

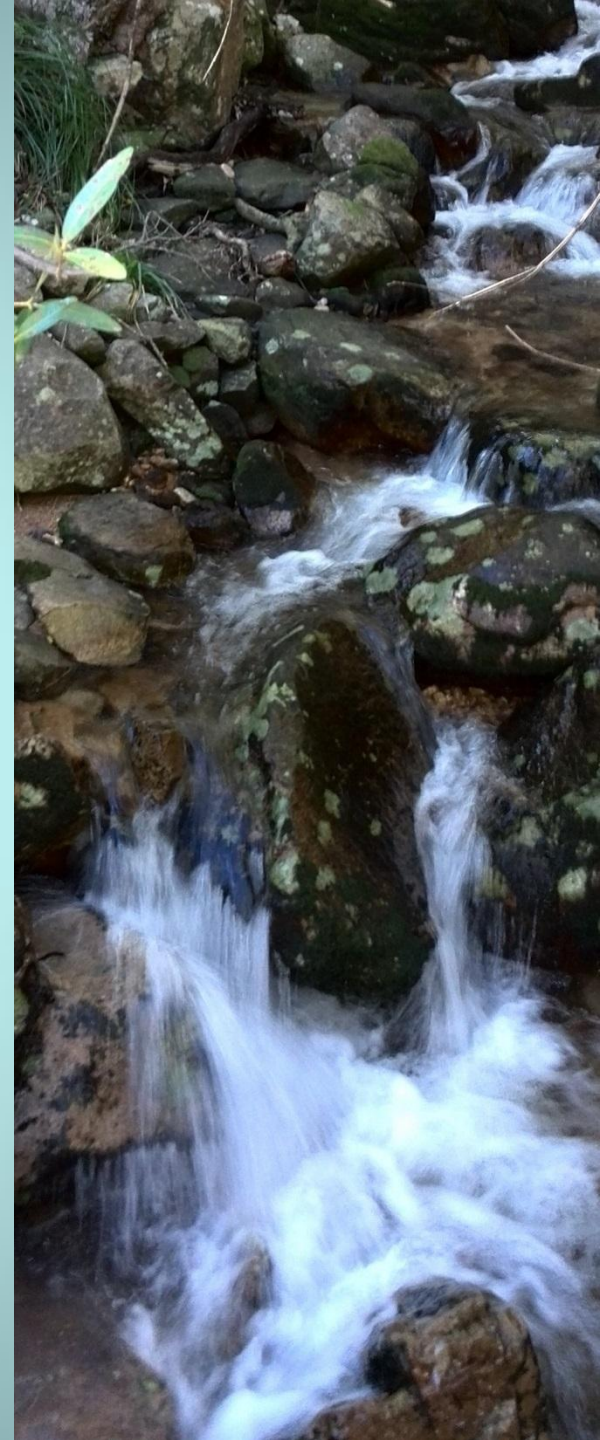
Decision-making in an uncertain world – the IPCC's AR5 and implications for water security in South Africa

Nicholas King, PhD, LLM

nking2020@gmail.com

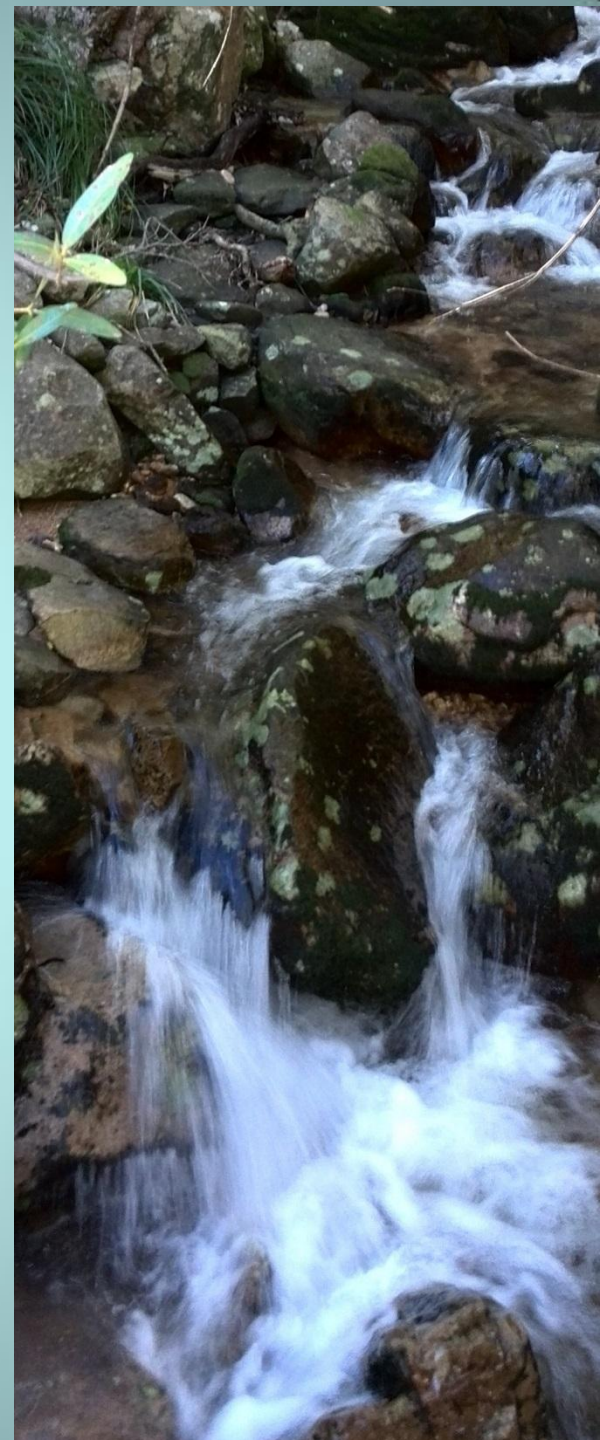
Change Analyst, Futures Strategist

UCPP Quarterly Meeting, Dec 3,

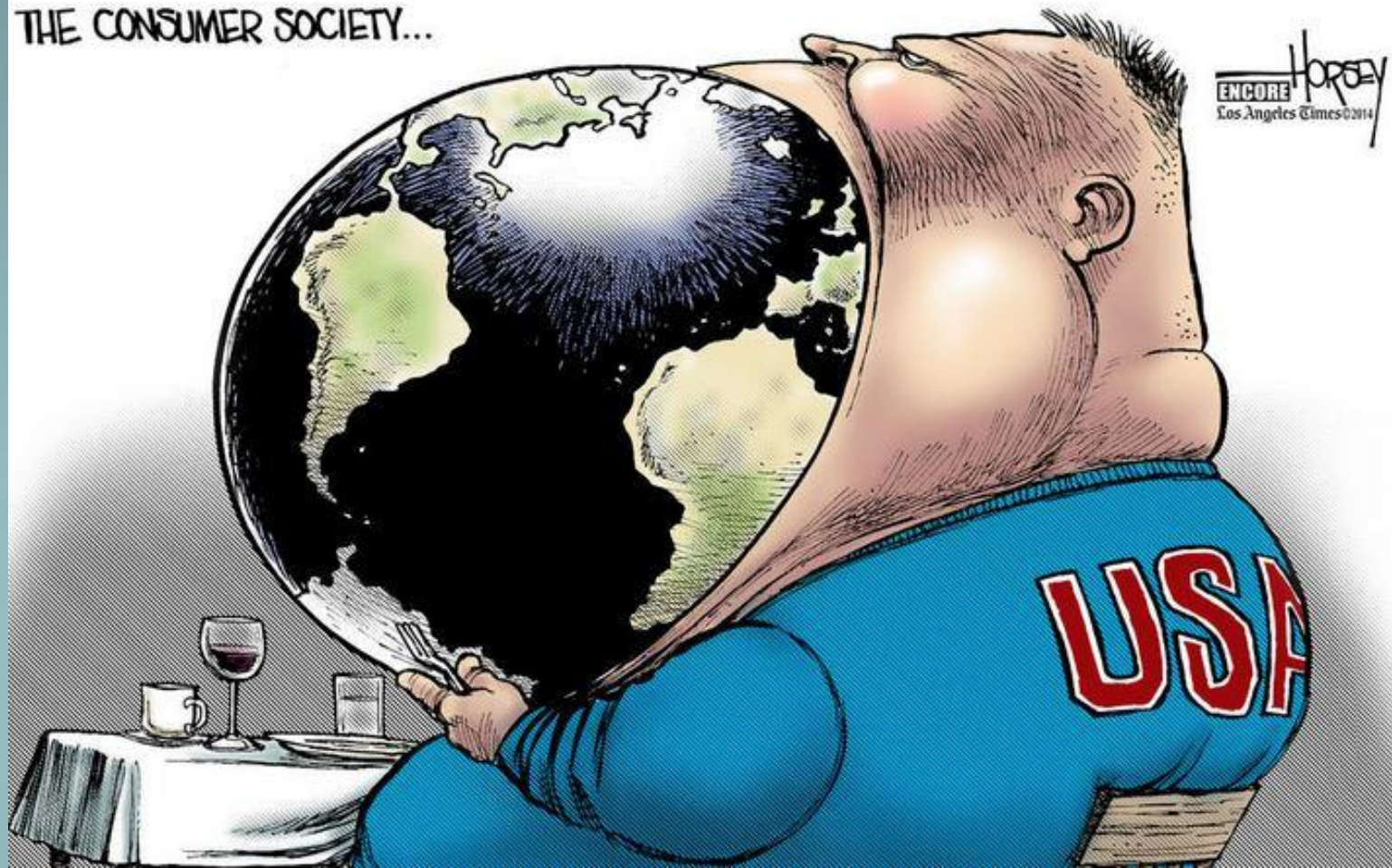


Overview

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?



THE CONSUMER SOCIETY...



- 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).



ABOUT US

FOOTPRINT BASICS

FOOTPRINT SCIENCE

PARTNERSHIPS

RESOURCES



IN THIS SECTION

Introduction

Overview

» World Footprint

- Earth Overshoot Day

- Video: What is Ecological Overshoot?

Footprint for Nations

Competitiveness 2.0

Our Human Development Initiative

Finance for Change

Footprint for Cities

Earth Overshoot Day

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



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?

