

## Irrigation System in Ancient Mesopotamia

*Hunter-gatherer groups first began agriculture in Mesopotamia more than 12000 years ago. Over time, these groups learned how to plant crops in Mesopotamia to produce their own food. Each year, the floods of the rivers Tigris and Euphrates brought silt to the land, a mixture of rich soil and tiny rocks. The fertile silt has made the region ideal for farming. Though there was fertile soil in Mesopotamia, farming was not easy there. There was little rain in the area. This meant that the levels of water in the rivers Tigris and Euphrates depended on how much rain fell in the east, where the two rivers fell. Water levels were very high after a significant amount of rain fell there. The floods damaged crops, killed animals, and washed away houses, and the crops dried up when the water levels became too low. The farmers realized that they needed a way to regulate the flow of the rivers. Thus, in both the rainy and dry seasons, early farmers faced the difficulties of learning how to regulate the flow of river water to their fields, and early settlements in Mesopotamia were situated near rivers. They could not regulate the water, and flooding was a big issue. Later, people constructed canals to safeguard houses from floods and pass water to their fields. Mesopotamians used irrigation, a method of providing water to a region of land, to solve their problems. They dug out large storage basins to carry water sources to irrigate their property. Then they dug canals, rivers created by humans, linking these basins to a network of ditches. These ditches supplied the fields with water. The farmers constructed the banks of the Tigris and Euphrates in order to protect their fields from flooding. Even when river levels were heavily irrigated, these built-up banks held back flood waters, raising the amount of food farmers were able to produce. Farmers may potentially generate a food surplus, or more than they need. Farmers have also used irrigation for cattle and sheep to water grazing areas. Mesopotamians consumed a number of foods as a result. There was abundant fish, meat, wheat, barley, and dates since irrigation made farmers more productive, farming required fewer individuals. Some individuals have been free to do other work. As a consequence, new occupations have grown. People became crafters, religious figures, and government employees for the first time. A division of labor is called the type of arrangement in which each worker specializes in a specific assignment or task.*

**Keywords:** *geography of Mesopotamia, Tigris and Euphrates River, Climate change, Water Resources, Agricultural Revolution, Irrigation system.*

### Introduction

The control of irrigation has been of classical interest to historians and archaeologist in early complex societies Large-scale irrigation (construction/operation, water distribution, dispute resolution) management requirements were considered to be necessary for state development, as most early civilizations in the Old World were located in river valleys. This study assumes that for the management of large-scale irrigation systems, centralized control is needed, as claimed.

Irrigation was of great economic significance to many early states, as it played a key role in agricultural intensification and surplus production.

Agricultural surpluses were the main source of wealth in early state societies, and political power was largely based on the exploitation of these surpluses by a small centralized party. In addition, agricultural surpluses were required to maintain the very features of statehood, such as urbanism, full-time labor specialization, state institutions, and status hierarchy.

Scholarly interest in the cross-cultural study of ancient irrigation has declined considerably over the last few decades. As a result, several critical questions were only partly answered. The study of ancient irrigation presents great opportunities to understand the early states' socio-political and economic organization. We do not know how states can presume or abstain from assuming control over irrigation management, and even more importantly, why. Furthermore, in a cross-cultural contrast, the implications of either option were not systematically explored.

Therefore, the object of this paper is to create an early Mesopotamian irrigation system. The research is organized into certain parts, each discussing one of the key elements of irrigation. The climate under which they occur, the source of water they regulate, the kinds of crops they irrigate, the length of their use, and how they are handled. The case studies discussed in this paper discuss the relationships between water flow, the atmosphere and the agency of humans.

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## Geography of Mesopotamia

Mesopotamia is an a triangle that occupies an area of around 240,000 square kilometers, so our study area is limited by arbitrary lines drawn between Aleppo, Lake Urmiah and Shatt-el-Arab mouth. Cities such as Ur, Uruk, Nippur, Agade, Babylon, Assur and Nineveh, all situated on or near the Tigris or the Euphrates, within the boundaries of modern Iraq, are called Chaldaean, Assyria-Babylonia, Summero-Akkadian or Mesopotamian civilization, according to the system of the day, a culture that flourished within our triangle that was only equal to the civilization of Egypt in quality and meaning.<sup>1</sup>

