Models and Measures

Analyzing the gap between local and scientific knowledge for effective adaptation

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Presentation by Catharien Terwisscha van Scheltinga, Director, Wageningen UR Project Office Dhaka, as part of the International Conference Climate Change related to Water and Environment organized 9 – 11 April 2015 at Dhaka University of Engineering and Technology, Gazipur

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Alterra/Wageningen UR in Bangladesh

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Focus:

- Climate change adaptation, water management and food security
- Science-policy interface

Projects:

- **Studies**: Towards a Bangladesh Delta Plan (www.bangladeshdeltaplan.org); Climate Adaptation Atlas; KB Deltas; Delta Alliance Bangladesh; Impact2C; NWO/WOTRO Deltas research
- **Advisory role:** NL Embassy, Water and Food Security
- **Capacity Development**: NICHE85 new MSc Climate Change & Water (WU lead) 880 kEuro, 2011-2015; NICHE155 research on scenario development in integrated water resources management (IHE lead, Alterra coordinator) 2.5 million, 2013-2017; NICHE156 integrated knowledge water-food-fish (CDI lead), 2.5 million, 2013-2017

Partners:

- **Institutes**: Institute of Water Modelling, Centre for Environmental and Geo-Information Services; Bangladesh Centre for Advanced Studies
- **Universities:** Dhaka University of Engineering and Technology, Bangladesh University of Engineering and Technology, Bangladesh Agricultural University, International Centre for Climate Change and Development, Patuakhali Science and Technology Uni
- **Government**: Planning Commission, WARPO

Set up:

- Staff member in Bangladesh – since mid 2010 – building up network;
- Project office since Dec 2011, hosted by one of our local partners, the Institute of Water Modelling (IWM), also coordinator of the Delta Alliance Bangladesh Wing

Overview of the presentation

1. Introduction
2. Models and measures
3. Pro-active adaptation
4. Case study
5. Summary of the findings
6. Discussion
7. Conclusions

Take home messages

1. There is science on climate change, and though it is uncertain, we need to use it to design for adaptation

2. We need action now to tackle climate change in future

Developing Countries Most At Risk: 6 Climate Threats

Drought	*Flood*	*Storm*	*Coastal 1m*	*Coastal 5m*	*Agriculture*
Malawi	Bangladesh	Philippines	All low-lying Island States	All low-lying Island States	Sudan
Ethiopia	China	Bangladesh	Vietnam	Netherlands	Senegal
Zimbabwe	India	Madagascar	Egypt	Japan	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Bangladesh	Mali
Mozambique	Mozambique	Moldova	Indonesia	Philippines	Zambia
Niger	Laos	Mongolia	Mauritania	Egypt	Morocco
Mauritania	Pakistan	Haiti	China	Brazil	Niger
Eritrea	Sri Lanka	Samoa	Mexico	Venezuela	India
Sudan	Thailand	Tonga	Myanmar	Senegal	Malawi
Chad	Vietnam	China	Bangladesh	Fiji	Algeria
Kenya	Benin	Honduras	Senegal	Vietnam	Ethiopia
Iran	Rwanda	Fiji	Libya	Denmark	Pakistan

Low Income
Middle Income
High Income

Source: World Bank

2. Models and measures

- Modelling gives information
- Adaptation also requires local solutions
- 'Translation' from models to measures not automatic
- Pro-active adaptation requires model input (knowledge about the future) to develop and assess measures

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Modelling in various steps

Step 1a. Climate Downscaling model/data set

Step 1b CC Impact model/ Vulnerability assessment

Step 2. Selection of adaptation options

Step 3. Evaluation of adaptation options

Multisectoral / visualization / Integration tools
- Klimaatatlas
- SIMCLIM
- CIAM
- RegIS

