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Conservation of Groundwater Resources in Arid Lands: A comparative study of NaiGaj Pakistan and WadiDhahban Saudi Arabia

N. H. CHANDIO[++], H.A. SAHITO*, N. CHANDIO

Department of Geography, Shah Abdul Latif University, Khairpur, Pakistan

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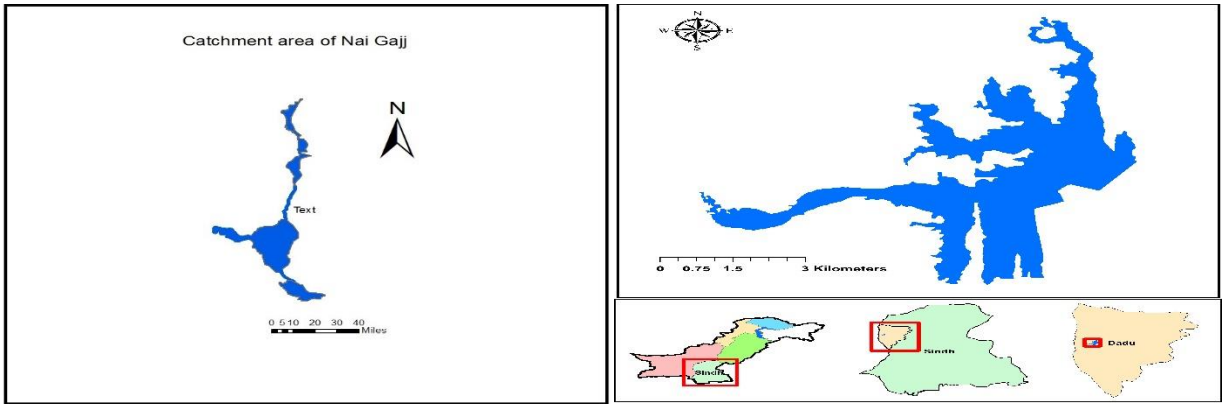
Abstract: This research was conducted to compare the two research areas NaiGaj, Pakistan and WadiDhahban, Saudi Arabia having Ground Water Potential (GWR). The main objectives of the research was to determine the different parameters that support the ground water availability such as vegetation, nature of slope, Rain Water Rills(RWR), climatic data and land cover area with help of modern techniques. Pakistan and Saudi Arabia emanates under as Arid or Semi-Arid category of land. Both research area have almost same topography, where ground and river water is not found. Growers irrigate land by saline water of different drain canals (in Pakistan) and Rain Water Rills coming from the uplands. A 61 km wide and 326 km long belt is found in slope of Khirthar Mountain in Sindh, Pakistan, this belt is rain shadowarea. Similarly, WadiDhahban has same geographical features, located near the coastal belt of RedSea, where dozens of RWRs are presents and trembled in the Sea.The maps of groundwater potential of both study areas were designed with the help of RS and GIS software.GIS and RS havesignificant role in mapping of ground-water quality and quantity for assessment and monitoring purposes.It was observed through the maps that both areas have ground water potential. Furthermore, the results indicated that NaiGaj has 30.3 % ground water potential and WadiDhahban has 15.8% ground water potential.

Key words: Conservation,Ground water resources, NaiGaj, WadiDhahban,Pakistan, Saudi Arabia

1. INTRODUCTION

Geographically, Pakistan is located at the end of Monsoon region, so that 92% of total area of the country is considered as arid and semi-arid area(WAPDA, 2009).Only 08% area is catching more than 500mm rain annually (PMD, 2010). Currently; Pakistan is facing theruthlessshortage of river water. River Indus is the main source of water for agriculture as well as for drinking. Almost all growers areirrigating their lands to use the Drain water, Rain water and ground water for agriculture and drinking purposes. The rain fed areas are going to convert in barren lands due to shortage of Monsoon rain(Cui 2010).In Sindh thousands of acres of land isconverting to barren and saline land due to the shortage of water. Khirthar Mountain is a natural boundary between the Sindh and Balochistan Province. At the Eastern slope of Khirthar Mountain 17120 km^2 of land is dry since two decades(Chandio 2012).

