iiasa info sheet

## Activities with Member Countries

# South Africa

Since South Africa's membership of IIASA began in 2007, a range of research collaborations and capacity building activities have been developed by IIASA and over twenty South African research partners. The most notable activity is the Southern African Young Scientists Summer Program that has developed system analytical research skills among over 80 doctoral students from 30 countries including 35 students from South Africa. Joint research studies have explored how South Africa can make the transition to a low-carbon economy; smart ways to increase crop yields in South Africa; and the impact of different education policies on South Africa's future population. These activities are complemented by scientific exchange with over 120 researchers either visiting South Africa from IIASA or visiting IIASA from South Africa. However, significant potential remains to enhance the mutually beneficial relationship between IIASA and South Africa through establishing new collaborations, new partnerships, and increasing capacity building activities. This IIASA Info Sheet provides a summary of this expanding relationship since 2008.

| Highlights of Interactions Between IIASA and South Africa (since 2008) | |
|---|---|
| **National Member Organization** | National Research Foundation |
| **Membership start date** | 2007 |
| **Key research partners** | 26 South African organizations collaborate with IIASA including:<br>■ Central University of Technology (CUT)<br>■ Council for Scientific and Industrial Research (CSIR)<br>■ Department of Science and Technology (DST)<br>■ Nelson Mandela Metropolitan University (NMMU)<br>■ North-West University (NWU)<br>■ Stellenbosch University (SU)<br>■ University of Cape Town (UCT)<br>■ University of Johannesburg (UJ)<br>■ University of KwaZulu-Natal (UKZN)<br>■ University of the Free State (UFS)<br>■ University of the Witwatersrand (WITS)<br>■ Water Research Commission (WRC) |
| **Areas of research collaboration** | ■ Toward a sustainable energy system for all in South Africa<br>■ Projecting demographic change in South Africa<br>■ Improving food security in South Africa<br>■ Advancing the methods of systems analysis |
| **Capacity building** | ■ 35 doctoral students from or studying in South Africa and 14 doctoral students from other African nations have taken part in the Southern African Young Scientists Summer Program<br>■ 9 South African doctoral students have also developed research skills and networks by taking part in IIASA's Young Scientists Summer Program |
| **Publication output** | 34 publications have resulted from IIASA-South African collaborations |
| **Other interactions** | Researchers, advisors, and diplomats from South Africa have visited IIASA 42 times, while IIASA scientists have visited South Africa over 80 times. |

## Activities with Member Countries: South Africa

IIASA Info Sheet 2014/16
January 2015

The electronic version of this document is available at
www.iiasa.ac.at/southafrica



Prepared by
Iain Stewart, Head
Communications–Library–Media
IIASA, Schlossplatz 1, A-2361 Laxenburg, Austria
E-mail: stewart@iiasa.ac.at

---

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's recent interactions with South Africa. It includes highlights with links to further information but is not meant to be a comprehensive report on all interactions.

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

# IIASA's National Member Organization in South Africa

The National Research Foundation (NRF) is the National Member Organization (NMO) representing South Africa's membership of IIASA. NRF is an independent government agency that promotes and supports research in all fields of knowledge in order to help improve the quality of life of all the people of South Africa. NRF pays IIASA's membership fees with funding provided by the South African Department of Science and Technology.

Dr Dorsamy (Gansen) Pillay, Deputy CEO (RISA: Research and Innovation Support and Advancement) at NRF, is the IIASA Council Member for South Africa. The IIASA Council consists of one representative of each of IIASA's National Member Organizations and is responsible for setting the overall strategic direction of the Institute as well as governing IIASA. Dr Aldo Stroebel, Executive Director, International Relations & Cooperation at NRF is the NMO Secretary for South Africa.

NRF has established an IIASA-South African NMO Committee to (1) strengthen communication between IIASA and the broader science and technology environment in South Africa; (2) work toward establishing systems analysis as a focus in South Africa; (3) contribute to developing capacity in systems analysis in South Africa; and (4) ensure South Africa's full participation in IIASA's global activities within the broader NRF mandate. The committee is comprised of members from South African government, government parastatals, funding agencies, research institutions, and universities. The current members are:

### IIASA-South African NMO Committee Members

Ms Eiman Karar, Water Research Commission (Chair)
Ms Phindile Baleni, National Energy Regulator of South Africa
Ms Elizabeth Marabwa, National Department of Energy
Professor Julian May, University of the Western Cape
Professor André Roodt, University of the Free State (Dean: SA-YSSP)
Dr Ursula Scharler, University of Kwazulu-Natal
Professor Mary Scholes, University of the Witwatersrand
Dr Happy Sithole, Centre for High Performance Computing
Professor Frans Swanepoel, Stellenbosch University
Professor Coleen Vogel, University of the Witswatersrand

