Impact of global change on soil erosion risk - Scenario analyses for the semi-arid Drâa catchment (South Morocco)

A. Klose & B. Diekkrüger

Global Change in Africa - Projections, Mitigation and Adaptation

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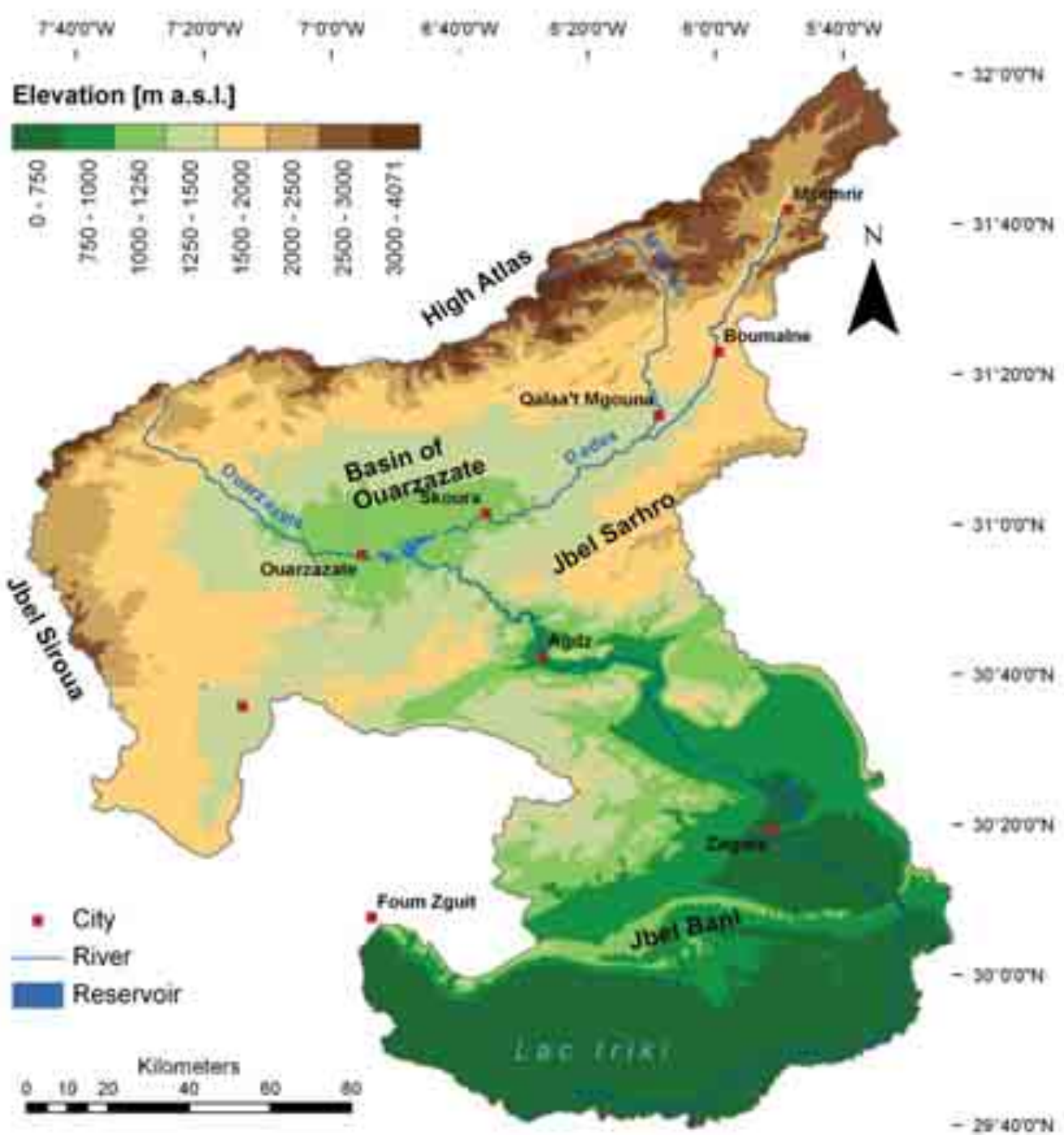
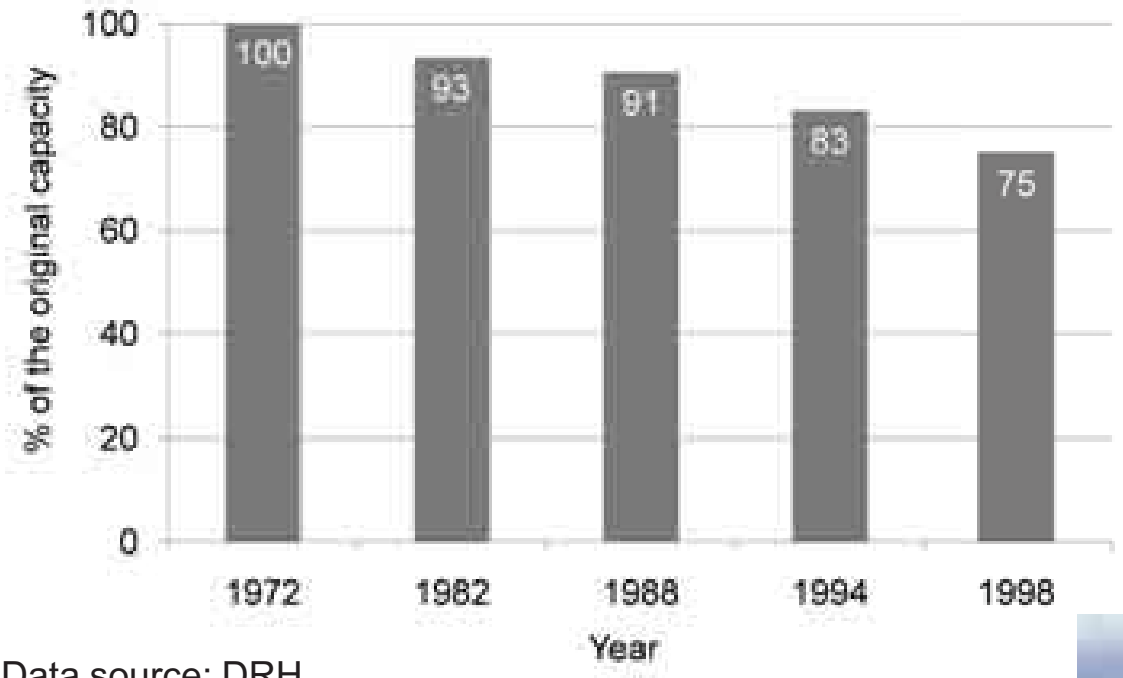


Study area & problem setting

- Relief: high energy
- Soils: shallow, stony, low organic matter content
- Vegetation: very sparse cover
- Use: 2% agricul-turally used oases, 98% pasture
- Climate: semi- to hyper-arid, precipitation very heterogeneous in space and time

