WP 4.1 Floods and Excess Water
The Middle Tisza case

Gábor Ungvári, András Kis
BCE-REKK

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Evaluating Economic Policy Instruments for Sustainable Water Management in Europe

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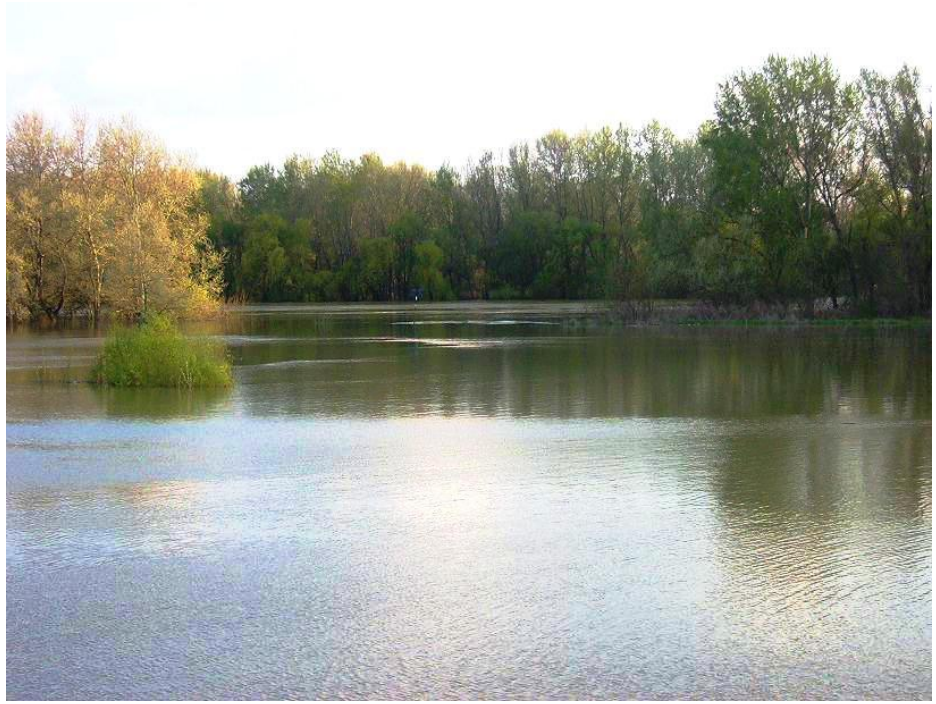
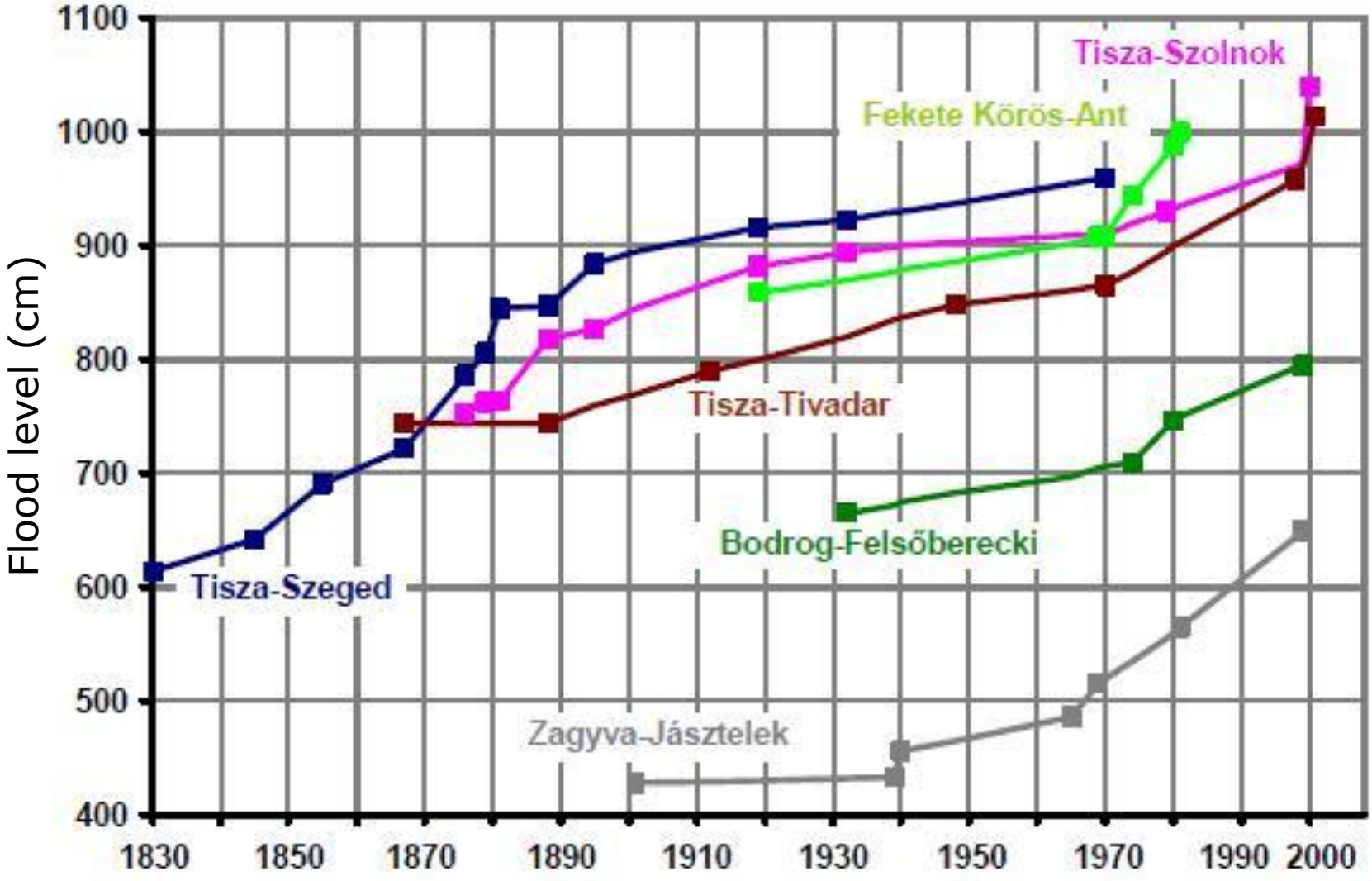
Middle Tisza case – a historic overview

