Decision-making in an uncertain world – the IPCC's AR5 and implications for water resources management in southern Africa

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IAIAsa 2014 Annual Conference

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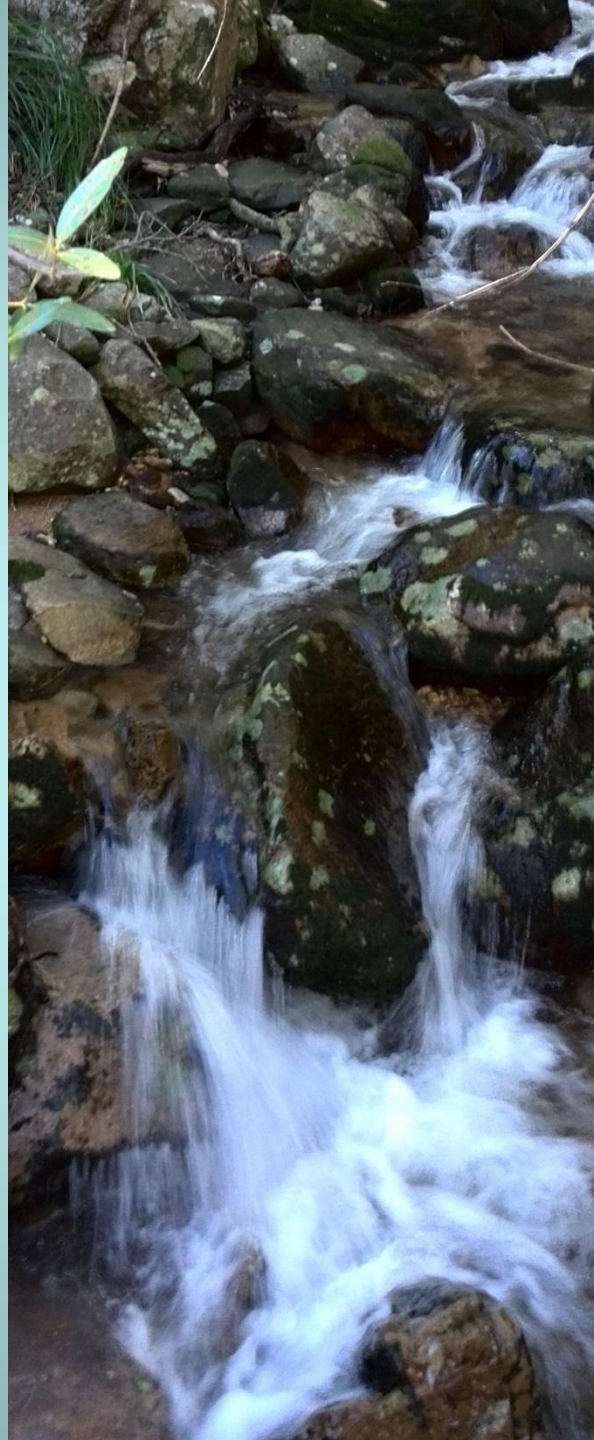
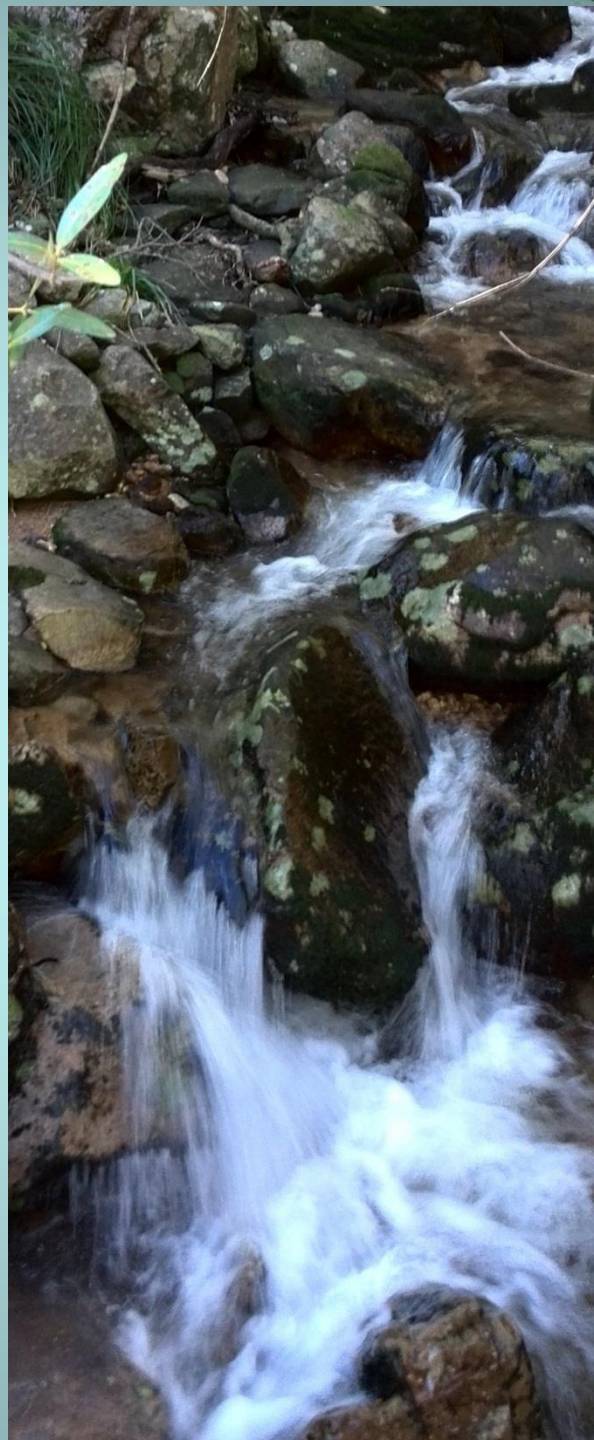
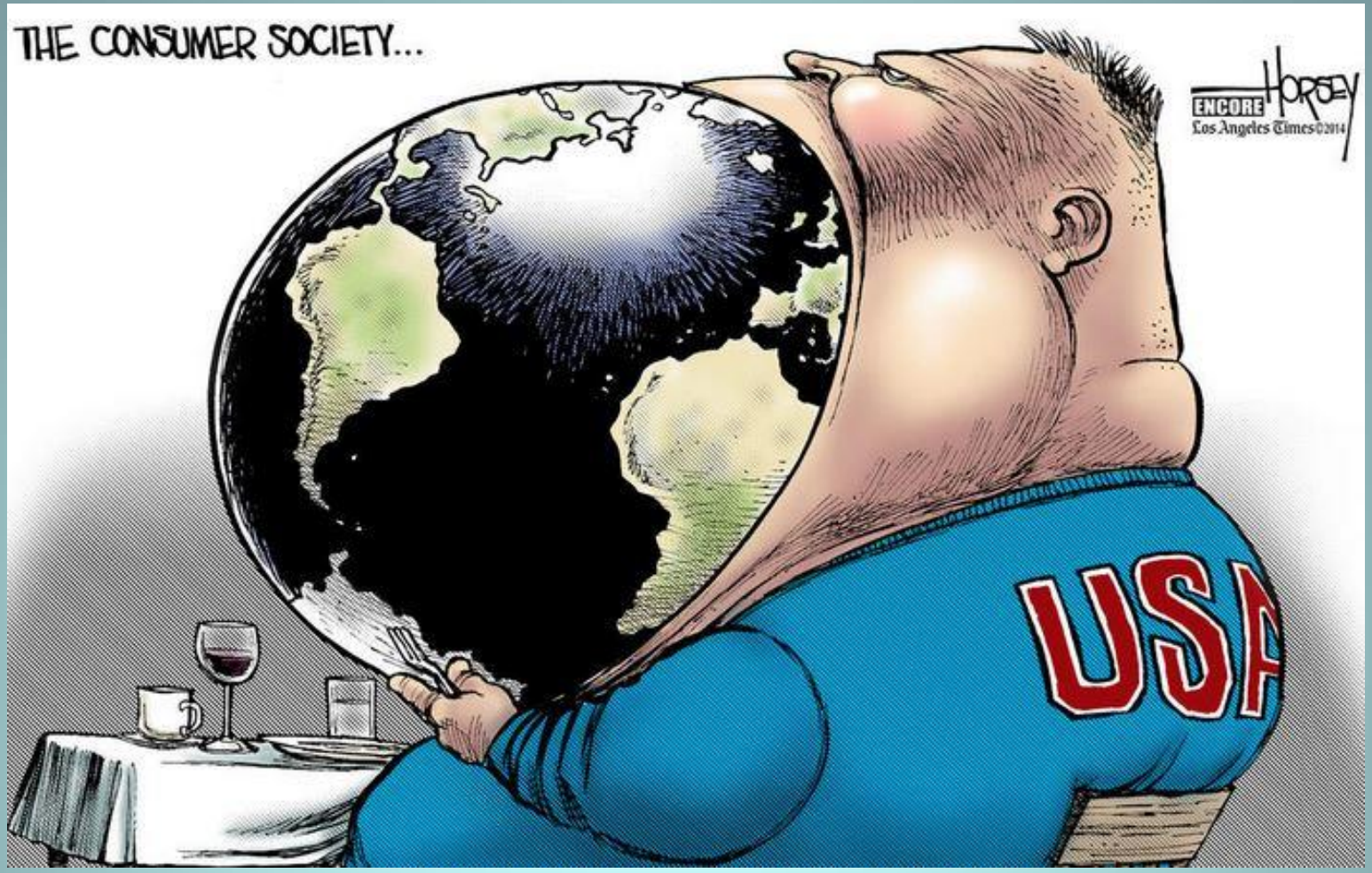


Overview

1. State of global **water use;**
2. **Latest climate change science** – IPCC AR5, published 2014;
3. Implications **globally for water**;
4. Implications for **Africa**, **SA**;
5. **Manage our future** – what should we do, what can we do?
6. Q&A





- The 20th century was characterized by a ***dramatic increase*** in the worlds' ***population***, placing immense pressure on living ecosystems and their services. Freshwater ecosystems have been ***severely impacted***, having experienced an incredible ***eightfold increase in worldwide water use*** (Glieck 1998).

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Earth Overshoot Day

In less than 8 Months, Humanity exhausts Earth's budget for the year

EARTH OVERSHOOT DAY 2014

August 19 is Earth Overshoot Day 2014, marking the date when humanity has exhausted nature's budget for the year. For the rest of the year, we will maintain our ecological deficit by drawing down local resource stocks and accumulating carbon dioxide in the atmosphere. We will be operating in overshoot.

