

International Symposium on Ecological Restoration and Management of the Aral Sea
咸海生态修复与综合治理国际研讨会

Agricultural development strategy in Central Asia under climate warming

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outline

- Background--Climate warming and water availability
- Challenge for regional sustainable development
- Some strategies for agricultural development

1. Background

Central Asia and Aral Sea basin



Central Asia area: $397 \times 10^4 \text{ km}^2$

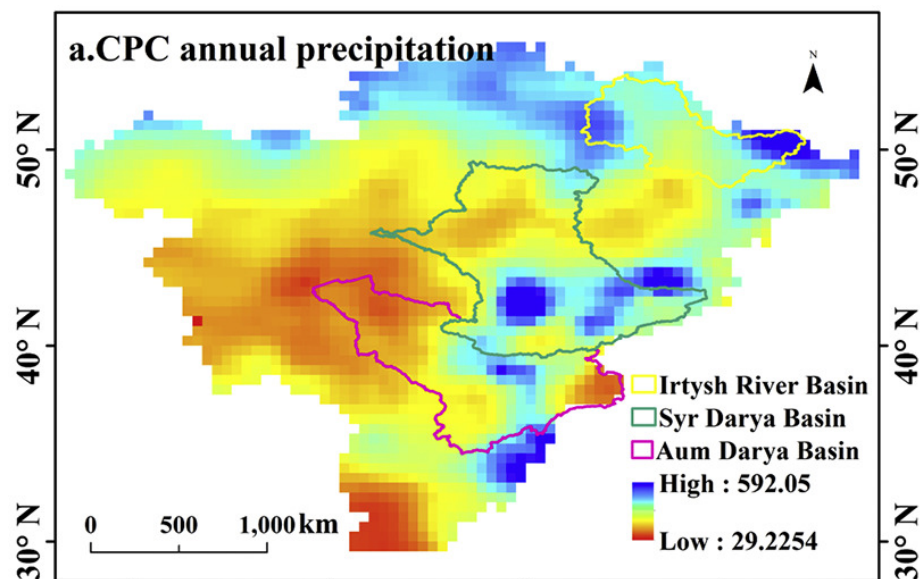
Aral Sea Basin Area: $154.93 \times 10^4 \text{ km}^2$

