Science and decision making

A personal journey …

Yvan Biot, EEDN (18/11/21)

Example 1

Soil erosion

ROUTLEDGE REVIVALS

The Political Economy of Soil Erosion in Developing Countries

Piers Blaikie

Soil Use and Management

BRITISH SOCIETY OF SOIL SCIENCE

Loss of yield caused by soil erosion on sandy soils in the UK

Y. Biot, X.X. Lu

Abstract

Abstract. Soil productivity, the intrinsic ability of land to yield useful products, can be affected by soil erosion. While much research has been carried out on the processes, there is as yet little information on the impact of soil erosion on *in situ* productivity of agricultural land in the British Isles.

This paper reports the results of a de-surfacing experiment on deep sandy soils in East Anglia. Grain yields of fertilized barley planted immediately after de-surfacing were at least 15 and 45% less on 15 and 25 cm de-surfaced plots than on non-desurfaced soils. There was strong evidence pointing to an acceleration of soil erosion itself on the de-surfaced plots. Both the amount of water stored in the topsoil and water use by the crop decreased with increasing severity of simulated erosion. We observed a drop in organic matter and readily available nitrogen with erosion. Nitrogen mineralization and leaching losses were also affected by simulated soil erosion.

The experiment showed that sudden severe erosion may induce substantial barley production losses on deep sandy soils. The size and effect of de-surfacing depends on a number of factors such as soil depth, subsoil type, precipitation and crop type.

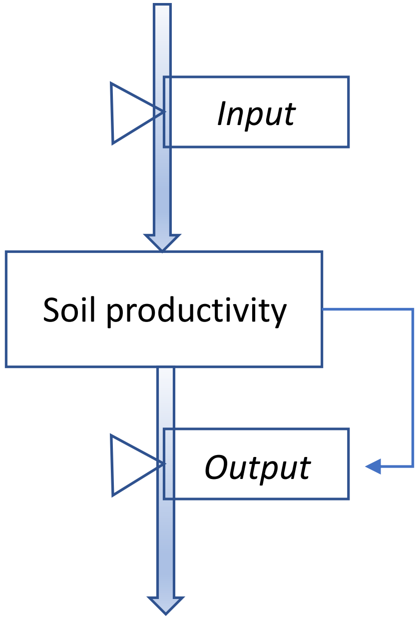


Table I. Annual production and rates of erosion for mean annual rainfall in a pilot region of the Hardveld of Botswana

soil depth (cm)	cumulative erosion (cm)	rate of erosion (cm y^{-1})	grass production (kg ha^{-1} y^{-1})
105	0	0·008	1046
75	30	0·024	771
45	60	0·048	614
15	90	0·003	460

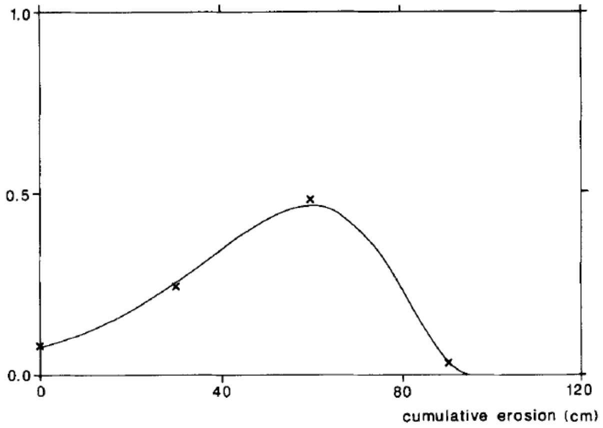
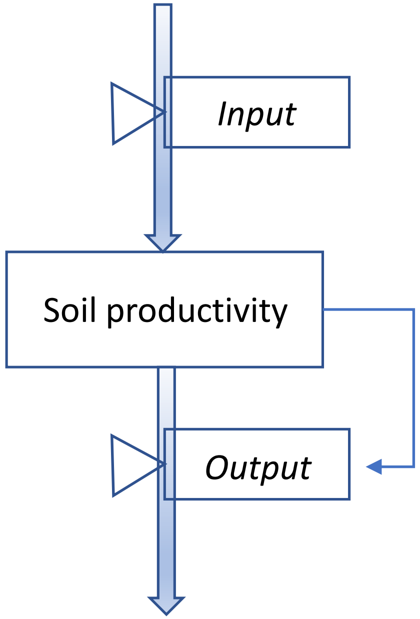


Figure 2. Rate of erosion versus cumulative erosion in the Hardveld of Botswana

LAND DEGRADATION & REHABILITATION, VOL. 1, 263–278 (1989)

ASSESSING THE SUSTAINABILITY OF AGRICULTURAL LAND IN BOTSWANA AND SIERRA LEONE

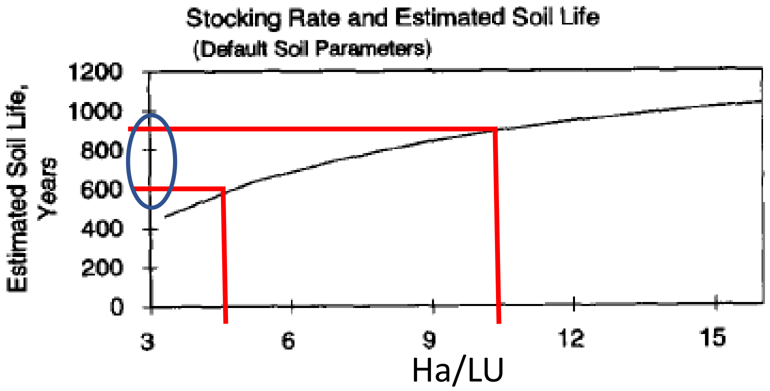
Y. BIOT, M. SESSAY AND M. STOCKING
School of Development Studies, University of East Anglia, Norwich, NR4 7TJ, UK

