The Impact Of The Man Activity in Duhok Dam Watershed On The Future Of Duhok Dam Lake North-Iraq

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Abstract

Duhok dam watershed is located on the north of Duhok governorate and it is about of 1.5 km from the downtown of Duhok city .It contents the Duhok dam infrastructure, which started its operation in 1988, at the beginning the dam was operated to meet water supply needs of Duhok city and irrigation needs for about of 4600 ha of the agriculture area.

The catchments area is about of 135 km2 and most of its water yield goes to be stored into Duhok dam. The watershed is divided into four sub-watersheds as follows:

The watershed is divided into four sub- watersheds as follow:

1-Bajlor sub-watershed: which covered 9.4 km^2 and contents of two villages (Grqasrok and Bajlor)?

2-Sindor sub-watershed: which covered 26 km^2 and contents of four vii/ages (Ekmala, Qarqarava, Phagree and sindur villages)?

3-Linava sub-watershed: which covered 52.6 km^2 and contents of seven villages (Bakhrnev, Botia, Peromera, Perafat, Khazyava, Bakoz and Linava)

4-Dole Germava sub-watershed: which covered 47 km^2 and contents of three villages (Zewa, Baski, and Berjene).

The watershed parameter can be divided into the following items

1-Climate

The catchments area situated in the north-west of Iraq near the Turkish border, where the climate is similar to Mediterranean climate and partly to the Iranian climate region with an expressed influence of the comparatively high altitude of the surrounding high mountains,

The climate characterized by a dry and hot summer and rainy winter, however cold weather prevails during the winter and snowfalls on the high mountains.

Major rainfall storm occur from October to May, the other months of the year are relatively dry. The annual rainfall of the region is about 535 mm.

The amplitude between summer and winter temperature is comparability high. The annual temperature is 19.5C° north-west winds are prevailing during the summer, which carry find sand and silt. While.North-east winds are prevailing during the winter. Table (1) illustrates the meteorological data of the region.

2- Geology

The study area is a hilly, surrounded to the south by the mountain chain jebel AL-Abiad and to the north by mountain chain Zakho. The geological structure of the area consists of deposits of the Eocene are represented by several formations:

A- Pelaspi Limestone" represented by slightly dolomite limestone and dolomites

B- Gercus", represented by an alternation of dolomite marls, marly dolomite and siltstone with some gypsum rocks.

C- Kolosh", represented by alternation of clay marls, dolomite marls, and clay limestone polemicist sandstone, -Fragmental Detritus", represented by small rock fragments
The quaternary is represented by alluvial and diluvia deposits.
An important factor here is the mineral spring water, which appear on the limit between the Eocene and chalk deposits in the tail of the reservoir. Their discharge is not constant and decreases considerably during the dry summer period

3-Topography

The watershed is located in a mountainous area, mostly with very deep and bare slopes due to soil erosion.
Garmava watershed includes 2 streams (Garmava and Linava) with small narrow river banks. The rocky slopes are very steep with more 'than 80% decreasing in the direction of the near the river, where they are between (20 and 30) %the northern part of Sindor stream has the same characteristics as above with several gullies with moderate slopes near Sindor villages. the slopes between Sindor and Bajlor streams are also very steep with few gullies.

Current problem

The watershed confronts the problem of a degradation of its natural resources in particular soil degradation affecting the dam infrastructure and the sustainability of its natural resources and living conditions of the settled villages in the area, basically the main identified problems are:

1. Soil erosion problems

Erosion is the detachment of earth material from the surface. Once detached, agents like water or wind transport the material to a new location where it is deposited. The most ubiquitous form of erosion is that done by water.
Rain splash erosion is caused by the impact of water striking the surface. As precipitation is absorbed by the surface it fills the pore spaces, loosening soil particles and driving them apart. The impact of subsequent rain drops hitting the surface splash the particle away from the point of impact. Surface runoff forms when the rainfall intensity of a storm exceeds the infiltration capacity of the soil.
Sheet erosion is caused by the unconfined flow of water running across the surface. The effects of sheet erosion are often hard to distinguish because such thin layers of soil are being removed. It isn't until several years later that significant degradation is perceived.
Rill erosion is caused by water concentrating into innumerable, closely-spaced small channels. Left unchecked, rills can cut vertically and horizontally and when joined, for gullies.
In general land of the lake has a bad formation, being eroded easily when rainfall occurs. This causes the sediment problems and affects negatively the capacity of the dam.
Soil erosion in the watershed is the result of the deterioration of the vegetation cover due to illegal cutting of wood, overgrazing, shifting cultivation, forest fire and unsuitable agricultural practices .On steep slopes of the mountains, badland, shale, sandy, and red clay are very common in widespread area. Therefore, water storage capacity of the soil is very poor and the runoff is relatively high. Consequently the soil erosion is very active in the most part of the watershed in particular in the Germava and Linava sub-catchments area as shown in fig (1),

According to the previous studies the permeability of the soil in the watershed is very slow, averaging 0.05-0.1 mm/sec.

