Towards integrated adaptation and mitigation measures in agriculture

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Climate change, water resources and agriculture. Mitigation and adaptation

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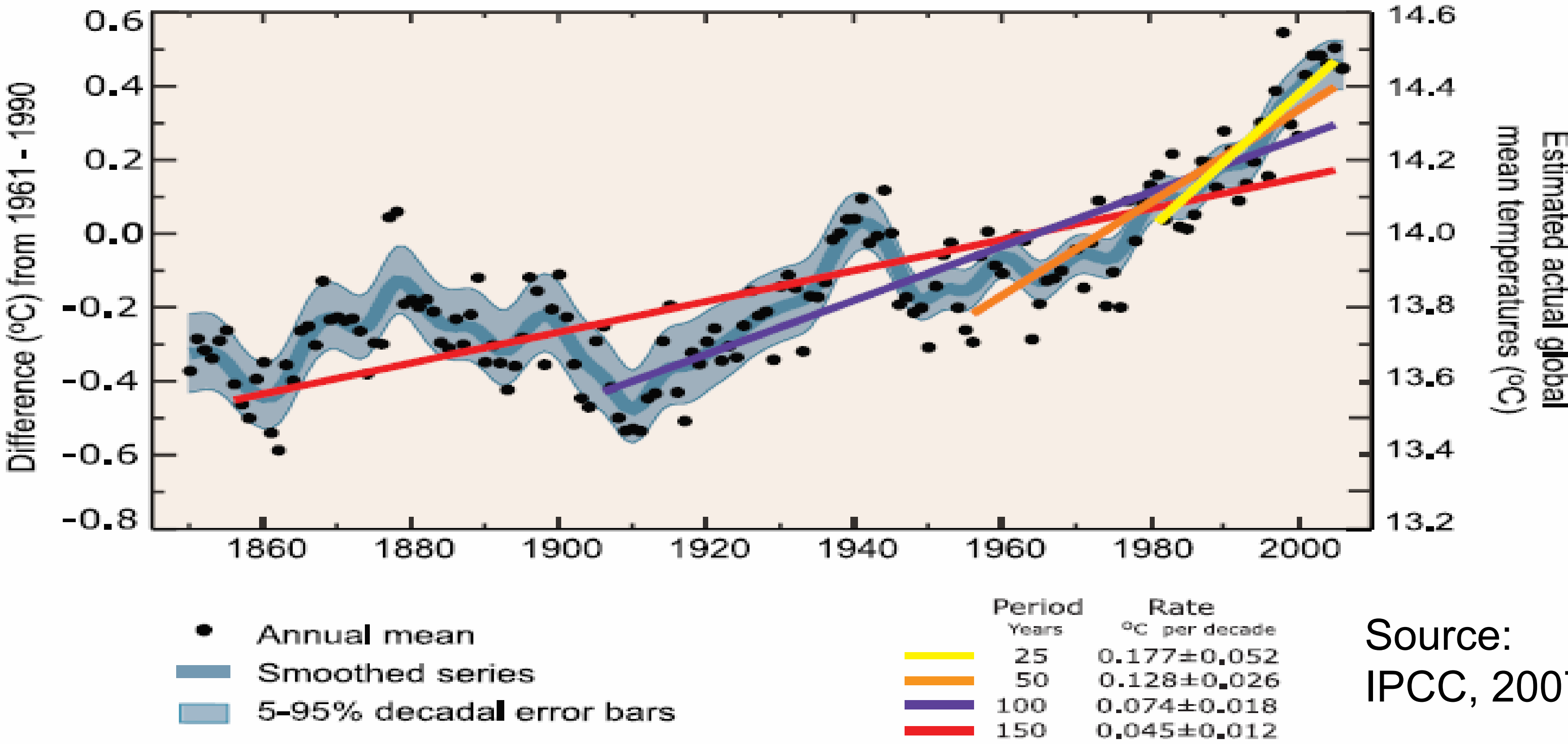
Agriculture *vs* climate change:

Cause (GHG emission)

Victim (where agriculture is P-limited and desiccation occurs; climate extremes)

