

# Framing Complexity

Arnold Bregt, 8 December 2015 (CAS Symposium)



# Mekong Delta, Vietnam



# Different systems for Shrimp farming



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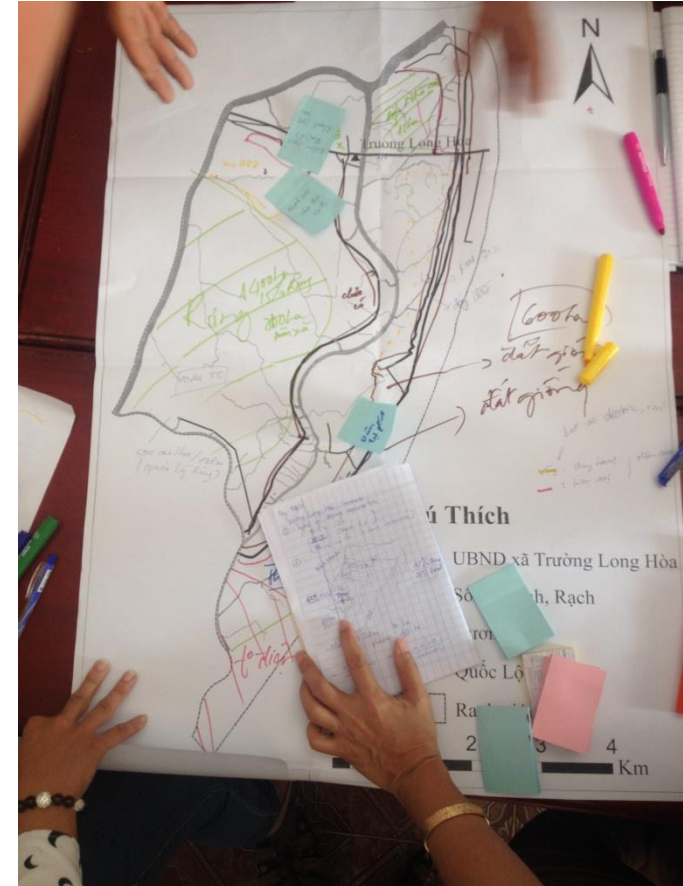


# Different systems for shrimp farming





# Interviews and participatory mapping





# Similar conditions different developments

## Characteristics

- Number of households:
  - 1825 vs 1443
- Bio-physical condition's comparable
- Development towards intensive shrimp

## Differences

- One commune -> intensive shrimps without threes.
- Other commune-> mixed systems with mangroves



# Reflection

- Initial conditions
- Interactions between farmers and role of hero's
- Sequence of activities
- Adaptive capacity of all stakeholders



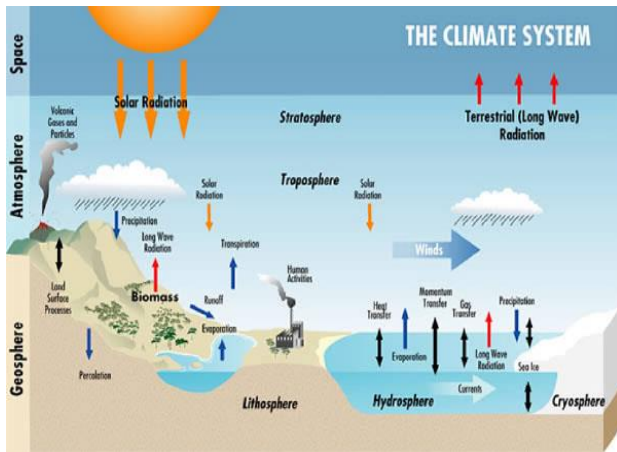
# With as a result

- Different **emergent behaviour** of these two communes
- Example of a **complex adaptive system**:
  - Interactions between agents
  - Sensitive to initial conditions
  - Path dependency
  - Open systems
  - Adaptive behaviour of agents