Material and Methods

1-Soil classification

Soil classification indicates that lithsol dominate 50% of the watershed area consisting of brown and gray limestone. They are shallow soil with parent rocks dominating the area except the southeast part .Rendzina soil dominate the south-east part of the watershed ,southern Sindor stream and some area of Bajlor sub-watershed where they are (20-30)cm deep consisting of brown clay covering the calcareous rocks.

Shallow soil with (3-4) cm depth could be found along the road Duhok Sindor where several vineyards are established.

2- Land use :

The land use of the watershed area is as follows:

-Poor forests and wood land covering about 23% of the area composed of scattered oak trees and open forest and shrubs on unstable slopes

-Rangeland is to be found mainly in the sub-watershed of Sindor and Bajlor covering 19% of the area, which is now in very poor conditions near the villages due to the Overgrazing and eroded soil

-Agricultural lands represent about 10% of the area are mainly located on the riverbanks of the main streams and on moderate slopes .Irrigation facilities are available along Duhok stream, Garmava and around Sindor village, the main area for vineyards. Rain fed agriculture could be found on the moderate slopes where vineyards are often established.

Soil erosion in this area is very active as the soil is yearly cultivated without any precaution to prevent the soil erosion.

In general land of the lake has a bad formation, being eroded easily when rainfall occurs. This causes the sediment problem and affect negatively of the deterioration of the vegetation. Soil erosion in the watershed is the result the capacity of the dam.cover due to illegal cutting of wood overgrazing, shifting cultivation, forest fire and unsuitable agricultural practices, on steep slopes of the mountains, dad land ,bare rock, shale, sandy and red clay are vary common in widespread area. Therefore ,

Water storage capacity of the soil is vary poor and the runoff is relatively high .Consequently the soil erosion is vary active in the most part of the watershed in particular in the Garmava and Linava sub-catchments area .according to pervious studies the permeability of the soil in the watershed is very slow averaging (0.1-0.05)mm/sec.

The annual soil losses volume for the Duhok watershed has been predicated based on daily runoff and sediment volume. Annual soil losses volume from Duhok watershed applying the regional regression model can be stated as :

$$Vs=e\ -2.383 * S\ 1.173 * W\ 2.321 * r\ 1.436$$

-watershed are Bad land, bare rocks, shale, marl soil and mountains peaks surrounding the a represent about 40% . This area is very degraded and not used for any agricultural purpose

Where; Vs=predicated mean annual soil/ass volume, m3/ha

S=land slope, m/m. R=rainfall volume of the given location, mm.

W=watershed condition parameter related to runoff and soil loss, which can be stated as :

W=C * 0 * T

Where ;C=conservation practice coefficient, O=vegetation cover coefficient.T=soil texture coefficient. These values of C, O and T can be determined according to the watershed characteristics as in table (2)

Watershed hydrologic coefficient

Watershed characteristics

A= conservation practice

C= No conservation practice Contouring

Wattle fence= 0.89 0.825 1.0

B. ~frustration cover density

D =No cover (bare soils) Medium vegetation cover Full cover, 0.374 0.651 1.0

C =Substituting the above values of Sand w into the equation of regression

Vs= e-2.383, (0.0942)1.173' (0.572)2.321 (r) 1.436

Results and recommendations: there are some potential and solution for this watershed, with some advantages for the right side (Sindor, Bajlor watersheds).some of the already identified solution are:

1- Construction of soil and water conservation project in the area like forestations area, making stone check dams in the eroded valleys making terraces in the versants of hills, making wattle fences, construction of retaining walls.

2- Improving the availability of surface and ground water through implementation of different technical solutions.

