

Quality *not* quantity

**New projections
bring a revolutionary view
of future population**

also in this issue

From story to science

Discovering the stakeholders
behind IIASA research

Bouncing forward

An unusual partnership aims
to build flood resilience
worldwide

Reflecting on inequality

Developing positive narratives
for the path to sustainable
development



Professor Dr. Pavel Kabat
Director General and CEO, IIASA

Keeping up to data

Conceiving his first novel, *This Side of Paradise*, took three minutes, wrote F. Scott Fitzgerald, but writing it took three months, and collecting the data for it had taken the whole of his life to date.

Hardly an issue of *Options* goes by without a story about data: our search for sources; the effort and expense involved in acquiring new data; mathematical techniques that scientists use to drill hidden information from existing data.

Our cover story this issue is data-themed, as Oxford University Press publishes *World Population and Human Capital in the 21st Century*, edited by IIASA scientists led by World Population Program Director, Wolfgang Lutz. The new projections provide a fundamentally improved view of future population, structured by age, sex, and level of education, which differ from recent projections by the United Nations. More than just population numbers, the new book also includes specific projections for population by age, sex, and education level, for 195 countries in the world, from 2010 to 2100 (page 14).

Also in this issue, you will read about a new interdisciplinary and intersectoral focus on inequality, the first topic to be tackled by the new Alpbach–Laxenburg Group established by IIASA and European Forum Alpbach in 2013. This group, from politics, business, science, civil society, and the arts, will rely on IIASA research to discuss sustainable solutions to persistent global problems (page 12).

As covered in the last issue of *Options*, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) is now finally finished and the Synthesis Report was published in November. I am proud of the 19 IIASA researchers who made a fundamental contribution to the AR5 process. Four IIASA researchers contributed to finalization of this synthesis report and participated in the plenary session in Copenhagen.

In 2015, IIASA will contribute in a major way to the scientific substantiation of the international climate negotiations which should lead to an agreement in Paris. These efforts go hand in hand with IIASA scientific support to the establishment of the new Sustainable Development Goals (SDGs), which are to be agreed at the UN Secretary General's General Assembly in September 2015.

As part of this process, IIASA will launch a new project called World 2050 in close collaboration with the Leadership Council of the Sustainable Development Solutions Network, which is chaired by Distinguished Visiting Fellow Jeff Sachs, and in collaboration with the Stockholm Environment Institute. This project will be launched at IIASA in March 2015, and is aimed to be a major scientific substantiation to help guide and implement the SDGs. ■

About IIASA

The International Institute for Applied Systems Analysis, located near Vienna, Austria, is an international scientific institute that conducts policy-relevant research into problems too large or complex to be solved by a single country or academic discipline.

IIASA's scientists research

- energy and climate change;
- food and water; and
- poverty and equity.

IIASA produces

- data, models, and research tools;
- refereed scientific literature; and
- policy-relevant information.

IIASA helps

- countries make better-informed policy;
- develop international research networks; and
- support the next generation of scientists.

IIASA is funded and supported by scientific institutions and organizations in the following countries:

Australia, Austria, Brazil, China, Egypt, Finland, Germany, India, Indonesia, Malaysia, Mexico, Japan, Netherlands, Norway, Pakistan, Republic of Korea, Russia, South Africa, Sweden, Ukraine, United States of America, Vietnam.



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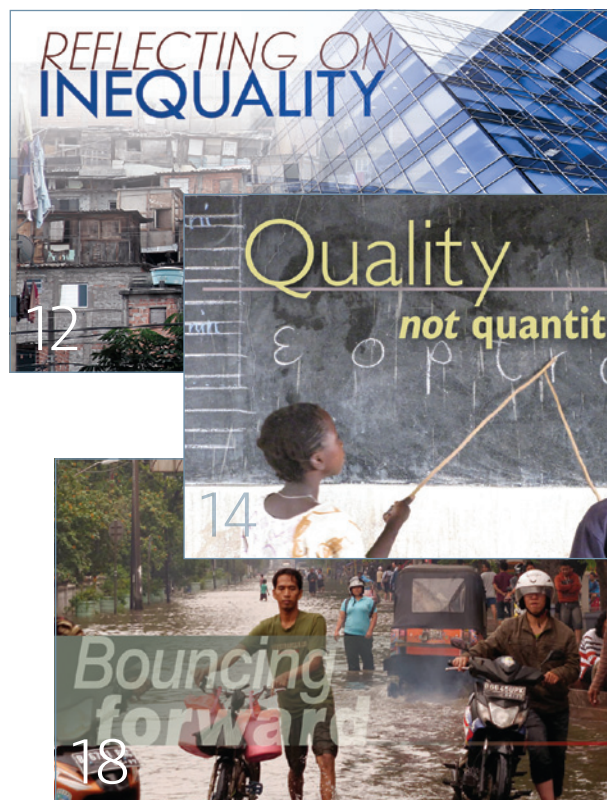
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The benefits of population aging

Population aging and the compositional changes that accompany it—such as increasing education levels—may turn out to have many positive impacts for society, according to IIASA research published in the journal *PLoS ONE*.

Around the world, people are living longer and having fewer children, leading to a population that is older, on average,

than in the past. Average life expectancy in developed countries has risen at a pace of three months per year, and fertility has fallen below replacement rate (two children per women) in the majority of Europe and other developed countries. Until the IIASA research, most academic discussion of this trend has focused on the potential problems it creates.

“In order to give a more complete picture of population aging, it is necessary to include both the positive and negative effects of population aging,” says IIASA researcher Elke Loichinger, who worked on the study in collaboration with researchers in Germany and the United States.

The researchers chose to use Germany as a case study because the country has the second oldest average population in the world, after Japan. They found five areas in which population aging could bring net benefits, when considered in combination with other demographic factors: productivity, environmental impact, wealth inheritance, health, and quality of life. The researchers say that the findings on Germany are applicable to many aging societies. **KL**

Further info Kluge F, Zagheni E, Loichinger E, Vogt T (2014). The advantages of demographic change after the wave: Fewer and older but healthier, greener, and more productive? *PLoS ONE* 9(9):e108501 [doi:10.1371/journal.pone.0108501].

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A growing danger of forest fires

By 2090 the area burned by forest fires in the European Union could increase by 200% because of climate change, according to IIASA research published in the journal *Regional Environmental Change*. However, fuel removal measures such as preventive fires could keep that increase to below 50%, the study shows, and improved firefighting response could provide additional protection against forest fires, decreasing burned areas even further.

The study was the first to examine adaptation to forest fire danger on a pan-European scale. While there are many potential options for forest fire management, the researchers focused on two adaptation strategies that were identified in collaboration with expert stakeholders: prescribed burning and fire suppression.

“There is still a big debate on the effectiveness of prescribed burning as a forest fire management tool. This study shows that it can be a promising option for protecting European forests from the impacts of climate change,” says Nikolay Khabarov, a researcher from IIASA’s Ecosystems Services and Management Program, who led the study.

Fire is a natural part of the ecology of many forests, but when fires get out of control they can burn huge areas and spread to neighboring homes and settlements. Prescribed burns help prevent these major fires by removing dead wood from forests.

The study also examined the potential of better firefighting to help decrease burned areas. However, no study has yet managed

to quantify the cost and benefit of such efforts at a continental scale. **KL**

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Climate targets move further from reach

Global carbon dioxide (CO₂) emissions from fossil fuel and cement production grew to a record high of 36 billion tons in 2013, according to a new report from the Global Carbon Project (GCP), released this fall. According to the report, fossil fuel CO₂ emissions are projected to increase by another 2.5% in 2014.

IIASA Deputy Director General Nebojsa Nakicenovic is the co-chair of the GCP. He says, "The scientific assessment of the Global Carbon Project should be a wakeup call to decision makers and the public at large."

One study released in conjunction with the report shows that the upward trend of CO₂ emissions over the past decades is continuing, despite discussions on limiting climate change. IIASA researcher Joeri Rogelj contributed to the study, which estimates that in order to limit climate change to below the internationally agreed 2°C limit (compared to pre-industrial levels), future cumulative emissions would need to be limited to below 1,200 billion tons CO₂.



Continuing at 2014 emissions levels, the 1,200 billion mark would be reached in 30 years. But if emissions continued to rise, as projected, the limit would be reached sooner and far stronger measures to reduce emissions would be required later, with a greater risk that climate targets would be overreached.

In a *Nature Climate Change* commentary, also published in conjunction with the GCP report, IIASA guest research scholar Sabine Fuss, of the Mercator Research Institute on Global Commons and Climate Change (MCC), Nakicenovic, and co-authors point out that most scenarios for achieving the 2°C stabilization target assume the use of negative emissions technologies, such as Bioenergy with Carbon Capture and Storage (BECCS), which remain unproven.

Fuss, lead author on the paper and a member of the steering committee of the GCP, says, "We're relying on an approach that involves considerable uncertainties." KL

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Citizen science on the farm

A new mobile phone app designed at IIASA makes agricultural data available to gardeners and smallholder farmers around the world. The app allows users to access publicly available data on temperature, precipitation, and soil conditions, and also to share information with other gardeners and farmers. The researchers hope that it could help reduce food insecurity in developing countries by helping farmers increase their crop yields. The data collected by the app could also be a boon for research in land use and food security.

www.iiasa.ac.at/news/growers-14

Rising tides

IIASA researchers have co-authored a new real-world, near-term solution action plan commissioned by the Republic of Nauru, which is the current Chair of the Alliance of Small Island States (AOSIS), and written by international climate and energy experts. Small island nations are poised to suffer earlier and greater impacts from climate change, although they have contributed far less to the problem than other nations. The report identifies a number of readily available steps to rapidly lower greenhouse gas emissions in the short term.

www.iiasa.ac.at/news/aosis-14

Biodiversity in the balance

A new study published in the journal *PLoS ONE*, brings together evolutionary theory and ecology to explore one of the big questions in ecology: how is biodiversity developed and maintained? IIASA Evolution and Ecology Program Director Ulf Dieckmann led the study, which shows that "Relative Nonlinearity of Competition," a well-accepted ecological theory of biodiversity, falls apart when examined from an evolutionary perspective.

www.iiasa.ac.at/news/biodiversity-14

Scenarios for climate research

A special issue of the journal *Climatic Change*, published in summer 2014, provides the first in-depth documentation of the Shared Socioeconomic Pathways (SSPs), the next generation of scenarios for climate change research. The papers in the special issue describe the methodology of the SSPs as well as challenges and concepts for future work. IIASA has been a hub for the SSP development process, with researchers from five different programs involved. More publications on the SSPs are planned for 2015.

www.iiasa.ac.at/news/ssp-14

How do new energy technologies come to fruition? *Energy Technology Innovation: Learning from Historical Successes and Failures*, a new book by IIASA researchers Charlie Wilson and Arnulf Grubler, uses case studies of past successes and failures to build a systemic perspective on historical energy innovation. By examining historical trends, the researchers find patterns for success that could be translated to future energy policy.

A new book, *Spatial Mobility, Migration, and Living Arrangements*, edited by IIASA researcher Raya Muttarak et al., explores how migration, both internationally and nationally, affects people's lives and families. What happens to relationships when couples live apart? Who do immigrants marry? Why don't young people leave the parental home? Which parent do children live with after divorce? The research covered in this book brings new light to the impacts of mobility on family lives as well as of life events on mobility.

How will likely future global trends—in fields ranging from demography and health to climate change—affect future generations? Will tomorrow's children be better off than their parents? In the book *Zukunft Denken*, IIASA World Population Program Director Wolfgang Lutz and European Forum Alpbach President Franz Fischler explore possible future scenarios for Austria and the world, based in large part on research conducted at IIASA by Lutz and colleagues.

www.ijasa.ac.at/events/zukunft-denken-14

Religion is a key factor in demography, important for projections of future population growth and for other social indicators. A new journal, *Yearbook of International Religious Demography*, is the first to bring a quantitative demographic focus to the study of religion. The journal is co-edited by IIASA researcher Vegard Skirbekk, an expert in the field of religious demography. It includes three studies by IIASA researchers focused on religion and ethnicity in Vienna, Europe, and the world.

www.iiasa.ac.at/news/pop-religion-14

Green growth and sustainable development

Green growth—the idea that economic growth can go hand in hand with climate mitigation, sustainable resource use, and the protection of biodiversity—sounds beautiful in theory. But finding practical green growth solutions remains a major challenge for economists and policymakers.

