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Approaches to integrated Modelling

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Overview

- Integration goals
- Approaches



Integration Goals

- Scrase & Sheate
- Brugnach & Pahl-Wostl
- Wesselink

Scrase & Sheate (2002)

Integrative Activities have specific goals

Integrated environmental-economic modelling

Integrated environmental management

Integration among assessment tools

Integration of assessment into governance

Integrated information resources

Focus (contents, values, governance)

Learning (technical, social, conceptual)

Changes (goal, delivery, setting)

Scruse & Sheate (2002)

Integrative Activities have specific goals

70s : Environmental Impact Assessment

80s : Cost Benefit Analysis

Goal EIA und CBA: changes in contents
of policy paradigm

90s : Integrated Assessment

Goal IA participatory policy making?

Brugnach & Pahl-Wostl (2005)

IA paradigm includes participation.

IA process goals und model attributes:

Prediction

Systems characteristics

Exploration

Role of uncertainty

Communication

Model properties

Learning

Model validation

X

Brugnach & Pahl-Wostl (2005)

	System characteristics	Role of uncertainty	Model properties	Validation
Prediction	Abstractable	to be	Structured	Against observation
Exploration	Evolutionary trajectories			Insights
Communication	Systems complexity			
Learning	Reflexive system	to be addressed	Under construction	Facilitation of learning

Assumption:
System is intrinsically complex

Wesselink (2007)

Studied integration in real policy processes.

(Flooding policy, spatial planning)

- Integration Expertise + Positions
- Argumentation + Negotiation

Wesselink (2007)

- Negotiation
 - Multi-interpretable goals help to merge positions
 - Local (non-generic) knowledge relevant
- Models relevant for
 - Introducing problem / solution options before
 - Legitimation afterwards

Goals integrated modelling

Scientific:

- Knowledge on feedback processes
- Resulting systems behaviour

Policy / decision support:

- Deliver boundary conditions to negotiations
- Moderate negotiations???
- **Raise new issues, optimise solution design**

Approaches

- Group Model Building
- Appropriate Modelling
- Agent Based Simulation

Group Model Building

Systems theory approach

mental models

phenomenological

Appropriate for learning and diagnosing, possibly
preamble for negotiation

Strategic political decision processes use scenario
analyses and expert knowledge/views; models
deliver boundary conditions

Warning: 'Negotiated knowledge'

Appropriate Modelling / Scales

Approach for determining scales for
Modelling (Booij, 2002)

Model results converge when refining resolution

No exact results required

Question: what scale?

Appropriate Modelling / Scales

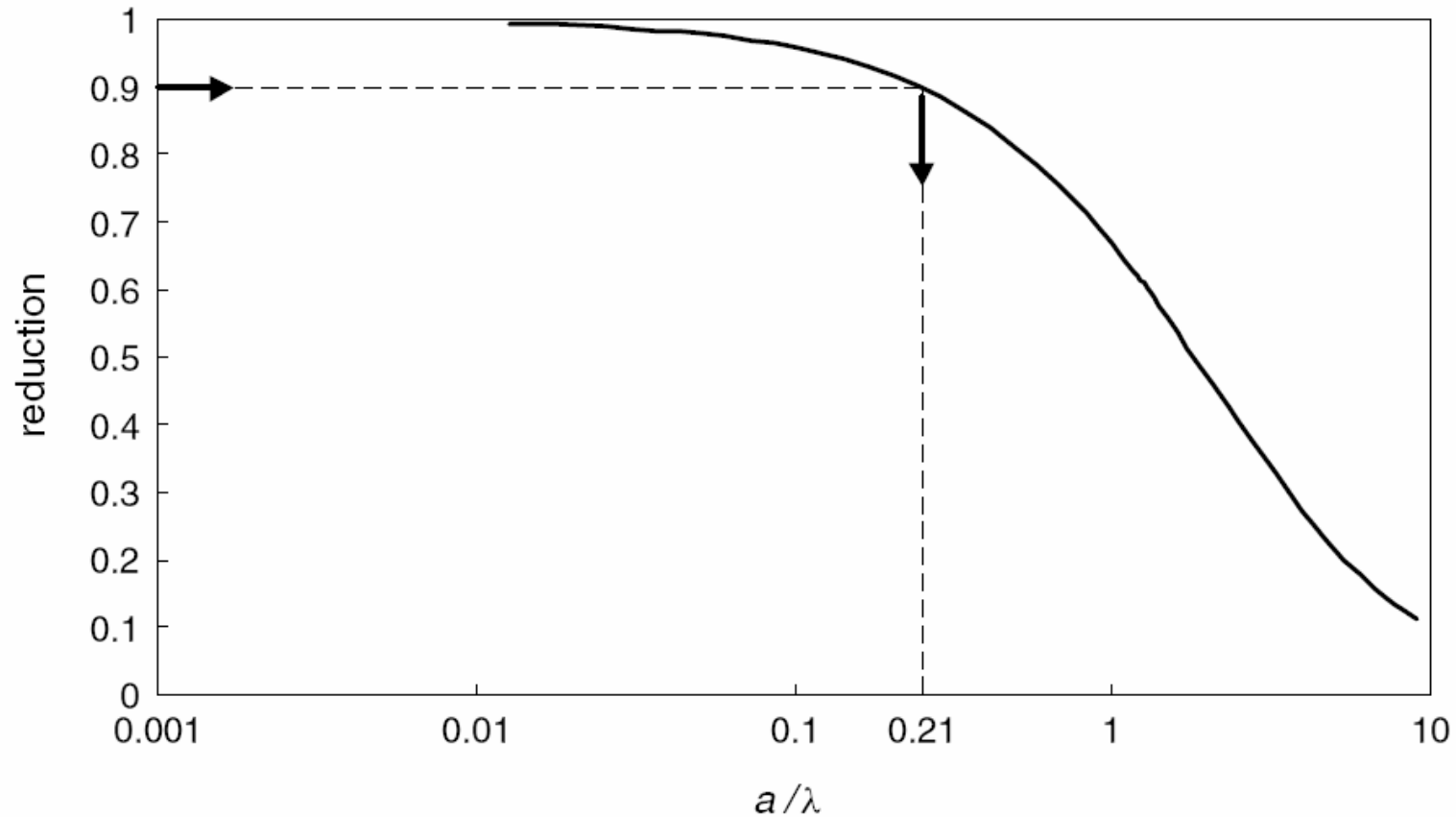
Goal: Choice spatio-temporal resolution for determining variables at river basin scale

