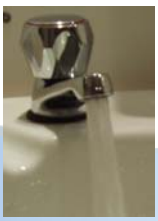
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Applied geoscience for our changing Earth

Water scarcity

An international perspective

Prof Alan MacDonald



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Are we running out of fresh water?

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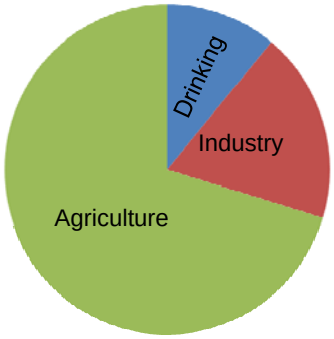
It depends....

Withdrawals



Source FAO 2010

- What do you want to use it for...
- 60,000 km^3 annual renewable freshwater
- 4,000 km^3 annual withdrawals
- Ignores rain fed agriculture – so much more used

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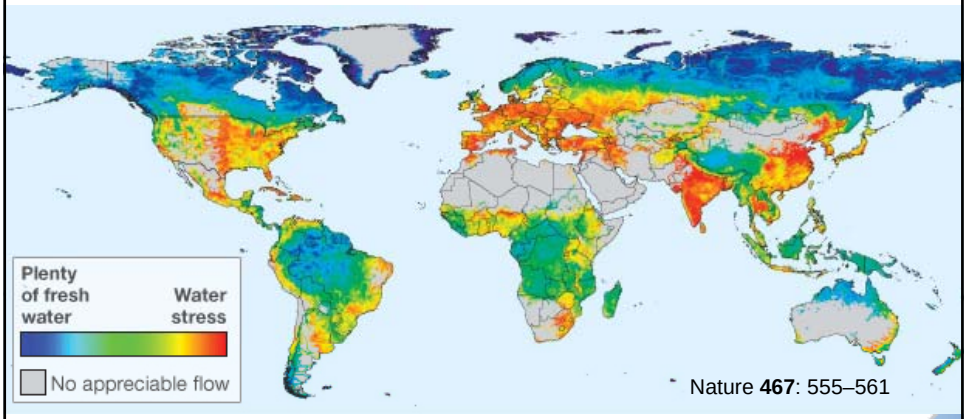
global water stress...

(population, access and water availability)



Nature **467**: 555–561

"people should be even more worried if you start to account for climate change and population growth" BBC September 2010

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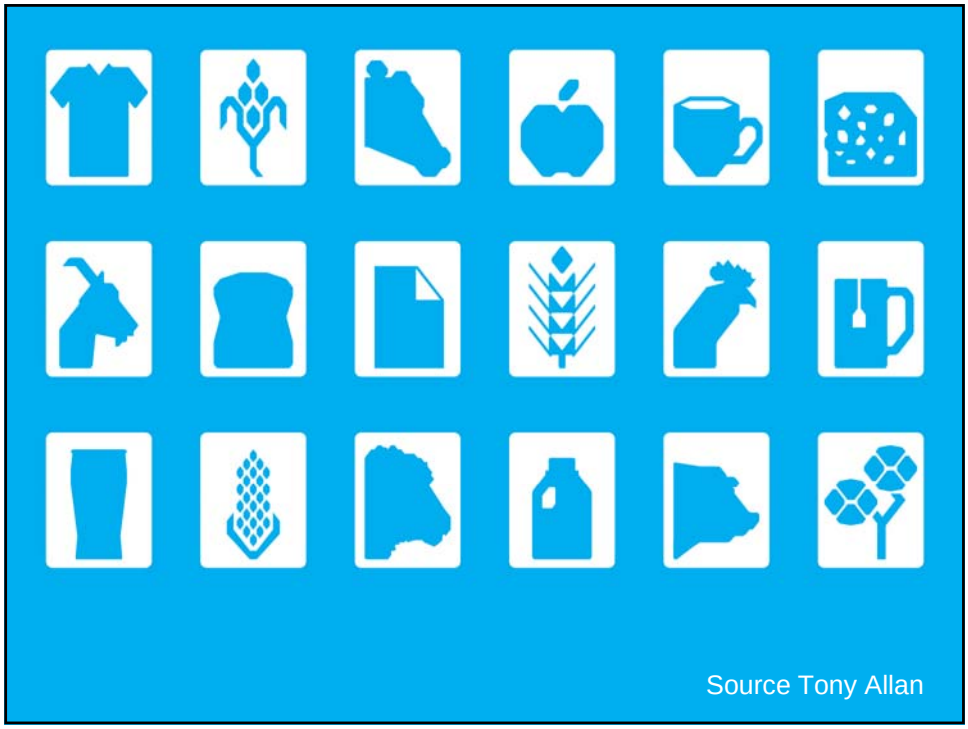
Source Tony Allan