Regional Climate Models
- REMO
- PRECIS
- RACMO

Data Sets
- WikiAdapt Climate Change Explorer
- Ensembles data set

Hydrological/ Hydraulic models
- Sobek
- Lisflood
- VIC
- WEAP
- Mike

Agricultural Models
- Apsim
- Wofost

Very Limited Number of tools
- ADAM Digital Compendium Adaptation Catalogue
- The Adaptation Actions database
- ESPACE - A toolkit for delivering water management climate change adaptation through the planning system'
- Touchtable

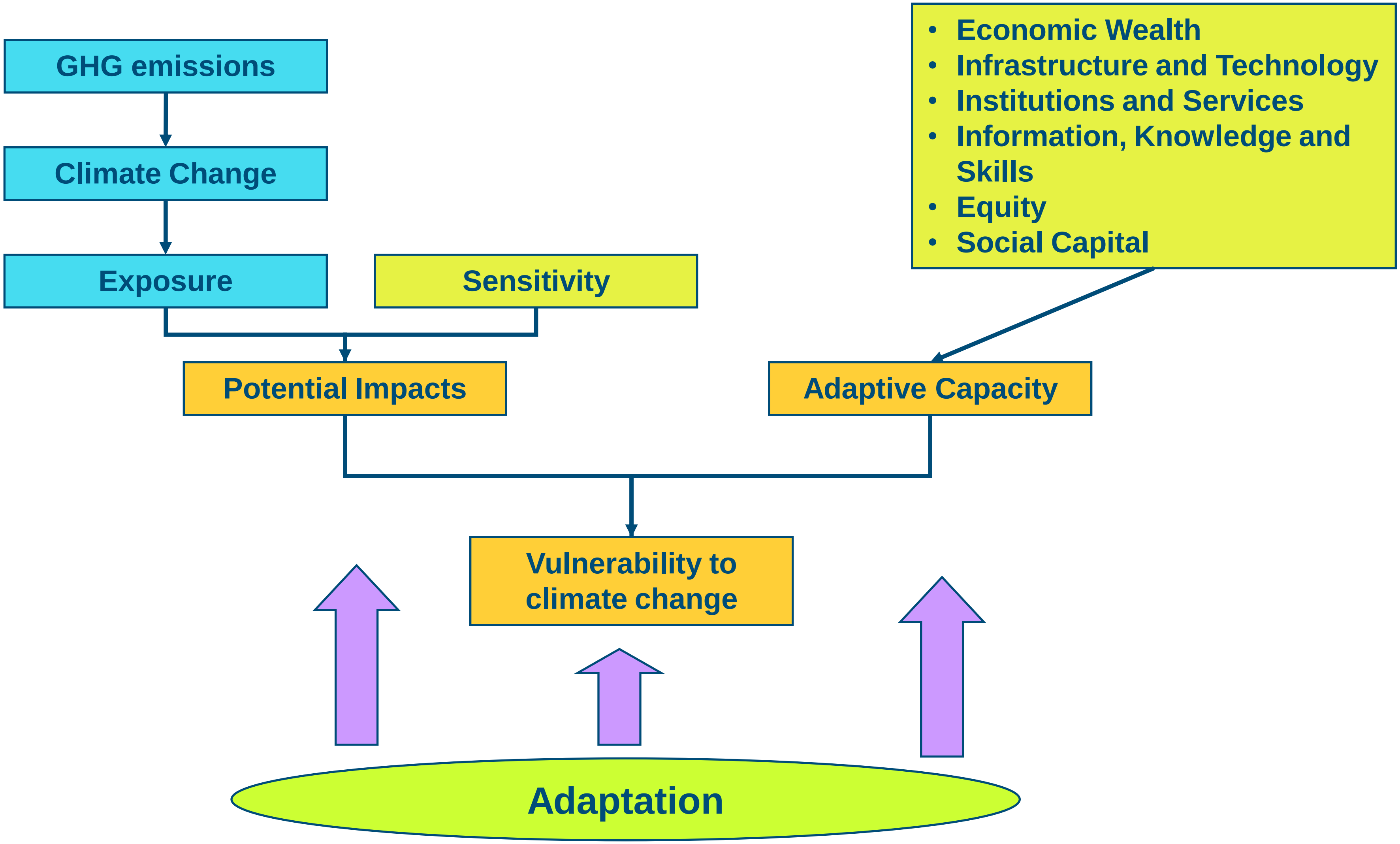
(Social) Cost – Benefit Analyses
- ClimateCost
- Calvin

