Decision making

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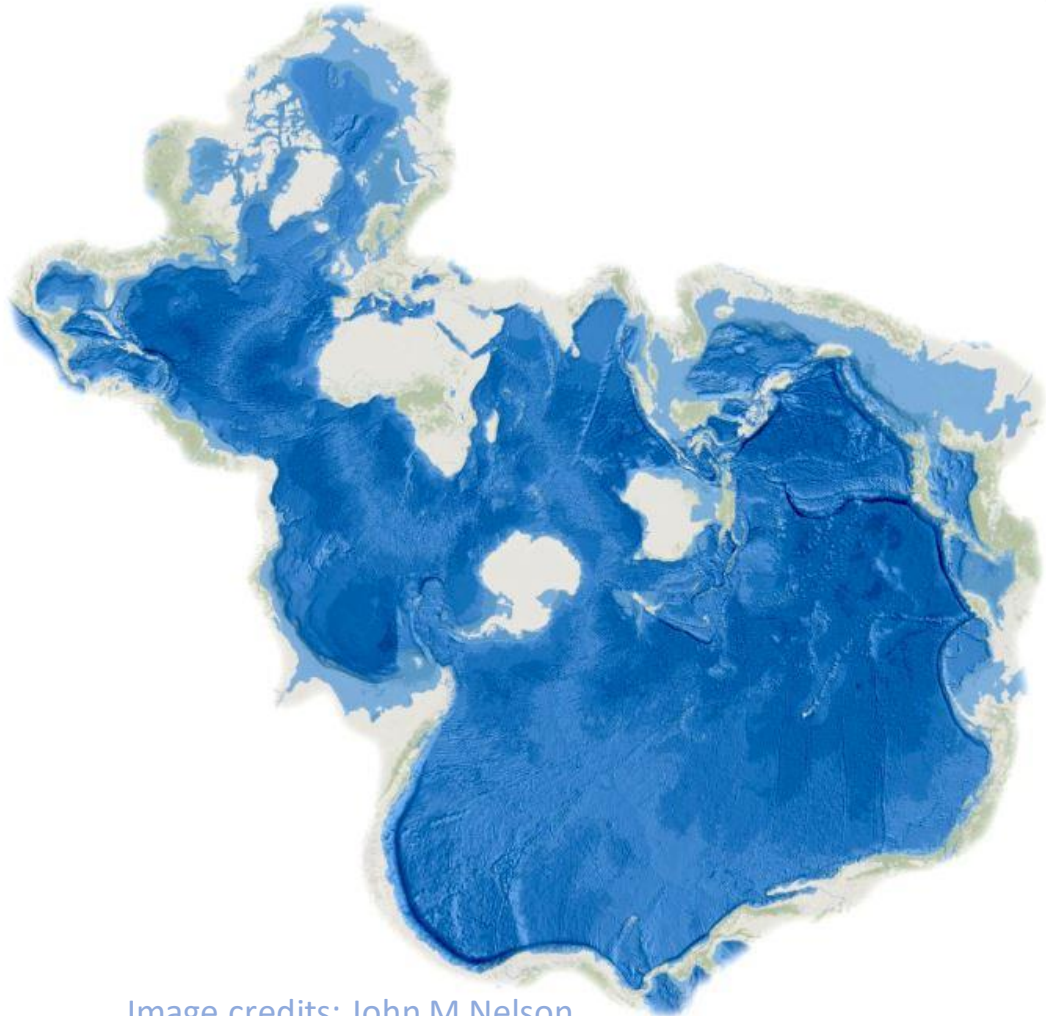
Image credits: John M Nelson

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From climate data to knowledge

- What happens once we produce climate data?

- Assumptions about socio-ecological systems and settings

- The end-user concept

- The plethora of decision-makers

Interdisciplinarity and transdisciplinarity in climate services

And in practice?

'An integrating synthesis is not achieved through the accumulation of different brains." Max-Neef, 2004

