Water Conservation
in Afghanistan

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Executive Summary: Afghanistan is landlocked country in central Asia having arid and semi-arid climate with precipitation from 75 mm per year in the plain to 1,170 mm in the highland area. Forests cover only 2 % of the country and de-forestations is going rapidly and if precautionary measure will not be taken, after 15 years the country will have a little forest. To measure natural resources of the country, the government established 31 stations for meteorological information and 140 stations for water stage recording on different location of the country. Out of 140 water stage stations, 40 were selected for sediment transport measurement.

Water is a precious material for human being in different uses as domestic, industries and increasing of agriculture products. Water utilization in Afghanistan is mostly for agriculture and about 85 % of the country crops produced under irrigation systems. Irrigation system in Afghanistan is mostly in traditional method and distributes water on traditional ways as common in the country. 84.6 % of irrigation water is tapped from rivers. 7.9 % and 7 % of irrigation water tapes water from springs and Karezes respectively. A small amount (0.5 %) of water is tapped from Arhat (dug wells).

Due to 25 years conflict in Afghanistan all infrastructures including irrigation related structures are damaged or completely destroyed. After 1980 there is no any information about water resources in the country. From other side the country is suffered from continuous drought during the last six years. Ground water dropped down considerably and affected Karezes to be dry or their water is reduced. All related reports to water resources are lost during 25 years of conflict.

After the new elected government in 2001, the government gave first priorities to security and communication system of the country and rebuilt 2,500 Km of pre-war paved highways. Less work on rehabilitation of natural resources has been done so far. As per reports prepared by FAO and the ministry of water and power under Afghan government, the total precipitation in the country is 180,000 million M^3 (150,000 million M^3 from snow and 30,000 million M^3 from rain). Meanwhile the total discharge of all rivers is 84,000 million M^3 (47 %) of the total precipitation in the country.

A total of 12 % of the country land is arable, where only 50 % of this area is irrigated per year due to shortage of water for irrigation and other 50 % will be irrigated next year. Out of total discharge produced in the country, only 55,000 million M^3 (65 %) is used within the country. The remaining is going out of the country. According to the ministry of water and power report, a total of 2,000 million M^3 is used for domestic water supply.

There are a limited number of reservoirs to store water for irrigation and power generation. The government has to develop a long-term strategy to manage water resources and reduce drought effect on agriculture. The strategy should focus on increasing water capital and making better use

of water. The strategy should include (i) water harvesting and watershed management, including more water reservoirs (small and large), (ii) effective control on ground water utilization, (iii) better information system on water availability, (iv) eliminating unsustainable land use practices, (v) improved intake structures and corresponding on-farm water management, (vi) Management transfer of state owned schemes, (vii) extending the irrigated command area. The geographical situation in the country is such, where water is available, there is no enough land for irrigation and where land is available there is no water to fulfill irrigation requirement.

Key words: Afghanistan, water resources management, water available and utilization, irrigation system, water conservation and water law.

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1. Introduction:

Afghanistan is a small mountainous, land-locked country with a surface area of 655,000 km^2, situated in the central part of the Asian mainland. The climate over the most part of the country is arid and semi-arid with rainfall ranging from 75 mm per year in Nimroz and Farah to 1,170 mm per year in South Salang **(see Fig.-1).** Approximately 85 % of the land is either mountainous or desert and more than 25 % of land lies above 2,500 m. in elevation.

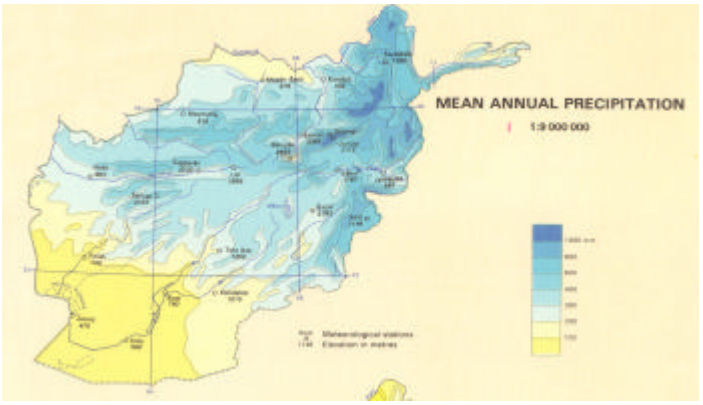

Fig. – 1: Mean Annual Precipitation in Afghanistan

Forest covers only 2 % of the land in the country. Unfortunately, forests that are most important for water conservation in Afghanisatn are declining due to increasing demand for fuel wood and illegal logging to abroad. This decline results a loss of about 30,000 ha of forest per year. If no precautionary measures will take place, Afghanistan will have a little natural forest after 15 years. Local communities with the help of NGOs have attempted to protect forest, but local leaders have disrupted these efforts leading to the destruction of physical barriers.

