



Activities with Member Countries

Mexico

Mexico is a member of IIASA through the Mexican National Council for Science and Technology (CONACYT). Since 2010, research collaborations between IIASA and Mexico have involved 21 Mexican organizations and led to 70 scientific publications in areas ranging from water resources, sustainable land use, and demography. Joint studies focus on the complex global systems that affect Mexico, its economy, environment, and people. Research topics include governance of transboundary water resources, risks to financial crises, climate change, sustainable energy, fiscal planning for extreme events, and projecting demographic change.

Underpinning the joint work is systems analysis—one of the few research tools with the breadth and depth to explore these complex problems across multiple sectors, countries, and timeframes. Moreover, the next generation of systems analysts are profiting from Mexican involvement in IIASA capacity building activities, including participating in the Luis Donaldo Colosio Fellowship and the IIASA-CONACYT Postdoctoral Fellowship. This mutually beneficial relationship involves scientific exchange, with over 20 Mexican researchers, advisors, and diplomats visiting IIASA or participating in IIASA events, and over 70 IIASA researchers participating in events or visiting institutions in Mexico. This IIASA Info Sheet provides a summary of interactions between IIASA and Mexico since 2010.

Highlights of Interactions Between IIASA and Mexico (since 2010)	
National Member Organization	Mexican National Committee for IIASA represented jointly by the Mexican National Council for Science and Technology (CONACYT) and the National Institute of Statistics and Geography (INEGI)
Membership Start Date	2014
Key Research Partners	<p>21 Mexican organizations collaborate with IIASA including:</p> <ul style="list-style-type: none"> ■ Autonomous University of Baja California Sur (Universidad Autónoma de Baja California Sur – UABCS) ■ Banco de México ■ Centro de Investigaciones en Ecosistemas (CIEco) ■ The College of Mexico (El Colegio de Mexico – COLMEX) ■ Mario Molina Center (Centro Mario Molina) ■ Megalópolis Environmental Commission (Comisión Ambiental de la Megalópolis - CAME) ■ National Council for Science and Technology (CONACYT) ■ National Institute of Statistics and Geography (INEGI)
Areas of Research Collaboration	<ul style="list-style-type: none"> ■ Water resources and governance of transboundary water resources ■ Foreign investment and risk of financial crisis ■ Sustainable land use and climate change ■ Sustainable energy and the Global Energy Assessment ■ Fiscal planning for extreme events in Mexico ■ Old-age pensions in Mexico ■ Projecting demographic change in Mexico ■ Enhancing expertise in integrated assessment models
Capacity Building	Five doctoral students from Mexico have taken part in IIASA Young Scientists Summer Program. Three postdoctoral students have participated in the Mexico-IIASA Postdoctoral Fellowship Program that was established in 2015. Five doctoral or postdoctoral students have participated in the Luis Donaldo Colosio Fellowship.
Publication Output	70 publications have resulted from IIASA-Mexican collaborations
Other Interactions	Researchers, advisors, and diplomats have visited IIASA from Mexico over 20 times and IIASA researchers have visited Mexico over 70 times

Activities with Member Countries: Mexico

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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 recent interactions with Mexico. 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 the External Relations Department.

IIASA National Member Organization in Mexico

Mexico joined IIASA in June 2014. Membership was established with the Mexican National Council for Science and Technology (CONACYT). A CONACYT representative, takes the role of IIASA Council Member for Mexico and is responsible for the payment of IIASA membership contributions.

The IIASA Council consists of one representative of each of IIASA member countries and is responsible for setting the overall strategic direction of the Institute as well as governing IIASA.

Dr. Maria Elena Alvarez-Buylla Rocés, Director General of CONACYT serves as Council Member.

Dr. Martha Ileana Rosas Hernandez, Director of International Cooperation and Evaluation at CONACYT serve as the NMO Secretary for Mexico.

The Mexican National Council for Science and Technology (CONACYT) represent Mexico and its scholarly community on the IIASA Governing Council

Web: www.conacyt.mx



Professor Diego Arjona-Arguelles, Managing Director, Research, Technology Development and Environment in the Mexican Government's Secretariat for Energy (SENER) General Director of the National Institute of Electricity and Clean Energies (INEEL) was a researcher at IIASA (1997-98).

Professor Asit K. Biswas, founder of the Third World Centre for Water Management in Mexico was an IIASA researcher (1980-81).

