Climate Adaptation in Rural arEas: Nature and Agriculture

Adri van den Brink

Wageningen University

Monitoring climate change

Climate research

Two programmes:

- Climate changes spatial planning (*Klimaat voor ruimte*): 2004-2010
- Knowledge for climate (*Kennis voor klimaat*): 2008-2014

Knowledge for Climate

To develop the scientific and applied knowledge required for climate-proofing the Netherlands and to create a sustainable knowledge infrastructure for managing climate change

1st tranche: applied short-term research

2nd tranche: fundamental research

3rd tranche: developing adaptation strategies

Knowledge for Climate

Societal Relevance

- Impacts of climate change
- Potential of providing ecosystem services
- Rural areas have to adapt: mitigating pressures and capitalizing on opportunities
- Broad view: metropolitan landscape
- Challenge is to combine certain governmental and societal demands with the individual objectives of land managers
- Knowledge gaps

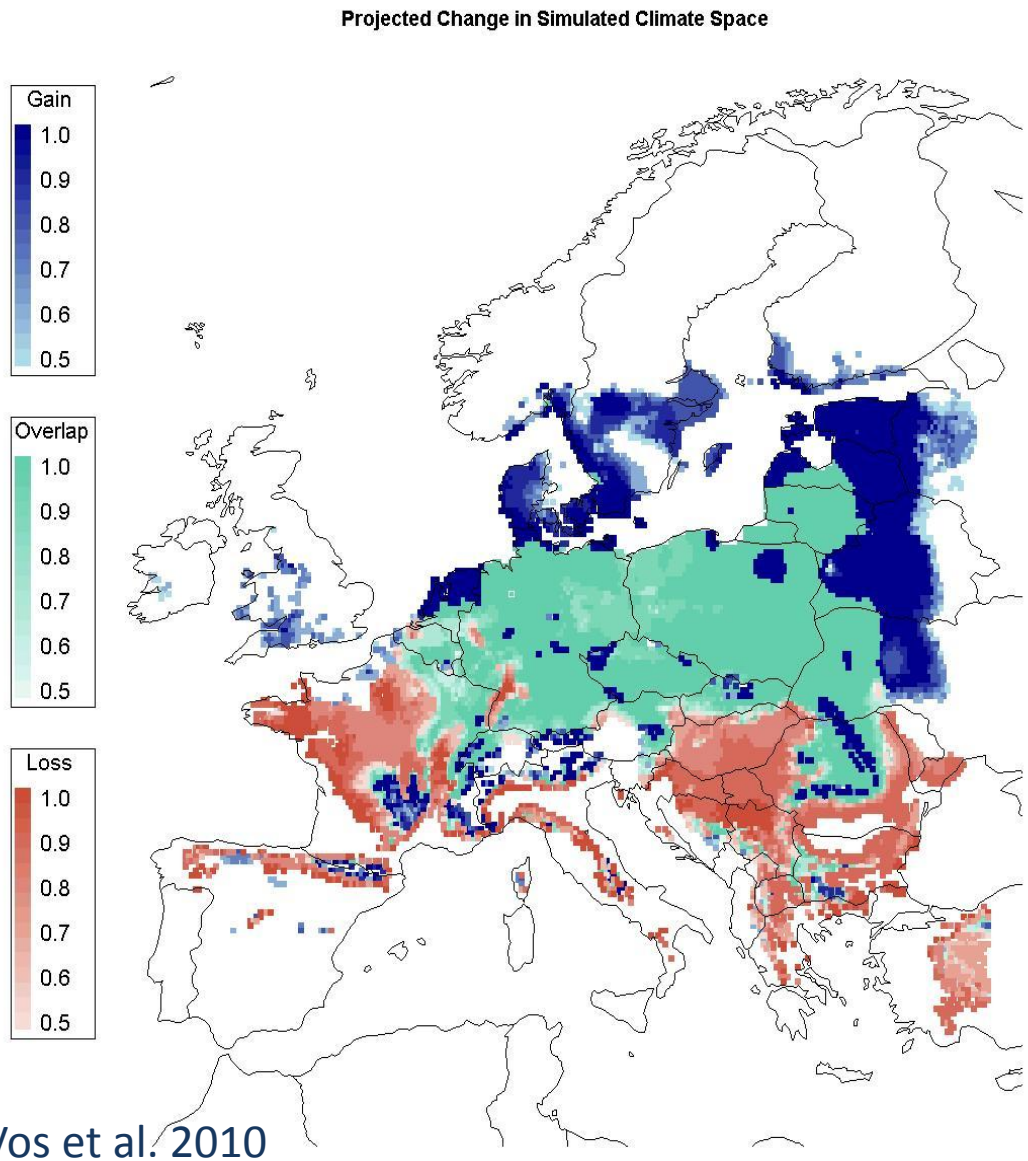
Knowledge gaps

- Lack of knowledge about the effects of *extreme weather events*
- Lack of *interdisciplinary* research about the interactions and trade-offs between different sectors and across adaptation options
- Insufficient understanding of *human* adaptation strategies