RELATED LINKS

- Calculate your own Ecological Footprint
- Video: What is Ecological Overshoot?

www.footprintnetwork.org

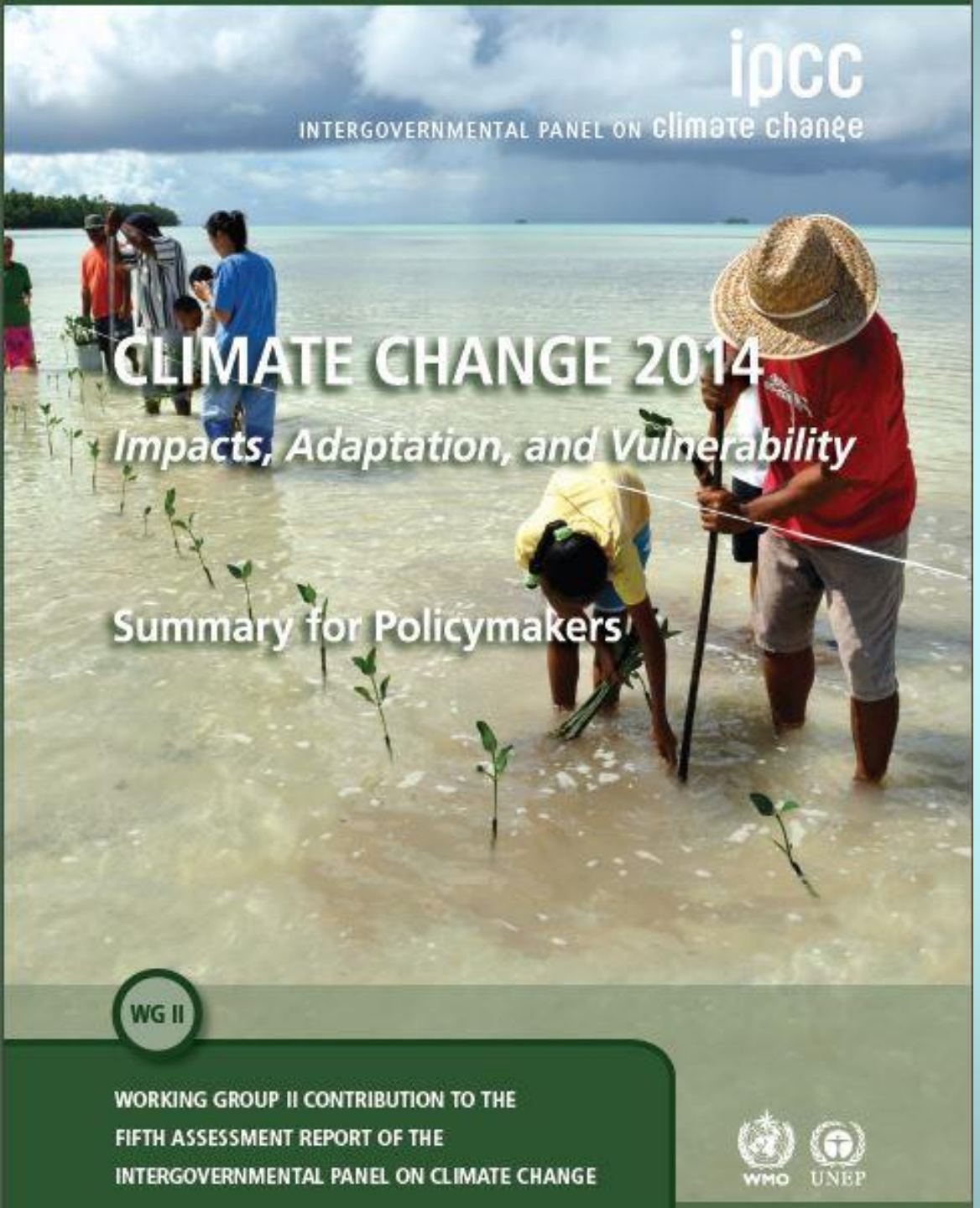
COUNTRIES IN THE RED

Today, 72 percent of the global population lives in countries struggling with biocapacity deficits and low income (as defined by the World Bank). This group is identified in the red lower left quadrant. Only 14 percent of the world lives in countries with more biocapacity than Footprint, including Australia and Brazil. A smaller subset of these biocapacity-rich nations is considered high income by the World Bank; they are identified in the green top right quadrant. (Data for 2010)

Living on water credit we don't have!

- Over 1b people ***– 15% of humanity*** – already live in extreme water shortage i.e. ***not enough for needed daily use***;
- ***70%*** of freshwater use is for agriculture;
- Increasingly, coming from aquifers – ***drawdown faster than recharge rates*** = unsustainable;
- Water use is growing at **double** population growth rate – **in 1900, water use 600km3**; by **2000, >4000km3**, projected to **>6000km3 by 2025**;

How?????



IPCC's AR5

1. **WGI:** Physical Science;
2. **WGII:** IAV;
3. **WGIII:** Mitigation Options & Costs
4. **Summary**

Scientific literature has more than doubled since AR4…

.

Useful independent summaries, of sectors, of regions, etc., e.g CDKN on Africa: ***"What's in it for Africa?"***

Current Climate Change – geological timescale changes within human timescales

- Levels ***>400 ppm*** last seen about ***3 million years ago*** (before modern humans evolved);
- Previous such changes took ***"tens of millions"*** of years…
- 4th IPCC Assessment Report 2007 – ***rate, extent and impacts are all that are now contentious…***
- IPCC 5th AR 2014 - ***happening much faster than models have predicted to date…rate and extent are "worst-case scenarios"…..***

Ramping up!

World Meteorological Organizatio
Weather • Climate • Water

Hottest decade ever recorded!

future tense ASU | NEW AMERICA | SLATE

FUTURE TENSE | THE CITIZEN'S GUIDE TO THE FUTURE | JULY 15 2014 9:53 AM

Earth Just Finished Its Warmest Quarter-Year Ever

theguardian.com, Wednesday 5 February 2014 10.01 GMT

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CC overview - AR5

- "In recent decades, CC has caused impacts on natural and human systems ***on all continents and across the oceans***;
- In all regions is ***altering hydrological systems, affecting water resources in terms of quantity and quality***;
- Many terrestrial, freshwater, and marine species have s***hifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions*** in response to ongoing climate change;
- Based on many studies covering a wide range of regions and crops***, negative impacts of climate change on crop yields*** have been more common than positive impacts;
- Impacts from ***recent climate-related extremes***, such as heat waves, droughts, floods, cyclones, and wildfires, ***reveal significant vulnerability and exposure*** of some ecosystems and many human systems to current climate variability;
- Climate-related hazards ***exacerbate other stressors***, often with negative outcomes for livelihoods"

What's new? Risk assessment..

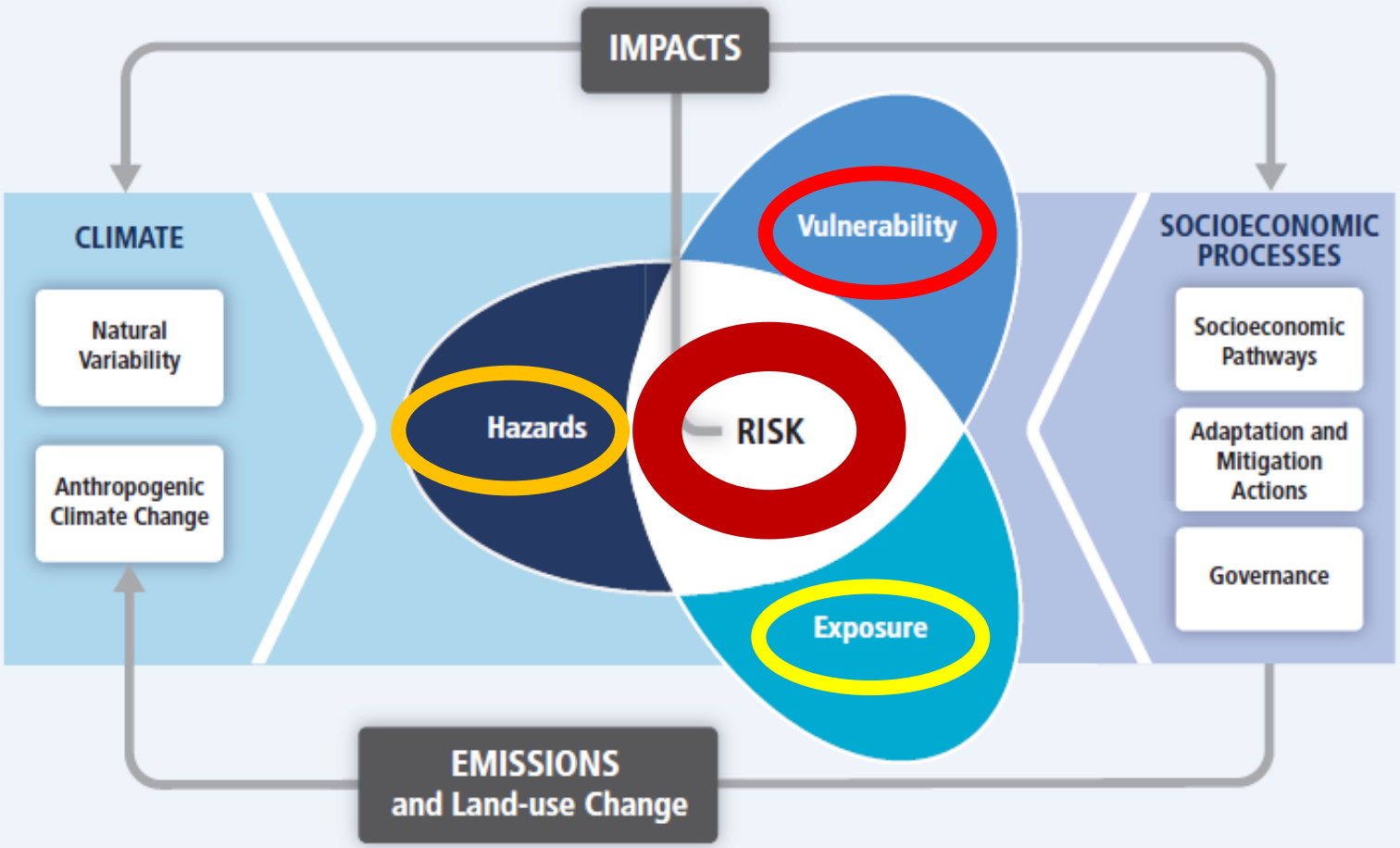
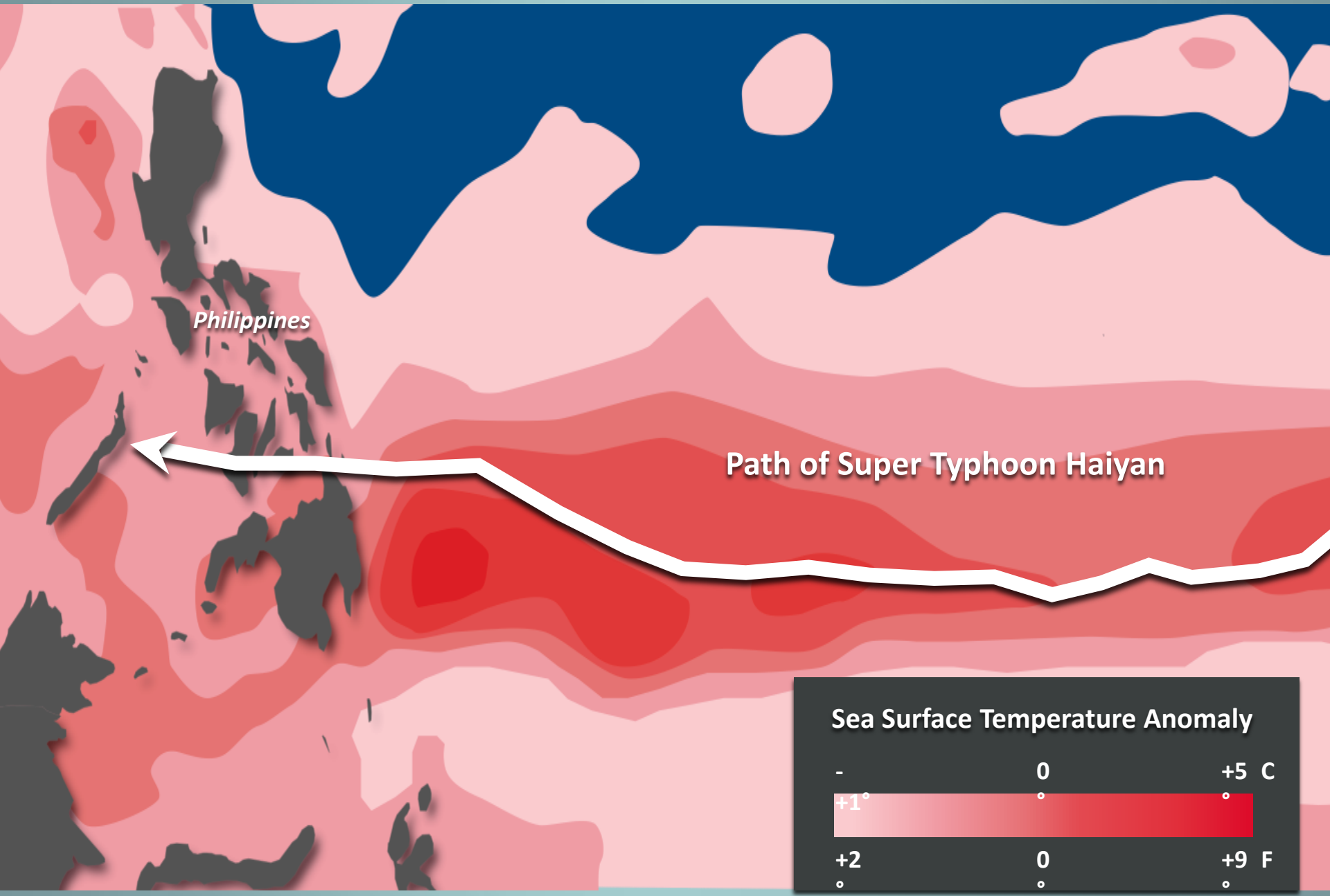


