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

Systems Analysis and Africa

The power of Systems Analysis: *How the integrated approach of systems analysis increases efficiencies and effectiveness of government policies*

Dr. Albert van Jaarsveld

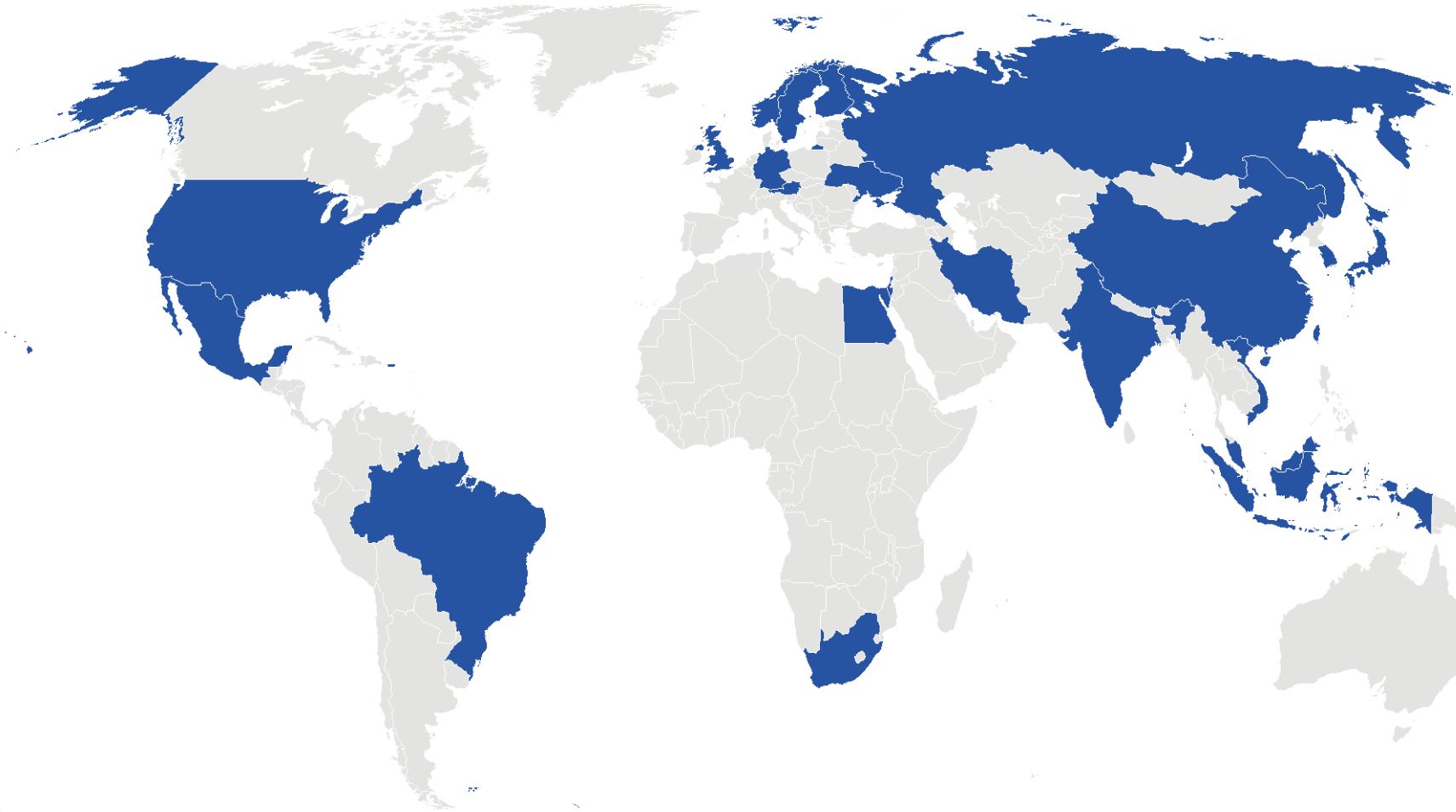
IIASA Director General and Chief Executive Officer

December 2019

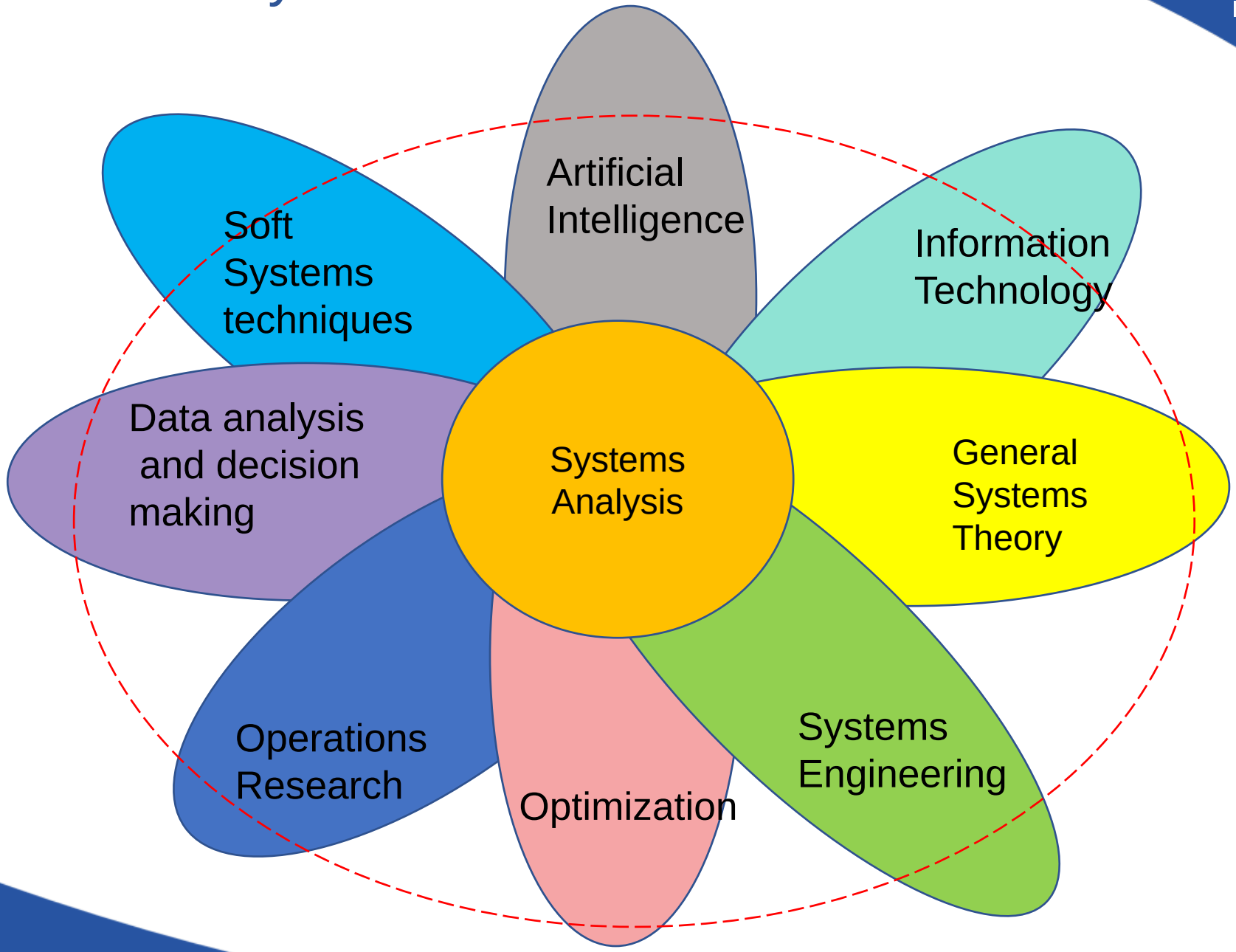
IIASA

An international research institute that conducts multidisciplinary/transdisciplinary research to help policymakers find long-term solutions to global and universal challenges facing countries

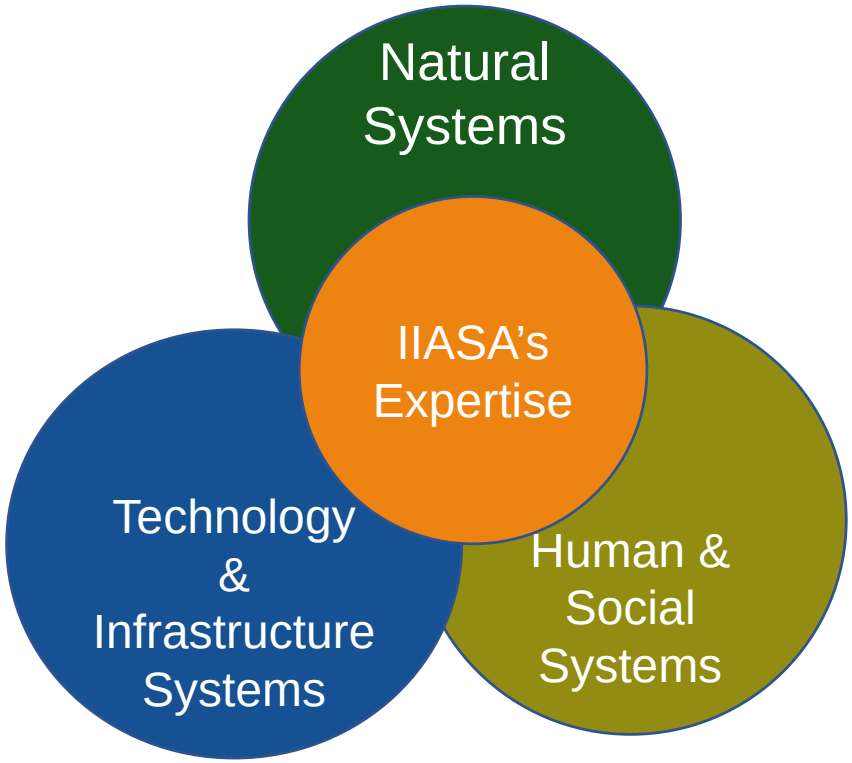
22 National Member Organizations
bringing together scholarly communities in:

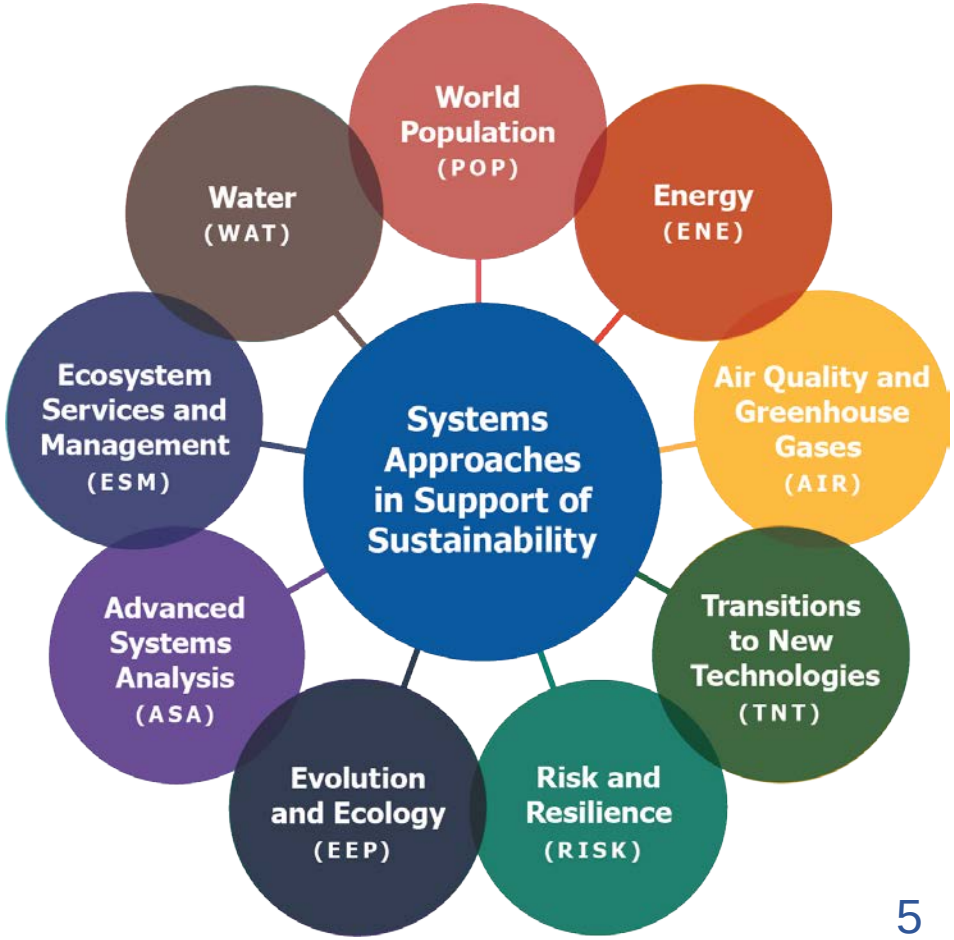


Systems Analysis: Tools of the trade



Solving global and universal challenges





IIASA highly cites researchers, 2018 - *Clarivate Analytics (top 1% 2006-2016)*

Keywan Riahi
Program Director: Energy

Zbigniew Klimont
Research Scholar: Air Quality and Greenhouse Gases

Petr Havlik
ERD Center Head and Deputy Program Director: Ecosystems Services and Management

Hugo Valin
Senior Research Scholar: Ecosystems Services and Management

Joeri Rogelj
Senior Research Scholar: Energy

Yoshihide Wada
Acting Program Director: Water

Hubacek, Klaus
Guest Senior Research Scholar: Water

Michael Obersteiner
Program Director: Ecosystems and Management Program

Andreas Richter
Guest Research Scholar: Ecosystems and Management

Volker Krey
Deputy Program Director: Energy

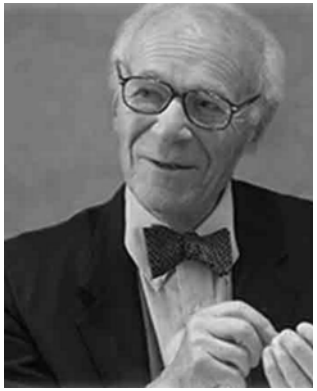
Shinichiro Fujimori
Guest Senior Research Scholar: Energy

Attracting some of the best researchers

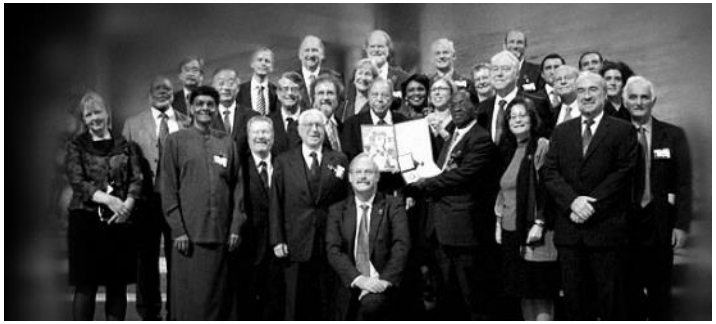
Prof. Tjalling Koopmans
and Prof. Leonid Kantorovich
Nobel Prize **in Economics** (1975)

Prof. Crutzen and
Prof. Mario Molina
Nobel Prize for **Chemistry**
(1995)

Prof. Lawrence Klein
Nobel Prize **in Economics**
(1980)



Prof. Thomas C. Schelling
Nobel Prize in **Economics**
(2005)



Authors of the Intergovernmental Panel
on Climate Change Reports
Nobel **Peace Prize** (2007)

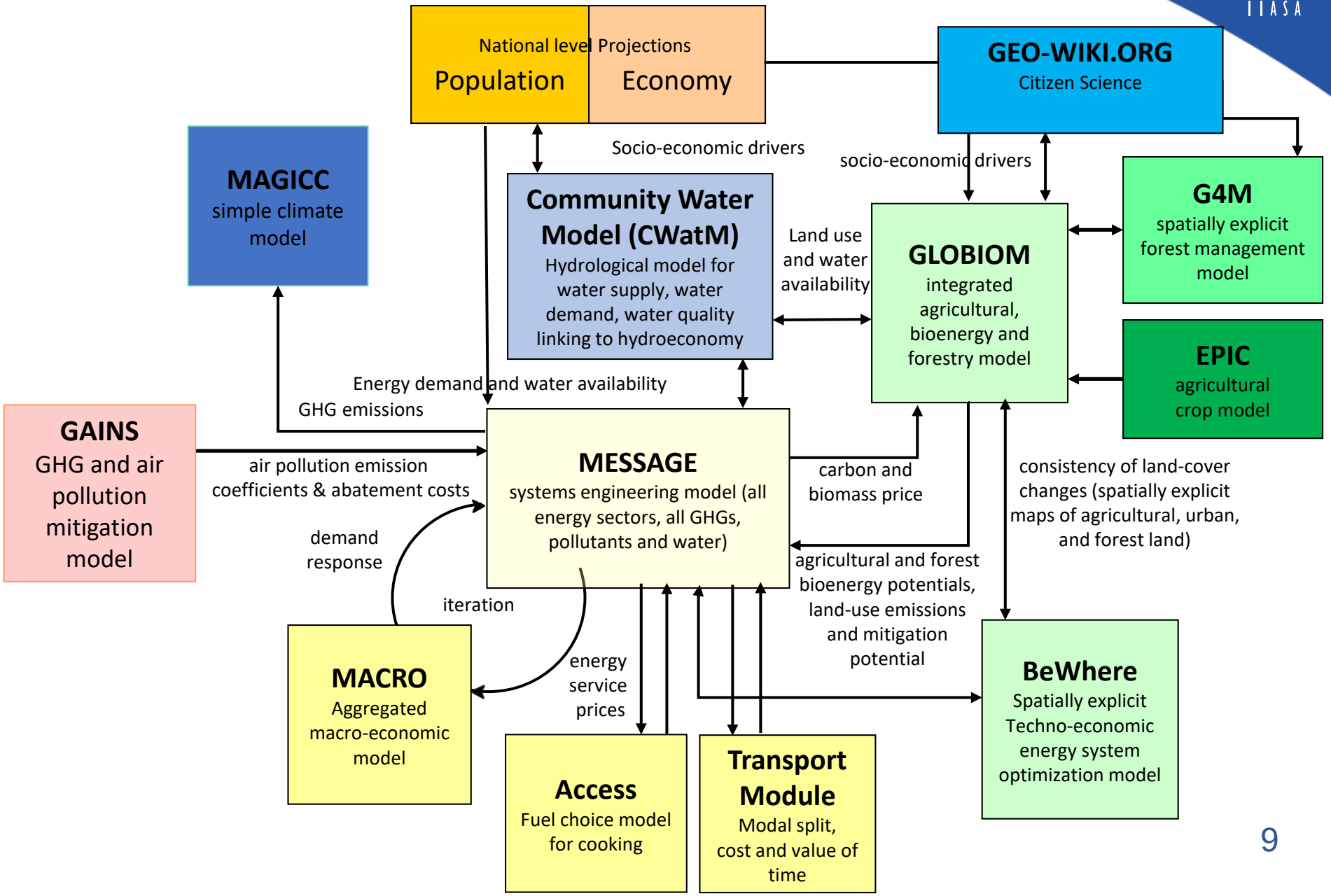
Prof. William
Nordhaus
Nobel Prize in
Economics (2018)

