

Research collaborations between IIASA and the United States of America (US) have been highly productive ever since the Institute was founded in 1972. The IIASA-US relationship is central to the Institute and consequently IIASA participates in more activities related to the US than any of its other member countries. This Info Sheet focuses on key aspects of this beneficial relationship since 2008. The US National Member Organization is the National Academy of Sciences, which partners with the White House Office of Science and Technology Policy and the National Science Foundation to promote cooperation with American scientists, research institutions, and government agencies. Opportunities for cooperation start with young PhD students from the US who receive grants to participate in IIASA's Young Scientists Summer Program and extend up to institutional cooperation such as the IIASA Director General's collaboration with Professor Jeffrey Sachs, Director of the Earth Institute, Columbia University, on achieving the sustainable development goals. Diverse research partnerships range from technical modeling with Stanford University's Energy Modeling Forum to policy advice to the US Environmental Protection Agency. US scientists' collaboration with IIASA (facilitated by over 850 visits to and from IIASA, over 40 US nationals among IIASA's staff, and regular scientific exchanges) has brought the Institute's applied systems analysis and global perspective to issues ranging from US energy policies to projection of US demographic changes. Research impact includes providing the intellectual underpinnings for the Climate and Clean Air Coalition launched by the then US Secretary of State Hillary Clinton in 2012; and shaping the key objectives for the UN Secretary-General's Sustainable Energy For All initiative.

Highlights of Interactions Between IIASA and the US (since 2008)

National Member Organization	National Academy of Sciences (NAS)
Membership start date	1972 (founding member)
Selected partners (collaborating, research, or funding)	<ul style="list-style-type: none"> ■ National Science Foundation (NSF) ■ White House Office of Science and Technology Policy (OSTP) ■ US Department of State ■ US Department of Energy (DOE) ■ US Environmental Protection Agency (EPA) ■ Harvard, Princeton, and Yale Universities ■ National Aeronautics and Space Administration (NASA) ■ National Center for Atmospheric Research (NCAR) ■ Pacific Northwest National Laboratory (PNNL) ■ Stanford University's Energy Modeling Forum (EMF)
Areas of research collaboration	<ul style="list-style-type: none"> ■ Advancing energy and integrated assessment modeling in the US ■ Global Energy Assessment and the US ■ Curbing the release of black carbon and methane ■ Projecting changing population and human capital in the US and around the world ■ Improving the use of land for food and for combating climate change ■ Advising countries with economies in transition ■ Increasing the resilience of vulnerable communities ■ Analyzing ecological and evolutionary dynamics ■ Developing the methods of systems analysis ■ Governance of transboundary water resources along the United States and Mexico border
Capacity building	<ul style="list-style-type: none"> ■ 88 doctoral students from the US have participated in IIASA's Young Scientists Summer Program since 2008 ■ 6 IIASA Postdoctoral Fellowships have been awarded to young scientists from the US ■ 5 doctoral students from the US have taken part in the Southern African Young Scientists Summer Program
Publication output	873 publications have resulted from research collaborations between IIASA and American scientists
Other interactions	<ul style="list-style-type: none"> ■ On average over 40 US nationals have been employed by IIASA every year ■ IIASA scientists have visited the US over 600 times and US citizens have visited IIASA over 270 times

Activities with Member Countries: United States of America

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

This Info Sheet summarizes IIASA's recent relationships with the US.
It includes highlights with links to further information, but it is
not a comprehensive report on all interactions.

Feedback and updates are encouraged and should be sent to Iain Stewart.

IIASA's National Member Organization in the United States of America

The National Academy of Sciences (NAS) is the National Member Organization (NMO) representing US membership of IIASA. The NAS was one of the founding members of IIASA in 1972, along with organizations from 11 other countries from the Eastern and Western blocs. US Government support of membership in IIASA is a policy decision, set and periodically reviewed by the White House Office of Science and Technology Policy. The annual membership payment is funded via a grant from the National Science Foundation, which works with the NAS to strengthen connections between IIASA and US science and policy communities. The American Academy of Arts and Sciences served as NMO from 1982 until 2003.

Professor Donald Saari, Director, Institute for Mathematical Behavioral Sciences at the University of California, Irvine, represents the US NMO on the IIASA Council, which is the governing body for the Institute. Professor Saari serves as Vice-Chair of the IIASA Council.

The NAS appoints a US Committee for IIASA, which is made up of leaders from the US science and policy communities, who have experience in IIASA's areas of research and their policy implications, and facilitate research collaborations and capacity building activities. Previous members of the US Committee include **Professor Simon Levin**, Princeton University; **Dan Arvizu**, Director, National Renewable Energy Laboratory; and **Professor Richard J. Zeckhauser**, Harvard University (see Appendix 6 for full list) and the current members of the US Committee for IIASA (January 2016) are:

Professor Donald Saari (Chair), University of California, Irvine

Dr. Robert Corell, H. John Heinz III Center for Science, Economics and the Environment

Dr. Peter Gleick, Pacific Institute for Studies in Development, Environment, and Security

Professor Stephen Robinson, University of Wisconsin-Madison (Emeritus)

Professor Kathleen Segerson, University of Connecticut

Dr. Barbara Boyle Torrey, National Institute on Aging, NIH

Dr. Elke Weber, Earth Institute, Columbia University

Professor Detlof von Winterfeldt, University of Southern California

Ex-Officio members are **Dr. Norman Neureiter**, American Association for the Advancement of Science, **Dr. Roger Levien**, Strategy and Innovation Consulting, **John Hildebrand**, University of Arizona.

The NMO Secretary for the US is **Kathie Bailey**, Director, Board on International Scientific Organizations, NAS.

The US National Academy of Sciences (NAS) represents the US and its scholarly community on IIASA's governing Council

Web: <http://sites.nationalacademies.org/PGA/biso/IIASA/index.htm>

Email: KBailey@nas.edu



Seven of IIASA's ten Director Generals have been American citizens: Professor Howard Raiffa (1972-1975), Dr. Roger Levien (1975-1981), Professor Thomas H. Lee (1984-1987), Dr. Robert H. Pry (1987-1990), Dr. Peter E. de Jánosi (1990-1996), Professor Gordon J. MacDonald (1996-2000), and Professor Detlof von Winterfeldt (2009-2012).

Professor Simon Levin, Moffett Professor of Biology at Princeton University, was Chair of IIASA's governing Council from 2003 to 2009, and was Vice-Chair from 2009 to 2013.

Professor Donald Saari, Distinguished Professor, Mathematics and Economics and Director, Institute for Mathematical Behavioral Sciences, University of California, Irvine, has been Chair of IIASA's governing Council since 2013.

Professor Ralph L. Keeney of the Fuqua School of Business at Duke University; **Dr. Jerry M. Melillo** of the Marine Biological Laboratory at Woods Hole in Massachusetts; and **Professor Fred Roberts**, Director, Center for Discrete Mathematics and Theoretical Computer Science at Rutgers University have all been members of IIASA's Science Advisory Committee since 2011.

Dr. Joanne Linnerooth-Bayer is Director of IIASA's Risk and Vulnerability Program and Dean of IIASA's Young Scientists Summer Program.

US citizens with leadership roles at IIASA

Some leading personalities
from academia in the US and
associated with IIASA

Professor W Brian Arthur, External Professor, Santa Fe Institute and Visiting Researcher, Intelligent Systems Lab, PARC, is credited with influencing and describing the modern theory of increasing returns, which he developed as a researcher at IIASA during the 1980s.

Professor William C Clark of Harvard Kennedy School has played a key role in the development of sustainability science. He is a long term collaborator with IIASA including serving on IIASA's Science Advisory Committee.

Professor George Dantzig, an American mathematical scientist who made important contributions to operations research, computer science, economics, and statistics and the won the US National Medal of Science in 1975; headed up IIASA's methodological program during the 1970s.

