UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

GLOBAL CHANGE Institute
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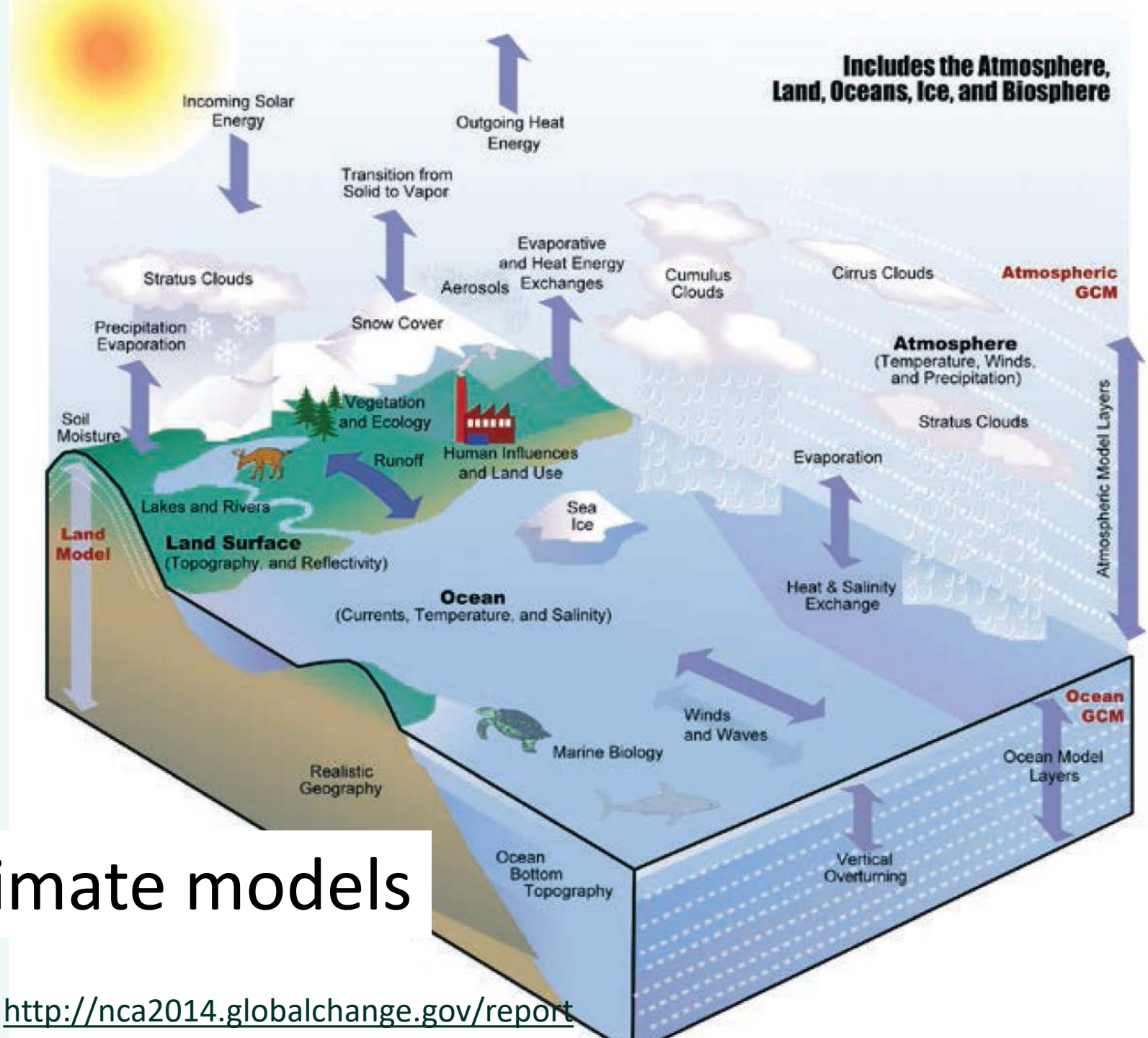
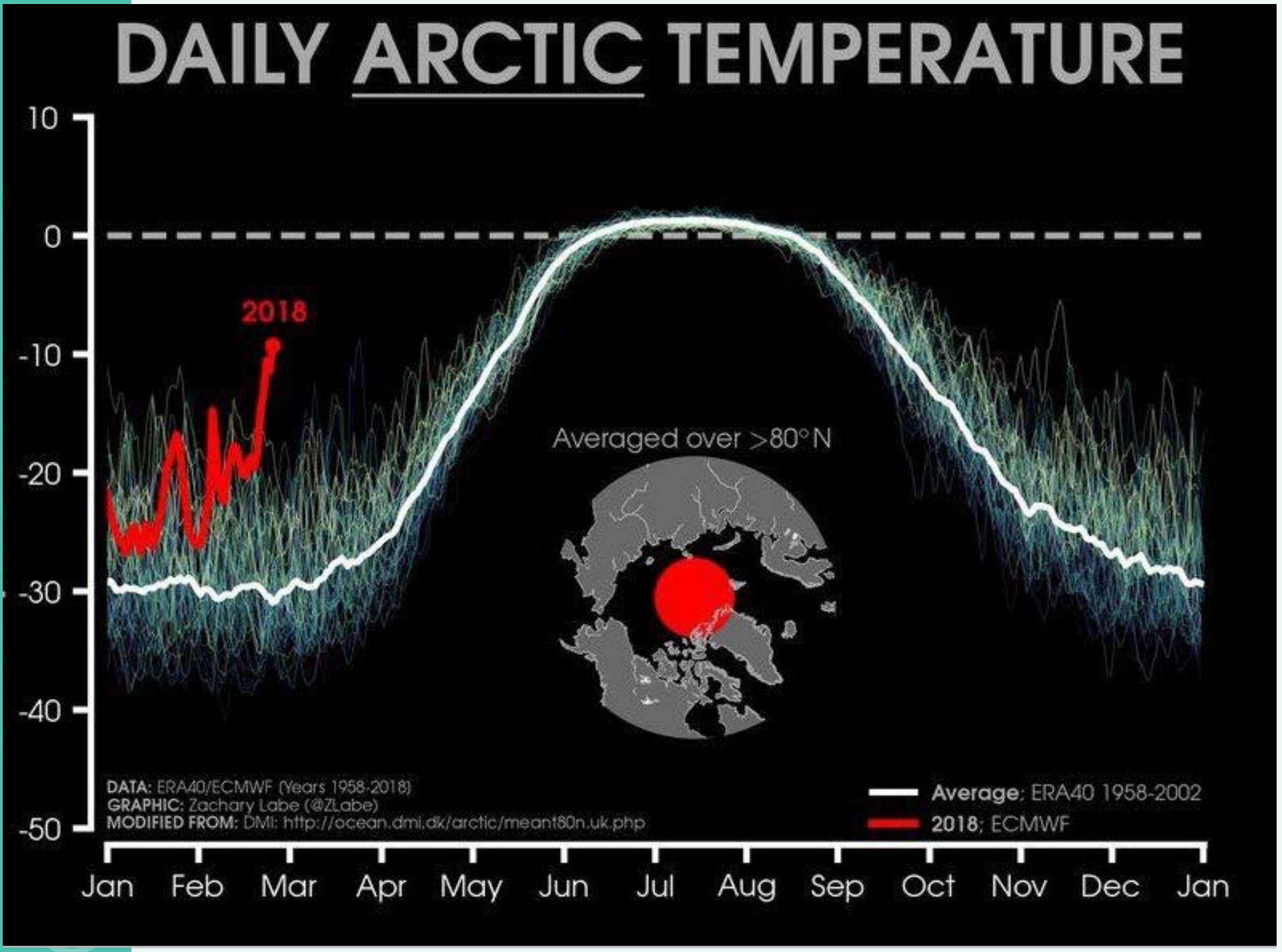
Land use change and climate change: amplified consequences for health