Annual mean P < 300 mm

Plain area P < 200 mm,

Mountain area P > 500 mm

Liu Yu, Wang Ping, et al. 2020



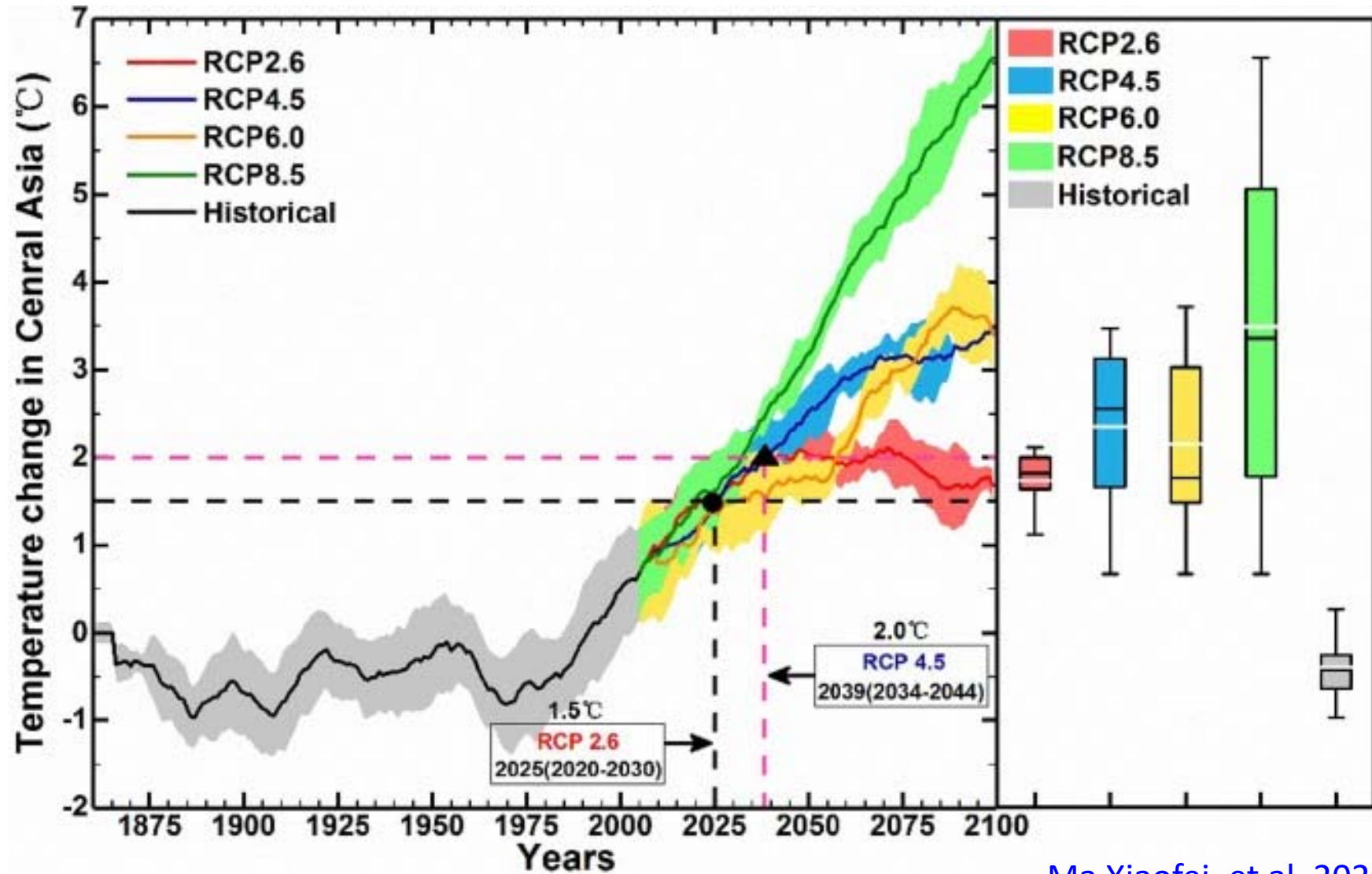
1980-2017

Yang, P, et al. 2020



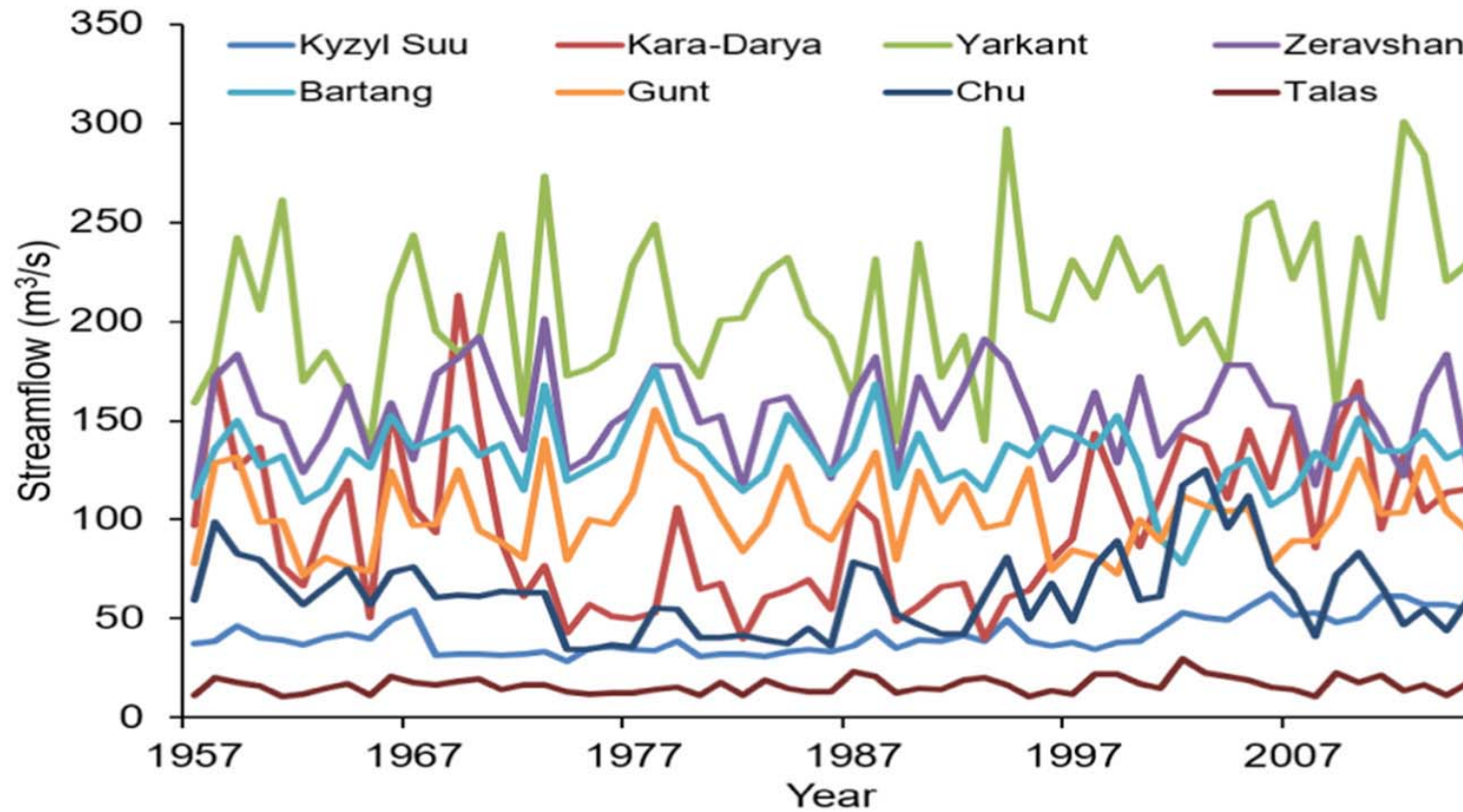
Tussupova, K. et al. 2020

Climate warming since 1980s and to be continue



Ma Xiaofei, et al. 2020

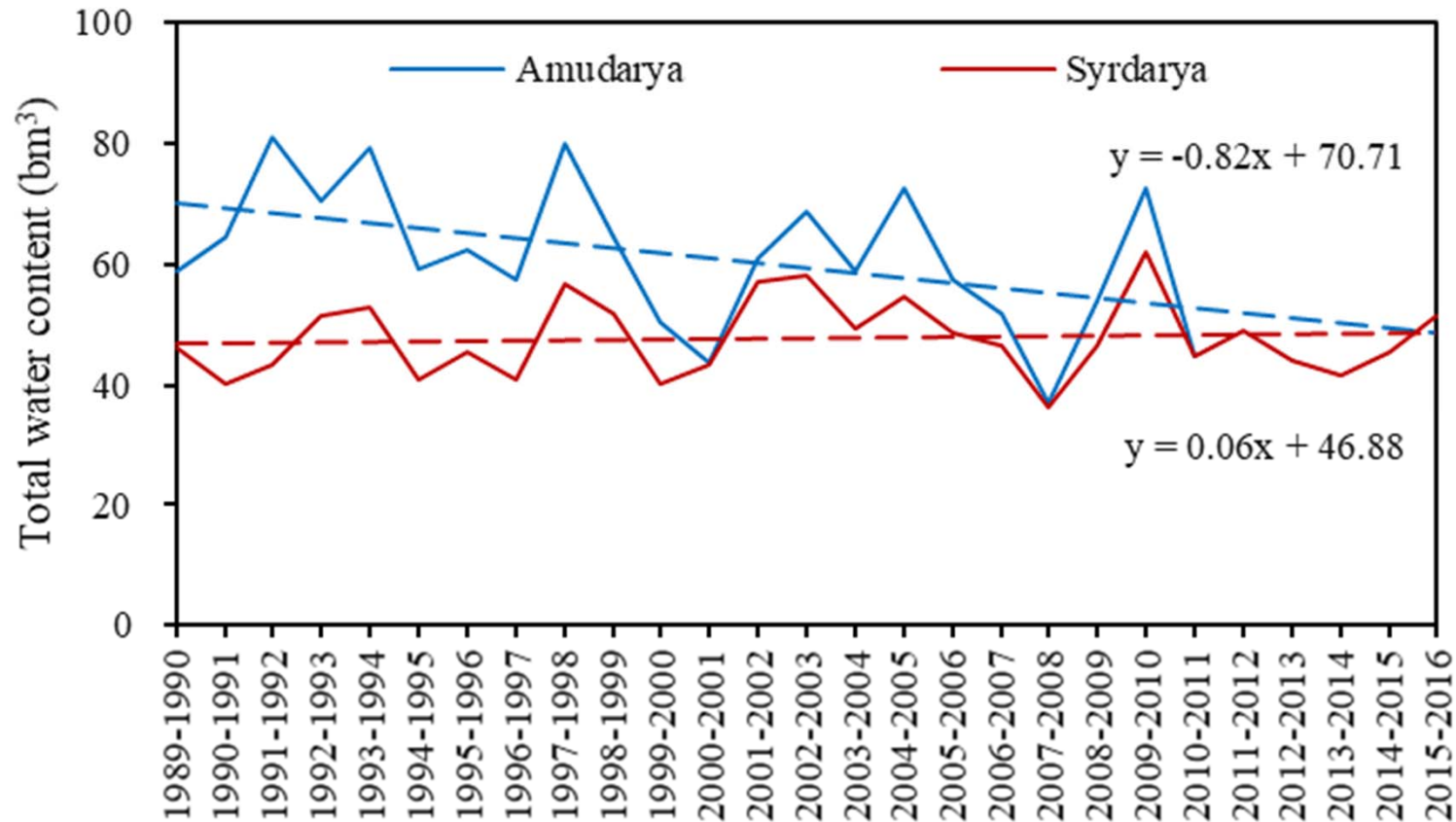