- Middle ages: meandering river occupying large areas
- 19th century: canalization of the river, to gain land for crop production
- 150 years of increasing flood levels, increasing damage
- 1999-2002: four serious floods, including a dike rupture



Increasing flood heights

More frequent floods, higher water peaks



What does the future hold?

Hydrological modelling by the Department of Sanitary and Env'l Engineering, Budapest Univ. of Tech. and Econ.

Dikes are designed to withhold specific flood levels.

Probabilities for a *critical flood* taking place in a given year on the river Tisza:

- Mid-20th century: 1%
- Currently: 1.5%
- 2nd half of the 21st century *: 16%

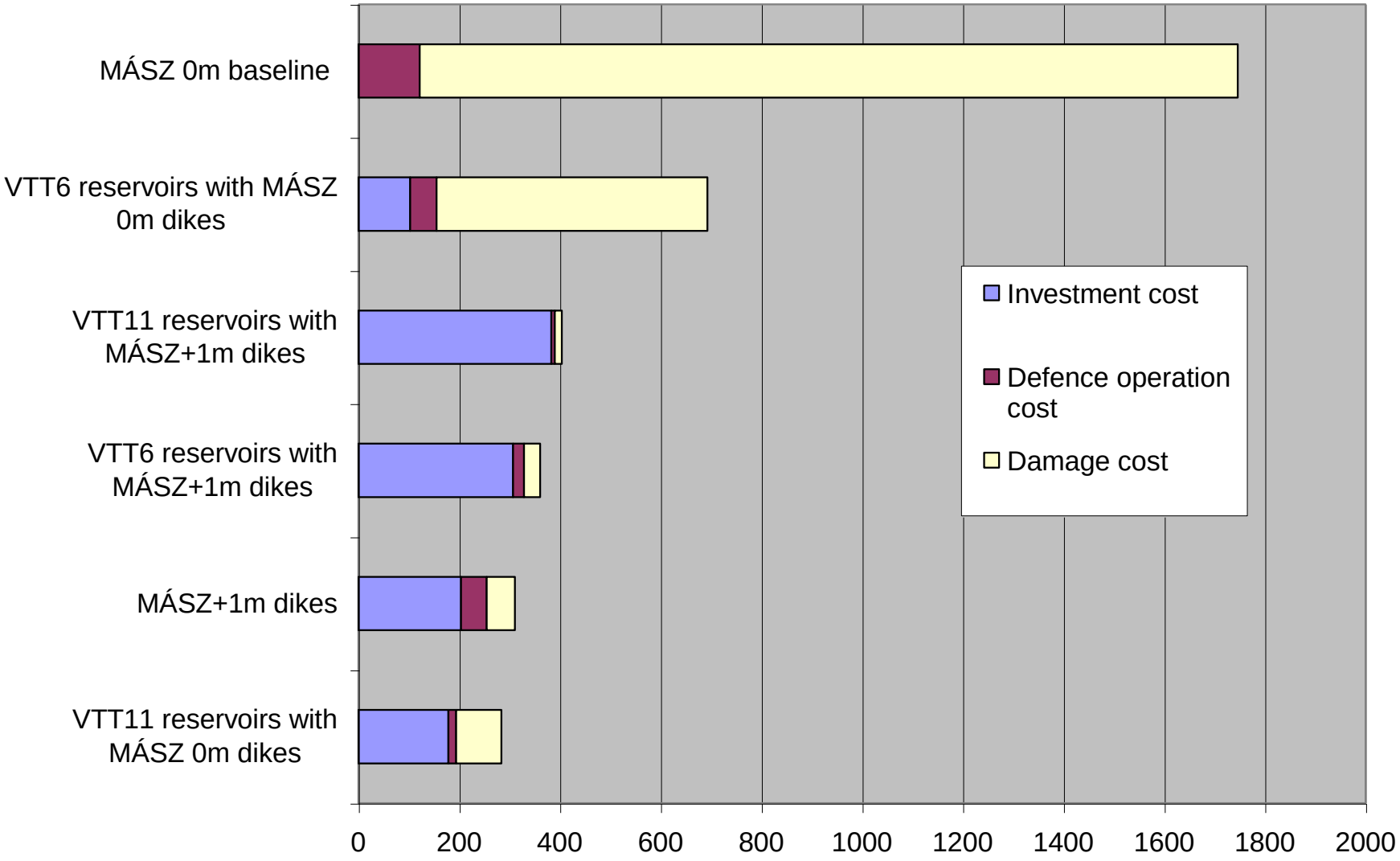
  * climate change + siltation together, siltation being the more important factor

4 *critical floods* between 1999 and 2002

Flood protection

- Usual response: increase the height of dikes
  - Costly to build and maintain
- The concept for peak shaving flood water storage reservoirs emerged after the 1999-2002 series of floods
  - Lower cost (especially investment cost!)
  - Improved local water balance - if water is retained
  - More valuable under an increasingly arid climate