Dr Beatriz Cárdenas González, Director General, Secretary of the Environment of Mexico City, General Directorate of Air Quality Management, has collaborated with IIASA's air pollution experts.

Luis Donald Colosio, a Mexican politician, economist, and Presidential candidate, researched at IIASA during the 1970s. The Colosio fellowship was established at IIASA following his assassination in 1994 to sponsor Mexican doctoral and post-doctoral scholars at IIASA.

Professor Eduardo Sojo Garza Aldape, an economist who served as chief economic advisor to President Vicente Fox and Secretary of Economy in the cabinet of President Felipe Calderón, was the IIASA Council Member from 2014-2015.

Professor Silvia Giorguli, President, El Colegio de México collaborates with IIASA's population experts and is a current member of IIASA's Science Advisory Committee (SAC).

Professor Omar Masera, Director of the Bioenergy Laboratory at the National Autonomous University of Mexico, was a contributor to the IIASA Global Energy Assessment.

Professor Mario Molina, Nobel Prize Winner (Chemistry 1995) is a collaborator with IIASA as well as being a member of the Earth League—an international alliance of world-leading researchers—along with IIASA Director General and Deputy Director General.

Professor Ursula Oswald Spring, Professor and researcher at the National University of Mexico in the Regional Multidisciplinary Research Centre (CRIM) and the first MRF Chair on Social Vulnerability at United National University Institute for Environment and Human Security (UNU-EHS), is a member of the IIASA Task Force charged with developing the implementation plan for the Institutional Review recommendations.

Some leading Mexican personalities in academia and government who are associated with IIASA

Research Partners in Mexico

IIASA is continually developing collaborations with Mexico and has recently been working with 21 organizations in Mexico via formal and informal connections

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

- Autonomous University of Baja California Sur (UABCS)
- Banco de México
- Centro de Investigaciones en Ecosistemas (CIEco)
- Center for Research and Advanced Studies of the National Polytechnic Institute (CINVESTAV-IPN)
- The College of Mexico (El Colegio de Mexico – COLMEX)
- Institute of Research in Ecosystems and Sustainability
- International Maize and Wheat Improvement Center (CIMMYT)
- Mario Molina Center (Centro Mario Molina)
- Megalópolis Environmental Commission (Comisión Ambiental de la Megalópolis - CAME)
- Ministry of Urban Development and Environment of Yucatan
- National Autonomous University of Mexico (Universidad Nacional Autónoma de México - UNAM)
- National Council for Science and Technology (CONACYT)
- National Institute for Ecology and Climate Change (Instituto Nacional de Ecología y Cambio Climático - INECC)
- National Institute of Psychiatry
- National Institute of Statistics and Geography (INEGI)
- Procesos y Sistemas de Información en Geomática
- Secretariat of Finance and Public Credit
- Universidad Iberoamericana Puebla
- Universidad de Occidente

IIASA Global Contribution

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:

- 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.
- IIASA 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 GAINS model guided negotiators and policy makers 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.

Recent Research Collaborations

Water resources and governance of transboundary water resources

Mexico faces significant water scarcity challenges. According to the National Water Commission, 9 million people do not have access to potable water and more than 10 million people lack basic sanitation infrastructure at home. Additionally, Mexico faces significant imbalances across the country in whether people have access to a reliable water supply and the efforts needed to ensure water access. Finally, Mexico shares the waters of the Colorado River and Rio Grande with the United States of America and is under binational agreements, which is governed by the International Boundary and Water Commission.

IIASA has significant expertise in this area and recently launched, with partners, the Water Futures and Solutions (WFaS) initiative – and interdisciplinary and international scientific project to explore complex water challenges and identify integrated solutions. The initiative uniquely combines scenario-based water analysis, multi-model ensemble analysis, and stakeholder consultation.

Recent Mexican-IIASA collaborations in this area include the following:

- An international research collaboration led by a former IIASA Colosio Fellow developed comparative approaches to transboundary water resources environmental governance along the Mexico and United States border, by looking at the Rio Grande/Rio Bravo Basin. The 1944 Water Treaty between the USA and Mexico aims to share the water resources of the river equitably between the two countries, but there is no clause relating to sustainable development. Seeking to understand the views of its stakeholders, which are an extremely diverse group from local people to research institutions to non-governmental organizations, IIASA researchers interviewed over 75 stakeholders. The researchers found that the stakeholders were concerned that there was no sustainability provision in the treaty to ensure enough water for river ecosystems; thought that communication should be strengthened among all stakeholders and related water agencies; and that environmental education, shall be provided. This research has direct policy implications, including allowing for reciprocal and temporary water re-distribution; taking better advantage of regional water experts; formulating small-scale strategies to move towards sustainability across the basin; and using the existing processes to adapt the 1944 Water Treaty to improve equitable sustainability. This research was published in the journal *Water* in 2016.

