

BANDSAR, A SUCCESSFUL STORY FOR FLOOD AGRICULTURE IN ARID REGIONS OF IRAN

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ABSTRACT

Bandsar is an ancient system for flood farming invented by the farmers of Khorasan provinces. This paper had introduced some basic characteristics of this system, spatial distribution of constructed Bandsars through Khorasan province and its correlation with climatologic and topographic indices. The rules or agreements used to determine the priority rights for flood irrigation are some special ones, which are explained in this paper. Technical design, cropping system and advantages of this system are discussed too.

INTRODUCTION

Generally speaking, Iran is an arid semi- arid country located between 25 and 40 degrees of northern latitudes. The major characteristics of these regions are obviously high evapotranspiration and uneven distribution of precipitations throughout the season. One of the strategies used by farmers of these regions to adapt with these hard variable conditions is flood agriculture. Different methods had been used by farmers throughout the world to control and use flood irrigation. Flood irrigation is reported from north America, Arizona state (USA), Kenya, the former Soviet, occupied Palestine, Australia, Afghanistan, Pakistan, Yemen, Tunisia, Burkina Faso and India (Qoddusi, 1999). Many years ago flood irrigation was popular among Iranians. The history of flood agriculture is reported to be related to more than 3000 years ago (Kovsar, 1993).

Different methods had been used for flood farming throughout the country with different names among them are Bandsar, Khooshab and Degar. In this paper we will introduce the Bandsar system in Sabzevar region as a successful story in flood farming.

SITE SPECIFICATION

This investigation was done in Sabzevar town which is located in the west of Khorasan-e-Razavi province, I.R. Iran. The center of town is located on 57°, 30' E and 36°, 12' N beside the Tehran- Mashhad road at 664th Km. Its long term average annual precipitation is 209.8 mm and yearly average temperature is 17.6°C, Annual evaporation

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is calculated to be 1436 mm from the pan data (Dadrasi Sabzevar, 2004). Fig. 1 shows position of studied site in Khorasan-e- Razavi province.

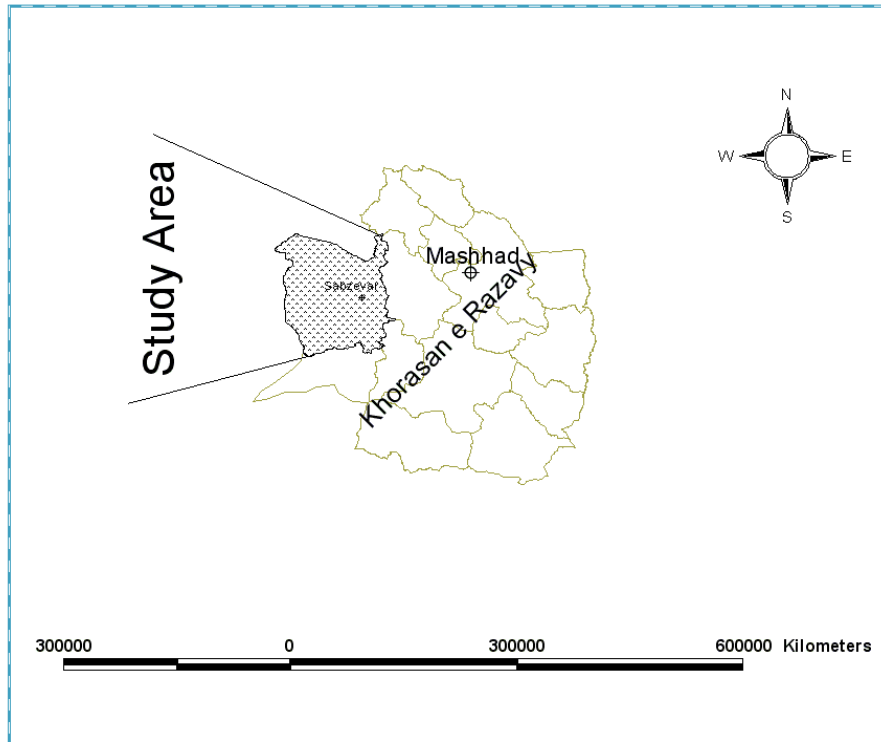


Fig. 1: Location of studied site in Khorasan-e-Razavi province

TECHNICAL CHARACTERIZATION

Bandsar which is one of the most ancient human made structures, had been reported only in Khorasan provinces. It is consisted from a basin with a weir which is constructed on the contour line. This basin in fact is a plot or a field for farming and is irrigated by two methods:

- 1- Conversion of surface run off of impervious surrounding lands which have small elevation difference to a main canal and conveyance of this water to a pre constructed basin (Bandsar).
- 2- Conversion of run off or floods from seasonal rivers to the field with a canal diverted from the river.

