Global Climate Change Alliance
Support Facility

Module 4
Understanding and planning under uncertainty

Training workshops on
mainstreaming climate change

MWH

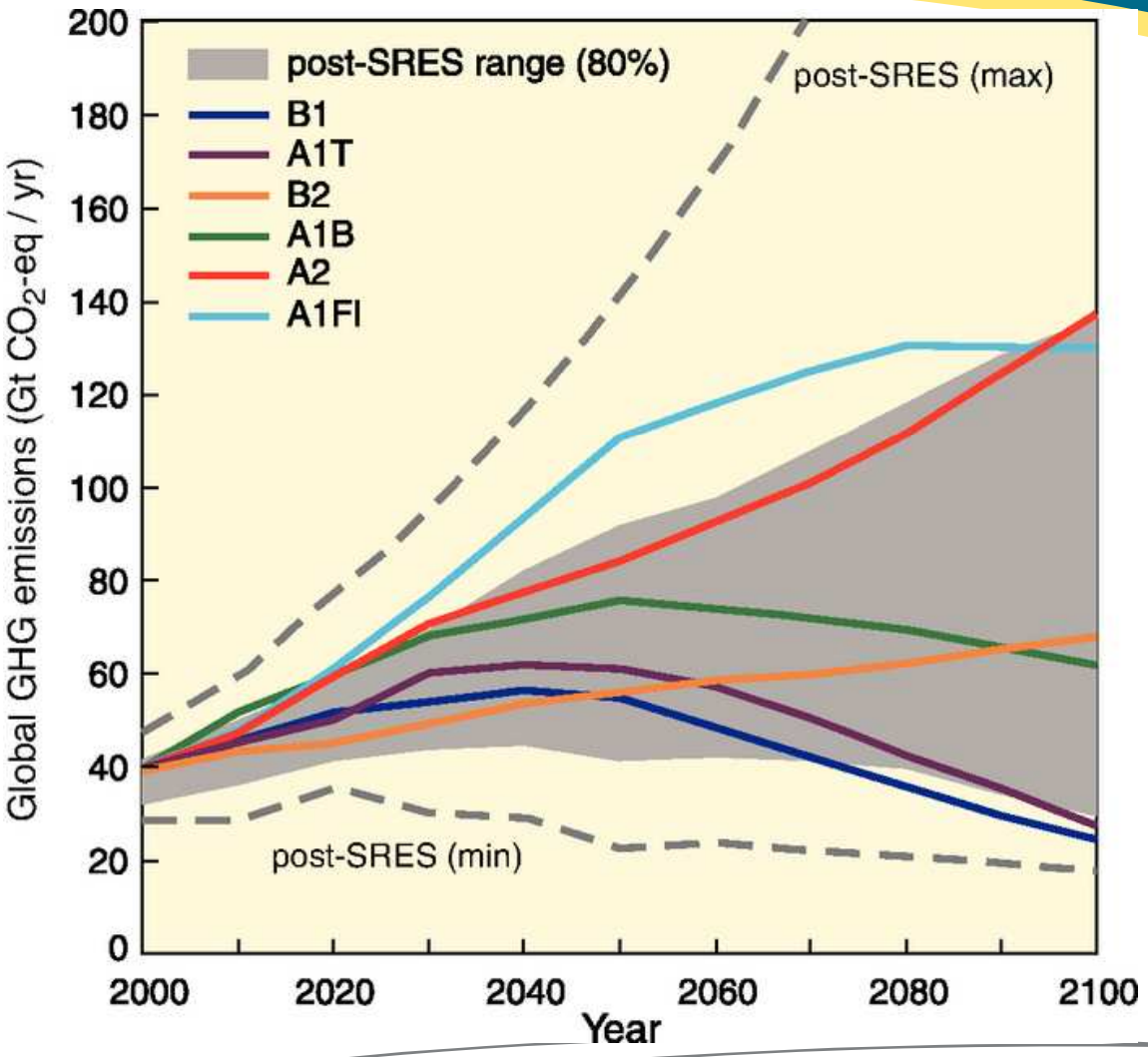
BUILDING A BETTER WORLD

Sources of uncertainty

Socio-economic uncertainties

- Socio-economic uncertainties (e.g. related to future population growth, economic growth, technological choices, societal choices, international relations):
  - influence the level of future emissions and thus the magnitude of climate change
  - also, create uncertainties about future vulnerability to climate change

