

# *Land-use scenario modelling recent results*

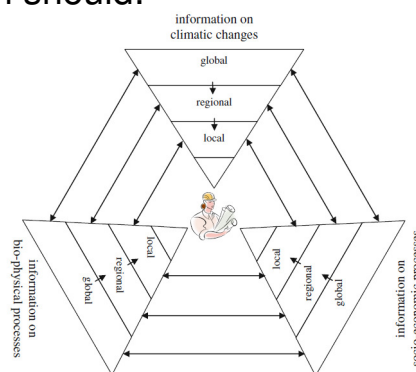
Eric Koomen  
VU University Amsterdam

International workshop  
Adaptation Decision Support Method and Tools  
October 3, 2012

## Introduction

Climate adaptation research should:

1. put decision maker central
2. offer an *integrated* view on landscape system and changes in its components
3. address links between scale levels

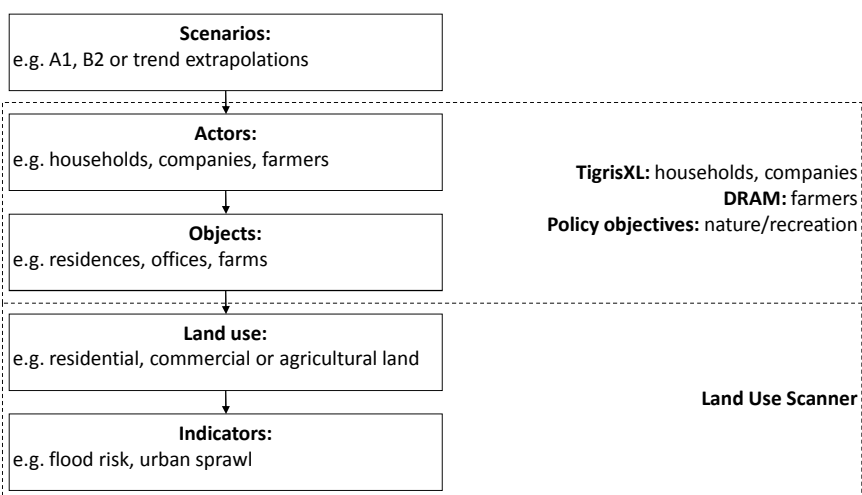


Koomen et al., 2012

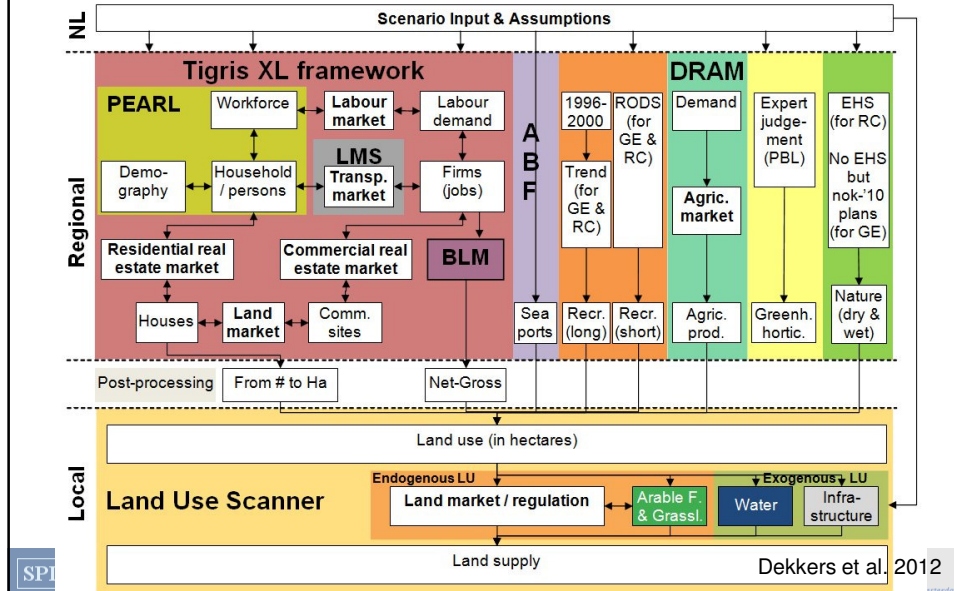
## Outline

- Land-use modelling
  - our framework and Land Use Scanner model
- Integrating climate and climate scenarios
  - LANDS project layout
  - assessing climate related impacts
  - exploring policy alternatives (nature, biofuel)