3-Take necessary legal measure to prevent erosion in the area close to the dam reservoir (e.g. prohibition of cultivation on slopes exceeding 40%.(and forest area

4-Protect and improve the natural vegetation covers in the natural range

5-improving the accessibility in the remote part of the watershed to facilitate the management of the natural resources,

6-Identify receptive farmers and local communities for preparation of agricultural project

Discussion

'Rainfall of year (2003) is up to 4 month only Rainfall of table is represented as average 'Volume-loss is compared to (Vs) at 1983 by Dawood, based on the different field observations and several studies carried in Duhok watershed it is concluded that soil erosion is a serious constraints for the dam, which reduces significantly the storage capacity of the dam reservoir each year if no measure of soil conservation, protection and Management of the watershed of the dam have been taken .The volume of the total discharge for the period from November 1978 to the end of October 1979 was estimated to be about 12 million m3, the highest monthly discharge was registered in Feb. 1980 with (80) m3/sec and the lowest in July 1979 with (2.4) m3/sec, the maximum suspended load from Dec. 1978 to Feb. 1980 was 5 kg/m3 or the equivalent of137, 959

Reference

1- M.R, Adil, 2007, Duhok Dam watershed management,

2- Dawood, 1986, modeling of soil erosion using rainfall volume, Ph.D. Thesis.

3- IWM, report, 2002, integrated watershed management, rapid appraisal.

4-, FAO, 2002 report,Soil erosion in Duhok dam watershed

5- M.T. Jaffer (1988), study the relation of rain with surface watershed suspended load in Duhok dam watershed, Msc thesis.

Table (1) soil and meteorological data (Duhok watershed),

Volume 10 ss(Vs) m3/yr	Volume 10ss(Vs) m3/ha/yr	Rainfall (mm)	Year
1.7' 105	13	535	1975
2.04' 105	15	588	1983
1.7' 105	13	535	1997
0.24' 105	1.7	133.1	2001
2.35' 105	17.5	656.58	2002
1.4 ' 105	10.45	457.92	2003

Table (2) Physical analysis of soil (Duhok watershed) C: Clay CL: Clay loam

Sample no.	Sand	Silt	Clay	Textural class
1	52.0	24.0	24.0	CL
2	22.2	37.8	40.0	C
3	19.1	29.4	51.5	C
4	39.2	29.4	31.4	CL
5	23.2	33.4	43.4	C
6	49.2	27.4	23.4	CL
7	45.2	24.0	27.4	CL
8	14.0	42.0	62.0	C
9	26.0	54.0	32.0	CL
10	16.0	32.9	30.0	CL

Table (3): Land use of Duhok dam sub –watersheds

Kind Of Land	Garmava Sub-Watershed	Lenava Sub-Watershed	Sindor Sub-Watershed	Bajlor Sub-Watershed
	Area in ha.	Area in ha.	Area in ha.	Area in ha.
forest land	1380	1545	175	85
grass land	0	60	1065	695
open land with tree	1000	800	0	0
rock west land	0	0	1120	0
cultivated land	345	575	410	115
open land	825	1410	0	0
waste land rock	880	660	210	25
Total	4430	5050	2980	920

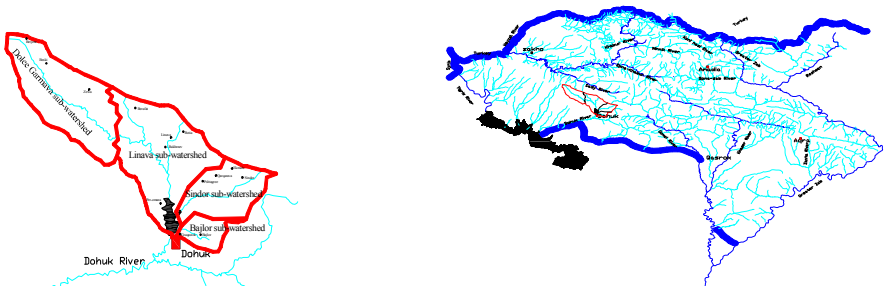

Fig (1): Duhok dam sub-watersheds details and location

Fig (2) Wattle fence device for soil erosion control in Duhok dam watershed

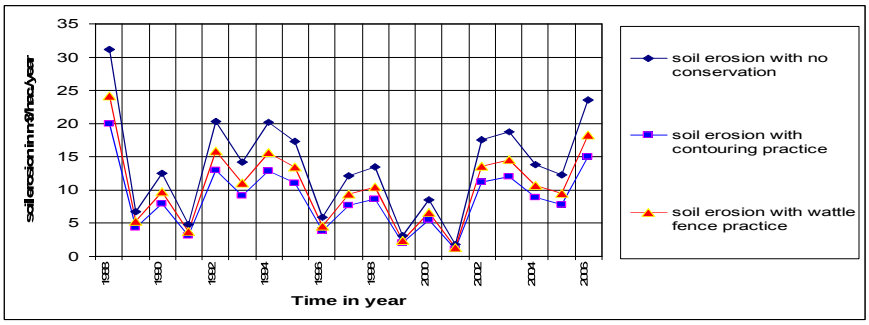

Fig (3): Soil losses for various soil conservation practice