Women, Water and Space: Role of Indigenous Women in using Geospatial Tech for Conserving Water

"We never know the worth of the water till the well is dry"

- Thomas Fuller

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Abstract:

In recent years, climate change has led to the phenomenon of global warming and the ensuing depletion of groundwater resources. Geospatial technology and GIS have helped in managing and conserving water more efficiently. Geospatial Technology uses aerial photography and satellite imagery to assess water resources. It further helps in terrain modeling, flow modeling, and debris flow.

This article focuses on the case study of Jordan and role of indigenous women and their engagement with geospatial technologies for better water resource management. These women live in affected areas and face problem related to water crisis and disasters and therefore, they best understand the use and potential of geospatial technology. It is high time we take prompt, decisive collective action to conserve water using space tech.

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INTRODUCTION:

Indigenous women throughout the world have long history in conserving water[1]. However, in recent times, the western scientific approach to natural resource management has become the dominant approach in managing seascapes.

Improving water efficiencies has become more critical today than ever and Geospatial technologies have a critical role to play here. Water conservation can be done more efficiently through digitization and large-scale adoption of GIS tools and geospatial tech[2]. Rainwater harvesting is one such step which can be used for both surface water recharge and groundwater recharge but this digitization of water infrastructure needs proper planning from the very conceptual stage.

Until now the possible application of GIS in indigenous knowledge management has been explored inadequately. In this article an alternate framework is developed as a way forward for conserving water through Rainwater harvesting based on integration of indigenous knowledge into GIS and this is demonstrated through the example of Badia region of Jordan. It is intended to conserve water by complementing and not by replacing the traditional knowledge of local women community. This will give an opportunity to the local women to participate in development programs and decision making both as contributors and user of knowledge.

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[1] Harmsworth, Garth, Shaun Awatere, and Mahuru Robb. 2016. "Indigenous Māori Values and Perspectives to Inform Freshwater Management in Aotearoa-New Zealand." *Ecology and Society* 21 (4). https://doi.org/10.5751/es-08804-210409 .

[2] Sharma, Bhavna. 2021. Review of *Geospatial World*. *Geospatial Tech: A Holistic Approach to Conserving Water* (blog). July 22, 2021. https://www.geospatialworld.net/article/gis-geospatial-tech-a-holistic-approach-to conserving-water/ .

Framework for integrating Indigenous knowledge into GIS Spatial Technology:

Women especially those living in rural areas, have extensive knowledge about traditional practices that are inherently sustainable, and are often excluded from decision about sustainable ecosystem. In order to design an appropriate framework for water harvesting management four steps are presented below for integration of indigenous knowledge and GIS Spatial technology for water harvesting (**Refer to Fig. 1 below**).

