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Federal Institute for Geosciences  
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# Managing the water buffer!

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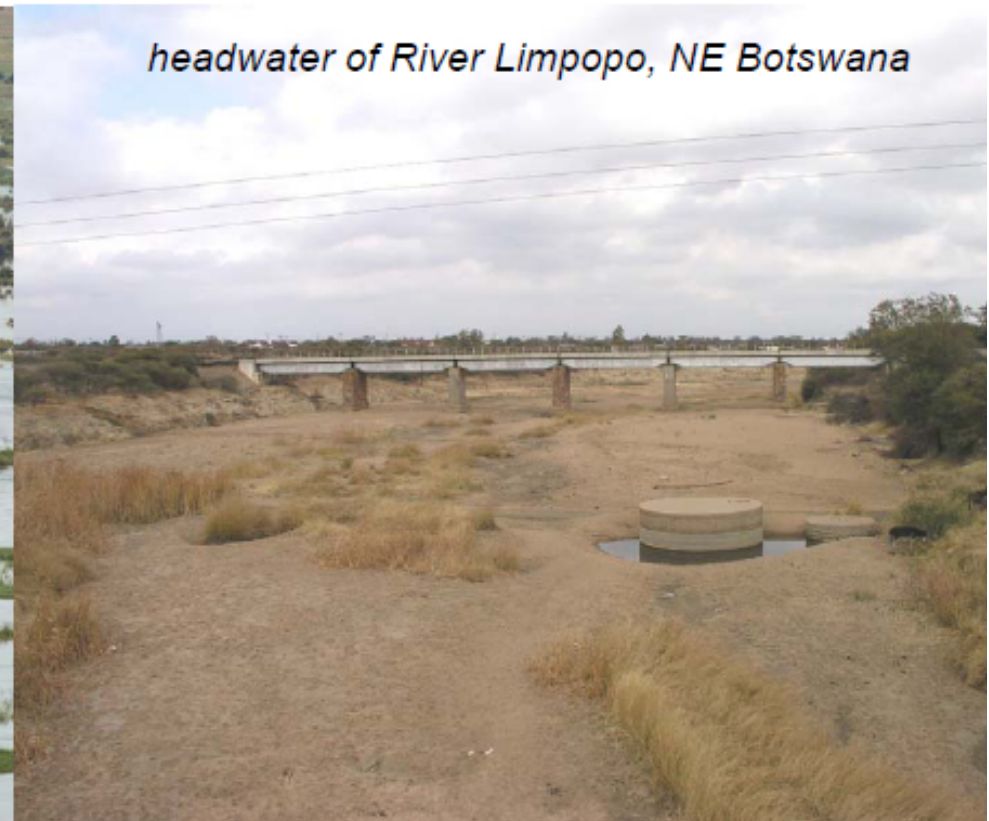
- fewer, low and medium intensity precipitation events
- more, very heavy precipitation events (*i.e.*, “extreme events”)

Allen and Ingram, 2002. *Nature* 419, 224-230  
Trenberth et al., 2003. *BAMS* 84, 1205-1216  
Mileham et al., submitted. *Hydrol. Sci. J.*