Babylonia, the area between the Persian Gulf and modern-day Bagdad, my seem an area with little diversity that relied on irrigation by the Euphrates and Tigris rivers for its survival. The north was a desert plateau where agriculture was only possible in the narrow river vallys, and downstream the rivers entered flat alluvium, still had clearly defined channels, allowing for irrigation agriculture in square.<sup>2</sup>

Mesopotamia is the southwestern Asian region where the earliest known civilization in the world developed. The term 'Mesopotamia' derives from the Greek word meaning between rivers that refer to the land between the Tigris and Euphrates rivers, but the area can be broadly defined to include eastern Syria, southeast Turkey, and much of the region that is now eastern Syria, Around Iraq. This region was the center of culture in the Indian subcontinent, Egypt, and the Mediterranean as the Indus Valley.<sup>3</sup>

With hills and undulating plains in the north where wheat growing and cattle-rearing could be practiced, the area is very diverse. The rivers are abundant in fish further south, and the river banks, full of wild animals and birds, were once forests of vegetation where lions roamed and wild boars could be caught. The rich biodiversity may have drawn humans first to the Mesopotamian plain, the southern plain is beyond the zone of rain-fed agriculture, but over the centuries, the rivers have laid dense deposits of very fertile silt, and once this soil is brought into ditches and canals, it proves to be a very desirable place for farmers for materials like wood, stone, and metals. As far as archaeologists can say, farmers and fishermen began to settle the southern Mesopotamian plain around 5500 B.C. However, people have to look north and east, to the mountains. Over time, some of their tiny villages have grown into large settlements. The cornerstone of these classes was the temple of the town's patron god or goddess In menu-mental buildings such as those found at Erode, Uric and Ur, the rich farmland provided an extra amount of agricultural property and some of the wealth produced was invested. Using the reeds and mud that line the river banks, temples and regular

<sup>1</sup>Georges Rou., *ancient Iraq*, third edition, penguin books, London, 1993, p.4.

<sup>2</sup>Marc Van De Mierop., *A history of ancient Near East ca.3000-323bc*, third Edition, Black well publishing, UK, 2006, p49.

<sup>3</sup>Britannica Educational Publishing., *Mesopotamia the world's earliest civilization*, ed. by Kathleen Kuipe and other , New York 2011,p18.

1 households have been constructed. Centuries of renewal using sun-dried mud  
 2 bricks culminated in high mounds, or the arenas and canals rising overhead. It was  
 3 ancient Greek explorers and historians who first gave the land the name by which  
 4 we It's known. Mesopotamia. Mesopotamia The name means "the land of the  
 5 rivers" (from mesos, the Greek word for "in the middle" between "between";  
 6 potamos, the Greek word for river and ia, a suffix used by the Greeks to name  
 7 places). There was no name for the entire land for the early Mesopotamians;  
 8 instead, their conceptual horizons were limited to the names of the towns and  
 9 kingdoms where they lived. Today, much of the earliest Mesopotamia lies within  
 10 the boundaries of modern Iraq, with some parts of Syrian and Turkish territories to  
 11 the west and north.<sup>4</sup>

12 Mesopotamian aircraft are very rich. Mud and clay deposited by two great  
 13 rivers, the Tigris and the Euphrates, made up the land. These twin rivers descend  
 14 from the northern mountains, cut through hilly grasslands to the southeast, and  
 15 finally cross the plain they formed to enter the Persian Gulf.<sup>5</sup>

16 The Tigris and Euphrates both have their bases in Armina, the former to the  
 17 south of Lake A, the latter near Mount Ararat, and when they appear from the  
 18 Taurus Mountains, the two rivers are separated by some 400 kilometers of open  
 19 plain from each other.<sup>6</sup>

20 There were two primary rivers in Ancient Mesopotamia. These were the  
 21 Tigris and the Rivers of the Euphrates. In that part of the world, much of the land  
 22 was very dry. There, plants could not grow. But the land was fertile and rich  
 23 between these two rivers. It had brilliant soil for plant growth. People settled down  
 24 and founded towns there. For travel, rivers were also important. The inhabitants of  
 25 ancient Mesopotamia were able to get to other parts of the land using vessels.  
 26 They could buy and sell food with other people from other cities..<sup>7</sup>

27

28

## 29 **Tigris River**

30

31 The watercourses that joint to form the Tigris River arise in high mountains  
 32 that rim Lake Van in northern Kurdistan. Separation Turkey, the Tigris touches the  
 33 northeastern border of Syria and then streams southeastward across Iraq. In Iraq it  
 34 is joined by branches from the east—principally the Great Zab, Little Zab, and  
 35 Diyala. The Euphrates, west of the Tigris, runs in the same overall direction. In  
 36 ancient times the two rivers had distinct mouths. Now they meet in a swamp in  
 37 southern Iraq and form a single stream, the Shatt al 'Arab, which flows into the  
 38 head of the Persian Gulf. The Tigris, 1,180 miles (1,900 kilometers) long, is  
 39 shorter than the Euphrates, but it is more important commercially because its

<sup>4</sup>Stephen Bertman.,*Hand book to life in Ancient Mesopotamia*, Oxford University Prees,New York, 2003, p4.