Figure SPM.1 | Illustration of the core concepts of the WGII AR5. Risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems. Changes in both the climate system (left) and socioeconomic processes including adaptation and mitigation (right) are drivers of hazards, exposure, and vulnerability. [19.2, Figure 19-1]



Data: Japan Meteorological Agency

Tacloban City, Philippines, after Super Typhoon Haiyan, Nov 2013

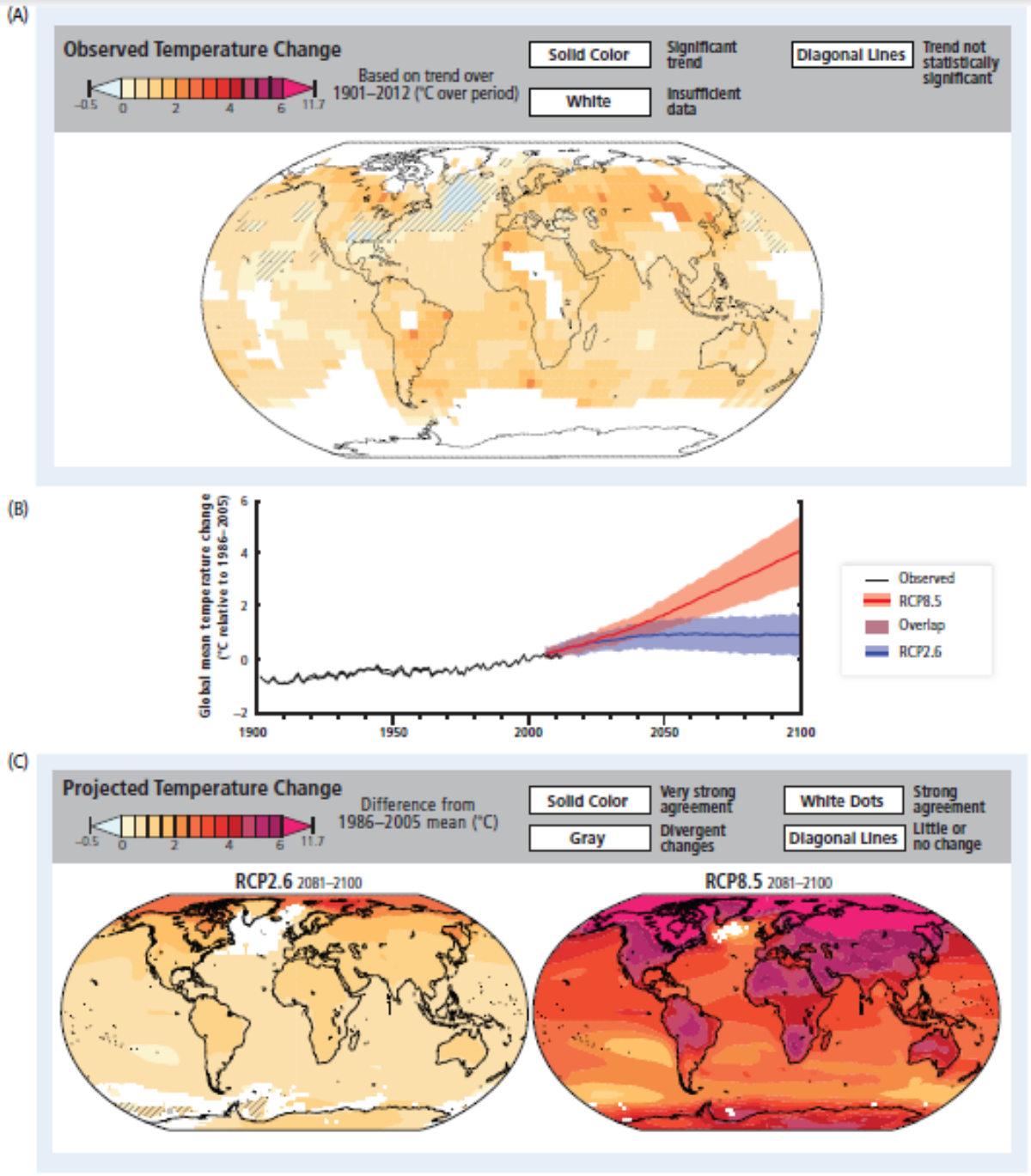


Figure SPM.4 | Observed and projected changes in annual average surface temperature. This figure informs understanding of climate-related risks in the WGII AR5. It illustrates temperature change observed to date and projected warming under continued high emissions and under ambitious mitigation.

"Increasing magnitudes of warming increase the likelihood of severe, pervasive, and ***irreversible*** impacts."

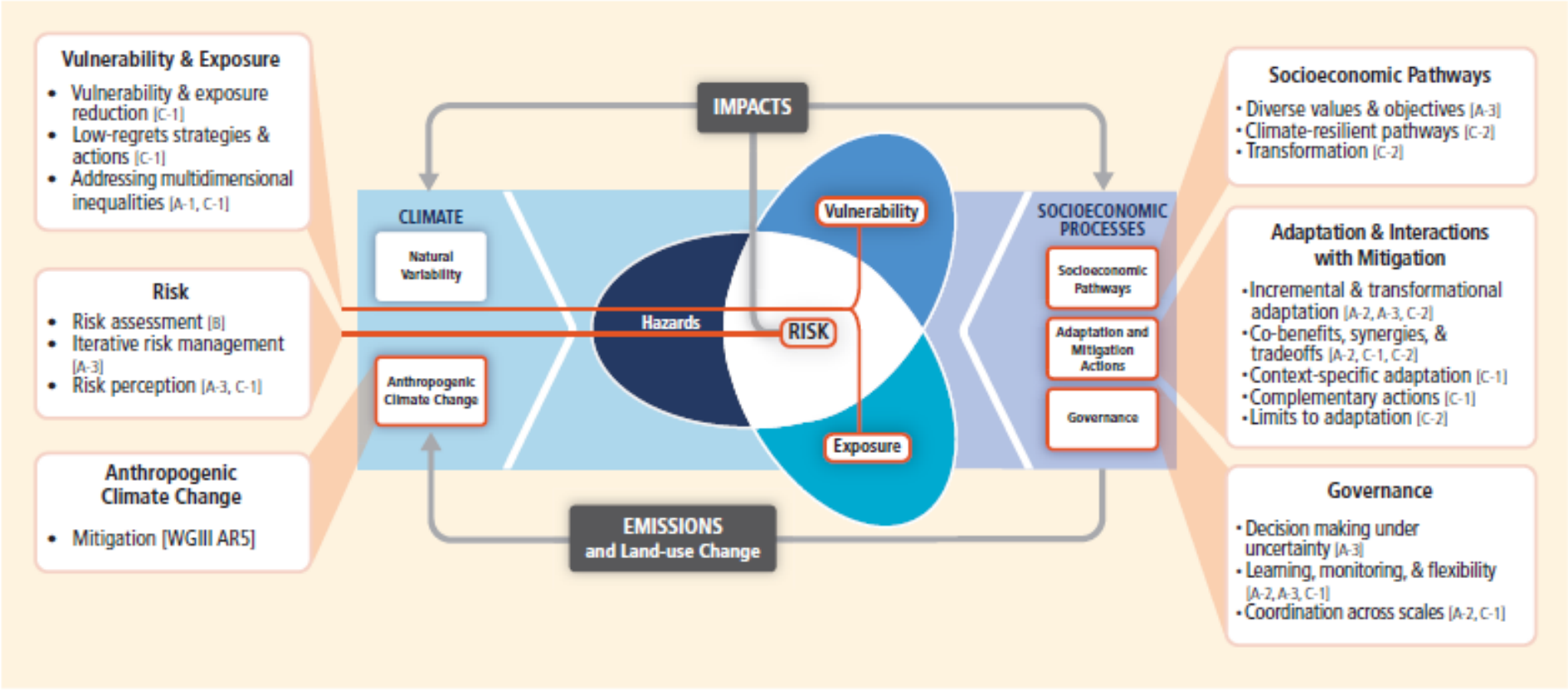


Figure SPM.8 | The solution space. Core concepts of the WGII AR5, illustrating overlapping entry points and approaches, as well as key considerations, in managing risks related to climate change, as assessed in this report and presented throughout this SPM. Bracketed references indicate sections of this summary with corresponding assessment findings.

- ***"The Solutions Space":*** Poor planning**, over-emphasizing short-term outcomes**, or **failing to sufficiently anticipate consequences** can result in ***maladaptation***…"
- Risk assessment must ensure that development programmes and adaptation strategies in one sector ***do not lower climate resilience in another***.

