(Ministry of Agriculture, Irrigation and Livestock)

GROUND WATER USE IN AGRICULTURE - AFGHANISTAN

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GW use in Agriculture

- Agriculture is the biggest user of GW in Afghanistan because,
  - Existence of weak irrigation networks, and GW make it possible to irrigate beyond canal's command area
  - Greater water-supply security complementing surface water with aquifer storage
  - Better timing of irrigation-water delivery i.e ground water being rapidly deployed when there is shortage of canal water
- Use of GW for Agriculture could have –tive or +tive effects

Ten Provinces with highest %age of irrigated area with Ground Water (2002)

	Name of the province	Area under GW irrigation (ha)	Percentage of the total area (%)
1	Uruzgan	73910	58.4
2	Ghazni	43170	36.7
3	Farah	36890	29.3
4	Helmand	27280	16.8
5	Zabul	24870	39.8
6	Kandahr	21870	18.5
7	Kabul	18270	32.5
8	Ghor	16940	23.3
9	Nangarhar	13820	32.6
10	Badghis	13050	39.2

Province wise distribution of different irrigation systems

No	P8rovince	Canals	Springs	Karez	Wells (2002)	Wells (2015)
1	Badakhshan	212	82		54	
2	Badghis	120	50	30		
3	Baghlan	109	63			
4	Balkh	250	92	3	82	
5	Bamayan	179	137		300	
6	Farah	312	94	352	327	
7	Faryab	157	79	960	867	
8	Ghazni	818	604	1516	636	
9	Ghor	804	570	4	263	
10	Helmand	227	135	276	60	6480
11	Herat	302	153	228	450	
12	Jawzjan	382	87	2	443	
13	Kabul	177	81	321	436	10,800
14	kandahar	279	258	631	252	9000

No	P8rovince	Canals	Springs	Karez	No of Wells (2002)	Wells 2015
15	Kapisa	285	72	49	176	
16	Kunarha	223	67		13	
17	Kunduz	88			55	
18	Laghman	45	3			
19	Logar	154	169	124	91	7200
20	Nangarhar	274	210	495	15	
21	Nimroz	193	2	18	140	
22	Paktia	625	392	528	800	5400
23	Parwan	120	93	34		
24	Samangan	20	73	7	271	
25	Takhar	316	288		509	
26	Uruzgan	363	429	84	210	
27	Wardak	589	519	336		
28	Zabul	199	756	743	148	
		7822	**5558**	**6741**	**6598**	