Transdisciplinary researches strive to understand the complexity of the whole problem, rather than only those parts that pertain to their main research discipline.

```
221 ### Convert C to Kelvin ###############################
222 atl3$mod   [ which  (atl3$mod    < 60) ] = atl3$mod  [ which  (atl3$mod    < 60 ) ] + 273.15
223 nino3$mod  [ which  (nino3$mod   < 60) ] = nino3$mod [ which  (nino3$mod   < 60 ) ] + 273.15
224 nino34$mod [ which  (nino34$mod  < 60) ] = nino34$mod [ which  (nino34$mod  < 60 ) ] + 273.15
225 ############## I abind the a0r2 to the nmme/eurosip ####################################
226   years =  dim  (atl3.a0r3$mod)[3]
227   atl3.a0r3.mod   <- array(NA, dim=c(1, 51 , years, 10))
228   nino3.a0r3.mod  <- array(NA, dim=c(1, 51 , years, 10))
229   nino34.a0r3.mod <- array(NA, dim=c(1, 51 , years, 10))
230
231   atl3.a0r3.mod  [,1:10,1:years,1:8]   <- atl3.a0r3$mod
232   nino3.a0r3.mod [,1:10,1:years,1:8]  <- nino3.a0r3$mod
233   nino34.a0r3.mod[,1:10,1:years,1:8] <- nino34.a0r3$mod
234
235   atl3.mod   = abind ( atl3$mod   , atl3.a0r3.mod   , along = 1)
236   nino3.mod  = abind ( nino3$mod  , nino3.a0r3.mod  , along = 1)