Healthy Natural Systems

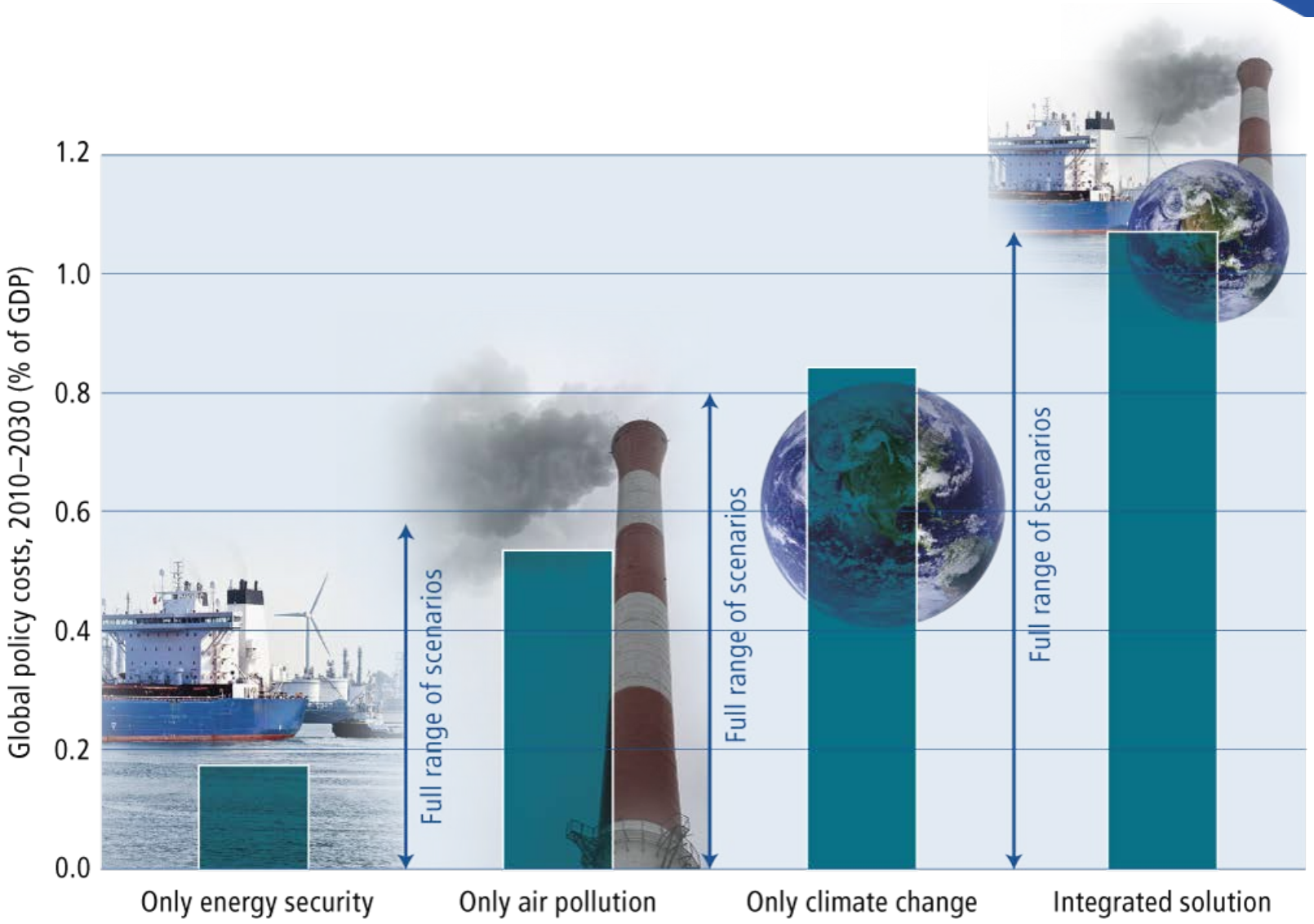
Robust Human & Social Systems

Conducive Technology Infrastructure systems

IIASA Integrated Assessment Framework

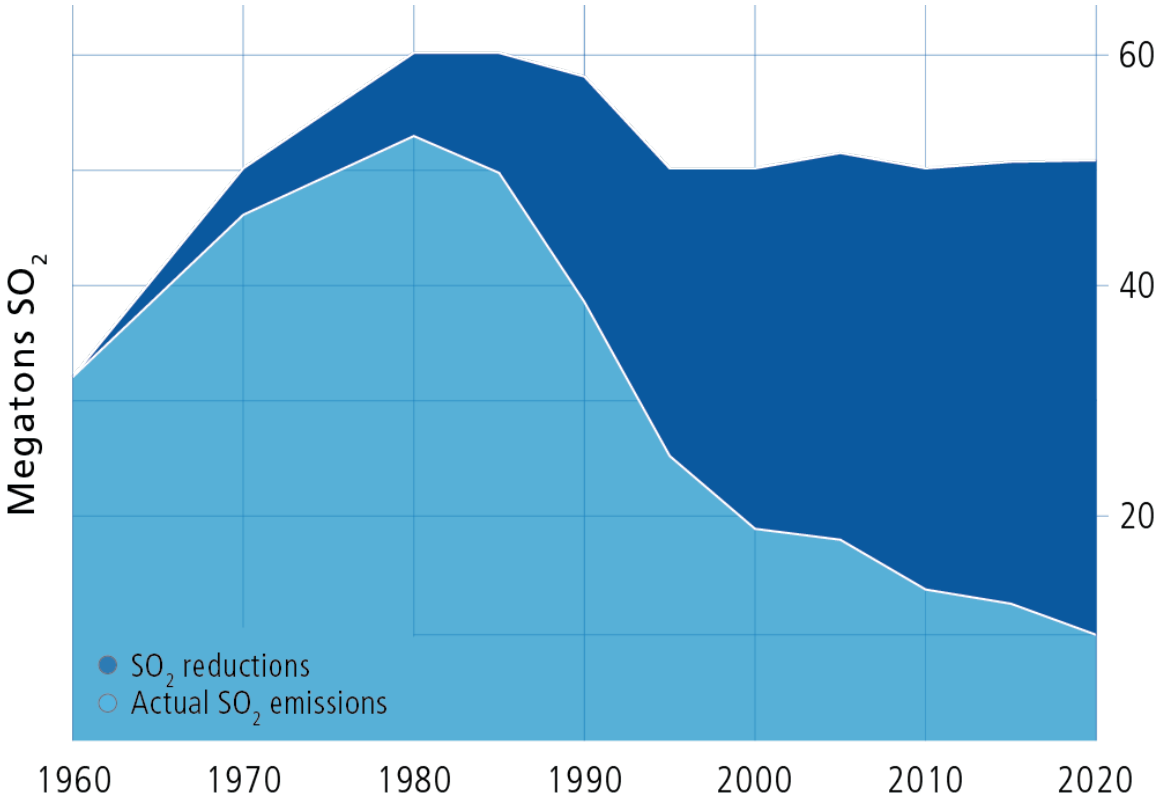


Multiple benefits of integrated policies



Source: McCollum, Krey, Riahi, 2012

Impacts: Reduced Air Pollution in Europe



- Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe
- EU National Emissions Ceiling Directive
- EU Thematic Clean Air Strategy

Six Major Transformations (TWI2050.org)