Prof Barend Erasmus
www.wits.ac.za/gci



Climate models

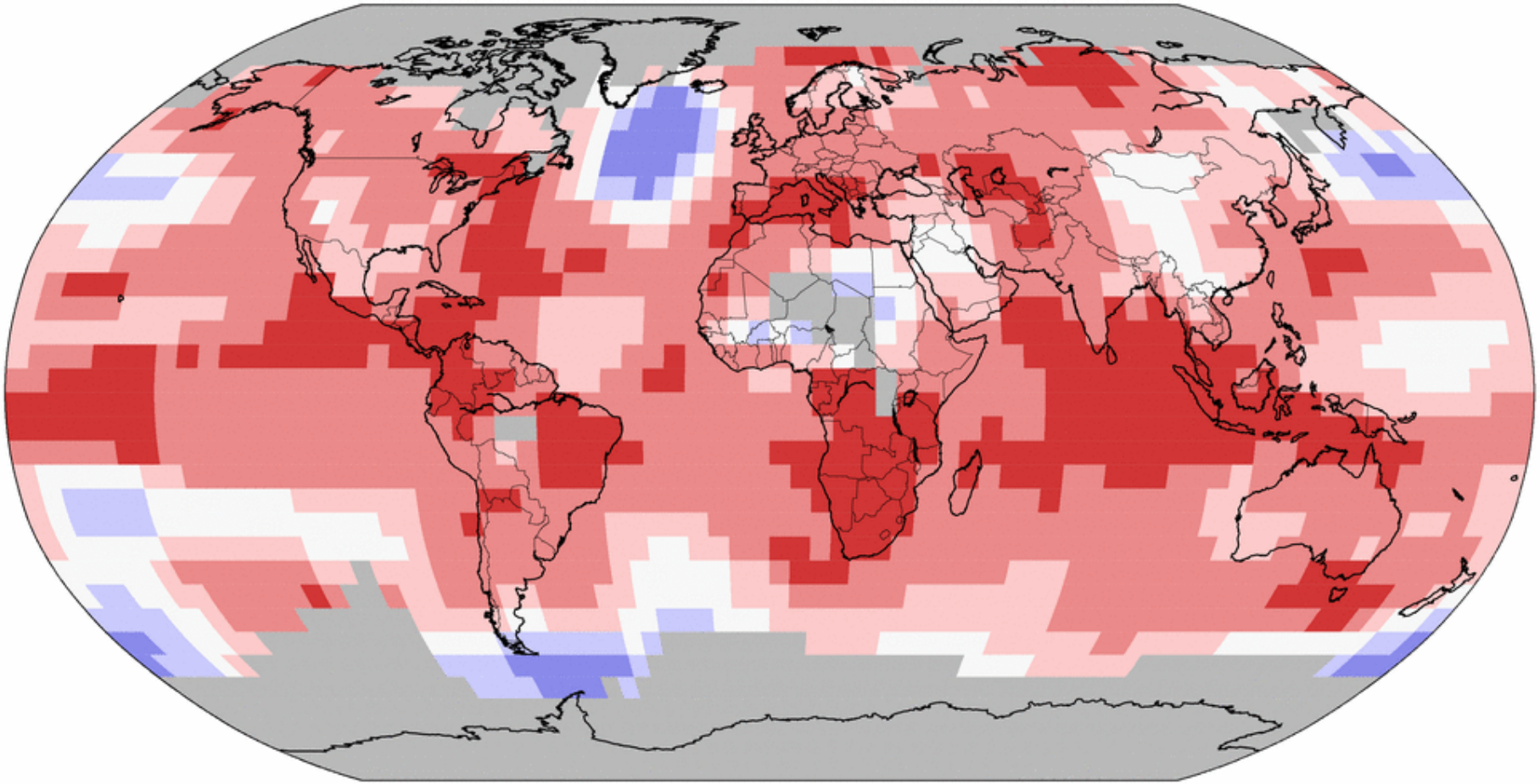
http://nca2014.globalchange.gov/report


DAILY ARCTIC TEMPERATURE
10
0
-10
-20
-30
-40
-50
2018
Averaged over >80° N
DATA: ERA40/ECMWF (Years 1958-2018)
GRAPHIC: Zachary Labe (@ZLabe)
MODIFIED FROM: DMI: http://ocean.dmi.dk/arctic/meant80n.uk.php
Average: ERA40 1958-2002
2018: ECMWF
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan

Land & Ocean Temperature Percentiles Dec 2015–Feb 2016

NOAA's National Centers for Environmental Information

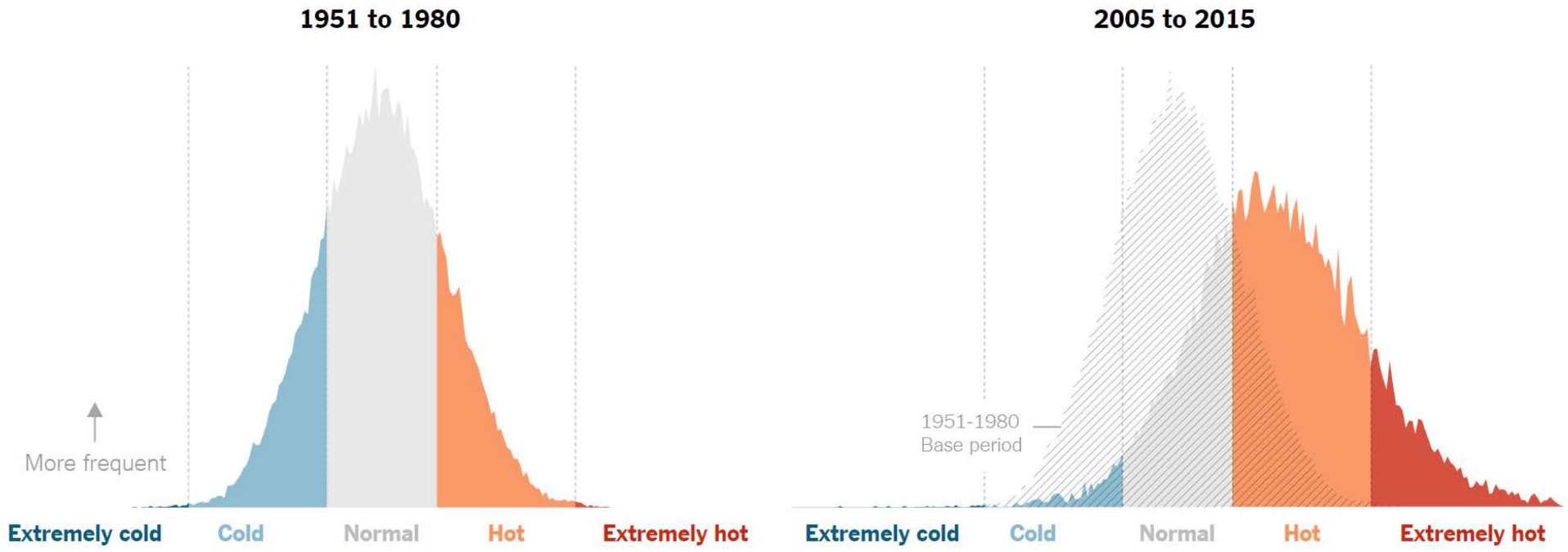
Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



