

University of Salahaddin ,Hawler  
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Department of Soil and Water  
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## Water Resources.

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What is the most important natural resource in arid and semi-arid regions?

Rainfall is the most important natural resources in arid and semi arid region.

What is the relation between rainfall and precipitation?

**The rainfall is a part of precipitation, since the precipitation includes the following:**

1-Rainfall. 2-Hail (Tazra). 3-Glaze (Shaxta yan tazrai shoshayi). 4-Fog (Tam). 5-Dew (Shawnm yan xonaw)

6-Freez (Zoqm).

7-Sleet (Krewa).

Types of rainfall:

A- Drizzle (Nma baran): The diameter of drops of rainfall(D) is less than 0.50 mm.

B-Light rain (soka baran) the diameter of drops of rainfall is between 0.50-2.50 mm

C-Moderate rain: The diameter of drops =(2.50-7.60mm).

# Classification of natural resources depending on their distribution



National



Multinational



International

# What is Resources ?

- ▶ A resource is a source or supply from which benefit is produced. Typically resources are materials, energy, services, staff, knowledge, or other assets that are transformed to produce benefit and in the process may be consumed or made unavailable. Benefits of resource utilization may include increased wealth or wants, proper functioning of a system, or enhanced well being.
- ▶ **Resources have three main characteristics:**
  - ▶ 1.Utility,
  - ▶ 2.Limited availability,
  - ▶ 3.Potential for depletion or consumption.

## **Resources have been variously categorized:**

- ▶ Biotic versus Abiotic,
- ▶ Renewable versus Non-renewable,
- ▶ Potential versus Actual

## **Types**

- ❖ Resources can be broadly classified on bases upon their availability they are
  1. Renewable and
  2. Non renewable resources
- ❖ On the basis of origin they can be classified as
  1. Natural Resources
  2. Human Resources

❖ **Natural Resources**

1. Land,
2. Water,
3. Forests,
4. Mineral and energy

❖ **Human Resources:**

1. Population,
2. Labor force,
3. Health and Education

## Why Water is Resource?

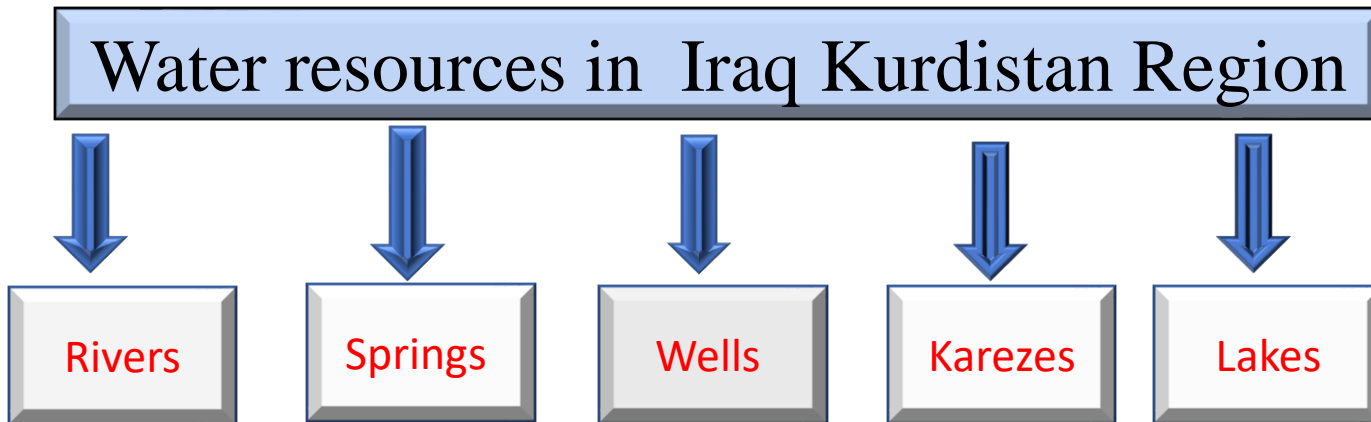
- ▶ Water resources are sources of water that are useful or potentially useful to humans. It is important because it is needed for life to exist. The majority of human uses require fresh water.
- ▶ Fresh water is a renewable resource, yet the world's supply of groundwater is steadily decreasing.