“Economic models do not tend to deal with the long horizons required to address the relevant questions of climate change, technological transitions, and long-run environmental depletion,” says IIASA researcher Jesus Crespo Cuaresma. He is a co-editor of a new book, *Green Growth and Sustainable Development*, which explores new research methods for understanding green growth.



The book came out of a three-day IIASA workshop co-organized by the Institute's Advanced Systems Analysis and World Population research programs, which brought together economists and mathematicians skilled in developing models for green growth and sustainability.

"In reality the feedback between environment and economic growth is manifold and complex. It becomes even more complex in a warming world," says Elena Rovenskaya, director of the IIASA Advanced Systems Analysis Program. "One way to explore the complex interactions within the human–earth system is to use small-scale stylized models that represent the feedbacks between economy and environment."

The studies in the book describe a number of different models and their application to specific questions at the environment–economy interface. One study, for example, explores the trade-offs between economic growth and air pollution, which is damaging to human health. Another study examines how the exhaustibility of natural resources impacts decision making. Other studies explore the impacts of environmental regulation on economic growth and innovation—and find different results depending on the specific setting.

Rovenskaya says, "This book is a good example of fruitful collaboration between mathematicians and economists, using advanced mathematics to generate qualitative insights into feedbacks within the coupled human–earth system." **KL**

Further info Crespo Cuaresma J, Palokangas T, Tarasyev A (Eds) (2013). *Green Growth and Sustainable Development*. Springer [doi:10.1007/978-3-642-34354-4].

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The game of life

Peer punishment can work surprisingly well as a strategy to build cooperation, according to a study led by IIASA researcher Karl Sigmund. The study, published in the journal *Experimental Economics*, compared the effectiveness of two punishment strategies: peer punishment and institutional punishment.

"In most aspects of everyday life, the task of punishing exploiters has been taken over by institutions," says Sigmund. "In fact in developed societies in particular, peer punishment is not only unusual, but also forbidden."

The study used an experimental game approach to explore the development of institutional punishment, involving 18 groups of volunteers who played a game for multiple rounds. The game allowed each player to choose whether to cooperate with others, and also allowed the group to decide on a punishment strategy for those who did not cooperate. After each round, the group could decide whether to change their punishment strategy, based on previous outcomes.

The researchers predicted that institutional punishment would develop naturally as the game proceeded. However in practice, they found that players entrusted punishment to a costly institution only if it punished non-cooperators as well as players refusing to contribute



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to its upkeep. In fact, over the 50 rounds of the game, the researchers found that the players chose peer punishment a majority of the time.

Experimental game theory studies such as this one can provide unique insights into human behavior, which often turns out to be more complex than standard theory assumes, say the researchers. **KL**

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The evolution of sanctioning institutions: An experimental approach to the social contract. *Experimental Economics* 17(2):285–303 [doi:10.1007/s10683-013-9367-7].

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Making climate change policy mainstream

In Eastern Europe, climate change is expected to impact precipitation levels, with potential increases in both droughts and floods. But because these projections are very uncertain, particularly in the short term, the European Union is encouraging countries to make risk management policies that are robust enough to reduce the risks of both increasingly dry and wet conditions.

In a new study published in the journal *Regional Environmental Change*, IIASA Risk, Policy and Vulnerability Program Director Joanne Bayer and colleagues worked with stakeholders in Poland to untangle

the web of EU climate policy guidelines and their implications for flood and drought policy in the country. The study found four major challenges with mainstreaming climate change into flood and drought policy.

"The first challenge is the uncertainty," says Bayer, "Nobody can tell policymakers with certainty if precipitation levels will go up or down in the next 10 to 15 years, but that is the time period that they have to plan for." When trying to implement robust solutions that could be helpful in both drought and flood situations, Bayer says, soft policy measures suggested by the EU are not necessarily effective, and some are extremely costly. A third problem is the complicated nature of the EU guidelines, which are often unclear and occasionally contradictory. Finally, the researchers say, implementing policies is extremely challenging in Poland, with a large number of institutions being involved in decision making on flood and drought risk, which leads to confusion about boundaries and responsibilities.

The researchers say that addressing these challenges could help lead to improved guidelines.

"We can talk about mainstreaming all we want, but to provide effective policy guidance, we need to put ourselves in the shoes of someone trying to make flood and drought policy in Poland," says Bayer. **KL**

Further info Linnerooth-Bayer J, Dubel A, Sendzimir J, Hochrainer-Stigler S.

Challenges for mainstreaming climate change into EU flood and drought policy: Water retention measures in the Warta River Basin, Poland. *Regional Environmental Change* (Published online 19 September 2014) [doi:10.1007/s10113-014-0643-7].

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The costs of delaying action on climate change

In January 2014 the AMPERE conference celebrated the end of three years of effective research using leading edge models to explore economically practical strategies to lessen the impact of climate change. The project's researchers, including many from IIASA, presented their results to more than 200 stakeholders in Brussels—findings which have directly informed the *Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC AR5)* and a White House Report published in July 2014.

The AMPERE project, a collaborative effort among 22 institutions in Europe, Asia, and North America led by the Potsdam Institute for Climate Impacts Research, was dedicated to the "Assessment of Climate Change Mitigation Pathways and Evaluation of the Robustness of Mitigation Cost Estimates." AMPERE scientists have been identifying strategies for cutting greenhouse gas emissions—strategies known as "mitigation pathways" and assessing whether these strategies prove practical and economically viable. In particular, IIASA researchers have led and coordinated the efforts to investigate the costs and risks of delaying such mitigation strategies.

"The goal was to better understand implications of short term actions on the long term costs and ability of reaching low stabilization targets," says IIASA Energy Program Director Keywan Riahi, who led and coordinated the IIASA AMPERE efforts. "This effective linking of short term action to mitigation risks has not been done before."

Comparing the results from 11 models, the scientists found that delays in implementing the necessary policies to limit warming to 2°C above pre-industrial levels will limit the possible mitigation options for the future. "Mitigation will become more difficult and, in some cases, even infeasible," Riahi says.

The researchers found that if current policies remain unchanged before 2030, meeting the target would require drastically steep emission cuts between 2030 and 2050. Achieving such cuts would involve unprecedented policy interventions and would require replacement of more than half the global energy supply infrastructure within the narrow 20-year period.

The findings also revealed that such extreme cuts would spell bad news for coal power plant owners. Currently, countries are still building new coal power plants—plants that only pay off their investment after 30–50 years of operations. Stricter emissions policies would mean that coal power would no longer prove competitive with cleaner fuel sources, and the plants would have to shut down before the investment in them was repaid.



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"These power plants become stranded assets because you need to prematurely shut them down, so investments in the order of hundreds of billions of US dollars, mostly in China and India, are pumped into the wrong choices and large portions of these investments are ultimately lost," says IIASA researcher Nils Johnson, the lead author of the analysis of stranded investments, which used IIASA's integrated assessment model MESSAGE.

Such key AMPERE research studies have provided the backbone of the analysis of delayed mitigation for the IPCC Fifth Assessment Report, Riahi says. Because of the policy relevance of the science, it was picked up and included in the 2014 White House Report *The Cost of Delaying Action to Stem Climate Change*.

The robustness and thoroughness of the research was directly due to the combined power of multiple models from different institutes, Riahi says. "The project has been very successful," he says, "and the high policy relevance of this research was a result of the coordinated joint effort of the international research teams." **JP**

Further info Johnson N, Krey V, McCollum DL, Rao S, Riahi K, Rogelj J. Stranded on a low-carbon planet: Implications of climate policy for the phase-out of coal-based power plants. *Technological Forecasting and Social Change* (Published online 29 March 2014) [doi:10.1016/j.techfore.2014.02.028].

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UN Climate Summit 2014

IASA made a substantial contribution to the United Nations Secretary-General's Climate Summit through the Leadership Council of the Sustainable Development Solutions Network (SDSN), the Sustainable Energy For All (SE4ALL) initiative, and contributions to various reports.

Over 100 Heads of State and Government, along with 800 leaders from business, finance and civil society, attended the United Nations Secretary-General's Climate Summit 2014. The purpose was to raise political momentum for a meaningful universal climate agreement in Paris in 2015.

Through his membership of the Leadership Council of the SDSN, IIASA Director General and CEO Professor Dr. Pavel Kabat met with world leaders, eminent experts from the Leadership Council, and mayors from many of the world's major cities. Together, they discussed how to make the necessary long-term transformations to sustainable development, including current and future initiatives, to make cities as sustainable and climate-friendly as possible.

"Listening to the Heads of State in the General Assembly Hall, I was particularly struck by how many IIASA initiatives were linked to countries' action plans," said Kabat. "For example, the United States has played a key role in new initiatives from the Climate and Clean Air Coalition (CCAC) on reducing black carbon and methane emissions from agriculture and the oil and gas industry. IIASA's work was key in establishing the CCAC."

On 23 September IIASA Deputy Director General Nebojsa Nakicenovic gave the opening speech at the SE4ALL policy session on how much energy efficiency can contribute to a sustainable energy future. Nakicenovic and two IIASA researchers were key authors on a new report on climate solutions, commissioned by the Alliance of Small Island States that was launched at the Summit.

Many members of the Alpbach-Laxenburg Group—a reflection group striving to create new narratives for sustainable development—also made important contributions to the Climate Summit. These included: Peter Bakker, Robbert Dijkgraaf, Tarja Halonen, Rajendra K. Pachauri, Mary Robinson, and Jeffrey Sachs.

IS

Further info www.iiasa.ac.at/news/UN-ClimateSummit-14



Global science advisors share knowledge

A global summit in New Zealand brought together top science advisers from around the world to discuss the latest improvements in the process of bringing science into decision-making. IIASA Director General and CEO Pavel Kabat spoke about the Institute's successes and lessons learned from years of providing science advice on an international level.

www.iiasa.ac.at/events/auckland-14

Population policy for the 21st century

Population policies for sustainable development should move away from a narrow focus on fertility rates and reproductive health services and instead focus more comprehensively on human capital, including education and health, argues Wolfgang Lutz, director of IIASA's World Population Program, in an article in the journal *Population and Development Review*. The publication came out just prior to a UN special session which set the agenda on global population policy beyond 2014.

www.iiasa.ac.at/news/pop-pol-14

Science, media, and democracy in the EU

On 25 September IIASA Director General and CEO Pavel Kabat spoke at the European Intersectoral Summit on Research and Innovation. The summit brought together science and policy leaders to focus on citizen engagement in science in Europe and on how to create dialogue between governments and the public.

www.iiasa.ac.at/events/eisri-14

Austrian climate report

Climate change has arrived in Austria—and for the first time, a major report has assessed its likely impacts on a nationwide scale. IIASA coordinated the rigorous review process, which involved more than 200 researchers, following the model of the Intergovernmental Panel on Climate Change. The report shows that temperatures are rising in Austria faster than the global average, with potentially major impacts on the environment and economy; it suggests that Austria's current mitigation efforts fall short of those necessary to meet global climate targets.

www.iiasa.ac.at/news/austria-climate-14



Research tools can bridge science & policy

Anne Glover,
the first Chief Scientific Adviser to the
President of the European Commission,
outlines how we can get better at
linking science to policy,
and vice versa.



Today's governments are facing far more complex global challenges than their predecessors—from climate change, to Ebola, to crises in the Middle East and Ukraine. Policymakers need to be more international in their outlook and to consider how all the various policy sectors interact with and impact each other.

Scientists can shed valuable light on such issues. But the links between science and policy—and vice versa—need to be improved if we are to get the best outcomes.

The good news is that governments globally are now much more committed to evidence-based rather than ideology led policymaking. In many areas evidence-based policymaking is working very well. For example, when the European Commission considers a new policy, say, on forests, it will consult scientists and the scientific literature to examine the evidence and analyze possible impacts on climate change. This process frequently leads to improvements to new policy proposals.

However, while conducting scientifically rigorous impact assessments of legislation on a global problem can help a government minimize the negative side effects of policies or regulatory failure, I have also seen scientific evidence being used badly.