Researchers are studying water resources and how improving communication and involvement could bring consensus solutions to transboundary water resources

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 4:

Corona-Núñez RO, Mendoza-Ponce A, López-Martínez R (2017). Model selection changes the spatial heterogeneity and total potential carbon in a tropical dry forest. *Forest Ecology and Management*, 405, 69-80

Nava LF, et al. (2016). Existing Opportunities to Adapt the Rio Grande/Bravo Basin Water Resources Allocation Framework. *Water*, 8(7), 291

Saldana-Zorilla SO (2015). Assessment of disaster risk management in Mexico. *Disaster Prevention and Management*, 24(2):230-248

Klimont Z et al (2013). New directions: GEIA's 2020 vision for better air emissions information. *Atmospheric Environment*, 81:710-712

Smith P, Haberl H, et al (2013). How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals? *Global Change Biology*, 19, 2285-2302

Sanchez Pena L & Fuchs R (2013). Using household surveys in climate change vulnerability and adaptation analysis. In: Martine G & (Eds) D Schensul (eds), *The Demography of Adaptation to Climate Change*. UNFPA, IIED, & El Colegio de Mexico, New York, London, Mexico City pp.96-114

**Selected publications
resulting from IIASA-Mexican
collaborations**

- A IIASA YSSP student studied the challenge that Mexico City is facing as it tries to provide water to its growing population and expanding economy. To keep the water flowing, the city imports large amounts of water from as far as 150 kilometers, which is energy-intensive and expensive, but also creates conflict with indigenous communities in the donor basins. The study assessed the effectiveness of water use rights in promoting sustainable water use and reducing groundwater exploitation in the city. The research suggested that solutions could include better enforcement of water use permits, providing stronger incentives to follow allocated water quotas, repairing decaying infrastructure, and scaling up alternatives such as rainwater harvesting and wastewater reuse.

Foreign investment and risk of financial crisis

Researchers from Banco de México and IIASA are examining the determinants of foreign investments and developed a more sophisticated methodology to analyze the risk of financial crises

Recent global financial crises have highlighted the risks of cascading failures in interconnected markets. IIASA has significant expertise in applying the integrated approach of systems analysis to global challenges, which include the risk of national and global financial crises.

Recent Mexican-IIASA collaborations in this area include the following studies:

- A research collaboration with an IIASA-CONACYT postdoctoral researcher and colleagues at the Central Bank of Mexico examined the determinants of foreign investments, known as capital flows, into Mexico in 1995-2015, a period characterized by a free-floating exchange rate. To analyze what determines capital flows in the short and medium term for Mexico, the researchers used an econometric model known as Vector Auto regression that examines the impacts of different shocks on capital flows. The researchers studied two sets of factors that can encourage investors to shift resources to emerging markets. External shocks, which are beyond the control of developing countries, such as foreign interest rates or economic activity in advanced countries, and prevailing economic conditions in the emerging economy, which include things like the Mexican GDP. The researchers found that investors are risk averse and prefer to invest abroad when foreign interest rates are higher. Additionally, this research highlighted the benefits of separately analyzing the components of capital flows. For example, a shock to the federal funds rate has important effects on portfolio investment in public-sector securities by foreign residents because public securities are the closest substitutes to US government bonds found in the Mexican financial market.

Research to support science 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 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 negotiated membership with Iran and Israel.

- A study by researchers from Banco de México, IIASA and others has found that the risk of a financial crisis is substantially higher than previously estimated. The research, published in the journal *Financial Stability*, introduces a new method that allows researchers to estimate the systemic risk that emerge from multiple layers of connectivity. For example if a major bank fails, it could trigger the failure of other financial institutions that are linked to it through loans, derivatives, securities, and foreign exchange exposure. The fear of such contagion is what drives governments to bail out banks. Previous studies of systemic risk have just examined one layer of this system, the interbank loans. The new study expands this to include three other layers of connectivity: derivatives, securities, and foreign exchange. By including the other layers, the researchers found that the actual risk was 90% higher than the risk just from interbank loans. Currently, financial regulators tend to use market-based measures to estimate systemic risk. The researchers find that these measures also underestimate the actual risk. In Mexico, which the researchers used as a case study, they found that systemic risk levels are about four times higher today than before the financial crisis—yet these risks are not reflected in market-based measures.

