get involved in efforts to restore forests and landscapes through mobile applications and contribute to scientific assessments supporting policymaking efforts.

"The platform aims to make the collection of massive amounts of data possible and more efficient. By using their mobile phones, people can engage in data-generating activities in a number of campaigns related to landscape restoration potential. As different campaigns require different approaches, Urundata provides several mini-apps to crowdsource the needed data. People can choose what kind of topics they are interested in and provide information accordingly," explains Ping Yowargana, an IIASA researcher and science policy coordinator of RESTORE+.

According to Yowargana, an added benefit of the Urundata platform lies in the fact that the crowdsourced data collection allows people that would not normally be concerned with land use issues to get involved, thereby significantly raising awareness around conservation issues and increasing the chance for collective action among Indonesians.

Plans are underway to expand the usage of the Urundata app in addressing other complex sustainability issues in Indonesia.

By Ansa Heyl Further info: www.iiasa.ac.at/news/Urundata-19

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Using water to store renewable energy

The energy sectors of most countries are undergoing a transition to renewable energy sources, particularly wind and solar generation. However, these sources have seasonal variations and are intermittent. According to IIASA researchers, seasonally pumped hydropower storage (SPHS) could fill a critical gap and provide an affordable way to store renewable energy over the long-term, and support the transition to renewable energy.



SPHS, an already established yet infrequently used technology, means pumping water into a deep storage reservoir built parallel to a major river during times of high water flow or low energy demand. When water is scarce or energy demand increases, stored water is released from the reservoir to generate electricity. The study, published in the journal *Nature Communications*, is the first to provide a global, high-resolution analysis of the potential

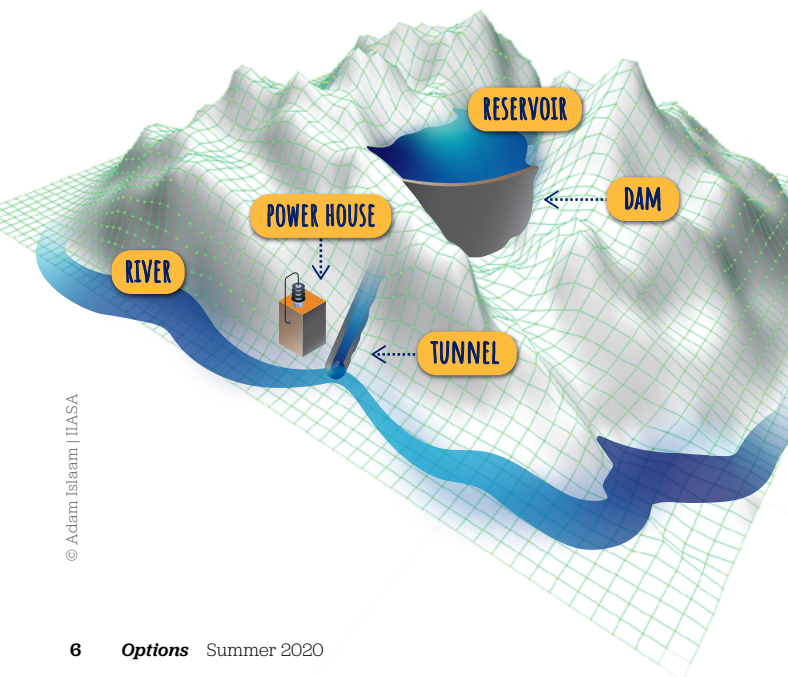
and costs for storing energy and water seasonally with SPHS, focusing on the locations with the highest potential and lowest cost.

The results show that compared with other mature storage solutions such as natural gas, there is considerable potential for SPHS to provide highly competitive energy storage around the world.

“With the need for a transition to a more sustainable world with lower CO₂ emissions, renewable energies and energy storage will play a major role in the near future. Given the vast untapped and cheap potential of SPHS, it will soon play an important role in storing energy and water on a yearly basis,” says IIASA postdoc Julian Hunt, the study lead author.

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Containing methane's contribution to global warming

Methane contributes to almost half of human-made global warming in the short-term. Keeping to the Paris Agreement of staying well below two degrees warming will require significant reductions to methane emissions in the period leading up to 2050. The many diverse sources of this greenhouse gas make it particularly challenging for policymakers to design strategies that will effectively reduce emissions.

IIASA researchers used the most recent version of the IIASA Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model to explore the potential and costs for lowering methane emissions relatively quickly in different countries and source sectors. The study found that within the 2050 timeframe, there is broad potential to reduce emissions with available technologies. The results provide detailed information on the possible global impacts and costs of various actions at the regional and sectoral levels that is useful to policymakers.

“There is no one-size fits all solution for the whole world. In the Middle East and Africa, for instance, oil production is a major contributor to methane emissions with relatively extensive potentials for emission reductions at low cost. In Europe and Latin America, dairy and beef production are the main sources with relatively limited technical mitigation potentials, while in North America it is emissions from shale gas extraction that can significantly contain emissions at a low cost. Our study illustrates just how important it is to have a regional- and sector-specific approach to mitigation strategies,” explains study lead author Lena Höglund-Isaksson.



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Vienna as a global hub for science diplomacy

In November 2019, IIASA cohosted the annual global meeting of science advisors to ministers of foreign affairs and other experts to discuss pressing issues in science diplomacy.

Using science to inform foreign policy is vital to furthering national interests and tackling shared global challenges. Climate change, as well as pandemics like COVID-19 impact everyone on the planet, regardless of international borders, and emerging digital technologies such as deep fakes and cryptocurrencies bypass national jurisdictions and create tensions between nations. National interests are increasingly entering international spaces previously governed by science, such as the Arctic, the deep sea, and outer space. Ministries of foreign affairs and diplomatic services around the world are being confronted with these issues, and including the methods and findings of science and technology into policymaking are part of a growing trend in foreign policy.

With this in mind, IIASA, the International Network for Government Science Advice (INGSA), the Austrian Federal Ministry of Europe, Integration and Foreign Affairs, the Diplomatische Akademie Wien (Vienna School of International Studies), and the Natural History Museum Vienna, jointly organized the global meeting of the Foreign Ministries Science and Technology Advice Network (FMSTAN) and the Science Policy in Diplomacy and External Relations (SPIDER) network. The two-day event was the largest since the founding of the network, and brought together more than 100 people at the intersection of science and diplomacy from around the world, representing governments and institutions from 50 countries.

Special Advisor to the UN Secretary-General on the Sustainable Development Goals (SDGs), Jeffrey Sachs, delivered an opening lecture highlighting the essential

role of science and diplomacy in achieving the SDGs, and emphasized the need for better collaboration with China to tackle climate change and other crises. Panel discussions focused on the role science has to play in international security policies and the challenges science diplomacy faces in the current geopolitical environment.

A range of thematic sessions addressed issues including the need for tech diplomacy in an age when the influence of technology companies has expanded to match, or even surpass, that of many nation states. Representatives from the European Space Policy Institute and the UN Office for Outer Space Affairs drew attention to challenges facing space diplomacy, emphasizing that the Earth's orbit is increasingly congested and competitive and can no longer be seen as an unlimited resource.

Martin Lees, the former Rector of the University for Peace of the UN, outlined the importance of systemic thinking in policymaking using the strategic partnership of IIASA with the Organisation for Economic Co-Operation and Development (OECD) as a case study.

"Against a backdrop of increasing global complexities, evidence-based information is vital for informed decision making in foreign affairs. The FMSTAN/SPIDER meeting demonstrated the extraordinary convening power of IIASA in the field of science diplomacy. We called, and science advisors to ministers of foreign affairs from across the world came to Vienna to discuss issues of joint concern, such as the SDGs and the impact of digital technologies," comments IIASA Acting Chief Operations Officer, Jan Marco Müller.

By Rachel Potter

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FMSTAN/SPIDER members and participants. © Mahmood | BMEIA



Jeffrey Sachs, Special Advisor to the UN Secretary-General on SDGs © Mahmood | BMEIA

Science into policy

By Katherine Leitzell

Systems analysis informs Arctic policy

Research undertaken by the IIASA Arctic Futures Initiative highlights new and emerging policy trends in the Arctic, a region on the frontlines of climate change, geopolitics, and global governance.

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The Arctic has long been seen as one of the Earth's most remote frontiers. Today however, the region is important in global governance, geopolitics, and the global economy — and it is changing fast. Temperatures have warmed faster than the rest of the planet; sea ice has dramatically declined in summers; and the exploitation of oil and gas, new (sea) trade routes, tourism, and other economic activities are expanding. At the same time, the region, which is claimed by eight states and inhabited by dozens of groups of indigenous people, has the potential for geopolitical stability and constructive cooperation — a precondition for largely international and multidisciplinary Arctic research.

IIASA research, conducted as part of the Arctic Futures Initiative (AFI), has brought a new systemic view on the environmental, social, economic, and political picture of today's Arctic. The project concluded in 2019 and culminated in a scientific report published in February. It provides a holistic analysis of current policies, strategies, and declarations of Arctic and non-Arctic states with interests in the region, as well as documents of indigenous peoples organizations.

