MODELLING AND FOOD

SAHER HASNAIN

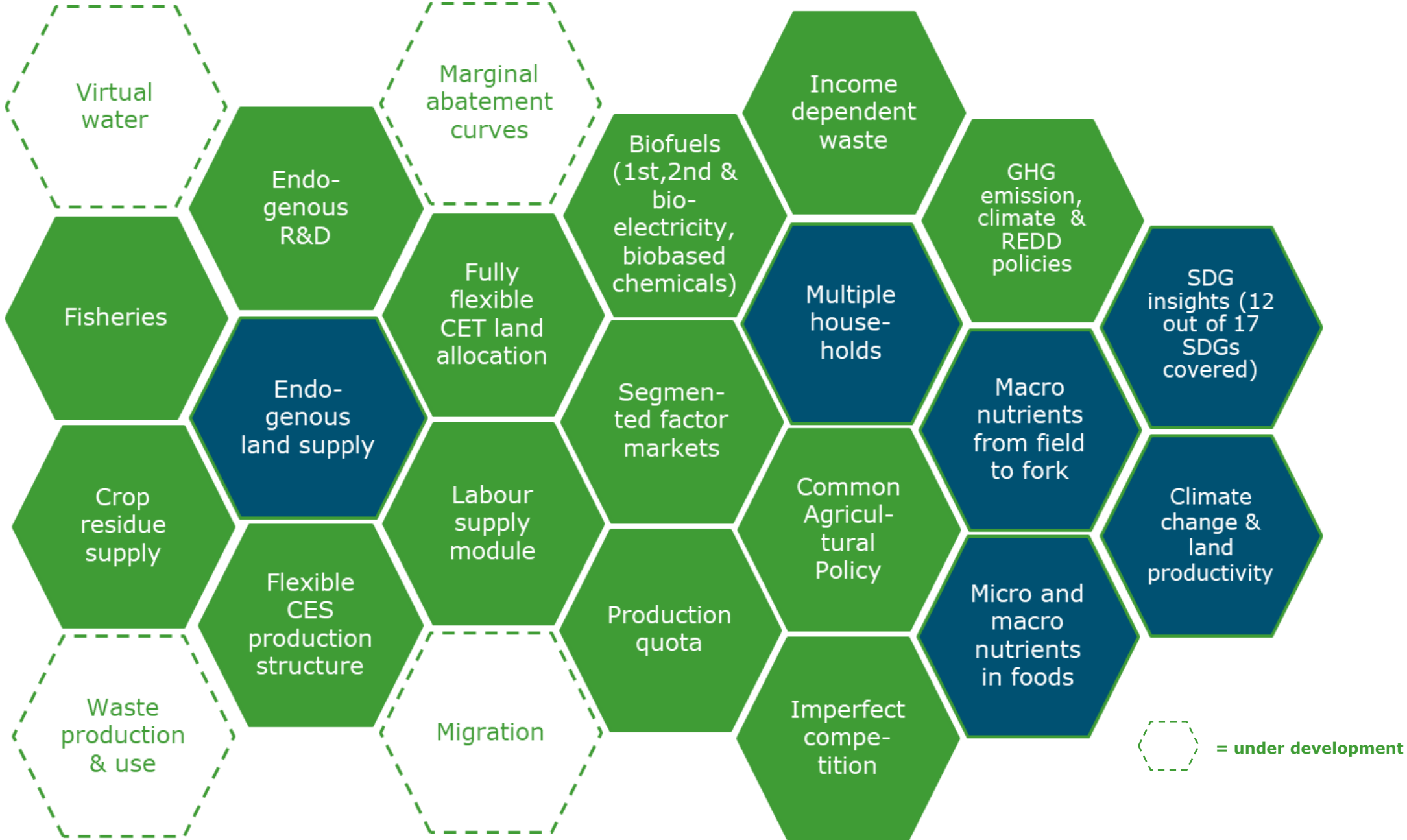
KEY MESSAGES

- Underlying assumptions and datasets
- Spatial sensitivity
- Difference in model parameters
- Model – of – models
- Where & when
- What do the results look like? (are they useful?)

MAGNET (MODULAR APPLIED GENERAL EQUILIBRIUM TOOL)

- Simulates the effects of agricultural, trade, land and biofuel policies on the global economy, as well as for long-term projections
- Allows researchers to adjust the complexity of a model to the questions at hand
- Includes a **household module** to distinguish incomes and expenditures for various representative household types in selected developing countries and a **nutrition module** to trace nutrients from farm – via food processing and food-service sectors – to fork, allowing for nutrition impact to be included in economy-wide analyses.
- Provide a more nuanced picture of the effects of climate change on food and nutrition. E.g afforestation is Ghana, OR fisheries in the UK

MAGNET Database



Methodology (A4NH project)

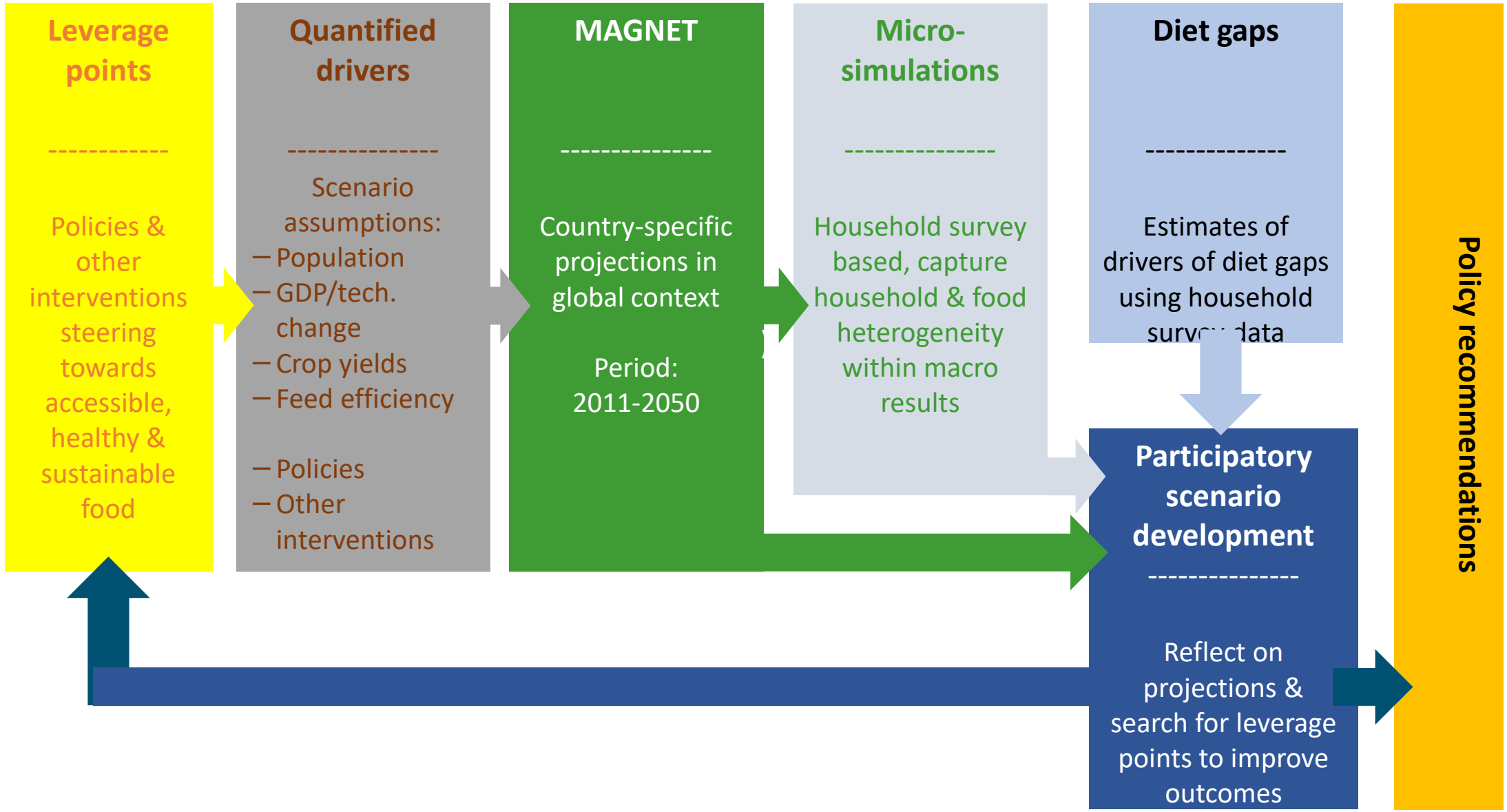
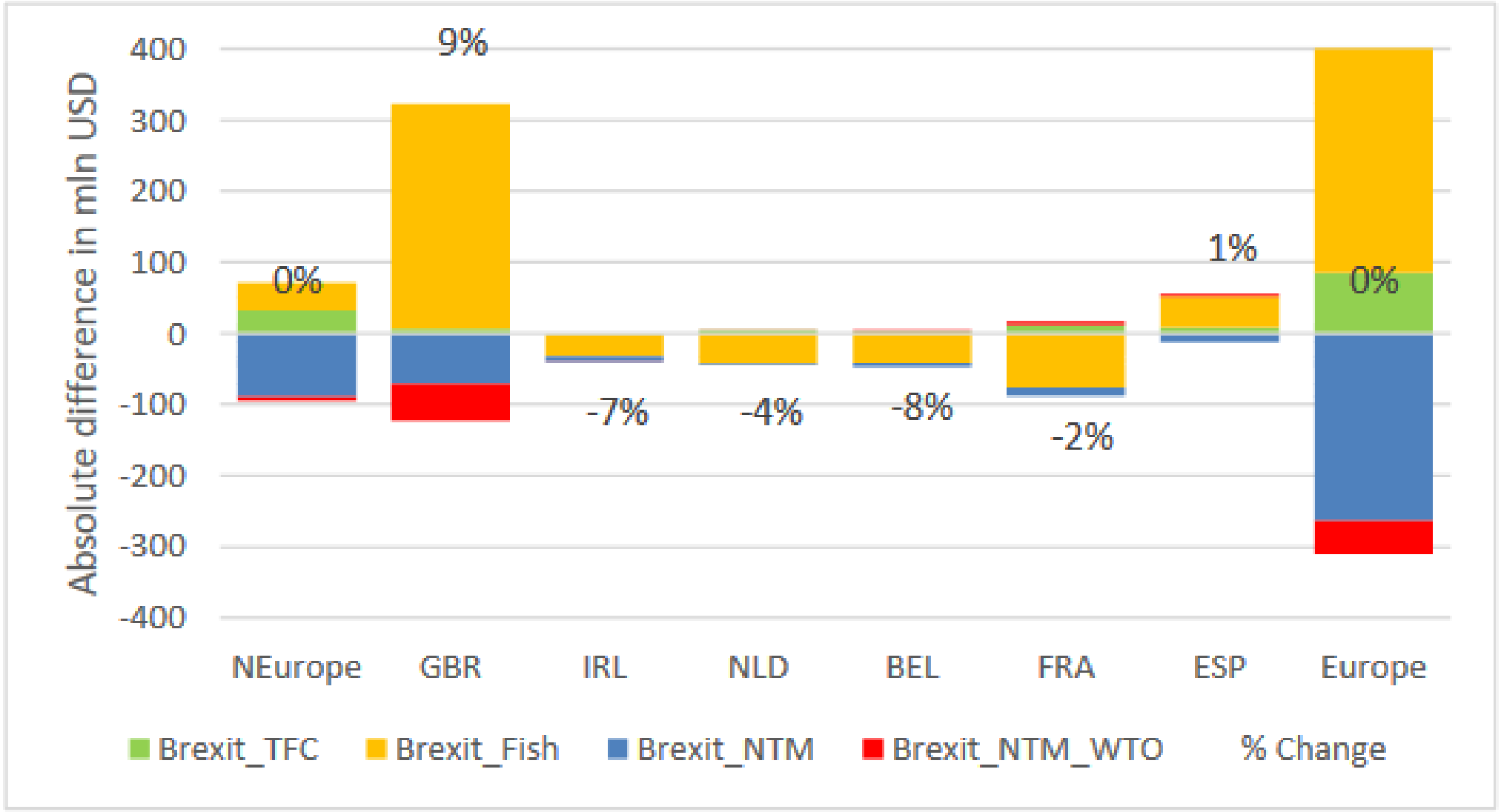


