AgMIP The Agricultural Model Intercomparison and Improvement Project

Workshop S8
AgMIP, the Paris Agreement, and the SDGs: Simulating Multiple Demands on Agriculture

Cynthia Rosenzweig, Joshua Elliott, Tomoko Hasegawa, Senthold Asseng,
Mouhamed Ly, Christoph Müller, David Leclere, Alex Ruane

Impacts World 2017
Potsdam, Germany
October 13, 2017

UKaid from the Department for International Development

USDA

USAID United States Agency International Development

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

NASA

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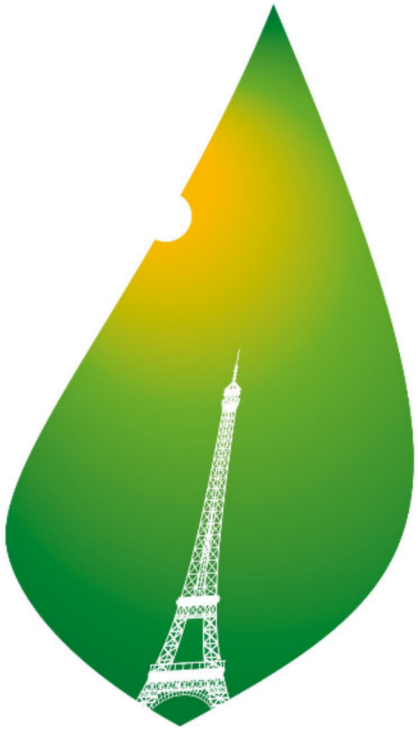
The Paris Agreement



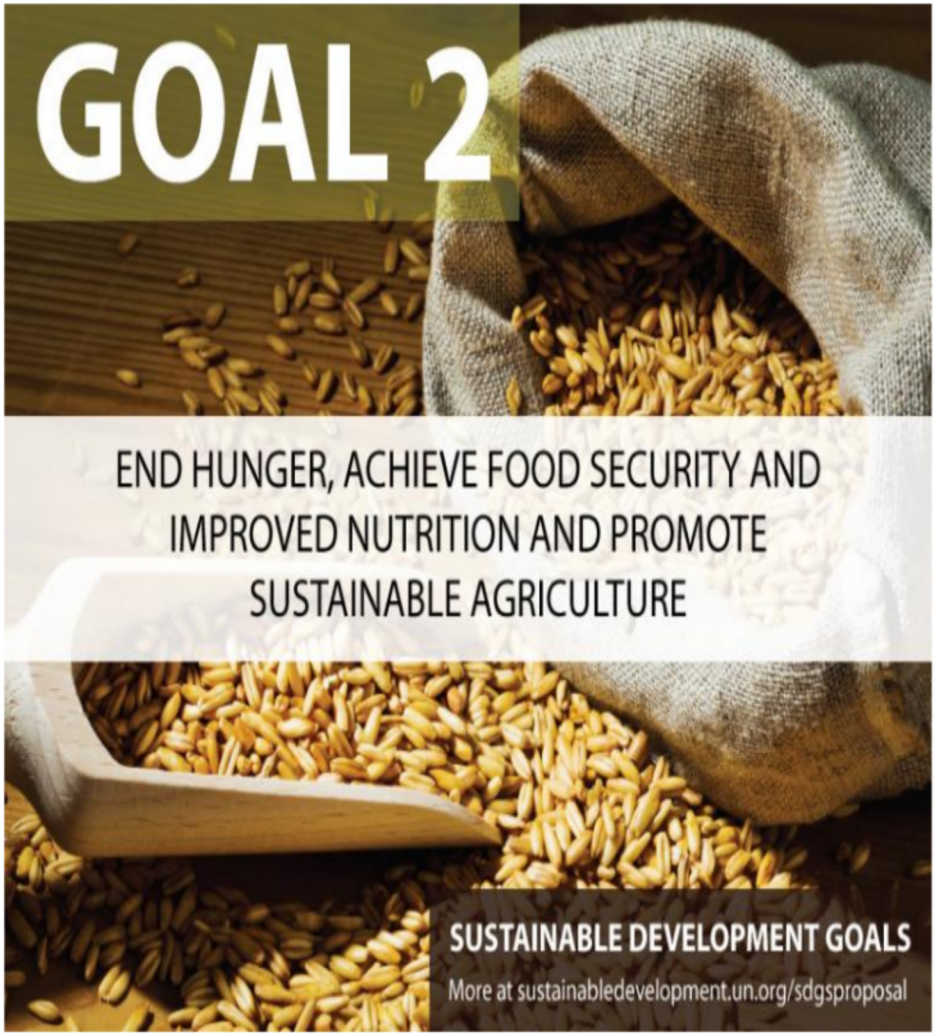
COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