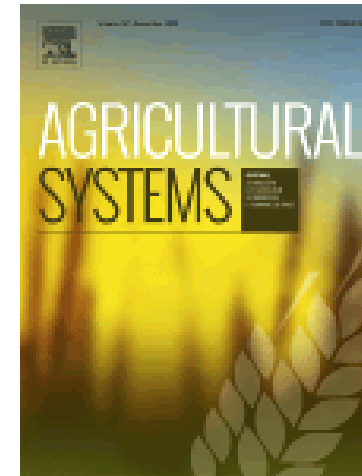


# Thinking in systems is popular, e.g

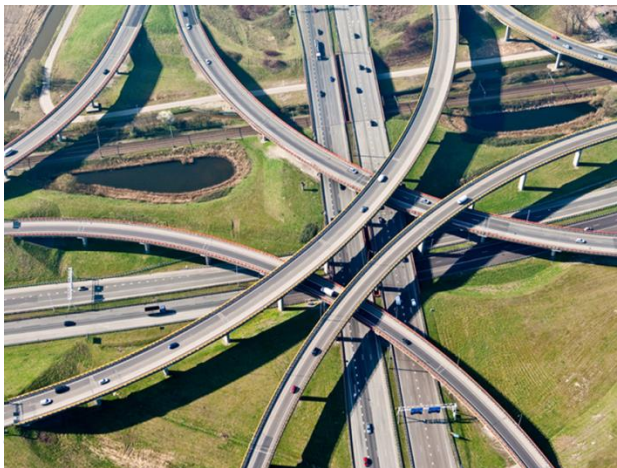
## Climate system



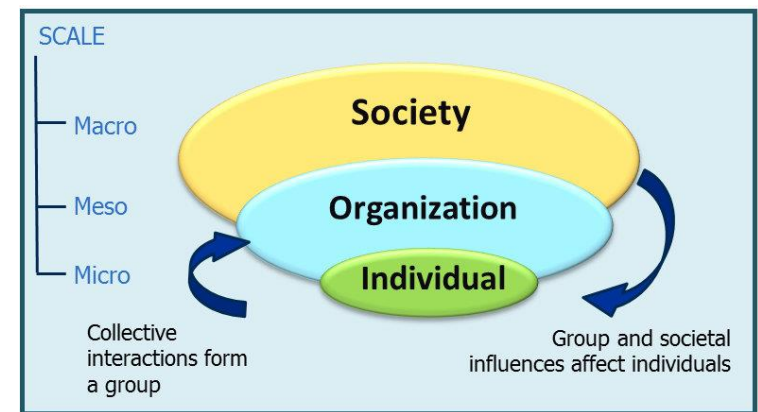
## Agricultural system



## Transport