NaiGaj: This Rain Water Rill/River is located in the North West of Sindhprovince. Rivers water comes from the catchment area of Balochistan and enters into Sindh in Dadu District. A large number of human population depends on this river (World Bank. 1994). Geographically the basin of NaiGaj is located between 26.877046 N67.318387 E.



Source: Altaf, 2018. **Fig: 1. Location of NaiGaj in Pakistan**

[++]Corresponding e-mail: hussain.chandio@salu.edu.pk

*DIPRI, Shah Abdul Latif University, Khairpur, Pakistan

A part from this, a dozen of Rain Water Rills are entering in the area coming from the Khirthar Mountain, which are main source of the water in the region, and all RWRs are seasonal. The study area is known as Kacho or Kohistanremote area or Kachho or Kohistan, where main occupation of the population is cattle, but due to drought gross/vegetation is rare. The current situation of the study area is very sensitive.

Saudi Arabia is a country of Asia, located in Northern Hemisphere, with uneven and rough topography.

WadiDhahban: The RWRs are also present in Saudi Arabia, among those a famous RWR is known as WadiDhahban. The Geographical location of this area is $18^0$6'25" N $41^0$36'46"E near the Al-Qahma. The Wadi starting from a Mountain peak and drain out in the Red Sea. The satellite images showed that the rill is flowing only in rainy season only, at the end of the Wadi near coast of the Red Sea a few acres of land is cultivated by natives.

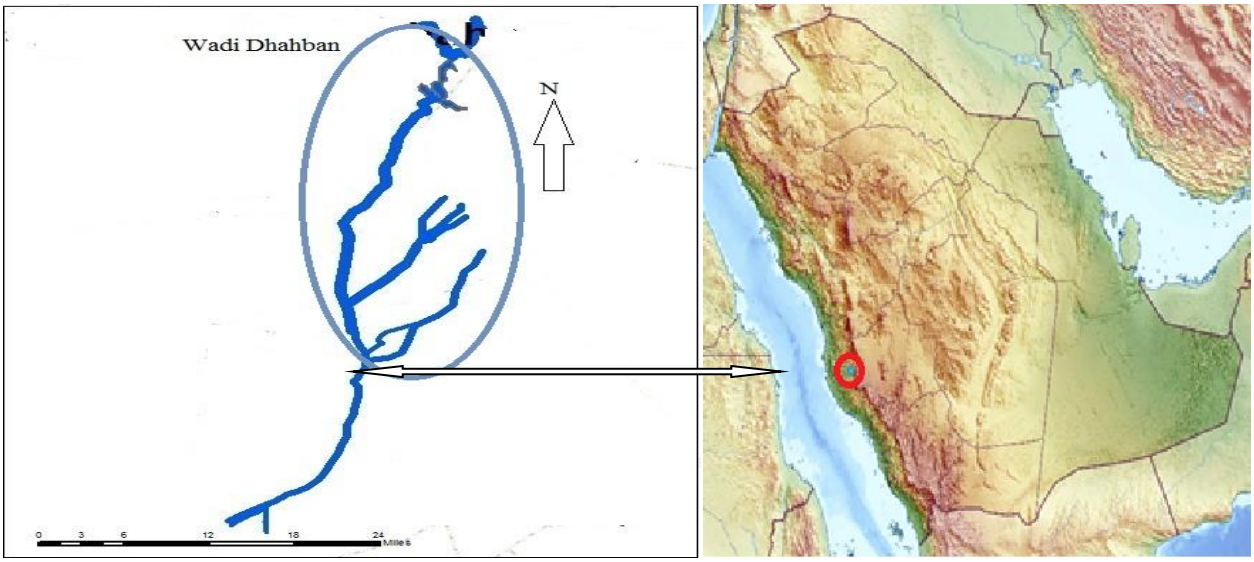


Fig: 2. Location catchment area of WadiDhahban in Saudi Arabia

This cultivation depending upon the flow of the Wadi, in case of dry season the cultivation is not possible. It is also observed in the images that a Ground Water Table (GWT) of WadiDhahban is affordable at two or three places.