Digital Revolution for Sustainable Development

Education, Gender & Inequality

SDGs: Prosperity Social Inclusion Sustainability

Sustainable Cities & Communities,

TWI2050
The World in 2050
www.twi2050.org

Health Wellbeing & Demography

Sustainable Food Land, Water & Oceans

Energy Decarbonization & Sustainable Industry

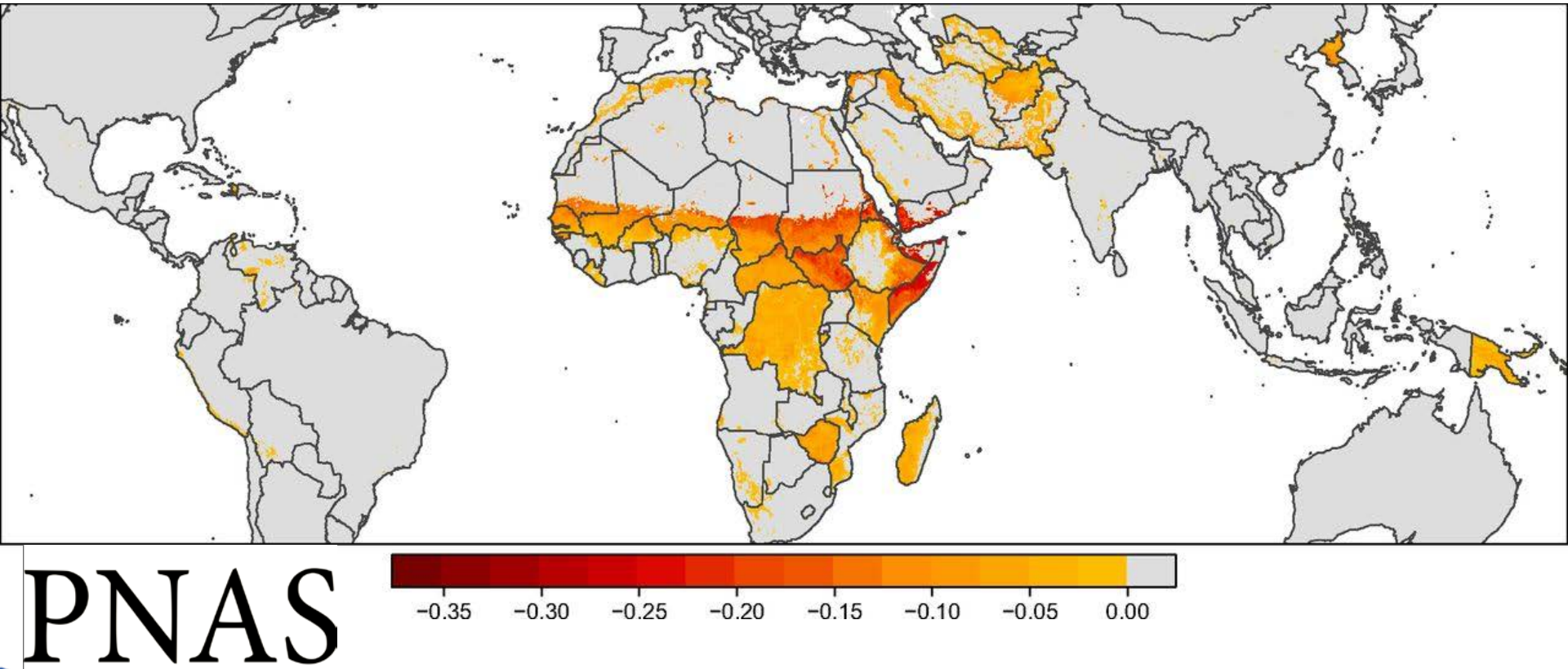
A network of 60 research partners led by IIASA, the UN Sustainable Development Solutions Network, and the Stockholm Resilience Center. Brazilian members:

TWI2050
The World in 2050
www.twi2050.org

CAPES · Cemaden · COPPE UFRJ · Embrapa · FAPESP · FIOCRUZ · INPE

Mapping the effects of drought on vulnerable populations

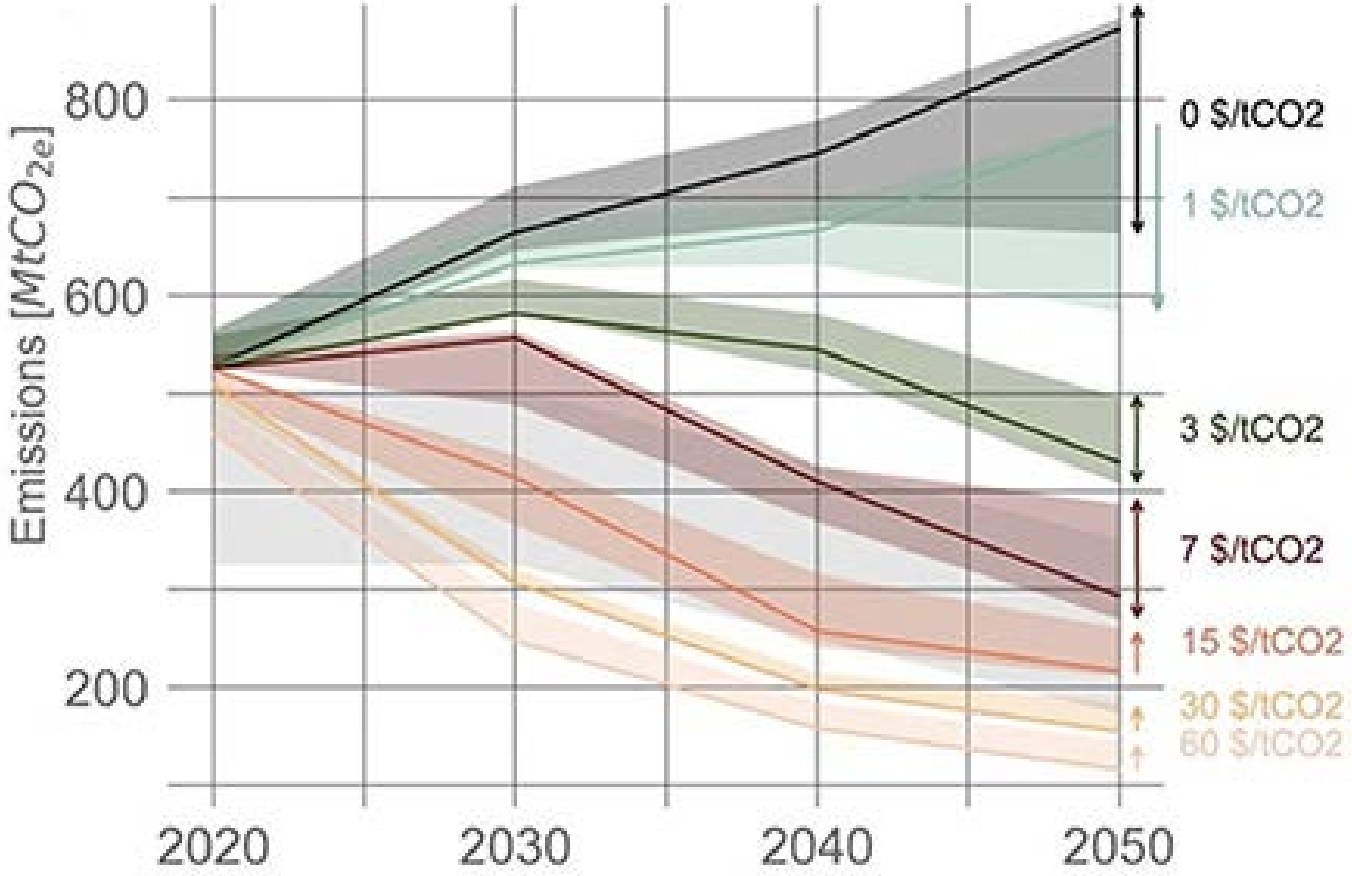
The greater frequency of droughts, combined with underlying economic, social, and environmental risks means that dry spells have an increasingly destructive impact on vulnerable populations, and particularly on children in the developing world.



PNAS

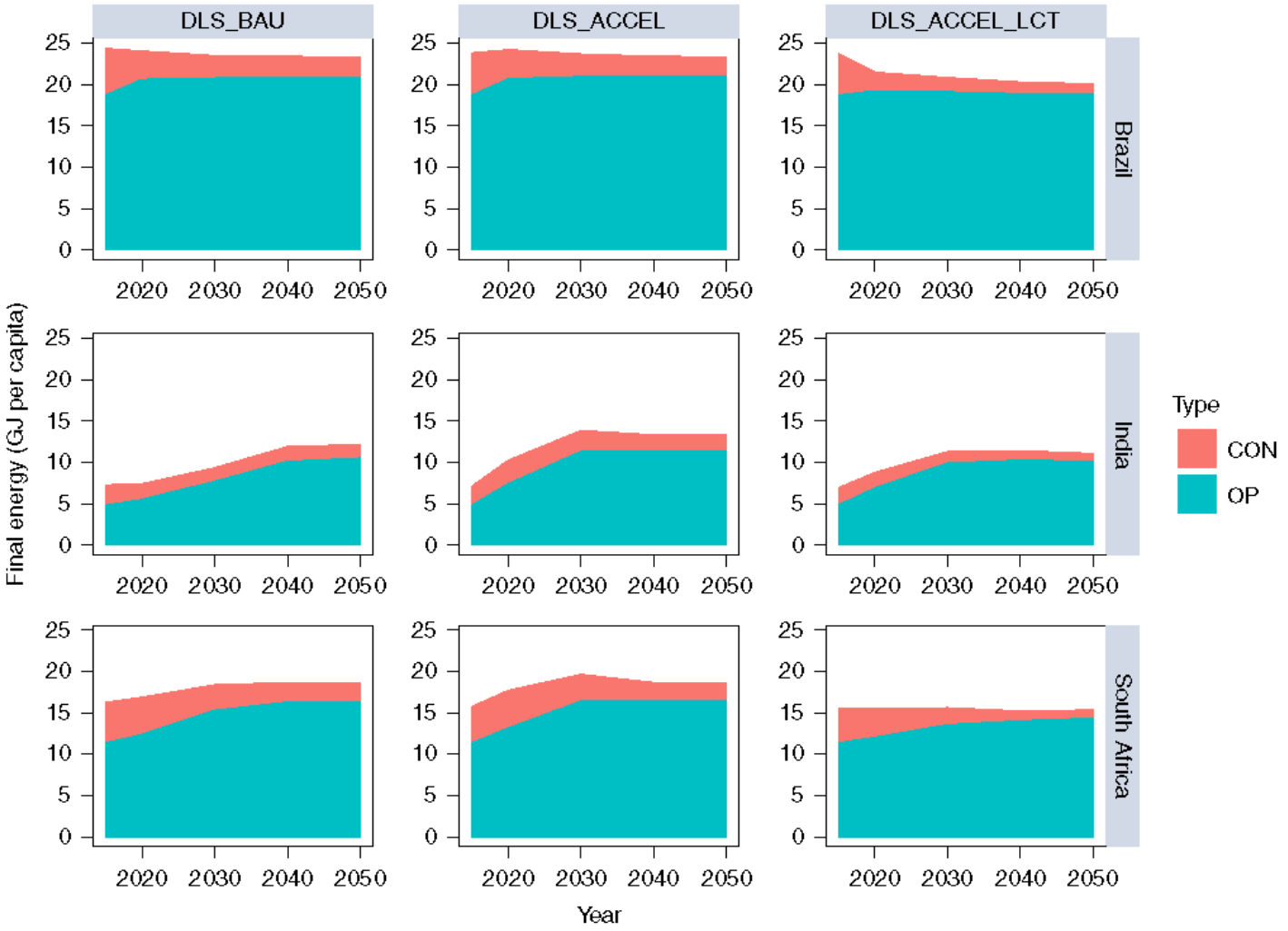
Expected decrease in mean child Height-for-Age Z scores during drought conditions