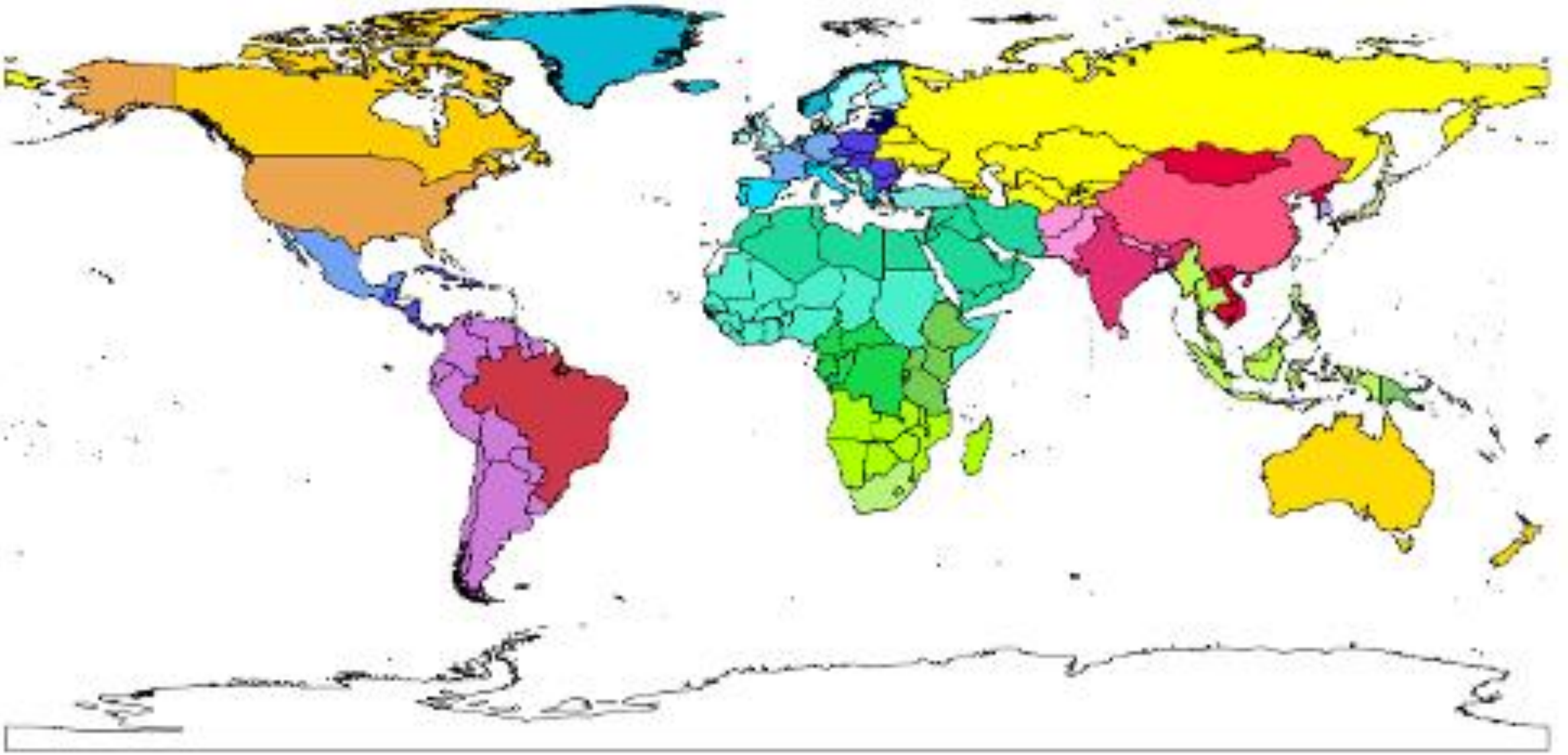
Figure 6: The decomposition of impact of Brexit on wild fish production (difference from Baseline)



Bartelings & Kristova 2018

GLOBIOM (GLOBAL BIOSPHERE MANAGEMENT MODEL)

- GLOBIOM is global recursive dynamic bottom-up partial equilibrium model integrating the agricultural, bioenergy and forestry sectors
- The model depicts all world regions aggregated to 30 regions which either represent single countries or country aggregates.
- Can be used to explore the various trade-offs and synergies around land use and ecosystem services, and helps scientists and policymakers understand and minimize land use and resource competition
- It uses FAOSTAT data for the year 2000 (average 1998 - 2002) and runs recursively dynamic in 10-year time-steps up to 2050.
- Example - TRANSMANGO



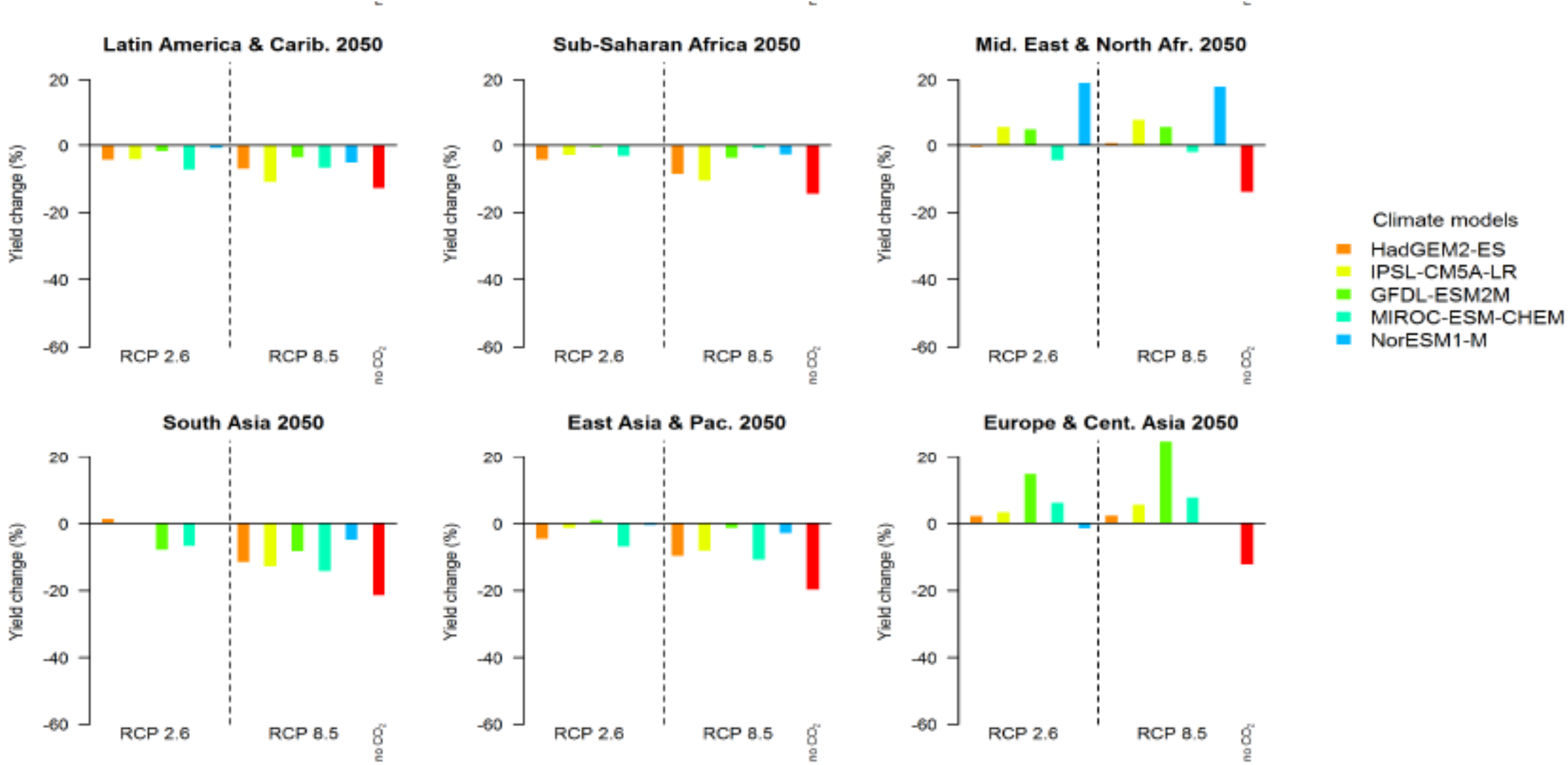


Figure 5: Climate change induced average crop yield changes for major world regions in 2050 calculated by different climate models. Crops correspond to the 18 species represented in GLOBIOM and impacts are aggregated on a dry matter yield basis.