2006 CBA of alternatives



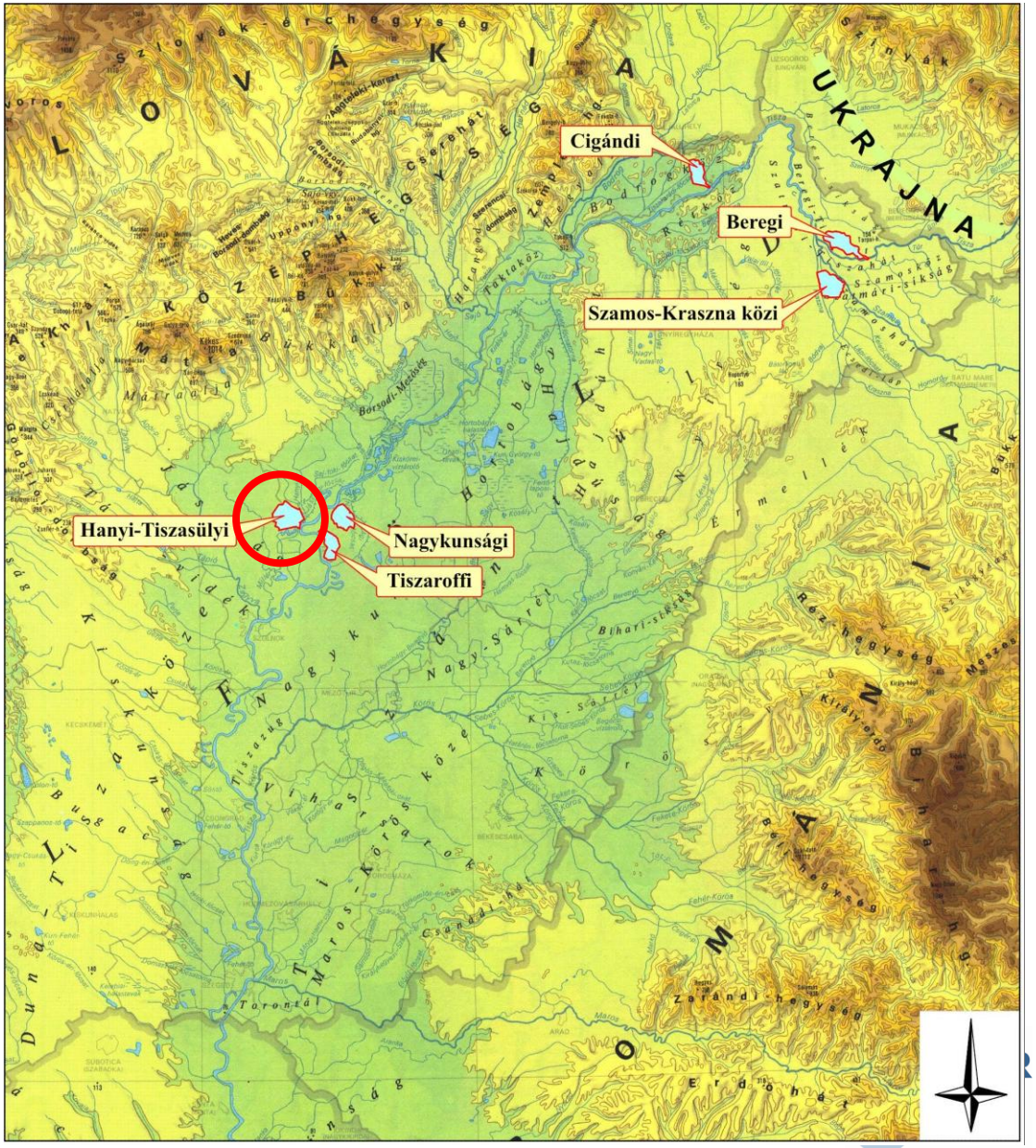
Expected present value of different scenarios of flood-defence expenditures and damages for a 100 year-period on the Hungarian section of River Tisza, billion HUF, discounted at a 3% real discount rate.

Note: HUF 1,000 billion is equivalent to about EUR 4 billion.

Based on: Koncsos, L. (2006), A Tisza árvízi szabályozása a Kárpát-medencében, summary of the NKFP 3/A 0039 /2002 research program

