Water Management and Soil Conservation

for a climate resilient agriculture

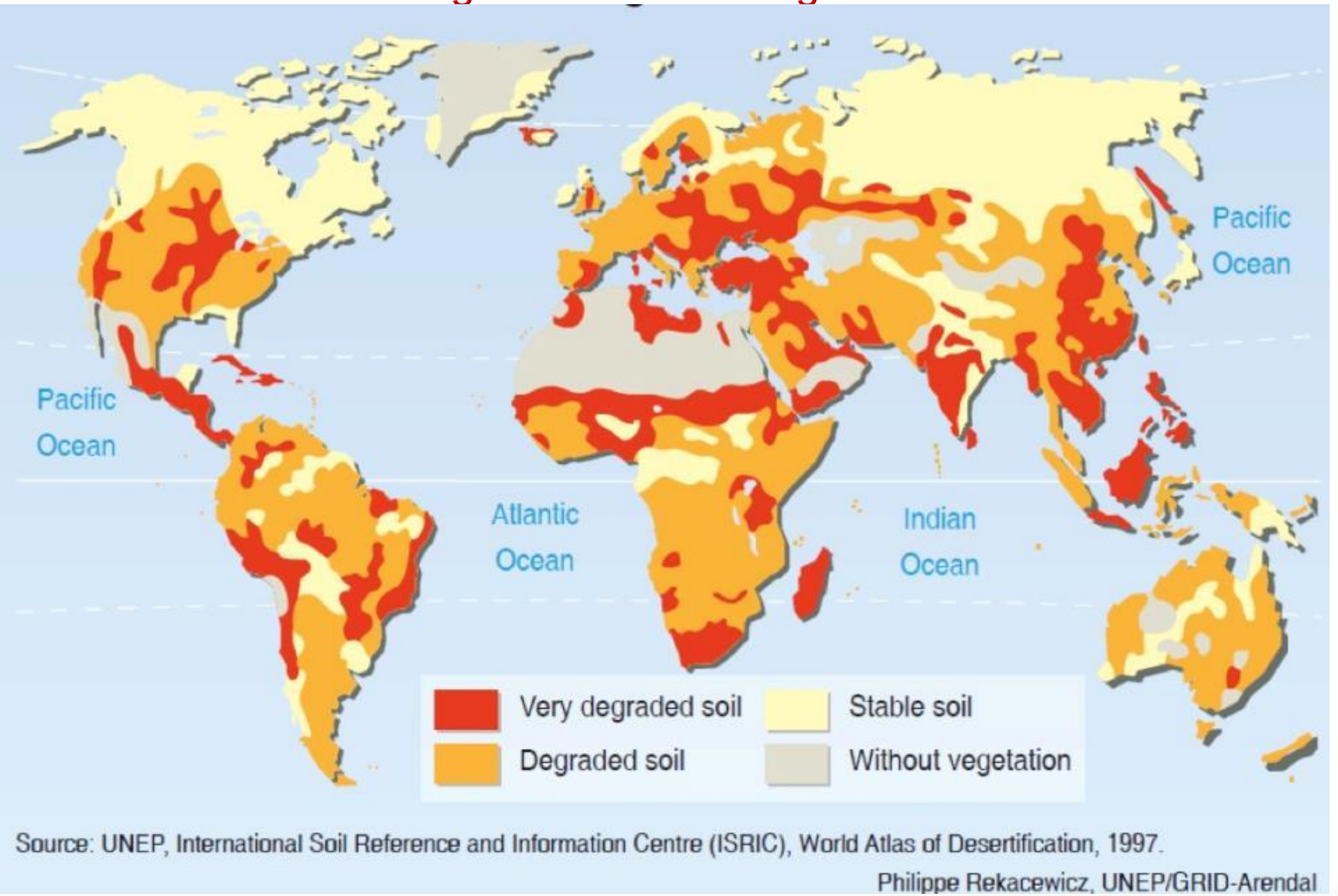
Sarah Beerhalter
ACCRA Programme Manager
Contact: sarah.beerhalter@giz.de

Learning goals of this module

Participants are able to…

- ... position water use in agriculture and erosion into a wider context
- … choose from a spectrum of agricultural water and soil management practices
- … summarize and critically appraise sustainable water use and soil management in agriculture