Is shale gas a viable solution for South Africa's energy challenge – fools gold?



frontiers

How much energy do we really need? Brazil, India and South Africa



nature energy

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Integrated Solutions for Water, Energy and Land: Zambezi river basin case study

Zambezi Challenges

Water-Land

- Low agricultural productivity addressed mainly through irrigation development
- Water quality deterioration linked to urbanization and mining

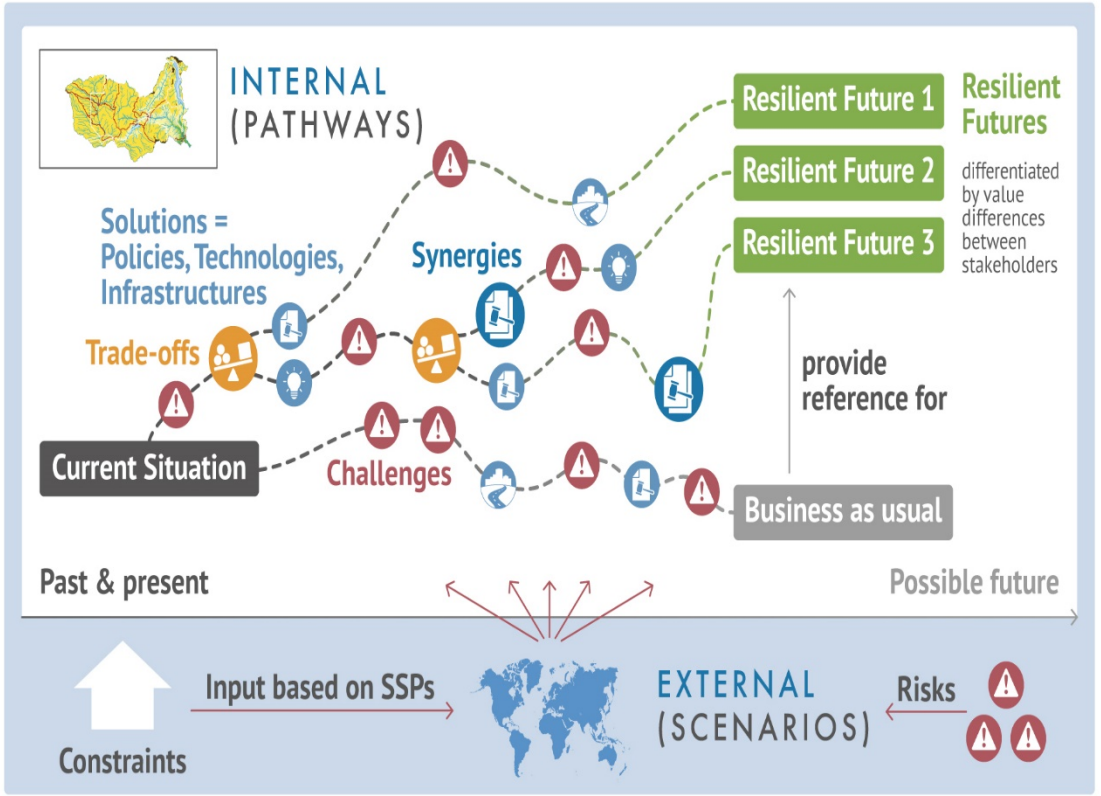
Energy-Land

- High deforestation rates linked to use of charcoal
- Soil erosion is causing sedimentation and affecting hydropower potential

Water-Energy

- Energy deficit addressed through the development of new hydropower without consideration of CC impacts
- Hydropower development threatening wetlands and safari tourism

Integrating disciplines, temporal and spatial scales



14 local stakeholders along Zambezi river basin and 3 funders (IIASA plus:

GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

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Food, **A**griculture, **B**iodiversity, **L**and, **E**nergy (FABLE – SDSN-IIASA)

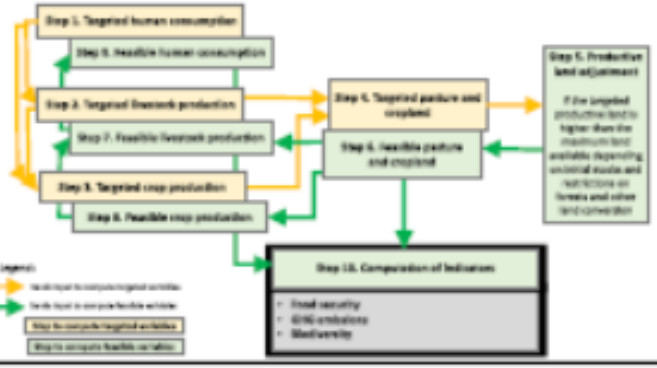
Co-design, co-production and co-implementation

1. National data

Collect and harmonize national data on consumption patterns, land use, biophysical characteristics, biodiversity, population, etc.

2. National pathways

Compute the evolution of key variables of the land-use and food system by mid-century using appropriate models



4. Linker tool

Aggregates country results at the global level

5. Scenathon

Iterative adjustment of country pathways to align ambition with global targets and balance trade flows

Share data, tools and results

3. Verification tool

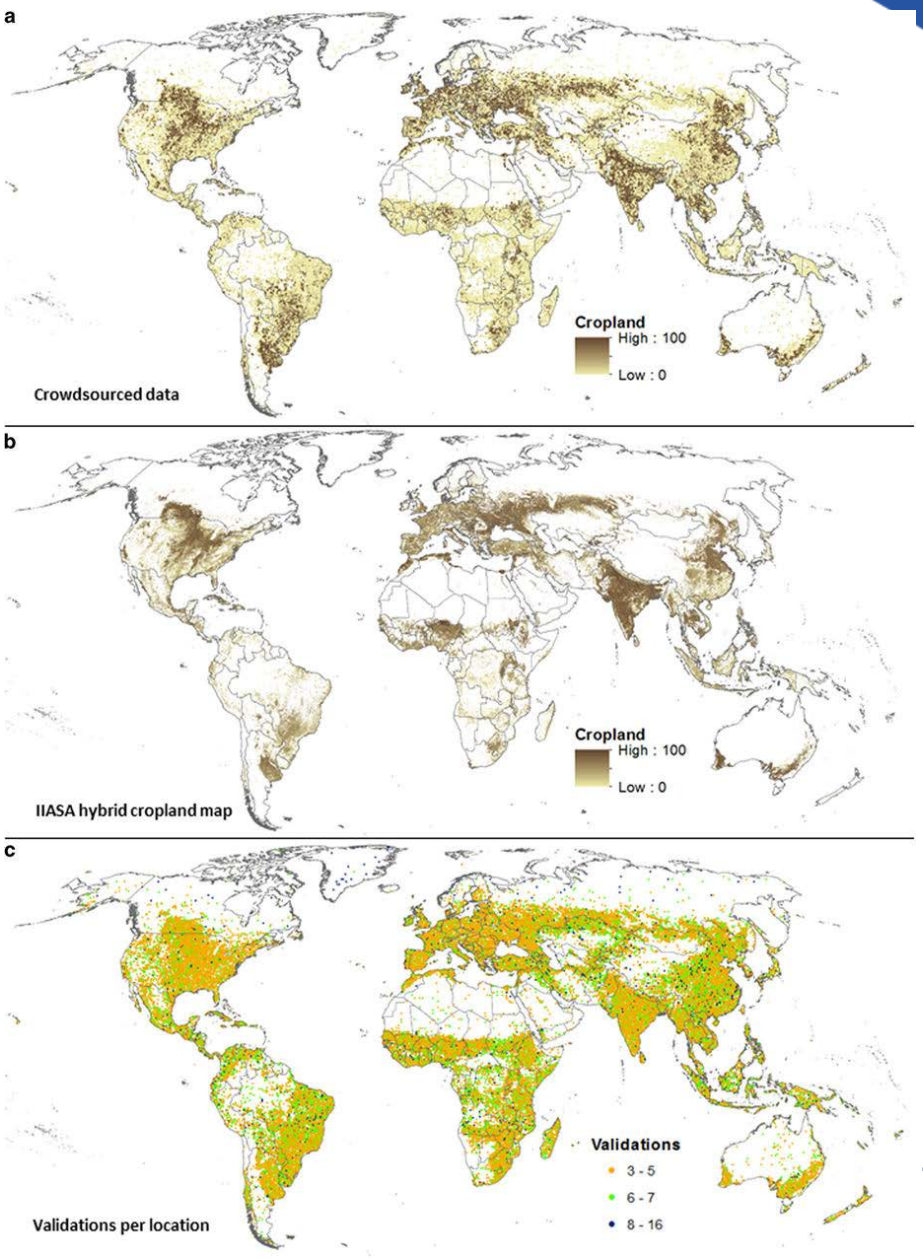
Compares models parameters' values and results with relevant benchmarks

