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Methodologies to assess climatic change impacts on sustainability of agriculture at different levels

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Introduction

- Impact Assessment (IA) of climatic changes in agriculture is to be carried out at different organisational levels
- EU research and policy calls for *integrated* IA, seeking tools for (FP7 2012 Environment): (a) climate predictions, (b) assessing costs of mitigation, (c) identifying pathways for GHG emissions reduction, (d) cost-effective policy mix

Wageningen UR (University and Research Centre)

Wageningen UR is the lead party in the major national Climate Changes Spatial Planning and Knowledge for Climate research programmes. Wageningen UR promotes multi-disciplinary cooperation between the Plant, Social, Environmental, Animal, Agrotechnology & Food science groups and interaction between Education-Science-Business-Policy.

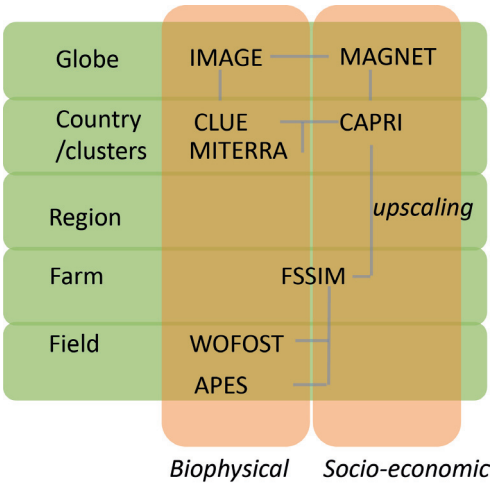

Figure 1: Stand-alone tools applied/developed at WUR and integrated into modeling frameworks to predicting multi-scale effects of adaptation to climate change in agriculture

APES: Agricultural Production and Externalities Simulator
WOFOST: WOrld FOod STudies (crop growth simulation model)
FSSIM: Farm System SIMulator (optimisation bio-economic model)
CAPRI: Common Agricultural Policy Regionalised Impact (agricultural market model)
CLUE: Conversion of Land Use and its Effects (spatial land use and land cover change model)
MITERRA-Europe: GHG, N and P emission model
MAGNET: Modular Applied GeNeral Equilibrium Tool (former GTAP - Global Trade Analysis Project)
IMAGE: Integrated Model to Assess the Global Environment

Linking climate and policy scenario's

SRES A1: strong economic growth and new technologies
SRES B2: moderate economic growth, sustainable regional EU economies

Measures at Farm/Region level

Adaptation: develop stress-tolerant crops, implement modern irrigation technology, rainwater harvesting, flexible land use, reserve water retention areas, widen field margins, etc.
Mitigation: reduce/substitute fossil fuel consumption, optimise crop and livestock management (improved crop rotation, nutrition cycle, manure utilisation), etc.

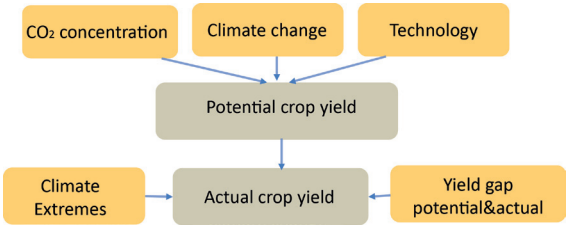

Figure 2: Crop level assessment of the effects of CO2 concentration, climate change, climate extremes and technology on crop yields (Wolf et al., 2011)

Table 1: Current and forecast yields and fertiliser application in 2050 (CC) and 2050+ (CC + technological change) scenarios (Flevoland, the Netherlands)

	Current Yield	Movement in yield (%)		Movement in fertiliser application (%)	
		2050	2050+	2050	2050+
Soft wheat	8	14	72	17	90
Potatoes	57	7	47	9	58
Sugar beet	74	30	69	37	86
Vegetables	66	20	56	25	69

Source: Wolf *et al.* (2011).

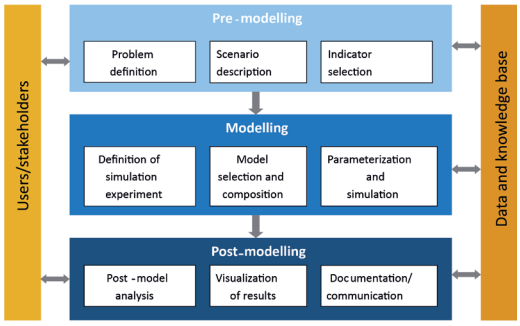

Figure 3: Integrated assessment procedure (Van Ittersum et al., 2008)

Related EU Projects:
SEAMLESS www.seamlessassociation.org
LUPIS www.lupis.eu
Eururalis www.eururalis.eu
SENSOR www.sensor-ip.org

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Further reading

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Verburg, R. *et al.* 2009. The effect of agricultural trade liberalisation on land-use related greenhouse gas emissions. Global environmental change: human and policy dimensions 19 (4), 434 - 446.
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Hermans C.M.L. *et al.* 2010. Exploring the future of European crop production in a liberalised market, with specific consideration of climate change and the regional competitiveness. Ecological Modelling 221(18), 2177-87.
Schaap, B.F. *et al* 2011. Impact changes of climatic extremes on arable farming in the north of the Netherlands. Reg. Env. Change 11(3)