237   nino34.mod = abind ( nino34$mod , nino34.a0r3.mod , along = 1)
238
239 #### PERSISTENCE #################################################
240 atl3.per.ano   <- Ano_CrossValid(atl3.per$obs, atl3.per$obs)
241 nino3.per.ano  <- Ano_CrossValid(nino3.per$obs, nino3.per$obs)
242 nino34.per.ano <- Ano_CrossValid(nino34.per$obs, nino34.per$obs)
243
244 atl3.obs.ano   <- Ano_CrossValid(atl3$obs, atl3$obs)
245 nino3.obs.ano  <- Ano_CrossValid(nino3$obs, nino3$obs)
246 nino34.obs.ano <- Ano_CrossValid(nino34$obs, nino34$obs)
247
248 atl3.per.ano2  <- abind( atl3.per.ano$ano_obs,    atl3.obs.ano$ano_obs, along = 4)
249 nino3.per.ano2 <- abind( nino3.per.ano$ano_obs,   nino3.obs.ano$ano_obs, along = 4)
250 nino34.per.ano2 <- abind( nino34.per.ano$ano_obs,  nino34.obs.ano$ano_obs, along = 4)
251
252 corr.per.atl3   <- array(0, dim = 10)
253 corr.per.nino3  <- array(0, dim = 10)
254 corr.per.nino34 <- array(0, dim = 10)
```
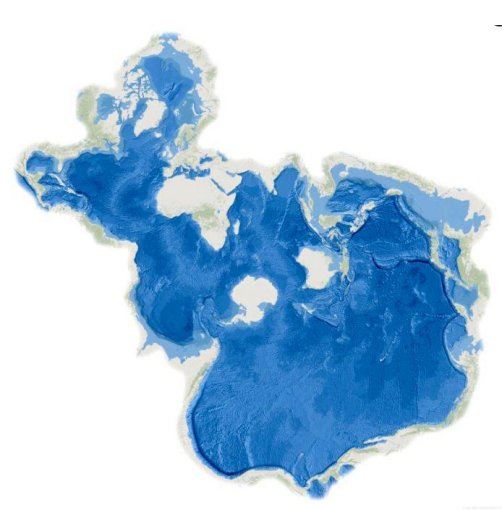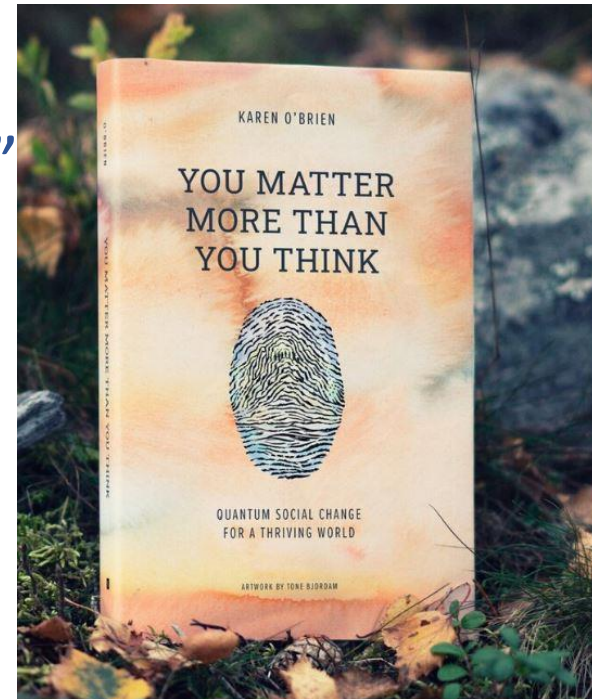
The binary/fragmented view trap
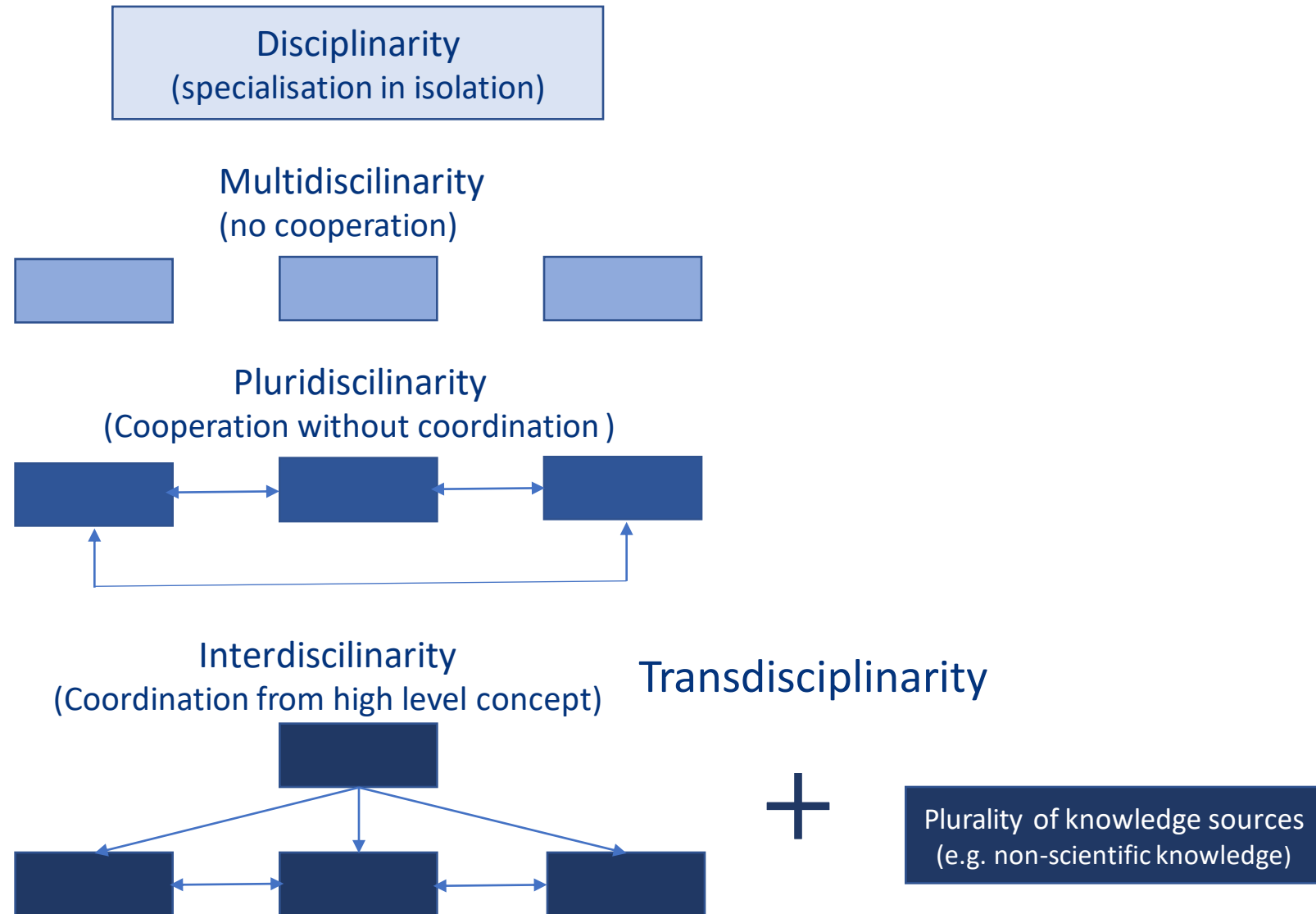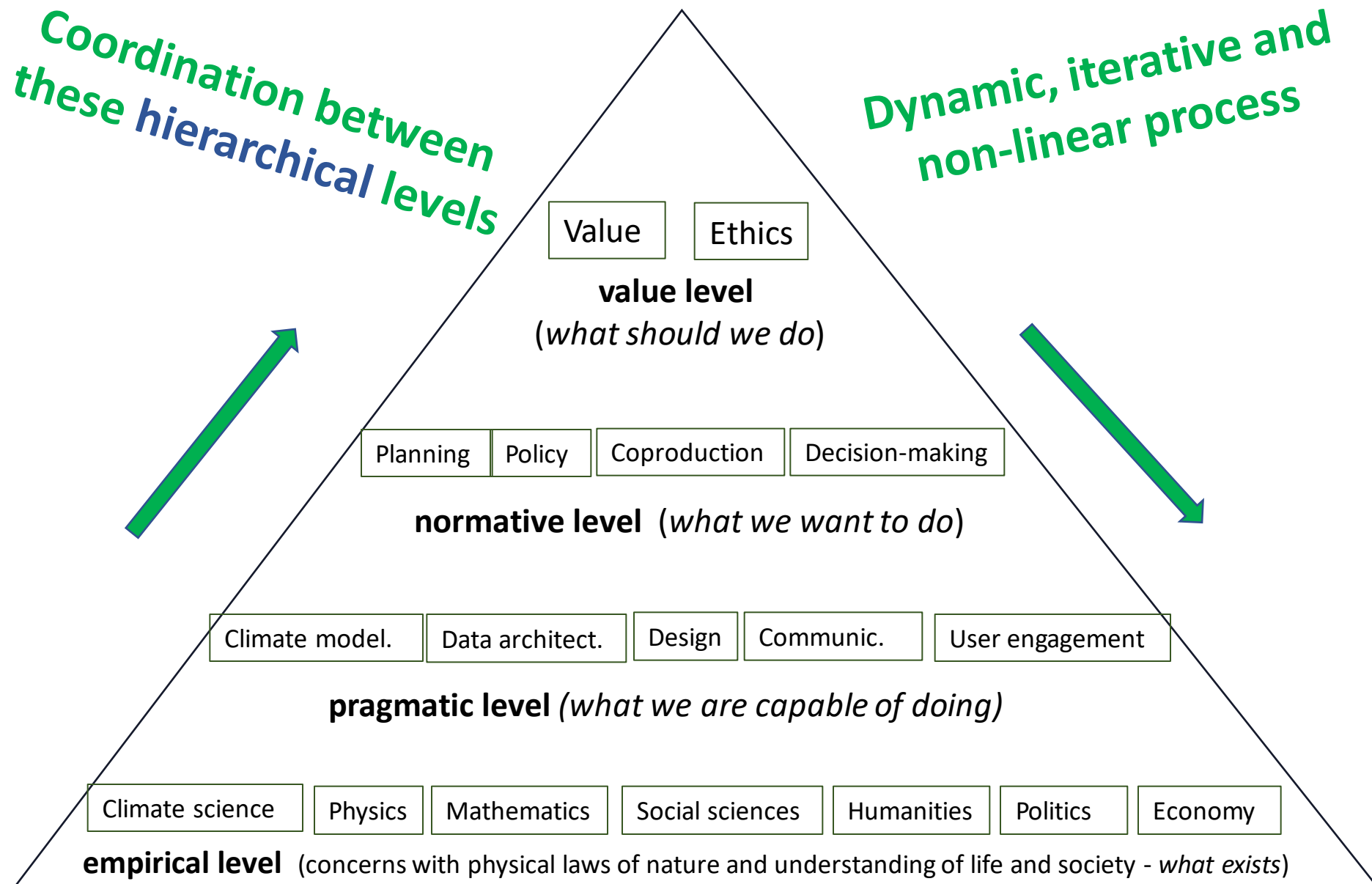
- Individual vs society/ Climate service producer vs user/Natural vs social scientists