<sup>5</sup>*Ancient Mesopotamia civilization*, Britannica Educational Publishing, E.D., Sherman hollar. New York, 2012, p11.

<sup>6</sup>Georges Roux, *op.ct.*, p5.

<sup>7</sup>Cynthia Klingel and Robert B. Noyed., *ancient Mesopotamia* ,Compass point books, Philadephia, 2003, P.16.

channel is deeper. The Tigris was the great river of the kingdom of Assyria. The earliest city of Assur, which gave its name to Assyria, stood on its banks, as did Nineveh, Assyria's splendid capital.<sup>8</sup>

## Euphrates River

Maps of the 3rd millennium B.C. channels show some Euphrates branches, with the main channel probably passing through the Mesopotamia region. During the 3rd and 2nd millennia B.C., these channels formed the Irnina and Zubi branches to the north and the Kish branch to the south. Although the history of these channels is not known in detail, their presence is recorded from Akkadian place names on clay tablets. It has, therefore, been possible to relate these place names and their associated named channels to ancient levees evident on large-scale topographic maps. Beginning about the first half of the 2nd millennium and ending about 900 B.C., a gradual of these multiple channel networks took place. During the Isin-Larsa and Old Babylonian periods in the earlier half of the 2nd millennium B.C. a previously insignificant Babylonian branch became the most important of the Euphrates courses, indicating further westward shift in flow. Beginning in the 3rd millennium B.C., repetitive avulsions took place near Sippar/Fallujah, where the Euphrates, called Purattum in Sumerian and Akkadian vocabularies, emerges from its incised valley. From the beginning of the 1st millennium B.C., another branch of the Euphrates, called Pallukkatu existed west of the Babylonian branch, its position closely approximating that of the Hindiya branch of the modern Euphrates.<sup>9</sup>

The 1700-mile (2,700-kilometer) Euphrates is Western Asia's longest river. It starts in eastern Turkey's high mountains, crosses eastern Syria, and then flows through Iraq to the southeast. Much of the river's water is lost by evaporation and use for irrigation due to Iraq's hot, dry climate. From the winter rains and snowfall, the river gets most of its water. Only flat bottom edriverboats can navigate it. The Tigris runs almost parallel to the Euphrates and together they form a broad, agriculturally fertile alluvial plain, a plain made of rivers deposited silt, sand, clay, and gravel. Each year, there are two flood cycles.<sup>10</sup>

The rivers of the Tigris and Euphrates begin in the Kurdistan Mountains and flow southeast across the plains of Iraq. They joined together to build the Shatt-al-Arab River there. Through the Persian Gulf, this channel empties. Baghdad, the current Iraqi king, stands on the banks of the Tigris. Often referred to as "a civilization cradle." Civilization originated in the valleys of the Tigris and Euphrates rivers because this region offered abundant resources, such as plants that grew well there and game to hunt. These rivers would flood their banks in

<sup>8</sup> Ammar Ali and other., Morphology of tigris river within Bagdad city, hydrology and Earth system sciences, Sweden, 2012, pp.378-390, p379.

<sup>9</sup> Galina Morozova., A review Holocene Avulsions of the Tigris and Euphrates and possible effects on the evolution of civilizations in lower Mesopotamia, Article in Geoarchaeology pp402-423 · April 2005, <https://www.researchgate.net/publication/230035623>

<sup>10</sup> Sherman Holer, op.ct., 11.