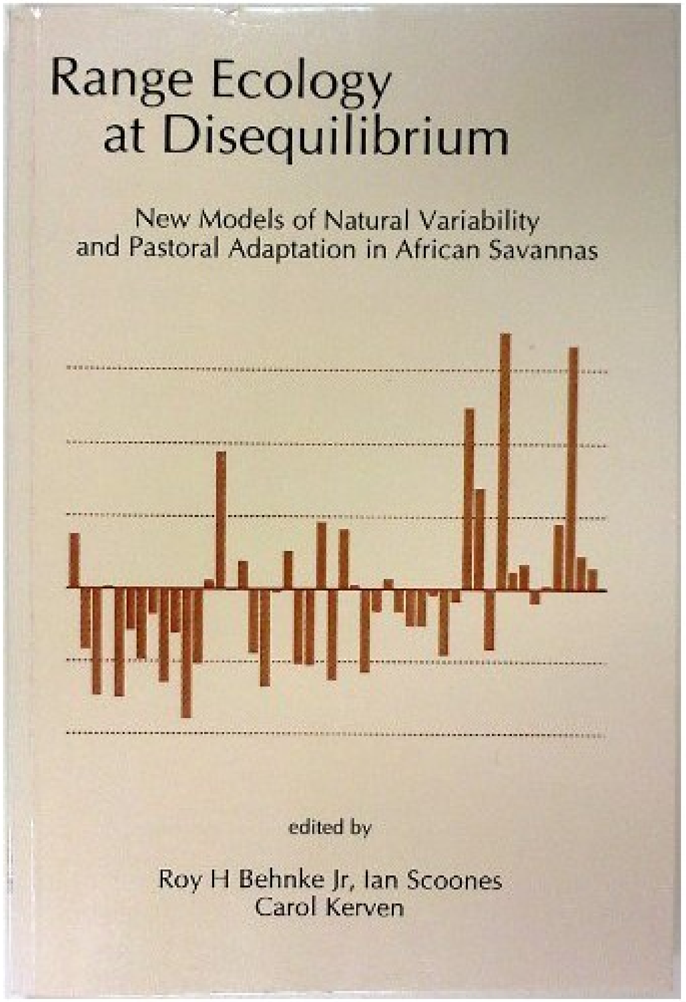


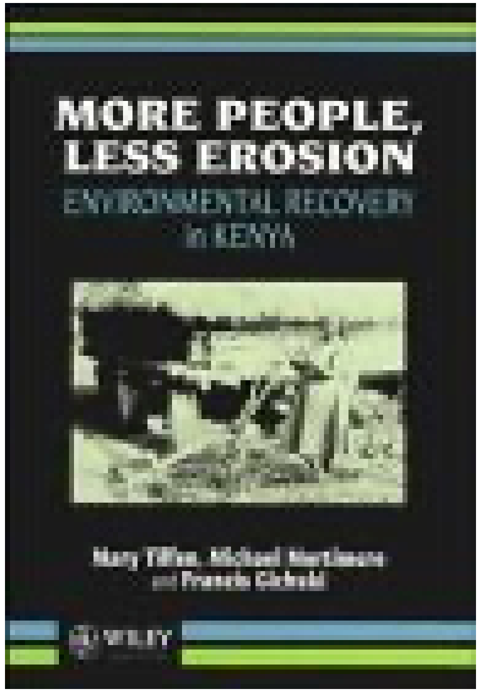
ELSEVIER
Ecological Economics 23 (1997) 113–133
ECOLOGICAL ECONOMICS

Mis-measurement of the productivity and sustainability of African communal rangelands: a case study and some principles from Botswana

Nick Abel *




Range Ecology
at Disequilibrium
New Models of Natural Variability
and Pastoral Adaptation in African Savannas
edited by
Roy H Behnke Jr, Ian Scoones
Carol Kerven

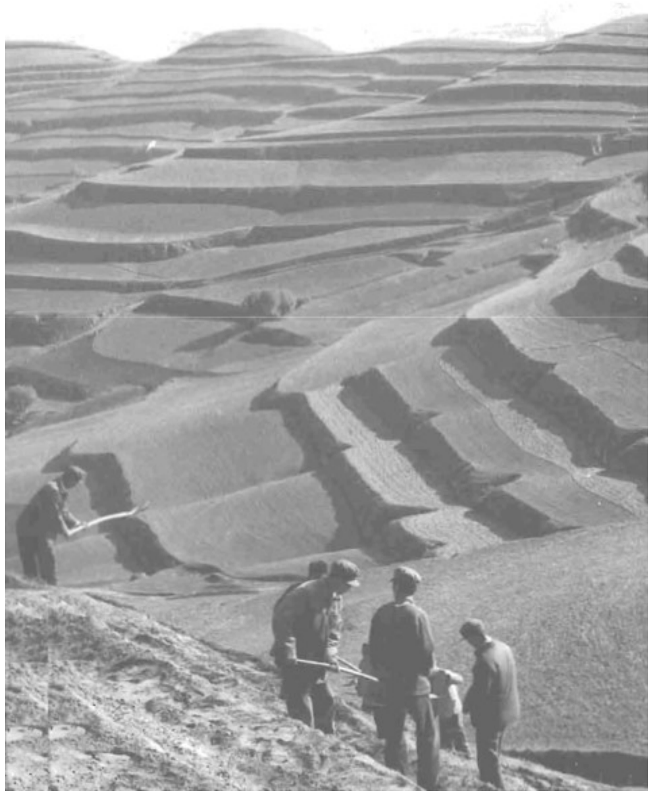

MORE PEOPLE,
LESS EROSION
ENVIRONMENTAL RECOVERY
in KENYA
WILEY

SOIL AND WATER
CONSERVATION
SOCIETY

WORLD ASSOCIATION
OF SOIL AND WATER
CONSERVATION

Land Husbandry

A Framework for Soil and Water Conservation



289 World Bank Discussion Papers

Rethinking Research on Land Degradation in Developing Countries

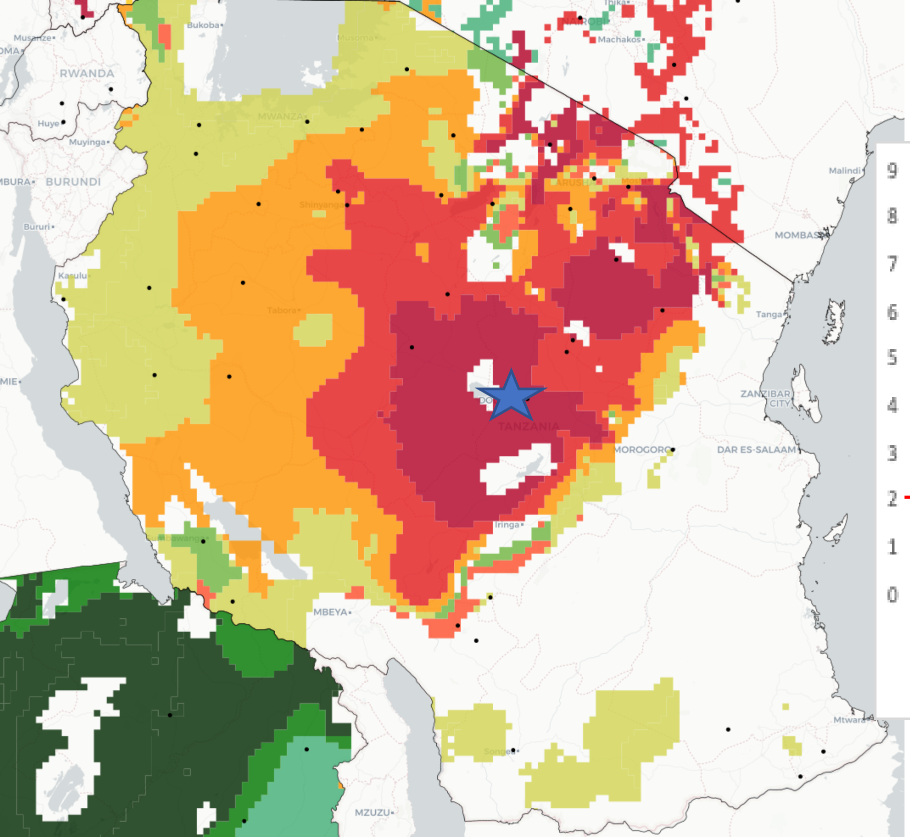
Yvan Biot
Piers M. Blaikie
Cecile Jackson
Richard Palmer-Jones

Uncertainty on a Himalayan Scale: An Institutional Theory of Environmental Perception and a Strategic Framework for the Sustainable Development of the Himalaya.

