

# Activities with Member Countries

## Japan

Research collaborations between IIASA and Japan have been highly productive since the institute was founded in 1972. This Info Sheet focuses on key aspects of this beneficial relationship since 2010, which has involved cooperation with more than 40 Japanese organizations and resulted in over 460 scientific publications and a range of research advances. Recent studies have included in-depth analyses of how to maximize the co-benefits from measures to reduce both air pollution and greenhouse gas emissions in Japan and Asia; the development of a new set of scenarios to underpin future climate modeling, impact, vulnerability, adaptation, and mitigation assessments; and research into the evolution of diseases and commercially-exploited fish. IIASA long-standing connections to business in Japan include the Toyota Motor Corporation and the Tokyo Electric Power Company, with collaborations focused on efficient and sustainable energy systems. Knowledge transfer between IIASA and Japan is also facilitated by multiple exchanges with Japanese researchers working at or visiting IIASA, and IIASA researchers visiting and attending events in Japan. In addition, since 2010, 9 Japanese doctoral students and 2 postdoctoral fellows have gained international and interdisciplinary research skills from IIASA programs for young scientists.

### Highlights of Interactions Between IIASA and Japan (since 2010)

<b>National Member Organization</b>	The Japan Committee for IIASA
<b>Membership start date</b>	1972 (founding member)
<b>Key research partners</b>	<ul style="list-style-type: none"> <li>■ Asia Center for Air Pollution Research</li> <li>■ Central Research Institute of Electric Power Industry (CRIEPI)</li> <li>■ Institute for Applied Energy (IAE)</li> <li>■ Institute for Global Environmental Strategies (IGES)</li> <li>■ Kyoto University</li> <li>■ Ministry of the Environment</li> <li>■ National Institute for Environmental Studies (NIES)</li> <li>■ Research Institute of Innovative Technology for the Earth (RITE)</li> <li>■ Toyota Central Research and Development Corporation (TCRDL)</li> <li>■ Tokyo Electric Power Company (TEPCO)</li> </ul>
<b>Areas of research collaboration</b>	<ul style="list-style-type: none"> <li>■ Co-benefits: Improving air quality and tackling climate change</li> <li>■ Advancing energy and integrated assessment modeling in Japan</li> <li>■ Global Energy Assessment and Japan</li> <li>■ Projecting demographic change in Japan</li> <li>■ Forests: Bioenergy resource and carbon sink</li> <li>■ Reducing disaster risk in Japan</li> <li>■ Growth, innovation, and technology research</li> <li>■ The future of fisheries and other evolutionary studies</li> <li>■ Analyzing global water challenges</li> </ul>
<b>Capacity building</b>	9 doctoral students from Japan have taken part in IIASA's Young Scientists Summer Program (75 since the program began in 1977). 2 postdoctoral fellows from Japan have developed their research skills at IIASA.
<b>Publication output</b>	500 publications have resulted from IIASA-Japanese collaborations
<b>Other interactions</b>	<ul style="list-style-type: none"> <li>■ Researchers, advisors, and diplomats from Japan have visited IIASA over 150 times, while IIASA scientists have visited Japan over 200 times.</li> <li>■ Over 250 Japanese nationals have participated in IIASA events since 2010.</li> </ul>

## **Activities with Member Countries: Japan**

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IIASA Info Sheets provide succinct summaries of IIASA activities.  
They do not necessarily reflect the views of IIASA staff, visitors,  
or National Member Organizations.

This Info Sheet summarizes IIASA interactions with Japan during 2010–2019.  
It includes highlights, with links to further information, but is not  
intended to be a comprehensive report on all interactions.

Feedback and updates are encouraged and should be sent to the External  
Relations Department.

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## IIASA National Member Organization in Japan

The Japan Committee for IIASA is the National Member Organization (NMO) representing Japanese membership of IIASA. The Committee was one of the founding members of IIASA in 1972, along with organizations from 11 other countries from the then Eastern and Western blocs. The Japanese Ministry of the Environment funds IIASA's annual membership fee and NMO activities. The Japan Committee supports the development and operation of IIASA in Japan and is made up of representatives from research institutes working in the same fields as IIASA and individuals who have worked at IIASA.

The current members of the Japan Committee for IIASA are:

**Professor Youichi Kaya (Chair)**, Professor Emeritus, University of Tokyo and President, Research Institute for Innovative Technology for the Earth (RITE)

**Dr. Hajime Akimoto**, Visiting Scientist, Center for Social and Environmental Systems Research, National Institute for Environmental Studies (NIES)

**Dr. Hideo Harasawa**, Vice President, National Institute for Environmental Studies (NIES)

**Dr Mikiko Kainuma**, Senior Research Advisor, Institute for Global Environmental Strategies (IGES)

**Mr. Hideyuki Mori**, Executive Director, Institute for Global Environmental Strategies (IGES)

**Dr. Kazuhiko Takeuchi**, President, IGES/Research Director, Integrated Research Systems for Sustainability Science (IR3S), University of Tokyo

**Professor Taikan Oki**, Senior Vice-Rector, United Nations University (UNU)

**Professor Kenji Yamaji**, Director-General, Research Institute for Innovative Technology for the Earth (RITE)

**Professor Tetsuzo Yasunari**, Director General, Research Institute for Humanity and Nature (RIHN)

Advisor:

**Professor Hironori Hamanaka**, Special Research Advisor, Institute for Global Environmental Strategies (IGES)

Observers:

**Ms. Hiroko Aotake**, Director, International Cooperation Office, Environmental Management Bureau, Ministry of the Environment (MOEJ)

**Ms. Minako Kawai**, Section Chief, International Cooperation Office, Environmental Management Bureau, Ministry of the Environment (MOEJ)

**Dr. Satoshi Kojima**, Principal Policy Researcher, Program Management Office, Institute for Global Environmental Strategies (IGES), serves as NMO Secretary for Japan

*The Japan Committee for IIASA represents Japan and its scholarly community on IIASA governing Council*

*Web: [www.iges.or.jp/en/network/iiasa.html](http://www.iges.or.jp/en/network/iiasa.html)*

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## Research Partners in Japan

*IIASA is continually developing collaborations with Japan and has recently been working with 43 organizations in Japan via formal and informal connections*

IIASA works with research funders, academic institutions, policymakers and individual researchers in Japan. The following list includes the names of the organizations, or the individuals' affiliated institutions, that have recently collaborated with IIASA.

Advanced Research Institute for the Sciences and Humanities, Nihon University  
Asia Center for Air Pollution Research  
Central Research Institute of Electric Power Industry (CRIEPI)  
Climate Experts Ltd  
Gifu University  
The Graduate University for Advanced Studies (SOKENDAI)  
Hirosaki University  
Hokkaido University  
Institute for Applied Energy (IAE)  
Institute for Global Environmental Strategies (IGES)  
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)  
Japan Advanced Institute of Science and Technology (JAIST)  
Japan Atomic Energy Agency  
Japan Automobile Research Institute  
Japan External Trade Organization  
The Japan Gas Association  
Japan Nus Co Ltd  
Keio University  
Kyoto University  
Kyushu University  
Meiji Institute for Advanced Study of Mathematical Sciences  
Meiji University  
Ministry of Economy, Trade and Industry (METI)  
Ministry of the Environment  
Musashino University  
Nagoya University  
National Institute for Environmental Studies (NIES)  
Okinawa Institute of Science and Technology Graduate University  
Research Institute of Innovative Technology for the Earth (RITE)  
Science Council of Japan  
Shinshu University  
Soka University  
Tohoku University  
Toyota Central Research and Development Corporation (TCRDL)  
Toyota Motor Corporation  
Tokyo City University  
Tokyo Electric Power Company (TEPCO)  
Tokyo Gas Co. Ltd.  
Tokyo Institute of Technology  
Tokyo University of Science  
University of Niigata  
University of Shiga Prefecture  
University of Tokyo

## Recent Research Collaborations

### *Co-benefits: Improving air quality and tackling climate change*

IIASA GAINS model is a scientific tool that helps policymakers select a smart mix of measures to simultaneously cut air pollution and greenhouse gas emissions in the most cost-effective way. It has been applied successfully in international negotiations of the Convention on Long-range Transboundary Air Pollution and the European Union to curb air pollution; and it has been used to analyze mitigation efforts for the climate negotiations under the UN Framework Convention on Climate Change.

*Japanese and IIASA researchers are jointly investigating how to simultaneously reduce air pollution and greenhouse gas emissions in Japan and Asia*

Most recently Japanese researchers and policymakers have collaborated with the IIASA GAINS modeling team to identify measures to curb the release of short-lived climate pollutants such as black carbon and methane. By implementing an integrated approach to reducing these pollutants, there is potential to simultaneously increase human wellbeing through reduced local air pollution, improve local environmental quality, increase security of food and energy supply, and lower water demand as well as reducing greenhouse gas emissions. Activities include:

- Collaboration with the Asia Center for Air Pollution Research in Niigata on the Japanese-funded S7 project 'Co-benefits of reducing short-lived climate pollutants in East Asia.'
- A series of IGES-IIASA international workshops (2012, 2013, 2014, 2015) organized by the Institute for Global Environmental Strategies (IGES) and Japan's Ministry of the Environment to discuss the design and implementation of an integrated approach to air pollution and climate change policy in Asia.
- An evaluation using GAINS of measures to reduce short-lived climate pollutants in Asia, which will feed into the IGES Integrated Policies for Sustainable Societies Area with funding from Japan's Ministry of the Environment.
- IGES serves as the secretariat for the Asian co-benefits Partnership, of which IIASA is a member—a network to facilitate the implementation of the co-benefits approach in tackling environmental challenges.
- Japan is a member of the Climate and Clean Air Coalition to Reduce Short Lived Climate Pollutants—the first international effort to treat these pollutants as a collective challenge. IIASA and international partners provided the intellectual underpinnings for this coalition via an article in *Science* in 2012.

IIASA GAINS modelers have been part of a systematic intercomparison of Asian atmospheric-chemistry models (MICS-Asia) since 1998. Japanese partners include the Asia Center for Air Pollution Research, the Central Research Institute of Electric Power Industry (CRIEPI), the Disaster Prevention Research Institute at Kyoto University, and the National Institute for Environmental Studies (NIES).

### *Advancing energy and integrated assessment modeling in Japan*

Japanese national interests are integrally connected to complex global systems that impinge on the country's economy, energy systems, and climate among others. IIASA recent collaborations with Japanese researchers and institutions are improving energy and integrated assessment modeling and thereby contributing to Japan's strategic research base through enhancing modeling knowledge and skills. In addition, the research improves understanding of how global and national energy and climate policies may impact Japan.

