



## Activities with Member Countries

# Austria

iiasa info sheet

Research collaborations between IIASA and Austria have been highly productive throughout IIASA history. Since 2010, this cooperation has involved over 55 Austrian organizations and led to over a 1,900 scientific publications. Recent joint studies focused on Austria, have included an in-depth assessment of climate change, analyses of demographic change, investigations into the potential of biofuels, and the development of innovative techniques to collect land use data. Additionally, many young Austrian scientists are profiting from IIASA capacity building activities. Underpinning the joint work is systems analysis—one of the few research tools with the breadth and depth to explore complex global problems and how they impact countries. As the IIASA host country, Austria also benefits from the arrival of considerable international scientific talent to IIASA, and a significant amount of scientific exchange through events, lectures, and visits in addition to joint projects between IIASA researchers and Austrian institutions. In turn IIASA greatly benefits from a wide range of Austrian support, including the buildings that house the Institute. This IIASA Info Sheet provides a summary of interactions between IIASA and Austria since 2010.

Highlights of Interactions Between IIASA and Austria (since 2010)	
<b>National Member Organization</b>	Austrian Academy of Sciences (ÖAW)
<b>Membership start date</b>	1973
<b>Selected research partners</b>	55 Austrian organizations collaborate with IIASA including: <ul style="list-style-type: none"> <li>■ Austrian Federal Ministry for Education, Science &amp; Research (BMBWF)</li> <li>■ Austrian Federal Ministry for Europe, Integration &amp; Foreign Affairs (BMEIA)</li> <li>■ Austrian Institute of Economic Research (WIFO)</li> <li>■ Climate and Energy Fund</li> <li>■ Environment Agency Austria (UBA)</li> <li>■ JOANNEUM Research</li> <li>■ Universities of Graz, of Innsbruck, of Klagenfurt (AAU), and of Vienna</li> <li>■ University of Natural Resources and Life Sciences, Vienna (BOKU)</li> <li>■ Vienna Institute of Demography (VID), ÖAW</li> <li>■ Vienna University of Economics and Business (WU)</li> <li>■ Vienna University of Technology (TU Wien)</li> </ul>
<b>Areas of research collaboration</b>	<ul style="list-style-type: none"> <li>■ Advancing demographic methods and applying them to the analysis of human capital and population dynamics</li> <li>■ Research collaborations to tackle climate change</li> <li>■ Transitions toward a sustainable energy future</li> <li>■ Global Energy Assessment and Austria</li> <li>■ Increasing climate and disaster resilience</li> <li>■ Land use in Austria and Europe: Food, energy, water, and climate change</li> <li>■ Developing expertise in big data</li> <li>■ Basic research: Advancing the methods of systems analysis</li> </ul>
<b>Capacity building</b>	34 Austrians have gained international and interdisciplinary research experience from participating in the IIASA Young Scientists Summer Program.
<b>Publication output</b>	1934 publications have resulted from IIASA-Austrian collaborations
<b>Other interactions</b>	<ul style="list-style-type: none"> <li>■ Over 850 researchers, policymakers and diplomats who live in Austria have participated in IIASA events.</li> <li>■ On average 103 Austrians have been employed by IIASA every year.</li> </ul>

## Activities with Member Countries: Austria

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

This Info Sheet summarizes IIASA interactions with Austria during 2010–2018. It includes highlights, with links to further information, but is not intended to be a comprehensive report on all interactions.

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

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## IIASA National Member Organization in Austria

The Austrian Academy of Sciences is the National Member Organization (NMO) representing Austrian membership of IIASA. Membership began in 1973 and in addition to its membership fee; Austria provides the buildings that house IIASA along with favorable tax concessions and other privileges typical for international organizations in Austria. Today, Austria's Federal Ministry of Education, Science and Research (BMBWF) funds the NMO and the IIASA annual membership fee.

The Austrian Academy of Sciences entrusts the Austrian IIASA Committee with oversight of IIASA and with strengthening connections between IIASA and Austria's science and policy communities. The committee has 29 members which include representatives of the Academy, ministries, universities and other research organizations.

**Professor Dr. Christian Köberl**, Natural History Museum (nhm), University of Vienna, and Austrian Academy of Sciences, is the Chair of the Austrian IIASA Committee and the IIASA Council Member for Austria. 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.

### *Other members of the Austrian IIASA Committee are:*

Other representatives of the Austrian Academy of Sciences:

**Professor Dr. Gerhard Glatzel** (Vice Chair of Committee), Austrian Academy of Sciences, Vienna

**Professor Dr. Anton Zeilinger**, President, Austrian Academy of Sciences

**Dr. Michael Alram**, Vice-President, Austrian Academy of Sciences

Representatives of Austrian Ministries:

**Mr. Heribert Buchbauer**, Austrian Federal Ministry of Education, Science & Research

**Ges. Mag. Arnold Obermayer**, Austrian Federal Ministry of European and International Affairs

**Mr. Robert Pichler**, Austrian Federal Ministry for Sustainability and Tourism

Representatives of Austrian Universities:

**Professor Dr. Georg Brasseur**, Graz University of Technology

**Professor Dr. Otto Doblhoff-Dier**, University of Veterinary Medicine, Vienna

**Professor Dr. Manfred Fischer**, Vienna University of Economics and Business

**Professor Dr. Erich Gornik**, Vienna University of Technology

**Professor Dr. Gottfried Kirchengast**, University of Graz

**Professor Dr. Dietmar Kuhn**, University of Innsbruck

**Professor Dr. Andreas Ludwig**, University of Leoben

**Professor Dr. Reinhard Neck**, University of Klagenfurt

**Professor Dr. Kurt Schlacher**, Johannes Kepler University Linz

**Professor Dr. Erwin Schmid**, University of Natural Resources and Life Sciences, Vienna

**Professor Dr. Jean-Robert Tyran**, University of Vienna

**Professor Dr. Peter Zinterhof**, University of Salzburg

Representatives of other Austrian Research Institutes:

**Mr. Jürgen Busch**, Ludwig Boltzmann Society

**Professor Dr. Herbert Edelsbrunner**, Institute of Science and Technology Austria

**Dr. Emmanuel Glenck**, Austrian Research Promotion Agency

**Professor Dr. Matthias Weber**, Austrian Institute of Technology

**Professor Dr. Wolfgang Pribyl**, JOANNEUM RESEARCH

**Dr. Ulrike Famira-Mühlberger**, Austrian Institute of Economic Research

**Professor Dr. Leopold Sögner**, Institute for Higher Studies

**Professor Dr. Christof Gattringer**, Austrian Science Fund

**Professor Dr. Robert Trapp**, The Austrian Research Institute for Artificial Intelligence

**Mag. Andreas Schiefer**, Statistics Austria

*The Austrian Academy of Sciences represents Austria and its scholarly community on the IIASA governing Council*



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Other representatives:

**Dr. Johannes Ortner**, International Space University

The NMO Secretary for Austria is **Dr. Viktor Bruckman**, Austrian Academy of Sciences.