system



## Social system

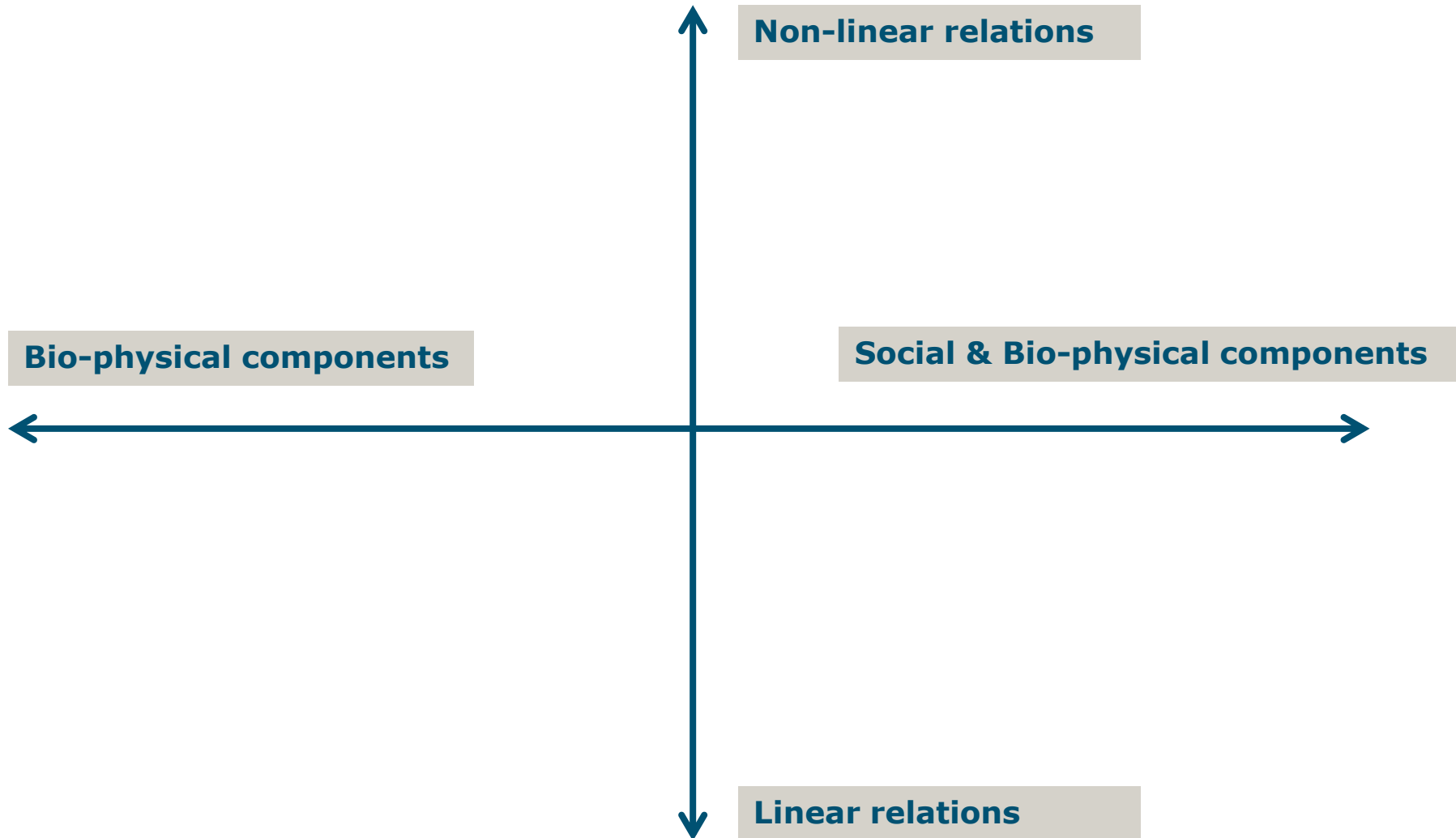


# System thinking

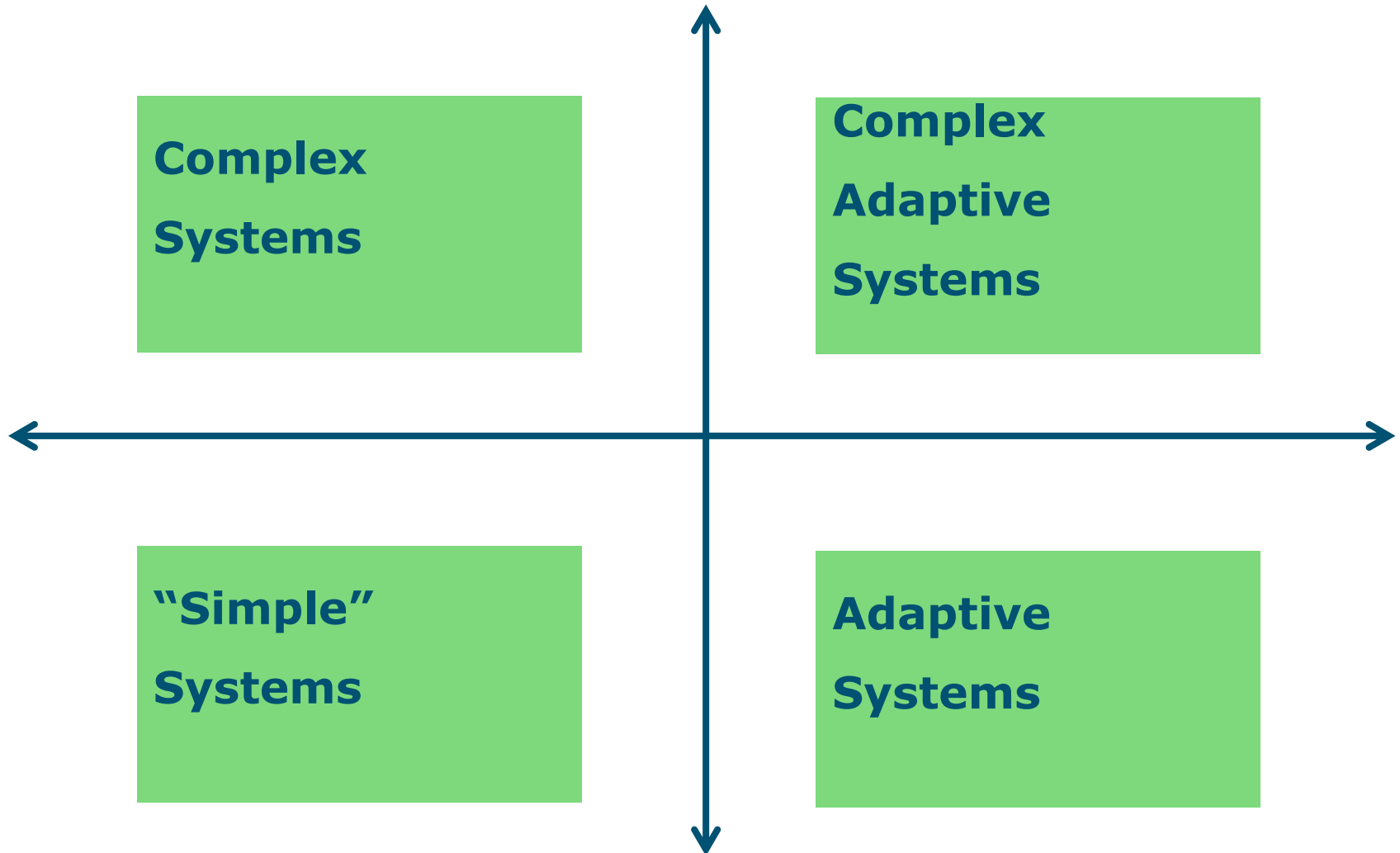
- System consists of:
  - Components
  - Relation between components
  - Boundary
  