Criteria: reduction in Variance

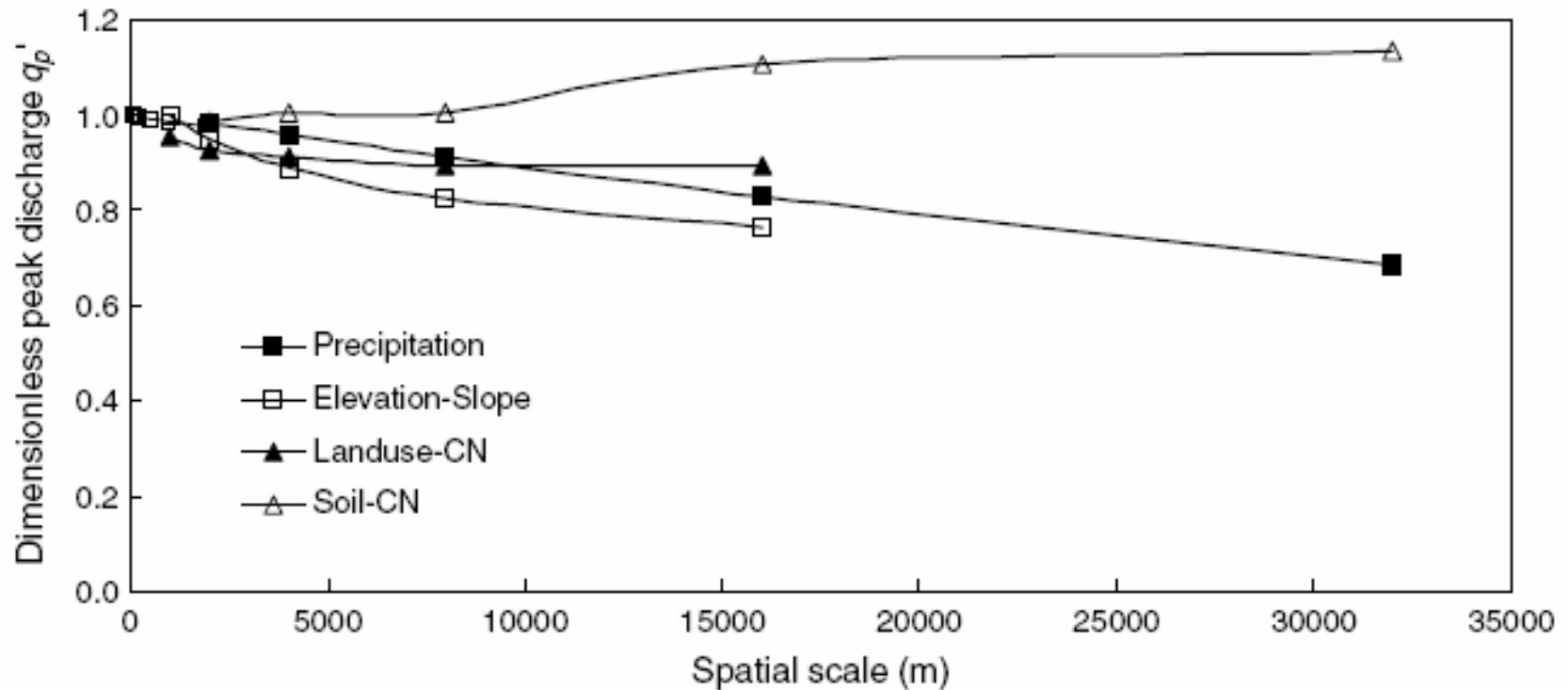
Method:

- Use correlation structure
- Integration using weights based on sensitivities

Appropriate Modelling / Scales



Appropriate Modelling / Scales



Sensitivities approximated using SCS approach

Appropriate Modelling / Scales

Variable	Appropriate variable scale (km)	Weight (-)
Precipitation	19.9	0.39
Elevation	0.1	0.26
Soil	5.3	0.21
Land use	3.3	0.14
Integrated	9.5	1.00

Maximum daily discharge / Meuse:

- 10 km / ± 100 sub-basins

Appropriate Modelling / Scales

Problem issues

- ‘Appropriate scale’ can be too small to be implemented → larger reductions in Variance
- Spatial correlations of Variables

Agent Based Simulation

Approach to represent coexistence
society and environment

Taxonomy (Hare&Deadman, 2004)

- Cognition (no, fine tuning, strategies)
- Social interactions
(no , local, global, group)
- Spatial explicit coupling
society - environment

Agent Based Simulation

Example:

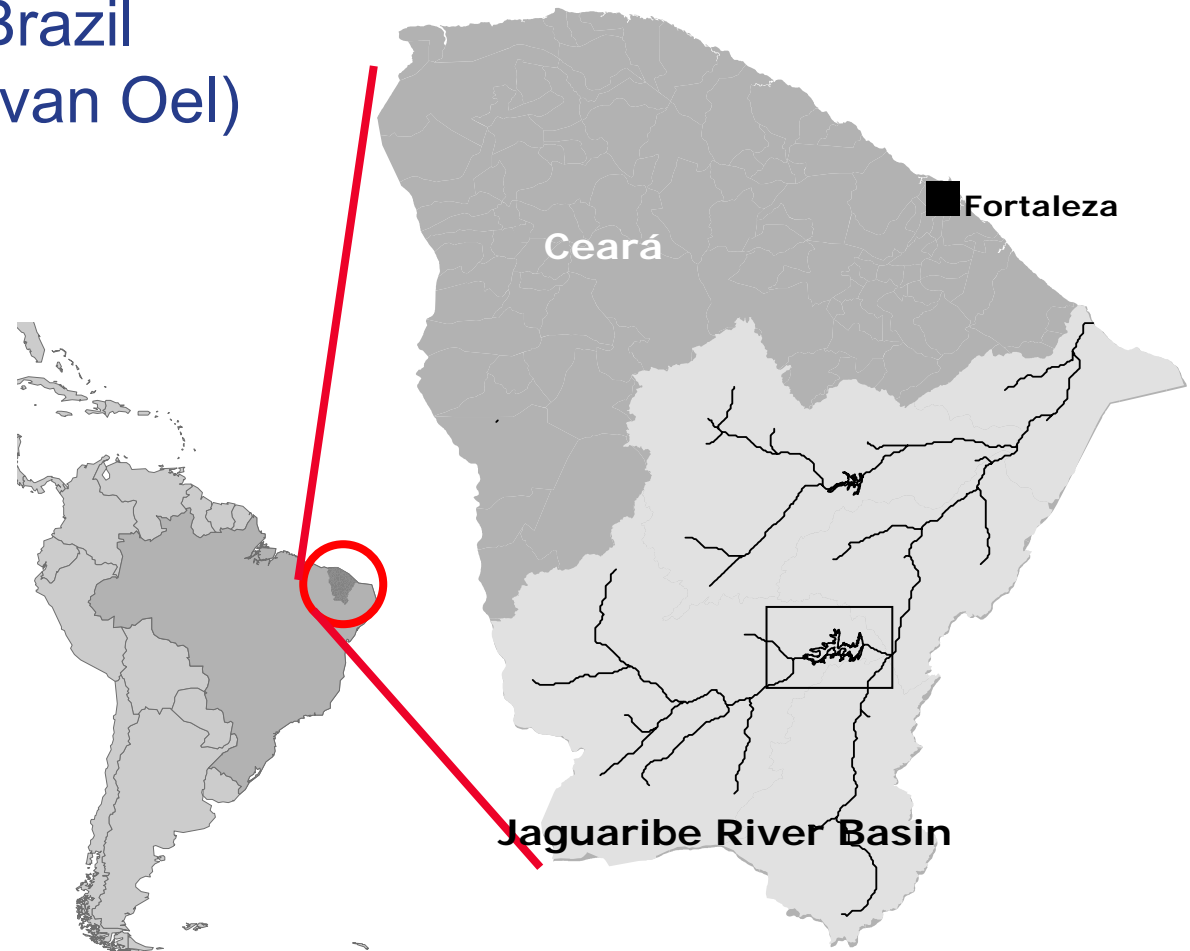
Use of variably available resources →
Vulnerability, Semi-arid areas