## Research Partners in Austria

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

*IIASA is continually developing collaborations with Austria and has recently been working with 55 organizations in Austria via formal and informal connections*

Alpen-Adria University Klagenfurt (AAU)  
 Austrian Academy of Sciences (ÖAW)  
 Austrian Agency of Health and Food Safety (AGES)  
 Austrian Climate Research Program (ACRP)  
 Austrian Development Agency (ADA)  
 Austrian Exchange Service (OeAD)  
 Austrian Energy Agency (AEA)  
 Austrian Federal Chancellery for Woman, Families and Youth  
 Austrian Federal Ministry for Europe, Integration and Foreign Affairs (BMEIA)  
 Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT)  
 Austrian Federal Ministry of Education, Science and Research (BMBWF)  
 Austrian Institute of Economic Research (WIFO)  
 Austrian Institute of Technology (AIT)  
 Austrian National Bank (OeNB)  
 Austrian OpenTrack Railway Technology  
 Austrian Partnership Programme in Higher Education and Research for Development (APPEAR)  
 Austrian Polar Research Institute (APRI)  
 Austrian Research Centre for Forests (BFW)  
 Austrian Research Promotion Agency (FFG)  
 Austrian Service for Torrent and Avalanche Control  
 Austrian Science Fund (FWF)  
 Austrian Security Research Project KIRAS  
 Center for Energy and Innovative Technologies (CEIT)  
 Climate Change Center Austria (CCCA)  
 Climate and Energy Fund  
 Complexity Science Hub Vienna (CSH)  
 Environment Agency Austria (UBA)  
 Geological Survey of Austria  
 Graz University of Technology (TU Graz)  
 Institute for Advanced Studies, Vienna (IHS)  
 Johannes Kepler University Linz  
 JOANNEUM Research  
 Konrad Lorenz Institute for Evolution and Cognition Research (KLI)  
 Kommunalkredit Public Consulting  
 Main Association of Austrian Social Security Institutions  
 Medical University of Vienna  
 OMV  
 Research Institute for Limnology  
 Science Center Netzwerk  
 United Nations Industrial Development Organization (UNIDO)  
 University of Applied Sciences, Wiener Neustadt (FHWN)  
 University of Graz

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University of Innsbruck  
University of Leoben  
University of Natural Resources and Life Sciences, Vienna (BOKU)  
University of Salzburg  
University of Veterinary Medicine, Vienna  
University of Vienna  
Vienna Graduate School of Finance (VGSF)  
Vienna Institute for International Economic Studies (WIIW)  
Vienna Institute of Demography (VID)  
Vienna School of International Studies  
Vienna Science and Technology Fund (WWTF)  
Vienna University of Economics and Business (WU)  
Zentralanstalt für Meteorologie und Geodynamik Institute for Meteorology (ZAMG)

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## Recent Research Collaborations

### *Advancing demographic methods and applying them to the analysis of human capital and population dynamics*

*IIASA demographers are providing independent analysis and projections of the future Austrian population including population drivers such as education*

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

A partnership between IIASA, the Vienna Institute of Demography, and the Research Institute on Human Capital and Development at the Vienna University of Economics and Business established the Wittgenstein Centre for Demography and Global Human Capital in 2011. The Centre combines the partners' strengths in the fields of demography, human capital formation, and analysis of the returns to education. It builds on a highly successful collaboration that has already generated significant scientific advances and provides sound scientific foundation for decision-making at various levels. This partnership also ensures there is a critical mass of demographic research skills in Austria and helps deliver further research excellence through knowledge exchange. In addition, IIASA interdisciplinary setting encourages the 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.

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*

#### Austrian foreign policy and IIASA

Austrian leaders emphasize the unique role the country plays as an East-West hub and as a moderator between industrialized and developing countries. Neutrality and multilateral problem solving are cornerstones of Austria's long-term foreign policy and have seen Vienna become one of the most important headquarters of international organizations in the world. IIASA contributes to this policy through building international consortiums of researchers to find global solutions to global problems. From the Institute's headquarters just outside Vienna, these multinational teams gather to research today's major global challenges ranging from tackling climate change to building sustainable energy systems to solving water scarcity. The Austrian Federal Ministry for Europe, Integration and Foreign Affairs (BMEIA) supports these efforts both in Austria and abroad:

- Former Foreign Minister Dr Michael Spindelegger visited IIASA in 2010 along with United Nations Secretary General Ban Ki-moon. BMEIA has sponsored a range of major international conferences organized by IIASA including its fortieth anniversary conference in 2012 and the Vienna Energy Forum in 2013. And BMEIA brings together ten Vienna-based international organizations dealing with energy to further develop a cluster of innovative international expertise in energy in Austria via the Vienna Energy Forum.
- Austrian embassies facilitate interactions between IIASA and its member countries to develop mutually beneficial activities between IIASA and Austrian embassies in those countries, which are illustrated by the following selected examples of meetings between Austrian Ambassadors and former IIASA Director General and CEO Professor Dr. Kabat: meeting with HE Ambassador Hubert Heiss at the Austrian Embassy in Tokyo in 2017; meeting with HE Ambassador Friedrich Stift at the Austrian Embassy in Beijing in 2018; and meeting with HE Ambassador Franz Josef Kuglitsch at the Austrian Embassy in Mexico City in 2018.

*Capital in the Twenty-First Century*. Findings for Austria show how different policies over the next few decades could lead to the country's 2010 population of 8.4 million falling to 7.1 million by 2060 or increasing to 9.7 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.

Collaborations between demographers at IIASA, the Vienna Institute of Demography, and the Vienna University of Economics and Business have also researched:

- The religious affiliation, religiosity, and attitudes of individuals seeking asylum in Austria. The researchers found that although religion was an important influence on refugee's attitudes, the share of individuals reporting not being religious exceeded those reporting being very religious. Additionally, the researchers found the individuals had high levels for religious tolerance. The study was published in *Religions* in 2018.
- Whether sex differences in academic strengths affect the career choices across gender and if so, how that impacts society. Study was published in *Intelligence* in 2018.
- Exploring the sustainability of the capital investment, including old age benefits, in 24 EU countries. The research was published in *Journal of Population Ageing* in 2018.

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 online:

Schroeck AM, Gaube V, Haas E, & Winiwarter W (2019). Estimating nitrogen flows of agricultural soils at a landscape level – A modelling study of the Upper Enns Valley, a long-term socio-ecological research region in Austria. *Science of the Total Environment* 665: 275-289. DOI:10.1016/j.scitotenv.2019.02.071.

Bruckman VJ, Kraxner F, et al. (2018). Sustainable Forest Bioenergy Development Strategies in Indochina: Collaborative Effort to Establish Regional Policies. *Forests* 9 (4): e223. DOI:10.3390/f9040223

Buber-Ennsner I, Goujon A, et al. (2018). Multi-Layered Roles of Religion among Refugees Arriving in Austria around 2015. *Religions* 9 (5): e154. DOI:10.3390/rel9050154.

Nabernegg, Bednar-Friedl B, et al. (2017). The deployment of low carbon technologies in energy intensive industries: a macroeconomic analysis for Europe, China and India. *Energies*, 10, 360; doi:10.3390/en10030360.