*IIASA and Japanese researchers collaborate on advancing the modeling of energy and climate change globally*

Recent collaborations include:

- An international collaboration including researchers from the Institute of Applied Energy (IAE), National Institute for Environmental Studies (NIES), the Global Carbon Project-Tsukuba International Office, and IIASA investigated the global impacts of different negative emissions technologies (NET) and found that resource implications need to be addressed before NETs could play a significant role in achieving climate change goals. This result was published in *Nature Climate Change* in 2016.

- IIASA, the National Institute for Environmental Studies (NIES), and Stanford University coordinate the work of the Integrated Assessment Modeling Consortium (IAMC), an international research consortium created to lead the integrated assessment modeling community in the development of new scenarios to form the basis for future climate modeling, assessment of impacts, vulnerability, and adaptation and mitigation options. The first phase saw the development of projections of greenhouse gas emissions, known as the Representative Concentration Pathways (see box: IIASA's global contribution, page 9), that serve as inputs for earth system and climate models. The global collaboration's second phase is currently developing the Shared Socio-economic Pathways that facilitate the integrated analysis of future climate impacts, vulnerabilities, and adaptation and mitigation options. Both these are critical to the work of the Intergovernmental Panel on Climate Change (IPCC).
- The IAMC also includes the Central Research Institute of Electric Power Industry (CRIEPI), the Institute for Applied Energy (IAE), and the Research Institute of Innovative Technology for the Earth (RITE).
- IIASA and RITE work closely on the "ALternative Pathways towards Sustainable development and climate stabilization" (ALPS) project to analyze (1) holistic transformation pathways toward a more sustainable future, and (2) historical and future technology diffusion dynamics. Part of the findings of this project contributed to of quantitative analysis on better understanding future energy demand and supply and the role of innovation of both sides driven by digitalization, Artificial Intelligence (AI), the Internet of Things (IoT), and the sharing economy, as recognized by G20 Energy and Environmental Ministerial Meeting in 2019.
- A global model comparison of 23 energy-economy and integrated assessment models has helped better articulate Asia's role in mitigating climate change—crucial given the growing economic relevance of Asia in the world and its energy and environmental impacts. This Asian modeling study was a global collaboration between multiple modeling teams including IAE, NIES, RITE, the Tokyo University of Science, and IIASA, and ran from 2009 to 2012.
- Other collaborations include:
  - Researchers from the Institute for Global Environmental Strategies (IGES) contributed to an IIASA assessment of the water needs of the energy sector under different energy system transformation pathways.

### Supporting evidence-based policy making in Japan

Interactions between policymakers and scientists provide governments with the evidence and research to make the most effective policies. Recent activities between IIASA and Japanese policymakers include:

- Director General & CEO Pavel Kabat spoke at the Science and Technology in Society (STS) forum in 2014 and in 2015 on global water challenges. STS brings together world leaders, not only scientists but also academics, policymakers, business leaders, and journalists from various different fields, to Kyoto to meet and exchange opinions on global issues.
- A series of IGES-IIASA international workshops (2012, 2013, 2014, 2015) organized by the Institute for Global Environmental Strategies (IGES) and Japan's Ministry of the Environment to discuss the design and implementation of an integrated approach to air pollution and climate change policy in Asia.
- Every year, Deputy Director General Nebojsa Nakicenovic gives the keynote presentation at the ALPS International Symposium, hosted by the Research Institute of Innovative Technology for the Earth (RITE) with support from the Japanese Ministry of Economy, Trade and Industry (METI). The symposium brings together Japanese ministers and climate scientists from across the globe to share new knowledge and ideas regarding policies to achieve a sustainable future.
- Japan's Ministry of the Environment and IGES have been funding IIASA's air pollution experts to use the GAINS model to evaluate measures to reduce short-lived climate pollutants in Asia.
- Deputy Director General Nakicenovic is a Steering Committee Member of the Innovation for Cool Earth Forum (ICEF), which is aimed at addressing climate change through innovation.

- Studies with the Tokyo Electric Power Company (TEPCO) have used energy modeling and empirical analyses to research future markets for energy technologies, the potential for global electrification to reduce greenhouse gas emissions, and a possible future hydrogen energy system.
- The EU-funded project, CD-LINKS, with NIES and RITE is exploring national and global transformation strategies for climate change and their linkages to a range of sustainable development objectives.
- The EU-funded project, LIMITS (2011-2014), with NIES explored the co-benefits of climate policy for air pollution, energy security, and economic growth.
- The EU-funded project, AMPERE (2011-2014), with RITE researched climate change mitigation pathways and associated mitigation costs.

### **Global Energy Assessment and Japan**

The Global Energy Assessment (GEA), published in 2012, defines a new global energy policy agenda—one that transforms the way society thinks about, uses, and delivers energy.

*Japan was a significant contributor to the Global Energy Assessment*

Coordinated by IIASA and involving over 500 specialists from a range of disciplines, industry groups, and policy areas, GEA research aims to facilitate equitable and sustainable energy services for all, in particular for around three billion people who currently lack access to clean, modern energy.

Japan contributed to the GEA through nine Lead Analysts, a further four contributors, and one reviewer. Findings relevant to Japan and Asia were presented at a workshop in Tokyo in 2013.