Central Asian river streamflows **have not continued to increase**



Amu-Darya River Basin: Kyzyl Suu , Zeravshan, Bartang, Gunt
Syr-Darya River Basin: Kara-Darya

Chen et al., 2020.

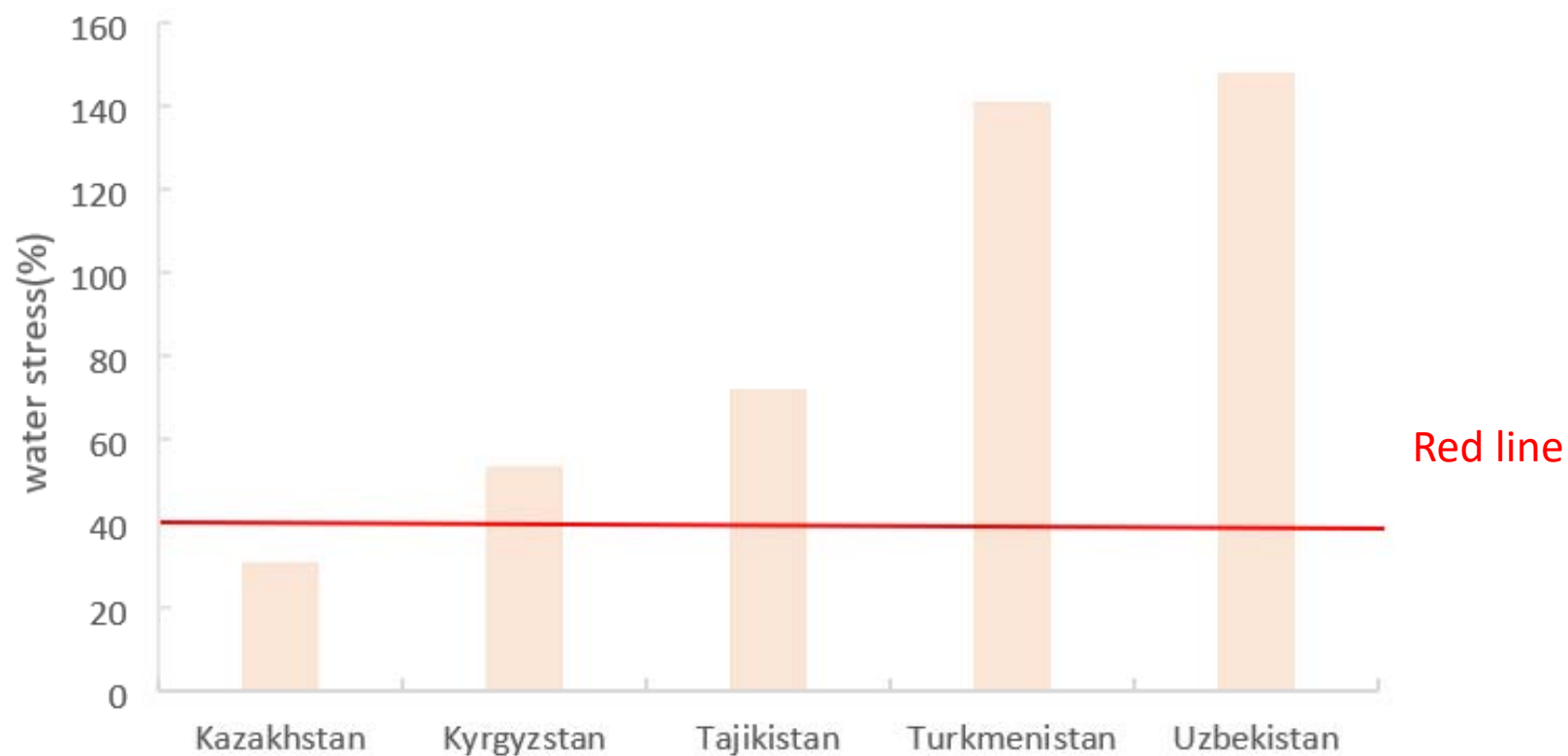
Runoff in Amudarya showed rapid decrease and without significant increase in Syrdarya during the last two decades



