CAWa Regional Research Network «Central Asian Water»

Water use efficiency as subject to irrigation management on the field scale: a case study from Fergana Valley

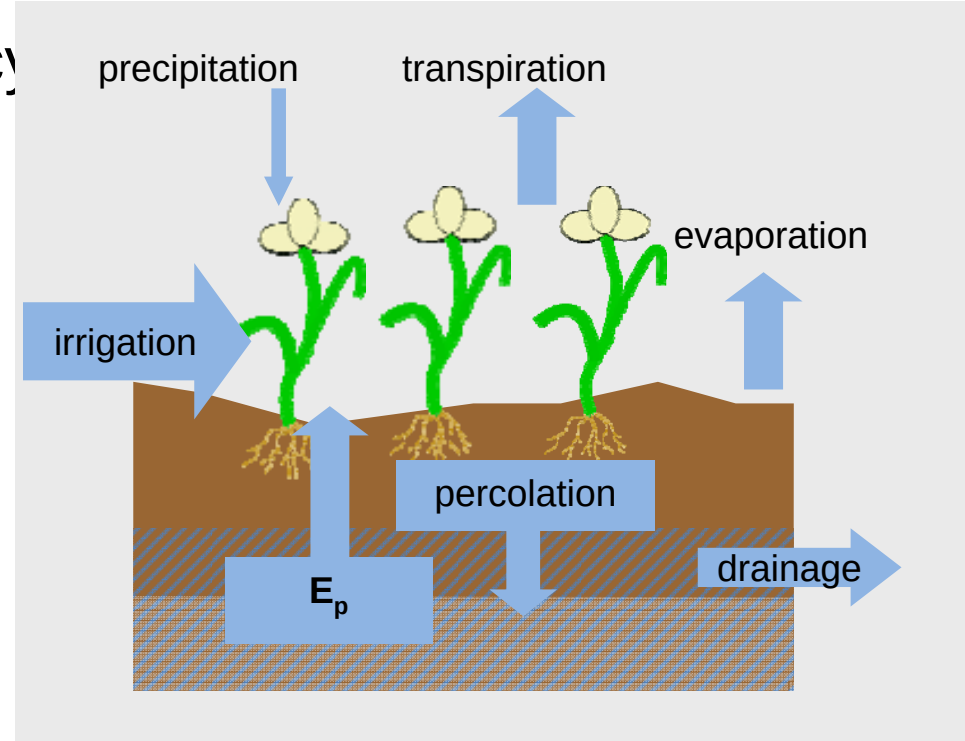
K. Schneider[1], Y. Dernedde[2,3], M. Starke[2,3], A. Klipstein[4], G. Stulina[5], H-G Frede[2,3]

[1]alpS Center for Climate Change Adaptation Technologies, Innsbruck, Austria
Email: schneider@alps-gmbh.com
[2] Institue of Landscape Ecology and Resources Management, Justus-Liebig-University Giessen, Germany
[3]Center for international Development and Environmental Research, Justus-Liebig-University Giessen
[4]Institute of Geography, Johann-Wolfgang-Goethe-University Frankfurt
[5] Scientific Information Center of Interstate Coordination Water Commission (SIC-ICWC), Tashkent, Uzbekistan

Background & Scope

- Agricultural production in Central Asia relies on irrgation
- Need for improvement of water use efficiency

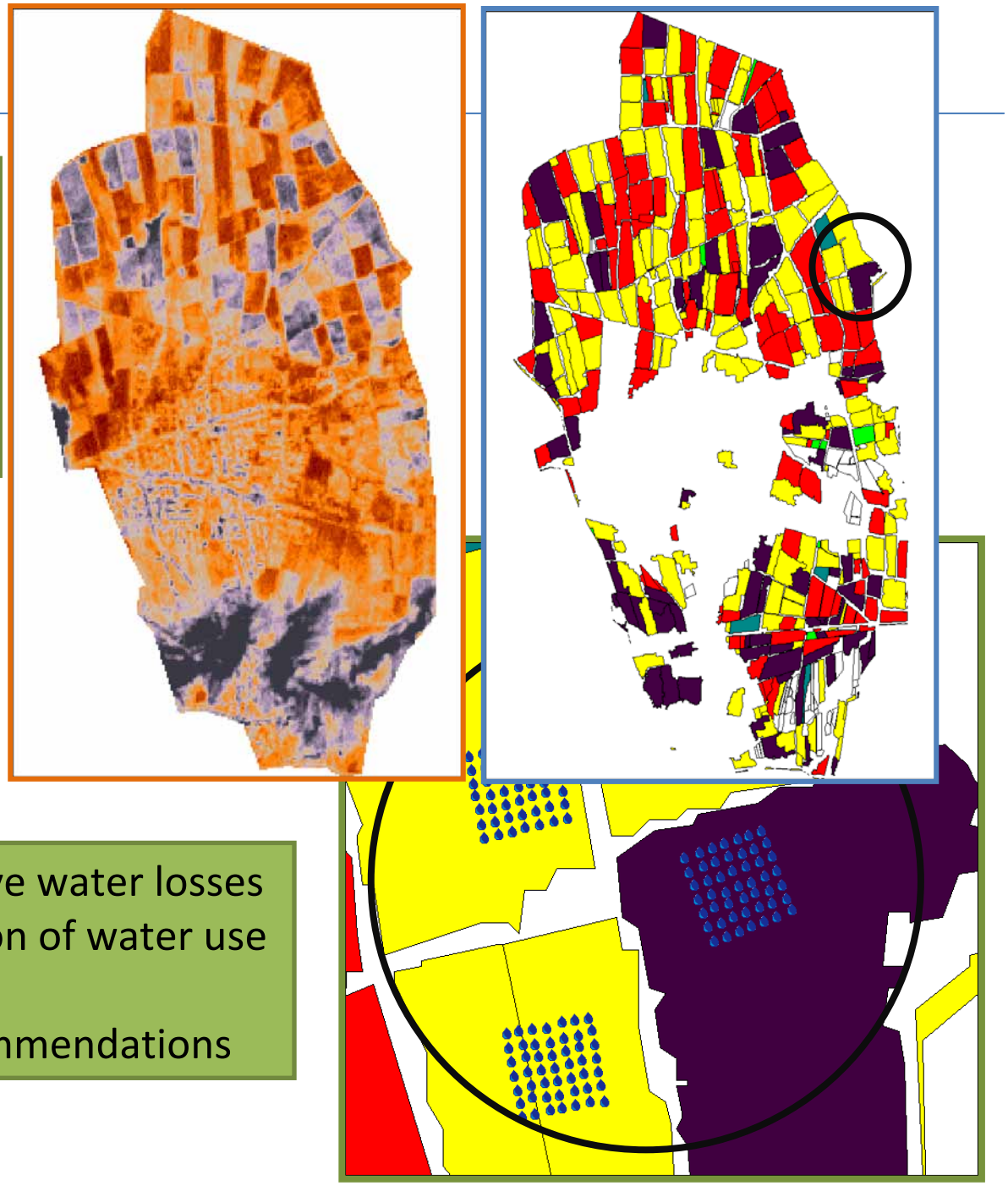
> assessment of current water management and its effect on
  - water resources
  - water use efficiency