Professor Myron Fiering, was a leading authority on water resources systems design at Harvard University, who created a new field within hydrology called "operational" hydrology. He worked and collaborated with IIASA during the 1970s.

Professor Nathan Keyfitz, who is credited for developing the field of mathematical demography, came to IIASA from Harvard University in 1983. At IIASA, where he led the Population Program between 1983 and 1992, he pioneered the application of demographic methods to several other fields.

Professor Tjalling Charles Koopmans was a Dutch-American mathematician and economist who jointly won the Nobel Prize in Economics in 1975. He joined IIASA in the 1970s to work with fellow Nobel Prize winner, Professor Leonid Kantorovich, to expand IIASA's study of advanced systems science and methodology.

Professor Daniel P. Loucks has directed research in the development and application of economics, ecology and systems analysis methods to the solution of environmental and regional water resources problems at Cornell and in Delft, NL, and Vienna, Austria. He is a long term collaborator with IIASA.

Professor Alan Manne, who is known for developing large-scale optimization and equilibrium models to understand critical world issues, worked at IIASA during the 1970s and collaborated with the Institute until his death in 2005.

Dr. Donella Meadows and **Professor Dennis L Meadows**, widely known as authors of *The Limits to Growth*, and key figures in the development of sustainability as a field of study, researched at IIASA during the 1970s and 1980s.

Professor William D. Nordhaus of Yale University and known as "the father of climate change economics" by the *Economist*, developed his first economic model of global warming as a young researcher at IIASA during the 1970s. He has collaborated with the Institute ever since.

Professor Jeffrey Sachs, Director of the Earth Institute at Columbia University and Special Advisor to the UN Secretary-General, has collaborated with IIASA since the early 1990s when he participated in IIASA's Economic Reform and Integration project that brought together leading economists from Eastern and Western Europe, Japan, USA, and USSR to identify the policies to guide the Soviet Union through its economic crisis and make the transition into a market economy.

Professor Thomas C. Schelling, who was jointly awarded the 2005 Nobel Prize in Economics, worked at IIASA in several research areas from 1994–1999.

Professor M. Gordon 'Reds' Wolman, who published pioneering studies on how and why rivers change, served as Chair of the US Committee for IIASA and US member of IIASA's governing Council from 1999 to 2003.

Professor Eric F Wood of Princeton University and recipient of the 2014 Alfred Wegener Medal for his pioneering contributions to hydrology and to its interactions with meteorology and climate change, worked at IIASA from 1974 to 1976 on the water project.

Collaborating, research, and funding partners in the United States of America

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

- Aleut International Association, AIA
- American Association for the Advancement of Science
- Appalachian State University
- Arctic Slope Regional Corporation
- Boston University
- Brookings Institution
- City University of New York
- Clean Air Task Force (CATF)
- ClimateWorks Foundation
- Dartmouth College
- Duke University
- Earth Institute, Columbia University
- Electric Power Research Institute (EPRI)
- Environmental Defense Fund (EDF)
- First Solar
- Forest Trends
- George Mason University
- Global Energy and Technology Foundation (GETF)
- Global Environment and Technology Foundation
- Harvard Kennedy School of Government, Harvard University
- Harvard School of Public Health
- Harvard University
- Hewlett Foundation
- Institute for Social and Environmental Transition
- Joint Global Change Research Institute (JGCRI), Pacific Northwest National Laboratory (PNNL)
- Madison River Group LLC

IIASA is continually developing collaborations with the US and has recently been working with 73 organizations in the US via formal and informal connections

Mr McGeorge Bundy, Advisor to Presidents John F. Kennedy and Lyndon B. Johnson, initiated the discussions in 1967 with the Soviet Union which led to the establishment of IIASA.

Dr. John P. Holdren is Assistant to the US President for Science and Technology and Director of the White House Office of Science and Technology Policy. He was one of the key members of an IIASA research team that compared fusion and fast breeder nuclear reactors as part of IIASA's Energy Program's systematic analysis of energy supply options.

Dr. E. William Colglazier served as the fourth Science and Technology Adviser to the US Secretary of State from 2011-2014 and has followed IIASA's contributions for 30 years. Most recently he spoke at IIASA's Anniversary Conference in 2012.

Dr. Norman Neureiter, the first Science and Technology Adviser to the US Secretary of State, and currently Director, Center for Science, Technology and Security Policy at the American Association for the Advancement of Science is Chairman of the Board of the IIASA Endowment Fund.

Mr. Robert S. McNamara, US Secretary of Defense from 1961 to 1968 and subsequently President of the World Bank until 1981, gave the second distinguished lecture in IIASA's Dr. Bruno Kreisky Lecture Series in 1986.

Dr. Steven Chu was US Secretary of Energy from 2009 to 2013 and a Nobel Prize Laureate (Physics in 1997). He most recently collaborated with IIASA researchers on a book examining how to shift to a more sustainable transport system.

Dr. Jerry M. Melillo, a former Associate Director for Environment at the White House Office of Science and Technology Policy, now serves on IIASA's Science Advisory Committee.

Some leading personalities from government in the US and associated with IIASA

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- Massachusetts Institute of Technology (MIT)
 - National Academy of Sciences (NAS)
 - National Aeronautics and Space Administration (NASA)
 - National Center for Atmospheric Research (NCAR)
 - National Oceanographic and Atmospheric Administration (NOAA)
 - National Renewable Energy Laboratory (NREL)
 - National Science Foundation (NSF)
 - New School for Social Research
 - Oak Ridge National Laboratory
 - Pew Research Center
 - Population Council
 - Princeton University
 - RAND Corporation
 - Rockefeller University
 - RTI International
 - Santa Fe Institute
 - Stanford Precourt Institute of Energy
 - Stanford University's Energy Modeling Forum
 - State University of New York
 - Towson University
 - Tufts University
 - United States Agency for International Development (USAID)
 - United States Arctic Research Commission
 - United States Department of Agriculture – Economic Research Service
 - United States Department of Agriculture – Forest Service
 - United States Department of Energy
 - United States Department of State
 - United States Environmental Protection Agency (EPA)
 - University of Alaska Fairbanks
 - University of Buffalo
 - University of California, Berkeley
 - University of California, Irvine
 - University of Colorado Boulder
 - University of Connecticut
 - University of Florida
 - University of Georgia
 - University of Maryland
 - University of Michigan
 - University of Southern California, Los Angeles
 - University of Washington
 - University of Wisconsin
 - University of Vermont
 - University of Virginia
 - Wharton School, University of Pennsylvania
 - White House Office of Science and Technology Policy (OSTP)
 - Wilson Center
 - Yale University

Recent Research Collaborations

Advancing Energy and Integrated Assessment Modeling in the US

US national interests are integrally connected to complex global systems that impinge on the country's economy, energy systems, and climate among others. IIASA's longstanding collaborations with US researchers and institutions have continually improved energy and integrated assessment modeling resulting in clearer understanding of how today's energy and climate policies will impact the US.

Recent collaborations include several projects that compare the results of multiple models:

- With Stanford University's Energy Modeling Forum (EMF), IIASA participated in (1) a global model comparison of what 18 energy-economy and integrated assessment models revealed about how different technologies can help achieve ambitious climate targets; (2) the first large-scale modeling comparison addressing the implications of delayed action on climate change for achieving different climate targets; and (3) the pros and cons of bioenergy deployment for long-run climate management.
- Another global model comparison, this time 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 collaboration with the Joint Global Change Research Institute at the Pacific Northwest National Laboratory (JGCRI/PNNL) and partly funded by the US Environmental Protection Agency (EPA).