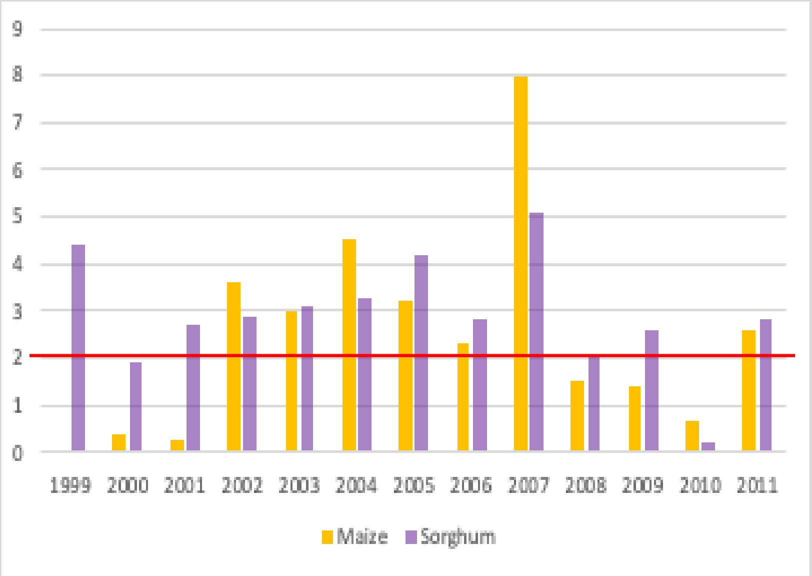
First published in 1986 by *Milton Ash Editions*, an imprint of Ethnographica, 19 Westbourne Road, London N7 8AN, UK.

Example 2

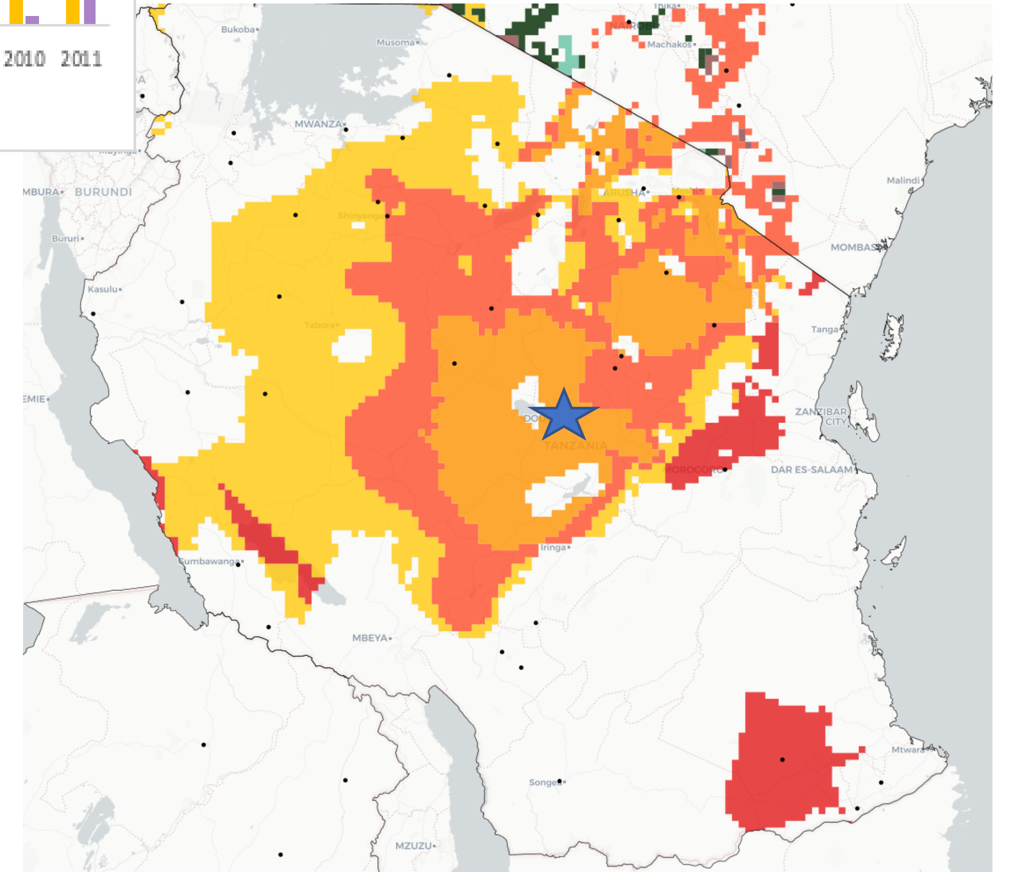
Climate change



Maize



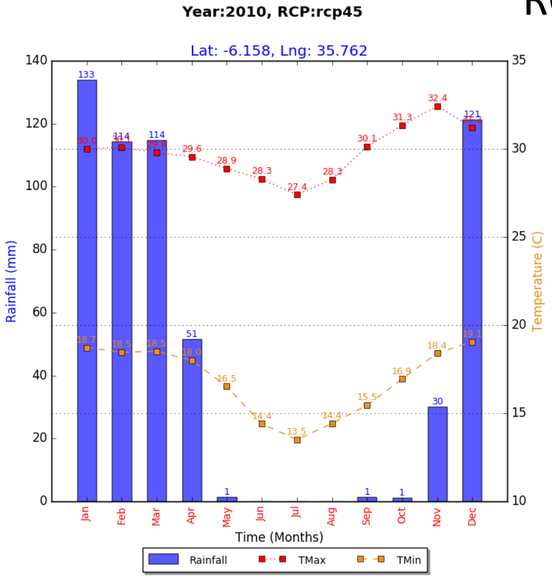
Sorghum



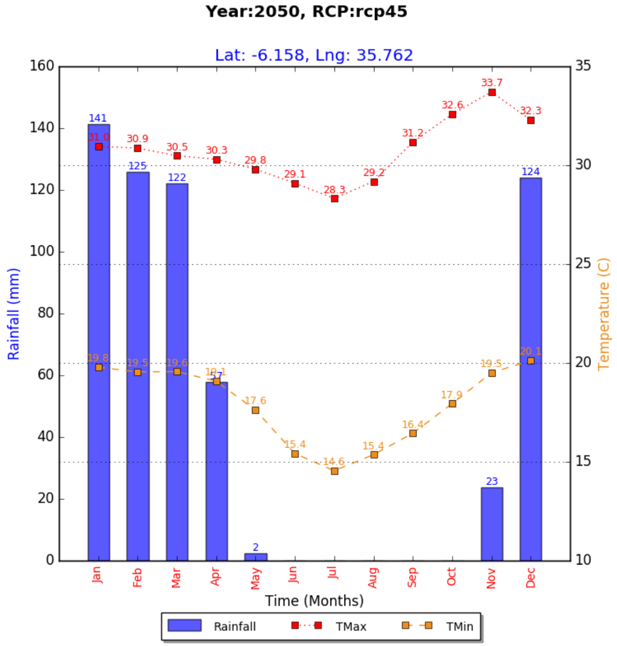
	Maize	Sorghum
Mean	2.4	2.9
St. Deviation	2.2	1.2
CoV (%)	90	42
Yields < 2t/ha	1/2 years	1/7 years