Citizen science

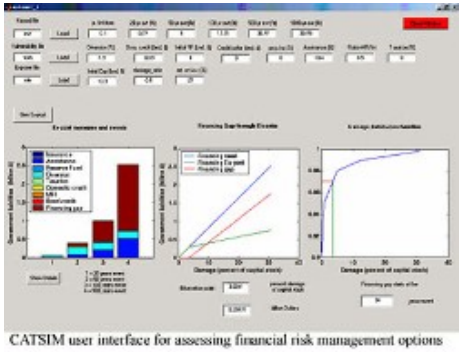
Citizen scientists and IIASA scientific network make three new data sets on forest cover, land use and cropland publicly available

Laso Bayas JC, Lesiv M, Waldner F, Schucknecht A, Duerauer M, See L, Fritz S, Fraisl D, et al. (2017). A global reference database of crowdsourced cropland data collected using the **Geo-Wiki platform**. Scientific Data 4: e170136. DOI:10.1038/sdata.2017.136.

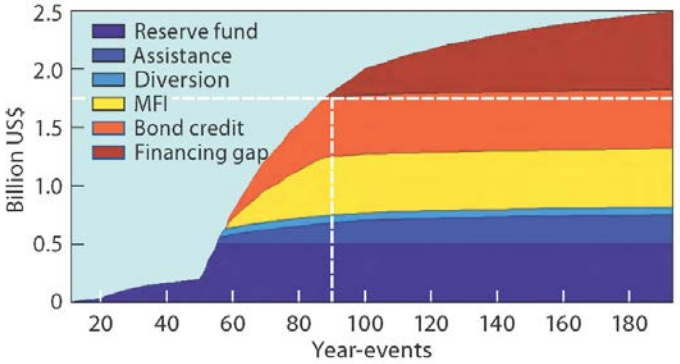
SCIENTIFIC DATA



Dealing with systemic risks under conditions of uncertainty

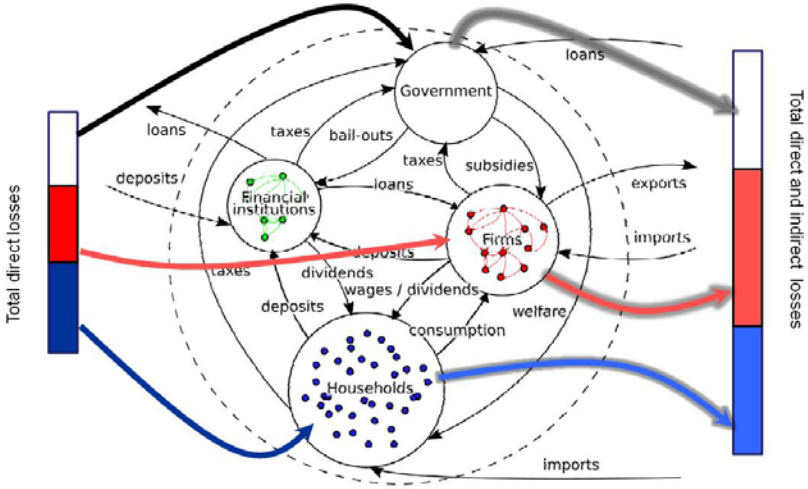

CATSIM user interface for assessing financial risk management options

1. CATSIM (catastrophe simulation) model for disaster mitigation and development planning – 25 Finance ministries (risk transfer mechanisms)



CATSIM: The Mexican government issued catastrophe bonds to cover the risk of a major earthquake or hurricane--risk transferred to the international reinsurance and capital markets.

2. SHELscape - spatially-explicit agent-based model: post-natural disasters impacts on local economies with regional dependencies (100 000s).



IIASA and Africa

- Two members: Egypt (since 2003) and South Africa (since 2007)
- Multiple research activities across Africa:
  - 29 projects since 2017
  - Research partners or research users in Angola, Benin, Botswana, Burkina Faso, Cameroon, Democratic Republic of Congo, Egypt, Ethiopia, Gabon, Gambia, Ivory Coast, Kenya, Malawi, Nigeria, South Africa, Tanzania, Uganda, Zambia
- New IIASA strategy will increase IIASA regional focus
- Africa-UniNet – being set up by the Austrian Agency for International Cooperation to create long term cooperation between research institutes and universities in Austria and Africa.

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THE CASE FOR systems analysis

Achieving multiple goals isn't easy

Systems analysis

Finds long-lasting solutions to global issues by analyzing all components of the problem in an integrated way

International Institute for Applied Systems Analysis
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Thank you

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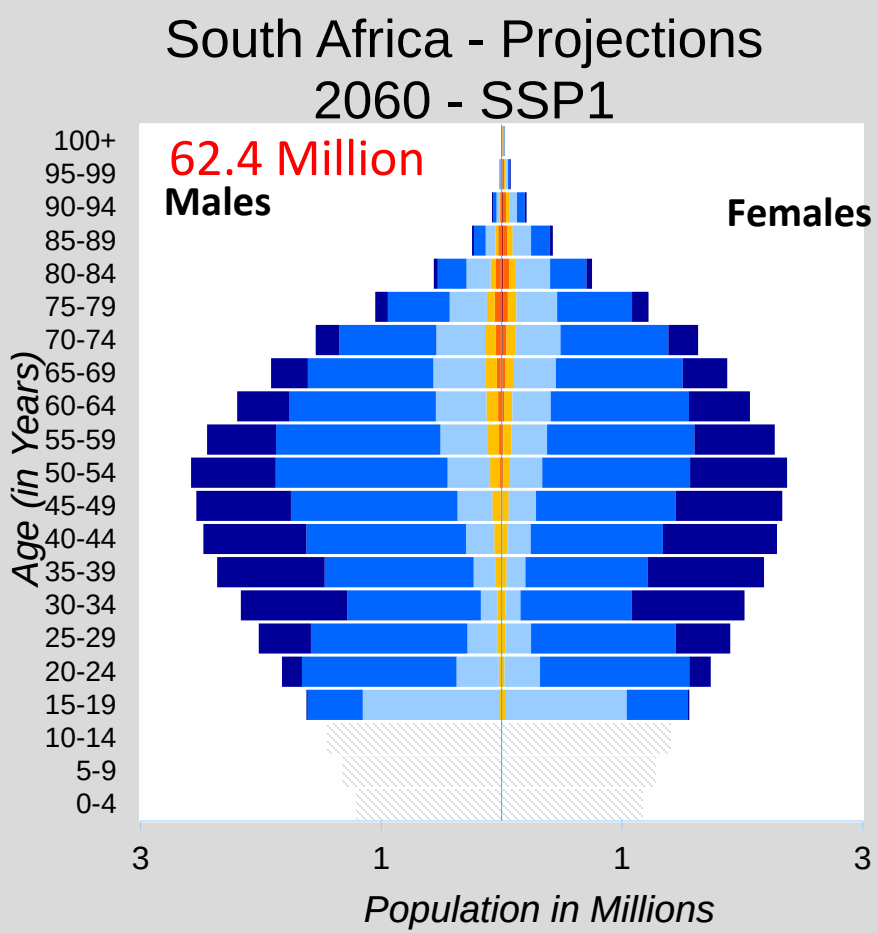
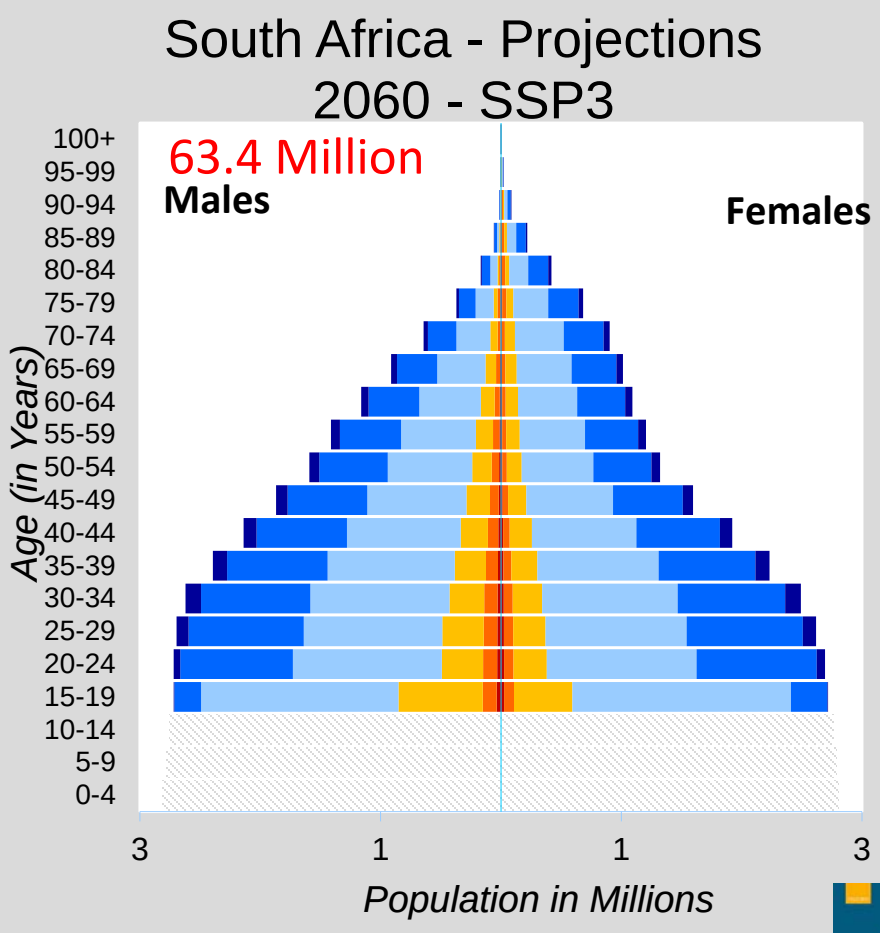
Projecting Population trends in South Africa

