Exploring Concept of Sustainability through Understanding Traditional Resource Management Practices: Case of Thar Desert, India

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Abstract. The Brundtland Report published in 1980s, for the United Nations Organization, mentioned the concept of sustainability for the first time. It explained the concept as it is understood in modern times. However, while the term itself may not be very old, but is the core idea of sustainability and sustainable development also so recent? Or has it been central to the historic cities and developments which have managed to survive for centuries. Following paper examines various components, principles and parameters of sustainability, as defined in contemporary discourse, in a specific geographical context. The background is set in Indian subcontinent’s desert landscape- Thar, an arid and semi-arid geographic region. It explores knowledge systems developed and still practiced by native communities, over generations, to brave tough climatic condition and have shaped unique habitat in this/such resource parched geographies. The paper highlights the core values of sustainability as understood by the native communities of Thar and the nature of development it eventually shaped here as a product of this understanding. Finally, it concludes the merits in taking clues from traditional practices of resource management and strengthening the role of communities towards a more sensitive and sustainable future.

1. Introduction

1.1. Concept of sustainable development
In the early 1980s, the United Nations Assembly realised the need to bring together member nations to pursue development in a manner which will mitigate the then ongoing misuse/abuse and deterioration of natural resources and human habitat. Consequently, the Brundtland Commission came into existence between 1983-87, which defined and mainstreamed the word "sustainable development". According to this landmark report, sustainable development was defined as a kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs [1]. Therefore, the idea of "need" or requirement and access to resource for the future generations appears to be central to "sustainable development".

1.2. Context
The paper is set in Thar Desert, India. It is located in the north western region and shares international border with Pakistan. Spread across four Indian states, the desert is bound by Aravali hills in the North East, Rann (salt marsh) of Kutch along the coast and alluvial plains of river Indus to its West and North
West. Considered to be the most heavily populated desert in the world, Thar is an arid, semi-arid desert landscape. Traditionally, a livestock based economy, it had a predominantly pastoral life that was shaped by its ecological context such as forests, rivers, flora/fauna, which provided many basic material for survival of life form. This has resulted into complex socio-economic-cultural (natural and built) system anchored on the ecological setting. Further, it has led to emergence of built environment and social institutions that regulated use of available natural resource and planned for unforeseen conditions/lean periods. Therefore, continued existence and development over generations in an area with limited resources and harsh climatic conditions, renders Thar an appropriate context to verify the concepts of sustainability.

Figure 1. Location of Thar Desert, India

Today, sustainability is one of key aspects of majority of developments, in most parts of the world. Modern methods are exploring and ensuring the most judicious use of resources and well-being of our natural environment. Therefore, it is imperative to verify if this definition of sustainable development can be corroborated through actual examples on ground? And further, if it is indeed a relatively "new approach" or have there been instances in history with similar developmental approaches that may be relevant even today.

2. Approach and methodology
This study examines very complex ecological and environmental relationships (that have highly scientific connotation to it otherwise) between various life forms through a more culturally oriented ecological study. This enables understanding ecology and sustainability through a socio-cultural framework, hence it brings to light what the communities think is critical for their survival and systems they adopt to conserve/balance the same. It is this sensibility/relationship between man and nature which is manifested in built, cultural and economic environment/context. Hence, the study identifies community practices pertaining to ecological conservation that have sustained and shaped life in the desert landscape for generations, further assessing their validity in contemporary times. Chief source of information are primary field work and data from published and unpublished sources, including maps, gazettes, documents etc.

The approach to verify the concepts of sustainability in various settlements of the region is exploratory and empirical. In order to explore such socio-cultural institutions/traditions resulting in sustainable spatio-cultural environment, this study firstly takes cognizance of existing resource base of the region, followed by use of such resources by native community: modes and practices. Documentation of conservation practices currently in use and those that are only part of memory, is an integral part of this process. (Refer fig. 2)
Figure 2. Working methodology
3. Natural context of study region
Accordingly to the classification of deserts by U.S Geological Survey (U.S.G.S), Thar is a monsoon desert region. As monsoons cross India in late June/July, it loses moisture on the eastern slopes of the Aravali range. Hence the rains are scanty, though there are bouts of heavy rains, but the rainy days are few. Average rainfall within study area varies from 127.93 mm (approx.) per year, to 280.14 mm (approx.) per year. Further, analysis of rainfall data from in past century indicates a drought once in every 2–3 years along with flood situation in monsoon due to heavy rainfall in short spells. (Refer fig. 3)