The report, which was co-funded by IIASA and the Finnish Ministry of Foreign Affairs, considers how different Arctic actors define and address issues around the human dimension, governance, international cooperation, environmental protection, pollution, climate change, security, safety, economy, tourism, infrastructure, and science and education.

"This report delivers the first systematic and holistic analysis and synthesis of all the existing policies and strategies of the Arctic states and other relevant

stakeholders using quantitative and qualitative methods," says Lassi Heininen, former leader of the AFI project at IIASA and research director at the Institute for Atmospheric and Earth System Research (INAR) at the University of Helsinki. "As the Arctic is facing severe challenges, and the global Arctic has worldwide implications that affect the rest of the globe, it is important to include existing policies and strategies of non-Arctic states and indigenous peoples organizations in the analysis, and based on that recognize new trends."

New and emerging overall trends identified in the report include ambivalence about development in the Arctic, state domination rather than international cooperation, an increasing focus on science, and a heightened focus on the role of the Arctic in information technologies, satellite communication, and security.

The project team members and authors of the report say it is striking that the Arctic states clearly identify the economy and economic development, as well as either climate change or environmental protection, as priorities. By outlining these new and emerging trends of Arctic governance and geopolitics, the report will be useful to policymakers and researchers for further discussion in the context of different images and perceptions, and the dominant narratives of the Arctic.



Reference: Heininen L, Everett K, Padrtova B, & Reissell A (2019). Arctic Policies and Strategies—Analysis, Synthesis, and Trends. IIASA, Laxenburg, Austria. [pure.iiasa.ac.at/16175]

Further info: www.iiasa.ac.at/news/arctic-20

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Modeling Israel's energy future

By 2050, Israel's population is projected to almost double, expanding from 9 million to 17.6 million people, according to government projections. The country, similar in land area to Belgium, already has one of the highest population densities in the world. With the growing population density and impacts of climate change on temperature and water availability, Israel's energy system is expected to be stressed by greatly increased demand. At the same time, the country aims to significantly reduce greenhouse gas emissions, which demands a growing investment in renewable energy options.

In December 2019, IIASA researchers presented a new energy analysis to policymakers with the Israeli Ministry of Energy. The analysis, developed through a collaboration of IIASA and Israeli researchers, provides pathways to achieve needed energy capacity and emissions reductions at the lowest possible cost. Using the IIASA MESSAGE energy optimization model and Global Biosphere Management Model (GLOBIOM), Israeli researchers Ruslana Rachel Palatnik and Ayelet Davidovitch, and IIASA researchers Volker Krey, Matthew Gidden, and Keywan Riahi modified the framework to apply specifically to Israel's unique context.

The analysis presents four scenarios based on a range of policy options and climate and socioeconomic developments, thereby presenting Israeli policymakers with a useful set of options and analysis of needed investments as they plan for the future. The analysis will allow decision makers to better understand the costs, trade-offs, and potential consequences of their decisions for meeting targets in terms of both energy needs and climate change mitigation, enabling them to make more robust choices for the future of the country.

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DIGITAL FUTURES IN EURASIA

In December 2019, IIASA organized a workshop on "Connectivity in the Digital Age. Digital Futures of Trade and Economic Cooperation in Eurasia". This event brought together experts from relevant leading think tanks and international organizations to discuss how to promote connectivity, strengthen economic ties, and create new business opportunities through new technologies and digitalization.

www.iiasa.ac.at/events/Connectivity-19

DIGITAL TRANSFORMATION AND SCIENCE DIPLOMACY

A global digital transformation poses great economic opportunities, as well as serious challenges. In 2019, IIASA continuously contributed to deliberations by the Organization for Security and Co-operation in Europe (OSCE) on this subject. A side event was also organized at the 26th OSCE Ministerial Council in December to provide evidence-based input and different perspectives on how to promote economic cooperation, progress, and security in Europe and Eurasia through new technologies and connectivity in the digital era.

www.iiasa.ac.at/events/OSCE-19

IIASA-OECD REPORT INFORMS GLOBAL CHALLENGES

In February, IIASA and the Organisation for Economic Co-operation and Development (OECD) released a new report: Systemic thinking for policymaking: The potential of systems analysis for addressing global policy challenges in the 21st century. The report is the fruit of a strategic partnership with the OECD established in 2018, and provides timely insights into the value of systems analysis for addressing interconnected global economic, environmental, and health systems.

www.iiasa.ac.at/news/OECD-20

ENGAGING DIVERSE GROUPS FOR BETTER POLICYMAKING

How can system analysts engage in, or even co-design and implement, processes that provide inclusive, effective, and informed policy guidance? IIASA researchers are at the forefront of addressing this question.



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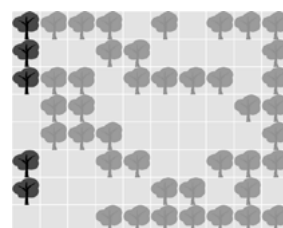
Engaging actors across governments, businesses, civil society organizations, and the public has become essential to informing the complex policy issues decision makers are faced with today. To this end, IIASA researchers are applying system concepts such as citizen science, smart games, role-playing, and policy exercises to support research and to aid stakeholders in co-designing and co-generating policy options that recognize the unique perspectives and knowledge of others, thus leveling the policy field so that stakeholders become partners in developing solutions.

“A benefit of these approaches is that the whole social learning process is really enhanced. Rather than researchers sitting behind their desks and trying to unravel a problem, we can interact with others and initiate a process of bidirectional learning, in other words, we learn what is relevant to the people affected by a particular problem or situation, while they can also understand how we see things. It’s really all about encouraging interaction and building trust to ultimately arrive at better decisions,” says Piotr Magnuszewski, an IIASA researcher who has experimented with innovative co-design methods and applications.

A role-playing exercise developed at IIASA to manage flood risk in a municipality plagued by

stakeholder conflicts and implementation stalemates, serves as a good example of the value of including the views of multiple stakeholder groups in decision-making processes. In this instance, the stakeholder participants dealt with simulated tasks on climate risk management at the municipal level by putting themselves in the shoes of their counterparts on the other side of the negotiations. By seeing the problems through the eyes of others, the participants were better able to co-generate compromise measures to deal with the escalating flood risk, and importantly, identify the ‘problem owners’ or the responsible institutions and persons that could help overcome the implementation gap.

In another study, the authors for the first time combined a gaming approach with cultural theory to shed light on the mechanisms that govern human-environment interactions when it comes to the sustainable use of common resources. The researchers designed a forest-harvesting game to see how awareness of additional risks affects the sustainable management of a resource. The objective was for participants to harvest trees to generate income, while the forest also served as protection against



© The Forest Game

floods, meaning that if rainfall intensity exceeded the size of the remaining forest, players would be subject to flood damage, thus reducing their payoffs. The findings highlighted the influence of shared benefits, communication, and individual worldviews on the outcome of players' decisions.

A variety of participatory approaches were also used as part of a project aimed at implementing measures towards regional energy transitions in Austria.

"This project's objectives included understanding diverse stakeholder motivations, clarifying strategic stakeholder interactions and institutional framework settings that contribute to policy implementation gaps, and identifying policy options that would enable and motivate stakeholders to take action," explains IIASA researcher Jenan Irshaid.

The team used a combination of in-depth stakeholder interviews, policy exercises, a game-theoretic model, and design-thinking workshops to encourage innovative ideas on how to overcome the associated challenges. The process enabled the participants to successfully identify key problems and possible pathways to problem solutions. Interestingly, the study also revealed that where decision makers were not actively involved, the implementation of innovative solutions did not lead to immediate action due to a lack of implementation capacities and political support.

In addition to the above, games and social networking are also being used to build a citizen scientists network that provides valuable data for expert-generated models and analyses. A large number of people have, for instance, participated in the IIASA game, Cropland Capture, validating more than 2.5 million km² of land cover data – an area half the size of the EU. Several other applications are also enlisting the help of citizens and other stakeholders to, among others, map deforestation, identify damaged buildings, and collect land-cover and land-use data across Europe.

Apart from those discussed above, a range of other participatory methods and tools to determine stakeholder preferences and aid robust evaluation in complex and uncertain multi-stakeholder policy contexts, such as multi-criteria decision analysis, qualitative systems mapping, and participatory scenario planning, have been successfully used in IIASA projects all over the world. Examples include the analyses of energy policy in the Middle East North African Sustainable Electricity Trajectories (MENA Select) Project; and the strategic planning of water resources and water infrastructure in Eastern Europe as part of a project undertaken by IIASA and the Organisation for Economic Co-operation and Development (OECD).