1 glass of milk
200 litres
1 cup of tea
35 litres
1 cup of coffee
140 litres
1 orange
50 litres
1 apple
70 litres
1 glass of wine
120 litres
1 potato
25 litres
1 hamburger
2400 litres
waterfootprint.org
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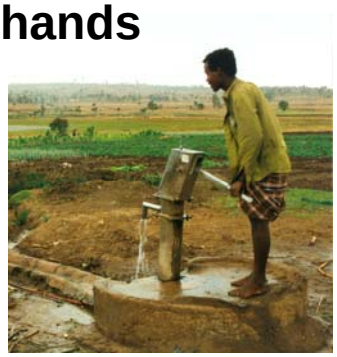
Water future is in our hands

9 billion



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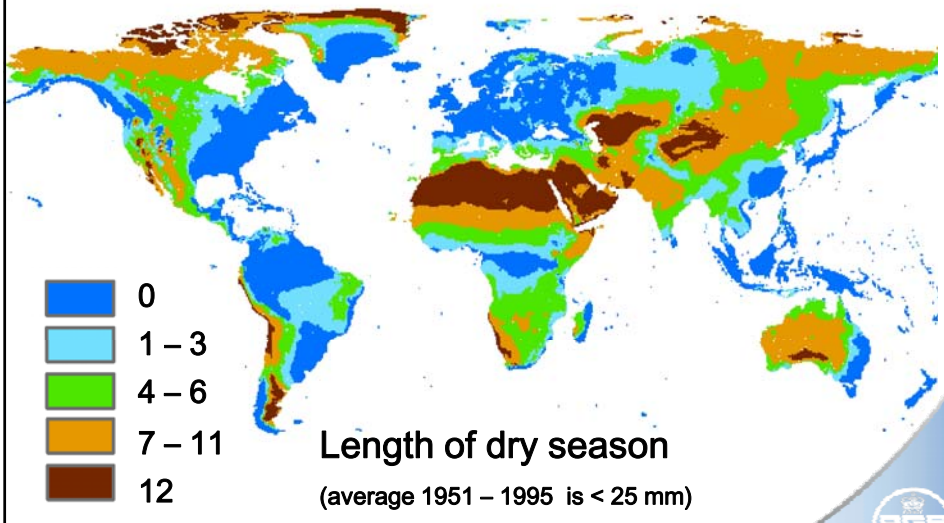
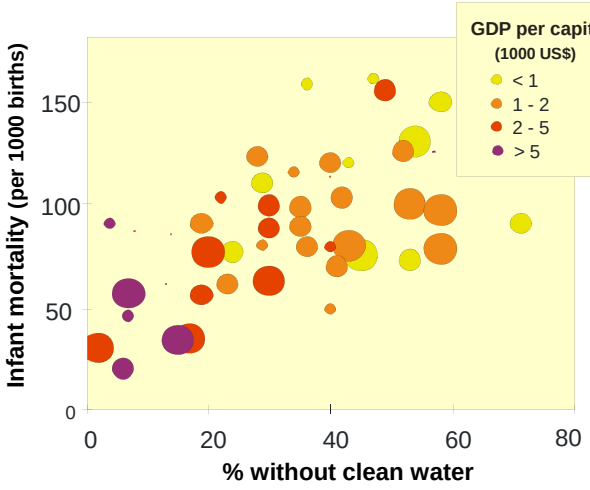
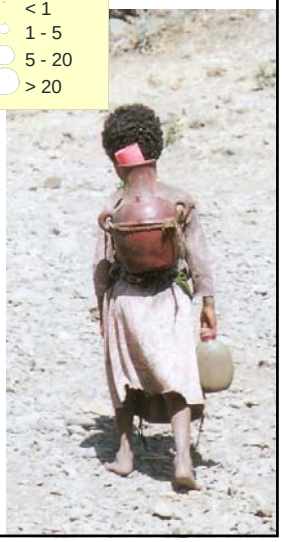
Back to basics