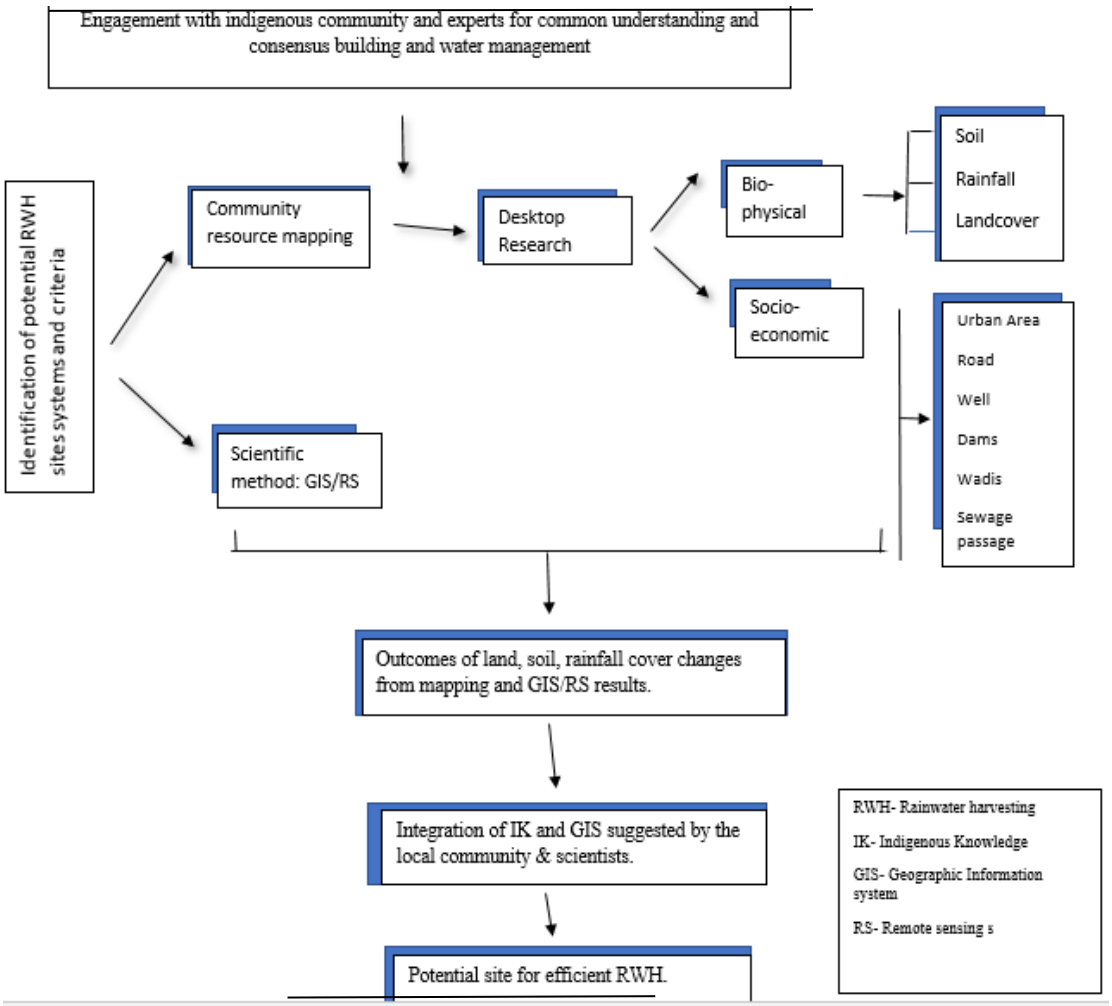

Figure 1: Conceptual integrated rainwater harvesting management framework.

1. ***Community resource and knowledge mapping for preliminary identification of suitable site for indigenous Rainwater harvesting (step 1)***: Primary step is to collect data from indigenous community based on their experience and knowledge which includes (a). Suggested potential sites by local community for water harvesting and (b) Suggested constraints by local community for selecting an optimum site for water harvesting. The

site selection criteria are based on various socio-economic & Bio-physical criteria i.e., soil and topographic suitability, land cover and land use, and surface runoff generating potential (**Fig 1 at Point A**).

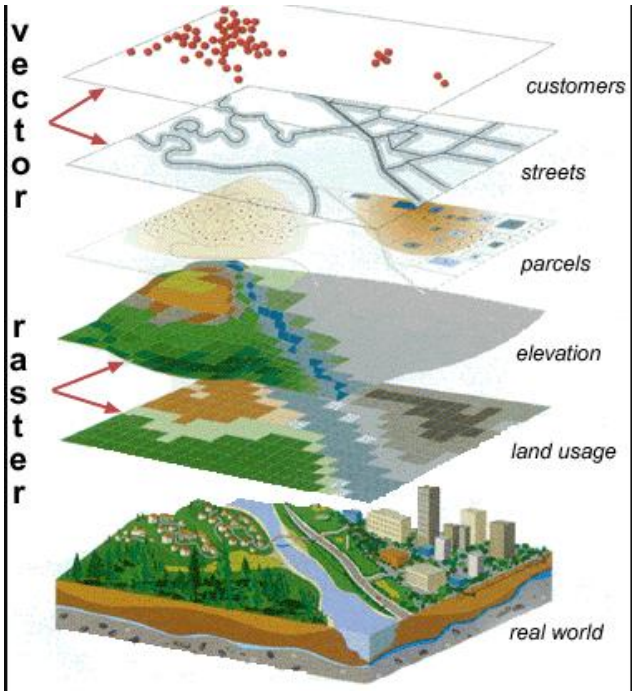

Figure 2: Various layers as seen in GIS for representation of real-world scenarios and hydrological features. (Source: Esri Press Team)