New Vásárhelyi Plan

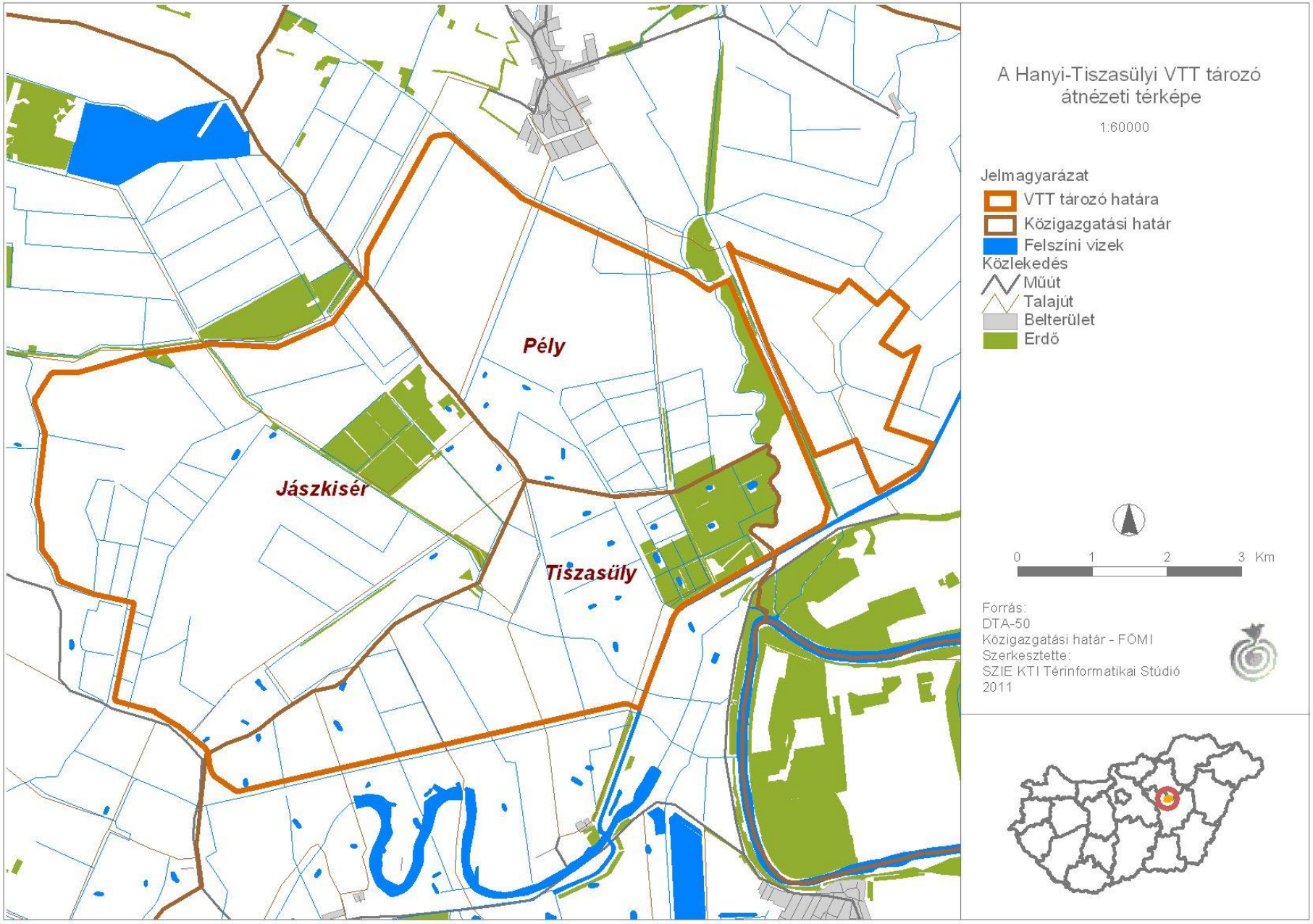
- Adopted by the Government in 2003
- 6 reservoirs in the first stage
  - Tiszaroffi and Cigándi already in operation
  - Hanyi-Tiszasülyi and Nagykunsági close to completion
  - Beregi and Szamos-Kraszna under design
- Tiszaroffi already used in 2010 – first experience assessed
- Case study site



Hanyi-Tiszasülyi reservoir – the focus of our case

- Reservoir territory: 60 km^2
- Flood storage capacity: 250 million m^3
- Rural area, declining population, unemployment rate 15-25%, 41-48% of families without any earner
- Three nearby villages with total population of 8,000
- Main economic activity: agriculture
- Recent land use in the reservoir: 87% arable land; 8.5% forest, bush; 1% pasture
- Mostly privately owned land, a minor share is state owned and rented by farmers
- Medium land quality – but better than the surrounding areas
- Land use is vertically integrated with other agricultural activities, especially milk cows
- Rigid and illiquid land market