Examples of CcSP research

1. How to increase the adaptive capacity of the national ecological network (NEN) to cope with the effects of climate?

Suitable climate zones for species are shifting

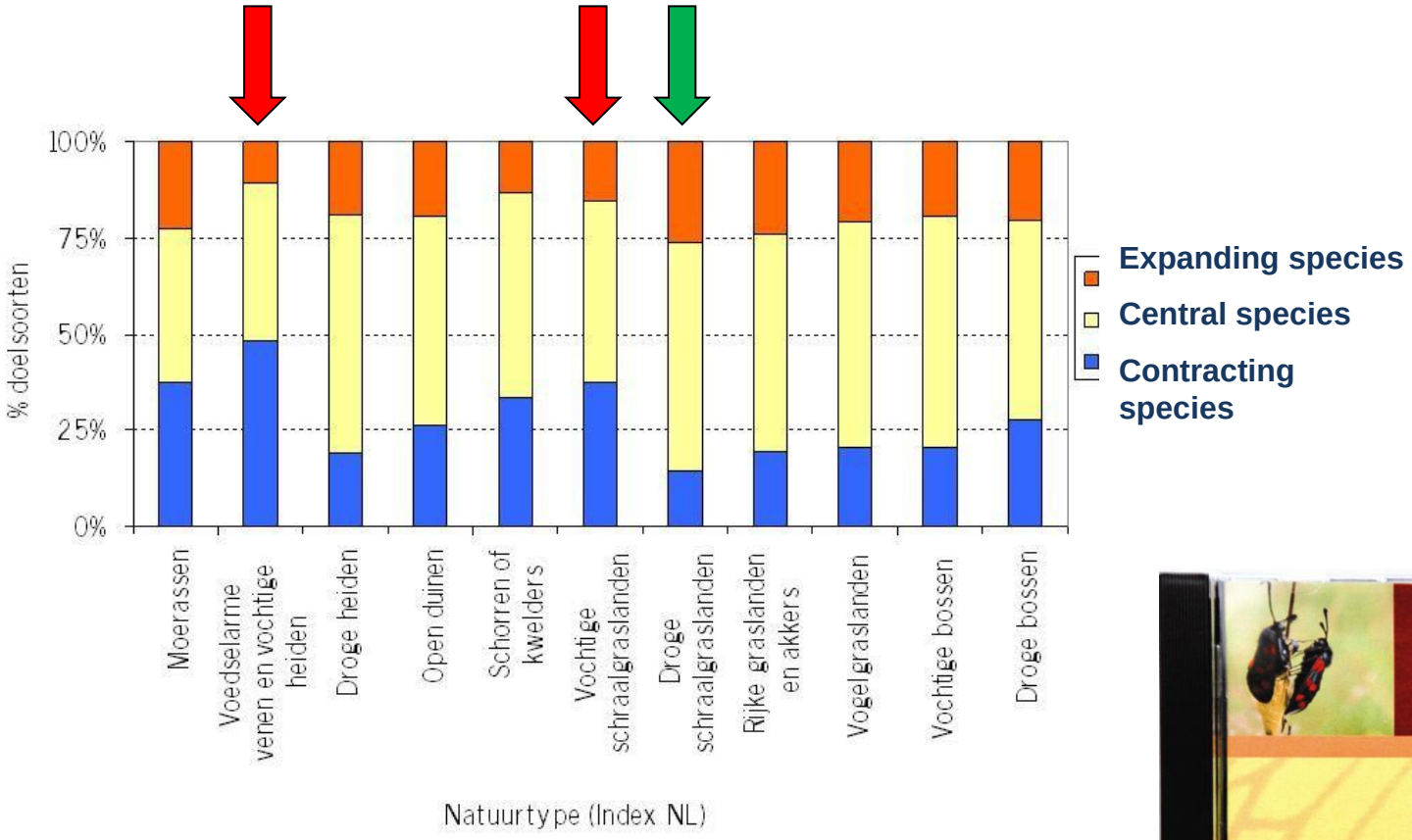


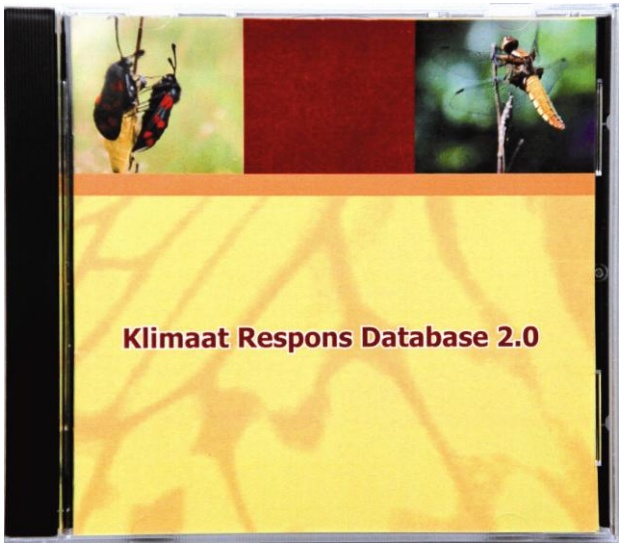
- Species respond differently
- This will alter known species combinations of habitats
- This has consequences for biodiversity targets