For instance, independent and reliable scientific research shows that introducing genetically modified (GM) crops could, if used judiciously, improve agricultural productivity, reduce the use of herbicides and pesticides, and enhance the nutritional value of some crops as well as making them more climate change resistant. It also shows that GM technology poses no more risk than any other selective plant-breeding techniques already in use. Yet both supporters and opponents of GM crops pick and choose evidence to support their own arguments.

This selective use of evidence (by both sides) generates mistrust in science, making scientists appear to be in conflict. Even worse, it clouds the debate by focusing on whether or which research findings are reliable, when it would be more honest to say that the real reasons behind not adopting GM crops are ideological, ethical, cultural, or something else entirely.

Therefore, bringing greater transparency to the process of evidence-based policymaking is key to making wise policy decisions that tackle the challenges of the twenty-first century. One aspect of transparency is to say where evidence comes from—is it anecdotal or is it from a peer-reviewed journal, for instance? Transparency is needed to explain choices and trade-offs made when setting policies.

Research tools can help achieve this transparency. Scientifically developed models and scenarios allow decision makers to experiment with different policies, and see the likely outcomes. If the models are sufficiently sophisticated and have been put together with a systematic and analytical approach, they also show the policymaker the implications across the huge range of factors that the new policy may affect. And if provided to all the main parties involved in negotiating the new policies, the research tools can also help build consensus. ■

Photo © European Union

Inequality is a lifelong story

“Being poor does not mean that you are stupid; it sometimes demands a lot of intelligence to survive if you are poor. It is very important to take these issues seriously and our primary focus should be the empowerment of people.”

Q How have you been involved in the formation of the Sustainable Development Goals? Why is this process important?

A I have been involved in this process since the development of the Millennium Development Goals, and I consider that it is very important that we continue to work for these principles after the implementation of the millennium goals has ended in 2015.

In spite of all of their weaknesses the Millennium Development Goals were important goals, informing the knowledge and expectations that we have regarding sustainable development and a global climate agreement or commitment. To me, the post-2015 Agenda and the Sustainable Development Goals are perhaps the most important guarantee for the future of the world.

Q What is different about the approach of the Alpbach–Laxenburg Group?

A We have said many times—and many world leaders agreed at Rio+20—that it is time to stop working in silos. We need a multidimensional approach, where academia, politicians, business, civil society, and also NGOs are involved. This is where the Alpbach–Laxenburg Group is so important. I think that this group is an effort to address that need, and I hope that by bringing together the various areas of society we can address the great social injustices in the world. It is not only the business of scientists what happens in the world. It is not just someone else's problem: everyone needs to be involved in the process.

Q How do you hope to see the issues of gender inequality reflected in the group?

A In 2012 I was co-chair of a report entitled *Resilient People, Resilient Planet: A Future Worth Choosing* for the UN Secretary General, as part of my role on the High-level Panel on Global Sustainability. While compiling this report we noticed that there are a lot of resources that are overused and which cause problems. However, what is underused is human capital.

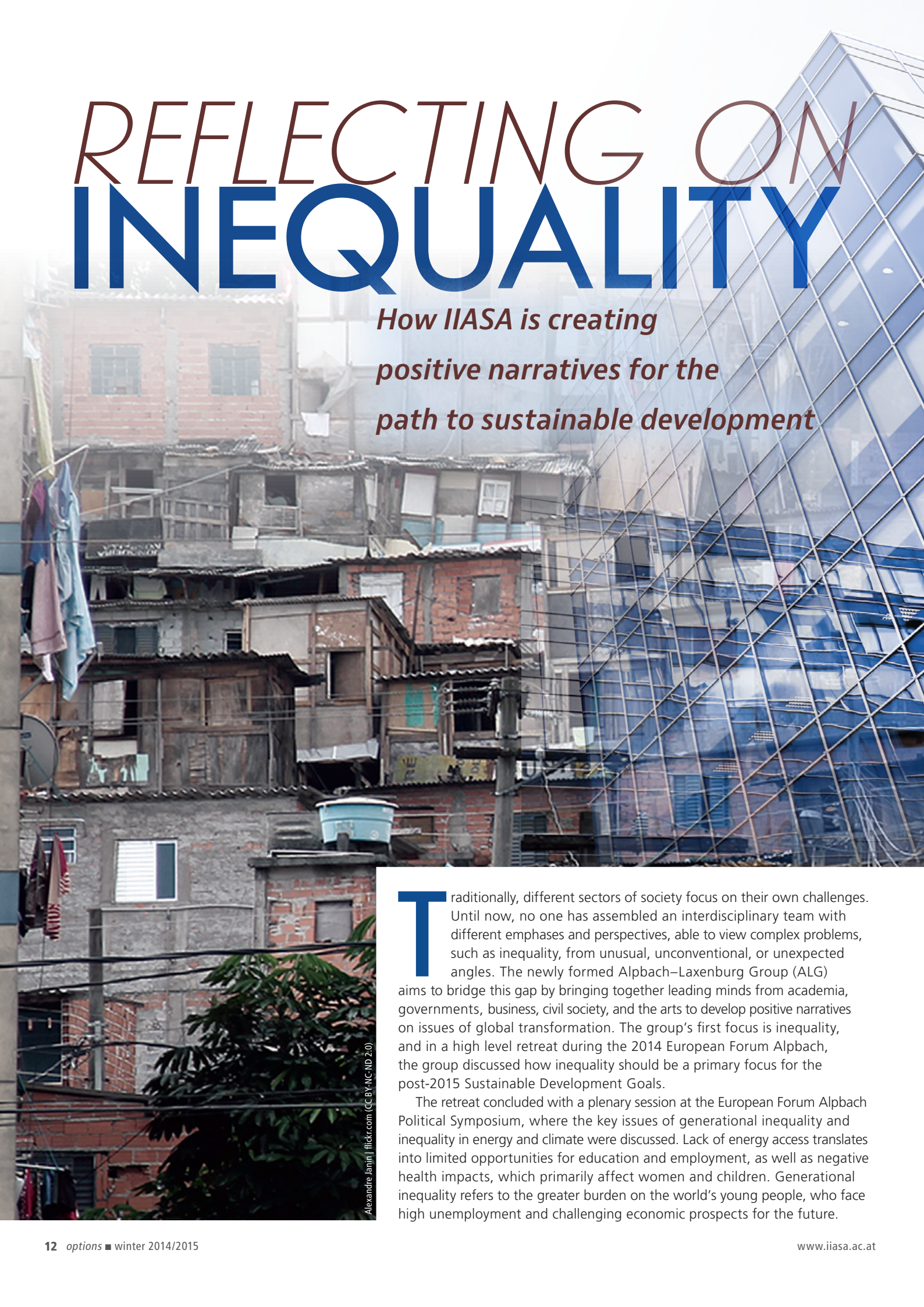


Tarja Halonen, Finland's first female head of state, was the 11th President of the Republic of Finland from 2000 to 2012. She currently serves as Co-Chair of the UN High-level Panel on Global Sustainability and Chair of the Council of Women World Leaders. She is also a member of the high-level reflection group, the Alpbach–Laxenburg Group.

There are three categories we should focus on: the poor, youth, and women. Of course all of these groups are very important to include. But for women, inequality is a lifelong story that you cannot get rid of.

It is very important to take these issues seriously and implement measures to change the status quo. I have already tried in many ways; and of course the Council of Women World Leaders has already done a lot of work which I am very thankful for. I am also very proud of Michelle Bachelet, current President of Chile and the first Under-Secretary General and Executive Director of UN Women, who has led work on the empowerment of women at all levels. We need to make an effort to strengthen gender and women's rights as part of the post-2015 goals. There are many similar attempts to raise this issue but I hope this group can make it a stronger voice. **PB**

Further info www.iiasa.ac.at/alp



REFLECTING ON INEQUALITY

*How IIASA is creating
positive narratives for the
path to sustainable development*

Traditionally, different sectors of society focus on their own challenges. Until now, no one has assembled an interdisciplinary team with different emphases and perspectives, able to view complex problems, such as inequality, from unusual, unconventional, or unexpected angles. The newly formed Alpbach–Laxenburg Group (ALG) aims to bridge this gap by bringing together leading minds from academia, governments, business, civil society, and the arts to develop positive narratives on issues of global transformation. The group's first focus is inequality, and in a high level retreat during the 2014 European Forum Alpbach, the group discussed how inequality should be a primary focus for the post-2015 Sustainable Development Goals.

The retreat concluded with a plenary session at the European Forum Alpbach Political Symposium, where the key issues of generational inequality and inequality in energy and climate were discussed. Lack of energy access translates into limited opportunities for education and employment, as well as negative health impacts, which primarily affect women and children. Generational inequality refers to the greater burden on the world's young people, who face high unemployment and challenging economic prospects for the future.

Alexandre Janin | flickr.com (CC-BY-NC-ND 2.0)



ALPBACH-LAXENBURG DECLARATION

In August the Alpbach–Laxenburg Group (ALG) produced a declaration pointing to inequality as a key target for the post-2015 Sustainable Development Goals.

“We identify three groups in particular: the world’s poorest people, often forgotten and struggling daily for survival; the world’s women and girls, still facing legal and social barriers to full participation and empowerment; and the world’s young, facing the stark crises of high unemployment and seemingly diminished lifetime economic prospects.”

“Yet the Alpbach–Laxenburg Group also emphasizes that the recent advances in science and technology—most dramatically in the form of the information and communications revolution—have the potential to empower these groups and thereby to promote societies that are fair, inclusive, and with broadly shared prosperity.”

The full declaration and list of ALG members are available online: www.iiasa.ac.at/alg

ENERGY POVERTY

People usually talk about inequality in terms of wealth, but disparities in energy access can in some cases be greater than inequality in income—with a major impact on people’s livelihoods and health.

Results from the 2012 Global Energy Assessment showed that the poorest 40% of the world’s population only account for 10% of global income and energy use, while the richest third account for two-thirds. Inequality in electricity access is even greater with around a fifth of the population currently having no access to electricity at all. The distribution of modern fuels also remains highly unequal, with a much higher dependence on solid biomass fuels in the least developed countries.

A lack of adequate and affordable energy supplies limits people’s opportunities to work, study, and earn money. It also has a negative impact on human health and welfare—particularly in the case of women and children who are exposed to harmful emissions from cooking with solid fuels. Energy poverty—the lack of access to modern energy—therefore contributes to chronic or persistent poverty.

POVERTY ERADICATION VS. CLIMATE CHANGE

New research recently published in *Nature Climate Change* addressed the question of conflict between poverty eradication and climate change.

Narasimha Rao, research scholar in IIASA’s Energy Program, says, “Many people associate raising living standards in developing countries with increases in greenhouse gas emissions. However, our research shows that it may take fewer emissions to raise the poor’s basic living standards than it does to grow affluence. If this is the case, then progressive development policies may well support climate mitigation.”

The study used data on well recognized poverty indicators—adequate nourishment, water supply and sanitation and electricity access—to relate countries’ growth over time to these indicators and to emissions, and suggests that climate research needs to focus on how countries’ emissions growth relates to the services people are provided.

THE OPPORTUNITY OF EDUCATION

IIASA World Population Program Director Wolfgang Lutz argues that policies aimed at improving human wellbeing need to consider inequality within human populations, such as differences in entitlements, including education.

The “Laxenburg Declaration”—a policy paper produced by an international scientific panel convened by IIASA in 2011—stated that there is clear evidence that demographic differences affect people’s ability to participate in sustainable development and that these populations are identifiable by age, gender, education, place of residence, and standard of living.

IIASA’s World Population Program has produced a consistent set of reconstructions and projections of educational attainment distributions by age and sex for 195 countries worldwide (see *main feature*, page 14). These data provide an important portrait of inequality across and within both populations and age groups and demonstrate that both the level and distribution of education can have significant positive effects on both population and economic growth.

TAKING ACTION

During the Alpbach Forum, Mary Robinson, Former President of Ireland, President of the Mary Robinson Foundation for Climate Justice, and ALG member, said, “We can address the huge poverty gaps in the world, and we have a means to provide sustainable energy for all, whatever the economic system. We all need to change. We need governance, business, and civil society. We need young people and women to, say, ‘take responsibility.’ I hope we can all go away to contribute to a movement to contribute to the right decisions in 2015.”