Sustainable land use and climate change

Agriculture contributes around 4% to the Mexican GDP and employs almost 15% of the labor force. The Mexican agricultural sector is important for feeding a growing population, maintaining trading relationships, alleviating poverty, and addressing climate change.

Identifying ways to deliver sustained food production, while at the same time understanding the impacts of climate change and potential mitigation strategies to combat those effects, is a complex challenge that countries across the world, including Mexico, face. IIASA has developed significant expertise and research tools in these areas.

Joint Mexican-IIASA collaborations are investigating reducing emissions from the agricultural sector, how to achieve food security, and how best to model above ground biomass

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:

- A recent analysis explored the impact of different education and development policies on Mexico's future total population. If Mexico follows a conventional development scenario over the coming decades, IIASA demographers project the country's 2100 population of 113 million will peak this century at around 133 million and then fall to 98 million by 2100. Rapid development would lead Mexico to following a similar scenario with its population reaching over 138 million this century and then falling to around 108 million by 2100. However, if development were to stall, Mexico's population is likely to continue to rise and reach over 238 million by 2100. (Source: Lutz W, Butz WP, KC S (Eds) (2014). *World Population & Human Capital in the Twenty-first Century*. Oxford University Press, UK).

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).

IIASA Models, Tools, and Data

Recent Mexican-IIASA collaborations in this area include:

- A research study involving researchers from Procesos y Sistemas de Información en Geomática and IIASA investigated the performance of different modeling approaches used to reconstruct the spatial distribution of above ground biomass found in a tropical dry forest located on the Southern Pacific coast in the state of Oaxaca, Mexico. The researchers found that the general linear model (GLM) and the general additive model (GAM) performed equally and outperformed more complex approaches. This research provides insights into the strengths and weaknesses of different models and their ability to estimate the spatial heterogeneity of potential above ground biomass. Ensuring accurate prediction is necessary to understand the estimates of carbon emissions due to deforestation and forest degradation. The research was published in the *Forest Ecology and Management* in 2017.
- A collaboration involving researchers from the International Maize and Wheat Improvement Center (CIMMYT) in El Batán and IIASA reviewed that information on mitigation efforts from the agricultural sector to reduce agricultural greenhouse gas emissions in the Paris Agreement. The researchers noted that there needs to be a more comprehensive target for the 2°C target that includes soil carbon and agriculture-related mitigation options. If they are not included, the researchers indicate that the cost of mitigation in non-agricultural sectors will increase or the feasibility of meeting the 2°C target will be reduced. The research was published in *Global Change Biology* in 2016.
- IIASA is supporting the efforts that CIMMYT is undertaking in Mexico to promote agricultural sustainable intensification by building a farmers' crowdsourcing mobile application. The application allows farmers across Mexico to register parcels and log information such as crop management practices and yield performance. Then the application uses geo-location to identify the registered parcel and provide information relevant for that location and crop. It gives farmers access to benchmarking local information that is based on previous performance of nearby parcels or areas of lands with similar conditions extracted from the CIMMYT database and potential performance based on the outputs of IIASA EPIC crop model that shows crop yield for five different years for irrigated and non-irrigated areas. Additionally, farmers get local historical weather information and forecasts as well as recommendations for things like the optimal time for fertilizer application. Future plans for this project include providing additional market and financial information, allowing farmers to provide feedback and communicate between them, and using the application for machine learning of crop modeling.

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, **Petrobrás**, 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.

- An international research collaboration involving researchers from the National Autonomous University of Mexico and IIASA reviewed the supply and demand-side climate mitigation potential in the land use sector and possibilities for providing food security. The researchers looked at supply-side estimates of mitigation including reductions in emissions from agriculture, reductions in emissions from energy use in agriculture and forestry; as well as demand-side mitigation potentials including changes in food supply and reduction in losses in the food supply chains. The researchers concluded that due to the challenges of demand-side measures, supply-side measures should be implemented as soon as possible. The research was published in *Global Change Biology* in 2013.

Sustainable energy and Global Energy Assessment

Mexico has significant energy resources including fossil fuels and renewable energy sources. Mexico is the third-largest oil producer in the Organization for Economic Co-operation and Development (OECD). The Mexican Government has proposed increasing electricity generated from clean energy sources to 35 percent by 2024 and 50 percent by 2050.