Middle spotted woodpecker

Vos et al. 2010

Consequences for biodiversity targets

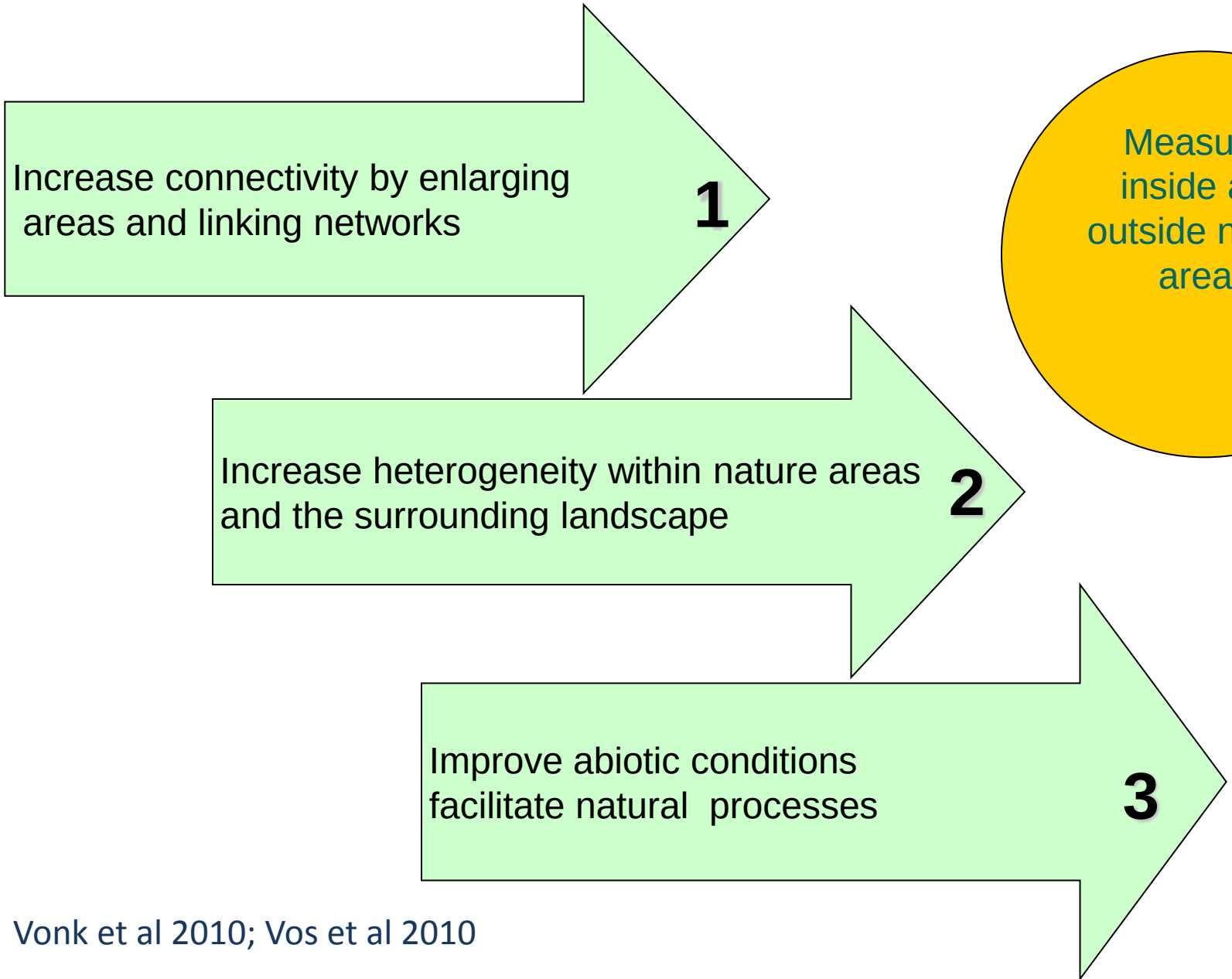




Predictions for over 3000 species: based on modelling and empirical research

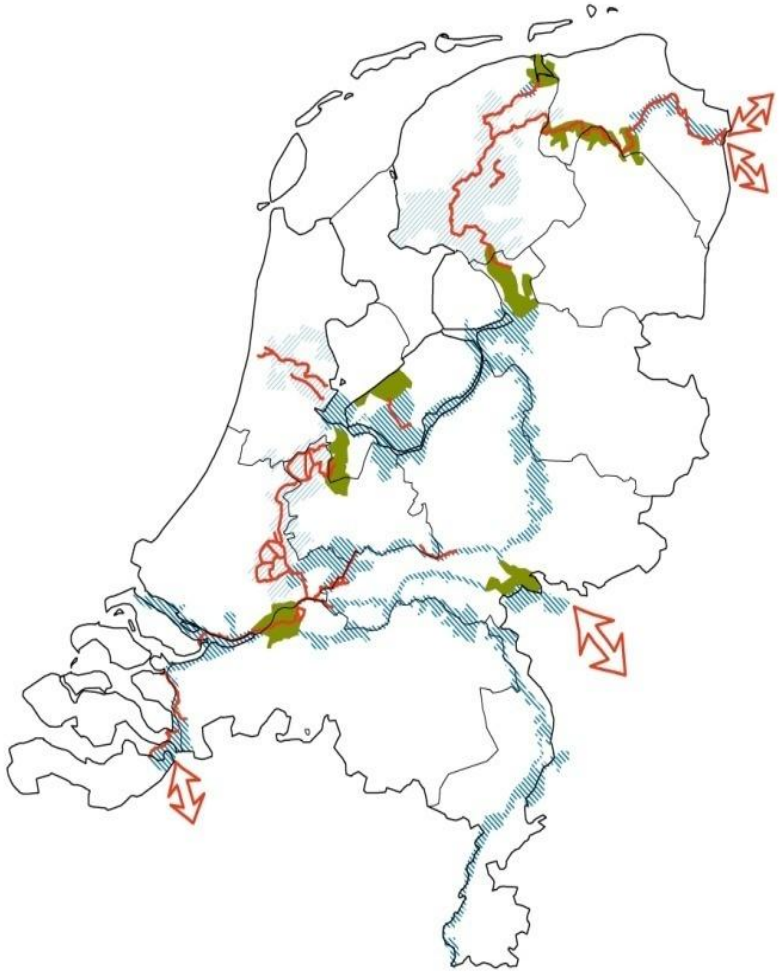
Van der Veen et al. 2010

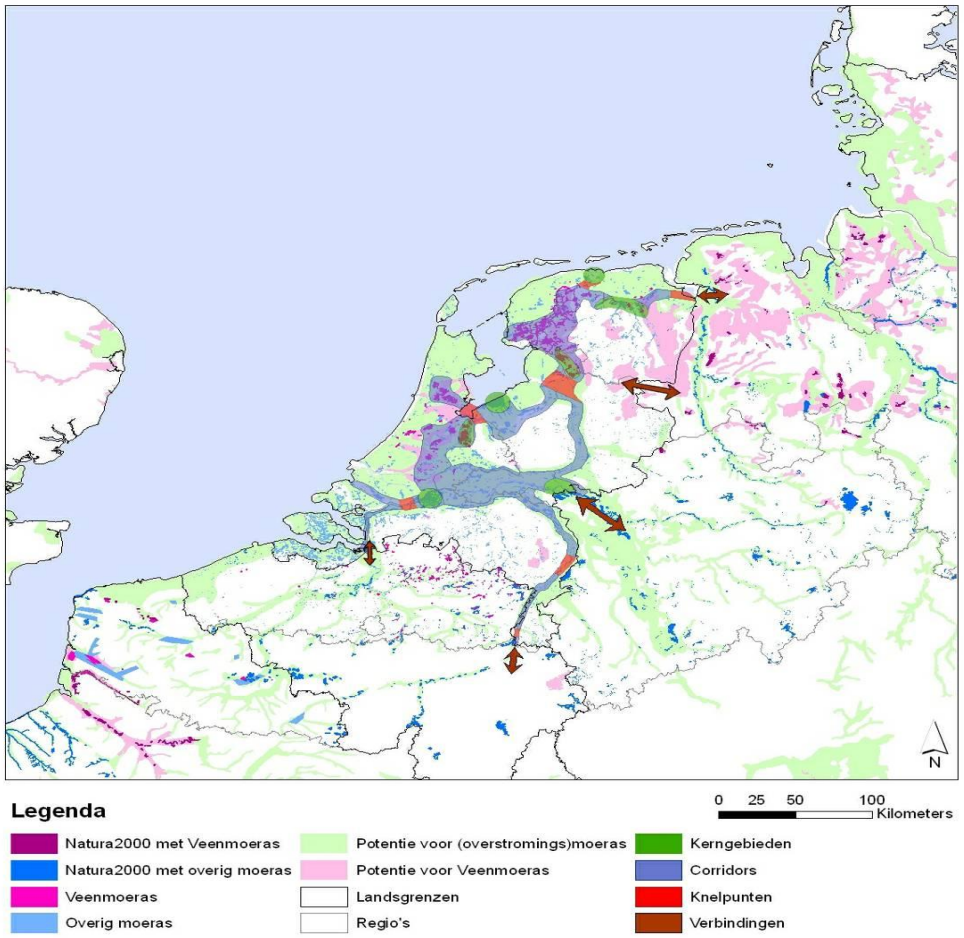
Adaptation measures to increase the adaptive capacity