"Recognizing the **fundamental priority of safeguarding food security** and ending hunger, and the particular vulnerabilities of **food production systems** to the adverse impacts of climate change"

SDGs


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

SDG2: Zero Hunger



Targets

- By 2030 end hunger
- By 2030 end all forms of malnutrition
- By 2030 double the agricultural productivity and the incomes of small-scale food producers
- By 2030 ensure sustainable food production systems and implement resilient agricultural practices
- By 2020 maintain genetic diversity of seeds, cultivated plants, farmed and domesticated animals and their related wild species

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Panelists, Presentations, and Posters

Panelists

- Joshua Elliott, University of Chicago
- Tomoko Hasegawa, NIES – Japan
- Senthold Asseng, University of Florida
- Mouhamed Ly, Climate Analytics
- Christoph Müller, PIK
- David Leclere, IIASA
- Alex Ruane, NASA GISS

Workshop-relevant Posters

- Carl-Friedrich Schleussner, Hot spots of crop production changes at 1.5C and 2C (P.S31)
- Shinichiro Fujimori, Macroeconomic impacts of climate change associated with changes in crop yields (P.S46)

Full Presentations: https://drive.google.com/drive/folders/0B2oRAdUWx1V6cHRTbU9TY2lteW8?usp=sharing

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Workshop Questions

1. How does your work contribute to fulfilling the Paris Agreement and making agriculture and food systems nutritious and sustainable? What innovative methods are you bringing to the table to move solutions to these challenges forward?

2. From your perspective, what are the next steps required for agricultural/food system modeling to achieve the Paris Agreement and the SDGs, especially SDG2? What are the main barriers to overcome and the key considerations to take into account? What are the best opportunities to move forward and how can we seize them?

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AgMIP7 GLOBAL WORKSHOP

APRIL 24-26, 2018 • SAN JOSÉ, COSTA RICA

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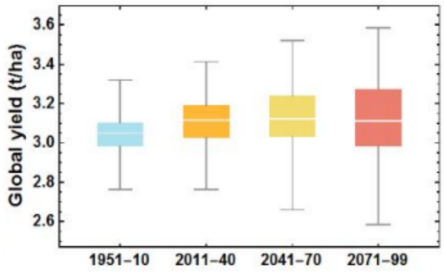
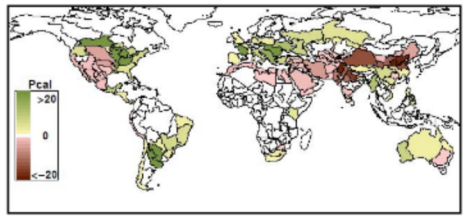
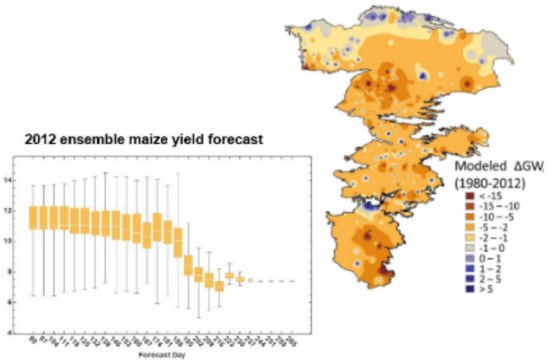
Weather-induced risk in crop production