IIASA has substantial expertise in understanding global energy systems and their connections with economic, environmental and societal systems.

Recent IIASA collaborations in this area include:

- Researchers from IIASA, PBL Netherlands Environmental Assessment Agency, and Utrecht University assessed the mitigation components of Intended Nationally Determined Contributions (INDCs), countries' outline of post-2020 climate actions they intended to take under the Paris Agreement. The researchers found that despite reductions, the global and G20 emission level is projected to be higher in 2030 than it was in 2010. Additionally, the researchers demonstrated that the greenhouse gas emissions of Mexico would peak before 2025. The research was published in *Climate Change* in 2016.
- An international research collaboration assessed the emission trajectories and the energy system transition of 11 major economies, including Mexico, that were responsible for 70% of global emissions in 2012. The researchers found that for Mexico, the INDCs were relatively close to reach the mitigation level of the 2°C scenarios. However, limiting global temperature increase to below 2°C would require substantial reduction of the carbon budget for all countries. The research was published in *Climate Change* in 2017.

Collaborations between Mexican and IIASA researchers are investigating global and national emissions trajectories and how they relate to the Paris Agreement

Global Energy Assessment and Mexico

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.

Researchers from Mexican institutions including the Autonomous University of Southern Baja and the National Autonomous University of Mexico were contributors or reviewers of the GEA. Outcomes from the GEA include the adoption of GEA's findings as the three key objectives of the UN Secretary-General's Sustainable Energy for All (SE4All) initiative on energy access, energy efficiency, and renewable energy, which in turn have informed the targets of the Sustainable Development Goal on energy.

Fiscal planning for extreme events in Mexico

Research collaboration between IIASA risk experts and the Mexican Secretariat of Finance and Public Credit (Ministry of Finance) has helped Mexico prepare financially for a major natural disaster. IIASA catastrophe simulation model (CATSIM) provided the Mexican authorities with a clear picture of the risks posed by natural hazards (earthquakes, hurricanes, mudslides, and volcanic activity) to the public finances. From this, the researchers were able to explore how much risk could be transferred to the international reinsurance and capital markets at an acceptable cost. Subsequently in 2006 and 2009, the Mexican government issued catastrophe bonds to cover the risk of a major earthquake or hurricane.

Joint Mexican-IIASA studies helped the Mexican government to issue catastrophe bonds to cover the risk of a major earthquake or hurricane

Old-age pensions in Mexico

A recent IIASA research project explored the rise of social pensions in Mexico

IIASA research recently chronicled the rise of social pensions in Mexico which have helped increase the number of older Mexicans with a pension from 22% in the year 2000 to 88% by 2013. The analysis also suggests what still needs to be done in order to achieve pensions for everyone in Mexico.

Projecting demographic change in Mexico

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

IIASA demographers are providing independent analysis and projections of Mexico's future population. 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 Intergovernmental Panel on Climate Change 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 with *Oxford University Press volume World Population and Human Capital in the Twenty-First Century*. Findings for Mexico show how different policies over the next few decades could lead to the country's 2010 population of 113 million increasing to 238 million by 2100 or falling to around 98 million. Additionally, in 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.

Other joint studies with Mexican collaborators include:

- Research with El Colegio de México analyzed how using household surveys within integrated assessment models can shed new light on people's vulnerability to climate change and ways to adapt to these threats.
- In 2011, IIASA demographers assembled a global panel of experts, including Silvia Giorguli of El Colegio de México. Together, they issued the Laxenburg Declaration which outlined the demographic challenges for sustainable development and was subsequently published in *Science*.

To further develop research collaborations in the area of demographic change, IIASA researchers led a course on demographic methodologies of population projections at the Centro de Investigación y Estudios Avanzados de la Población (CIEAP) of the Universidad Autónoma del Estado de México in July 2017.

Enhancing expertise in integrated assessment models

Mexican and IIASA researchers are working together to develop and apply integrated assessment models

Mexico's national interests are integrally connected to complex global systems that impinge on the country's economy, energy systems, and climate, among others. Integrated assessment models are one of the few research tools that enable researchers to analyze highly complex and interconnected global problems and test the impact, including negative side effects, of different national policies. For example, IIASA GAINS model explores the synergies and interactions between climate change, air quality and other policy objectives.

