RUHR-UNIVERSITÄT BOCHUM

Coping with sparse data in evaluating a multitude of water saving measures in a coastal watershed in N-Eastern China

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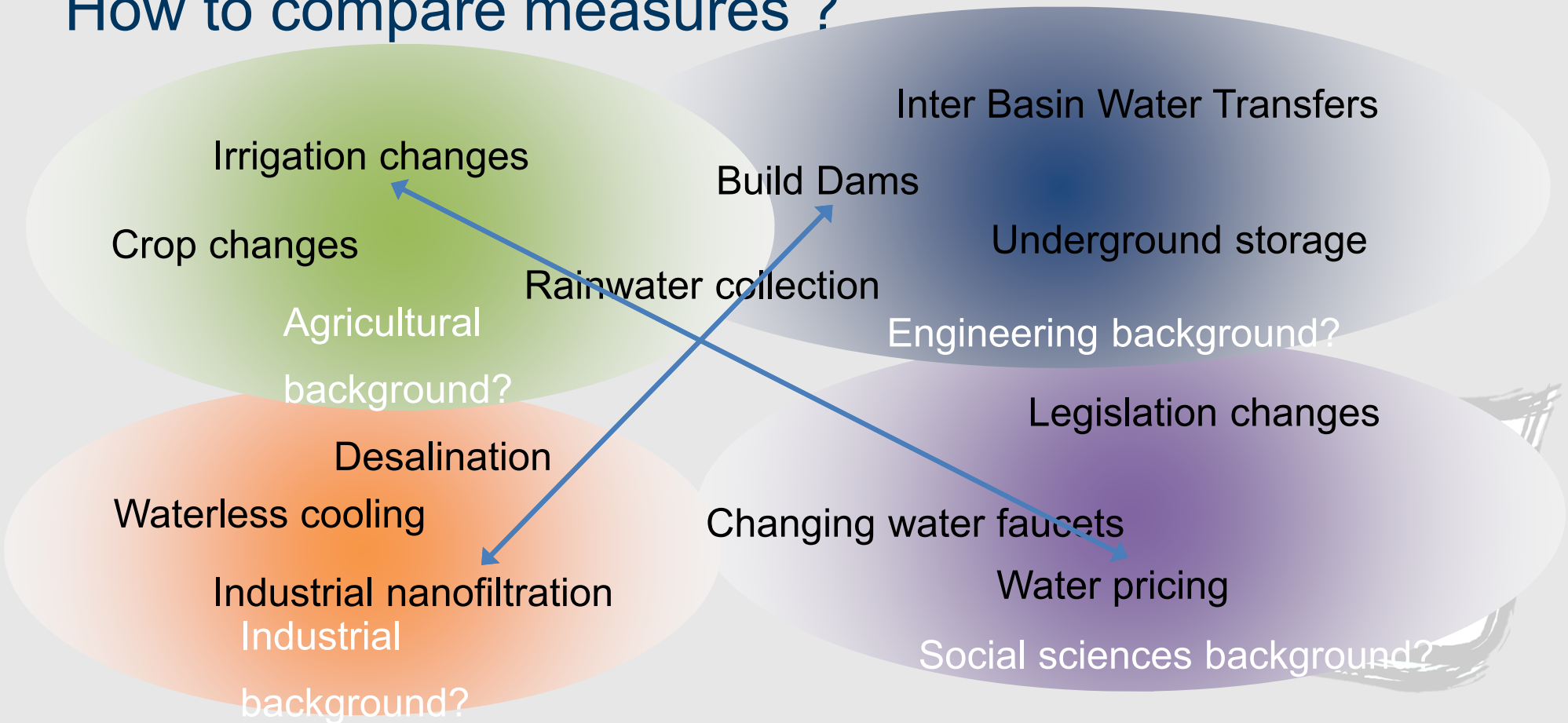
Choosing measures

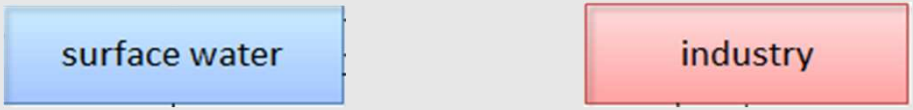
How to compare measures ?



Choosing measures

How to compare measures ?