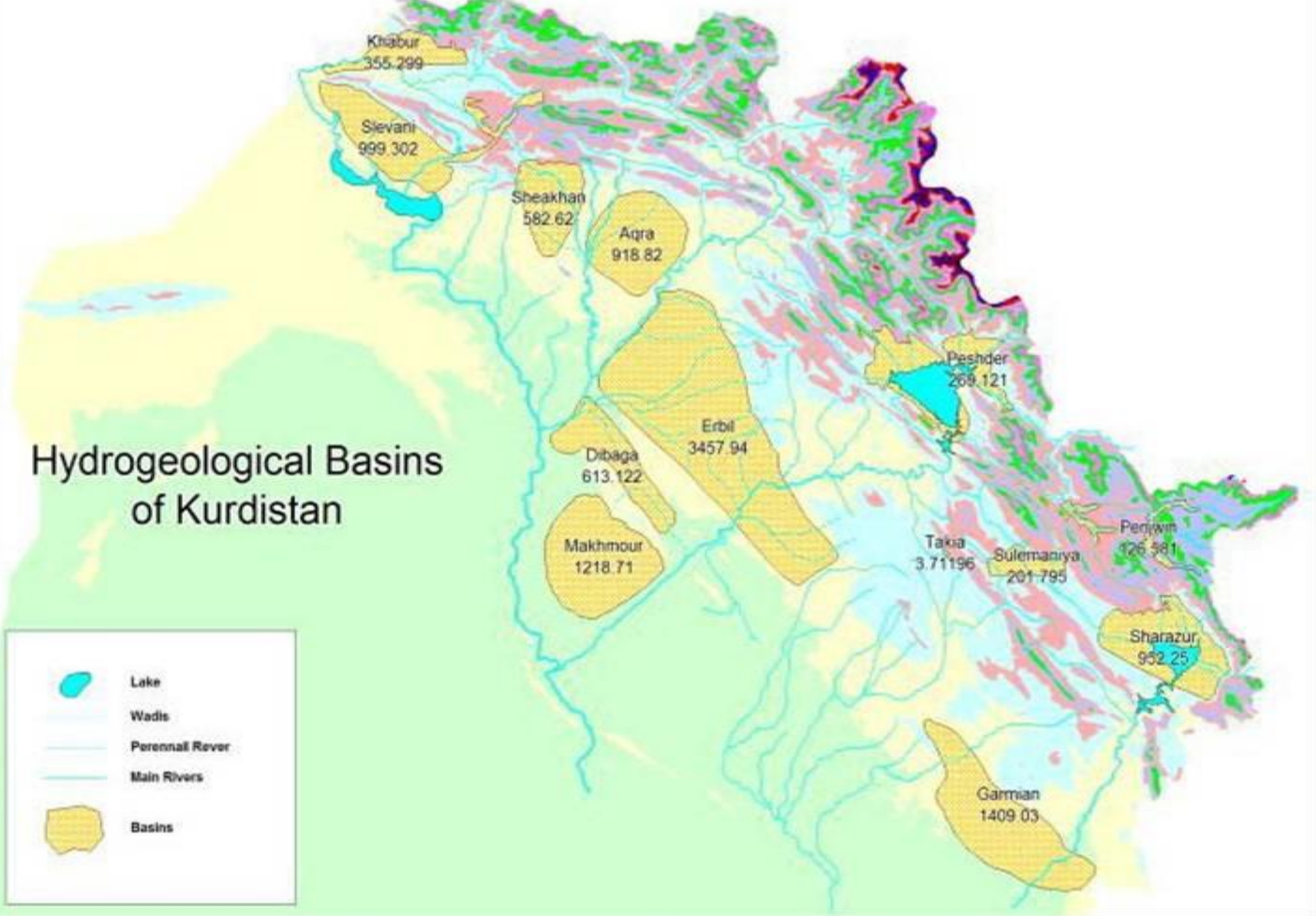
## Water resources :

Water is an essential ecological factor and is a most important natural resource. There are large number of water systems in the world including Oceans ,Seas, Rivers Streams, Springs ,Marshes, Lakes and Ice masses in polar regions.