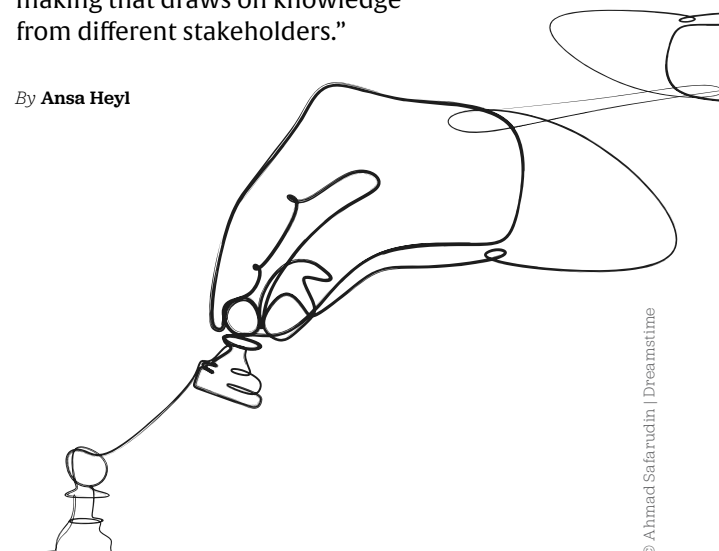
Researchers at IIASA have embraced citizen science and co-design, not only as an integral part of many research projects, but also as a creative input into advisory processes. According to IIASA researcher Leena Ilmola-Sheppard, the trust built between the institute and policymakers over the years is key to continued successful collaboration in terms of informing the decisions that will affect all of us into the future.

She says, "When policymakers are faced with a complex challenge, traditional research tools are often insufficient to serve their needs. IIASA researchers have developed close ties to decision makers at all levels and have advised them on a myriad of problems using participatory approaches. Continuous dialogue is however extremely important in this regard, especially in terms of reaching decision makers at higher levels of government, to enable informed decision making that draws on knowledge from different stakeholders."

By Ansa Heyl



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THE GENDER DIMENSION OF SUSTAINABLE DEVELOPMENT



Our world is in the midst of an economic transformation as labor upheavals and climate change wreak havoc on present sustainability models. Could a focus on women's empowerment help find a way out?

By Michael Fitzpatrick



Despite the recent ravages of plague, war, and pestilence, we humans still excel in one unceasing task — breeding. So much so, humanity is on course to squeeze nearly double the present number of people onto planet Sardine-Can by 2100. The COVID-19 crisis alone illustrates the alarming and increasingly interconnected nature of the challenges facing systems of government around the world. Putting systems thinking at the center of policymaking for a sustainable way forward will be essential in tackling such obstacles. Research at IIASA is exploring possible answers. The link between education and demographic change, for example — particularly women's education — is a promising and tantalizing solution to the question of sustainability. Nor is the institute alone in this thinking.

The UN identified that making women more socioeconomically involved in our world and more self-sufficient could help enormously with our economic, social, and environmental sustainability.

"Women and girls play a crucial role in the fight against climate change, and it is essential to make sure that this role is not only fully understood, but incorporated into the Sustainable Development Goals," says one UN report from 2018.

Several IIASA studies also link the empowerment and self-efficacy of women to increasing access to affordable, clean energy, as well as quality education, and future economic growth.

So many are agreed: it's time to recalibrate the gender imbalance for all our sakes. IIASA research is supporting policymakers by providing the evidence needed to make the argument that gender issues have impact.

"The higher the education, the higher their productivity, and the higher their contribution to economic wellbeing."

WOLFGANG LUTZ

THE POWER OF EDUCATION

Achieving sustainable outcomes as per the UN Sustainable Development Goals (SDGs) is probably a good start. When devising strategies for sustainable development in both developing and developed countries, IIASA has successfully pinpointed how increasing the self-efficacy of women, for instance, through education and workforce participation, will affect future population dynamics.

One such analysis links education and demographic change. The authors highlight how lifelong education strategies that take gender issues into account, starting from early childhood, can promote productive working lives and healthy aging.

"In general, what matters for the economic wellbeing of societies is the proportion of the total population that earns an income as part of the workforce. Not all people in the usual working ages 20–65 are, however, part of the workforce. At the same time the proportion of people above age 65 is increasing due to population aging," explains IIASA researcher Wolfgang Lutz who has been studying the intersection of demographics, migration, population, and education.

"Since the workforce participation of women is still rather low in southern Europe compared to northern Europe, there is still room for compensating the increasing number of pensioners through higher proportions of women participating in the workforce. The higher the education of the workers, the higher their productivity, and the higher their contribution to economic wellbeing," he adds.

MORE WOMEN IN THE WORKPLACE

Likewise, another team of IIASA researchers has been researching how migration, workforce participation, and education can balance the cost of aging in Europe.

The EU had been shaped by population growth, but now, thanks to longer life expectancy and low fertility, its population is aging. This new demographic frontier suggests that the burden on our social system will be too great to bear.

So how do we avoid overburdening our social system with population aging? The study agrees that getting more women into the workforce would be a good start.



***“...gender aware policies,
programs, and actions
are required to meet
multiple SDGs”***

SHONALI PACHAURI

“It’s important to reduce barriers that prevent women from having higher labor force participation. By doing so, previously economically inactive people can enter the workforce, thereby reducing the dependency ratio and mitigating consequences of population aging,” says study lead author Guillaume Marois, a researcher at IIASA and the Asian Demographic Research Institute of Shanghai University.

The study highlights the “huge reservoir of talent” women represent and their potential rising-tide-lifts-all-boats dynamism. Marois adds that stabilizing demography is a prerequisite for sustainability, while women’s empowerment is a key driver in stabilizing demography.

This new IIASA research shows that higher levels of education and expected increases in labor force participation (particularly among women) in both migrant and local populations will mitigate the financial challenges posed by aging populations in EU countries.

“Although demographic aging is unavoidable in Europe, our research shows that the fears associated with the coming economic burden have been unduly exaggerated. Conventional projections use the simplistic and inappropriate conventional age-dependency ratio, which assumes that everyone aged over 65 is not working and that everyone aged between 15 and 64 is equally productive,”

Marois explains. “With better labor force participation among migrants and the general population, Europe could largely avoid the widely expected negative impacts of aging.”

Conversely, the study also found that high immigration volumes combined with both low education and integration leads to increasing economic dependency.

The best policy options would be to match Swedish levels of workforce participation — the highest in the EU — and lift labor-force participation in the general population, particularly among women, while practicing education-selective migration accompanied by high integration.

It is clear that getting more women into the workforce could make European development more sustainable in terms of population dynamics, but outside of Europe, where there are arguably even more gender disparities, gender issues are having an even greater impact.

EQUALITY IN THE SPOTLIGHT

“We live in a world ridden with inequalities, some of which overlap,” notes IIASA researcher Shonali Pachauri.

One study exploring links between gender, energy, and poverty, she contributed to, found that increasing access to affordable, clean energy is also gender linked and addressing gender imbalances is a possible solution to persistent issues.

“The study, based on a five-year research program, brought out last year, highlighted certain key findings and recommendations. The most important of these is that gender aware policies, programs, and actions are required to meet multiple SDGs,” she explains.

The report emphasizes that while SDG5 separately recognizes the importance of gender equality from energy access addressed by SDG7, in reality energy access and gender equality are inextricably linked, and addressing them together can offer multiple development gains. The authors also point out the challenges and the triumphs of such policies, particularly in the Global South, where many gender-rebalancing projects are underway.



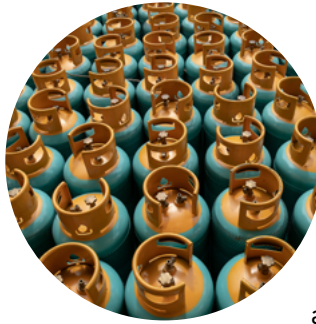
One project in Ethiopia perhaps typifies some of the work highlighted in the report. In the “Light for Eve” trials, thousands of girls are being given small solar-powered lanterns. These lamps are helping to stop child marriages and are changing the way girls are seen in rural areas. Instead of being sold off as child brides to bring income, girls are chosen to receive a rechargeable solar light. The lamp is used for light so girls can study at home at night, and they sell excess power to those who want to recharge their phones for extra income. This helps them become breadwinners, keeps them in school, and breaks the cycle of child-bride-births and poverty.

The study also revealed that energy policies that do not explicitly target women often result in inequitable access to energy services between men and women, and that the involvement of women as entrepreneurs and employees in energy-system supply chains – particularly in non-traditional roles – is a win-win situation.

Unfortunately, it is not all success stories on the march to women’s empowerment. As satirist H.L. Mencken once said: “For every complex problem, there is an answer that is clear, simple, and wrong.”

Efforts to address the multiple dimensions of sustainable development are challenging, as is illustrated by the well-publicized venture to replace the dirty-fuel burning cooking stoves of India with Liquefied Petroleum Gas (LPG). Recent research by the IIASA Energy Program looked at the adoption of LPG gas for cooking by rural communities in India.

The researchers found that despite the success of the LPG program, which reached a large number of low-income Indian households, many did not use LPG on a continuous basis, but continued to rely on biomass fuels as the predominant fuel for cooking, using LPG sparingly or only for specific purposes such as making tea and snacks.