- Systems are human constructs



# Framing systems



# Framing systems



# Simple Systems

- Characteristics:
  - A few components
  - Closed systems
  - Well defined interactions
- Behaviour:
  - Predictable

Falling ball





# Adaptive systems

- Characteristics:
  - Respond to changes in the environment
  - Feedback loops
- Behaviour:
  - Respond in predictable way

## Driving a car



# Complex systems

- Characteristics:
  - Interaction between components non-linear
  - Feedback loops
  - Tipping points
- Behaviour:
  - Sudden, emerging events

Land sliding



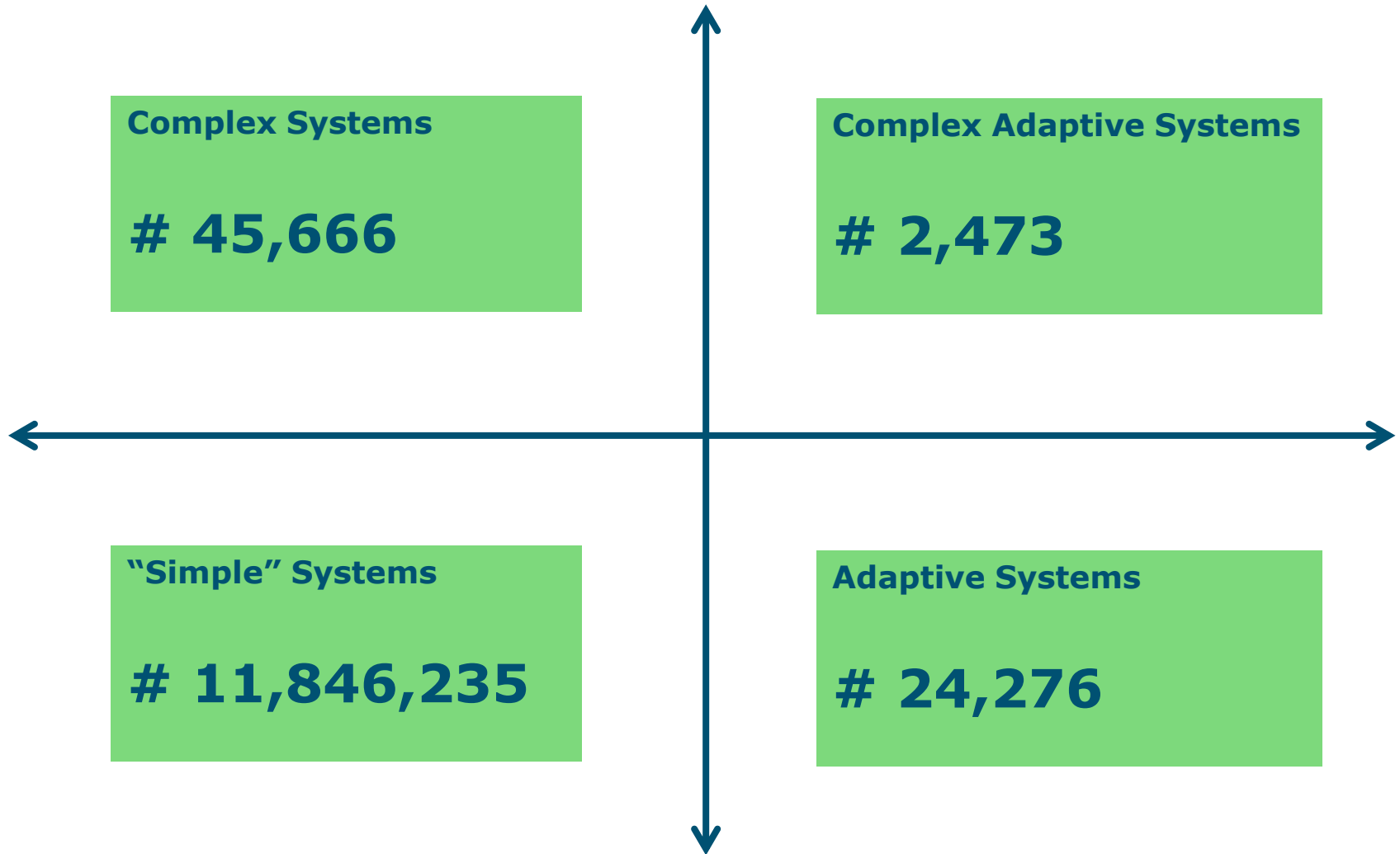
# Complex adaptive systems

- Characteristics:
  - Multi level
  - Open systems
  - Non-linear interaction
  - Learning
- Behaviour:
  - “Dynamic stability”
  - Emergence