IPCC GHG emission scenarios



Source: IPCC (2007a) 4th Assessment report – Synthesis report, Fig. 3.1

Climate uncertainties

- For any given emission scenario, different atmosphere-ocean general circulation models (AOGCMs) provide different projections of future change – sometimes very different ones
- Due to the complexity of the climate system, many uncertainties prevail and will persist over the evolution of climate

Uncertainties in climate change projections

- Temperatures and sea levels:
  - consensus that they will increase
  - magnitude of the increase quite uncertain
- Rainfall:
  - expected to increase overall
  - but some regions are likely to get more and some less
  - for many regions in the world, uncertainty about the direction of change
- Changes in extreme parameters:
  - average future conditions are easier to project than extremes

Problems associated with downscaling

- AOGCMs produce projections of future climate change for large areas (e.g. 200x200 km) – but used alone, do not allow the downscaling of projections to local and regional scales (e.g. 10x10 km, 100x100 km)
- Downscaling requires extra data and efforts
  - In developing countries, the data needed to downscale projections of climate change to the local or regional level are often missing
  - The level of uncertainty is greater at downscaled levels than at large scales

Planning in the face of uncertainties

The cost of inaction

- The uncertainties surrounding climate change are often invoked to justify inaction
- In a medium- to long-term perspective, however, inaction now is likely to be more costly:

Failure to adapt	Failure to reduce emissions
*Wasted investment *Increased vulnerability	*More harmful impacts *Higher adaptation costs

The benefits of action

- Some climate adaptation and mitigation measures are expected to provide developmental benefits, regardless of the scope and magnitude of climate change or, as far as mitigation is concerned, regardless of carbon prices
- Even in the face of uncertainty, some types of measures are justified

Justified measures in the face of uncertainty (1)

- ‘No-regret’ measures:
  - those expected to produce net benefits for society even in the absence of climate change (adaptation) or independently of any ‘reward’ for mitigation (zero or negative net cost at a zero carbon price)
- ‘Low-regret’ measures:
  - those expected to have a cost for society, but an acceptable one in view of the benefits they would bring if climate change turns out to produce significant effects (adaptation), or to have a low net cost at zero or low carbon prices (mitigation)

Justified measures in the face of uncertainty (2)

- ‘Robust’ measures:
  - those that produce net benefits or deliver good outcomes across various possible climate change or carbon price scenarios and economic development scenarios (rather than just under the ‘most likely’ scenario)

Adaptive management

- Adaptive management: a flexible and pragmatic type of management, aimed at continually improving management policies and practices, on the basis of ‘learning by doing’
  - Uses pilot projects and experiments; results and outcomes are analysed and lessons learnt before scaling up or adjusting responses
  - Involves robustness as a decision criterion, the inclusion of safety margins in investment and the choice of reversible/flexible options
- Well suited to situations involving uncertainties

Scenario-based planning (1)

- To support the choice of adaptation measures, scenarios reflecting prevailing uncertainties can also be developed, e.g.

1) No change
2) Moderate change
3) High change

1) No change
2) Temperatures up, rainfall up
3) Temperatures up, rainfall down

Scenario-based planning (2)

Contents of scenarios

- **Changes in climate conditions**
- **Resulting biophysical effects**
- **Resulting socio-economic impacts**

Scenario development

- **Key experts with a range of technical skills**
- **Other national stakeholders for their knowledge of local conditions (e.g. government and civil society organisations)**

Scenario-based planning (3)

Once scenarios have been designed:

