Jakarta Climate Adaptation Tools

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JCAT: main objective

- To contribute to the development of tools to assess, compare, and optimise options for flood risk management and adaptation in delta cities, with a case study for Jakarta

Jakarta Climate Adaptation Tools (JCAT)

- **Research partners:**
  - VU University Amsterdam
  - Wageningen University
  - UGM Yogyakarta
  - IPB Bogor
  - BPPT: Agency for the Assessment and Application of Technology

- **Funding agencies**

Knowledge for Climate

DeltAlliance

Recent flood impacts




- Parts of city flood every month (high tides)
- Major floods in 2002, 2005, and 2007
- Flood of 2007
  - 58-74 deaths
  - > USD450 million direct damage
  - Closure of many main arterial routes for days
  - Missed work days (indirect economic damage)

Brief history of flooding

	1652	Present
Jakarta		
Rotterdam		

Traditional flood management

Traditional flood management

Flood risk management

The elements (e.g. buildings, humans, economic values) present in the area affected

The threatening event (including its probability and geographical extent)

The resistance or lack of resistance of the exposed elements to the hazard

Flood risk management

Flood risk reduction: examples

JCAT: setup

Research Theme 1 – Pak Yus Budiyono

UGM Yogyakarta and VU University Amsterdam

- to develop methods to assess the impacts of climate change **and other physical and socioeconomic** changes on flood risk in Jakarta, and to use these to assess the impacts of various adaptation measures on flood risk

Research Theme 2 – Ibu Pini Wijayanti

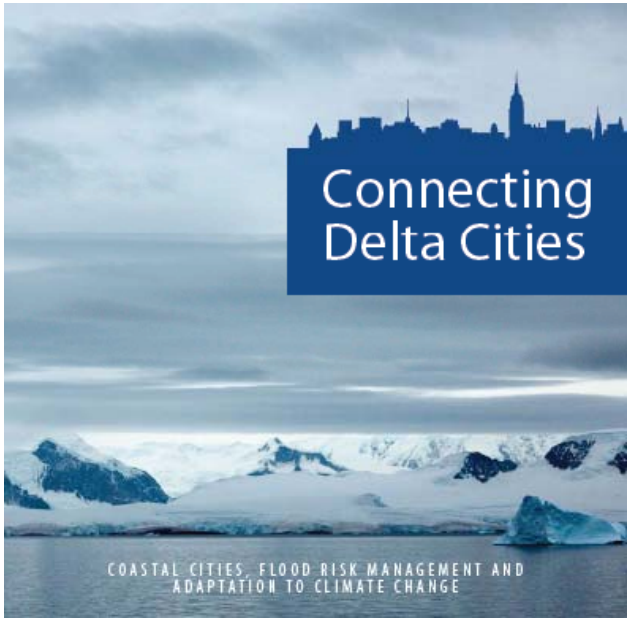
IPB Bogor and WUR Wageningen

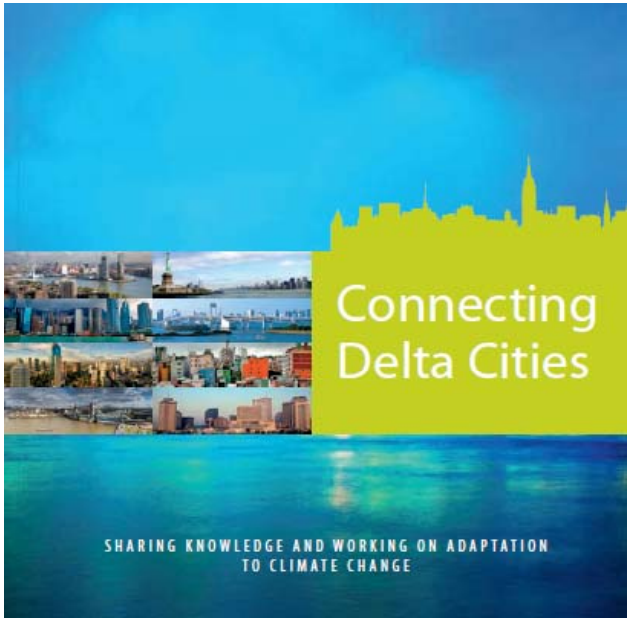
- to assess the economic costs and benefits of alternative options for adaptation to climate change for Jakarta

JCAT: publications

Ward, P.J., Pauw, W.P, Van Buuren, M.W., Marfai, M.A., 2012. Governance of flood risk management in a time of climate change: the cases of Jakarta and Rotterdam. **Environmental Politics**, doi:10.1080/09644016.2012.683155

Ward, P.J., Marfai, M.A., Yulianto, F., Hizbaron, D.R., Aerts, J.C.J.H., 2011. Coastal inundation and damage exposure estimation: a case study for Jakarta. **Natural Hazards**, doi:10.1007/s11069-010-9599-1.