Numerous collaborations between IIASA and US researchers are advancing the modeling of energy and climate change and thereby improving the scientific advice for US energy and climate policies

Many of today's most pressing challenges do not stop at international borders. IIASA's research areas such as climate change, energy security, and population change 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's 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's global contributions

- Other research with JGCRI/PNNL (1) Looked into the co-benefits of climate policy for air pollution, energy security, and economic growth as part of the EU-funded LIMITS project; (2) explored mitigation pathways and associated costs as part of the EU-funded AMPERE project; (3) advances the analysis of costs and impacts of mitigation policies in order to trigger the development of a new generation of Integrated Assessment Models as part of the EU-funded ADVANCE project; (4) examines the national and global transformation strategies for climate change and their linkages to a range of sustainable development objectives as part of the EU-funded CD-LINKS project; and (5) analyzed the long-term impact on climate change from the increased use of shale gas due to the wide deployment of hydraulic fracturing technologies particularly in North America.

Other joint activities have provided significant input to the work of the Intergovernmental Panel on Climate Change (IPCC):

- The Integrated Assessment Modeling Consortium is an organization of scientific research organizations including IIASA, EMF, JGCRI/PNNL, Electric Power Research Institute (EPRI), and the National Center for Atmospheric Research (NCAR). It facilitates and fosters the development of integrated assessment models. Recent work includes the Representative Concentration Pathways (RCP) database that provides greenhouse gas emission and other projections for the Fifth Assessment Report of the IPCC (see box, IIASA's Global Contribution).
- Developed the Shared Socioeconomic Pathways in collaboration with NCAR for the climate change research community to facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptation, and mitigation.

Selected publications resulting from IIASA-US collaborations

IIASA's work is underpinned by high-quality science, which is regularly published in high impact publications. A few selected publications are presented here and full list can be found in appendix 5:

Jackson R B , Canadell J G , Le Quéré C , Andrew R M , Korsbakken J I , Peters G P , Nakicenovic N (2016). Reaching peak emissions, *Nature Climate Change*, 6 (1): 7-10.

Smith P , Davis S J , Creutzig F , Fuss S , Minx J , Gabrielle B , Kato E , Jackson R B , Cowie A , Kriegler E , Van Vuuren D P , Rogelj J , Ciais P , Milne J , Canadell J G , McCollum D , Peters G , Andrew R , Krey V , Shrestha G , Friedlingstein P , Gasser T , Grubler A , Heidug W K , Jonas M , Jones C D , Kraxner F , Littleton E , Lowe J , Moreira J R , Nakicenovic N , Obersteiner M , Patwardhan A , Rogner M , Rubin E , Sharifi A , Torvanger A , Yamagata Y , Edmonds J , Yongsung C (2016). Biophysical and economic limits to negative CO2 emissions, *Nature Climate Change*, 6 (1):42-50.

Liu Z , Guan D , Wei W , Davis S J , Ciais P , Bai J , Peng S , Zhang Q , Hubacek K , Marland G , Andres R J , Crawford-Brown D , Lin J , Zhao H , Hong C , Boden T A , Feng K , Peters G P , Xi F , Liu J , Li Y , Zhao Y , Zeng N , He K (2015). Reduced carbon emission estimates from fossil fuel combustion and cement production in China, *Nature*, 524 (7565): 335-338.

Riahi K , Kriegler E , Johnson N , Bertram C , den Elzen M , Eom J , Schaeffer M , Edmonds J , Isaac M , Krey V , Longden T , Luderer G , Méjean A , McCollum D L , Mima S , Turton H , van Vuuren D P , Wad, K , Bosetti V , Capros P , Cricqui P , Hamdi-Cherif M , Kainuma M , Edenhofer O (2015). Locked into Copenhagen pledges - Implications of short-term emission targets for the cost and feasibility of long-term climate goals, *Technological Forecasting and Social Change*, 90: 8-23.

Nelson G C , Valin H , Sands R D , Havlík P , Ahammad H , Deryng D , Elliott J , Fujimori S , Hasegawa T , Heyhoe E , Kyle P , Von Lampe M , Lotze-Campen H , Mason D'Croz D , Van Meijl H , Van Der Mensbrugghe D , Müller C , Popp A , Robertson R , Robinson S , Schmid E , Schmitz C , Tabeau A , Willenbockel D (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): 3274-3279.

Other recent modeling work has looked at technology, renewable energy, and energy infrastructure:

- IIASA played a central role in a series of EMF-organized seminars in Snowmass in 2008 and 2009, which were sponsored by a consortium that included the US Department of Energy, US National Science Foundation, US National Oceanographic and Atmospheric Administration (NOAA), EPA, and EPRI. One outcome from these meetings was a special issue of *Energy Economics* on “The Economics of Technologies to Combat Global Warming.” It was co-edited by **Bill Nordhaus**, Sterling Professor of Economics at Yale University, and IIASA’s Deputy Director General, **Nebojsa Nakicenovic**, who have been collaborating since the 1970s.
- A study to improve the representation of renewable energy sources in Integrated Assessment Models with the US National Renewable Energy Laboratory.
- An exploratory project with researchers from the Massachusetts Institute of Technology enables IIASA’s MESSAGE model to also analyze how different financial constraints limit infrastructure investments in the energy system and so affect the transition toward improved energy access and greenhouse gas emission reduction.

Global Energy Assessment and the US

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. 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.

The US was a significant partner in and contributor to the Global Energy Assessment

Americans held approximately 50 positions on the GEA including five Convening Lead Analysts and three GEA Governing Council members. Nearly every writing team included US members from the academic, business, and policy communities. The US Department of Energy provided \$1 million to support GEA, which went in part to setting up a US GEA Support Office at the Global Energy and Technology Foundation (GETF) in Washington. GETF sponsored stakeholder workshops in the US and cooperated with IIASA and the US NMO to disseminate the assessment to the US energy community in 2012 and 2013. Events included the launch of the GEA report at Stanford Precourt Institute of Energy and the University of Maryland in 2013.

The UN Secretary-General’s Sustainable Energy For All (SE4ALL) initiative adopted findings from the GEA as its key objectives for energy access, energy efficiency, and renewable energy. Several senior American officials are involved in SE4ALL including **Charles O. Holliday**, Chairman, Bank of America; and **Carlos Pascual**, Special Envoy and Coordinator for International Energy Affairs, US State Department on SE4ALL’s Executive Committee, and **John F. Kerry**, US Secretary of State on its advisory board. IIASA is also one of several institutions responsible for building up a global research and knowledge network for the initiative.

US and IIASA collaborations to curb the release of black carbon and methane

IIASA’s 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.

Joint research into reducing short-lived climate pollutants has galvanized international action

Most recently US researchers and policymakers have collaborated with the IIASA GAINS modeling team to identify measures to curb the release of either black carbon or methane (pollutants that harm human or plant health while simultaneously exacerbating climate change):

- IIASA researchers have worked with the US Clean Air Task Force to prepare a handbook on black carbon and IIASA studies are cited repeatedly in the US Environmental Protection Agency's (EPA) March 2012 report to Congress on black carbon. EPA also provided funding for IIASA's GAINS modeling team to participate in the Arctic Council's Task Force on Short-lived Climate Forcers in order to identify measures to reduce black carbon and methane emissions to slow Arctic climate change.
- A joint study between NASA, IIASA, EPA, and various US universities among others pinpointed 14 emission reduction strategies for methane and black carbon. The research, published in *Science*, identified measures that would simultaneously increase human wellbeing through reduced local air pollution, improve local environmental quality, increase security of food and energy supply, and lower water demand. In many cases, these measures would also result in more efficient energy use and thereby also reduce emissions of long-lived greenhouse gases.
- This *Science* study provided the intellectual underpinnings for the then US Secretary of State **Hillary Clinton** to launch the Climate and Clean Air Coalition to Reduce Short Lived Climate Pollutants in 2012. It was the first international effort to treat these pollutants as a collective challenge and initially supported by the governments of Bangladesh, Canada, Ghana, Mexico, Sweden and the United States. By January 2016, it has 50 member countries and 59 other partner organizations committed to taking action on short-lived climate pollutants. IIASA's **Markus Amann** is on the scientific committee.
- Together with Stanford University's Energy Modeling Forum, IIASA is conducting a project to analyze air pollution and short-lived climate forcers.