1 spring, and, as the floodwaters receded, the soil left behind was rich in many  
 2 nutrients required by plants to grow. As more permanent settlements were  
 3 developed for religious and social reasons, changes in farming methods and the  
 4 growth of settlements were encouraged by rich soil and water supply. The  
 5 floodwaters enriched the soil often, but whether they were too high or too low,  
 6 they often disrupted agriculture. Over time, farmers have learned to construct  
 7 drainage ditches to direct the river's water to the fields, as well as dikes to hold  
 8 back the floodwaters and channel them to reservoirs for later use. This was very  
 9 important because year after year the floods varied, so farmers learned to monitor  
 10 the unpredictable flooding and store food for potential use. It is necessary to  
 11 structure dikes, reservoirs, and irrigation ditches that individuals work together,  
 12 not only inside villages, but from village to village. This was the start of  
 13 centralized power.<sup>11</sup>

14 Mesopotamia region bounded by mountains in the north and east and desert  
 15 in the west and restricted in the south by the Persian Gulf, ancient Mesopotamia  
 16 was formed by its two rivers, the Tigris and Euphrates. These provided water for  
 17 agriculture and daily life and were the main highways for communication. Major  
 18 environmental differences divided Mesopotamia into two diverse regions, the  
 19 northern plains of Assyria and the southern Babylonian alluvium. Further  
 20 differences split Babylonia into a northern river plain (Akkad) and southerly delta  
 21 plain. These geographical contrasts were mirrored by cultural, political, and  
 22 economic differences. Marshes separated Babylonia from Elam, the eastern  
 23 alluvial plain and head-to-head Zagros Mountains, a land whose history regularly  
 24 intertwined with that of Mesopotamia. At times, cities and states beyond the desert  
 25 and the mountains were also involved with Mesopotamia, while mountain and  
 26 desert fringes were home to tribal groups who regularly raided their settled  
 27 neighbors.<sup>12</sup>

28

## 29 **Temperate and Climate Change**

30

31 One of the clear parallels is the atmosphere of the Mesopotamian plains.  
 32 While the winters are cold, often even freezing, with strong winds and rain, the  
 33 summers are so warm and dry. In order to explain these contrasts, the monthly  
 34 mean temperature in summer is about 95° and the temperature can rise to 50 ° C  
 35 (120 ° F) in July. The temperature can drop as low as -5 ° C in December and  
 36 January, with a monthly average of around 10 ° C (50 ° F). Monthly mean  
 37 temperature in the north in the summer is not quite as high as south, but the  
 38 winters are not as high. Since November, frosts have been common and small falls  
 39 of snow occur very regularly in the northern plains. Every winter, the Kurdish and  
 40 Zagros mountains are covered in snow. As of November, frosts are common and

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<sup>11</sup>E.D Hirsch, Jr., *Mesopotamia, History and Geography, core Knowledge programs, London, 2019, p.18.*

<sup>12</sup>Jane R. McIntosh., *ancient Mesopotamia new perspective, Library of Congress Cataloging-in-Publication Data McIntosh, Jane 2005, p9.*

1 small falls of snow occur very frequently in the northern plains. Every winter, the  
2 Kurdish and Zagros hills are covered in snow.<sup>13</sup>

3 As far as the climate of Mesopotamia is concerned, it should be noted that  
4 there has been no significant shift since very early times, according to geologists'  
5 findings. When the melting snows in the mountains of Taurus and Zagros feed  
6 their tributaries. Then came the spring floods that were considered nearly  
7 uncontrollable a century earlier and posed an ominous danger to the inhabitants of  
8 the lower plain throughout history. Paradoxically, this also occurs between April  
9 and June, which is also late for watering the main crop, normally harvested in  
10 April from an agricultural point of view. This was the climate regime and seasonal  
11 variations with which, at the wrong time, the ancient farmers of southern  
12 Mesopotamia encountered rain in insufficient quantities; river water, even at the  
13 wrong time, accumulated in almost unmanageable quantities along the river beds.  
14 In the end, water had to be supplied to the nation, simply through the objects of  
15 human ingenuity: a complicated system of canals, reservoirs, dykes and regulator-  
16 sluices.<sup>14</sup>