Vonk et al 2010; Vos et al 2010

Climate adaptation zone for wetlands





Vonk et al 2010; Vos et al 2010

Next steps

- Learn more about the impacts of weather extremes on the survival of species in ecological networks
- Develop (multifunctional) adaptation strategies outside nature areas: green infrastructure
- Regional case studies where adaptation measures for different functions are integrated: agriculture, water and nature

Examples of CcSP research

2. What are the impacts of climate and market changes on agrarian land use in Europe?

Background

- To develop strategies and action plans for agriculture in the Netherlands to adapt to both climate and market change, with NL-North as a pilot region;
- In the context of the EU27, and for two scenarios (global economic scenario A1 and regional environmental scenario B2), for three crops relevant for NL-North (wheat, potatoes, grass/milk)

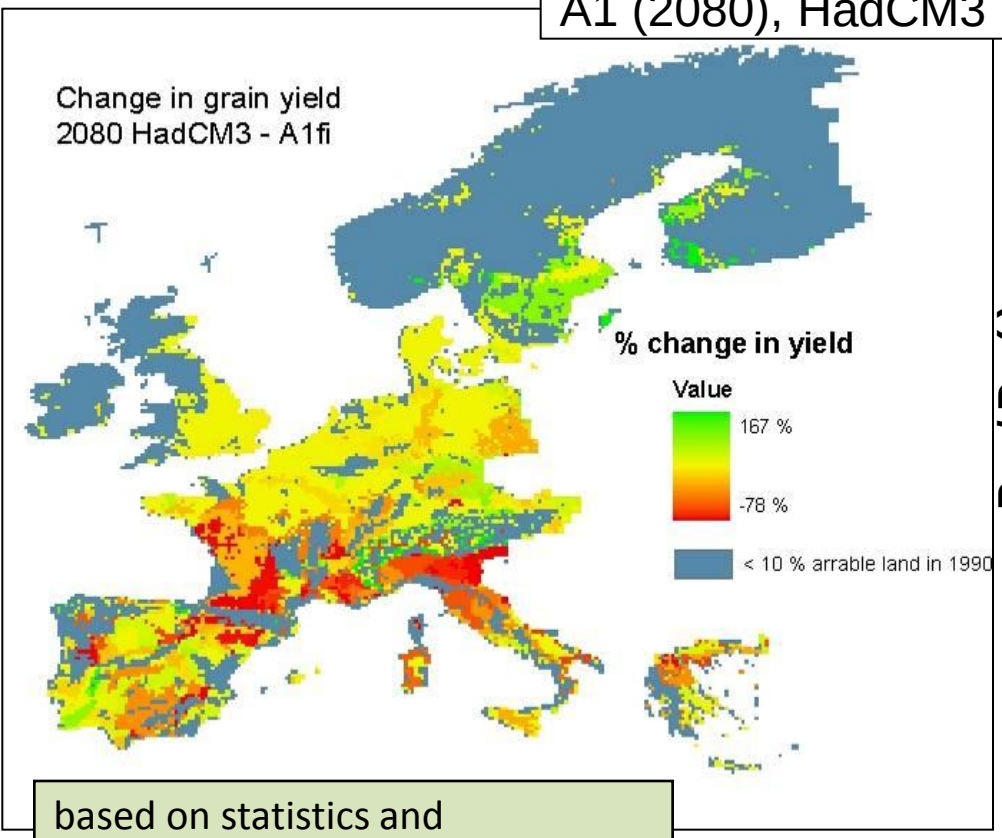
Estimating impacts on achievable production

Climate effect on yield changes

Technology effects on yield changes

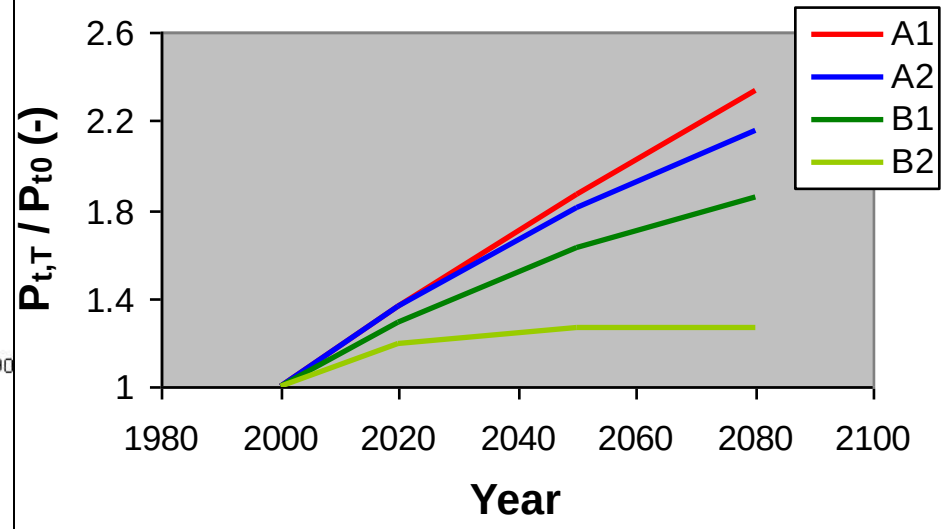
Relative yield change (%)