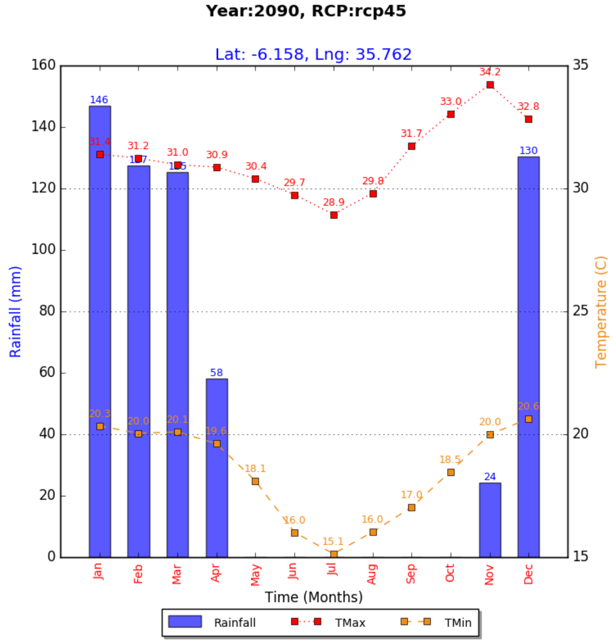
Source: https://www.yieldgap.org

MarkSIM - Dodoma CMIP5

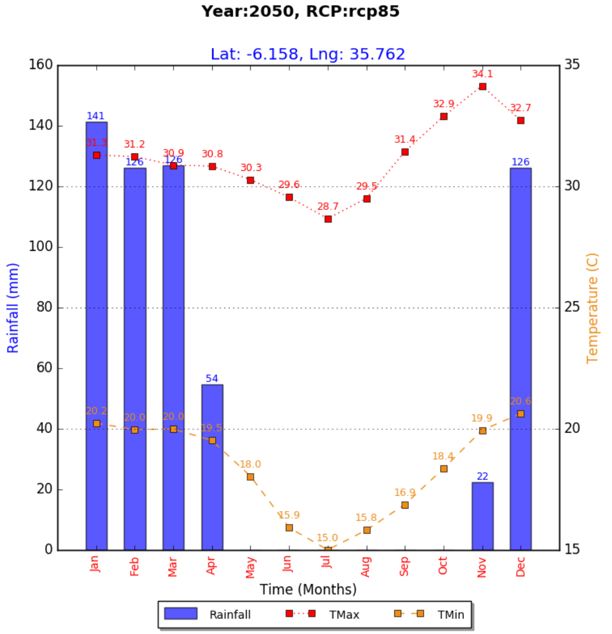


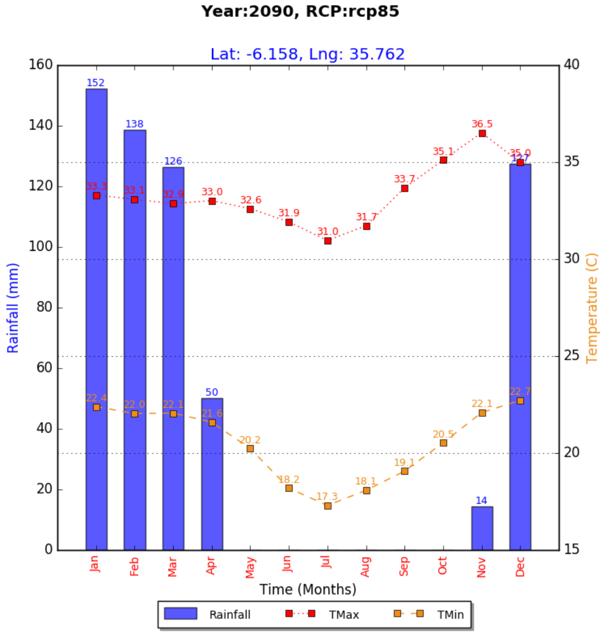
RCP4.5

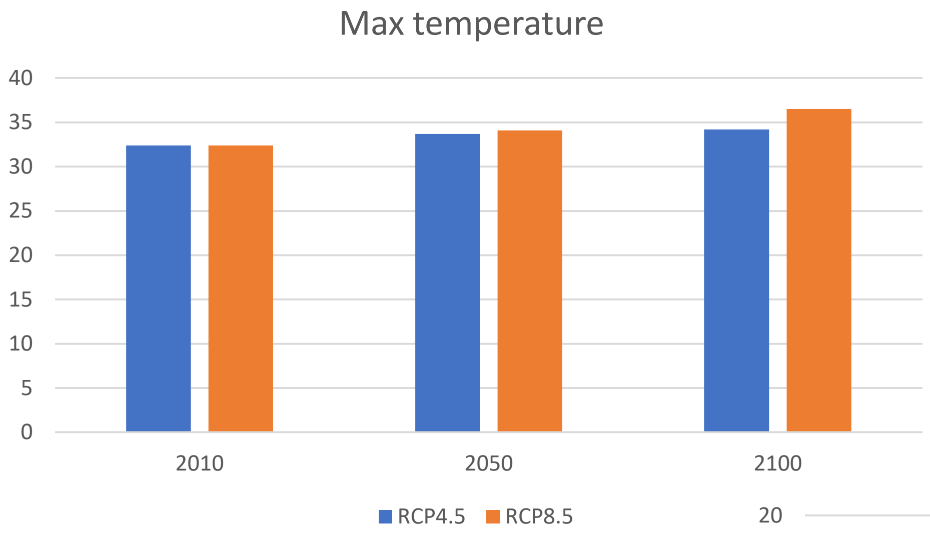


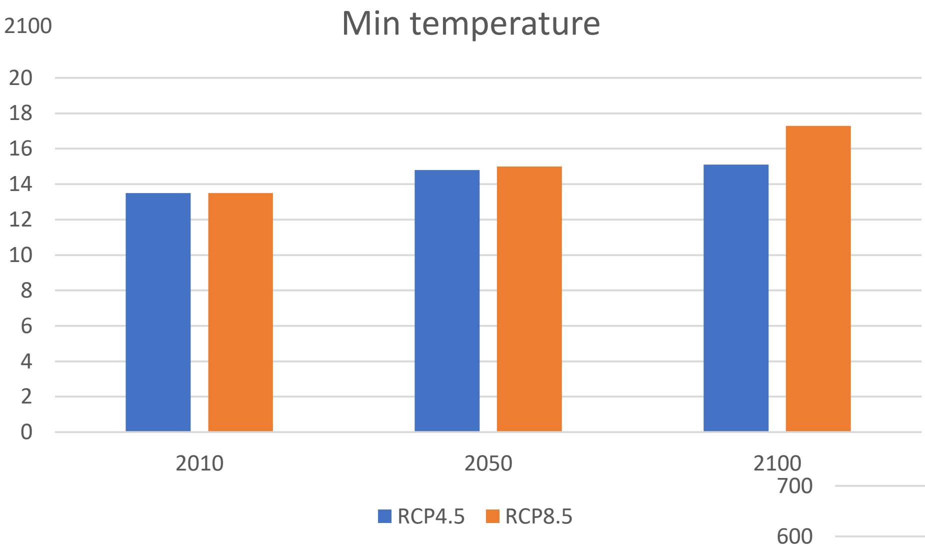


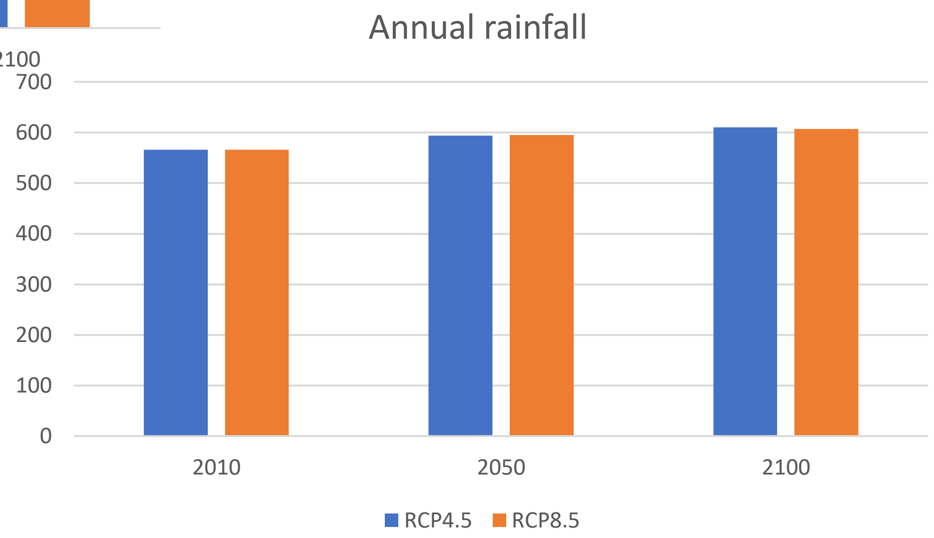
RCP8.5

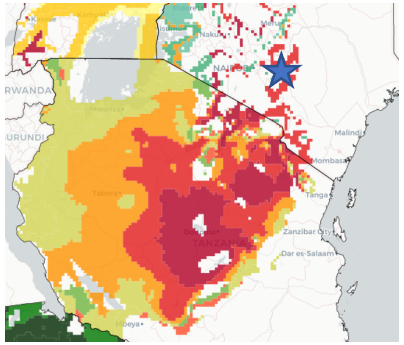


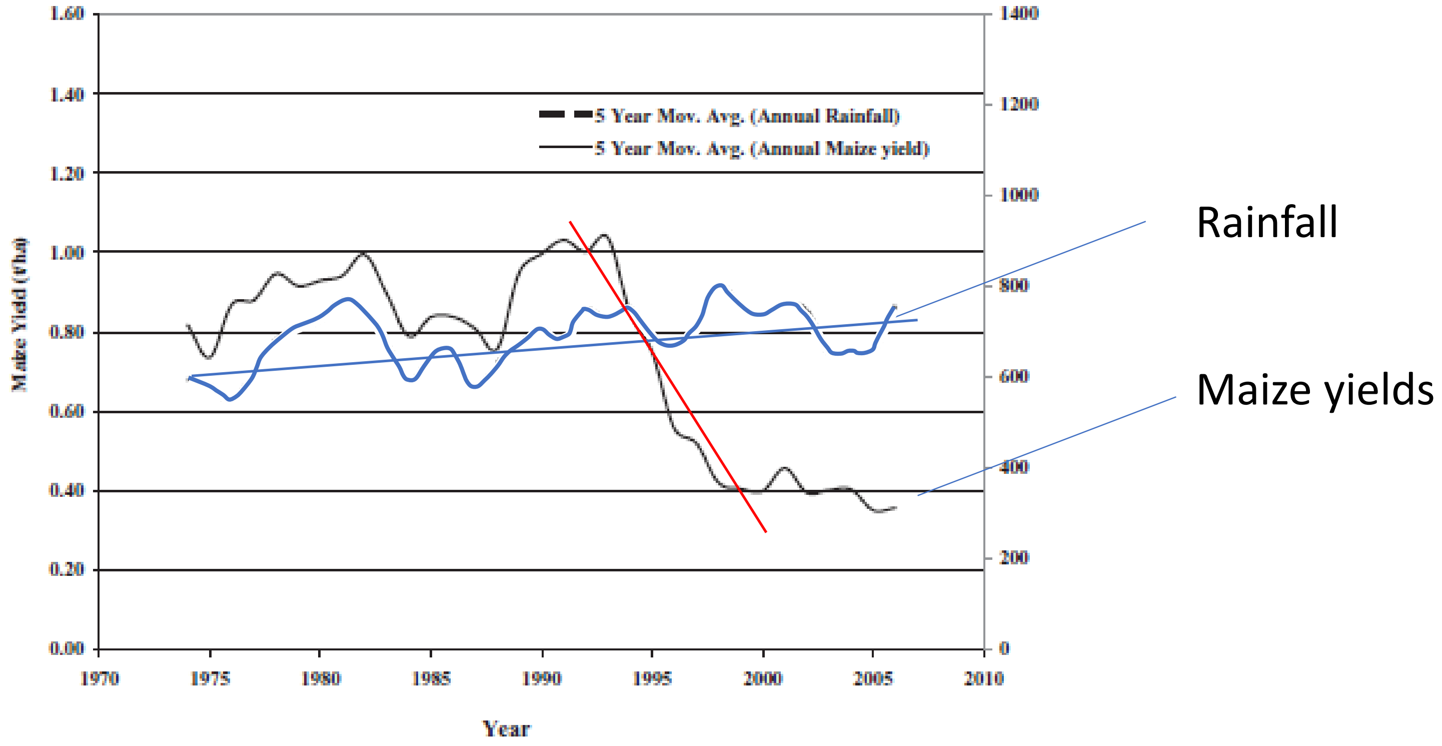



Max temperature