*lead to more variable river discharge and surface water levels*



*Mutarara District, Mozambique, 22 February 2007*



*headwater of River Limpopo, NE Botswana*



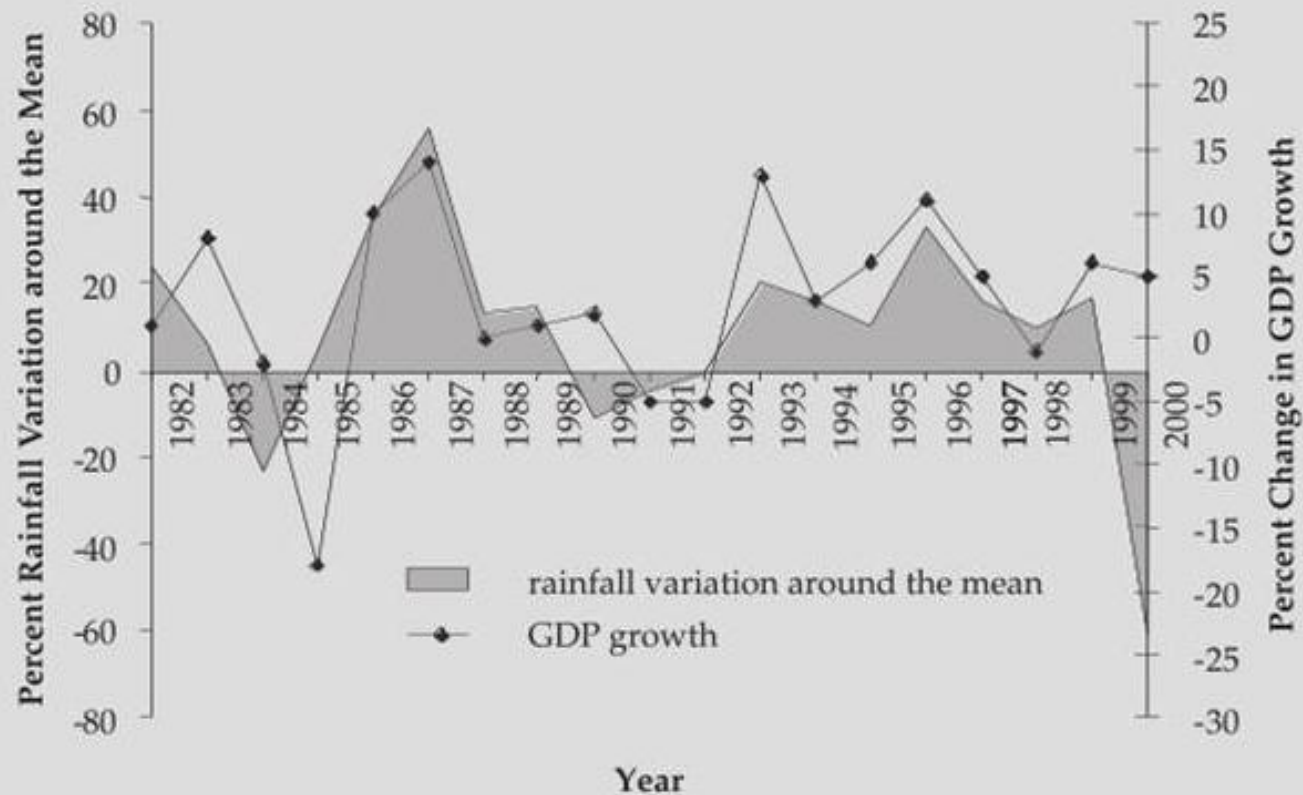
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## Rainfall variation and GDP



Source: Compiled from SIMA and African Rainfall and Temperature Evaluation System data.





# To ADAPT to climate change we need to manage the buffer

- **Recharge: Managing natural and artificial recharge**
- **Retention: Creating wet buffers in the basin**
- **Re-use: Extending the 'chain of uses'**