Hanyi-Tiszasülyi reservoir



The current algorithm for reservoir use

- Large flood is projected
- Constant monitoring of the situation at the regional water directorate, using hydrologic models
- If risk threshold is triggered, they decide to open the reservoir(s)
  - If not all reservoirs are needed, then which one to open? No rules yet
  - Crop damage will have to be compensated, but there is no earmarked budget for this – hesitation to open
- Reservoir flooded, water stays there for weeks before releasing it back to the river
- Water will stay in low-lying areas longer
- Crop damage assessed
- Crop damage compensation paid in about a year

Reservoir use – the farmers' perspective

- Lack of profound consultation with local stakeholders (farmers, village population) – their endorsement is largely absent, frustration is sensible
- Crop damage compensation: slow and incomplete
  - In case of the Tiszaroffi reservoir it took one year for the government to pay compensations to farmers
    - Financing cost for farmers
  - Registered costs and lost profit is compensated
    - Indirect costs and specific cost items were not covered (e.g. depreciation)
    - Revenue level is just as important for farmers as income level (to pay for loans, labour)
  - Access water that stays in the reservoir – currently viewed as a problem
- If reservoir use becomes frequent, farmers may have to make adjustments:
  - Switch to lower cost crops
  - Move some activities out of the reservoir
  - Difficult due to tight land market (for both purchase and rent)

Reservoir use – the perspective of the authority

- Intensive farming within the reservoir:
  - High damage profile when flooded
  - Pollution risk (fertilizers, pesticides; effluents carried by the river)
- Financing problems
  - Authorities open the reservoirs only when they are absolutely certain that it is needed
  - This may lead to sub-optimal decisions (opening too late, damage to dikes)
- In about 70% of the critical flood cases not all reservoirs need to be flooded, it is enough to open less then six of them
  - Which ones to open?
  - Uncertainty of damage levels in each reservoir
  - Hydrological modelling utilising relative damage functions of reservoirs: large shifts of reservoir use between scenarios