1. Different measures have strongly heterogeneous (direct/indirect) impacts



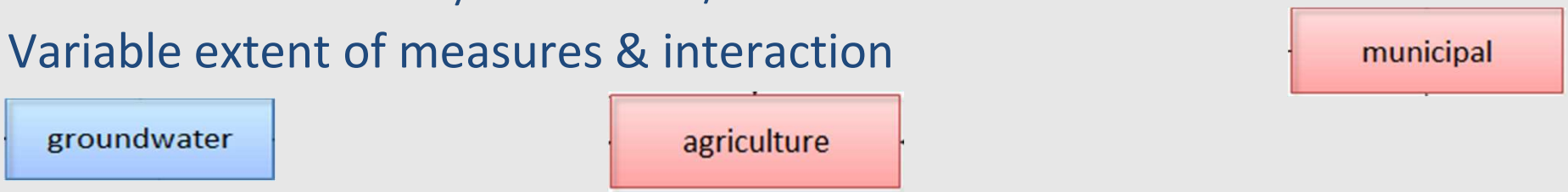
→ Integrate & compare different measures & their effects across compartments

→ Need for a “translation” to a common currency

2. Relevance of measure impacts to the main targets of the project

→ common currency = GW deficit / costs ?

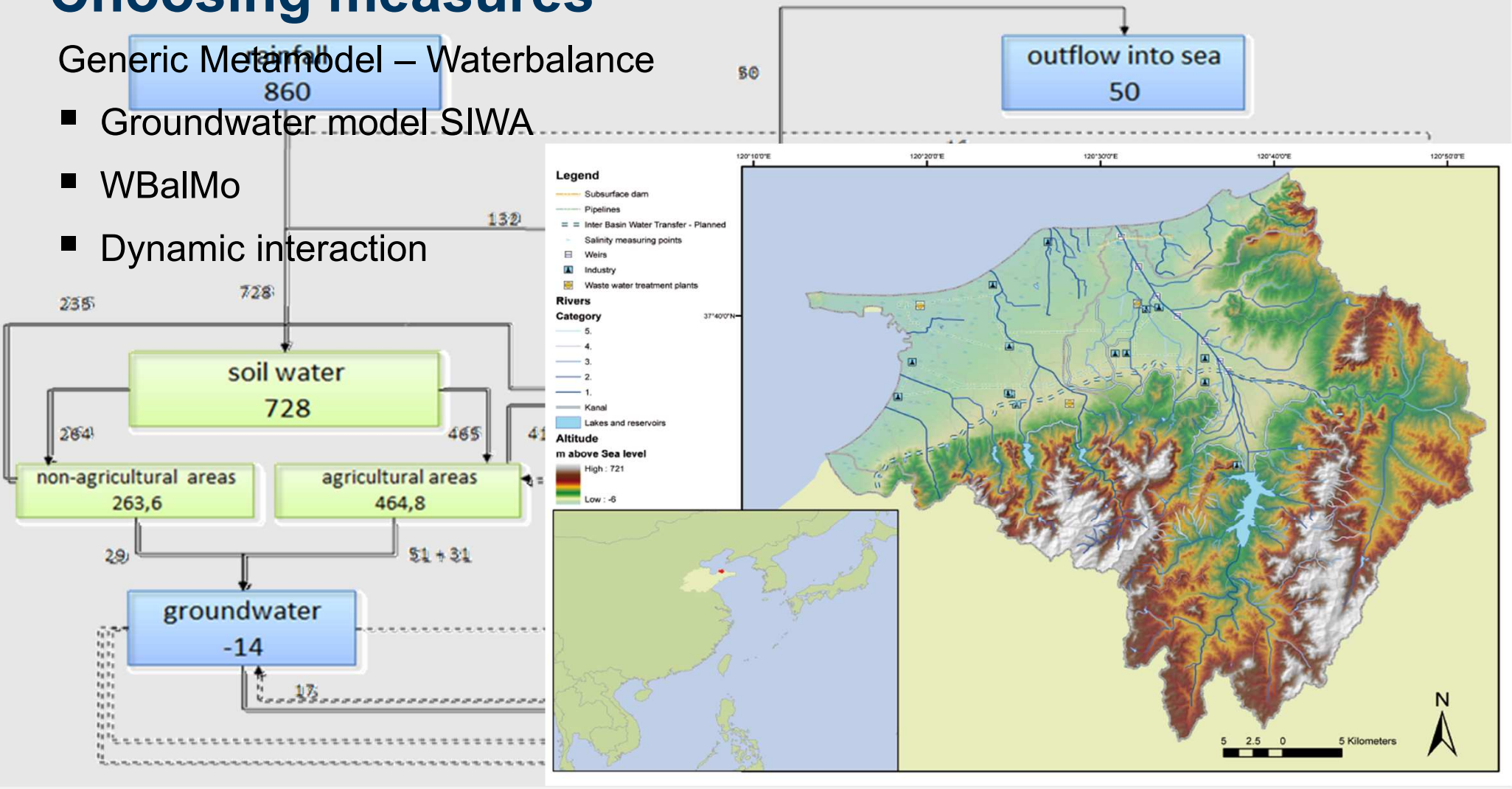
3. Variable extent of measures & interaction