COUNTRIES IN THE RED

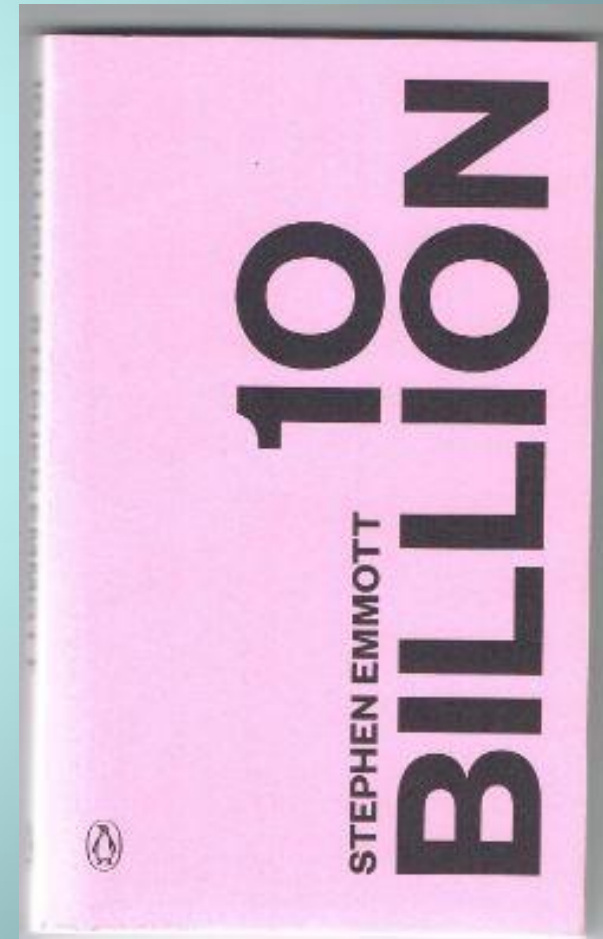
Today, 72 percent of the global population lives in countries struggling with biocapacity deficits and low income (as defined by the World Bank). This group is identified in the red lower left quadrant. Only 14 percent of the world lives in countries with more biocapacity than Footprint, including Australia 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)

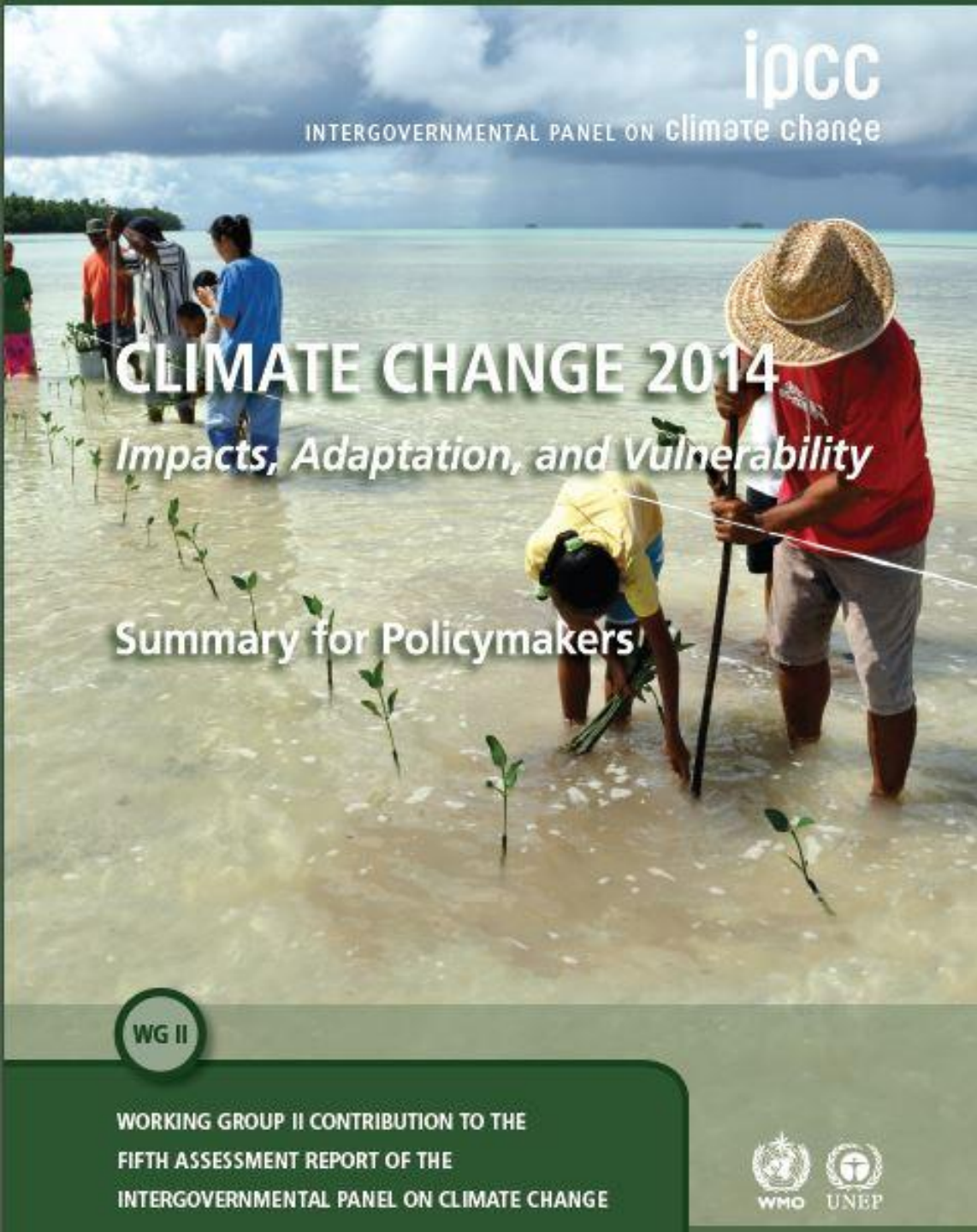


Already living on water credit we don't have!

- 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...

.

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 Organization
Weather • Climate • Water

THE GLOBAL CLIMATE 2001–2010

A DECADE OF CLIMATE EXTREMES
SUMMARY REPORT

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

NASA: Earth Just Experienced the Warmest Six-Month Stretch Ever Recorded

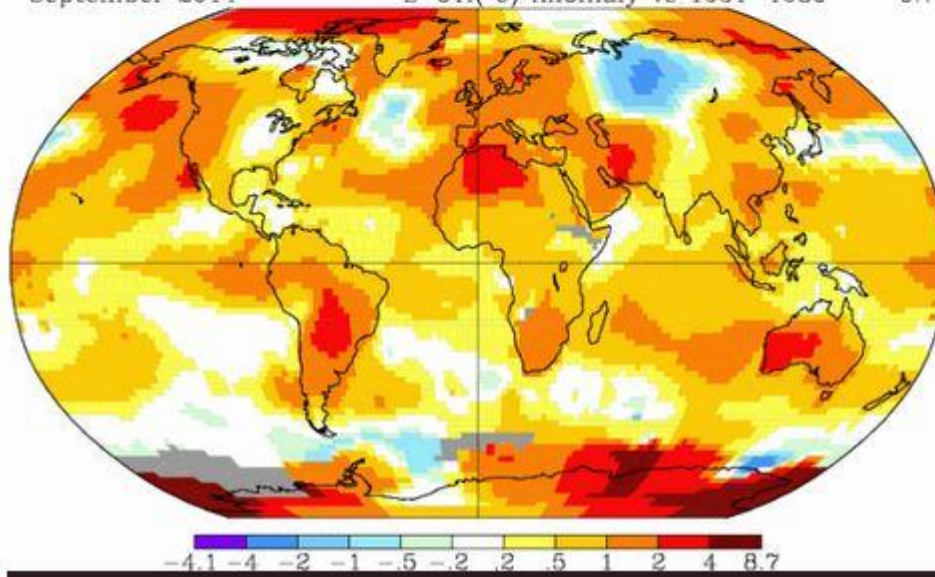
By Eric Holthaus



September 2014

L-OTI(°C) Anomaly vs 1951-1980

0.78



“..the current warm stretch is probably the planet’s warmest in 4000 years. That means global temperatures may already have passed a level that human civilisation has never experienced....”

Sea Ice Extent

09/05/2012

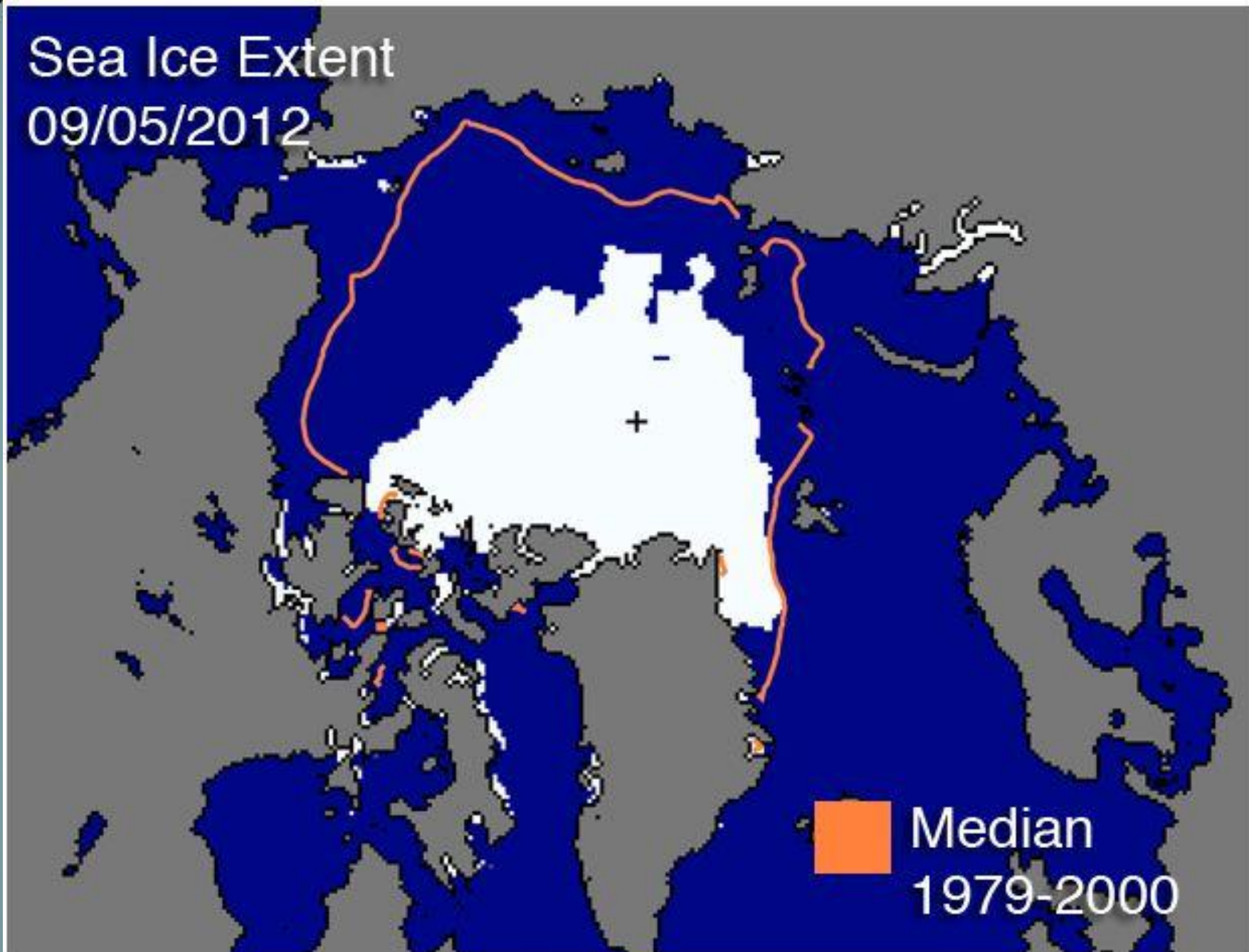


Figure 2. Sea ice extent on September 5, 2012, showed that half of the polar ice cap was missing, compared to the average from 1979 - 2000. Image credit: National Snow and Ice Data Center.