### Ex-officio members

Ms Mmampei Chaba, Department of Science and Technology
Dr Sepo Hachigonta, NRF
Dr Gansen Pillay, NRF
Dr Aldo Stroebel, NRF
Mr Daan du Toit, Department of Science and Technology

*South Africa's National Research Foundation represents South Africa and its scholarly community on IIASA's governing Council*

National Research Foundation

*Web: www.nrf.ac.za*
*Email: aldo.stroebel@nrf.ac.za*

**Some leading South African personalities in academia and government who are associated with IIASA**

Minister of Tourism, **Derek Hanekom**, launched the inaugural Southern African Young Scientists Summer Program at its opening ceremony in November 2012 while he served as South Africa's Minister of Science and Technology.

Deputy Minister of Science and Technology, **Zanele Magwaza-Msibi**, opened the third Southern African Young Scientists Summer Program in Bloemfontein in November 2014.

**Dr Albert van Jaarsveld**, CEO of the National Research Foundation, which is the National Member Organization representing South Africa's membership of IIASA, is also a visitor to IIASA. In March 2014 he took part in a lecture and debate with Professor Dr Jeffrey Sachs, Director, The Earth Institute at Columbia University and special advisor to the United Nations Secretary-General Ban Ki-Moon.

**Some leading South African personalities in academia and government who are associated with IIASA**

**Dr Phil Mjwara**, Director General of the Department of Science and Technology, which has partnered with IIASA and the National Research Foundation to establish a program to develop the skills of systems analysis among doctoral students in South Africa.

Minister of Science and Technology, **Naledi Pandor**, has met with IIASA's Director General to discuss and support the development of activities to build capacity in systems analysis within South Africa's science community.

**Dr Bob Scholes**, leader of the Ecosystem Processes and Dynamics Research Group at the Council for Scientific and Industrial Research (CSIR), is a research collaborator with IIASA.

**Professor Mary Scholes** from the School of Animal, Plant and Environmental Sciences at the University of the Witwatersrand, where she is also Director of the Graduate Support Division, chairs IIASA's Science Advisory Committee.

**Professor Roland Schulze**, Professor Emeritus of Hydrology at the University of KwaZulu-Natal, has collaborated with IIASA's water experts.

**Professor Coleen Vogel**, Professor of Sustainability at the University of the Witswatersrand serves on IIASA's Science Advisory Committee.

## Research Partners in South Africa

*IIASA is continually developing collaborations with South Africa and has recently worked with 26 organizations in South Africa via formal and informal connections*

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

African Institute for Mathematical Sciences (AIMS)

Central University of Technology (CUT)

Council for Geoscience

Council for Scientific and Industrial Research (CSIR)

Department of Science and Technology (DST)

Eskom

Human Sciences Research Council (HSRC)

National Research Foundation (NRF)

Nelson Mandela Metropolitan University (NMMU)

North-West University (NWU)

Rhodes University

South African National Energy Development Institute (SANEDI)

Stellenbosch Institute for Advanced Study (STIAS)

Stellenbosch University (SU)

Tshwane University of Technology (TUT)

University of Cape Town (UCT)

University of Fort Hare (UFH)

University of Limpopo (UL)

University of Johannesburg (UJ)

University of KwaZulu-Natal (UKZN)

University of Pretoria (UP)

University of South Africa (UNISA)

University of the Free State (UFS)

University of the Western Cape (UWC)

University of the Witwatersrand (WITS)

Water Research Commission (WRC)

# Recent Research Collaborations

## *Toward a sustainable energy system for all in South Africa*

*A range of collaborations between South African and IIASA researchers are investigating how South Africa can transition to a low-carbon economy and reduce energy poverty*

The South African economy is highly energy and (mineral) resource intensive, yet the South African government is committed to contributing its fair share of global greenhouse gas mitigation efforts in order to keep the global temperature increase to below 2°C. Achieving this vision of a low-carbon economy requires a thorough understanding of the complex global energy system and its multiple connections with South Africa's economy, environment, and society.

Researchers from IIASA and the Energy Research Centre at the University of Cape Town recently collaborated to identify technically feasible pathways to achieve deep decarbonization both in South Africa and globally. The resulting 2014 report was part of the Deep Decarbonization Pathways Project which is convened under the auspices of the United Nation's Sustainable Development Solutions Network (SDSN).