Flood risk assessment in Jakarta

Yus Budiyono

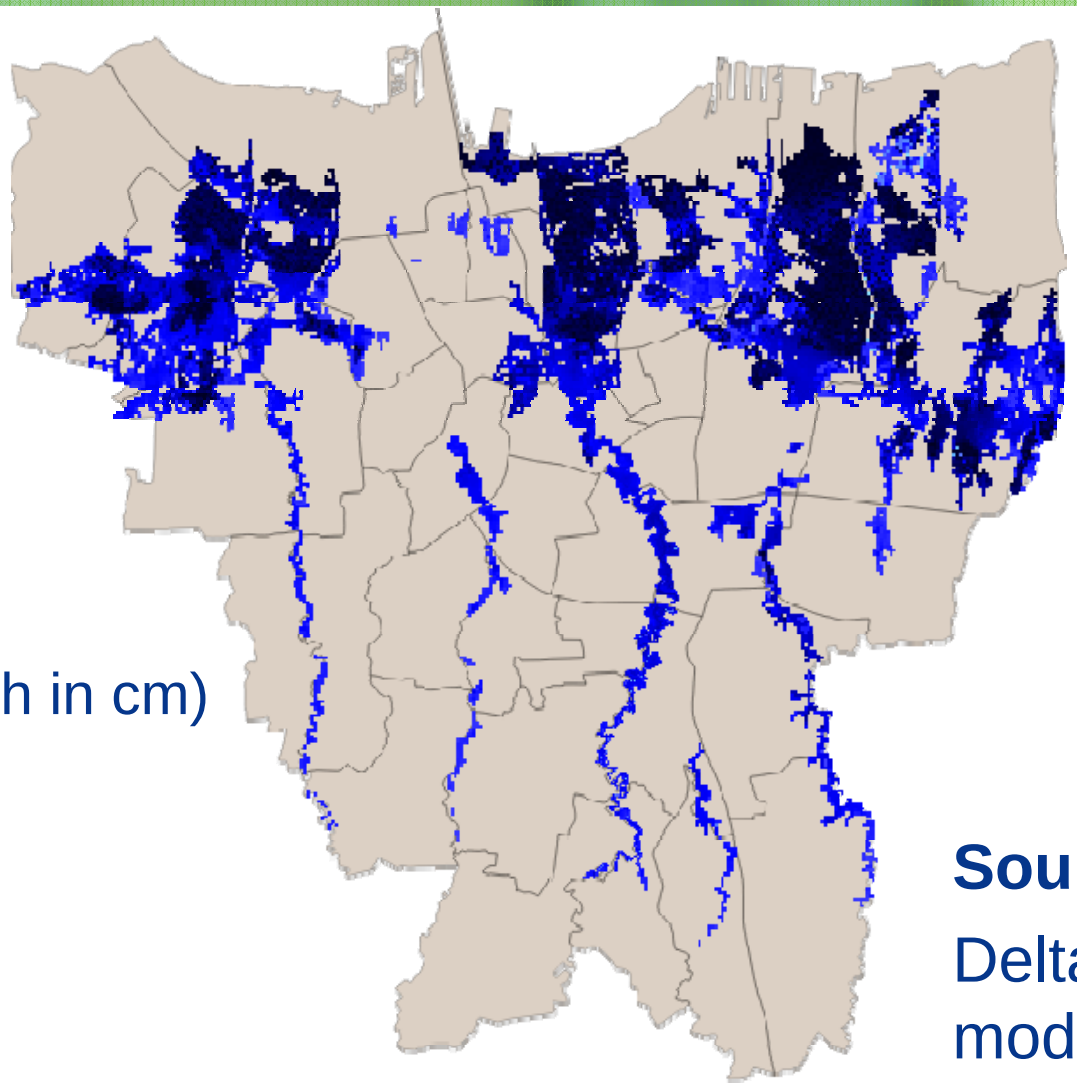
Map of Jakarta: overview

North

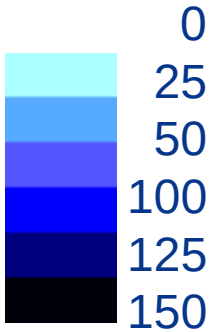
Map of Jakarta: delineation of districts

North

Hazard: inundation depths, 25 year return period



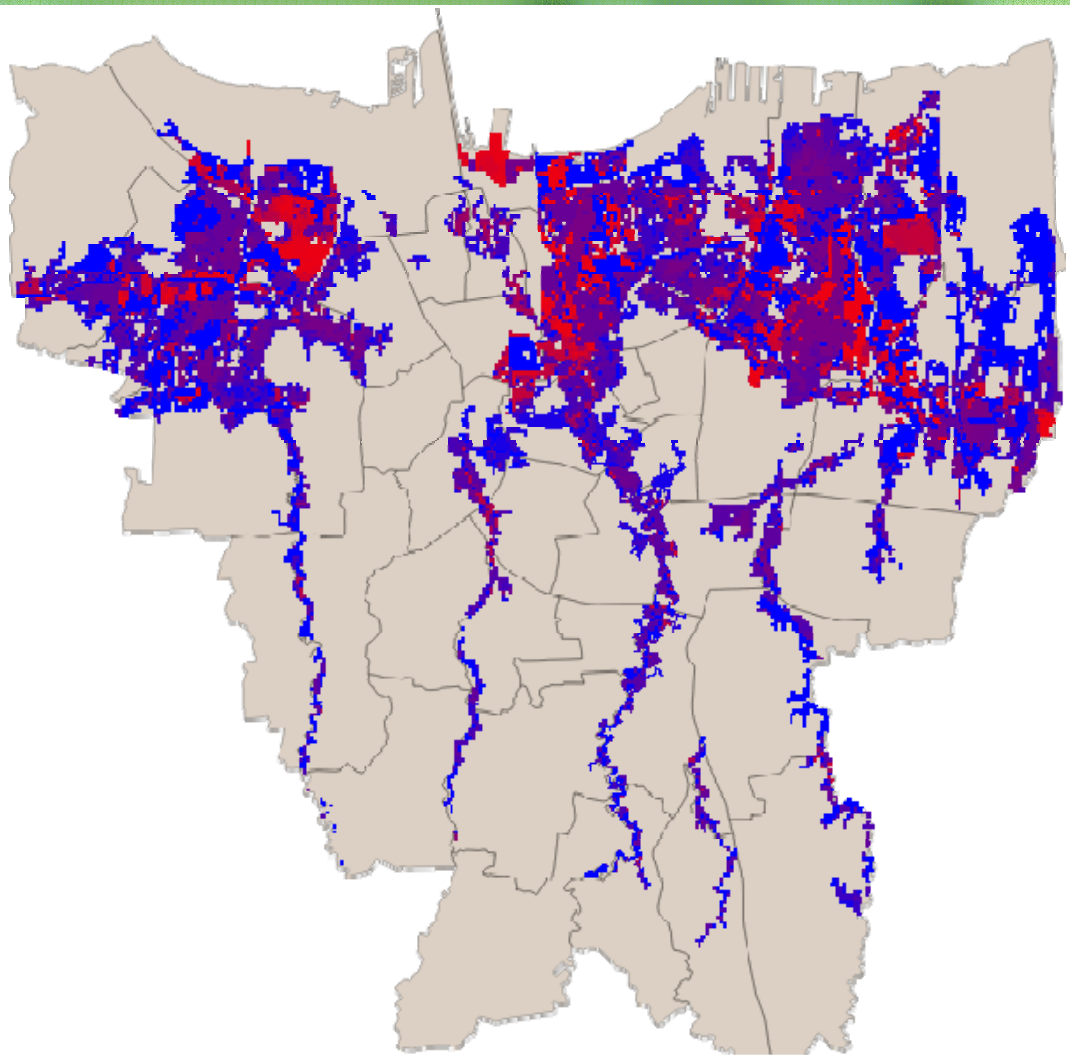
Legend:
(inundation depth in cm)



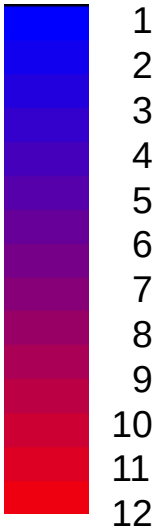
Source:

Deltares hazard model 2011

Flood loss/damage map: 25 year return period



Legend:
loss in million USD/ha



Risk reduction based on Flood Early Warning System (FEWS)

- Flood Early Warning System combined with mobile phone SMS message to alert citizens in potentially inundated areas

- Analysis carried out **for residential areas only** (which account s for 55% of total loss).