- Reservoirs dampen variable availability
- Low availability dampens use?
 - Strategy to reduce usage
 - Effects of eg. prices
- Tool: Catchscape (CIRAD):
Multi Agent Simulation

Agent Based Simulation

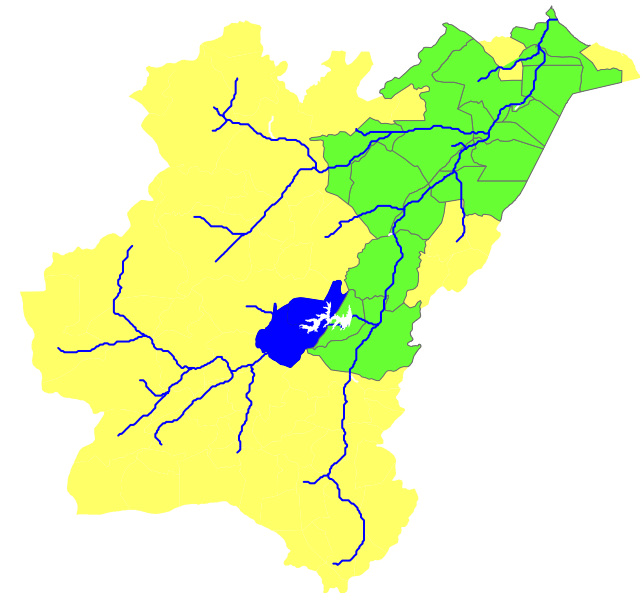
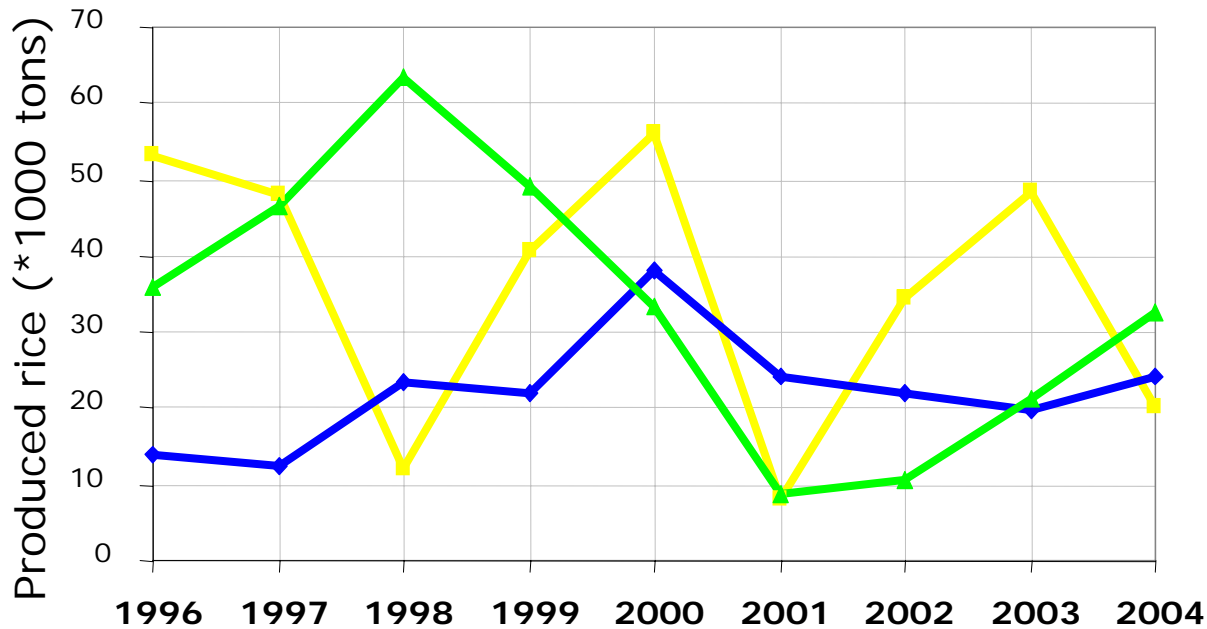
Analysis Northeast Brazil
(PhD-Project van Oel)

