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Traditional Rejuvenated Rainwater Harvesting Water Bodies (NADI) Help to Sustain Livestock-Based Livelihood in Thar

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Abstract
The western Rjasthan has been in the grip of drought for last so many consecutive years. The year 2002 drought is the worse among the four years and much severer than even 1987 when few million animals had died. The impact of this drought has been very extensive and intense. Animals have been hard hit due to acute shortage of water and fodder. There has been a terrible crisis of drinking water for human and animal population. The small and marginal cultivators, landless labors and destitute families were worst affected as they did not have any food, water and fodder. Many people in Thar believe that they had never witnessed such a severe drought (in fact it is Trikal) in their living memory. The acute scarcity of water and fodder has caused casualties of animals in large numbers. The thar marusthal region the rural communities face acute problem of scarcity of water, food grain and fodder. Water for human being is the main theme of human interest. But due to introduction of tap water, canal water, deep tube wells these technologies are abended in these areas. In this paper attempts are made to explain the traditional water resource management systems and the innovations such as catchment improvements, masonry super structure "NESTA/spillway" to allow excess water from Nadi and protect to embankment of Nadi bund, provision of outlet "Nesta" in the Nadi to protect embankment of nadi heavy rainfall and to support long life of the structure. The innovations suggested in the structures are proving very useful and increasing the water bearing capacity in the nadi for animal and ensure their productivity and continuing dairying program. Women continuing their animal-based livelihood to earn income generation to sale milk, butter and butter milk in near by markets, at local dairy out lets.

Keywords: Thar desert, nadi, fodder, water, animal-based livelihood, migration etc.

Introduction

About Thar Marusthal

In India there are about 2.34 million km2 of hot desert called 'Thar Marusthal'. About 85% of the Great Indian Desert lies in India and the rest in Pakistan. About 91% of the desert, i.e. 2.08 million km2, falls in Rajasthan covering about 61% of the geographical area of the state. Thar Desert receives between 100 to 500 mm of rainfall every year, most of which is received between July and September. The Rajasthan state has only 1% water resource, whereas area is 10% & population 5.1% of the entire country. Thar is the most populous desert in the world 64% of its population resides in the Thar despite scanty rainfall with all its variations, timing, and intensity. The rural economy is predominantly based on agriculture and animal husbandry. These traditional techniques are our only weapons to combat the scarcity of food and fodder for Thar people Livelihood of people is dependent on monsoonal behavior. Rajasthan is facing probably the most severe drought of the century and that too for the third year in succession.

Drinking Water, About 7.5% of the households provide water twice a day to the animals, while 92.5% provide thrice a day. In the control group 38% of the respondents provide water twice a day, while 62% provide thrice a day. About 37% of the household's face water shortage for some period, of these about 44% face shortage for up to 4 months, 37% face shortage for 4 to 8 months, and 19% face shortage for more than 8 months a year. Similar figures are reported in the

control group – 41% up to 4 months, 38% 4-8 months, and 21% more than 8 months. The goat owners arrange for water during the shortage period from sources outside their house such as beris, water bodies, tanks, wells, hand pumps, some use lease pipelines (0.93%), and most of them (83%) purchase water by the tankers. In the control group also a high proportion of people (73%) purchase water during the scarcity period.

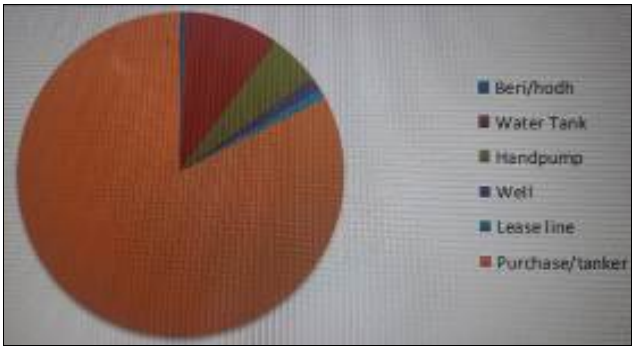

Fig 1: describe about water used during scarcity

(Source: Goat Based Livelihood Program under MPOWER Impact Assessment, Figure 19 Sources of water used during scarcity)

Introduction: Nadi is a traditional water harvesting structure, constructed, and maintained with spiritual values. This is a simple embankment made to collect rain water for human drinking purpose in western part and exclusive for livestock in eastern part of Rajasthan.

Definition: Nadi is defined as water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout. The Nadi constructed by both ways the excavation and the embankment methods. This is simple in design and easy to layout.