In addition, the capital cost subsidies through India’s Ujjwala (Bright and Lustrous) cooking gas program, which is a policy specifically directed at women, helped promote rapid adoption of LPG gas, but not regular use. The authors concluded that unless women are empowered to make decisions about the fuels and stoves they use, just providing the stoves for free or through loans to women, does not ensure they will continue to use them.

Women may be key agents in supporting low-emissions development, but perhaps the above studies more importantly show that if women are properly equipped with skills and knowledge they can make an equal contribution in the sustainable development of the world.

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EXPLORING THE ECONOMICS OF CLIMATE CHANGE

Climate change not only poses a threat to the planet and to people, it is also affecting economic stability. IIASA researchers are investigating how this can be addressed and what it will cost.



A decade ago, three of the world's great wheat-growing regions were struck, in the same year, by separate weather disasters. Russia endured a heatwave that affected over a third of its cultivable land. Harvest rains reduced Canada's wheat quality to that of animal feed. In Western Australia, intense drought shrank wheat production.

Normally, regions buffer each other. But this time, multiple failures led to export bans. Prices spiked.

Hunger, a disaster in itself, can have knock-on effects such as political unrest and migration. It would therefore be useful to know whether, as climate changes, extreme weather will increasingly affect multiple places at once.

IIASA researcher Franziska Gaupp has shown that this is already happening. Gaupp's research is part of a growing body of IIASA research that can help policymakers and communities take the right action in response to climate change as it gathers pace, increasingly puts pressure on systems, and threatens survival.

Gaupp gathered rainfall, temperature, and solar radiation data going back to 1967, as well as soy, maize, wheat, and rice yield data for the major agricultural breadbaskets of the world. She found that the likelihood of the weather being bad enough to impact crop yields in more than one place has increased over time.



For example, the chance that wheat crops would fail simultaneously in the breadbaskets she had chosen was 0.3% before 1990 and 1.2% afterwards; while the chance of wheat failing in three or four breadbaskets in the same year rose by 16%.

It wasn't all bad news, however. Simultaneous outbreaks of extra solar radiation boosted rice harvests around the world between the two periods, reducing the chances of multiple failures from 21% to 12%.

This trend is likely to continue. Gaupp modeled the chances of simultaneous failures under global temperature rises of 1.5°C and 2°C. A cap at 1.5°C reduced the risk of multiple failures by about a quarter for each crop.

Gaupp says the work should help governments and businesses identify risks and refine contingency plans.

"Climate has an impact on yields, and then this impacts prices; prices can have policy implications like trade bans or a change in policy towards crop storage, while huge price spikes can become a humanitarian crisis," she says.

The impacts of climate change can't always be expressed in economic terms, but one advantage of assessing the financial impact is that it helps determine whether it is cheaper to cut emissions and take adaptive measures – or to do nothing, and just absorb the cost of the damage.



To answer this question, researchers must include in the same model the costs of cutting carbon emissions (mitigation), adaptation, and building climate resilience, as well as the cost of the destruction that will ensue if we do none of these things, and the residual damage that will happen even if we do. IIASA researcher Thomas Schinko led an international research team costing the potentially huge financial impacts of coastal flooding due to rising seas. The problem is that the cost of fighting coastal flooding is also high in terms of cutting emissions, and building defenses and resilient infrastructure.

“Sea level rise is one of the highest climate-related risks because you have so many effects related to it, like coastal erosion, flooding, storm surges, and the intrusion of salt water into agricultural land,” says Schinko.

The team used different economic models to compare two scenarios – the costs to global GDP of coastal flooding and storm surges if the world invests in capping temperature rise below 2°C; and the same costs if current policies continue and temperature rises further. At the same time, they considered the effect on GDP of building dykes along the world’s coastlines.

In the first half of this century, capping temperature makes little difference to the economic burden of coastal flooding. Adaptation, however, more

than pays for itself, with GDP suffering more if we don’t adapt than if we do.

The picture however changes dramatically after 2050, when strong mitigation and adaptation leave us better off economically in the decades leading up to 2100 than doing nothing. In GDP terms, it’s a global loss of 0.5% compared with 4%.

“We have to think long-term but act swiftly” — Thomas Schinko

“The problem with this kind of conclusion is that it assumes that the people of today care about the people of 2100. If you are short-term orientated and you say: I don’t care about climate change beyond 2050, then you have a high “discounting rate” and you are blind to the need to mitigate. If you do care about the future, then in the extreme case, what happens in 2100 has equal weight for you as what happens next year. Most people lie somewhere in between,” comments IIASA researcher Fabian Wagner.

It matters because it influences political decisions about fighting climate change. Modelers can help by putting assumptions about how much the average person socially discounts the future into economic models. For example, a model could be asked what needs to be done now to ensure that the people of 2100 have sufficient food.

Wagner and his team found some deficiencies in current models. Population projections, for example, have not taken account of the dawning realization that fertility is not declining as swiftly as anticipated in sub-Saharan Africa.

By refining inputs such as these, the group has shown that, even to ensure a minimal level of economic welfare for the people of 2100, we need to cut our emissions far more aggressively, accelerate human and economic development, and reduce fertility levels.

“If we make the demographic transition quickly,” says Wagner, “we can spend less on climate mitigation.”

By Aisling Irwin

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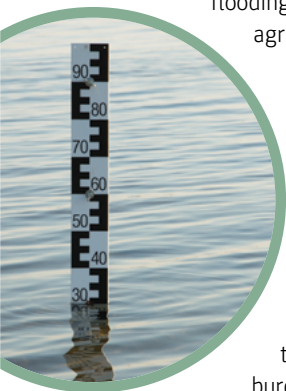
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REGIONAL IMPACTS

IIASA researchers collaborate with colleagues from member countries and partner institutions around the globe to develop holistic, systems-based solutions and provide policy advice for some of the most pressing problems society face today.

The Systems Analysis and the **AMERICAS** regional conference in Rio de Janeiro looked at challenges shared by countries in the region and how systems analysis can address them.

Researchers investigated the determinants of different types of capital flows to **MEXICO** and the impact of shocks on each component of the financial account for the Mexican Balance of Payments.

The first US Aging Data Sheet presented traditional and new measures of aging for all **US** states.

A study showed that female yellow perch in Lake Erie, **US**, may be rapidly evolving delayed maturation since harvest was relaxed in the late 1990s. The results provide a rare example of evolutionary bounce-back.

A course on policy planning in aging societies and population projections was held in Bangkok, with participants from **CHINA, INDONESIA, and THAILAND**.

Engagement with multiple stakeholders in **CHINA, JAPAN, and MALAYSIA** resulted in the development of a regional water resources assessment model to build capacity and a research- and policy framework.

The results from a collaboration with researchers in **CHINA** showed that a global power grid could help unlock remote renewable energy resources and reduce greenhouse gas emissions.





Government on the design of a program that provides liquid petroleum gas access for clean cooking in rural **INDIA**.



Researchers contributed to the land use sector assessment in the Low Carbon Development **INDONESIA** (LCDI) Report, launched by the Ministry of National Development Planning.



Collaborating with the **KOREA** Environment Institute, researchers used participatory research methods to operationalize climate risk management with a focus on disaster risk management and climate adaptation.



The BeWhere **MALAYSIA** model, developed with the Universiti Teknologi Malaysia, was used for bioenergy policy assessment for the country.



Researchers investigated cooperation opportunities in **GREATER EURASIA**, including the impact of digitalization, the potential to enhance the economic ties, and fostering dialogue among stakeholders.



The risk of large-scale arboviral outbreaks in **EUROPE** resulting from the spread of a specific mosquito species due to climate change was highlighted in a study.



A citizen science mobile app was launched to gain insights into the use of urban green spaces in **AUSTRIA**.



An **ISRAEL** version of the Greenhouse Gases – Air Pollution Interactions and Synergies (GAINS) model is being implemented in collaboration with the Israeli Ministry of Environment, to support the development of cost-effective pollution control policies.



Studies for the **SWEDISH** Environmental Protection Agency investigated the trade-offs between forestry and moose populations, and the risks and mitigation options for chronic wasting disease, which poses a threat to the country's wildlife.



A regional conference co-hosted with South African partners focused on the transformative uses of systems analysis to address regional challenges in **AFRICA**.

RC



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Climate adaptation lessons learned from the Cape Town drought

A mere century ago, the vast majority of the global population lived in rural areas. Today, however, more than half of all people live in cities.

As people continue to flock to cities, the need for adequate water and sanitation infrastructure will become more important than ever before. Nowhere has this pressing need been documented more extensively than in South Africa.

The city of Cape Town is an excellent case study for efficient water supply as it has seen a rising influx of people. Since 2015, the city has faced a long period of severe drought, largely due to climate change. By mid-2017, the city faced an existential threat of running out of water.

Luckily, this day never came, but the crisis exposed vulnerabilities in the city's water supply system. Moreover, it became an example on the world stage for how cities—especially those in the Global South—can enhance governance around climate change adaptation. In a recent study, IIASA Risk and Resilience Program researcher Wei Liu, interviewed two researchers that have devoted years to studying the Cape Town drought.