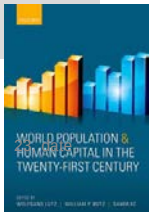
SUSTAINABLE DEVELOPMENT



STALLED DEVELOPMENT



Pop < 15 yrs | No Education | Incomp. Primary | Primary | Lower Secondary | Upper Secondary | Post Secondary



Improved Human Development Index

The Human Life Indicator

IIASA researchers have introduced a new, simple measure for human wellbeing across countries, called the Human Life Indicator (HLI), that takes inequality int account and could replace the commonly used but error-prone Human Development Index (HDI).

Huge crowds of people, Hong Kong © Tidusx | Dreamstime.com

Measuring the overall wellbeing of populations is cruci for evaluating the success of policies. The Human Life Indicator expresses wellbeing in terms of years of life, similar to life expectancy at birth. However, unlike any other current measure, it takes not only the mean valu but also the inequality in longevity into account. The wide availability of mortality data means that the HLI can be used for reliable comparisons of wellbeing acro countries, in the past as well as the present.

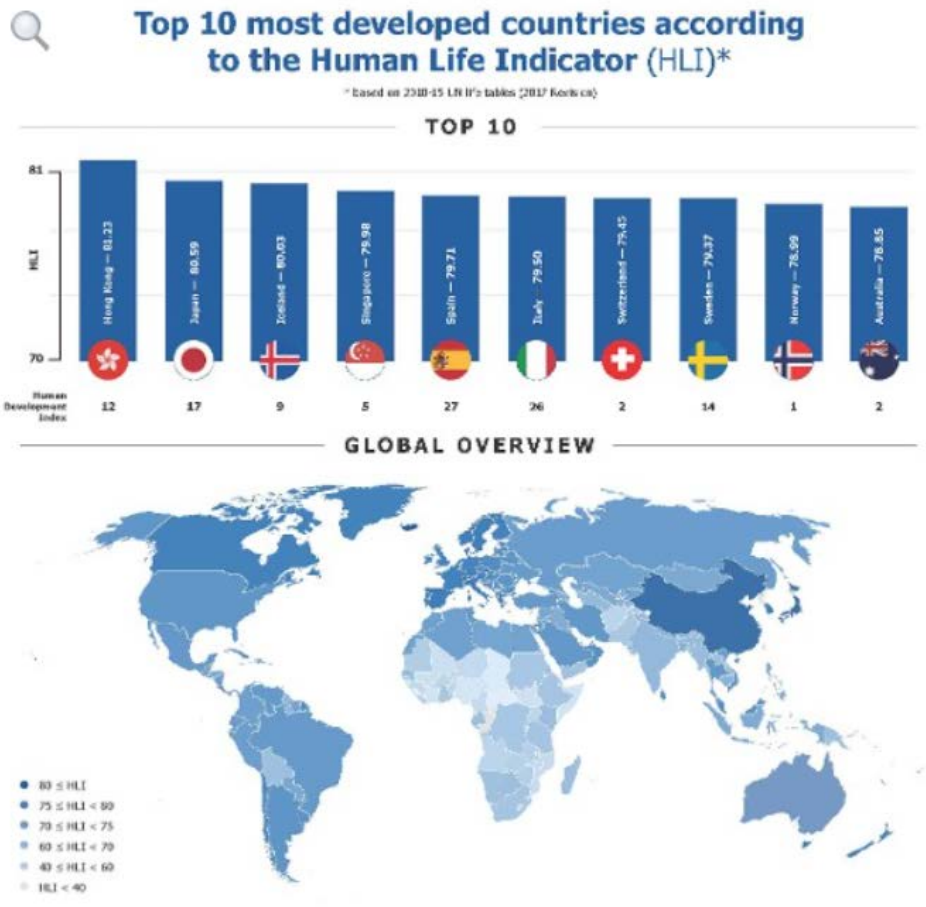
Figures in Table Re-Aging 4 includes the Human Life Indicator, the Human Development Index, and life expectancy at birth for all UN countries and regions. The Human Life Indicator and life expectancy at birth are based on the UN's 2017 revision of *World Population Prospects*. The Human Developme Index is from 2016.

New measures of human development are now available for downloading

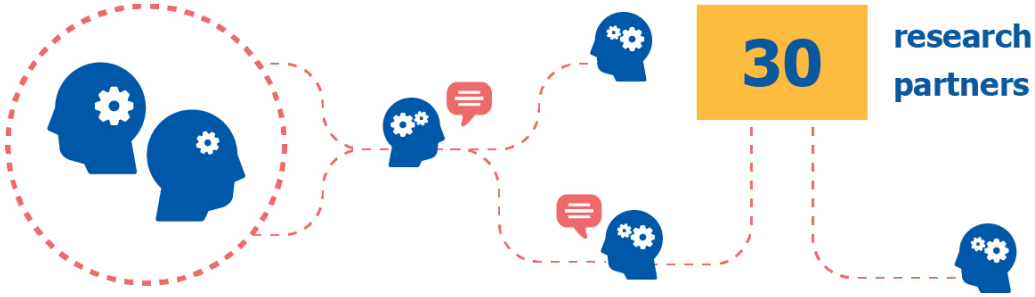
DOWNLOAD DATA

Data accompanying Ghislandi S, Sanderson WC, Scherbov S (2018), A Simple Measure of Human Development: the Human Life Indicator *Population and Development Review.*

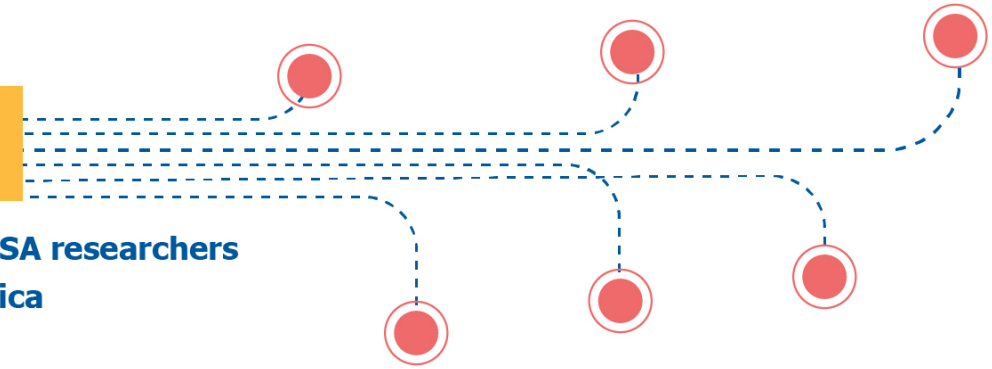
The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ER grant agreement no ERC2012-AdG 323947-Re-Ageing. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.



Member of IIASA since: **2007**



30 research partners



156

visits by IIASA researchers to South Africa

167 researchers, advisors, and diplomats from South Africa have visited or attended an event at IIASA since 2010

Areas of research collaboration

- Overcoming challenges to sustainable renewable energy in South Africa
- Improving water and food security in South Africa and the wider region
- Projecting demographic change in South Africa
- Advancing the methods of systems analysis

74 publications have resulted from collaborations between IIASA and researchers at South African institutions since 2010

12 participants of the Young Scientist Summer Program since 2010

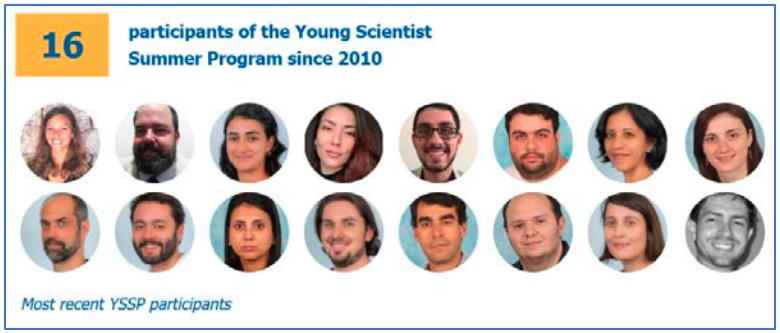
Building the Systems Analysis Research Base in Southern Africa

Between 2012 and 2015 the Southern African Young Scientists Summer Program (SA-YSSP) developed system analytical research skills among over 80 doctoral students from 30 countries including 35 students from South Africa, this led to the development and establishment of the Southern African Systems Analysis Centre (SASAC) in 2015.