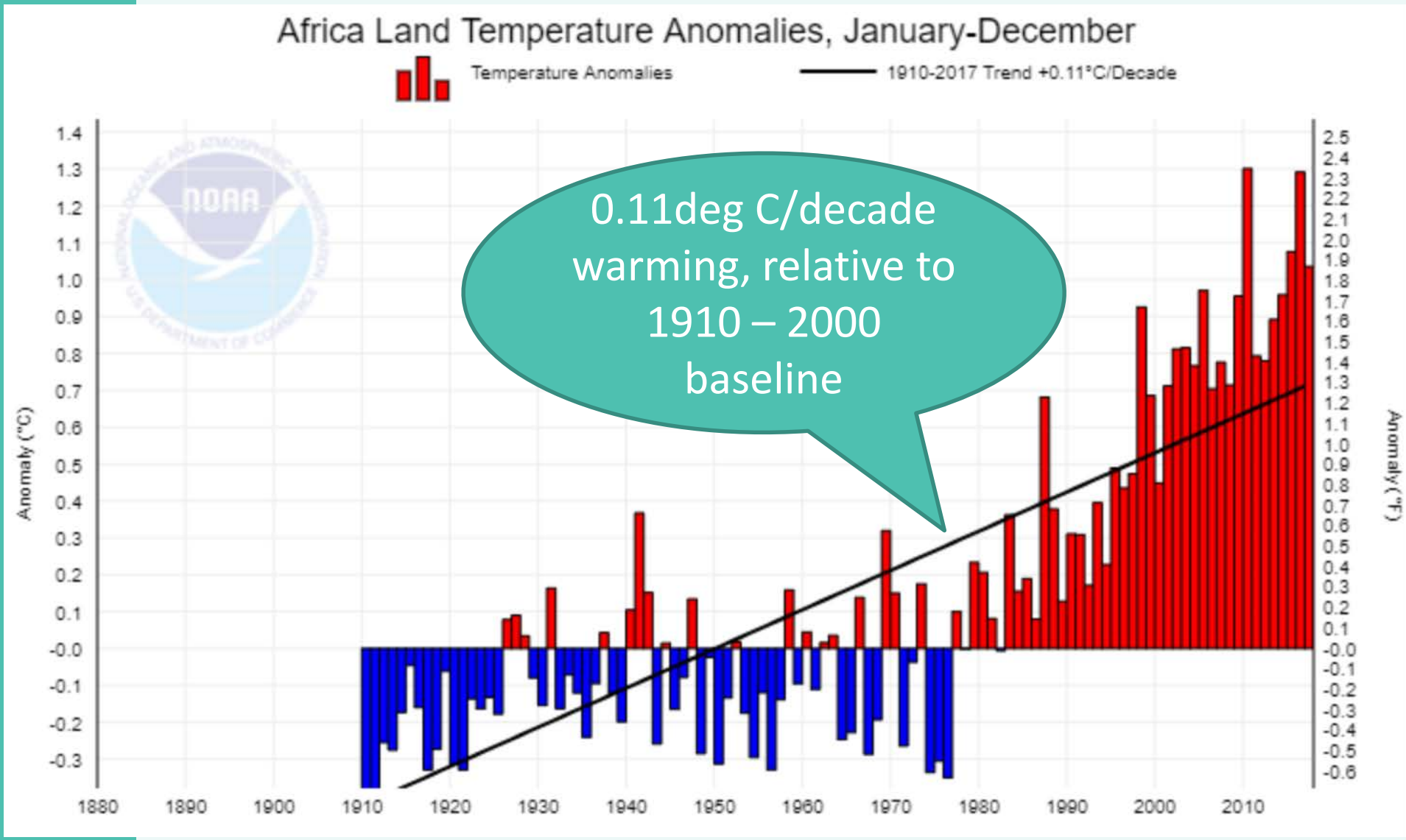
Record Coldest | Much Cooler than Average | Cooler than Average | Near Average | Warmer than Average | Much Warmer than Average | Record Warmest

Mon Mar 14 07:22:20 EDT 2016

Shift in observed variance and means of northern hemisphere summer temperatures



Dr James Hansen, Columbia University, published https://www.nytimes.com/interactive/2017/07/28/climate/more-frequent-extreme-summer-heat.html



NOAA National Centers for Environmental information, Climate at a Glance: Global Mapping, published February 2018, retrieved on March 6, 2018 from http://www.ncdc.noaa.gov/cag/

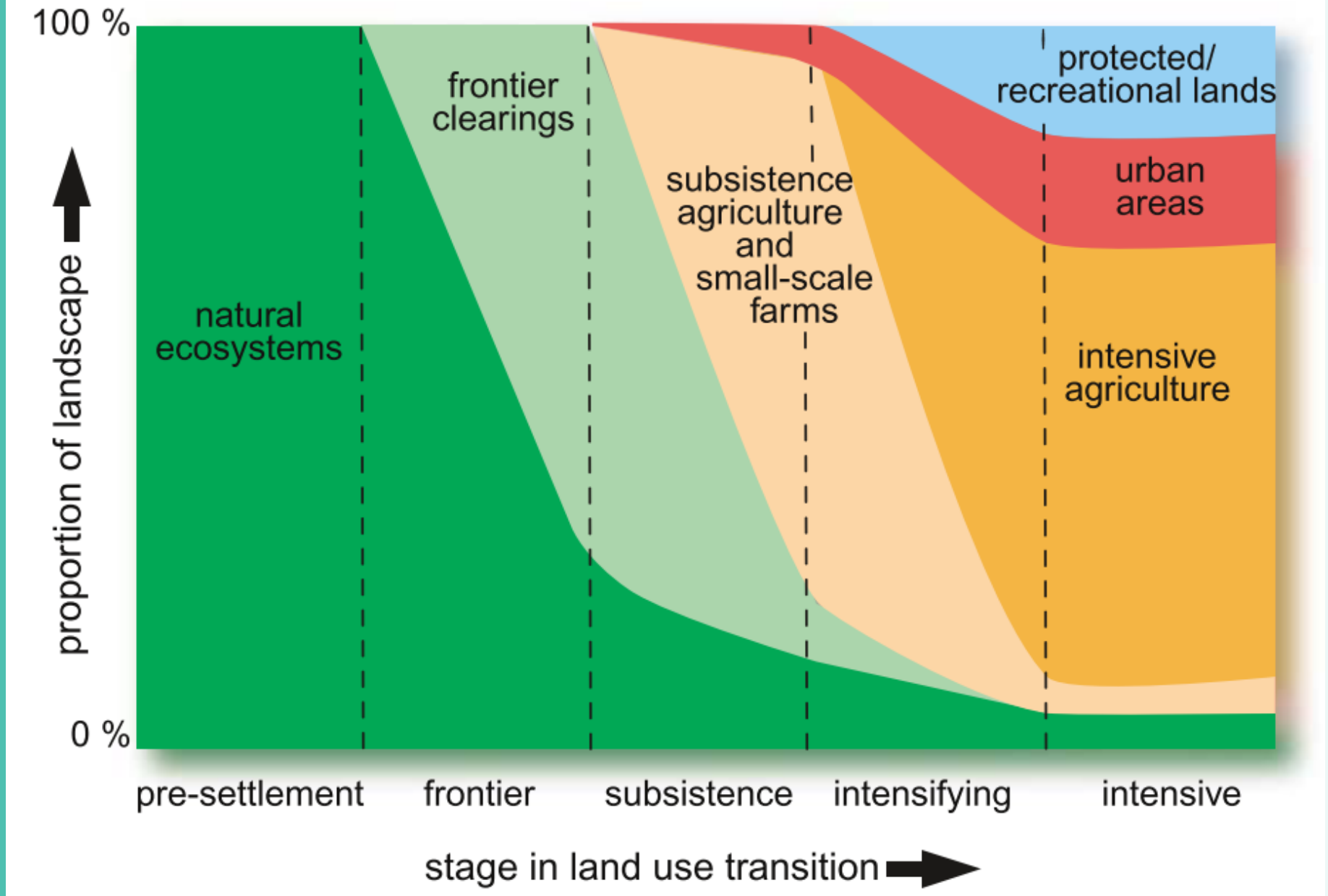
Dangerous climate change: ~2 ºC (and in some places, 1.5 ºC)