Fritz S, See L, et al. (2015). Mapping global cropland and field size. *Global Change Biology*, 21, 1980-1992.

Winkler T, Winiwarter W (2015). Scenarios of livestock – related greenhouse gas emissions in Austria. *Journal of Integrative Environmental Sciences*, 12, 107-119

Fuss S, Kraxner F, et al. (2014). Betting on negative emissions. *Nature Climate Change*, 4:850-853.

Krey V, Riahi K, et al. (2014). Limited impact on decadal-scale climate change from increased use of natural gas. *Nature*, 514(7523):482-485.

Rao ND, Riahi K & Grubler A (2014). Climate impacts of poverty eradication. *Nature Climate Change*, 4(9):749-751.

Amann M, Klimont Z, et al. (2012). Simultaneously mitigating near-term climate change and improving human health and food security. *Science*, 335(6065):183-189

Fritz S, McCallum I, et al (2012). Geo-Wiki: An online platform for improving global land cover. *Environmental Modelling & Software*, 31, 110-123.

Lutz W, Riahi K, et al. (2012). Demography's role in sustainable development. *Science*, 335(6071):918

#### Selected publications resulting from IIASA-Austrian collaborations



*Joint Austrian-IIASA studies have produced an assessment report on climate change in Austria as well as identifying strategies to reduce greenhouse gas emissions in the most cost effective way*

- The basic hypothesis that societies can develop the most effective long-term defense against the dangers of climate change by strengthening human capacity—primarily through education.
- How skills, productivity, attitudes and beliefs in Europe will change over the coming decades.
- The effect of demographic change on economic growth.
- The dynamics of an improving educational composition of the population and to demonstrate the long-term implications of near-term investments in education.
- New approaches to the study of age and aging that are appropriate for the 21st century.

### **Research collaborations to tackle climate change**

Although Austria has not currently set long-term reduction targets for greenhouse gas emissions, the EU foresees a reduction of 80% by 2050 compared to 1990 levels. The measures to achieve that proposed by the Energy Strategy Austria include stressing renewable energies, reducing greenhouse gas emissions, increasing energy efficiency, and the efficient use of natural resources. Achieving such a goal will require adopting and implementing the most effective and efficient strategies. Integrated, international assessments are one of the few research approaches that have the breadth and depth to explore such complex problems across multiple sectors, regions, and timeframes.

The Austrian Climate Change Assessment Report 2014 was the first national-level report that mirrors the breadth and rigor of the Intergovernmental Panel on Climate Change, examined the historical and future development of climate change, as well as the potential response and mitigation measures for the problem. The IIASA Deputy Director General was the project leader of the report which brought together data and findings from over 240 scientists at over 50 institutions including IIASA, the Climate Change Center Austria, Vienna University of Technology (TU Wien), the Wegener Center for Climate and Global Change at the University of Graz, and the Center for Global Change and Sustainability at the University of Natural Resources and Life Sciences, Vienna (BOKU). IIASA also led and managed the review process of the report to ensure rigor and the highest research standard.

The holistic approach of systems analysis helps identify climate change strategies that reap multiple benefits across sectors and regions, as well as avoid policies that lead to negative side effects in remotely connected activities. The IIASA integrated assessment model, GAINS, identifies smart mixes of measures to simultaneously cut air pollution and greenhouse gas emissions in the most cost-effective way. It has been applied successfully to many international

#### **Alpbach-Laxenburg Group**

Between 2014 and 2018 the European Forum Alpbach (EFA) and IIASA co-ordinated the Alpbach-Laxenburg Group (ALG). The group brought together some of the best minds in the world from academia, governments, business leaders and civil society to support global economic and social transformations towards sustainability by creating and communicating positive narratives for sustainable development and business opportunities, grounded in cutting edge systems-science.

Austrian members of the Alpbach-Laxenburg Group included Franz Fischler, President of the European Forum Alpbach and former EU Commissioner for Agriculture, Rural Development and Fisheries; and Clemens Hellsberg, President of the Vienna Philharmonic Orchestra. They joined other members including: Tarja Halonen, former President of Finland; Pascal Lamy, former Director General of the World Trade Organisation; Rajendra K. Pachauri, Chairman of the Intergovernmental Panel on Climate Change; Mary Robinson, former President of Ireland; and Jeffrey Sachs, Director of the Center for Sustainable Development, Earth Institute, Columbia University, and Director of the United Nations Sustainable Development Solutions Network.

Following a three-day high-level retreat during the 2014 European Forum Alpbach, ALG issued a declaration arguing that inequality must be a primary focus for the post 2015 sustainable development goals. Other meetings and declarations explored climate change, women's empowerment, energy for all, and education for all among other global issues.



environmental negotiations. The European implementation of GAINS includes Austria and experts from the Environment Agency Austria have visited IIASA to learn more about GAINS and how it guides EU policy and the National Emission Ceilings Directive. Other Austrian-IIASA collaborations using GAINS include:

- The research project SYNADAPT (2009-10) with JOANNEUM Research, sponsored by the Austrian Climate and Energy Fund analyzed the synergies between adaptation and mitigation strategies.
- The joint study RE-ADJUST (2013-15) with the University of Graz, also sponsored by the Climate and Energy Fund is carrying out a comprehensive model-based analysis of technological options, taking into account international trade, to achieve European energy and climate targets.

In addition, IIASA has been a member of the Climate Change Centre Austria (CCCA) since 2011. CCCA is a contact point for research, policy, media and the public for all aspects of climate research in Austria.

### *Transitions toward a sustainable energy future*

The long-term Austrian energy strategy aims to establish a sustainable energy system through increasing energy efficiency; promoting and intensifying renewable energy; and guaranteeing energy supply for the long term. Achieving these goals requires a thorough understanding of the complex global energy system and its multiple connections with Austria's economy, environment, and society.

IIASA has developed substantial expertise in international energy assessments, most recently in the Global Energy Assessment, which involved significant collaboration with Austria (see: Global Energy Assessment and Austria, page 11).

*A range of collaborations between Austrian and IIASA researchers are investigating how to manage the transition toward a sustainable energy system*

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

1. IIASA supports the climate change research community by hosting the Representative Concentration Pathways (RCP) database. The database provides data on greenhouse gas emissions for four different future scenarios that underpin the analysis of thousands of climate change researchers. IIASA also calculated the data for one of the scenarios, all of which have been developed for the world's most comprehensive analysis of climate change—the Intergovernmental Panel on Climate Change Fifth Assessment Report.
2. 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 policymakers as they worked on the treaty to identify the most cost-effective approach to cleaning Europe's air. The negotiators chose the GAINS model not only because of its accuracy and usability but also because it had been developed by an international team with funding from multiple countries, which assured them that the model was nationally unbiased.