- To move beyond dualism of the natural and social (science)

- To transform society we need to shift from the "us vs them" perspective and acknowledging the entanglements and connectedness and our shared reality (O'Brien, 2021)

- The emerging knowledge networks

Image credits: John M Nelson

What is transdisciplinarity?

Disciplinarity
(specialisation in isolation)

Multidiscilinarity
(no cooperation)

Pluridiscilinarity
(Cooperation without coordination)

Interdiscilinarity
(Coordination from high level concept)

Transdisciplinarity

+

Plurality of knowledge sources
(e.g. non-scientific knowledge)

Adapted from Max-Neef, 2004

Transdisciplinary pyramid for climate services

Coordination between these **hierarchical** levels

Dynamic, iterative and non-linear process

| Value | Ethics |

value level
(*what should we do*)

| Planning | Policy | Coproduction | Decision-making |

normative level (*what we want to do*)

| Climate model. | Data architect. | Design | Communic. | User engagement |

pragmatic level (*what we are capable of doing*)

| Climate science | Physics | Mathematics | Social sciences | Humanities | Politics | Economy |

empirical level (concerns with physical laws of nature and understanding of life and society - *what exists*)

Adapted from
Max-Neef, 2004
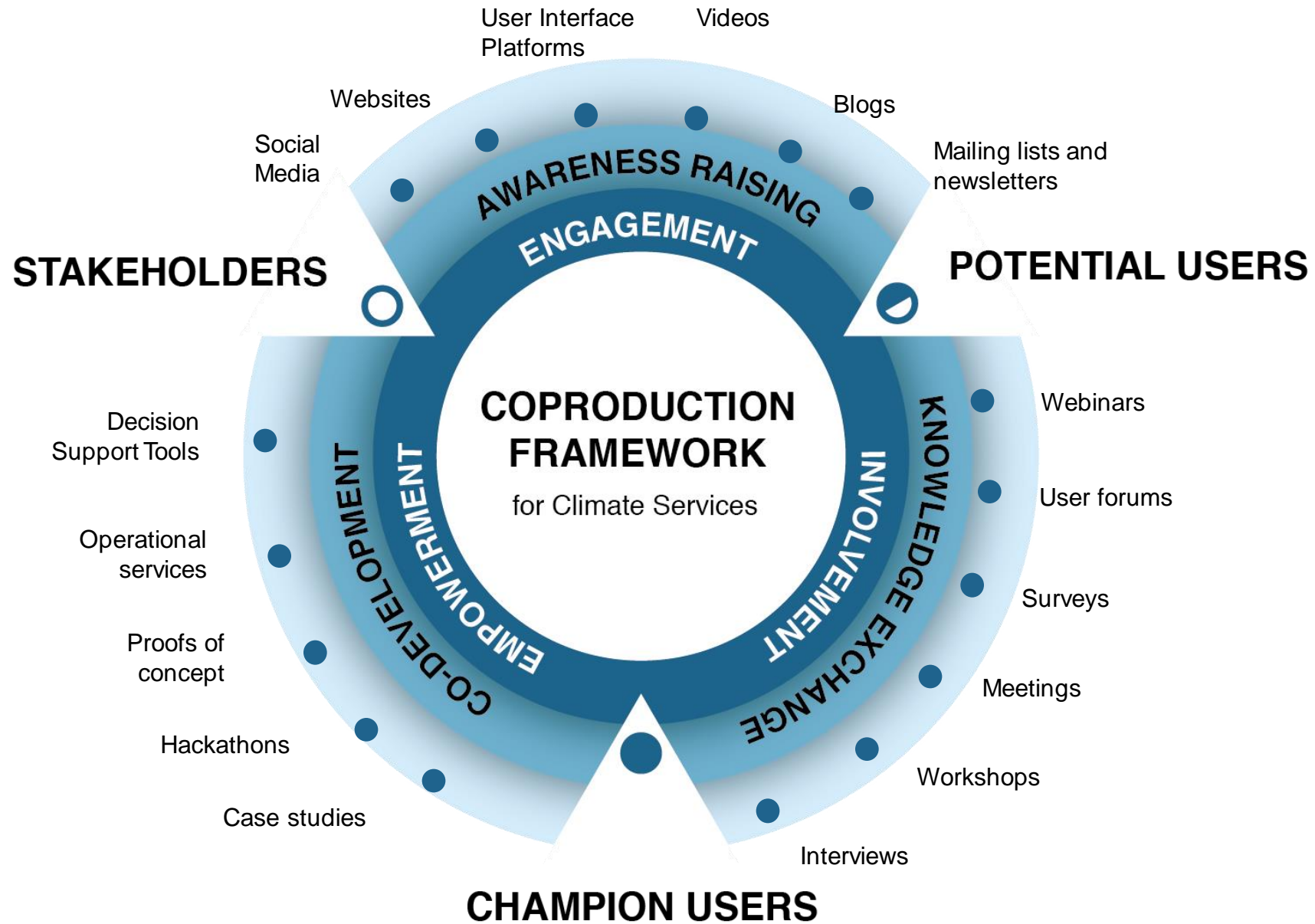
Recommendations for reaching a transdisciplinary process

❖ Achieving meaningful **interdisciplinarity**

❖ Overcoming power imposition and hierarchies

❖ Dismantling the term *user* and grasping the heterogeneity of stakeholders and the array of the knowledge they can provide

❖ Rethinking and harmonising the language, words and methorphans we chose

❖ Fitting *communication channels* and spaces to stakeholders' circumstances

❖ Approaching *stakeholder engagement* as a lasting process through *knowledge coproduction*

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Knowledge coproduction

Coproduction is "a complex meeting place where several **different academic traditions** and **practices** converge, overlap, affect each other, come into conflict, or cooperate" *Bremer and Meisch, 2017*
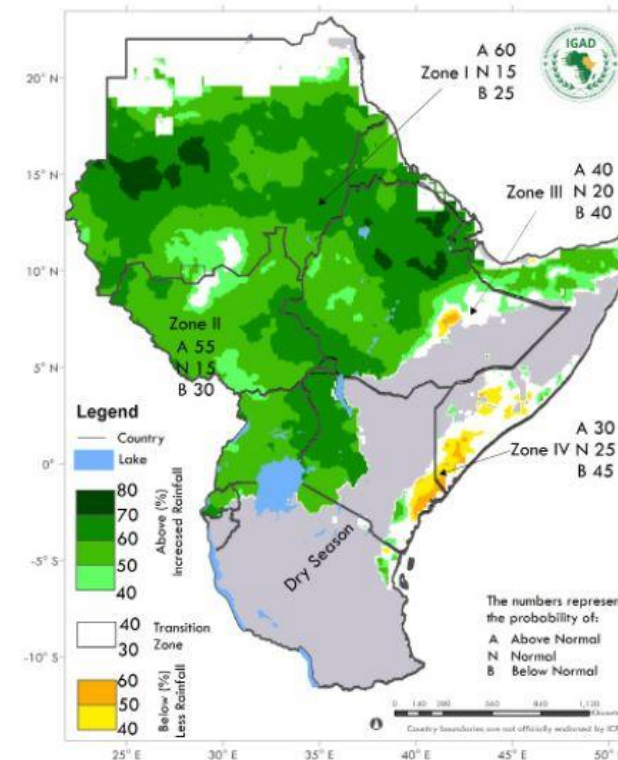
Bojovic et al. 2021

Decision-making in practice

Making decision based on seasonal climate forecasts

- RCOFs

- Consensus-based decision making
  - The forecasts based on
    - atmospheric circulation models from regional and international centres
    - statistical models
    - participants' expert interpretation

- Verification of African RCOFs: evidence of syste not always be immediately apparent
  - over-forecasting of the normal category