17 Global sea levels were about 100 meters lower at the height of the latter Ice  
18 Age than they are today. The entire Gulf was dry land, and the Tigris and  
19 Euphrates rivers flowed through it. Universal sea levels started to rise from about  
20 14,000 B.C.E., quickly covering the shallow Gulf, which expanded its current  
21 shores by 5000-4000 B.C.E. Waters in the Gulf may have risen 1-2 meters further  
22 by 3000 B.C.E., taking the coast some 150 kilometers further northwest and nearly  
23 touching Ur, which is documented in early texts as a port. Why and when did the  
24 Gulf hit its current shoreline? The delta may have been gradually widened by  
25 alluvium deposited by the rivers, allowing the head of the Gulf to withdraw,  
26 although a major study by Lees and Falcon indicated that this relief was stable by  
27 subsidence caused by continued tectonic activity. There is some evidence that  
28 about 1500 B.C.E., the current shoreline was extended, but other data commends  
29 that this did not happen until about 1000 C.E. while the field at the head of the  
30 Gulf is very flat, slight changes in the levels of sea and alluvium can cause  
31 important changes in the line of the coast, and flooding can make new regions of  
32 swamp. It is also difficult to assess when and in what way the region's type has  
33 evolved over time. Deep-sea core evidence may suggest that severe annual floods  
34 made southern Mesopotamia largely marshland before 4000 B.C.E. and that this  
35 area became drier during the late fourth millennium, initially creating a land  
36 crisscrossed by water rays but becoming the same as it is today by 3000-2800  
37 B.C.E. However, the lack of proof from the region itself implies that not all  
38 academics support this scenario.<sup>15</sup>

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<sup>13</sup>*Ibid.*

<sup>14</sup>Seton Lloyd., *The Archaeology of Mesopotamia from the Old Stone Age*, Boston public library, Boston 1984,p.17.

<sup>15</sup>Jane McIntosh., *op.ct.*, p10.

## Water Resources

The Tigris and Euphrates Rivers would fill the mountains with water from melting snow, so that the rivers would overflow. The floods have brought fertile land to the province. However, the weather in the region was very hot and dry. The ancient Greek historian Herodotus considered the gift of the Nile to Egypt, the gift of the Tigris and the Euphrates to Mesopotamia, this was particularly true of the alluvial plain to the south, where such staples of the human diet as barley, sesame, and dates were nurtured by the well-watered fertility of the soil. Southern Mesopotamia's alluvial and deltaic plains occupy part of the Mesopotamian depression, a foreland basin confined to the northeast by the Zagros Mountains, and a fine-grained alluvium underlies the Arabian platform to the southwest plain, up to 200 km wide. Of the Rivers Euphrates and Tigris, Active channels, natural levees, crevasse splays, and flood basins compose the latest flood plain, as well as regions now removed by avulsion or channel migration from active fluvial deposition. Elial landforms, including sand dunes and deflation basins, often show such areas and undergo intense salinization. The southern portion of the plain, called "Ahwar," consists of fresh- and salt-water lakes surrounded by reed marshes along with large levees and inland delta lobes. Natural levees stand up to 3-4 m above the surrounding flood basins, these marshlands currently occupy only about one tenth of their former territory, drastically reduced in response to irrigation practices, global warming, and different petroleum-related and other industrial practices activities.<sup>16</sup>

In the mountains of southern Turkey, the Euphrates and Tigris rise, flow along the Mesopotamian depression, and join near its southeastern end, where they form the Shatt al-Arab estuary of the Persian Gulf, together with the Karun River. The Euphrates is an exotic ,lower land Mesopotamia stream, while four major tributaries are accepted by the Tigris. The Euphrates divides between Hindiya and Samawah into two branches: Hindiya, the main channel, and Hill The desert area in the western part of the lower Mesopotamian plain is characterized by relict alluvial fans produced during a wetter climate mid-Holocene period.

In general, several ephemeral streams are perpendicular to the flow of the Euphrates.<sup>17</sup> Fan piedmont stretches along the front of the Zagros Mountains along the northeast edge of the plains. The climate is arid, with about 100-150 mm of average annual rainfall. In January, temperatures range from 10 to 12.5 ° C to 34-35.5 ° C in July. Winds blow from the north and northwest much of the year, with some southeasterly winds from April to mid-June and from September to November. Low-pressure areas and cold fronts are migrating carrying

Most of the rainfall falls in winter and spring. Lower Mesopotamia was primarily irrigated by water from the Euphrates rather than the Tigris the annual rainfall numbers above provide a rough indication of the variation that can be expected between locations. Seasonal precipitation - from July to June - over a

<sup>16</sup>Galina Morozoya , op.ct. pp402-423

<sup>17</sup>Elizabeth Rosemary Ellison., *A study of diet in Mesopotamia 3000-600 BC and associated agricultural techniques and methods of food preparation*, University of London, May 1978, P.7.