- irrigation dominant water user
- problems in dry years



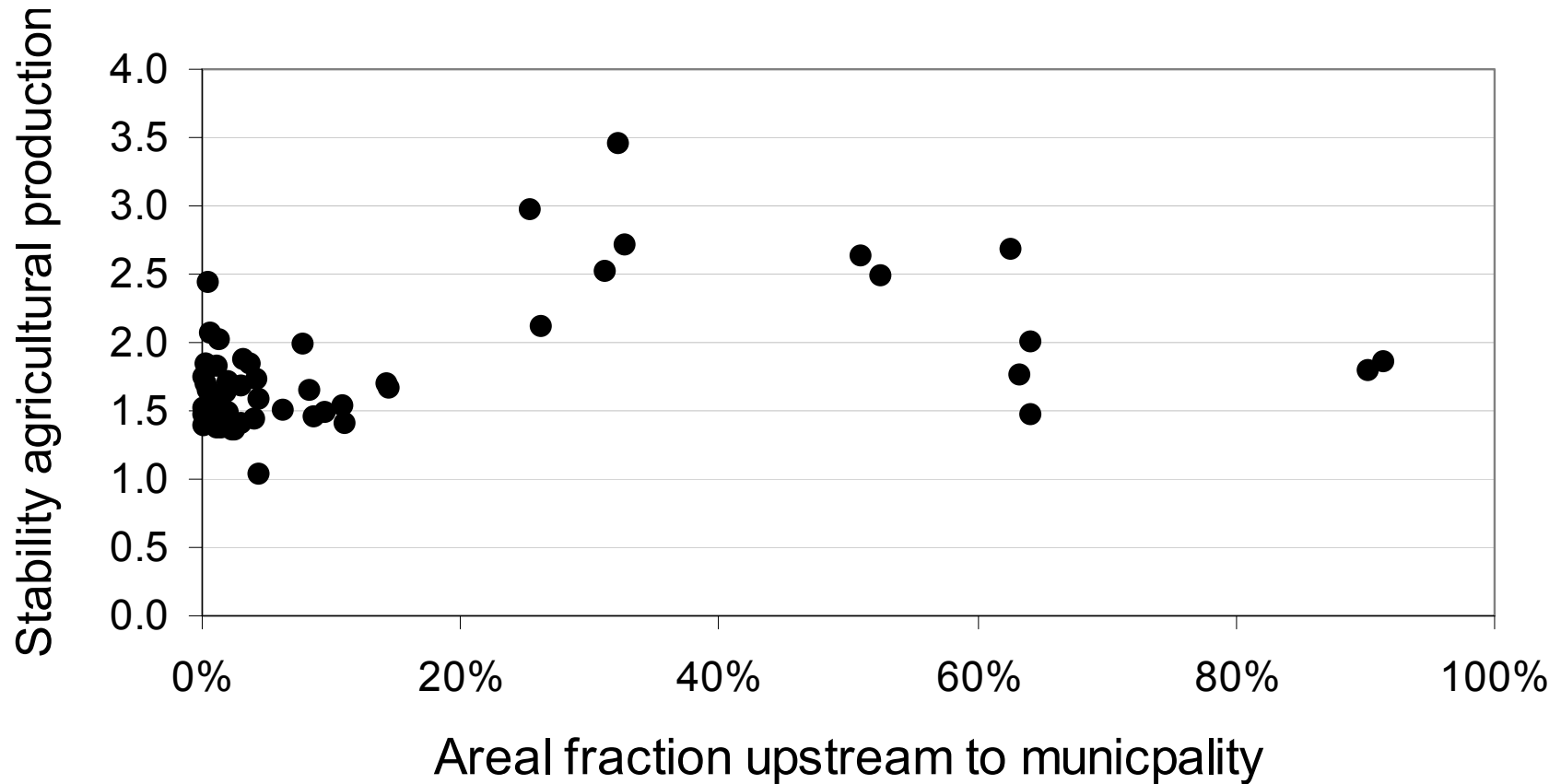
Agent Based Simulation

Rice production

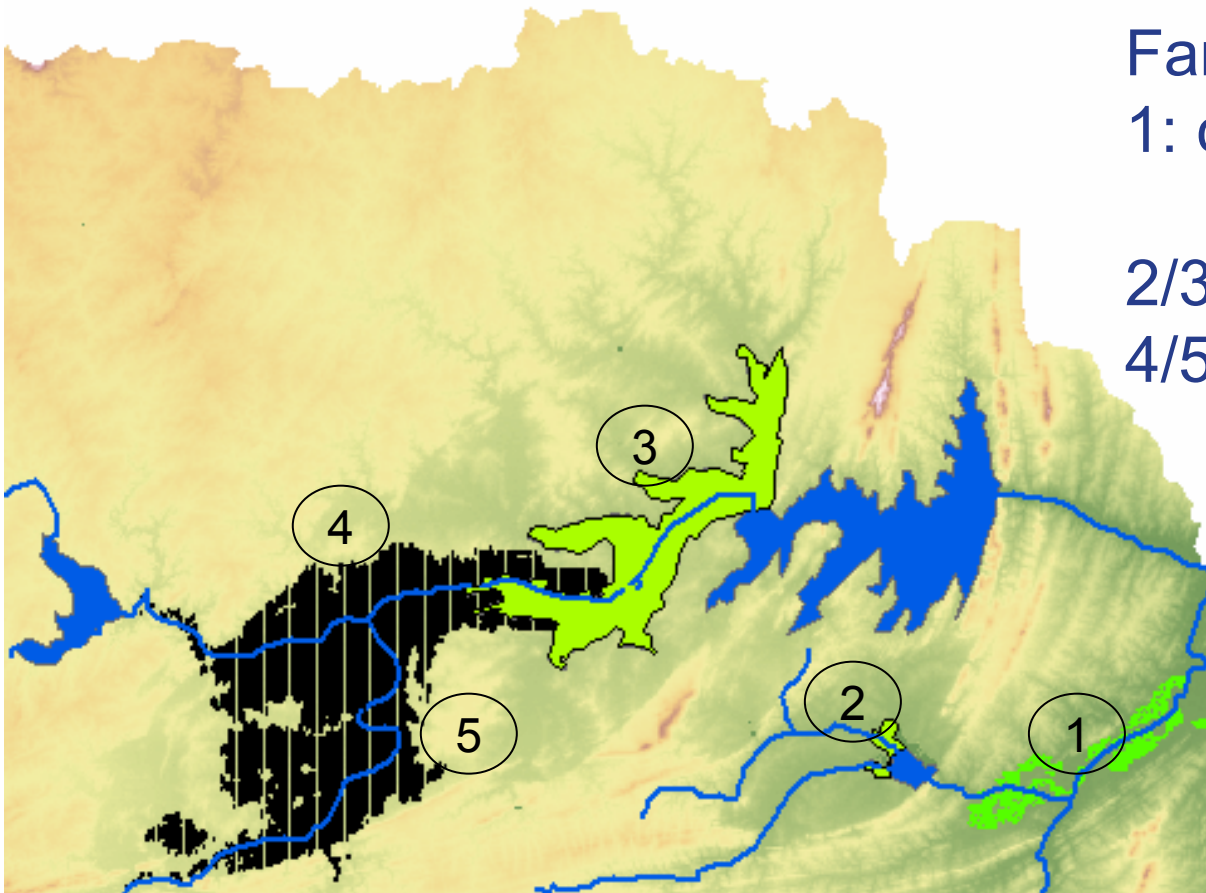


- Upstream
- Intermediate
- Downstream

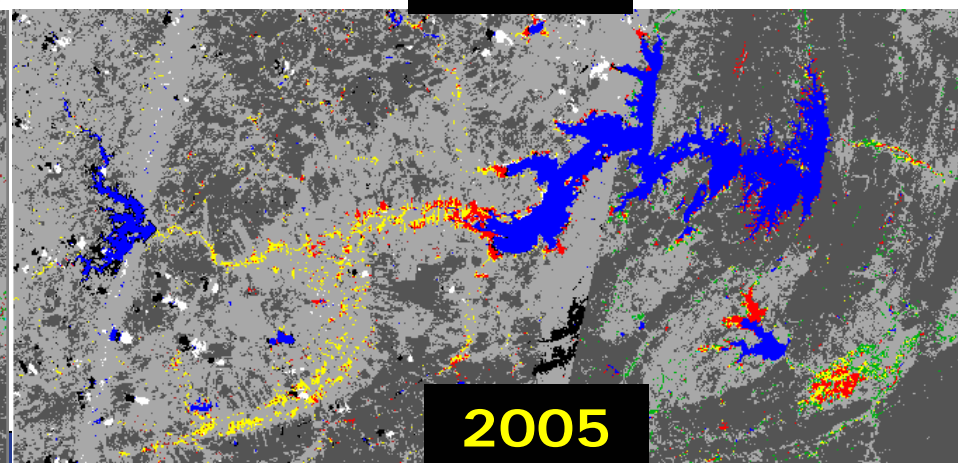