2. MATERIALS AND METHODS

This researchis based onsatellite imagesof last 32years by the help of Google Earth Pro, Google Earth Engine (Google time-lapse)of different years from 1984 to 2016. The digital data were processed for using ERDAS imagine processing software. A number of software such as GIS 10.3, ERDAS Imagine version 9.4, Microsoft office 2013 (Word, Excel) were used during the research (Garg, 1991). The study was based on visual (Visits of NaiGaj, Pakistan) and digital Landsat images(of WadiDhahban, Saudi Arabia) preparation of different maps respectively. A part from this Garmin e Trex H (GPS) Digital Camera, 100ft measuring tape and soil knife were the main devices used for ground turtlingof the study area. The aim of this method is to prepare the latest maps with the help of Remote Sensing (RS) and GIS software (Elbeih, 2015). Theworkflow chart is shown in **(Fig.3).** The water shed area has been developed to show of ground water availability, NaiGajh as three main water sheds and WadiDhahban has two water sheds. A large water shed of WadiDhahban is at the end of Rill; where speed and velocity of water reducednear the Red Sea, which is 7.71 km^2long. This water shed area is attractive for the any cultivation.

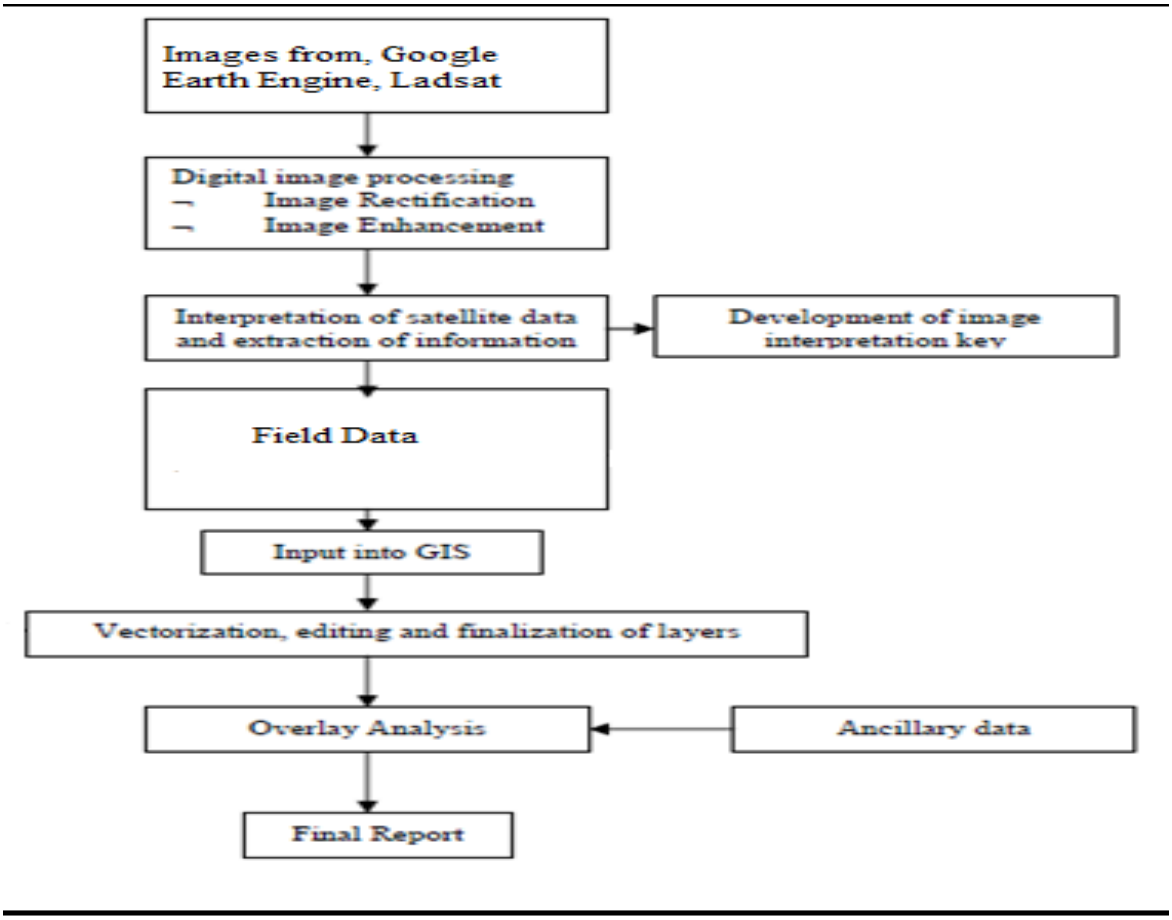


Fig: 3: Work flowchart of research methodology

3. RESULTS