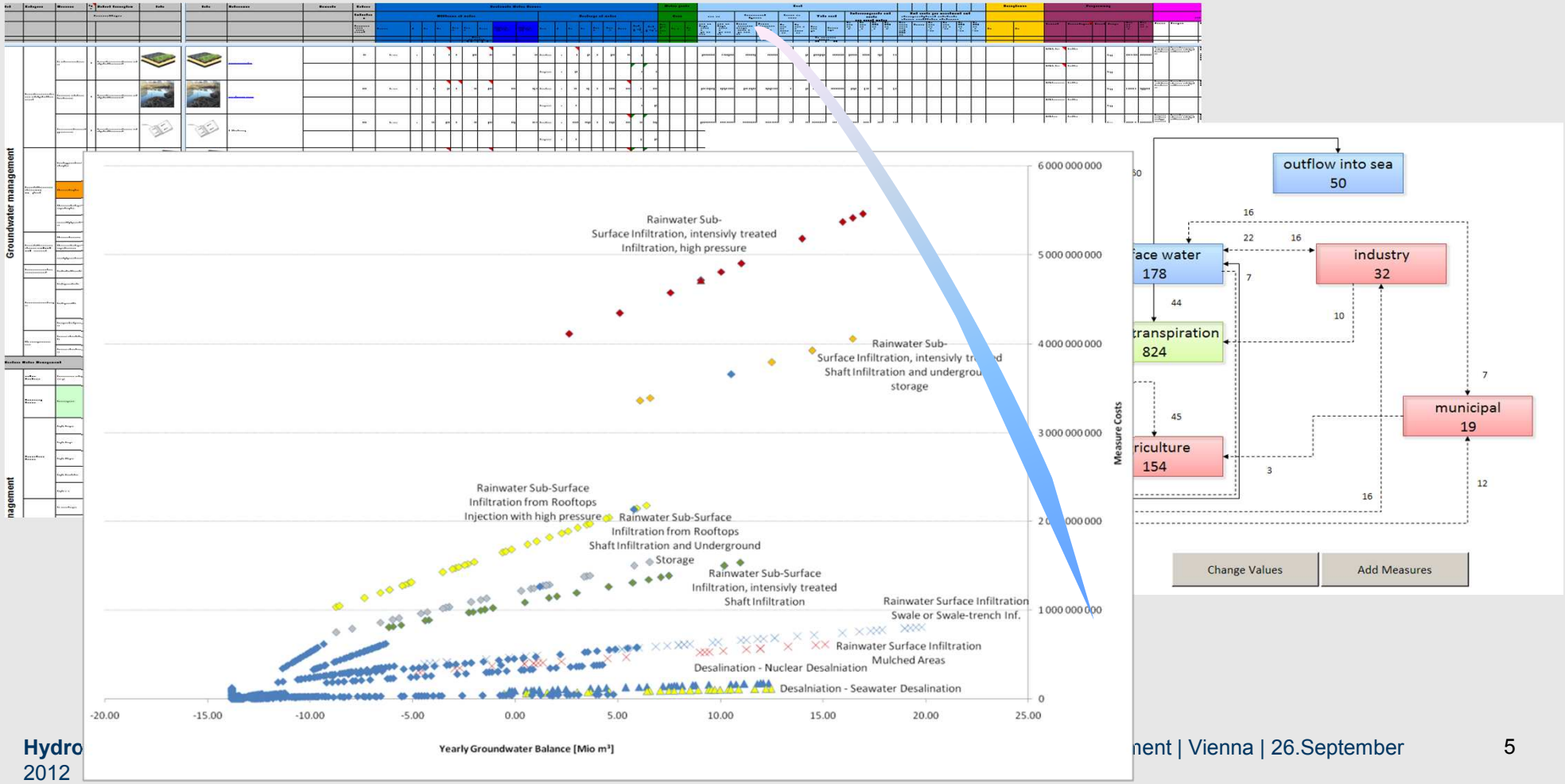
Choosing measures

Generic Metamodel – Waterbalance

- Groundwater model SIWA
- WBalMo
- Dynamic interaction



Choosing measures



Dimensioning measures

Multi-dimensional problem:

a. Changing which variables to which ?
   10 Crops/ 7 Irrigation types <-> others: $10^{10} * 7^{7}$ possibilities
b. Dimensioning
   what steps? 10 m², 100 m², 1 ha: $80000^{10} * 100^{7}$ possibilities

Unknowns:

a. Economical / social situation,
b. Cultural / historical situation
c. Market developments, …