- Preliminary results indicate that Flood Early Warning System could decrease flood risk in residential areas by up to 65% (upper-end estimate)

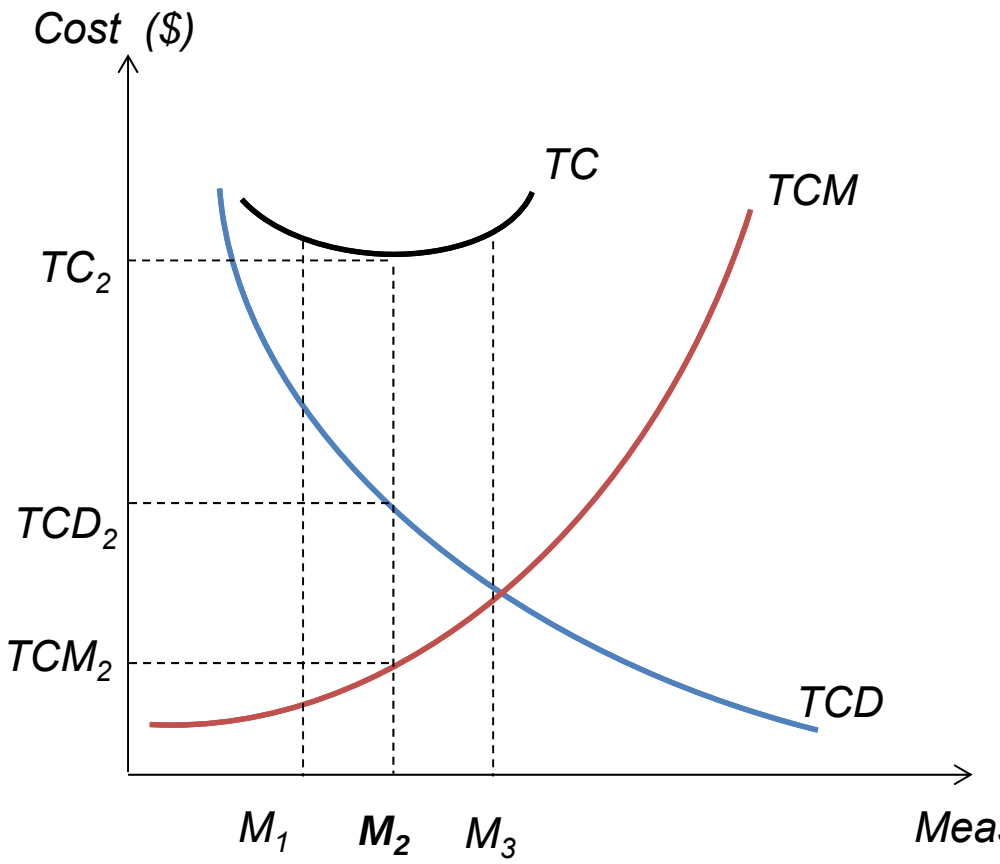
Economic setting of flooding issues in Jakarta

Pini Wijayanti

How to find the best adaptation measures?

- Stakeholder consultations
- Social planner's objective: maximizing society's welfare, by minimizing total costs
- *TC = TCM + TCD*
- Budget constraint
- Spatial issues
- Time issues

The social planner's objective



To minimize

$$TC = TCM + TCD$$

TC : Total Costs ($)
TCM : Total Costs of Measures ($)
TCD : Total Costs of Damages ($)

Choosing the best measures in one area

Objective:

$$\text{Minimize } TC = TCM + TCD$$

$$TCM = \sum_{i=1}^{n} C_i$$

$$C_i = \sum_{j=1}^{m} \alpha_i (M_i)^2$$

$$TCD = D0 - \sum_{i=1}^{n} \beta_i M_i$$

Subject to

$$C_1 + \ldots + C_n \leq B$$

Where:

C_i : cost of a measure i ($),

α_i : the price of measure i ($/unit measure i),

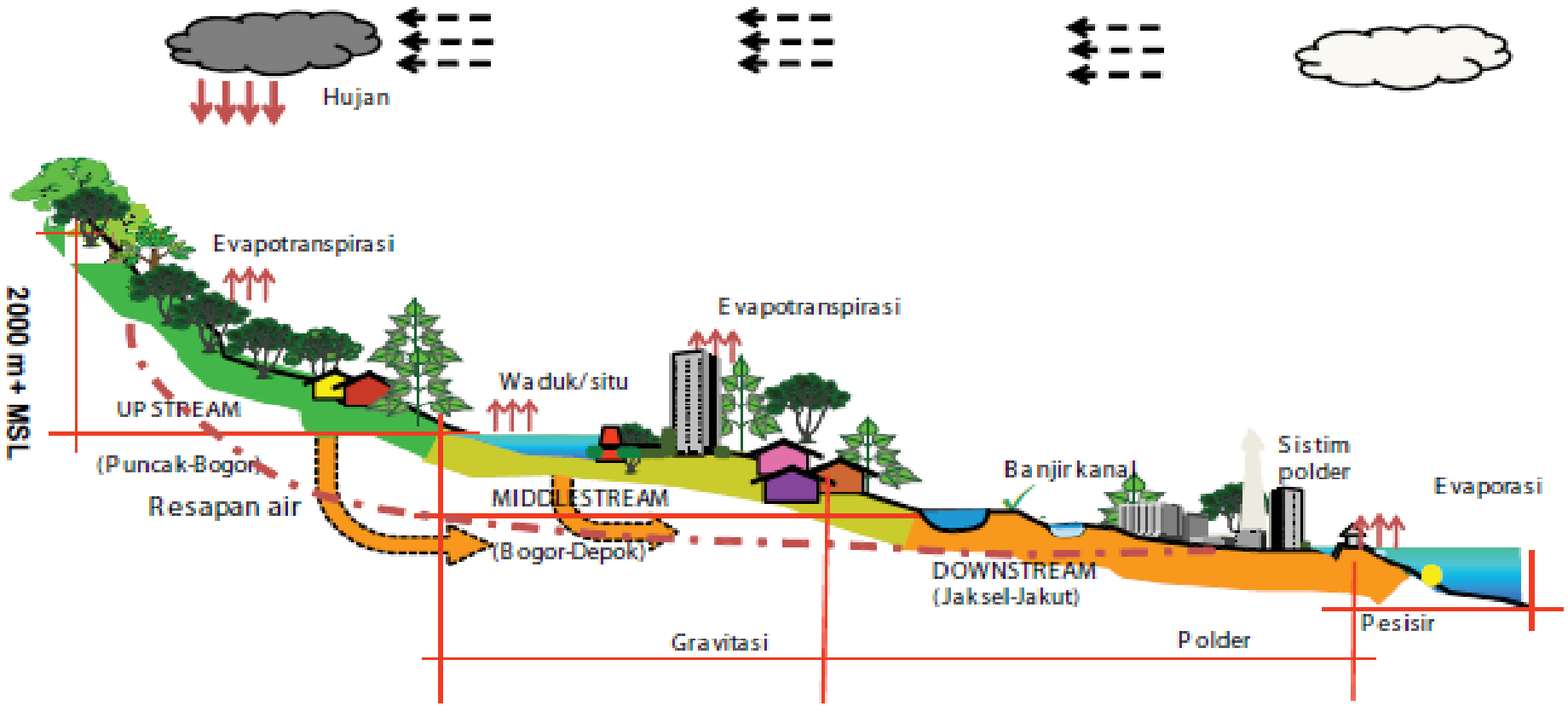
M_i : level of measure i (level)