Optimization Models
- FARM-Adapt
- Berg River Spatial equilibrium model –

Water/Agricultural models
- WEAP
- VIC
- MIKE models
- APSIM

Covering all steps: Adaptation guidelines
- UKCIP – Adaptation Wizard
- NordRegio, 'Climate Change Emergencies and European Municipalities: Guidelines for Adaptation and Response
- The Australian Government's Climate Change Impacts & Risk Management Guide for Business and Government
- Klimaatwijzer

Adaptation framework



3. Pro-active adaptation

- Predicting the future to estimate when and where adaptation is necessary (= adaptation turning point)
- Combined bottom-up and top-down approach
- Use of thresholds to indicate critical levels
- Case study: from IMPACT2C
  - climate: +2 degrees
  - areas: drought prone, flood prone, salinization
  - Last one was chosen as case

4. Case study ‘Salinization southwest Bangladesh’

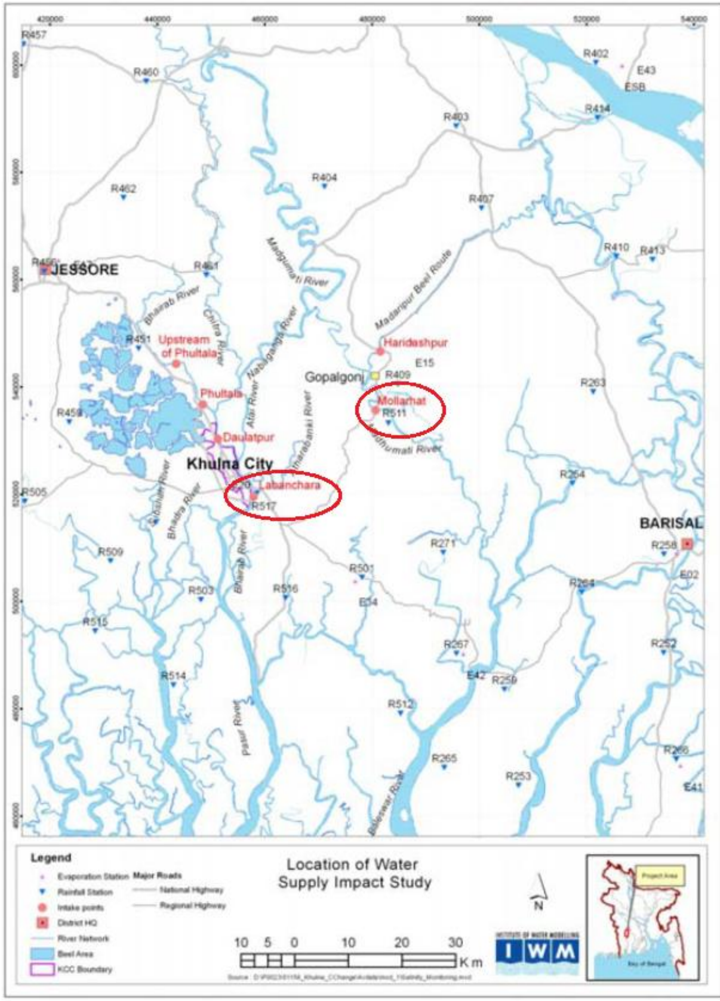
- Southwest delta
  - Satkhira, Khulna, Pathuakali
- Increased salinization due to
  - sea level rise
  - land subsidence
  - Reduced outflow from upstream (a.o. related to water extraction)
- Problems not only in agriculture: health risks of increased salinization (analyse!)
- Adaptation Turning points approach
  - Threshold determination
  - Turning point assessment