Fig. 2 represents a scheme from Bandsar in Sabzevar region and Fig 3 shows Bandsars in the satellite imagery.

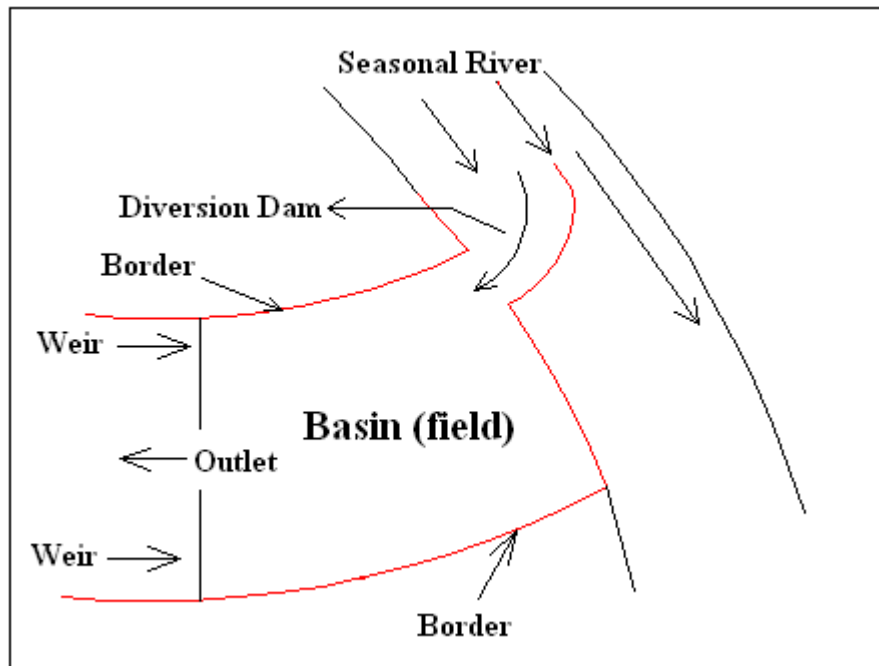


Fig. 2: A scheme of Bandsar in Sabzevar region

Area of each field or basin varies between more than 20 m² up to hectares. In the homogeneous low steep slopes basins are larger. The steeper the slope, the smaller are the dimensions of basins. The height of boarders in these basins varies between 0.5-4 meters depending on the discharge rate of flood and dimensions of basin.

PRIORITY IN IRRIGATION RIGHT

There are two local agreements to determine the priority in irrigation right:

- 1- Upstream agreement: Based on this agreement the irrigation right in each flood event is belong to the farmer whose field (Bandsar) is located near the river at the upper point. After full irrigation of upstream Bandsar, the farmer gives the permission of irrigation to the next farmer whose field (Bandsar) is located in the lower part of stream. In the next flood event the irrigation right is belonged to the first farmer again. On the other word the upstream farmer has the right to use water in all flood events.
- 2- Weekly cycle agreement: due to this agreement each day of week is contributed randomly to a farmer. Depending on the day of flood occurrence the first farmer to use water is determined. The next farmers are determined based on previously randomized schedule. These Bandsars do not benefit floods but generally they use surface run off of slopes.