The IIASA GAINS team also conducted a recent study that showed how the US could save energy and avoid greenhouse gas emissions. The researchers demonstrated how district

IIASA's 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 air pollutant, sulfur dioxide, contributes to particulate pollution (associated with negative impacts on human health) and to acid rain—which leads to ecosystem damage. Emissions of this common air pollutant have generally declined since the mid 1970s. A joint study between IIASA and JGCRI/PNNL showed that a worrying upturn in emissions from 2000 to 2005 proved short-lived. By 2006 the upward trend halted following the implementation of sulfur emission controls in China and further large reductions in more affluent regions, particularly the US and Europe as the following table shows:

Region	Change in sulfur dioxide emissions (Gg)	
	2000–2005	2005–2010
China	8203	–2559
Europe	–2792	–2361
US & Canada	–1447	–6660
Latin America & Caribbean	–1946	–310

Source: IIASA's GAINS model. Research published in: Klimont Z, Smith SJ, Cofala J (2013). The last decade of global anthropogenic sulfur dioxide: 2000–2011 emissions. *Environmental Research Letters* 8(1):014003.

Many of the research projects summarized in this Info Sheet draw on analyses from IIASA's 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)

heating (a system for distributing heat generated in a central location to meet residential and commercial heating needs), which is virtually non-existent in the US, could supply up to 43% of heat in residential and commercial buildings.

The Arctic and the US

As an Arctic country, the US has a natural interest in Arctic affairs. The global significance of the region has also risen considerably in recent years as the economic potential of the Arctic's natural resources and new transport routes emerge.

In 2014 IIASA began planning a new flagship project, known as the Arctic Futures Initiative, to conduct a holistic, integrative assessment of plausible futures of the Arctic. The project will use systems analysis to cut across different disciplines and integrate the perspectives of academia, policy, business and media. It will focus on developing future scenarios for the region and providing insights for decision makers that are independent of any particular country's interest. Numerous US organizations are collaborating and helping to shape the initiative and

IIASA and US researchers are advancing our knowledge of the Arctic region, its fragile environment, economic potential, and global significance

Petr Havlik on "Productivity in the Global Livestock Sector: Variations across Regions, Species and Production Systems and the Implications for GHG Abatement" at the 7th EPA/USDA/AAFC Forestry and Agricultural GHG Modeling Forum in West Virginia (2014).

Nils Johnson on "How negative can biofuels with CCS take us and at what cost? Refining the economic potential of biofuel production with CCS using spatially-explicit modeling" at the International Conference on Greenhouse Gas Technologies in Austin (2014).

Christina Kaiser on "A microbial community perspective on the regulation of soil organic matter turnover" at the American Geophysical Union (AGU) Fall Meeting in San Francisco (2014).

Wilfried Winiwarter on "Nitrogen, its sources and environmental effects – a future perspective" at a lecture at Princeton University, Woodrow Wilson School for Public and International Affairs (2014).

Arnulf Grubler on "Urban Energy Systems: Challenges and Opportunities" at the Global Energy Assessment West Coast Launch at Stanford University (2013).

Wolfgang Lutz on "Intergenerational tradeoffs: What Do Future Generations Lose Because of Efforts to Equitably Improve Current Human Well-being?" at a National Academy of Sciences workshop on "Sustainability of Science: Can Earth's and Society's Systems Meet the Needs of 10 Billion People?" in Washington DC (2013).

Pavel Kabat on "Benefits of Systems Science for Policy Support" at the INFORMS Annual Meeting in Minneapolis (2013).

Samir KC on "Differential Fertility by Level of Education in DHS Countries" at the Annual Meeting of the Population Association of America in New Orleans (2013).

David McCollum on "Energy Pathways for Sustainable Development: Insights from the Global Energy Assessment" at University of Tennessee (2013).

Nebojsa Nakicenovic on "What do Energy and GHG Scenarios Tell Us?" at the 14th Biennial Conference on Transportation and Energy in California (2013).

Narasimha Rao on "Explaining Country Income Inequality: an Integrated Approach" at National Center for Atmospheric Research (NCAR) in Boulder (2013).

Joeri Rogelj on "Incorporating Climate-System and Carbon-Cycle Uncertainties in Integrated Assessments of Climate Change" at the fall meeting of the American Geophysical Union (AGU) in San Francisco (2013).

Elena Rovenskaya on "Coarse-graining of data: a better approach to building robust projections?" at the Theory and Knowledge Systems for Sustainability Science Workshop in Santa Fe (2013).

Joanne Linnerooth-Bayer on "Are disasters becoming deadlier?" at the National Bureau of Economic Research in Boston (2012).

Selected presentations in US by IIASA researchers

include: Advanced Science Research Center, City University of New York; Arctic Slope Regional Corporation; Aleut International Association, AIA; US Department of State; American Association for the Advancement of Science; Oak Ridge National Laboratory; University of Alaska Fairbanks; Tufts University; Global Environment and Technology Foundation; Madison River Group LLC; National Science Foundation; Office of Science and Technology Policy, OSTP; US Arctic Executive Committee; and US Arctic Research Commission, USARC.

Other collaborators on the project include researchers and diplomats from Canada, Denmark, Finland, Germany, Greenland, Norway, Russia, Sweden, and international organizations such as the Arctic Monitoring and Assessment Program (AMAP) of the Arctic Council (of which the US is a member).

Other recent studies about the Arctic in collaboration with partners in the US include:

- An assessment of emissions and mitigation options for black carbon—a short-lived climate forcer that along with methane and ozone offer unique opportunities to slow Arctic warming in the near term. The research was presented at the Arctic Council Ministerial Meeting in 2011 and conducted by an Arctic Council Task Force which included researchers from the US Environment Protection Agency and IIASA.
- Researchers from IIASA, the Universities of Colorado and of Michigan, and the National Oceanic and Atmospheric Administration among others evaluated the ability of eleven different models to capture the seasonal change in concentrations of sulfate, black carbon (BC) and other aerosols associated with Arctic Haze.

Projecting changing population and human capital in the US and around the world

IIASA's demographers are providing independent analysis and projections of the future US population including population drivers such as education and fertility along with population characteristics like aging

IIASA's 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 and US Bureau of the Census among others. As a testament to the quality of IIASA's demography, the IPCC in 2011 adopted IIASA's population projections as its source data in all modeling for the Fifth Assessment Report; and UNESCO has adopted IIASA's demographic methods as part of its literacy forecasting.

The Institute's interdisciplinary setting has encouraged its demographers to research 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. This pioneering approach to demography was shaped by US demographer **Nathan Keyfitz** who led IIASA's demographers from 1983 through 1991.

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 with Oxford University Press. Findings for the US show how different policies over the next few decades could lead to the country's current population of 310 million falling to 261 million by 2100 or soaring to 761 million by the end of the century.

Other population studies research aging:

- Researchers from IIASA and Stony Brook University measured aging based not on people's chronological age but on remaining life expectancy, people's health and cognitive function among other measures. It calculated that Americans who were 73.4 years old in 2007 would be as healthy as 65 year olds in 1965. This ongoing collaboration also recently (1) quantified the policy trade-offs to support aging populations, (2) analyzed how faster increases in human life expectancy could lead to slower population aging, and (3) has produced a suite of measurements that could replace conventional measures of age.

- Research found cognitive function may be a better indicator of the impact of aging on an economy than age-distribution, with chronological age imposing less of a social and economic burden if the population is “functionally” younger. The study was published in the *Proceedings of the National Academy of Sciences* (PNAS) and included participants from the US.
- A study, published in *PNAS*, with NCAR and NOAA with funding from the US Department of Energy, EPA, and the Hewlett Foundation found that changes in population, including aging and urbanization, could significantly affect global emissions of carbon dioxide over the next 40 years.