Threshold determination

- Health impacts related to high salt intake (from literature study and interviews)
  - Cardiovascular diseases
  - Hypertension
  - Kidney Failures
  - Preeclampsia
- Outcome: 2 critical thresholds
  - 1 ppt, 60 days
    - Low threshold based on WHO guidelines and advised daily intake.
  - 2.5 ppt, 15 days
    - High threshold based on concentration directly related to hypertension

Turning points assessment

- Threshold linked to SWR SAL model output (source: IWM)
- Based on SRES A2 and B1
- Selected 2 location of interest (based on ADB, 2011 research)
  - Mollarhat, threshold expected to exceed within the coming decades
  - Labanchara, threshold expected to have been passed in the past decades



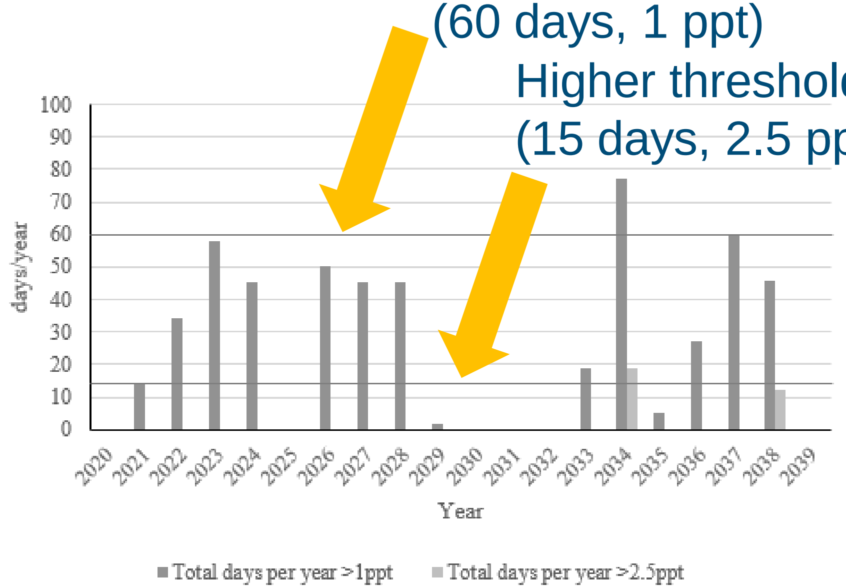
5. Results: Mollarhat 2020 - 2039

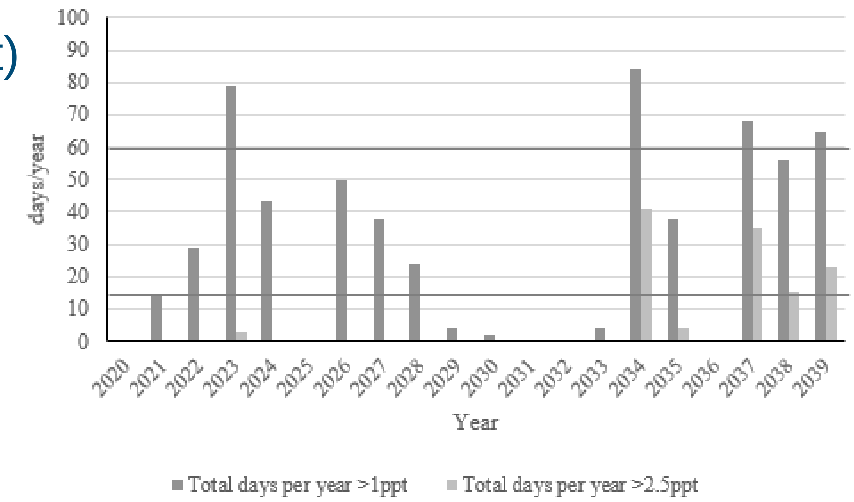
Total number of days per year in which the threshold is exceeded in Mollarhat