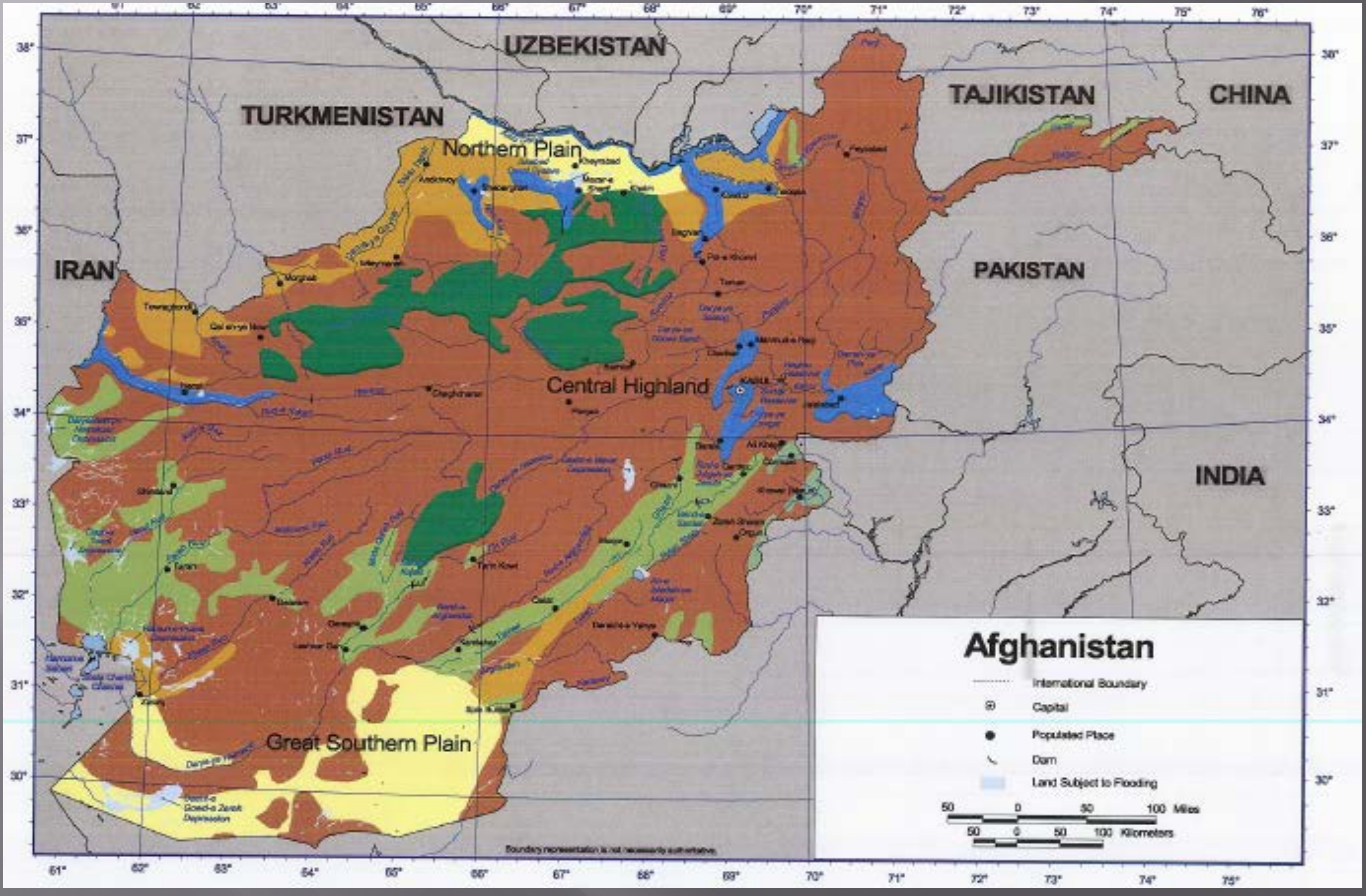
Ground water use in agriculture now-2015

- In Kabul province, approx. no of 3 or 4 inches solar pumps/day = 10
- In Gazni, Logar, Paktiya, Helmand, Kandahar = 10 -15 solar pumps / day in each province
- Each of these pumps irrigation on avg bases up to 3ha
- Discharge 400 – 500 L/min
- Only Dehsubz and adjacent areas have more than 1000 wells for irrigation

Issue with Karezs!

- No of Karezes=6741,
  - Karez discharge = 10 L/s to 200 L/s
  - It irrigates 10 to 200 ha
  - 25% of its total annual volume get wasted in winter

GROUNDWATER RESOURCES (2011)



1 — Moderate to very large quantities of fresh water available from Quaternary age alluvial and colluvial aquifers consisting of unconsolidated and semi-consolidated clastic sediments of sand and gravel. Depth to water ranges from 0 to 101 m. Karez are common on sloping ground, at the margins of basins and near streams.

FRESH WATER LOCALLY PLENTIFUL

2 — Small to enormous quantities of fresh water available primarily from springs issuing from fractured, weathered, and karstic zones in Permian to Paleocene age limestone and dolomite aquifers. Depth to aquifer ranges from 4 to 300 m.

3 — Small to very large quantities of fresh water available locally from Pliocene to Quaternary age alluvial and colluvial deposits consisting of unconsolidated to consolidated sand, gravel, cobble and boulders. Depth to water varies from a few meters to 50 m and depth to aquifer is less than 150 m. Karez are common on sloping ground and at the margins of basins and near streams.