Systems analysis helps identify strategies that reap multiple benefits across sectors and regions, as well as avoid policies that lead to negative side effects in remotely connected activities. Integrated, international assessments are one systems analytical approach that has the breadth and depth to explore complex energy problems across multiple sectors, regions, and timeframes. From 2006-12, IIASA led the Global Energy Assessment (GEA), in which a new global energy policy agenda was defined—one that transforms the way society thinks about, uses, and delivers energy. GEA involved over 500 specialists from a range of disciplines, industry groups, and policy areas, to identify pathways and policies to facilitate equitable and sustainable energy services for all:

- Five South African scientists contributed to the GEA with analysis and research on developing policies to (1) increase energy access; (2) transform energy systems; and (3) build capacity.
- 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.

**Selected publications resulting from IIASA-South African collaborations**

IIASA's work is underpinned by high-quality science, which is regularly published in high impact publications. A selection of current publications is presented here and the full list can be found in appendix 4:

Ebi KL, Hallegatte S, Kram T, Arnell NW, Carter TR, Edmonds J, Kriegler E, Mathur R, O'Neill BC, Riahi K, Winkler H, van Vuuren DP, Zwickel T. A new scenario framework for climate change research: Background, process, and future directions (2014) *Climatic Change*, 122 (3), pp. 363-372.

Pfenninger S, Gauché P, Lilliestam J, Damerau K, Wagner F, Patt A. Potential for concentrating solar power to provide baseload and dispatchable power (2014) *Nature Climate Change*, 4 (8), pp. 689-692.

Paasonen P, Asmi A, Petäjä T, Kajos MK, Äijälä M, Junninen H, Holst T, Abbatt JPD, Arneth A, Birmili W, Van Der Gon HD, Hamed A, Hoffer A, Laakso L, Laaksonen A, Richard Leaitch W, Plass-Dülmer C, Pryor SC, Räisänen P, Swietlicki E, Wiedensohler A, Worsnop DR, Kerminen V-M, Kulmala M. Warming-induced increase in aerosol number concentration likely to moderate climate change (2013) *Nature Geoscience*, 6 (6), pp. 438-442.

Bindraban PS, van der Velde M, Ye L, van den Berg M, Materechera S, Kiba DI, Tamene L, Ragnarsdóttir KV, Jongschaap R, Hoogmoed M, Hoogmoed W, van Beek C, van Lynden G. Assessing the impact of soil degradation on food production (2012) *Current Opinion in Environmental Sustainability*, 4 (5), pp. 478-488.

Patt AG, Tadross M, Nussbaumer P, Asante K, Metzger M, Rafael J, Goujon A, Brundrit G. Estimating least-developed countries' vulnerability to climate-related extreme events over the next 50 years (2010) *Proceedings of the National Academy of Sciences of the United States of America*, 107 (4), pp. 1333-1337.

Europe has also been successful at reducing greenhouse gas emissions through policies aimed primarily at cutting air pollution. An integrated assessment model from IIASA, known as the GAINS model, has helped the European Commission identify smart mixes of measures to simultaneously cut air pollution and greenhouse gas emissions in the most cost-effective way. IIASA is currently in discussion with the University of Johannesburg, CSIR, and North-West University to develop and implement the GAINS model for the South African region over the next few years.

Other energy and climate related studies on South Africa or with South African partners include:

- IIASA has collaborated with the University of Cape Town among other partners to develop the Shared Socioeconomic Pathways (SSPs)—part of a new framework of scenarios that the climate change research community has adopted to facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptation, and mitigation.
- IIASA researchers developed a new method to evaluate the status and progress of rural household energy sustainability. The analysis, published in 2014, suggested that South Africa's rural energy sustainability index was the highest among the countries studied: Bangladesh, China, Ghana, India, and Sri Lanka.
- IIASA researchers in collaboration with a Kenyan participant in the SA-YSSP analyzed the relationship between energy poverty and the risks of burns, scalds and poisonings from household energy use in South Africa and found that the risks of burn incidents and fires initially rise with income only to decrease at higher income levels.
- Researchers from IIASA and Stellenbosch University among others demonstrated the potential for concentrating solar power to provide baseload and dispatchable power—key to allowing greater flexibility in planning a balanced energy system.
- An analysis of the potential for harnessing geothermal energy from relatively low temperature geothermal resources in the Limpopo Province, originating as a YSSP project by a South African student from Nelson Mandela Metropolitan University, explored this renewable energy source and resulted in a joint publication that also involved a researcher at the Council for Geoscience.