Implications for FW resources

- ***"FW-related risks*** of climate change ***increase significantly*** with increasing emissions;
- fraction of global population experiencing water scarcity and the fraction affected by major river floods ***increases significantly;***
- projected to ***reduce renewable surface water and groundwater resources significantly*** in most dry subtropical regions, intensifying competition for water among sectors.
- will ***reduce raw water quality*** and ***pose further risks to drinking water quality***, due to interacting factors: increased temperature; increased sediment, nutrient, and pollutant loadings from heavy rainfall; increased concentration of pollutants, and disruption of treatment facilities during floods;
- Adaptive water management techniques, including scenario planning, learning-based approaches, and ***flexible and low-regret solutions, can help create resilience*** to uncertain hydrological changes and impacts due to CC"
- ***Is the IA profession prepared for assessing all this?***

Pakistan, August 2010

20,000,000 people affected by flooding—further destabilizing a nuclear-armed country

Implications for freshwater ecosystems

- Climate change a ***powerful stressor on terrestrial and freshwater ecosystems; exacerbates other impacts on biodiversity;***

- biota and ecosystem processes were ***strongly affected*** by past climate changes at rates of climate change ***lower than those projected during the 21st century under high warming scenarios;***

- ***high risk of abrupt and irreversible*** change in the ***composition, structure, and function of terrestrial and freshwater ecosystems, including wetlands***;

- ***A large fraction*** of both terrestrial and freshwater species faces ***increased extinction risk***, ***especially as climate change interacts with other stressors***,

- ***Is the IA profession prepared for assessing all this?***


The 2006 – 2010 drought turned 60% of Syria's fertile land into desert and killed 80% of the country's cattle
"I had 400 acres of wheat, and now it's all desert."
Ahmed Abdullah, Syrian farmer
October 2010
© 2010 Reuters/Khaled al-Hariri


Refugee Camp, Dael, Syria
March, 2011
A million people fled their homes and farms due to drought
© 2010 Reuters/Khaled al-Hariri

“…the Syrian Minister of Agriculture ... stated publicly that economic and social fallout from the drought was ‘beyond our capacity as a country to deal with.’”

Cable from the U.S. Embassy in Damascus to the State Department, November 8, 2008

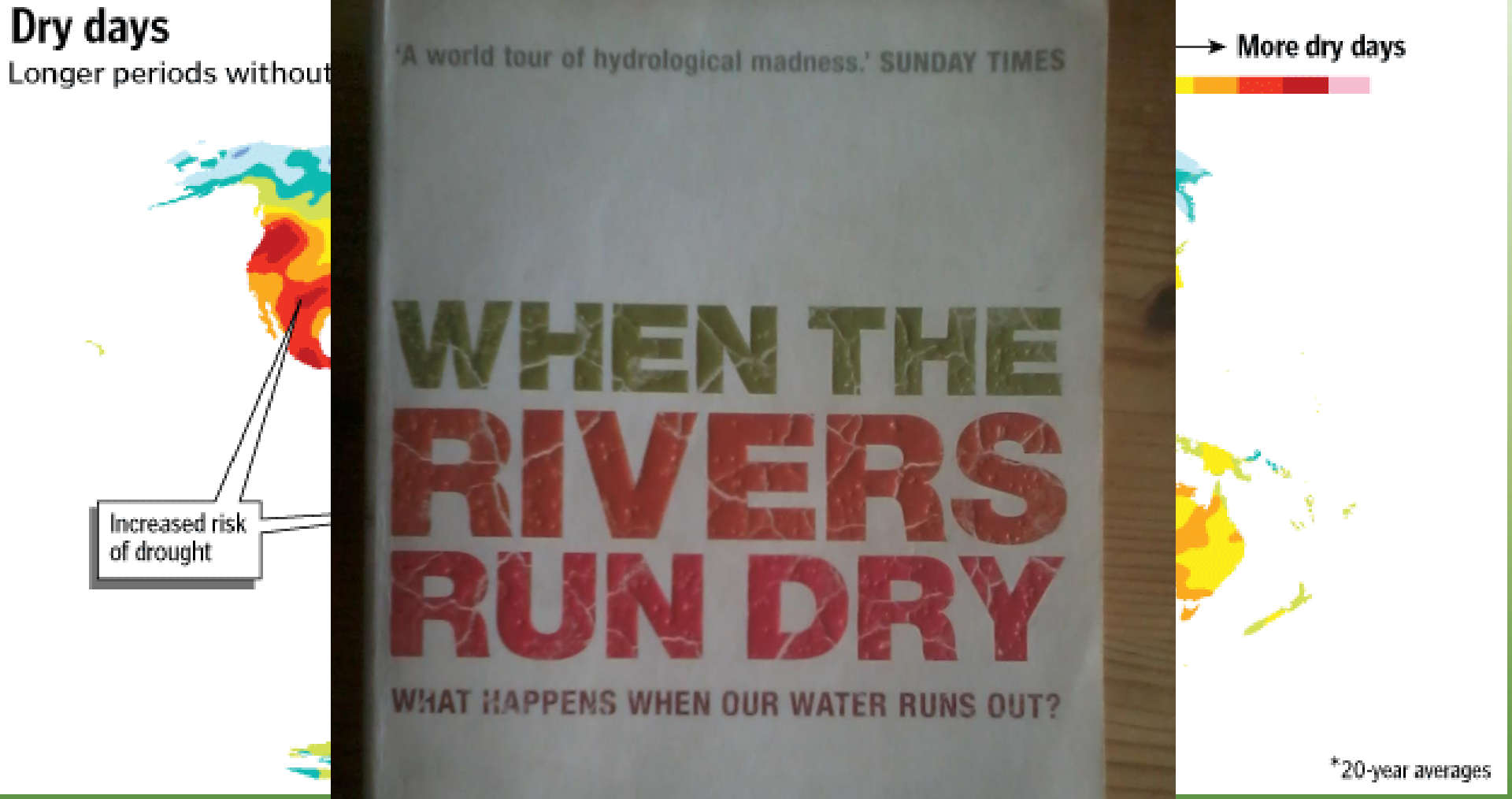
(Only in public domain thanks to WIKILEAKS!!!!!)

UN Global Trends Report 2013:

More than 50 million displaced worldwide, UN says

Source: Reuters - Fri, 20 Jun 2014 06:12 AM

- Highest annual figure **since WW2**;
- **>60%** due to climate related events;
- **86%** in developing countries;
- As people **lose their livelihoods and migrate,** so social conflict rises…