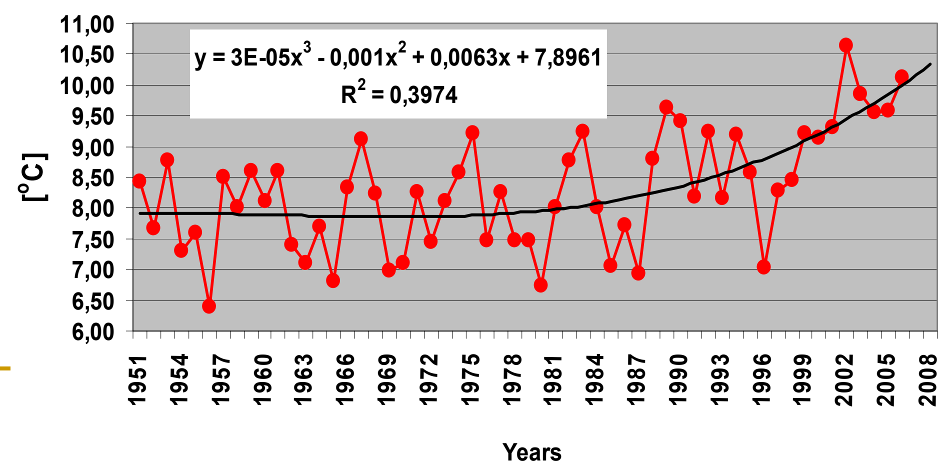
Beneficiary (where agriculture is T-limited; CO_2 fertilization)

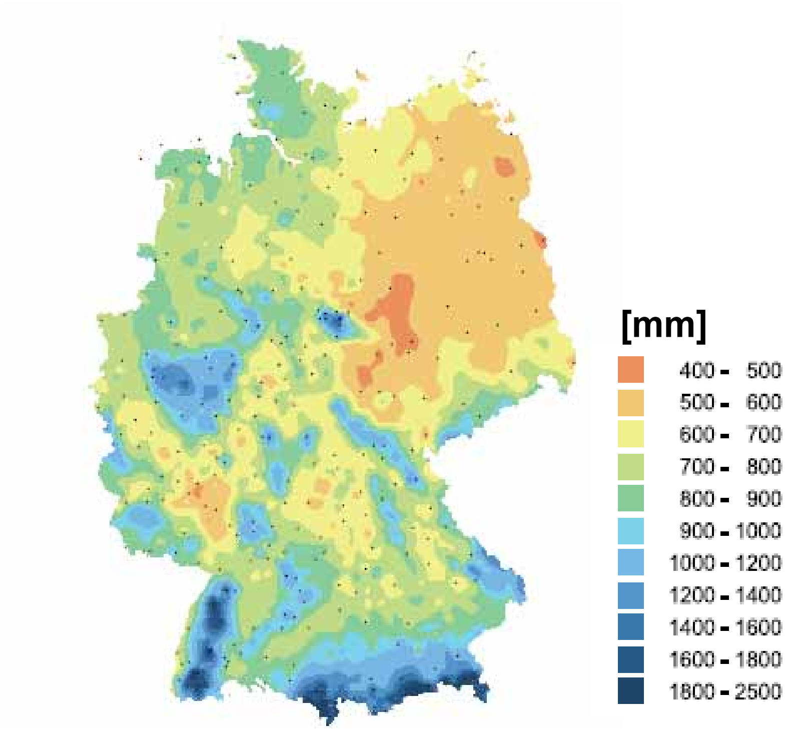
Remedy (carbon sequestration)