Photo: RAIN



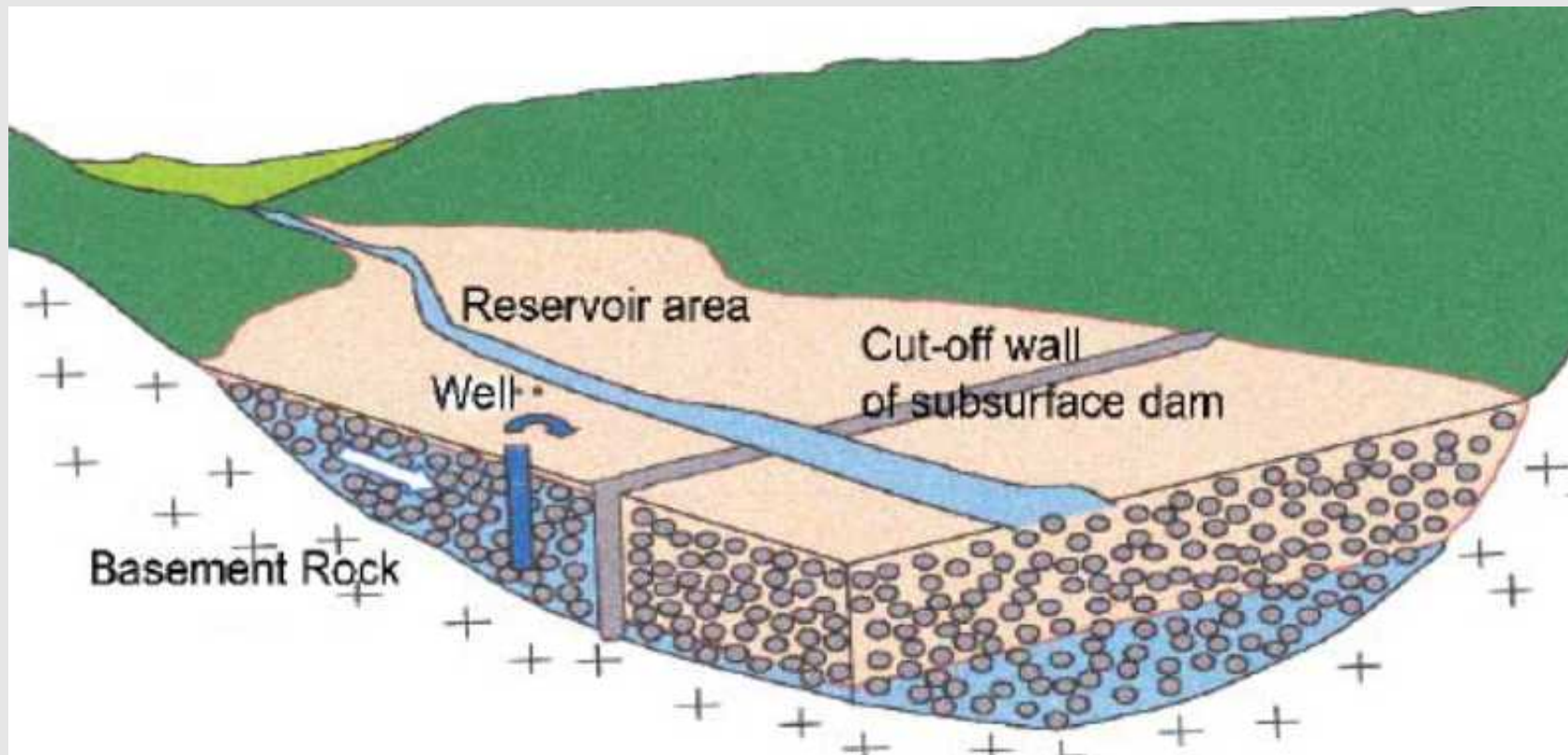
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## 3R = Recharge, Retention, Re-use