$D0$: current direct damages flood flooding ($),

β_i : parameter of reduced damage from measure i

B : total budget ($)

River and catchment from upstream to downstream for Jakarta basin



Choosing the priority locations and best measures

Objective:

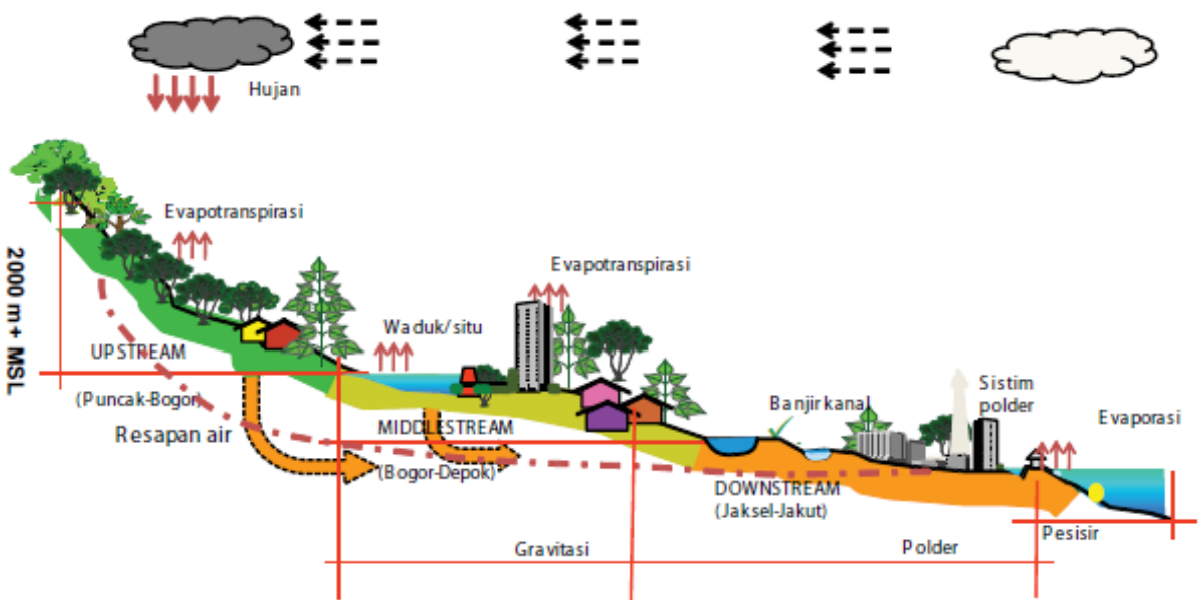
$$\text{Minimize } TC = TCM$$

$$TCM = \sum_{j=1}^{m} TCM_j$$

$$TCM_j = \sum_{i=1}^{n} \alpha_{ij} (M_{ij})^2$$

$$TCD = \sum_{j=1}^{m} TCD_j$$

$$TCD_j = D0_j - \sum_{i=1}^{n} \beta_{ij} M_{ij}$$



Subject to: $TCM_1 + \ldots + TCM_n \leq B$

Choosing the priority locations and best measures in time

Objective:

$$\text{Minimize } TC = TCM + TCD$$

$$TCM = \sum_{t=0}^{T}\sum_{i=1}^{n}\sum_{j=1}^{m}\frac{1}{(1+r)^t}TCM_{i,j,t}$$

$$TCD = \sum_{t=0}^{T}\sum_{i=1}^{n}\sum_{j=1}^{m}\frac{1}{(1+r)^t}TCD_{i,j,t}$$

Subject to:

$TCM_1 + \ldots + TCM_n \leq B$

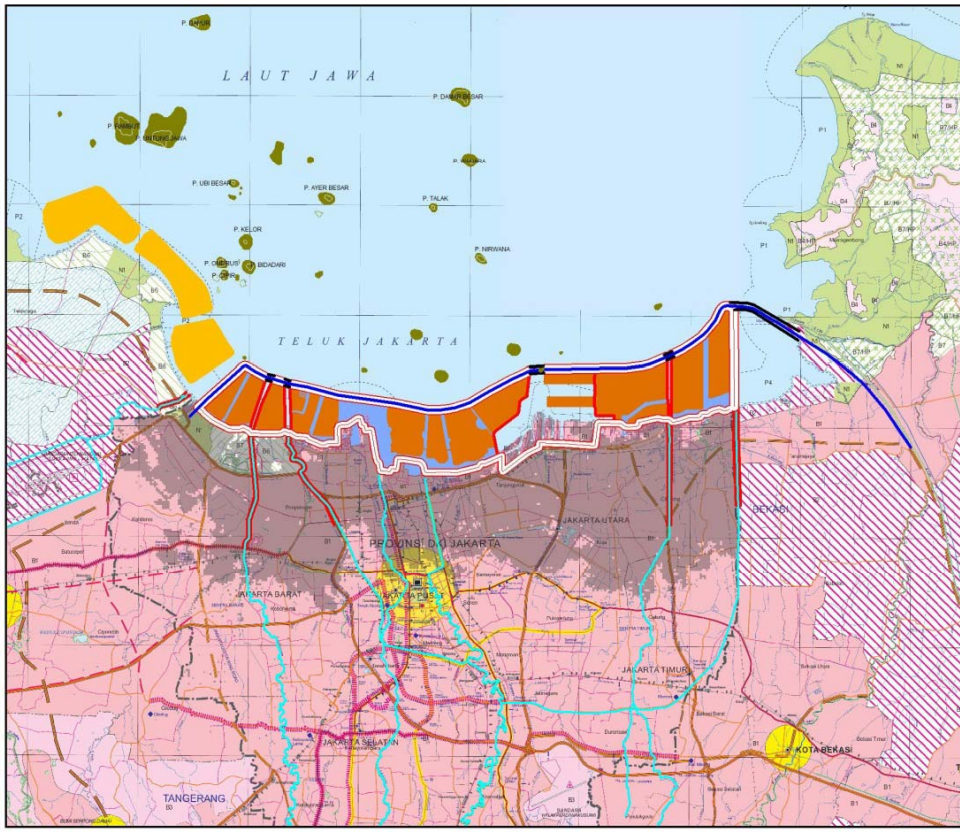


Figure: Jakarta Coastal Defence Strategy

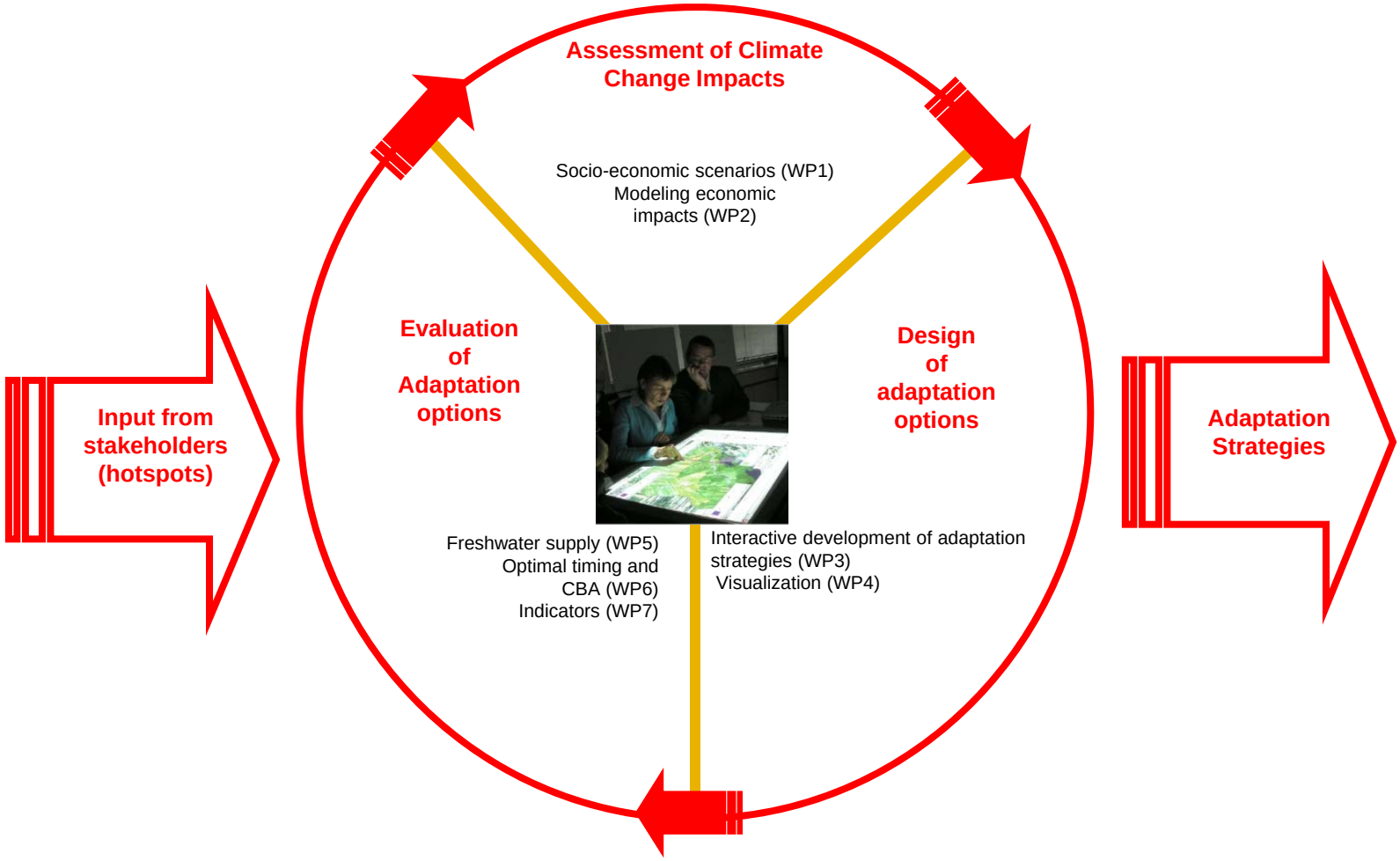
National Research Programme: The Netherlands