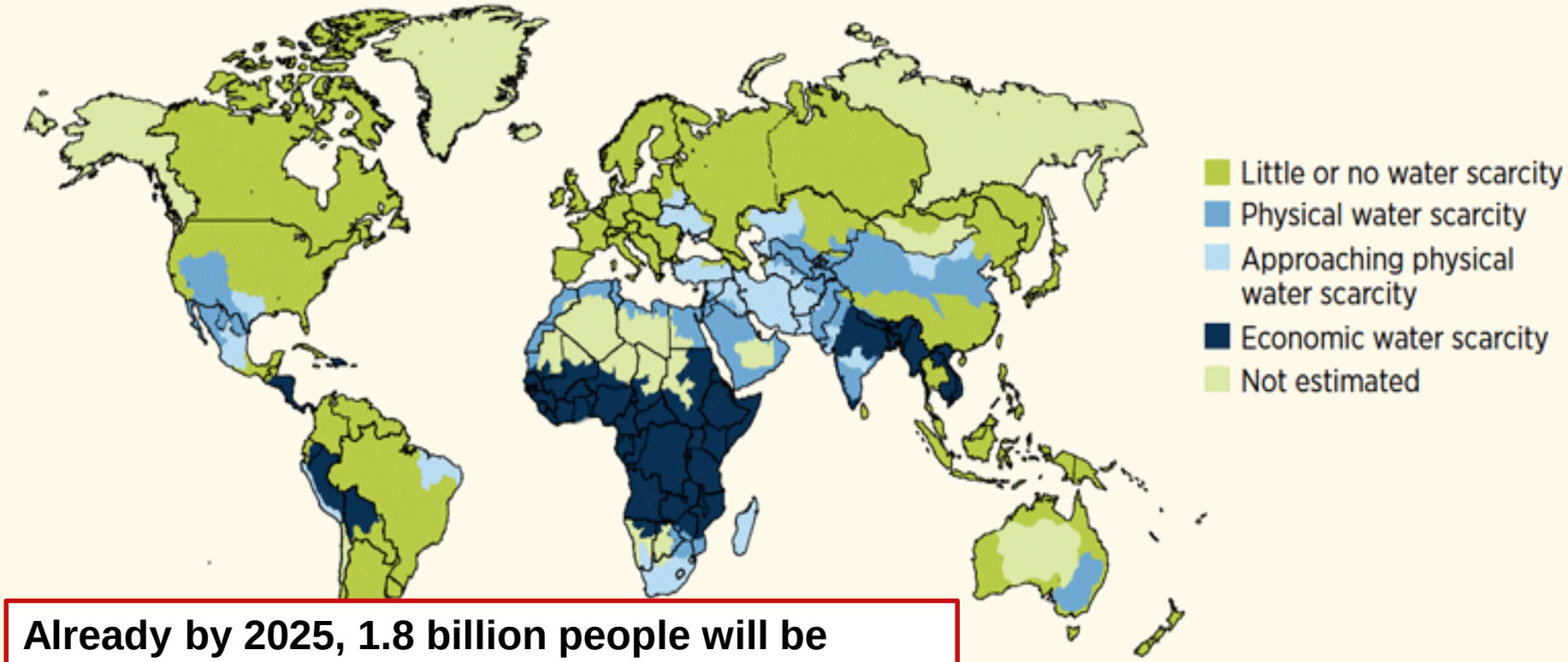
Alarming rates of land degradation



Source: UNEP, International Soil Reference and Information Centre (ISRIC), World Atlas of Desertification, 1997.

Philippe Rekacewicz, UNEP/GRID-Arendal

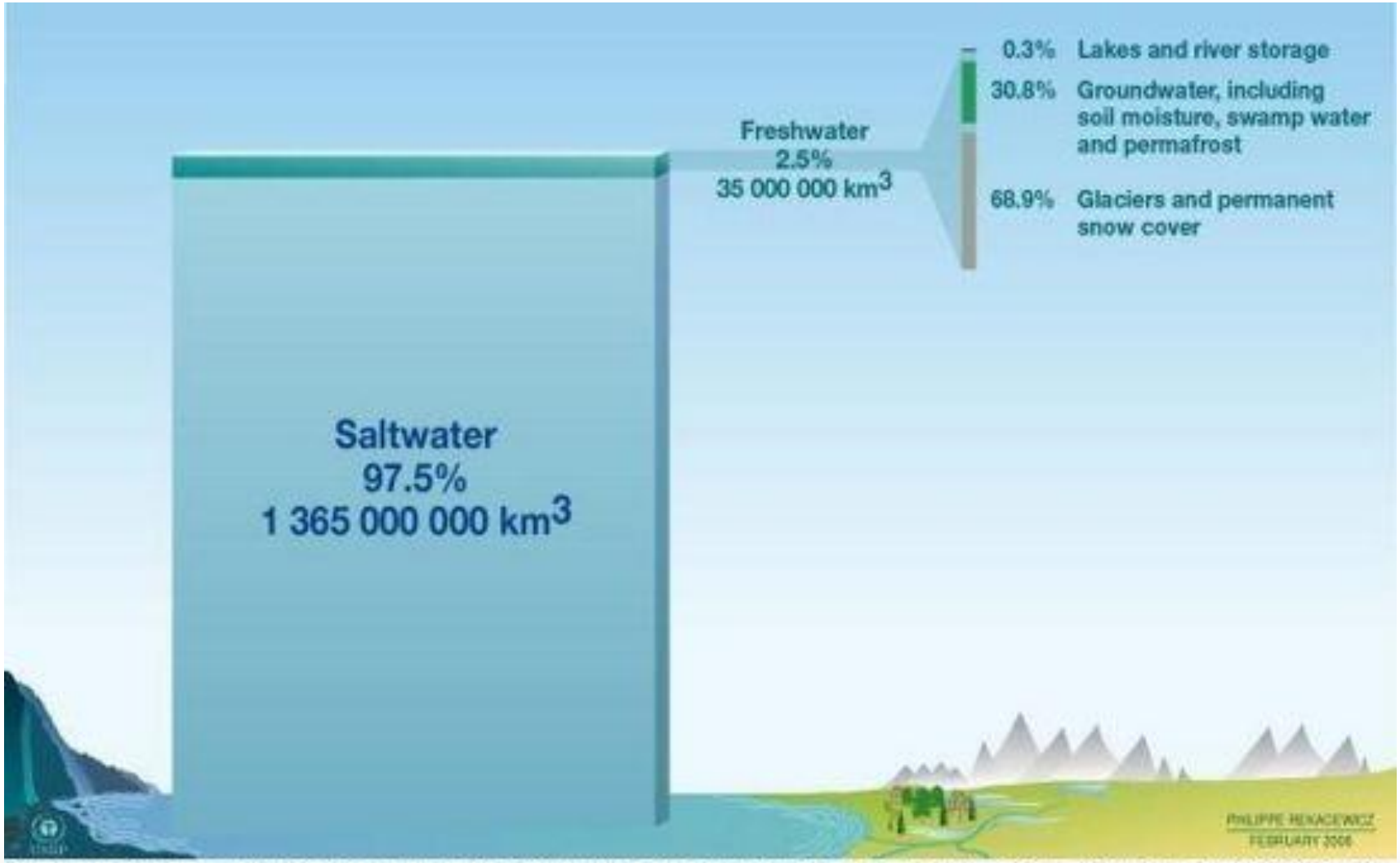
Global physical and economic water scarcity



Already by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two thirds of the world population could live under water stress conditions.
(UN Water, 2013)

Source: World Water Development Report 4, World Water Assessment Programme (WWAP), March 2012

Available Water on Earth



Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999.