### IIASA global contribution

Recent Austria-IIASA collaborations in this area include:

- Researchers from IIASA and the University of Graz assessed the effects of deploying low carbon technologies in six energy intensive industrial sectors – petroleum, iron and steel, non-metallic minerals, paper and pulp, chemicals, and electricity – in Europe, China and India in 2030. The researchers did not find low-carbon technology options competitive in Europe, but they were competitive in China and India. Thus, for energy policy in Europe, to foster low carbon technologies and maintain industrial competitiveness, targeted technology policy is needed to supplement carbon pricing. The research was published in *Energies* in 2017.
- IIASA energy experts and TU Wien explored mitigation pathways and associated costs as part of the EU-funded AMPERE project (2011-14).
- With the Center for Energy and Innovative Technologies on the EU-funded, EnRiMA project (2010-14), IIASA developed a decision support system to help energy managers of public buildings in certain cities in Austria to improve energy efficiency.

#### IIASA models, tools, and data

Through intense data gathering, computer modeling, and other advanced research methods, IIASA provides a country's researchers and their policymakers with the essential numbers and tools to select the most effective policies. For example:

- The Austrian Climate Change Assessment Report (AAR14), published in 2014, was the first national-level climate report that mirrors the breadth and rigor of the Intergovernmental Panel on Climate Change (IPCC), examining the historical and future development of climate change, as well as the potential response and mitigation measures for the problem. Its findings include:
  - Since 1880, average temperature in Austria has risen by nearly 2°C, compared with a global average increase of 0.85°C. The report projects that by 2050, the average temperature in Austria will likely increase by approximately 1.4°C compared to current temperatures.
  - Extremely hot days are expected to become more frequent in summer, while very cold days will become rarer in winter.
  - Snow cover duration and glacier extent have decreased significantly in recent decades, and this trend is likely to continue.
  - Precipitation patterns are likely to change, but with significant regional differences. On average, the report projects an increase in precipitation in winter months, and a decrease in summer months.
  - The risk of natural disasters including landslides and rockfalls, as well as forest fires, is projected to increase as precipitation patterns change and the temperature increases.
  - Former IIASA Deputy Director Nebojsa Nakicenovic led the project, IIASA researchers were among the authors, and IIASA led and coordinated the peer-review process to ensure the report was of the highest standard. (Source: APCC (2014): Summary for Policymakers (SPM). In: Österreichischer Sachstandsbericht Klimawandel 2014 (AAR14), Austrian Panel on Climate Change (APCC), Verlag der Österreichischen Akademie der Wissenschaften, Wien, Österreich).

Many of the research projects summarized in this Austria 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).

## Global Energy Assessment and Austria

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.

Austrians played important roles directing the GEA with Nebojsa Nakicenovic serving as GEA Director and Luis Gomez-Echeverri as GEA Associate Director, and Ambassador Irene Giner-Reichl as a member of the GEA governing Council. Austrian scientists made a significant contribution to the GEA with eleven authors from IIASA, University of Leoben, and the Universities of Graz, and Klagenfurt. Austria was an important sponsor of the GEA with the Austrian Development Agency providing substantial financial support.

Outcomes from the GEA included 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.

Other energy-related activities have contributed to knowledge exchange between the cluster of energy-related international organizations in Vienna including the International Atomic Energy Agency and SE4ALL. These include:

- UNIDO, IIASA, and the Federal Ministry for Europe, Integration and Foreign Affairs host the Vienna Energy Forum to facilitate international dialog on energy issues ranging from how to reduce energy poverty to how to increase energy efficiency.
- IIASA is a member of the Vienna Energy Club, which brings together ten Vienna-based international organizations dealing with energy, to provide an informal platform for discussions and exchange of views.

*Austria was a significant partner in and contributor to the Global Energy Assessment*

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.

Research to support science diplomacy

## Increasing climate and disaster resilience

*Findings from collaborations between IIASA and Austrian researchers are helping to enhance climate and disaster resilience in Austria, Europe, and developing countries*

Joint research has assessed ways to improve proactive climate and disaster risk management through improving our understanding of the risks faced by Austria, Europe and vulnerable regions of the world; identifying cost effective ways for Austria to adapt to anticipated changes from climate change; providing management tools for those working in disaster prevention and emergency preparation roles; and researching how to make countries and systems more resilient.

Research collaborations improving our understanding of risks include:

- IIASA researchers are identifying the reasons behind energy transition gaps in Austria. This project's primary objectives are to characterize the policy implementation gap facing Austria's Climate Energy Model regions and to understand heterogeneous stakeholder motivations; to clarify strategic stakeholder interactions that contribute to policy implementation gaps; and to co-design and co-generate low-carbon transition implementation options to help close those implementation gaps. This project is funded by the Austrian Climate Research Program.
- IIASA is leading an interdisciplinary project consortium aimed at fostering the operationalization of comprehensive climate risk management at the local and national level in Austria by employing a risk-layering approach in a participatory environment with key actors. This project is supported by the Austrian Climate Research Program.
- IIASA researchers are investigating agricultural drought risk management both in a broad European context and more specifically in Austria. This project involves conducting interviews and workshops with key actors and interest groups and is financed by the Austrian Climate Research Program.
- IIASA collaborated with JOANNEUM Research and the University of Graz as part of the EU-funded IMPACT2C project (2011-15) to assess the biophysical impacts and socio-economic risks associated with a global temperature increase of 2°C for Europe and the most vulnerable regions of the world.
- IIASA researchers played important roles in the latest IPCC Special Report on extreme events and joined the Austrian Federal Minister for Sustainability and Tourism to launch the report in 2012 and explain how its findings relate to Austria and Europe.

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

Joint studies are identifying cost effective ways for Austria to adapt to anticipated changes from climate change and include:

- IIASA researchers calculated the costs of climate change in Austria if the country takes no action on adaptation and no further action on mitigation as part of the Costs of Inaction (COIN) project from 2013-14 with the Austrian Institute for Economic Research (WIFO), Austrian Research Centres for Forests (BFW), Climate Change Centre Austria (CCCA), Environment Agency Austria, JOANNEUM Research, University of Graz, University of Klagenfurt, BOKU, TU Wien, and the Central Institute for Meteorology and Geo-dynamics (ZAMG).
- IIASA conducted, as a policy case study, an assessment of the fiscal consequences of extreme weather events and adaptation to future events at the federal and provincial level in Austria as part of the Public Costs of Adaptation (PACINAS) project (2014-16) with the Austrian Institute of Technology (AIT), the Environment Agency Austria, and the University of Graz. Researchers sought to generate more robust estimates of the potential costs of extreme weather events and the consequences for public budgets and to demonstrate that the scale of costs may be contingent on the choice of risk management options that are implemented.
- IIASA risk experts investigated the link between risk-transfer instruments (especially insurance) and the promotion of climate adaptation in general and risk mitigation in particular in Austria as part of the InsAdapt (2013-16) project funded by the Austrian Climate Research Program.

Decision support and management tools include:

- With the Austrian Agency of Health and Food Safety (AGES), WIFO, BFW, Environment Agency Austria, University of Salzburg, and ZAMG, IIASA developed a decision support system to help the city of Linz build resilience and reduce the risk of hazards stemming from climate change. The project known as ARISE ran from 2014-16 was funded by the Climate and Energy Fund.
- Landslide risk management tools as part of the EU-funded Safelands project (2009-12) which included the Geological Survey of Austria as a research partner, and the Austrian Service for Torrent and Avalanche Control as end users.
- New multi-sector partnerships to reduce or redistribute risk as part of the EU-funded ENHANCE project (2012-16) and including the Austrian OpenTrack Railway Technology GmbH.
- A collaboration with the Universities of Salzburg and Vienna and other partners is modeled the anticipated changes in natural disaster patterns in Europe in order to assist emergency preparedness officials and to train young scientists in the risk management skills needed to respond to future disasters. This joint study is the EU-funded project, CHANGES, and ran from 2011-14.