GLOBIOM

GLOBIOM is best positioned for global environmental analyses with a high spatial resolution


EUROPEAN COMMISSION

Brussels, XXX
[…](2016) XXX

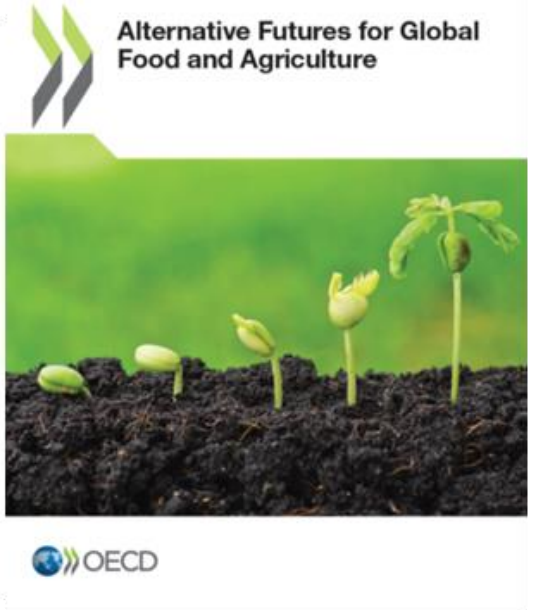
COMMISSION STAFF WORKING DOCUMENT

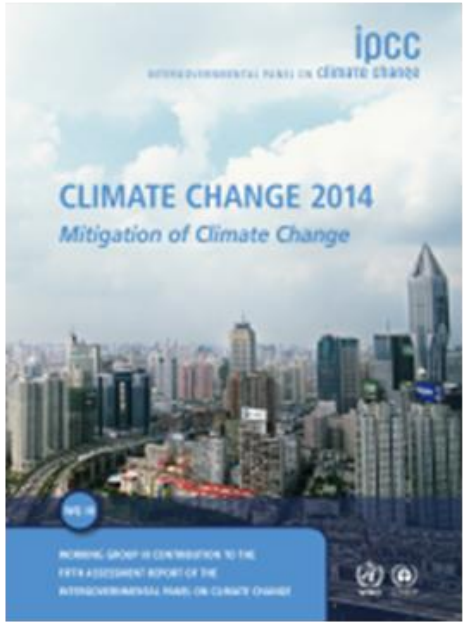
IMPACT ASSESSMENT

Accompanying the document

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change

{COM(2016) 482 final}
{SWD(2016) 248 final}





2000 2010 2020 2030 2040 2050 2060 2070 2080 2100

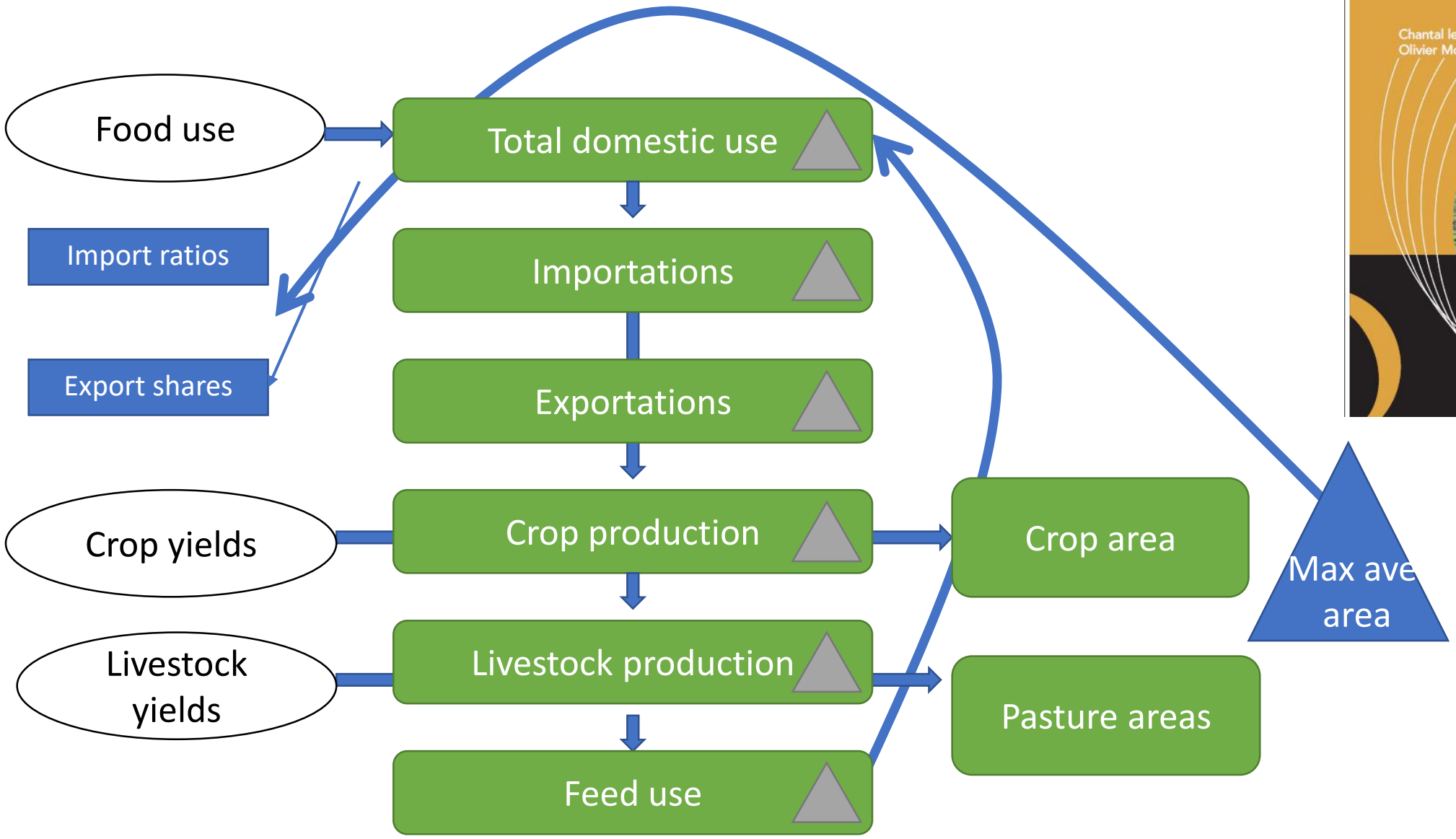
Validation period

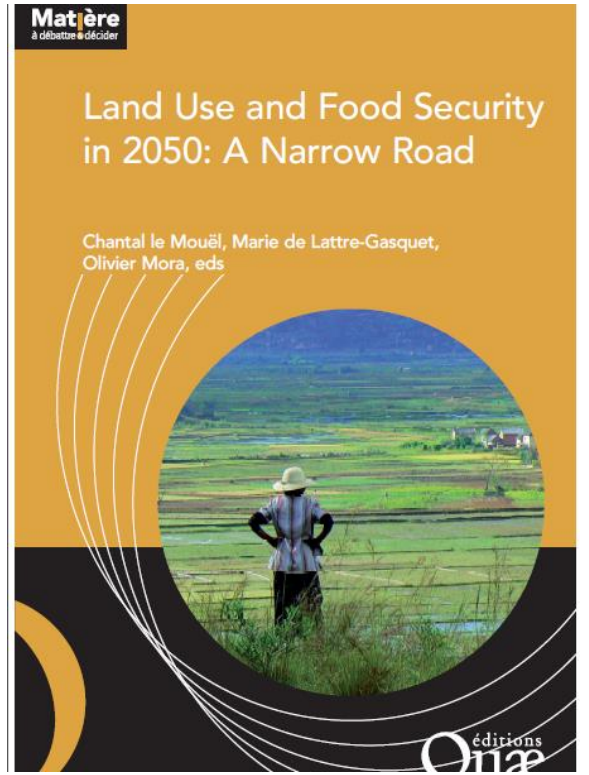