- "encouraging the forecasters to forecast their t

Position Paper: Verification of African RCOF Forecasts(Maso

Rainfall Forecast June - September 2022

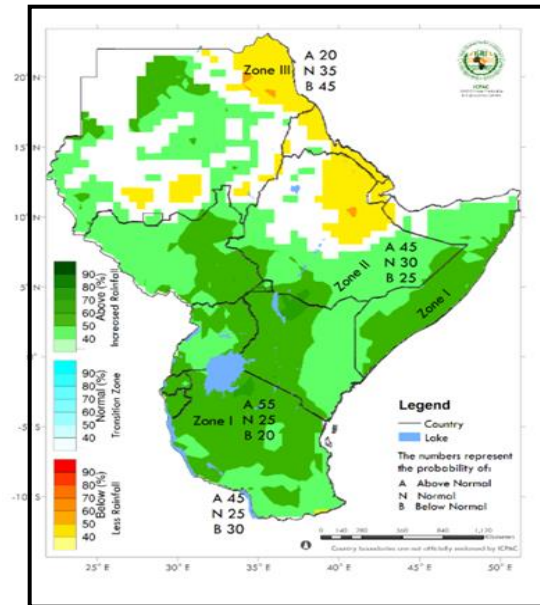*Seasonal forecast for June to September 2022*

Rainfall

Figure 1 (a): June to September 2022 rainfall forecast
ICPAC

Objective seasonal forecasting

WMO (2020): "Guidance on Operational Practices for Objective Seasonal Forecasting"
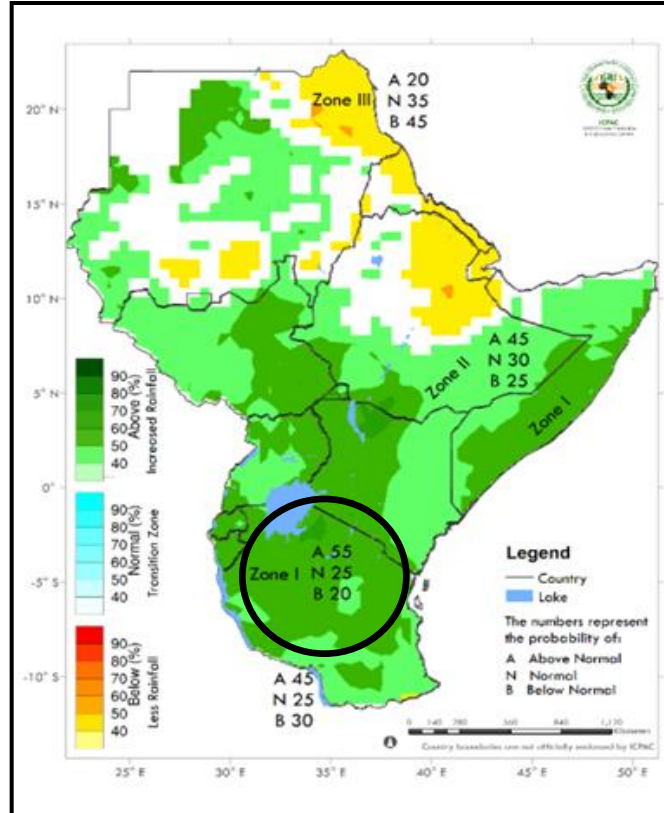
- Use a procedure that is traceable, reproducible, well-documented – with forecasts amenable to verification

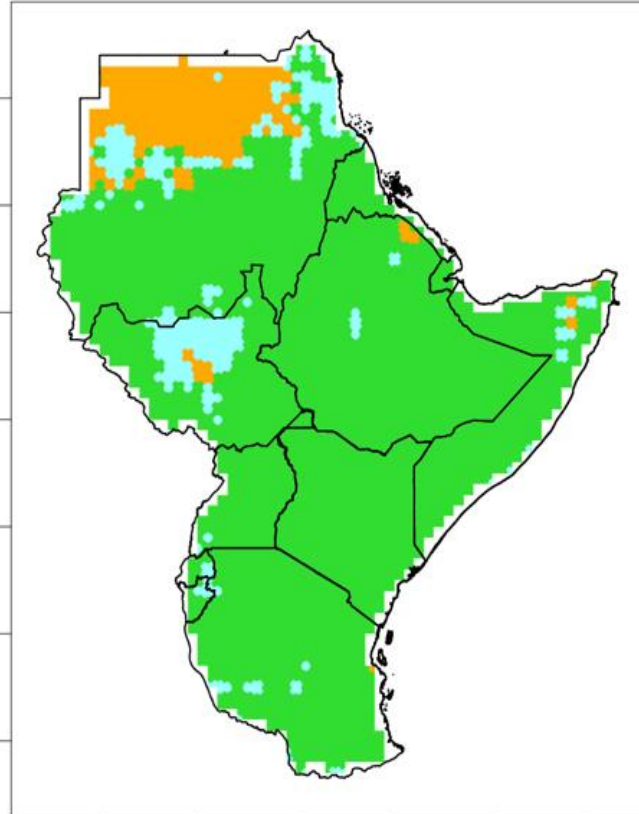- Use dynamical climate models as the primary basis

ICPAC regional seasonal rainfall forecast: Oct-Dec 2019
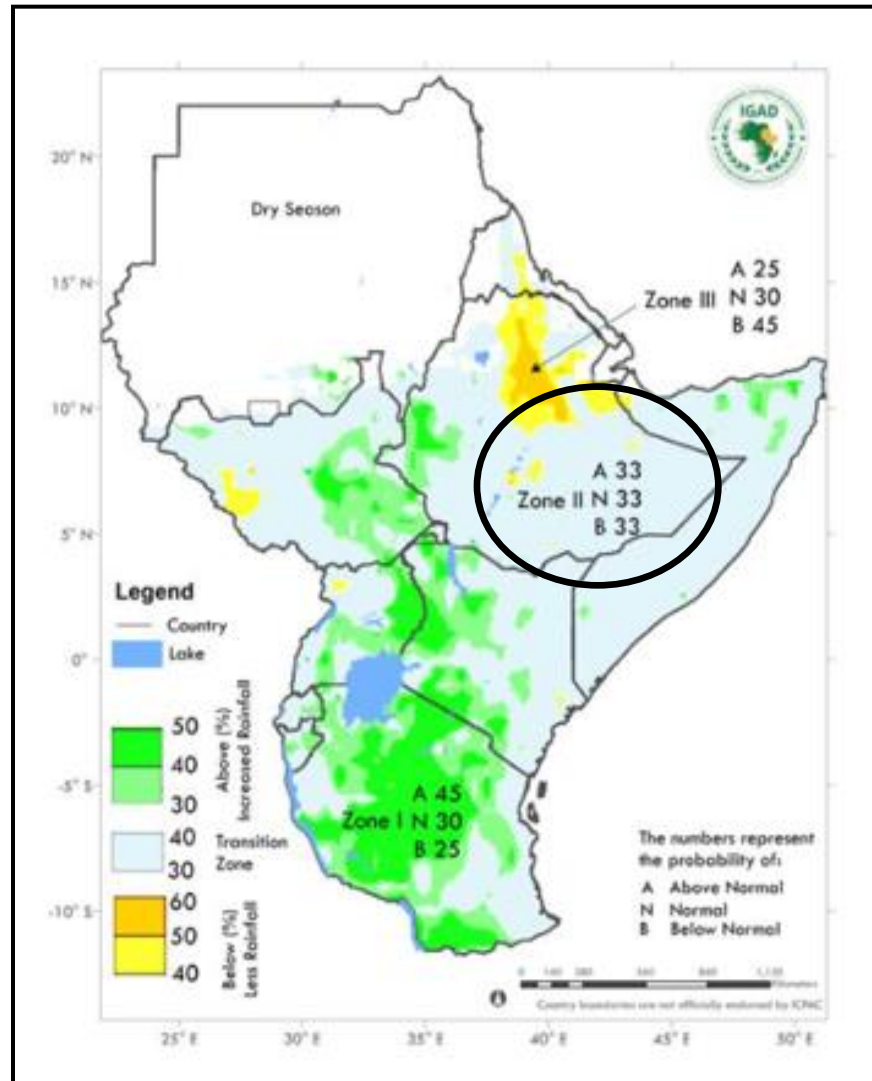
OND 2019 - bold probabilities