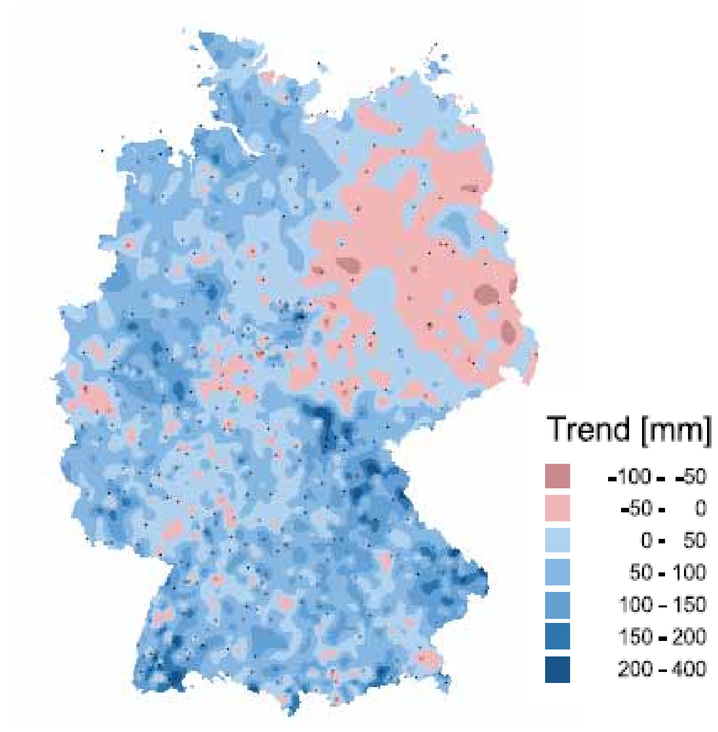


Source:
IPCC, 2007

Temperature rise over last decades has been strong in Wielkopolska





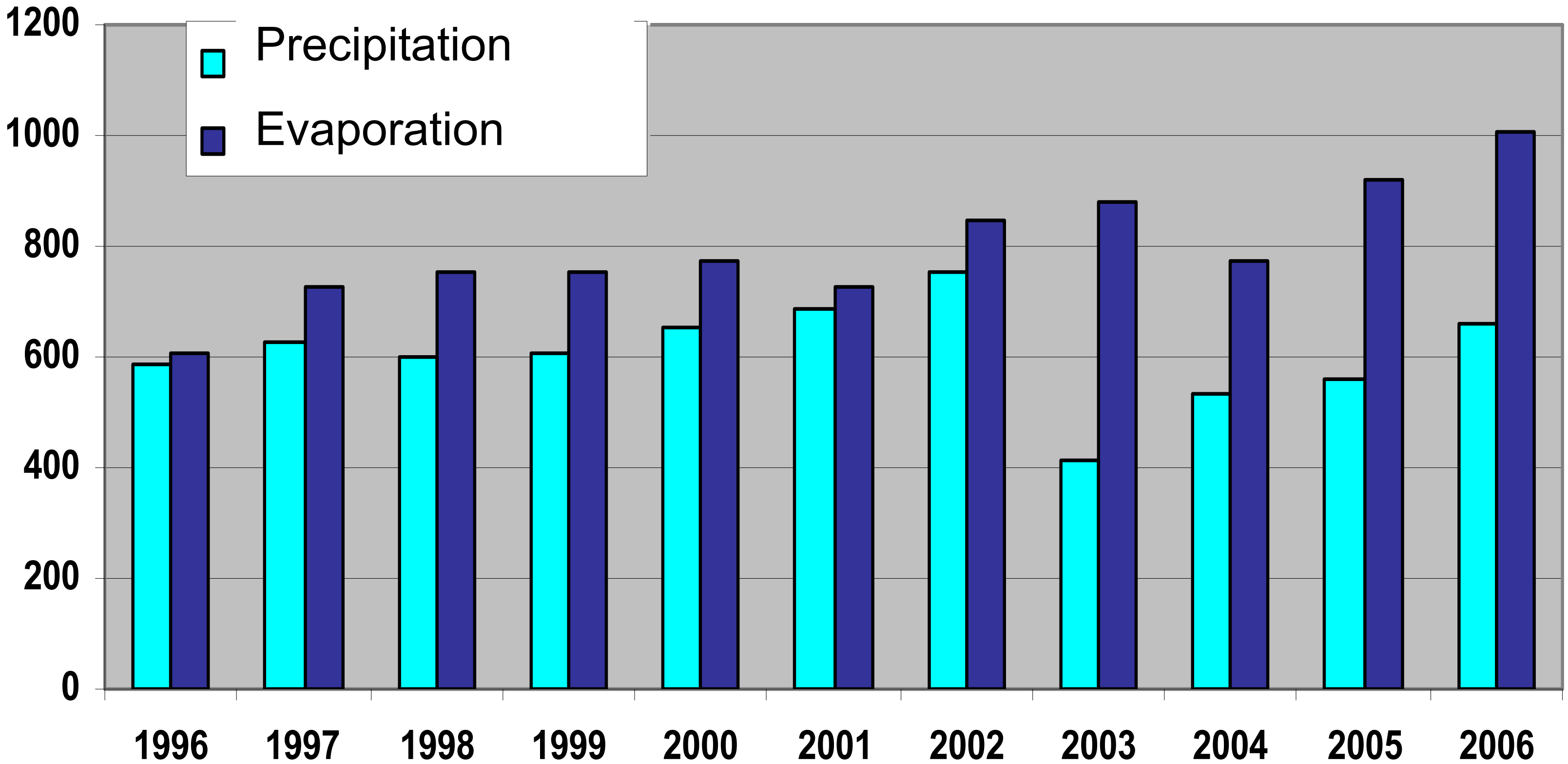