Alaska forest fires 'worst for 10,000 years'

Last updated on 29 July 2013, 9:38 am

Northern American forests face a 'unique regime' of unprecedented fire activity as world warms say researchers



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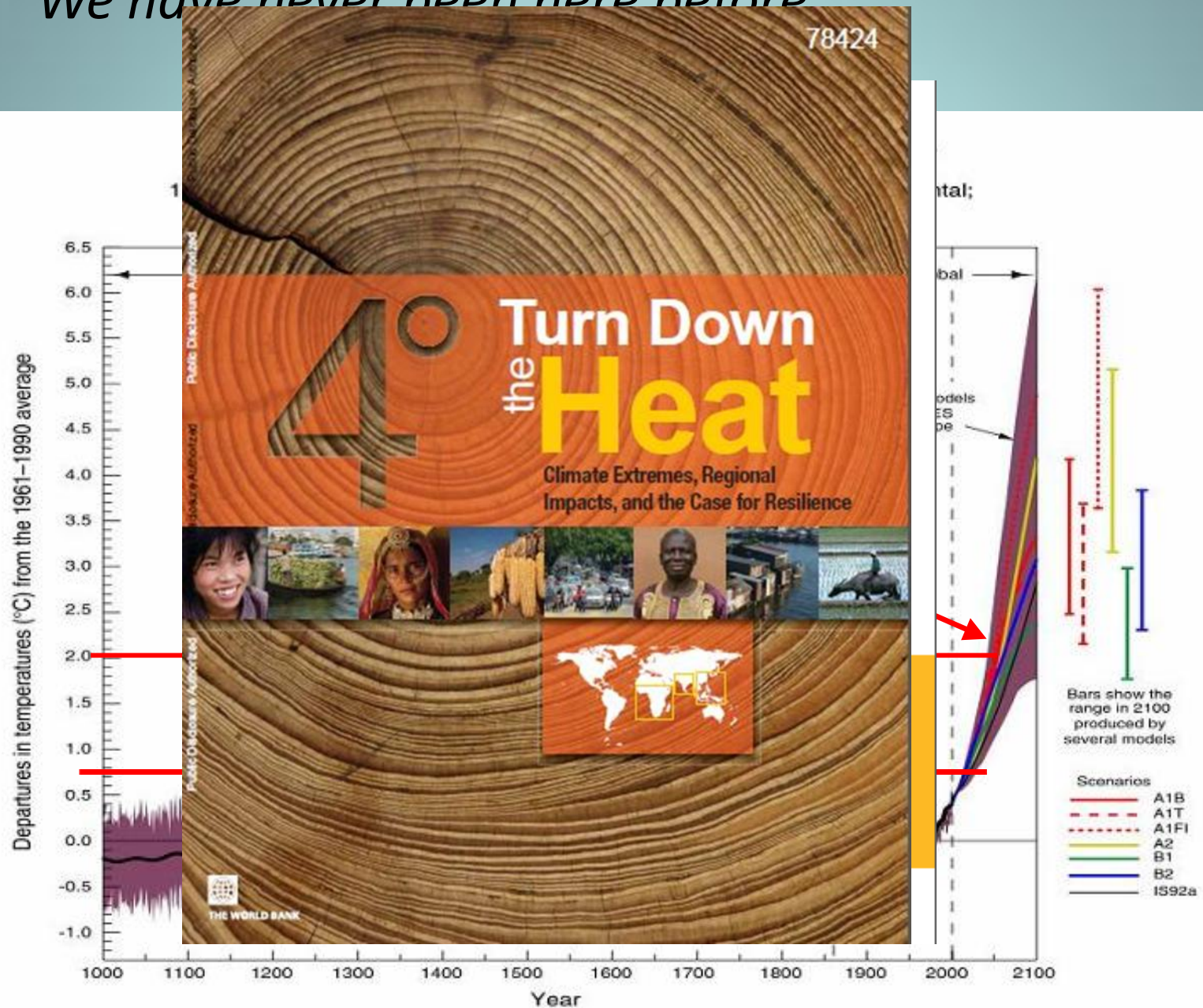
Stu

sh

En

US researchers say fires are hitting forests with an unusually high frequency (Pic: Sam Beebe/ECOTRUST)

We have never been here before



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 ***shifted 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..

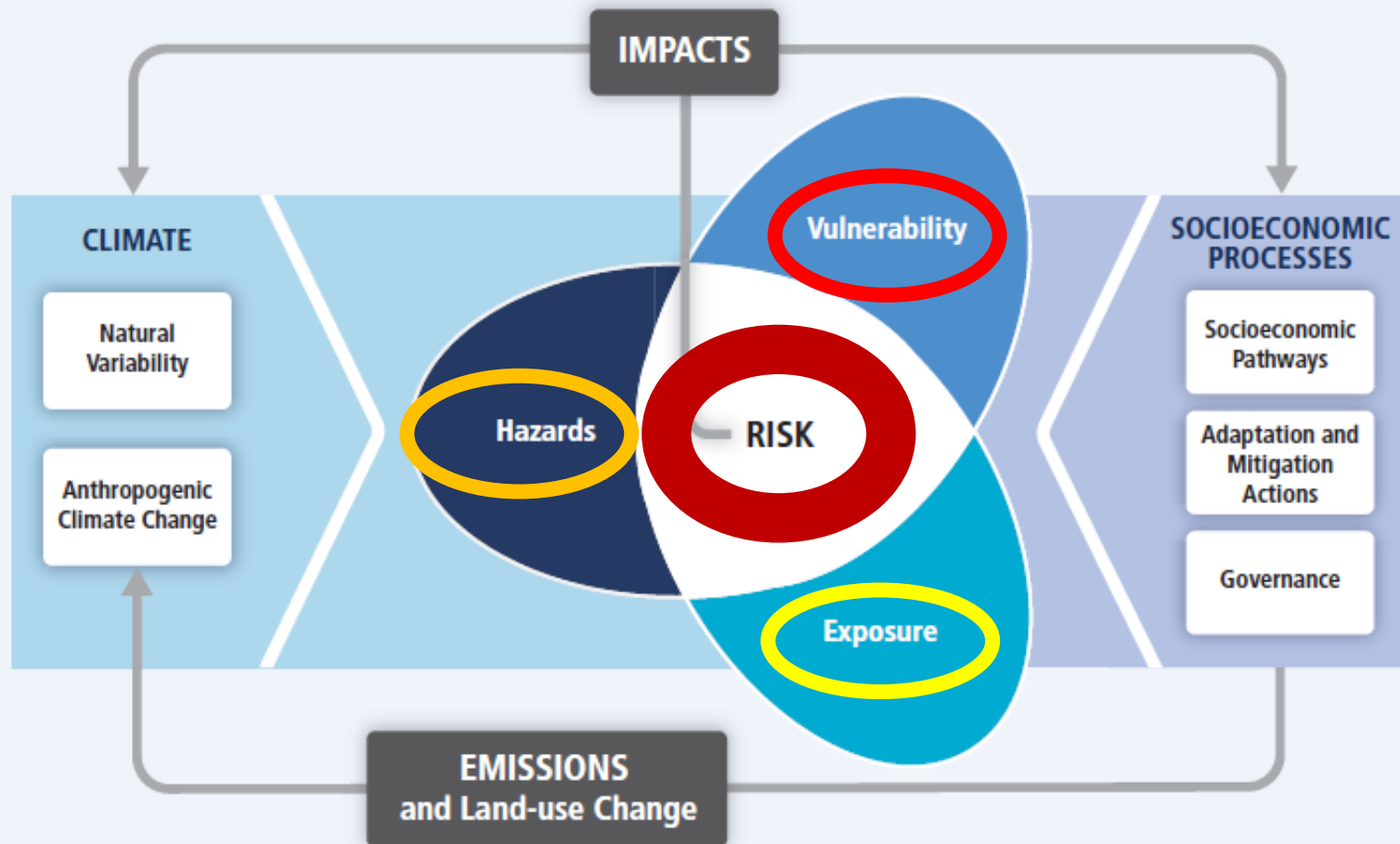
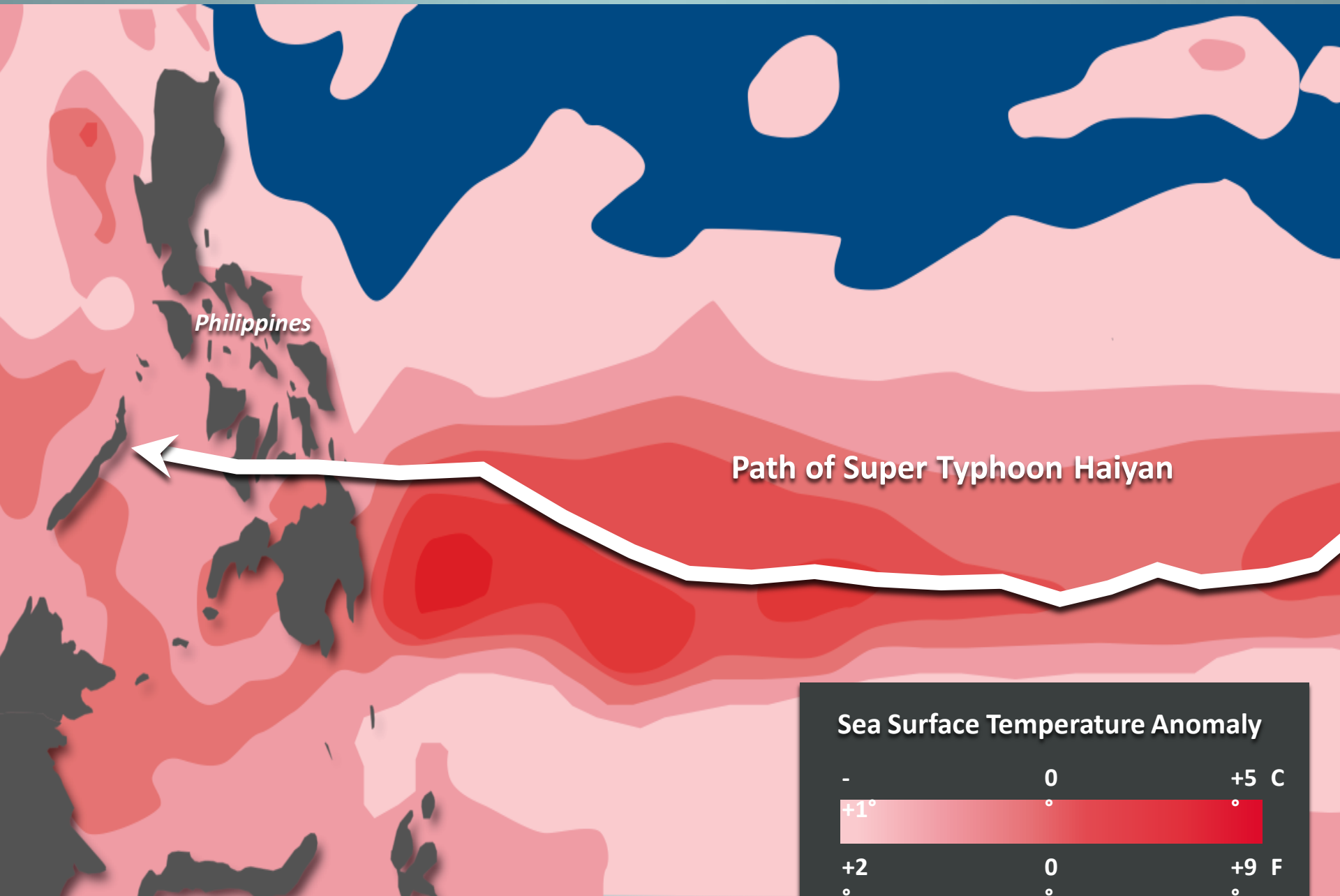