4 — Meager to small quantities of fresh water available from Jurassic to Cretaceous age discontinuous aquifers consisting of fractured and weathered limestone and dolomite with thin interbeds of sandstone and conglomerate. Depth to water ranges from 0 to 100 m, and depth to aquifer ranges from 5 to 300 m.

Note: map unit numbers refer to entries in Table 2.

5 — Meager to small quantities of brackish to saline water available from aquifers consisting of eolian sand deposits. Depth to water ranges from near the surface to greater than 150 m. Well siting is impractical due to shifting sand and strong winds.

6 — Meager to large quantities of brackish to saline water available from aquifers consisting of loam, clay, and sand loam with interbeds of sand and gravel lenses. Water table ranges from near the surface to 150 m.

7 — Unsuitable to small quantities of fresh water available from a complex of discontinuous formations that are composed of varying sedimentary, metamorphic, and igneous rocks which are generally poor aquifers. Meager to very large quantities of brackish to saline water available in the desert and plain areas. Depth to water ranges from near the surface to 100 m. Depth to aquifer ranges from 5 to 305 m. Karez are common at the margins of basins.

QUANTITATIVE TERMS:

Enormous	=	>100 liters per second (L/s), (1,600 gallons per minute (gal/min))
Very Large	=	>50 to 100 L/s (800 to 1,600 gal/min)
Large	=	>25 to 50 L/s (400 to 800 gal/min)
Moderate	=	>10 to 25 L/s (160 to 400 gal/min)
Small	=	>4 to 10 L/s (64 to 160 gal/min)
Very small	=	>1 to 4 L/s (16 to 64 gal/min)
Meager	=	>0.25 to 1 L/s (4 to 16 gal/min)
Unsuitable	=	≤0.25 L/s (4 gal/min)

QUALITATIVE TERMS:

Fresh water	=	maximum total dissolved solids (TDS) ≤1,000 milligrams per liter (mg/L); maximum chlorides ≤600 mg/L; and maximum sulfates ≤300 mg/L
Brackish water	=	maximum TDS >1,000 mg/L but ≤15,000 mg/L
Saline water	=	TDS >15,000 mg/L

HARDNESS TERMS:

Soft	=	0 to 60 mg/L calcium carbonate
Moderately hard	=	61 to 120 mg/L calcium carbonate
Hard	=	121 to 180 mg/L calcium carbonate
Very hard	=	>180 mg/L calcium carbonate

CONVERSION CHART:

To Convert	Multiply By	To Obtain
liters per second	15.84	gallons per minute
liters per second	60.00	liters per minute
gallons per minute	0.063	liters per second
gallons per minute	3.78	liters per minute

Note: Features are from various sources of differing scales. Alignment and locational accuracy are approximate.

Collecting runoff and then using it for irrigation as alternative to GW use!