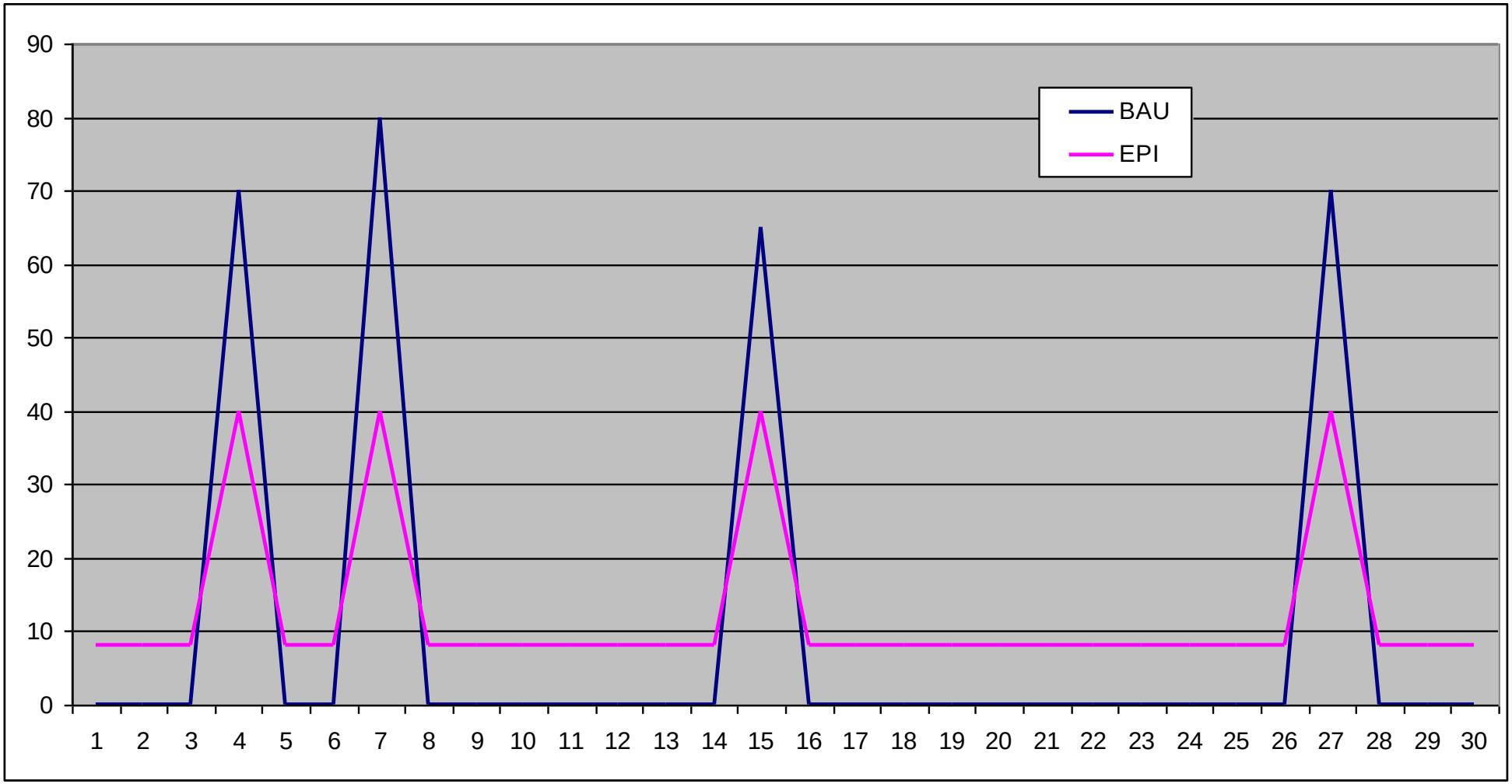
The proposed EPI

EPIs have been evolving in parallel with the study of the area, stakeholder consultations and hydrological modelling

Main features of the proposed EPI:

- annual fixed payment to farmers +
- a preset amount of compensation when the reservoir is flooded
  - based on production of a low profile crop (e.g. barley)
  - quick administration and payment

An example of compensation payments to farmers



Why is it good?

Advantages to the farmers:

- no need for bridging loans
- annual fixed payment can cover formerly uncompansated fixed costs
- they can retain/improve their economic position while lowering risks

Advantages to the government:

- the annual fixed payment could be covered from the CAP budget (?!)
- lower damage compensation payment from the tight annual budget
- less uncertainty of payment obligations
- reservoirs can be opened in borderline situations
- optimal choice of reservoirs becomes possible
- lower transaction costs (no damage assessment)
- lower risk of pollution (less intensive farming)
- improved ecology (?!)
- happier farmers