The UN Secretary-General's Sustainable Energy For All (SEforALL) initiative adopted findings from the GEA as its key objectives for energy access, energy efficiency, and renewable energy. Several senior Japanese officials are involved in SE4ALL including Masahiko Horie, Japan's Ambassador for Global Environmental Affairs, Dr. Naoko Ishii, the CEO and Chairperson of the Global Environment Facility, and Takehiko Nakao, the President of the Asian Development Bank. IIASA

Business can benefit from science through the analysis and knowledge it provides. In turn, science can benefit from business through its experience on the ground and in implementation. IIASA also recognizes that closer collaboration between business and its researchers can increase the impact of the institute's work.

Since 2008, Toyota Central Research and Development Laboratory has funded IIASA and partners to study (1) the reduction of energy consumption, carbon dioxide emissions and the improvements of air quality in Asia with a particular focus on the transport sector; and (2) future energy scenarios to improve air pollution (ozone) in East and South Asia. The latter involved the development of a simulator able to predict tropospheric ozone concentrations across the whole of South and East Asia.

IIASA is also seeing a growing number of contracts with commercial partners worldwide, including:

- The global insurer, Zurich Insurance Group, began working with IIASA in 2013 to identify and address research gaps on flood resilience and community based disaster risk reduction, demonstrate the benefits of pre-event risk reduction over post-event disaster relief and to improve public dialogue around disaster resilience.
- The German carmaker, Daimler AG, has collaborated with IIASA researchers to assess biofuel potential from marginal and degraded lands in India and Brazil.
- The Brazilian energy company, Petroleo Brasileiro, was one of nineteen sponsors of IIASA Global Energy Assessment.
- The multinational consumer goods company, Unilever, funded IIASA agricultural experts from 2008-10 to analyze yields and land suitability of key agricultural crops under a changing climate.

In addition, IIASA works with the Austrian industrial company, OMV via the IIASA Deputy Director General serving on OMV's Advisory Group on Sustainability and being Chair of the Advisory Board of OMV Future Energy Fund from 2006-11.

**IIASA working with business**

is also one of several institutions responsible for building up a global research and knowledge network for the initiative.

### **Projecting demographic change in Japan**

*IIASA demographers are providing independent analysis and projections of Japan's future population*

Japan's demographics are changing and Japan, like many developed countries, is becoming older. In 1960, 6% of the population was 65 or older, but in 2015, 26% of Japan's population was estimated to be 65 years or older.

IIASA demographers study and project the changing composition of population for all countries of the world. They produce one of the few independent alternatives to the demographic projections of the UN Population Division. As a testament to the quality of IIASA demography, the IPCC in 2011 adopted IIASA population projections as its source data in all modeling for the Fifth Assessment Report; and UNESCO has adopted IIASA demographic methods as part of its literacy forecasting.

The institute's interdisciplinary approach has encouraged its demographers to reach beyond the traditional boundaries of demography and to explore how changes in society, economy, and the natural environment influence the health and mortality, migratory patterns, and reproductive behavior of human society.

A recent innovative example of this broader approach has been the development of research methods to project population by level of education. This equips researchers with the tools to explore the implications of different education policies on a country's future fertility, life expectancy, migration, and population level as well as economic growth and ability to adapt to climate change. In 2014 IIASA published the first projections of educational attainment by age and sex for 195 countries in the *Oxford University Press*. Findings for Japan show how different policies over the next few decades could lead to the country's 2010 population of 126.5 million declining to 84 million by 2060 depending on which policies are adopted. Additionally, in

### **Selected publications resulting from IIASA-Japanese collaborations**

IIASA work is underpinned by high-quality science, which is regularly published in high impact publications. A selection of current publications is presented here and a full list can be found in appendix 5:

- McCollum DL, et al (2018). Interaction of consumer preferences and climate policies in the global transition to low-carbon vehicles. *Nature Energy*, 3, 664-673.
- Rosa IMD, et al (2017). Multiscale scenarios for nature futures. *Nature Ecology & Evolution*, 1, 1416-1419.
- Veldkamp, et al (2017). Water scarcity hotspots travel downstream due to human interventions in the 20th and 21st century. *Nature Communications*, 8, 15697.
- Smith P, Davis SJ, Creutzig F, et al (2016). Biophysical and economic limits to negative CO<sub>2</sub> emissions. *Nature Climate Change*, 6, 42-50.
- Nelson GC, Valin H, et al (2014). Climate change effects on agriculture: Economic responses to biophysical shocks. *Proceedings of the National Academy of Sciences of the United States of America*, 111 (9), pp. 3274-3279
- Yashima K & Sasaki A (2014). Epidemic process over the commute network in a metropolitan area. *PLoS ONE*, 9(6):e98518
- Fuss S, Canadell JG, et al (2014). Betting on negative emissions. *Nature Climate Change*, 4, 850-853
- Sasaki T & Uchida S (2013). The evolution of cooperation by social exclusion. *Proceedings of the Royal Society B: Biological Sciences*, 280(1752):20122498
- Watanabe C, Kanno G & Tou Y (2012). Inside the learning dynamism inducing the resonance between innovation and high-demand consumption: A case of Japan's high-functional mobile phones. *Technological Forecasting and Social Change*, 79(7):1292-1311
- Moss RH, Edmonds, et al (2010). The next generation of scenarios for climate change research and assessment. *Nature*, 463 (7282), pp. 747-756

2016, *Who Survives? Education decides the future of humanity*, a book summarizing scientific research conducted at IIASA was published detailing the importance of education for societal and economic development. The researchers found that education is often more important than income when looking at health, resilience, and wellbeing.