The general information of land use survey and land cover area of any region is so important for land management and assessment (Anji 2002). The major land cover areas are vegetation, plantation, nature of topography and settlements which support to prepare a map of the Earth surface of any particular area.After completion of map; researcher can calculated the results that how many percent area is covered by vegetation, water resources, and aquifers (Choudhury, 1999).

Hydro-Morphology:

In the mountainous topography, the ground water isalmost found in cracks of hard rocks and other geological features, this is happened in sedimentary rocks (Mesa, 2006). Usually, sedimentary rocks are soft and easily dissolved by rain water.The rain water reached at the bottom area beneath the rocks, where water table may raise. This water appeared on surface in the form of grasslands, which is main indication of ground water resources.

Geographically, the landforms of the research area areclassified under four types as potential landform (at end of RWR) moderate landform (at center of RW R) low potential landform and non-potential landform (at upperarea of RWR (Seif, and Kargar, 2011). This classification is based on the land cover area and weathering evidence of rain water.

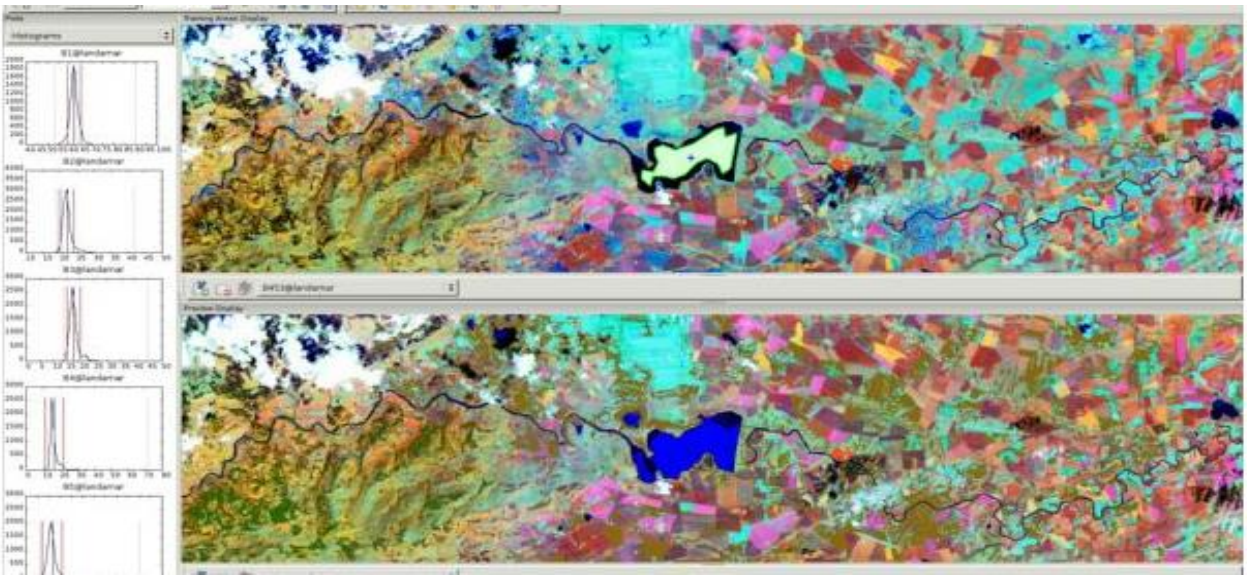


Fig: 4.WadiDhahban: Resulting of ground water potential.