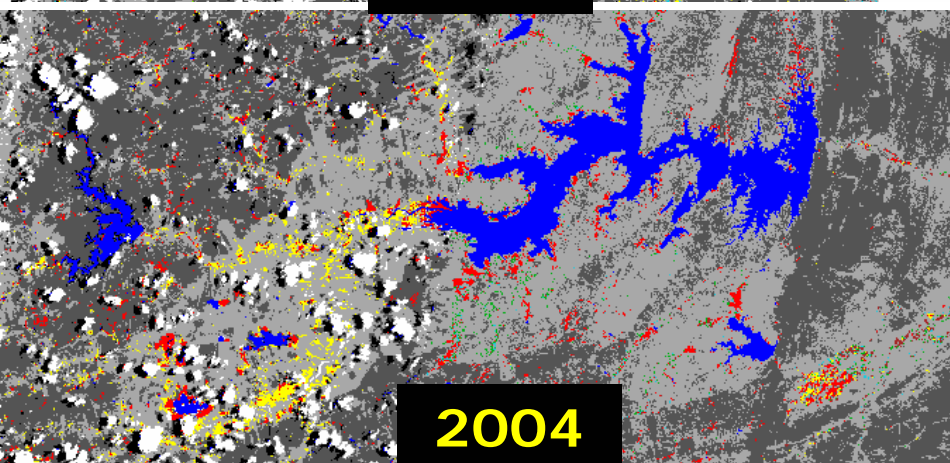
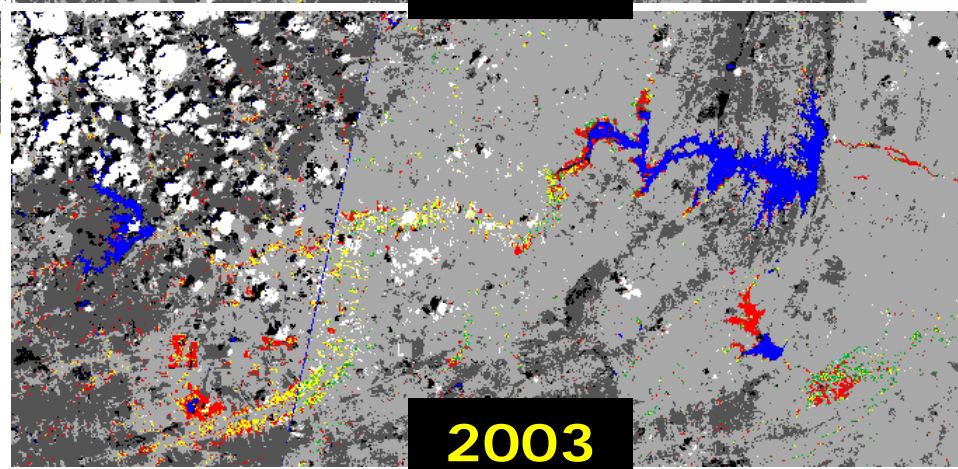
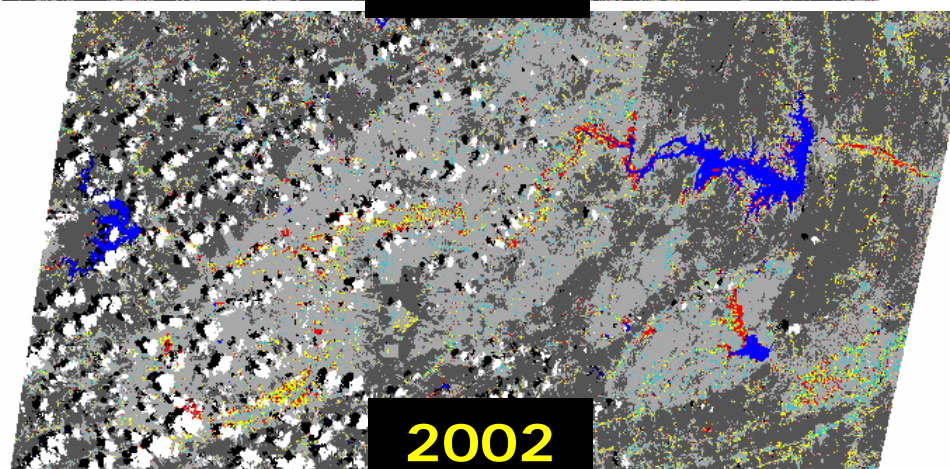
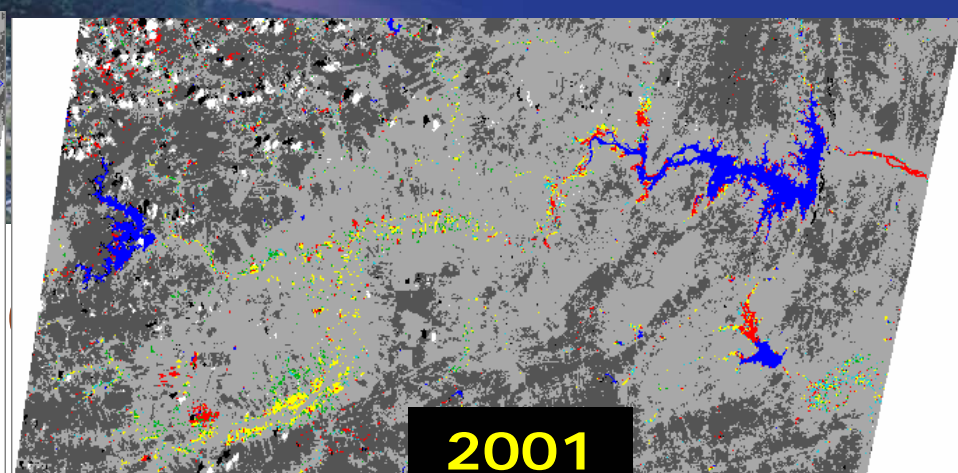
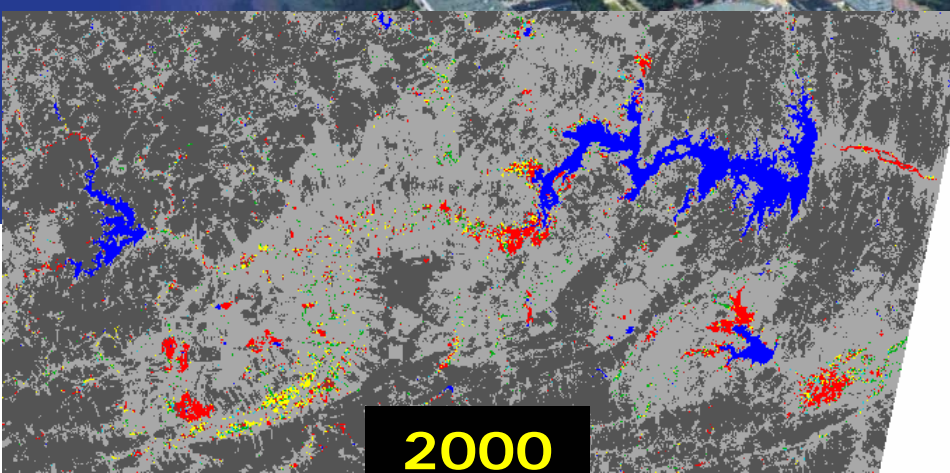
Agent Based Simulation