## Land-use modelling framework



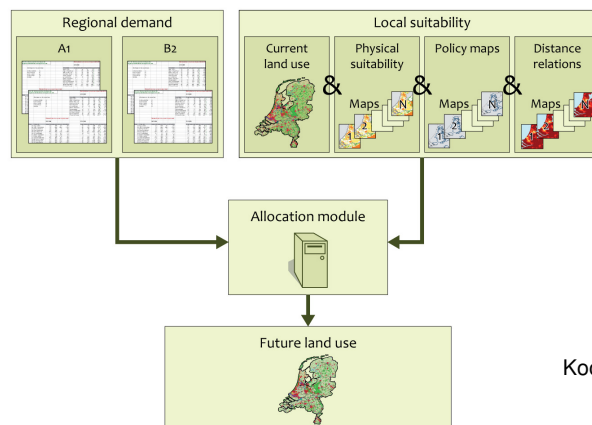
## Modelling framework more extensive



## Land Use Scanner

- Operational information system since 1997
- Developed by several institutes

Land Use Scanner layout



## Recent applications

- Scenario framework for climate adaptation
- Potential for biofuel (with LEI & WUR in LANDS)
- Evaluating nature adaptation strategies (Lands)
- EU-ClueScanner (with OV for EC-DG Env./JRC)
- Developing regional spatial strategies (Geodan for several provinces)
- SEA new national spatial strategy (for Min. IM)
- Rhinescanner (flood risk assessment)
- Regional climate adaptation (Veenkoloniën)
- Climate adaptation in Flanders (with Univ. Gent)
- Germany, Honduras, Surinam and Bangladesh

## Scenario framework for climate adaptation

Designing national land-use adaptation and mitigation strategies under changing climate conditions (LANDS)

Many partners, interdisciplinary, large and long-lasting: 2005-2011



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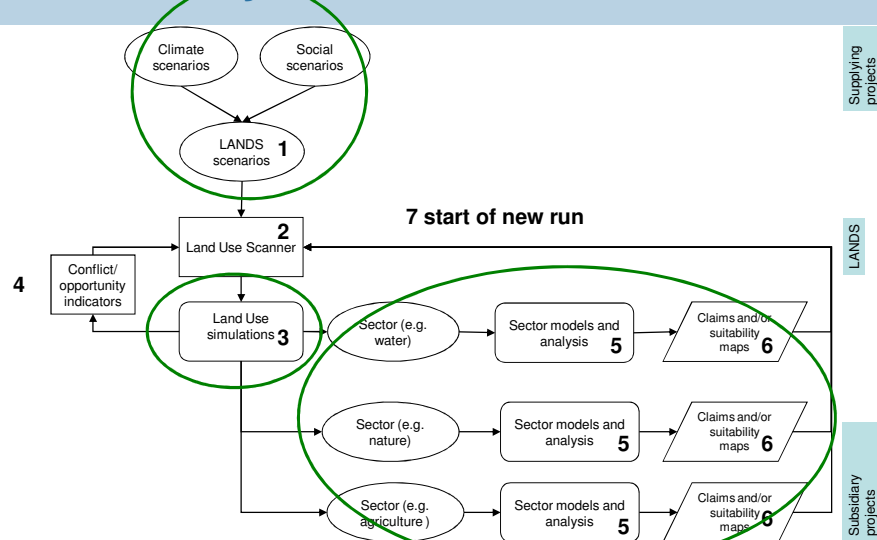
Government-funded project in 'Climate changes spatial planning' program that consists of over 30 projects



## LANDS - objectives

- developing a consistent scenario-framework
- improving the *Land Use Scanner* model
- delivering baseline outlooks for 2040:
  - integrated land use, adaptations for nature, water en urban functions to be added later
- integrating sector-specific adaptation measures from other projects