SADC – a very water scarce region
Situation overview

- Southern Africa is a very water scarce region
- Impacts of climate change are worsening the situation (with droughts and floods sometimes even occurring in the same locations) – extreme weather events increase
- Water of several big transboundary rivers is already over allocated; consequences for environment, increased business risks and also political implications
  - Environmental minimum flow
  - Water quality
  - Water availability
  - Example: Orange River
  - Example: Limpopo River

SADC – a very water scarce region
Situation overview

- World Economic forum declared water security in 2015 as No. 1 business risk world wide !!!
- SADC region was going through the worst drought since 35 years (2015/16), regional drought disaster has been declared in July 2016
- Two Examples:
  - Botswana, 2015: Dam for water supply of the capital has been filled at the end of the rainy season to 2.1 %, severe water restrictions, partly people for weeks without water supply, supermarkets run out of drinking water.
  - South Africa, 2015, Drought in KZN, severe water restrictions, agricultural water supply restricted, set up of emergency schemes for cross basin water transfer (expensive)

SADC – a very water scarce region
Situation overview

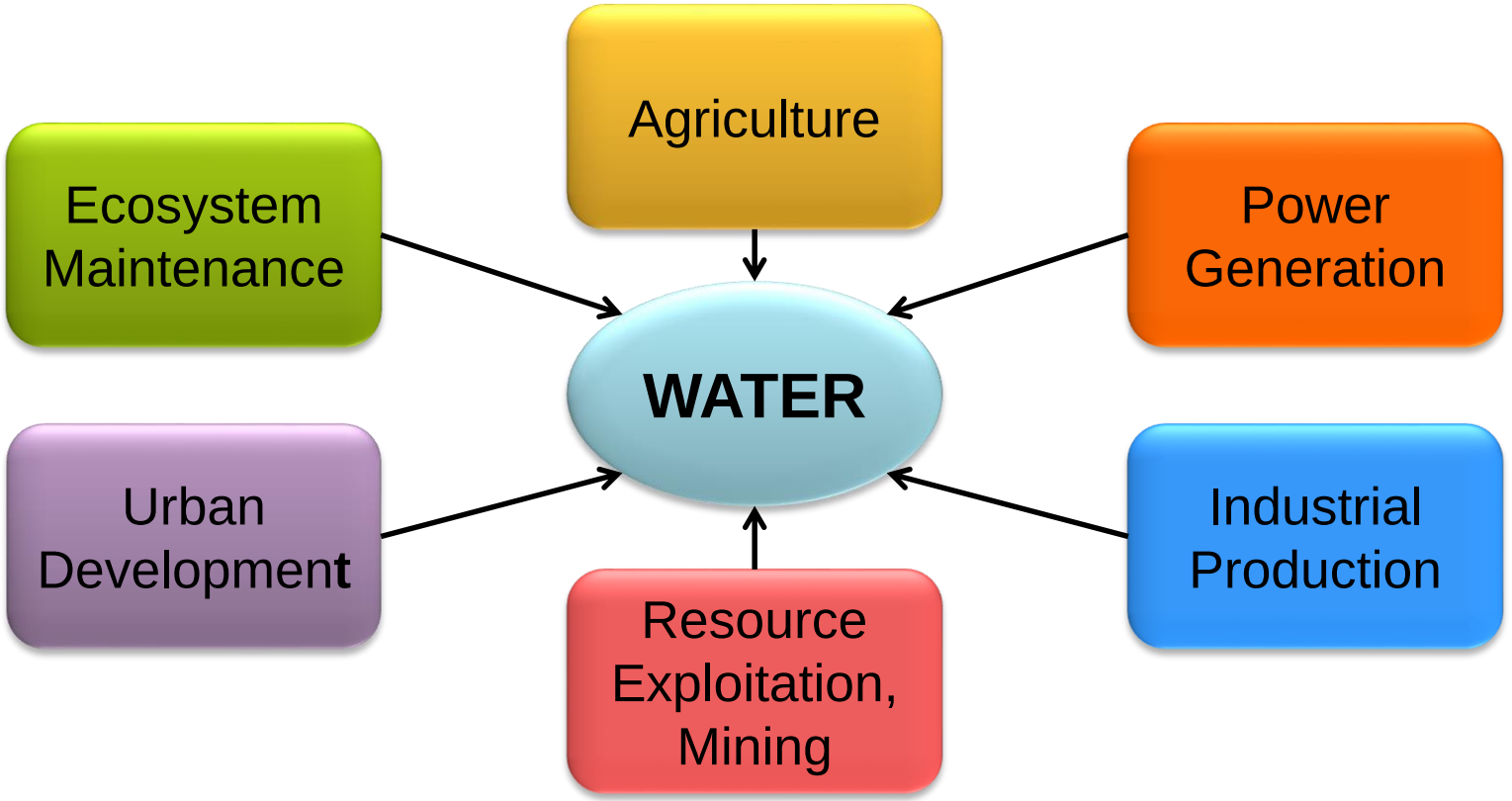
Impact of the 2015/16 drought:

- Cereal deficit: 9,3 Million tons
- 643.000 cattle perished
- Food insecure population increased by 31% since 2015
- 40 Million people in SADC had been declared food insecure and needed humanitarian assistance

SADC – a very water scarce region
Situation overview

- Several countries in our region are already importing water from their neighbours
  - 50% of Namibia's population relies on water from Angola
  - Botswana gets water from South Africa
  - RSA imports water from Lesotho
    - 60 % of the water supply in Gauteng is supplied by Lesotho
- Other projects are already on the way:
  - Transboundary water supply between Swaziland und Mozambique
  - Water supply from Lesotho to Botswana (900 km!)