10m x 10m x 5m

Rational formula is used to estimate pond size.
Q=CiA

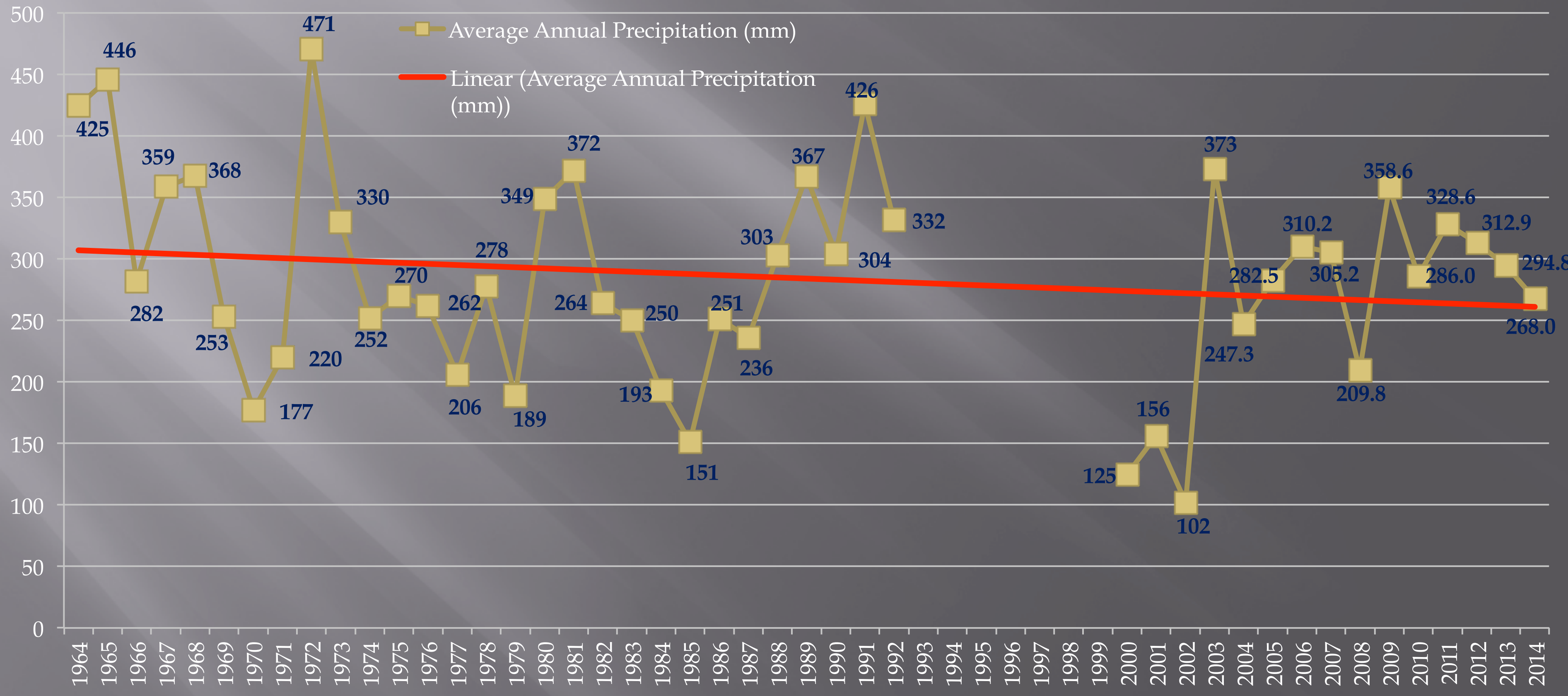
Water Harvesting structures:
2014 = 96
2015 = 320

Solar Surface Irrigation projects:= 299

Future Outlook

- Due to the use of solar energy for pumping, Increased utilization of GW for agriculture in the next coming 5-10years will cause widespread excessive exploitation & will cause crises.
- The impact of Climate-change on GW replenishment is uncertain and required more detailed monitoring and analysis
- It is clear that groundwater storage reserves will be a critical element in climate-change adaptation