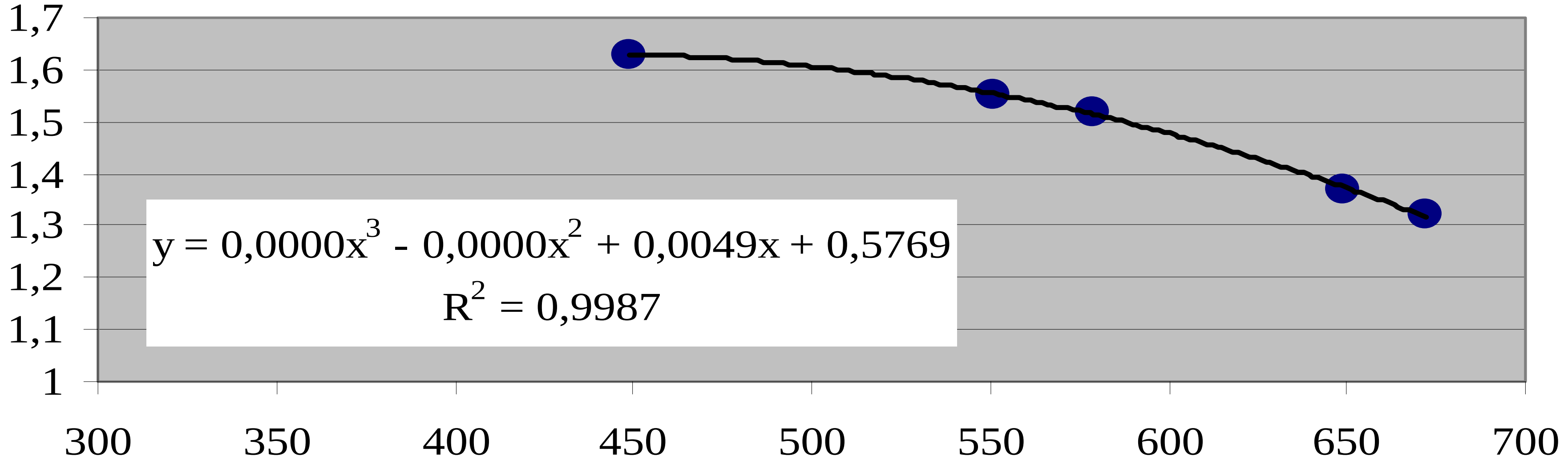
Mean annual precipitation in Germany 1951-2006.

Trend in mean annual precipitation in Germany 1951-2006.