Competition for water



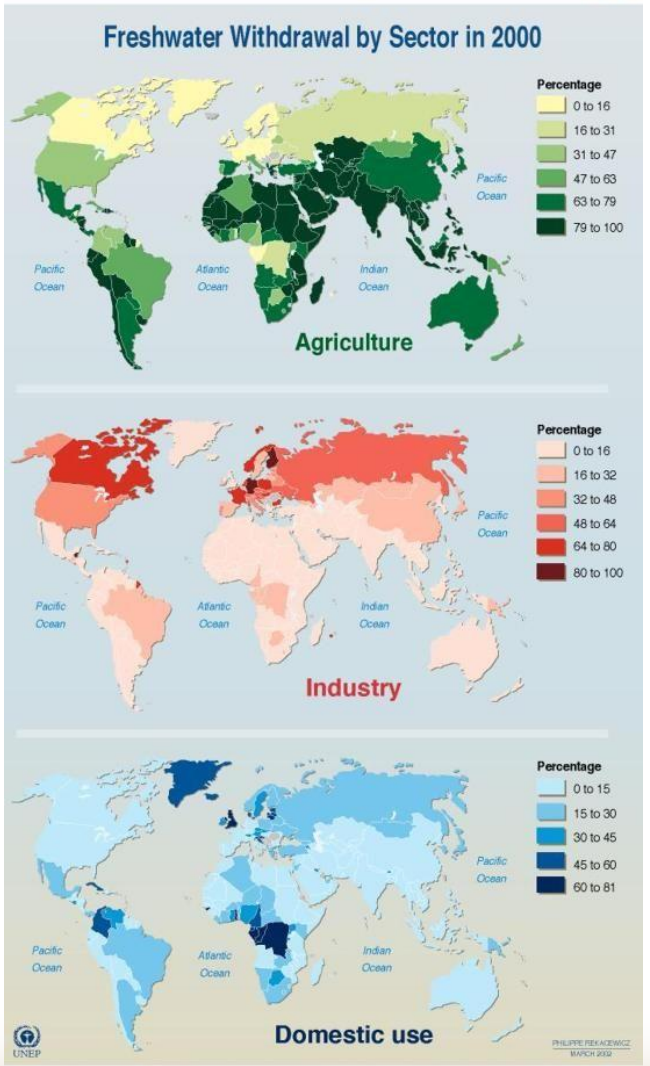
Agricultural water use

Agriculture is the biggest water user world wide and accounts for approx. 70 % of the total fresh water withdrawal.

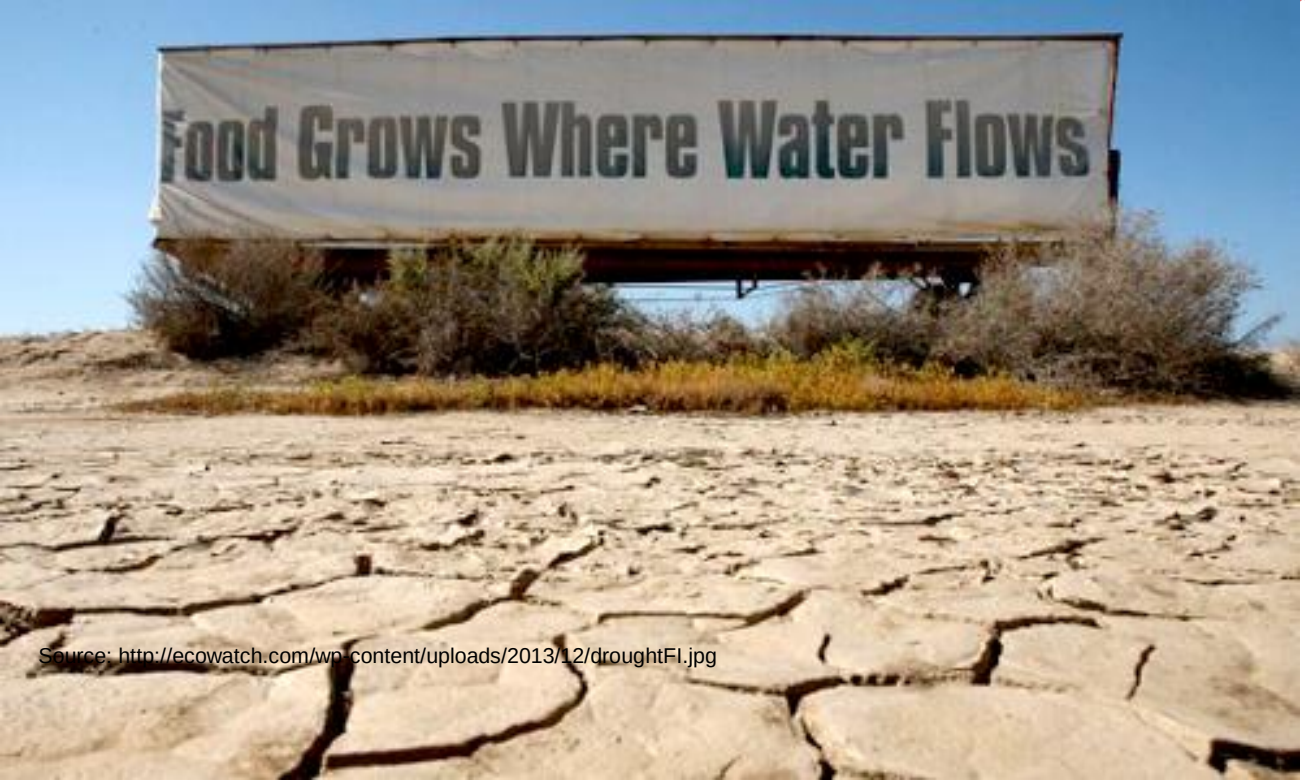
Whereas the industry and domestic sectors are already undergoing radical changes to increase water use efficiency.