Policy Impact Assessment

Long-Term Outlook

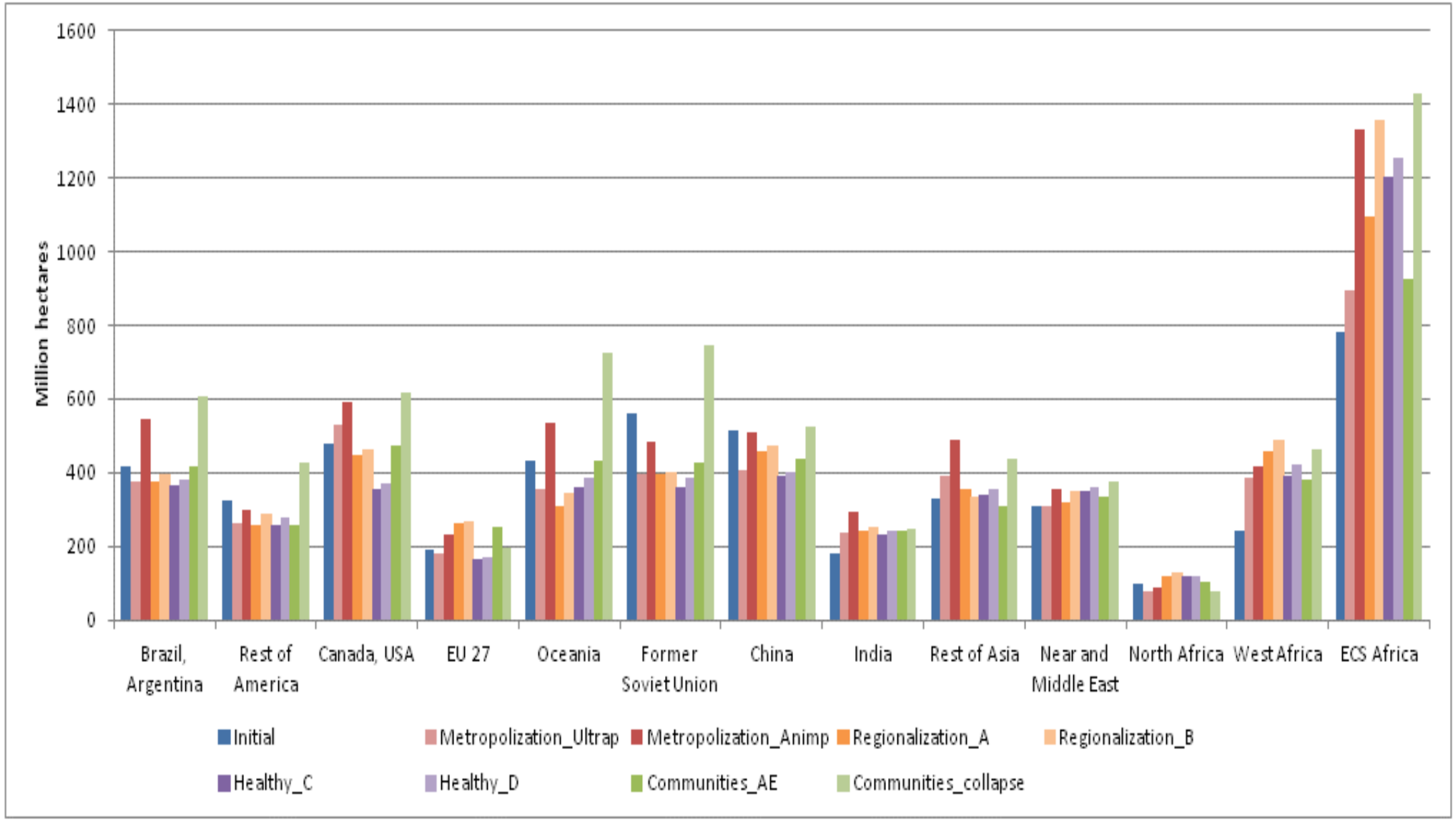
Climate stabilization pathways

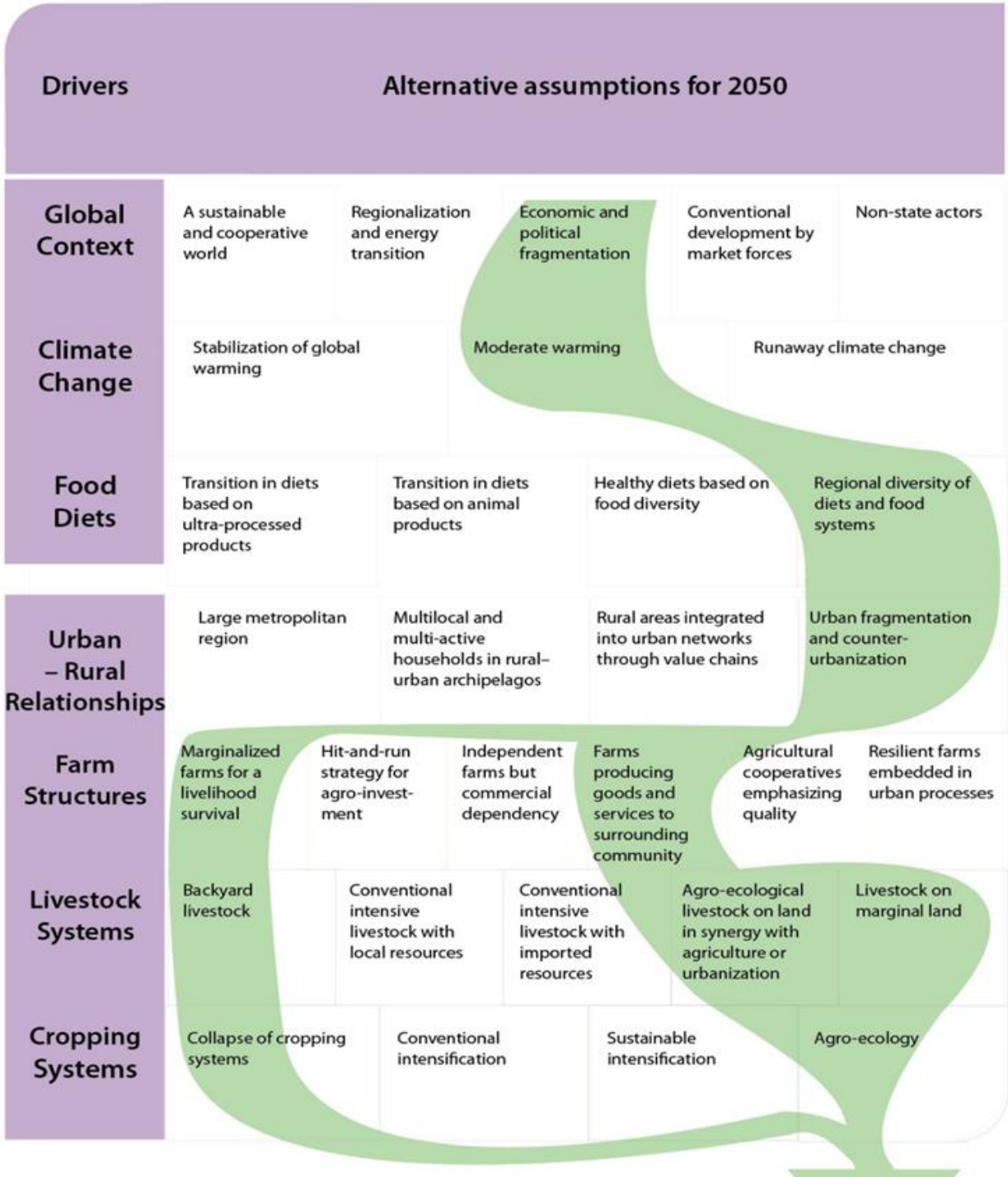
GlobAgri-T

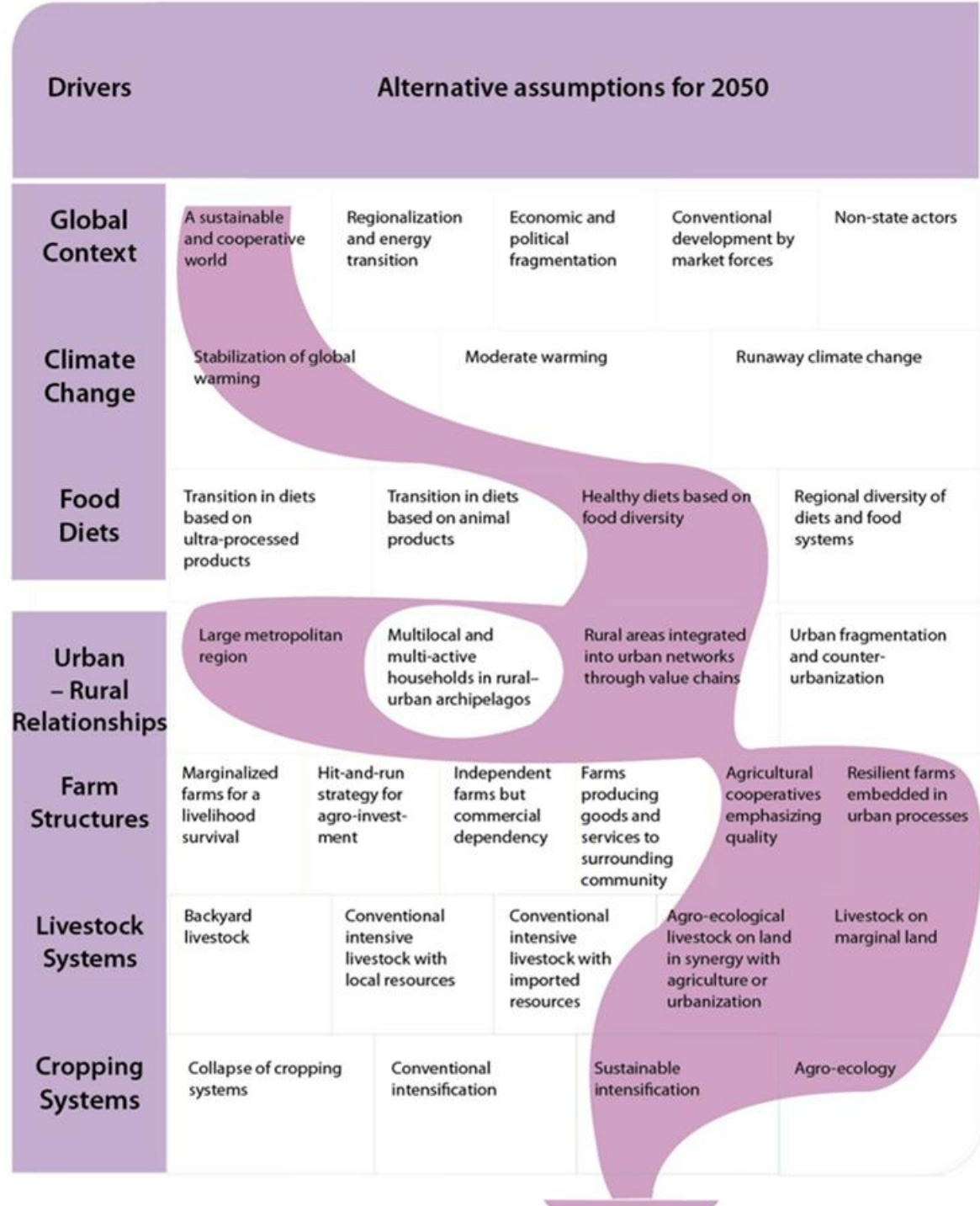

Food use
Total domestic use
Import ratios
Importations
Export shares
Exportations
Crop yields
Crop production
Crop area
Max ave area
Livestock yields
Livestock production
Pasture areas
Feed use


Matière
à débattre et décider
Land Use and Food Security in 2050: A Narrow Road
Chantal le Mouël, Marie de Lattre-Gasquet, Olivier Mora, eds
éditions Quæ