“It is clear that the responsibility for water issues can no longer only be the remit of government,” explains interviewee Gina Ziervogel. “We need to build systems and relationships of mutual accountability for effective water management between spheres of government, enhance horizontal management between municipal departments and entities, and strengthen leadership and the capacity to enable flexible and adaptive decision-making.”

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Using modeling to plan for agricultural production increase in South Africa

South Africa is one of the world's leading producers and exporters of agricultural products. Roughly one in ten South Africans are employed in the agriculture sector, with total export earnings topping US\$10 billion in recent years.

Despite this, around 10% of households in the country experience hunger. With the population set to grow significantly and also get richer over the next three decades, South Africa will need to find a way to not only increase agricultural production, but also ensure access to food for all citizens.

In a recent research report, IIASA Water Program researchers Günther Fischer and Sylvia Tramberend modeled projections for the South African agricultural sector through 2050. The study found that during this time, the nation's population will grow by 10 to 17 million people. Additionally, per capita income will increase by 150 to 200%. This income increase will likely result in dietary shifts towards healthier options, like vegetables, fruits, and livestock.

According to these models, South Africa has the resources to increase production to meet rising demand. However, sustained growth is heavily dependent on careful planning and water use for irrigation.

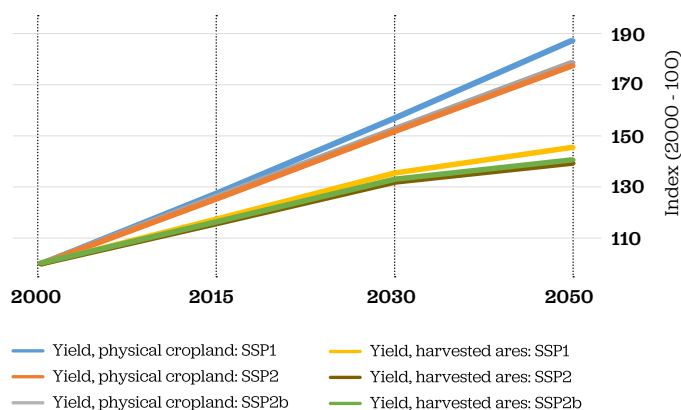
“South Africa is a good example of complex system linkages having an effect on food security,” explains Fischer. “While increasing agricultural production is a prerequisite, sustainable development must also ensure access to healthy, high-nutrient food options for all citizens. It is important that policymakers take the guidance of systems analysis models into account when planning for food security over the coming decades.”

Further info: pure.iiasa.ac.at/15796

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Productivity increases 2000-2050, per scenario: Scenario implementation and simulations using IIASA World Food System model.

Analyzing US trade interdependencies using the Food-Energy-Water Nexus concept

Trade between nearby states in the US is mutually beneficial and is at the heart of interstate commerce. However, growing concerns over natural resources make interstate food transfers prime for analysis. Groundwater aquifers are, for instance, often shared by vast regions and increasing reliance on these water sources immediately impact agriculture and trade for all nearby states.

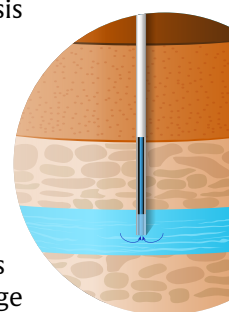
In a recent study, Advanced Systems Analysis Program researcher Nemi Vora and her coauthors used systems analysis methods to measure trade interdependencies between states. Using pointwise mutual information (PMI), the team measured expected trade versus statistical expectations based on the structure and flow of trade networks. They found that overreliance on common aquifers for irrigation poses a threat of water shortage for food supply in Texas and neighboring states.

Additionally, the study found that states with ample water resources rely on fossil fuels like diesel and gasoline for irrigation. This means avoiding water scarcity will require a potential tradeoff between resources needed to procure water for irrigation and investing in equipment that will reduce emissions.

"Our current food supply chain is often not optimized for using available natural resources," explains Vora. "Systems analysis methodologies, such as combining PMI with environmental life cycle assessment can provide a quick estimate of alternative options given current trade, without going into detailed economic models, and help policymakers continue to meet these demands in ways that are both sustainable and environmentally friendly."

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Exploring biofuels without increased deforestation

Biofuels are often considered essential for meeting increasing energy demands while reducing global greenhouse gas emissions. However, long-standing concerns have moderated the perception of their efficacy, as clearing native vegetation to grow biofuel crops leads to significant carbon emission increases, sometimes even more than traditional fossil fuels.

In the 1970s Brazil embraced biofuels and consequently established itself as the global leader in biofuel production, until the US launched its own program in the early 2000s. Future demand may however lead the country to increase its sugar cane plantations by a further 5 million hectares by 2030.

As part of a Young Summer Scientists Program project, IIASA researchers modeled potential increases in ethanol production with respect to key influencing drivers, such as population growth and energy efficiency. They found that increased sugarcane production could be done largely in pasturelands and natural vegetation areas. As such, the study shows that Brazil could increase production without significantly affecting food production or increasing deforestation. However, the changing political landscape could reduce environmental protections that are vital to sustainable biofuel production in Brazil.

"Biofuel policies have triggered very legitimate concerns in terms of sustainability," explains Hugo Valin, a researcher in the IIASA Ecosystems Services and Management Program. "Sugar cane is one of the most efficient ways to produce ethanol, and land use change impacts should remain limited in the case of Brazil. However, we must remain vigilant as Brazil's political context is constantly changing and it remains to be seen if environmental safeguards will be maintained."

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A systems approach for measuring disaster and climate resilience pays off

Despite the benefits of reducing disaster risk, many policymakers remain unmotivated to invest in risk reduction efforts before the next event occurs. A systems approach to disaster and climate resilience measurement that accounts for short-term development co-benefits in addition to longer-term risk reduction can show a way forward.

The Risk and Resilience Program recently created such evidence in collaboration with the Flood Resilience Alliance to inform the Asian Development Bank. A study by researchers Finn Laurien and Adriana Keating, builds on the Flood Resilience Measurement for Communities (FRMC) tool that assesses community-level resilience. For a subset of 88 communities in Asia, the study shows that a systems approach to investing in risk reduction positively impacts broader development efforts. For example, proper waste management can help in a disaster but also in day-to-day life.

A related study by Reinhard Mechler and Stefan Hochrainer-Stigler of the same program examined whether a broad range of decision-support tools is appropriate for measuring risk reduction benefits and co-benefits, creating development opportunities, and unlocking development potential. In addition to further collating such “multiple dividend” evidence, the authors found that the need to truly support participatory resilience decision-making is increasingly being acted upon.

“Our studies highlight the importance of taking a systems approach to measuring resilience for effectively tackling the underlying drivers of risk and for building longer-term resilience,” explains Laurien. “The evidence, decision tools, and processes are there. Policy and implementation should follow.”

Further info: pure.iiasa.ac.at/16137 / pure.iiasa.ac.at/16224

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Accurately modeling emissions reductions in China's steel industry

Researchers from the IIASA Air Quality and Greenhouse Gases, and Water Programs are working to reduce emissions, and energy and water use, while still meeting material demand. Integrated Assessment Modeling (IAM) is one of the primary tools researchers have for forecasting the consumption of these resources, as well as emissions of greenhouse gases and air pollution on a meaningful scale.

The MESSAGEix model is one of the more accurate types of these models, while others often fail to take into account the complexity of manufacturing sectors. The result is incomplete data that does not address linkages across subsectors and is therefore unrealistic and not helpful for informing policy.

IIASA researchers integrated a Material-Energy-Water Flow analysis and a nexus approach into the MESSAGEix model to analyze China's iron and steel industry. The results showed that energy efficiency measures and structural changes in the country's steel industry will have large positive effects on material, energy and water use, as well as reductions of carbon emissions, but will have a negative effect on atmospheric particulate matter emissions and water withdrawals.

“It is necessary to improve state-of-the-art IAM to further improve the representation of demand subsectors with process scale and associated interactions across subsectors at national, regional, and global scales,” said study lead-author Shaohui Zhang. “The tradeoffs and co-benefits of energy and resource efficiency, climate, and air quality must be taken into account. It is our hope that policymakers will consider nexus effects when designing plans to achieve multiple targets.”

Further info: pure.iiasa.ac.at/15938

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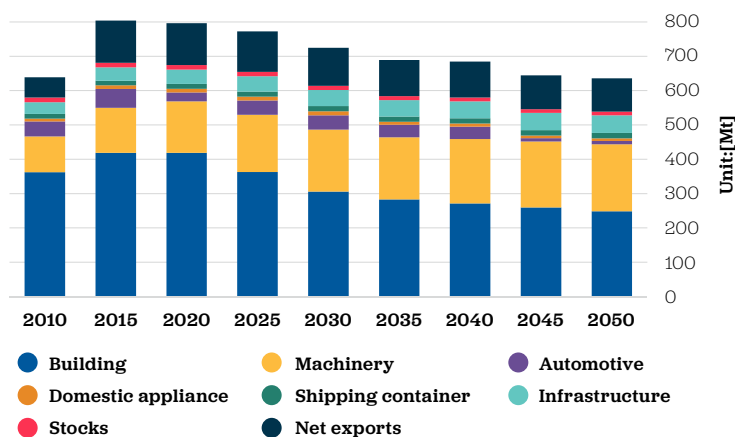


Figure: Steel demand and production from 2010 to 2050.