- Relative to 20th century average, global **land** temperatures:
  - 2015: +1.35 ºC
  - 2016: +1.45 ºC
  - 2017: +1.33 ºC
  - 2018: +1.29 ºC
  - 2019 (YTD): +1.46ºC
- South Africa
  - Warms at double the global rate, predicted, and observed.

NOAA National Centers for Environmental information, Climate at a Glance: Global Mapping, published February 2018, retrieved on March 6, 2018 from http://www.ncdc.noaa.gov/cag/

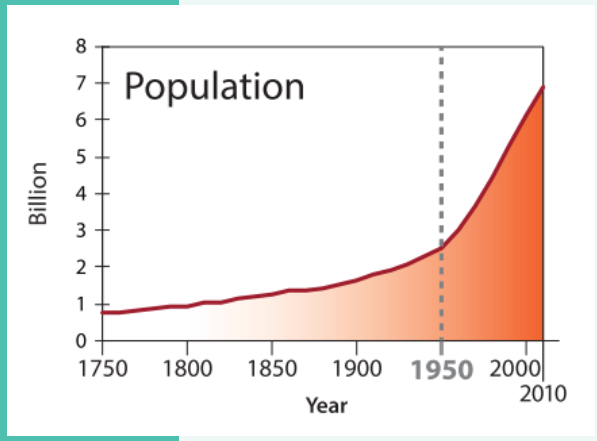
Land use

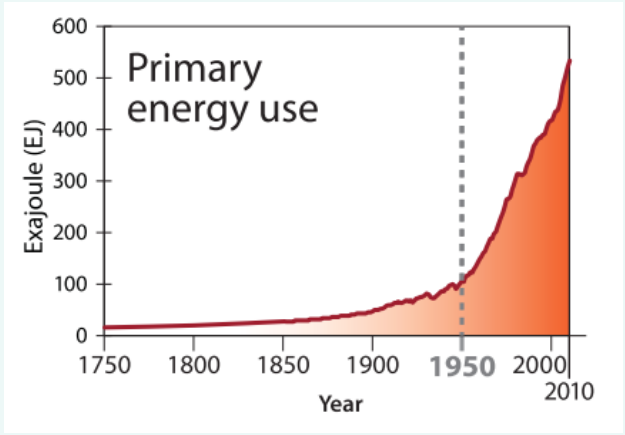
- Intensification
  - Same use (e.g. agriculture), but more intense (e.g. free roam cattle vs feedlot cattle)
- Change
  - Different use (e.g. grazing lands, changes into settlements)

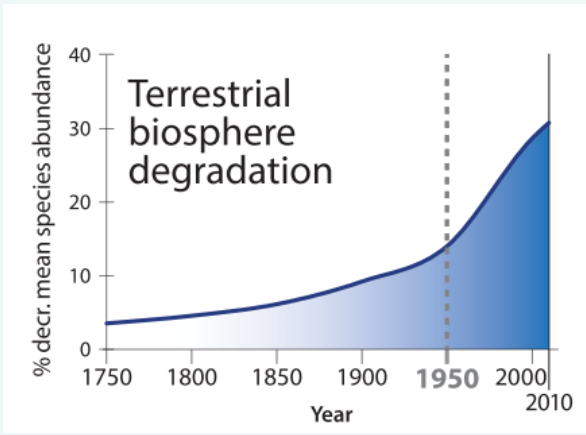


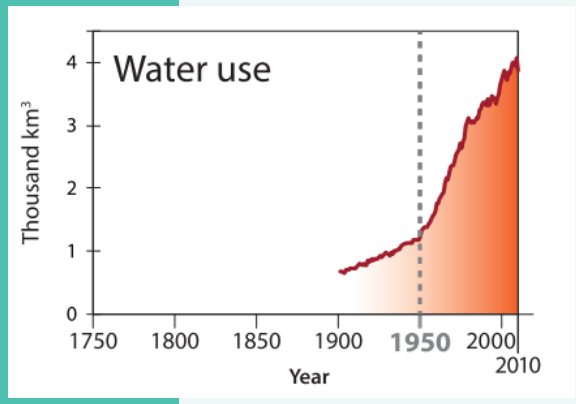
Foley, J. A. J. A., et al. (2005). Global Consequences of Land Use. *Science*, *309*(5734), 570–574. https://doi.org/10.1126/science.1111772