What is the most important terms in water resources ? They are :  
1-Catchment area. 2-drained area. 3-Total basin area .4-Water shed.  
All of them have the same definition meaning the area from which water flows into a river ,lake...etc which comes from precipitation

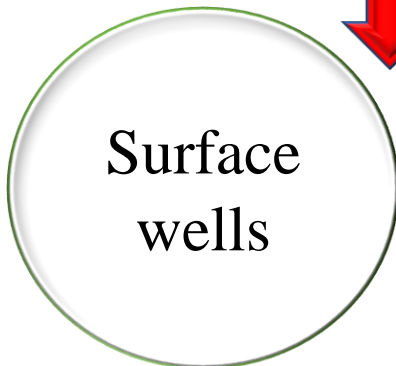
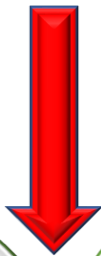
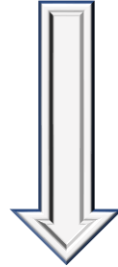
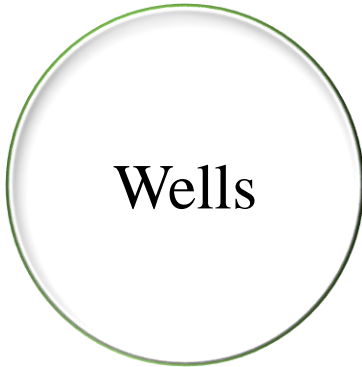
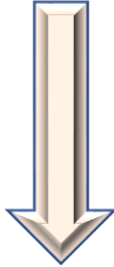


## Hydrogeological Basins of Kurdistan



Figure(3) Hydro geological Basins of Kurdistan .

# Groundwater in Kurdistan Region:



Type of wells depending on depth :

1-Shallow wells less than 30 m

2-Depth wells 30-600 m

Type of wells of wells depending on types of aquifer

1-Artesian wells

2-Non-artesian wells

## Types of aquifer

In general there are three types of aquifer:

1- Aquifer.

2- Aquiclude.

3- Aquifuge

## *Water resources in Kurdistan region and Iraq:*

Water is an essential element for maintaining a productive environment and adequate food supply for human, animal and plant population. The areas of irrigated lands in Kurdistan region of Iraq is expanding very slowly due to the shortage of irrigation water. The irrigation water quality depends on the water resources, chemical composition of the rocks, soils in surrounding catchment areas, impoundment run-off water, environmental factors... ..etc. Numerous studies have been done on groundwater quality in Kurdistan Region during the last six decades, but they have not included ion pairs and ion activity.

# Rivers

| Rivers                | Length (KM) | Annual flow $10^9 M^3$ | % outside of Kurdistan | % inside of Kurdistan |
|-----------------------|-------------|------------------------|------------------------|-----------------------|
| Khabour               | 160         | 2.20                   | 58                     | 42                    |
| Upper Zab             | 392         | 14.32                  | 42                     | 58                    |
| Lower Zab             | 400         | 7.07                   | 36                     | 64                    |
| Awa Spi               | 230         | 0.70                   | 00                     | 100                   |
| Sirwan                | 384         | 5.86                   | 59                     | 41                    |
| Total Amount of Water |             | 30.15                  | 40.2                   | 59.8                  |

# Dams

- (1-14 dams are under implementation
- 4) dams are completed+ (3) dams
- (5) dams are completed studying.
- (29) dams are under studying.
- (5) dams are ready for tendering
- (5) dams are suggested in 2012:
  - Taq taq dam's design is ready in Erbil.
  - Deralook-reshawa dam design is ready in Duhok.
  - Bawanoor- Garmian dam design is ongoing in Garmian.
  - Gowmaspan dam design is done in( Bastora)
  - Rawandiz dam is design



## **Some studies on ground water in Erbil governorate:**

The first investigation on ground water in Erbil was done by Ralph and Person (1955), after that numerous studies were conducted by Esmail (1986, 1992, and 2001) , Salih (2008) ,Hamasaheed (1998) and Othman (2011) in additional to the studies or analysis conducted by ministry of agriculture and water resources. The results indicated that the water family of ground water in Erbil governorate is  $\text{Ca-HCO}_3$ .

Ground water samples were collected and analyzed by Othman (2011) from 109 tube (drill) wells scattered at different locations within sub-districts (Qushtapa, Daratoo, Kasnazan, Shawes and Pirzin) and Bnaslawwa and the results were as follow:

-Ministry of Agriculture of water resource (2013)  
Conference on activation of MAWR. (1-11-2013).  
Parsons, R. M. (1955). Ground water resource of Iraq.  
Development Board. Ministry of Planning, Baghdad.  
Vol. (4).