Agent Based Simulation



Farmers rationality:
1: controlled irrigation schemes
2/3: reservoir flood plains
4/5: alluvial aquifer, access to river, local sources

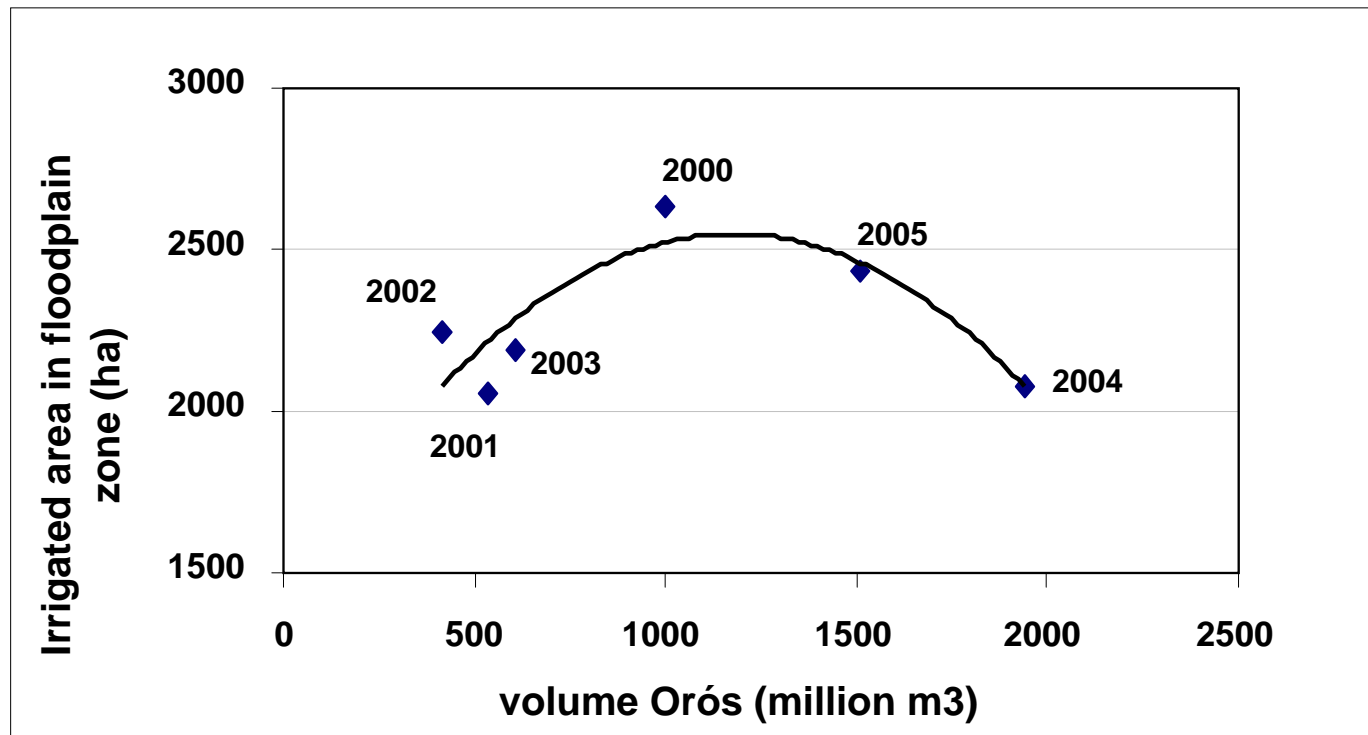