In the country, a total of 31 locations for metrological data collection (rainfall, temperature, relative humidity, snow, wind and sunshine) were available at least one in each province centre. For recording the water stage of each river to calculate its discharge, the construction of gauging station started in Helmand river basin with limited number in 1940s. Installation of those water stage recorders on Helmand river basin was done by USGS. In late 50s, the German water economy department started installation of gauging stations on Kabul river basin and USSR started few gauging stations on the North flowing rivers including Amu Darya. During 60s all gauging stations came under water and soil survey department of the government. Totally 140

gauging stations to record water stage were established on river systems all over the country. Out of which 131 were equipped by automatic water stage recorders and remaining were equipped with staff gauges to be read manually three times a day.

Out of 140 gauging stations, 40 key gauging stations were selected for collecting information regarding sediment transport of the rivers systems either periodically or daily. Most of the daily sediment transport gauging stations were at the inlet of existing dams or on key location where the possibility of dam construction was there in future.

Water is essential for human being different uses as domestic, industries and agricultural products. The world population is increasing rapidly and the demand for water is also going high to meet their requirement for different uses. From other hand considering the importance of water need for human life, UN announced 80s as water decade for the world. Water utilization and conservation is the most crucial issue to be taken into consideration during different use of water. Any further positive steps toward effective water utilization, conservation and management will response the world next generation.

2. Irrigation Systems used in Afghanistan:

The agriculture sector in Afghanistan relies considerably on irrigation systems both traditional and modern which tap water from rivers and streams. About 85 % of all crops are produced under irrigation systems. The irrigation systems in Afghanistan are traditional and in very poor condition with efficiency about 25 %, where the norm for efficient irrigation systems is 40 %. The following irrigation systems are commonly in used:

1. Modern and relatively large scale irrigation systems, mainly taps water from the rivers either by direct diversion of water or by construction of dam to store water. These systems are limited to a few governmental projects in Helmand, Kandahar, Nangarhar, Ghazni and Parwan provinces. The construction of few more projects were under construction before 1978 in Baghlan, Kunduz, Nimroz and Heart provinces, but they are not completed yet. For the details see **Table – 1** bellow:

Table -1: Major Modern Irrigation Systems

Name	Province	Command Area in Ha.	Donor	Const. Year	Const. %
Helmand and Arghandab	Helmand Kandahar	103,000	USA	19940 - 50	100
Parwan	Parwan	24,800	China	1960	100
Nangarhar	Nangarhar	39,000	Former USSR	1960	100
Kelagai	Baghlan	20,000	GoA	1970	100
Gawargan	Baghlan	11,000	ADB & GoA	1978	70
Kunduz-Khanabad	Kunduz	30,000	WB	1980	80
Sardeh	Ghazni	15,000	Former USSR	1980	90
Salma	Herat	115,000	WAPCOS	1976	20
Total		**357,800**			

2. Temporary or locally built diversion structures over perennial and semi-perennial rivers to convey water through canals/streams (Jui) to land for irrigation.

3. Diversion structures over seasonal river and stream beds to convey flood waters to the fields whenever it rains. This system also is known as Sailabi or flooding.
4. Karezes (Qanat in old literature): Are the most widely used irrigation systems in South part of Hindu Kush ranges from Kabul to Herat.
6. Springs: Where is available, the water conveyed by gravity to land for irrigation.
7. Dug wells (Arhat). This type is very old method and animal (donkey, horse or camel) is used to draw water by a series of buckets going up and down from a big dug well about 5 meter in diameter and up to 5 m. deep.

The ministry of water and power under government of Afghanistan divided the sources of irrigation water into four classes: rivers (84.6 %), springs (7.9 %), Karezes (7 %) and Arhat, (0.5 %), see (**Fig-2**).