## IIASA's global contribution

Many of today's most pressing challenges do not stop at international borders. IIASA's 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's National Member Organizations recognize this need and view their investment in IIASA, in part, as a contribution to a global public good. The benefit of this contribution is paid back to global researchers, policymakers, and citizens in multiple ways as the following examples show:

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

- An investigation into the critical success factors for the environmental leadership necessary to transform the South African energy sector was carried out by researchers at the University of Johannesburg and IIASA and the resulting manuscript is in preparation.

## *Projecting demographic change in South Africa*

*IIASA's demographers are providing independent analysis and projections of the future South African population*

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

In addition, the Institute's interdisciplinary setting has encouraged its demographers to research beyond the traditional boundaries of demography and to explore how changes in society, economy, and the natural environment influence the health and mortality, migratory patterns, and reproductive behavior of human society.

A recent innovative example of this broader approach has been the development of research methods to project population by level of education. This equips researchers with the tools to explore the implications of different education policies on a country's future fertility, life expectancy, migration, and population level as well as economic growth and ability to adapt to climate change. In 2014 IIASA published the first projections of educational attainment by age and sex for 195 countries with *Oxford University Press*. Findings for South Africa show how different policies over the next few decades could lead to the country's 2010 population of 50.1 million increasing to 70.5 million by 2100 or falling to around 39.3 million.

### IIASA's models, tools, and data

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

- An analysis into the impact of climate change on crop yields and undernutrition in Sub-Saharan Africa identified regional hotspots where early intervention using adaptive measures may avert future hunger and improve food security. In the near future, regions located in Ethiopia, Uganda, Rwanda and Burundi, southwestern Niger, and Madagascar are likely to remain hotspots of food insecurity, while regions located in Tanzania, Mozambique and the Democratic Republic of Congo might face serious undernutrition. It is likely that both the groups of regions will suffer from lower capacity of importing food as well as lower per capita calorie availability, while the latter group will probably have sharper reduction in per capita calorie availability. (Source: Liu J, Fritz S,van Wesenbeeck CFA, Fuchs M, You L, Obersteiner M, Yang H (2008) A spatially explicit assessment of current and future hotspots of hunger in Sub-Saharan Africa in the context of global change. *Global and Planetary Change*, 64(3-4):222-235).

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

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

Other joint studies with South African collaborators include:

- Research with the Centre for Actuarial Research at the University of Cape Town among others analyzed the future of mortality in high-mortality countries.
- A project with the University of Cape Town on estimating AIDS mortality in Africa.
- A collaboration with the Stellenbosch Institute for Advanced Study on a book examining education and development.

## *Improving food security in South Africa*

*IIASA's researchers are collaborating with South African organizations to identify smarter ways to manage Sub-Saharan Africa's land, soil, and water resources*

IIASA collaborates with researchers in South Africa and other African nations to develop and apply the Institute's sophisticated models to issues of food security as well as land and water management. Activities since 2008 include:

- Several studies have explored the impact of climate change on agriculture in Sub-Saharan Africa (SSA). An analysis using IIASA's GAEZ model found that while some 200 million hectares could be used to expand food and energy production, the key to enhancing food security in SSA will be achieving yield increases on current cultivated land. A further study considered potential impacts to 2100 and identified regional hotspots where early intervention using adaptive measures may avert future hunger and improve food security.
- A case study of South Africa identified options for improving crop yields in the rain-fed systems of the semi-arid tropics, again using IIASA's GAEZ model.
- Researchers from IIASA and North-West University among others argued for a comprehensive approach to assess both the extent and impact of soil degradation on food production by interlinking various scales, based on ecological approaches and remote sensing in order to disentangle natural and human induced causes of degradation.
- IIASA and partners are developing more accurate maps of cropland in Africa through IIASA's Geo-wiki tool that uses Google Earth and information provided by a global network of volunteers to fill in 'data gaps' and to verify existing land cover information.
- IIASA and the Council for Scientific and Industrial Research (CSIR), along with other partners, analyzed the benefits of using satellite imagery to study climate change, energy, water, agriculture and ecosystem research as part of the EU-funded GEOBENE project (2006-09).
- South Africa's Water Research Commission is part of the project group of IIASA's Water Futures and Solutions Initiative, which is a ground-breaking study into sustainable solutions to meet local, national, and global water challenges.
- Research with CSIR and other partners has explored how to develop a fair and effective mechanism to reduce greenhouse gas emissions from deforestation and forest degradation (REDD).