Other joint studies are researching how to make countries and systems more resilient:

- IIASA researchers are assessing resilience of Austria to six specific scenarios: (1) political instability; (2) economic and financial crises; (3) societal crises (polarization, exclusion, gangs); (4) environmental risks (climate change, extreme weather events); (5) technological risks (cyber-attack and breakdown of critical infrastructure) and (6) pandemic risks. IIASA worked FASResearch on this project (2013-15) which was funded by the Austrian Security Research Project KIRAS.
- IIASA is improving our understanding and management of the resilience of forested social ecological systems in the Congo Basin as part of the CoForTips project funded by the Austrian Science Fund (FWF).

## Land use in Austria and Europe: Food, energy, water, and climate change

*A wide range of collaborations between IIASA and Austrian researchers are exploring the interfaces between land, food, forests, energy and climate change*

Increasing the potential of land in Austria and Europe to provide food, energy, and water as well as provide a host of ecosystem services from biodiversity to tourism, requires an integrated approach to identify synergies, explore trade-offs, and avoid unintended consequences. Systems analysis provides the tools for researchers to find the most effective policies among these competing uses and within the context of a changing climate that both influences the productivity of our land and is influenced by how we use the land. Recent collaborations between Austrian partners and IIASA are improving our understanding of how farmland and forests contribute to climate change, the potential of biofuels and other renewable energy in Austria and the Alps, and exploring the availability of future water resources.

IIASA global land use model GLOBIOM and its global forestry model G4M support multiple research projects that have improved our understanding of how Europe's forests and farmland—and people's management of them—release and absorb greenhouse gases. Other collaborations use the models to analyze how climate change and associated government policies impact Europe's agricultural and forestry sectors, which account for some 50% of Europe's land surface. Projects and partners include:

- Researchers from the Austrian Academy of Sciences, BOKU, IIASA, and others did a study focused on promoting biomass and bioenergy markets in Cambodia, Laos, Myanmar, Thailand, and Vietnam. The researchers collaborated on three regional bioenergy workshops and led discussions on the National Bioenergy Development Plans. The study recommended several measures, including involvement of rural community stakeholders and consideration of science-based evidence to ensure regulations that support the aims of the network. The study was published in *Forests* in 2018.
- Researchers from IIASA and the University of Graz compared existing livestock emissions and projections on different spatial levels (global, European, and national) and on different system boundaries. The researchers looked at the livestock sector and found that the goal of keeping average global temperature rise under 2°C is more ambitious than any of the national projections. The researchers concluded that the higher livestock emissions could be compensated by higher emission reductions elsewhere, but that could be challenging. The research was published in the *Journal of Integrative Environmental Sciences*.
- An international research study with researchers from IIASA, GeoVille GmbH, and the University of Applied Sciences, Wiener Neustadt developed two new global cropland maps that combine multiple satellite data sources, to provide an improved record of total cropland extent as well as field size around the world. The study also presented the first ever global field size map—an important proxy for mechanization and human development. This map was based entirely on crowdsourced data collected through IIASA Geo-Wiki project, a crowdsourcing initiative that relies on a global network of citizen scientists, who have looked at thousands of high-resolution images of land cover to determine whether cropland was present or not. The research was published in *Global Change Biology* in 2015.

### Austrians with senior scientific roles at IIASA

**Dr. Markus Amann** has been Program Director of the IIASA Air Quality and Greenhouse Gases Program and earlier versions of the program since 1991.

**Professor Dr. Arnulf Grubler** has been Acting Program Director of the IIASA Transitions to New Technologies Program since 2008.

**Professor Dr. Wolfgang Lutz** has been Program Director of the IIASA World Population Program since 1994.

**Professor Dr. Nebojsa Nakicenovic** was Deputy Director General of IIASA between 2008 and 2019, and was Director of the IIASA coordinated Global Energy Assessment from 2006-12.

**Dr. Michael Obersteiner** was Program Director of the IIASA Ecosystems Services and Management Program between 2011 and 2019.

**Professor Dr. Keywan Riahi** has been Program Director of the IIASA Energy Program since 2008.



- The EU-funded GHG Europe project (2010-13) with BFW, Joanneum Research, and the University of Innsbruck.
- The EU-funded CC-TAME project (2008-11) with Joanneum Research and BOKU.
- Joanneum Research and the University of Graz on the EU-funded IMPACT2C project (2011-15).
- The EU-funded SIGMA project (2014-18), with the geo-information firm Geoville and other partners, is assessing the longer term impacts of agricultural dynamics on the environment and vice versa.

The impact of extreme weather events on the carbon cycle was the focus of the EU-funded CARBO-Extreme project (2009-15), which included IIASA and the University of Innsbruck as project partners. Together they are improving our understanding of how extreme weather events impact the Earth's ability to absorb carbon; early findings from the project appeared in *Nature* in 2013.

Research into the potential of biofuels and renewable energy includes:

- IIASA BeWhere model determines the optimal size and location of bio-energy production plants based on minimizing the cost of the complete supply chain. An international team, coordinated by IIASA, develops the model and includes BOKU with whom IIASA developed a detailed version of the model for Austria. Recent research has assessed the cost-effectiveness of energy policy instruments to reduce greenhouse gas emissions by substituting fossil fuels with new bioenergy technologies; as well as identifying the optimal location, size and technology of second generation biofuel production plants in Austria.

Every year, IIASA hosts around 90 lectures, seminars and workshops in Austria to facilitate internal collaborations, progress research and provide academic training. In addition, it hosts a number of major events to highlight the world-class research and researchers that IIASA brings to Austria. These events include:

- A major international conference every five years: "Worlds within Reach: From Science to Policy" at the Hofburg Palace in Vienna and at IIASA from 24-26 October 2012 and under the patronage of Dr. Heinz Fischer, The former Federal President of the Republic of Austria, and with sponsorship from the Federal Ministry of International and European Affairs, and the Federal Ministry of Science, Research and Economy.
- A series of public lectures jointly hosted by the Austrian Academy of Sciences and IIASA since 2012:
  - Why Evidence Matters by Professor Dame Anne Glover (2018)
  - Extreme States of Matter on Earth and in Space by Academician Vladimir Fortov (2016)
  - On Plants and Carbon by Professor Christian Körner, University of Basel (2016)
  - Obstacles and Opportunities in Environmental Management by Professor Simon Levin, Princeton University (2014)
  - The Age of Sustainable Development by Professor Jeffrey Sachs, Columbia University & Special Advisor to United Nations Secretary-General (2014)
  - The Polar Regions under Climate Change by Professor Peter Lemke, University of Bremen (2013)
  - Surviving the Century by Lord Martin Rees, University of Cambridge (2013)
  - Can we maintain sustainability for the future of humankind? by Professor Carlo Rubbia, Institute for Advanced Sustainability Studies e.V., Potsdam, Germany (2012)
  - Maastricht and Kyoto: A Tale of Two Treaties by Professor William Nordhaus, Yale University (2012)