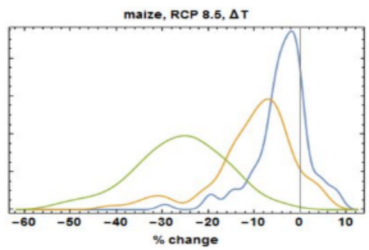
Joshua Elliott

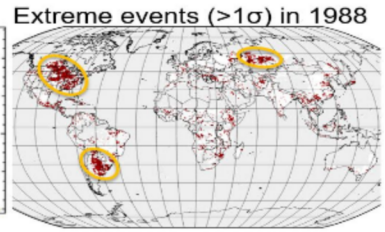
- Extreme shocks to global and regional food systems likely to become more frequent and more severe
  - Must include climate, tech, and resource changes to capture risk
- Tech and management will push yields higher in coming years
  - But not without more water
  - CC slows yield growth, demands much more water
  - Adaptation possible, but not without advances in breeding and more water
- Optimistic climate models give 10-15 years breathing room
- System-level resilience has not changed much in >80 years; still highly vulnerable to large scale and especially persistent drought events
- CC offers exploitable opportunities, could be used to offset losses
- Data and tools offer new opportunities for monitoring and seasonal forecasting of extremes











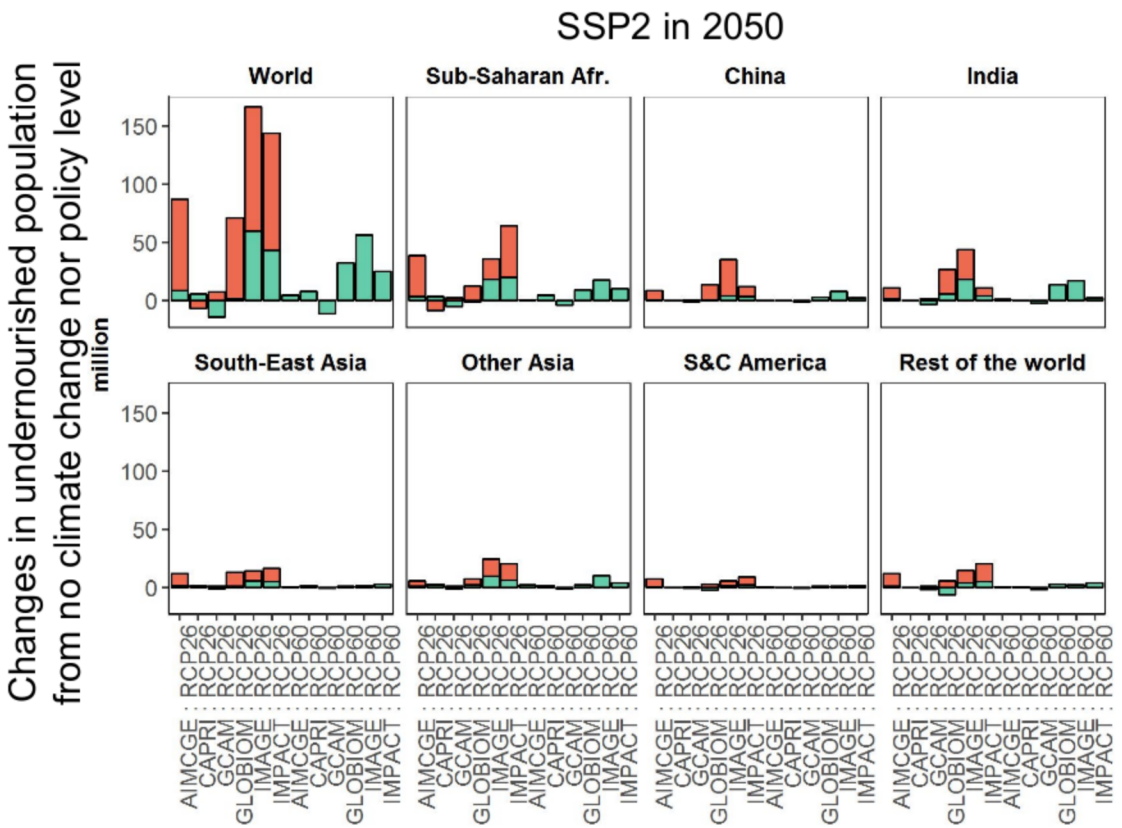
rdcep
A Center for Robust Decision Making on Climate and Energy Policy