Agent Based Simulation

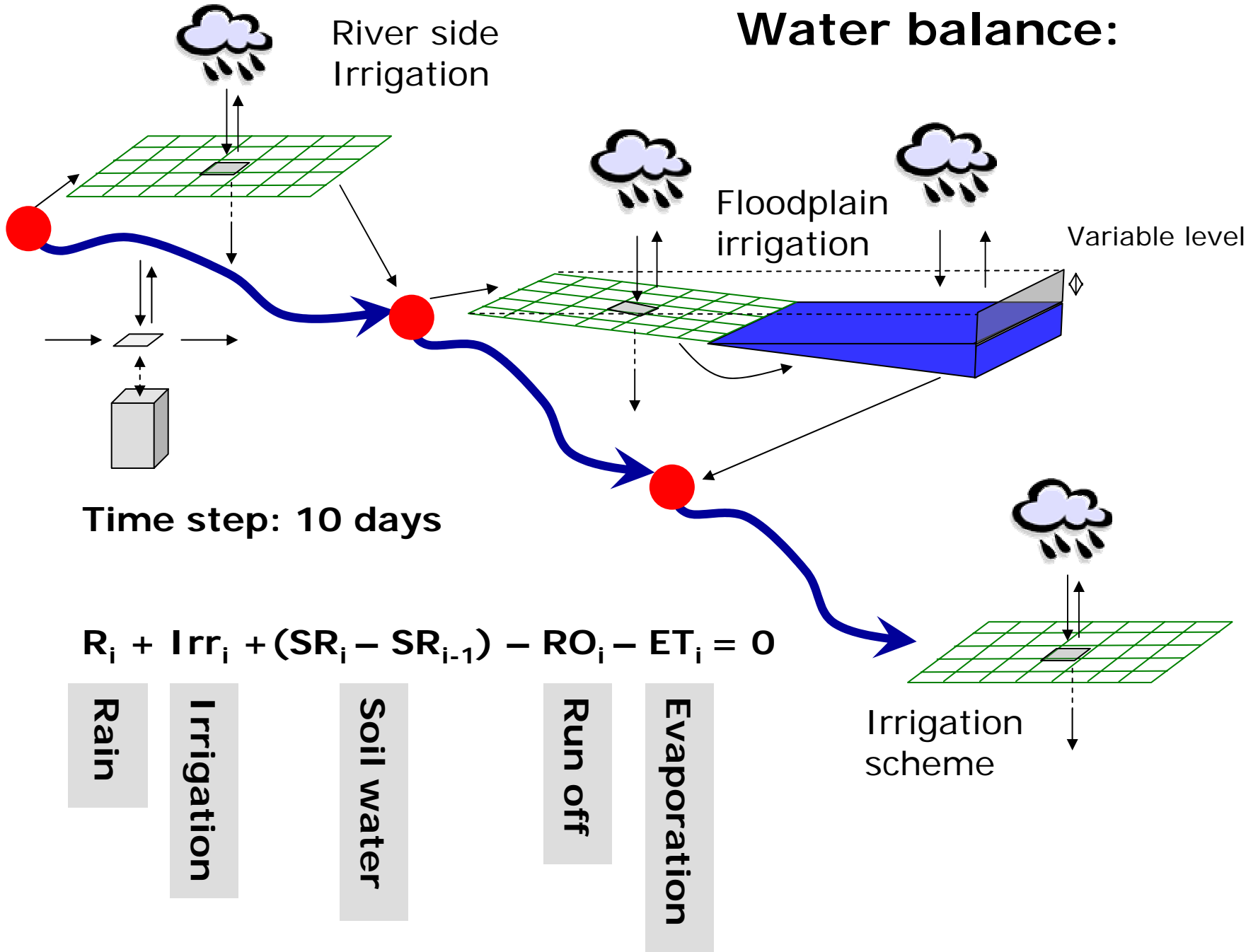
Disaggregated:

Description resource use decisions farmers

Aggregated:



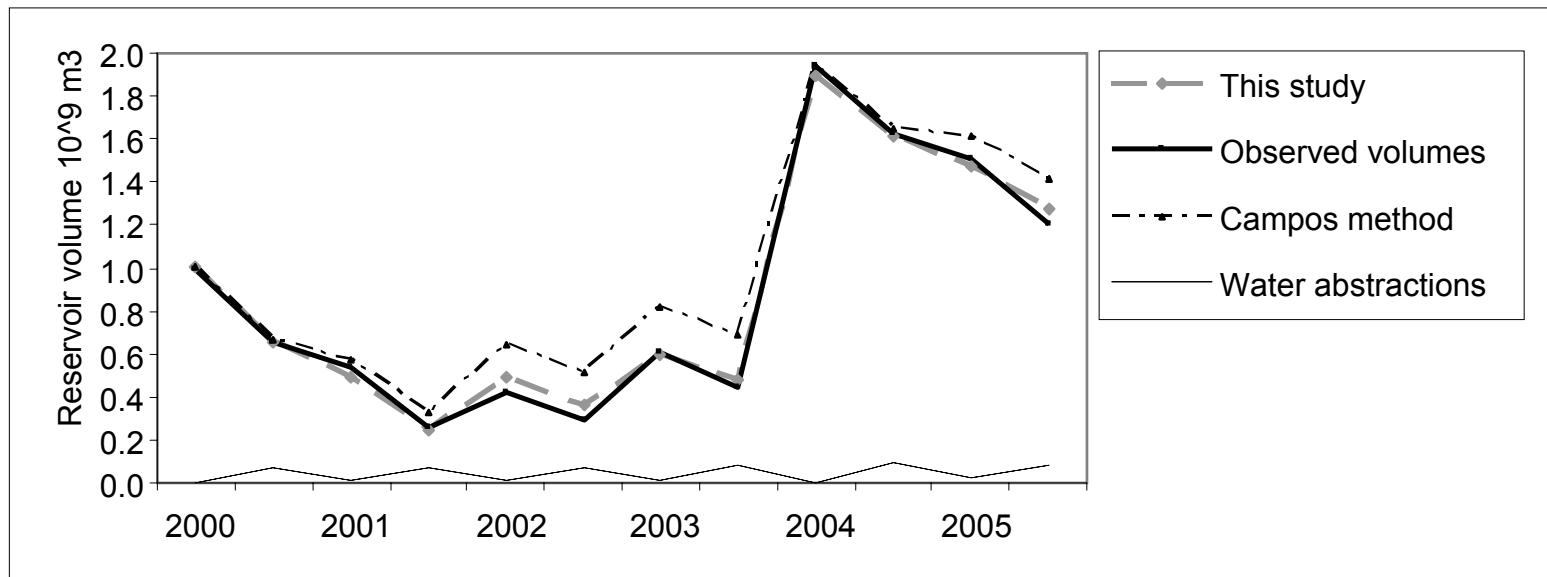
Water balance:



Agent Based Simulation

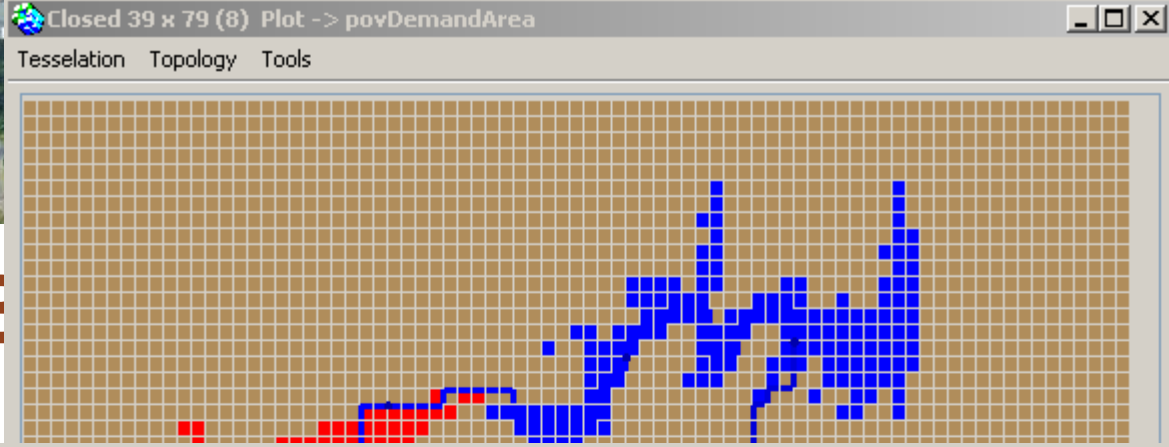
Aggregated:

- Use within sub-basin significantly important
- Reservoir yield Q_{90} : - 20%
- Effect variability in use fully dampened by reservoir



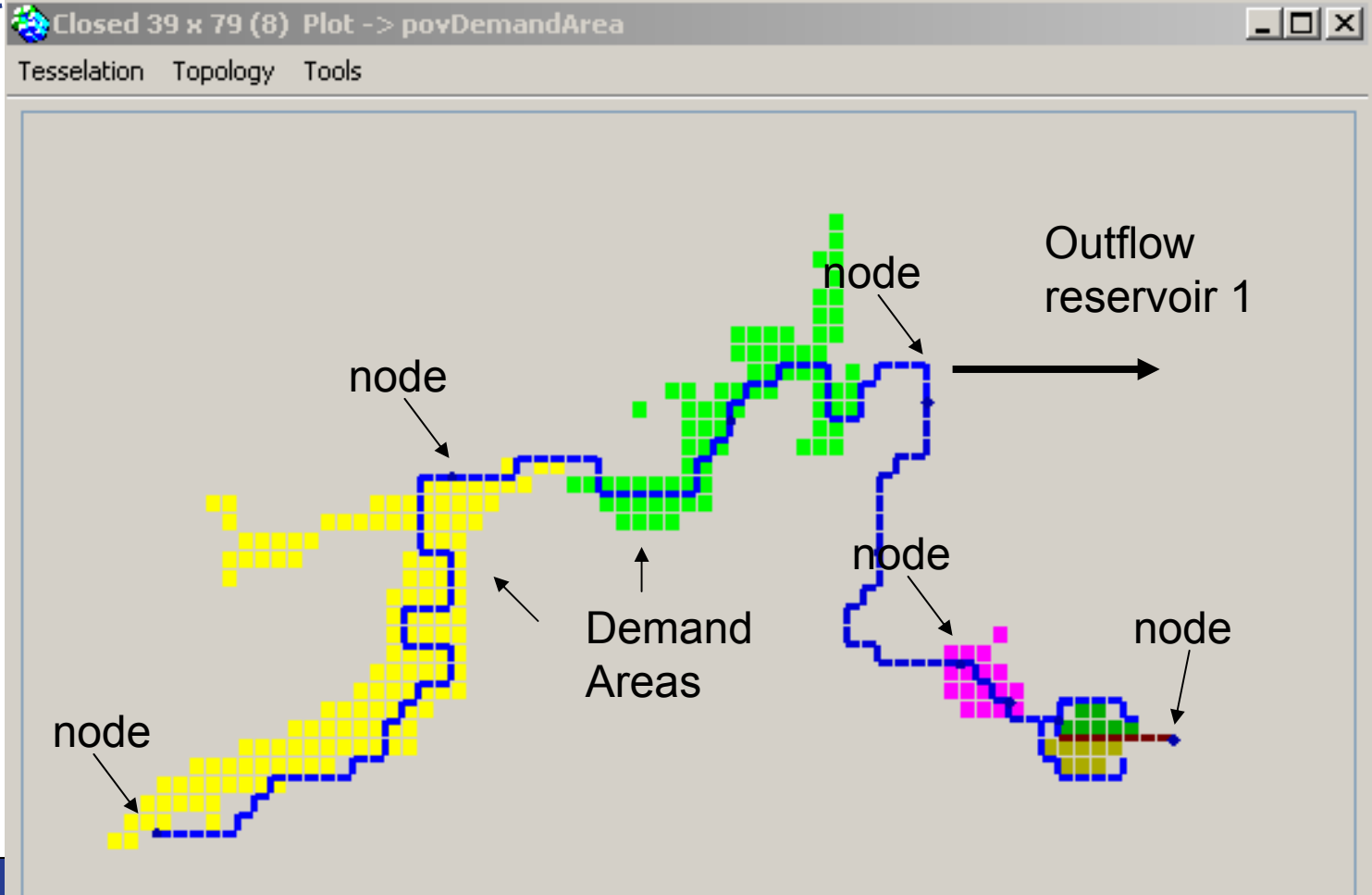


Agent E



Disaggregated:

- Regional vulnerability
- Explain spatial patterns
- Impacts in scenarios



Conclusion

- Roles of models in policy making are overemphasized in integrated-modelling-relative to policy-analysis-literature
- Models aiming at learning / issue raising may be simple, bear major uncertainty
- Appropriate modelling considerations may help in defining scales / model complexity
- Agent-based simulation may help to deepen understanding of resource use