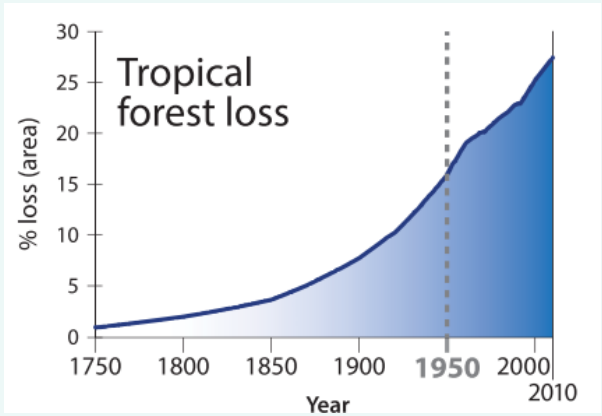
Anthropocene: new epoch

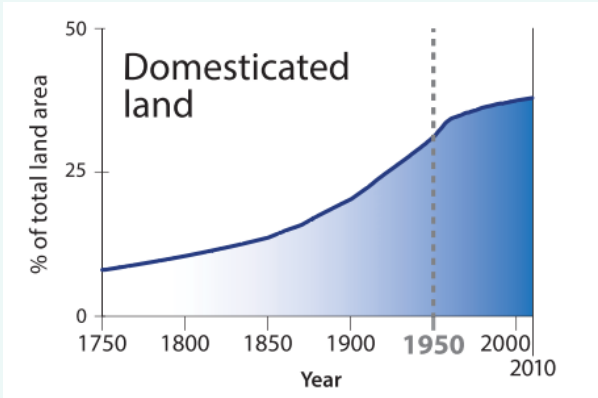




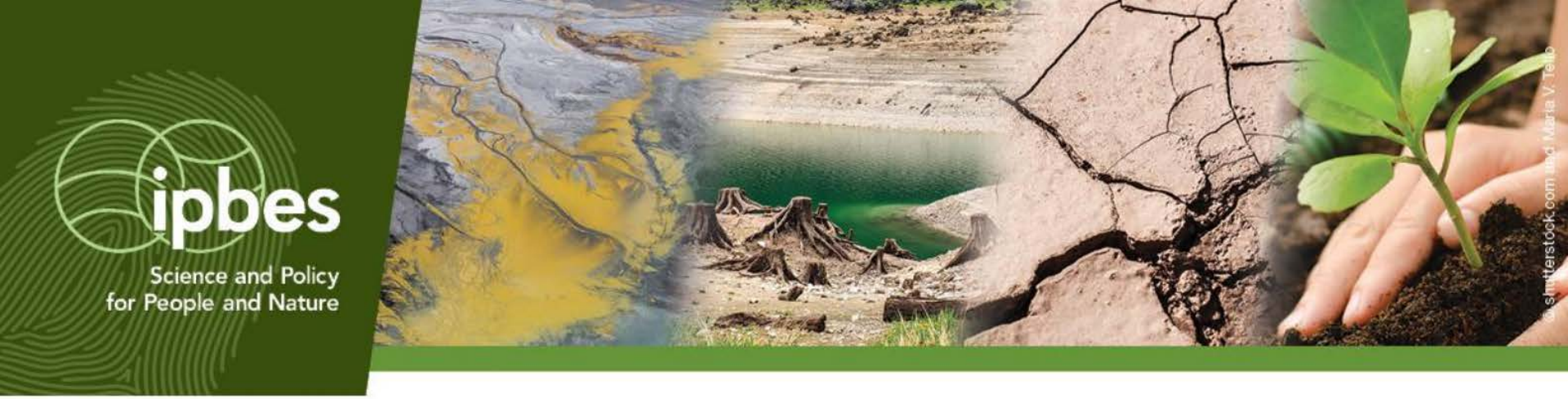








Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., & Ludwig, C. (2015). The trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review*, *2*(1), 81–98. https://doi.org/10.1177/2053019614564785

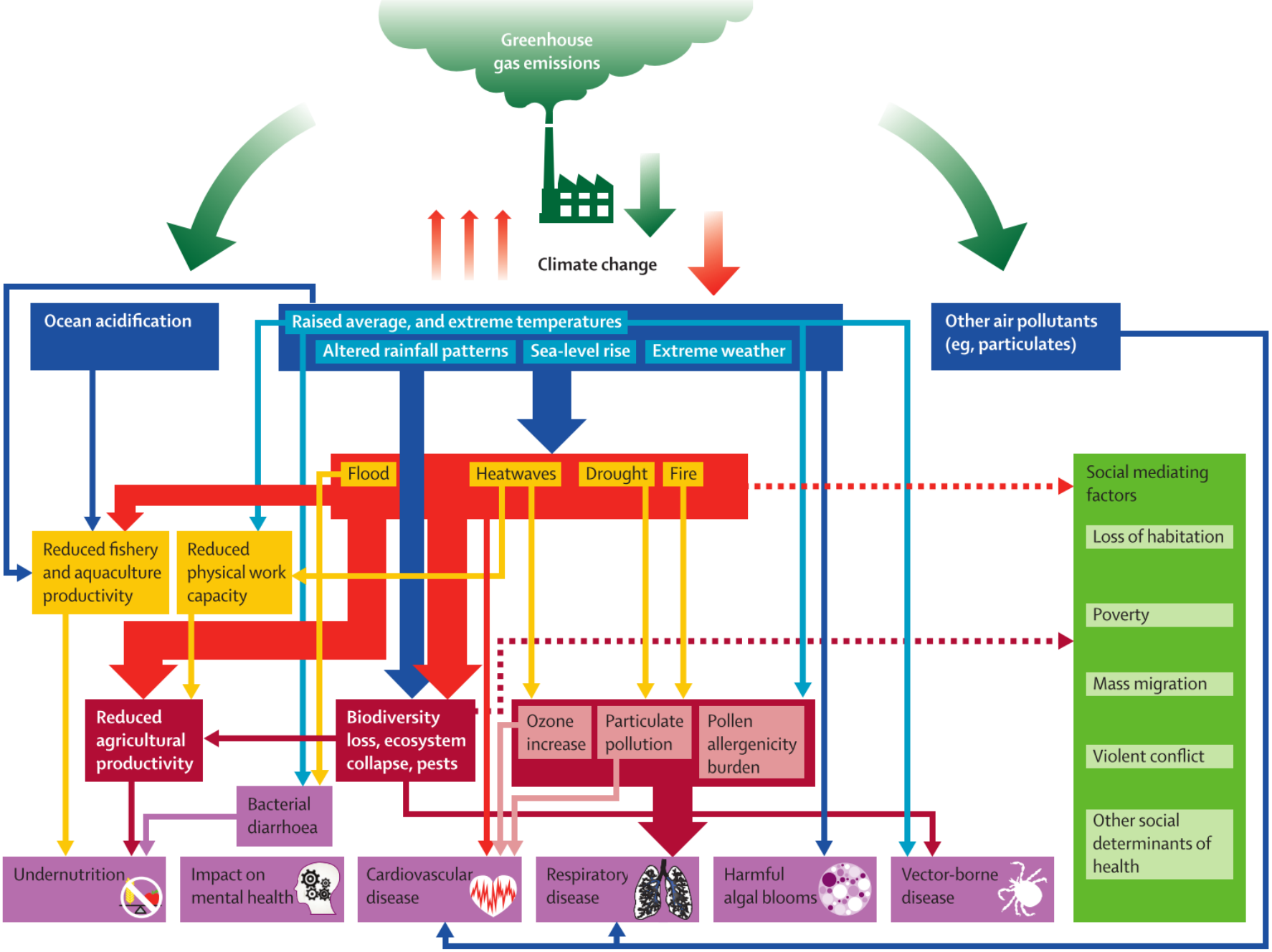


Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

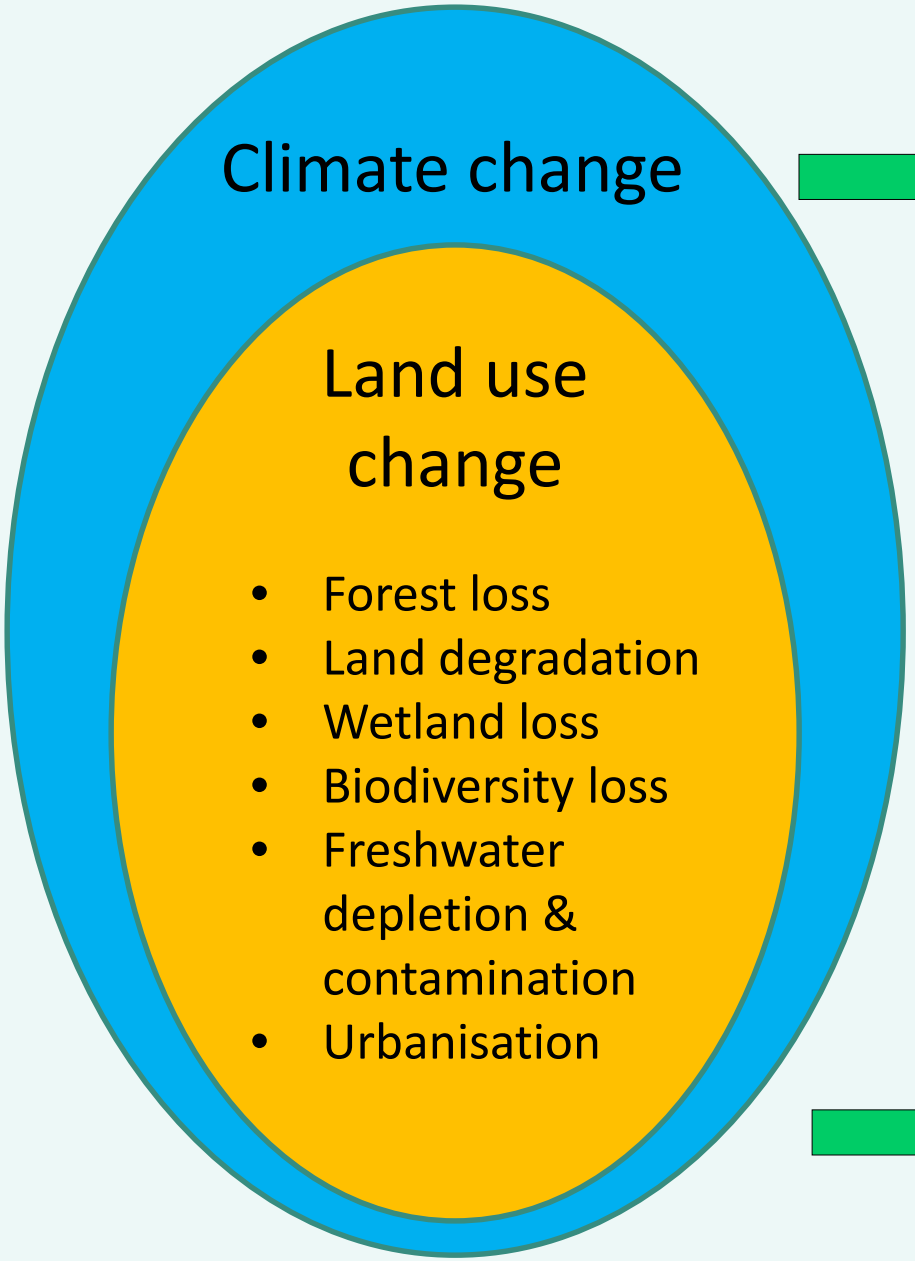
Worldwide Land Degradation and Restoration Assessment Report: A Primer