Data source: Scientific-Information Center of the Interstate Commission for Water Coordination of Central Asia (SIC ICWC), 2019. Regional information system and land resources in the Aral Sea basin (CAREWIB). Available online. www.cawater-info.net

2. Challenge for sustainable development especially agricultural development

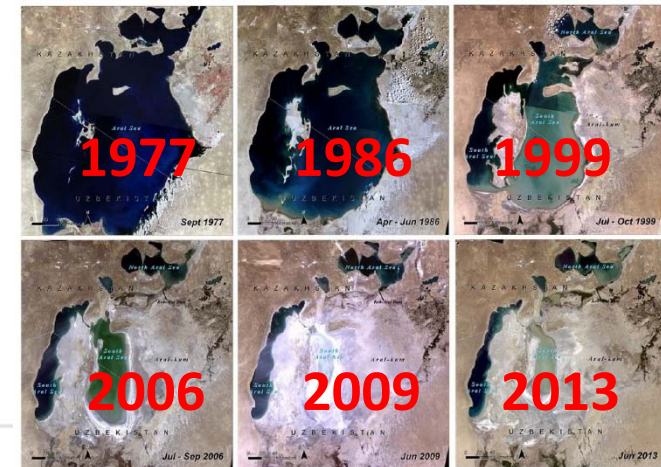
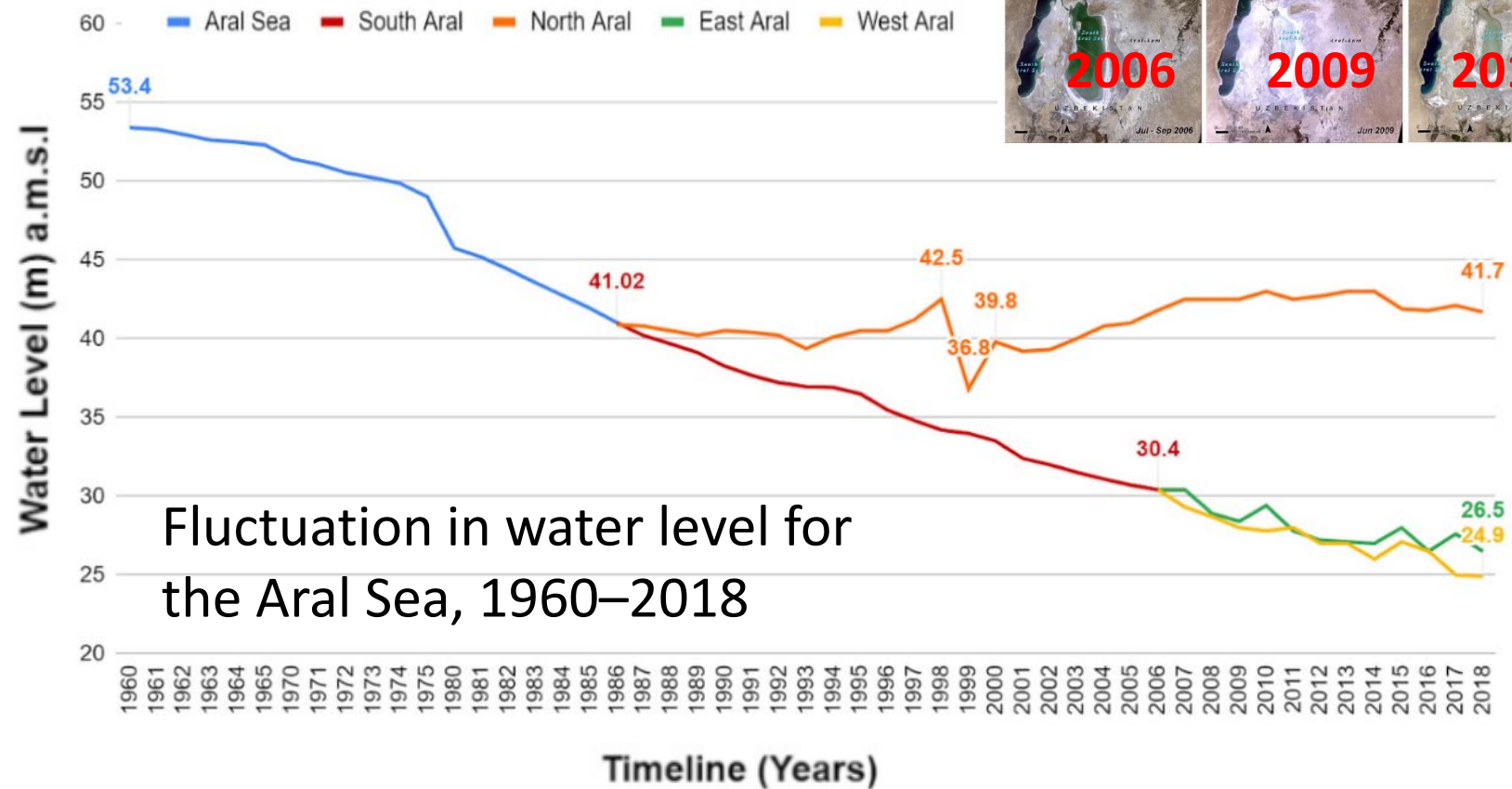
water stress (2000–2017)



FAO's sustainable development goals(SDG) data

<http://www.fao.org/sustainable-development-goals/indicators/642/zh/>

Aral sea shrink and water level decline as a result of water demand increase from economic development