1) Identify potentially suitable adaptation or mitigation options

2) Calculate costs and benefits for each chosen scenarios

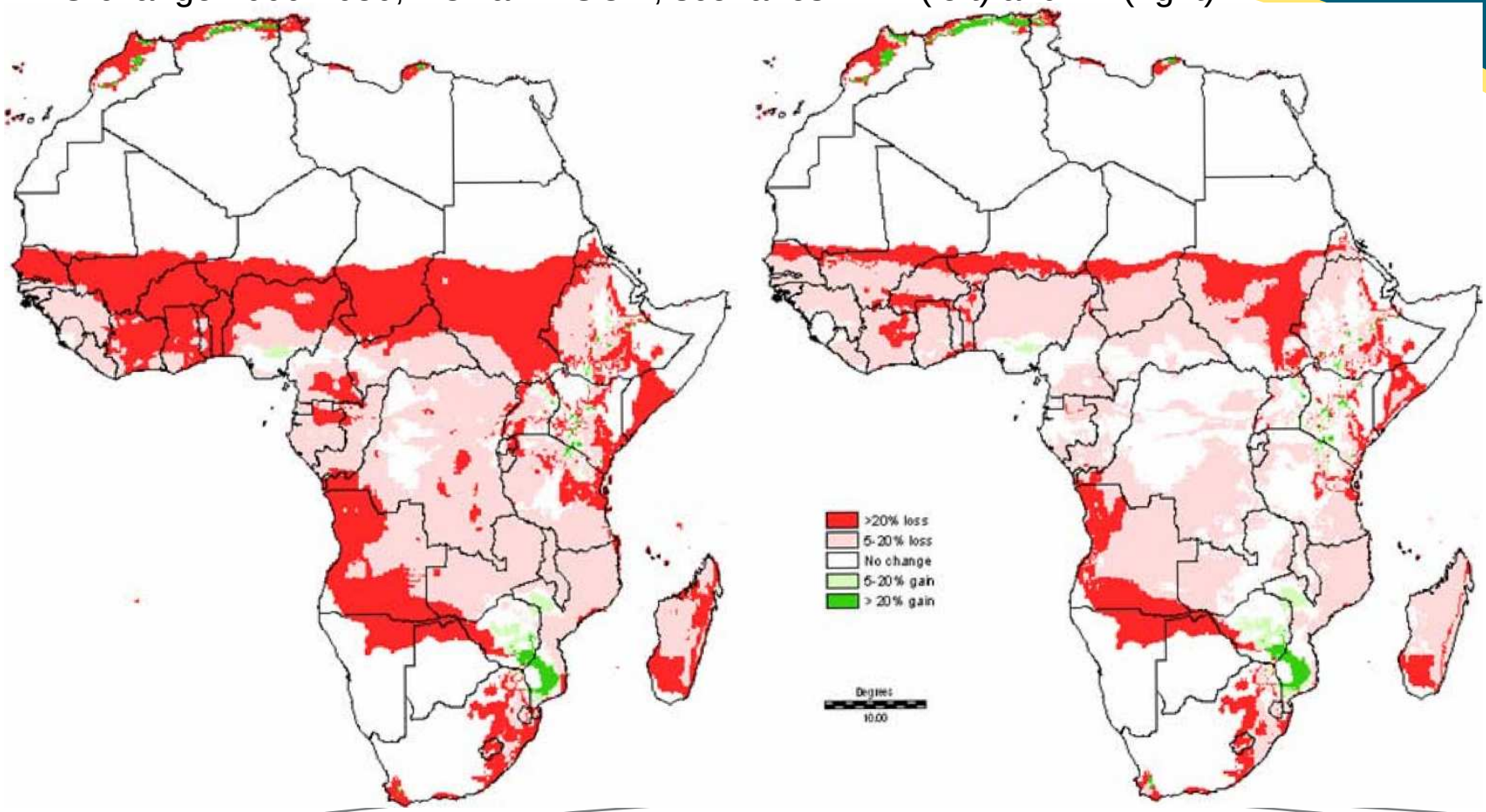
3) Compare costs and benefits across the various scenarios