The Alpbach–Laxenburg Group aims to support three major decision making processes slated for 2015: The Financing for Sustainable Development Conference (12–15 July); the adoption of the Sustainable Development Goals by the United Nations (23 September); and the pledge for a global climate agreement at the 21st Conference of the Parties of the UN Framework Convention on Climate Change in Paris (30 November–11 December).

IIASA Director General and CEO Professor Dr. Pavel Kabat said, “The next 18 months will be decisive for the path that our world will take. We will have these three fundamental moments in 2015 when we can make a real difference. The Alpbach–Laxenburg Group is poised to provide cross-sectoral rigor and input to these three key moments in the world’s decisive discourse.” **PB**

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A young girl with dark skin and short hair, wearing a white patterned shirt, is seen from the side, pointing with a wooden stick at a chalkboard. The chalkboard is dark and has several white chalk marks, including the Greek letter epsilon (ε), a circle, and a plus sign (+). The word 'Qualit' is written in large yellow letters across the top of the board, and the word 'not' is written in smaller yellow letters to the right. The background is a light-colored wall.

Qualit

not

**New projections
bring a revolutionary view
of future population**

Y quantity

The United Nations (UN) projects that the world population will grow to 11 billion by 2100. But that number may be off by two billion, according to new population projections developed by IIASA and the closely affiliated Wittgenstein Centre for Global Human Capital.

Their projections show that world population is likely to peak at 9.4 billion around 2070 and then decline to around 9 billion, with alternative scenarios that range from 7 billion to almost 13 billion.

Why do IIASA's projections differ from the UN's? In part it is because of different data being used for fertility trends, which are the main drivers of long-term population growth. But the major difference lies in the explicit consideration of education and in the assembly of massive expert knowledge used to produce the new IIASA projections, which were published this fall in a new book, *World Population and Human Capital in the 21st Century*. ►

Traditional demographic projection tools normally only structure the population by age and sex. The multidimensional demographic tools developed at IIASA and applied in these new projections structure the population by age, sex, and level of education. Since all demographic rates and, in particular fertility rates in developing countries, differ greatly by level of education, the future looks different when researchers explicitly account for the changing education structure of the population.

"This book presents the broadest ever synthesis of expert knowledge on drivers of fertility, mortality, migration and education in all parts of the world," says Wolfgang Lutz, director of IIASA's World Population Program and founding director of the Wittgenstein Centre for Demography and Global Human Capital, a collaboration of IIASA, the Austrian Academy of Sciences, and the Vienna University of Economics (WU). Lutz led the project, which involved over 550 experts in a series of surveys and expert workshops held on five continents.

Beyond numbers

The potential number of people on the planet is far from the most important information contained in their new data, say Lutz and his colleagues.

"What's important is not simply the number of people, it is their capabilities, their health, and how much education they have—what we call human capital" says Lutz. A growing body of research from demographers at IIASA and beyond has shown clearly that education is vital in determining future population growth, future health, as well as many other factors including economic growth, quality of governance, and the capacity to adapt to climate change. Education has long been considered a key driver in demography but was not explicitly incorporated into the models

because of lack of data and unfamiliarity with the multidimensional methods.

"But now the data and the appropriate methods are there, and there is no reason to maintain the conventional narrow focus on just age and sex," says Lutz. As Joel Cohen of The Rockefeller University and Columbia University wrote in a review of the book, "This monumental, pioneering volume proselytizes for a new trinity of fundamental of demography: age, sex and education. If this book succeeds in its mission, as I hope it will, the future will look different, not only for the science of demography, but also for all people's lives."

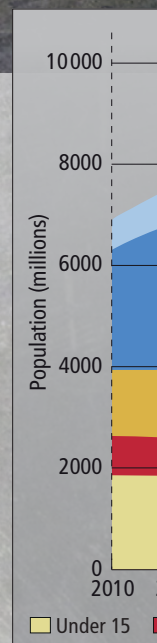
"When we think about human behavior it makes sense that what is in your brain is equally or even more important than your age, gender, or what is in your wallet," says Lutz.

He notes that the new approach will have far-reaching implications for research on future social and economic change.

This explicit consideration of education also has direct implications for population projections. In the case of Nigeria, the above-mentioned UN projections show an increase from 160 million in 2010 to 914 million in 2100.

"These projections assume that fertility has remained stagnant at six children for the past 10 years, and will then decline more slowly than IIASA projections suggest," says Lutz. "But if we look at the education of young women today, we see that in the 20 to 24 age group, half already have secondary education, while among women aged 40 to 44 it is only a quarter. And since more educated women consistently have lower fertility, future fertility is likely to decline, as the more educated girls enter reproductive age. Disregarding this important structural change leads to higher projections of future fertility."

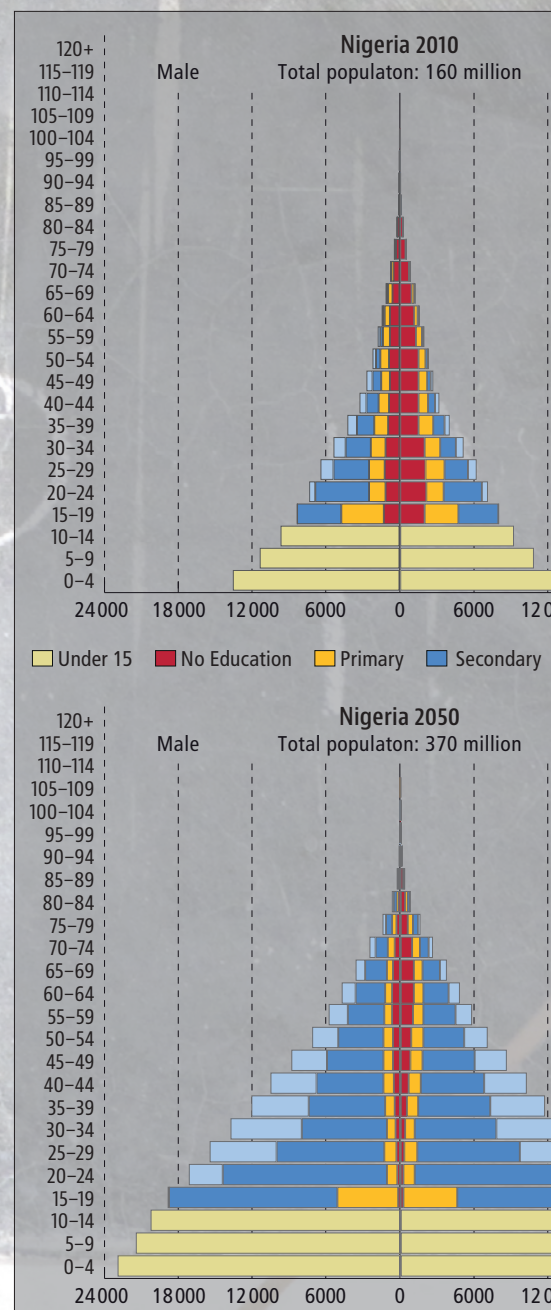
The new IIASA projections also take into account a growing body of research that redefines how people age, so that in the new projections, the proportion of the population that is considered old is based on years of remaining life expectancy, rather than an arbitrary number of years lived.

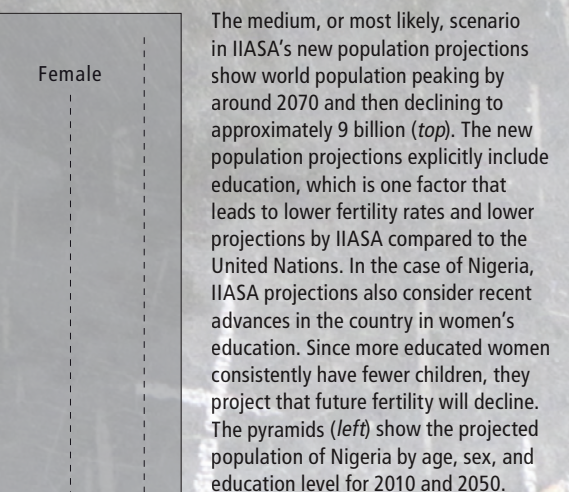
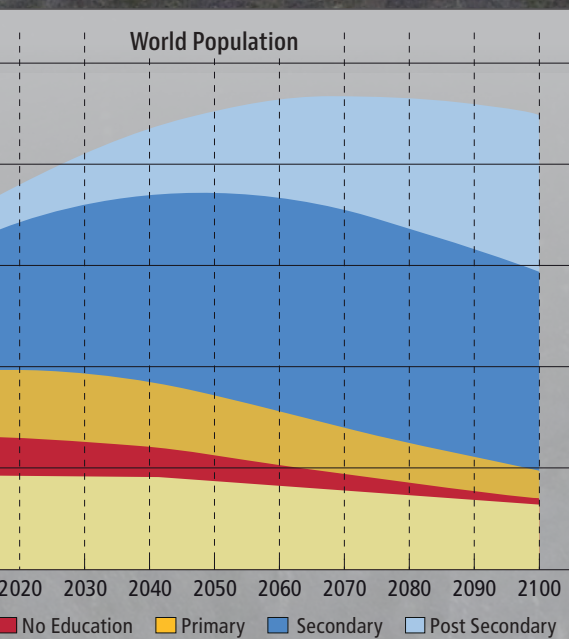


A long history of IIASA population projections

The 2014 projections build on a long history of groundbreaking population research from IIASA scientists. In the 1970s and 80s, IIASA researchers Andrei Rogers and Nathan Keyfitz made history by developing the methods multidimensional demographic projections. IIASA also published the first global probabilistic projections and spearheaded the approach of expert-argument based projections.

Previous sets of projections were published in three major research papers published in the journal *Nature* in 1997, 2001, and 2008, by Lutz and IIASA colleagues Sergei Scherbov and Warren Sanderson. ■





The medium, or most likely, scenario in IIASA's new population projections show world population peaking by around 2070 and then declining to approximately 9 billion (top). The new population projections explicitly include education, which is one factor that leads to lower fertility rates and lower projections by IIASA compared to the United Nations. In the case of Nigeria, IIASA projections also consider recent advances in the country in women's education. Since more educated women consistently have fewer children, they project that future fertility will decline. The pyramids (left) show the projected population of Nigeria by age, sex, and education level for 2010 and 2050.

Data Explorer

IIASA's population projections have always been freely available for anyone to use. But with so much data on assumptions and results now available for 195 countries, by education level, age, and sex for sets of scenarios until 2100, the newly released population projections reach into the realm of big data—far too much information to be easily explored in a spreadsheet. So along with the book, IIASA researchers for the first time released the data via the online Wittgenstein Centre Data Explorer, which allows people to delve into the details and pick out the countries or world regions, and indicators about assumptions and results that they are specifically interested in, at any level of detail regarding age, sex, and education categories. The data can be viewed online in maps, graphs, or tables, or easily exported for additional use.

"The initial version is still aimed at scientists, but we hope to make these data useable for policymakers, journalists and the general public soon," says IIASA researcher Anne Goujon, who led the Wittgenstein Centre Data Explorer development. ■

Population, climate change, and sustainable development

Having such a detailed view of future population and relevant characteristics lends itself to application in today's ever more complex and interconnected research, and the projections were designed with this in mind: They form the "human core" of the next generation of climate scenarios, known as the Shared Socioeconomic Pathways (SSPs), which will likely play a key role in future global change analysis including the Intergovernmental Panel on Climate Change (IPCC). The medium population and human capital projection, considered the most likely, corresponds to the middle-of-the road SSP (SSP2), which assumes that many aspects of the world will continue along their current trajectory.

The other four SSPs represent various possible future paths, depending on different assumptions about future changes in education, economic growth, and other factors that can influence population growth. IIASA researcher Samir KC worked closely with the population side of the SSP development. He says, "Past climate scenarios only used total population size. Now, the representation of population as a driver is much richer by having the full age, sex, and education distributions." Different scenarios based on these distributions can make a big difference to future economic growth and technology and in fields related to climate change, including energy and food demand.

A treasure trove for research

The data are now freely available for download via an online data exploration portal (see box), and researchers have already begun using them to enrich their understanding of natural disaster vulnerability, impacts of aging populations, and more.