Soil erosion extent

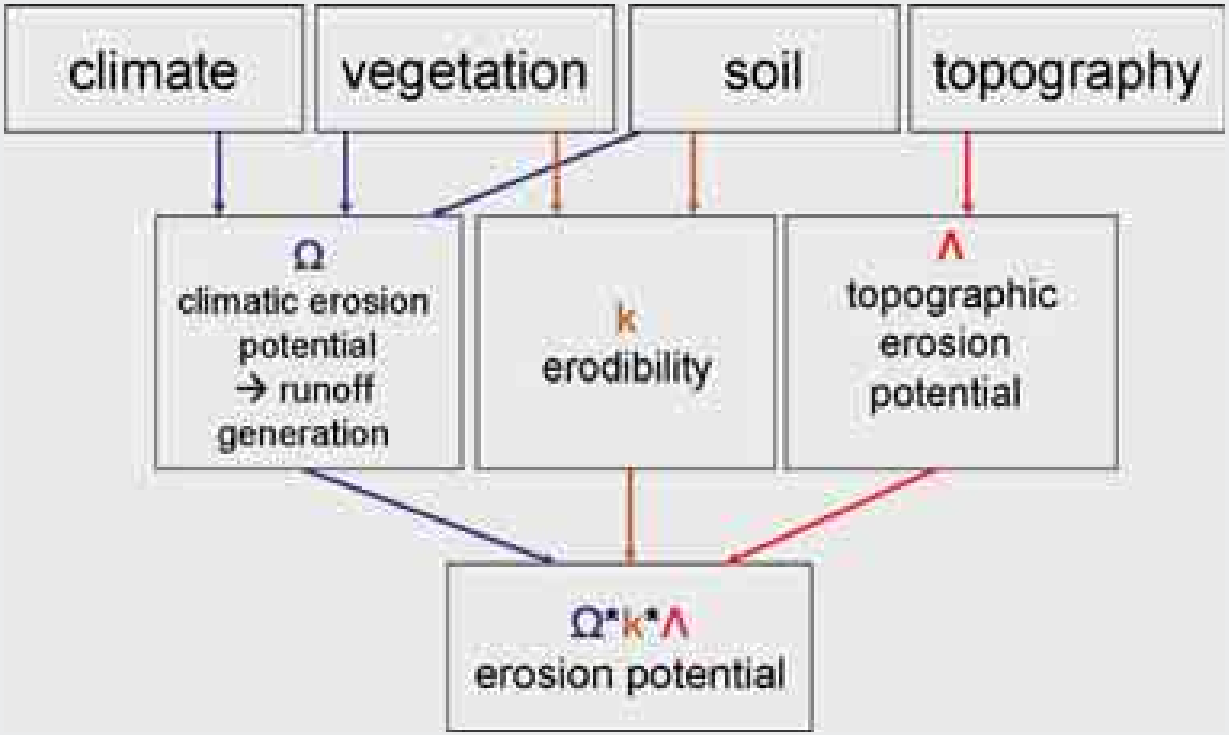


Data source: DRH

- Reservoir:
  -25% in 26 years
  (= 5.6 t/ha/a)
- Erosion pins:
  28.4 t/ha/a

No spatially distributed information on erosion risk!

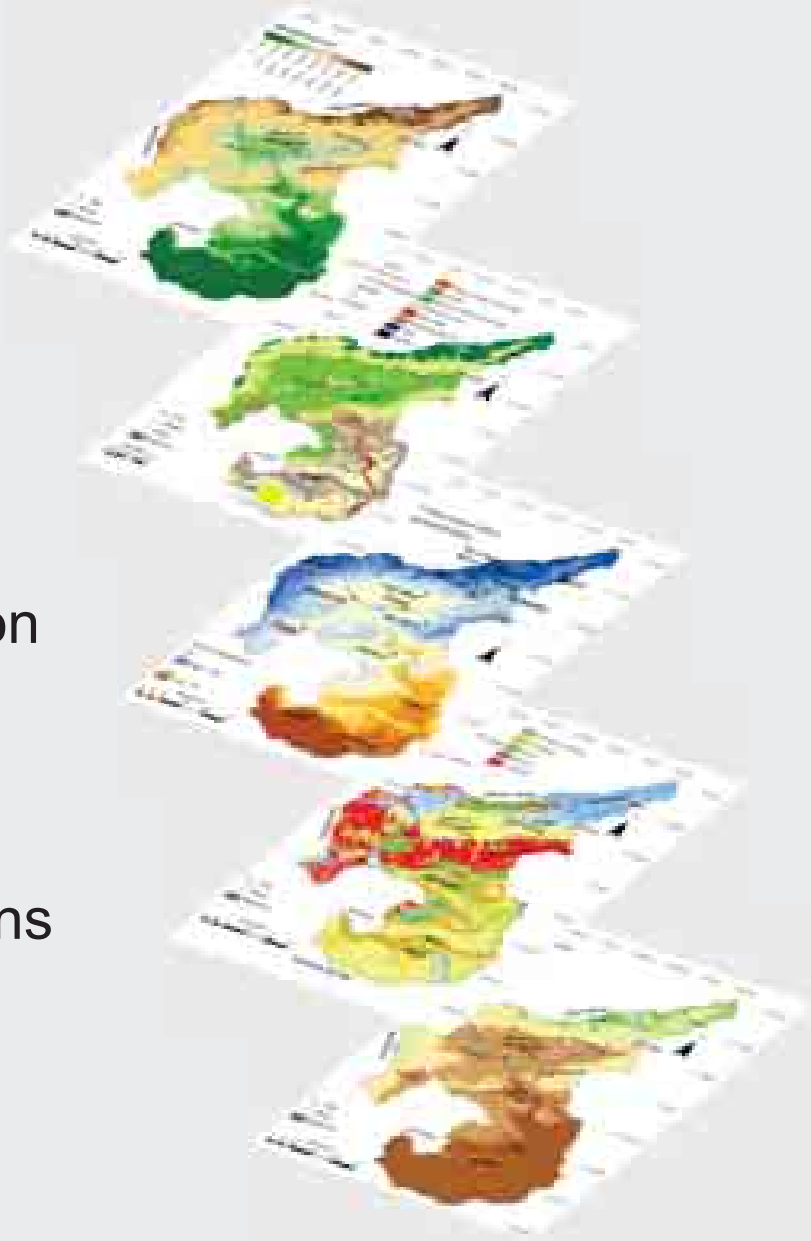
Approach – the PESERA model



- Pan European Soil Erosion Risk Assessment
- Physically based
- Spatially explicit
- Long-term, monthly
- Adapted to large, data-sparse catchments
- Adapted to semi-arid conditions
- Plant growth routine allows scenario simulations

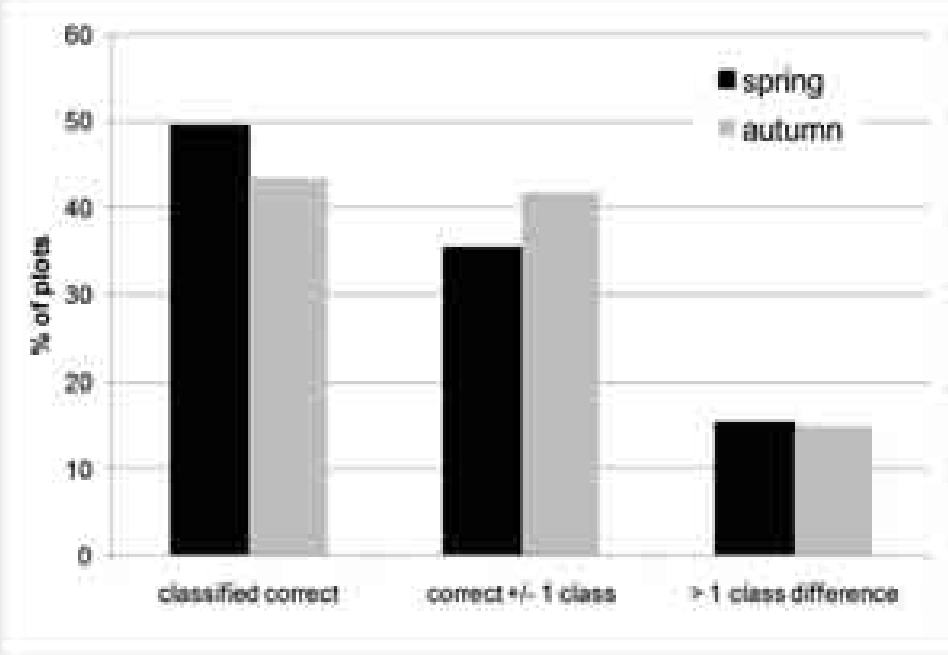
Model setup

- 250 x 250 m pixel size
- SRTM DEM
- Vegetation: Landsat TM classification combined with habitat modelling (SCHMIDT, 2003 & FINCKH)
- Climate: regionalisation of meteorological station data based on altitude
- Soils: maps of soil properties conducted from own field work combined with pedotransfer functions
- Vegetation degradation based on grazing exclusion experiments (FINCKH)