- Worlds 1st comprehensive evidence-based assessment report on land degradation will be launched in March 2018
- Best-available evidence for decision makers to make informed decisions to halt & reverse land degradation
- Prepared by more than 100 leading international experts from 45 countries over 3 years
- Draws on more than 3,000 scientific papers, Government reports, indigenous and local knowledge & other sources
- Improved by over 7,300 comments from more than 200 external reviewers, including Governments
- Examines implications of land degradation for achieving SDGs, Aichi Targets & Paris Agreement

https://www.ipbes.net/assessment-reports/ldr



Watts, N., Adger, et al (2015). Health and climate change : policy responses to protect public health. *Lancet*, *386*, 1861–914. https://doi.org/10.1016/S0140-6736(15)60854-6



Direct health effects
- Floods
- Heat
- Water shortage
- Exposure to pollutants

Ecosystem mediated health effects
- Change in infectious disease risk
- Reduced food yields
- Mental health
- Cultural impoverishment

Indirect health effects
- Consequences of livelihood loss
- Population displacement
- Conflict
- Maladaptation

Adapted from: Whitmee, S et al. (2015). *The Lancet*, *386*(10007), 1973–2028.

Heat in cities

- Informal settlements
- Heat island effect
- Role of urban green spaces?

- Direct effect: for 1ºC above European city-specific threshold, 3.1% increase in mortality rate.

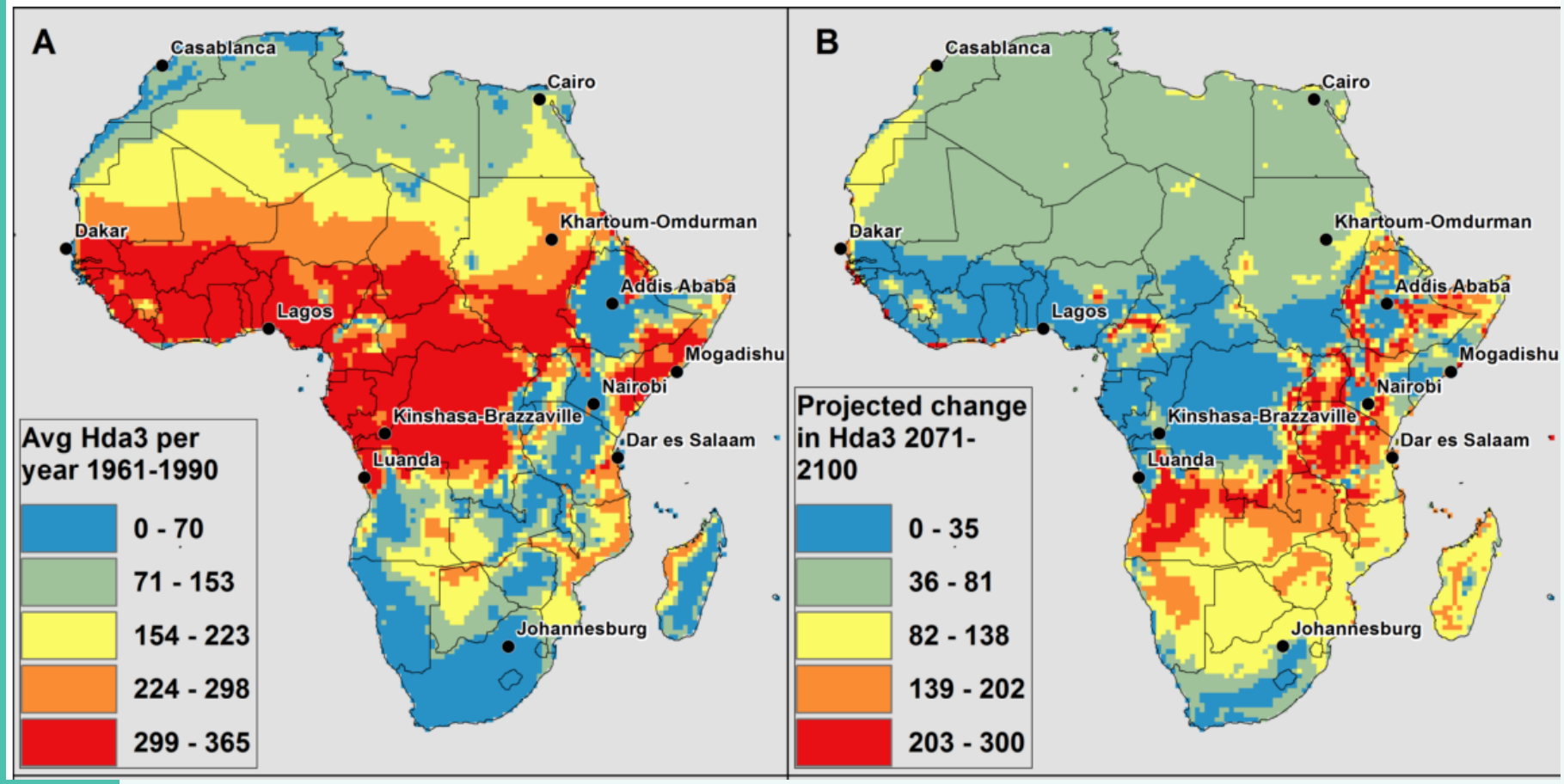
Baccini, M., Biggeri, A., Accetta, G., Kosatsky, T., Katsouyanni, K., Analitis, A., … Michelozzi, P. (2008). Heat effects on mortality in 15 European cities. *Epidemiology*, *19*(5), 711–719. https://doi.org/10.1097/EDE.0b013e318176bfcd

Bad news for golfers...