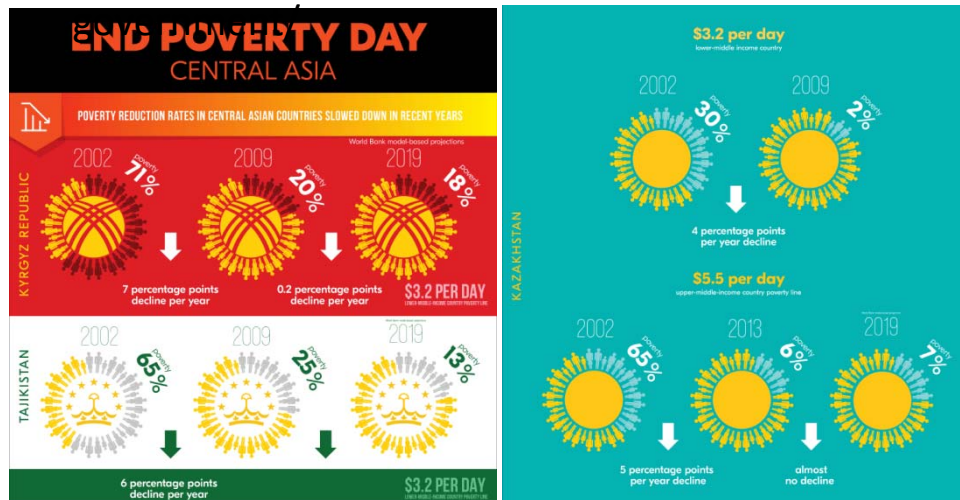


Seawater salt content increased, the dry lake bottom became a source of salt storms, which seriously threatened the surrounding agriculture and human health.



Soil salinization led to a decrease in crop yields: corn crops fell 3 times, rice 2 times, cotton 1.6 times and potatoes and vegetables 1.5-2.5 times

<https://www.timeskuwait.com/news/environmental-protection-is-main-priority-of-uzbekistan->



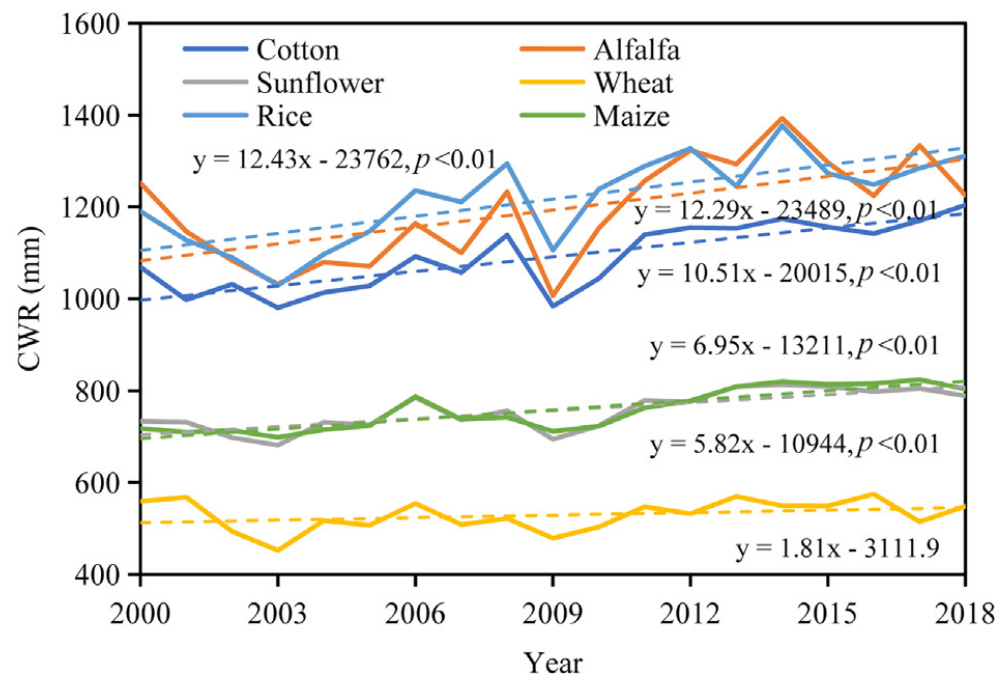
Pace of Poverty Reduction is Slowing in Central Asia, more demand for clean fresh water in the future

<https://www.timeskuwait.com/news/environmental-protection-is-main-priority-of-uzbekistan-government/>

percentage of agricultural water withdrawal

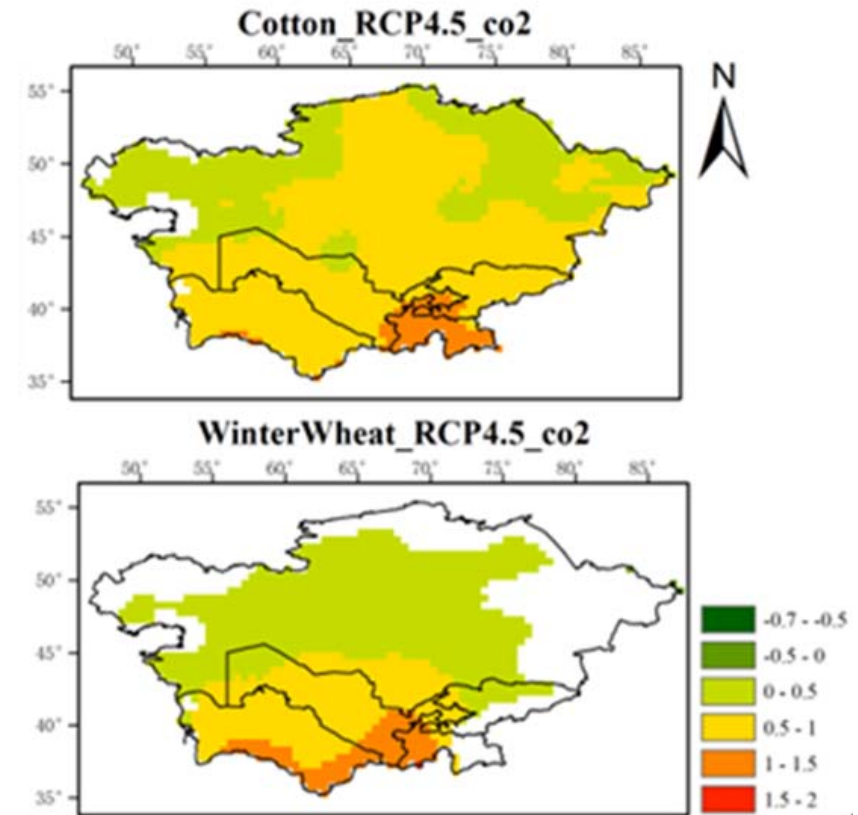
KAZ	UZB	KGZ	TJK	TKM
66.70%	90%	93%	90.82%	94.30%