### 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's member countries through using scientific cooperation to improve international relations, and through international teams jointly researching controversial issues to find consensus such as through integrative assessments of the future for the Arctic or of the economic integration of Eurasia.

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

## *Advancing the methods of systems analysis*

*Ongoing collaborations with South African researchers are developing new research methods and applying them to ecological challenges*

Researchers at Stellenbosch University, the African Institute for Mathematical Sciences, and IIASA collaborate to develop novel approaches to the study of complex adaptive systems in ecology and evolution, and to understand the stability and complexity of adaptive ecological networks. The joint activities often include the joint supervision of young scientists in the SA-YSSP capacity building partnership. Studies include:

- An assessment of how the interplay between natural and artificial selection, in the simplest setting in which a fishery and a target stock co-evolve, can lead to disruptive selection, which in turn may cause trait diversification.
- An investigation into the conditions for evolutionary branching and trapping in multidimensional adaptive dynamics.

Joint studies between researchers at the University of KwaZulu-Natal, Stellenbosch University, and IIASA have developed and applied new frameworks to analyze ecological networks representing socio-economic environments and highly productive estuarine/marine environments, in order to better understand their stability, robustness and organizational properties.

### IIASA working with business

Business can benefit from science through the analysis and knowledge it provides. In turn, science can benefit from business through its experience on the ground and in implementation. IIASA also recognizes that closer collaboration between business and its researchers can increase the impact of the Institute's work. Not surprisingly, IIASA is seeing a growing number of contracts with commercial partners, including:

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

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

# Capacity Building

## *Young Scientists Summer Program*

*Since 2008, nine South African students have developed research skills and networks by taking part in IIASA's Young Scientists Summer Program*

The Young Scientists Summer Program (YSSP) develops the research skills and networks of talented PhD students. Program participants conduct independent research within the Institute's research programs under the guidance of IIASA scientific staff. Funding is provided through IIASA's National Member Organizations. Since 2008 the following nine South African doctoral students have participated in this program:

**Gbenga Abiodun** (YSSP '14 & University of the Western Cape) analyzed the impacts of temperature, rainfall, and land-use changes on the distribution, activities, and life histories of the three Anopheles species that are mainly responsible for malaria transmission in Africa. From this, he predicted malaria incidence over the coming decades in three provinces of South Africa.

**Morag Ayers** (YSSP '12 & University of KwaZulu-Natal) explored the robustness of marine ecosystems to climate change and anthropogenic activities such as fishing, freshwater abstraction from rivers, and eutrophication.

**Taufeeq Dhansay** (YSSP '11 & Nelson Mandela Metropolitan University) studied the possibilities of harnessing geothermal energy in South Africa by producing geothermal and hydrogeological models using available heat-flow and groundwater data.

**Nimi Hoffmann** (YSSP '11 & Rhodes University) developed a strategy to form a partnership between villagers and universities in South Africa to engage local and provincial government in order to foster the participatory management of their water and climate risks.

**Donald Iponga** (YSSP '11 & University of Stellenbosch) studied the forces that drive future invasion of alien plants in the African Savannah.

**Prestige Makanga** (YSSP '11 & University of Cape Town) investigated how volunteered geographic information can be used to generate meaningful injury data and data on the socio-economic determinants of injury to inform and equip policy and decision makers to adequately respond to the burden of injury in low and middle income countries.

**Hayley McIntosh** (YSSP '10 & University of Cape Town) researched the application of Bayesian networks for the analysis of large amounts of seasonal rainfall data, in particular for supporting decision making in agriculture in South Africa.

**Danielle Nell** (YSSP'12 & University of Johannesburg) conducted a systematic risk assessment of the BRICS countries in order to identify impediments to developing green infrastructure for a green economy.

**Ikechukwu Umejesi** (YSSP '09 & University of Fort Hare) examined the environmental risk perceptions of indigenous people, international oil corporations and the state in the Niger Delta and identifies some "shifts" in cultural biases and "convergences" in land use practices and subsequently analyzes the consequences for the environment.

## *Regional Young Scientists Summer Program*

*The Southern African Young Scientists Summer Program (SA-YSSP) has been developing international and interdisciplinary research skills among doctoral students since 2012*

In 2012 IIASA, NRF, and the South African Department of Science and Technology launched the Southern African Young Scientists Summer Program (SA-YSSP)—the first regional YSSP. In 2014-15, the program is completing its third year at the University of the Free State in Bloemfontein, South Africa, for three months between November and February. During these first three programs, 83 doctoral students from 30 countries have participated, including 35 students from or studying in South Africa and 14 students from other African nations. Each SA-YSSP participant is co-supervised by one senior researcher from IIASA and one from South Africa, which is leading to further research collaborations with South Africa.