- By 2070, 5 – 14 days per year will be too dangerous for outdoor leisure activity in Perth, compared to 1 day in 5 years at the moment.
- By 2070, for unacclimatised people, manual labour will be dangerous 15-26 day per year, compared to 1 day per year at present

Maloney, S. K., & Forbes, C. F. (2011). What effect will a few degrees of climate change have on human heat balance? Implications for human activity. *International Journal of Biometeorology*, *55*(2), 147–160. https://doi.org/10.1007/s00484-010-0320-6

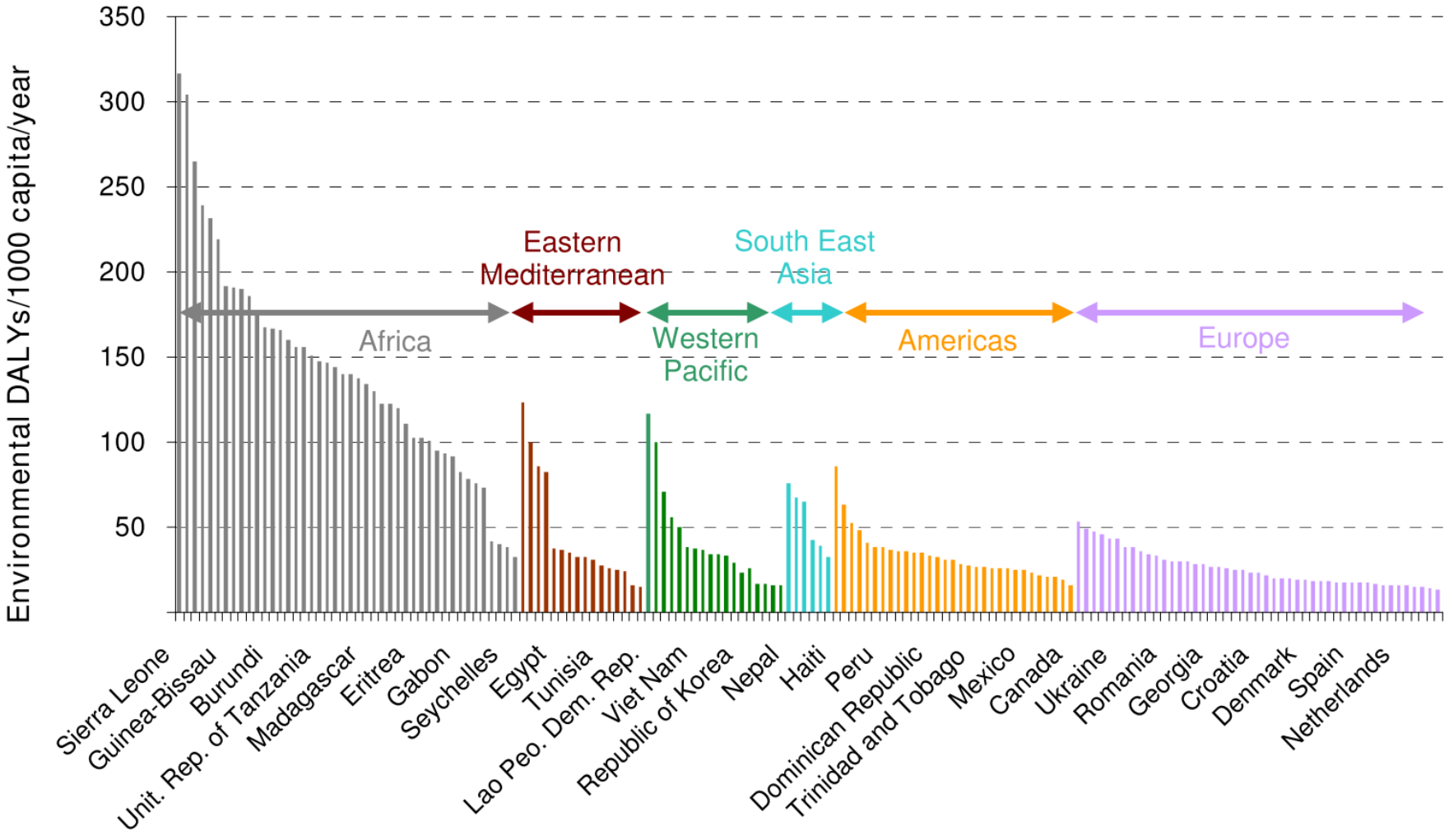
#days with apparent temperature >32ºC



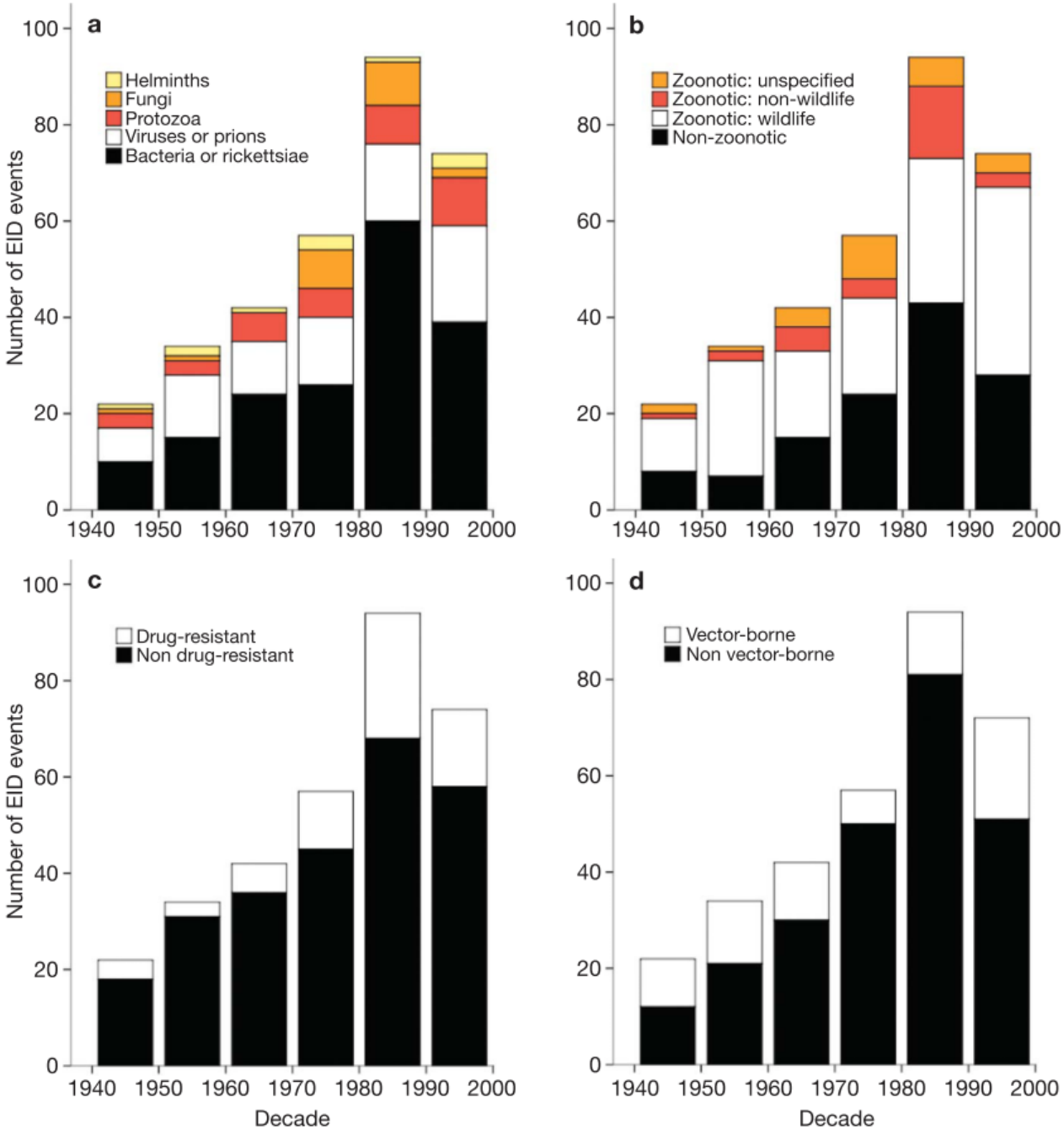
Implications for communities with pre-existing vulnerabilities: Informal settlements, manual labourers, subsistence farmers, rain-fed agriculture

Garland et al (2015). Regional projections of extreme apparent temperature days in Africa and the related potential risk to human health. *International Journal of Environmental Research and Public Health*, *12*(10), 12577–12604.