- Scenario A2
- Scenario B1

Lower threshold
(60 days, 1 ppt)

Higher threshold
(15 days, 2.5 ppt)

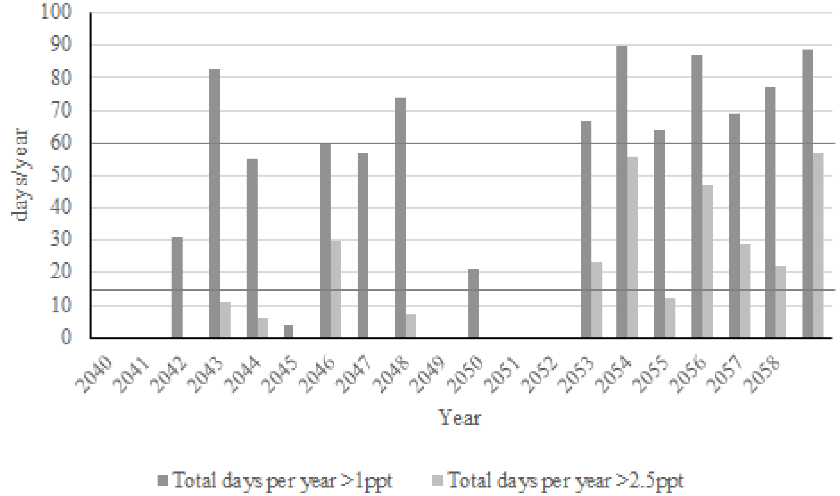




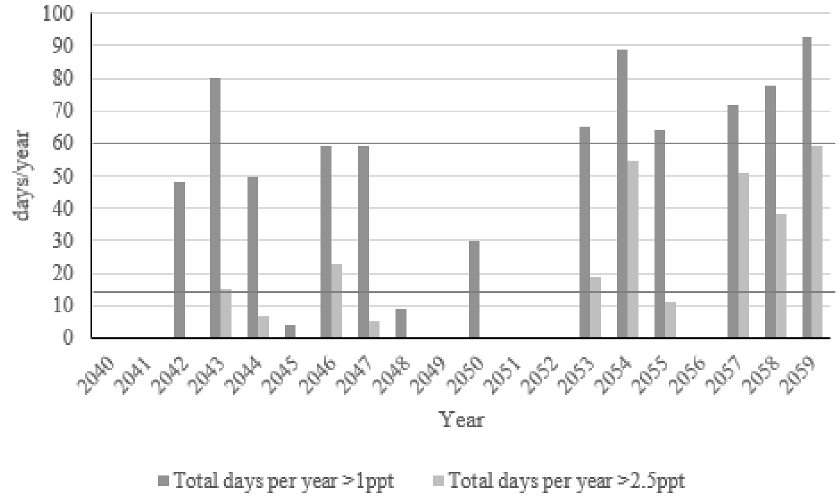
Mollarhat 2040 - 2059

Total number of days per year in which the threshold is exceeded in Mollarhat, second time period