Quantitative impacts of the scenarios on land use at the regional scale




Drivers
Alternative assumptions for 2050
Global Context
A sustainable and cooperative world
Regionalization and energy transition
Economic and political fragmentation
Conventional development by market forces
Non-state actors
Climate Change
Stabilization of global warming
Moderate warming
Runaway climate change
Food Diets
Transition in diets based on ultra-processed products
Transition in diets based on animal products
Healthy diets based on food diversity
Regional diversity of diets and food systems
Urban – Rural Relationships
Large metropolitan region
Multilocal and multi-active households in rural–urban archipelagos
Rural areas integrated into urban networks through value chains
Urban fragmentation and counter-urbanization
Farm Structures
Marginalized farms for a livelihood survival
Hit-and-run strategy for agro-invest-ment
Independent farms but commercial dependency
Farms producing goods and services to surrounding community
Agricultural cooperatives emphasizing quality
Resilient farms embedded in urban processes
Livestock Systems
Backyard livestock
Conventional intensive livestock with local resources
Conventional intensive livestock with imported resources
Agro-ecological livestock on land in synergy with agriculture or urbanization
Livestock on marginal land
Cropping Systems
Collapse of cropping systems
Conventional intensification
Sustainable intensification
Agro-ecology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Collapse of cropping systems
Conventional intensification
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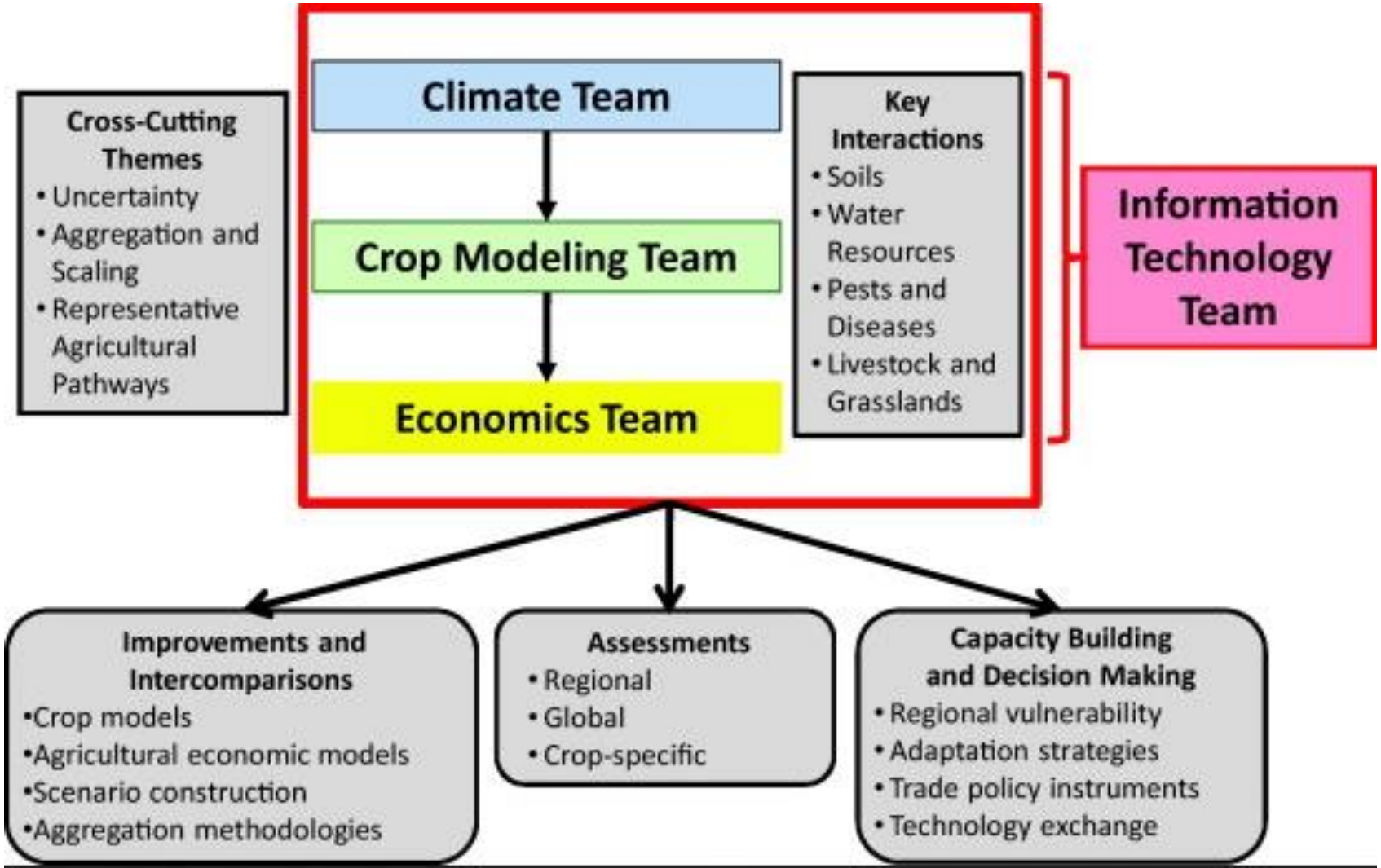
AgMIP (Agricultural Model Intercomparison and Improvement Project)



AgMIP

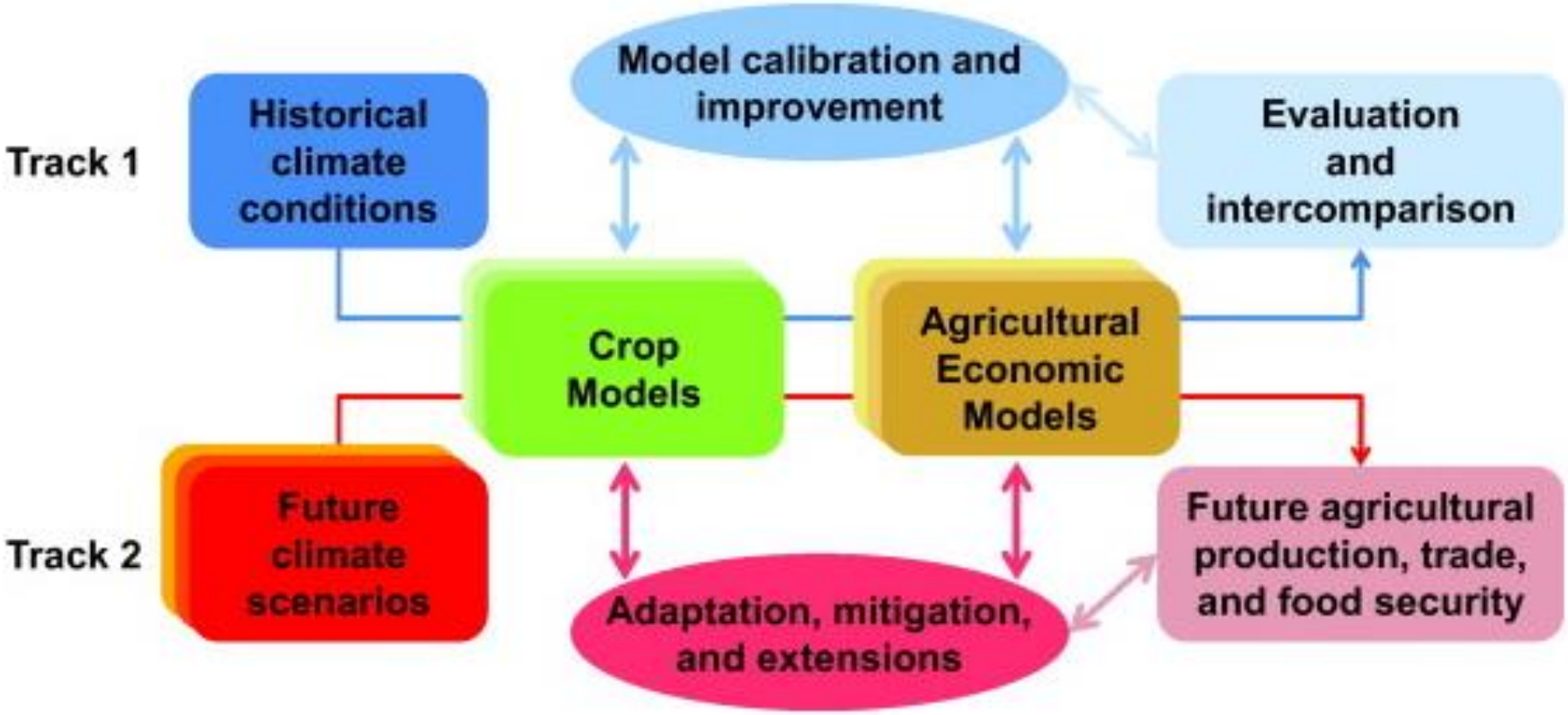


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Fig. 2. Two-track approach to AgMIP research activities. Track 1: Model Intercomparison and Improvement; Track 2: Climate Change Multi-Model Assessment.