'South hit by
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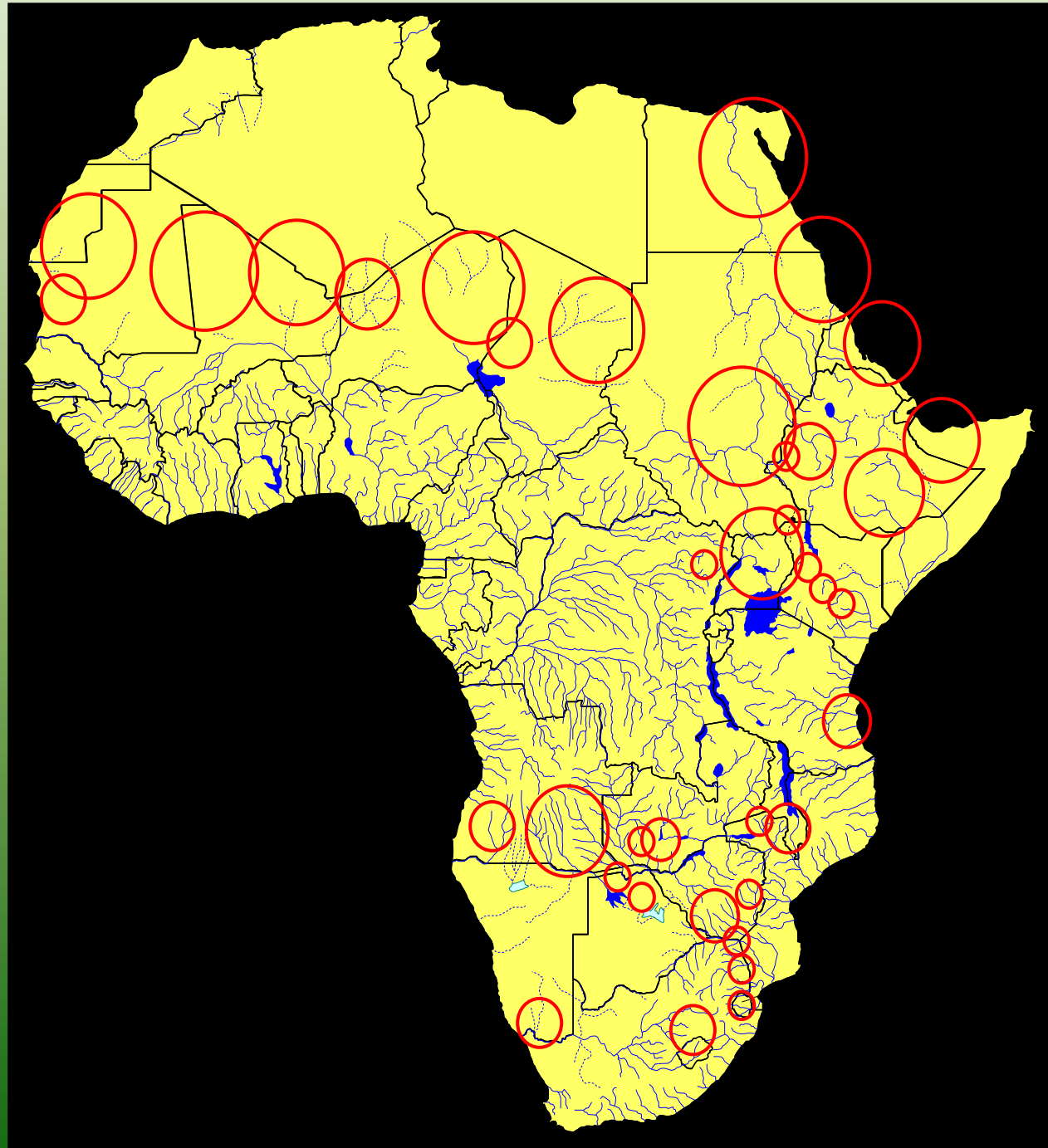
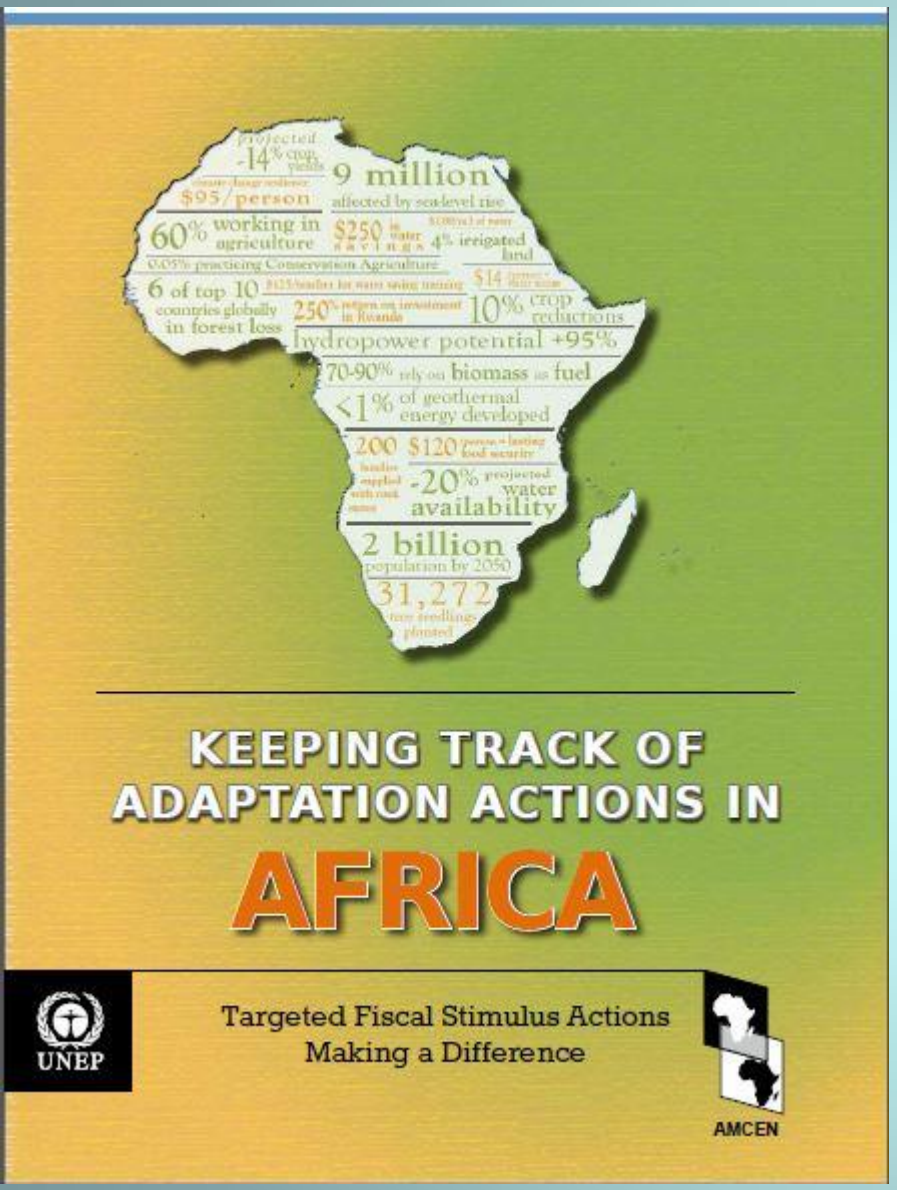
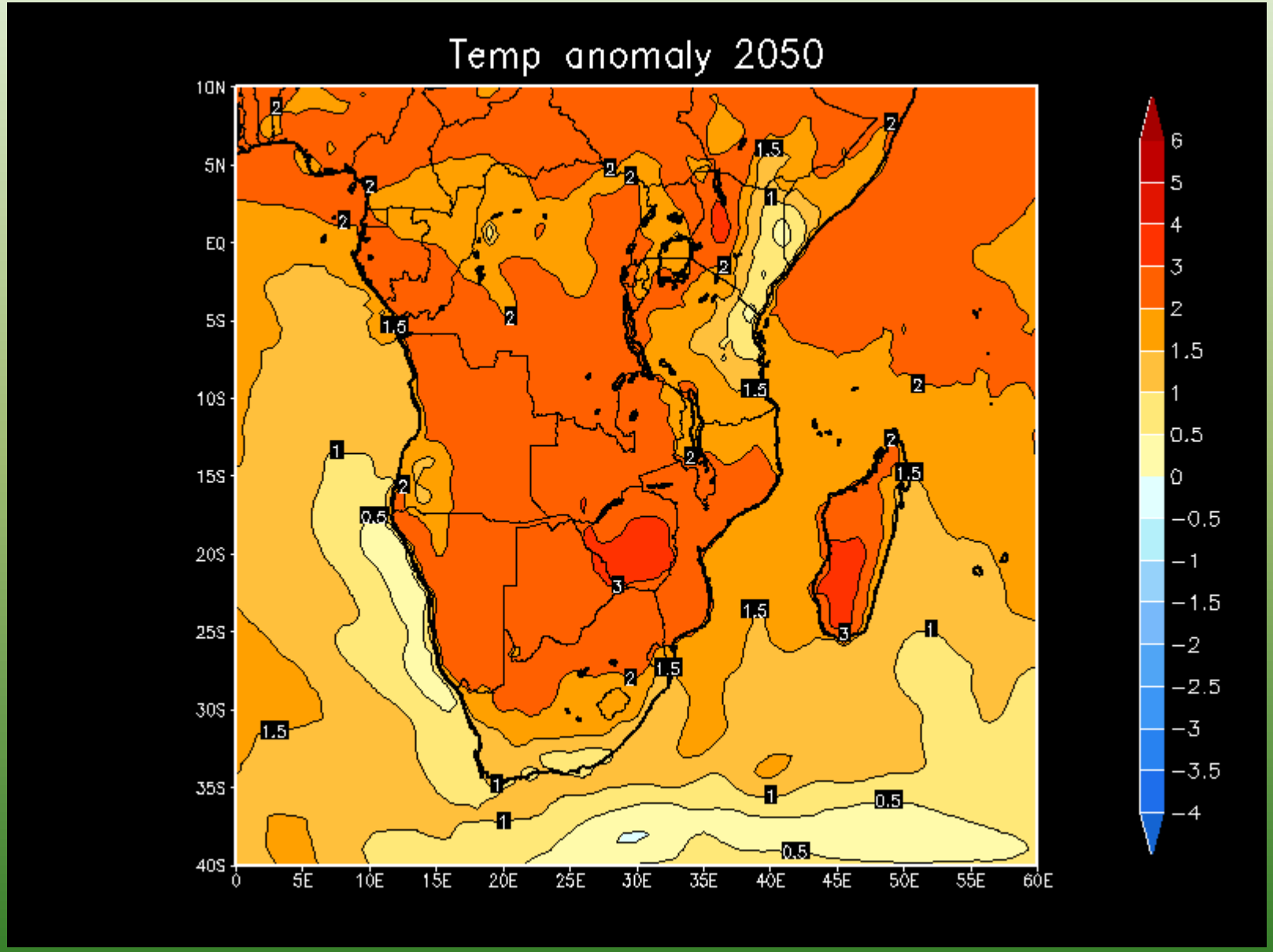
Sites of Disputes and Conflicts in Africa Linked to Water Resources

Most disputes over water occur in areas where *supplies are uncertain*, or where there is a *transition from perennial to ephemeral rivers* – an increasing trend with climate change….

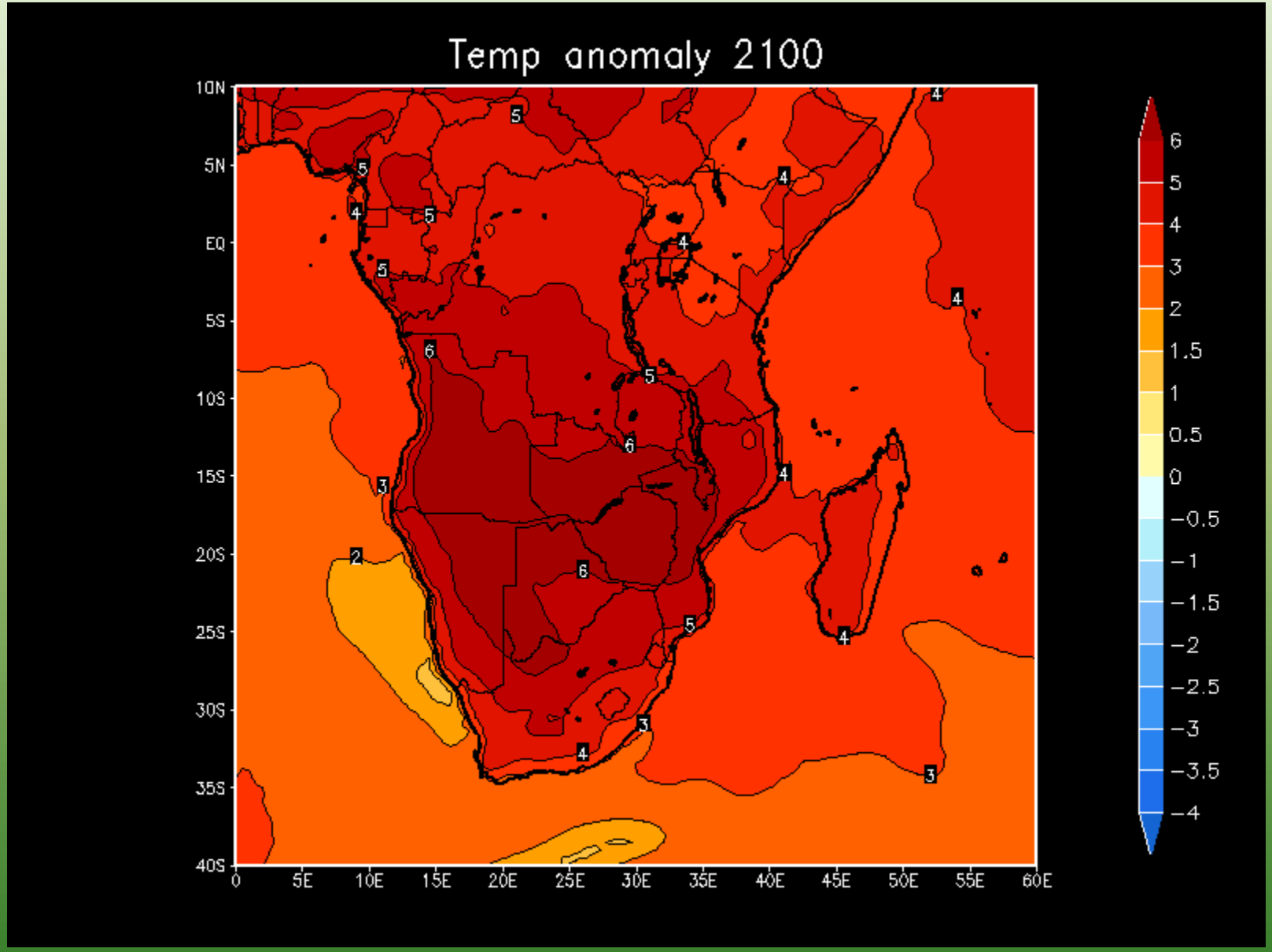




"Investment in climate change adaptation can help ensure that the impacts of climate change - ***including a projected 20-50 per cent decline in water availability*** - do not reverse decades of development progress in Africa."



2050 Temp increases relative to the 1961-1990 average
(CSIR 2011)



2100 Temp increases relative to the 1961-1990 average

(CSIR 2011)

CLIMATE CHANGE AND THE WATER SECTOR

Climate and Impacts Factsheet Series, Factsheet 3 of 7

THE LONG-TERM ADAPTATION SCENARIOS FLAGSHIP RESEARCH PROGRAMME (LTAS) FOR SOUTH AFRICA

The LTAS aims to respond to the South African National Climate Change Response White Paper (NCCRP, para 8.8) by developing national and sub-national adaptation scenarios for South Africa under plausible future climate conditions and development pathways. This will be used to inform key decisions in future development and adaptation planning.