IIASA demographers also collaborate with researchers from the Advanced Research Institute for the Sciences and Humanities at Nihon University on re-measuring aging in Japan.

### **Forests: Bioenergy resource and carbon sink**

IIASA works with a range of Japanese research institutions to investigate bioenergy, forest management, and the global carbon cycle. Collaborations include:

- IIASA collaborated with the Center for Global Environmental Research at the National Institute for Environmental Studies (NIES) to verify measurements taken from Japan's GOSAT (Greenhouse Gases Observing Satellite) by comparing the satellite data with IIASA vast databases of land resources and estimates of carbon in the terrestrial ecosystem. Such verification processes are crucial to developing accurate techniques to translate satellite imagery into assessments of forest, vegetation, and carbon resources on the ground.
- Other studies with the Center for Global Environmental Research at NIES have explored Japanese public opinion toward forest biomass for bioenergy, the potential of bioenergy and carbon capture and storage, and an assessment of renewable energy production from waste in Japan.
- In addition NIES and IIASA are collaborating on a joint project MaGNET (Managing Global Negative Emission Technologies) with the Global Carbon Project and have recently published a commentary in *Nature Climate Change* on the risks of betting on negative emissions from bioenergy and carbon capture and storage.
- NIES has also been an associate partner on two EU-funded projects that IIASA has coordinated:
  - The CC-TAME project (2008-11) developed an integrated model cluster to assess the efficiency and environmental effectiveness of agricultural and forestry policies on the climate system.
  - The GEOBENE project (2006-09) analyzed the benefits of using satellite imagery not just in the study of climate change but also for energy, water, agriculture and ecosystem research.

*A range of collaborations between IIASA and Japanese researchers are improving our understanding of the carbon cycle and the roles played by forests and agricultural lands*

Many of today's most pressing challenges do not stop at international borders. IIASA research areas such as climate change, water scarcity, and poverty are affected by multiple factors across the globe. In turn these global problems have impacts on nations, regions, and continents. Finding long-lasting solutions to these challenges requires scientific expertise that is free from the interests of a single nation. IIASA National Member Organizations recognize this need and that their investment in IIASA is a contribution to a global public good. And the benefit of this contribution is paid back to global researchers, policymakers, and citizens in multiple ways as the following examples show:

1. IIASA supports the climate change research community by hosting the Representative Concentration Pathways (RCP) database. The database provides data on greenhouse gas emissions for four different future scenarios that underpin the analysis of thousands of climate change researchers. IIASA also calculated the data for one of the scenarios, all of which have been developed for the world's most comprehensive analysis of climate change—the IPCC's (Intergovernmental Panel on Climate Change) Fifth Assessment Report.
2. IIASA's research provides scientific guidance to the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe. This international environmental treaty between 33 countries has slashed air pollution in Europe, improving people's health and countries' crop production. IIASA's GAINS model guided negotiators and policymakers as they worked on the treaty to identify the most cost-effective approach to cleaning Europe's air. The negotiators chose the GAINS model not only because of its accuracy and usability but also because it had been developed by an international team with funding from multiple countries, which assured them that the model was nationally unbiased.

**IIASA global contribution**

- Collaborations with the University of Tokyo have explored the factors driving the use of forests certifications across the world.

### Reducing disaster risk in Japan

#### *IIASA and Japanese researchers are working to improve integrated disaster risk management*

A collaboration between Kyoto University's Disaster Prevention Research Institute (DPRI) and IIASA explored how to implement disaster risk management in a systematic and integrated way. Joint activities included a series of forums jointly organized by DPRI and IIASA which culminated in 2009 with the establishment of the Integrated Disaster Risk Management (IDRiM) Society in Kyoto. Through events and an international journal the IDRiM society promotes knowledge sharing and interdisciplinary research to develop integrated disaster risk management. IIASA researchers are among the board of directors of IDRiM and on the journal's editorial board.

For the past several years, researchers from Kyoto University and IIASA have been organizing joint sessions at the IDRiM annual conferences. Additionally, IIASA are working with Kyoto University,

#### IIASA models, tools, and data

Through intense data gathering, computer modeling, and other advanced research methods, IIASA provides a country's researchers and their policymakers with the essential numbers and tools to select the most effective policies. For example, the following collaboration between IIASA, the Japan Automobile Research Institute, and partners in China, South Korea, and the US:

Emissions of air pollutants in East Asia play an important role in the regional and global atmospheric environment. A recent collaboration between researchers in China, Japan, South Korea and IIASA evaluated the recent emission trends of sulfur dioxide ( $\text{SO}_2$ ), nitrogen oxides ( $\text{NO}_x$ ), particulate matter (PM), and non-methane volatile organic compounds (NMVOC) in East Asia, and projected their future emissions up until 2030 with six emission scenarios. Results showed that during 2005–2010, the emissions of  $\text{SO}_2$  and PM2.5 in East Asia decreased by 15 and 12%, respectively, mainly attributable to the large-scale deployment of flue gas desulfurization in China's power plants, and the promotion of highly efficient PM removal technologies in China's power plants and cement industry. During this period, the emissions of  $\text{NO}_x$  and NMVOC increased by 25 and 15%, driven by rapid increase in the emissions from China due to inadequate control strategies. In contrast, the  $\text{NO}_x$  and NMVOC emissions in East Asia except China decreased by 13–17%, mainly due to the implementation of stringent vehicle emission standards in Japan and South Korea. Under current regulations and current levels of implementation,  $\text{NO}_x$ ,  $\text{SO}_2$ , and NMVOC emissions in East Asia are projected to increase by about one-quarter over 2010 levels by 2030, while PM2.5 emissions are expected to decrease by 7%. Assuming enforcement of new energy-saving policies, emissions of  $\text{NO}_x$ ,  $\text{SO}_2$ , PM2.5 and NMVOC in East Asia are expected to decrease by 28, 36, 28, and 15%, respectively, compared with the baseline case. The implementation of "progressive" end-of-pipe control measures would lead to another one-third reduction of the baseline emissions of  $\text{NO}_x$ , and about one-quarter reduction of  $\text{SO}_2$ , PM2.5, and NMVOC. (Source: Wang SX, Zhao B, Cai SY, Klimont Z, Nielsen CP, Morikawa T, Woo JH, Kim Y, Fu X, Xu JY, Hao JM, He KB. Emission trends and mitigation options for air pollutants in East Asia (2014) *Atmospheric Chemistry and Physics*, 14 (13), pp. 6571–6603)