Long Term Precipitation Trend for whole Afghanistan

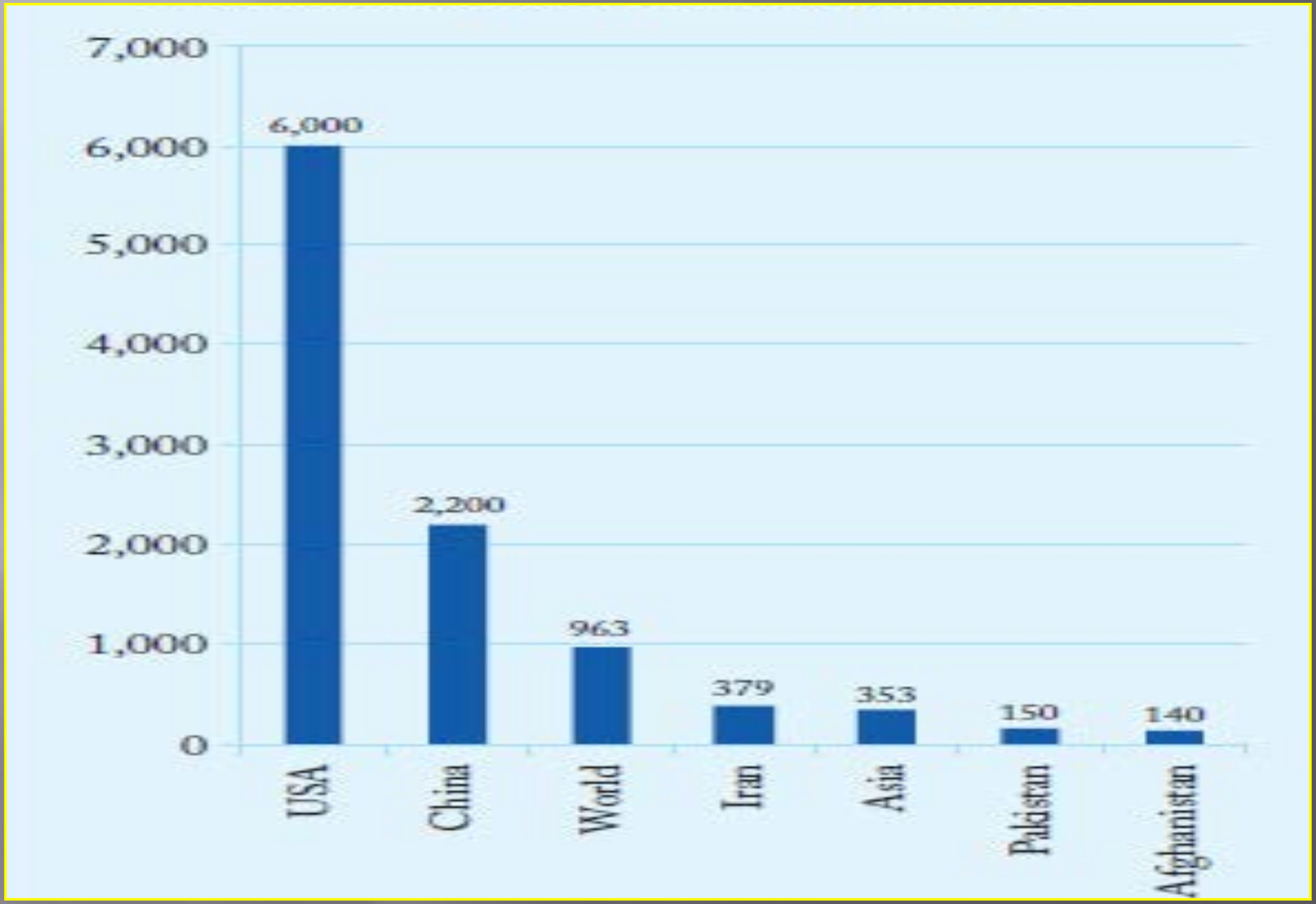


Possible solutions

- Strengthening of groundwater governance through increase investments in
  - institutional capacity, policy formulation,
  - Measurements, resources administration, monitoring, and user awareness and participation