40
35
30
25
20
15
10
5
0
2010
2050
2100
RCP4.5
RCP8.5


Min temperature
20
18
16
14
12
10
8
6
4
2
0
2010
2050
2100
RCP4.5
RCP8.5


Annual rainfall
700
600
500
400
300
200
100
0
2010
2050
2100
RCP4.5
RCP8.5



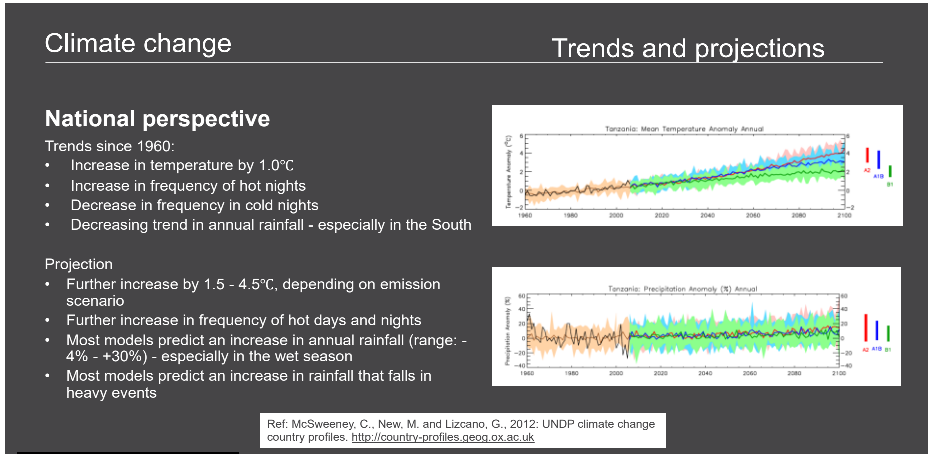


Rao, K., *et al*:, 2011. Climate variability and change: farmer perceptions and intra-seasonal variability in rainfall associated risk in semi-arid Kenya

? * ?

?