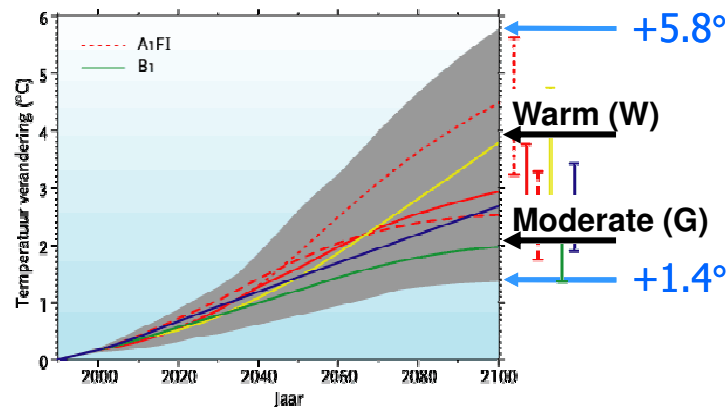
## LANDS – layout



Koomen et al., 2008

## Dutch climate scenarios

Based on variability climate models:



Van der Hurk et al., 2006

SPIN lab Spatial Information Laboratory



## Climate scenarios: figures

WINTER <sup>[1]</sup>	G	G+	W	W+
Mean temperature	+0,9°C	+1,1°C	+1,8°C	+2,3°C
Yearly coldest day (K)	+1,0°C	+1,5°C	+2,1°C	+2,9°C
Mean precipitation (%)	+4%	+7%	+7%	+1,4%
Wet day frequency (%)	0%	+1%	0%	+2%
10 year return level daily precipitation sum (%)	+4%	+6%	+8%	+12%
Yearly maximum daily mean wind speed (%)	0%	+2%	-1%	+4%
SUMMER <sup>1</sup>	G	G+	W	W+
Mean temperature	+0,9°C	+1,4°C	+1,7°C	+2,8°C
Yearly coldest day (K)	+1,0°C	+1,9°C	+2,1°C	+3,8°C
Mean precipitation (%)	+3%	-10%	+6%	-19%
Wet day frequency (%)	-2%	-10%	-3%	-19%
10 year return level daily precipitation sum (%)	+13%	+5%	+27%	+10%
Potential evaporation (%)	3%	+8%	+7%	+15%
Absolute sea level rise	15-25 cm	15-25 cm	20-35 cm	20-35 cm

<sup>[1]</sup> Winter is December, January and February.  
Summer is June, July and August.

Van der Hurk et al., 2006

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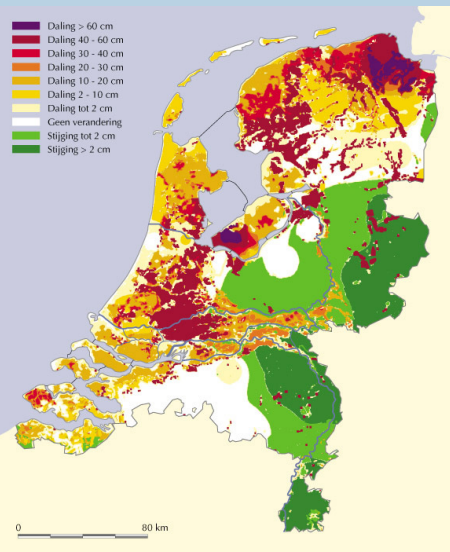