Agriculture still has huge scope for improvements and can make water available for additional production through improvements in water use efficiency and modern water and soil management.

10 a



Source: *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000.



Source: http://ecowatch.com/wp-content/uploads/2013/12/droughtFI.jpg

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

The Challenge

How to reduce withdrawals from water resources for agriculture while at the same time increasing agricultural production and maintaining essential environmental flows?

In other words:

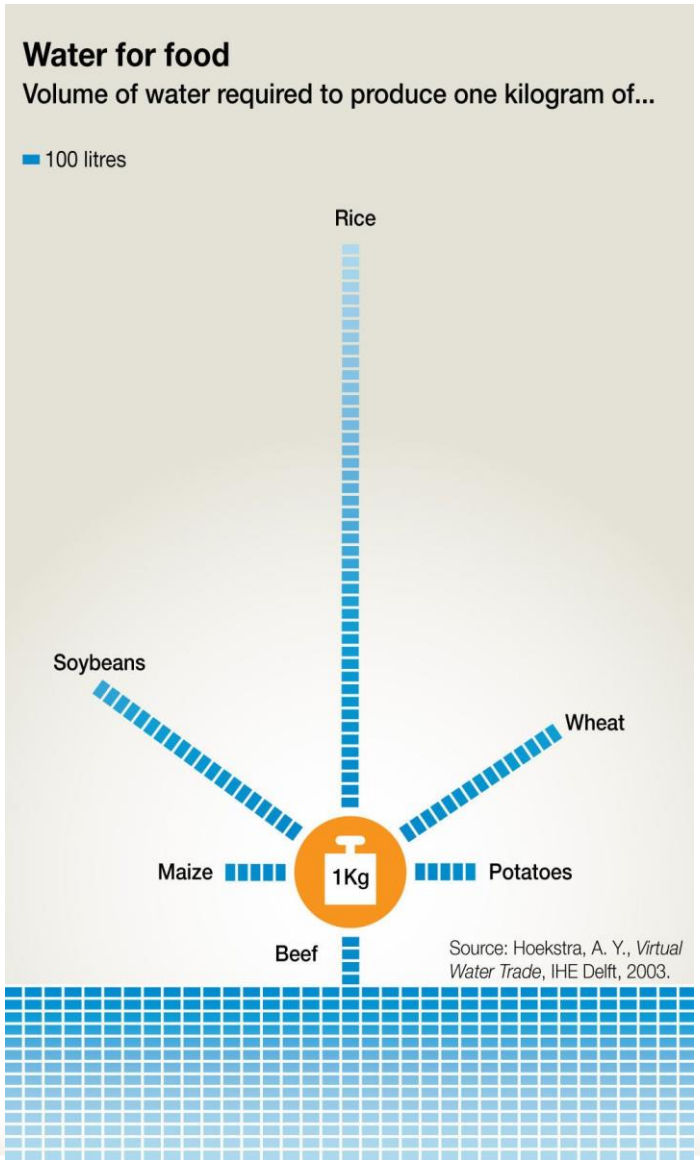
How to promote sustainable enhancement of systemic water productivity in agriculture: on the field and in the water catchments?