Conceptual diagram of a subsurface dam

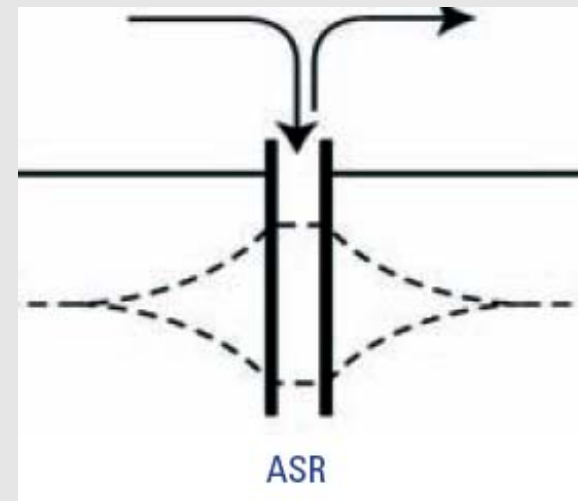
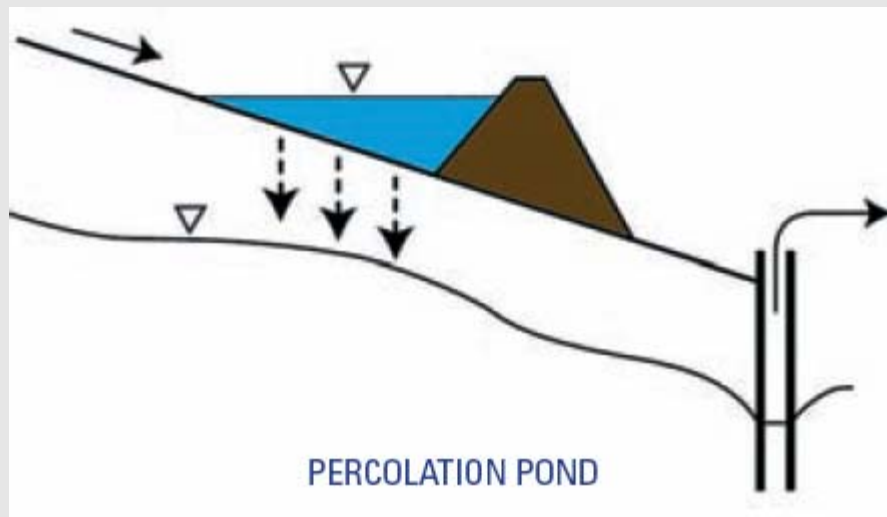
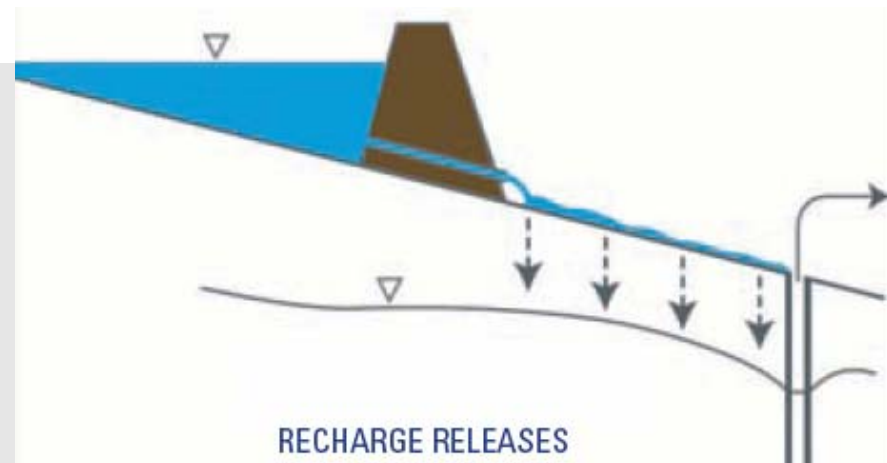
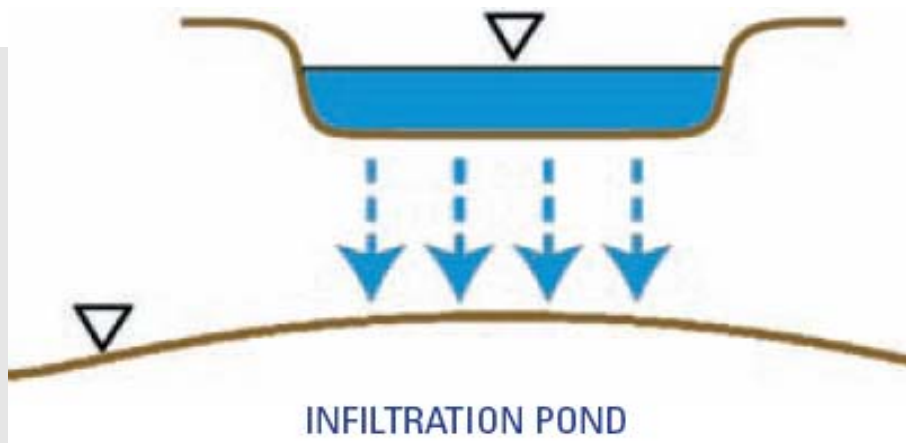
( Source: Vétérinaire sans frontier 2006)



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Source: Managed Aquifer Recharge (MAR) in semi-arid areas; Ian Gale and Peter Dillon, 2005



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## 3R Processes

- Identifying local needs
- Assessment at scale:
  - 3R potential mapping
  - Medium term climate information
- Link to regional planning
- Implementation and financing
- 3R: climate change adaptation + rain and floodwater harvesting + groundwater management
- 3R: dry and wet areas to adapt, sustain and improve water resources management for people, food and environment.