A1 (2080), HadCM3



based on statistics and
shifting agro-environmental zones

Assumed future technology effects



Ewert et al., 2005

Yield changes as result of climate, CO_2 & technology

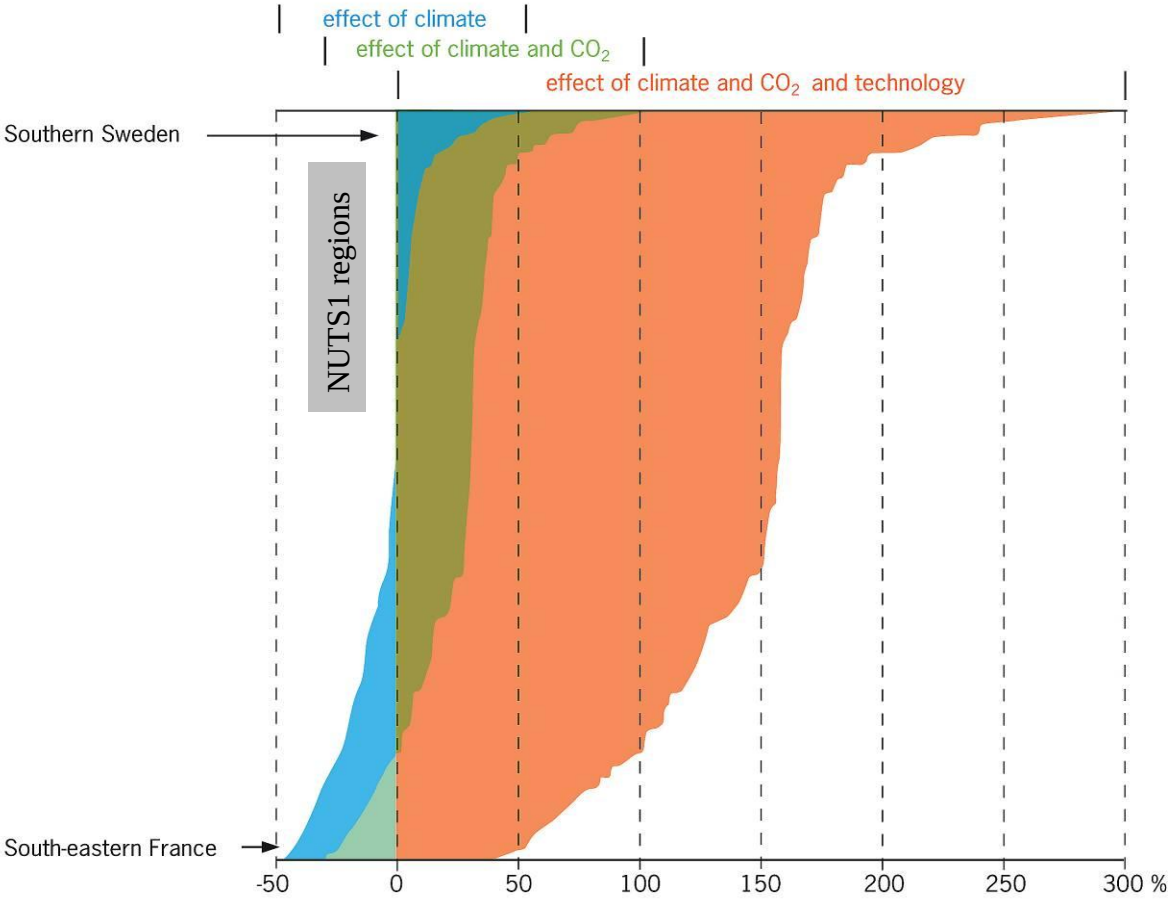
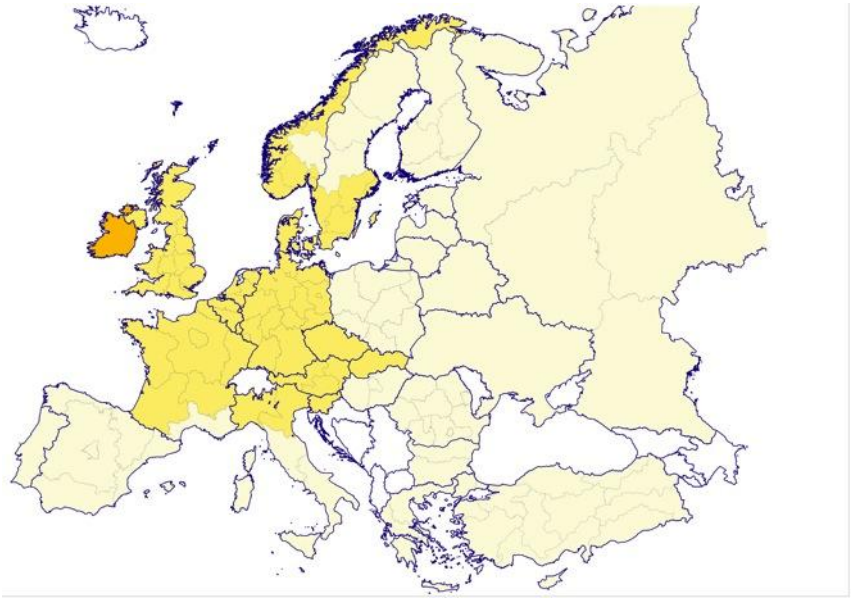


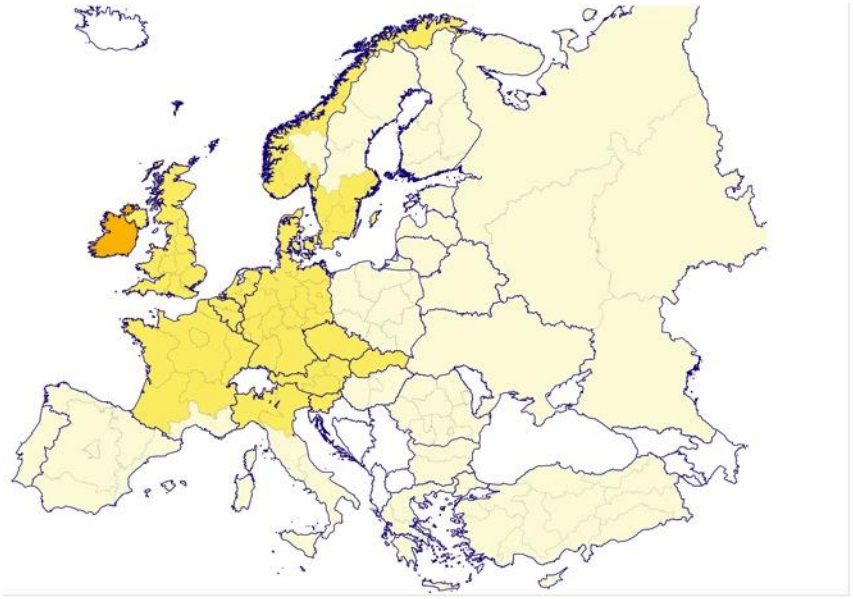
Figure 3: Changes (%) of productivity of wheat in European regions in 2050 compared to 2005 in scenario A1