Other US–IIASA collaborations research fertility and the factors, such as religion and recession, that affect it:

- An investigation found the recent global economic recession had halted the rising fertility in the US that had begun in 1998. And another study showed how differing fertility rates could play a role in deciding America’s long-term political future.
- With funding from the Pew Research Centre, IIASA conducted a demographic assessment of the religious structure of populations in select countries including the US. An earlier study from 2010 projected that the US Hispanic Catholic population will increase from its current 10% to 18% of the American population by 2043.

Finally in 2011, IIASA’s demographers assembled a global panel of experts, including researchers from State University of New York, NCAR, University of Buffalo, Population Council and the Harvard School of Public Health. Together, they issued the Laxenburg Declaration which outlined the demographic challenges for sustainable development.

Improving the use of land for food and for combating climate change

There is a long history of collaborations between IIASA and US researchers in areas of forests and agriculture, for example IIASA research from the 1970s and 1980s argued for a new adaptive approach to forest and pest management which has been subsequently widely adopted. Building on such productive collaborations, IIASA agriculture experts have recently:

- Worked with researchers from the Universities of California Berkeley, of Colorado, of Florida, of Maryland, of Virginia, and US Department of Agriculture among others on a range of studies that identify policies to develop climate-smart agriculture (links to study 1, 2, 3, 4, and 5).
- Provided cropland mapping expertise to collaborators at the University of Maryland as part of the GEOGLAM (GEO Global Agricultural Monitoring) initiative which was launched by the Group of Twenty (G20) Agriculture Ministers in June 2011, and aims to strengthen global agricultural monitoring by improving the use of remote sensing tools for crop production projections and weather forecasting.
- Taken part in a major project to compare global agro-economic models with collaborators across the globe including MIT, PNNL, and the US Department of Agriculture – Economic Research Service. Findings have been recently published in the *Proceedings of the National Academy of Sciences*.
- Analyzed the role of the livestock sector in the sustainable development of Africa for a report commissioned by the US Agency for International Development.
- Given expert input to a roundtable discussion on responsible agricultural investment that was hosted by the US Government. IIASA researchers had recently used its Global Agro-ecological Zones (GAEZ) model to assess crop production potentials of land as part of a World Bank project and in response to growing numbers of large-scale land acquisitions.
- Worked with researchers at Duke University and RTI International to analyze the impact of US biofuel policies on fossil fuel displacement and indirect land use change and subsequently on greenhouse gas and nitrogen emissions. The findings underscored the importance of global feedback effects from local policies as while US biofuel policies may reduce net US emissions of greenhouse gases, they would increase global emissions.

Collaborations between IIASA and US researchers are helping our understanding of land and ecosystems and how they can be harnessed to reduce greenhouse gas emissions

IIASA's risk experts are also investigating how adaptive forest governance emerges. The project is funded by the National Science Foundation and includes researchers from the University of Colorado and the University of Connecticut.

US–IIASA collaborations are also improving our understanding of ecosystems and the role they can play in tackling climate change. Activities include:

- A collaboration with researchers from the US Department of Agriculture Forest Service as part of the Global Forest Carbon Working Group is investigating the future of the world's forests. The group recently published an analysis in *Science* of how much carbon the world's forests absorb.
- Teaming up with the Northern Eurasia Earth Science Partnership (NEESPI) to improve our understanding of the interactions between the ecosystem, atmosphere, and human dynamics in northern Eurasia. US partners in NEESPI include NASA, National Oceanic and Atmospheric Administration (NOAA), and University of Maryland.
- A partnership with the Environmental Defense Fund among others in a project to contribute to rapidly scaling up demand and supply for credits to reducing emissions from deforestation and forest degradation (REDD).
- Work with researchers at Princeton University among others to look at the potential of bioenergy with carbon capture and storage (BECCS) to achieve negative emissions of greenhouse gases.
- A collaboration with researchers at Appalachian State University on dealing with uncertainty in greenhouse gas emission inventories.

Advising countries with economies in transition

IIASA's neutral setting has helped it offer advice at sensitive times to countries going through economic transition

In early 2012, IIASA's role as a neutral setting for examining options dealing with complex and sensitive international issues provided the impetus for a remarkable retrospective. The institute held a conference into how our understanding of successful reforms in transition economies has changed since the early 1990s, and how it can help support economic transformation in the future. Participants included **Václav Klaus**, former President and Prime Minister of the Czech Republic, **Andrey Illarionov**, former senior economic advisor to President **Vladimir Putin**, and fourteen US researchers from organizations ranging from the Brookings Institution to Harvard University.

The conference took place over twenty years after IIASA's Economic Reform and Integration project brought together leading economists from Eastern and Western Europe, Japan, USA and USSR. Findings from this project underpinned many of the economic reforms that helped the Soviet Union overcome its economic crisis and make the transition into a market economy in the 1990s.

Other associated research at IIASA includes: (1) a collaboration with the New School for Social Research in New York on the modeling of economic growth, and (2) a dynamic optimization of investment in capital and labor in the US.

Increasing the resilience of vulnerable communities

Researchers from IIASA and US are collaborating to identify the activities that help make communities more resilient to the impacts of natural disasters and climate change

Helping to reduce the vulnerability of communities to natural disasters and the impacts of climate change is an ongoing area of research at IIASA. Collaborations with the US include:

- A new partnership with the Wharton School, University of Pennsylvania, and funded by Zurich Insurance, aims to improve the flood resilience of communities by applying advanced resilience and risk modelling techniques to the challenges that the communities face.
- Recently completed work funded by the US Institute for Social and Environmental Transition showed the benefits of pro-active disaster risk management in meeting the needs of vulnerable communities in South Asia.
- An IIASA study has warned that thermoelectric power generating capacity in the US is likely to reduce by 4-16% for the period 2013-2060. The research explored the impact of climate change on higher water temperatures and reduced river flows in the US and the impact that this lack of cooling water will have on thermoelectric power plants.

- A collaboration with the University of Georgia is examining how a city's infrastructure can be re-engineered to restore the natural ecosystem services that existed on the land before the city was built.
- IIASA's risk experts are also part of the Urban Climate Change Research Network (UCCRN) led by Columbia University and have identified ways to integrate mitigation and adaptation for to find win-win actions for cities.

Analyzing ecological and evolutionary dynamics

Developing new methods and pioneering their applications, IIASA analyzes and forecasts how ecological and evolutionary dynamics shape populations, communities, and ecosystems, and how behavioral dynamics and adaptations determine the fate of groups of interacting agents.

Recent collaborations with US researchers have examined options and challenges for the development of aquatic food resources and include:

- Research with the University of Washington provided a published case study that showed the evolution of age and length at maturation of Alaskan salmon and how this was linked to different commercial fishing practices.
- Additional studies with Dartmouth College and other institutions have explored the evolution of Korean chum salmon under changing environmental conditions and also warn that current fishing practices favor adaptations that, in the long run, reduce the commercial value of the fish stock.

Other studies have opened up new methodological avenues for the applied systems analysis of biodiversity and include:

- A study published in *Nature* presented the first theoretical model demonstrating that picky females play a critical role in the survival and diversity of species. The research resulted from a collaboration between IIASA researchers and a former participant of IIASA's Young Scientists Summer Program who is now at the University of California, Berkeley.
- A collaboration with the University of Vermont considered conditions under which new species can form.
- Research with Boston and Harvard universities extended the reach of the canonical equation of adaptive dynamics theory to complex interaction structures.
- The use of evolutionary methods to investigate the dynamics of influenza with researchers at the University of Michigan.

Building on collaborations forged during the Young Scientists Summer Program, IIASA and US re-searchers are advancing our understanding of how ecological and evolutionary dynamics shape populations, communities, and ecosystems

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's 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 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 is also exploring closer collaboration with countries in the Middle East including Iran and Israel.