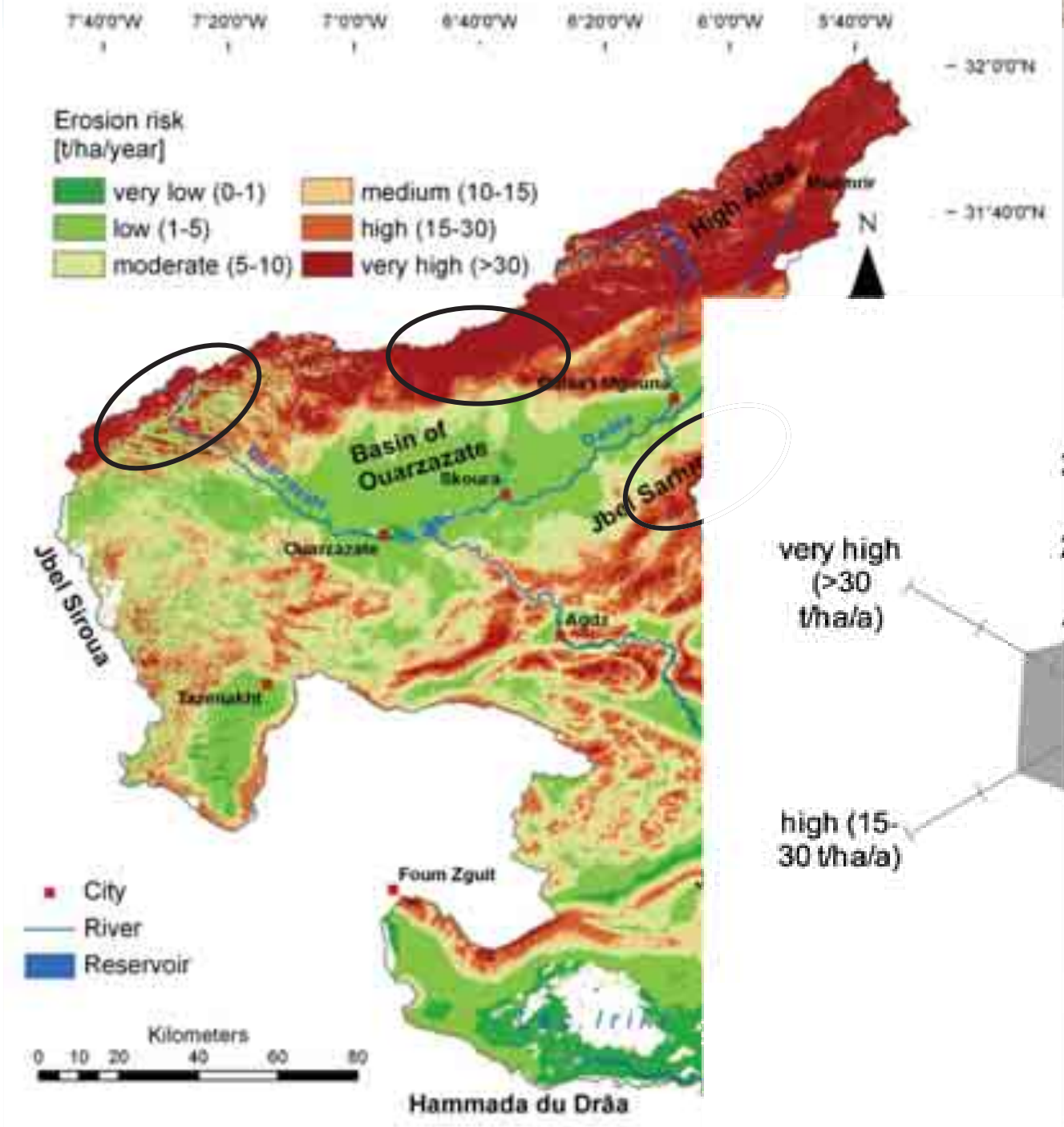
Model setup

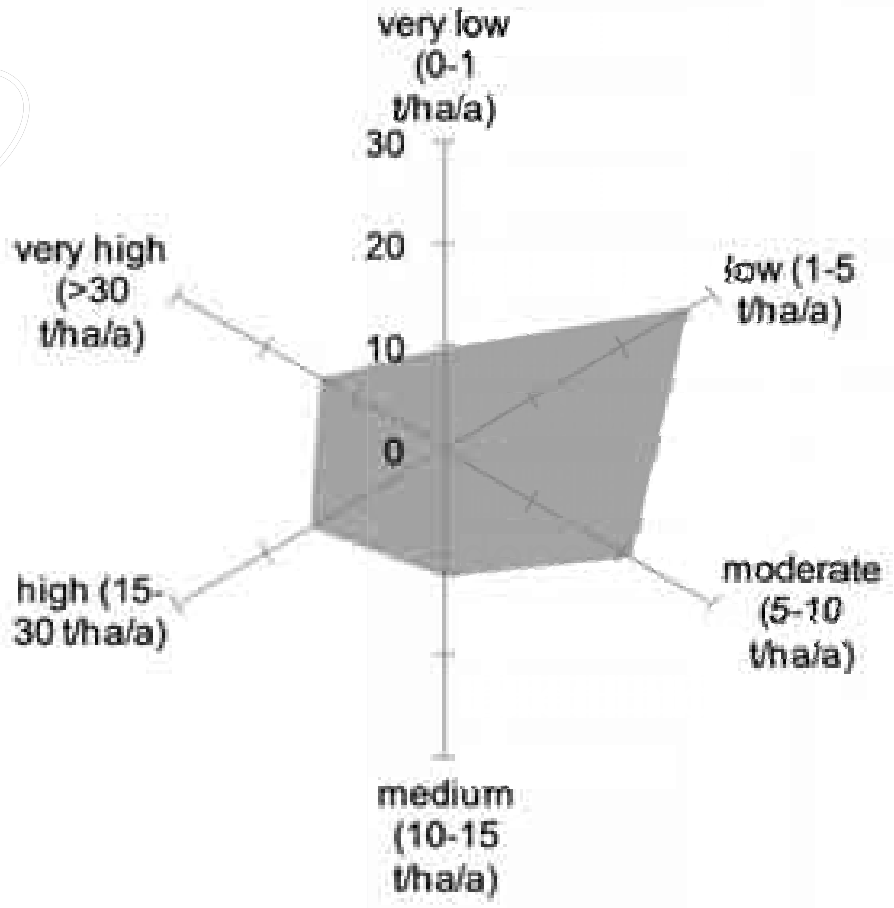
- Calibration based on results of the hydrological model SWAT (BUSCHE, in prep.)
- Plausibility check:
  - Comparison of measured (FRITZSCHE, in prep.) and modelled vegetation cover classified into 6 classes