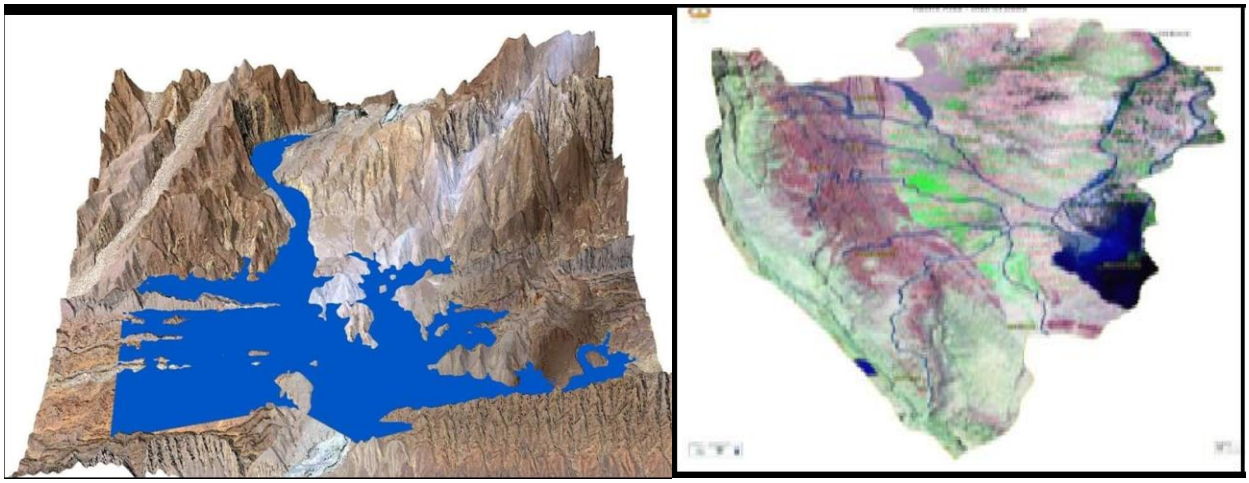


Fig: 5. Nai Gaj: Resulting of ground water potential.

The calculated results by the modern soft wares and digital images showed that both research areas have attractive ground water potential. Furthermore, the results are indicated that NaiGaj has 30.3 % ground water potential and WadiDhahban has 15.8% ground water potential, which is attractive for human survival as shown in **(Fig. 4-5)**.

4. CONCLUSION AND DISCUSSION

By the help of RS & GIS, ground water is available at both research area. The both research areas are dry and belong to semi-arid area (Murthy, 2000). Where ground water is bless of the Nature, ground water can be used for agriculture purpose or may be for the drinking purpose. It is observed in the maps taken from the Google Earth Time Lapse of last 32 years that rain fall at the WadiDhahban is not frequent. Maps are shown that heavy rain falls at study area in 1986, 1990, 2003, 2005, 2009, and 2011.

5. SUGGESTIONS

It suggested that in a year of low rain seasons, a network of tube-wells system may install at Water Shed Area (WSA) where water table is near the surface to continue the supply of water for different purposes for locale inhabitants. Here, texture of soil is also favorable of the installation of tube well. Except this low values of drainage density indicates that the watershed region is high resistant of highly permeable sub soil materials dense vegetation cover and low relief. As federal and provincial governments of Pakistan are working for Gaj Dam on NaiGaj, similarly Kingdom of Saudi Arabia

should announce the Dhahban Dam on area of WadiDhahban to save the water for future as Saudi Arabia is already facing the shortage of water.

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