Study Area

Topographic and hydrographic map of Fergana Valley (top) (UNEP/GRID-Arendal, 2005) and overview over the Water User Association (WUA) Akbarabad (right) (Yakubov 2006)

Plant available water
Crop water requirement
Soil moisture
Ground water
Irrigation



- quantification of unproductive water losses
- quantification and comparison of water use efficiency
- Land use and irrigation recommendations

Assessing water use efficiency

$$VWC = \frac{CWR}{CY}$$

VWC = virtual water content [m³/t]
CWR = crop water requirement [m³/ha]
CY = crop yield [t/ha]

Country	Virtual water content of cotton [m³/t]
China, USA	Approx. 2000
Turkmenistan, Uzbekistan, Pakistan	> 4500

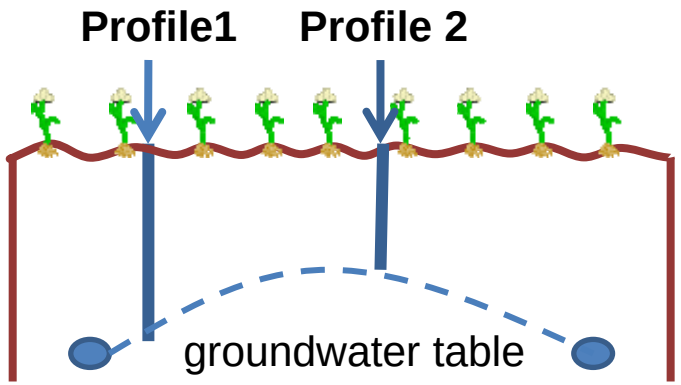
Source: Chapagain et al. 2006

Application of alternative management scenarios

Irrigation management scenarios		
1	**2**	**3**
Current irrigation management	Change in irrigation scheduling & irrigation volume	Change in cropping system

Results: evaporative losses from groundwater

Phreatic evaporation at different depths to groundwater		
Depth to groundwater	2.4 m	1.8 m
Evaporation from groundwater [m a^{-1}]	0.14	0.6



> Evaporation from groundwater ranges between 0.14 – 0.6 m per year.

> Evaporative losses depend largely on depth to groundwater.

Effect of irrigation management on water use efficiency

Virtual Water Content of cotton in WUA Akbarabad under current irrigation management and with management scenarios (calculated with CROPWAT)

	Current irrigation	Optimised irrigation	Deficit irrigation
VWC [m³/t]	4932	3069	2386
Reduction of irrigation		38 %	52 %
Yield loss		-	~ 7 %

Irrigation scheduled according to soil moisture content

Conclusions

- Currently, poor water use efficiency and high water losses
- Alternative management scenarios show that the volume of irrigation can be reduced without yield losses.
- Introduction of cheap measures may improve water management, e.g.:

- Change of irrigation management (improved scheduling, driven by water demand; prevent rise of groundwater level)
- Introduction of less water demanding crops
- Introduction of incentives for improved water management
- Low budget and continuous monitoring of crop water requirement (e.g. soil moisture measurements)
- Improved education of farmers
- Planning reliability and transparency for irrigation

Thank you for your attention

www.cawa-project.net

Effects of temperature increase and water limitation on crop production

Effect of climate change scenario on cotton production (calculated with DRAINMOD)			
	Current	**+2°C**	**+2°C -5 % water**
Crop yield [t/ha]	2.25	2.09	2.07
Number of water stress days	42	52	54