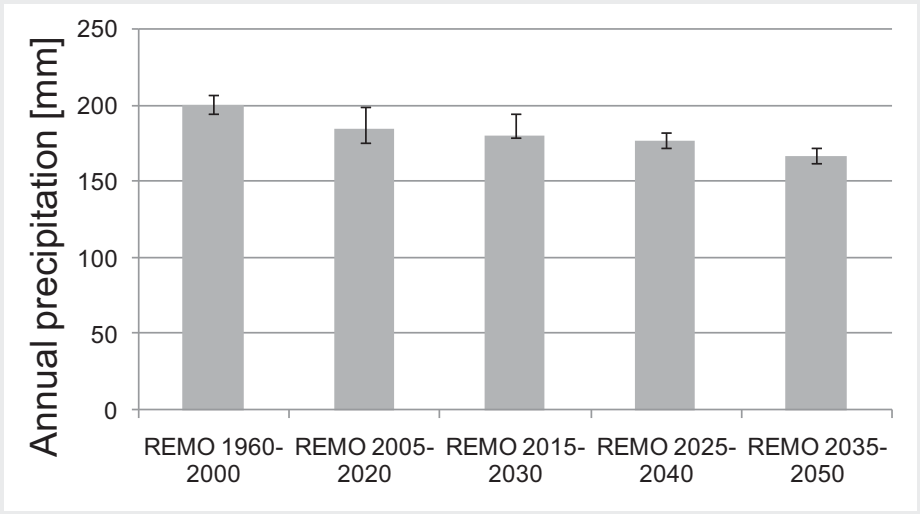
  - Model-model comparison RUSLE (HCEFLCD, 2008): reasonable spatial agreement