## Climate changes spatial planning

### Climate change impacts policy domains:

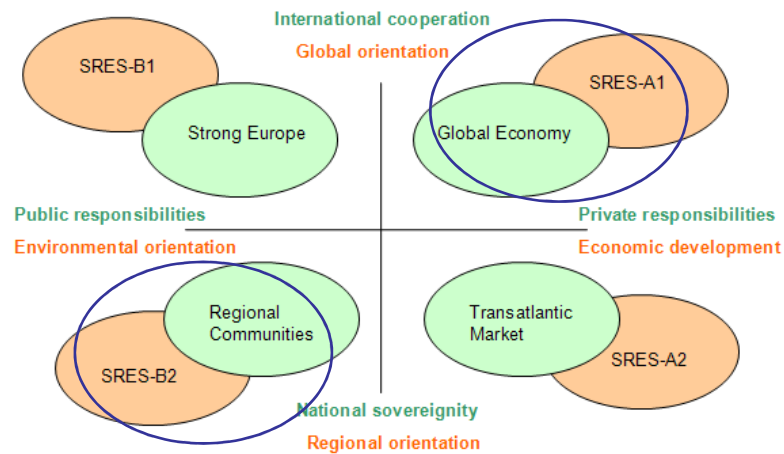
- water management
  - retention areas
  - safe construction
  - adapt sewage system
- coastal defence
- adapt spatial policies (i.e. National Ecological Network, urbanisation)
- changes in agricultural sector?
- But other changes are (more?) relevant!

## Physical changes: soil subsidence



Rijkswaterstaat, 1997

## Socio-economic changes: WLO-scenarios



CPB et al., 2006

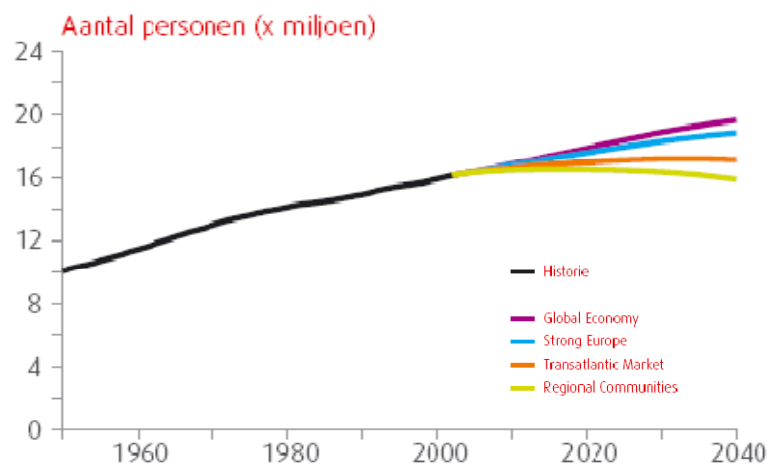
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## Dutch socio-economic scenarios (WLO)