Many of the research projects summarized in this Info Sheet draw on analyses from IIASA models, tools, and data including:

- Reducing air pollutants and greenhouse gas emissions simultaneously (GAINS model).
- Planning a sustainable energy system (MESSAGE model, Global Energy Assessment Scenario Database).
- Reducing energy poverty (Energy Access Interactive Tool [ENACT]).
- Improving food security through identifying yield gaps (GAEZ model) and assessing competition for land use between agriculture, bioenergy, and forestry (GLOBIOM model).
- Financial disaster risk management (CATSIM model).
- Projecting future population (Demographic multistate modeling).
- Utilizing the power of citizen science to verify and improve land use data (GEOWiki).

University of Tokyo, and RIKEN on large-scale agent-based modeling to estimate disaster impact using Japan's next generation super computer K.

IIASA researchers have contributed to a project and book, funded by the Asian Development Bank Institute in Tokyo, on financing disaster risk reduction in Asia and the Pacific. And a recent analysis of natural disaster risk among Asian megacities including Tokyo, found that Asian megacities would benefit from pooling financial risks using a model similar to one used by Caribbean nations.

IIASA researchers are also collaborating with the University of Tokyo on the application of ABM using high performance computing to simulate disaster recovery in Japan.

IIASA Risk and Resilience researchers have also started a collaboration with the Ocean Policy Research Institute in Tokyo on the topic of blue economy and disaster risk financing. They are building a new dynamic macroeconomic model of disaster risk (Binary constrained Disaster (BinD) model) and are collaborating with the OPRI in Tokyo to apply the model in Fiji, Palau and the Maldives.

### **Growth, innovation, and technology research**

Ongoing joint studies between IIASA and the Tokyo Institute of Technology have explored:

- The role of innovation in manufacturing technology and how this relates to economic growth with a comparison of Japan and the USA. The study was funded by Japan's Ministry of Education, Culture, Sports, Science and Technology and the results were published in a book: *Managing Innovation in Japan – The role institutions play in helping or hindering how companies develop technology*.
- Technological innovation through a range of case studies including Singapore's water industry, Japan's mobile phone sector, and green technology.

IIASA also collaborated with Japan Advanced Institute of Science and Technology (JAIST) among other partners to develop new methods for the multi-criteria analysis of problems for which different values of attributes are specified by different experts.

*Collaborations between Japan and IIASA researchers are improving our understanding of innovation*

### **The future of fisheries**

Seafood is the primary source of animal protein for more than one billion people. Many developing nations and coastal communities depend on fisheries. However, expanding food production from fisheries is hindered by rampant overfishing and changes in marine habitats. By combining fields of expertise as diverse as population genetics, evolutionary theory, and fisheries science, IIASA researchers have been analyzing the consequences of commercial fishing practices on the evolution of fish.

*Japanese and IIASA researchers have found mounting evidence of rapid evolution of fish due to commercial fishing practices, and identified management practices to safeguard future fish stocks*

IIASA was established in 1972 to use scientific cooperation to build bridges across the Cold War divide and research growing global problems on a truly international scale. Today the soft power of science diplomacy continues to help IIASA member countries through using scientific cooperation to improve international relations, and through international teams jointly researching controversial issues to find consensus such as through integrative assessments of the future for the Arctic or of the economic integration of Eurasia.

In Japan IIASA has been interalia cooperating with the National Graduate Institute for Policy Studies (GRIPS), who also organized the 2018 International Network for Government Science Advice (INGSA) 3rd biennial conference on International Science Advice to Government.

In addition, IIASA also maintains its original bridge-building objective through attracting member countries that represent a range of geo-political interests (see full list of members: Back page). For instance, both Russia and the US are members; as are Brazil, China, India, and South Africa. Several key factors also unite all IIASA member countries: their interest in systems analysis, scientific and academic infrastructure, economic stability and the geopolitical role in future global transitions. With this in mind, IIASA negotiated membership with Iran and Israel.

**Research to support science diplomacy**

Collaborations with Japan in this field have included a postdoctoral researcher from Kyoto University who contributed to the ADAPTFISH project—a project between IIASA and the Leibnitz Institute for Freshwater Ecology and Inland Fisheries to develop models to explore the evolution of fish, the impact of angler behavior, and the implications for fisheries management. Joint studies have continued with the researcher, now at Gifu University, resulting in a range of publications on fisheries-induced evolution including a case study of northern pike, and assessment tools for fisheries managers among others.