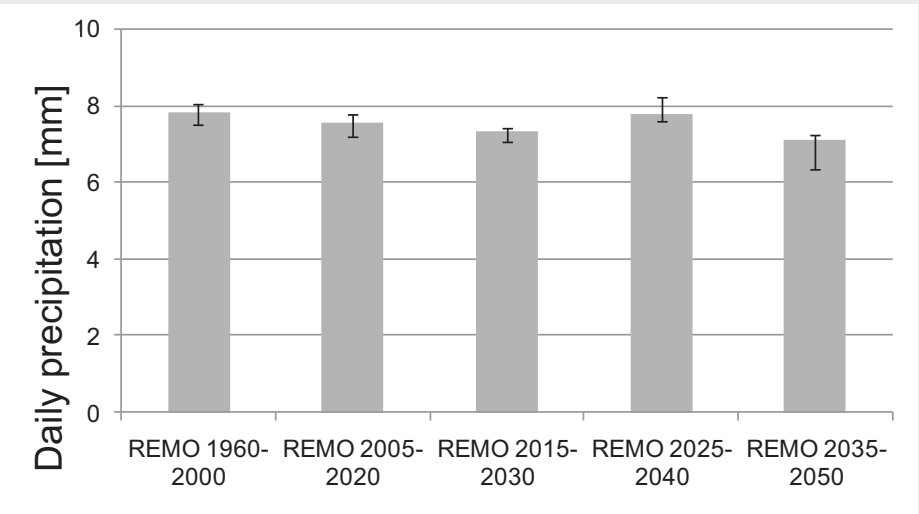
Results of the baseline simulation

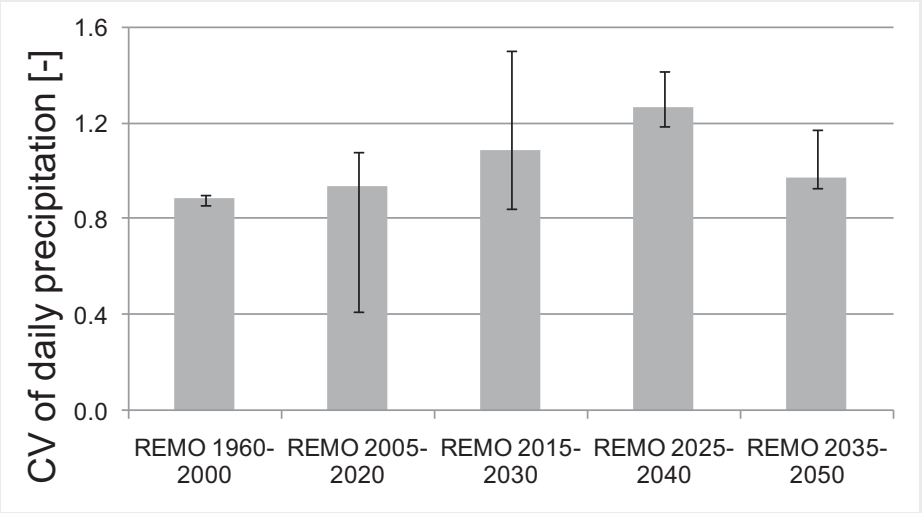


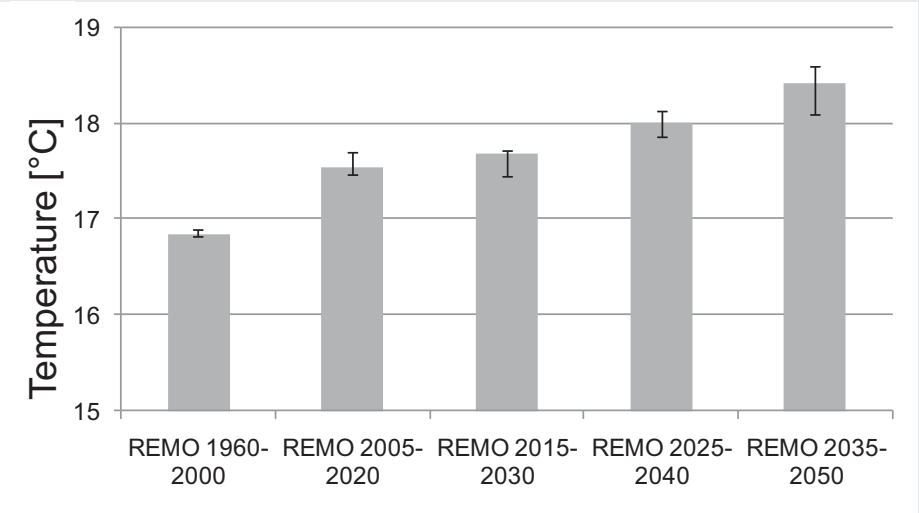


Climate change scenarios



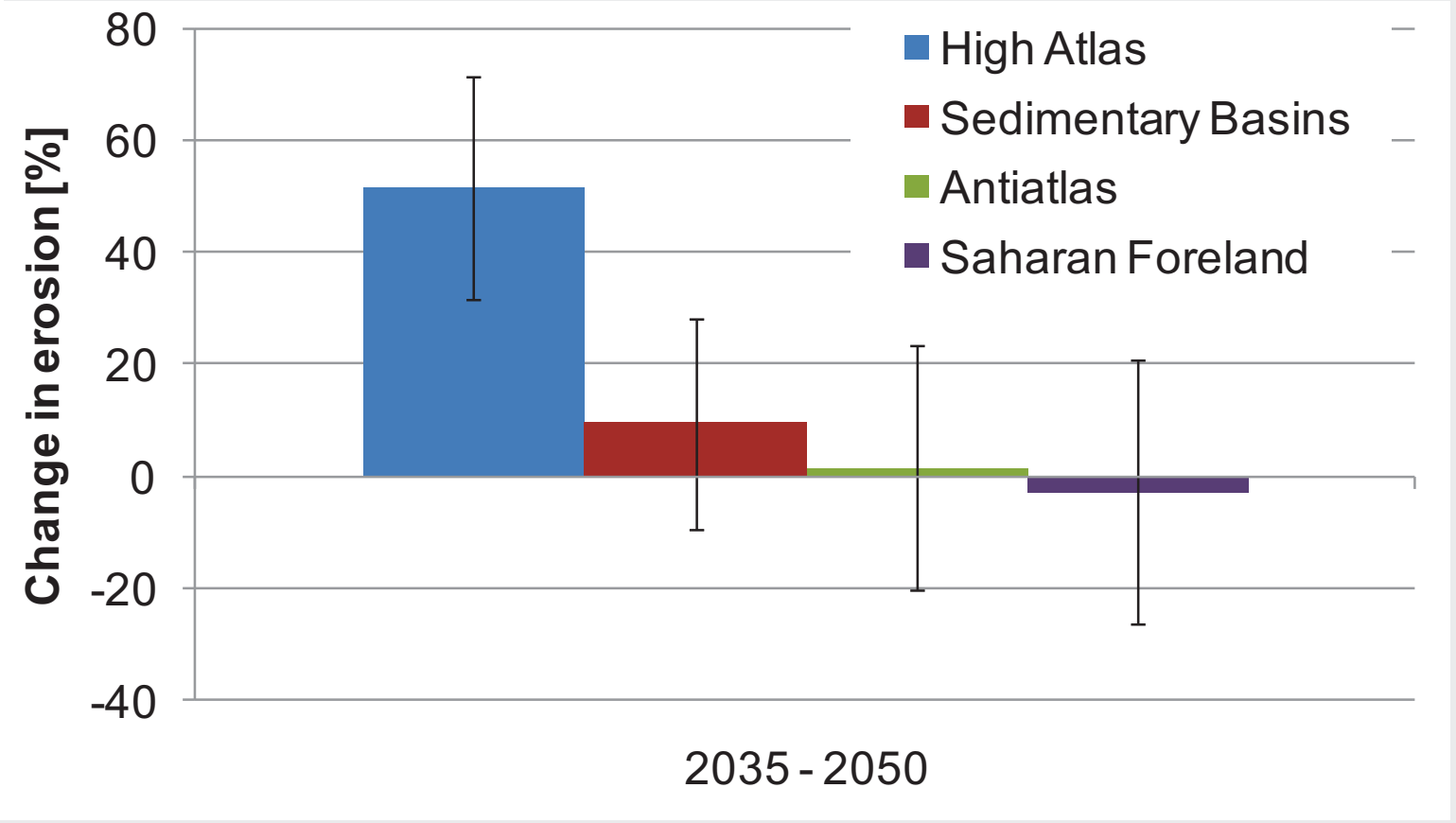






Reference period 1960 – 2000, IPCC SRES scenarios A1B and B1 2001 - 2050

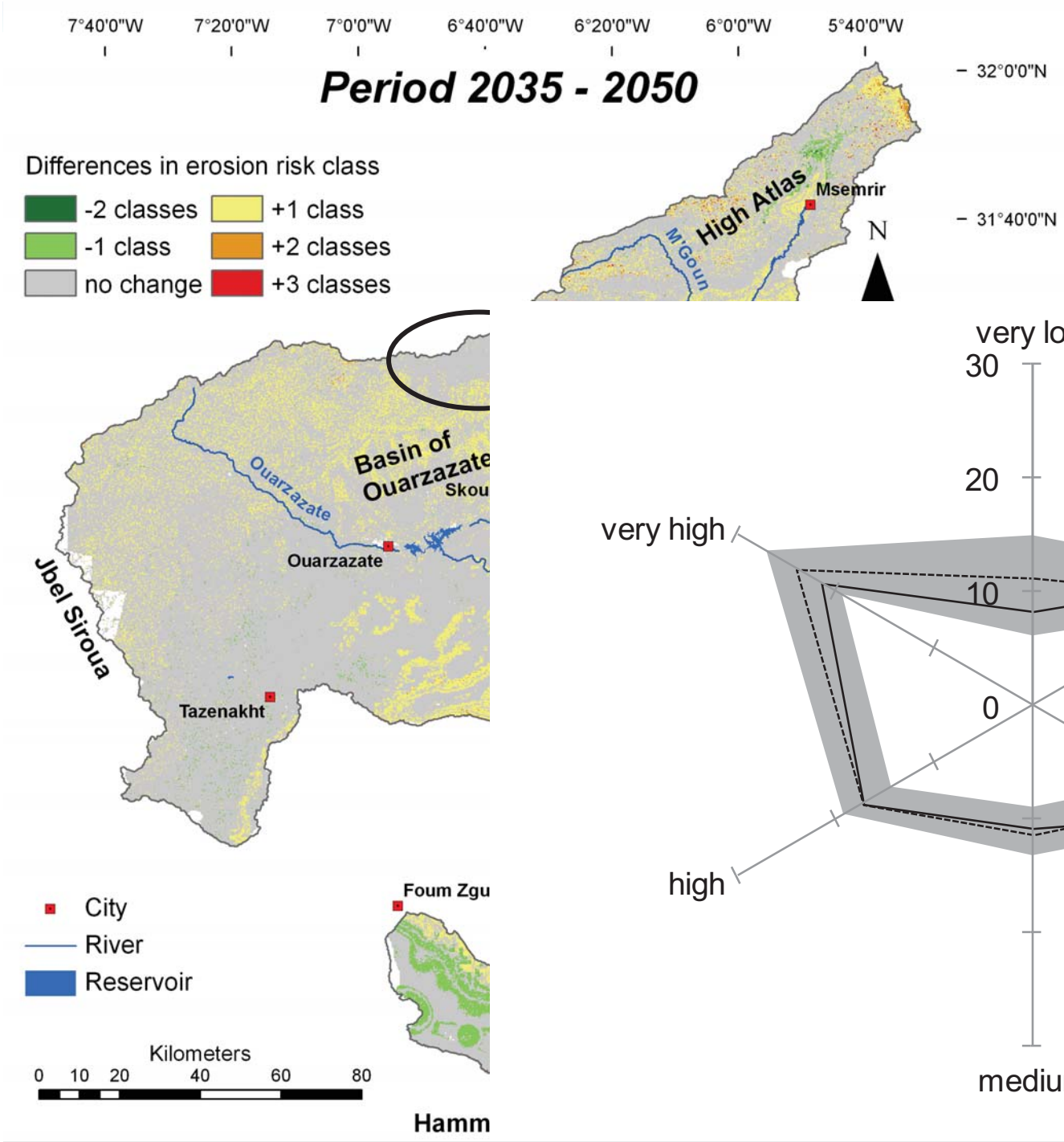
Climate change: results



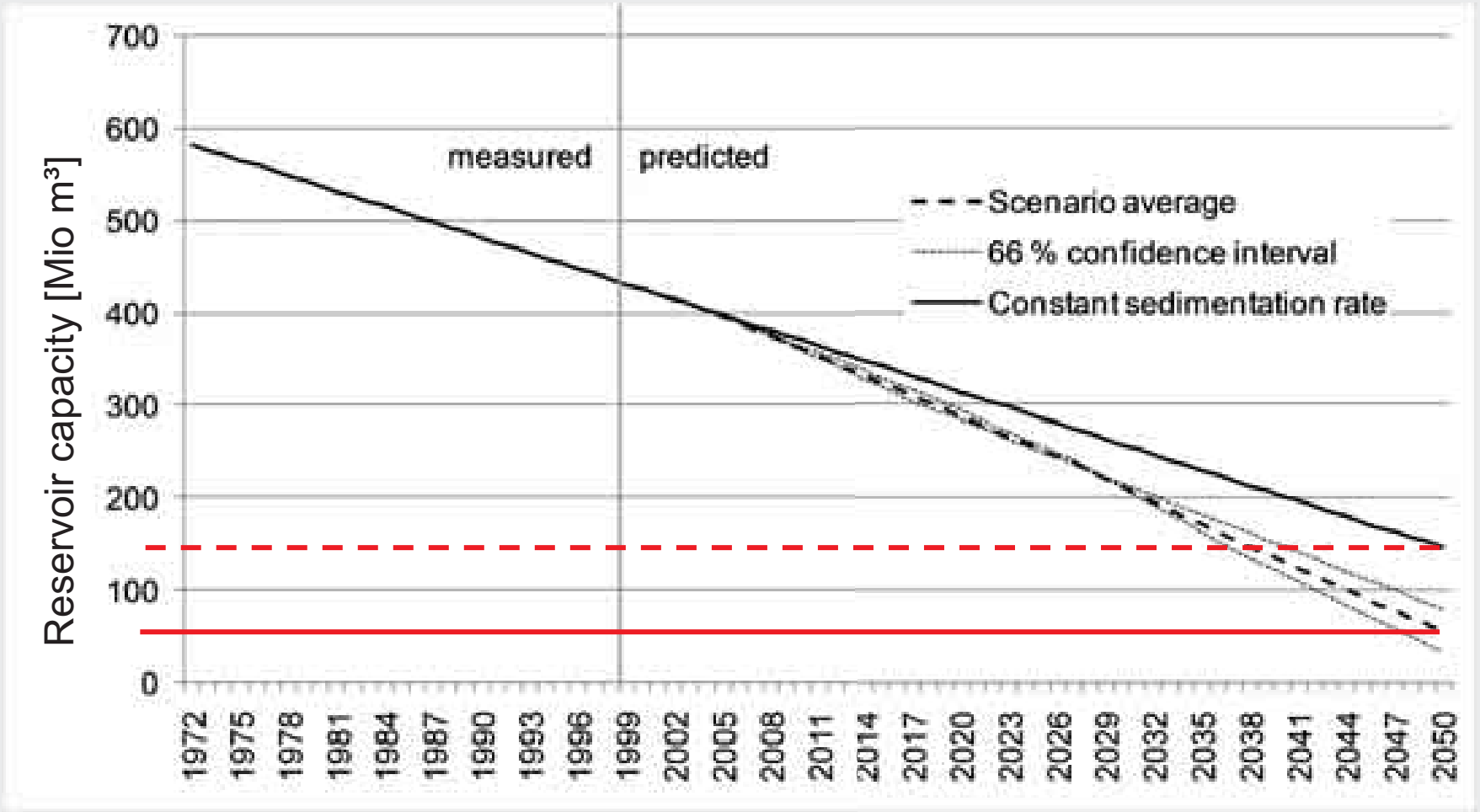