variety of seasons. In order to give a picture of the rainfall settings in their region at the present time, the conditions of important excavated archaeological sites nearest to these rainfall stations were involved. The reliability of the rain and the time of year in which it falls is much more significant, although the amount of rainfall per year is imperative. A region in Mesopotamia may have thick rain for one year, but the next may be very slight.<sup>18</sup>

## Agricultural Revolution

By the end of the Pal eolithic, around 12,000 years ago, after hundreds of thousands of biological and cultural advances, human communities were able to build increasingly complex, sophisticated and specialized instruments by which they evolved distinct modes of hunting, fishing, gathering, and improving predation to the most diverse environments.<sup>19</sup>

It was no coincidence that the first major civilizations in the world grew up along broad river banks. The vital waterways were the Tigris and Euphrates Rivers in ancient Mesopotamia, what is now Iraq. The culture that emerged more than six thousand years ago in the huge Tigris-Euphrates valley was more than just one of the four great ancient river civilizations. It was also the first to spring into being among them. In the valley, farms and villages appeared as early as 75 hundred years ago. The inhabitants of Mesopotamia depended on the local rivers for life-giving water, including the Chinese, Egyptians, and Harappans. Agriculture first started about 9000 BC, or around eleven thousand years ago, in the northern reaches of this region. Residents have found out how maize, barley, lentils, cucumbers, cabbage, grapes, and other crops can be produced. Livestock, sheep, goats, pigs, and other livestock are also raised and bred. Together, these crops and animals established such a broad and stable food system.

The source is that the Fertile Crescent people abandoned the lifestyle of hunter-gatherers, They settled and founded tiny villages alongside their fields. A few dozen huts made of thatch and other natural materials were present in each of these tiny villages. The new agricultural lifestyle has proven so successful that the number and size of the small villages in the northern sector of the Fertile Crescent has gradually increased. This population increase, in turn, encouraged society's more restless members to migrate southward onto the plains of the great rivers. They became the first of many waves of colonists who remained permanently in the Tigris-Euphrates valley around 5500 BC.<sup>20</sup>

<sup>18</sup>*Ibid.*

<sup>19</sup>Marcel Mazoyer and Laurence Roudart., *A history of world Agriculture from the Neolithic age to current crisis*, translated by: James H. Memres, published by Earthscan, London, 2006. P71.

<sup>20</sup>Don Nardo., *Life in ancient Mesopotamia*, reference point press, San diago, 2014, p.10.

## 1    **Agricultural Techniques**

2  
3        For their many inventions, or new ways of doing things, the people of  
4 Mesopotamia, especially the Sumerians, are remembered. For instance, new  
5 agricultural techniques, such as irrigation, were created by early farmers, leading  
6 to economic surpluses. The Mesopotamians used only basic farming technologies  
7 at first. Early instruments were made of clay and copper, such as sickles and hoes.  
8 Metalworkers began combining copper and tin over time to create bronze, which  
9 is much stronger than copper alone, by 2500 B.C.E., bronze instruments such as  
10 bronze-tipped plows were used by many farmers. Farmers could transform the soil  
11 more quickly with stronger plows, which led to larger fields that yielded larger  
12 crops. Next, by adding a funnel filled with seeds to the plow, farmers found a way  
13 to plow and plant at the same time. The seeds were freed from the funnel as the  
14 plow moved along each row. This agricultural technique has allowed more crops  
15 to be planted by fewer farmers. The Sumerians also wrote farmers' advice.<sup>21</sup>

## 16 17 18    **Irrigation System**

19  
20        Mesopotamia is in the Near East sub-desert region, with low rainfall and low  
21 precipitation.

22        High temperatures mean that irrigation is a must for farming to take place on  
23 a reliable basis.

24        Base. The region we are concerned with is far beyond the dry land cultivation  
25 limits proposed.<sup>22</sup>

26        Irrigation can be described by all average dictionaries as "the artificial  
27 application of water to land to assist in crop production." That is exactly how it  
28 was used by the Mesopotamians, 7000 years ago. It is still used in the majority of  
29 the world today, in a similar way. The techniques did not really need to be  
30 improved by humans, since the irrigation method was effective and simple from  
31 the beginning. Basically, it was necessary for large-scale farming, especially in the  
32 middle of the desert. The only drawback was that, at least when the  
33 Mesopotamians used it, it had to be used close to a water source. Irrigation, in fact,  
34 was the first engineering spectacle that the Pulled off by the Mesopotamians.<sup>23</sup>

35        Mesopotamia developed agriculture for irrigation. The earliest settlers of the  
36 region drained the swampy land and constructed canals through the dry areas in  
37 order to irrigate the land. This was achieved in other areas before the time of  
38 Mesopotamia. What made Mesopotamia the home of the first culture of irrigation  
39 is that the irrigation systems were constructed according to a schedule, and to

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<sup>21</sup>C. Leonard Woolley., *Mesopotamian Achievements, The Sumerians*. W.W. Norton & Company, 196, P2.