Using dynamic modeling to reduce acidification

Most countries around the globe are looking for effective ways to reduce nitrogen and sulphur emissions. Over the last two decades, researchers have utilized the concept of critical loads to analyze air pollution inputs to model corrective protocols in Europe.

More recently, researchers developed the concept of target loads, which is an extension of the critical loads concept that allows researchers to define depositions of nitrogen and sulphur, as well as the target year for when chemical limits will no longer be violated.

In a study by IIASA Air Pollution and Greenhouse Gases researcher Maximilian Posch and colleagues, the authors used target loads to model acidic deposition in 848 lakes across Finland, Norway, Sweden, and the UK. They found that in the majority of these lakes, the critical limit would be achieved by 2050. However, current protocols would not ensure that nearly a quarter of these lakes recover from acidification over the next three decades. Additionally, the results show that target loads can be used effectively on a large, regional scale, and can inform effects-based emission reduction policies.

“Much has been done over the last three decades to reduce sulphur and nitrogen emissions in Europe and North America,” explains Posch. “Nevertheless, sensitive ecosystems still suffer from the deposition of nitrogen and sulphur. To help targeting and timing of further emission reductions, appropriate indicators are needed to characterize the sensitivity of ecosystems.”

Further info: pure.iiasa.ac.at/15898

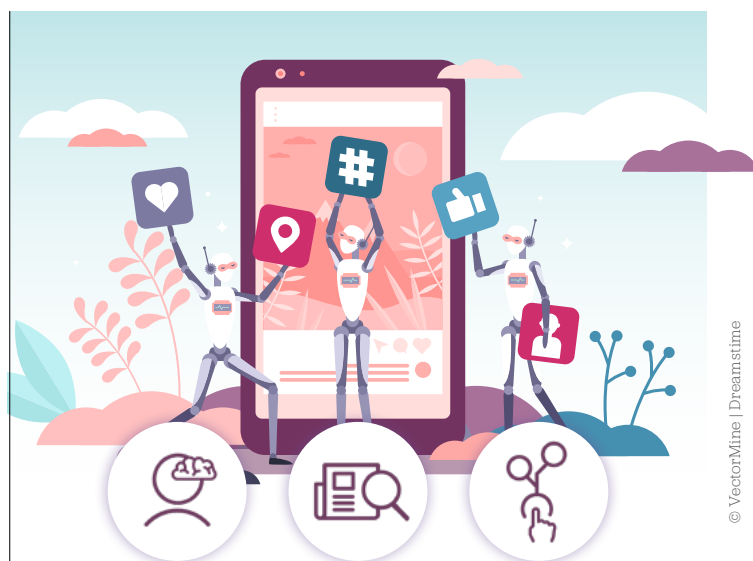
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Employing artificial intelligence to address misinformation about migration on social media

Social media and the internet ushered in a new age of connectedness and access to information. What people did not anticipate, however, was that these platforms could easily be manipulated to willingly or unwillingly spread false information. Misinformation, rumors, and fake news can shift public opinion, create preconditions and prejudices, influence risk perceptions, and lead to social conflicts, especially around polarizing topics such as migration.

The solution to this problem, then, must involve raising awareness about the prevalence of misinformation and promoting a culture of critical thinking. This is precisely the goal of Co-Inform, a joint project between IIASA and seven European countries, funded by the European Union. The project's goal is to create tools like browser plugins and fact-checking dashboards to help promote critical thinking and digital literacy.

This can however be an uphill battle. Misinformation targets the emotional part of our brains where it triggers strong reactions. Corrective information is based on logical thinking, which is far less passionate. This means that the spread of misinformation can be very quick, while the truth can take much longer to reach people.

“Misinformation is not a new phenomenon,” explains Advanced Systems Analysis Program researcher Nadejda Komendantova. “However, nowadays, it is facilitated by new technologies and the global reach of the internet. It is essential to address this phenomenon and to provide major stakeholders, including policymakers, journalists, and citizens, with tools to address misinformation and the preconditions and prejudices that directly trigger social conflicts.”

Further info: www.iiasa.ac.at/Co-Inform

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John Handmer, Senior Science Adviser in the IIASA Risk and Resilience Program and Emeritus Professor with RMIT University's School of Science in Australia, writes about the devastating impact of the Australian wildfires.



© Bushfire & Natural Hazards Cooperative Research Centre (CRC), Australia

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What implications do the Australian wildfires hold for the world?

The Southern Hemisphere summer's Australian wildfires received extensive and continuous media coverage – right up until it was displaced by the coronavirus outbreak. This coverage documented their devastating impact on people, communities, economies, as well as the ecology and ecosystem services. A striking aspect of the fires is that they kept burning for months, growing in size and number. Very large areas were badly damaged, with broader health impacts from severe smoke pollution and interruptions to normal economic activities in the affected areas. Post-fire surveys indicate that about half the Australian population was directly impacted by the fires. There has also been significant political fallout from the perceived lack of national leadership, both in terms of the fires, and in tackling climate change.

But what are the real implications of these fires for the world? Below, I highlight a few that are of immediate concern, but which are also harbingers of what lies ahead.

The long lasting and extensive nature of these fires in an environment already badly stressed by heat and drought, resulted in damage to local ecosystems, as well as to the Earth system as a whole. Some of this might be irreversible, and it is probable that many critical habitats will be permanently reduced in size, likely reducing global biodiversity.

There are also more direct global environmental implications. Some 400 million tonnes of CO₂ has been emitted. Even though fires have generally been seen as carbon neutral due to post-fire regrowth, there is doubt about this for these fires because of their intensity. In any case, climate feedback in the form of increased

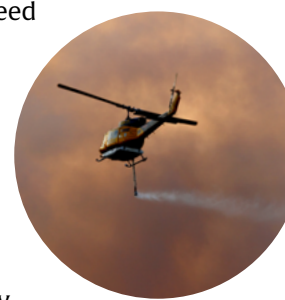
heating from the surge in CO₂ is expected. Another global, or at least Southern Hemisphere impact is the effect of smoke and soot on increasing glacial melt and ocean acidification.

In terms of strategic implications, some climate scientists argue that the record-breaking drought, heat, fires, and smoke are what the world can look forward to with global heating. Richard Betts of the Hadley Centre suggests that it could represent a “normal” summer in a 3°C warmer world. As we can do little about climate change in the short term, we need to adapt to the impacts.

A major challenge in adaptation concerns how risk can evolve. The fires demonstrate how a seemingly straightforward hazard like wildfire, can transform into a complex cascading, and potentially systemic risk.

Changing risk likely requires a change in approach. Australia's approach to wildfires relies on volunteers and expands capacity by importing fire fighters from overseas. Australian and foreign military personnel are also involved. This internationalisation represents a positive cooperative attitude to be encouraged and expanded – such resource sharing is in fact long established in Europe. However, the future is likely to see an increasing number of long running, complex, cascading events, where the existing top-down model will need to be complemented by an approach that incorporates local capacities, livelihoods, and economies.

John Handmer: john@iiasa.ac.at



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Interview

Q&A with Alena Rybkina, Vice-President of the Committee on Data of the International Science Council (CODATA) and Deputy Director for Development of the Geophysical Center at the Russian Academy of Sciences.

Building the foundation for a world of open data and open science

Q What are open data and open science, and why are they important?

A There is growing recognition that data is key to addressing global challenges. Imagine what the world could be like if we shared our data. I am a researcher and a geologist. During my PhD research, I collected a large volume of data, but there was no advice on how I should manage it. If I had had access to all the data sets in my particular field, it would have had a significant impact on what I could accomplish scientifically. If researchers around the world could avoid overlapping efforts collecting data, we would have the beginnings of a new generation of science. Improved data access would dramatically improve researchers' efficiency and productivity. However, moving to a fully open data system is of course a very complex undertaking, both because cultural change is required and because available data cannot always be freely available for a variety of reasons.

Q How did the initiative between IIASA and CODATA originate?

A The CODATA task group on systems analysis was created one year ago for a two-year period. The principle goal is to build connections between CODATA and IIASA. We also hope to jointly publish our collaborative efforts by the end of the year.

The group was successful in bringing together the right people from CODATA and IIASA to lay the foundation for a new data world.

To quote Alexei Gvishiani, the Chief Scientist and Chair of the Scientific Council of the Geophysical Center at the Russian Academy of Sciences and former IIASA

National Member Organization Council Member for Russia: "Systems analysis is the mathematics of big data." This is why CODATA and IIASA need one another.

Q Can you share the impacts you hope open science and open data will achieve?