2. ***Scientific methods: GIS & Remote Sensing (step 2& 3):*** Hydrological modelling, Remote Sensing and ArcGIS are used for site selection are developed to find a suitable map for rainwater harvesting (Fig 1 at point B). GIS can show different kinds of data on one map, thereby, enabling people to easily analyze and understand patterns. (Refer to Figure 2 for GIS representation of various layers of land). This image processing by GIS-Arc software is used to process the images and to establish a geo-information system comprising digital data sets of satellite imagery, topography, soil, vegetation, hydrology, and meteorology (Fig 1 at point C). This model generates suitability maps for finding potential site for water harvesting by integrating different criteria maps then all criteria are combined by applying a weight to each followed by a summation of the results to yield a suitability map.

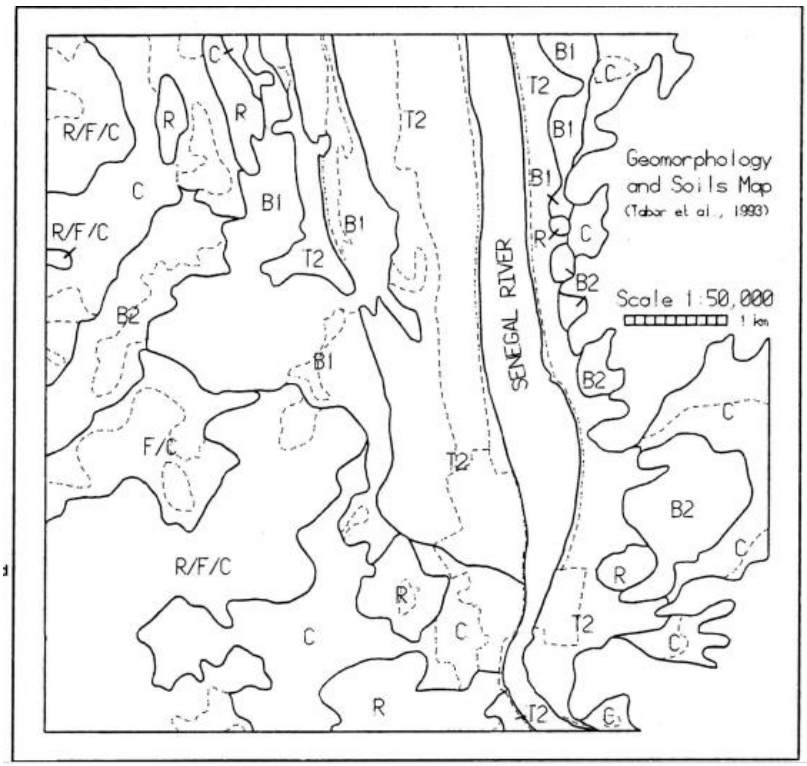

Figure 3: This is North area of Senegal. Soil map based on units recognized by indigenous community (represented by dotted lines) and these have been grouped by appropriate larger complexes as recognized by GIS (represented by black lines).
(Source: Tabor et al, 1993)

3. ***Integration of Scientific Results and Indigenous knowledge*** **(step 4):** The primary data collected (at step 1) is then applied to the study area with the GIS environment using ArcGIS (at step 2 & 3). The final map then shows the suggested sites by the indigenous women and suggested sites by GIS **(reference map at Figure 3 of Senegal area)**. Then the integration of these two methods has to be carried out to yield a hybrid solution with what is indigenously known but blended to yield more acceptable and productive results in conservation (Fig 1 at point D). By this approach suggested here, the designation of the units to be mapped comes from the resource manager itself rather than remote sensing specialists or surveyor. This technique shows good relationship between the sites defined by the use of scientific methods and the site suitability for water harvesting that was specified based on indigenous knowledge and thus, the time required by non-local conservationist to learn about local resources is minimized if they start with the base of

indigenous knowledge as local women are already aware of this knowledge. (**Refer to figure 3)**.