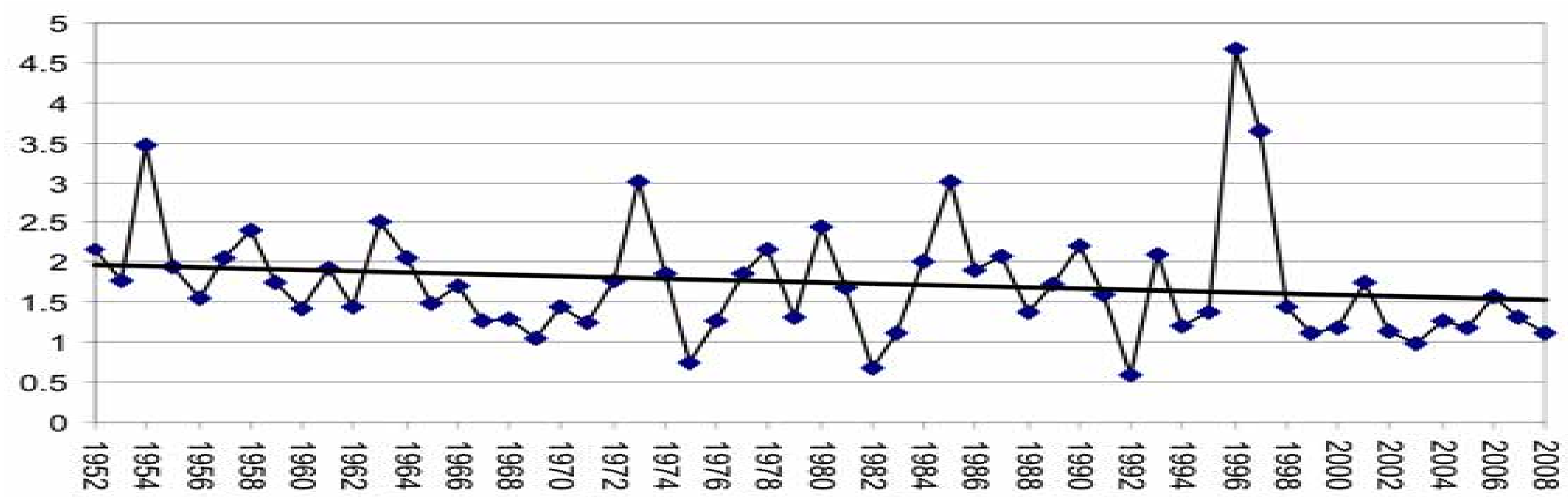
Source: Wodinski, Gerstengarbe & Werner

Annual precipitation and evaporation from water surface in Wielkopolska in 1996-2006





Ratio of summer to winter precipitation vs annual precipitation. Source: Kędziora