### Population



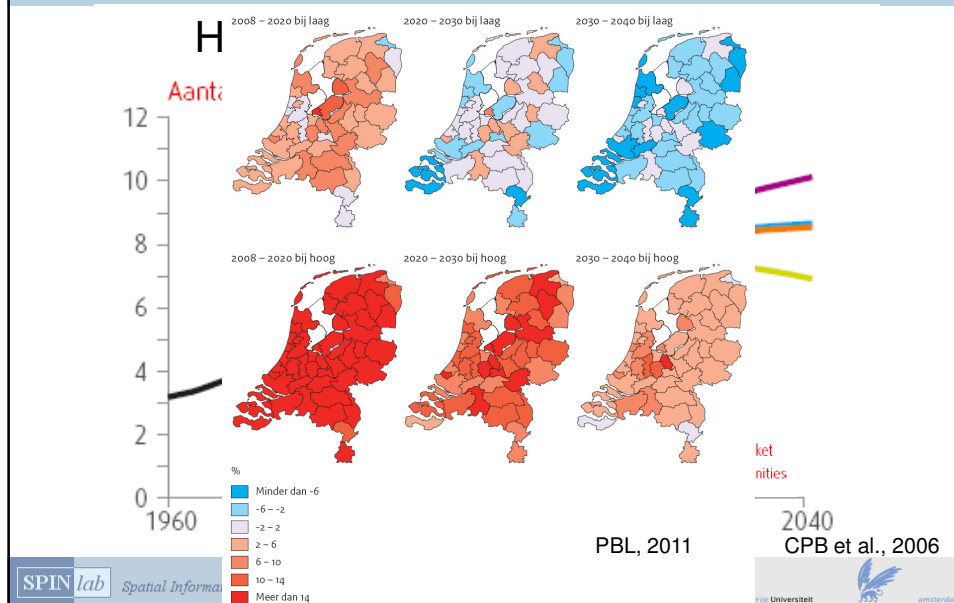
CPB et al., 2006

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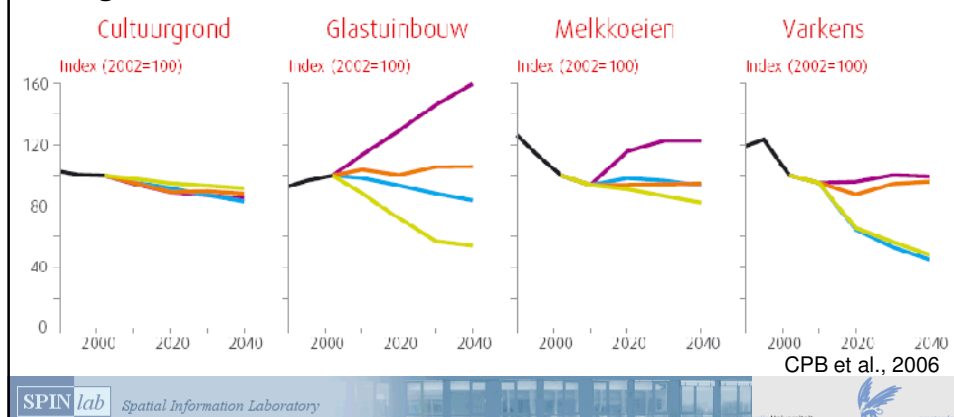


## Dutch socio-economic scenarios (WLO)



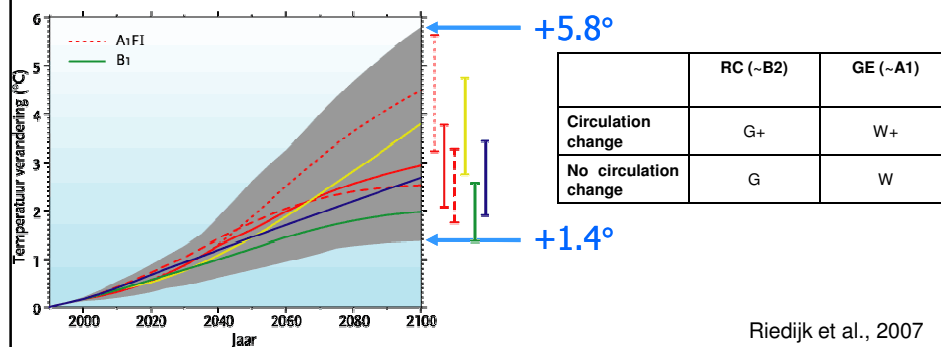
## Dutch socio-economic scenarios (WLO)