Land-use system



# Scientific publications (Scopus, 2-12-2015)



# Reflection

- The focus of science is on a “simple” system description of the real world
- Understandable from both a science and human point of view:
  - Ockham's razor heuristic
  - Reductionism
  - Bias for linear cause-effect relations
  - Our mind likes to simplify (Kahneman)



# Reflection

- But, our real-world problems are not simple. Quite often they have:
  - Many components, with partly unknown relations
  - Adaptation takes place
  - History (path) is important
  - Open
- Therefore we must be open to a more complex approach for understanding our world



# But How?

- Complex adaptive system (CAS) view:
  - Theory is relative young (1990, Santa Fe)
  - No consensus on definitions, characteristics
  - Interdisciplinary field
  
- CAS in practice:
  - Last 10 years
  - Agent-based modelling (ABM)
  - Design principles

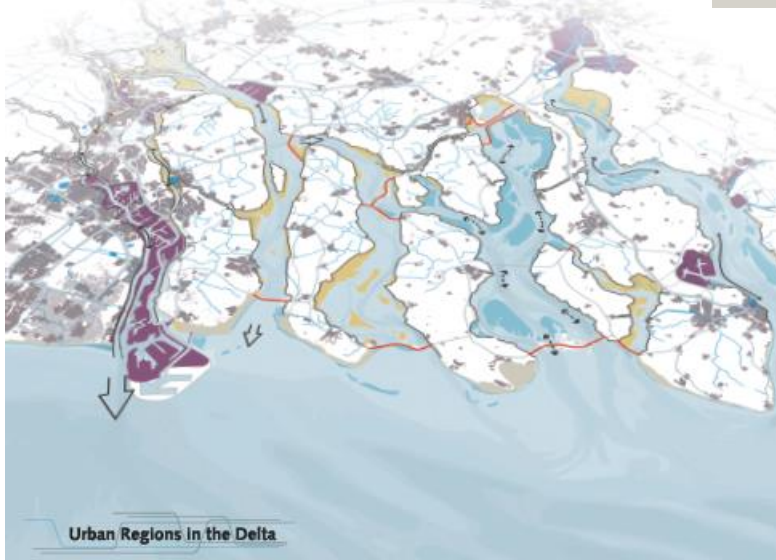


# An example of CAS in practice

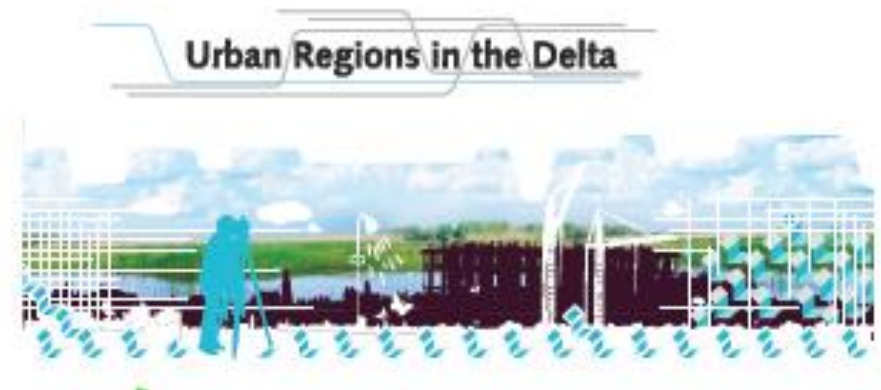
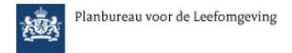
Integrated Planning and Design In the Delta (IPDD)