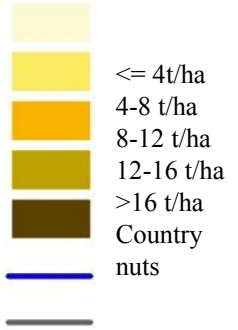
Achievable wheat productivity in 2005

A1



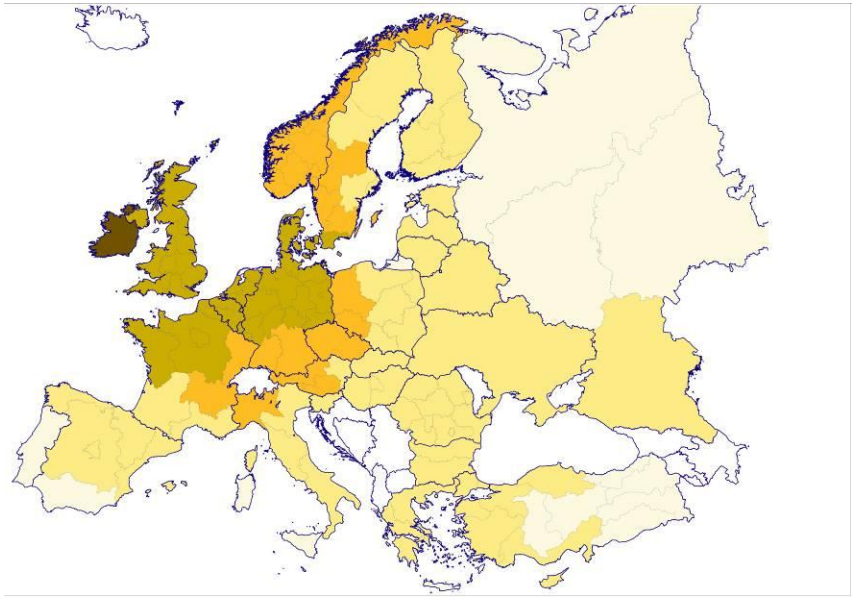
B2





Achievable wheat productivity in 2050

A1



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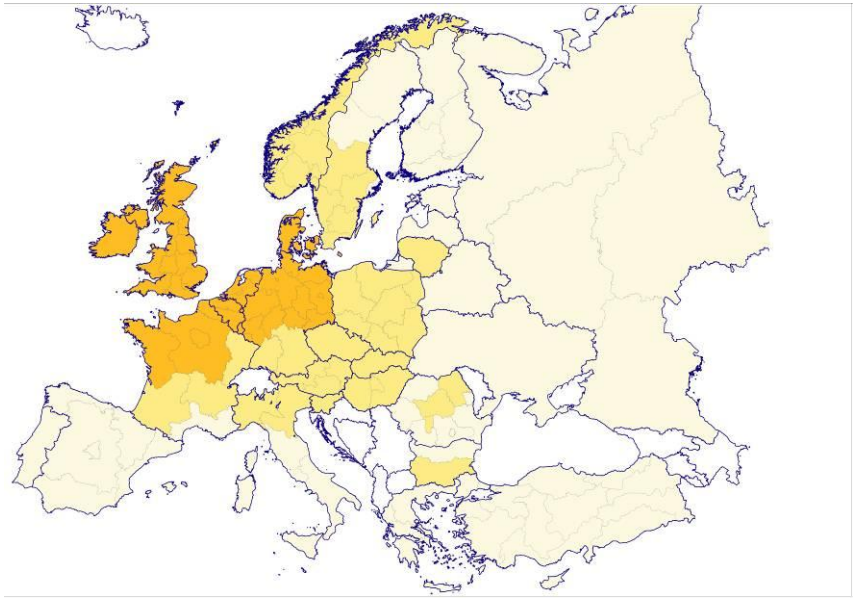
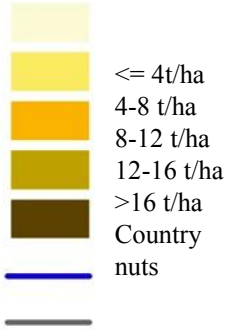
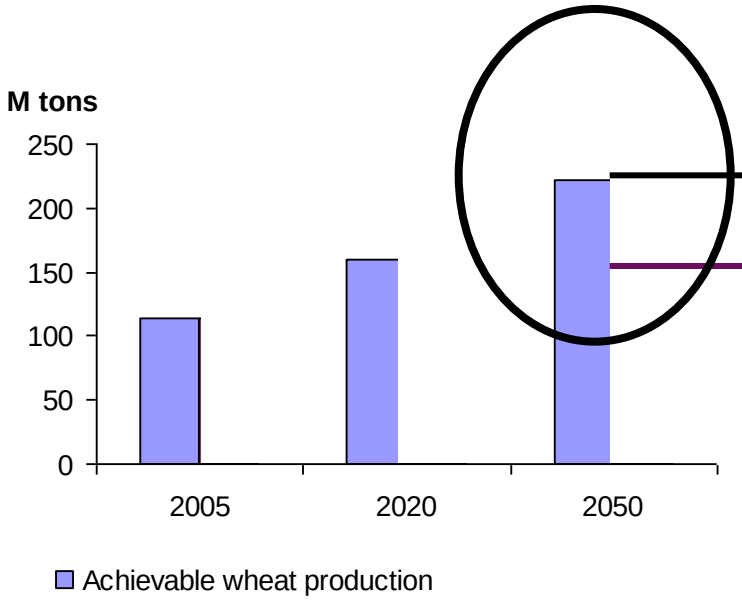