- "Climate change impacts on South Africa are likely to be felt ***primarily via effects on water resources***;

- ***Significant trade-offs*** are likely to occur between developmental aspirations… … with significant social, economic and ecological consequences through ***restricting the range of viable national development pathways***. "

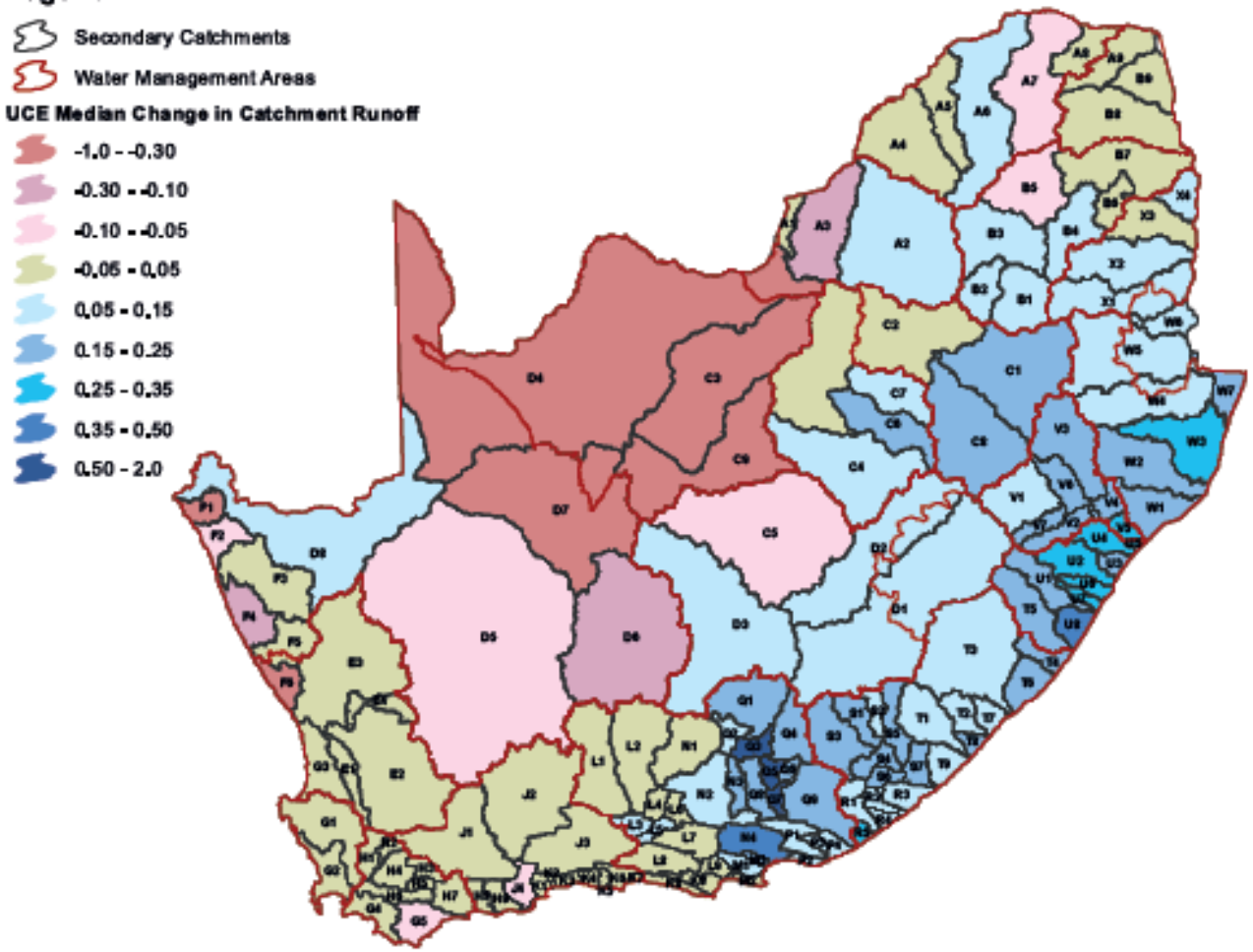


Figure 1. Median impact of climate change on the average annual catchment runoff for the period 2040–2050 relative to the base scenario average for 1990–2000 for all secondary catchments in South Africa derived from a Hybrid Frequency Distribution (HFD) analysis of all possible global circulation model (GCM) outputs (+6000 scenarios) for an Unconstrained Emissions Scenario (UCE).

BOX 1. CLIMATE CHANGE WATER QUALITY-RELATED IMPACTS.

- Less irrigation and drinking water could be available due to increasing water temperatures linked to higher ambient temperatures.
- Favourable conditions for the incubation and transmission of water-borne diseases may be created by increasing air and water temperatures.
- Increased fish mortality due to reduced oxygen concentrations in aquatic environments and mortality of temperature-sensitive fish species.
- Deterioration in water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates.
- Human health and ecosystem impacts, associated with increased rainfall intensities, flash floods and regional flooding including overflowing sewers due to sewage pipes blocked with washed-off debris, damage to sewerage infrastructure resulting in raw sewage discharges into rivers, scouring and erosion of urban streams, increased sediment and pollutant overflow and damage to low lying water and wastewater treatment works disrupting drinking water supplies.
- Increased periods of drought mean less water is available to dilute wastewater discharges and irrigation return flows resulting in reduced water quality and associated downstream health risks to aquatic ecosystems.

BOX 3. EFFECTS OF EXTREME CHANGES IN RUNOFF AS A RESULT OF CLIMATE CHANGE.

- Increased erosion and sedimentation, causing loss of fertile topsoil and reductions in the fertility and quality of agricultural produce as well as disruptions in aquatic ecosystems.
- Increased transportation of water pollutants (petroleum and hazardous substances/chemicals, herbicides, fertilisers and sediments) through surface water, groundwater and soil systems leading to human health risks, contamination of drinking water, ecosystem disturbance and aesthetic impacts on water resources.
- Increased flooding or drought, resulting in loss of life, livelihoods and assets, damage to infrastructure, contamination and/or limitation of water supplies, loss of crops, and community displacement.

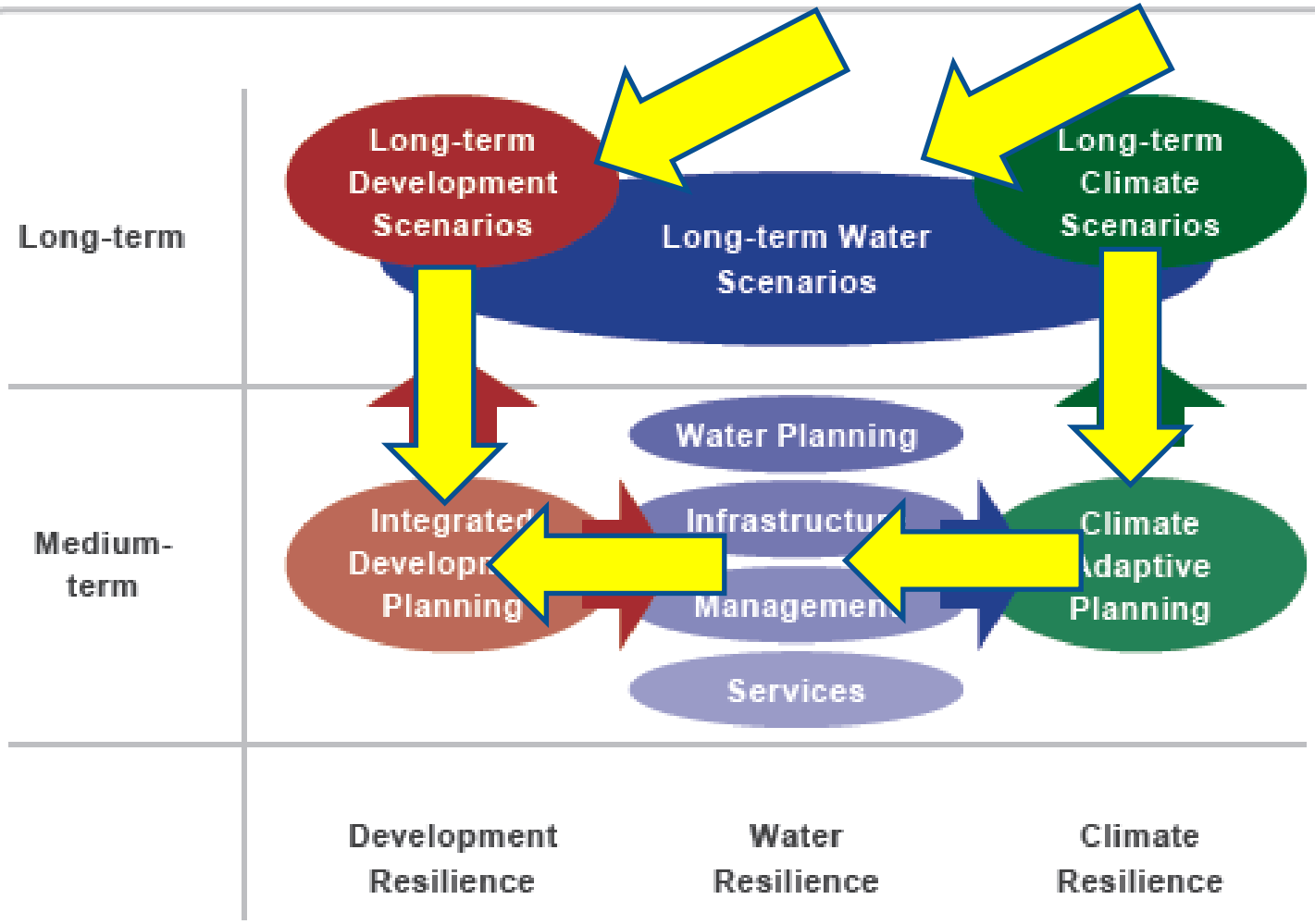


Figure 2. Distinction between medium and long-term planning for water, development and climate