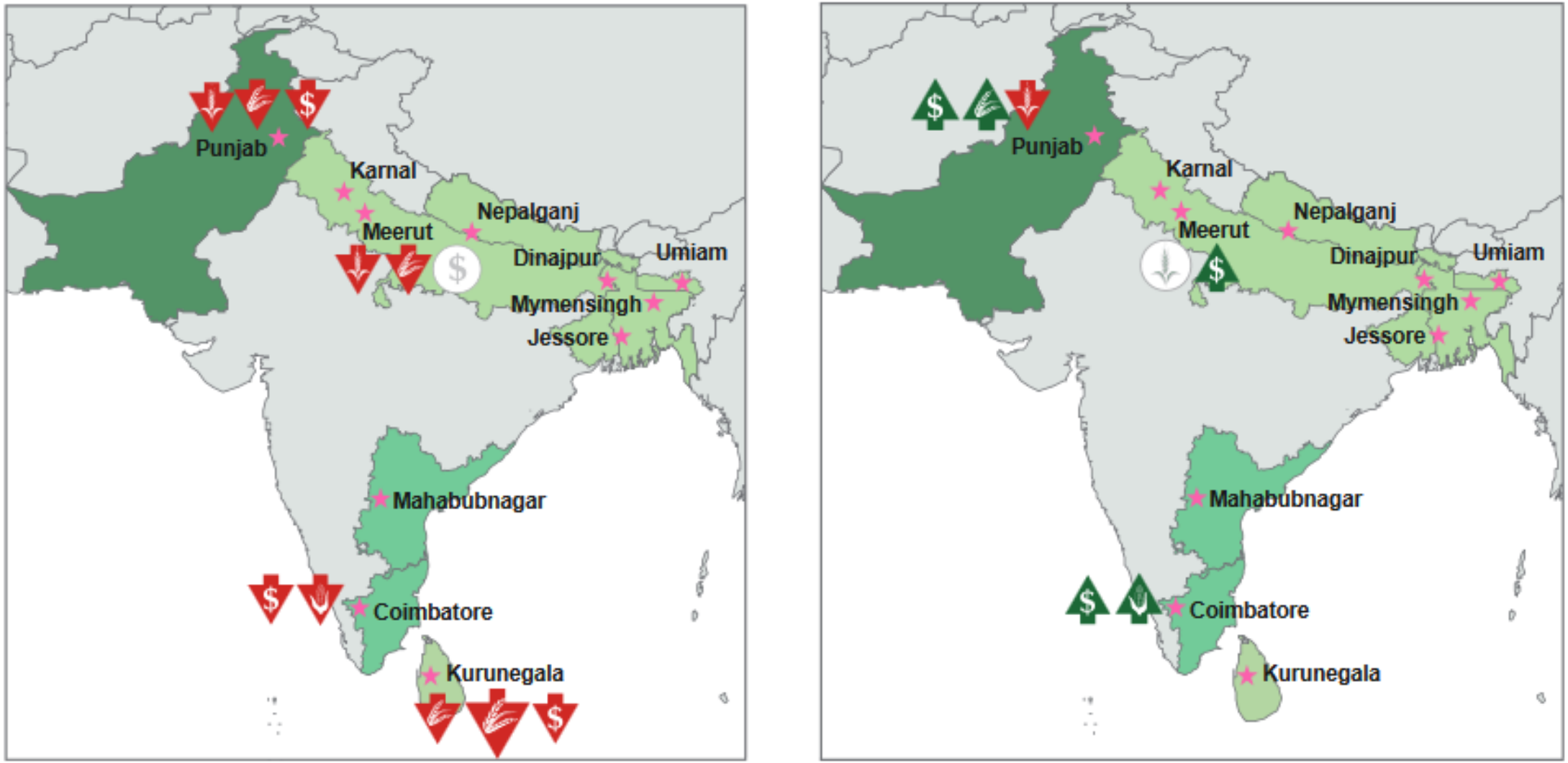
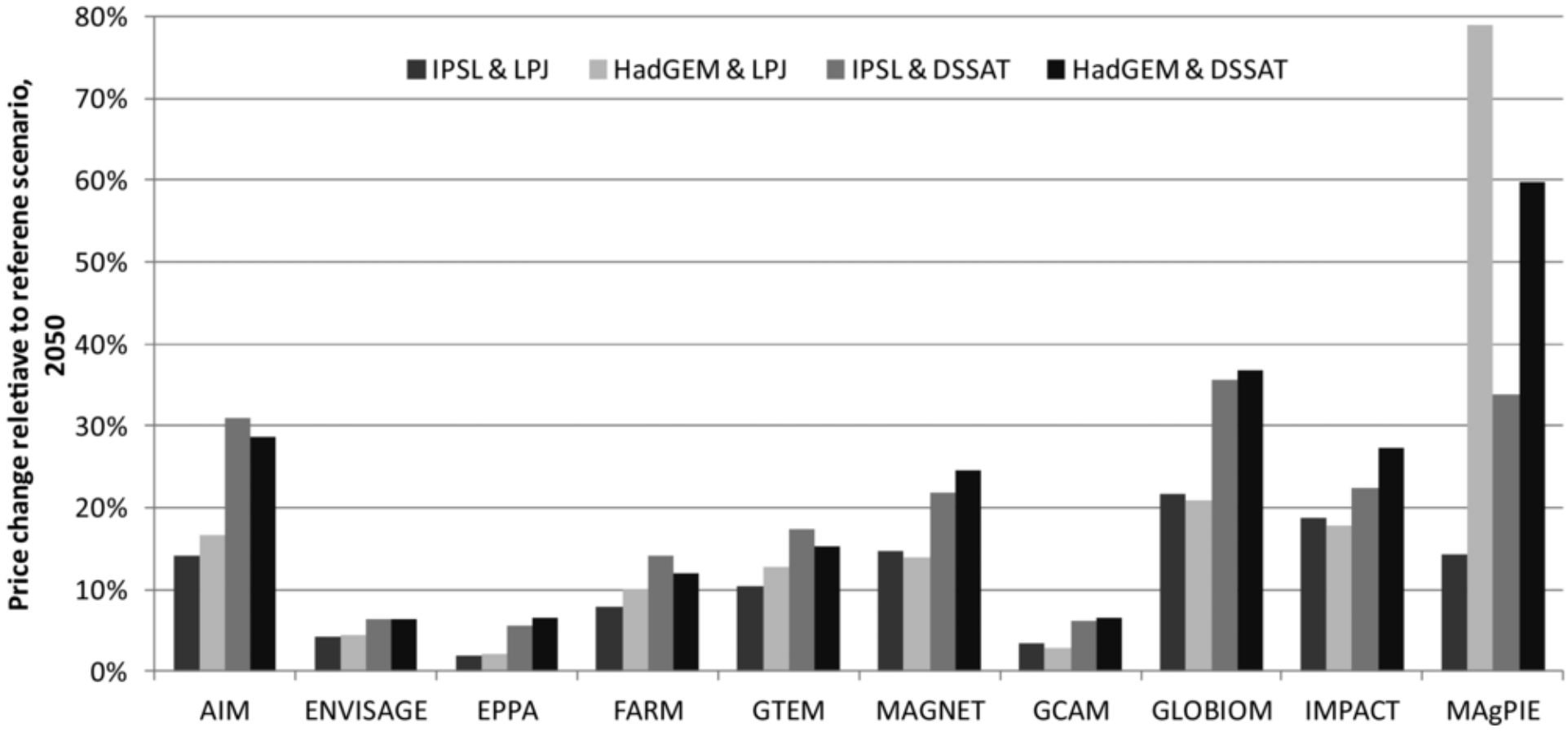


Figure 6: *Yield and income impacts projected by South Asia regional integrated assessments for (left) climate change but no adaptation; (right) climate change with adaptation. Green arrows represent yield or income increases in comparison to a future without climate change; red arrows represent yield or income decreases; white circles represent yield or impact changes of less than 5%; symbols represent maize, rice, and wheat. Larger arrows indicate a greater amount of projected change. Country and Indian state shading indicates the geographical domain of each AgMIP regional research team.*



Price effects for the average of the five main crop aggregates range between a low +2% and a high +79% across models and scenarios.

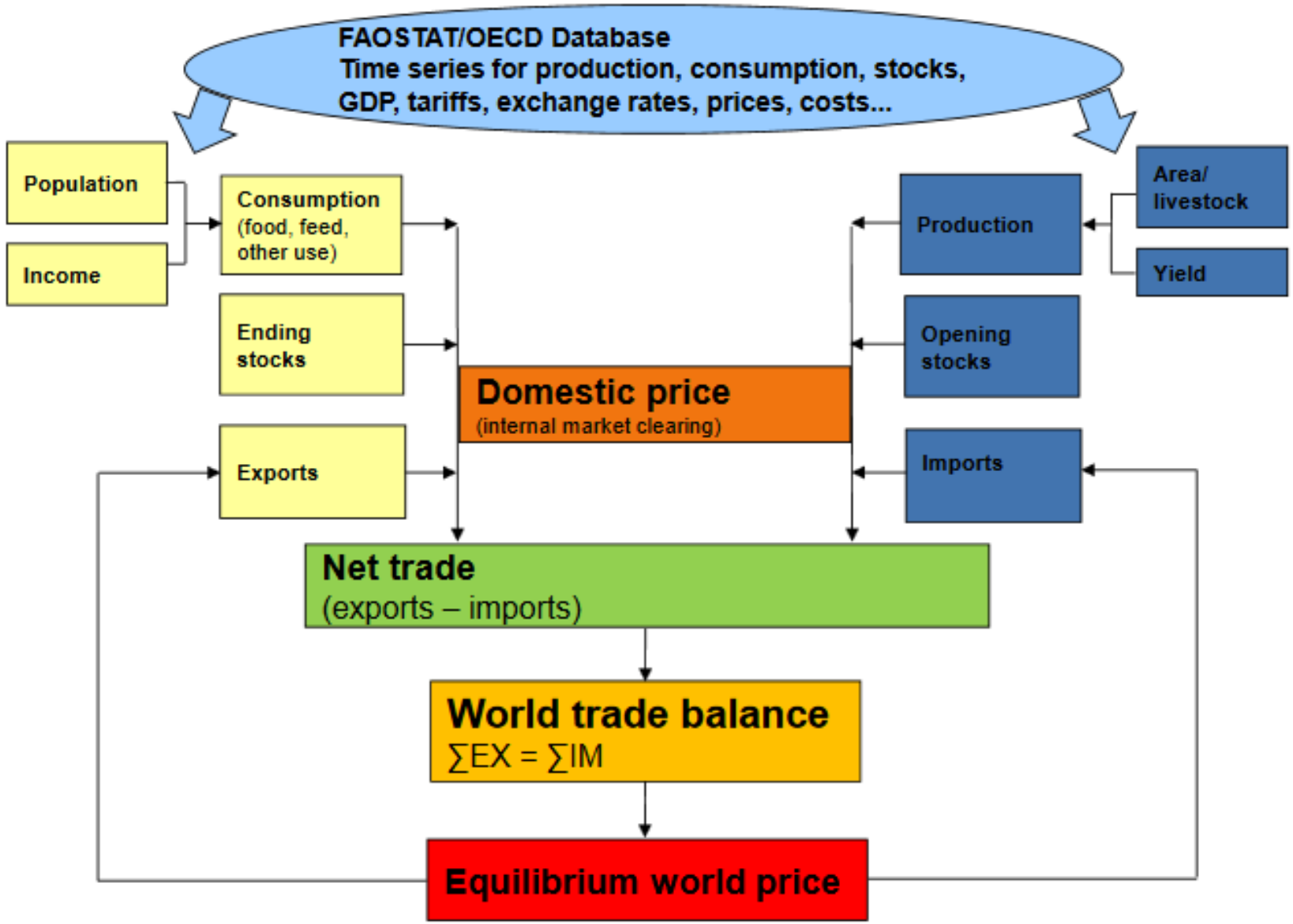
DIFFERENCES IN GLOBAL SCENARIOS

- For a comparison of scenario results to be meaningful, a careful analysis of the interpretation of the relevant model variables is essential.
- E.g. The use of "real world commodity prices" differs widely across models, and comparing the prices without accounting for their different meanings can lead to misleading results.
- Differences in basic model parameters such as income and price elasticities, sometimes hidden in the way market behavior is modeled, result in significant differences in the details.
- The analysis shows that agro-economic modelers aiming to inform the agricultural and development policy debate require better data and analysis on both economic behavior and biophysical drivers – i.e. more interdisciplinary research