Data source: FAO. <http://www.fao.org/faostat/en/#data>



Water consumption of five crops increased gradually in Syrdarya river basin

Ruan H.W., Yu J.J., et al. 2020.



two major crops (cotton and winter wheat) water requirement will increase under the future climate change scenario (RCP4.5)

Jing Tian et al. JoH. 2020.

3. Some strategies for agricultural development

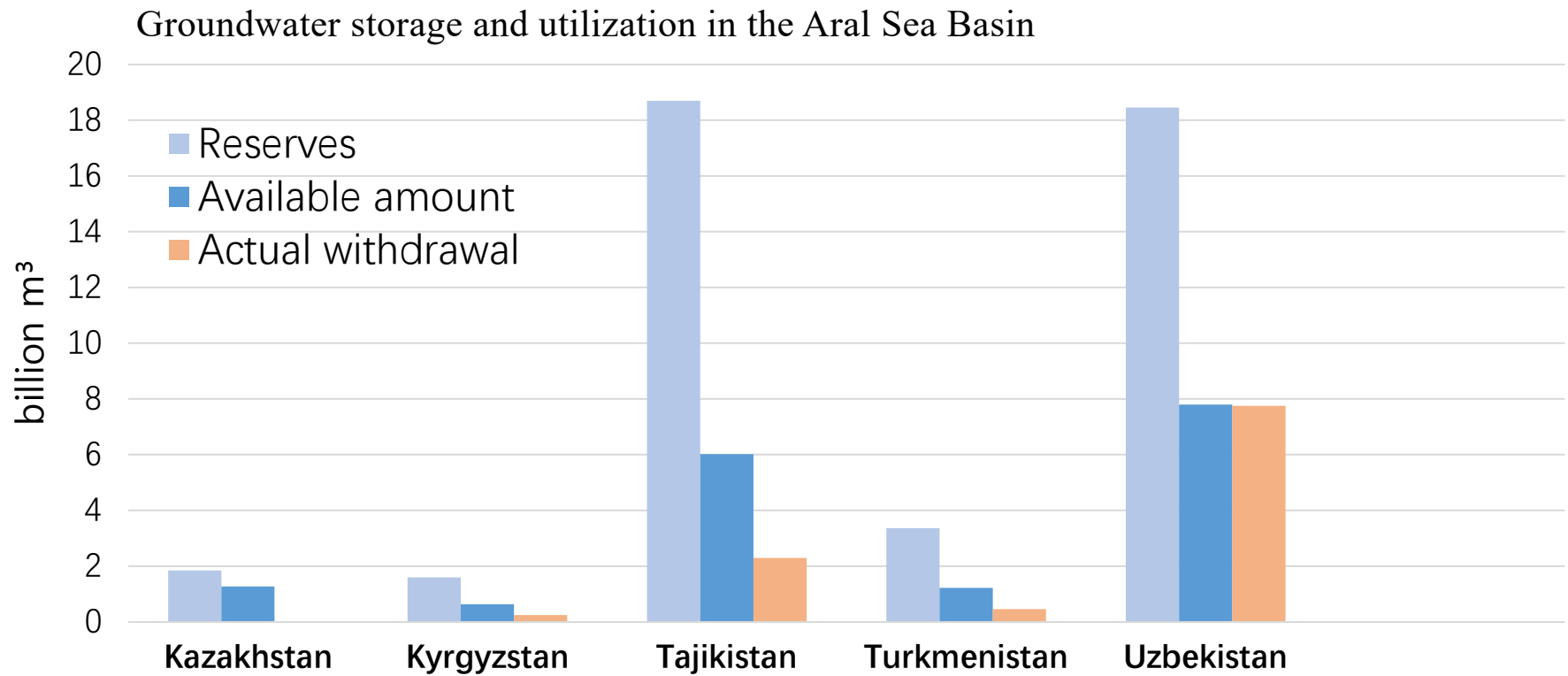
- To increase amount of water available
- To reduce irrigation water demand
- To improve land productivity

Water saving and efficient agricultural development

To increase amount of water available

uncertain climate change ✕
unreliable water diversion ✕

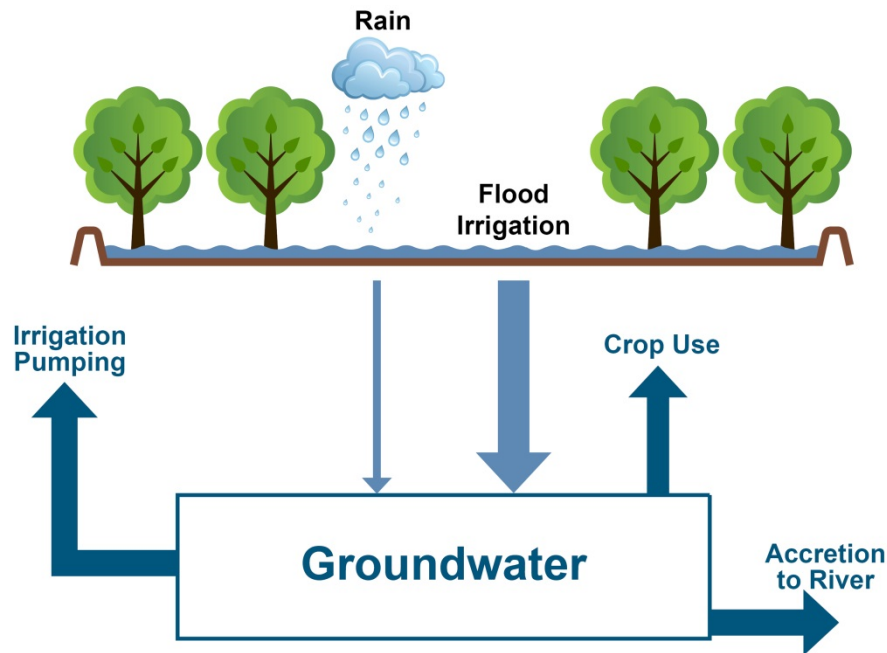
to maximize local water available ✓



Data from Deng Mingjiang, et al. 2011.