Erosion increases although precipitation decreases

- lower vegetation cover
- higher precipitation intensity

Climate change: results



Climate change: results



Socio-economic change scenarios

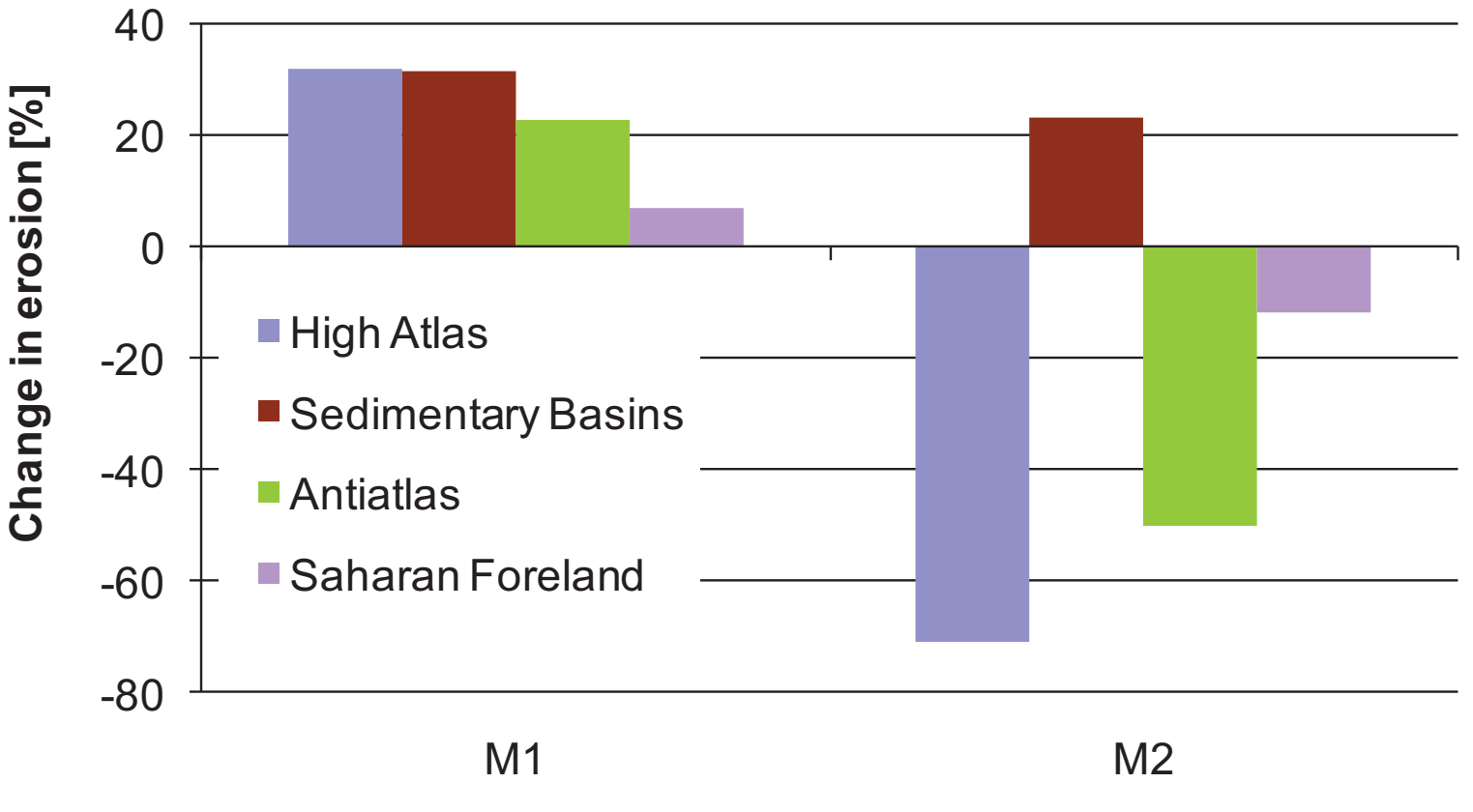
M1 – Marginalisation (low income, high energy costs)

Firewood extraction	2 km radius around village	5 km radius around village
2005 – 2020	+ 10 %	
2015 – 2030	+ 20 %	
2025 – 2040		+ 20 %
2035 – 2050		+ 30 %