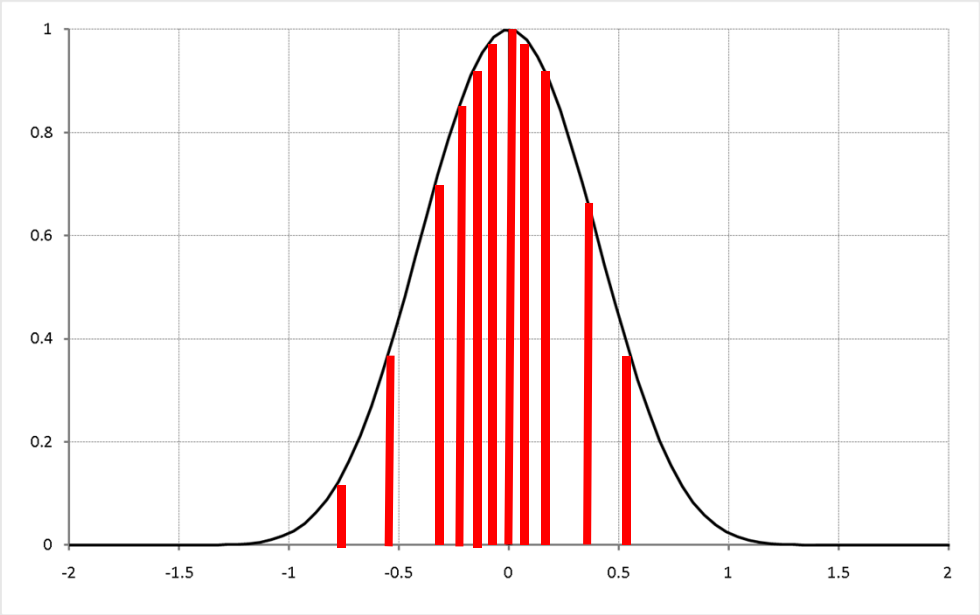
Actual agricultural land use pattern = end result of a multitude of physical, social and economical constraints ?

Dimensioning measures

Total Area [ha]

Corn	14 831.95
Wheat	13 783.54
Peanuts	4 875.61
Vegetables outside	5 849.42
Vegetables greenhouse	3 149.69
Other annual crops	2 976.91
Apple	13 027.92
Pear	8 913.19
Grape	6 181.73
Other Fruit	5 936.29
	79 526.24 ha
	795.26 km²

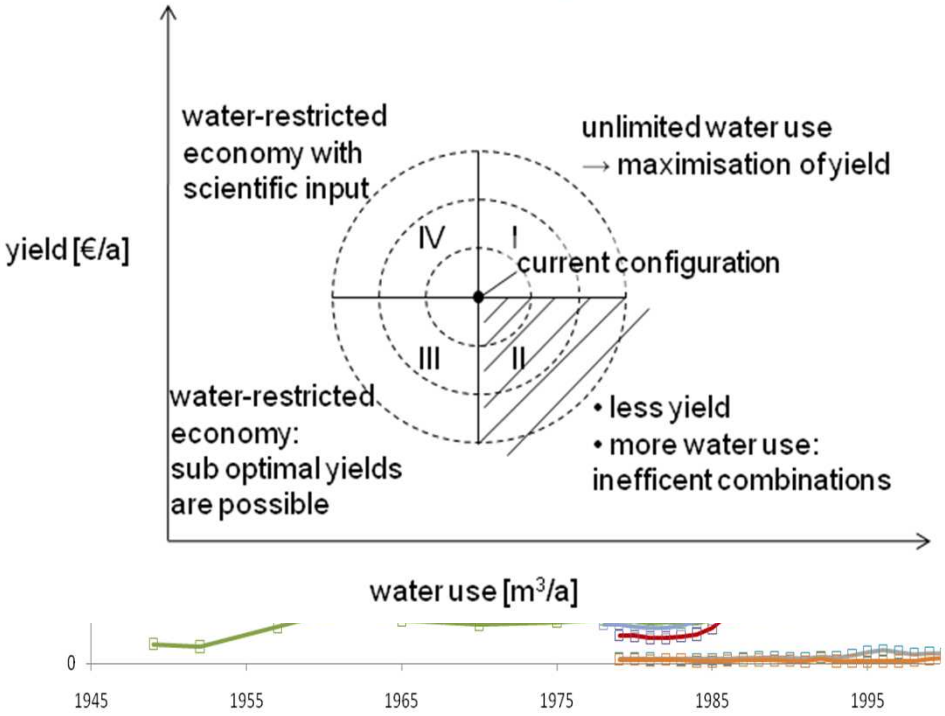
Acceptance *f(normalised distance to original)*