Knowledge for Climate

Theme 8: Tools for adaptation

Ekko van Ierland

Coherence of the programme

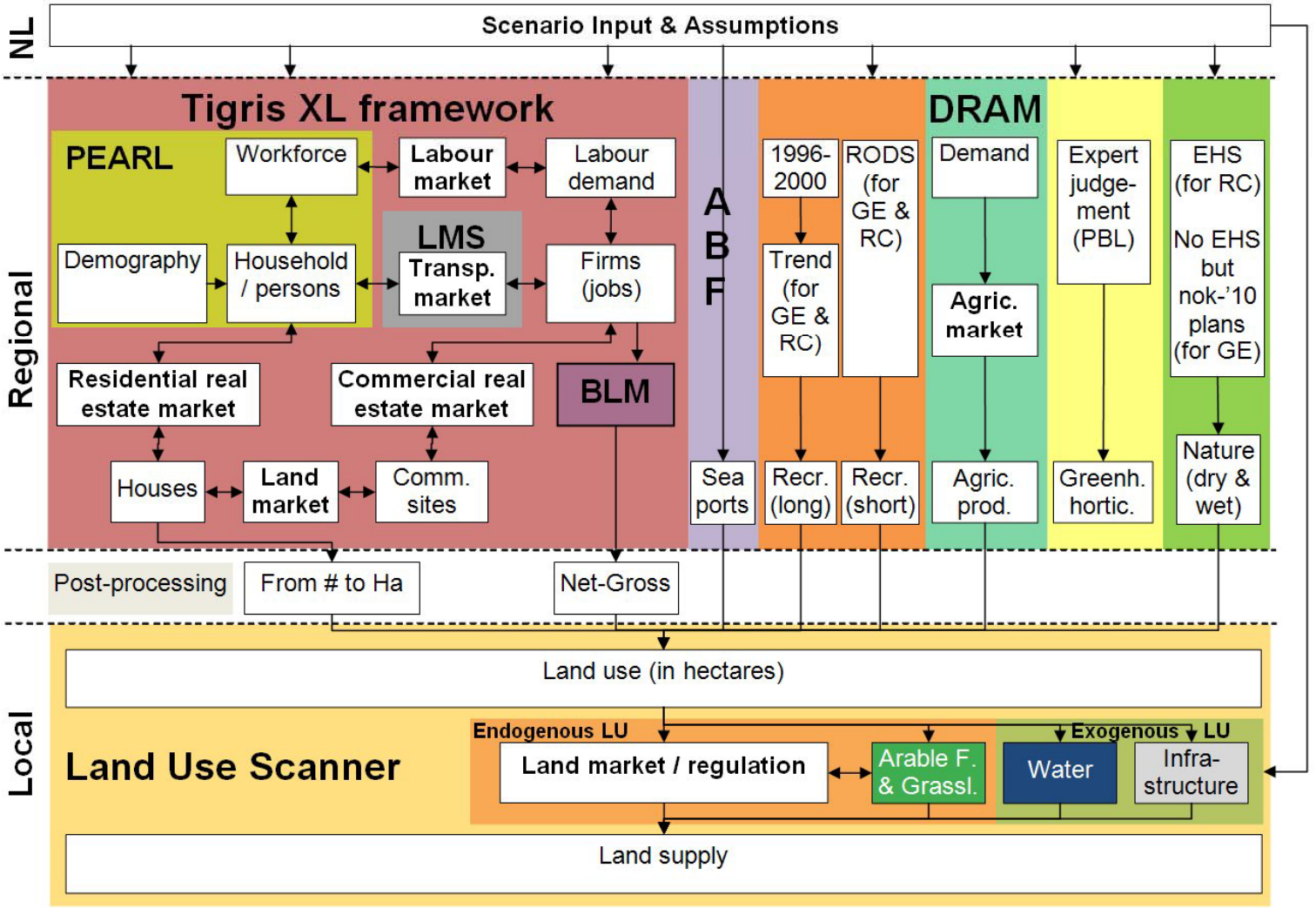


Research aims Work Package 1

1. Integrating socioeconomic and climate scenarios in a land-use modeling framework

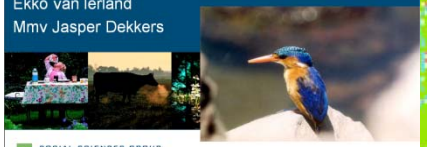
2. Incorporating intensity and multi-functionality in a land-use model

Revised modelling framework



Het Nederlandse landschap in economisch perspectief: de Vechtstreek

Ekko van Ierland
Mmv Jasper Dekkers



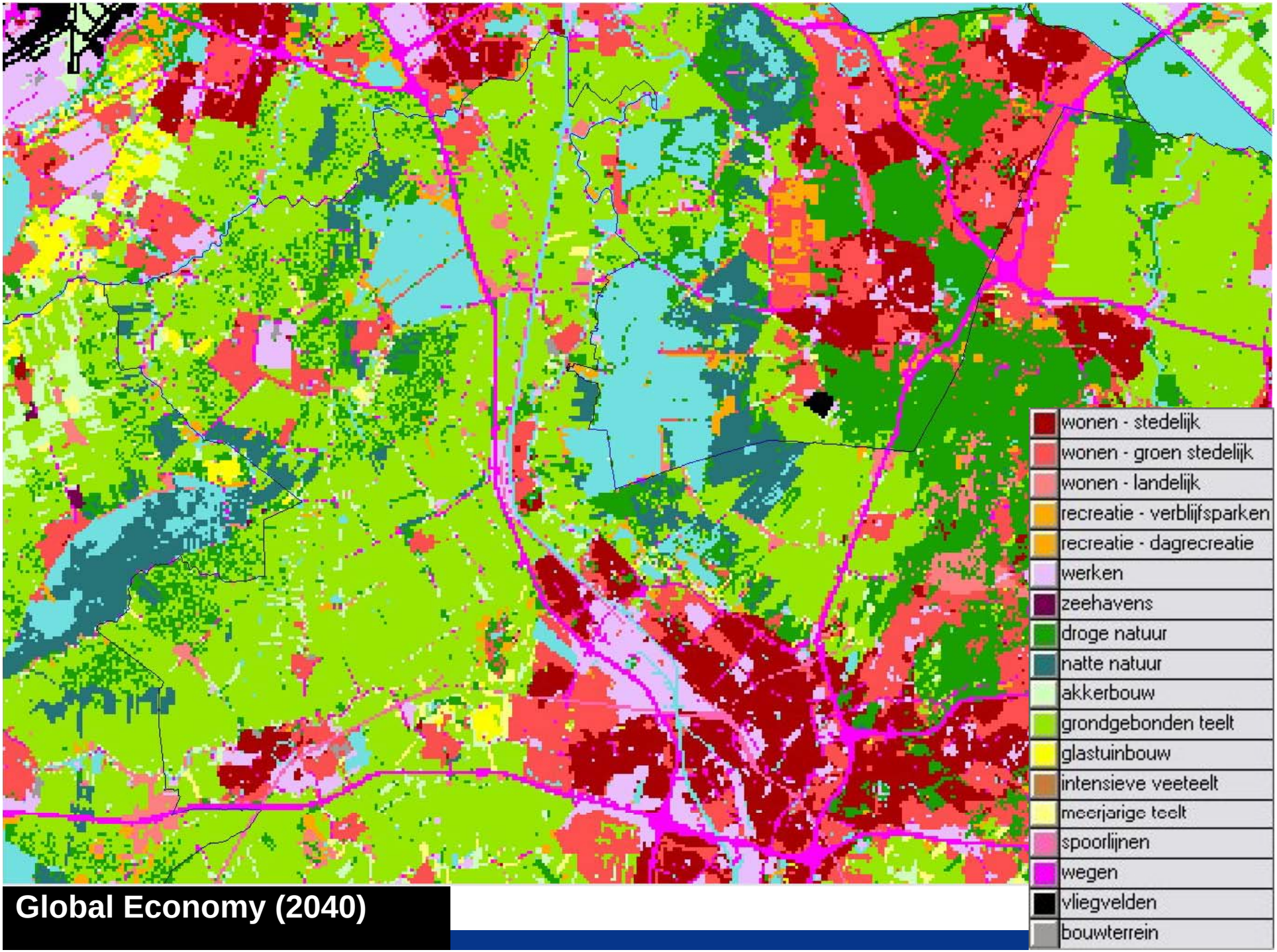
Land use in the Central Province of the Netherlands