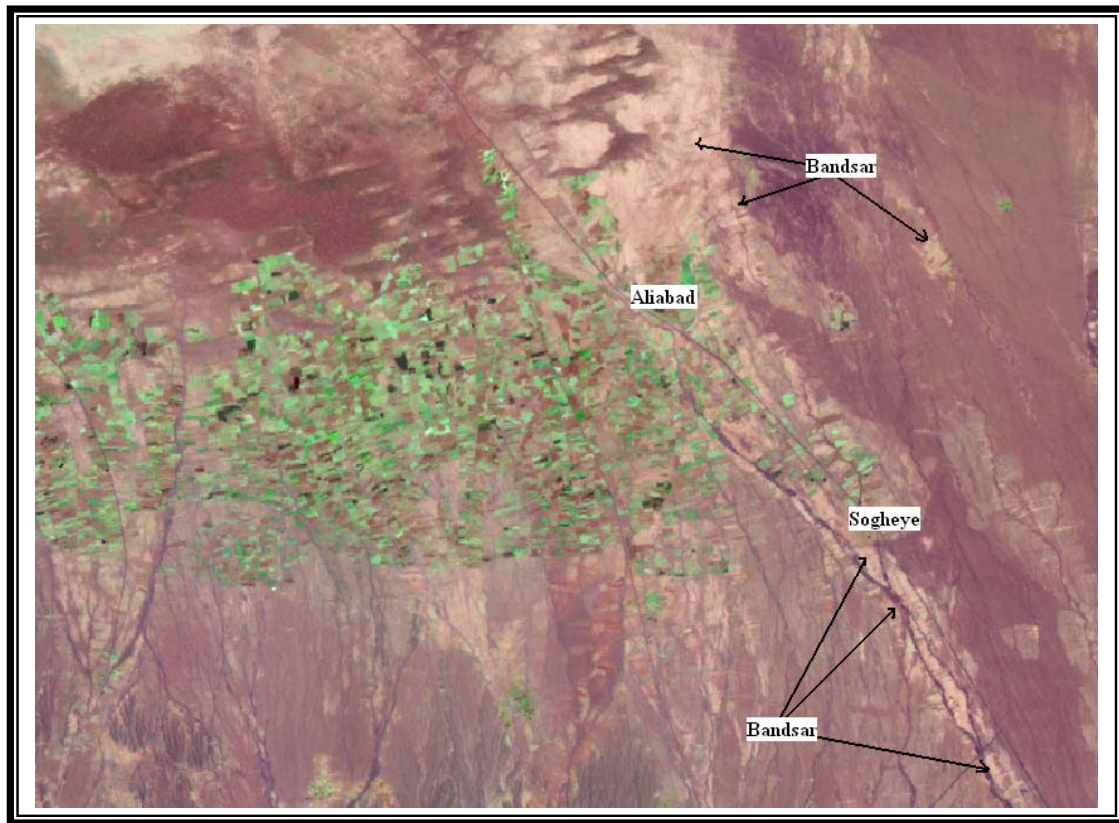


Fig. 3: TM False Color Composit (FCC 731:RGB)

DISCUSSION

As previously mentioned the Bandsar system is invented only in Khorasan provinces. Sabzevar is one of the most important cities of Khorasan-e-Razavi province which has the most number of Bandsars. Previous investigations show that Bandsars had been constructed in regions with 75-257 mm annual precipitation. In Sabzevar, Bandsars are constructed in a region with 194.5 mm annual precipitation. Precipitation regime in this region is Mediterranean in which the dry season occurs at summer and precipitations take place in the winter and early spring. Coefficient of variance for precipitation varies between 25.7-42 percent. On the studied site this coefficient is 35.7%. Yearly average of air temperature in these regions is between 14-26°C and for the studied site is 16.9°C. It had been reported that the rainfall/evapotranspiration ratio has a good agreement with the areas of Bandsar development (Arabkhedri, 1996). This ratio is measured to be about 0.027 to 0.078 in the studied site while its value was about 0.9 in the surrounding lands.

Trapped sediments behind the bandsars are rich of organic mater which are consisted of animal manures and crop residues which can improve soil fertility. On the other hand high porosity of these organic residues will improve the infiltration rate of heavy textured soils accumulated behind them. The other benefit of this system is periodical leaching of soil profile through out the root zone with high quality flood water which can control soil salinity within the tolerable limits for the crop in the next season. The main crops cultivated in this system are wheat and barley in rotation with melon and

water melon. The other crops are cumin, sunflower and peas which can produce acceptable yields. On the other hand agricultural return flow of Bandsars can recharge the groundwater table for the farmers of lower parts who have limited access to the flood water and in turn have positive social- economical effects for clients.

REFERENCES

1. Arabkhedri, M., (1996) Effect of climatologic conditions on Bandsar development. Second national symposium of desertification and desertification control methods. Pp. 159- 168. (In Persian).
2. Arabkhedri, M., A., Partovi, K., Kamali, A., Ghaffari and A., Sarreshtedari (1997) Completion report: Effect of sediment on infiltration rate of traditional flood spreading networks (Bandsar). Soil conservation and watershed management research center of Iran. (In Persian).
3. Dadrasi Sabzevar, A., (2004) Meteorologic studies of aquifer recharge project of Sabzevar. Soil conservation and watershed management research center of Iran. 65p. (In Persian).
4. Hudson, N., W., (1975). Field engineering for agricultural development. Oxford university press.
5. Medina, J., (1976). Harvesting surface runoff and ephemeral streamflow in arid zones. F.A.O. Conservation Guide No.3. Conservation in arid and semi-arid zones. F.A.O. rome.
6. Kavsar, A., (1993) Desertification control with flood spreading, Natural resources and livestock research center of Fars province. 57 p. (In Persian).
7. Qoddusi, J., (1999) Introduction of flood spreading methods and its application. The first workshop of flood management and application. 226p. (In Persian).