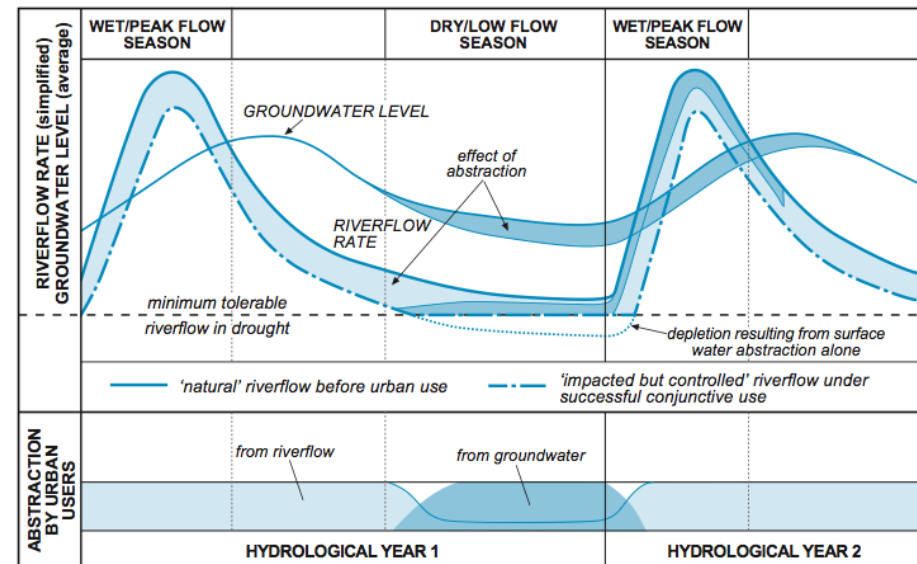
To increase amount of water available

To promote conjunctive use of surface and groundwater and to maximize the use of rainfall



<http://www.tid.org/irrigation/irrigation-information/groundwater-management/>

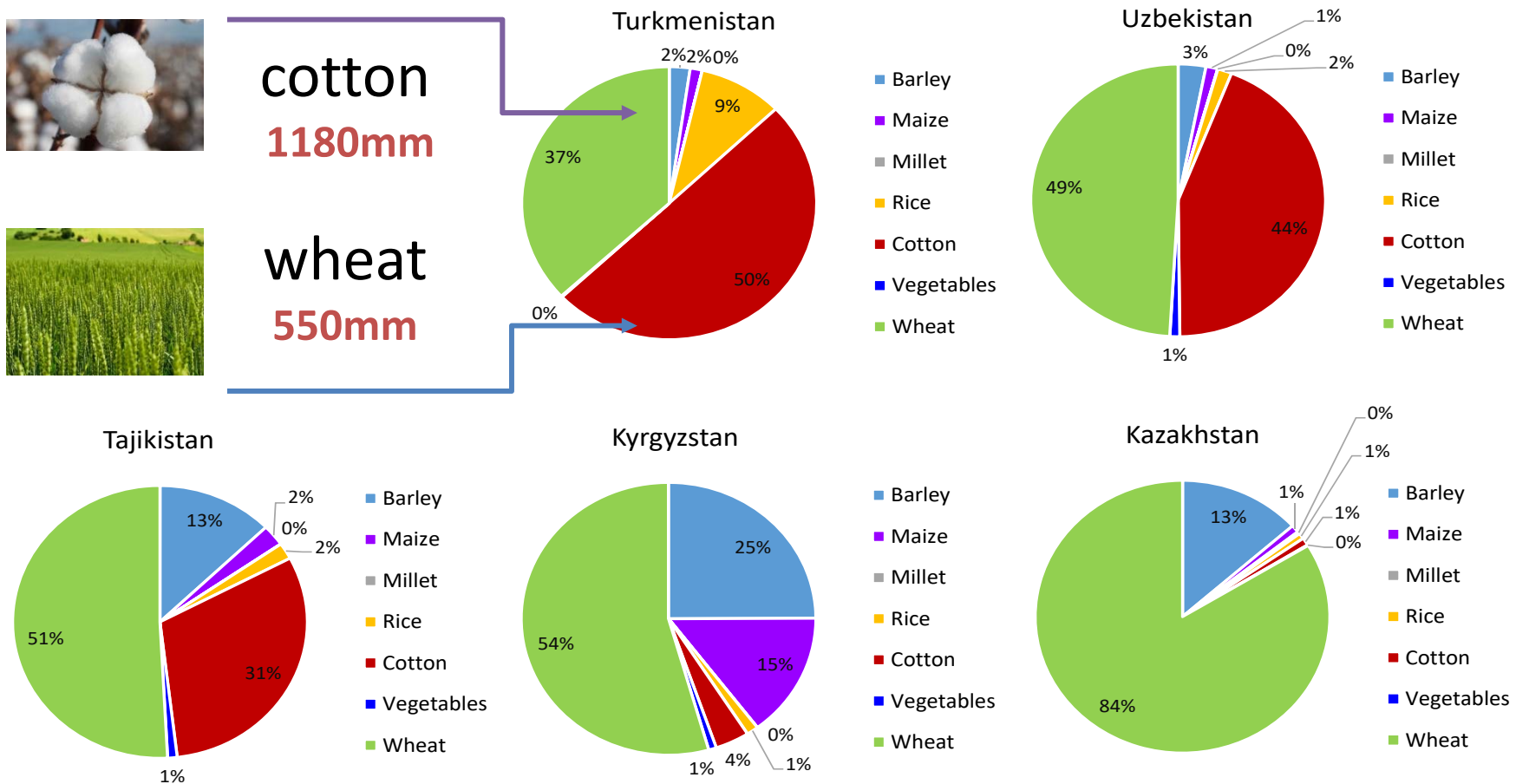
To enlarge amount of water available and to prevent soil salt accumulation in shallow groundwater area