wonen - stedelijk
wonen - groen stedelijk
wonen - landelijk
recreatie - verblijfsparken
recreatie - dagrecreatie
werken
zeehavens
droge natuur
natte natuur
akkerbouw
grondgebonden teelt
glastuinbouw
intensieve veeteelt
meerjarige teelt
spoorlijnen
wegen
vliegvelden
bouwterrein

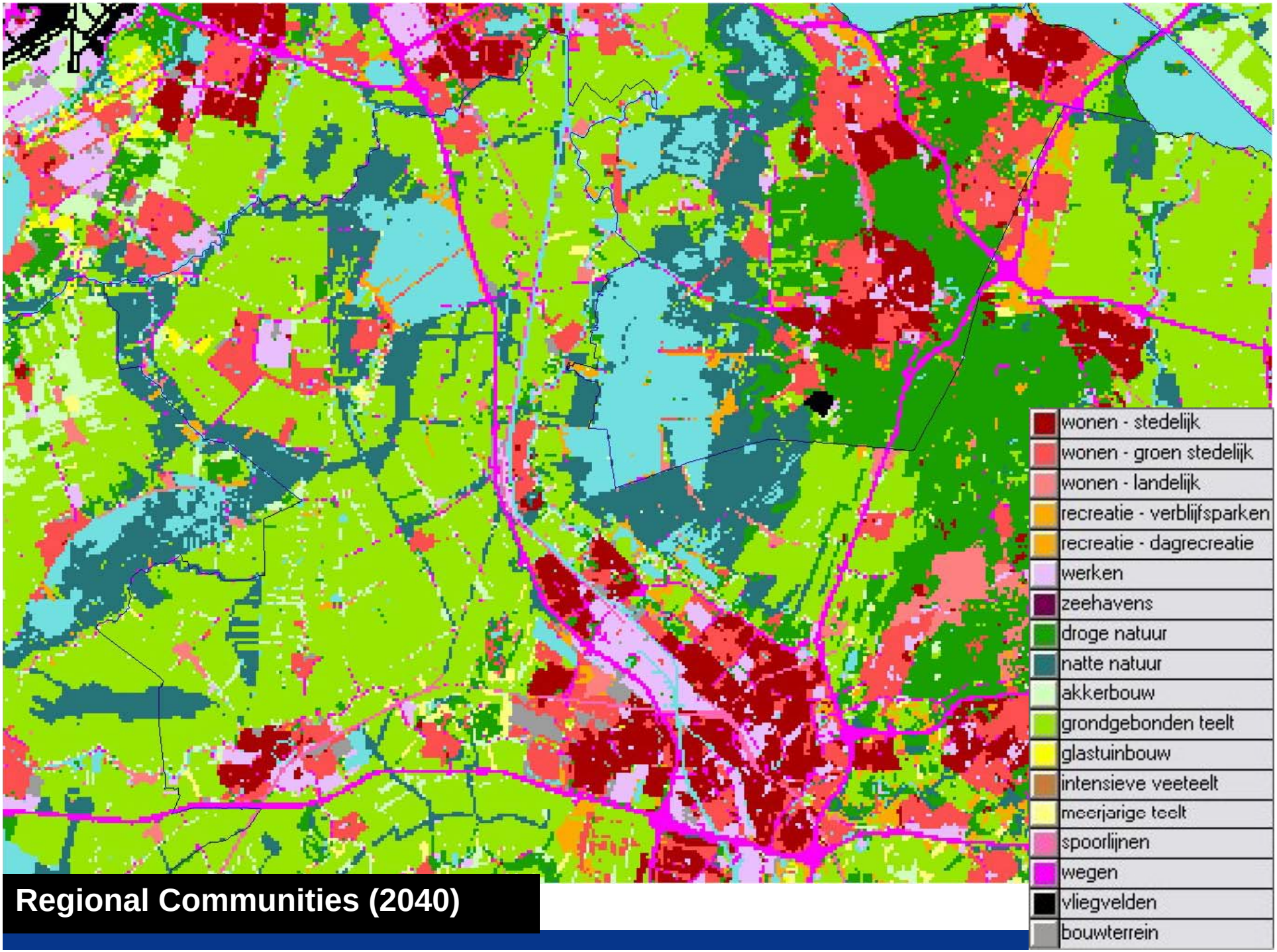
10 km

tudies

Model Base Year



Global Economy (2040)