Forecast Probabilities for categories

Observed tercile category

- 55% predicted probability of above normal

- Strong positive Indian Ocean Dipole was developing - favouring widespread wet

- But not all models were in line with this

- Subjective intervention would likely have led to weakening of probabilities

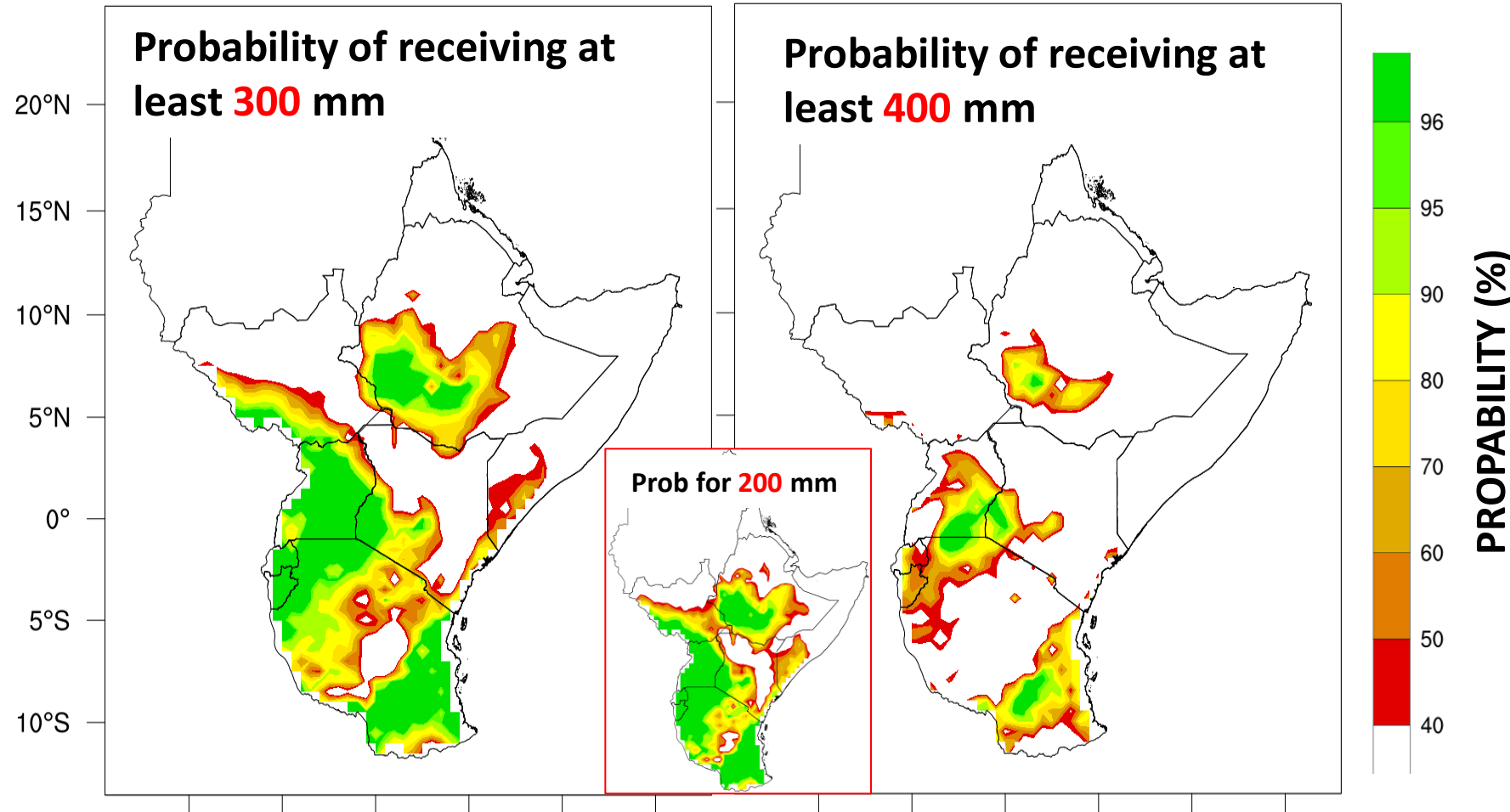- In the event, objective output encouraged better decision making

FOCUS-AFRICA
Full-value chain Optimised Climate User-centric Services for Southern Africa

Forecast category probabilities

MAM 2021 - confronting uncertainty

- For MAM 2021, much spread in models resulted in wide areas with "equal chances"

- Low predictability for the MAM season is well known to climate producers...