4) Identify no-regret, low-regret and robust options/measures

Illustration and discussion

Projected changes in the length of the growing period – 2 scenarios

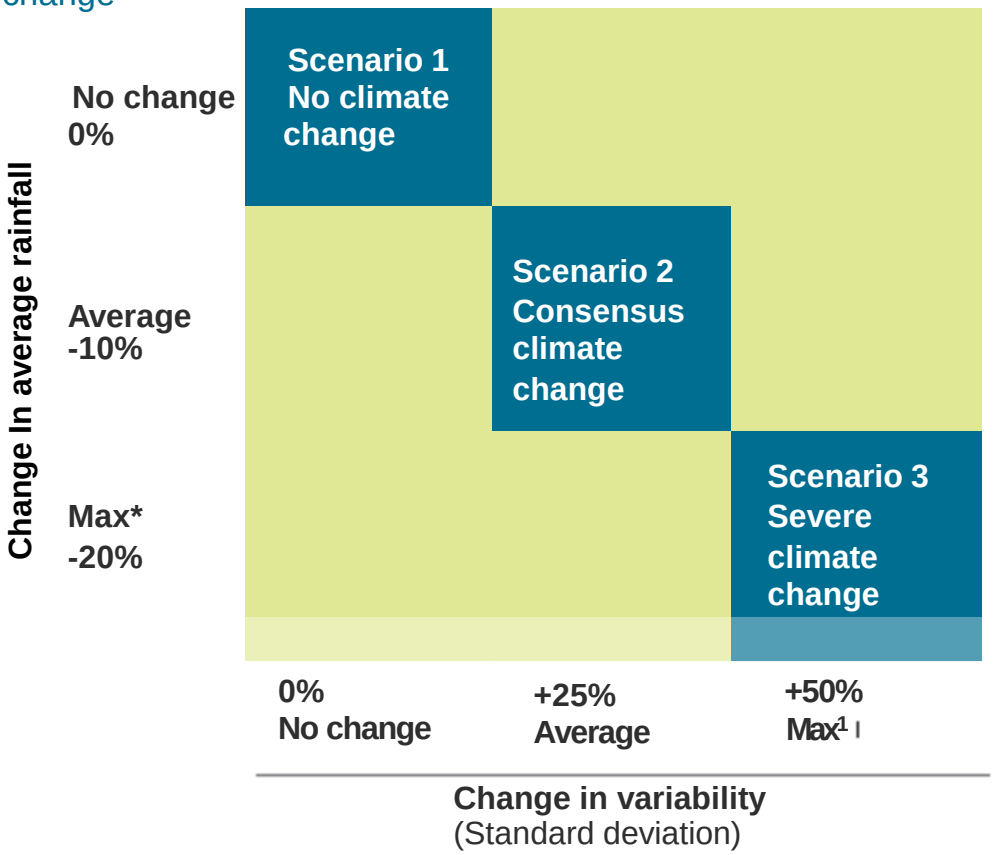
LPG change 2000-2050, ECHam4 GCM, scenarios A1FI (left) and A2 (right)