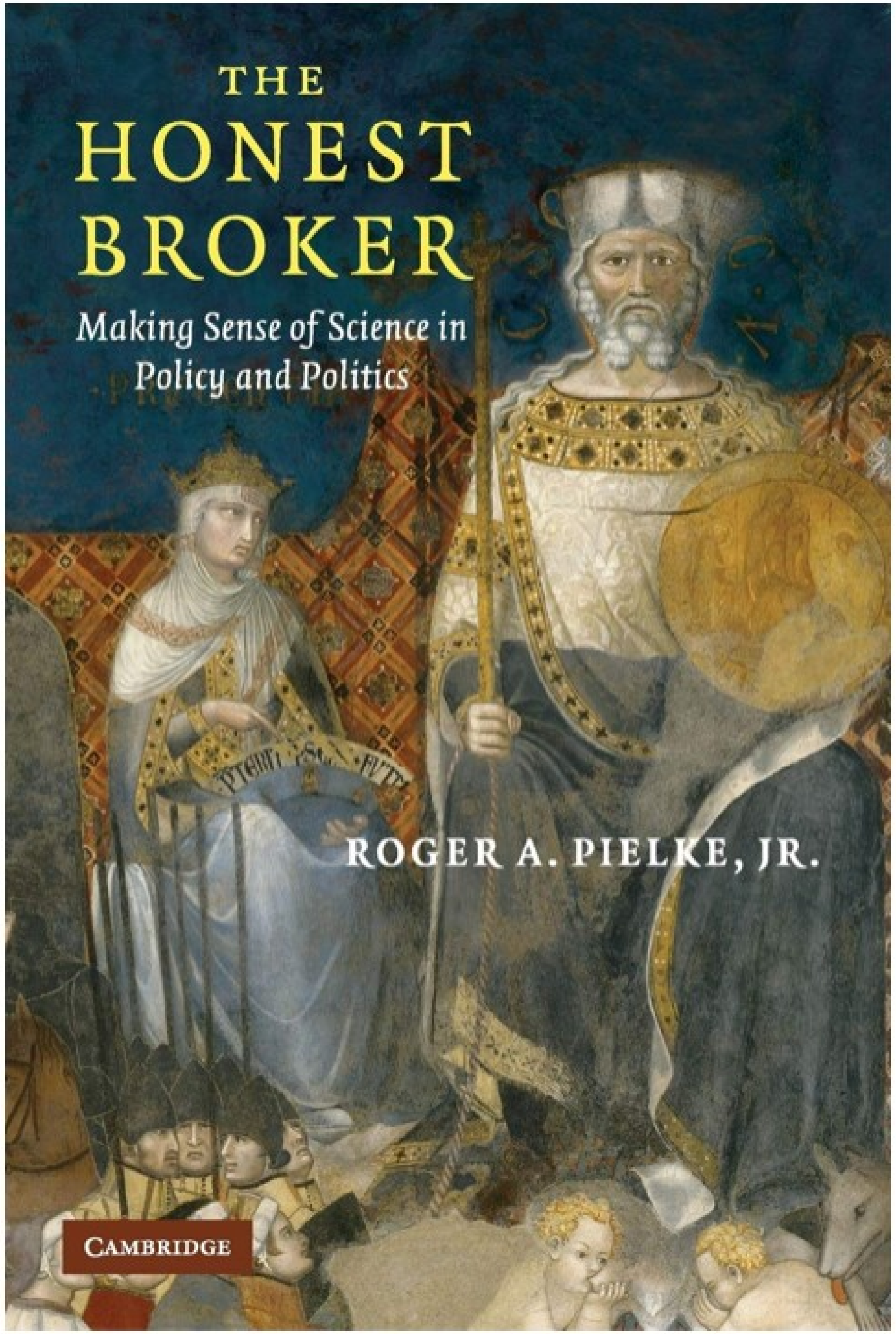
$$\text{Risk} = \text{Hazard} * \frac{\text{Sensitivity} * \text{Exposure}}{\text{Adaptive Capacity}}$$

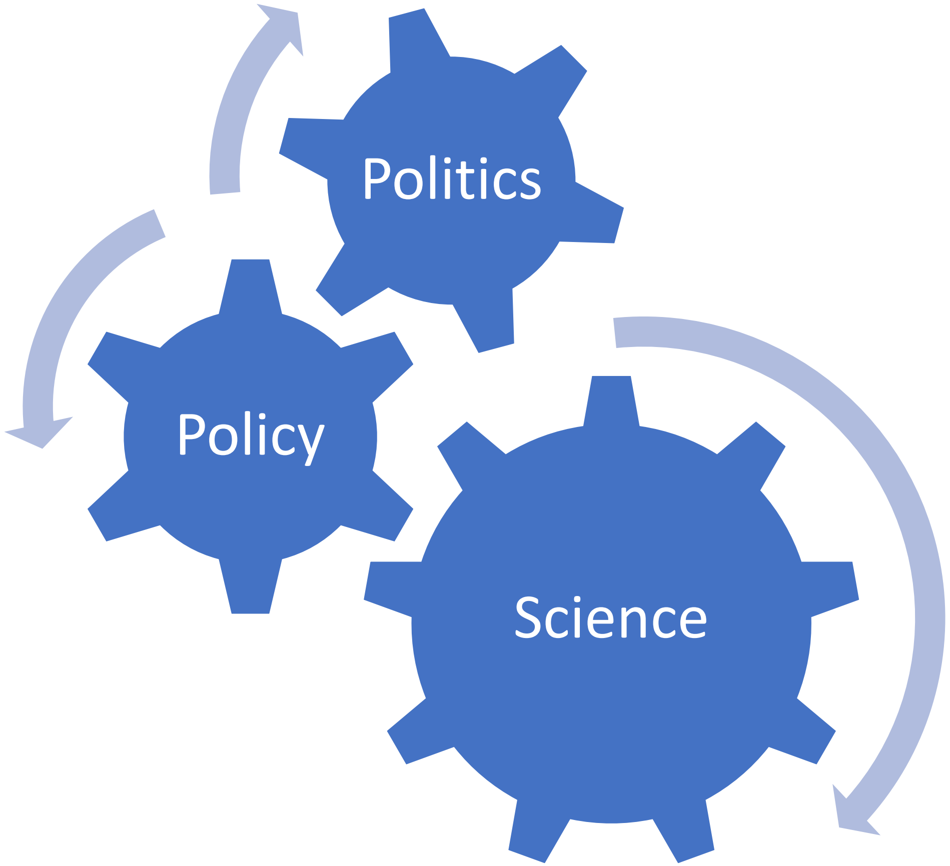


Your examples …

Science and decision making …

Towards a conceptual framework …


THE
HONEST
BROKER
Making Sense of Science in
Policy and Politics
ROGER A. PIELKE, JR.
CAMBRIDGE



- Science: systematic pursuits of knowledge
- Policy: group decision, particular course of action
- Politics: process of bargaining, negotiations and pursuit of compromise to achieve desired ends

“The role of the scientist is not to determine which risks are worth taking or deciding what choices we should make, but the scientist must be involved in indicating what the possible choices, constraints and possibilities are … The role of the scientist is not to decide between the possibilities but in determining what the possibilities are”