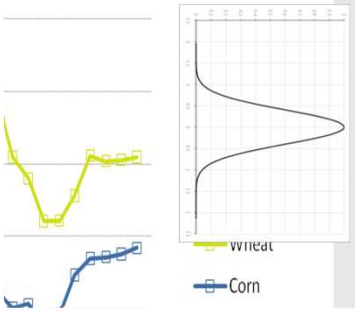


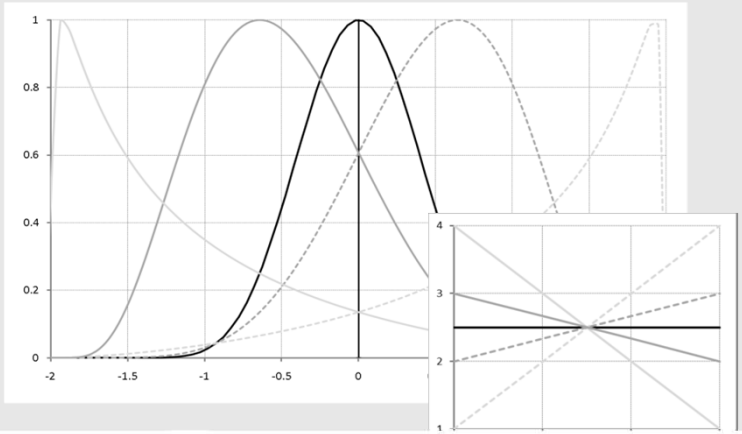
$$A_c = \begin{pmatrix} A_1 \\ A_2 \\ \vdots \\ A_{n_c} \end{pmatrix}$$

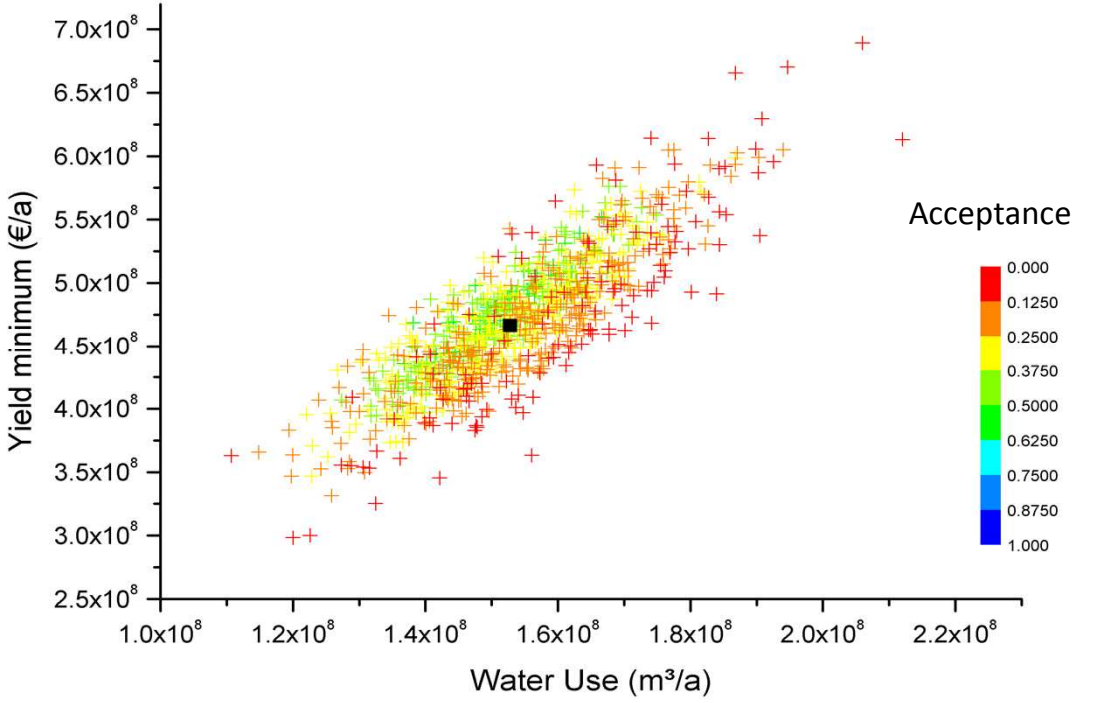
$$L_c = \prod_{c=1}^{n_c} l_c \qquad D_{Ac} = \frac{A_c^{'} - A_c}{A_c} \qquad l_c = f(D_c) = e^{-\frac{D_c^2}{2\sigma^2}}$$