- Scenario A2



- Scenario B1

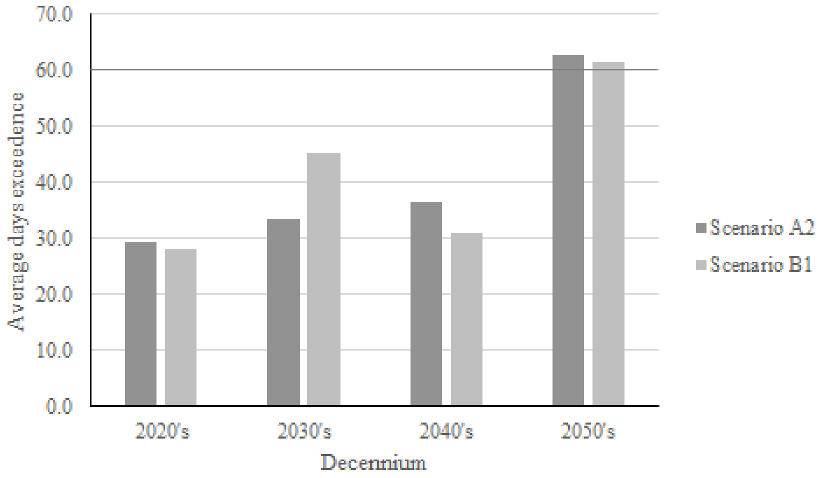


Threshold is exceeded in more years than in the earlier period

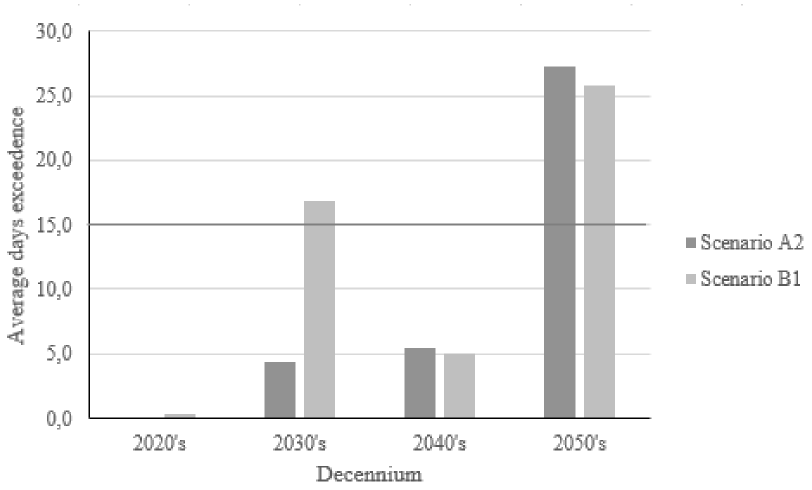
Mollarhat – average excedence

Decadal average number of years in which the thresholds are exceeded

- Low threshold



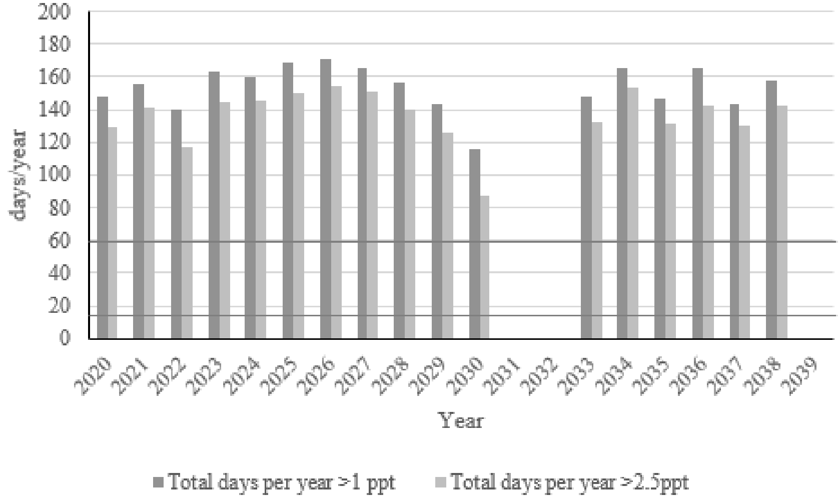
- High threshold



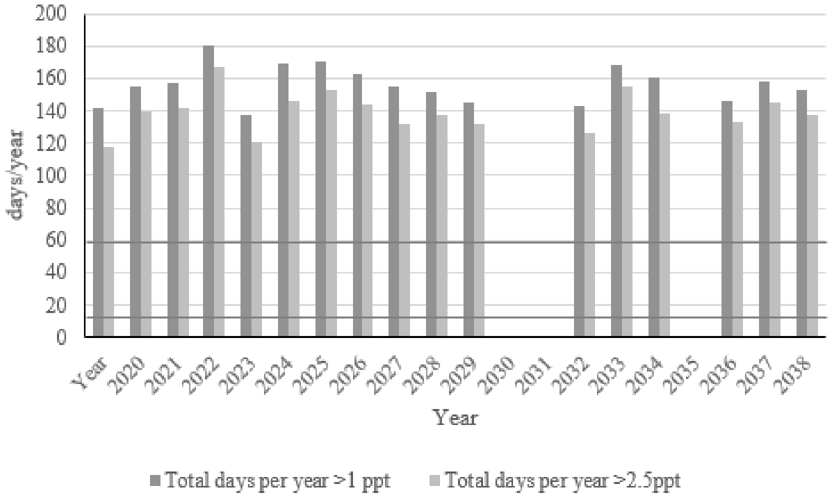
Labanchara 2020 - 2039