For example, one major research project at IIASA has examined the links between education and vulnerability to natural disasters. The research, now published in a special issue of the journal *Ecology and Society*, showed that female education is strongly associated with lower levels of disaster fatalities around the world, both in developing and developed countries. Researchers found a correlation across 167 countries for which data were available, and have also conducted detailed case studies in specific countries and regions, including Nepal, Thailand, and the Caribbean. In each case, the researchers found a strong link between education and lower fatality rates in the case of natural disasters—from hurricanes to landslides—which could not be explained by differences in income or national GDP.

Lutz and colleagues have also drawn on the new projections in a re-examination of what should be seen as desirable fertility levels. In many developed countries, birth rates have been declining to what are now well below replacement rate, or two children per woman. The new projections assume that fertility trends are unlikely to rebound to replacement level in the foreseeable future. Is this a problem? In a recent study in the journal *Demographic Research*, the researchers found that it may in fact be a positive.

"People have this idea that replacement level fertility is the ideal," says Lutz. "But like other questions, when we factor in education, the picture looks quite different." A more educated workforce tends to be more productive and healthier, according to the study, which means that even with fewer people of working age, the economy does not have to go into decline and that there are more resources per child to invest in human capital formation. **KL**

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Project Adaptive Capacity to Climate Change: www.iiasa.ac.at/futuresoc
Data Wittgenstein Centre Data Explorer: www.wittgensteincentre.org/dataexplorer

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Bouncing forwa

Floods are the most devastating natural hazard globally. In order to operationalize, measure, and help build the resilience of communities to floods, IIASA is participating in the innovative Flood Resilience Alliance launched by Zurich Insurance. This extensive research project brings together IIASA's expertise on risk modeling and systems science with the on-the-ground presence of the International Federation of Red Cross and Red Crescent Societies (IFRC), the international development NGO, Practical Action, and the University of Pennsylvania's Wharton Risk Management and Decision Processes Center.

The Flood Resilience Alliance aims to find innovative ways to reduce risk before a flood strikes. NGO collaborators will use IIASA findings to design and implement interventions to benefit communities. IIASA's effort, which is truly cross-cutting, involves three IIASA programs: Risk, Policy and Vulnerability; Ecosystems Services and Management; and Water.

The Alliance is working with communities in Mexico, Nepal, Indonesia, and Peru. As Reinhard Mechler, IIASA's scientific lead for the project, explains, "IIASA is designing advanced modeling techniques that are robust, user-driven, and user-friendly. The work and findings will not only help communities directly at risk, but also eventually support local, national, and international policymakers, NGOs, and donors worldwide."

FLOODING IN INDONESIA

In 2013, 47 people died in serious flooding in West Java and Jakarta. Jakarta has been subject to recurrent flooding—risk is intricately linked to development of this megacity in a complex socioeconomic environment. Rapid urbanization and a lack of building and zoning regulations coupled with land subsidence and sea-level rise have led to heightened exposure and vulnerability of houses and infrastructure to extreme rainfall in this megacity. ■

**A unique alliance between
leading humanitarian and
development NGOs, IIASA,
and the private sector
will help build flood resilience
in communities across the globe**

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THE IMPERATIVE: FROM RISK AVOIDANCE TO LIVING WITH RISKS

The world is facing increasing risks as globalization connects people, economies, and ecosystems. Globally, the number of people exposed to floods each year is increasing at a higher rate than population growth. People are drawn to live on flood plains partly because of economic opportunity. However, it is increasingly recognized that communities cannot totally avoid risks.

To date, the development and the disaster risk management (DRM) communities have relied on a mix of interventions to help communities cope with flooding: “hard” interventions like building a dam or flood evacuation routes and, to a much lesser extent, “smart and soft” interventions like land use planning, insurance, and early-warning systems.

Flood risk management is dominated by single interventions, many of which fail to meet their objectives because they do not consider the wider socioeconomic system within which they operate. In some instances interventions can even be counterproductive for resilience, inadvertently undermining development or actually increasing risk in another way.

The Flood Resilience Alliance is using a participatory and iterative approach to develop sustainable portfolios of interventions that tackle both flood risk and development objectives in synergy.

Says Adriana Keating, IIASA’s Flood Resilience Alliance project manager, “The strategies communities use to pursue their development and wellbeing objectives have a profound impact on risk.

WHAT IS RESILIENCE?

Resilience has a rich history and multiple interpretations. Used widely in engineering, psychology, and economics, it was brought to IIASA by C.S. Holling in 1973 for application to ecological systems. The centrality of “shocks” to the concept has made resilience an appealing concept in the disasters field where it has proliferated in recent years.

IIASA researchers conceptualize disaster resilience as, “the ability of a system, community, or society to pursue its social, ecological, and economic development and growth objectives, while managing its disaster risk over time in a mutually reinforcing way.” This understanding of resilience stresses that a resilient community is one that can not only survive and recover from disaster events, but actually thrive in the face of these events and continue to strive toward new opportunities as risks change.

The project’s approach to resilience is to focus on the outcomes of actions for people’s wellbeing. Wellbeing goes beyond wealth to encompass the social, human, environmental, physical, and financial capitals and capacities which make up the community system. ■

Likewise, the way a community approaches its disaster risk has a profound impact on development and wellbeing. The trick is to get these two working in a virtuous cycle, rather than undermining each other.”

Mechler explains, “A proper understanding of resilience in qualitative and quantitative terms has been lacking in resilience research to date. Arguably, this is why there has been little concrete, measurable progress on the ground. The new initiative focuses on benchmarking and tracking the underlying sources of resilience and the long-term outcomes.”

For the flood-prone communities involved in the study, this means shedding light on why one community may fare better than another in the same disaster, despite seemingly identical levels of development and vulnerability.

According to Keating, “With the information and resources acquired in this work,

communities will not just be able to bounce back after a disaster. They’ll be able to actually bounce forward in terms of making progress on important development objectives, such as increasing and strengthening livelihoods, and building requisite infrastructure.”

KP

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■ www.iiasa.ac.at/Flood-Resilience

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Stakeholder consultations, engaged scholarship, bottom-up science— Buzzwords in IIASA research, but what do they mean in practice?

IIASA stakeholders include farmers in Africa, Asia, and South America affected by climate change; EU officials and international governments developing air pollution and climate policies; and world leaders at the top levels of global decision-making, including United Nations processes on climate change and sustainable development.

"A stakeholder can be anyone with an interest, concern, or knowledge about an issue," says Joanne Bayer, director of IIASA's Risk, Policy and Vulnerability Program, "At its most basic level, 'stakeholder consultation' just means going to people to get information that can inform research." But today, the term means far more: intimate and innovative processes that engage stakeholders in model development and policy formation, not just informing research, but also ensuring that the people involved have ownership of the science.

The people behind the models

Much IIASA research relies on complex models that can explore future changes across multiple linked areas. Researchers use these models to produce scenarios that can project how different policy choices may lead to different future developments. For example, the Global Biosphere Management Model (GLOBIOM) is used to analyze competition between agriculture, bioenergy, and forestry in land use.

GLOBIOM researchers talk to stakeholders to understand what factors drive land use change, and how. But to put these drivers in their model, scientists need numbers, while the farmers and policymakers they work with rarely think in terms of spreadsheets, percentages, and plus and minus signs.

IIASA researcher Amanda Palazzo traveled to Nepal, Vietnam, Costa Rica, and Colombia in 2013 to help facilitate a series of scenario-building workshops as part of a project on food security, environment, and rural livelihoods for the Climate Change, Agriculture and Food Security (CCAFS) research program of the global agriculture consortium CGIAR.

During the workshops, Palazzo and her colleagues worked step-by-step with the stakeholders to understand what factors they expect to influence future agriculture, working together to develop the verbal descriptions into more quantitative indicators that could be fed into a model.

Following the workshop, the researchers then ran the model and came back with a set of scenarios for the stakeholders to discuss. Palazzo says, "We asked them if the scenarios looked credible, and why or why not, and then we went back to refine them."

When the quantitative modeling results did not fit the context of the region or the storylines, the group made changes, and then ran the model again, repeating until the scenarios seemed useful.



to science

By involving stakeholders directly in research aimed at policy solutions, researchers gain more buy-in from the people who will implement and be affected by new policies. In the photos above, stakeholders from southeast Asia discuss climate adaptation during a workshop in Vietnam in November, 2013.

Workshop photos: Elisabeth van de Grift | CGIAR (flickr.com CC BY-NC-SA 2.0)

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Agreeing to disagree

Another challenge with stakeholder consultation is that every person has a different worldview.

"If you ask a group of engineers for a solution to retain water in a landscape, they'll tell you to build a reservoir. Ask an environmentalist and they may argue for wetlands preservation," says Bayer.

In a long-running research project focused on landslide risk in the Italian town of Nocera Inferiore, Bayer and her colleagues worked with local residents and decision makers to define a risk management policy. In 2005, a massive landslide decimated the town and killed three people. But nearly 10 years later, the community remains at a stalemate with how to prevent such future catastrophes, because of public opposition to potential solutions.

The project took a new tack by encouraging the participants to maintain their own opinions and ideas, rather than push them to agree on a consensus. In that way, the researchers gathered a range of opinions and inputs and at the same time, allowed the participants to learn from each other.

"Our goal was to encourage compromise," says Bayer.

Sometimes, the researchers say, numbers are not the best representation of reality—and recognizing that can be key to better science.

Sendzimir says, "We must push to obtain numbers that allow us to model, for that enables us to much more rigorously explore options. But in many cases, we are not modeling reality. We are modeling people's perceptions, and if we really better understood the diversity of perceptions involved and their implications, that would be an excellent contribution to better decision making." **KL**

Further info Kok K, Bärlund I, Flörke M, Gramberger M, Holman I, Sendzimir J, Stuch B, Zellmer K. European participatory scenario development: Strengthening the link between stories and models. *Climatic Change* (Published online 3 June 2014) [doi:10.1007/s10584-014-1143-y]. ■ Kok K, van Vliet M, Bärlund I, Dubel A, Sendzimir J (2011). Combining participative backcasting and exploratory scenario development: Experiences from the SCENES project. *Technological Forecasting and Social Change* 78(5):835–851 [doi:10.1016/j.techfore.2011.01.004].

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"Unique in this process was that we asked them not just about the factors they were sure about, but also to note things that are uncertain, but relevant to the future," says Palazzo. "It is a lot of work, but it is worth it to know that we are not just pulling our scenarios for the future out of thin air."

In another recent project funded by the European Commission, IIASA researcher Jan Sendzimir and colleagues in 16 countries explored the conceptual and practical challenges of linking stories to models, working with stakeholders with an interest in climate change and freshwater resources in Europe.

Wageningen University researcher Kasper Kok led the stakeholder interaction activities. He says, "The weakest link in connecting stories to models is turning the storyline into numbers. When you ask stakeholders to put a number on something, often they throw their arms up and say, 'How am I supposed to know? You're the expert.'"

So the researchers introduced a way to include uncertainty in their process, an approach known as Fuzzy Set Theory.

"The reason it's called 'fuzzy' is that we allow them to be uncertain," says Kok. For example, when asked to define 'low' or 'high' rates of population growth, the stakeholders can provide an overlapping set of numbers as the definitions for low and high growth.

The goal of the project was for stakeholders to provide crucial inputs to a model that they could use themselves to examine the potential impacts of their choices. By involving them directly, said Kok, the stakeholders also had more ownership over the process and results. He says, "Sometimes stakeholder input gets a bit lost under all the descriptions of modeling efforts. But we take their involvement very seriously. We try to produce scenarios that are authored by the stakeholders—not by the scientists."

Solving the maize?

Scientists from IIASA's Ecosystems Services and Management (ESM) Program have been studying ways of increasing yields of staple food crops in sub-Saharan Africa, which has some of the lowest crop yields in the world. Researchers projected potential climate change impacts on maize yields under three different intensification options using the GIS-based EPIC (GEPIC) agronomic model—one with a high mineral nitrogen (N) supply and rotating with bare fallow, and two with a moderate N supply and rotating with the fast-growing nitrogen-fixing tree *Sesbania sesban* or the herbaceous N-fixing crop, cowpea.