- Opportunity to emphasise that 33/33/33/ does not mean "average" - it means there is, e.g. "a 33% chance of worst case"

- The objective discipline forces/fosters confrontation of uncertainty

- At the GHACOF user response planning, consideration of pre-existing vulnerabilities come to the fore

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New, more user-relevant products

Probability of receiving at least **300** mm

Probability of receiving at least **400** mm

Prob for **200** mm

PROPABILITY (%)

- Probability of rainfall exceeding user-relevant thresholds
- Virtually impossible to generate with consensus approach

¡BUT!

Climate services promise better decisions but mainly focus on better data (Findlater et al. 2021)

1. **Process vs products**

"Does this process exclude the role of NHMS?"
(a SADC NHMS representative)

- Established practice
- Downstream products
- Believes and trust

2. Demand-driven vs demand-relevant

"many climate services would more accurately be described as relevant to assumed demand rather than driven by actual demand" (Finslater et al. 2021)

3. Evaluation vs valuation

- Valuation ignores process and addresses only quantifiable outcomes
- It precludes learning because as it uses prior assumptions
- It blurs distinction between better data and better service

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Decision-support: techniques for decision analysis

- Cost-Benefit Analysis (**CBA**) - when the various dimensions of the problem can be converted into monetary units

"What we do now creates damage that hits decades later, so we don't charge ourselves for it, and the standard approach has been that future generations will be richer and stronger than us, and they'll find solutions to their problem. But by the time they get here, these problems will have become too big to solve." (Robinson: The Ministry for the Future, 2020)

- **Robust decision-making approach -** explores how options perform in a multitude of possible future scenarios

- CCA decision problems are multidimensional and expected performances of options are measured according to multiple indicators - **Multi-criteria analysis (MCA)**

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Multi-criteria analysis

- MCA methods provide a wide set of techniques for elicitation and aggregation of decision preferences

- Involving stakeholders for discussing and deciding on **criteria** and their weightings for the prioritisation and selection of adaptation options

- Criteria examples: effectiveness, efficiency, robustness , flexibility, acceptability, enhancement of adaptive capacity, conflict resolution…

- MCA aggregates partial preferences describing individual criteria into a global preference and rank the alternatives

- **Group decision-making** is a final phase that facilitates the identification of a compromise solution, combining all individual rankings
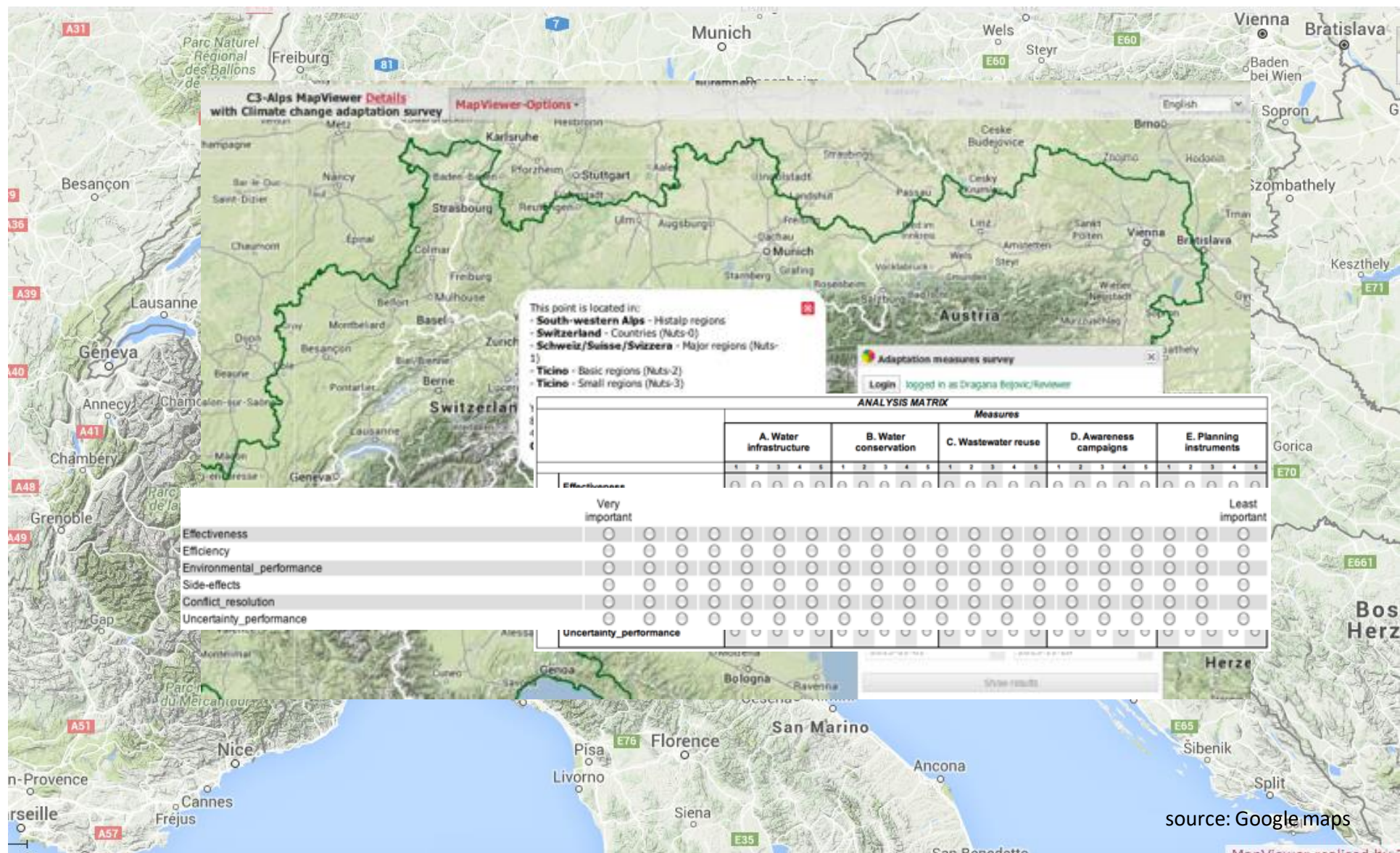
Multi-criteria analysis for assessment of CCA measures in the Alps