Research to support science diplomacy

Developing the Methods of Systems Analysis

IIASA recently partnered with two US organizations to host a major international conference to explore the current state and future directions of systems analysis

Systems analysis is one of the few research tools that combines both depth and breadth to truly understand complex global challenges. IIASA plays a leadership role in systems analysis as a research field, development of its tools and methodologies, and advancing of its science. With this in mind, IIASA in collaboration with the Institute for Operations Research and the Management Sciences (INFORMS), the Santa Fe Institute and others hosted Systems Analysis 2015. The conference highlighted recent advances, current lacunas, and untapped disciplinary potentials in the field of systems analysis.

IIASA's methodological experts have also recently collaborated with researchers at George Mason University, Princeton University, Massachusetts Institute of Technology, the Wilson Center, University of California Irvine, University of Southern California, among others. Together they studied how the increasing interdependencies of contemporary global systems are leading to systemic risks posed by the actions and interactions of individual actors. Although these individual forces are potentially small, they can be the catalysis for significant impacts; this gives rise to the notion of "femtorisks."

Governance of transboundary water resources along the United States and Mexico border

IIASA A study involving researchers from IIASA, Mexico and the USA among others is analyzing how to improve the governance of transboundary water resources

A new research project is developing comparative approaches to transboundary water resources environmental governance along the United States and Mexico border, with case studies of the Rio Grande/Río Bravo Basin and the Colorado River Basin. The project, which runs from 2014-16, (1) analyzes institutional and organizational regional arrangements for transboundary river governance, (2) addresses stakeholders' involvement at the local level, (3) develops a qualitative methodology to evaluate and compare different scenarios of transboundary water resources environmental governance, and (4) formulates recommendations to enhance and optimize current environmental governance. Researchers from Canada, Mexico, and the US (University of California, Davis & New Mexico State University) and IIASA are collaborating on the project.

IIASA working with business

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. Not surprisingly, IIASA is seeing a growing number of contracts with commercial partners, 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, **Petrolero Brasileiro**, was one of nineteen sponsors of IIASA's Global Energy Assessment.
- The research institute of the Japanese carmaker, **Toyota**, has an ongoing collaboration with IIASA to research measures to reduce ozone emissions in Asia.
- The multinational consumer goods company, **Unilever**, funded IIASA's agricultural experts from 2008-10 to analyze yields and land suitability of key agricultural crops under a changing climate.

In addition, IIASA is exploring ways that it can work more closely with multinational corporations, including through input to the development of their global sustainable business plans.

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's National Member Organizations.

Since 2008, 88 students from the US have developed research skills and networks by taking part in IIASA's Young Scientists Summer Program

Since the first American participant in the program in 1977, over 260 students have participated in the program with many going on to develop highly successful careers such as **Jesse Ausubel**, who is currently Director of the Program for the Human Environment at Rockefeller University, New York and Science Advisor to the Alfred P. Sloan Foundation. Former US NMO Committee member and Nobel Laureate **Tom Schelling** said of the program "the YSSP program alone would be worth the cost of US membership."

The US National Science Foundation supports around 10 YSSP fellows annually from US institutions, while the majority of these students are US nationals the US NMO regularly supports non-US students who show exceptional scientific abilities to attend the program. The following 88 young researchers from the US or undertaking a PhD in the US have taken part in the YSSP since 2008. Funding is provided by the US NMO unless otherwise stated:

Arda Aktas (YSSP '15 & Stony Brook University) investigated how "subjective age"—how long people think they have left to live—changes with characteristics such as gender and education.

Robert Barron (YSSP '14 & University of Massachusetts) examined the welfare impact of R&D investment on the supply side across a range of demand, transportation sector, and climate policy scenarios.

Inbal Becker-Reshef (YSSP '11 & University of Maryland) developed a generalized approach for wheat yield forecasting at national scales using coarse-resolution remotely-sensed data.

Eleanor Brush (YSSP '13 & Princeton University) explored if it is possible for discriminators to stabilize cooperation and how this may depend on how much information the discriminators store and use.

Miguel Poblete Cazenave (YSSP '15 & Stony Brook University) developed a model in which individuals decide their optimal retirement age according to changes in demographic and economic variables.

Yuche Chen (YSSP '12 & University of California Davis) re-analyzed emission measurement data to identify the amount and contribution of high emitting vehicles in order to ascertain whether targeted measures specifically at those vehicles could be a very cost-effective approach to reducing air pollution.

Danielle Mousseau Davidian (YSSP '11 & Stanford University) reviewed current renewable energy supply curve studies and applied this knowledge to improving energy supply curves in the IIASA developed MESSAGE model.

David Eitelberg (YSSP '13 & VU University in Amsterdam), who is a US national, compared the downscaling methods of scenarios modeled using the CLUMondo, GCAM, and GLOBIOM models to explain differences in spatial allocation of global agricultural lands.

Julio Enrique Herrera Estrada (YSSP '15 & Princeton University) characterized the spatio-temporal dynamics of drought around the world during the past 30 years, identifying patterns of motion and behavior.

Sarah Elizabeth Evans (YSSP '12 & Colorado State University) researched what mechanisms explain soil carbon dioxide flux under fluctuating rainfall patterns.

Etienne Fluet-Chouinard (YSSP '14 & University of Wisconsin-Madison) presented a classification of wetland ecosystems that are biodiversity hotspots in Africa and South America.

Gillian Foster (YSSP '15 & Vienna University of Economics and Business), a US citizen, estimated the future demand for ethylene in the US and the impact of gas prices.

Margaret Garcia (YSSP '14 & Tufts University) studied how to improve evaluation of water supply reliability alternatives using a case study of Las Vegas, USA.

Jessica Gephart (YSSP '14 & University of Virginia) investigated how the global seafood trade network responds to environmental and policy perturbations.

Zhaomiao Guo (YSSP '15 & University of California) used a stochastic game-theoretic model to study energy security and energy capacity issues in the USA, China, and Organization of the Petroleum Exporting Countries (OPEC).

Danielle Haak (YSSP '14 & University of Nebraska at Lincoln) assessed how humans aid the movement of an aquatic species and what effects this species has on an ecosystem after introduction.

Kandice Harper (YSSP '13 & Yale University) assessed the regional importance of short-lived climate pollutants mitigation measures in China using updated emission projections.

Alexandra Karambelas (YSSP '15 & University of Wisconsin-Madison) studied how urban and rural emissions contribute to air quality in very populous northern India and how air quality may change in the future with new policies and further population growth.

Mary Leeann King (YSSP '11 & University of Maryland) used the IIASA-FAO GAEZ model to evaluate potential yields and the extent of agricultural production by incorporating finer, and more recent agricultural statistical data within the newest version of the GAEZ model.

Kalaivani Ramea Kubendran (YSSP '13 & University of California, Davis) developed a bridging approach to bring consumer behavioral parameters – specifically for the transport sector – into a linear-programming IAM framework, testing this approach through scenario analysis.

Matthew James Labrum (YSSP '11 & Washington State University) investigated the ecological consequences of incorporating intransitive competition in a habitat-destruction model.

Nicholas Lam (YSSP '13 & University of California, Berkeley) assessed the potential benefits of reduced kerosene use to meet lighting demand in developing countries plus the viable alternatives for its replacement.

Matthew Lampert (YSSP '11 & University of Cambridge), who is a US national studying in the UK, explored how social mood is expressed within a population and used this knowledge to produce a model complementary to financial markets to anticipate mood change and concomitant changes in the tenor and character of social events.

Mathieu Leduc (YSSP '13 & Stanford University) researched how the strategic solicitation and provision of insurance can affect systemic risk.

Benjamin Leibowicz (YSSP '13 & Stanford University) represented spatial technology diffusion in an energy system optimization model to bring diffusion projections more into line with reality.

Vijay Limaye (YSSP '12 & University of Wisconsin-Madison) analyzed new research into the relationship between levels of the air pollutant, particulate matter, and human health to provide a health impact analysis for IIASA's GAINS model.