Disability-adjusted life years (DALYs) lost per 1000 people per year as a result of a degraded environment



Prüss-Ustün, A., Bonjour, S., & Corvalán, C. (2008). The impact of the environment on health by country: a meta-synthesis. *Environmental Health : A Global Access Science Source*, *7*, 7. https://doi.org/10.1186/1476-069X-7-7



Increase in emerging infectious disease by decade.

No conclusive climate link.

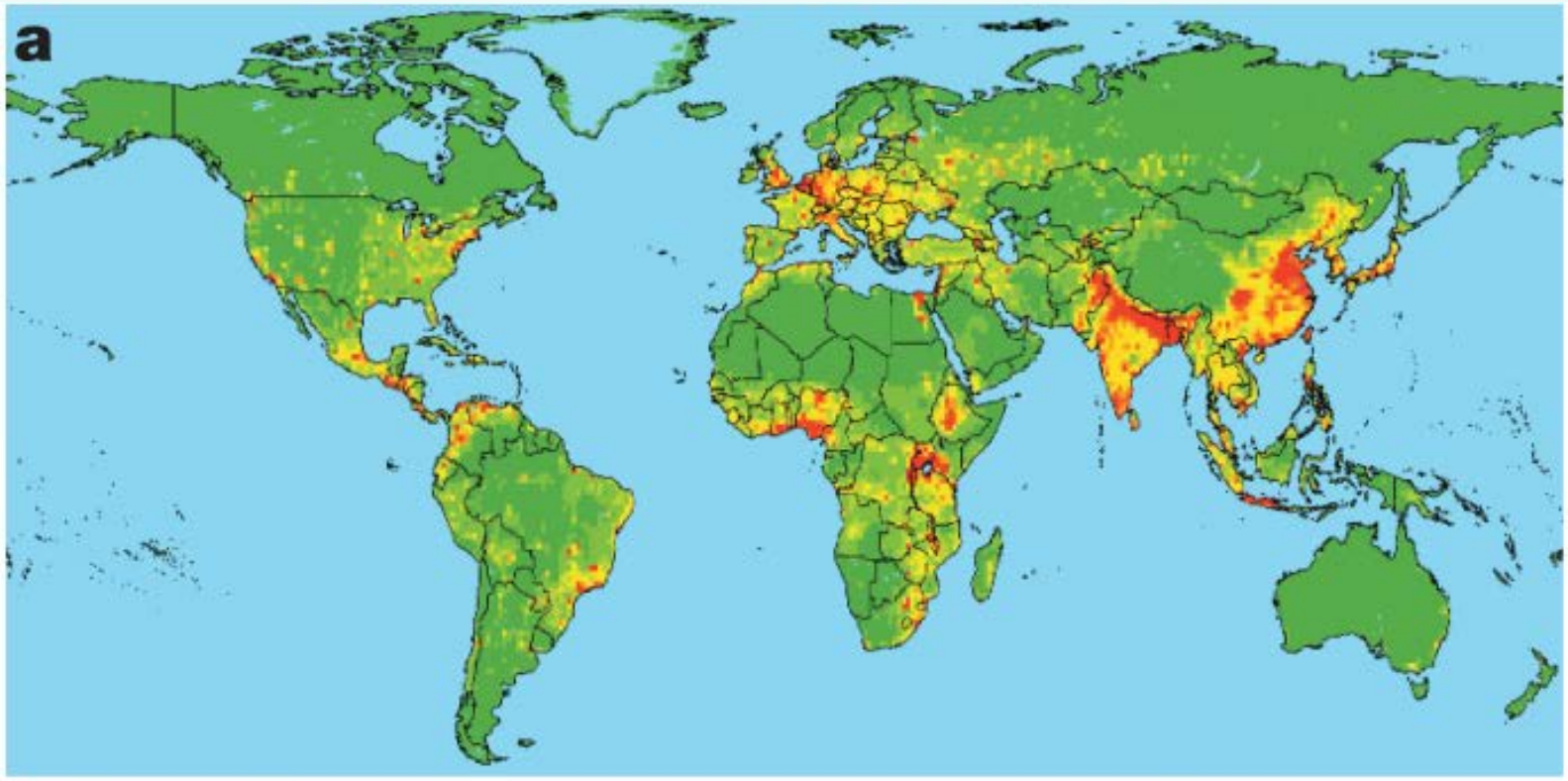
Jones, K. E., et al (2008). Global trends in emerging infectious diseases. *Nature*, *451*(7181), 990–993.

Changes in infectious disease exposure due to land use change and climate

- Changes in density: forest loss, malaria and climate
- Changes in exposure pathways: bushmeat, road clearing, urbanisation, climate (?)
- Changes in life cycles: higher temp due to deforestation and/or climate change, quicker life cycle
- Changes in species composition: biodiversity dilution effect
- Changes in env, trigger genetic changes: pig-duck farms, Nipah virus

Myers, S. S., & Patz, J. A. (2009). Emerging Threats to Human Health from Global Environmental Change. *Annual Review of Environment and Resources, 34*, 223–252. https://doi.org/10.1146/annurev.environ.033108.102650

Predicted hotspots of zoonotic disease emergence from wildlife



"Finally, our analysis suggests that efforts to conserve areas rich in wildlife diversity by reducing anthropogenic activity may have added value in reducing the likelihood of future zoonotic disease emergence."

Jones, K. E., Patel, N. G., Levy, M. A., Storeygard, A., Balk, D., Gittleman, J. L., & Daszak, P. (2008). Global trends in emerging infectious diseases. *Nature*, *451*(7181), 990–993.

Complex, linked systems have surprises: lessons from mass mortality events (MME) in animals

- MME: rapid, catastrophic demographic events
- Review: 727 publications on 2407 animal popula
- Magnit h and marine
- Causal oxicity and mu

Fey, S. B. et al (2015). Recent shifts in the occurrence, cause, and magnitude of animal mass mortality events. *Proceedings of the National Academy of Sciences*, *112*(4), 1083–1088. https://doi.org/10.1073/pnas.1414894112

Climate & land use interactions, for health - limitations in the literature:

- Much of the existing research has a narrow focus on a single health outcome
- Research methods and analyses that can deal with multiple causes and complex interactions are needed
- What are the limits to human adaptation to these impacts on health?
- Whose health matters?
- More potential for unexpected systems' behaviour

Myers, S. S. et al (2013). Human health impacts of ecosystem alteration. *PNAS*, *110*(47), 18753–18760. https://doi.org/10.1073/pnas.1218656110

Chersich, M.F. et al (2018) Impacts of climate change on health and wellbeing in South Africa. International Journal of Environmental Research and Public Health, 15(1884): 1 – 14