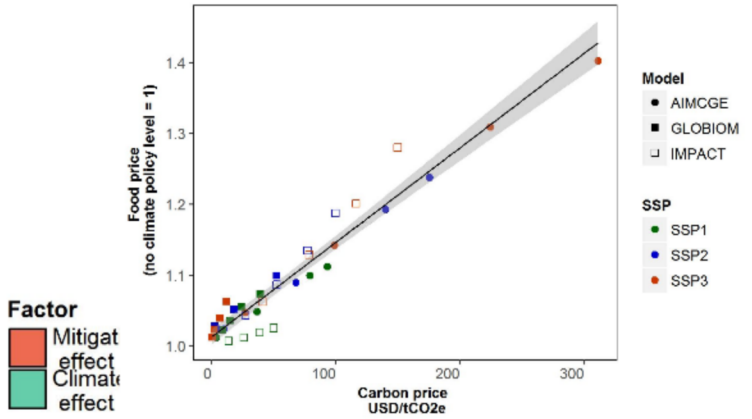
AgMIP

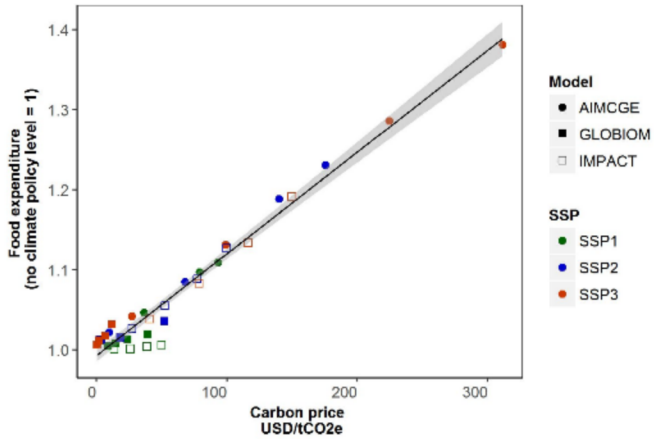
Climate-included food security analysis using multi-economic models

Tomoko Hasegawa and other AgMIP Global Econ Modeling teams

- If not carefully designed, the stringent mitigation could indirectly lead more food insecurity than that in no climate policy.
- Highlight needs for careful mitigation policy design including complementary measures to compensate vulnerable households (e.g. food subsidy or reallocation).