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## Sand Storage Dams, Kitui, Kenya

- Carefully create - in stages - a sandy aquifer behind the sand dam
- Store floodwater and increase local water levels







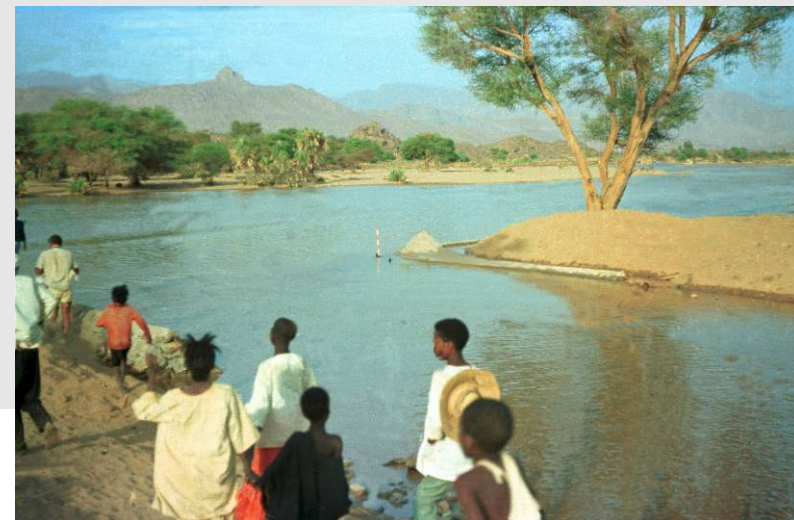
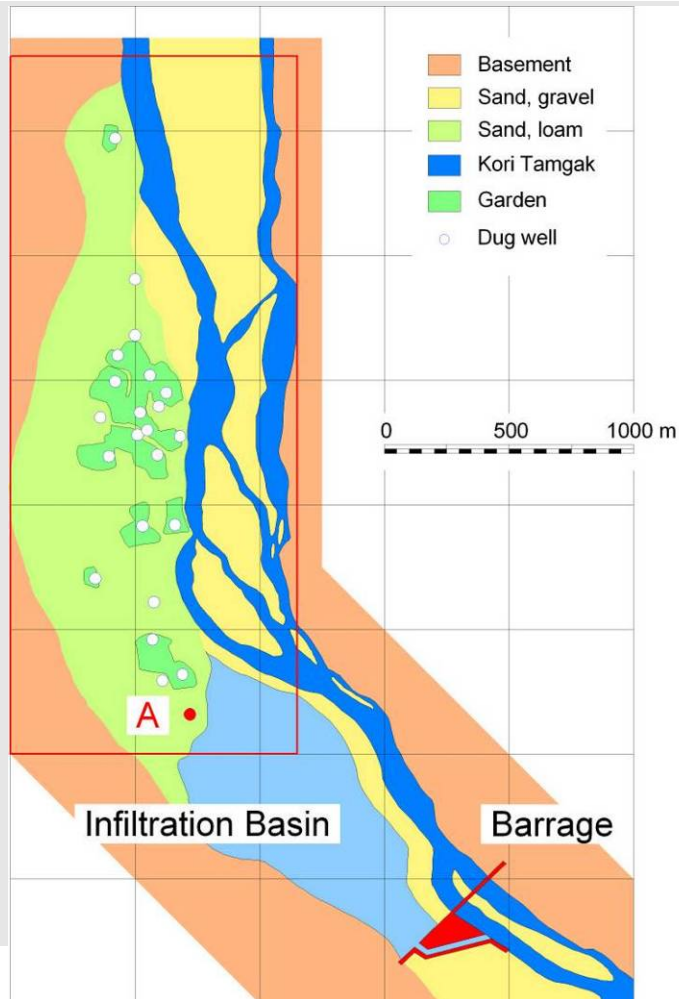
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## Diverting short floods to infiltration basins Niger, Iferouane





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## Retaining water in a very humid area (North Bengal India)