CLIMATE CHANGE AND THE WATER SECTOR

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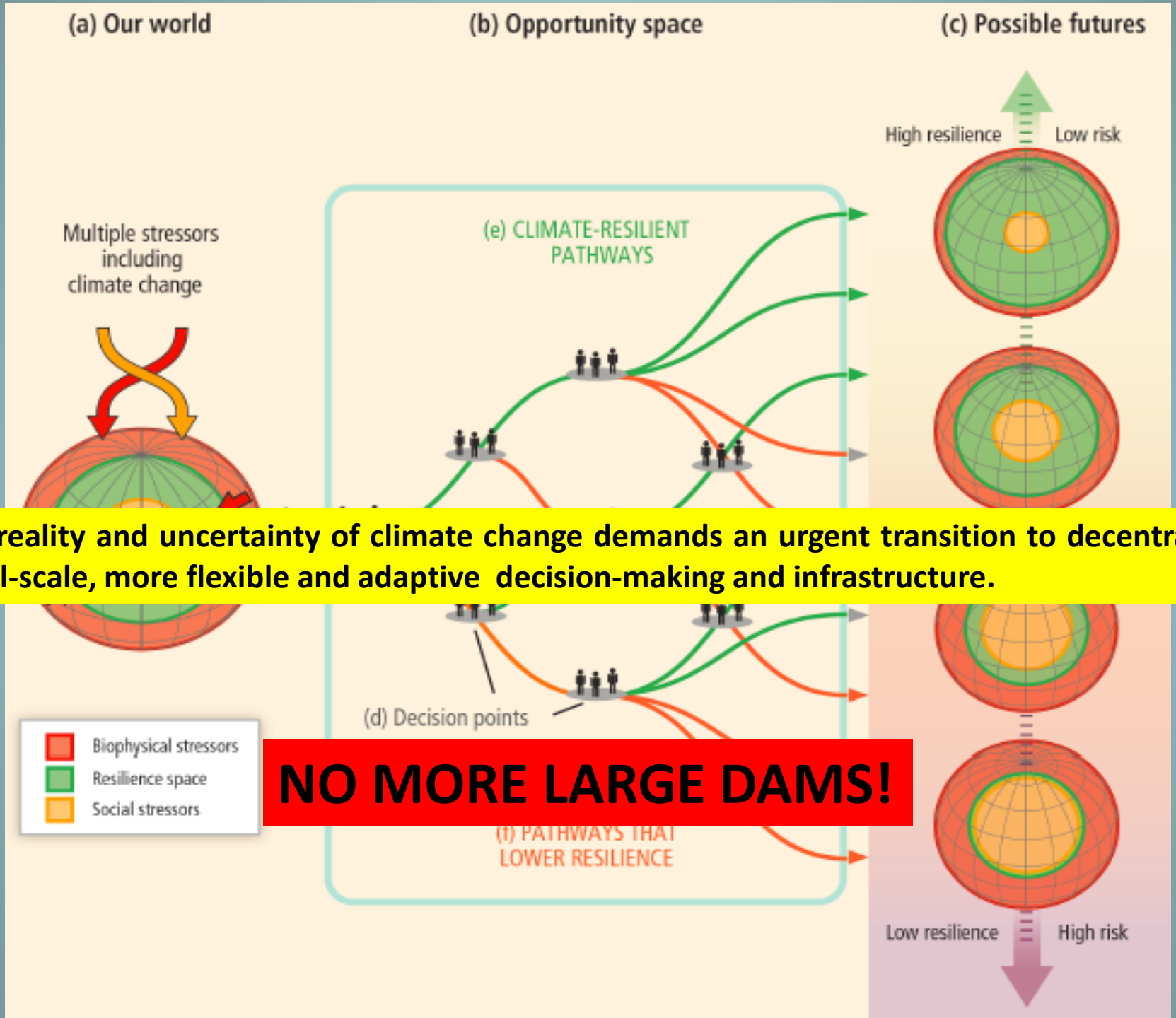
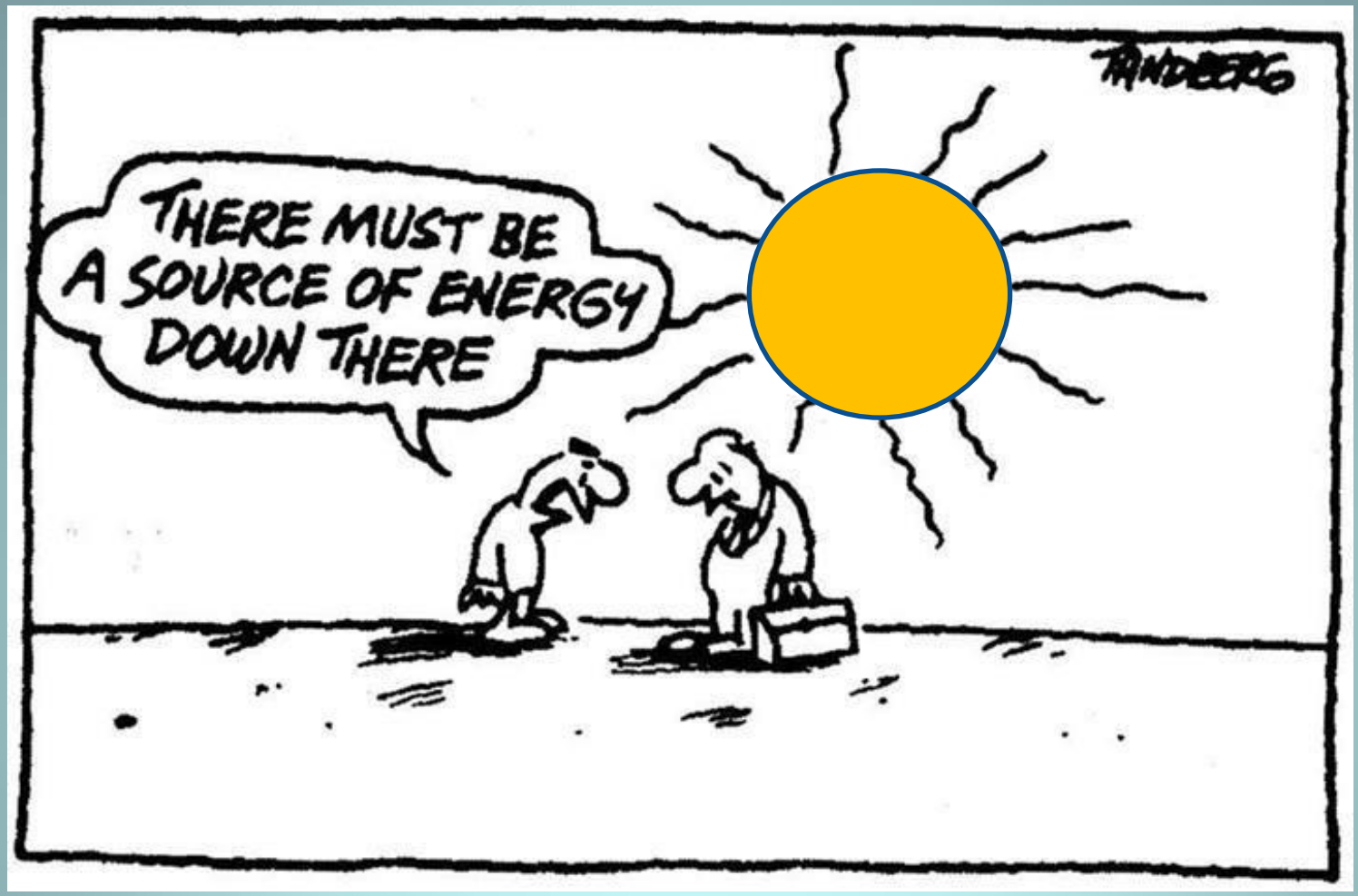


The reality and uncertainty of climate change demands an urgent transition to decentralised, small-scale, more flexible and adaptive decision-making and infrastructure.

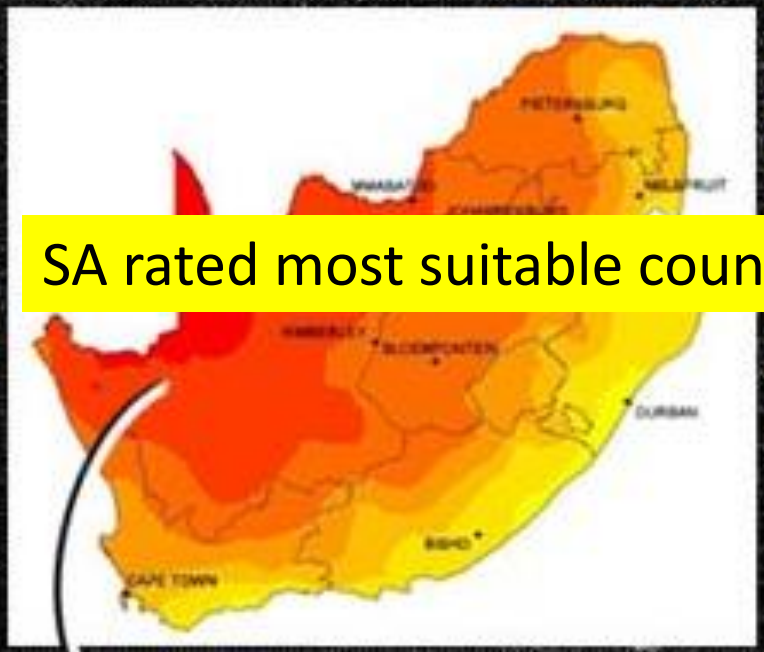
NO MORE LARGE DAMS!



- **Enough raw solar energy reaches the Earth in *one hour* to equal all of the energy used by the *entire world in a full year*.**

  C*ost of carbon-based energy continues to increase*, cost of solar has *declined by an average of 20% per year since 2010….*

South Africa's (INCREDIBLE) SOLAR POTENTIAL



5501 - 6000
6001 - 6500
6501 - 7000
7001 - 7500

Germany's average solar intensity

SA rated most suitable country worldwide for solar energy potential!

8501 - 9000
9001 - 9500

South Africa's Annual Solar Radiation
Measured in MJ/M²

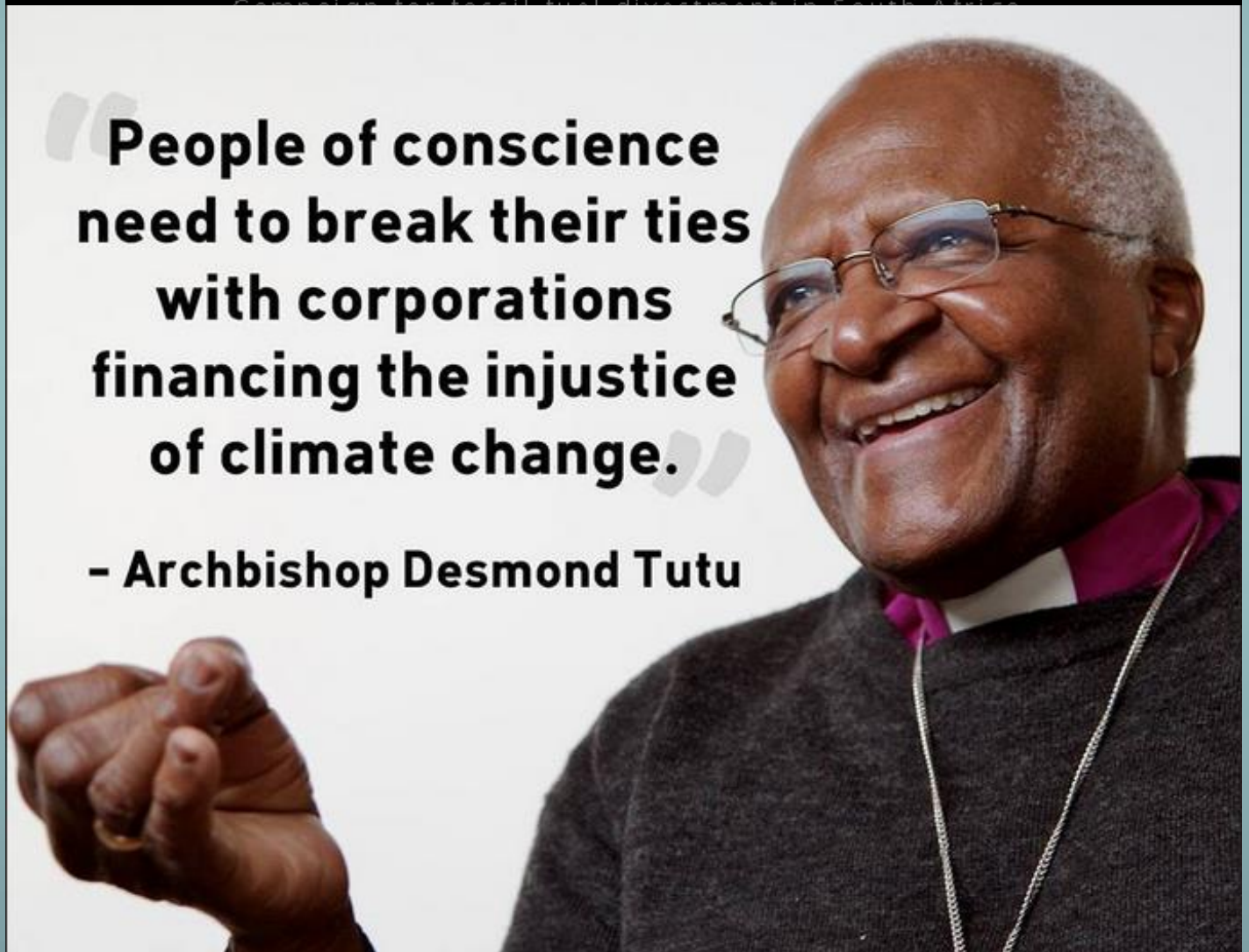
Despite a very low solar potential, Germany generates 30GW from solar power -- that's over 6 times what Eskom's largest coal plant will generate.