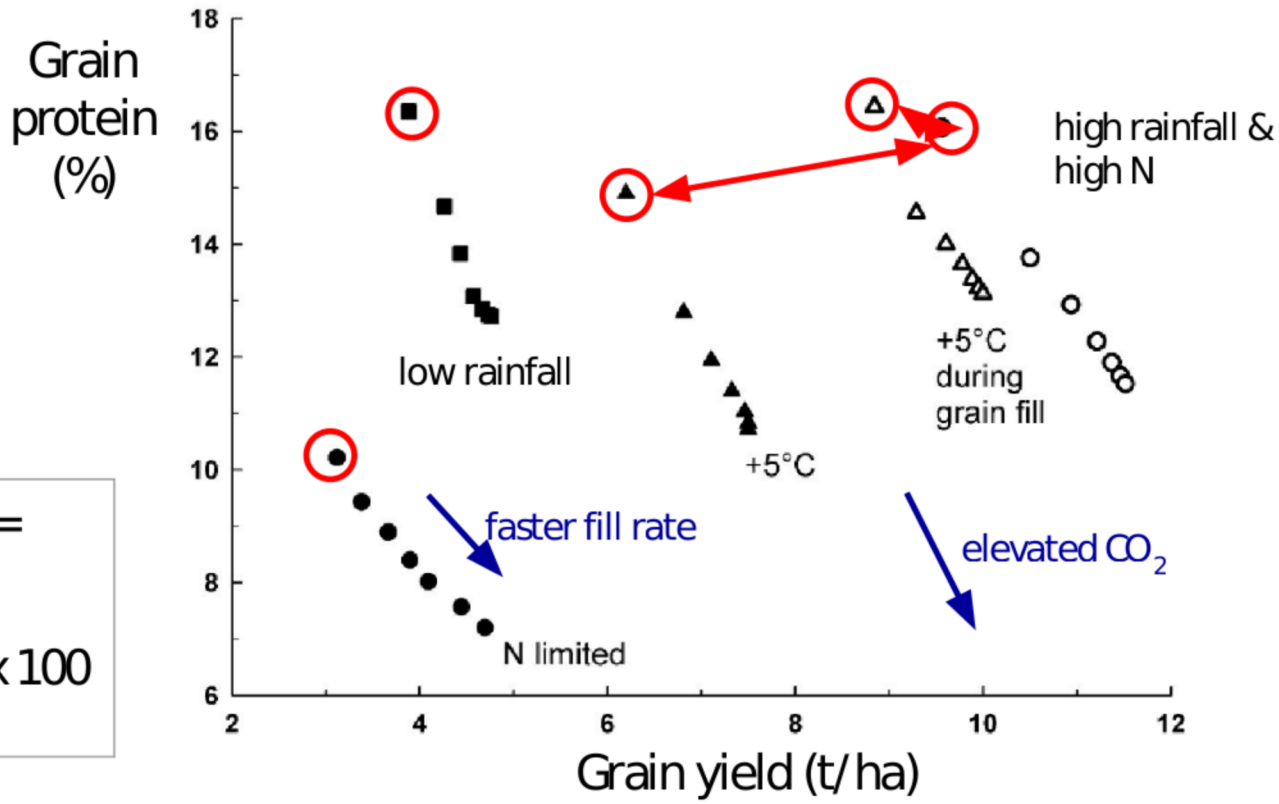




Climate change impact on grain protein

Region-specific (local climate, projected change, soil, cultivar, crop management, adaptation)

Senthold Asseng



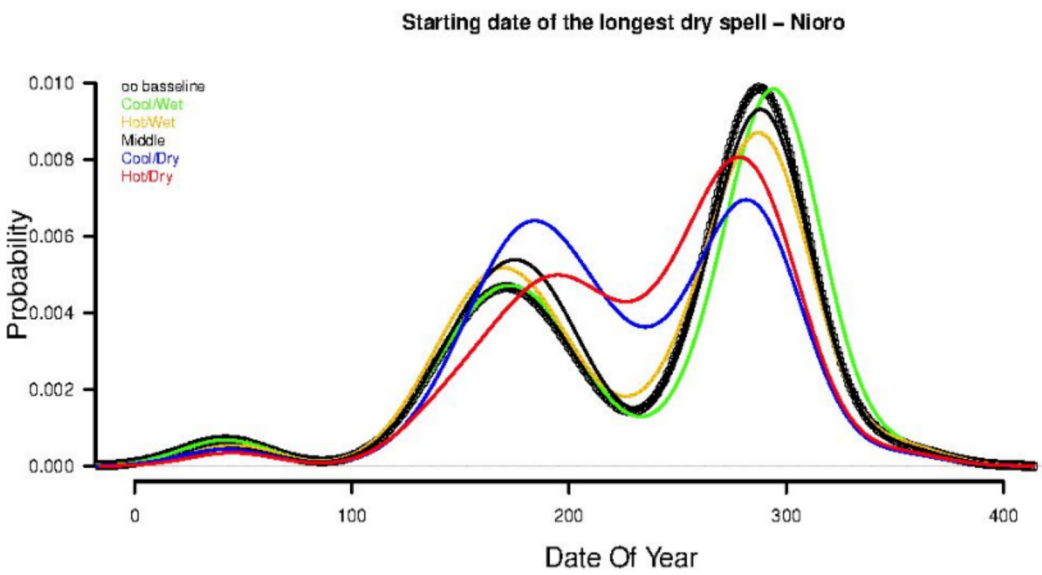
$$\text{Grain protein (\%)} = \frac{\text{Grain N} \times 5.7}{\text{Grain yield}} \times 100$$

Asseng et al. 2006 EJA

Multi-model characterization of climatic stress patterns on the reproductive stage of West African crops

Mouhamed Ly

An Agro-climatic characteristic to strengthen the adaptive capacity of all stakeholders to reduce the vulnerability to climate change and variability (e.g Climate Outlook Forum for West Africa, PRESASS)