#### High-profile events in Austria



- IIASA led the economic-ecological modelling of the recharge.green project (2012-15) using the BeWhere model. The project analyzed how to develop the potential of the Alps to provide renewable energy at the same time as conserving nature and ensuring sustainable land use, and was funded by the European Regional Development Fund in the Alpine Space Programme.
- The EU-funded S2Biom project (2013-16) developed research tools and a roadmap for Europe to make more efficient use of the continent's biomass resources. Austrian partners included JOANNEUM Research.
- BOKU, IIASA and TU Wien assessed the vulnerability of the Austrian bio-based industries to climate change and provided policy guidelines for regional adaptation to these changes as part of the CC2BBE project (2013-15), which was funded by the Austrian Climate and Energy Fund.
- IIASA in collaboration with Joanneum Research and other partners completed the EU-funded Refuel project, which produced an EU road map for biofuels in transport in 2010.

Finally, in 2013, IIASA launched a new flagship initiative, Water Futures and Solutions (WFaS), to conduct an integrated analysis of global water challenges and solutions. Progress toward meeting global water challenges has not been enough. For example, 770 million people lack access to improved sources of drinking water, and 35 million die prematurely each year from water-related diseases. The Austrian Development Agency supported the WFaS to compile estimates of the future availability of water resources (in space and time) and changes in demand across multiple sectors under various scenarios of climate change and selected shared socio-economic development pathways.

### **Developing expertise in big data**

*IIASA and Austrian researchers are finding new ways to improve data quality and uses*

The growth in data is a global phenomenon; and IIASA and Austrian researchers are collaborating to research and develop new tools and techniques, and innovative ways to extract insight and value from data:

- The Geo-Wiki project. IIASA and partners, including TU Wien and the University of Applied Sciences Wiener Neustadt (FHWN), lead a team of citizen scientists to improve maps of different land uses by examining satellite data to identify more exactly how people use the land. After launching, the project had a little over 100 registered users in 2009, but had nearly 15,000 users by September 2017. The rise of citizen scientists provides potential to radically improve the accuracy of maps and subsequently the quality of the research and policy recommendations that are based on mapping data. This project has expanded from maps of land uses to a flood resilience project in Nepal.
  - In 2013, IIASA Geo-Wiki team won a €1.4 million grant from the European Research Council to further develop the global network of citizen scientists for environmental monitoring. The new project focuses on two pilot areas in Austria and Kenya. In Austria the researchers will focus on collecting on-the-ground data along the lines of the Eurostat's Land Use Change Analysis System surveys, by building and engaging a local network of citizen scientists to collect the data.
  - One question the research teams always get is whether the analysis from laypeople is as good as that from experts. In other words, can they rely on non-experts to provide accurate data analysis? Together with a researcher from FHWN, IIASA researchers showed in the journal *PLOS ONE* (2013) that data gathered and analyzed by non-experts can rival the quality of data from experts.
- In 2015, IIASA launched FotoQuest Austria that allows participants to explore the outdoors while taking pictures and collecting observations for science. The project aims to gather information about land use change in Austria that is important for research on climate change and flood risk. The project is supported by the ERC funded CrowdLand project.

Joint Austrian-IIASA studies are combining satellite data and other information to provide African farmers with early warning of droughts:

- Using satellite data and models, researchers from IIASA, TU Wien and ZAMG developed a prototype to provide early warning to farmers in East Africa of the risk of drought as part of the GEOSAF project (2012-13) funded by the European Space Agency. The same collaborators developed a system to provide weather forecasts and soil moisture information to farmers in Ethiopia and Kenya as part of the FFG-funded FarmSupport project (2012-13).
- This research was extended as part of the FFG-funded Satida project (2014-18). IIASA with BOKU, TU Wien, ZAMG, and Médecins Sans Frontières, Austria are further developing innovative methods to use satellite data to improve the assessment of drought risks.

The above projects and studies build on earlier collaborations with BOKU which analyzed the benefits of using satellite imagery not just in the study of climate change but also for energy, water, agriculture and ecosystem research as part of the EU-funded GEOBENE project (2006-09) and developed tools to take advantage of these benefits as part of the developed tools to take advantage of these benefits as part of the EU-funded EuroGEOSS (2009- 12).

In 2016, IIASA joined the Complexity Science Hub Vienna, which has the objective to host, educate, and inspire complex systems scientists who are dedicated to collect, handle, aggregate, and make sense of big data in ways that are directly valuable for science and society. Focus areas include smart cities, innovation dynamics, medical, social, ecological, and economic systems. The Complexity Science Hub Vienna is a joint initiative of AIT Austrian Institute of Technology, Medical University of Vienna, Vienna University of Technology, Graz University of Technology, Vienna University of Economics and Business, and IIASA.

### **Basic research: Advancing the methods of systems analysis**

Many of the most serious problems that confront humanity—including climate change, global food security, and sustainable energy—are complex and interconnected. Austrian national interests are tightly connected to these complex global systems. Resolving such challenges requires an understanding not only of the detailed components of each element (disciplinary research) but also their dynamic and interconnecting elements (systems analysis). IIASA has recently worked with Austrian organizations to advance research methods that cross multiple disciplines in the following areas:

*IIASA and Austrian researchers are collaborating to advance the methods of systems analysis*

- With WIFO and other partners as part of the EU-funded PASHMINA study (2009-12), IIASA integrated its economic, energy and land-use models with models of project partners to analyze paradigm shifts in the way societies use energy, land, and transport over the next 40 years.
- With researchers at TU Wien, IIASA is applying optimal control theory to economic growth modeling. IIASA, WIFO and WU researchers collaborate on economic growth modeling. And with researchers from BOKU, IIASA is analyzing long-term metabolic social transitions.
- Collaborations with researchers from BOKU and other partners are conducting multiple model assessments of the impacts of climate change (ISI-MIP) and of agricultural production (AgMIP). By carrying out comprehensive and rigorous model inter-comparisons, researchers find more robust findings and improve the underlying models. Results have recently been published in a 2013 special issue of *PNAS*.

Other research has developed new methods and techniques to study evolution, biodiversity, and cooperation:

- By applying mathematical techniques of evolutionary game theory and adaptive dynamics, researchers from IIASA, the University of Vienna and WU among others are analyzing the evolution of cooperation, with particular emphasis on the nature and impact of incentives.
- Researchers from IIASA and the University of Vienna have explored how living systems respond to changing conditions. Studies include finding unexpected patterns of skipped reproduction in environments with uncertain energy supply, and how the degree of phenotypic plasticity is evolutionarily destined to change over the lifespan of individuals, which is likely to have as yet unprobed implications for population dynamics.

- By combining fields of expertise as diverse as population genetics, evolutionary theory, and fisheries science, IIASA's researchers are analyzing how to achieve sustainable harvesting of fish. Collaborations with a researcher at the University of Innsbruck are shedding light on the impacts of climate change on fish stocks.