© NERC All rights reserved Source: Hunter et al. PLOS Medicine **7**(11)

Improved access to water: fundamental





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Source: Hunter et al. PLOS Medicine **7**(11)

Irrigation: small-scale and/or intensive

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Source: Calow et al 2010 Ground Water 48, 246-256

So where does the water come from?

... groundwater

Can meet dispersed rural demand

Naturally protected

Generally good natural quality

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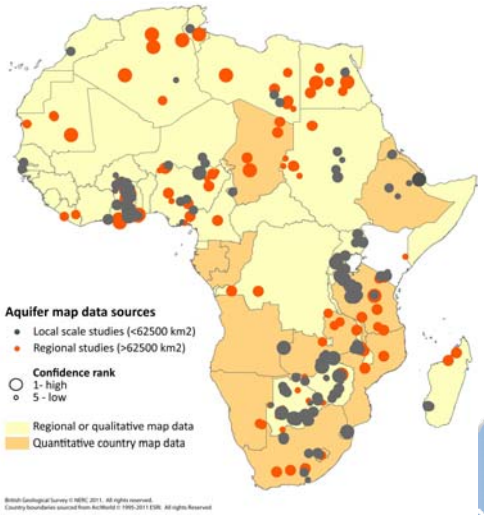
Looking deeper: groundwater

DFID grant 2010-11: to improve understanding of groundwater across Africa and its resilience to climate change



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DFID Department for International Development

UCL

odi Overseas Development Institute

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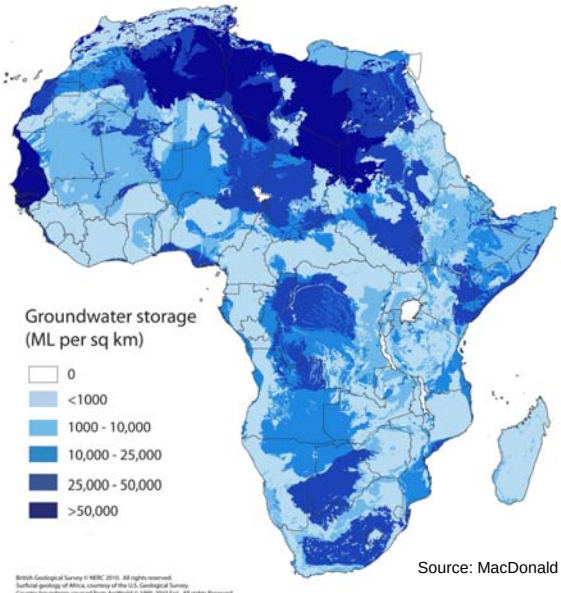
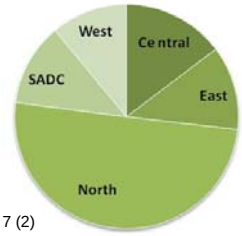
Volumes of groundwater storage