photos by: Jonathan Gaventa

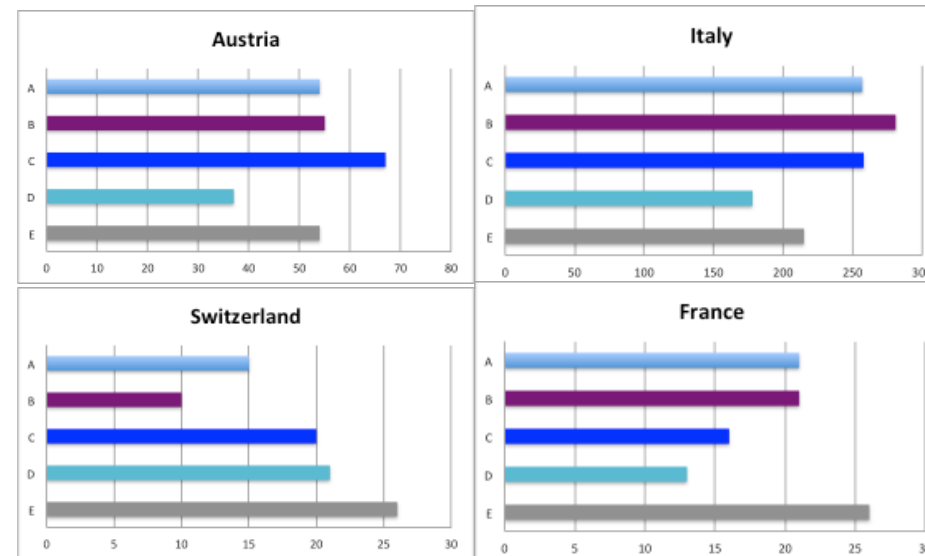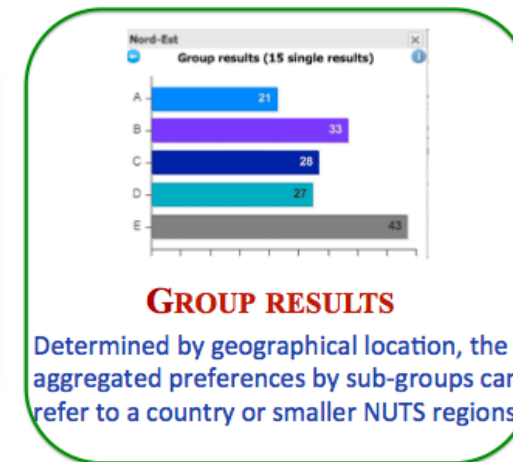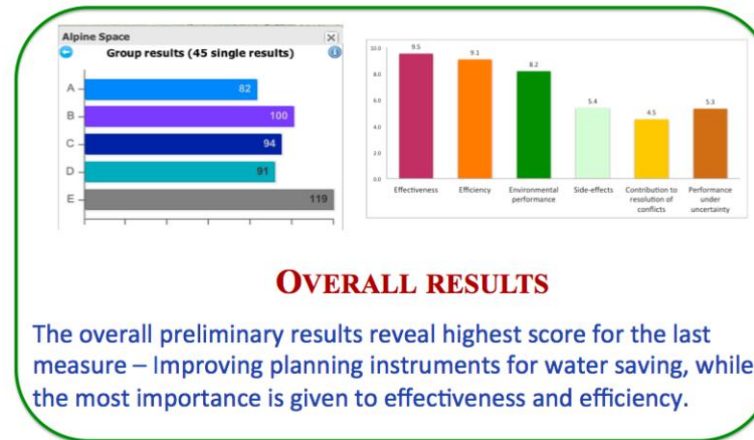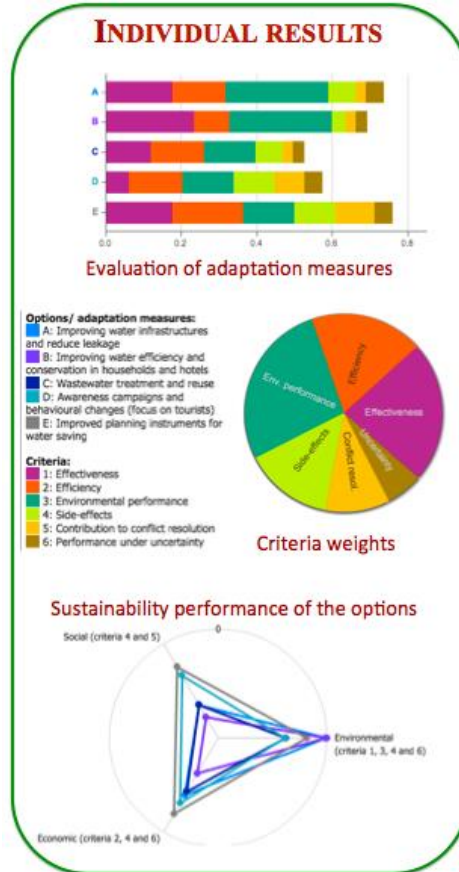# Multi-criteria analysis for assessment of CCA measures in the Alps

- The Alps - 1,200 kilometres across eight countries
- Spatial element of climate change and adaptation needs
- mDSSweb tool combined with the C3-Alps Web Map Viewer
- Involvement of experts in assessment of measures
- Exercise available in different Alpine languages

source: Google maps

Results of the assessment of CCA measures in the Alps

Bojovic et al., 2017

Missing assessment of adaptation options

- Absence of assessment can result in reduced incentive to adapt and lack of acceptability of proposed measures

Social network of actors involved in water and flood management in Kenya
(Bojovic and Giupponi, 2019)

Missing assessment of adaptation options

- Nzoia river basin in Western Kenya - intensive floods and frequent droughts
- Local knowledge, entrenched habits, informal institutions - Indigenous early warning committee
- Proposed measures:
  - Early warning system - radio broadcasting for flood warning communication, but there is lack of trust in conventional weather forecast
  - Sorghum seed - resilient to droughts and floods, but inadequate for the local staple food and paying school fees

➢ Decision support can help structuring the adaptation problem and decision-making processes and selecting cost-effective, multiple-benefits and no-regret adaptation options

Thank you for your attention!

"One of the most profound aspects of climate change, and environmental change in general, is that more people are beginning to consciously perceive themselves to be part of a larger system. When we perceive of ourselves as entangled quantum systems and recognize consciousness and free will as inherent within our being, we can choose to relate differently to ourselves, each other, the environment, and the future. Yet an equitable and thriving world will not just "happen"...we may need a different way of "being in action", including a different understanding of individual and collective agency." (Karen O'Brien, You matter more than you think, p. 86)

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