## Capacity Building

### Young Scientists Summer Program

*Since 2010, 34 Austrian students have developed research skills and networks by taking part in the 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. Since the start of the YSSP in 1977, 109 students from Austria have taken part in the program. Funding is provided through the IIASA Austrian National Member Organization unless otherwise stated.

The following 31 young researchers from Austria or undertaking a PhD in Austria have participated in this program since 2010:

#### YSSP '19

**Nepomuk Dunz** (Vienna University of Economics and Business (WU)) studied the opportunities and risks of development banks to close the climate finance gap by extending a North-South Stock-Flow Consistent model, and calibrating it to Austria and the Western Balkans, with international trade and financial capital flows. A German National funded by the Austrian NMO.

**Julian Joseph** (Wirtschaftsuniversität Wien) studied agricultural productivity and foreign direct investment (FDI) in land in Sub-Saharan Africa. A German National funded by the Austrian NMO.

**Hanspieter Wieland** (University of Natural Resources and Life Sciences, Vienna) assessed the robustness of global iron & steel supply chains over time (1995-2015) to identify vulnerability hotspots in trade networks.

#### YSSP '18

**Raphael Asada** (University of Graz) studied material based indicators of bioeconomic transition, with the aim to further develop the IIASA GLOBIOM and BeWhere models for refining future demand projections under bioeconomic transition.

**Kian Mintz-Woo** (University of Graz) examined the links between losses and damages and obligations of private actors, especially large energy producers, which have historically made disproportionate contributions to climate change.

**Anton Pichler** (University of Oxford) studied implications of heterogeneous technologies on climate policy focussing on an agent-based model approach.

**Sonja Spitzer** (Vienna Institute of Demography) studied projecting multidimensional health expectancies in 13 European countries.

#### YSSP '17

**Cornelius Hirsch** (Austrian Institute of Economic Research) analyzed the rush for foreign land (FLA-deals) by the means of an extended gravity-model analysis.

**Bernd Lenzner** (University of Vienna) developed a first global quantification of relevant drivers for the development of alien species richness and related them in the Global Biosphere Management Model (GLOBIOM).

#### YSSP '16

**Fabian Heidegger** (University of Natural Resources and Life Sciences, Vienna) studied ITS (Intelligent Transport Systems) environmental monitoring using improved energy consumption and emission data from road traffic for the IIASA GAINS Model.

**Alexandre Köberle** (Universidade Federal do Rio de Janeiro) studied down scaling of shared socioeconomic pathways (SSPs) to Brazil using the MESSAGE modelling framework.

**Sebastian Maier** (Imperial College) studied using approximate dynamic programming with decision dependent uncertainties

**Clara Orthofer** (University of Munich) studied scenarios for the development of South Africa's power system as a emerging economy, under the influence of the UNFCCC Paris Agreement.

**Julia Puauschender** (University of Vienna) studied financing climate stability, making suggestions for global governance policy makers to efficiently herald climate justice in the 21st century.

**Navid Rekabsaz** (Vienna University of Technology) studied detecting systemic risk in the financial system by sentiment analysis of textual big data.

#### YSSP '15

**Tamara Fetzl** (Institute of Social Ecology, Vienna) analyzed ecological constraints to grazing intensity.

#### YSSP '14

**Thomas Schinko** (University of Graz) studied how to better govern risks in the financing of renewable energy projects in North and South Africa.

**Fabian Schipfer** (Vienna University of Technology) explored cost-efficient and environmentally sound (non-food) biomass-to-end-use chains and addressed their potential to contribute to the transition toward a knowledge- and bio-based economy.

#### YSSP '13

**Martin Bruckner** (University of Natural Resources and Life Sciences, Vienna) gave a structured overview of different approaches for the calculation of virtual land and water embodied in traded goods.

**Markus Enenkel** (Vienna University of Technology) researched how to integrate vulnerability assessments into the Satellite-Derived Combined Drought Index.

**Mathias Kirchner** (University of Natural Resources and Life Sciences, Vienna) researched how climate change and agricultural trade can impact Austrian agriculture, the environment, and how decision makers can respond in a sustainable way to negative impacts as well as opportunities.

#### YSSP '12

**Sebastian Busch** (Vienna University of Technology), a German national, developed a regulatory framework to facilitate cooperation among European states on the generation and transmission of renewable energy. (Funded by German NMO)

**Harald Ficker** (Research Institute for Limnology) developed a model to analyze how different management interventions (angling and stocking) as well as temperature changes could alter trajectories of exploited whitefish populations.

**Stefan Schreier** (University of Bremen), an Austrian national, estimated nitrogen emissions from wild fires in northern Eurasia for 2001 to 2010.

#### YSSP '11

**Marcela Doubkova** (Vienna University of Technology) studied the effects of extreme soil moisture on crop yields in the Sahel region using the Erosion-Productivity Impact Calculator model.

**Viktoria Gass** (University of Natural Resources and Life Sciences, Vienna) conducted an assessment of the economic wind power potential in Austria.

**Julian Matzenberger** (University of Technology Vienna) conducted research on demand side modeling of biomass products to help provide more accurate forecasts of demand.

**Anna Valerievna Timonina** (University of Vienna) used multi-hazard modeling to assess the behaviors that promote the adaptation, resilience, and resistance of societies to catastrophic events. (IIASA funded)

**Natallia Tratsiakova** (Vienna University of Economics and Business) studied catastrophe bonds as a complementary tool to reduce inefficiencies in the reinsurance market in the face of natural disasters. (IIASA funded)

#### YSSP '10

**Hamed Ghoddusi** (Vienna Graduate School of Finance) extended IIASA MESSAGE model by incorporating the effect of financial constraints on future energy supply and demand. (Self-funded)

**Christine Heumesser** (University of Natural Resources and Life Sciences, Vienna) developed a model to analyze decisions by farmers to invest in different irrigation technologies in the Marchfeld region of Austria.

**Doris Anita Oberdabernig** (University of Innsbruck) analyzed the different effects of education on economic growth and on the transition to a democratic form of government.

**Wolf Heinrich Reuter** (Vienna University of Economics and Business) modeled the optimal behavior of an electricity producer.

**Marianne Zeyringer** (Technical University of Vienna) modeled the demand for electricity among households in Kenya taking into account different income levels and affordability to pay for electricity.

#### Special Awards

*Two doctoral students from Austria or studying in Austria won awards for the quality of their research undertaken during the Young Scientists Summer Program since 2010*

Young scholars from Austria or studying in Austria have 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.

In 2012, **Stefan Schreier** (University of Bremen), an Austrian national, won the Peccei award for his paper "Estimates of Forest Fire Nitrogen Oxides Emissions in Russia between 1998 and 2010". In 2011 **Anna Timonina** (University of Vienna) won the Mikhalevich award for assessing the behaviors that promote the adaptation, resilience, and resistance of societies to catastrophic events.