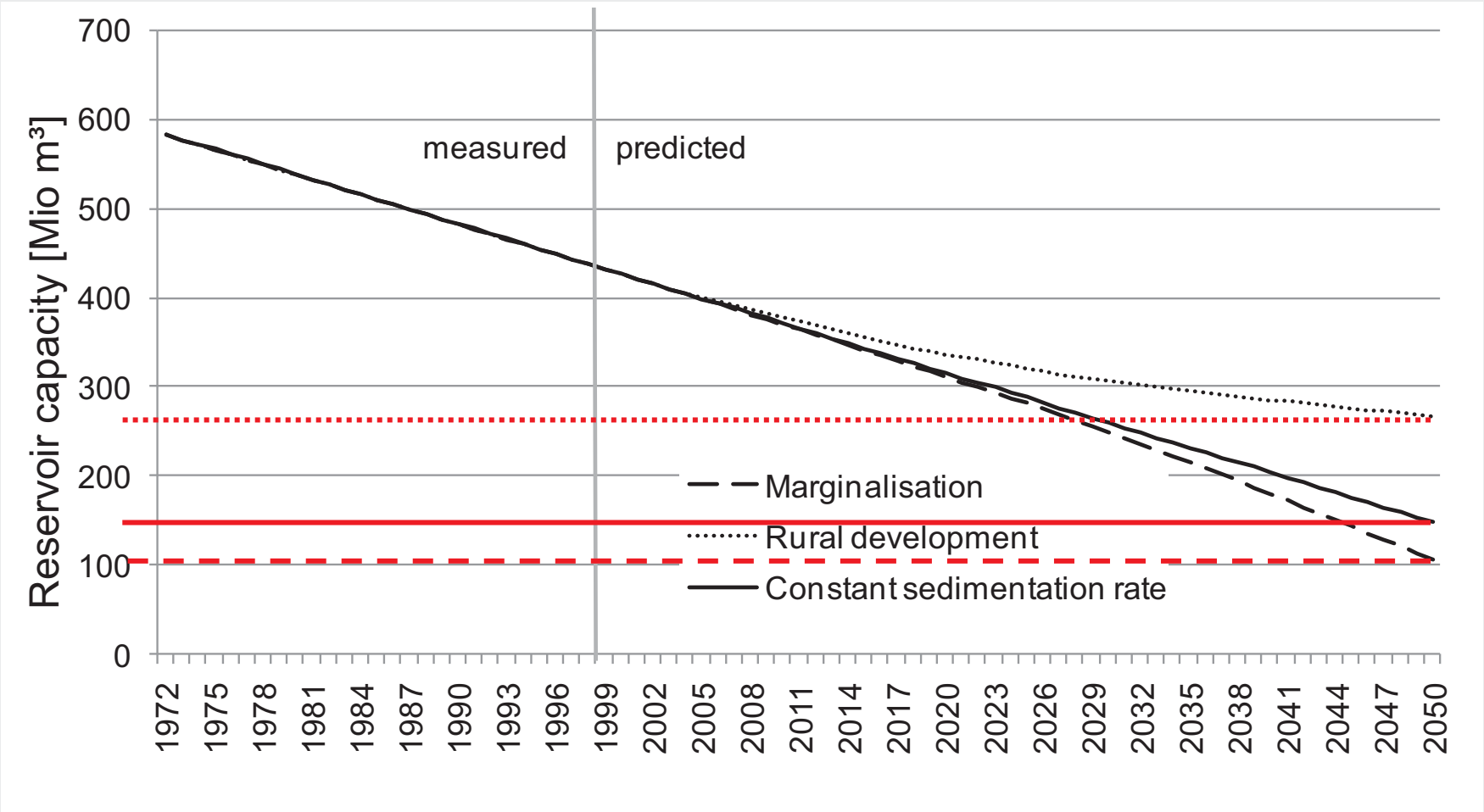
M2 – Rural development (loss of importance of nomadic lifestyle)

Vegetation degradation	High Atlas	Basin of Ouarzazate	South
2005 – 2020	- 10 %	+ 10 %	- 10 %
2015 – 2030	- 20 %	+ 20 %	- 20 %
2025 – 2040	- 30 %	+ 30 %	- 30 %
2035 – 2050	- 40 %	+ 40 %	- 40 %