Total number of days per year in which the threshold is exceeded in Labanchara

- Scenario A2



- Scenario B1

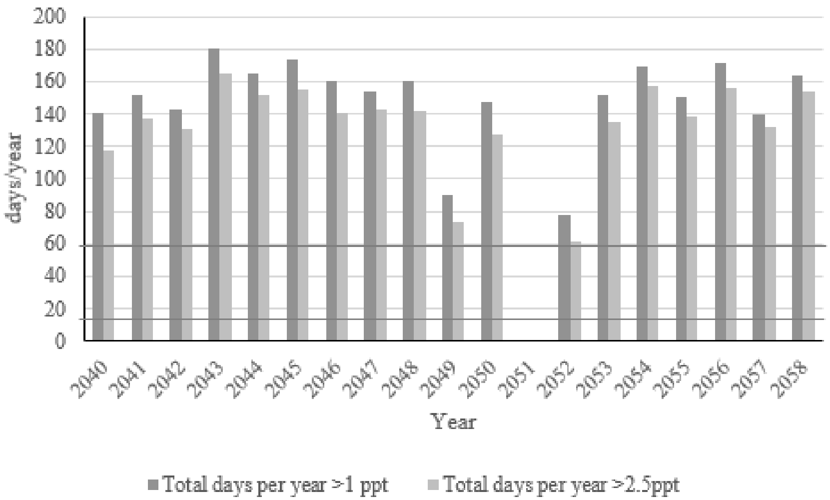


Threshold already exceeded. No increase. People noticed increased incidence of heart failure, hypertension etc.

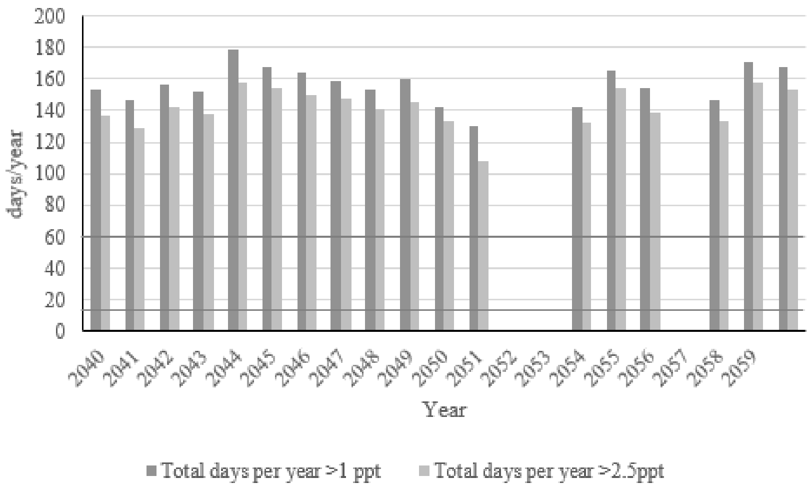
Labanchara 2040 - 2059

Total number of days per year in which the threshold is exceeded in Labanchara, second time period