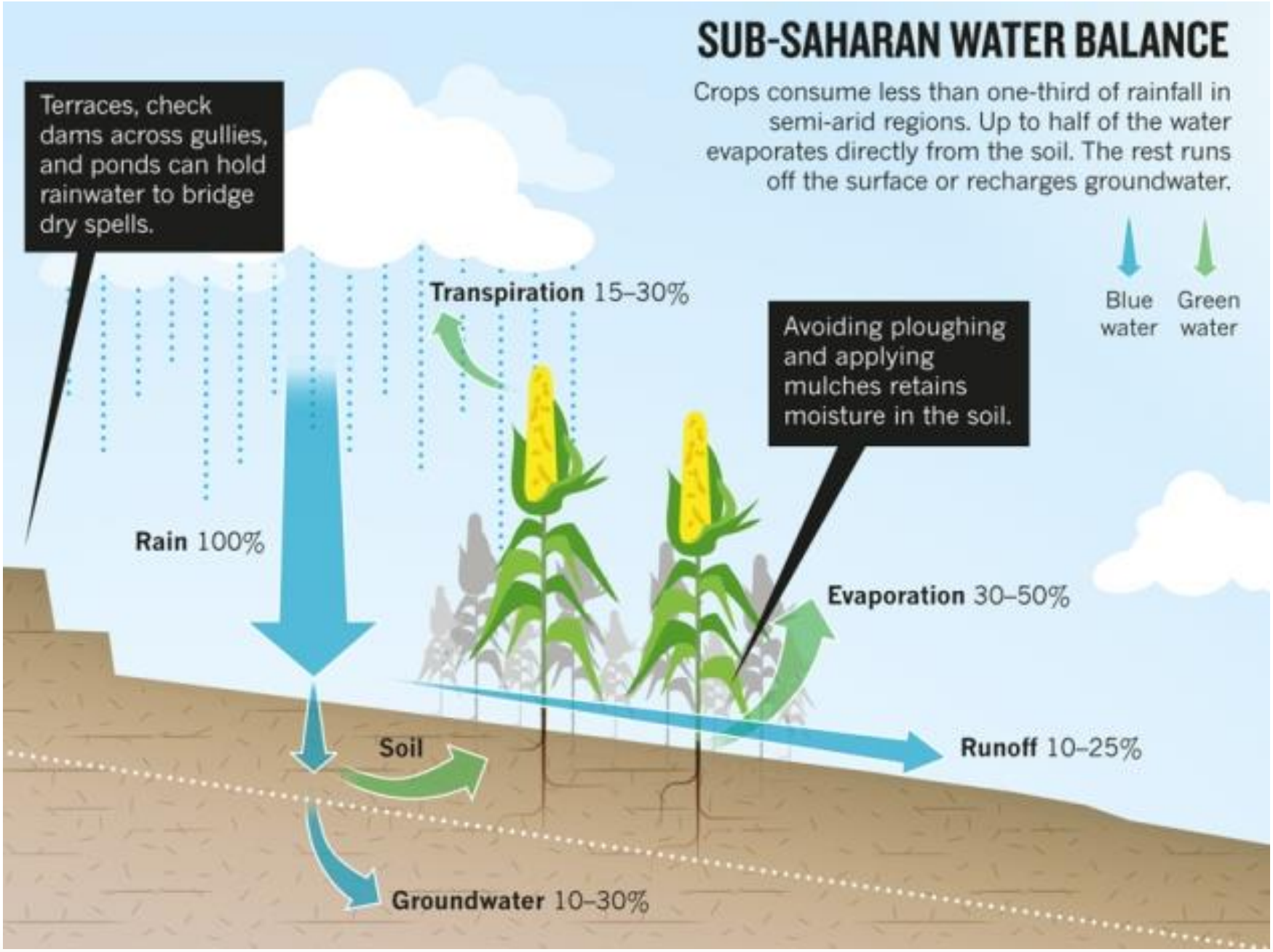
Slide adapted from Walter Huppert

Water for food security

Food production needs to increase by 60% by 2050 to satisfy the demand of a population of more than 9 billion people.

Source: FAO, Coping with Water Scarcity, 2012





Source: D. Molden (ed.) Water for Food, Water for Life (IWMI, 2007)

Crop water need

"[…] The crop water need (ET crop) is defined as the depth (or amount) of water needed to meet the water loss through evapotranspiration. In other words, it is the amount of water needed by the various crops to grow optimally[…] ."

ET crop = crop evapotranspiration = crop water need

Reference: Irrigation Water Management: Irrigation water needs, Training Manual No.3, FAO

How to increase the water use efficiency ???

- Apply water directly where it is consumed (drip irrigation, bottle solution for small fields)
- Prefer irrigation in the early morning or evening, even at night - but never during full sunshine
- Support the water storage capacity on the field (ditches, mulch, higher organic content etc.)
- Shade netting
- Use drought tolerant and water efficient varieties

Soil and water conservation

Climate Smart Agriculture
Concepts and Technologies for Sustainable Use of Water and Soil

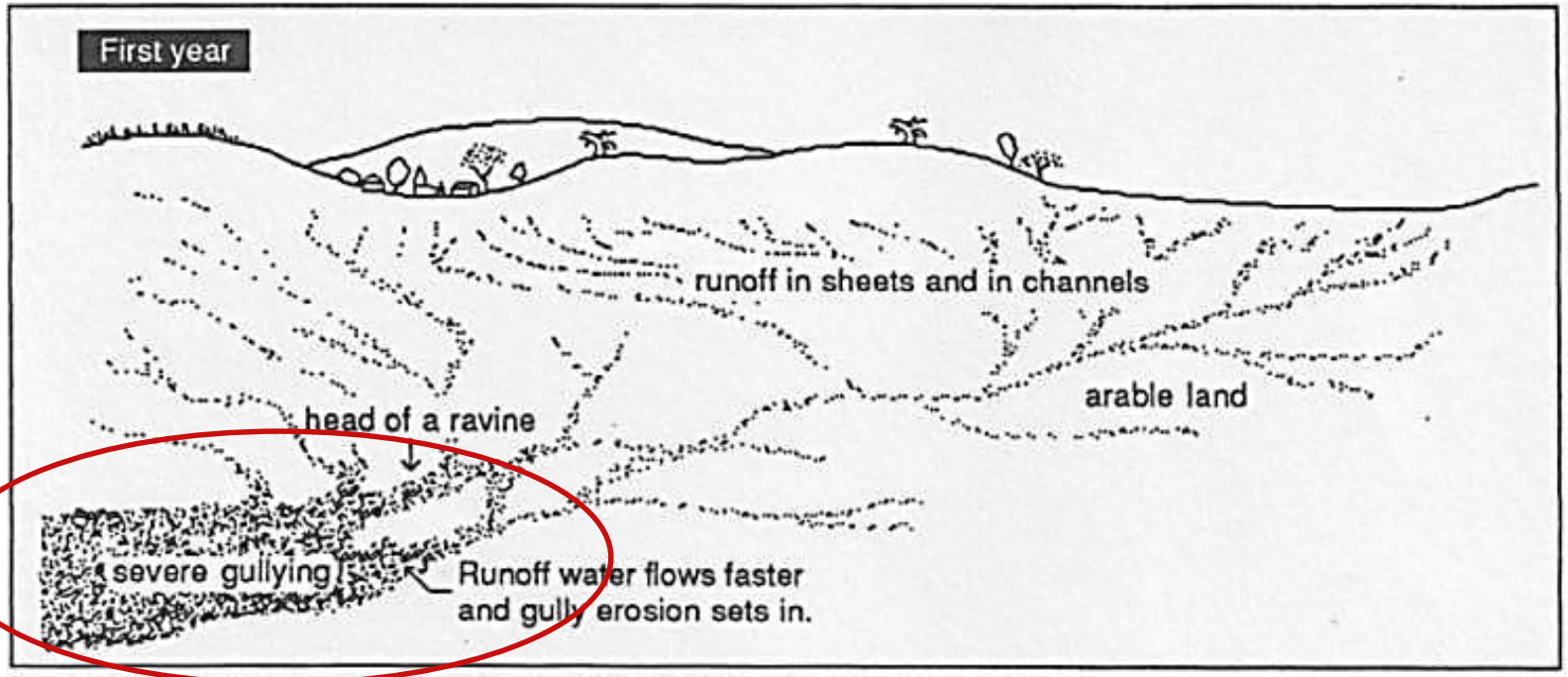
Soil and water conservation (SWC) – main points