Figure SPM.1 | Illustration of the core concepts of the WGII AR5. Risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems. Changes in both the climate system (left)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



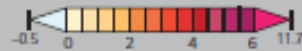
Tacloban City, Philippines, after Super Typhoon Haiyan, Nov 2013



(A)

Observed Temperature Change

Based on trend over 1901–2012 (°C over period)



Solid Color

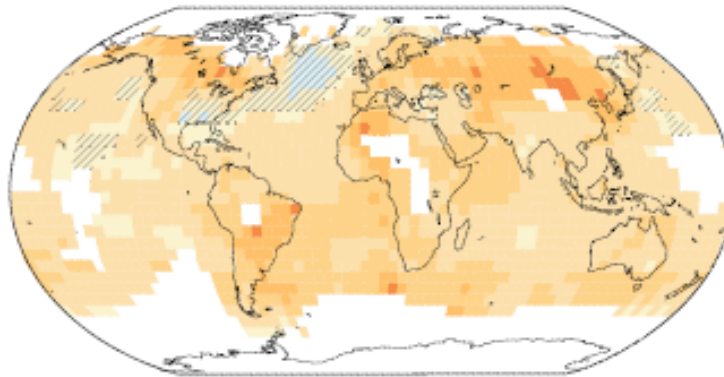
Significant trend

Diagonal Lines

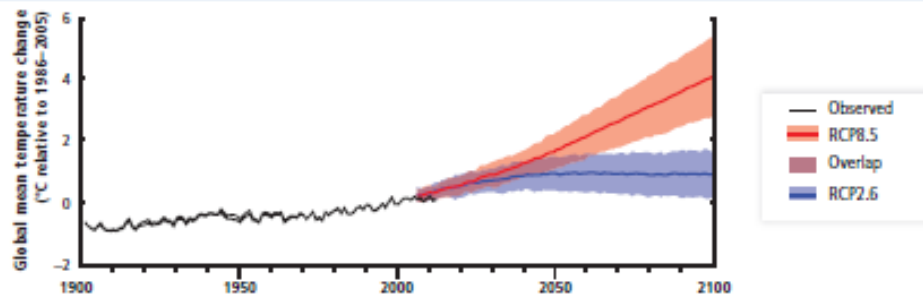
Trend not statistically significant

White

Insufficient data



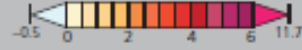
(B)



(C)

Projected Temperature Change

Difference from 1986–2005 mean (°C)



Solid Color

Very strong agreement

White Dots

Strong agreement

Gray

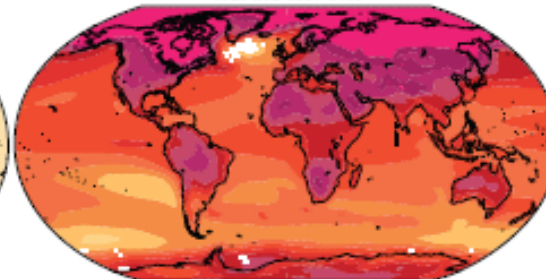
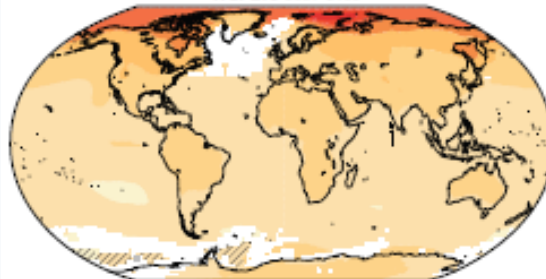
Divergent changes

Diagonal Lines

Little or no change

RCP2.6 2081–2100

RCP8.5 2081–2100



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

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.

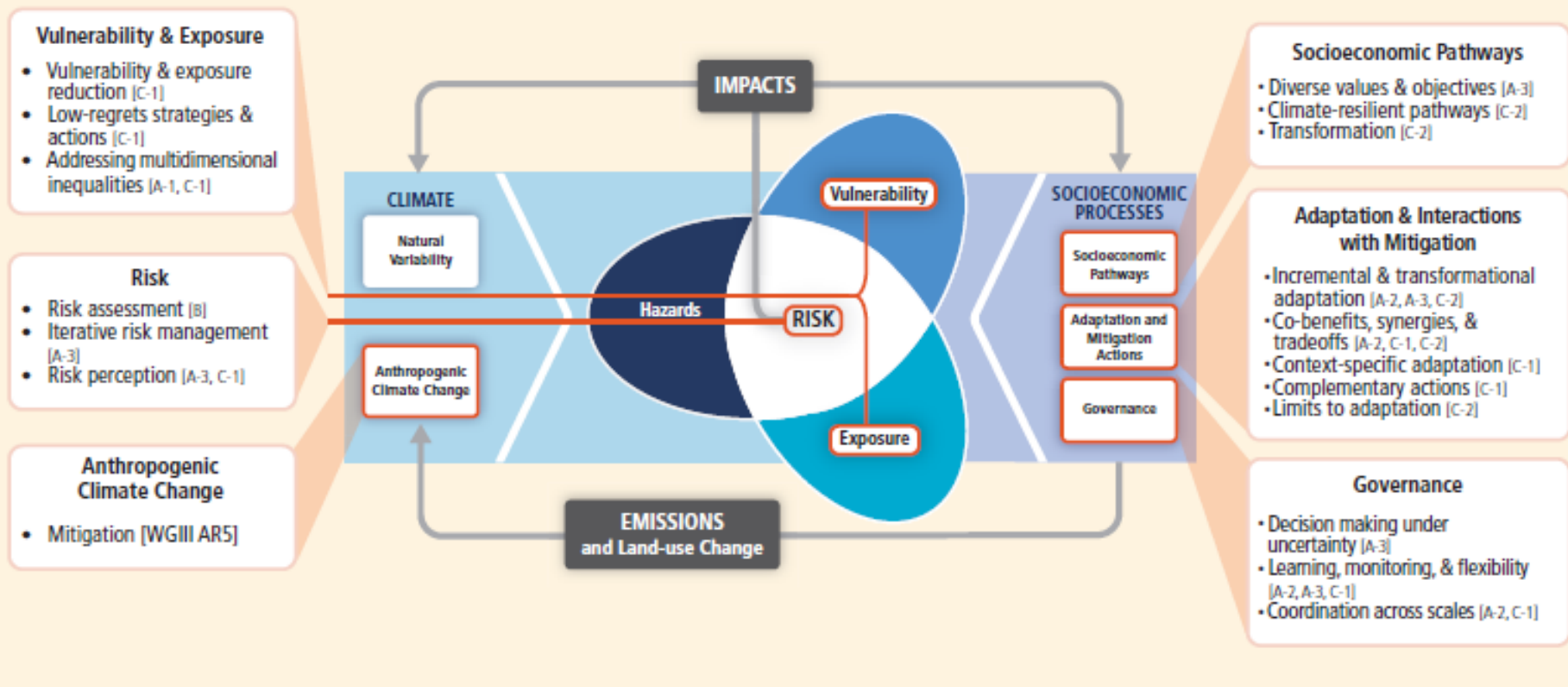


Figure SPM.8 | The solution space. Core concepts of the WGII AR5, illustrating overlapping entry points and approaches, as well as key considerations, in managing risks related to climate change, as assessed in this report and presented throughout this SPM. Bracketed references indicate sections of this 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”
- *Are the planning professionals prepared for all this?*