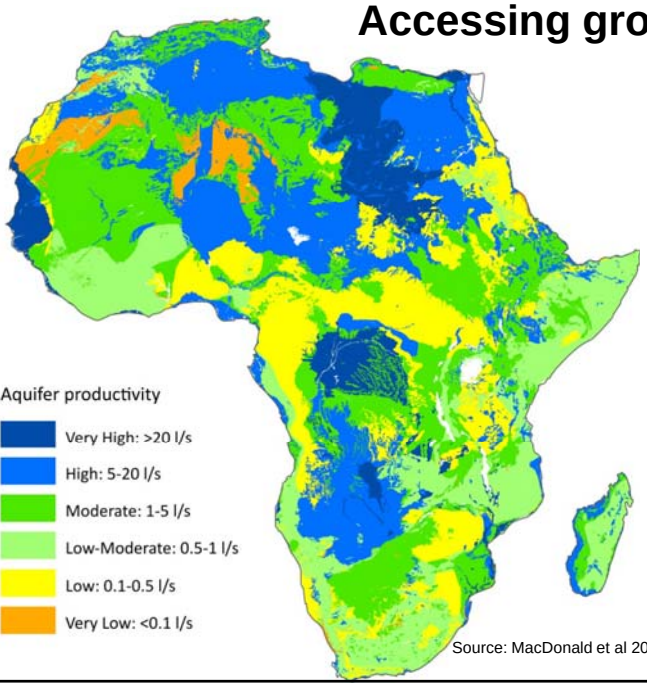


1. Overall storage high: 0.5 - 1 million km^3
2. Dominated by north African basins
3. But often 20 times more storage than used annually by a handpump

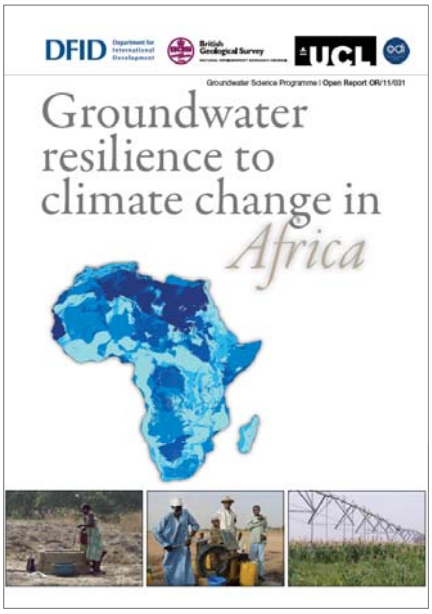


Source: MacDonald et al 2012 ERL 7 (2)

Accessing groundwater



Source: MacDonald et al 2012 ERL 7 (2)



www.bgs.ac.uk

New project Indo-Gangetic Basin: 2012 – 2014

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What about renewability?

Headlines – recharge will decline with climate change

Evidence much more complicated - recharge could increase

Importance of natural stores and episodic recharge

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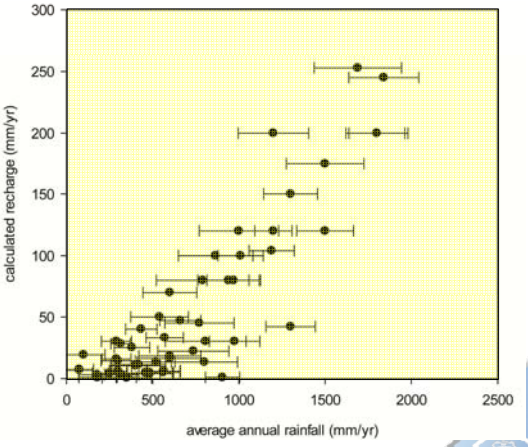
Recharge vs rainfall for 80 African studies

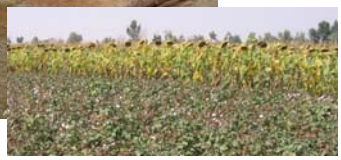


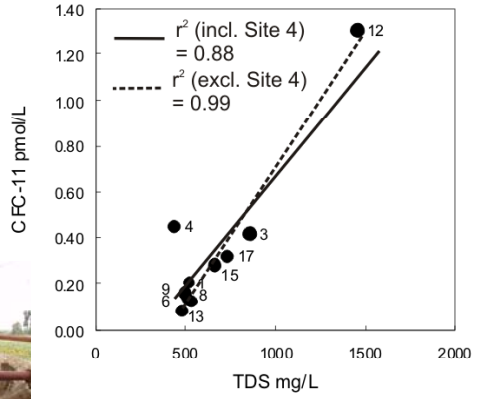
Source: MacDonald et al 2011. BGS OR/11/031