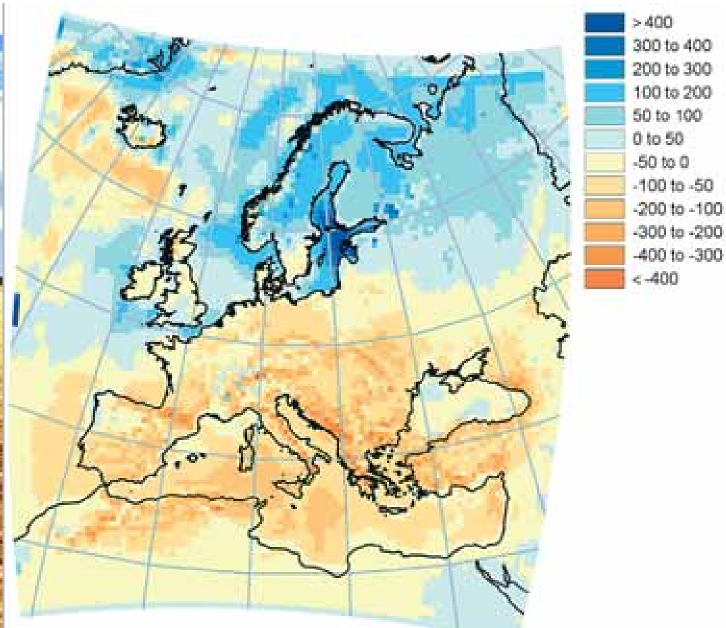


Ratio of summer to winter precipitation in Poznań. Source: Pińskwar

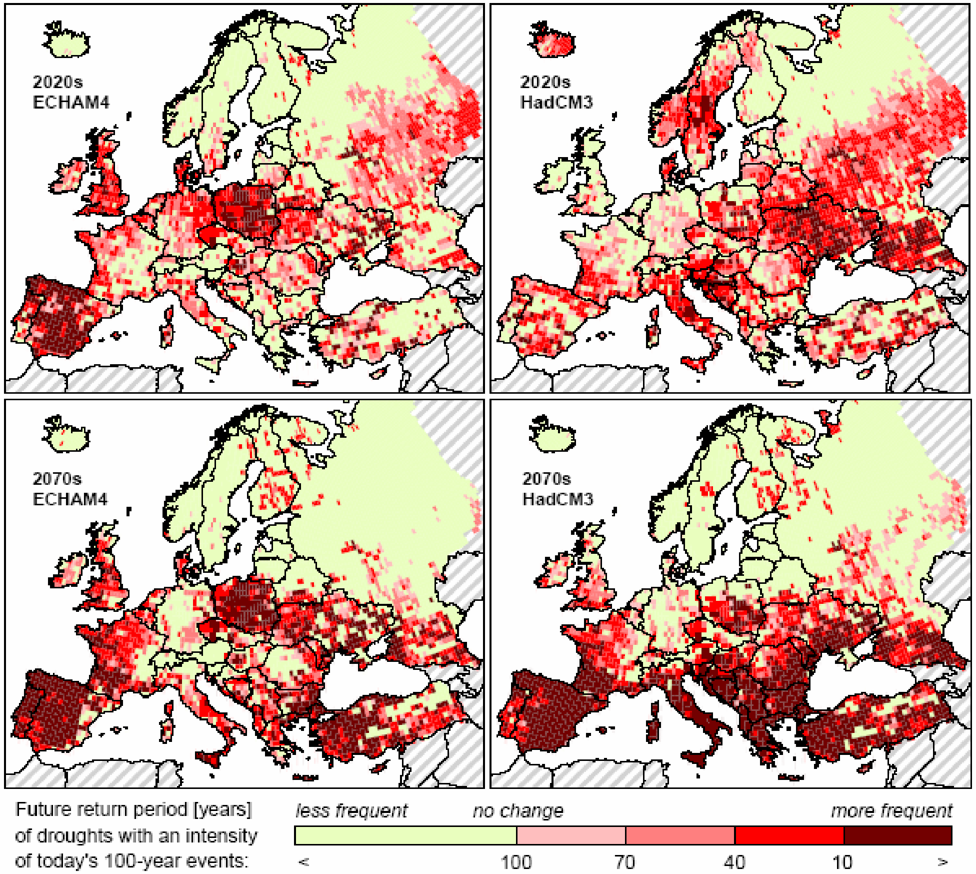
Agriculture in Europe - Loosers and winners

Agriculture in Europe is temperature-limited in the N and N-E and moisture-limited in the S and S-E. Climate change is likely to **reduce** the former limitation and to **exacerbate** the latter.

At the time horizon of 2050, average aggregate impact of climate-related change on agriculture in Europe is likely to be positive.



More precipitation falls as rain rather than snow. Less snowpack in spring. Snow-melt occurs faster and earlier. Less soil moisture in summer. More drying (evaporative demand).