Lord May

Values and uncertainties

Values

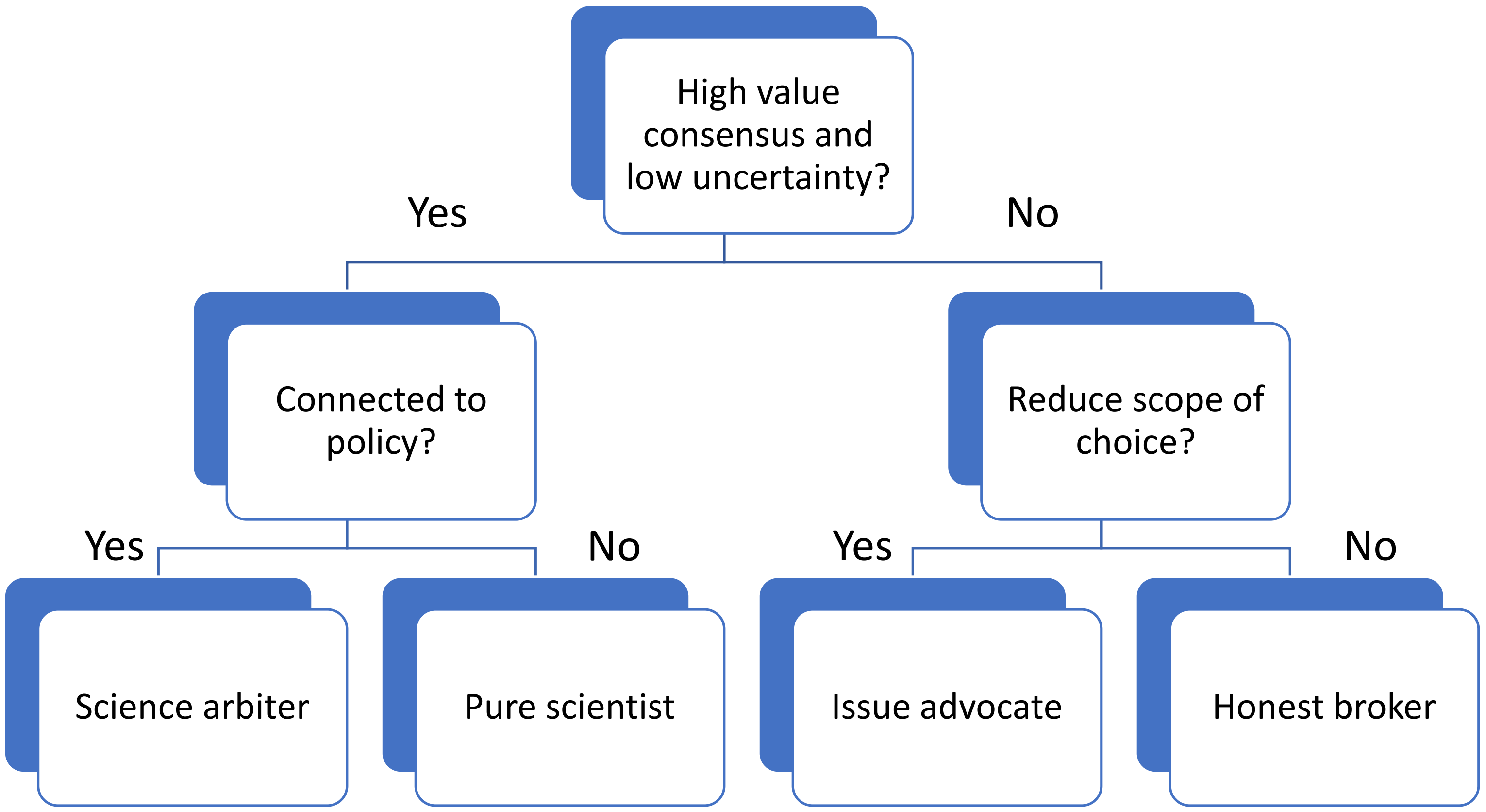
- Tornado politics: shared ends
  - Science can help by providing knowledge
- Abortion politics: contested ends
  - No amount of science about abortion can help reconcile different values
  - High danger of distorting the process of making a political decision …

Uncertainties

- More than one outcome is consistent with our expectation
- Objective and subjective
- Reducible and not-reducible
- Danger of politicisation of science

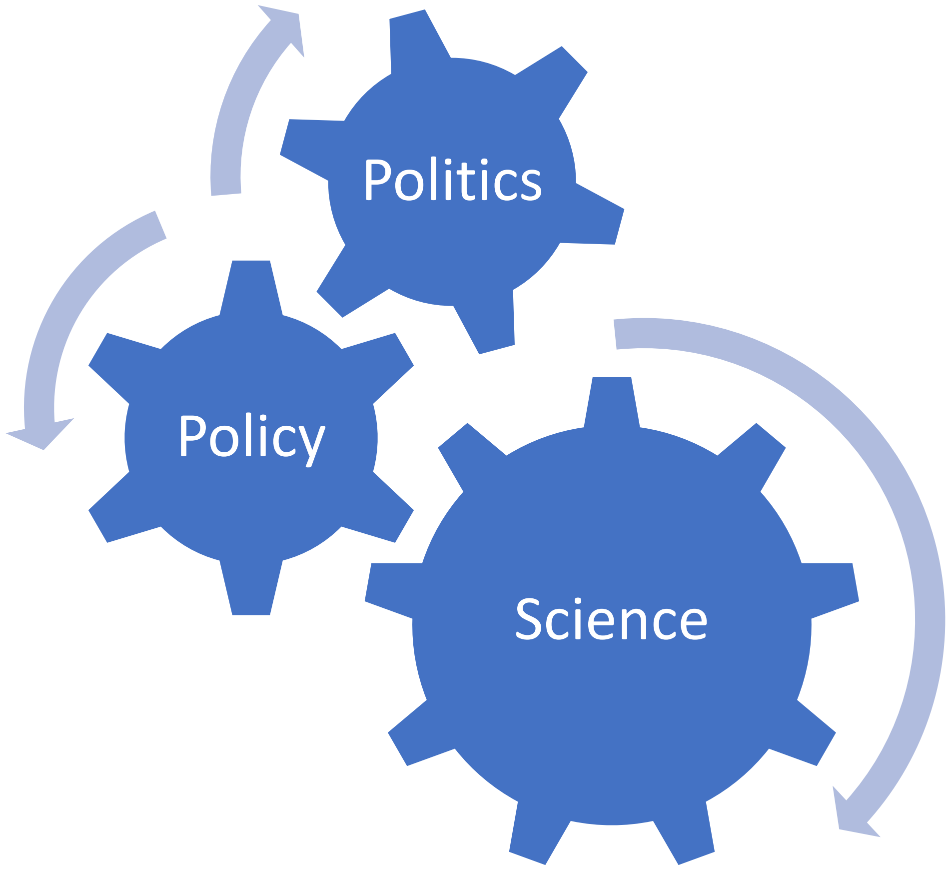
Wicked problems …

High uncertainty + Conflicting desired outcomes



- Pure scientist: focuses on research without consideration for its use
- Science arbiter: interacts with policy maker and helps adjudicate debated queries
- Issue advocate: aligns themselves with a faction seeking to advance their interest through policy / politics
- Honest broker: engages in decision making by clarifying and at times seeking to expand the range of choices available to decision makers

Triangle of mutually reinforcing interests …



“Rather than resolving political debate, science often becomes ammunition in partisan squabbling, mobilised selectively by contending sides to bolster their position. Because science is highly valued as a source of reliable information, disputants look to science to help legitimate their interests. In such cases, the scientific experts on each side of the controversy effectively cancel each other out and the more powerful political or economic interests prevail, just as they would have done without the science”

- *“Politics without policy threatens the democratic process for 2 reasons. First, it may lead to a limited participation in processes of decision making, as some groups might be excluded. Secondly, political power can do little to serve common interests if there are no good alternatives for action available for decision making”*

- *“Attempts to turn all policy making into technical exercises that obviate the need for political debate have been called “technocracy” and “scientization of politics”*

- *“It is dangerous for scientists to participate in politicisation of science, particularly through the media. This leads to a loss of credibility of the process of science and the credibility of the democratic process.”*

Assessing evidence

DFID guidance …

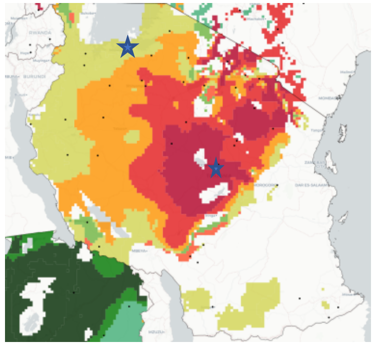
Individual pieces of evidence …

Principles of quality	Associated principles
Conceptual framing	Does the study acknowledge existing research?
	Does the study construct a conceptual framework?
	Does the study pose a research question?
	Does the study outline a hypothesis?
Openness and transparency	Does the study present or link to the raw data it analyses?
	Does the author recognise limitations/weaknesses in their work?
Appropriateness and rigour	Does the study identify a research design?
	Does the study identify a research method?
	Does the study demonstrate why the chosen design and method are good ways to explore the research question?
Validity	Has the study demonstrated measurement validity?
	Is the study internally valid?
	Is the study externally valid?
Reliability	Has the study demonstrated measurement reliability?
	Has the study demonstrated that its selected analytical technique is reliable?
Cogency	Does the author 'signpost' the reader throughout?
	Are the conclusions clearly based on the study's results?

