Introduction

Water is a precious and finite resource of the planet earth which is getting scarce day by day due to rapid population growth, industrialization, urbanization, agricultural intensification and life style change. Keeping in view the importance, limitation and unfavourable spatio-temporal distribution of water resources, historically, different techniques of rainwater harvesting have been developed, particularly in arid and semi-arid regions of the world.

Aim

The aim of this study is to explain the concept, technology, merits and demerits of Sowma, one of the indigenous techniques of rainwater harvesting and utilization in northeast of Iran (Figure 1).

Method

Sowma is practiced in northeast of Iran near the southern border of Turkmenistan where a well known desert of Kara Kum exist. This area suffers from arid and semi-arid climatic condition with average annual precipitation of about 200 mm and mean annual potential evapotranspiration rate of greater than 1000 mm. Wind blown deep loess and marls blanket the study area and topography is characterized by low to medium height undulating hills (Figure 2). Due to these climatic, geologic and physiographic conditions, the good quality fresh surface and ground water is lacking in the area. Therefore, Turkmen as ancient inhabitants of the area have developed the rooftop rainwater harvesting system for drinking and household water supply and the Sowma micro-catchment rainwater harvesting system for agricultural production. Since, no information can be found in the literature about this system, in 2010, field and questionnaire surveys have been conducted to achieve the aim of this study.

Results

Concept

Sowma is considered as a macro-catchment floodwater harvesting system within streambed (Oweis, et al., 2001). Sowma means diversion in the Turkmen language. It is an earth bund across the relatively flat and wide U-shaped valley beds surrounded by deep loess hills. Although they are built in cascading order along the main streams, their runoff areas are mainly sub-watersheds draining from lateral channels (Figure 3).

Technical features

Height of bunds is 0.5 to 2 m and spaced between 20 and 100 m apart. Area between two bunds (cropping area) ranges from 1000 to 10000 m². Runoff area of each Sowma varies from about one up to a few hundreds ha. Cross section of bunds is trapezoidal with side slopes of 1:1 (Figure 3). Materials of bunds are transported from nearby hills and are built manually or mechanically perpendicular to the direction of valleys with slopes up to 10%. Earth bunds are compacted through trampling by animals and machinery. Since the bunds are susceptible to seepage and erosion, spillways are built by digging a gently sloping channel across surrounding hills in one end of the bunds rather directly on bunds (Figure 3). Despite these consideration breakdown of bunds due to seepage and tunnels excavated by rodents is the major issue after establishment (Pourali, 2011).

Farmers perception toward Sowma

Sowmas are traditionally constructed to harvest water for crop production, animal watering and domestic uses. Recently, due to increasing trend of floods and droughts, the local authorities are seeking to integrate and optimize this indigenous technique with modern technologies to control floods and mitigate droughts, using participatory approach. Therefore, in this study local perception about implementation and optimization of Sowma has been assessed. A questionnaire survey of 35 households indicated that more than 80% believe that construction of Sowma is profitable, 90% were interested to invest only in case of receiving financial and technical support, and 73.3% evaluated that benefits of Sowma is high. However, high establishment and maintenance cost has been regarded a major hindrance. About 86% asserted on their readiness for participation in construction of Sowma providing financial support as subsidy or low interest loan.

Discussion

Since geological formation of the study area is not suitable to form aquifers, the only reliable source of water is rainwater. Although the natives of the area have already developed indigenous techniques to harvest rainwater, but in order to adapt and sustain these techniques in accordance with socio-economic and climate change, the optimization and integration of local knowledge and modern technologies is necessary. Construction, maintenance and repair of an optimized Sowma is out of financial affording of the locals, therefore, government should use fiscal incentives to force farmers for implementation of rainfall harvesting either for promoting agricultural production or reducing flooding and drought impacts.

References


Figure 1. Geographic distribution of Sowmas in Iran

Figure 2. A typical Sowma in the study area

Figure 3. Flow pattern in Sowma rainwater harvesting system

Figure 3. a) Trapezoidal cross section; b) inundation after a rainfall; c) a spillway dug across a natural hill