Achievable wheat production and demand

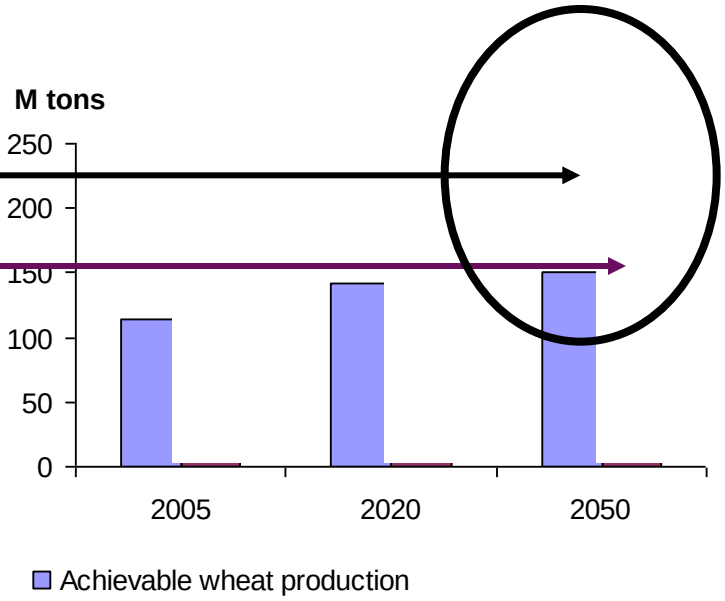
A1

Surplus of land



B2

Shortage of land



Verburg & Woltjer, pers.comm., based on GTAP

Results

- The effects of technology and market change are more pronounced than the effect of climate change
- A wide variability in regional production in Europe is predicted
- Possible policy responses should differ depending on the region

Aims of CARE research

- To assess the effects of climate change and adaptive measures (i.e. sets of concrete adaptation measures) on agriculture, nature and other land use functions in the rural landscape of the Netherlands
- To investigate, in a case study specific setting and in close collaboration with stakeholders, the feasibility and effectiveness of adaptation strategies

Central research questions (selection)

- Which adaptative measures are feasible options to create opportunities for nature restoration?
- What are promising adaptation measures for agriculture; how do farmers respond to them?
- What are the cross-sectional effects of adaptation?
- Which strategies are likely to have the highest potential in multifunctional landscapes?

Strategies are meant to

- Achieve a climate-versatile ecological structure that allows meeting high-standard, climate-adjusted nature targets
- Achieve good prospects for agriculture, the drinking water sector and other land use functions
- Whereby the overall functionality of the landscape is optimized

Research approach

- Quantify the spatial and abiotic requirements for adaptation
- Quantify the attitudes of land managers towards adaptation using ABM
- Generate design options for adaptation strategies in close cooperation with stakeholders
- Synthesis: comparison of alternative options

Work packages and projects

WP1: Integration

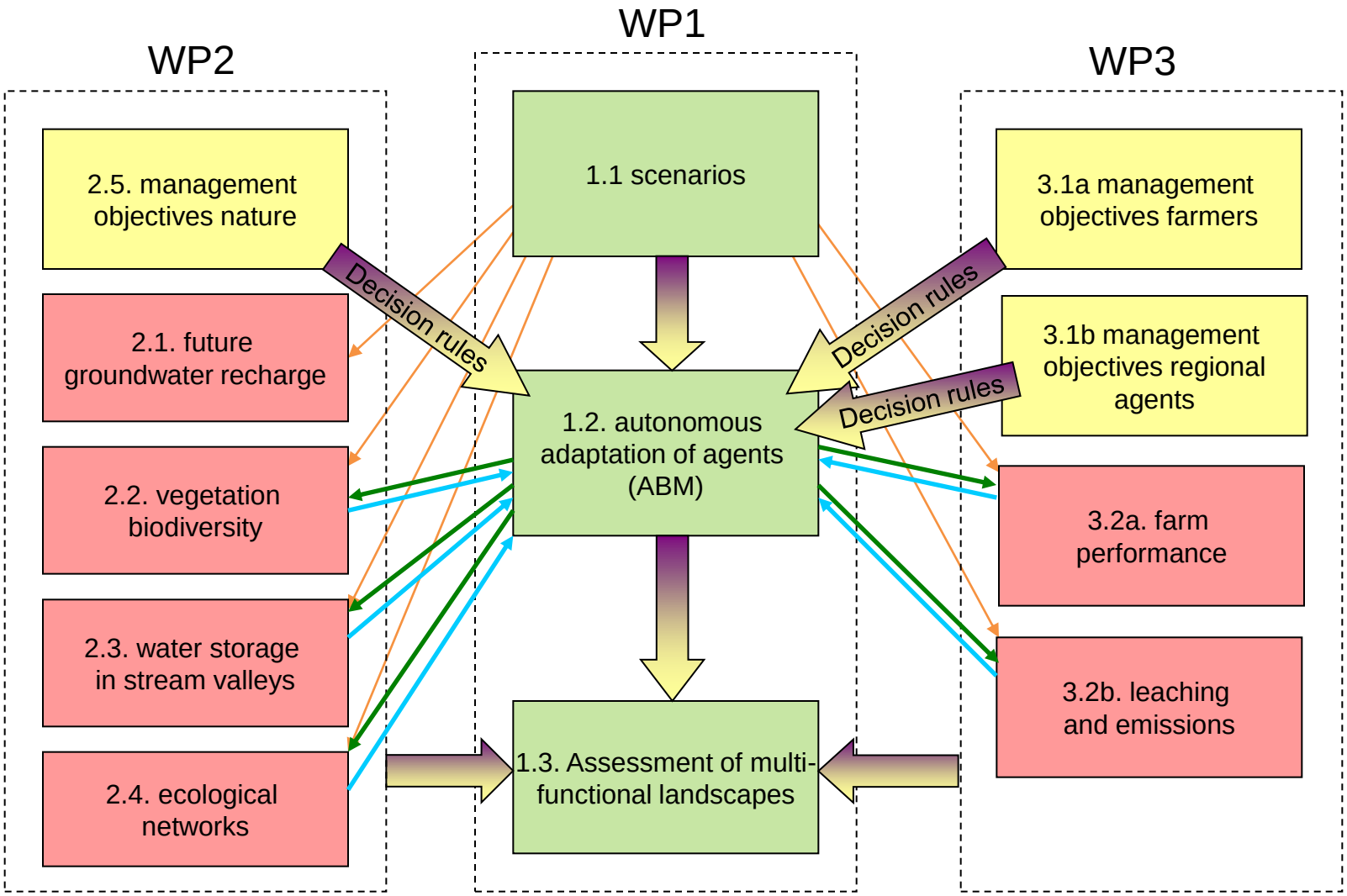
- 1.1 Coordination of scenarios and case studies; synthesis
- 1.2 Modelling attitudes to ecosystem services for adaptation
- 1.3 Participatory design options for integrated multifunctional adaptation strategies