Zhimin Mao (YSSP '15 & Pardee RAND Graduate School) analyzed a proposed action plan to cut air pollution in China, showing that rapid reduction of air pollution can be achieved. (Funded by the Roger Levien Fellowship, part of the IIASA Annual Fund)

Pallavi Marrapu (YSSP '11 & University of Iowa) used the IIASA GAINS model and the Weather Research Forecasting-Chemistry (WRF-Chem) model to understand many issues associated with air pollution in India including: the contribution of various sectors to pollutant concentrations at regional and megacity scales, specifically focusing on New Delhi, and the role of aerosol feedbacks in air quality models to observe interactions between meteorology, chemistry, and aerosols.

Madeleine McPherson (YSSP '14 & University of Toronto), a US citizen, incorporated distinct time scales for the variability of renewable energy resources into the MESSAGE model.

Jon Nordling (YSSP '14 & University of Maryland) explored ways to utilize F-VGI (Facilitated-Volunteered Geographic Information) ground observation information, remote sensing, and GIS to gain a month-to-month understanding of production crops on a global scale.

Pheak Kdey Nguon (YSSP '12 & Clark University) explored the perceptions of stakeholders involved in schemes to reduce emissions from deforestation and forest degradation.

Guilherme De Paula (YSSP '14 & Yale School of Forestry and Environmental Studies) conducted a project to explain the significant cost reductions in sugarcane ethanol production in Brazil since 1975.

Colin Payne (YSSP '12 & University of Pennsylvania) researched the role of education in the aging process for those on the lowest income levels in Malawi.

Debra Perrone (YSSP '12 & Vanderbilt University) explored past trends and drivers in water use in the US to help improve projections of future water use.

Joshua Ramos (YSSP '13 & University of Denver) analyzed religious conversions and secularization within a global perspective, and their overall impact on population dynamics.

Adriana Reyes (YSSP '14 & Pennsylvania State University) used a harmonized global database of international migration flows to investigate the determinants of migration with a special focus on the relationship of fertility in sending and receiving countries.

Thanicha Ruangmas (YSSP '14 & University of Wisconsin-Madison) investigated if emission reduction in Europe is due to adoption of pollution abatement technology or to a relocation of production to other regions. (Funded by donations to IIASA's Annual Fund)

Daniel Sanchez (YSSP '15 & University of California, Berkeley) quantified the spatial and temporal variation of renewable energy sources in the Alpine region to determine the potential contribution of each energy source to different sectors, including electricity, heating, and transportation.

David Shanafelt (YSSP '13 & Arizona State University) provided new insights into a pivotal ecological model, as well as perspective on the spatial insurance hypothesis.

Ethan Jennings Sharygin (YSSP '11 & University of Pennsylvania) studied the impact of social and demographic changes on population projections in China to produce a new population forecast for China that takes the interaction of the relative scarcity of women and the educational attainment of men and women into account.

Xiaopeng Song (YSSP '12 & University of Maryland) used satellite observations, FAO statistics, and socio-economic parameters to better understand deforestation.

Daniel Suarez (YSSP '14 & University of California, Berkeley) USA, examined the spread and uptake of ecosystem services approaches in global environmental governance.

Jacob Teter (YSSP '13 & University of California, Davis) looked at policies for the wise use of scarce water resources in energy infrastructure development, under GHG mitigation targets.

Melissa Whitaker (YSSP '13 & University of California, Berkeley) modeled the effects of interaction asymmetries in order to explore the role of functional diversity on interaction dynamics.

Fang Yan (YSSP '11 & University of Illinois-Urbana and Champaign) identified and parameterized superemitters in emission models and investigated the effectiveness of policies which aim at eliminating superemitters.

Aika Yano (YSSP '11 & Georgia Institute of Technology) researched the impacts of the 2010 Russian Wildfire Emissions on air quality in the surrounding region and the affects this had on local communities and how deaths may have been avoided if the fire had burnt differently.

Sam Hyun Yoo (YSSP '12 & Arizona State University) investigated the contribution that female education had on the decline in fertility in South Korea since the mid-twentieth century.

Jie Zhang (YSSP '14 & University of Maryland) examined the sensitivity of different MODIS-derived indicators for agricultural drought and investigated their effectiveness for agricultural drought monitoring during the growing season on the Southern Great Plains of the USA.

YSSP '10

Regina Clewlow, Massachusetts Institute of Technology; **Avery Cohn**, University of California, Berkeley; **Maud Comboul**, University of Southern California; **Siyi Feng**, Texas A&M University; **Rennie Lee**, University of California, Los Angeles; **J. Alice Nixon**, University of Maryland College Park; **Katrina Running**, University of Arizona; **Carl Salk**, Duke University; **Wei-Shiuen Ng**, University of California, Berkeley; **Arame Tall**, Johns Hopkins, School of Advanced International Studies; **Alma Vega**, University of California, Berkeley; **Chen Wang**, University of Wisconsin-Madison; **Glenn Wright**, University of Colorado

YSSP '09

Benjamin Isaac Allen, Boston University; **Erica Elizabeth Bickford**, University of Wisconsin-Madison; **Carl David Boettiger**, University of California Davis; **Zachary Brown**, Duke University; **Benjamin Paul Bryant**, Pardee RAND Graduate School; **Zoe Anna Holtz Chafe**, University of California, Berkeley; **Samrat Chatterjee**, Vanderbilt University; **Luciana Kindl Da Cunha**, University of Iowa; **Lin Fan**, Johns Hopkins University; **Marta Maja Jankowska**, San Diego State University; **Marie Christine Dionela Lasco**, University of Illinois Urbana Champaign; **Courtney Anne Lee**, University of Colorado Denver; **Derek Mark Lemoine**, University of California, Berkeley; **David Lloyd McCollum**, University of California, Davis; **Patrick Turek Sullivan**, National Renewable Energy Laboratory; **Jun Wan**, University of Illinois at Urbana Champaign; **Ekbordin Winijkul**, University of Illinois at Urbana-Champaign; **Yun Wu**, North Carolina State University

YSSP '08

Zack Almquist, University of California Irvine; **Jinsong Chen**, Virginia Polytechnic Institute and State University; **Jung Chen Huang**, Ohio State University; **James Mcnerney**, Boston University; **Kenichi Okamoto**, University of California at Los Angeles; **Joshua Payne**, University of Vermont; **Monika Sawhney**, Tulane University; **Ekundayo Shittu**, University of Massachusetts; **Win Trivitanurak**, Carnegie Mellon University

Special Awards

Four doctoral students from the US have won awards for the quality of their research undertaken during the Young Scientists Summer Program

Candidates from the US have also been recipients of the annual YSSP Peccei and Mikhalevich Awards, which reward the YSSP participants whose research papers have met standards of the highest quality, originality and relevance of research. The winners receive a scholarship to return to research at IIASA.

The second Peccei Award for 2015 went to **Zhimin Mao** (Pardee RAND Graduate School) for her evaluation of the costs and effectiveness of Pearl River Delta's Air Pollution Reduction Action Plan. And in the preceding year the Peccei Scholarship was awarded to **Danielle Haak** (University of Nebraska-Lincoln) for her research on ecological and social network modeling of invasive species.

Both the Peccei and Mikhalevich Awards for 2013 were awarded to Americans, as well as one of two honorable mention awards. **Eleanor Brush** (Princeton University) received the Mikhalevich Award for her paper "The Stabilization of Cooperation by Discriminators Using Imperfect Information" and **Ben Leibowicz** (Stanford University) received the Peccei Award for his paper "Representing the Spatial Diffusion of Technologies in an Energy System Optimization Model". **Matt Leduc** (Stanford University) was granted an honorable mention for his paper "Systemic Risk with Strategic Interactions." In previous years, **Carl Salk** of Duke University won the 2010 Peccei Award for his research into how climate change will alter the carbon balance of temperate forests; and **Zachary Brown** also of Duke University won the 2009 Peccei Award for his investigations into cost-effective malaria control strategies.