CASE STUDY OF JORDAN-

Jordan has been on the forefront of using a lot of GIS derived information to its fullest possibilities. Badia region of Jordan has turned to GIS in order to streamline their water conservation efforts. 200 stakeholders from within the indigenous women community in the Badia district participated in the process of potential site selection of water harvesting wherein, they provided with some constrains that from their point of views are vital in choosing the suitable sites for water harvesting in their region. Also, they pointed out locations based on their knowledge which could be used for water harvesting[3]. The end result was promising and it was found that there is high degree of agreement between both the results. Local community selected water harvesting site within reasonable proximity to the selected ones by the GIS Spatial Tech.

<u>The Way Forward: The Future of Indigenous-led Space and Innovation in Water Conservation:</u>

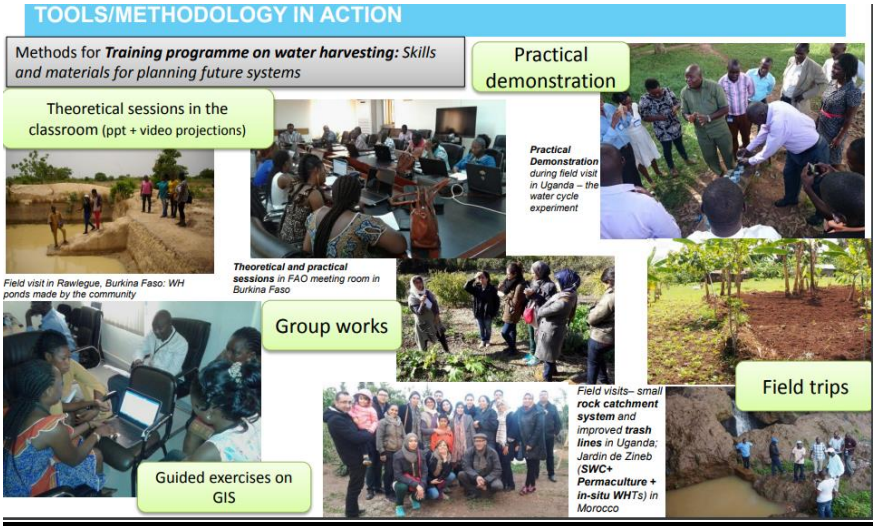

Figure 4: Methodology for training program on use of GIS /RS etc. for water harvesting.

[3] Al-Shabeeb, Abdel Rahman, Ibraheem Hamdan, Hani Al Amoush, Rida Al-Adamat, and A'kif Al-Fugara. 2022. "Integrating Indigenous Knowledge with MCDA in the GIS Environment to Determine Site Potential for Water Harvesting in Wadi Hammad Basin in Jordan." *Sustainability* 14 (21): 14033. https://doi.org/10.3390/su142114033.

This approach of using GIS in a participatory context maximizes the utility of indigenous information for managing water and this not only has the potential to empower the local women community but also provides a platform that can be shared by many water conservationists. Moreover, with this approach, comparisons can be made and scenarios can be prepared on the basis of the information stored in the system which will minimize the time in finding potential sites for water harvesting. This article recommends inclusion of indigenous women community into GIS Spatial Tech for specification and selection of optimal sites for water harvesting.

To further the approach of integrating indigenous knowledge into GIS, the aim should be to strengthen the relationship between GIS spatial tech and indigenous women communities through trainings, meetings, knowledge sharing activities and dialogue. (**Figure 4**). We need to bring the people who are knowledgeable, and at the same time, we also need to bring the scientists, so that they can learn from each other. But ‘Indigenous Knowledge’ has to be given the forefront, in terms of merging it together. Collaboration, Coordination and Cooperation are the key for success.

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