Purpose/Scope: Nadi also known as livestock pond in eastern part of Rajasthan, where, it is constructed to provide drinking water for livestock and wild life.

i) In the western part of the state Nadi is multipurpose structure build to harvest rainwater to meet out drinking water requirements of human as well as livestock population. Nadi is the structure which protects animal husbandry occupation of desert area from adverse effects of continues drought and climate change. Water available in this structure throughout the year in a normal year. We can say this structure increase community resilience against drought.

ii) Managing natural resource base for animal-based livelihood about 85% of the respondents' experience fodder shortage for some period and 99% of them have to purchase water and fodder to tide over the scarcity period. Bulk buying of fodder is practiced among both GBLG members as well as other households. 37% of the respondents said they faced water scarcity for some period with 66% of them facing shortage for more than 4 months. Out of households that face water scarcity, 83% purchase water. Activities such as fodder tree plantation in the villages, and water harvesting will go a long way in reducing inputs costs as well as drudgery for the animal owners. These activities may be implemented by convergence with the MGNREGA and by CSR/philanthropies initiatives.

iii) Women are the main actors in rearing of milch animal, goats' interventions have met the practical gender needs through enhanced knowledge and skills related to this livelihood. Provision of credit and loans through the thrift groups has empowered them to take reins of the animal-based livelihoods. They feel that there is improvement in their status within family as they are able to contribute to household income. (Source: Goat Based Livelihood Program under MPOWER Impact Assessment)

Hydrological Details: There are some important hydrological considerations while designing the Nadi; these are estimation of runoff, runoff volume and design of waste weir.

The villagers' long practices of Nadi made the hydrological design very simple, and as a thumb rules many NRM practitioner and villagers follow the following hydrological points in Nadi design;

The drop spillway design is very common and known to all villagers. Normally one end contracted and both end contracted structures construct in Nadi. Generally, two sizes of spillway are commonly constructed in Nadi in Rajasthan these are 3.5 and 6 meter long crest lengths spillways. The crest length and size of spillway is directly proportional to catchment area. Size increases with increase in catchment

Geographical Coverage: The concept of Nadi was introduced in 14th century when Kings were built such structure for welfare of the community or some time in memories of their relatives. These structures were linked with faith and result of that each Nadi has a place to warship. These Nadis are water temples; by excavating soil from Nadi bad, is the way to serve the God. This is a community structure and its maintenance requires strong community organization to serve for ever to village community.

This is the structure which is available everywhere in Rajasthan. It named Johad in Mawat area (Alwer district), Pokhar in Dang (Karauli district) and Nadi in western and central part of Rajasthan. Karuna Social Welfare Foundation (KSWF) has promoted rejuvenation/ renovation of these structure last two years of period. More than 100 individuals as well as community Nadis were rejuvenated/renovated.

Scope

Where it should be constructed

Following are the minimum requirements for design and construction of Nadi:

- Identify a natural desperation where large catchment area is available.
- The drainage area above the Nadi must be protected against erosion.
- The catchments area and resultant runoff should be sufficient enough to submerge the Nadi in full capacity.
- The topography and soil of the site shall permit storage of water at depth and volume that ensure year long arability of water in the structure.
- Land slope should be within 1 to 3 % range and the height of embankment varied from 1m to 5m to submerge 75 per cent of the Nadi area.
- Local material such as sand and stone in the village should be available.

Structural Details

Traditional Linkages: Nadi is a traditional water harvesting structure, constructed with spiritual values. This is a simple embankment made to collect rain water for human drinking purpose in western part and exclusive for livestock in eastern part of Rajasthan.

Nadi is 1 to 5 m high and length varies as per the size of catchment (150 ha-250 ha.) and its cross section varies with height. It is a high height earthen embankment built along three sides down slope. Upstream land is kept open to receive rainwater. Traditionally, Nadi was not equipped with spillway "NESTA", gradually in course of development it was then introduced along with the structure as an essential component.

Possibility of Replication in Other Area

Easy in Construction: The concept of Nadi was introduced in 14th century when Kings were built such structure for welfare of the community or some time in memories of their relatives. These structures were linked with faith and result of that each Nadi has a place to warship. These Nadis are water temples; by excavating soil from Nadi bad, is the way to serve the God. This is a community structure and its maintenance requires strong community organization.