SASAC was developed in collaboration with the NRF, South African Department of Science and Innovation and IIASA, in recognition of the pivotal role that Systems Analysis and research in this field can play in solving both global challenges and those faced by developing nations.

About 65 doctoral students from South and Southern Africa, based at 12 South African higher education institutions, currently receive scholarship support through SASAC.

Capacity Development: IIASA YSSP, SA-YSSP, Postdoc Program



Southern-African Young Scientist Summer Program: (SA-YSSP)
Alan de Barros (2014-15, University of Sao Paulo)

IIASA Postdoc Program:
Luciano Mendes (2015 - 2017) - agricultural pollution
Edmar Teixeira (2007-2011) – land-use modeling

IIASA-CAPES Doctoral Sandwich and Postdoctoral Programs

2017-2019
Three calls

CAPES

5 Postdocs:

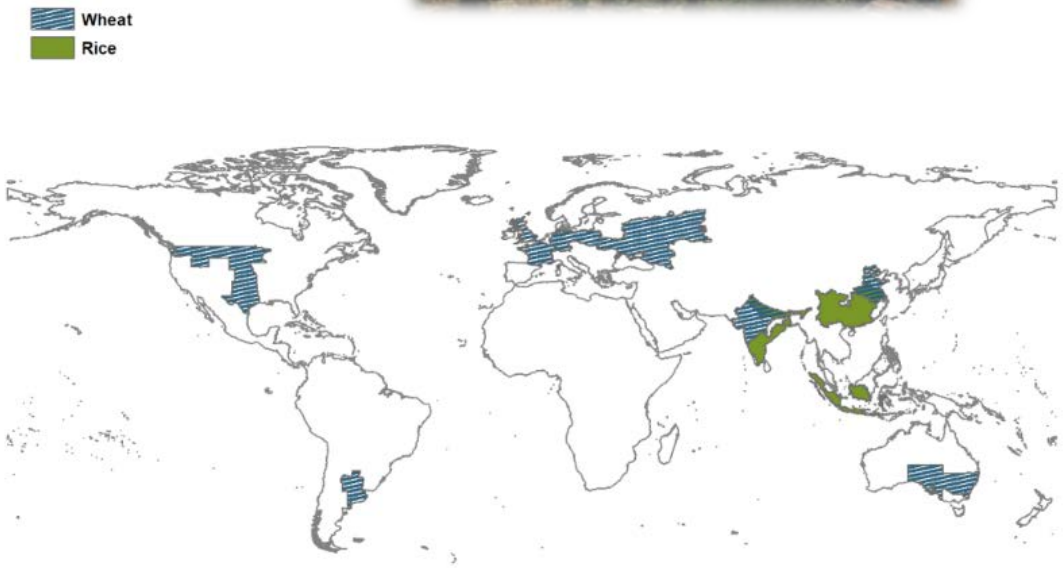
- Cláudio Cristino (2017-2018) probabilistic models.
- Raquel Guimaraes (2019-present) immobility, vulnerability and floods in Brazil
- Julian Hunt (2017-2018) energy and water management.
- Alessandra Kortz (2019-present) biodiversity
- Andreas Nascimento (2018-present) real-time data streaming and analysis.

4 PhD students:

- Camila Callegari (2018-2019) less carbon intensive transport system.
- Rafael Cancella Morais (2017) renewable energy in Latin America.
- Vágna da Costa Pereira (2017-2018) soil organic carbon dynamics.
- Luís Gustavo Tudeschini (2017-2018) regional development, inequalities, household consumption, energy and carbon footprint.

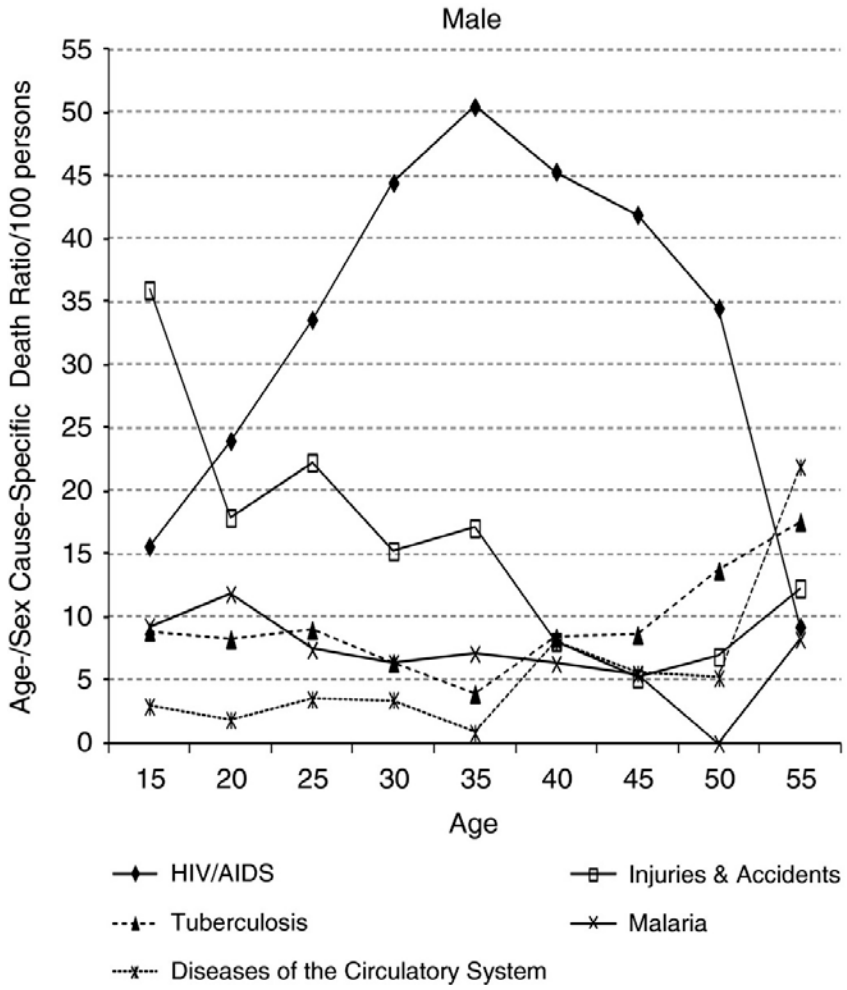
3. Soft systems techniques - Participatory decision support systems, smart games and social simulations to tackle policy issues - overcome analysis paralysis (>15)

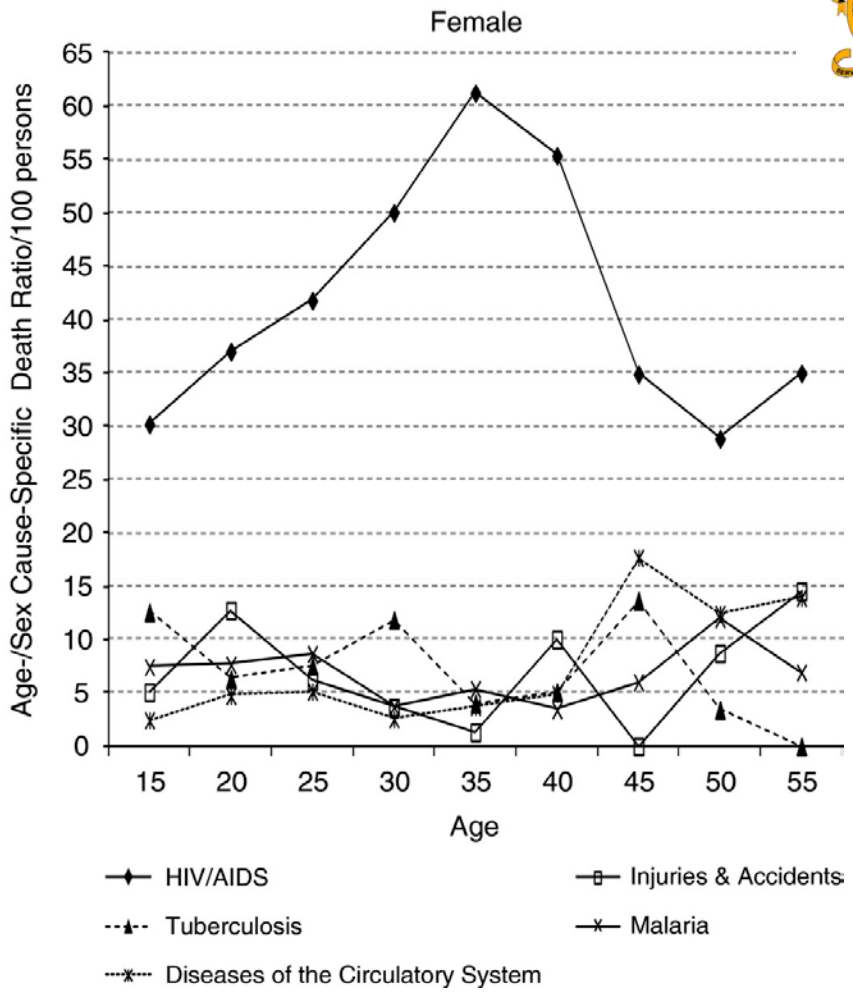
4. IIASA applies advanced methods (copula) that improve assessments of spatially diverse risks by accounting for their interdependencies



Risk of failure of multiple bread baskets

Addressing causes of mortality in Zambia





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