Studies using the GAINS model and related to Mexico include:

- Researchers from IIASA and the Megalópolis Environmental Commission (CAME) among others are steering committee members of the Global Emissions Initiative (GEIA), which aims to constantly improve the quantification of chemical emissions into the air in order to identify feasible controls that reduce adverse impacts associated with air quality and climate, to track the success of implemented policies, and to estimate future impacts.
- Mexico was a founding member of the Climate and Clean Air Coalition to Reduce Short Lived Climate Pollutants (CCAC). Starting with six member countries in 2012, the coalition had 58 state partners and 63 non-state partners by February 2018—all committed to taking action on short-lived climate pollutants (SLCPs). IIASA GAINS model provided the intellectual underpinnings for CCAC by demonstrating, in an article in *Science*, how an integrated approach to reduce short-lived climate pollutants, methane, and black carbon, could simultaneously increase human wellbeing through reduced local air pollution, 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. In 2014, IIASA with researchers from the National Autonomous University of Mexico, National Institute for Ecology and Climate Change, and the Mario Molina Center among others began a major regional assessment of SLCPs in Latin America and the Caribbean for CCAC. The purpose is to foster increased awareness, knowledge, and mitigation actions on SLCPs.

Other collaborations on integrated assessments include:

- The Universidad Iberoamericana Puebla is a member of the Integrated Assessment Modeling Consortium (IAMC), which is coordinated by IIASA and partners in Japan and the US. IAMC is a consortium of scientific research organizations that facilitates and fosters the development of integrated assessment models. Recent IAMC work for the climate change research community involved in the IPCC's Fifth Assessment Report includes: (1) the Representative Concentration Pathways (RCP) database that provides greenhouse gas emission and other projections, and (2) the Shared Socio-economic Pathways (SSPs) database that facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptation, and mitigation.
- Researchers used a multidisciplinary and systems analytical approach to investigate the vulnerabilities of Mexican coffee farmers to external factors.

Capacity Building

Young Scientists Summer Program

Since 2010, five Mexican doctoral students developed research skills and networks by taking part in IIASA 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 following four students from Mexico have participated since 2010:

YSSP'18

Nain Breslau Martinez (University of California, Berkeley), a Mexican national, explored the emergence of new governance instruments that seek to manage the relationship between renewable energy projects and communities. Specifically, analyzing the Social Impact Assessment and the Indigenous Consultation in Mexico, which were created within the framework of the Energy Reform (2013) and the Energy Transition Law (2015) with the aim of reducing the growing social conflicts associated with renewable energy projects.

YSSP'17

Jose Pablo Ortiz Partida (University of California, Davis), a Mexican national, investigated combining simulation and optimization models to design water management strategies for sustainable water resources systems that improve systems operations to meet both societal and environmental water requirements. He also won the 2017 YSSP-Mikhalevich Award and will return to study at IIASA in the summer of 2018.

Gibran Vita (Norwegian University of Science and Technology), a Mexican national, working with the IIASA Energy Program, used the EXIOBASE model to study the economic and material transitions in developing countries.

YSSP'15

Julio Enrique Herrera Estrada (Princeton University), a Mexican national, investigated how compound events of droughts and heatwaves around the world may change in the future due to climate change, and what this means for water stress in different regions, given trends in water use.

Yolanda Lopez Maldonado (Ludwig Maximilian University of Munich), a Mexican national, conducted an early identification of the human drivers affecting the groundwater system of Yucatan, Mexico, using material flow analysis.

Mexico-IIASA Postdoctoral Program

A bilateral postdoctoral fellowship program to support Mexican postdoctoral researchers at IIASA

In 2015, a new Mexico-IIASA Postdoctoral Fellowship Program was launched. The program is organized jointly by IIASA and CONACYT. The program supports up to three Mexican researchers for the postdoctoral program at IIASA for the duration of one year, with the possibility of renewal for a second year, depending on evaluation and development. The following three postdoctoral fellows are currently participating in the program:

Katya Pérez-Guzman (2017-present) works with the Advanced Systems Analysis Program, carrying out a network analysis of various world input output tables, looking for edge patterns that could characterize the implications of oil extraction on a country's carbon intensity.

Valeria Javalera Rincon (2017-present) works with the Advanced Systems Analysis and Ecosystems Services and Management Programs on providing a general structure to perform optimal control in networked distributed environments, where multiple dependencies between subsystems are found.

Isela-Elizabeth Téllez-León (2017-present) works with the Advanced Systems Analysis and Risk and Resilience Programs examining the determinants of foreign investments into Mexico.