Pakistan, August 2010

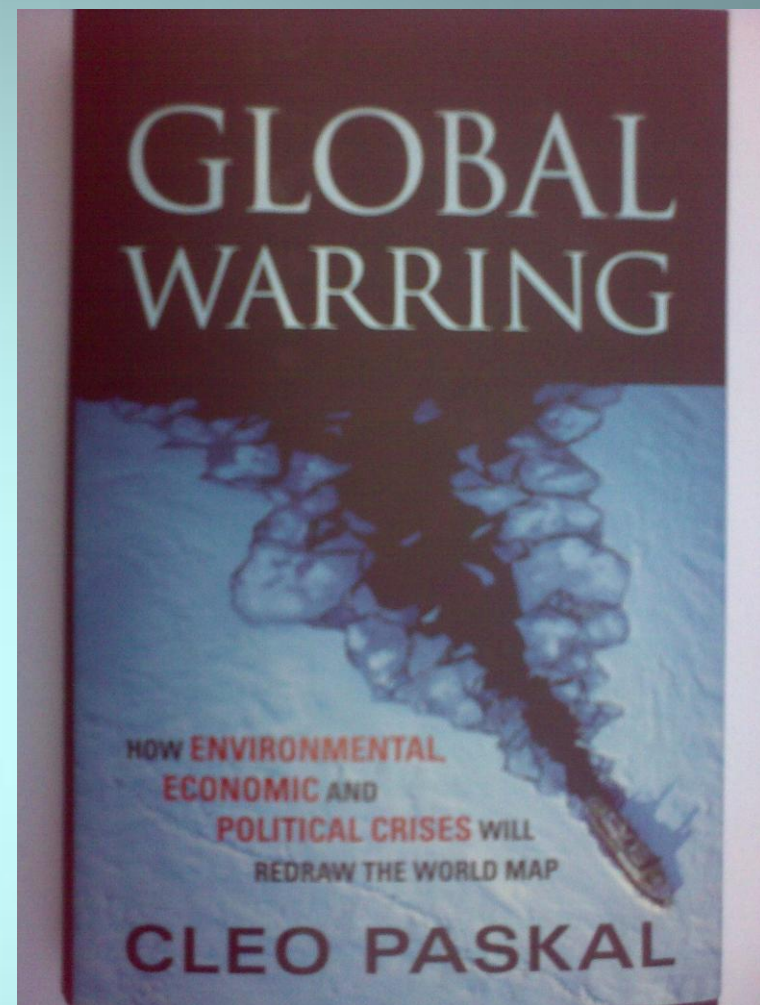
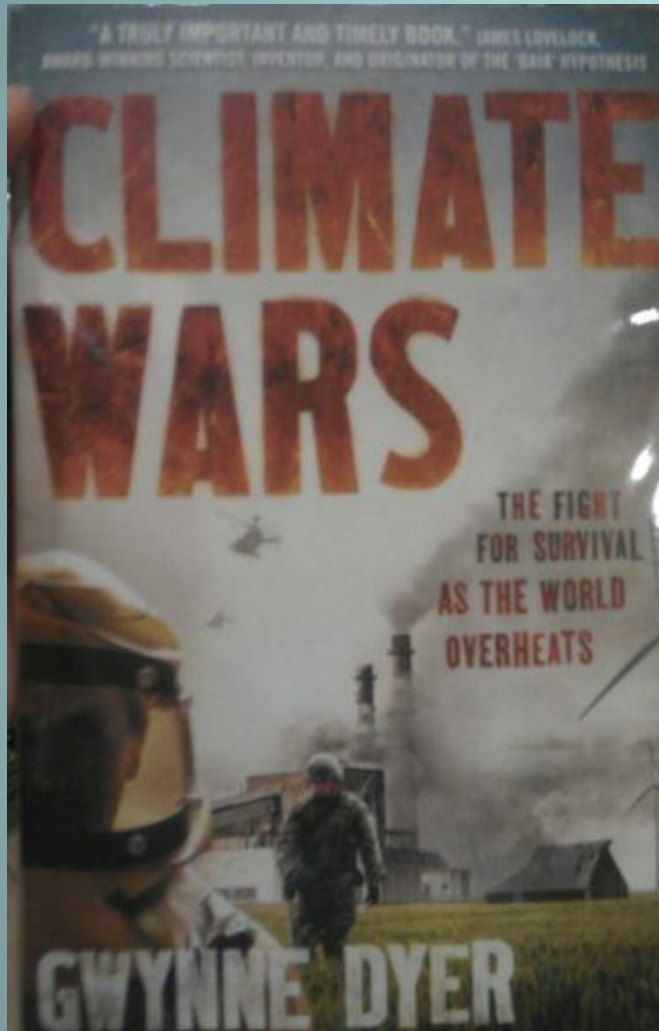
20,000,000 people
affected by flooding—
further destabilizing a
nuclear-armed country

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 for 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;***
- ***Are the planning professionals prepared for all this?***

Resource wars?



Many political analysts predicting catastrophic social upheaval....



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



**“...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

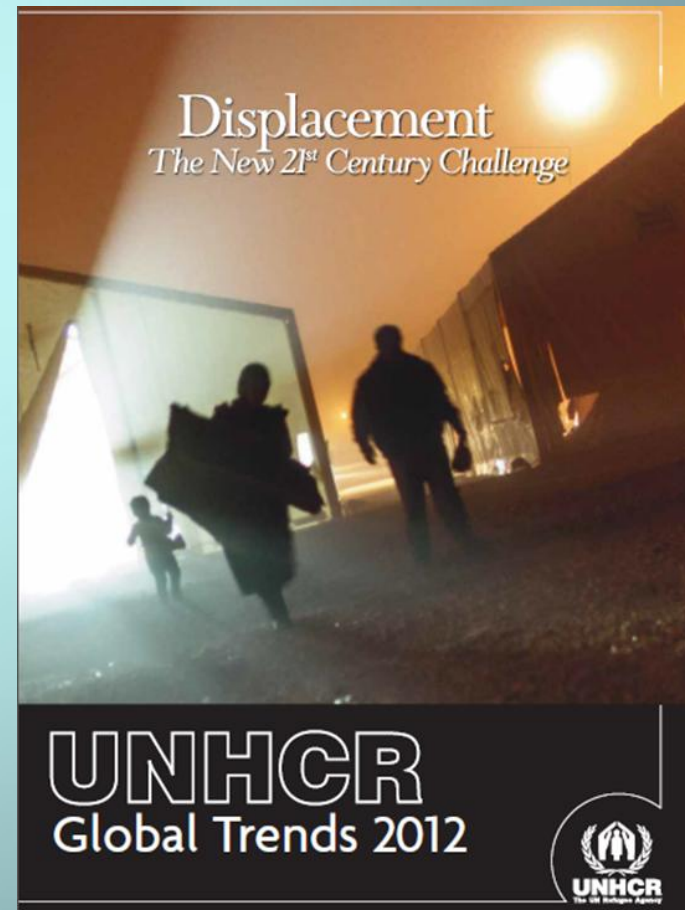
(Only in public domain thanks to WIKILEAKS!!!!!!)

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...



Dry days

Longer periods without

Increased risk
of drought

'A world tour of hydrological madness.' SUNDAY TIMES

WHEN THE RIVERS RUN DRY

WHAT HAPPENS WHEN OUR WATER RUNS OUT?

*20-year averages

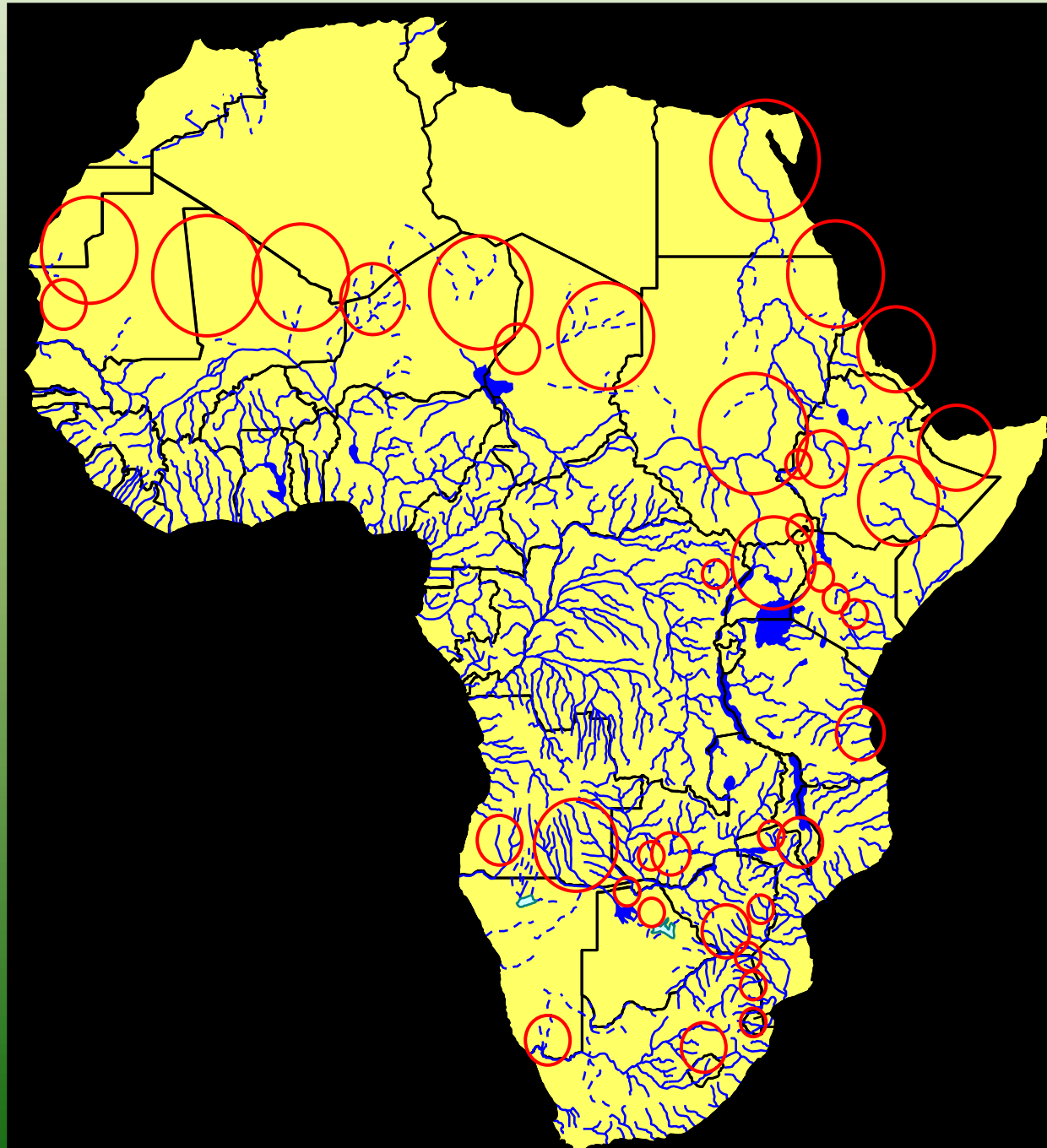
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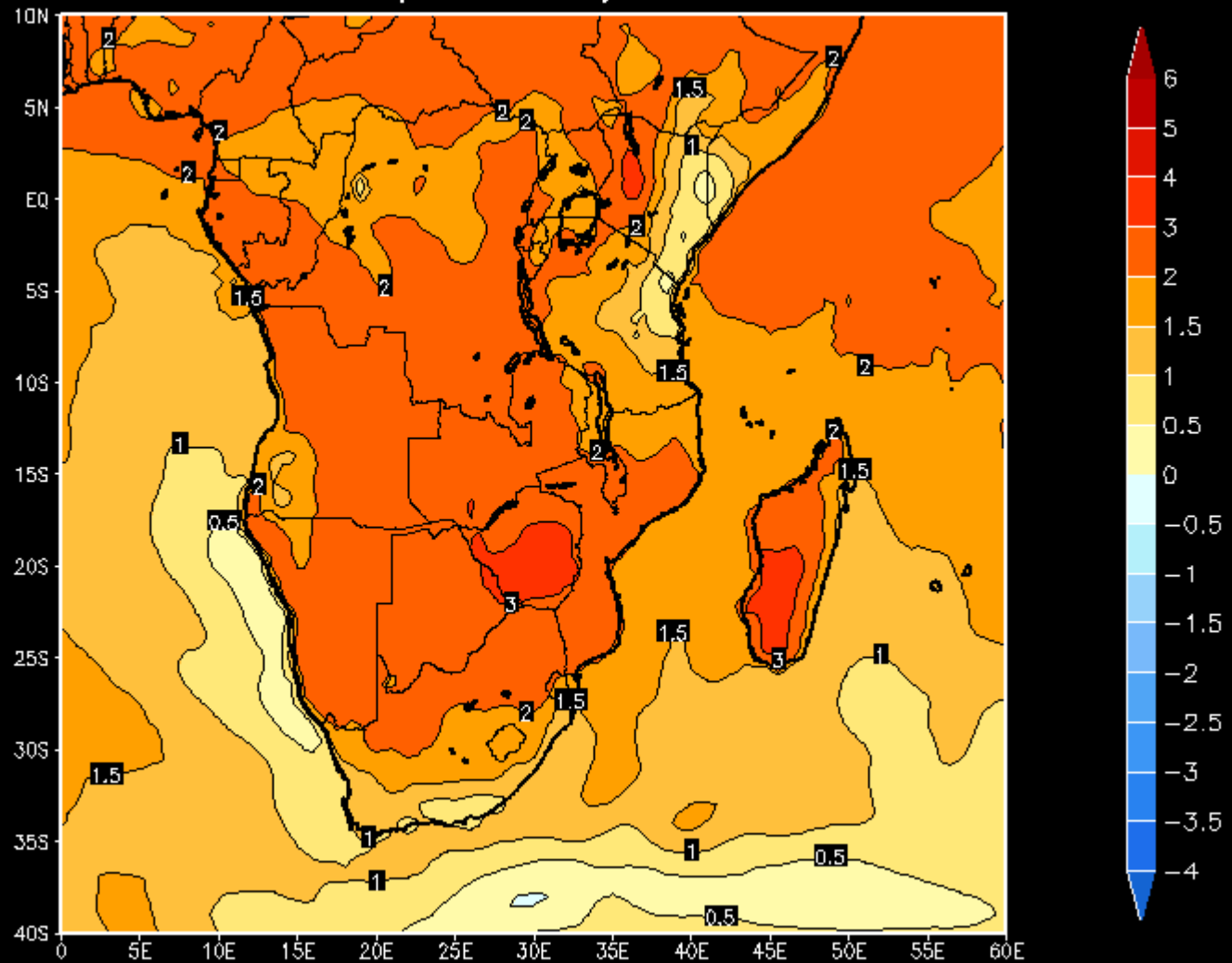
FRED PEARCE