<sup>22</sup>Nicholas Postgate., *Irrigation and cultivation in Mesopotamia, Volume IV*, Cambridge, December 1988, p.1.

<sup>23</sup>Mays, Larry W., "Irrigation Systems, Ancient." Water Encyclopedi. JRank, [www.waterencyclopedia.com/Hy-La/Irrigation-Systems-Ancient.ht](http://www.waterencyclopedia.com/Hy-La/Irrigation-Systems-Ancient.ht)

1 sustain the system, an organized workforce was required. The irrigation system  
 2 started on a small-scale basis and grew into a large-scale project that gained more  
 3 control from the government. Originally, Mesopotamia was swampy in some  
 4 places and dry in others the climate in most areas was too hot and dry to grow  
 5 crops without any assistance. Archaeologists have discovered 3,300-year-old plow  
 6 furrows lying near Ur in southern Iraq with water jars still lying by small feeder  
 7 canals. To keep it maintained, it also required a large amount of labor Water  
 8 distribution was developed by government and legislation to ensure that the  
 9 process was run smoothly.<sup>24</sup>

10 As far as the climate of Mesopotamia is concerned, it should be noted that,  
 11 according to the findings of geologists, since very early times, there has been no  
 12 perceptible change. The country has summer temperatures ranging from 130  
 13 degrees Celsius in the shade, and eight months without precipitation in the year.  
 14 Rivers are reduced to stagnant brown meanders in the waste of dried mud by the  
 15 end of the dry season. Then winter arrives, with pale midday sunshine and freezing  
 16 nights, bringing with it occasional rainstorms. But until spring, when the melting  
 17 snows of the Taurus and Zagros Mountains feed their tributaries, the rivers do not  
 18 obtain their maximum volume of water, Then came the spring floods that were  
 19 considered virtually uncontrollable a century earlier, and posed an ominous danger  
 20 to the inhabitants of the lower plain throughout history. Paradoxically, this often  
 21 occurs between April and June, which is too late to water the main crop, normally  
 22 harvested in April, from an agricultural point of view. This was the climate and  
 23 seasonal variations faced by the ancient farmers of southern Mesopotamia: rain at  
 24 the wrong time in insufficient amounts; river water, even at the wrong time,  
 25 concentrated in almost unmanageable quantities along the river beds So, in the  
 26 end, water had to be supplied to the country, simply through the architecture of  
 27 human ingenuity a complex system of canals, reservoirs, dykes and regulator-  
 28 sluices. This required a great deal of organization and a lot of patience as well. The  
 29 canals themselves filled their beds very quickly with silt, and required repeated  
 30 dredging as a result. And, as this process went on, the banks were too large to  
 31 throw the spoil out, and a new canal had to be excavated parallel to the first one.<sup>25</sup>

32 The first to build canals between two rivers that enclosed Mesopotamia, the  
 33 Tigris and the Euphrates, was the Sumer. The canals brought water out of one  
 34 river and separated it into several agricultural fields, leading to another river. By  
 35 digging trench, these canals were built, then piling up soil on both sides, creating  
 36 breaks in it when necessary to water lands. Later on, their own levees were made  
 37 by the Sumer, essentially a larger canal that could hold even more water. Natural  
 38 levees is an embankment formed by floods, built up over time. They are  
 39 perpendicular to the surface of the sea, but then backwards arc to land The Sumer

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<sup>24</sup>Merle, Severy, *Agriculture, crops, irrigation and livestock in Mesopotamia*, *Geographic, Smithsonian Magazine*, May 1991. <http://factsanddetails.com/world/cat56/sub363/item1513.html>

<sup>25</sup>Seton Lloyd, *op.ct.*, p11.

repeated this by creating tiny walls with fir-hardening reeds, tying them together and packing mud around them.<sup>26</sup>