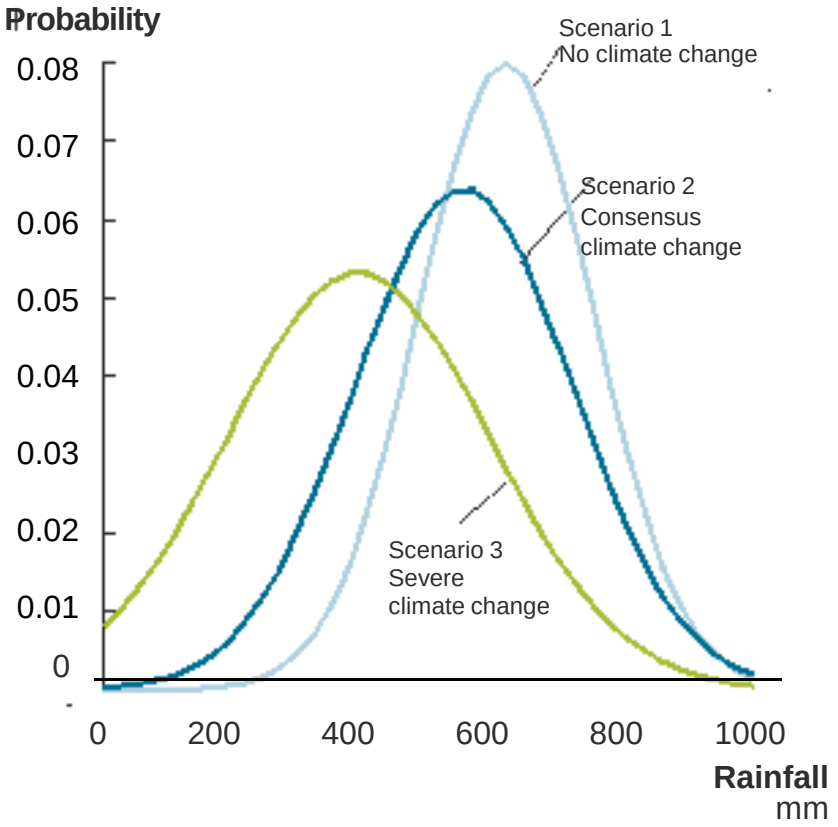
Source: Thornton et al (2006), Figure 7(A)

Illustration: Three climate change scenarios built for the central regions of Tanzania

Scenarios are built to reflect potential outcome of climate change