An alternative EPI

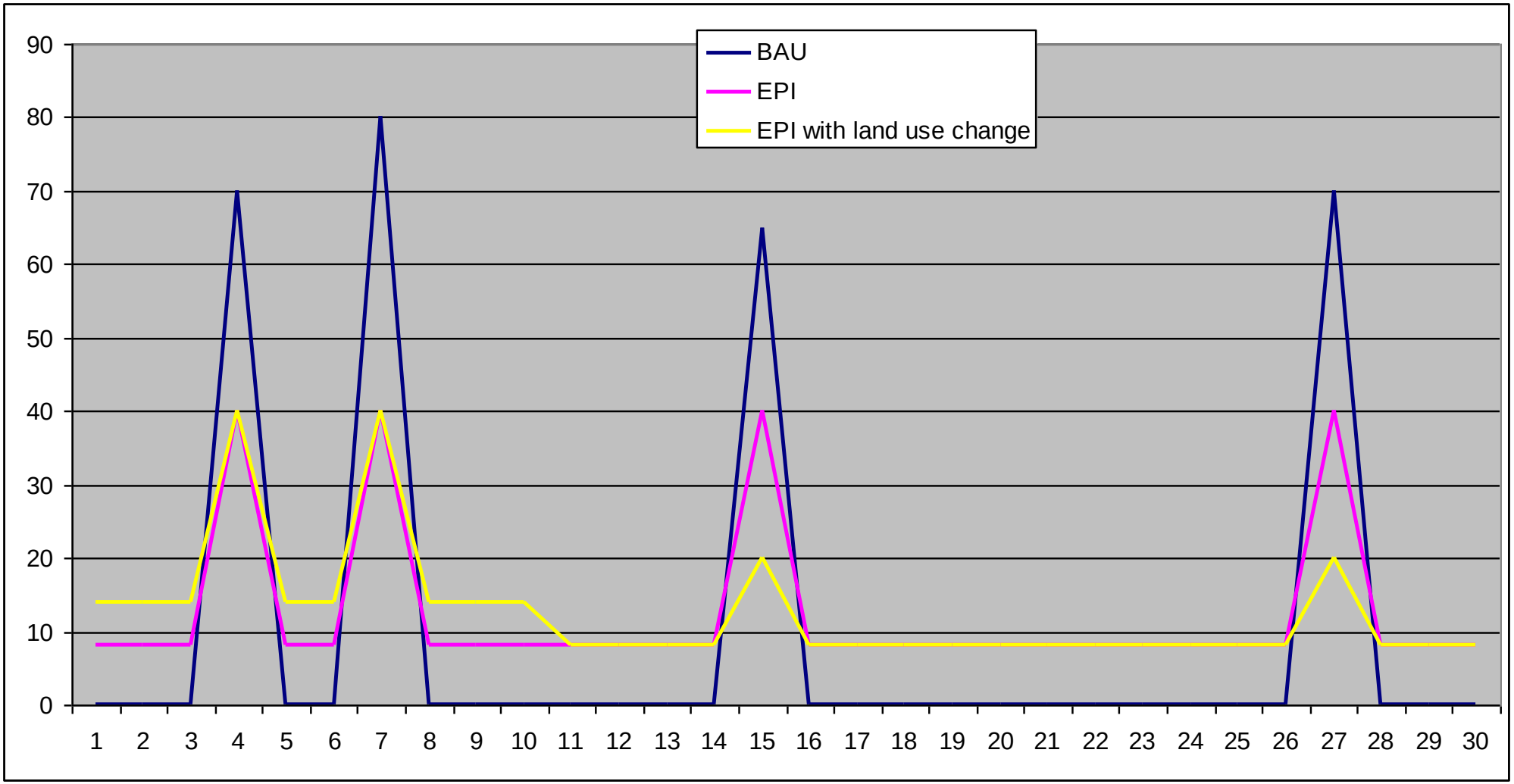
The goal of land use change is incorporated

- Same concept as the previous one (annual payment + preset flood damage compensation)
- A 10-year premium annual payment (supplement) in exchange for land use change (from crop production to other uses: meadow, forest or wetland)
- Land use switch to be completed by the 10th year
- Cannot be shorter than 10 years, because land within the reservoir is part of vertically integrated farms, while the land market in the area is very rigid – any adjustment has considerable cost and time need

Importance of land use change:

- Even lower damage profile
- Improved ecology and lower risk of pollution

An example of compensation payments to farmers



Testing the feasibility of the EPI

Consultation with the local water directorate: they like the concept

Assessment of the farmers preferences: workshop in February

- Seeking willingness-to-accept bids for the annual fixed payment component if the algorithm for the preset amount of compensation is exogenously set (e.g. regional average barley yield from the last three years, using three year average prices, independent of what they produce)
- Revealing shadow price of endorsing the service, land use change from intensive arable production
- Same for the land use change incentive payment
- CBA of different EPI scenarios

Assessment Framework

Environmental outcome	Likely improvement
Economic impacts	Lower overall flood defense costs (investment + operation + damage)
Transaction costs	Considerably lower than currently
Distributional effects	More balanced economic position for farmers
Institutions	
Policy implementability	Local and regional level: probably good Government level: ?
Uncertainty	Reduced

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