The following 35 doctoral students studying in South Africa have participated in this program:

**Abraham Alemayehu** (SA-YSSP '13/14 & University of South Africa) reviewed the integration of gender and indigenous decision making power in reproductive health policies.

**Anette Alleman** (SA-YSSP '14/15 & University of the Free State, Bloemfontein) researched the effect of herbicide formulations and soybean genotype on the relationship between beneficial organisms and root pathogens.

**Everardt Burger** (SA-YSSP '13/14 & Central University of Technology) researched the re-engineering of public transportation systems to develop greener cities in central South Africa.

**Hung-Yu Chaun** (SA-YSSP '14/15 & University of the Free State, Bloemfontein) studied the influence of sorghum root physiology on rhizosphere interactions and their effect on the incidence of root disease.

**Witness Chirinda** (SA-YSSP '13/14 & University of the Western Cape) estimated healthy life-expectancy in South Africa.

**Stephan Eromobor** (SA-YSSP '13/14 & Central University of Technology) dynamically modeled the feasibility of sustainably built infrastructure in South Africa.

**Aleksandra Falkiewicz** (SA-YSSP '14/15 & University of KwaZulu-Natal) explored asymptotic behaviour of dynamical systems in complex networks.

**Emile Goufo** (SA-YSSP '12/13 & North West University) conducted a mathematical analysis of the dynamics of social groups.

**Sunday Hosu** (SA-YSSP '12/13 & University of Fort Hare) analyzed the vulnerability to climate change of smallholder farmers in the Eastern Cape Province in South Africa.

**Frederic Isingizwe** (SA-YSSP '12/13 & University of KwaZulu-Natal) used experimental data to explore the effectiveness of a flow model of aquatic ecosystems.

**John Kandala** (SA-YSSP '12/13 & University of Johannesburg) studied criminal engagement by identifying the demographic aspects, including education, that might contribute to this phenomenon.

**Alois Katiti** (SA-YSSP '14/15 & University of Fort Hare) conducted a satellite-based estimation of evapotranspiration in the green scheme irrigation (projects) of Namibia.

**David Kimemia** (SA-YSSP '12/13 & University of Johannesburg) investigated the interface between energy poverty and energy incidents such as shack fires and paraffin poisoning using quantitative analyses of energy access and injuries data.

**Serge Kubanza** (SA-YSSP '14/15 & University of the Witwatersrand) researched the social and environmental injustice in solid waste management in Kinshasa, the Democratic Republic of Congo.

**Mantsebo Letsie** (SA-YSSP '14/15 & University of the Witwatersrand) examined the vulnerability to climate change and variability on crop yields and implications on household welfare in Lesotho.

**Omowunmi Longe** (SA-YSSP '12/13 & University of Johannesburg) researched the feasibility of a standalone microgrid to supply electricity to the Ntabankulu Local Municipality in Eastern Cape.

**Decide Mabumbo** (SA-YSSP '14/15 & University of Pretoria) studied the political, economic, social and ecological implications of large scale biofuel investments in South Africa.

**Takunda Mambo** (SA-YSSP '13/14 & University of Cape Town) researched multidimensional energy poverty in Zimbabwe.

**Brian Mandikiana** (SA-YSSP '12/13 & University of Pretoria) assessed the potential of extracting bio-gas from organic waste generated in South Africa.

**Tafadzwa Makonese** (SA-YSSP '13/14 & University of Johannesburg) conducted a systems analysis of residential coal combustion and ambient air quality in the South African coal-burning region.

**Henintsoa Minoarivelo** (SA-YSSP '12/13 & University of Stellenbosch) explored the adaptive dynamics of trait diversification in mutualistic networks.

**Shakespear Mudombi** (SA-YSSP '12/13 & Tshwane University of Technology) examined social learning in the climate change adaptation initiatives in South Africa.

**Shingirirai Mutanga** (SA-YSSP '14/15 & University of Pretoria) modeled an effective energy mix for developing economics using spatial system dynamics: The case of Biofuels in the SADC Region.

**Given Mutimudye** (SA-YSSP '13/14 & University of the Witwatersrand) researched strategic concerns for South Africa of integrating the greenhouse effect in economic growth.