A Access to open data and open science will allow researchers to evaluate data faster, act faster, and provide solutions faster. We are currently establishing data principles and best practices, in order to establish a new approach. It is important to mention that moving forward will also require a mindset change in how researchers look at data. The aim is to start discussing this with young scientists. If they start considering how to improve the management of their data, keeping in mind the goals of an open data world, this would change science. This is why we are promoting open data. We have a new generation of scientists, and in the future, we will have many new data sets, but we also have a wealth of existing data sets that we must manage properly, because science is based on the history of observations.

By **Monika Bauer**

Message from the director

“ We are living through challenging times. In a few months, the coronavirus infected millions of people globally.

Many governments restricted travel and around a third of the world was under some form of lockdown. Schools were closed, factories shut, events cancelled. Unimaginable scenes of deserted streets in big cities became a reality in this globalized world. The coronavirus pandemic is a global crisis, but it has shown us that it is possible to make drastic, ad-hoc changes and economic sacrifices to save lives.

Governments, scientists, and the public have to work together to eradicate the virus. The IIASA remit is exactly that: Help governments and stakeholders around the world to produce effective, science-based policies that enable them to face global problems. I am particularly proud of the institute's contribution to important and time-sensitive coronavirus-related research: The website covid19.iiasa.ac.at brings together all our researchers' work on the subject, including blogs and publications. This also shows that despite the strange reality we found ourselves in, the institute continued to move forward.

Following the Austrian governments' guidance, which implied that social distancing is of the utmost importance, the IIASA premises in Laxenburg were closed, but the institute remained operational via remote working. With the support of our Information and Communications Technologies Department, there were virtual executive, science leadership, and operations committee meetings, as well as numerous science engagements and staff consultations. However, not just work-related meetings took place online. The IIASA community set up internal groups on WhatsApp and other platforms to exchange information and provide each other with mutual support. The first half of 2020 has been a test for us all, but I am happy that the IIASA family has responded in an exemplary fashion.



ALBERT VAN JAARSVELD



2019 YSSP participants

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Awards for aspiring young scientists

Four researchers from the 2019 Young Scientists Summer Program (YSSP) have been recognized for their exceptional papers. Felicia Chiang from the University of California, Irvine, USA, won the IIASA Peccei Award for her analysis titled, Concurrent temperature and precipitation shifts in historical and historical natural-only model simulations. She will be returning to IIASA to continue work on her study. Nicolas Choquette-Levy from Princeton University, USA, received the IIASA Mikhalevich Award for his study on the impact of risk sharing mechanisms on smallholder farmer climate adaptation strategies.

The Peccei award is named in honor of IIASA alumnus Aurelio Peccei and recognizes policy-related research, while the Mikhalevich Award, named after IIASA alumnus Vladimir S. Mikhalevich, acknowledges mathematically and methodologically oriented research. The winning papers were selected by a committee comprised of one member from each IIASA program based on their outstanding quality, originality, and relevance.

Fellow YSSP participants Roope Kaaronen from the University of Helsinki, Finland, and Rory Gibb from the University College London, UK, received honorable mentions from the committee for their work. Kaaronen analyzed the cultural evolution of sustainable behaviors, and Gibb's study focused on interacting effects of land use, climate, and socioeconomic change on Lassa fever in West Africa.

"A lot of global change models have been developed at IIASA, so participating in the YSSP has been a great opportunity to work with experienced scientists on simulations of the global environment, and getting to know them personally," says Gibb.

Further info: www.iiasa.ac.at/yssp/awards

IIASA announces new appointments

Recent structural changes at the institute will bring fresh perspectives and continue to ensure that IIASA research stays at the forefront of scientific endeavor. The changes reflect the institute's focus on strengthening operational effectiveness and its vital role in capacity building.

CHRISTIANE POHN-HUFNAGL APPOINTED CHIEF OPERATIONS OFFICER



Photographs: © Matthias Silveri | IIASA

Responsible for the overall coordination of IIASA services, including finance, human resources, infrastructure, and information technology, the Chief Operations Officer (COO) will ensure that researchers are supported by an environment that facilitates the delivery of world-class research.

Pohn-Hufnagl was previously the Chief of Staff and Head of General Services at the International Anti-Corruption Academy (IACA) in Laxenburg, Austria. She has a master's degree in Law from the University of Graz, a master's degree in Political Sciences from the University of Vienna, and a diploma in Controlling.

"I am very much looking forward to taking up this position in such stimulating surroundings and to supporting the researchers, the staff, and the institute in their important work," says Pohn-Hufnagl on her new appointment.

FABIAN WAGNER TO LEAD CAPACITY DEVELOPMENT ACTIVITIES



One of the institute's cornerstones is its capacity-building program. The flagship Young Scientists Summer Program (YSSP) and postdoc opportunities in particular, showcase outstanding research by the next generation of scientists from all over the world. The Capacity Development and Academic Training Dean is responsible for coordinating and expanding the overall capacity development strategy of the institute. Wagner has been at IIASA since 2004, and is a researcher in the Air Quality and Greenhouse Gases Program, a role that he will continue in addition to the new appointment.

"IIASA is the world-leading one-stop destination for systems analysis, and part of its mission is to give others access to our methods, and to train the next generation of system thinkers," said Wagner. "I see huge potential for enhancing the institute's capacity development activities."

NEW DIRECTORS AND DEPUTIES ACROSS VARIOUS PROGRAMS

There have been several internal changes, which bring new career opportunities to younger researchers at IIASA. JoAnne Linnerooth-Bayer stepped down from her role as Risk and Resilience (RISK) Acting Program Director. Her successor, Reinhard Mechler was appointed Acting Program Director, together with Thomas Schinko as Deputy Program Director. In addition, John Handmer from the University of Melbourne joined the RISK team as a Scientific Advisor.

Nebojsa Nakicenovic, previously Transition to new Technologies (TNT) Program Director, and his colleague Arnulf Gruebler have become the first IIASA Emeritus Scholars and will continue to support the

TNT Program. Shonali Pachauri has been appointed Acting Program Director.

Raya Muttarak is the new World Population Deputy Program Director (POP), replacing Sergey Scherbov who will remain with POP as Senior Researcher and Re-aging Project Leader. Petr Havlik was appointed Ecosystems Services and Management Acting Program Director, taking over from Steffen Fritz with whom he shares this temporary appointment.

All acting appointments are interim arrangements until the end of December 2020 after which the new IIASA strategy – and with this an updated organizational structure and new leadership – will be in place to move IIASA forward.

Solving the world's most complex problems together: UK, India, and Slovakia renew ties with IIASA



© IIASA



Today, the world is facing increasingly complex and interconnected problems. These problems require countries to cooperate to find solutions.

Systems analysis combines in-depth analysis of each problem along with their dynamic and integrative parts using a variety of tools such as mathematical modeling and scenario assessments. IIASA National Member Organizations build a global network of researchers dedicated to this problem-solving process, in which many people take part: scientists of relevant disciplines, stakeholders, and decision makers. Recognizing the mutual benefits of scientific collaboration in a broad field of activities of global concern and interest, the UK, India, and Slovakia are strengthening and rebuilding research ties with IIASA.

CONTINUED UK MEMBERSHIP BRINGS NEW OPPORTUNITIES

The three UK Research and Innovation (UKRI) councils that jointly represent the UK membership of IIASA have confirmed funding for a further five years of UK membership of the institute. The Natural Environment Research Council (NERC), the Economic and Social Research Council (ESRC), and the Engineering and Physical Sciences Research Council (EPSRC) placed a solution-focused approach at the heart of the country's strategy to increase interdisciplinary challenge led research.

This also brings new opportunities for researchers: NERC, ESRC, and EPSRC have collectively agreed to allow IIASA scientists to apply for funding as co-investigators on proposals led by researchers at UK higher education institutions on calls announced from January 2020. In addition, in 2020 IIASA and NERC awarded three fellowships to support talented early career researchers

in delivering challenging research and supporting collaboration between IIASA and the fellows' UK research organisations.

"UKRI welcomes the strong links that have been built with IIASA over the first five years of UK membership and looks forward to continuing a productive relationship over the next five years. The ESRC, EPSRC, and NERC, are keen to facilitate even greater interactions between UK and IIASA researchers," said Duncan Wingham, Executive Chair of NERC.

INDIA AND SLOVAK REPUBLIC REJOIN IIASA

Research collaborations between IIASA and India stretch back to the 1970s and continue to bring new insights into the challenges the country and wider region face. This partnership is set to be strengthened and expanded by the country's membership of IIASA through the Technology Information, Forecasting, and Assessment Council (TIFAC), who will represent India as National Member Organization on the IIASA Council with support from the Department of Science and Technology of the Government of India. India's membership of IIASA will initially be for five years from January 2020 after which it will automatically be renewed.

Another returning member is the Slovak Republic, who was a full member of IIASA from 1994 to 2003. The Slovak Ministry of Education, Science, Research, and Sport will be the National Member Organization representing the country's membership on the IIASA Council and will be supported by a recently established Slovak Committee for Cooperation with IIASA, made up of representatives of the Slovak government and the scholarly community.