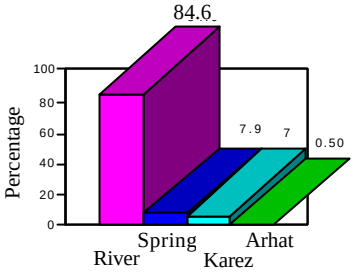

Fig. – 2: Irrigation water Sources

It is worth mentioning that in a traditional method, the distribution of water is not uniform according to crop water requirement. Upstream land is taking more water where downstream land does not get enough water for their cultivation.
The reasons for not uniform distribution are improper design of outlets, lack of efficient water distribution system (water law) and weak maintenance system. The government approved water law for the country about 25 years back, but unfortunately it did not put in practice due to its complicity and contradiction with common traditional distribution methods. Owners of land put a huge amount of money to purchase or lease water for his use and they are not agree to give those water to someone else without any payment.

3. Present Status of Water Resources:

Before 1978, Afghanistan was self-sufficient in cereals production and a flourishing horticulture market provided about 40 % of the country's export earning in fresh and dried fruits and nuts. During the last two and half decades of war, all infrastructures including irrigation systems in the country have been severely damaged or completely destroyed.
Additionally these systems require excessive maintenance to provide a continuous supply of water. Canal intakes are washed away and excessive water entered the canals and washed its embankment or canals filled with sediment. Such repeated failures were time-consuming and costly to repair. As the result it caused interruption in the supply of water at critical times during irrigation season. This interruption caused considerable losses in crop yields. The rehabilitation of these systems, in term of their ability to supply greater quantities of water, distributes it with minimum losses are crucial issues to be taken into consideration immediately.

During 80s and 90s international communities rushed to the country to help Afghans to rehabilitate their irrigation systems. These assistances were on emergency basis and their main tasks were to clean Karezes and canals. Rarely happened that water intakes were designed and constructed by few NGOs, but soon due to lack of flood information for design, they washed out within one flood season. The farmers were not satisfied with these types of jobs and they wanted permanent structures to get full and continuous water for their irrigation.

The recording network of all river systems collapsed and all 140 hydrological gauging stations were destroyed completely. Most of the hydrological year books printed by the hydrology

department were lost. Recording process in the country continued until 1980 and then due to distortion of gauging station on river basins it stopped. After 1980, there is no a single station to record water stage of the river in the country. So far no action on re-installation of those gauging stations has been taken by the concerned department.

During the last six years while drought hit Afghanistan the demand for water went high and rich farmers tried to find another source of water for their agriculture. As the result they drilled the ground for deep wells and drew ground water for their irrigation. This resulted considerable drop down (up to 10 m) in ground water table, especially in the south of the country. Dropping of ground water level result dryness/reducing of discharge of Karezes.

It is worth mentioning that all reports related to water resources development projects were lost due to conflict between different Afghans factions. Now what most of the donor agencies are working to redo those reports and started work from the bottom. After Bonn agreement, the new government established in the country and started work to prepare constitution and get approval from Afghan Loya Jirga (Supreme Council). Meanwhile the government gave the first priority to security and communication system. The government rebuilt the pre-war paved highways about 2,500 Km. Regarding water resources development less work has been done so far.

4. Available Water Resources:

The rivers regime in Afghanistan depend on annual rain and snow melt in highland above 2000 m in elevation and represented 80 % of Afghan water resources (excluding ground water) of the country. The annual water received from snowmelt in highland is estimated to be 150,000 million M^3 and the rest of the country received only 30,000 million M^3 through rainfall results a total of 180,000 million M^3 for the whole country. Out of total runoff in Afghanistan, only 15 % contributes to recharge ground water in the country.

According to the hydrology department under the ministry of water and power, all river systems in Afghanistan are divided into following five basins :

1. The Amu Darya basin in the north of the country flowing from east to west.
2. The north flowing rivers basin either disappear inside or outside of the country.
3. The Hari Rud river basin flowing toward west, then to north and enters Turkmanistan.
4. The Helmand river basin flowing toward south-west and ponds in Hamun-i-Sabiri.
5. The Kabul river basin flowing toward east and joins Indus river in Pakistan. **(see Fig-3)**