Dimensioning measures









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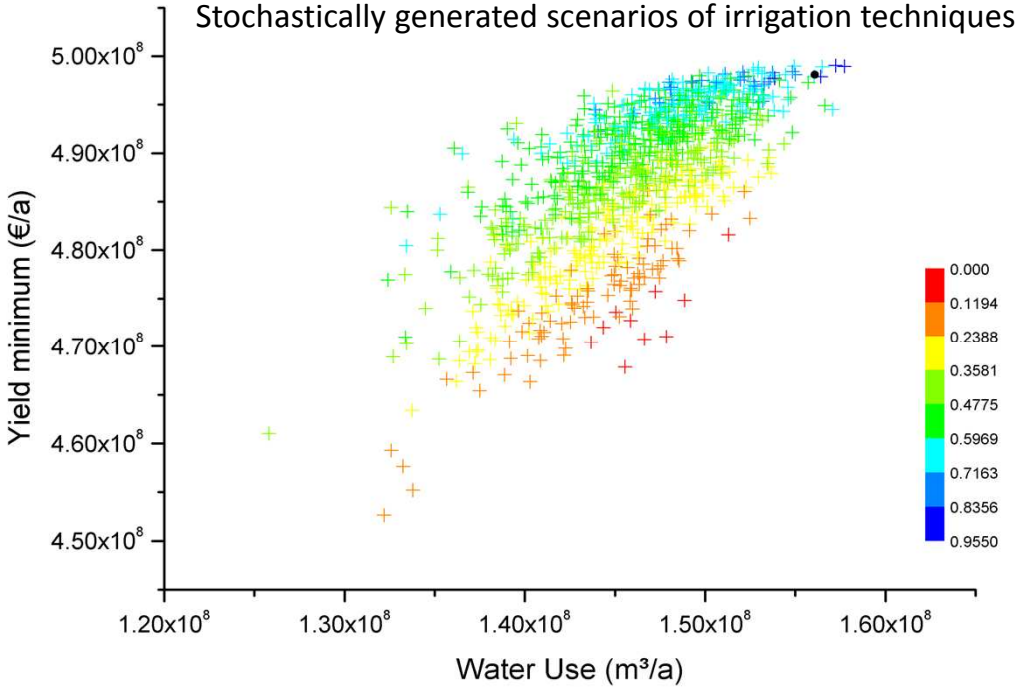
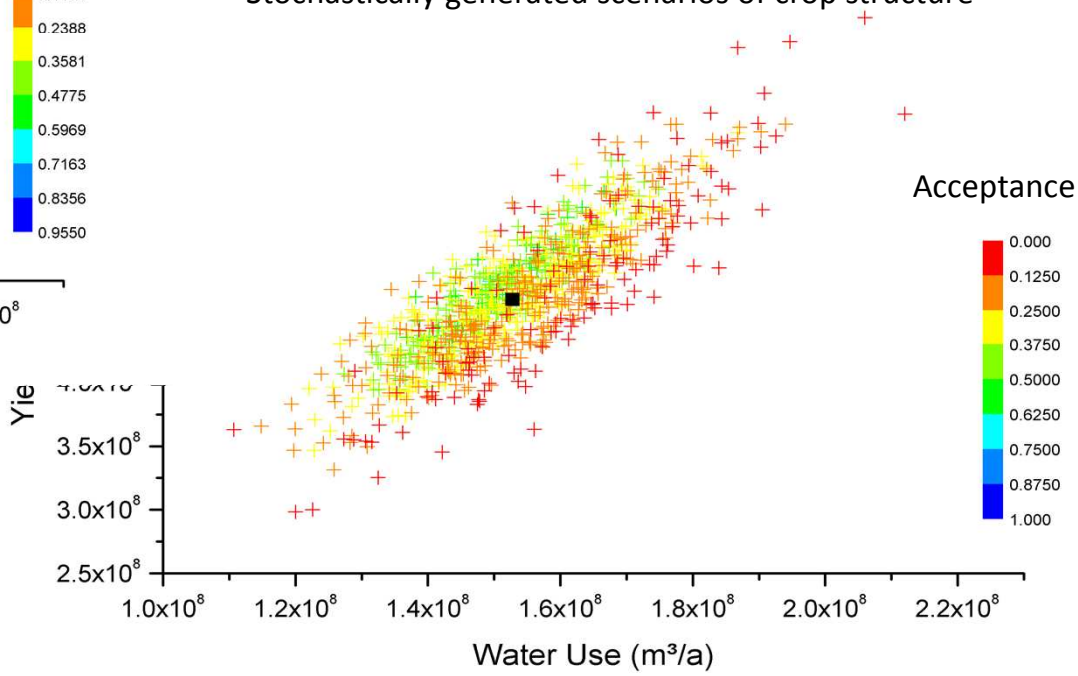
Dimensioning measures