**Thakane Ntholi** (SA-YSSP '13/14 & Nelson Mandela Metropolitan University) investigated the geothermal power potential of deep gold mines.

**Savannah Nuwagaba** (SA-YSSP '13/14 & Stellenbosch University) studied the role of adaptive foraging behavior in food-web emergence and biodiversity maintenance.

**Kgothatso Shai** (SA-YSSP '13/14 & University of Limpopo) analyzed whether there is a shared or competing interest between the use of oil for Africa's development or US energy security.

**Mercy Shoko** (SA-YSSP '13/14 & University of the Witwatersrand) researched the universality of aging in different population groups in South Africa.

**Blessing Silaigwana** (SA-YSSP '13/14 & University of KwaZulu-Natal) reviewed the efficacy of medicinal plants for the treatment of soil-transmitted helminthic parasites.

**Milaine Tchamga** (SA-YSSP '13/14 & University of Cape Town) analyzed dynamical systems in ecology using models and simulations.

**Emmanuel Vellem** (SA-YSSP '14/15 & Rhodes University) explored acid mine drainage and salinity catchment systems.

**Marcele Vermuelen** (SA-YSSP '14/15 & University of the Free State, Bloemfontein) studied the biotic and abiotic interactions of above and below ground parts of an allelopathic plant, using Amaranthus cruentus as a model.

**Romeo Xavier** (SA-YSSP '13/14 & University of the Witwatersrand) explored the factors needed to implement participatory governance in the transformation of the South African energy sector.

**Ganzamungu Zihindula** (SA-YSSP '14/15 & University of KwaZulu-Natal) investigated the access to health care services by refugees in South Africa: A case study of the Congolese community living in the city of Durban.

**Verena van Zyl-Bulitta** (SA-YSSP '12/13 & University of Stellenbosch) investigated negative externalities of measures to adapt to climate change in Africa through in-depth interviews with stakeholders.

IIASA partners with a wide range of senior researchers in South Africa to co-supervise SA-YSSP participants across different research themes. The South African supervisors are drawn from the following universities and research organizations:

- African Institute for Mathematical Sciences
- Central University of Technology (Department of Civil Engineering; Department of Management Sciences)
- Council for Scientific and Industrial Research (Centre for Mining Innovation)
- Human Sciences Research Council
- Nelson Mandela Metropolitan University (Sustainability Research Unit)
- North-West University (School of Mathematical and Physical Sciences)
- Stellenbosch University (Department of Mathematical Sciences)
- University of Fort Hare (School of Health Sciences)
- University of the Free State, Bloemfontein (Centre for Development Support; Department of Plant Sciences; Department of Sociology)

- University of Johannesburg (Department of Geography; Department of Public Governance; Faculty of Engineering and the Built Environment)
- University of KwaZulu-Natal (School of Accounting, Economics and Finance; School of Agricultural, Earth and Environmental Sciences; School of Mathematics, Statistics and Computer Science; School of Life Sciences)
- University of South Africa (Department of Sociology)
- University of the Western Cape (Department of Earth Sciences; Department of Statistical Sciences; Department of Electrical Engineering)
- University of the Witwatersrand (School of Animal, Plant and Environmental Science)

## IIASA-South African scientific exchange through people

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

**Zbigniew Klimont** on "Dialogue on Integrated Local and Regional Scale Air Quality Modelling using the GAINS Model" at a CSIR policy workshop in Pretoria in 2014.

**Brian Fath** on "The Craft of Systems Analysis" at the SA-YSSP in the University of Free State, Bloemfontein in 2013.

**Kaarle Kupiainen** on "Emissions of Black Carbon in Europe" at the 16th International Union of Air Pollution Prevention and Environmental Protection Associations (IUAPPA) in South Africa in 2013.

**Elena Rovenskaya** on "Bridging the gap between agents' aims in socio-environmental models" at the SA-YSSP in the University of Free State, Bloemfontein in 2013.

**Sabine Fuss** on "Bioenergy in mitigation portfolios: the role of uncertainty" at the International Energy Workshop in Cape Town in 2012.

**Alessandra Garbero** on "Survival Differentials by Level of Education" at the experts workshop on the 'Likely Future Trajectory of Mortality in High Mortality Countries' in Cape Town in 2012.

**Wolfgang Lutz** on "Demographic and Development Contexts of Aging in Africa" at the 1st IAGG Africa region Conference of Gerontology and Geriatrics in Cape Town in 2012.