As shown figure (7):

Salih, H.O.(2008)the Role of ionic Activity in classification of some Ground Water ,Soil chemical Properties and wheat Yield in Erbil plain .MS c.Thesis, University of Salahaddin. College of Agriculture Department of soil and water .

Who studied the ground water quality of 37 wells in plain Locations (wells) , the results indicated that at different the dominance cation was calcium ,while the dominance anion is bicarbonate for this reason the water family is Ca-HCO<sub>3</sub>,as shown table (4) :

The Iraqi water strategy is highly influenced by the Euphrates water where 100% of its flow comes from outside the country. While only 50% of the Tigris flow comes from Turkey. According to the negotiations between riparian countries, Iraq is supposed to receive 58% of the Euphrates flow, which crosses the Turkish- Syrian border, while Syria receives 42%. Turkey promised in the past to secure minimum flows of 15.8km<sup>3</sup> /year at its border which gives Iraq 9km<sup>3</sup> /year. Up to now, there has been no formal agreement between the three countries concerning the Euphrates and Tigris water. Present estimates indicate that Iraq is receiving only about 0.03km<sup>3</sup> /year of the Euphrates water (Al-Ansari and Knutsson, 2011, Al-Ansari, 2013, 2016, Al-Ansari et.al., 2012)

## **Surface water**

The two dominant rivers in Iraq are the Tigris and Euphrates. The watersheds, including their tributaries, account for 100% of the country's surface water. These fabled rivers, which helped feed the Garden of Eden in the Book of Genesis, now provide drinking water, supply industry and irrigate massive swathes of farmland.

Both the Tigris' and Euphrates' main stems are transboundary rivers, originating in Turkey. Before their confluence into the Shatt al-Arab, the Euphrates flows for about 1,000km and the Tigris for about 1,300km within the territory of Iraq. The fact that these important rivers do not originate within the country has been a long-standing source of tension with Iraq's riparian neighbours, and puts Iraq in a difficult position when trying to plan for and manage its water resources.

In addition to these major rivers, there are also a number of major tributaries, including the Greater Zab (which originates in Turkey); the Lesser Zab (which originates in the Islamic Republic of Iran); the Diyala (which originates in the Islamic Republic of Iran); the al-Adhaim, which drains about 13,000km<sup>2</sup> entirely in Iraq; and the Nahr at Tib, Dewarege and Shehabi rivers, draining together more than 8,000km<sup>2</sup>. In southern Iraq, the Karkheh River, the main course of which is in the Islamic Republic of Iran, brings over 50,000km<sup>2</sup> and flows inside the Hawr al-Hawiza marsh, which is connected downstream with the Tigris and Euphrates system.<sup>[1]</sup> The most significant downstream tributary is the Karun River, with a catchment of about 67,000km<sup>2</sup>, which has a primary impact on the salinity intrusion along the Shatt al-Arab.<sup>[</sup>

Water Resources of Iraq :Iraq relies in its water resources on the water of the Tigris and Euphrates Rivers and their tributaries. The long-term average annual flow of the Euphrates River was 30 BCM while it is 21.2 BCM for the River Tigris. The tributaries of the Tigris River contribute about 24.78 BCM and in addition, there are side valleys from the eastern border that contributes at least 7 BCM. The flow of these rivers decreased for since the seventies due to the hydrological projects built in riparian countries and climate change. Now, the discharge of the Tigris River and its tributaries at Baghdad is about 16 BCM while it is about 4.4 BCM in the Euphrates.

The total natural run-off of the Euphrates watershed is estimated to amount to between 27.0 and 35.1 billion m<sup>3</sup>/year, while the Tigris watershed, including its tributaries, is between 41.2 and 58.3 billion m<sup>3</sup>/year.[3] These estimates vary considerably between sources. This lack of homogeneity is due to two reasons: the scarcity of data released by qualified authorities; and the high variability of the flow recorded at gauging stations. Despite this discrepancy in the amount of natural contribution of the two rivers to Iraq, it is generally acknowledged that the amount of surface run-off has been reduced by upstream impairment to the order of 30%. This impact is forecasted to increase further in the next 20 years, reducing the water available to Iraq by up to 60%.[4]

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