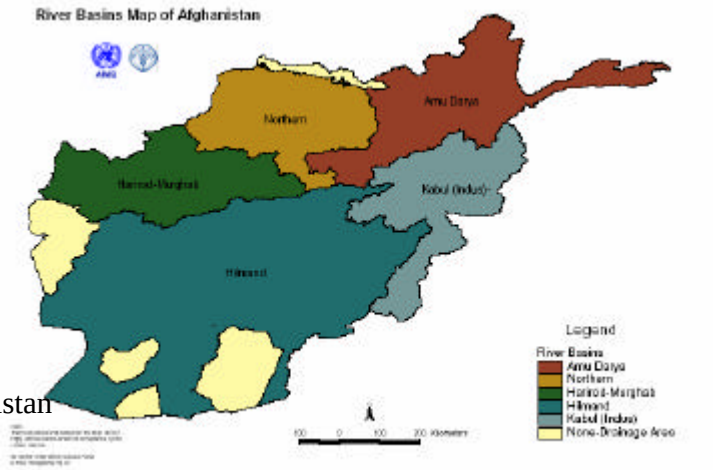

Fig.-3: River Basins in Afghanistan

The total annual discharge of above mentioned river basins is 84,000 million M^3 (47 %) of the total precipitation in the country. For the detail see **Table – 3** bellow:

Table – 3: Mean Annual discharge of each river basin in Afghanistan.

River Basin	River Name	River Regime	Discharge in million M^3	Percentage of Total
Amu Darya	Ab-i-Panja	Snow/glacier-fed	36,420	43
	Kokcha	Snow/glacier-fed	5,700	7
	Kunduz	Rain/Snow-fed	6,000	7
Total Amu Darya			**48,120**	**57**
Kabul/Indus	Gomal	Rain/snow-fed	350	0
	Margo, Shamal, Khuram.	Rain/snow-fed	400	0
	Panjshir	Rain/snow-fed	3,130	4
	Kunar	Snow/glacier-fed	15,250	18
	Kabul, itself	Rain/snow-fed	2,520	3
Total Kabul/Indus			**21,650**	**26**
Northern Rivers	Khulm	Rain/snow-fed	60	0
	Balkhab	Rain/snow-fed	1,650	2
	Ab-i-Safid	Rain/snow-fed	40	0
	Shirin Tagab	Rain/snow-fed	100	0
	Amu Darya desert	Rain/snow-fed	30	0
Total Northern			**1,880**	**2**
Helmand	Farah Rod	Rain/snow-fed	1,250	1
	Adraskan Rod	Rain/snow-fed	210	0
	Khuspas Rod	Rain/snow-fed	40	0
	Khash Rod	Rain/snow-fed	170	0
	Kaj Rod	Rain/snow-fed	60	0
	Ghazni Rod	Rain/snow-fed	350	0
	Helmand at Kajaki dam	Rain/snow-fed	6,000	7
	Musa Qala Rod	Rain/snow-fed	220	0
	Arghandab	Rain/snow-fed	820	1
	Lower Helmand	Rain/snow-fed	110	0
	Southern river	Rain/snow-fed	70	0
Total Helmand			**9,300**	**11**
Har-i-Rod	Murghab	Rain/snow-fed	1,350	2
	Kashan and Kushk Rod	Rain/snow-fed	110	0
	Har-i-Rod	Rain/snow-fed	1,600	2
Total Har-i-Rod			**3,060**	**4**
Grand Total			**84,010**	**100**

Ground water in Afghanistan has not been surveyed yet completely. What figures are reflected in different reports are base on assumption. The ministry or water and power did survey of ground water in a limited area as Moqur area in Ghazni by the ministry of water and power, Herat centre by Erkon company, from England, Har-i-Rud by Montreal company from Canada, Omakay in Zabul, Jerai in Kandahar and Bakwa in Farah province by jointly WAPCOS India and WAPECA

(Water and Power Engineering Company of Afghanistan). The ministry of Mine and Industry surveyed only Kabul area.

5. Water Resources Utilization:

As mentioned before, the country is mountainous and only 12 % of the country's land ($7.86x10^6$ ha) is arable. In a normal year due to shortage of water only 50 % of arable land is cultivated. Out of the total discharge only 55,000 million M^3 (65 %) is used within the country. The remaining water without any use is going out of the country.

According to NGOs and UN agencies assessments the water resources utilization in Afghanistan is in poor shape. Beside utilization of water resources for agriculture the government constructed limited reservoirs on locations to store flood water to be used for both irrigation and power generation. For detail of location of dams, see **Table – 2,** bellow:

Table – 2: Dams

Name	Province	Storage in 10^6 m^3	Purpose or use
Kajaki	Helmand	2,700	For irrigation & power, completed.
Arghandab	Kandahar	479	For irrigation, completed.
Salma	Herat	900	Irrigation & power, but not completed
Naghloo	Kabul	450	Power, completed
Sardeh	Ghazni	164	Irrigation, completed
Daroonta	Nangarhar	120	Irrigation and power, completed.
Total		**4,813**	

It is worth mentioning that the live capacity of the above completed dams is reduced considerably due to silts entered from water shed during flood season.