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....



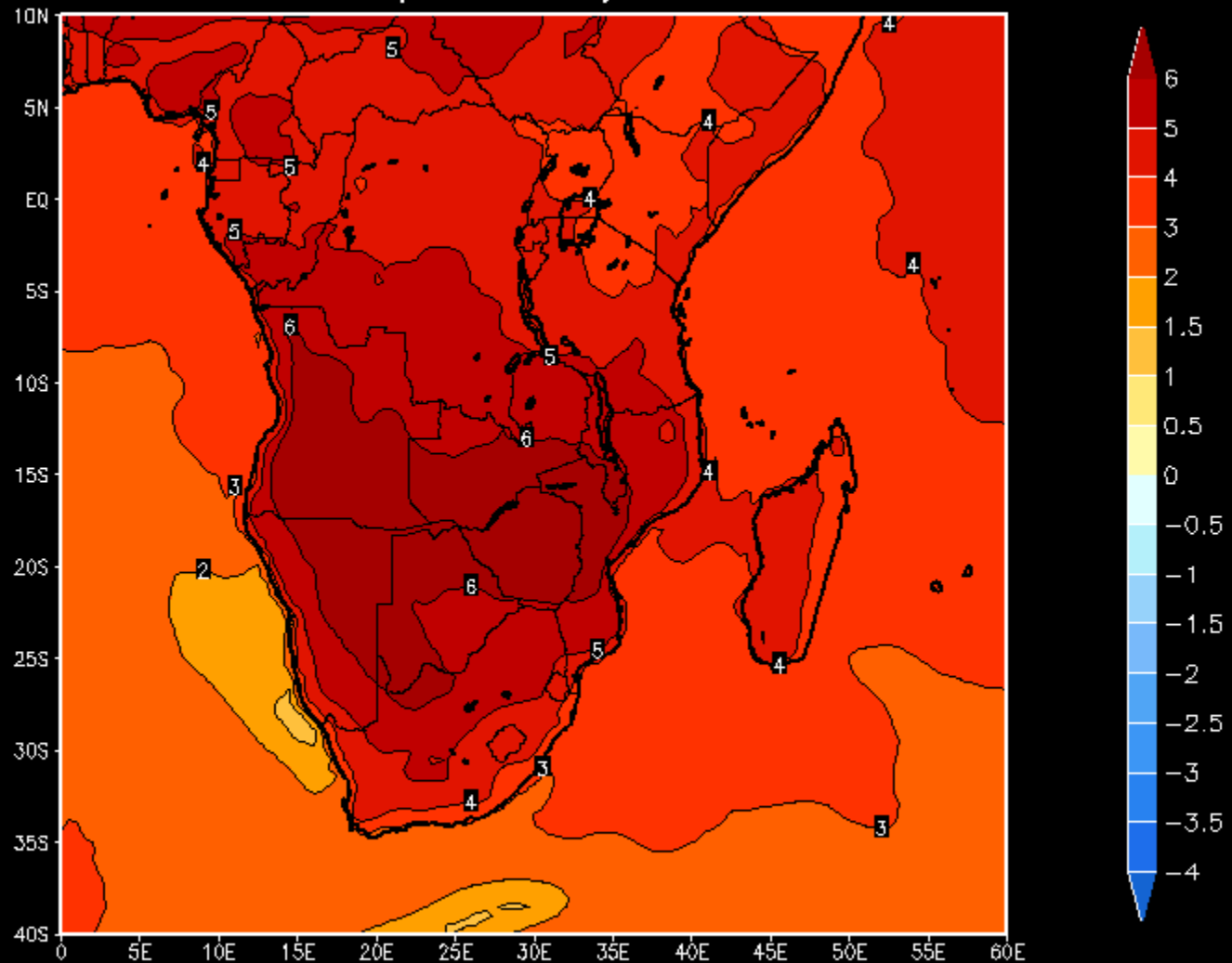
Temp anomaly 2050



2050 Temp increases relative to the 1961-1990 average

(CSIR 2011)

Temp anomaly 2100



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***. “

Legend

- Secondary Catchments
- Water Management Areas

UCE Median Change in Catchment Runoff

- 1.0 - -0.30
- 0.30 - -0.10
- 0.10 - -0.05
- 0.05 - 0.05
- 0.05 - 0.15
- 0.15 - 0.25
- 0.25 - 0.35
- 0.35 - 0.50
- 0.50 - 2.0

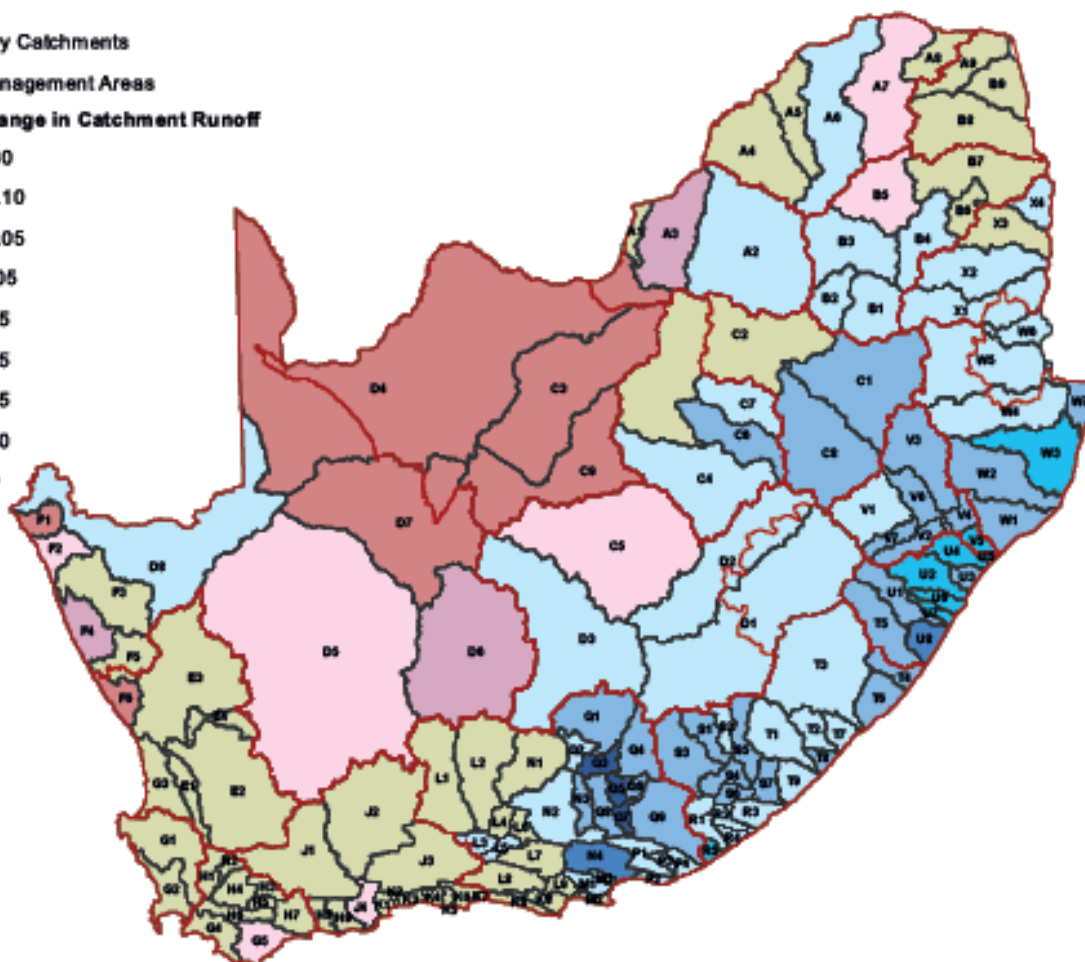


Figure 1. Median impact of climate change on the average annual catchment runoff for the period 2040–2050 relative to the base scenario average for 1990–2000 for all secondary catchments in South Africa derived from a Hybrid Frequency Distribution (HFD) analysis of all possible global circulation model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

BOX 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.