On the use of mathematics in the irrigation systems of the early civilizations in Mesopotamia, Kazuo Muroi wrote that digging and maintaining canals was an important activity for the rulers of Mesopotamia, as canals were not only necessary for irrigation, but also useful for transporting goods and armies. Babylonian mathematicians may have been instructed by the rulers or high government officials to measure the gross workers' salary expenses.<sup>27</sup>

### **Difficulties in Building Maintaining a Complex Irrigation**

There were many problems facing the farmers who migrated to Sumer. The unregulated availability of water was one of the main concerns. The rain and melted snow poured from the mountains into the Tigris and Euphrates Rivers during the spring, causing them to flood across the plains. But no one could be sure when the floods would arrive, exactly. If it happened after farmers planted their crops, it would wash away their young plants. The sunbaked soil was dry and hard as stone for most of the remainder of the year. Thick clouds of dust drifted across the field from the heavy, powerful winds. Faced with these drastic seasonal shifts, farmers had to work constantly to grow crops. They either had too little water, or had too much water. They needed a way to regulate the water to succeed in growing food, so that they would have a stable water source all year round.<sup>28</sup> Irrigation systems gave Sumerian farmers ample water to produce plenty of food. But now a new issue has arisen: how to sustain the irrigation system outside the limits of the village. As it brought water from the river to the fields, the irrigation system went through several villages. It was important to continually manage the system. The canals had to be frequently washed as they were clogged with silt (very fine mud). The whole system could be spoiled by one clogged canal. Farmers could not live separately, even in small groups, anymore. They were connected by canals for miles around them they had to work together for the common good. Steadily, to develop and sustain their complex irrigation system, villagers began to rely on each other. Staff were potentially coming together from various villages. To keep them from clogging, they cleared the silt off the canals. To ensure the water levels were balanced, they scooped water from one reservoir into another.<sup>29</sup>

<sup>26</sup>Kielmas, Maria., "Ancient Sumerian Levees & Canals." Sciencing, Sciencing.com, 25 Apr. 2017, sciencing.com/ancient-sumerian-levees-canals-168741. <http://factsanddetails.com/world/cat56/sub363/item1513.html>

<sup>27</sup>*Ibid.*

<sup>28</sup>Nicholas R. Magliocca & Erle C. Ellis (2016) Evolving human landscapes: a virtual laboratory approach, *Journal of Land Use Science*, pp643-671, 11:6, 642-671, DOI: 10.1080/1747423X.2016.1241314

<sup>29</sup>*Ibid.*

## Conclusions

- Mesopotamia, without an irrigation scheme, was not a suitable land for living and farming. The northern portion was hilly, with rain coming in. There were small plains in the southern portion, or flat ground. On the plains between the Tigris River and the Euphrates River, the sun beat down brutally there was slight rain, So the Mesopotamians were farmers, demanding water from farms. When the rivers flooded, they carried water to the plains, but the soil remained strong and dry for much of the year.
- As the total climate became heater, hunters and collectors started to settle in stable villages along the Tigris and Euphrates rivers, leading to more promising farming conditions. These rivers provided the lifeline for developing and embellishing civilizations such as Mesopotamia as they offered access to transportation, cleanliness and health, crop irrigation, food, and defense. As early humans were trained to adapt and adapt to their environments, especially by using water to serve a community, They made social and technical developments that are known collectively as the Neolithic Revolution.
- Mesopotamia: The First Civilization of the World is not healthy and dry and unfit for the cultivation of plants for at least eight months of the year. Consequently, in Mesopotamia itself, the real heart of civilization, agriculture without the possibility of crop failure, which appears to have started in the higher rainfall zones and in the hilly borders of Mesopotamia in the 10th millennium BC, began, It was only after the development of artificial irrigation that water was brought to vast stretches of territory via a wide-branching canal network. Although the soil is very fertile and will produce in abundance with irrigation and the requisite drainage, southern Mesopotamia has become a land of plenty that could sustain a considerable population. When the people there reacted to the challenge of their situation, the cultural hegemony of northern Mesopotamia, which may have lasted until around 4000 BC, was eventually overtaken by the south.
- There is no doubt that the development of irrigation, especially economic development, attempts to assess the technological performance and impact of ancient Mesopotamian water technologies reveal that the task is very complex.

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**Figures**



MESOPOTAMIA RIVERS:

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[http://www.emersonkent.com/map\\_archive/egypt\\_syria\\_mesopotamia\\_1450\\_bc.htm](http://www.emersonkent.com/map_archive/egypt_syria_mesopotamia_1450_bc.htm)



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