WP2: Nature

- 2.1 The future groundwater recharge
- 2.2 A spatial and climate-robust model for vegetation biodiversity
- 2.3 Optimization of water storage in stream valleys in the elevated cover-sand landscape
- 2.4 Adaptation strategies for ecological networks
- 2.5 Climate proofing management objectives and spatial planning of nature

WP3: Agriculture

- 3.1 Drivers of adaptation by farmers
- 3.1.b. Drivers of adaptation by regional agents
- 3.2 Consequences of adaptation by farmers
- 3.2.b Consequences for emissions


WP1
WP2
WP3
1.1 scenarios
1.2. autonomous adaptation of agents (ABM)
1.3. Assessment of multi-functional landscapes
2.5. management objectives nature
2.1. future groundwater recharge
2.2. vegetation biodiversity
2.3. water storage in stream valleys
2.4. ecological networks
3.1a management objectives farmers
3.1b management objectives regional agents
3.2a. farm performance
3.2b. leaching and emissions
Decision rules
Decision rules
Decision rules

Innovative aspects

- Simulating human response by agent based modelling
- Optimizing the functionality of the landscape
- Simulating spatial “spill-over” effects between nature and agriculture
- Quantifying and assessing the biophysical effects of climate change

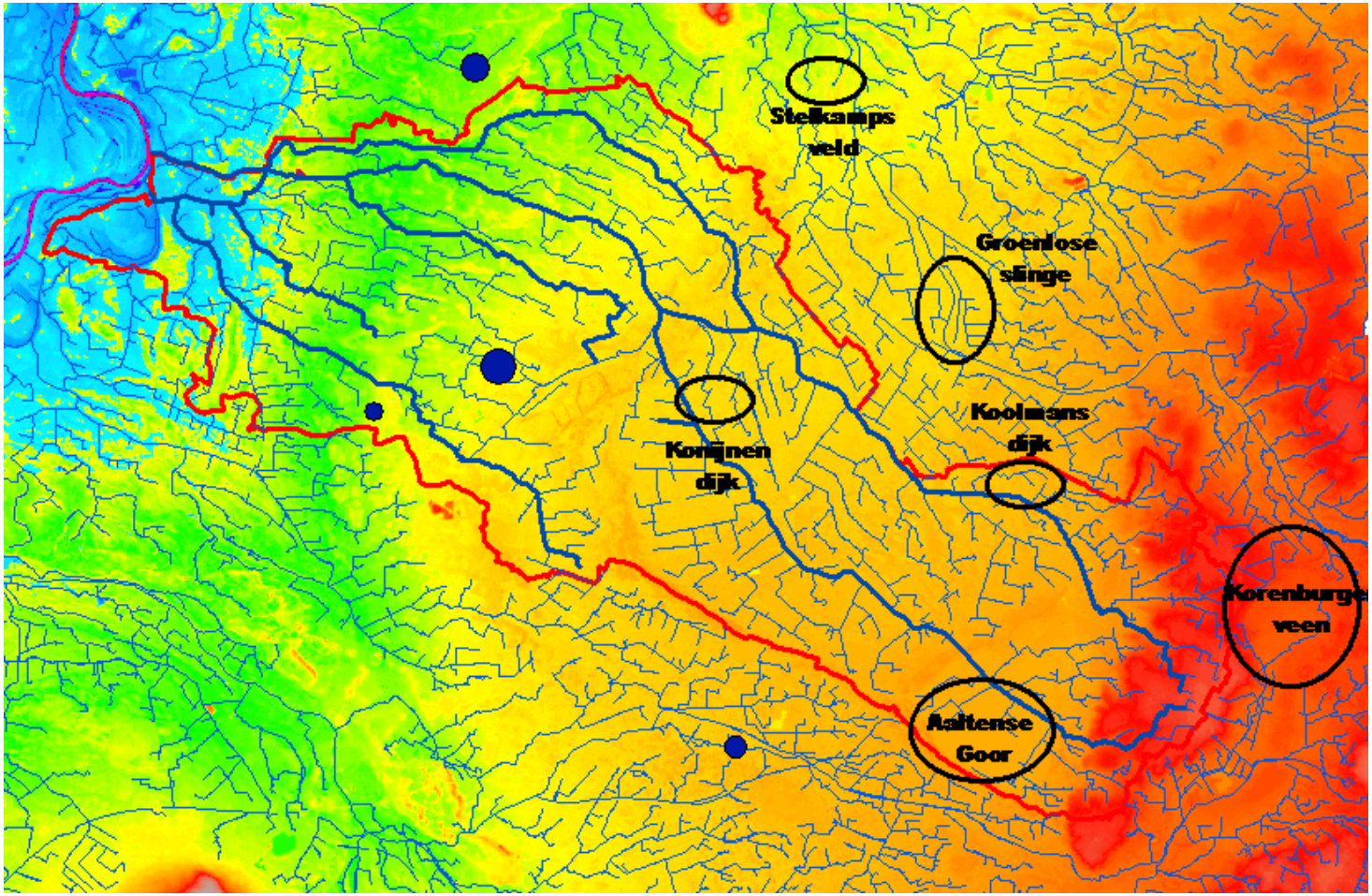
Case study areas

- Baakse Beek
- Blauwe Bron
- Tungelroyse Beek
- Groene Ruggengraat (Green Backbone)
  together with KfC 2 Fresh water supply
- Texel


Amsterdam
Netherlands
Rotterdam
Duisburg
(Dusseldorf)
Düsseldorf
(Cologne)
Köln
Bruxelles
Brussel
Belgium

Case study Baakse Beek

Ground levels



Current activities

- Identification of specific climate related problems and adaptation options
- Scenario building: storey lines for exogenous model inputs
- Selection of policy options and land management alternatives
- Interviews with farmers
- Communication with regional stakeholders