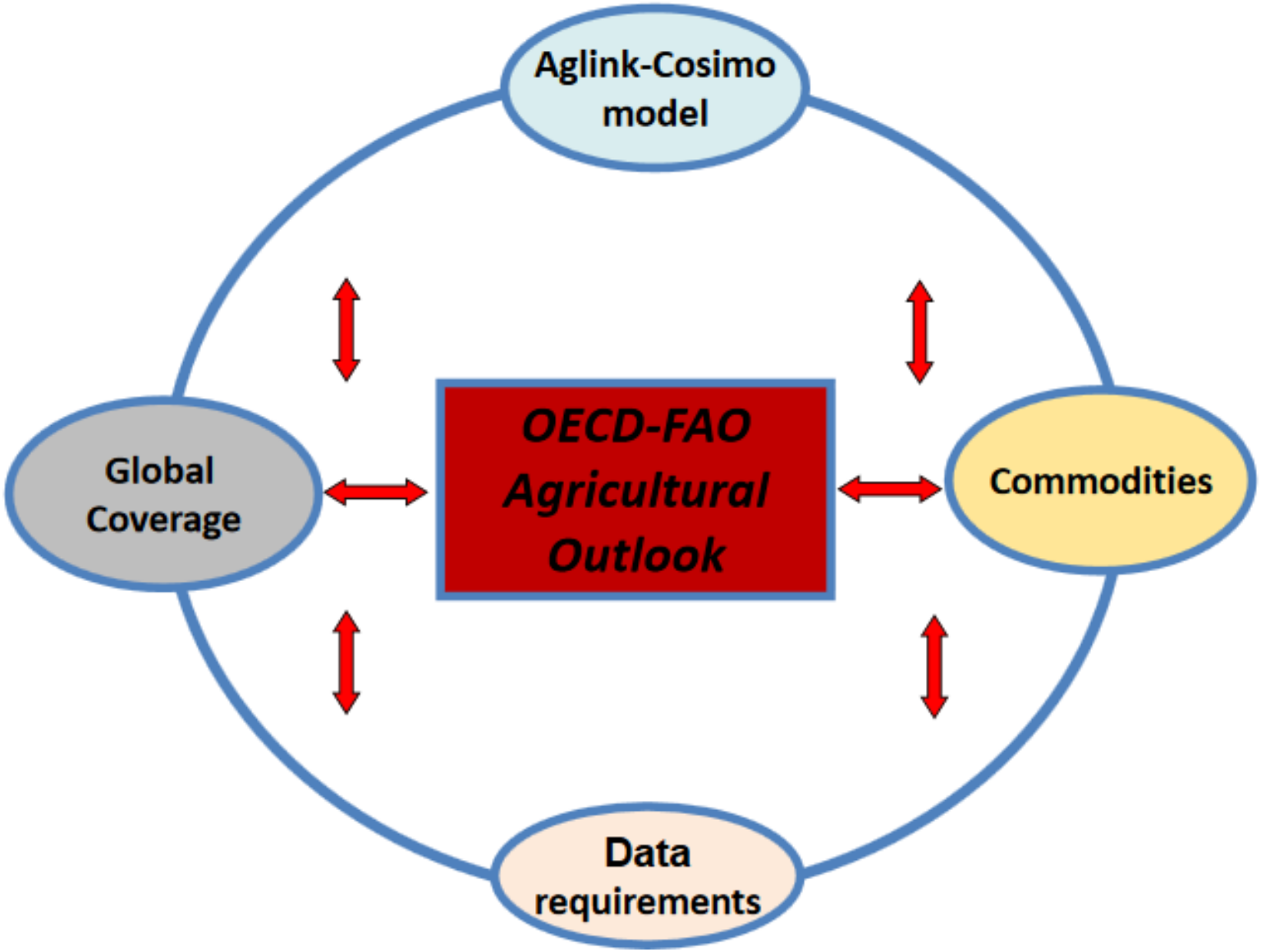
AGLINK-COSIMO

- It is an economic model that analyses supply and demand of world agriculture – NOT spatial
- Managed by the Secretariats of the OECD and FAO and used to generate the OECD-FAO Agricultural Outlook and policy scenario analysis (+ country experts for country reports)
- It is a recursive-dynamic, partial equilibrium model used to simulate developments of annual market balances and prices for the main agricultural commodities produced, consumed and traded worldwide.
- 10 years into the future

Aglink-Cosimo model



OECD-FAO Agricultural Outlook



VFS/AEZ (WORLD FOOD SYSTEM/AGROECOLOGICAL ZONE)

- WFS: a series of national and regional agricultural economic models.
- ANNUALLY—**how much** food will be produced and consumed in the world, **where** it will be produced and consumed, the **trade** and financial flows related to such activities, any actual and potential environmental impacts
- For the purpose of international linkages, the production, consumption, and trade of goods and services of a country are aggregated into nine main agricultural sectors and one non-agricultural sector.
- The integrated WFS/AEZ system produced policy-relevant knowledge on Climate Change and Agricultural Vulnerability in the 21st Century and was used to analyze key concerns regarding Biofuels and Food Security.

SUSFANS

- Metrics, Models and Foresight for European SUStainable Food And Nutrition Security
- Contributes to food systems change by providing policy and decision makers across Europe with the tools to get a holistic understanding of the EU food system and how it relates to Sustainable Food and Nutrition Security.
- The novelty of the SUSFANS approach is bringing these models together and as such give a holistic insight into the food system and the four key goals related to food system change.
- The models are specialised in certain food system domains;
  - MAGNET focusses on the macro-economy,
  - SHARP and DIET are both designed for the exploration of issues related to diet and health at consumer level
  - GLOBIOM and CAPRI were developed to assess agricultural production.

SUSFANS

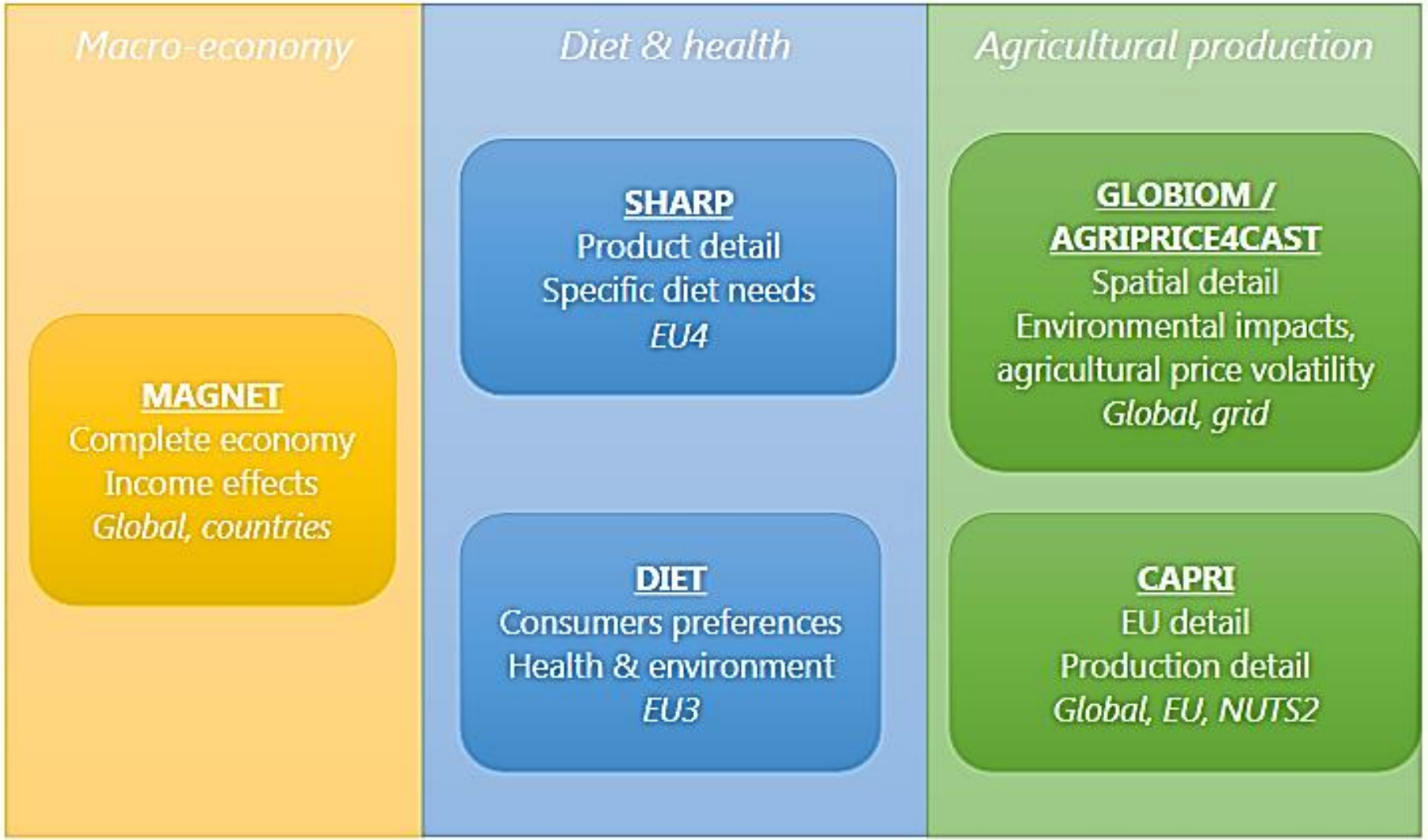
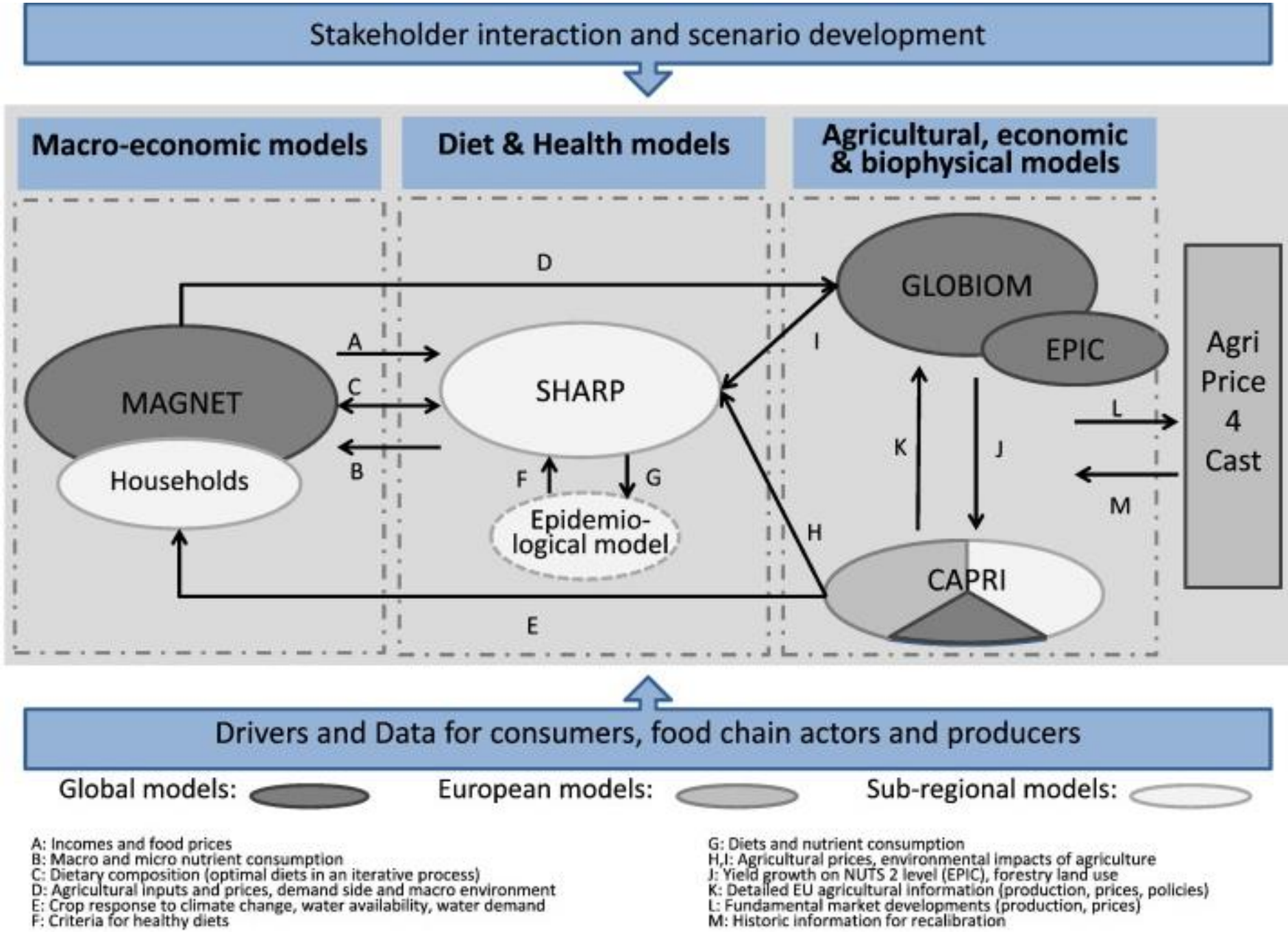