5 STAR RATINGS!

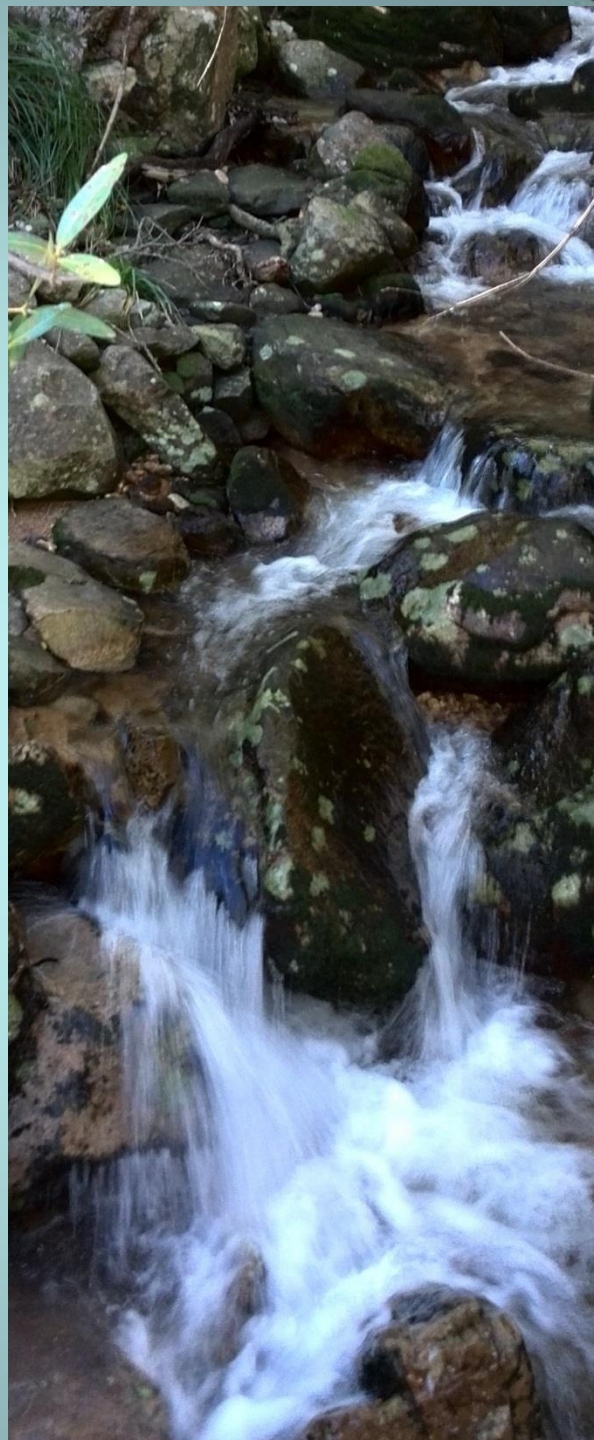
★★★★★

Another fossil fuel - why risk damaging our most precious resource???

GO FOSSIL FREE SOUTH AFRICA



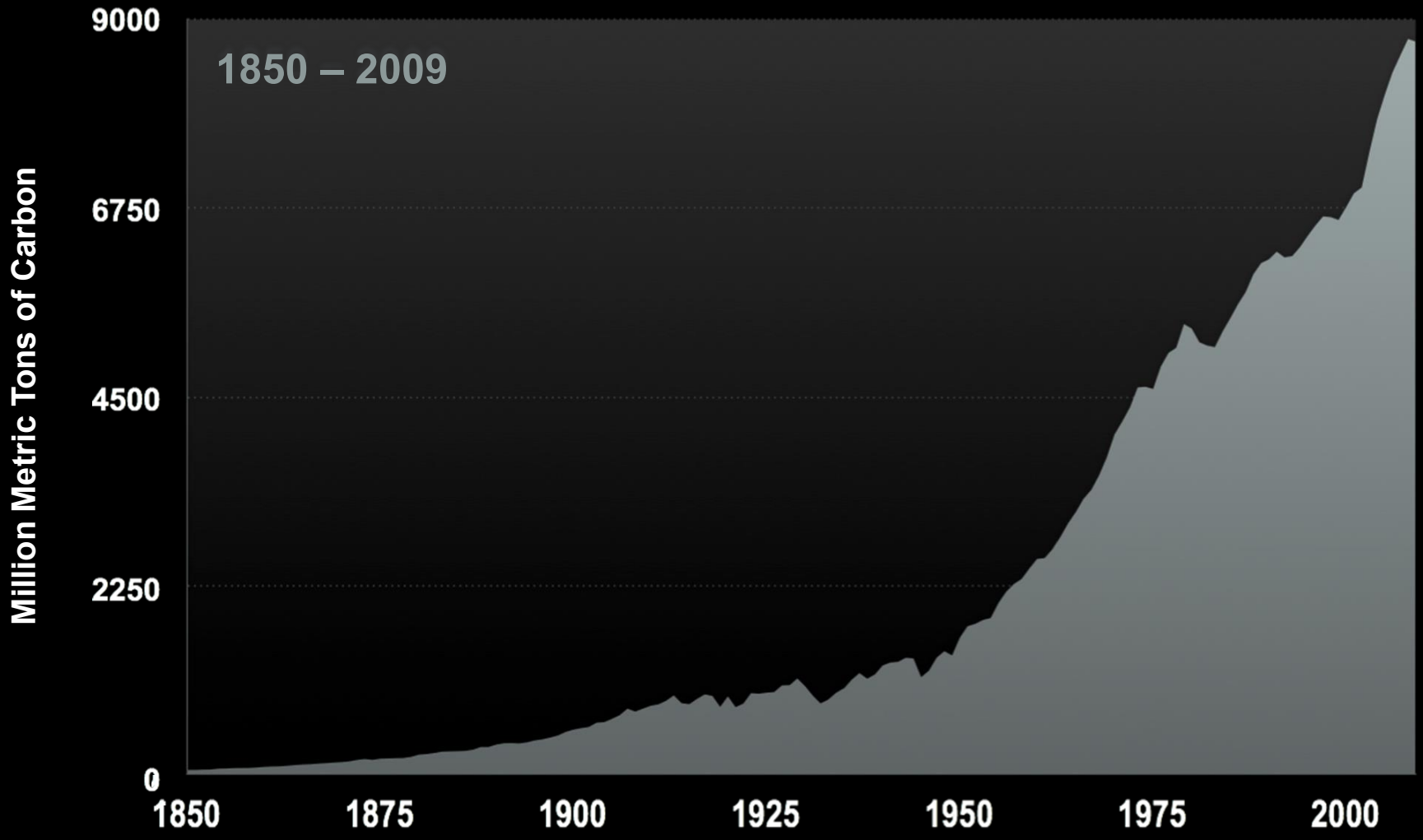
Thanks!



Responsibility of IA

- By encouraging all water sectors to use water more ***efficiently***, ***demand management*** provides a more sustainable long-term solution to the problem of water scarcity than do supply side measures;
- IA needs to assess ALL water use against alternative options!

Global Carbon Emissions from Fossil Fuels
"Carbon Pollution"



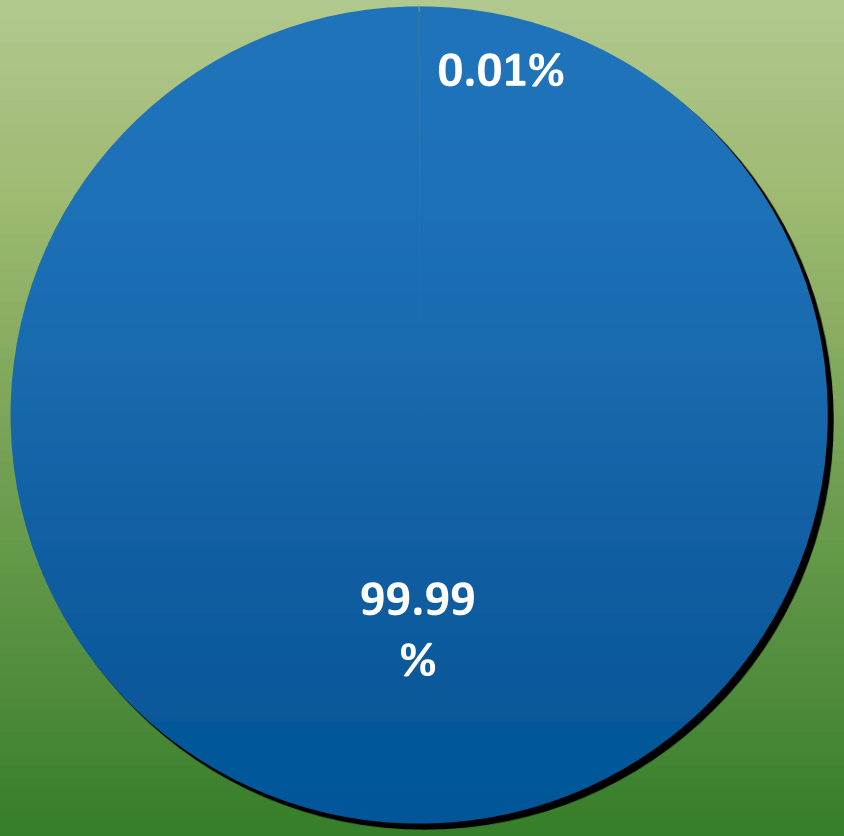
Source: U.S. Department of Energy/CDIAC

Peer-Reviewed Climate Science Papers

- November 2012 – December 2013

9,136 authors agree that climate change is happening and is primarily caused by human activity.

One does not.



Source: 2014, James Lawrence (Climate Reality Project)