As per the government report, the total use of water for domestic is estimated to be 2,000 million M^3. This figure is rough and there is no detail information on the matter. In Afghanistan, industries have not been developed too much yet and water use of industries has not been estimated yet.

6. Water Conservation:

Although the construction of dams (both reservoirs and check dams), over perennial, semi-perennial and seasonal rivers, and their use for irrigation and power generation, is probably the best long term solution. From other side international experience has shown that the river basin is not only the best unit for planning but also for management of both water supply and demand and conservation of natural resources. But the geographical situation in Afghanistan is such, where water is available there is no enough land to irrigate. i.e. Kabul and Kunar are major rivers considering their annual discharge. Both are flowing in a long narrow valley and crossing Afghanistan boarder near Torkham and joins Indus river in Pakistan. Where land is available there is no enough water to fulfill the irrigation requirement. i.e. Helmand river with its tributaries are flowing in a large plain areas and joins Hamon-i-Sabiri between Afghanistan and Iran. This limitation results the available water resources can not be used efficiently. The government has to develop a long-term strategy to manage water resources and reduce drought effect on agriculture. The strategy should focus on increasing water capital and making better use of water. The strategy should include (i) water harvesting and watershed management, including more water reservoirs (small and large), (ii) effective control on ground water utilization, (iii)

better information system on water availability, (iv) eliminating unsustainable land use practices, (v) improved intake structures and corresponding on-farm water management, (vi) Management transfer of state owned schemes, (vii) extending the irrigated command area.

7. Conclusion/Recommendation:

7.1. Short-Term Programmes:

In the short term the emphasis of the strategy and opportunities will be on investment in the rehabilitation of traditional small and medium irrigation schemes, with such programmes to play a key role in institutional restructuring and capacity building, planning for the rehabilitation of formal and large-scale schemes, establishing database and information systems, initiating the institutional change process. More detailed provisions:

1. Conduct water conservation and harvesting through soil, vegetation, and forest cover management by constructing check dams, control bunds, and other facilities to conserve water and enhance ground water recharge in all watersheds.
2. Rehabilitate small to medium-scale irrigation schemes requiring infrastructures repair work that extends beyond routine preventive maintenance and needs resources and that farmers and villagers are unable to mobilize.
3. The rehabilitation programmes will be based on systematic technical assessment of problems in consultation with Mirab (water master).
4. Involving the communities in the maintenance and operations is key factor to increase agricultural productivity and outputs. Therefore, rehabilitation of these systems will be under taken within the community development framework. Pilot projects will also be implemented to support community management of watersheds and water harvesting.
5. Plans the rehabilitation of formal and large-scale irrigation schemes. Initial assessment work has to be done in MWP (Ministry of Water and Power), with schemes identified and preliminary technical assessments to be undertaken. Users will have to be organized into an appropriate institutional framework and water delivery contracts agreed upon. This will include a water charging policies and collection mechanism.
6. Database and information system establishment should commence as soon as practical. Rebuilding of the water resources knowledge base will be a collaboration effort of all core ministries and agencies, coordinated by the Afghan Information Management System (AIMS).
7. A government task force including AIMS will be required to develop standards and protocols to enable efficient sharing and use of a wide range of data for different purposes. Coordination of this work by the government is essential to ensure that all studies contribute the overall goal. Re-establishing the hydrological and hydro-geological network (including stations to monitor snow pack) is a high priority, though it should be undertaken within the context of earlier network design.
8. Appropriate institutional arrangements for water resource management are an essential prerequisite. These options should be assessed in the context of the broader review of required sector agencies and their respective role.

7.2. Medium-Term Programmes:

The medium-Term interventions will involve expansion of the investment programme and implementation of institutional and policy reform, via the following key activities:

1. Expansion of the existence traditional small and medium irrigation systems with rehabilitation programmes under the community development.
2. Implementation of an investment programme for rehabilitation of formal and large-scale irrigation schemes. This rehabilitation should be based on feasibility studies for each scheme and selection criteria for prioritizing individual scheme.
3. Institutional reform and capacity building.
4. Policy and legislative reform for water policy and right, water charges, community-based watershed management and irrigation system transfer to users, and ground water and inter-country water transfer.
5. The present water law should be revised and community established rules should be taken into consideration to response both traditional and modern irrigation systems.
6. The government should take over the responsibility to protect forests and provides a law to avoid de-forestation of the country.

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