### **Other evolutionary studies**

*Studies between researchers at IIASA and at Japanese Universities have advanced knowledge of evolution in the areas of biodiversity and epidemiology among others*

Other research collaborations between IIASA and Japan have explored evolution in the following areas:

- Research into the eco-evolutionary dynamics of living systems with The Graduate University for Advanced Studies (SOKENDAI) has explored the spread of disease among commuters in the Tokyo metropolitan area, the timing of the emergence of new strains of influenza, and the risk of polio emerging after stopping vaccination among other epidemiological studies. Collaborations with other researchers at SOKENDAI have improved our understanding of the ecological niche and its evolutionary dynamics.
- Studies with researchers at Kyoto University have developed models to help understand the emergence and maintenance of biodiversity through looking at complex food webs.

### **Analyzing global water challenges**

*A new IIASA flagship project, involving Japanese partners, is conducting an integrated analysis of global water challenges*

Progress toward meeting global water challenges has not been enough. For example, 770 million people lack access to improved sources of drinking water, and 35 million die prematurely each year from water-related diseases. In 2013, IIASA and partners launched Water Futures and Solutions (WFaS)—an interdisciplinary and international scientific project to explore our complex water challenges and identify integrated solutions. The initiative uniquely combines scenario-based water analysis, multi-model ensemble analysis, and stakeholder consultation. This initiative includes collaborators from the National Institute for Environmental Studies (NIES), who also provides IIASA with data from its global hydrological model H08, and the University of Tokyo.

An international research collaboration including researchers from IIASA, the University of Tokyo, and the National Institute for Environmental Studies compared three global water models and found significant differences among the models. The researchers suggested ways to reduce uncertainty in global water use modeling and how to improve water use projections.

## Capacity Building

### Young Scientists Summer Program

The Young Scientists Summer Program (YSSP) develops the research skills and networks of talented PhD students. Program participants conduct independent research within the institute's research programs under the guidance of IIASA scientific staff. Funding is provided through IIASA National Member Organizations. The YSSP has attracted over 1,800 participants from over 85 countries since it was established in 1977.

*Since 2010, 9 Japanese students have developed research skills and networks by taking part in the IIASA Young Scientists Summer Program*

In 2012, IIASA launched its first regional YSSP called the Southern African Young Scientists Summer Program (SA-YSSP) aimed primarily at PhD students based in the southern hemisphere. The program was organized jointly by the South African National Research Foundation, the South African Department of Science and Technology, the University of the Free State in Bloemfontein, South Africa, and IIASA.

Since 2010, the following 9 Japanese students have participated in this program:

#### YSSP '17

**Mr. Takuji Oba** (Kyoto University) investigated enhanced realism in models of biodiversity evolution.

#### YSSP '16

**Ms. Fuko Nakai** (Kyoto University) designed and evaluated evacuation policies taking account of uncertainty of tsunami and heterogeneity of evacuees.

#### YSSP '14

**Miho Kamei** (University of Tokyo) analyzed potential opportunities for improving urban energy efficiency while ensuring energy security, sustainability, and resilience.

#### YSSP '13

**Kanae Matsui** (Keio University) created a web-based gaming simulation of how people consume green electricity.

#### YSSP '12

**Taiki Fuji** (Kyoto University) developed and analyzed a model of the population dynamics of Japanese seabass, which is commercially important in Japan, to predict how this species will be affected by the anticipated degradation of river nurseries and changes in river discharge brought about by human activities.

**Kei Kabaya** (Institute for Global Environmental Strategies) investigated the potential of energy efficiency improvements in the residential sector and assessed their effects on CO<sub>2</sub> emissions.

**Joung hun Lee** (Kyushu University) studied the evolutionary dynamics of the spread of corruption and its suppression.

**Hiroto Shiraki** (University of Tokyo) enhanced the AIM energy system model to provide robust solutions for the mitigation of future climate change.

#### YSSP '11

**Mitsuhiko Nakamura** (University of Tokyo) studied a system of indirect reciprocity based on reputation in which information is costly and works as currency.

### ***Postdoctoral Program***

*Two postdoctoral fellows from Japan have developed their careers through joint research and publications at IIASA since 2010*

Postdoctoral researchers at IIASA work in a rich international scientific environment alongside scientists from many different countries and disciplines. The institute's research community helps its postdoctoral researchers to develop their research from fresh angles, to publish widely in journals, and to establish their own global network of collaborators. Two postdoctoral fellows from Japan have participated in the program since 2010:

**Hiroshi Ito** (2011) worked on the extension of adaptive dynamics theory for multidimensional trait spaces, focusing on conditions for evolutionary branching. His postdoctoral scholarship was funded by IIASA. (PhD in Ecology and Computer Science from Tokyo University)

**Tatsuya Sasaki** (2010-2012) carried out research on the coevolution of cooperation and volunteering in public goods games. His postdoctoral scholarship was funded by the Austrian Science Fund, FWF, as part of the project, 'The adaptive evolution of mutualistic interactions.' (PhD in Information Systems Science from Soka University).