## New perspectives on urbanizing deltas

a complex adaptive systems approach to planning and design



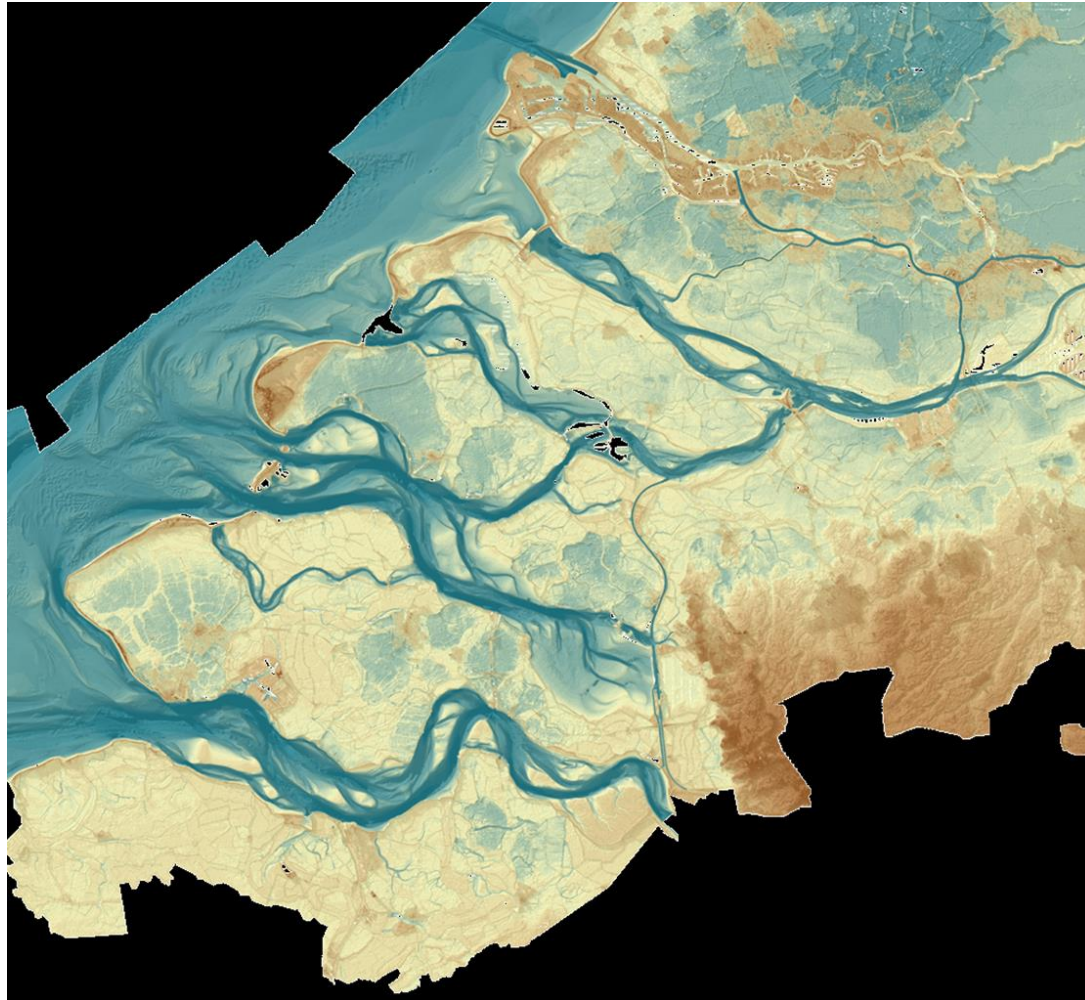
Partners