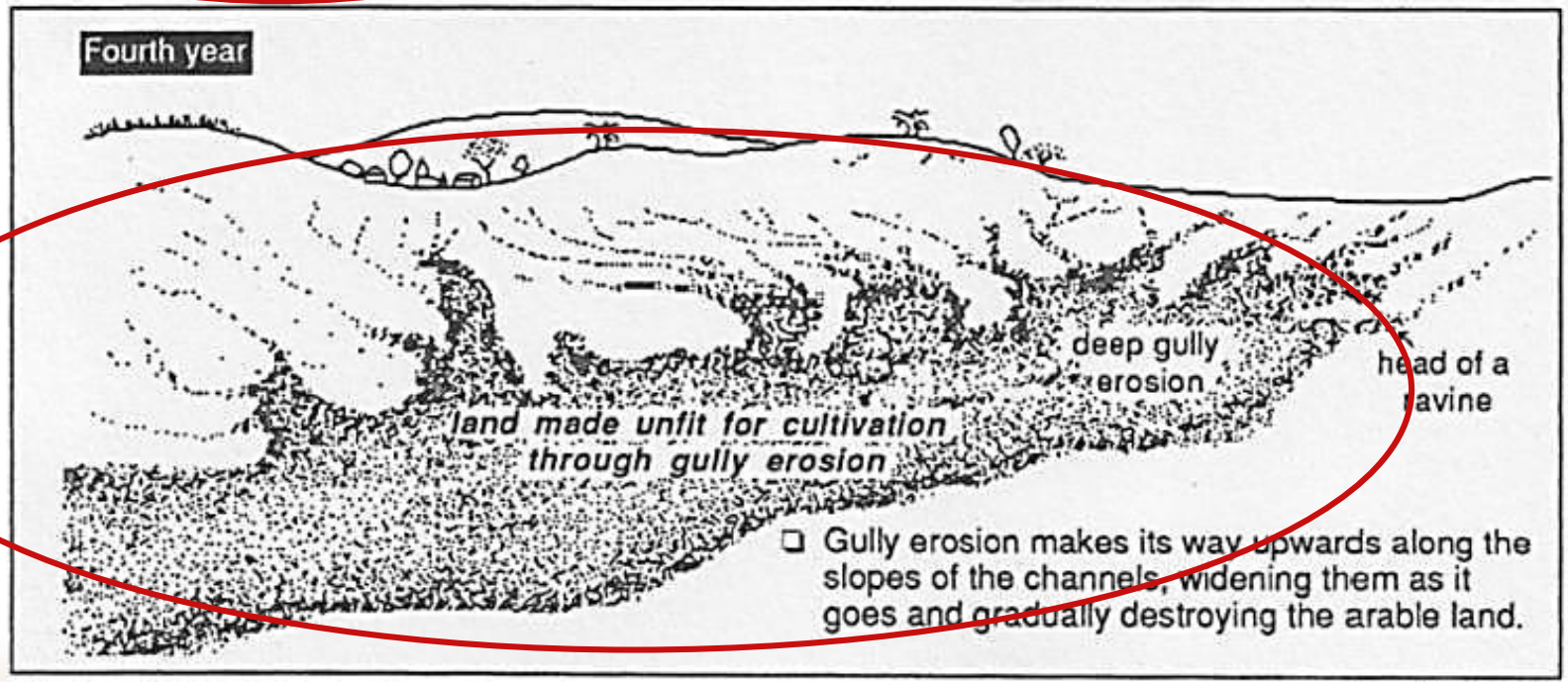
Technical principles of conservation

- Reduce erosive power of rain drops by keeping the soil covered
- Fight erosion at its source and retain water where it falls (facilitate infiltration)
- Reduce speed of water flowing down slopes with constructions (e.g. gabions, erosion blankets/geotextile etc.)
- Store and reuse of water for irrigation

Organizational aspects

- SWC requires a collective action
- Catchment approach and village land-use planning





Source: Dupriez & de Leener

Erosion on grasslands

Practical Examples I

Wetland rehabilitation and Rangeland Management in Lesotho (SADC-GIZ)

Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

Re-planting/Reseeding
Concentrated and controlled herding
Improved Rangeland Management

Technologies of erosion control

Biological methods:

- Contour planting of crops, mixed cropping and mulching
- Vegetation strips along contour

Mechanical methods:

- Terracing
- Infiltration ditches along contour lines
- Earth bunds: retain surface water
- Stone bunds: allow water to permeate but reduce flow velocity considerably

© WAC

© GIZ

Increasing the infiltration

Contour trenches

Semi-circular bunds

Circular bunds

Plant pits with mulch

Water conservation / Increase in water use efficiency

- Key factor for resilience building in agriculture
  - Increased storage capacities for water
  - Rainwater harvesting
  - Flood Water Retention / Flood Water Harvesting
  - Water reuse (Grey water use)
  - Use of waste water in Agriculture
  - Efficient irrigation („More crop per drop“)