Figure 1 SUSFANS modelling tools


Stakeholder interaction and scenario development
Macro-economic models
Diet & Health models
Agricultural, economic & biophysical models
MAGNET
Households
SHARP
Epidemio-logical model
GLOBIOM
EPIC
CAPRI
Agri Price 4 Cast
A
B
C
D
E
F
G
H
I
J
K
L
M
Drivers and Data for consumers, food chain actors and producers
Global models:
European models:
Sub-regional models:
A: Incomes and food prices
B: Macro and micro nutrient consumption
C: Dietary composition (optimal diets in an iterative process)
D: Agricultural inputs and prices, demand side and macro environment
E: Crop response to climate change, water availability, water demand
F: Criteria for healthy diets
G: Diets and nutrient consumption
H,I: Agricultural prices, environmental impacts of agriculture
J: Yield growth on NUTS 2 level (EPIC), forestry land use
K: Detailed EU agricultural information (production, prices, policies)
L: Fundamental market developments (production, prices)
M: Historic information for recalibration

CLIMSAVE INTEGRATED ASSESSMENT (IA) PLATFORM

- interactive exploratory tool with a series of linked models and databases to allow users to explore the complex issues surrounding impacts, adaptation and vulnerability to climate change at regional and European scales.
- The tool provides sectoral and cross-sectoral insights within a facilitating, rather than predictive or prescriptive, software environment.
- The tool is intended to complement, and not replace the use of more detailed sectoral tools used by sectoral professionals and academics.
- Not intended to provide detailed local predictions, but assists stakeholders in developing capacity to address regional/national/EU scale issues surrounding climate change.

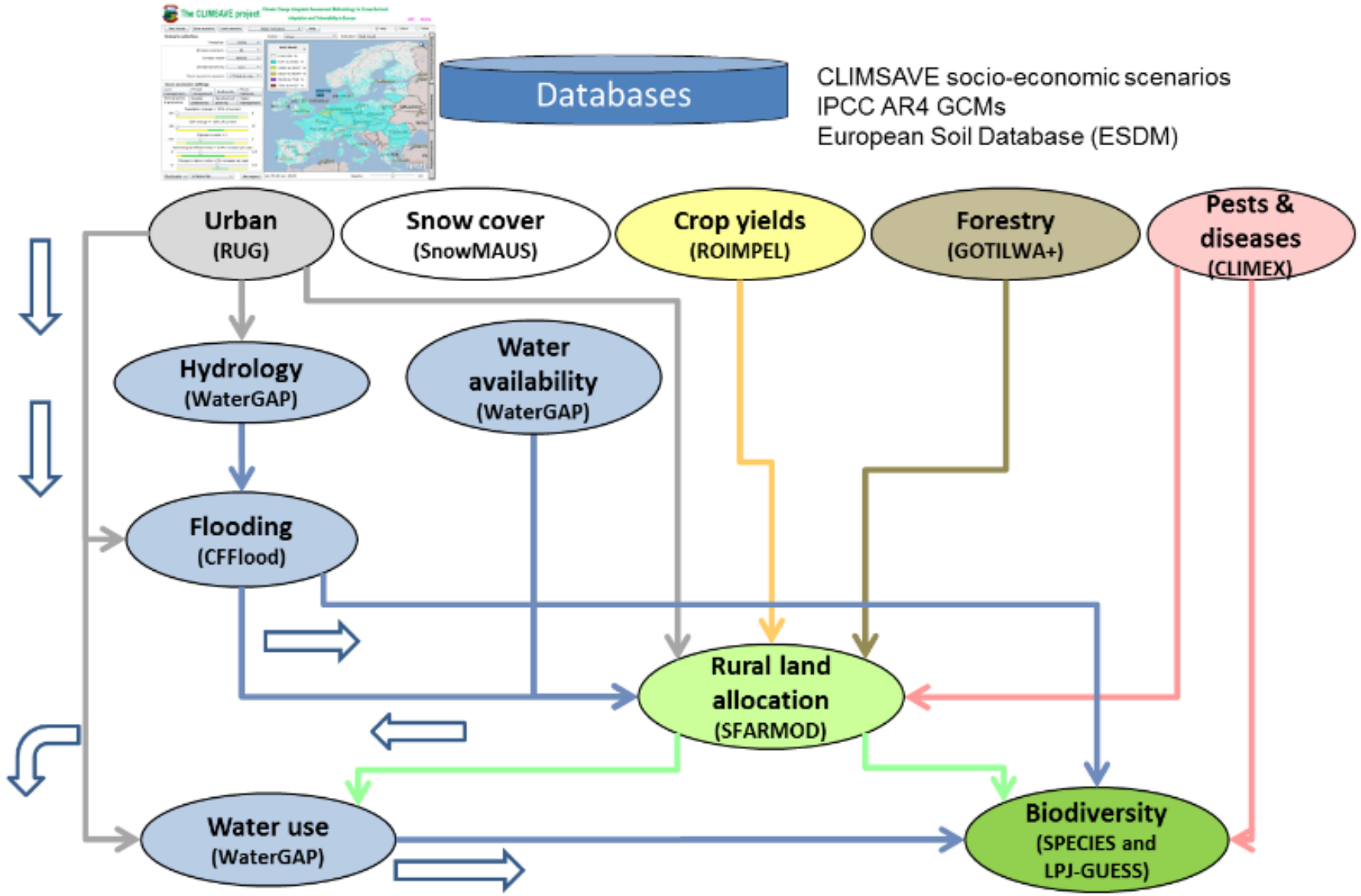


Figure 1.1a: Simplified schematic showing the structure of the linked models within the European CLIMSAVE IA Platform.

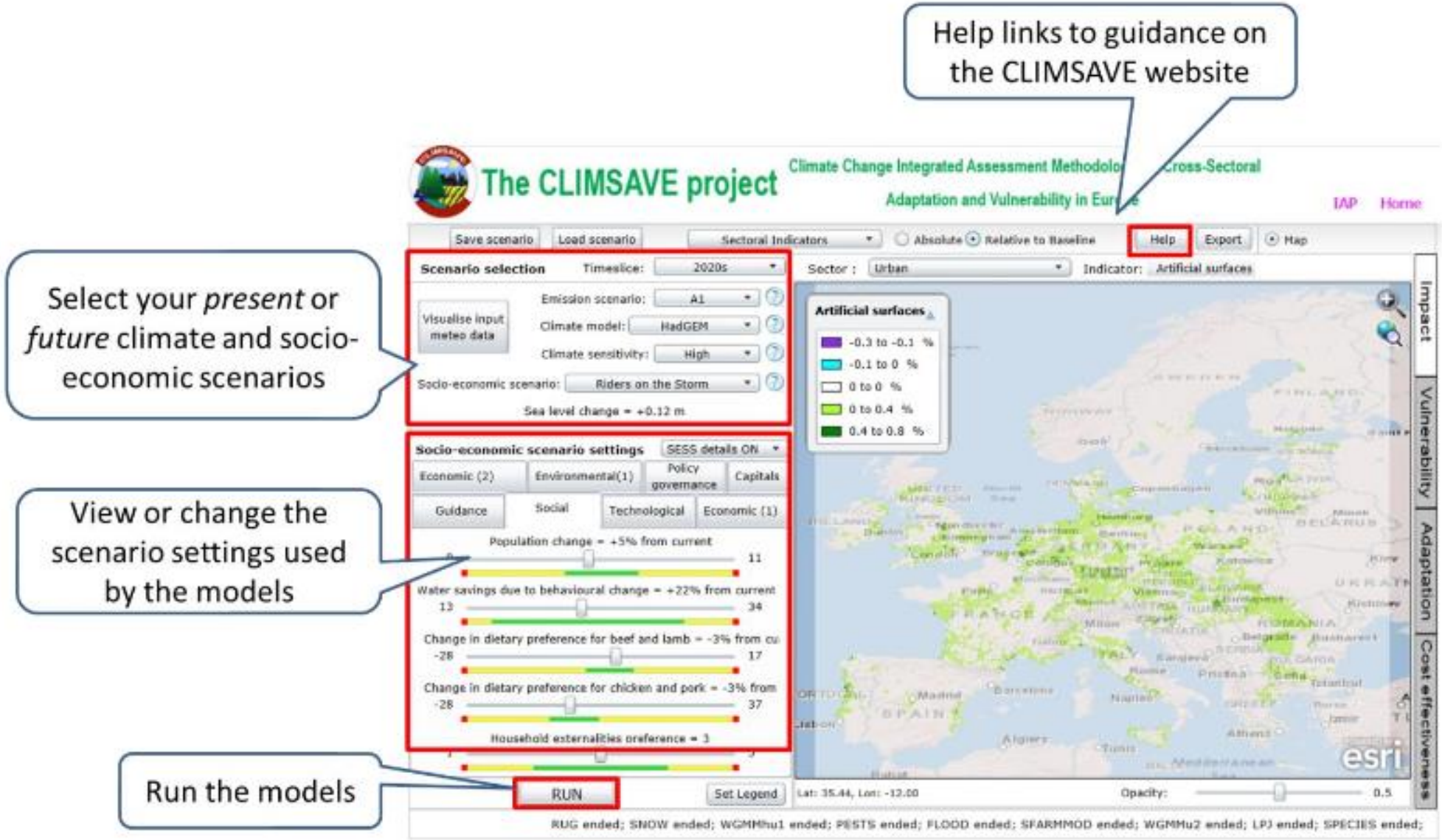


Figure 3.1a: Setting the scenario inputs in the Impacts screen of the European IA Platform.