Regional Young Scientists Summer Program

In 2012 IIASA launched its first expansion of the successful YSSP with the Southern African Young Scientists Summer Program (SA-YSSP) at the University of the Free State in Bloemfontein, South Africa. The Program is organized jointly by IIASA and the South African National Research Foundation, the South African Department of Science and Technology, the University of the Free State. In a competitive selection process, five US doctoral students were awarded fellowships to take part in the program:

Lucas Henneman (SA-YSSP 2014-15 & Georgia Institute of Technology) used the Greenhouse Gas Interactions and Synergies (GAINS) model to assess emissions and control costs associated with eight energy and air pollution scenarios in South Africa.

Simon Nampindo (SA-YSSP 2013-14 & University of Massachusetts) researched the competing land use and ecosystem services options to ensure the sustainable management of Greater Virunga Landscape.

Valentina Prado (SA-YSSP 2012-13 & Arizona State University) explored the potential of three main thermal electricity-generation technologies as viable options for an energy transition period.

Maria Rivera (SA-YSSP 2014-15 & University of Maryland) used a comprehensive review to examine whether reducing emissions from deforestation and degradation (REDD+) is the best policy instrument for the Virunga Park in the Democratic Republic of Congo.

Nathaniel Tindall (SA-YSSP 2013-14 & Georgia Institute of Technology) analyzed energy demand, reduction and environmental impact of the energy systems of South Africa.

Five young scientists from the US have taken part in IIASA's first regional Young Scientists Summer Program in South Africa

Postdoctoral Program

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 international journals, and to establish their own global network of collaborators. Six fellowships have been awarded to young scientists from the US since 2008:

Adam French (2015-present) is combining meta-analytical and empirical research to examine the implementation of the Integrated Water Resource Management (IWRM) paradigm in contexts of the Global South. This work is targeted at the production of policy-relevant insights and analytical tools, including a conceptual framework for identifying key governance factors that facilitate and hinder the development of more integrated—and ultimately more just, adaptive, and sustainable—watershed management practices. (PhD in environmental studies from the University of California, Santa Cruz).

Daniel Jessie (2014-present) is developing different analytic approaches to questions that arise in the analysis of complex systems, in particular, the nature of strategically interacting agents. This includes extending his methodology to include, among other things, dynamic agents situated on a network. (PhD in mathematics from the University of California, Irvine).

Carl Salk (2013-2015) used IIASA's GeoWiki geographical crowd sourcing tool to generate better land cover maps at different scales. These maps will in turn be used to address a variety of problems, such as how much land is available for different human needs to how natural resource users cooperate to manage ecosystems. (PhD in biology from Duke University).

Wei Liu (2012-2014), originally from China, developed models and scenarios to investigate integrated adaptive management of complex socio-ecological systems, with a focus on how changing land use affects ecosystem service provision and natural hazard vulnerability in Wolong Nature Reserve in China. His research topics included spatiotemporal dynamics of ecosystem service trade-off and synergy, multi-scale disaster resilience in complex socio-ecological systems, and integrated assessment of conservation policies. (PhD in wildlife conservation and wildland management from Michigan State University).

Narasimha D. Rao (2011 to 2013), originally from India, researched the relationship between electricity access, livelihoods, and carbon dioxide emissions in India. His methods included

Six recent PhD recipients from the US have been awarded IIASA Postdoctoral Fellowships

economic simulation models of the electricity sector and social welfare, input-output analysis, and carbon accounting. His work emphasized modeling policy and institutional influences, such as supply rationing and energy subsidies. He used his analysis to project the impacts of different urban and rural consumption patterns on carbon emissions. (PhD in environment and resources from Stanford University, California).

Jose Siri (2009-2011) researched how urbanization patterns and urban structure affect the transmission of mosquito-borne disease, and how better understandings of the dispersal of humans, vectors and infection in this context can lead to more effective and efficient public health policy. (PhD in epidemiology from the University of Michigan).

Scientific exchange through people

Several IIASA research scholars hold associate or full positions with universities in the US. These include **Bruce Beck** (University of Georgia), **Brian Fath** (Towson University), **Günther Fischer** (University of Maryland), **Arnulf Grübler** (Yale University), **Warren Sanderson** (Stonybrook University), **Laixiang Sun** (University of Maryland), **Stefan Thurner** (external professor at Santa Fe Institute), and **Fabian Wagner** (Princeton University).

Other IIASA staff hold advisory positions at universities in the US. IIASA Director General and CEO **Professor Dr. Pavel Kabat** is a member of the International Science Advisory Board of the NSF National Center on Earth Surface Dynamics at the University of Minnesota. Deputy Director General and CEO of IIASA **Professor Nebojsa Nakicenovic** is a member of the Mitigation Board of the Global Network for Climate Solutions (GNCS) at the Earth Institute of Columbia University. In addition, the Director of IIASA's World Population Program, **Wolfgang Lutz**, is a member of the Committee on Population of the US National Academy of Sciences. **Joanne Bayer**, the Director of IIASA's Risk, Policy and Vulnerability Program has served two terms on the National Science Foundation panel on decision, risk, and management sciences.

Other examples of scientific exchange include:

- Since 2008 US residents have participated in IIASA events over 800 times.
- 873 publications have resulted from collaborations between IIASA and US residents since 2008.
- On average over 40 US nationals have been employed by IIASA every year since 2008.
- Since 2008, 93 doctoral students from the US or studying in the US have gained international and interdisciplinary research experience from participating in IIASA's Young Scientists Summer Program or its southern African version.
- Over 270 researchers, advisors, and diplomats from the US have visited IIASA since 2008, while IIASA scientists have visited the US over 600 times.

Appendices

The details behind the above facts can be found in the following appendices to the country sheet. The appendices are either attached or available on request from Sanja Drinkovic (drinkovs@iiasa.ac.at):

1. Employees with US nationality at IIASA (2008-2016)
2. US visitors to IIASA (2008-2016)
3. Conference participants from US to IIASA (2008-2016)
4. Travel by IIASA scientists to US (2008-2016)
5. Publications relevant to IIASA-US Collaborations (2008-2016)
6. Members of the US Committee for IIASA (2004-2016)

Prospects for Future IIASA-US Activities

This Info Sheet summarizes recent research collaborations between IIASA and the US. Significant potential remains to further intensify the IIASA-US relationship through further developing activities including:

Enhancing the IIASA-US relationship offers benefits for US research, government policy, and international relations

- **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 the US through using scientific cooperation to improve international relations. And IIASA's neutral venue provides the US with opportunities to lead or participate in multinational research collaborations to jointly research controversial issues to find consensus across multiple national perspectives. (see box: Research to support science diplomacy: page xx).
- **Academic training opportunities for young US scientists:** There is potential to further enhance participation by young US doctoral and post-doctoral students in IIASA's programs to develop international and interdisciplinary research skills (see page xx: Capacity Building). For example, by becoming a partner in IIASA's forthcoming International Postgraduate School of Excellence.
- **Conducting international assessments in areas of US strategic interest:** The US was a significant contributor to IIASA's Global Energy Assessment which brought together over 500 specialists, including a significant number from the US, to transform the way society thinks about, uses, and delivers energy. IIASA is embarking on several new assessments, at the request of its member countries that will focus on issues of strategic interest to the US. These are holistic, integrative assessments of plausible futures for the Arctic, global water challenges, Eurasian economic integration, and tropical forests. And most recently IIASA has launched a major international project, known as The World in 2050 to bring together leading modeling teams from across the globe to identify the smartest ways to achieve the Sustainable Development Goals in an integrated way.
- **New partnerships between IIASA and US institutions to strengthen international cooperation:** IIASA also provides a platform for the US and its other member countries to develop new innovative partnerships between business, civil society, government and science that are needed to support global transformations to sustainability. For example, the Alpbach-Laxenburg Group brings together some of the best minds in the world today from academia, governments, business leaders and civil society to identify positive narratives for sustainable development and business opportunities, grounded in cutting edge international systems-science.

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's research areas are energy and climate change; food and water; and poverty and equity.

IIASA is at the center of a global research network of around 2,500 scholars and over 550 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:

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

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