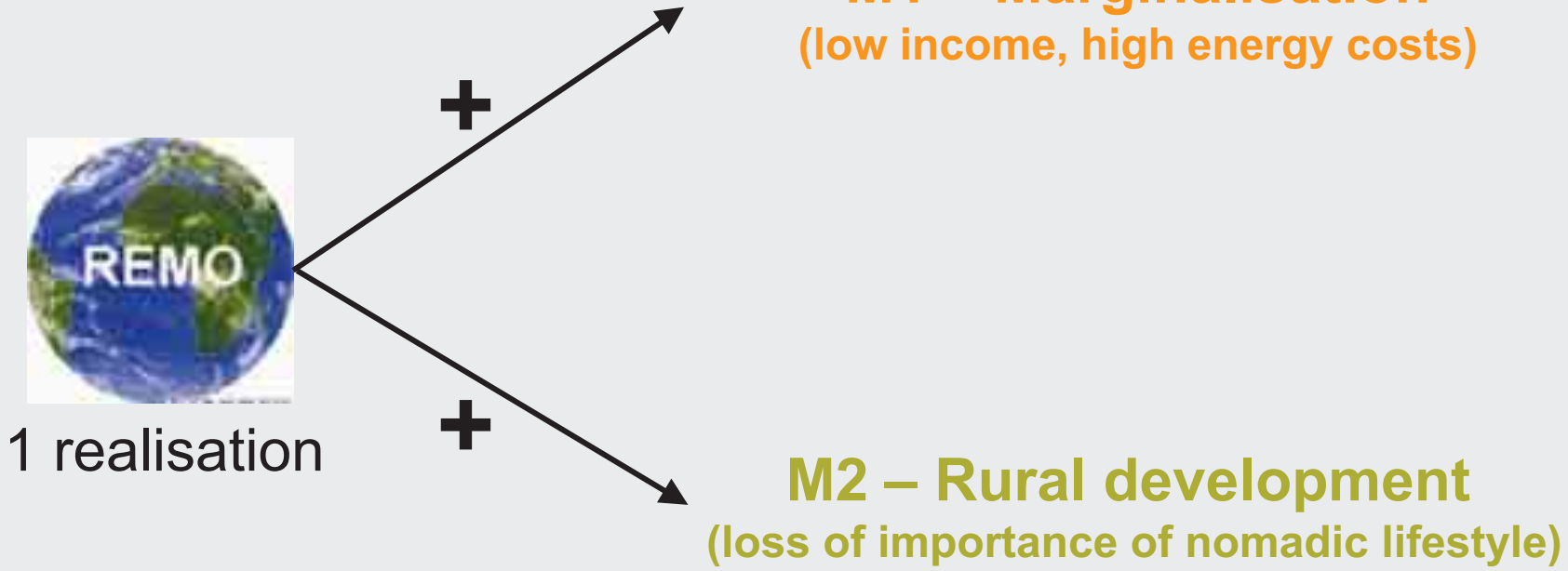
Socio-economic change: results



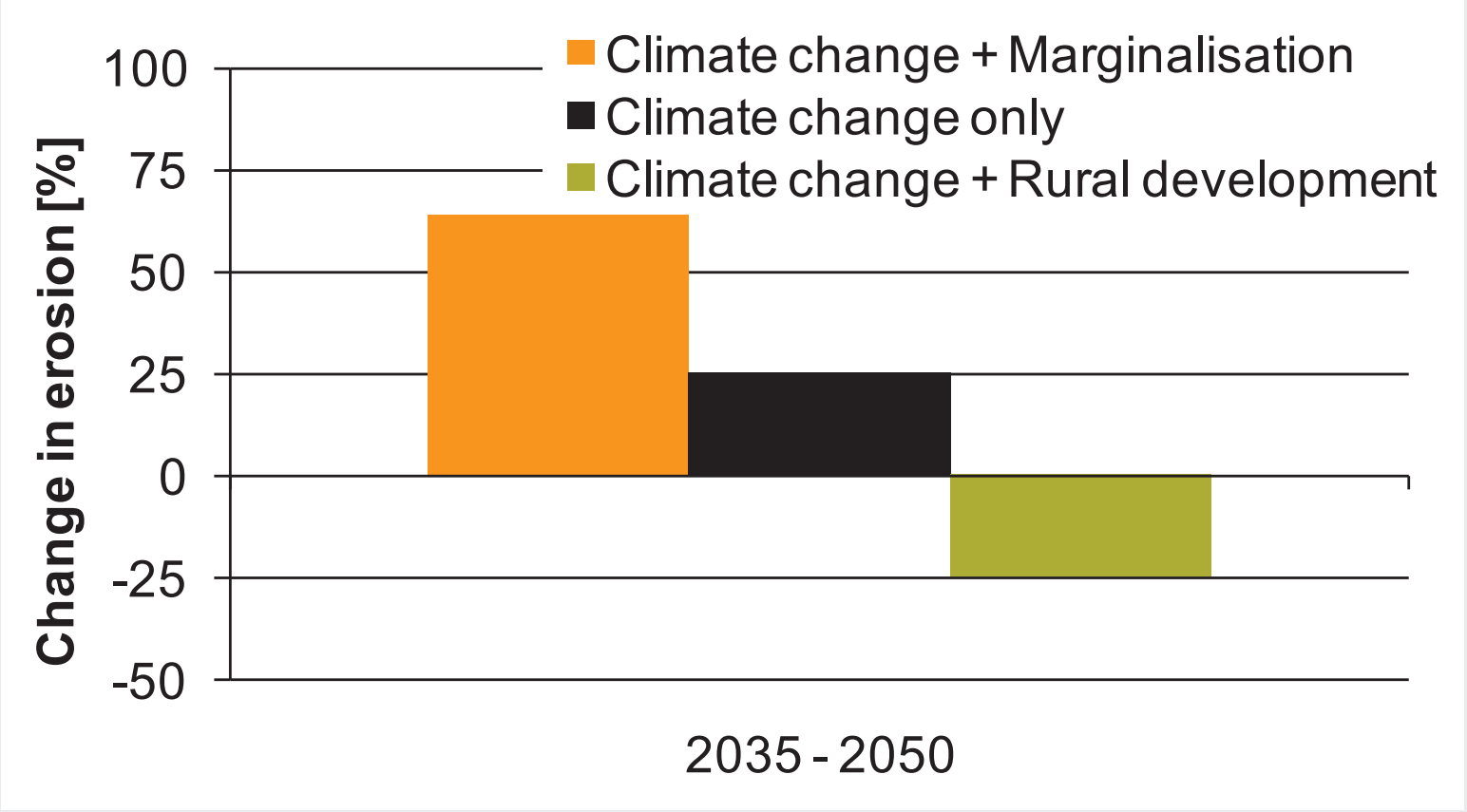
Socio-economic change: results



Global change scenarios

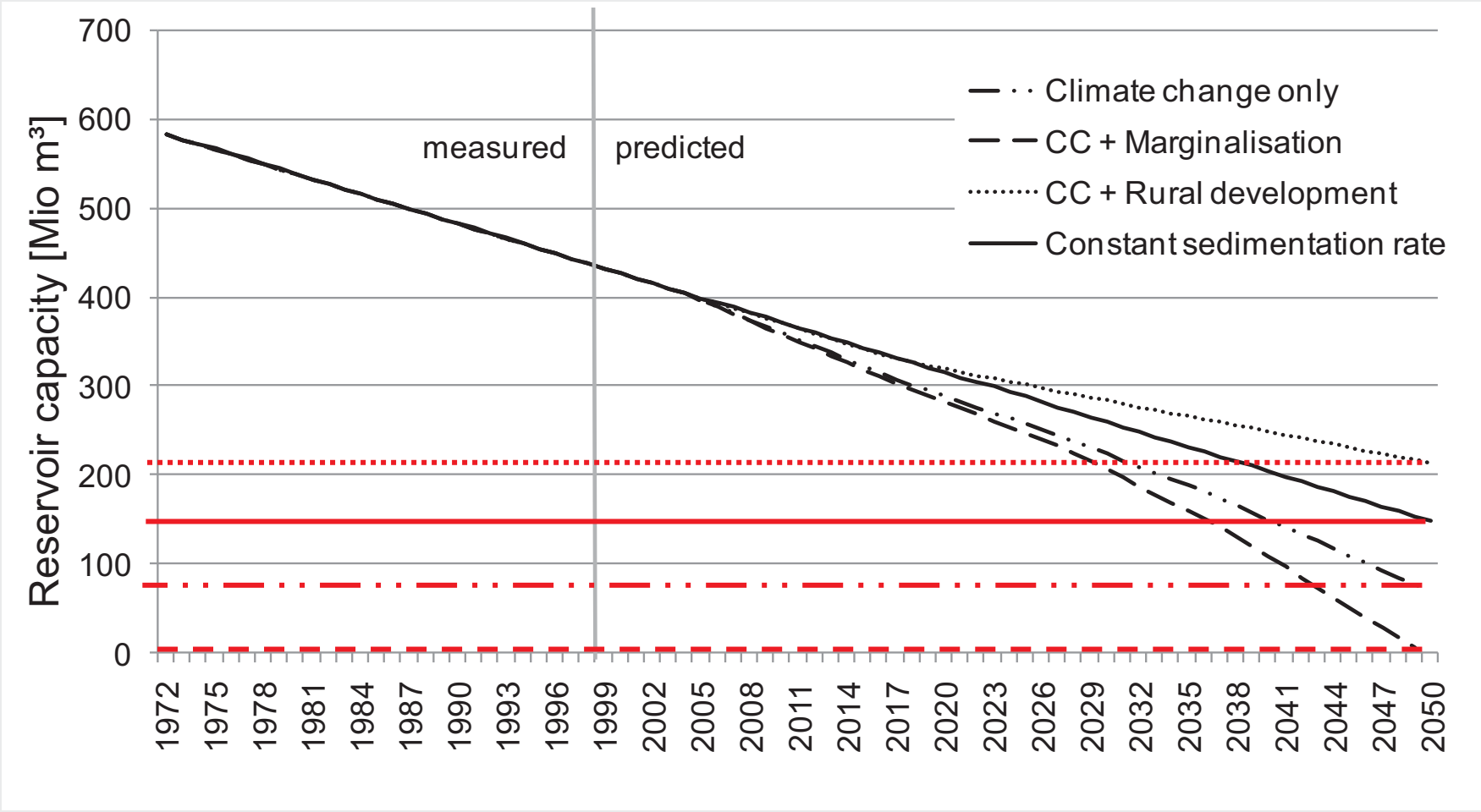


Global change: results



- Marginalisation - **aggravation** of climate change impact
- Rural development - **compensation** for climate change impact

Global change: results



Conclusions

- PESERA model is able to adequately represent erosion risk in the Drâa catchment
- Climate change → erosion risk↑ although precipitation↓
- Further marginalisation of the catchment → erosion risk↑
- Rural development → erosion risk↓
- Combination of climate and socio-economic change:
  - Firewood extraction further enhances climate change effect → erosion risk↑↑
  - Reduced grazing pressure is able to compensate for climate change effects → erosion risk↓
- Reservoir capacity in 2050:
  - Recent conditions: 25 %
  - Climate change: 10 ± 8 %
  - Socio-economic change: M1: 18 % M2: 46 %
  - Global change: M1: 0 % M2: 37 %

Thank you for your attention &

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