Increasing  
cropping intensity  
and securing soil  
moisture







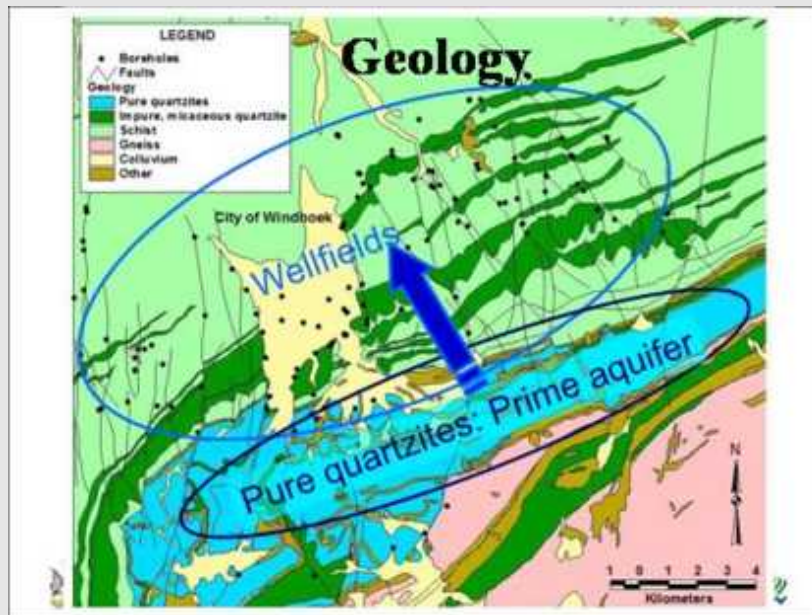
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## Creating a water bank



### LARGE DIAMETER DEEP BOREHOLE



Excess water from local dams injected in aquifer assures  
water availability for Windhoek city



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## Key elements of 3R:

- Proven techniques + not so well known techniques
- Work at scale
- Location-specific (urban + rural, dry + wet)
- Start from local priorities
- Integrate with regional planning, land use planning etc
- No-regret measures





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**Sometimes you are standing on a solution without even knowing it.**





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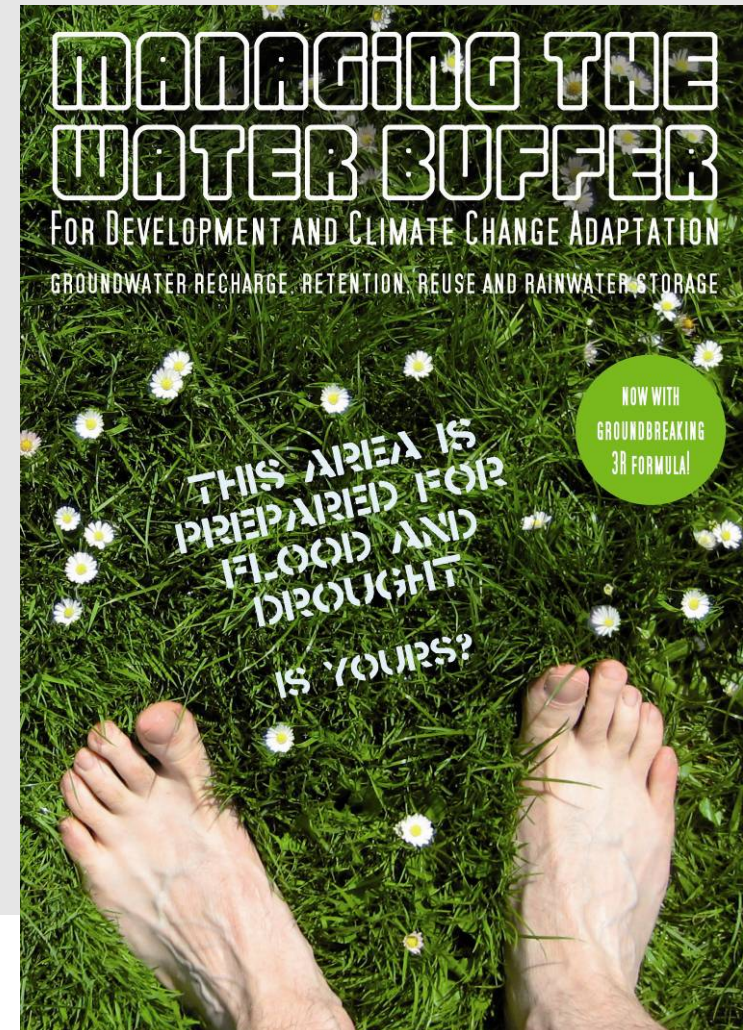
# Thank you for your attention

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[www.bebuffered.com](http://www.bebuffered.com)







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- 3R in arid and humid areas
- 3R for water and food security
- 3R for urban and rural development





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open well, adjacent to check weir in Vanvasi, India





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Using Road Infrastructure for 3R

Road embankments retain surface runoff