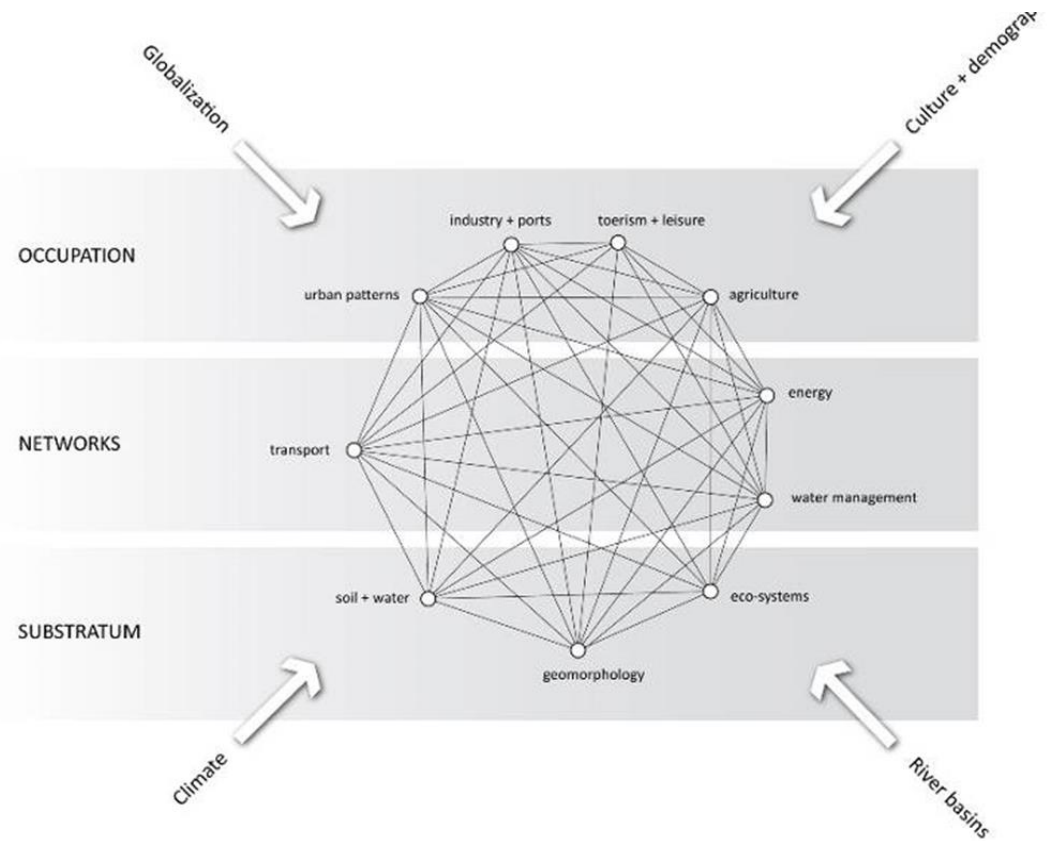
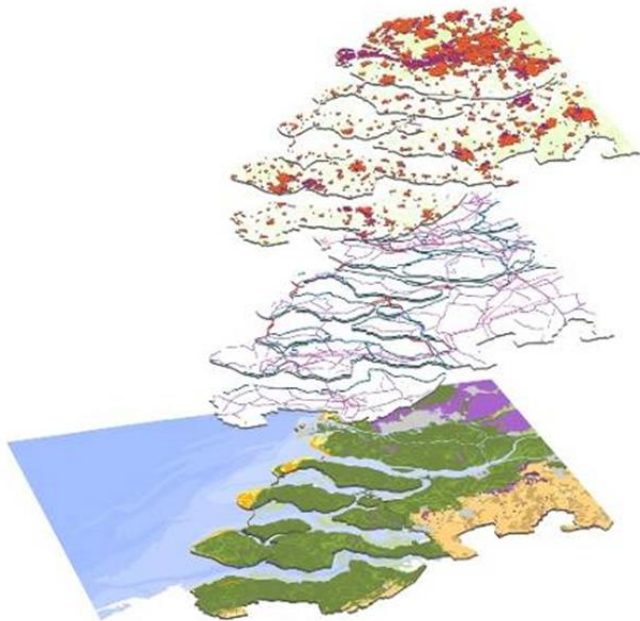
*H. Meyer, A. Bregt, E. Dammers, J. Edelenbos, 2014 (NL) 2015 (Eng)*