They found that to the 2040s the *Sesbania sesban* option would lead to increased maize yields due to increased soil N, enhanced water infiltration, and better soil water holding capacity; intensive cultivation with a bare fallow or rotation with cowpea, however, would result in lower yields and increased soil erosion. Spatially, though, the conventional intensification appeared more suitable in



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arid regions, while cowpea was the most efficient option in the humid tropics. Yields in all scenarios would decrease by 2100, should temperatures exceed critical thresholds.

Eco-intensification in sub-Saharan Africa as a sole means of adapting agriculture to climate change was thus limited. Highly adverse temperatures would require introduction of heat-tolerant cultivars, while strongly adverse precipitation decreases would necessitate expanding irrigation where feasible.

The scientists recommended further detailed studies at field and regional scale to analyze how changes in agro-environmental variables like soil organic carbon, erosion, and soil humidity might influence the field crop's resilience to climate change. **KP**

Further info Folberth C, Yang H, Gaiser T, Liu J, et al (2014). Effects of ecological and conventional agricultural intensification practices on maize yields in sub-Saharan Africa under potential climate change. *Environmental Research Letters* 9(4):044004 [doi:10.1088/1748-9326/9/4/044004].

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A urine-diverting dry toilet (UDDT) in Botswana. The walls of the superstructure are made of old beer cans. Photo: Stefanie Lorenz | SuSanA (flickr.com CC BY 2.0)

Curbing CH₄ from pit latrines

IIASA has contributed to a paper on global methane (CH₄) emissions from pit latrines. The research aims to provide policymakers with a comprehensive understanding of how emissions from on-site sanitation systems can best be limited, the appropriate mitigation technologies, and relative costs.

The UN has targeted universal access to adequate sanitation by 2030 for 2.5 billion people who currently lack improved sanitation services. However, this could also significantly increase CH₄ from wastewater in previously underserved areas of South Asia and sub-Saharan Africa.

The new analysis demonstrates that the problem of CH₄ emissions from pit latrines can be reframed as an opportunity to incentivize progress up the sanitation ladder to the use of composting toilets, or more advanced systems, with co-benefits for both greenhouse gas mitigation and water and sanitation development.

The paper uses a global hydrological model to estimate water table depths, and combines this with characteristics of various sanitation and composting technologies. A key ingredient in a sustainable sanitation system is more fully aerobic disposal. The use of well-maintained composting toilets, where the solids decompose aerobically to a nutrient-rich compost within a few months, is an excellent option. It would avoid groundwater contamination and provide an opportunity for nutrient recycling; it is also price-competitive with other CH₄ mitigation measures in organic waste sectors.

However, direct measurements of CH₄ and N₂O from pit latrines and composting toilets are not available in the literature. Scientists emphasize that these are needed to validate and improve emissions factors and inventories. **KP**

Further info Reid MC, Guan K, Wagner F, Mauzerall DL (2014). Global methane emissions from pit latrines. *Environmental Science & Technology* 48(15):8727–8734 [doi:10.1021/es501549h].

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Toward universal pensions in Mexico

In a new paper published by London-based charity HelpAge International, IIASA researcher Larry Willmore describes the remarkable rise of social pensions in Mexico, and suggests reforms to eliminate elder poverty and attain universal pension coverage.

Pension coverage from 2000 to 2013 rose from 22% to 88% of older Mexicans thanks to the introduction of social pensions, which require no employment record or contributions to qualify. Nonetheless, nearly one million older Mexicans still have no pension.

The first social pension began in 2001 when Mexico City (Federal District) Governor Obrador introduced a universal pension for residents over 70. In 2007 Congress, despite opposition from the conservative Partido Acción Nacional (PAN), launched a universal rural over-70s pension scheme with monthly benefits of MX\$500 (US\$45).

In January 2012 in a surprise move, the PAN president of the day (Felipe Calderón), extended the federal scheme to urban Mexico, but excluded older persons with earnings-related pensions. Notably, only the most and least developed federal entities, Federal District and Chiapas, respectively, have introduced universal pensions.

When Enrique Peña Nieto took presidential office in January 2013, he extended social pensions to the 65–69 age group, while continuing to exclude those with earnings-related pensions.

Willmore stresses the need to achieve universal coverage as soon as possible and to double minimum pension benefits in order to eliminate extreme poverty. He recommends the social pension also be extended to those with earnings-related pensions, restoring the ideal of a universal pension. **KP**



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Further info Willmore L (2014). Towards Universal Pension Coverage in Mexico. Briefing No. 13 (Pension Watch Series), HelpAge International, London, UK [www.helpage.org/download/537ccce61a7b6].

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Sustainability means business success

To attract and retain customers, real-estate developers of business parks around the world need to pursue integrated management plans that make environmental responsibility and sustainability a priority in building design, construction, and operation.

That is the message of a paper co-authored by IIASA researchers which discusses the development of a new expanded business operations model (EBOM). EBOM, which supersedes the typical business operations “flow diagram” model, indicates cycling

behavior that synergistically enhances each of four chosen categories—environment, facilities, business synergism, and green image.

The authors identified and reviewed measures taken in these four areas by four independently operated eco-smart communities: the Beijing Development Area in China and three in the United States (California, Maryland, and Texas). These case studies were used to build the EBOM model framework, with scientists analyzing the cascade of impacts resulting from efforts to enhance the four categories.

For instance, for the Texas case study, authors reviewed environmentally friendly strategies and general policies toward green design at the Hall Office Park, developed by Hall Financial Group, a member of the US Green Building Council since 2007.

The authors note the availability of affordable green alternatives to construction materials, adding that improved efficiencies can lower operating costs in the long run. Likewise, the potential for increased business from a positive green image is an increasingly important economic driver, and a positive EBOM feedback.

The model will help companies set achievable goals that mark reasonable progress in their environmental stewardship policies. **KP**

Further info Dean CA, Fath BD, Chen B (2014). Indicators for an expanded business operations model to evaluate eco-smart corporate communities. *Ecological Indicators* 47:137–148 [doi:10.1016/j.ecolind.2014.07.010].

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China's richest provinces worsen scarcity among water-poor regions

Many developed regions in China are importing food and other water-intensive goods from water-scarce regions in the rest of the country, according to a new joint IIASA study. "This has potentially adverse impacts on water availability for the entire country," explains IIASA and University of Maryland researcher Laixiang Sun, a study co-author.

Researchers used the concept of "virtual water," an economic concept used to track how water is traded through agricultural products and other goods that use water in production. As Sun points out: "It takes about 1,600 m³ of actual water to produce one tonne of wheat. By importing a tonne of wheat instead of producing it domestically, a region can save most of that water."

In China, ample water in the wealthier southern region contrasts with scarce water in most northern provinces. When rich provinces such as Shanghai and Beijing import water-intensive goods from less-developed provinces, this exacerbates the problem

of water scarcity in those other regions. In addition, the production of international exports in China's top exporting regions also draws on water resources in the water-scarce northern provinces.

This study, Sun says, lays the groundwork for smarter water resource management. Recognizing the problem of water scarcity, China has launched a multi-billion dollar water transfer project to divert water from

the south to the north of the country. But, replacing imports from the north with goods produced in the south could be a more efficient solution to the problem, researchers suggest. **JO**

Further info Feng K, Hubacek K, Pfister S, Yu Y, Sun L (2014). Virtual scarce water in China. *Environmental Science & Technology* 48(14):7704–7713 [doi:10.1021/es500502q].

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Climate-smart farming needed to reverse crop yield stagnation

Crop yield growth for many key food crops has stagnated in much of the world since the end of the last century, but the reasons for this are unclear. In a new joint study, IIASA researchers used process-based analysis to examine the role of different drivers (climate change, use of chemical fertilizer, change in location of rice cultivation areas, and changes in crop varieties and management) in explaining rice yield development in China.

While China's national rice production increased from 143 to 197 million tonnes between 1980 and 2010, yields have stagnated over the past decade. This stagnation jeopardizes the 20% increase in production required by 2020 to feed China's growing population.

Climate change is not a factor that has impeded rice yield growth, the study suggests. Rather, yield stagnation is due to a decreasing relative contribution of fertilizer that is not being compensated for by improved varieties and management. Findings show, however, that adapting to climate change may actually contribute to yield growth by facilitating the relocation of rice-growing areas and the adoption of improved rice management.

"Our crop model simulations show that national rice yield could increase by 20–50% through the introduction of climate smart rice varieties, changing sowing dates, and improving management



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techniques," IIASA's Wei Xiong points out. "Transforming agriculture to be climate-smart is one of the solutions for enhancing food supply in China, given the decreasing efficiency of chemical fertilizers, shrinking arable land, rising environmental concerns, and increasing food demand." **JO**

Further info Xiong W, van der Velde M, Holman IP, Balkovic J, Lin E, Skalsky R, Porter C, Jones J, Khabarov N, Obersteiner M (2014). Can climate-smart agriculture reverse recent slowing of rice yield growth in China? *Agriculture, Ecosystems & Environment* 196:125–136 [doi:10.1016/j.agee.2014.06.014].

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Major air pollutant reduction in East Asia “feasible”

The control of air pollutant emissions in East Asia—a major contributor to global emissions—is key to the improvement of both the regional and global atmospheric environment. Based on a new evaluation of emission trends and mitigation options for multiple air pollutants in East Asia, researchers now provide up-to-date projections upon which air quality and climate mitigation policies can be built.

“We examined air pollution control measures in East Asia in the last decade and evaluated the impact of control policies on emission trends during 2005–2010,” explains IIASA’s Zbigniew Klimont. “Our study also projected future emissions of sulfur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter (PM), and non-methane volatile organic compounds (NMVOCs) until 2030 under six emission scenarios based on a range of energy-saving and end-of-pipe emission control measures, like flue gas desulfurization systems.”

Findings indicate that by 2020 China’s emissions of NO_x, SO₂, and fine particulate matter (PM_{2.5}) could be 16–26% lower than the 2010 levels if control policies and associated regulations are enforced efficiently. Moreover, the adoption of further energy-saving measures (including behavioral changes) could play an essential role in cutting air pollutant emissions even more. “Assuming the full application of technically feasible energy-saving policies and end-of-pipe control



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technologies across East Asia, the emissions of NO_x, SO₂, and PM_{2.5} would account for only about one-quarter and NMVOCs for one-third of the baseline projection levels by 2030,” Klimont points out. **JO**

Further info Wang SX, Zhao B, Cai SY, Klimont Z, Nielsen CP, Morikawa T, Woo J-H, Kim Y, Fu X, Xu JY, Hao JM, He KB (2014). Emission trends and mitigation options for air pollutants in East Asia. *Atmospheric Chemistry and Physics* 14(13):6571–6603 [doi:10.5194/acp-14-6571-2014].

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Jakarta puts climate risk management theory into practice

A crucial aspect in climate adaptation is dealing with extreme events including natural disasters. A better understanding of the nature of climate-related disaster risk and risk management options could inform action on climate adaptation and point the way forward for more effective policy and practice, suggests IIASA’s Reinhard Mechler.

The IPCC Fifth Assessment Report recently documented that anthropogenic climate change, in addition to causing gradual shifts, is increasing the intensity, duration, and frequency of extreme temperatures and rainfall. In addition, another very different human contribution that renders disasters “unnatural” is the interaction of hazards with the exposure and vulnerability of affected people and

communities. “Climate science and risk analysis have recognized the need to provide input in terms of disentangling the contributions of these two complex sets of drivers, which is necessary for devising risk management options that work,” Mechler explains.

Science is already informing practice. The megacity of Jakarta, where IIASA is currently involved in research, is establishing a multi-billion dollar program to protect itself from rising sea levels using large levees. This effort is taking place in tandem with actions to manage rising flood exposure as a result of increasing urbanization. Options to implement new building and zoning regulations that lower the vulnerability of houses and infrastructure to extreme rainfall are also being explored.

While many policy and implementation-specific questions remain, researchers aim to take the agenda on climate risk management forward with a focus on informing policy as well as providing actionable information on the ground. **JO**

Further info Mechler R, Bouwer LM, Linnerooth-Bayer J, Hochrainer-Stigler S, Aerts JCJH, Surminski S, Williges K (2014). Managing unnatural disaster risk from climate extremes. *Nature Climate Change* 4(4):235–237 [doi:10.1038/nclimate2137].