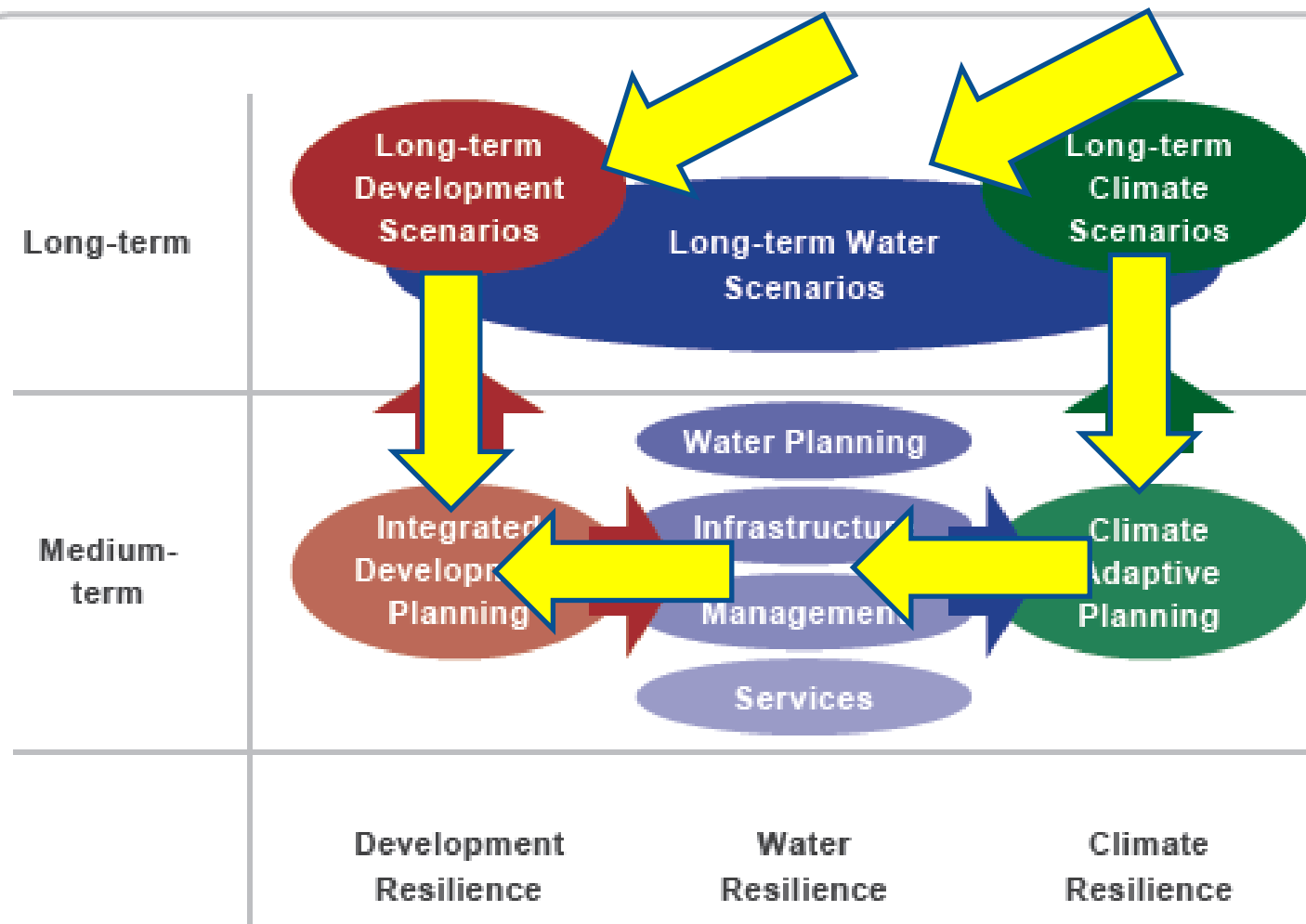


Figure 2. Distinction between medium and long-term planning for water, development and climate

CLIMATE CHANGE AND THE WATER SECTOR

Climate and Impacts Factsheet Series, Factsheet 3 of 7

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OCT 09, 2014

Back

103 mines have no water-use licences – Minister

BUY PHOTOS

Nomvula Mokonyane
Photo: Duane Davis

© Graham Arnold

BY SAPA

A total of 103 mines are breaking the law by operating without water-use licences, according to Water Affairs Minister **Nomvula Mokonyane**.

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A worldwide leader in water management

R10bn set aside for Witwatersrand AMD mitigation

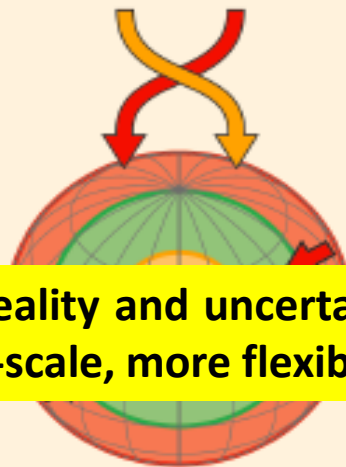


(a) Our world

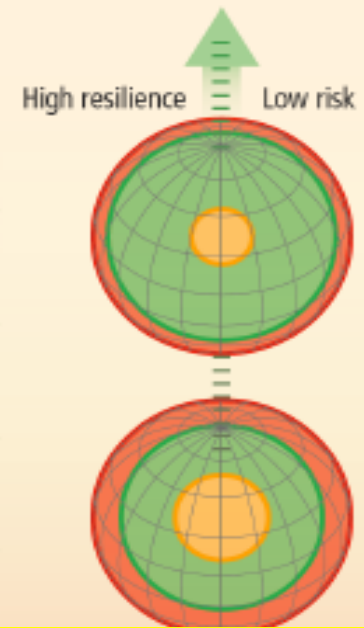
(b) Opportunity space

(c) Possible futures

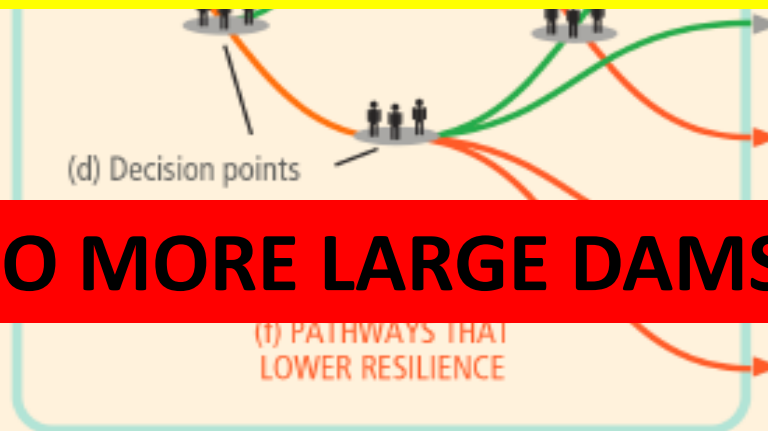
Multiple stressors
including
climate change



(e) CLIMATE-RESILIENT
PATHWAYS



(d) Decision points

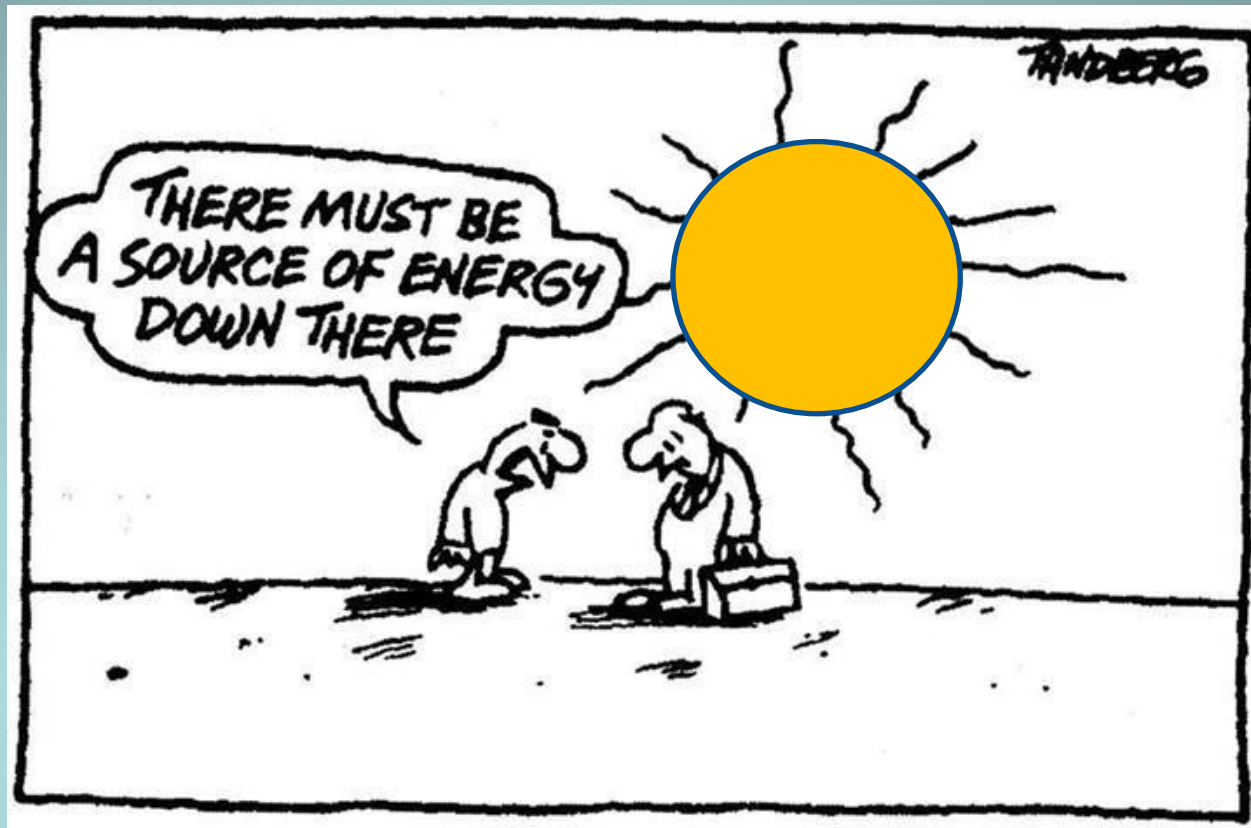


(f) PATHWAYS THAT
LOWER RESILIENCE



- Biophysical stressors
- Resilience space
- Social stressors

NO MORE LARGE DAMS!