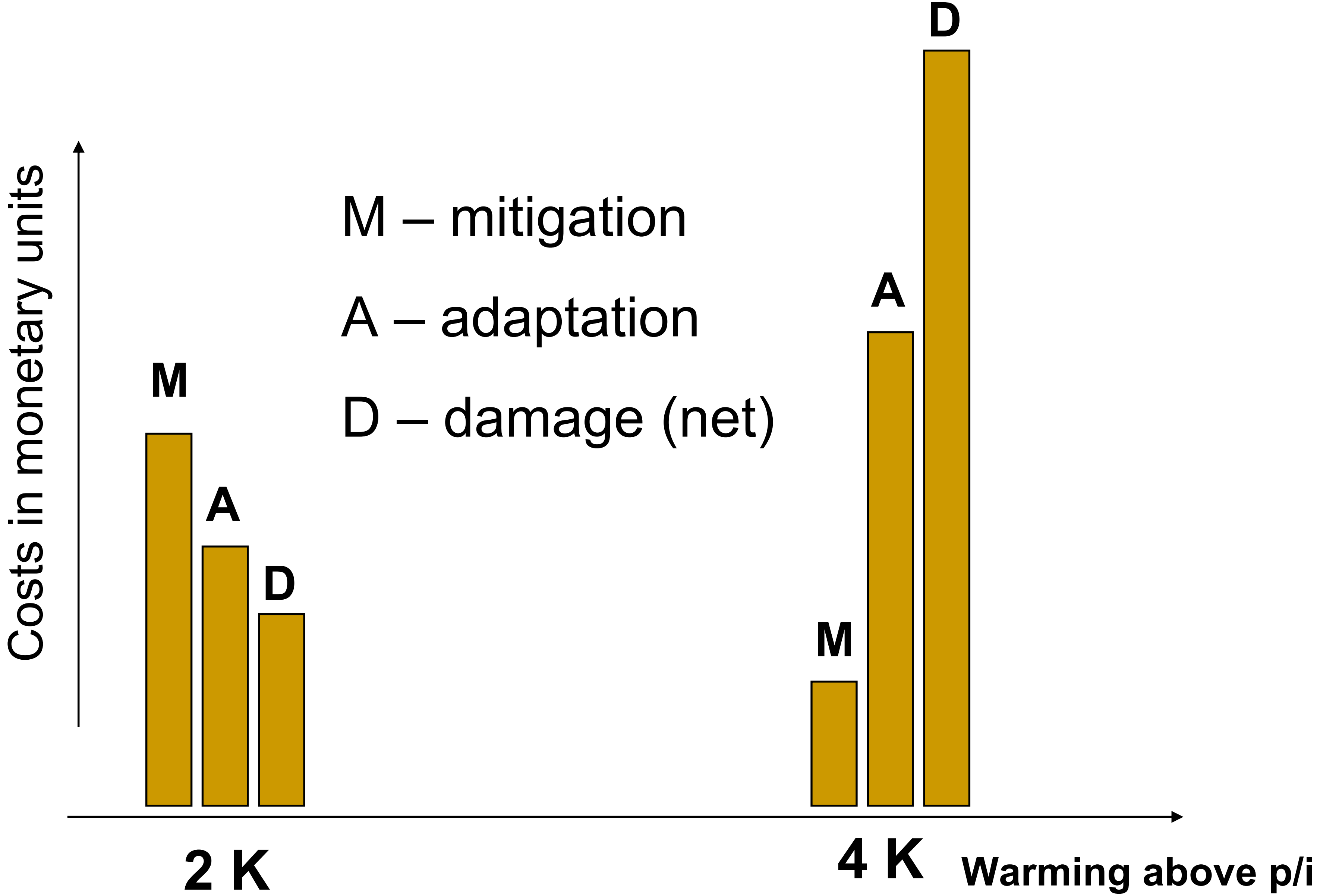
Change in recurrence of 100-year droughts, based on comparisons between climate and water use of 1961-90 and simulations for the 2020s and 2070s (Source: Lehner et al., 2005).

What can be done?

mitigate

adapt

suffer


Costs in monetary units
M – mitigation
A – adaptation
D – damage (net)
M
A
D
M
A
D
2 K
4 K
Warming above p/i

Drought adaptation measures in agriculture

Agronomic measures: intercropping; crop residue retention; conservative tillage, weed management; water harvesting
New drought-resistant varieties
Technical measures to increase water supply
Increasing efficiency of water use (more crop per drop)
Economic instruments (e.g. price)
Improved forecasting
Improving insurance schemes

In Poland there is no water for massive irrigation. Water management strategy badly needed.

Multi-purpose water storage:

- Flood control

- Water supply

- Hydropower

- Recreation, Navigation, Fishery, Aesthetics, Ecosystems (low flow augmentation)

Enhancing water storage can be advantageous for both adaptation and mitigation but adverse effects are possible (disruption of ecosystems – fish cannot migrate; resettlement; inundation of fertile land, including vegetation – GHG emissions)

Soil carbon sequestration – transferring atmospheric CO_2 into the soil.

Primary factors:

- Add organic matter (e.g. crop residue) to soil
- Protect soil (against degradation) and water
- Control soil disturbance (e.g. no-till)
- Improve soil structure (augment water retention)
- Enhance soil fauna activity

Services of shelterbelts in agricultural landscape:

- positive impact on water regime (enhancing evapotranspiration, percolation and retention, curbing surface runoff, longer snow cover duration);
- carbon sequestration;
- modification of microclimatic conditions (weakening of heat waves, wind);
- curbing water and wind erosion;
- control of diffuse water pollution;
- enhancing biodiversity;
- enhancing recreational value of the region;
- promoting aesthetic values of the countryside;
- providing wood and other products (berries, mushrooms).

Acknowledgements:

EU 6FP Integrated Project ADAM

(Adaptation and Mitigation Strategies)