#### Regional Young Scientists Summer Program

*1 Austrian national has taken part in IIASA's regional Young Scientists Summer Program in South Africa*

In 2012 IIASA launched its first regional YSSP called the Southern African Young Scientists Summer Program (SA-YSSP). The Program is organized jointly by the South African National Research Foundation, the South African Department of Science and Technology, the University of the Free State in Bloemfontein, South Africa, and IIASA. The following Austrian national has participated in the program:

**Carmen Klausbruckner** (SA-YSSP 2014-15 & Johannes Kepler University Linz) researched Southern Africa's energy policies including the legal framework in the field of local and regional air quality.

#### Postdoctoral Program

*2 postdoctoral fellows from Austria have developed their research and published widely at IIASA*

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 journal articles, and to establish their own global network of collaborators. Since 2006, IIASA has awarded Postdoctoral Fellowships to a select group of promising young scholars from around the world, including two from Austria:

**Peter Bednarik** (2015-18) designed a Common Pool Resource computer game based on the forestry sector, and used it to investigate the conditions under which a "tragedy of the commons" would be avoided. (PhD in Behavior and Cognition from the Georg-August University of Göttingen)

**Christina Kaiser** (2011-13) investigated the mechanisms behind the Rhizosphere Priming Effect, i.e. the effect of the release of labile carbon and nitrogen by plant roots on microbial decomposition of soil organic matter. She developed a model which links carbon and nitrogen input by plants to microbial community composition and function in a spatially structured soil environment, and analyzed how cooperation between microbial functional groups may lead to their coexistence and the emergence of the priming effect. (PhD in Ecology from the University of Vienna)

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## IIASA-Austrian scientific exchange through people

Many IIASA researchers hold positions at universities and other institutions in Austria. These include: Markus Amann (Member, Climate and Air Quality Commission, Austrian Academy of Sciences); Bilal Barakat (Vienna Institute of Demography); Jesus Crespo Cuaresma (Vienna University of Economics and Business, Austrian Institute for Economic Research); Alexia Fürnkranz-Prskawetz (Member Austrian Academy of Sciences, Technical University of Vienna, Vienna Institute of Demography); Anne Goujon (Vienna Institute of Demography); Arnulf Grubler (University of Leoben); Peter Havlik (Vienna Institute for International Economic Studies); Volker Krey (Vienna University of Technology); Wolfgang Lutz (Member Austrian Academy of Sciences, Vienna Institute of Demography, Vienna University of Economics and Business); Reinhard Mechler (Vienna University of Economics and Business); Raya Muttarak (Vienna Institute of Demography); Nebojsa Nakicenovic (Technical University of Vienna); Georg Pflug (University of Vienna); Keywan Riahi (Graz University of Technology); Serguei Scherbov (Vienna Institute of Demography); Karl Sigmund (University of Vienna); Nadia Steiber (University of Vienna); Erich Striebnig (Vienna Institute of Demography); Stefan Thurner (Medical University of Vienna and the Complexity Science Hub); Wilfried Winiwarter (University of Graz; Deputy Head, Climate and Air Quality Commission, Austrian Academy of Sciences).

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

**Ulf Dieckmann** on "Modelle der Biodiversitätsdynamik: Träger und Treiber evolutionären Wandels" at the Kerner von Marilaun lectures in the Austrian Academy of Sciences in 2014.

**Brain Fath** on "Cohesively Clinging to the Complex Systems Cycle: Ecosystem Growth Development, and Collapse" at the Third Viennese Talks on Resilience Research & Networks in Vienna in 2013.

**Anne Goujon** on "Modeling Past and Future Global Population By Levels of Education" at the 3rd ISA Forum of Sociology in Vienna in 2016.

**Arnulf Grubler** on "Innovationen für Nachhaltige Entwicklung Eine systemische Betrachtung der Möglichkeiten und Grenzen" at the Austrian Environment Agency in Vienna in 2014.

**Peter Havlik** on "Problems of Eurasian Economic Integration" at the Austrian Chamber of Commerce in Vienna in 2013.

**Lena Höglund-Isaksson** on "Why refund emission payments to the polluters? Lessons learnt from the Swedish NOx charge" at the ISIS Science Talk in Graz in 2013.

**Wolfgang Lutz** on "The Human Resources Based Approach for Human Development" at the Vienna Launch Event of the Human Development Report in Vienna in 2013.

**Nebojsa Nakicenovic** on "Global Transformation: Toward Sustainable Energy for All" at the OMV Business Talk entitled "Sustainable Energy for All" in Vienna in 2014.

**Piera Patrizio** on "How green can black be? Assessing the potential for equipping USA's existing coal fleet with carbon capture and storage" at the European Geosciences Union (EGU) General Assembly in Vienna in 2017.

**Keywan Riahi** on "Key Findings of the Global Energy Assessment" at the annual conference of the Austrian metal and steel manufacturing industry sector in Leoben in 2013.

**Elena Rovenskaya** on "Optimal harvesting of a size-structured forest under the perfect plasticity approximation assumption" at the Heterogeneous Dynamic Models of Economic and Population Systems in Vienna in 2016.

Other examples of scientific exchange include:

- Over 850 researchers, policymakers and diplomats who live in Austria have participated in IIASA events since 2010.
- 1,934 publications have resulted from collaborations between IIASA and Austrian nationals since 2010
- Since 2010, 34 Austrians have gained international and interdisciplinary research experience from participating in the IIASA Young Scientists Summer Program.
- Over 480 researchers, advisors, and diplomats who live in Austria have visited IIASA since 2010.

### Appendices

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



## Prospects for Future IIASA-Austrian Activities

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

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

- **Enhancing Austrian expertise in applying system analysis to national problems:** Developing bespoke Austrian versions of IIASA global models would allow researchers and policymakers to look at complex global problems and their impact on Austria 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 Austrian strategic interest:** Austria was a significant contributor to the IIASA Global Energy Assessment which brought together over 500 specialists to transform the way society thinks about, uses, and delivers energy. IIASA also plays key roles in the Austrian Panel on Climate Change. IIASA is embarking on new assessments, at the request of its member countries that will focus on issues of strategic interest to Austria. These are holistic, integrative assessments of plausible futures for the Arctic, global water challenges, and tropical forests.
- **New partnerships between IIASA and Austria institutions to win grants from international research funders:** IIASA high-quality research and international research network makes it highly competitive in its applications for international research funds. Between 2012 and 2017, this additional funding reached €52 million. This was part of a total funding portfolio of €265 million, the total awarded to external projects featuring collaboration between IIASA and member countries.
- **Using international scientific cooperation to support diplomacy:** IIASA was established in 1972 to use scientific cooperation to build bridges across the Cold War divide and research growing global problems on a truly international scale. Today the soft power of science diplomacy continues to help IIASA member countries through using scientific cooperation to improve international relations, and through international teams jointly researching controversial issues to find consensus, free from the constraints of national self-interest (see box: Research to support science diplomacy: page 11). 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 Austrian scientists:** There is significant potential to enhance participation by young Austrian scientists in IIASA programs to develop international and interdisciplinary research skills (see page 18: 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 (Observer), Mexico, Norway, Republic of Korea, Russia, South Africa, Sweden, Ukraine, United Kingdom, United States of America, Vietnam.

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