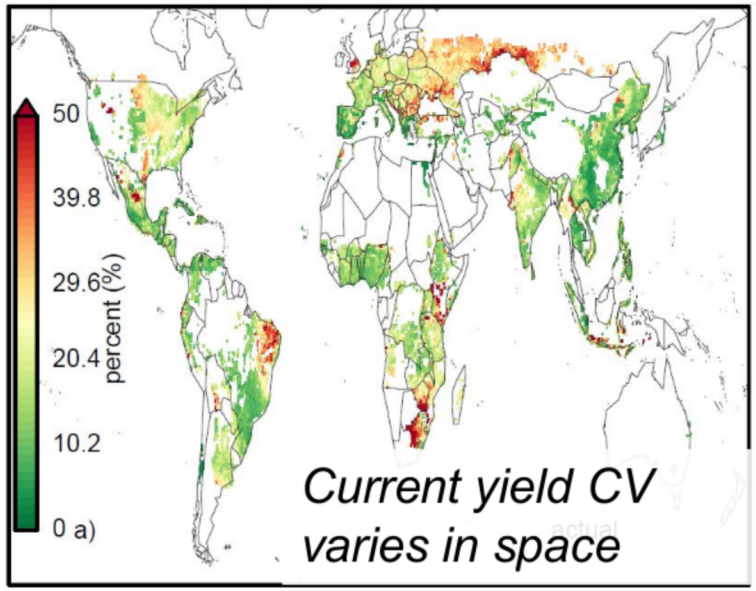


- drought/heat tolerant crop varieties
- A longer crop life cycle is a sufficient adaptation to eliminate negative impacts of climate change on maize and millet, which then always exhibit yield increases compared to today
- A longer crop life cycle in peanut depresses yields systematically and cannot be recommended as a valid adaptation

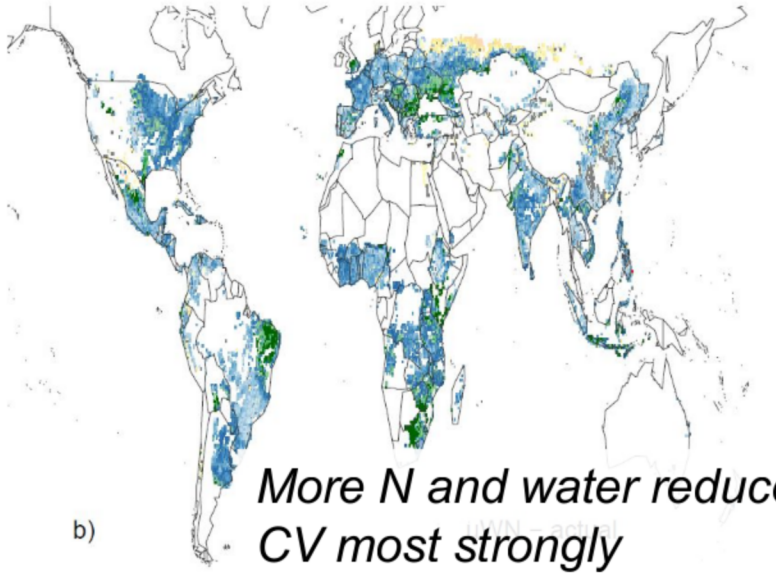
- Substantially improve the characterization of food security and livelihood risks due to climate variability and change in semi-arid region
- Enhance the adaptive capacity West African populations for changing climate (biophysical, socio-economic) and technological conditions

Spatial patterns of yield CV (maize)