# The Dutch South-west delta



# A detailed actor and interaction analysis



# Historical analysis (path dependency)



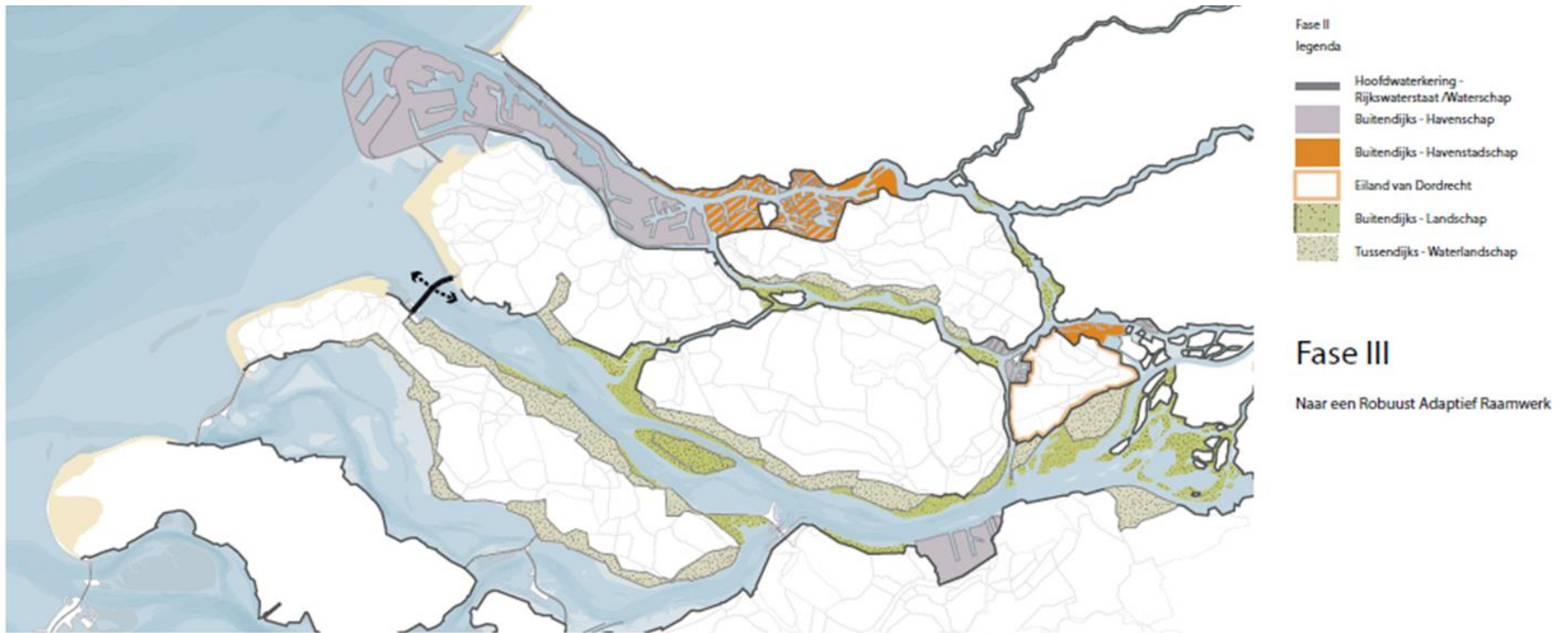
# Scenario analysis



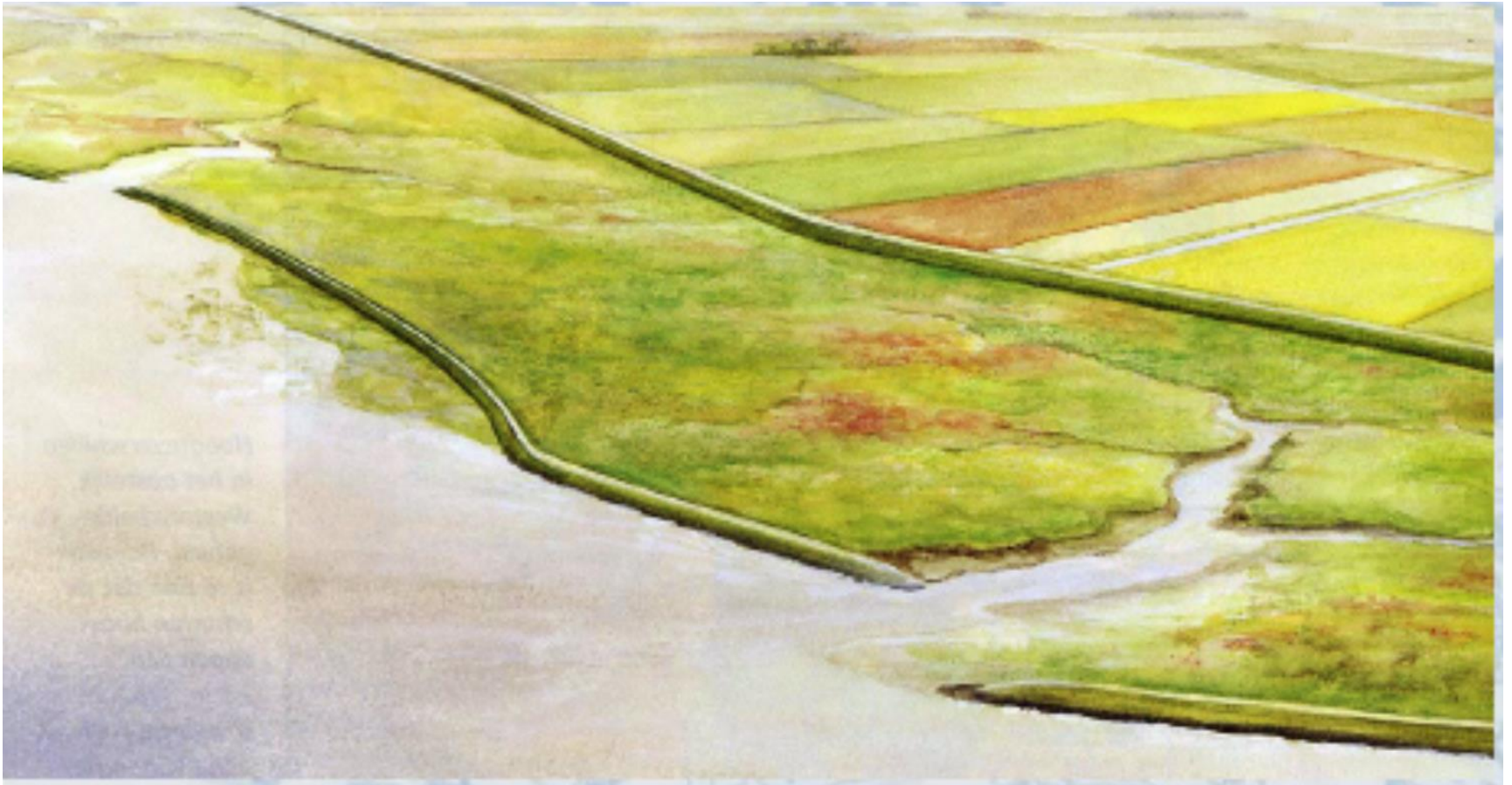
# Actor interaction



# Towards a Robust, Adaptive Framework



# Flood defence is not a dike, but a zone



# Towards a resilient and adaptive urbanized delta





Our world is  
complex and  
adaptive:

Let's also study  
it as such!