Communities of Rajasthan are well aware about the catchment (Agor) and they have well proven indigenous knowledge on runoff calculation. Large catchment area is the essential requirement and one of the site selection criteria of Nadi. The Nadi an age old structure in Rajasthan and its design, site selection, and construction is a traditional knowledge exits with people. However, with time and continuous evolution by farmers, scientist and NGOs, the masonry drop spillway (drop-one end/two end contracted) have replaced the pipe (clay/cement etc) spillway. The introduction of masonry spillways increases the efficiency in water regulation and reduced the changes of erosion and breach of bund.

Material Used

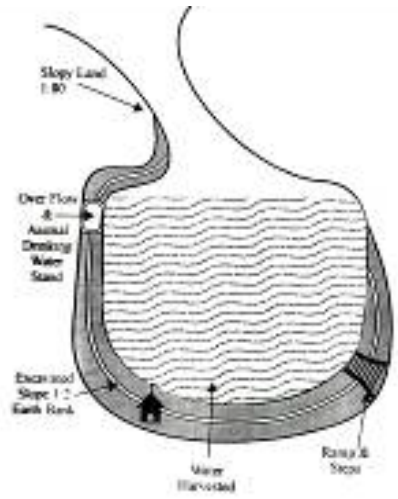

Fig 2: About design and different parts of Naadi structure

Earthen embankment usually constructed by local soil available in farmer's field, while for spillway construction stone and cement may not be available at site and required to collect from outside. Normally stones are available within 20 km radius of villages as informed by villagers, they need to arrange transportation to bring stone. In-absence of stone farmers can build cement brick or clay brick and use for construction of spillway with plaster or pointing.

Easy Design/Maneuverable: Very easy in design and construction, any community member can design the structure, moreover in all villages few local experts (Jankars) on Nadi are available they usually help villagers in site identification, layout, and construction of structure. The design of spillway needs little more technical skills but Karunalya Social Welfare Foundation (KSWF) introduced very simple three different types of designs. This makes the job very simple at village level at the time of its construction. The introduced deign is well established in Jodhpur, Nagaur, Pali area and other NGOs and agencies are using the design for construction of Spillways in Nadi.

Technically the following investigations are essential for designing the Nadi:

- PRA map of area; a general understanding on submergence area along with the layout map of proposed Nadi to ensure its alignments.
- Status map of all the old water harvesting structures (may be in defunct form)
- Catchment area map and type of catchment. Average monsoon rainfall and per hour intensity of rainfall for 25 years recurrence interval.

Less Maintenance: Maintenance of structure is essential requirement for longer life of any structure. Normally a huge sum (maximum 10-15% of total cost) goes for maintenance. The poor and irregular maintenance of structure increases the operation cost and reduce the life of structure. The traditional method of maintenance comprises of protection of bund by stone pitching on bund and planting/protecting natural vegetations and trees on bunds in conjunction with some earth work in heavily eroded bund section.

Long Life and Multipurpose Uses: Technically the life of structure decided on the basis of recurrence interval of rainfall for which structure is designed. This means scientifically the life of "Nadi" varies from 40-50 years but as per the perception of villagers, life varies from 5-7 years without maintenance and 80-100 years with regular maintenance. The life of structure is also function of its location in the watershed in "Thar."

- It provide drinking water security for all type of animal whole years I,e goats, sheep, cows, buffaloes, bullocks, camel, donkey, wild life
- It helps to reduce the migration of animal rearing and farming families due to availability of water in the rejuvenated water bodies
- It helps to mitigate droughts effects, reduces soil erosion and conserves moisture
- It helps to continuing animal-based livelihood income generation dairy farming
- Control run off and Recharging ground water.
- Provide opportunity to grow and protect vegetation around the structure.
- Support livelihood and help to build resiliency in drought situation.
- Low investment and high return in term of social status of the village among nearby villages.
- In Rajasthan there is saying "Ghee dhule mahra ki na jasi par pani dhule to mahra ji baljasi" (means if Cow milk ghee spills and waste no problem but if water spills and waste I cannot tolerate) reflects high regards and value for water. Nadi is the structure help in storing water therefore liked by all. No body damage Nadi in village.
- Nadi is one of the important rain water harvesting structure for arid region, where rain fall is lesser then 300 mm annually.

Fig 3: Rejuvenated Nadi (Community Pond): Animals are stand & drinking harvested rain water

Conclusion

The structure is sustainable by nature because of its simplicity in design and community ownership on that. The structure is lifeline for agro- pastoral community of Thar-the desert people. The structure also not requires much maintenance as compare to other structure and most of the time self-maintenance takes place in Nadi due to natural and environmental causes. The high rate of wind erosion transport soil which deposits on bund and raise the height which makes Nadi sustainable. The vegetation over the Nadi bund is also play an important role to protect the structure from high wind.

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