Water harvesting in practice

Source: http://www.searnet.net/fileadmin/Experiences_in_promoting_In-Situ_RW_technologies.pdf

Example (Video): Water harvesting in Bolivia as a way to adapt to climate change

4 main types of irrigation systems

- Irrigation by flooding
- Sprinkler irrigation
- Irrigation with buckets or cans
- Drip irrigation

Depending on

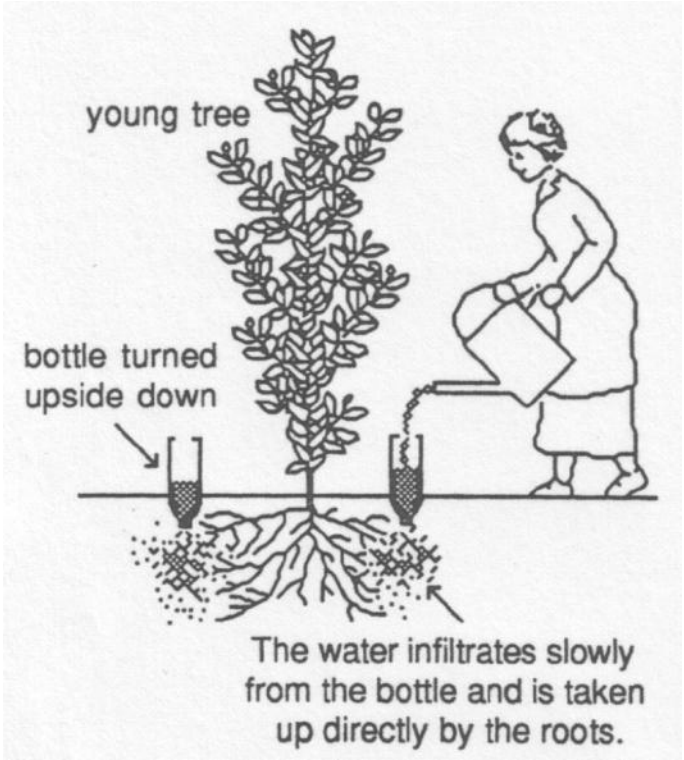
- Natural conditions
- Type of crop
- Type of technology
- Financial ability
- Previous experience with irrigation /Knowledge
- Required labor inputs costs and benefits

Source: http://nrcca.cals.cornell.edu/soil/CA3/CA0324.php

Drip irrigation

Low cost systems

Plastic bottles – simple and very efficient



Practical Examples II

Flood and rain water harvesting and efficient irrigation in Northern Namibia (Cuve waters)

Practical Examples III

Flood water harvesting for agriculture In Mozambique (SADC-GIZ)

Waste Water and Grey water Reuse in Agriculture - a sensitive matter -

- Huge advantages by far outweigh the risks.
- Huge available water resource in water scarce areas.
- Already existing unregulated use from rivers and streams (people are often not aware – more dangerous).
- Open discussion of possible use of waste water often reveals big sensitivities around the matter.
- Excellent water source comes already with fertilizer.
- Global paradigm shift from parameter driven approach towards risk assessment and related measures.
- National legislations often not up to date.

Waste Water and Grey Water Reuse in Agriculture
WHO guidelines for the safe use of wastewater, excreta and greywater (2006)

Guidelines for the safe use of wastewater, excreta and greywater - Volume 1
Policy and regulatory aspects

Guidelines for the safe use of wastewater, excreta and greywater - Volume 2
Wastewater use in agriculture

Guidelines for the safe use of wastewater, excreta and greywater - Volume 3
Wastewater and excreta use in aquaculture

Guidelines for the safe use of wastewater, excreta and greywater - Volume 4
Excreta and greywater use in agriculture

Waste Water Reuse in Agriculture

In the past:

- Parameter centred approach with unjustifiably restrictive standards
- Wastewater treatment as only control mechanism – doubt on reliability of operations, financial implications, etc.
- Not supportive for WW reuse in Agriculture

Today:

- Risk assessment centred approach taking into account:
- Type of Wastewater treatment
- Type of crops produced/permitted
- Type of irrigation technique used/permitted
- Control of human exposure (Farmers, workers, neighbours, crop handlers, consumers)

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

"Anyone who can solve the problems of water will be worthy of two Nobel Prizes – one for peace and one for science"

John F Kennedy

Thank you for your attention !!!!

References

Agriwaterpedia at: http://agriwaterpedia.info/wiki/Main_Page

Aquastat, FAO, available at: http://www.fao.org/nr/water/aquastat/main/index.stm

Clay, J. (2004), World Agriculture and the Environment: A Commodity-by-Commodity Guide to Impacts and Practices, Island Press

Gleick, P.H., (several), available at: http://pacinst.org

Irrigation Water Management: Irrigation water needs, Training Manual No.1 and 3, FAO, available at: ftp://ftp.fao.org/agl/aglw/fwm/Manual1.pdf or...Manual3.pdf

Mekdashi Studer,R. et al.(2013), Water harvesting, Guidelines to good practice, CDE et al.

Molden, D. (2007), Water for Food, Water for Life: A comprehensive Assessment of Water Management in Agriculture, Earthscan

Nature http://www.nature.com/news/agriculture-increase-water-harvesting-in-africa-1.17116

Teca/FAO: Water Management in Organic Agriculture, compiled by Ilka Gomez and Nadia Scialabba. Online available at: http://teca.fao.org/pt-br/read/8366

World business council for sustainable development: Water and energy linkages to food, feed, fibre. Online available at: http://www.wbcsd.org/work-program/sector-projects/water/waterenergyfood.aspx

World Water Development Report 4 (March 2012), World Water Assessment Programme (WWAP)