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VOA Indonesian Service, via Wikimedia Commons

Fisheries research tips the scales

Optimal fisheries management depends on understanding fish reproduction, growth, and mortality. IIASA research published in February 2014 sheds new light on sexual maturation of the European freshwater whitefish *Coregonus lavaretus*, an important commercial and recreational fish.

IIASA scientists studied *C. lavaretus* living in the Austrian pre-alpine Lake Irrsee, assessing, for the first time in this species, the probability that a fish matures at a certain age and length (the so-called probabilistic maturation reaction norm or PMRN).

Since 2000 the Lake Irrsee whitefish population has been sampled every October prior to the spawning season, determining the total length, age, sex, and maturity status of 2,000 individuals. Each individual's age was identified by scrutinizing its scales, which bear patterns akin to tree rings.

By disentangling the effects of maturation from those of survival and growth, the researchers showed fish length to be the



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only relevant determinant of maturation probability, irrespective of age. This is surprising, since older fish tend to mature at larger sizes in almost every other species for which PMRNs have so far been estimated. More accurate stock predictions in Lake Irrsee are enabled by these findings. **KP**

Further info Ficker H, Mazzucco R, Gassner H, Wanzenböck J, Dieckmann U (2014). Fish length exclusively determines sexual maturation in the European whitefish *Coregonus lavaretus* species complex. *Journal of Fish Biology* 84(4):1164–1170 [doi:10.1111/jfb.12301].

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Paris to breathe easier in 2050

IIASA scientists, together with experts from Airparif, which monitors air quality for the French Environment Ministry, used the CHIMERE model to downscale pollution data to a 4 km-resolution grid to investigate local-scale air pollution over the city of Paris for 2045–2054. CHIMERE, a regional atmospheric composition model, assessed pollution relative to present-day emissions under a business-as-usual (BAU) scenario and a climate mitigation scenario (consistent with the RCP 2.6). Scientists from the French CNRS and INERIS research institutes led the project, and the long-term scenarios drew on IIASA's Global Energy Assessment.

This was the first time a study of a 10-year air-quality projection for the mid-21st century under climate and city-level emission changes has been conducted over a large European agglomeration at such fine scale.

Former atmospheric pollutant studies had only a few hundred kilometers resolution and thus did not capture the high spatial variability of short-lived pollutants like ozone (photochemical smog) and fine breathable particles (dust, soot) or their sharp horizontal gradients over urban areas.

While previous regional-scale, lower-resolution studies had found 2050 maximum ozone decreasing under both scenarios, this study found projections differing substantially from present data values: +7 parts per billion (ppb) under BAU and a moderate decrease of –3.5 ppb under the “low emissions” climate mitigation scenario.

Interestingly, concentrations of fine particulate matter (PM_{2.5}) decreased by 78% and 89% under the BAU and mitigation scenarios, respectively. The reduction was much more prominent over the urban part of the region because of the effective particle reduction from road transport and residential emissions by 2050. **KP**

Further info Markakis K, Valari M, Colette A, Sanchez O, Perrussel O, Honore C, Vautard R, Klimont Z, Rao S (2014). Air quality in the mid-21st century for the city of Paris under two climate scenarios; from the regional to local scale. *Atmospheric Chemistry and Physics* 14(14):7323–7340 [doi:10.5194/acp-14-7323-2014].

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Indonesian seminar on applied systems analysis

In cooperation with National Member Organizations of Indonesia, Vietnam, and Malaysia, IIASA co-hosted a session on applied systems analysis as part of the ninth Association of Southeast Asian Nations (ASEAN) Science and Technology Week (ASTW), which took place in August.

ASTW showcases science and technology achievements in ASEAN member countries, relevant to the needs of the public and private sectors in the region.

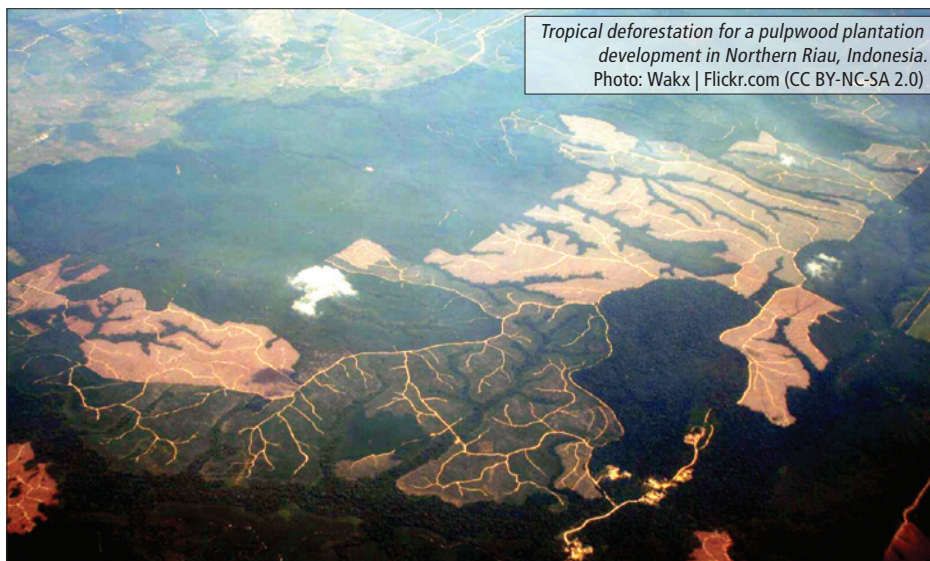
The aim of the session on applied systems analysis was to connect international expertise and experience with domestic challenges and initiatives. Participants included researchers, central and regional government agencies, science and technology leaders, decision makers, industry representatives, and media practitioners, as well as representatives from IIASA's National Member Organizations in Australia, Austria, Indonesia, Malaysia, and Vietnam.

Gerhard Glatzel, IIASA Council Member for Austria, Austrian National Academy of Sciences, and Kuntoro Mangkusubroto, IIASA Council Member for Indonesia, Head of Indonesia National Committee for

Applied Systems Analysis, took part in a keynote discussion on how applied systems analysis can support policy measures for complex problems in the ASEAN context. This was followed by a panel discussion led by Florian Kraxner, Deputy Program Director, Ecosystems Services and Management, IIASA, on sharing Indonesia's experience in applying systems analysis to address national challenges. One of these experiences

includes the Tropical Flagship Initiative (TFI)—a new flagship project launched earlier this year by IIASA in cooperation with, among others, the Indonesia National Committee for Applied Systems Analysis (INCASA). The TFI aims to provide a new approach to tackling tropical deforestation through policy assessment and capacity building. **PB**

www.iiasa.ac.at/events/ASTW-14



*Tropical deforestation for a pulpwood plantation development in Northern Riau, Indonesia.
Photo: Wakx | Flickr.com (CC BY-NC-SA 2.0)*

Enhancing collaboration with Korea and Malaysia

In June and July, Director General and CEO Professor Dr. Pavel Kabat and his advisor Chin-Min Lee made an official visit to the Republic of Korea and Malaysia to strengthen cooperation on global problems ranging from air pollution to tropical deforestation. They met with National Member Organizations, the National Research Foundation (NRF) of Korea and the Academy of Sciences Malaysia (ASM),

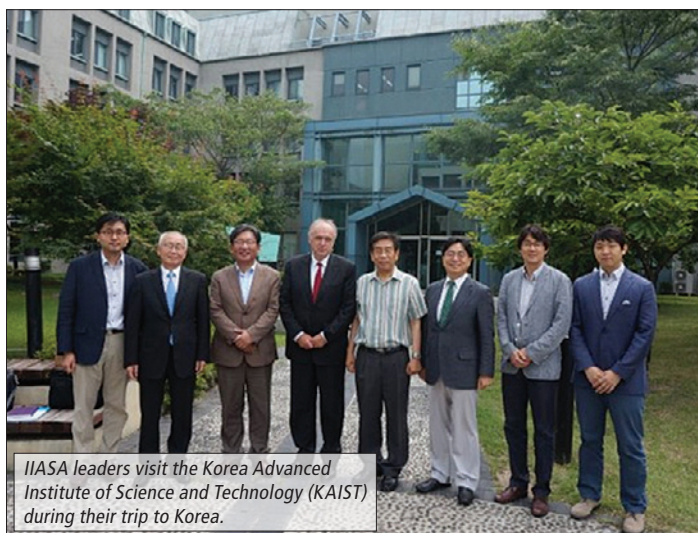
which have facilitated studies and capacity-building activities with in-country research partners.

In Korea Kabat met with the President of NRF, Professor Min Keung Chung, and discussed ways to build on current collaborations, including a new study on using agent-based modeling to explore the resilience of Korea to a range of extreme events, development of a Korean version of IIASA's GAINS model, IIASA's role at the opening session of the 7th World Water Forum in Daegu in 2015, green growth, and forest cooperation.

During his visit, Kabat took part in a national debate on Malaysia's water future which was co-organized by ASM, IIASA, and the New Straits Times.

Water management is one of the global problem areas where IIASA and Malaysia wish to strengthen collaborations. Meetings between Kabat and ASM President Tan Sri Datuk Ahmad Tajuddin Ali and, subsequently, with Datuk Seri Zakri Abdul Hamid, Science Advisor to the Prime Minister of Malaysia, also identified IIASA's Tropical Flagship Initiative, postdoctoral program, the Alpbach-Laxenburg Group, and the Water Futures and Solutions initiative as fields where IIASA-Malaysian collaborations could be intensified.

Details of IIASA's collaborations with its NMO countries are available at www.iiasa.ac.at/infosheets. **KP**



IIASA leaders visit the Korea Advanced Institute of Science and Technology (KAIST) during their trip to Korea.

Peter E. de Jánosi Postdoctoral Fellowship campaign

IIASA is launching a second fundraising campaign for a Peter E. de Jánosi Postdoctoral Fellowship to honor the substantial contributions made by de Jánosi in 1990–1996 as IIASA Director, in 1987–1990 as council member, and in 1976–1978 as program leader.

With the help of its alumni network, IIASA is aiming to raise US\$1 million to fund the annual award of the postdoctoral fellowship for the next 10 years. The annual stipend envisaged for each fellow is about US\$65,000 (~€50,000) over two years.

It is intended that the fellows will carry forward de Jánosi's deep interest in applying interdisciplinary analyses to large-scale public policy and management problems, particularly through integration of the social sciences into IIASA's work.

Postdoctoral research scholarships at IIASA carry special recognition both within and outside the Institute, with IIASA's multidisciplinary approach to



real-world problems resulting in a lively and challenging postdoctoral environment. Postdocs have daily access to scientific staff across the Institute who help them approach problems from different angles, develop their professional skills, and provide research advice. IIASA is thus a particularly good proving ground for postdocs considering a career in the policy advisory sphere.

With their contributions, alumni will help ensure that this memorial to de Jánosi and his role at IIASA will continue for many years into the future. There will be a permanent plaque at Schloss Laxenburg honoring de Jánosi and listing the Peter E. de Jánosi fellows.

Read more on de Jánosi's contributions to IIASA at www.iiasa.ac.at/dejanosi. KP

New appointments at IIASA

DONALD SAARI was appointed as Council Chair at the biannual meeting of the IIASA Council in June 2014, effective from 11 November 2014. Saari, Distinguished Professor of Economics and Mathematics at the University of California, Irvine, succeeds Peter Lemke. Saari is a member of the US National Academy of Sciences and Chair of the US National Member Organization Committee for IIASA. His research interests include dynamical systems and their application to the physical and social sciences.

ALEXEI GVISHIANI was appointed as Council Vice-Chair at the same meeting, succeeding Saari. Gvishiani, a member of the Russian Academy of Sciences, is Director of the Geophysical Center, Russian Academy of Sciences, and specializes in mathematical geophysics. Saari and Gvishiani will serve in their new posts through December 2018.

ELENA ROVENSKAYA has been appointed as Program Director of the Advanced Systems Analysis Program at IIASA. A participant in the 2005 IIASA Young Scientists Summer Program, Rovenskaya is also a Research Scholar at the Optimal Control Department of the Faculty of Computational Mathematics and Cybernetics, Lomonosov Moscow State University. Her scientific interests lie in the fields of theory of optimal control, ill-posed problems, and economic–environmental modeling.