- Scenario A2



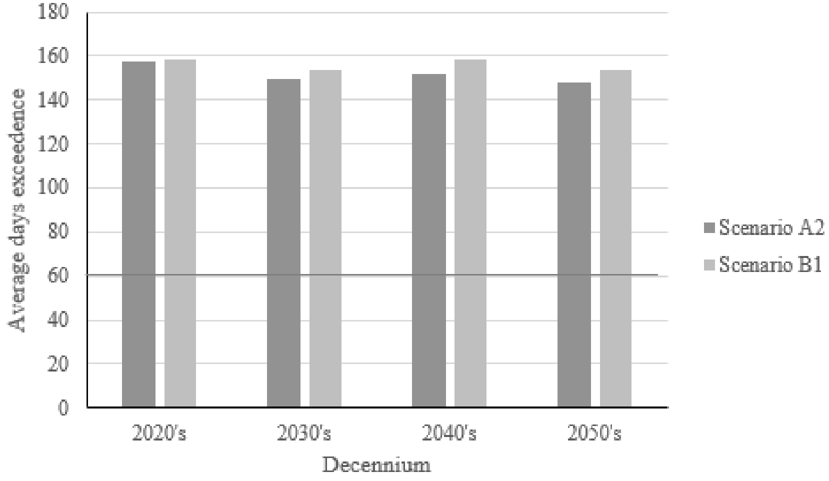
- Scenario B1



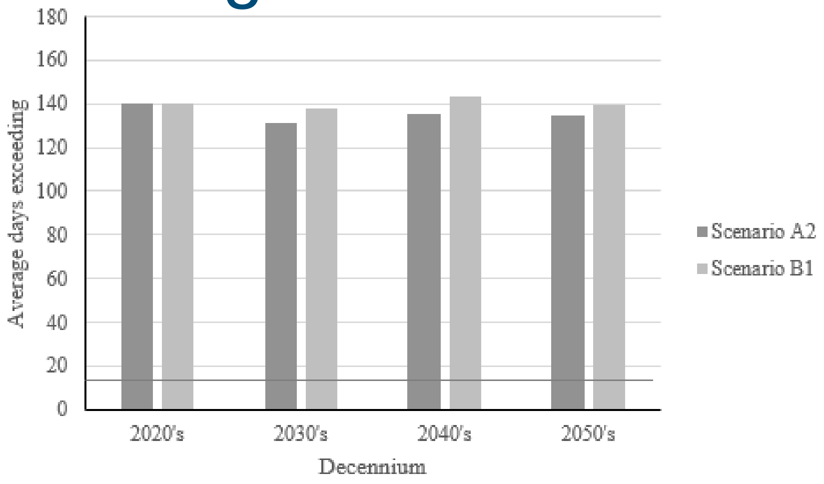
Labanchara – average days excedence

Decadal average number of years in which the thresholds are exceeded

- Low threshold



- High threshold



5. Summary of the case study findings

- For Mollarhat: both thresholds expected to be exceeded – in 2050 (= adaptation turning point)
- Labanchara: Existing problems continue (= adaptation turning point already passed: action necessary!)

6. Discussion

- Interesting findings: need to use climate science in adaptation; finding a way how to do it
- Comparable regions (Satkhira, Dacope, Mongla) studied by Khan et al, Rabbani et al, etc. – conclusions on action required for adaptation also applicable in those regions
- More advanced models might increase level of detail.

7. Conclusion

Use of thresholds gives policy-makers a clear guideline: use climate science in adaptation, uncertainty not less – but finding a way to deal with it

Assessing thresholds and predicting when and where these will pass are a good tool for adaptation planning

Assessment of today – makes it clear to take action for tomorrow: Expectation that there is a need for adaptation in southwest Bangladesh. Make it priority for investment

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