# Water Harvesting Methods for Rural Water Supply

**Rabi H. Mohtar, Project Leader**

## Cooperators:
Faraj A. El-Awar (Hydrologist, Beirut, Lebanon); Adriana Bruggman (ICARDA-Alleppo, Syria); Mohammed Ouessar, Fethi Abdelli (IRA-Tunisia); Tong Zhai, Jin-Yong Choi, Bernard A. Engel (ABE, Purdue).

## Goals:
The aim of this research is to help understand and sustain the wadi communities in dry areas. It is a pioneering attempt to model the complex physical and socio economic wadi hydrology system. Our goal is to accurately represent the small water harvesting system and study their hydrological and socioeconomic impact.

## Recent Publications:


## Statement of Problem:
Water availability is the main limiting factor in dry-land agriculture and economy, throughout arid and semi-arid regions, due to low annual rainfall depth and its often non-uniform temporal and spatial distribution. Water harvesting has been used since ancient times by people in dry areas to collect and supplement scarce water resources. For agricultural production, rainfall collection has been practices mostly at local scale from deep percolation ditches to on-farm catchments. Surface reservoirs make storage of water more efficient due to reduced surface area for evaporation and centralized management.

Siting of water collection structures depends on a multitude of factors, ranging from basic hydrologic characteristics of the local area to the social-economical interests of government, local authorities, various interest groups and shareholders of a potential project. Therefore, a large amount of social, economic and environmental information need to be considered in the decision making process to address not only water needs, but also government policies, stakeholder values, public opinions and other management goals.

## Current Activities:
A systematic approach to facilitate the siting of water harvesting reservoirs in dry areas was developed and tested based on the Analytic Hierarchy Process (AHP) concept. The developed methodology helps locate and rank potential sites for small water harvesting reservoirs based on the Reservoir Suitability Index (RSI). RSI for each potential site is calculated from a four-level decision hierarchy structure shown in the Figure below. The main obstacle for implementing this methodology comes with the intense efforts dealing with data collection, formatting and preparation for hydrologic modeling, and post processing for visualization with a GIS. In this research, a Web-based GIS-modeling system is designed and implemented for streamlining the tasks involved in the calculation of RSI and the analysis thereafter. The proposed implementation of the AHP system is built on the foundation of an existing spatial decision support system (SDSS).
Reservoir Site Selection Loop

Install reservoir → Simulate hydrology

Site selection

Runoff/Sediment yield

Socio-economic impact

Hydro-Spatial AHP

GIS Database
- Satellite Imagery
- Topography
- Soil Permeability
- Land Cover
- DEM
- Precipitation
- Subwatershed Stream Network

Hydrologic model
- Potential Runoff
- Socio-economic

AHP → BSI (Potential Site Ranking)
The AHP Decision Hierarchy structure

Level 1: Goal
Level 2: Major Decision Criteria
Level 3: Sub-Criteria
Level 4: Attribute Classes

- Potential Storage
- Topographic Characteristics
- Soil Characteristics

Potential Surface Runoff

RSI
Socio Economics
Land Cover

Socio Economics exclusionary criteria

Best ranked subwatersheds common to all sub-senarios