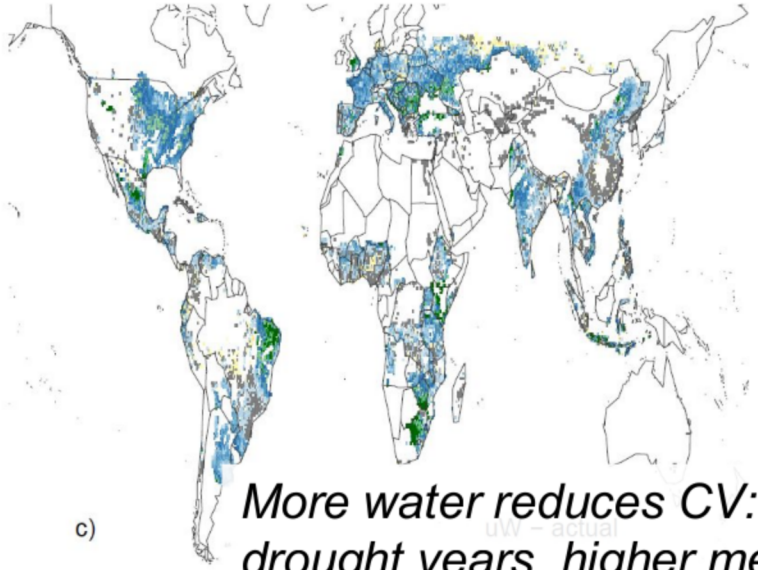
Christoph Müller



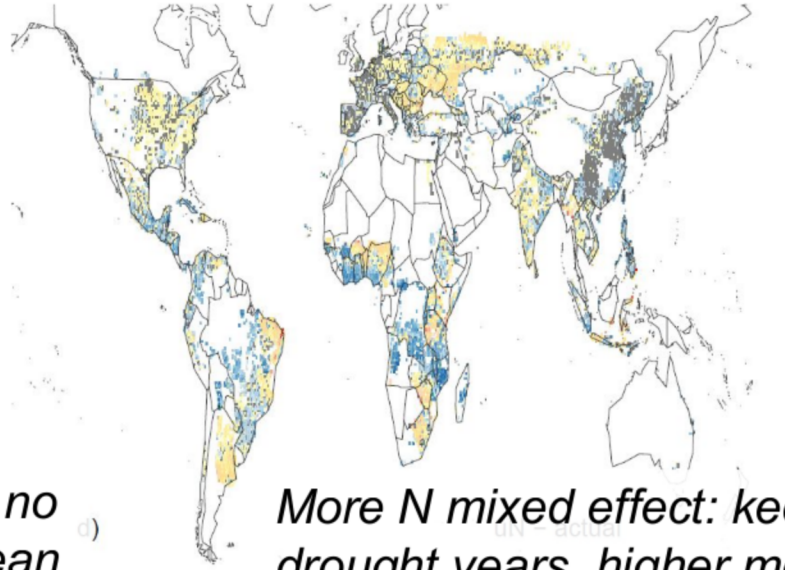
Current yield CV varies in space



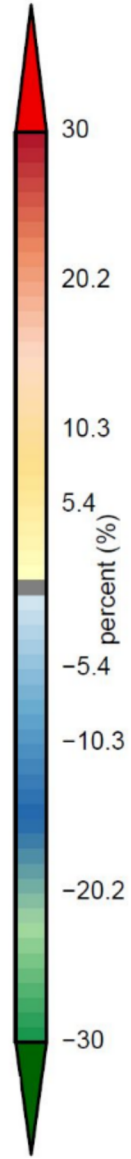
More N and water reduces CV most strongly



More water reduces CV: no drought years, higher mean



More N mixed effect: keep drought years, higher mean



Biodiversity impacts of future land use change scenarios

D. Leclère, S. Hellweg (ETH Zurich), T. Krisztin, F. Di Fulvio, P. Havlík & M. Obersteiner *Impacts World | 11-13th Oct. 2017*