Body of evidence …

- **quality** of the studies constituting the body of evidence
  - high, moderate, low;
- **size** of the body of evidence
  - Large, Medium, Small
- **consistency** of the findings
  - Consistent, Inconsistent
- **context** of the evidence
  - Global, Context Specific

Thanks!



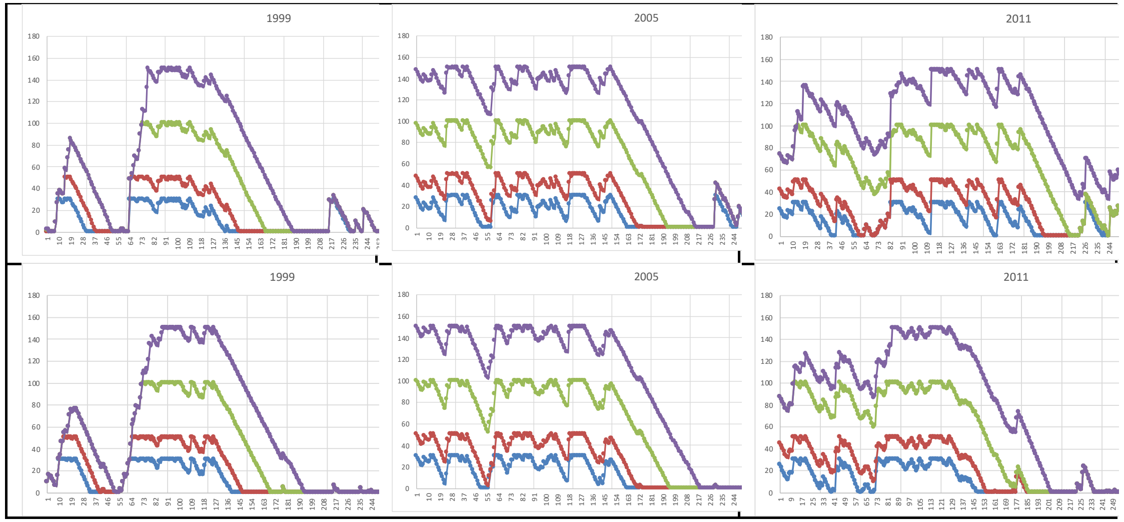
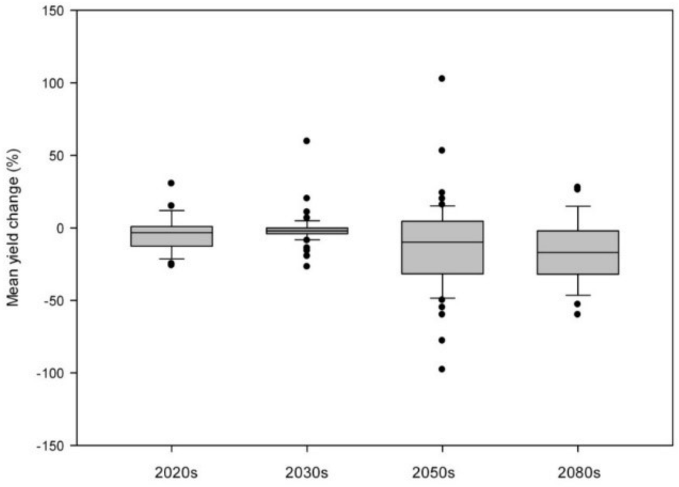


Figure 5: sample soil moisture balance profiles for the Somewhat Humid (Mwanza -upper row) and Subhumid (RFMZ1 - lower row) climatic zones for 1999 (left column), 2005 (middle column) and 2011 (right column). See text for methodology.

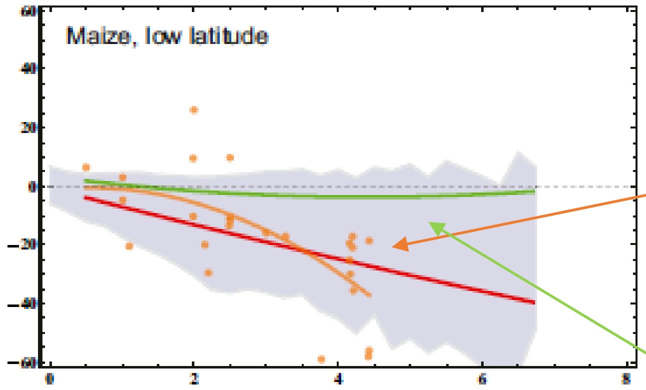
Table 10: main climatic characteristics of both climatic zones under the worse case climate change scenario. Values between brackets refer to changes compared to the current climate

	Somewhat humid (Mwanza)			*Semi-humid (RFMZ1)*		
	Uplands	*Planosol*	*Vertisol*	*Uplands*	*Planosol*	*Vertisol*
ETo	1,804 mm (+136)			1,906 mm (+169)		
Aridity index	73% (-6)			52% (-5)		
Onset date	266 (-)			304 (-)		
LGP annual	263-283 (-3)	256 (-1)	306 (-5)	210-233 (-9)	199 (-9)	254 (-14)
Season gap	10 – 15 (-)	24 (-)	5 (-1)	2-4 (-)	10 (-1)	1 (-1)
LGP sep-jan	154-160 (-1)	145 (-2)	164 (-1)	106-109 (-1)	99 (-1)	109 (0)
LGP feb-jun	90-110 (-5)	82 (-5)	141 (0)	96-119 (-12)	85 (-12)	141 (-16)
Dry season	78-98 (+3)	105 (+1)	55 (+5)	128-150 (+10)	161 (+8)	106 (+14)

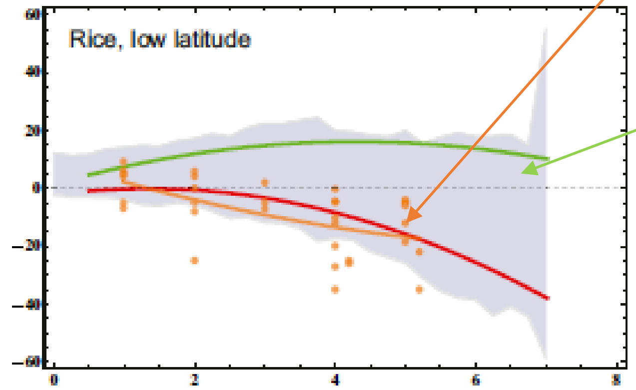


“Across Africa, mean yield changes of − 17% (wheat), − 5% (maize), − 15% (sorghum) and − 10% (millet). No mean change in yield was detected for rice.”

Knox, J., et al., 2012, Climate change impacts on crop productivity in Africa and South Asia.



There is a considerable risk of climate change affecting yields of nutrient stressed maize, rice and soya in the tropics by up to 20% by the end of the century (3 ℃ scenario)



Those risks largely disappear for non-nutrient stressed crops

Rosenzweig., C., et al., 2014: *Assessing agricultural risks of climate change in the 21st century in a global gridded crop model inter-comparison.*