Each scenario has its own distribution of probability for rainfall



1 One before the worse scenario

Source: Economics of Climate Adaptation (2009) – Case study on central Tanzania – Figure 02, p. 126

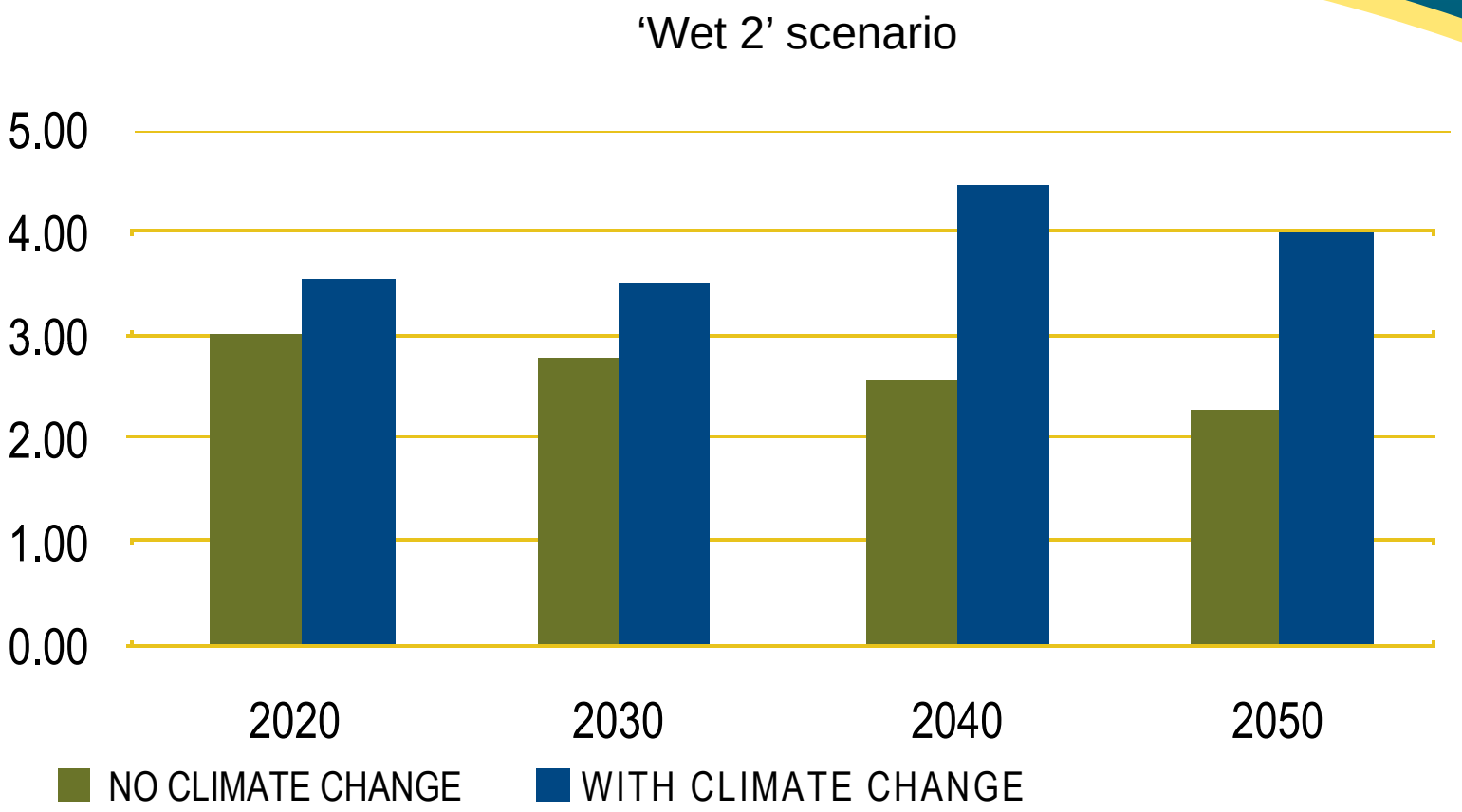
Ethiopia: climate change scenarios used for World Bank case study