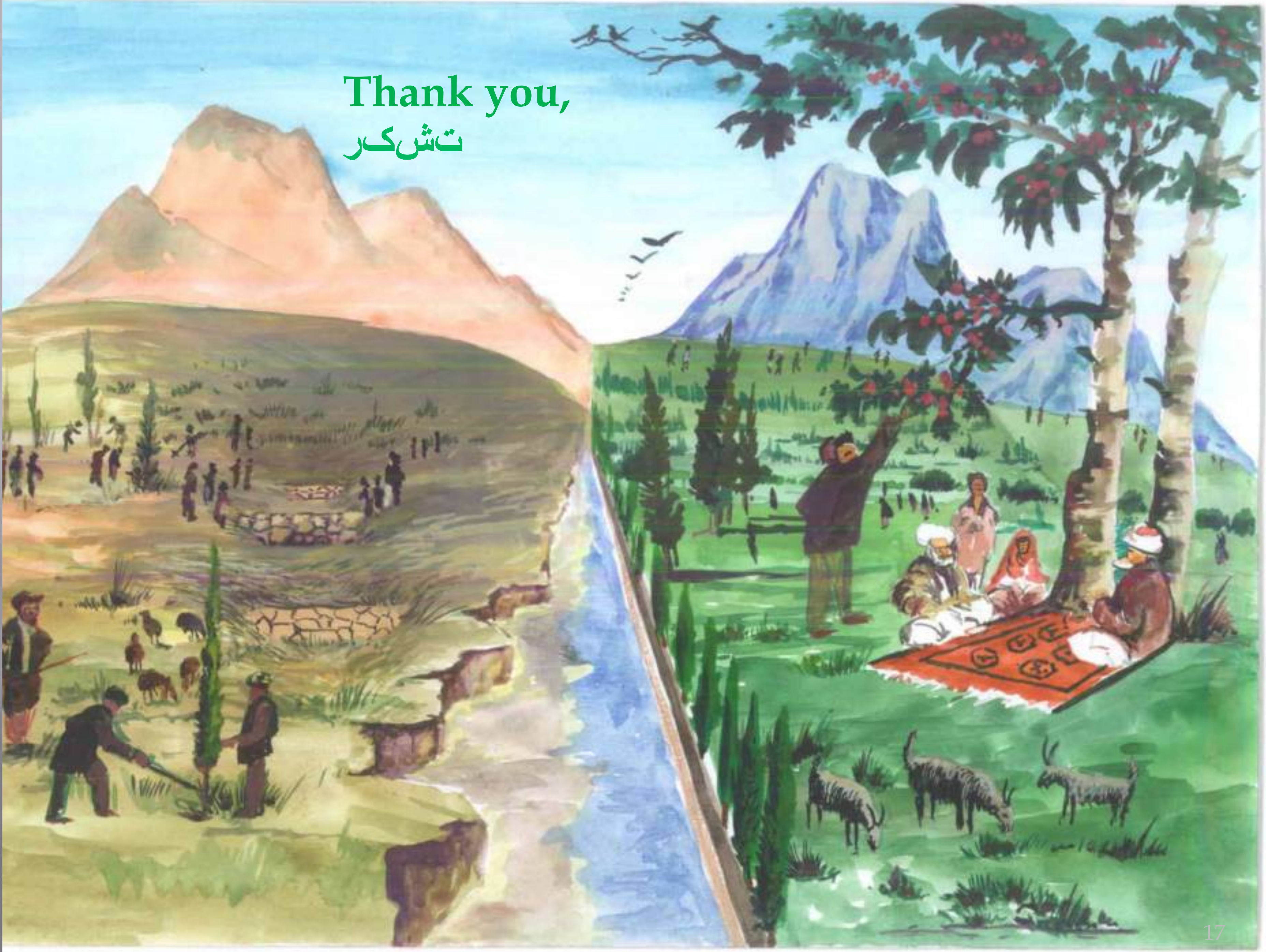
- Rainfall harvesting structures, artificial recharge boreholes with retention basins
- Increase vegetative cover (forests, shrubs)
- Use surface water from rivers as urban water supply

Storage capacity (m^3 per capita)



References:

i. *MAIL central Statistics Office (CSO), and GIS departments)*
ii. *MAIL Agro-met (weather data).*
iii. *FAO (Food and Agriculture Organization)*
iv. *Asian Development bank website (ADB).*
v. *USGS (United States Geological Survey)*
vi. *World Bank data bank*
vii. *ICIMOD publications*
viii. *United Nations Convention to combat desertification (UNCCD)*


Thank you,
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