Luis Donaldo Colosio Fellowship

The Colosio Fellowship funds a Mexican doctoral or postdoctoral scholar to develop their research skills in IIASA international and interdisciplinary scientific environment. The funding helps the young scientist to look at his/her work from fresh angles, to publish widely in journal articles, and to establish his/her own global network of collaborators. The fellowship was established in memory of former IIASA researcher Luis Donaldo Colosio, who was assassinated on 23 March 1994 while campaigning in Tijuana for the office of President of Mexico. The fellowship ran from 1994 to 2008 and in 2014 was re-launched to coincide with Mexico becoming IIASA's 22nd member country and so help strengthen IIASA ongoing collaboration with Mexico. Recent Colosio fellows include:

The Colosio fellowship has helped Mexican doctoral and postdoctoral scholars develop research skills in systems analysis since 1994

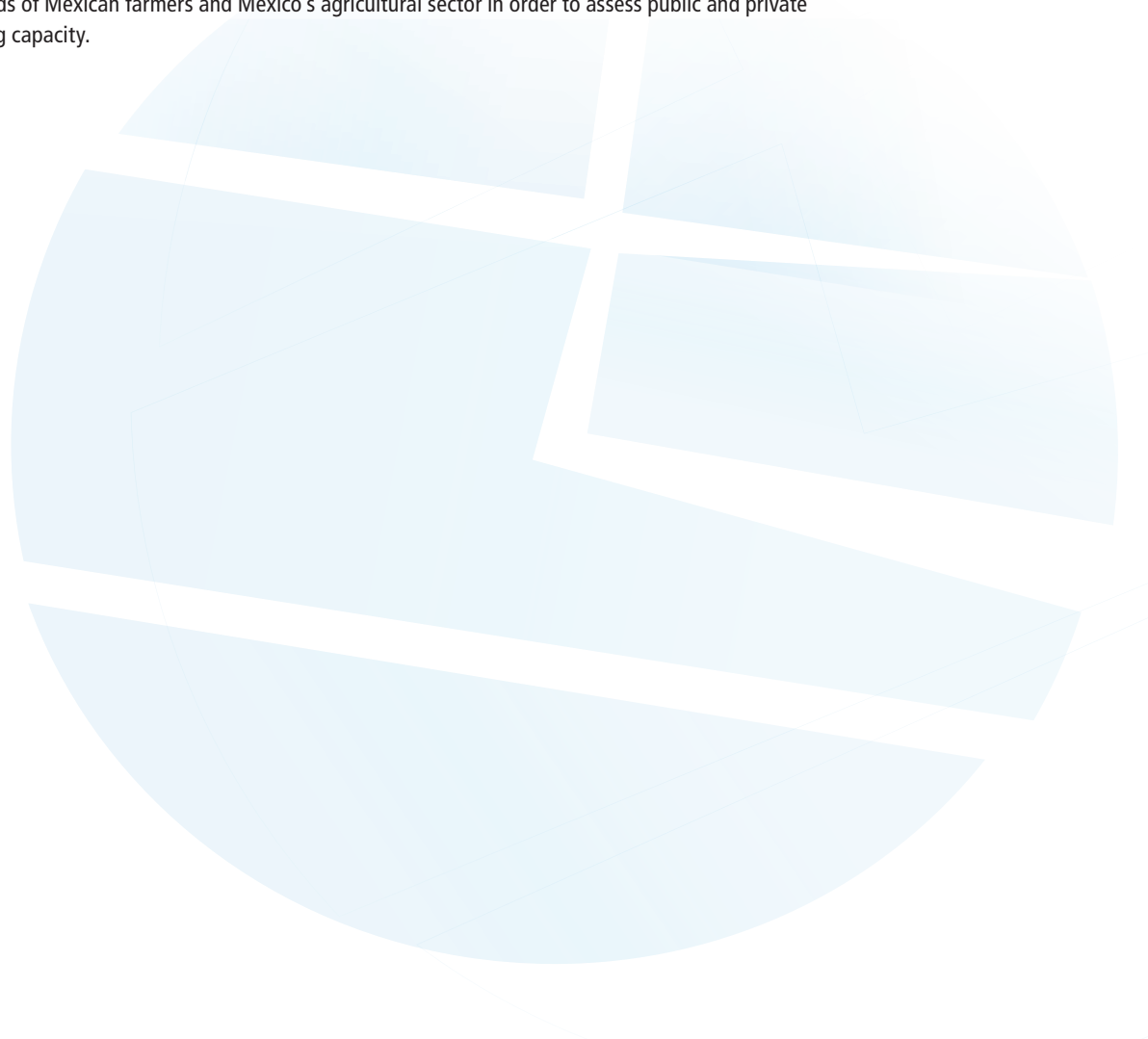
Alma Mendoza (2017-present) is researching the effects of climate change on land use and land cover, and the possible impact that changes in these aspects could have on biodiversity in Mexico.