CC scenario	GCM used	SRES scenario	CMI (*) deviation
Wet 1 'Global wet'	NCAR CCSM3	A2	+10%
Dry 1 'Global dry'	CSIRO Mk3.0	A2	-5%
Wet 2 'Ethiopia wet'	NCAR PCM1	A1B	+23%
Dry 2 'Ethiopia dry'	IPSL CM4	B1	-15%

(*) CMI = climate moisture index, determined by average annual precipitation and average annual potential evapotranspiration

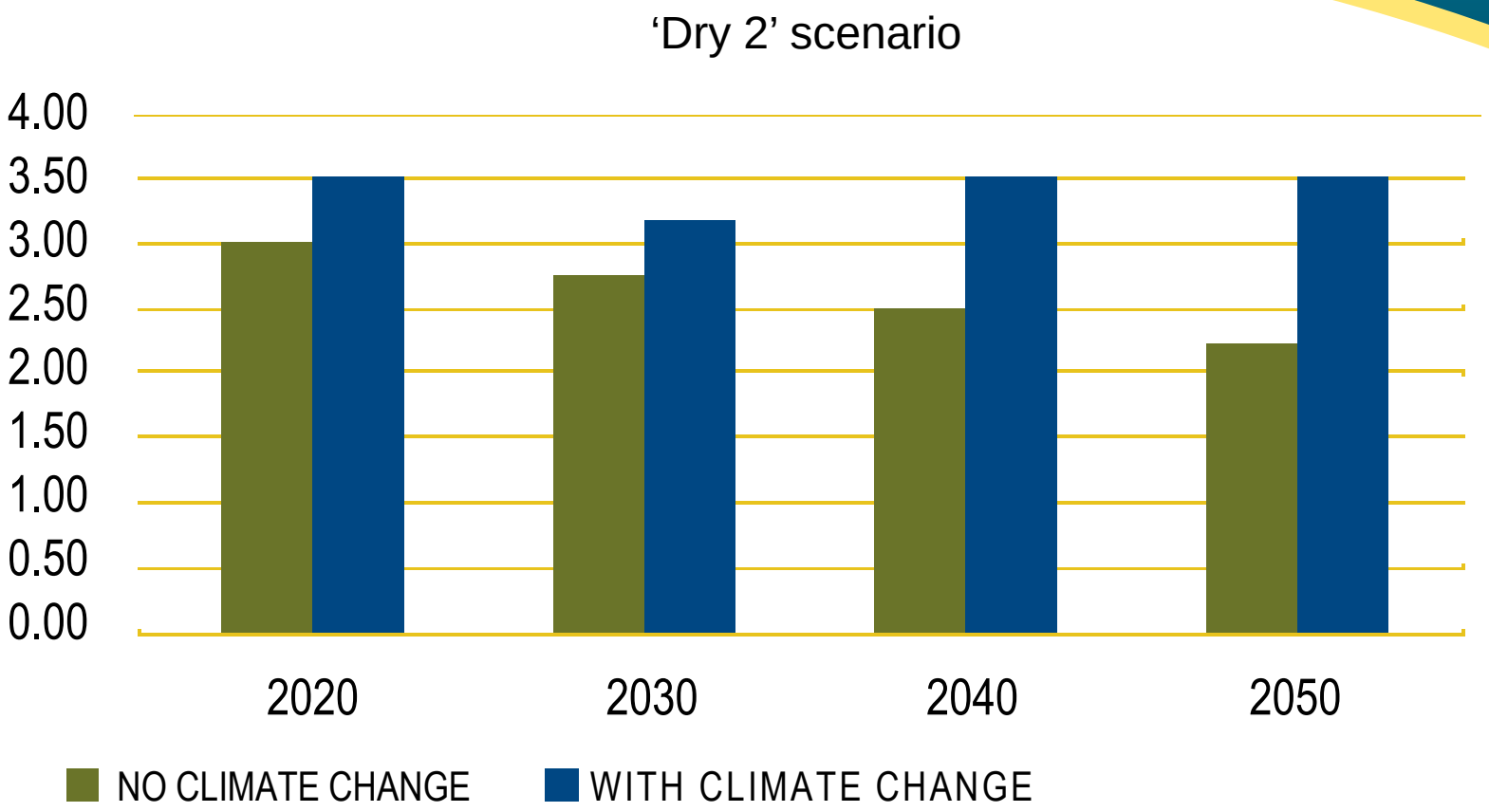
Source: World Bank (2010) *Economics of Adaptation to Climate Change: Ethiopia*. Table 3, p. 9

Ethiopia: benefit/cost ratio of upgrading road standards (1)



Source: World Bank (2010) *Economics of Adaptation to Climate Change: Ethiopia*. Fig. 44, p. 70

Ethiopia: benefit/cost ratio of upgrading road standards (2)



Source: World Bank (2010) *Economics of Adaptation to Climate Change: Ethiopia*. Fig. 44, p. 70

Illustration: background for Alice Springs CC scenarios

- Integrates data from several existing sources of information (climate model scenarios, economic data, natural resource management information)
- Scenarios representing possible futures for Alice Springs based on narratives produced as a result of stakeholder discussions
- The model does not make predictions of the future - it aims to explore trends and so make stakeholders think in terms of the whole system and a set of possible outcomes

Alice Springs CC scenario: on-line tool

www.users.on.net/~treehugger/ser/index.htm

References

- Alice Springs scenario-based planning tool: www.users.on.net/~treehugger/ser/index.htm
- Economics of Climate Adaptation Working Group (2009) *Shaping climate-resilient development: a framework for decision-making*. Climate Works Foundation, Global Environment Facility, European Commission, McKinsey & Company, The Rockfeller Foundation, Standard Chartered Bank & Swiss Re. Available from: http://www.mckinsey.com/clientservice/Social_Sector/our_practices/Economic_Development/Knowledge_Highlights/Economics_of_climate_adaptation.aspx
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- Thornton P.K., Jones P.G., Owiyo T., Kruska R.L., Herrero M., Kristjanson P., Notenbaert A., Bekele N. and Omolo A., with contributions from Orindi V., Otiende B., Ochieng A., Bhadwal S., Anantram K., Nair S., Kumar V. and Kulkar U. (2006) *Mapping climate vulnerability and poverty in Africa*. Report to the Department for International Development, ILRI, PO Box 30709, Nairobi 00100, Kenya. Available from: http://www.napa-pana.org/extranapa/UserFiles/File/Mapping_Vuln_Africa.pdf
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