Several IIASA researchers hold positions at universities and other institutions in Japan. These include: Masakazu Katsumoto (IIASA guest research scholar (2011-13) and Kyoto Institute of Technology); Akira Sasaki (IIASA research scholar (2005-14) and the Graduate University for Advanced Studies, Hayama); Chihiro Watanabe (IIASA Senior Adviser to the Director on Technology (1994-2009) and IIASA guest research scholar (2010-14) and Tokyo Seitoku University and Tokyo Institute of Technology); Detlof von Winterfeldt (IIASA Director (2009-2012) and member of the Research Advisory Committee of the Institute for Global Environmental Strategies (IGES)); Yoshiki Yamagata (IIASA guest research scholar (2011-14); principal researcher, Center for Global Environmental Research (CGER) at the National Institute for Environmental Studies (NIES); Institute of Statistical Mathematics, Tokyo; and gives lectures at the University of Tokyo, University of Tsukuba and Hokkaido University).

IIASA researchers regularly make presentations in Japan, a recent selection follows:

**Yoshihide Wada** gave a keynote presentation at the JpGU 2018 Conference in Chiba in 2018.

**Junko Mochizuki** on "Multi-agent models in disaster economics" at the World Bosai Forum at the IDRC 2017 in Sendai in 2017.

**Arnulf Grubler** on "Post COP21 and Thereafter: The need for new concepts to monitor progress and compliance and for assisting policy" at the ALPS symposium in Tokyo in 2016.

**Nebojsa Nakicenovic** on "Future of Mobility" at the Global Carbon Project (GCP) Workshop at Toyota High-Level Symposium on Sustainable Cities in Toyota City in 2015.

**Zbigniew Klimont** on "Development and Application of the GAINS model in Asia" at a workshop on 'Bridging Atmospheric Science and Policy in Asia' in Tokyo in 2015.

**Florian Kraxner** on "Multiple objectives and interaction with other (land-based) emission reduction options" at the GCP-IIASA-MCC-NIES workshop on 'Sustainable negative emissions: A climate risk management option?' in Tokyo in 2013.

**Leena Ilmola-Sheppard** on "Resilience as a strategy for coping with uncertainty" at the Tokyo Institute of Technology in Tokyo in 2013.

**Keywan Riahi** on "Required near-term climate actions to limit global warming to 2°C" at the ALPS International Symposium on 'Moving toward Sustainable Climate Change Actions' in Tokyo in 2013.

**Akira Sasaki** on "Computational Virology" at the 23rd Annual Meeting of the Japanese Society for Mathematical Biology: Modeling viral replication processes and their evolution in Shizuoka University in Hamamatsu in 2013.

Other examples of scientific exchange include:

- Over 250 Japanese nationals have participated in IIASA events since 2010.
- 500 publications have resulted from collaborations between IIASA and Japanese nationals since 2010.
- Since 2010 researchers, advisors, and diplomats from Japan have visited IIASA over 150 times, while IIASA scientists have visited Japan over 200 times.

## Appendices

Summaries detailing the presented information can be requested by contacting the External Relations Department ([externalrelations@iiasa.ac.at](mailto:externalrelations@iiasa.ac.at)).

**IIASA-Japanese scientific exchange through people**

## Prospects for Future IIASA-Japanese Activities

*Enhancing the IIASA-Japan relationship offers benefits for Japanese research, government policy, and international relations*

This Info Sheet summarizes recent research collaborations between IIASA and Japan. Significant potential remains to further intensify the IIASA-Japanese relationship through developing a range of new joint activities such as:

- **Conducting international assessments in areas of Japanese strategic interest:** Japan was a significant contributor to IIASA Global Energy Assessment which brought together over 500 specialists to transform the way society thinks about, uses, and delivers energy. IIASA has proposed several new assessments, at the request to its member countries that will focus on issues of strategic interest to Japan. These could include a project exploring regional resource security over the coming decades in the Asia Pacific region.
- **New partnerships between IIASA and Japanese institutions to win grants from international research funders:** IIASA high-quality research and international research network makes it highly competitive in its applications for international research funds. Between 2012 and 2017, this additional funding reached €52 million. This was part of a total funding portfolio of €265 million, the total awarded to external projects featuring collaboration between IIASA and member countries.
- **Using international scientific cooperation to support diplomacy:** IIASA was established in 1972 to use scientific cooperation to build bridges across the Cold War divide and research growing global problems on a truly international scale. Today the soft power of science diplomacy continues to help IIASA member countries through using scientific cooperation to improve international relations, and through international teams jointly researching controversial issues to find consensus, free from the constraints of national self-interest (see box: Research to support science diplomacy: page 11). IIASA recently launched a new global project to evaluate issues arising at the nexus of food, water, energy, and climate change.
- **Academic training opportunities for young Japanese scientists:** There is significant potential to enhance participation by young Japanese postdoctoral students in IIASA programs to develop international and interdisciplinary research skills (see page 12: Capacity Building).



## About IIASA

Founded in 1972, the International Institute for Applied Systems Analysis (IIASA) conducts policy-oriented research into problems of a global nature that are too large or too complex to be solved by a single country or academic discipline. IIASA research is across and at the intersection of natural, human, social, knowledge and technology systems to support the development of integrated solutions to global sustainability challenges.

IIASA is at the center of a global research network of around 3,500 scholars and over 830 partner institutions in over 65 countries. It is funded and supported by its National Member Organizations which represent the scholarly community in the following countries:

Austria, Brazil, China, Egypt, Finland, Germany, India (Observer), Indonesia, Iran, Israel, Japan, Malaysia, Mexico, Norway, Republic of Korea, Russia, South Africa, Sweden, Ukraine, United Kingdom, United States of America, Vietnam.

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