Luzma Nava Jiménez (2014-2016) explored how to build strong and adaptive institutions to govern transboundary water bodies and withstand environmental challenges. Her works focuses on the transboundary river basin environmental challenges across the United States-Mexico border.

Manuel Benjamin Ortiz-Moctezuma (2008-2009) developed new models to better understand transportation systems in the context of economic growth.

Jaime Carrera Hernandez (2006-2007) used the multi-criteria model analysis methods developed at IIASA to analyze water management solutions in the 9,000km² Basin of Mexico, which encloses Mexico City and its metropolitan area.

Sergio Saldana Zorrilla (2002-2003) analyzed economic vulnerability to natural and economic hazards of Mexican farmers and Mexico's agricultural sector in order to assess public and private coping capacity.



IIASA-Mexican scientific exchange through people

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

Stephanie Bengtsson will present "The fifth 'P' of the Sustainable Development Agenda: Towards a 'revitalized Global Partnership for Sustainable Development' in and through education" on March 27, 2018 at the Comparative & International Education Society Re-Mapping Global Education conference in Mexico City.

Simon Langan organized a special session on the IIASA Water Futures and Solutions project at the XVI World Water Congress in Cancun in 2017.

Alma Mendoza Ponce presented her research at the VI Mexican Congress of Ecology in Leon in 2017.

Luzma Fabiola Nava presented her research at the 4th Meeting of the Network of Social Researchers on Water at the University of Guadalajara, University Center of Tonalá in 2016.

Nebojsa Nakicenovic participated in the round table discussions on "Accelerating Energy Productivity" and "Sustainable Urban Energy Transition" at the Clean Energy Ministerial 6 (CEM6) forum in Merida, Yucatan, in 2015.

Zbigniew Klimont on "GAINS and the regional assessment of short-lived climate pollutants (SLCPs) in Latin America and the Caribbean" at the second author meeting of the Latin America and the Caribbean Assessment SLCP meeting in Mexico City in 2015.

Wolfgang Lutz on "Global human capital: Integrating education and population" at the Center for Demographic, Urban and Environmental Studies at El Colegio de México in 2014.

Sergei Scherbov on "New measures of age and ageing" at the Center for Demographic, Urban and Environmental Studies at El Colegio de México in 2014.

Other examples of scientific exchange include:

- Since 2010, Mexicans have visited IIASA to participate in a range of IIASA organized events 20 times, while IIASA scientists have visited Mexico over 70 times.
- 70 publications have resulted from collaborations between IIASA and Mexican nationals since 2010.
- Since 2010, ten Mexicans have gained international and interdisciplinary research experience from participating in IIASA capacity building programs.

Appendices

Summaries detailing the presented information can be requested by contacting the External Relations Department (externalrelations@iasa.ac.at).

1.

Prospects for Future IIASA-Mexican Activities

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

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

- **Enhancing Mexican expertise in applying system analysis to national problems:** Developing bespoke Mexican versions of IIASA global models would allow researchers and policymakers to look at complex global problems and their impact on Mexico in a holistic and integrated way. For example, the Dutch government worked with IIASA to develop a Dutch version of the IIASA GAINS model. The new model helps ministries to identify cost-effective measures to improve air quality and reduce greenhouse gas emissions in the Netherlands at the same time as complying with the country's obligations under European air quality agreements.
- **Conducting international assessments in areas of Mexican strategic interest:** Mexico contributed to the IIASA Global Energy Assessment which brought together over 500 specialists to transform the way society thinks about, uses, and delivers energy. IIASA is embarking on two new assessments, at the request of its member countries that will focus on issues of strategic interest to Mexico. These are holistic, integrative assessments of plausible futures for global water challenges, and tropical forests.
- **New partnerships between IIASA and Mexican 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's 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 6). Recently, IIASA has launched a new global project to evaluate issues arising at the nexus of food, water, energy, and climate change.
- **Academic training opportunities for young Mexican scientists:** There is potential to further enhance participation by young Mexican doctoral and post-doctoral 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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