Water quality issues – from agriculture

Salinisation (e.g. Mongolia)

Nitrate / pesticides





Source: Ó Dochartaigh et al 2010

Hydrogeology Journal18: 1939-1952

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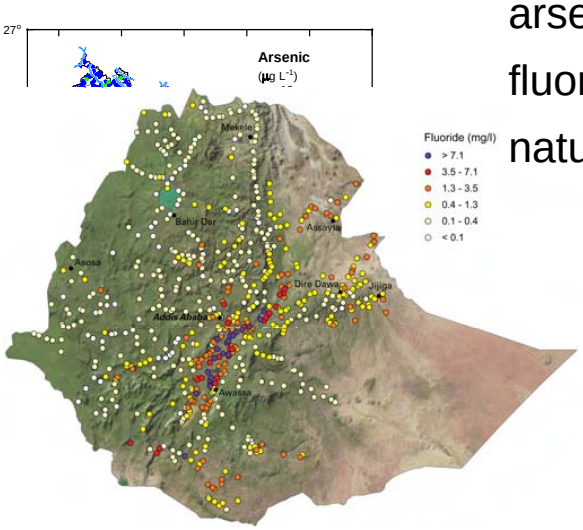
Water quality issues: natural



arsenic (e.g. Bangladesh)

fluoride (e.g Ethiopia)

natural salinity

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Summary

Water Scarcity – its complicated

Needs a thorough understanding of the water resources and processes

Don't ignore groundwater

Water security and water scarcity are different

Drinking water should always be found – Water for Food is the big user

Need to manage the water resources for others and future generations

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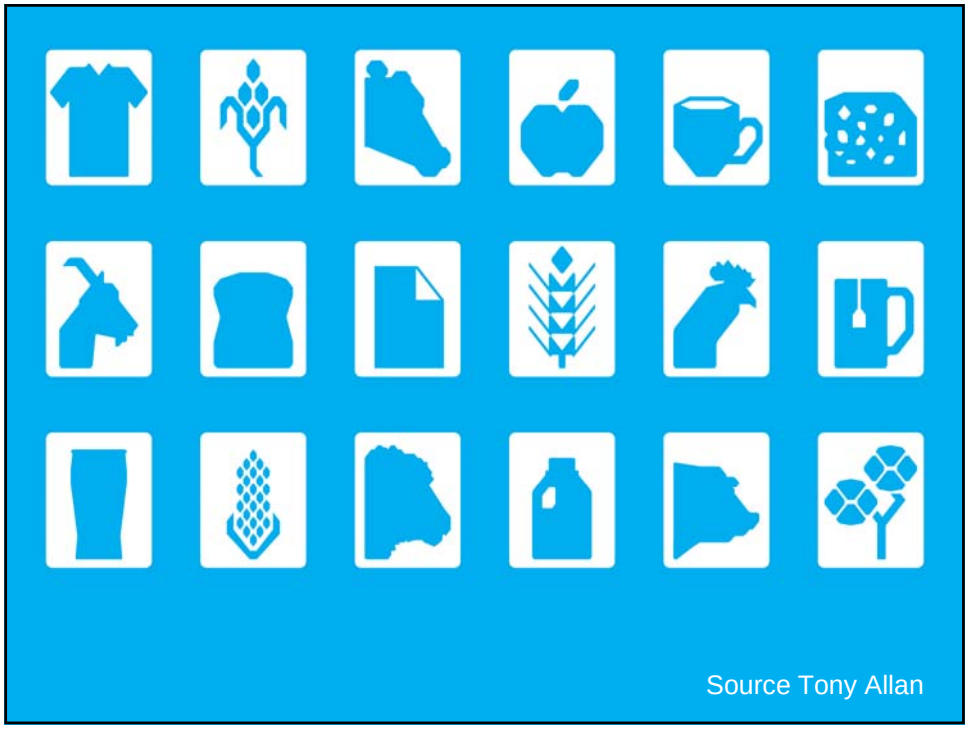
Source Tony Allan