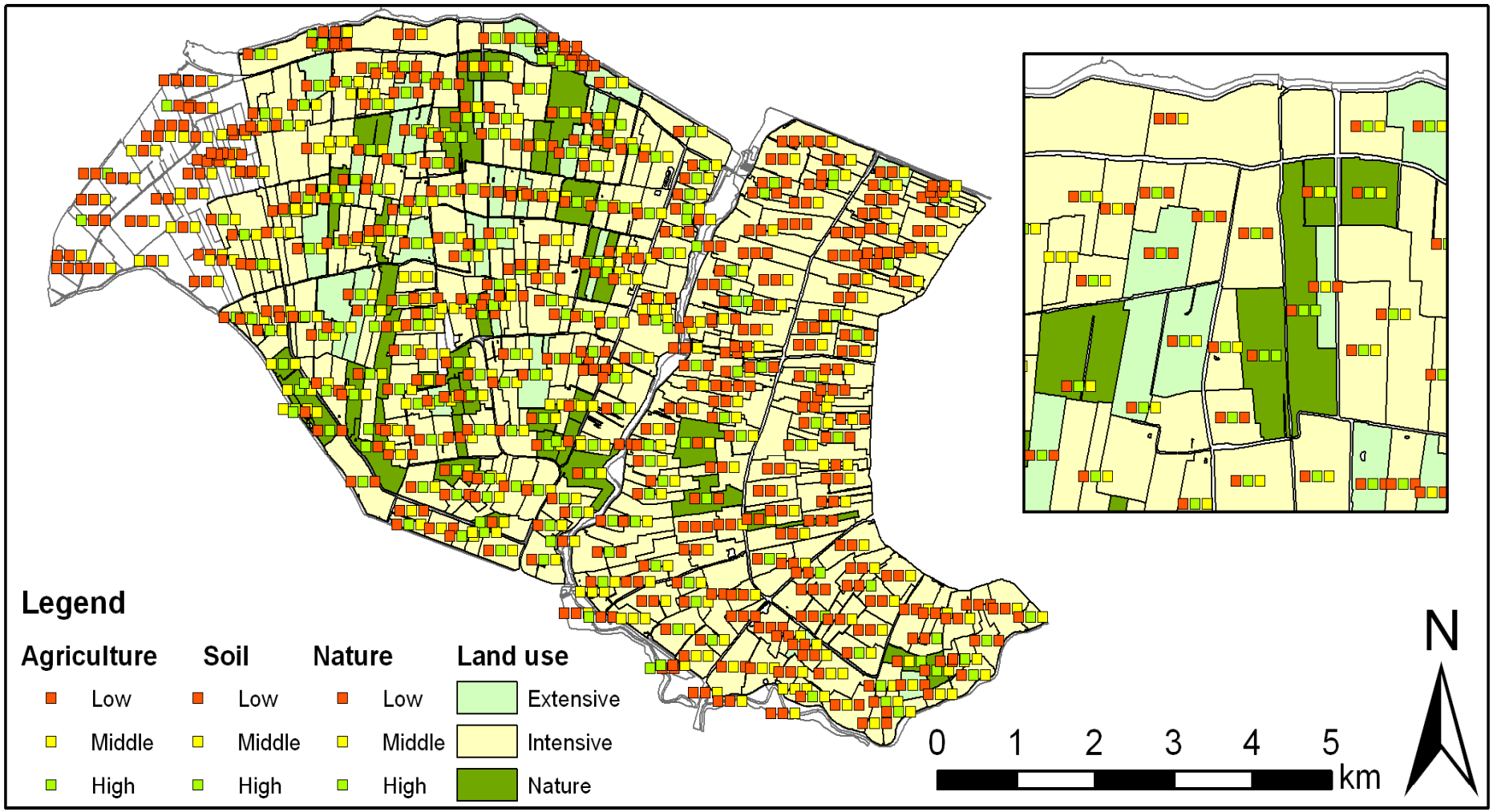


Regional Communities (2040)

Interactive spatial tools to support the development of regional adaptation strategies

Tessa Eikelboom, Ron Janssen WP3

Evaluation tool
Provide values for three objectives for all parcels

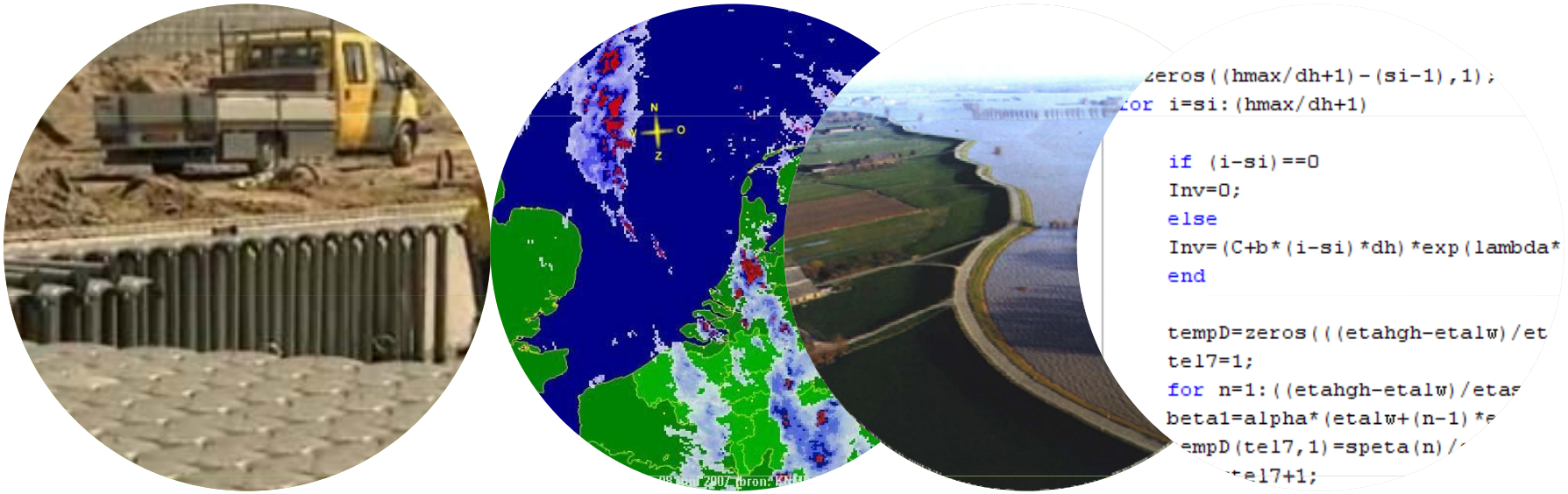


Optimal timing, cost benefit analysis and adaptation strategies

Work package 6

Ekko van Ierland, Hans-Peter Weikard, Thomas van der Pol

Environmental Economics and Natural Resources Group, Wageningen University



Monitoring, indicators, and evaluation of adaptation

Kaj van de Sandt, Jelle van Minnen, Leendert van Bree, Nico Pieterse and Judith Klostermann

Final messages

- To prepare for the future, we need risk assessment under scenarios of future socioeconomic development and climate change
- For climate change we need international cooperation on mitigation and adaptation
- Need good combination of top-down and bottom-up approaches to decide how, where, and when to adapt
- Integrate perspectives of all stakeholders, including communities, policy-makers, consultants, scientists, and NGOs

Terima kasih! Thank you!

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