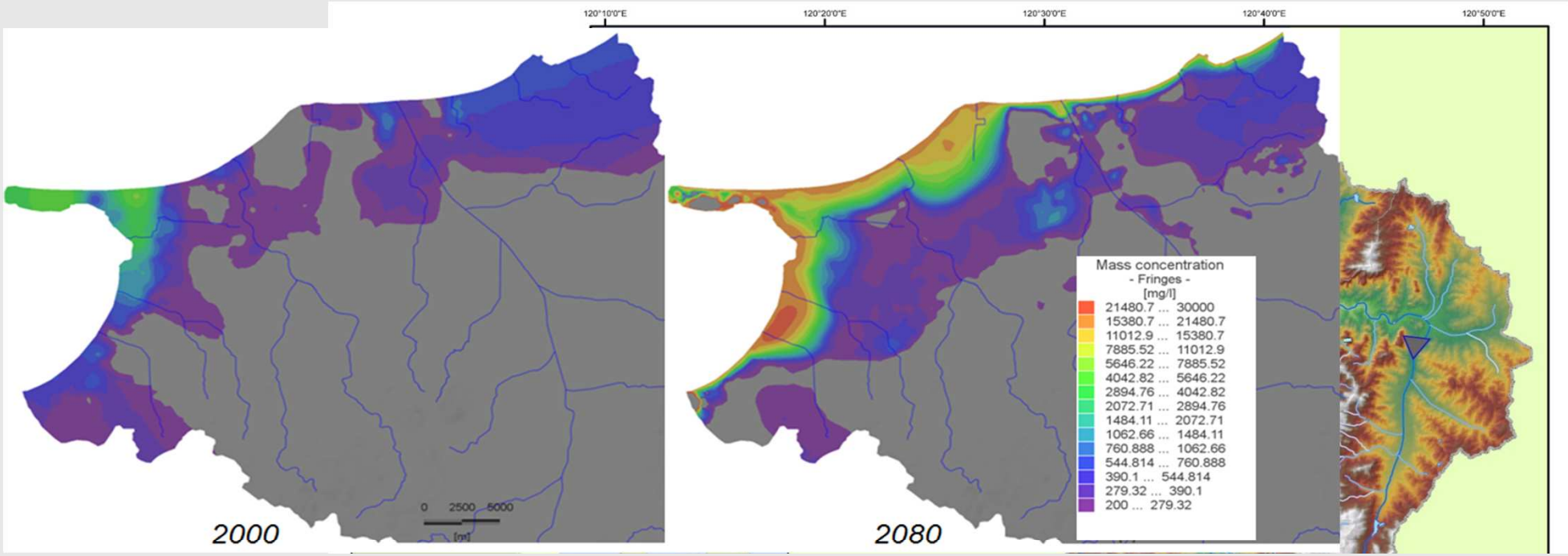
Stochastically generated scenarios of irrigation techniques