GEOFF CLARKE has been appointed Senior Science Officer within the IIASA Directorate. A former researcher at IIASA's Australian National Member Organization, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Clarke specializes in strategic, operational and change management within complex, multidisciplinary research environments. KP



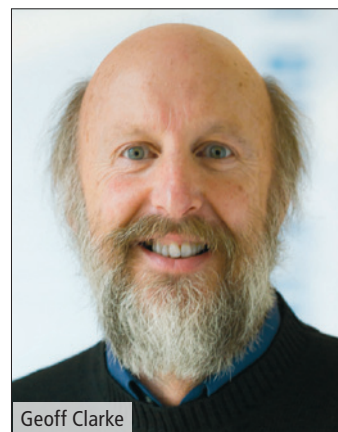
Donald Saari



Alexei Gvishiani



Elena Rovenskaya



Geoff Clarke

IIASA hosts major infrastructure symposium

The second International Symposium for Next Generation Infrastructure (ISNGI) imagined resilient infrastructure systems that meet the needs of twice today's world population with half of today's resources, while providing better livability.

Speakers at the symposium, held in Laxenburg this fall, emphasized that the future of infrastructure systems—transport, energy, water, waste, telecommunications, housing, social infrastructure, and green infrastructure—will be determined by two major “new” issues: (i) new technologies, which will reshape physical networks and services; and (ii) new institutions, involving a multitude of decision makers, such as public policymakers, private investors, planners, operators and users, who will decide whether and how new technologies and services are adopted. Delegates emphasized the importance of understanding how the physical network interacts with decision making in the multi-actor network, and how the former might be influenced by institutional changes.

Many of the interdependencies and interconnections that collectively make up the physical, economic, and social systems of cities and regions are incompletely known, said symposium participants. The symposium recognized that sophisticated analytical techniques and tools would be required to enhance the resilience of infrastructure, particularly given the mounting effects of global change, as infrastructure has already proven vulnerable to climate change, weather, and other extremes.

One keynote speaker was Peter Bakker, President of the World Business Council for Sustainable Development (WBCSD) and a member of the new high-level Alpbach–Laxenburg Group. Bakker discussed how the scientific and business communities can work better together to improve their ability to achieve common goals. He stressed the importance of scientific research in setting the priorities for sustainable development, and for business then taking action.

During the lecture, which is available to watch online, Bakker announced that the WBCSD, along with IIASA and the UN Sustainable Development Solutions Network, will organize a series of roundtables to identify the business and technological solutions to climate change and the potential barriers to such solutions.

KP

www.iiasa.ac.at/events/ISNGI-14



UNIDO and IIASA strengthen ties

UNIDO Director General Li Yong and IIASA Director General and CEO Pavel Kabat met at IIASA on 22 August. Talks centered on the signing of a Memorandum of Understanding under which IIASA would develop analytical frameworks and tools to assist UNIDO to shape its future multidimensional operations on poverty eradication. The new collaboration builds on successful UNIDO–IIASA partnerships in energy research, such as the Global Energy Assessment and the Vienna Energy Forum.

www.iiasa.ac.at/news/UNIDO-visit-14

Program evaluations

In the past year IIASA's distinguished external evaluation committee has evaluated six IIASA programs—Mitigation of Air Pollution and Greenhouse Gases; Energy; Transitions to New Technologies; World Population; Evolution and Ecology; and Ecosystems Services and Management. The committee, drawn from an international and interdisciplinary cross-section of top academics, assessed each program's goals and achievements under IIASA's strategic plan and their policy impact. They also looked ahead at research plans and strategy for the next five years.

www.iiasa.ac.at/events/evaluation-committee-14

IIASA meets Lower Austria

IIASA Director General and CEO Pavel Kabat met with Dr. Petra Bohuslav, Lower Austrian Commissioner for Economics, in August at the Alpbach Technology Forum at a joint working session on bioenergy and renewable resources held by ecoplus, the Business Agency of the Province of Lower Austria. Discussions centered on how to strengthen cooperation between IIASA and the Province of Lower Austria in achieving the aims of a zero-carbon society, given that both organizations have similar objectives.

www.iiasa.ac.at/news/bohuslav

Top global think tank

IIASA has again been ranked as one of the top five think tanks for climate change economics and policy worldwide. The International Center for Climate Governance (ICCG) published the results of its 2013 “Climate Think Tank Ranking” of the most cutting-edge institutions working in the field of climate change economics and policy. IIASA ranked fifth in the world in the Standardized Ranking and third in the Absolute Ranking, out of 295 think tanks worldwide.

www.iiasa.ac.at/news/ICCG-thinktank-14



IIASA Photos | Matthias Silveri

Challenges for humanity —and for researchers

A workshop organized by IIASA Young Scientists Summer Program participants brings a new perspective to global challenges

On 7 August 2014 participants in IIASA's Young Scientists Summer Program (YSSP) invited Institute scientists and staff to a workshop addressing five major questions regarding the future of humanity: adaptation to changing environments; planetary boundaries and resource constraints; quality of life; conflict management; and the morality and ethics of science and technology.

The impetus for the workshop came from a lecture at IIASA by Ernst Ulrich von Weizsäcker, author of the 2009 book, *Factor 5: Transforming the Global Economy through 80% Increase in Resource Productivity*. Weizsäcker spoke about how increasing efficiency improvements by a factor of five in some economic sectors, while maintaining the quality of service and wellbeing, can help achieve sustainability.

When the YSSP participants later discussed the lecture, they felt compelled to initiate a larger discussion on the subject of global challenges.



Workshop participants (left to right) Margaret Garcia, Miho Kamei, Thomas Schinko, Farid Karimi

IIASA Photo | Aleksandra Gofala

"We realized that there is a need for more radical rethinking of existing paradigms," said Fabian Schipfer, who organized the workshop along with fellow 2014 YSSP participants Mikko Dufva, Lukas Figge, Edoardo Borgomeo, and Thomas Schinko.

The organizers started by surveying YSSP participants to identify questions for discussion. The workshop included small group discussions, followed by a larger group discussion to share insights among the full group.

Co-organizer Edoardo Borgomeo said, "The workshop provided an opportunity to leave our own jargon-laden scientific 'silos' and discuss challenges faced by humanity and how we might address them." **KL**

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Rational water use

A 2013/14 SA-YSSP participant from China finds hidden water in her country's agricultural system

During the 2013/14 Southern African Young Scientists Summer Program (SA-YSSP), Delin Fang explored the effectiveness of a water conservation scheme in an arid region of Northwest China. In April she published a paper on her results in conjunction with her two SA-YSSP supervisors and her PhD advisor from Beijing Normal University.

The water conservation scheme in question was in the Ganzhou District in the Heihe River Basin. The river, which flows about 821 km from the Qilian Mountains to the Gobi Desert, has abundant water resources. But rapid socioeconomic development and increasing population density in the upper and middle reaches of the Heihe result in uneven water distribution downstream. As the main water consumption in Ganzhou is from farming, livestock, and agriculture, the government wished to reduce agricultural

water consumption here to allow more water to flow through to the lower reaches.

Most models developed for water system analysis ignore cycling and the indirect flows associated with importing and exporting products that contain water or have consumed water during the production process. This so-called embodied or hidden water is vital for an integrated view of water utilization efficiency.

In their study Fang and co-authors used Network Environ Analysis (NEA), a formal, quantitative methodology to account for cycling and indirect flows. This approach can show the efficiency of water utilization from a holistic perspective and investigate how various components of the system are linked to each other and to the overall system.

From their NEA analysis, the researchers concluded that the current water conservation scheme is neither rational



Delin Fang in Cape Town, South Africa, during the 2013/14 SA-YSSP

Photo: Delin Fang

nor effective and that, in a next step, water resource donation and extraction relationships need to be studied.

Fang says, "I was lucky to have been selected to attend the SA-YSSP. The research that I did during this exciting program helped further my PhD studies." **KP**

Further info Fang D, Fath BD, Chen B, Scharler UM (2014). Network environ analysis for socio-economic water system. *Ecological Indicators* 47:80–88 [doi:10.1016/j.ecolind.2014.04.046].

Recovering from disaster What does it take?

Q&A with IIASA Postdoctoral Research Scholar Wei Liu

Q What is the focus of your research?

A The major question that I address is: how to achieve transitions to sustainability, especially in ecologically vulnerable areas.

For example, I've been studying the Wolong Nature Reserve in China for ten years. Human exploitation of natural resources in that area led to severe ecological degradation that has impacted both endangered species such as giant pandas, and the livelihoods of local Tibetan residents. With the completion of a major cross-border road in the late 1990s, the subsistence-based agricultural economy has gradually changed to more of a market economy featuring cash crops and tourism.

During this time payment for ecosystem services programs was implemented in the reserve, giving the local people subsidies for environmentally friendly activities, including cutting fewer trees. These, together with the economic transition, have moved the community more toward sustainability. Within ten years the average household income has quadrupled and the forest cover has increased significantly.

This was a case where we had success. Very often you meet failure, but finding success and explaining the complex mechanisms behind that success story is very important. Then other places can learn from it and replicate the mechanisms.

Q How did you get interested in disaster risk research?

A A major earthquake struck the area in 2008—it was magnitude 8 and killed at least 80,000 people. I was 15km away from the epicenter and was able to observe firsthand the disaster, the damage, and how people responded. Then later, through participating in disaster relief and reconstruction, I observed how people coped and adapted over the following years. That event changed my life and got me into disaster risk research. I came to IIASA as a result of that research.

Previously I was interested in endangered species. Often if you want to protect these, you have to deal with development issues. Because of the earthquake and the related disasters—landslides, flood, and debris flow—I realized that in such ecologically vulnerable areas you have to deal with disasters too. Otherwise, neither conservation nor development goals can be achieved. They are connected and have to be addressed in an integrated way. So now I am interested in the overlapping areas of development, biodiversity conservation, and disaster risk reduction.

Q What type of research have you done since the earthquake?

A Since 2008 I have continued to monitor the ecosystem using remote sensing technology and I have also been monitoring the socioeconomic system by returning to visit the same households that we started sampling in the late 1990s. We go back every other year to see how they are adjusting their livelihoods and land use to cope with disasters and policy changes.

Q You've also started a non-profit that serves the local people in the region, haven't you?

A A few of us started Human and Environment Linkage Program (HELP) in 2006 and had it officially registered as a non-profit organization in 2008. HELP has been playing an important role in earthquake relief and reconstruction in Wolong and has recently expanded to work in other similar ecologically vulnerable areas in western China. **JP**

Wei Liu

is a postdoctoral research scholar in IIASA's Risk, Policy and Vulnerability Program. His research investigates the different interplays between biodiversity conservation, socioeconomic development, and disaster risk reduction.

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Photo: Wei Liu



IIASA YSSP Fellowships, Summer 2015

Every summer from 1 June to 31 August, the International Institute for Applied Systems Analysis (IIASA) hosts up to 50 doctoral students from around the world in its Young Scientists Summer Program (YSSP).

Apply now for the 2015 program

Deadline: 12 January 2015

Each YSSP participant works on a topic related to his or her PhD thesis and IIASA's research agenda, the goal being to write a publishable paper. All YSSP participants are personally mentored by IIASA senior scientists.

You should apply if:

- You are an advanced graduate student;
- Your field of study complements research at IIASA;
- You are interested in pursuing interdisciplinary research;
- Your research and career would benefit from working alongside young scientists and senior scientists from around the world;
- You would like to explore the policy implications of your work.

Successful applicants from countries with an IIASA National Member Organization (NMO) are eligible for funding, and some fellowships are also available for students from non-NMO countries.

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- Energy and Climate Change
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- Evolution and Ecology
- World Population
- Risk, Policy and Vulnerability
- Water

Questions?
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“It was a steep learning curve, but immensely stimulating and rewarding to work with and learn from experienced researchers at IIASA.

This opened up a whole new research direction for me, and one in which I am now fully immersed.”

Charlie Wilson, YSSP’08

“I came back to Edinburgh with new tools and expertise that will help me to work on PhD research with ease.”

Stephy Makungwa, YSSP’10



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