Typical hydrological modification of conjunctive use. Source: FOSTER et al. (2010)

To reduce irrigation water demand

Adjust crop planting structure by changing high water consumption crops to the lower's



Crop planting structure in five Central Asia countries 2002-2016, FAO

To reduce irrigation water demand

Water-saving irrigation technology application

To save water by drip irrigation instead of flood irrigation



To reduce irrigation water demand

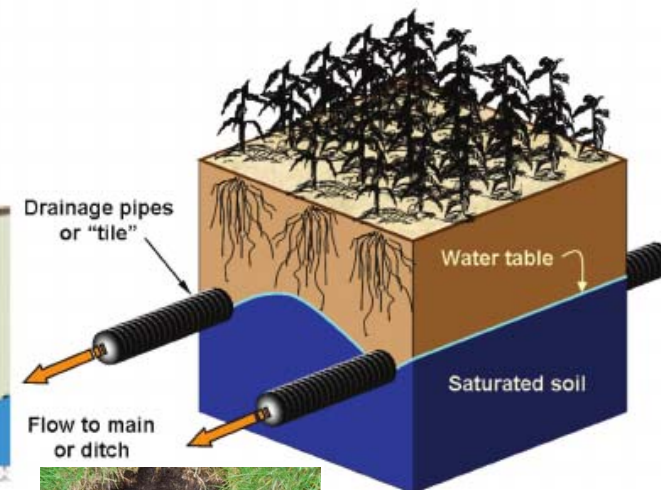
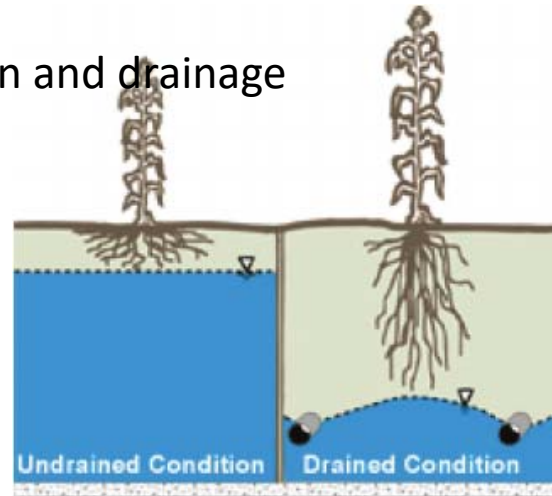
To lower unproductive water loss through mulching



To improve land productivity

Soil desalination by irrigation and drainage

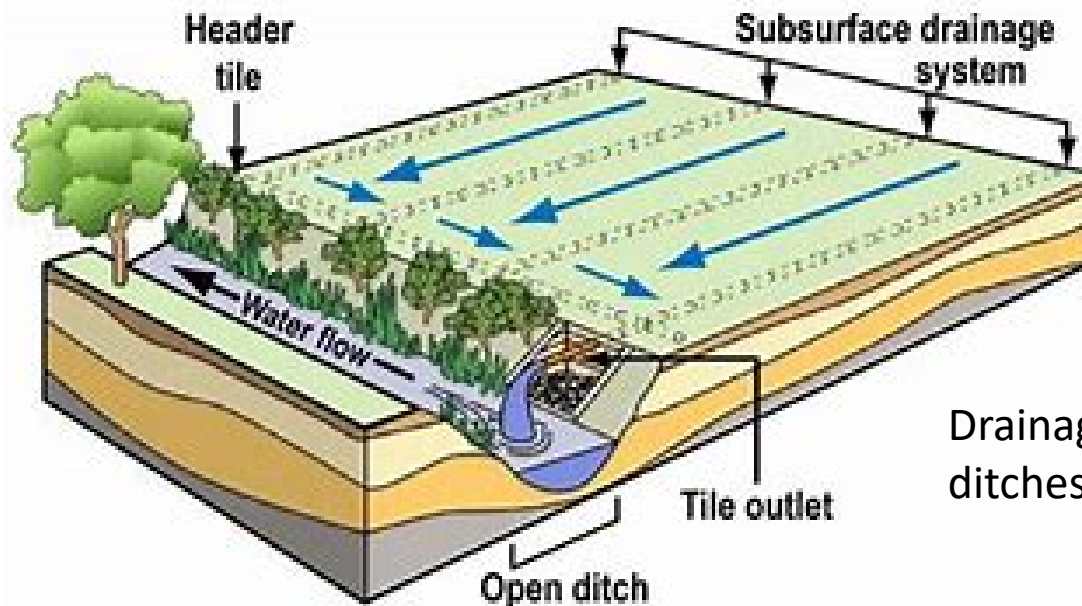
Use flood irrigation and shallow buried pipes to drain salt



Blann, et al. 2009.



<http://www.alamy.com/stock-photo-subsurface-drainage-system-in-an-agricultural-field-water-flowing-136252805.html>



Drainage with subsurface pipes into deep open ditches for leaching soil salt

To improve land productivity

to raise production by facility agriculture such as Green house



The above-mentioned views on agricultural development strategy are only put forward from a general perspective. Agricultural development in Central Asia is a systematic project, which needs thoughtful planning. And agriculture development must adapt to water carrying capacity and water-saving agriculture should be given top priority. Technologies and measures should be adapted to local conditions.

In order to achieve sustainable development, it is necessary to consider the Aral Sea as a whole. Just as the green Aral Sea initiative says, it needs the joint efforts of all parties and scientists from all countries to realize sustainable development.



Acknowledgement

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Major reference:

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Thank you for your attention!



2019-04-19
Aral Sea