The question

The methods

SSP & RCP scenarios

v

MESSAGE-GLOBIOM IAM

v

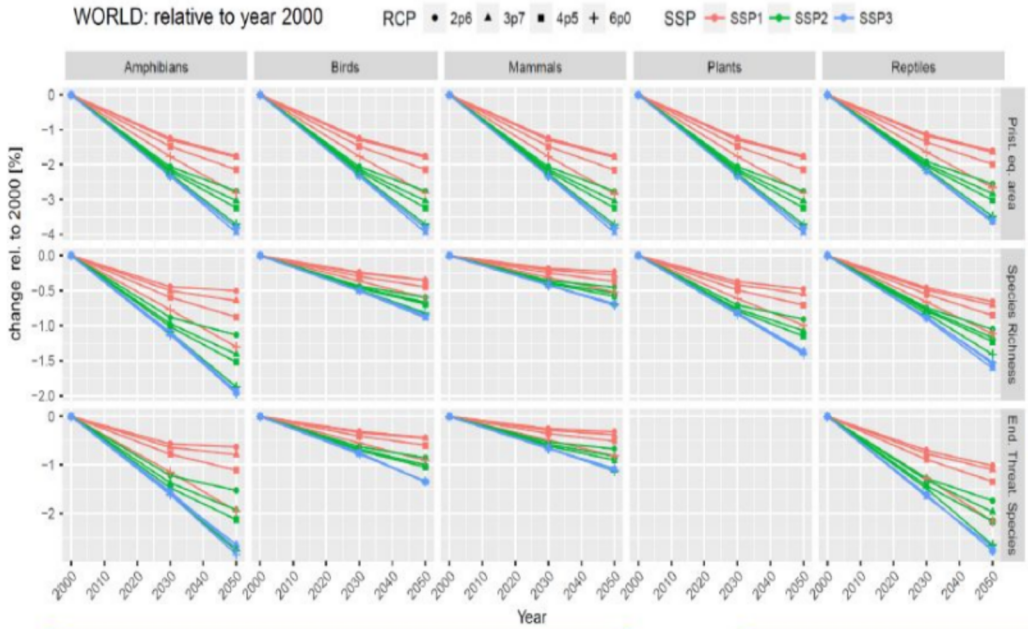
Downscaling of LUCC transitions

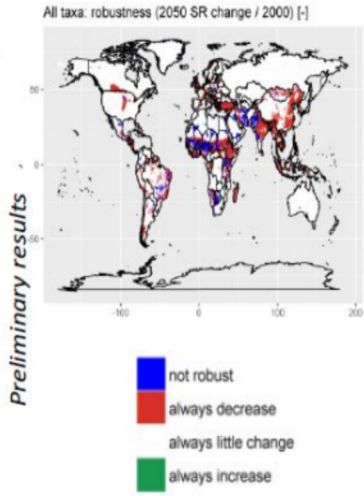
v

Countryside SAR model

v

Δ Habitat, Species richness & extinction risk





The short answer

SSP x RCP trends lead to robust ↘ in:

- Habitat quality
- Species richness
- End. & threat. species in year 2000

Impacts are worse for:

- Sub-S. Africa, South Asia & Latin America
- Amphibians & reptiles

Limits & implications

- More work required to clarify mitigation impacts
- More biodiversity facets & uncertainties to explore

We need innovative strategies designed to achieve SDG 2, 13 and 15 altogether

Coordinated Global and Regional Assessments of 1.5 and 2.0 C Warming – Synopsis

Alex Ruane

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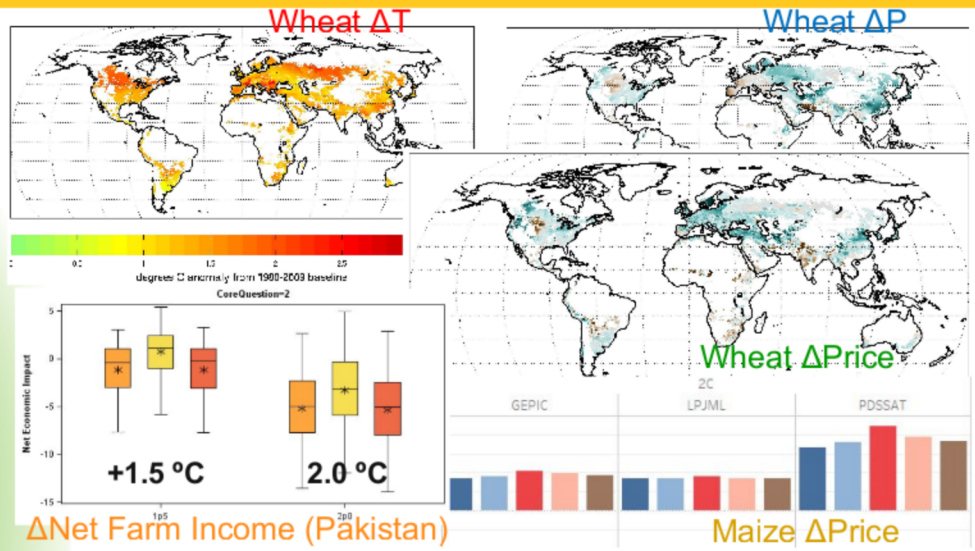

Key Messages:

- The agricultural sector in +1.5 and +2.0 ºC Worlds is characterized by differential outcomes across regions, farming systems and populations
- Rice, soy, and wheat systems benefit from increased rainfall and CO_2, but maize yield declines drive markets
- Direct climate effects combine with land use change and mitigation policies to increase overall prices.
- Substantial uncertainties and data shortcomings persist

Key Coordinated Studies of 1.5 and 2.0 Worlds

Ruane et al.: Overview of CGRA 1.5 / 2.0 Worlds
Rosenzweig et al.: CGRA framework
Hoogenboom et al.: Crops in US/Senegal/Pakistan
Ruane et al.: Agro-climatic changes and extremes

Asseng et al.: Wheat impacts
Havlik et al.: Mitigation pathways
Elliott et al.: Global crop production
Mason-D'Croz et al.: Global Ag markets

Schleussner et al.: Impact of Extremes
Webber et al.: West Africa and Europe
Valdivia et al.: Regional economics
Liu et al.: China wheat impacts
Cammarano et al.: Scottish barley