### Agricultural area and animal stock

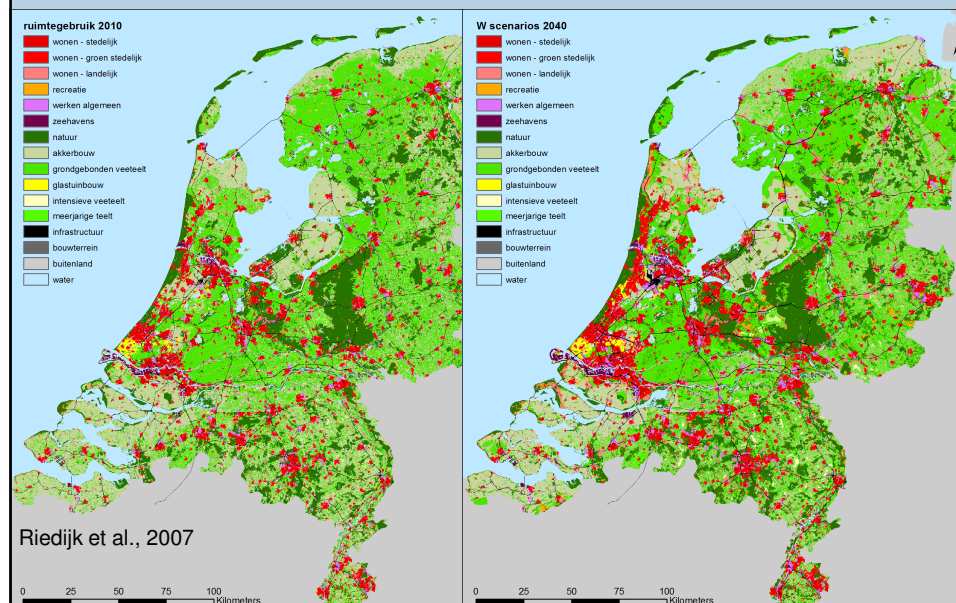


## LANDS - scenario framework

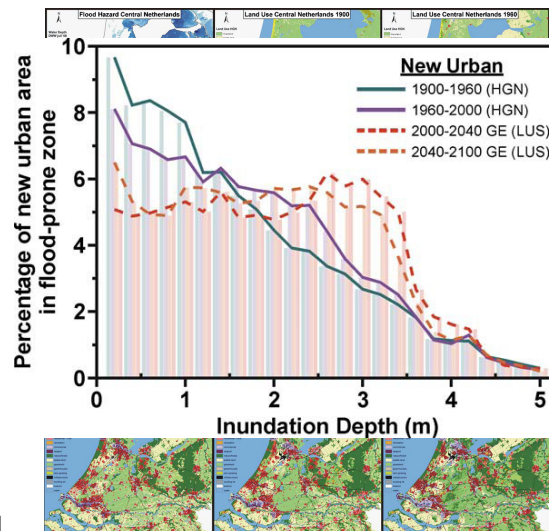
Quantitative assumptions regarding climate, population, economy and society are combined from KNMI and WLO



## LANDS - baseline outlooks 2040



## Scenario framework allows analysis of climate impacts: flood risk over time



De Moel et al., 2011

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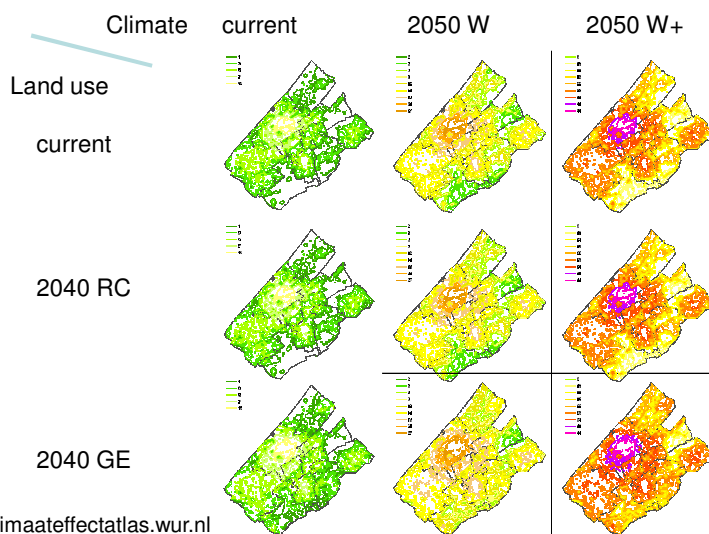
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## Scenario framework allows analysis of climate impacts: urban heat island effect



klimateffectatlas.wur.nl

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## Scenario framework allows exploration of policy alternatives: biofuel generation