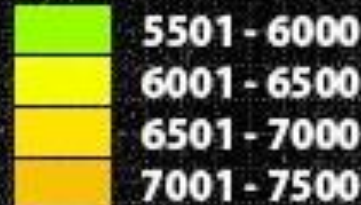
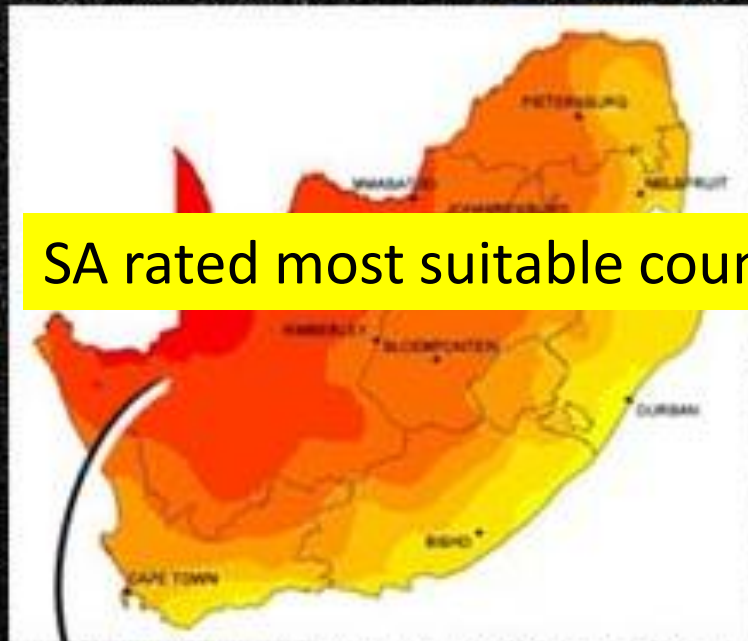


- Enough raw solar energy reaches the Earth in *one hour* to equal all of the energy used by the *entire world in a full year*.

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

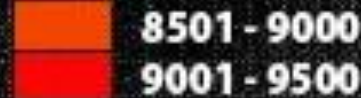
NB: Solar (renewables) is(are) a technology, not a fuel (finite, polluting resource)!!!

South Africa's (INCREDIBLE) SOLAR POTENTIAL



Germany's average
solar intensity

SA rated most suitable country worldwide for solar energy potential!



South Africa's
Annual Solar
Radiation

Measured in MJ/M²

→ 5 STAR RATINGS!



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.

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

unearthed.

HOME

ABOUT

The deeper the dig, the darker the secrets.

Frack Off!

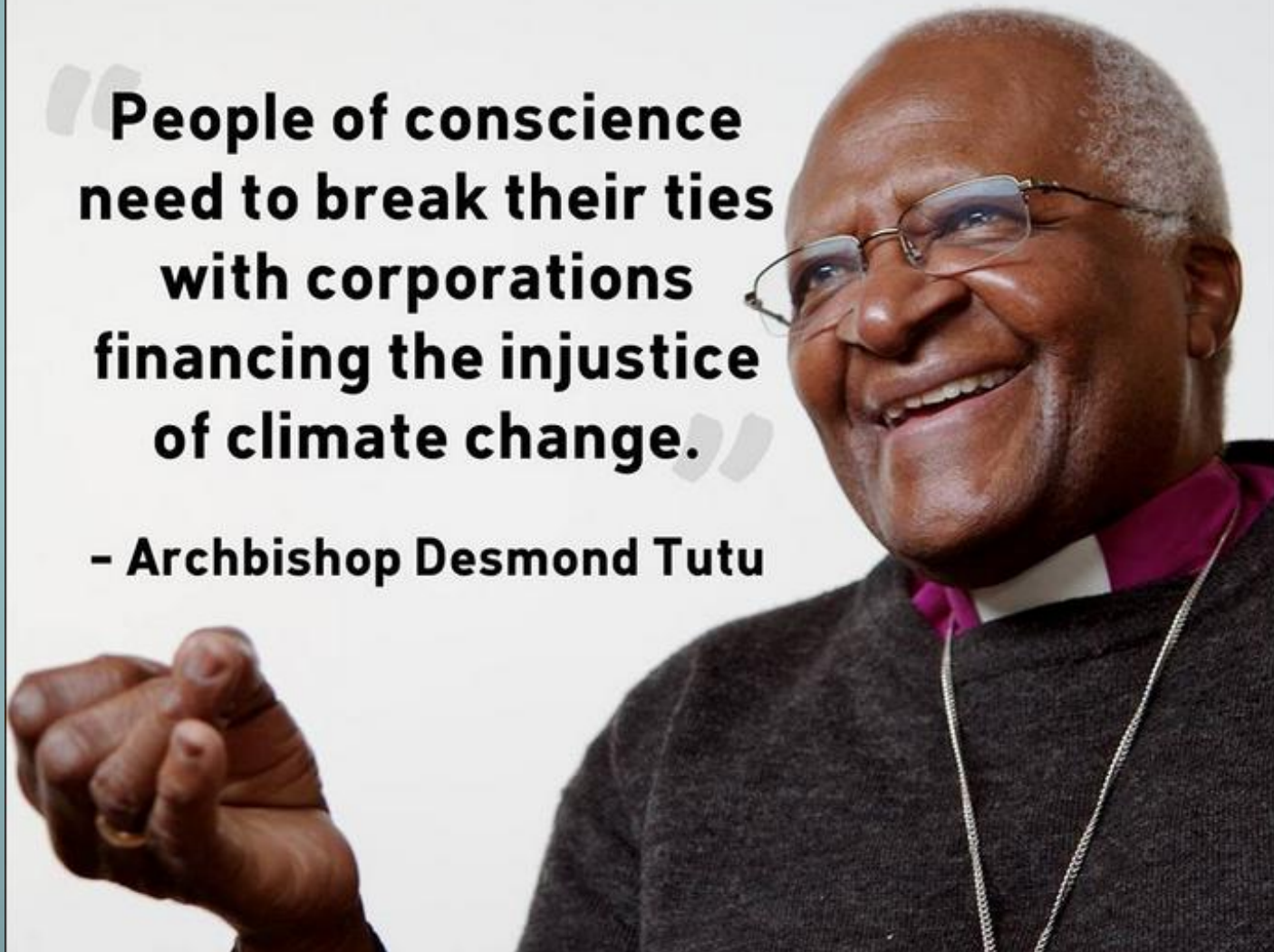


STAGE 5 FILMS AND ZOOTEES STUDIOS IN ASSOCIATION WITH SABIDO PRODUCTIONS AND NATIONAL FILM & VIDEO
"UNEARTHED" A FILM BY JOLYNN MINNAAR EDITED BY DANIEL MITCHELL VISUAL EFFECTS CANDICE WA

GO FOSSIL FREE SOUTH AFRICA

**“People of conscience
need to break their ties
with corporations
financing the injustice
of climate change.”**

- Archbishop Desmond Tutu



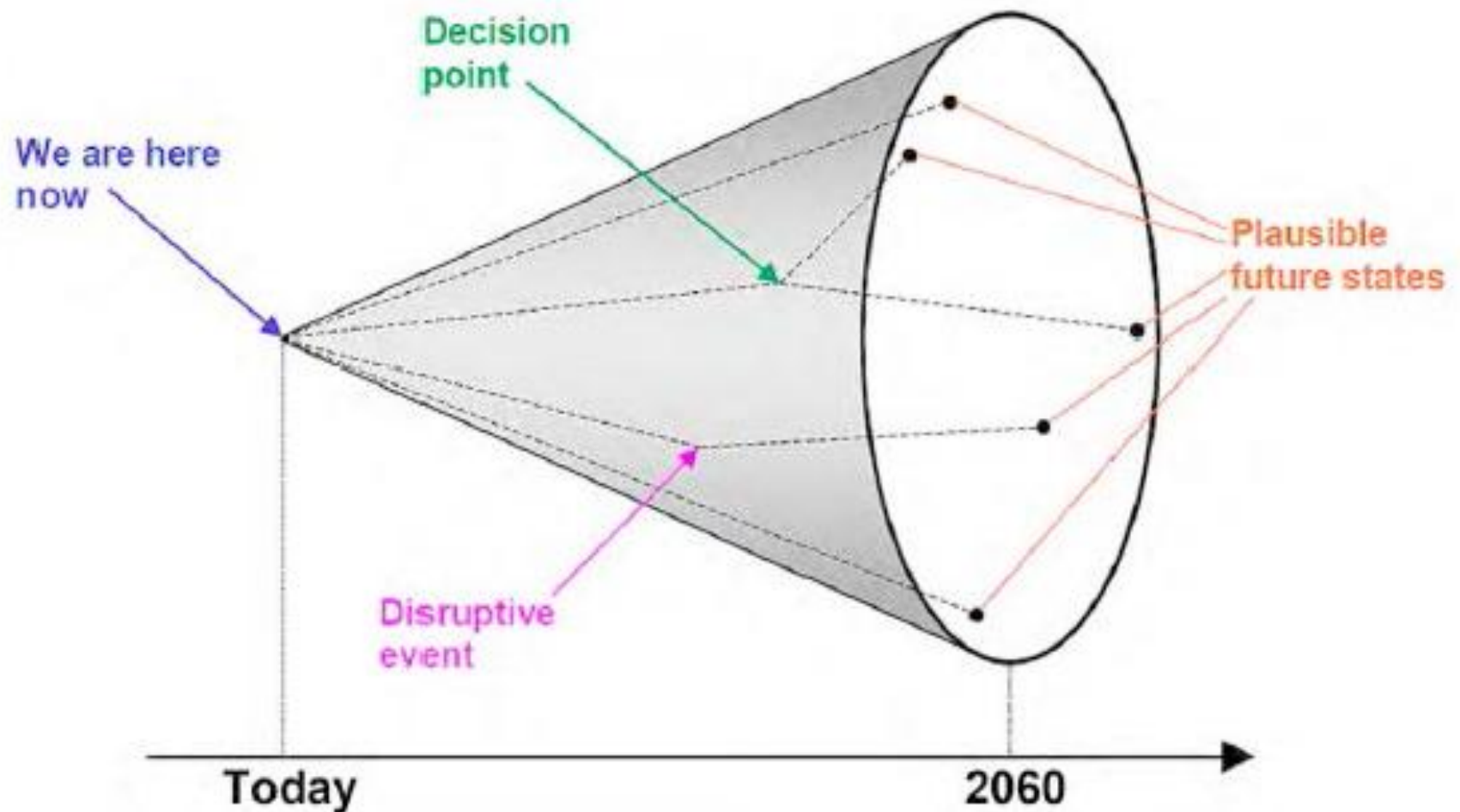


Figure 1.2. Conceptual diagram of the broadening range of plausible alternative futures as one moves farther away from the present and different events and decision points shift trajectories. (From BOR 2012, adapted from Timpe and Scheepers 2003).

*What do you want the Vubu
catchment to look like in future?*

Thanks!

nking2020@gmail.com