**Shonali Pachauri** on "Energy Poverty and Access" at the international Energy workshop 2012 (IEW2012) in Cape Town in 2012.

**Nebojsa Nakicenovic** on "Global Energy Transformation: Efficiency and Decarbonization" at the First Forum of the Africa-EU Energy Partnership in Cape Town in 2012.

**Ulf Dieckmann** on "An integrative approach to expanding capacity building at IIASA" in Cape Town in 2011.

**Anatoly Shvidenko** on "Impacts of wildfire in Russia between 1998-2010 on ecosystems and the global carbon budget" at the International Conference Wildfire in Sun City in 2011.

Other examples of scientific exchange since 2008 include:

- 44 South Africans have gained international and interdisciplinary research experience from participating in either the Young Scientists Summer Program or Southern African version.
- Researchers, advisors, and diplomats from South Africa have visited IIASA 42 times, and IIASA scientists have visited South Africa 84 times.
- 34 publications have resulted from collaborations between IIASA-South African collaborations.
- Over 30 South Africans have participated in IIASA events.

**IIASA-South African scientific exchange through people**

## Appendices

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

1. Visitors from South Africa to IIASA (2006-2014)
2. Conference participants from South Africa to IIASA (2006-2014)
3. Travel by IIASA scientists to South Africa (2006-2014)
4. Publications relevant to IIASA-South African Collaborations (2008-2014)

# Prospects for Future IIASA-South African Activities

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

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

- **Enhancing South African expertise in applying system analysis to national problems**: Developing bespoke South African versions of IIASA's global models would allow researchers and policymakers to look at complex global problems and their impact on South Africa 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 international air quality agreements.
- **Conducting international assessments in areas of South African strategic interest**: South African researchers contributed to IIASA's Global Energy Assessment which brought together over 500 specialists to transform the way society thinks about, uses, and delivers energy. IIASA is embarking on four new future assessments, at the request of its member countries. Two will focus on issues of strategic interest to South Africa: holistic, integrative assessments of plausible futures for global water challenges and tropical forests.
- **Academic training opportunities for young South African scientists**: Numerous doctoral students have developed research skills in systems analysis by participating in the Young Scientists Summer Program and the Southern African version (see page 10: Capacity Building). In addition, IIASA and NRF are developing plans to: (1) jointly issue calls for applications for postdoctoral fellows in areas of mutual interest; and (2) support the exchange of scientists and specialists to develop and conduct joint scientific programs and research projects through the International School of Excellence initiative.
- **Other activities to establish systems analysis as a focus in South Africa**: NRF and IIASA are also working together to establish a Systems Analysis Research Professorship (or Research Chair) within the South African higher education system, with the opportunity for joint supervision of postgraduate students. The value of systems analysis for policy-making will also be encouraged through NRF and IIASA working together to jointly organize workshops to train senior policy makers in the application of systems approaches and scientific insights to policy deliberations.
- **New partnerships between IIASA and South African institutions to win grants from international research funders**: IIASA's high-quality research and international research network makes it highly competitive in its applications for international research funds. Between 2006 and 2014, IIASA almost doubled its income by winning research grants that amounted to €69 million. This was part of a total funding portfolio of €329 million of the external projects in which IIASA was and is involved. One of these projects, the EU-funded GEOBENE project (€2.5 million) was led by IIASA and included CSIR as a project partner; it shows the potential for South African researchers to collaborate with IIASA to access funds from third parties.
- **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 8). Recently, IIASA has launched a new international project to analyze the prospects for economic integration between Europe and the countries of the former USSR.

# About IIASA

Founded in 1972, the International Institute for Applied Systems Analysis (IIASA) conducts policy-oriented research into problems of a global nature that are too large or too complex to be solved by a single country or academic discipline. IIASA's research areas are energy & climate change; food & water; and poverty & equity.

IIASA is at the center of a global research network of around 2,500 scholars and over 550 partner institutions in over 65 countries. It is funded and supported by its National Member Organizations which represent the scholarly community in the following countries:

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

## *Contact*

IIASA, Schlossplatz 1, A-2361 Laxenburg, Austria

Phone: +43 2236 807 0
Fax: +43 2236 71313
E-mail: inf@iiasa.ac.at
Web: www.iiasa.ac.at

facebook.com/iiasa
twitter.com/iiasavienna
linkedin.com/company/iiasa-vienna
youtube.com/iiasalive
blog.iiasa.ac.at
www.flickr.com/photos/iiasa/

International Institute for
Applied Systems Analysis
IIASA www.iiasa.ac.at