Stochastically generated scenarios of crop structure



Locating measures

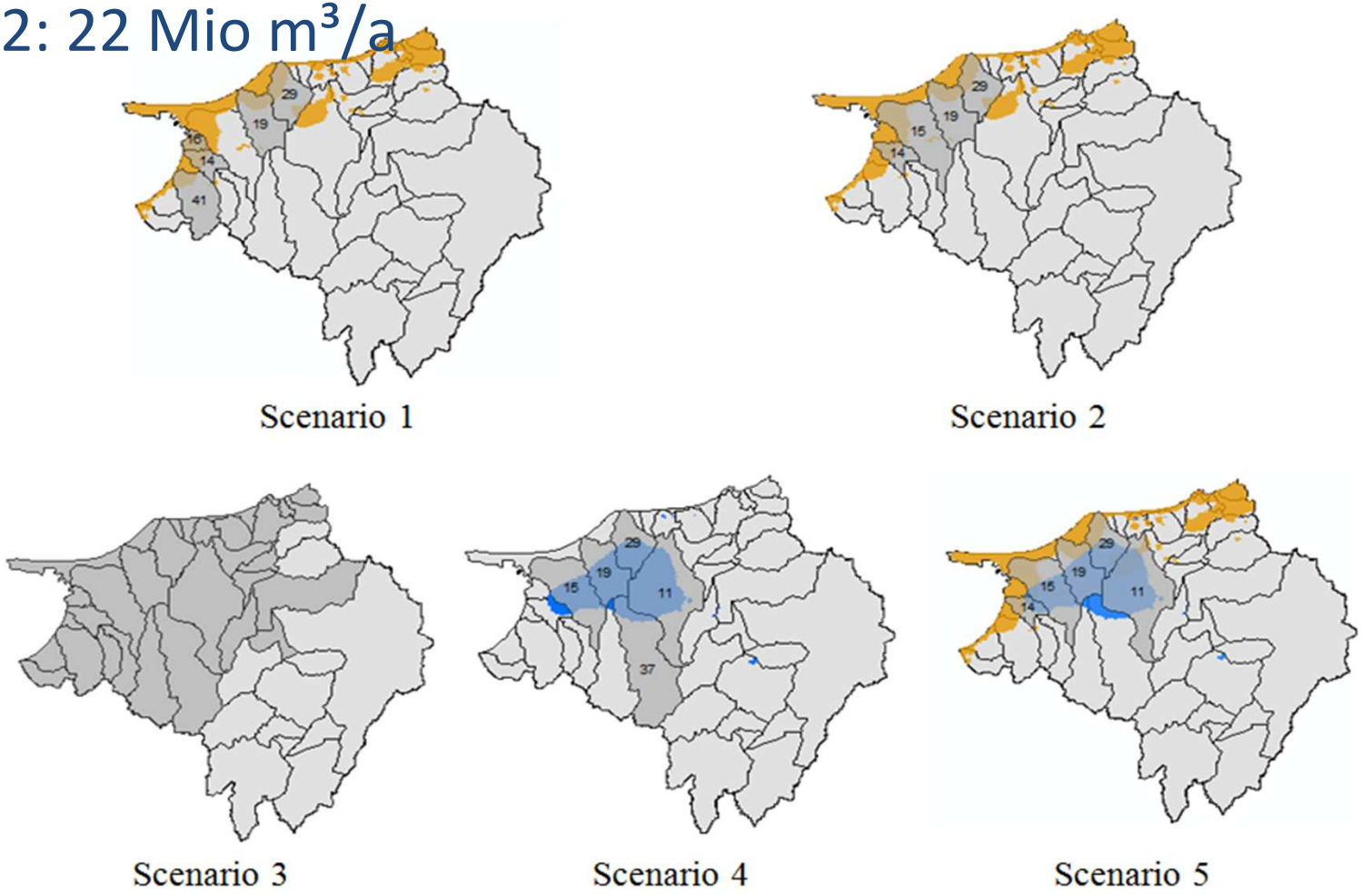


Two tier approach:

- spatial dimensioning of required amount of water
- spatial search to dimension & locate appropriate measures

Locating measures

Target: Scenario 2: 22 Mio m³/a



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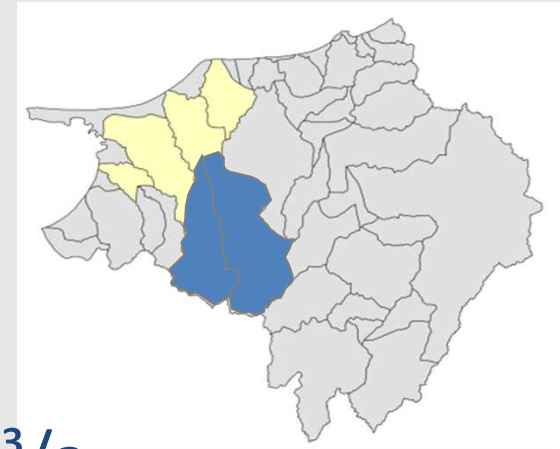
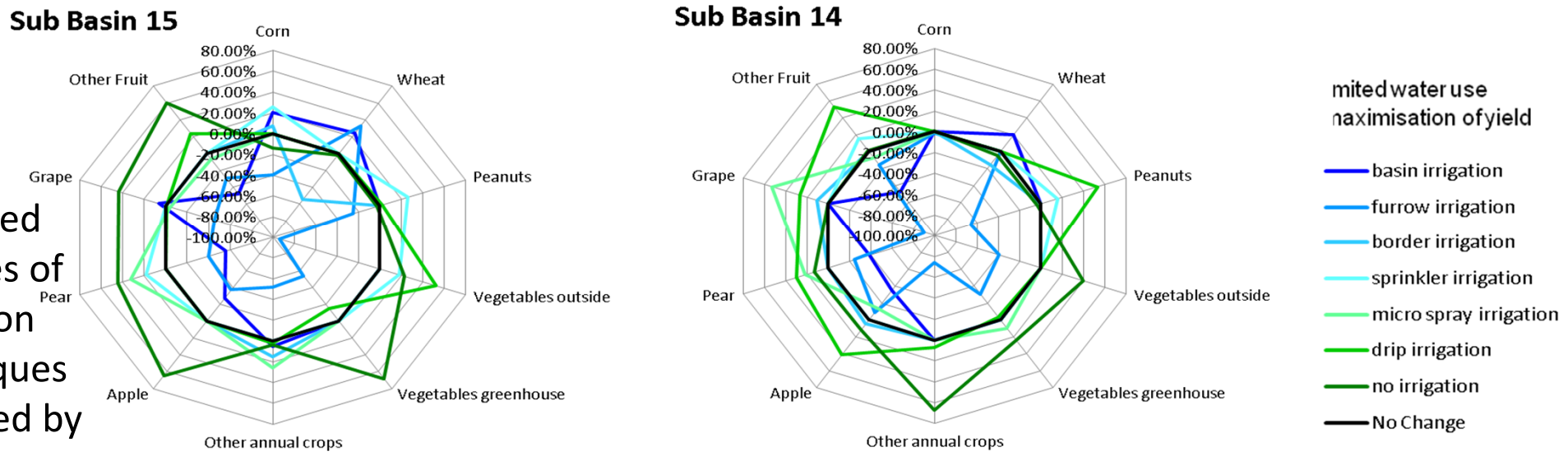
Locating measures



Target: Scenario 2: 22 Mio m³/a
Optimal acceptance: -2.3 Mio m³/a
OK acceptance, no yield loss: -6.6 Mio m³/a
σ= 0.6, less acc., no yield loss: -8.6 Mio m³/a
Optimisation of irrigation: : -10.7 Mio m³/a
Possible upstream reduction: additionally -12.6 Mio m³/a

Proposed changes of irrigation techniques specified by crops



Thank you for your attention