Left to right: © 1) Alexander Kirch
2) Kampee Patisena, 3) Tomas1111 | Dreamstime



© Andreas Gros

Andreas Gros

Andreas Gros is currently a data scientist at Facebook supporting their Data for Good project. His background is in computer science, mathematics, and the analysis and modeling of complex systems.

“What I love most about my job is that I get to work on real-world problems that usually affect a large number of people,” states Gros.

His work for Data for Good focuses on building privacy-preserving data products to help solve some of the world's biggest problems. Timely insights and relevant datasets, such as the High-Resolution Settlement Layer (HRSL) can improve how non-profits do their work, how researchers learn, and how policies are developed. When data is shared responsibly with the communities that need it, it can improve wellbeing and save lives.

For example, the HRSL population density data, which offers data at a 30-meter resolution — are much more accurate than other high-resolution maps, and their disease-prevention maps are informing spread-of-disease models used to help understand the COVID-19 pandemic.

In 2005, Gros participated in the Young Scientists Summer Program (YSSP) where he investigated dispersal strategies in the Evolution and Ecology

Program. “The IIASA approach of encouraging interdisciplinary research and collaborations has led me to select work environments that offer the same kinds of stimuli,” states Gros. He continues, “Through IIASA my wife and I have been able to build a strong network of colleagues and friends that we are still connected with.”

By **Monika Bauer**



CONNECT WITH THE IIASA NETWORK

IIASA Connect is an exclusive platform that brings together the institute's network of alumni, staff, and National Member Organizations. It offers members the opportunity to engage by connecting at events, post job opportunities, join groups, meet with IIASA alumni in cities around the world, and reconnect with former colleagues.

CONNECT.IIASA.AC.AT

To join or if you have any questions, please contact us at: alumni@iiasa.ac.at



Access a global interdisciplinary research network

Benefit by sharing your research, conference calls, and professional opportunities

Connect with others in the IIASA network within member countries

Share your updates, events, opportunities and more

People profiles

Informing food, land, and water policies at the global level

Günther Fischer has worked at the cutting edge of policy-based food, land, and water research for over 40 years.

Fischer began his career at IIASA as a research assistant in 1974, applying mathematical methods to evaluate food systems and provide policy suggestions on how to alleviate hunger. He was part of the groundbreaking IIASA Food and Agriculture Development Program in the 1980s that produced the IIASA world food systems model.

He says, "The starting point of my work was finding solutions to widespread hunger. As scenarios simulating different policy interventions have been assessed, it is clear that simply producing more food is not the answer. Achieving sustainable food production and water security requires a multidimensional systems approach, the political will to tackle poverty, and the motivation to make the world a better place."

Fischer has been at the heart of the development of the Agro-Ecological Zones (AEZ) model system in collaboration with the United Nations Food and Agriculture Organization. AEZ provides a standardized framework for analyzing synergies and trade-offs of



alternative uses of land, water, and technology to sustainably produce food and energy. It has informed policy at the regional, national, and global level in over 20 countries, including China, where Fisher played an integral role in the development of the IIASA-China connection.

"One of the most personally satisfying and successful collaborations is my work with China. I was lucky enough to build networks and relationships that aided IIASA-China relations and research," he concludes.

By Rachel Potter Günther Fischer: fischer@iiasa.ac.at

Making science accessible to all

Olha Danylo is an Earth observation systems researcher who has a special interest in making science accessible to people with disabilities.

Originally from Ukraine, Danylo first came to IIASA as a 2012 Young Scientist Summer Program participant and later joined the Ecosystems Services and Management Program with an Ernst Mach Scholarship. Her research



uses machine learning to analyze spatial and satellite data to map large-scale land use and land cover to help achieve the sustainable development goals.

Danylo's work includes combining citizen science with satellite observations to create an app-based system to aid disaster damage mapping, providing much-needed real-time data to help communities recover and rebuild after disasters. She has developed an oil palm map using Google Earth Engine to monitor plantation expansion and analyzed nighttime light data in North Korea to evaluate the country's economy and vulnerability to weather.

Alongside her research, Danylo is committed to ensuring science can reach people with disabilities, particularly those with visual impairments.

"During my university studies in Ukraine I had a class with a philosophy professor who was blind. Later, when working with him, I learned how little is done to make science accessible to audiences with physical challenges," she explains.

Danylo initiated a volunteer working group that is looking at solutions such as including the annotation of figures in scientific publications as part of the publishing process and finding alternatives to current color use in posters and presentations for those with color blindness.

By Rachel Potter Olha Danylo: danylo@iiasa.ac.at

Q&A

Taking action for a sustainable future

Thomas Schinko joined the institute as a Young Scientists Summer Program (YSSP) participant in 2014. He is currently the IIASA Risk and Resilience Deputy Program Director.

Q What are your key research interests?

A My work focuses on the socioeconomic assessment of climate-related risks, for example floods and droughts, and developing and analyzing risk management strategies to tackle those challenges. I'm particularly interested in climate-related risks that cannot and will not be addressed by climate change mitigation and adaptation, eventually breaching the coping capacities of communities. These are known to be part of the so-called "Loss and Damage" policy discourse. Methodologically, I use economic and risk-based modeling tools, but more recently, I have also started to apply social science methods, for example, role-play simulations, to engage more closely with societal stakeholders.

Q What does your involvement with "Scientists for Future" entail?

A Senior climate researchers from Austria, Germany, and Switzerland started this initiative. Together, they produced a statement supporting the legitimate concerns of the "Fridays for Future" movement with scientific facts. This statement was signed by more than 26,000 researchers – including myself – from various disciplines. In March 2019, around 30,000 climate activists gathered at Heldenplatz in Vienna, where I handed over the statement to the demonstrating crowd.



This movement has had a huge societal impact and really changed the discourse of climate change communication, not only in Austria, but worldwide. There has been enormous interest from the media, political stakeholders, and the general public.

Q IIASA is an independent research institute, how do you balance this with engaging with stakeholders that are active in campaigning?

A It is very important to point out that "Scientists for Future" does not belong to any political party or ideological camp. We support the "Fridays for Future" movement with independent and evidence-based research. It is our societal duty to provide scientific

information so that actions for a more sustainable future can be taken. Policymakers and politicians throughout the political spectrum have realized that we need to do something about the climate crisis. As we need to work with all kinds of stakeholders, I also balance my Austrian work with engagement in international climate policy debate, such as under the United Nations Framework Convention on Climate Change (UNFCCC).

Q What do you think are the biggest challenges we face and how can IIASA help?

A Societal grand challenges, for example, climate change, biodiversity loss, instability of financial systems, and water scarcity, are all linked. The research at IIASA – applied systems analysis – takes into account the interconnectedness of multiple goals, making IIASA a unique place. Systems thinking offers our best chance of overcoming the substantial barriers to sustainability, now and for future generations.

Q Are you able to keep your optimism in the face of the challenges affecting our planet?

A It's indeed challenging to stay optimistic when you see the climate crisis unfolding on a global scale. Current efforts are not enough to keep Earth's temperature from rising. The young people out on the streets demanding climate justice keep me motivated. They are willing to undergo major transformational changes. For the sake of our children, we have to stay optimistic.

By Bettina Greenwell

Thomas Schinko: schinko@iiasa.ac.at

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The International Institute for Applied Systems Analysis (IIASA) is an independent, international research institute with National Member Organizations in Africa, the Americas, Asia, and Europe. Through its research programs and initiatives, the institute conducts policy-oriented research into issues that are too large or complex to be solved by a single country or academic discipline. This includes pressing concerns that affect the future of all of humanity, such as climate change, energy security, population aging, and sustainable development. The results of IIASA research and the expertise of its researchers are made available to policymakers in countries around the world to help them produce effective, science-based policies that will enable them to face these challenges.

National Member Organizations:

AUSTRIA The Austrian Academy of Sciences
BRAZIL The Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES) **CHINA** The National Natural Science Foundation of China (NSFC)
EGYPT Academy of Scientific Research and Technology (ASRT) **FINLAND** The Finnish Committee for IIASA **GERMANY** Association for the Advancement of IIASA **INDIA** The Technology Information, Forecasting and Assessment Council (TIFAC) **INDONESIA** Indonesian National Committee for IIASA
IRAN Iran National Science Foundation (INSF) **ISRAEL** The Israel Committee for IIASA **JAPAN** The Japan Committee for IIASA **KOREA, REPUBLIC OF** National Research Foundation of Korea (NRF) **MALAYSIA** (Observer) Academy of Sciences Malaysia (ASM) **MEXICO** Mexican National Committee for IIASA **NORWAY** The Research Council of Norway (RCN)
RUSSIA The Russian Academy of Sciences (RAS) **SLOVAKIA** Ministry of Education, Science, Research and Sport **SOUTH AFRICA** The National Research Foundation (NRF)
SWEDEN The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) **UKRAINE** The Ukrainian Academy of Sciences **UNITED KINGDOM** UK Research and Innovation (UKRI)
USA The National Academy of Sciences (NAS)
VIETNAM Vietnam Academy of Science and Technology (VAST)

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