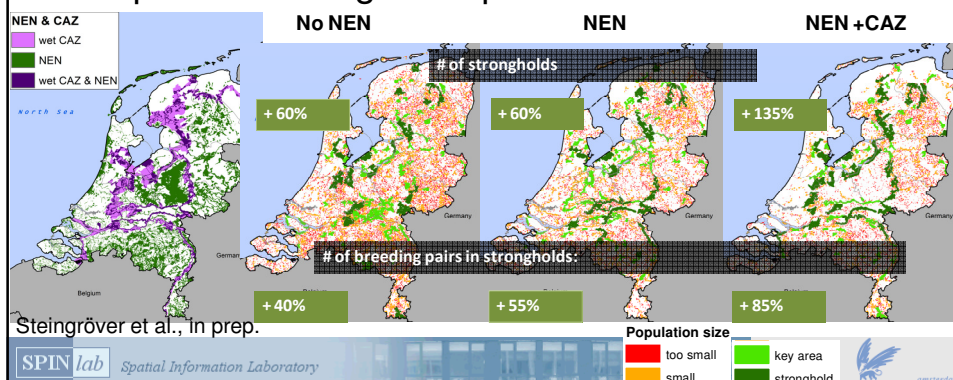
ID	Policy alternative	Removal of CAP subsidies for arable farming crops	CAP biofuel crops subsidies equal to arable farming crops	Seeds subsidy
#1	Reference	No	No	No
#2	CAP	Yes	No	No
#3	CAP Biofuel	No	446€/ha per year	No
#4	Investment	No	No	3600€/ha in year 1



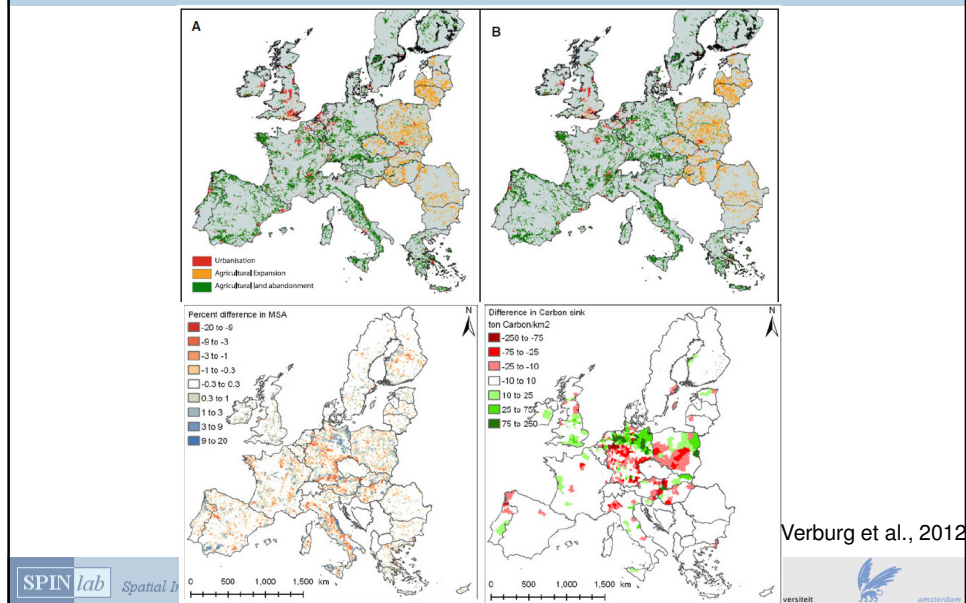
Diogo et al., 2012

## Scenario framework allows exploration of policy alternatives: nature adaptation

- Various nature development policies tested
- Focus on wet types of nature
- Incorporating future hydrologic conditions (W+)
- Impact on ecological impacts with LARCH model



## Similar experiences in EU



## Conclusion

- Land-use modelling allows
  - downscaling of global changes to local spatial patterns
  - integration of socio-economic and climate scenarios
  - assessment of local impacts (e.g. flood risk)
  - development and evaluation of sector-specific adaptations (policy alternatives)
- Methods and results used with policy makers
- Scenarios should cover bandwidth of possible developments
- Temporal mismatch societal and climatic changes

## Future work

- Updated land-use scenarios available soon (coordinated with development Delta scenarios)
- Incorporate bottom-up feedbacks, e.g. local profit for farmer
- Focus on densities rather than land use, e.g. number of residences or residents
- Explore other ways of representing outcomes
- New climate impact assessments
- Contribute to the development of interactive (participatory) planning tools

## Further reading

### Publications and downloads

- [www.feweb.vu.nl/ai](http://www.feweb.vu.nl/ai)