![Map of Rajasthan District with groundwater development stages](image)

**Figure 3.** Status of rainfall and ground water in study area

There are no major or minor rivers or perennial streams in the area. Small *nallas* (channels) are purely seasonal and ephemeral with the result that there is lack of effective discharge in the event of heavy precipitation. The intermediate depressions between hillocks, locally known as *marho*, have alluvium deposits, which become cultivable when sufficient water is available. Soils of the Thar region are typically low in fine textured material and almost negligible in humus content, yet, contain high calcium carbonate and gypsum leading to formation of hydrological barrier leading to salinity. Hence, there is an abundance of water soluble salts. Further, the sandy or light soil that are loose and single grained are more prone to wind erosion and are often subject to sand drift. However, due to their coarse pores, open texture and high infiltration capacity they are not susceptible to water erosion even during heavy cloud bursts. Due to above mentioned soil and water conditions, the land supports only certain specific types of flora and fauna. Further, the sub soil strata has major water bearing geological formations, such as Quaternary Alluvium, Tertiary Sandstone, Lathi sandstone, Jaisalmer sandstone, Badesar sandstone, Parewar sandstone and Granite.

Hence, one can infer that the naturally available resource for sustenance and development are limited and the living conditions are harsh due to extreme temperatures, scanty rainfall, wind erosion etc.

4. Principles of sustainability as understood by communities
The main philosophy of sustenance in the Thar Desert is based on judicious use of available resources, consuming less and no wastage. Pattern of consumption is restraint – what is taken from nature must be given back. Sharing is the basis of everyday life – what is owned privately is less important to the community assets. Exchange of labour and services has been most crucial to the economics of the region.

The communities which are part of the ecosystem for generations have evolved a low cost style of living with limited resources which is often referred to as Traditional Knowledge system. This is
reflected in the histories related to rules and regimes to protect natural places, natural reserves, and community conserved areas, along with settlement dispersal patterns, built forms, choice of material for construction and building construction techniques.

5. **Physical manifestation of values**

The topography and hydrology of a place has a close relationship with the disposition and dispersal of settlements. Typically, settlement pattern of any community is an indication of the traditions or customs of the particular community with regards to the pattern of the natural environment. These patterns are mostly the conscious response to the natural resources and reflect the culture of the place. There are instances where we see that when communities migrate from part to the other they also move with their settlement patterns and repeat their old settlement pattern at new place. In fact, the pattern of rural settlement is the result of a series of adjustments to the environment which have been going on for centuries. The various components of a typical settlement in Thar (Refer fig. 4) are described below along with the related management practices.

5.1. **Common open spaces**

1. *Oran*: protected forest covers, usually associated with local deities. *Orans* have traditionally been excellent repositories of plant bio-diversity. Traditionally, they were located on the fringes of the hamlets and long been the sites of rituals and ceremonial practices. Here, grazing and lopping of firewood is strictly prohibited and allowed only in the times of famine and scarcity. This has led to the perpetuation of local species, that best survived the harsh weather conditions and helped in maintaining the water table as well as the botanical balance in the area. *Orans* also conserve valuable water in the ponds, reservoirs, step wells, streams and springs that are an essential feature of the ecological setting of the area. Since the region has access to barely 1% of India’s water resources, all *oran* contain a protected water source, thereby recharging groundwater and ensuring respectable water levels.

There are about 7.5 million pastoralists and 54.5 million livestock in state of Rajasthan, all dependent on *Orans*. *Orans* of the Bishnois (a native community in Thar) in the desert known for the protection accorded to the Blackbuck and Khejri (Indian Mesquite/Prosopis cineraria) tree, which are sacred to them. The local committees are integral to *oran* management, though communities believe that the ultimate authority remains with the deity. *Van Samitis* (local committees for managing oran) supervise utilization and maintenance of oran, to ensure that there is no deviation from the village-appointed rules and address offences like encroachment and destructive extraction of resources.

2. *Beed*: *Beed* is a part of the agricultural land left aside for grazing animals. It is not a community operated land but, associated with an individual. Usually, it forms one-fourth of the total land available to any farmer.

3. *Gauchar*: *Gauchar*- similar to *beed*. They are community owned and are separate from the agricultural land of individuals. Just like the *oran*, every village has its own *gauchar*.

4. *Doli*: As per the traditional practice, each family in the village donates some portion of their land for the priest of the *Matha* or temple based institution, for their livelihood. This piece of land is referred as *doli*.

Traditionally, the communities would move out of the desert area during monsoons to allow for the vegetation to grow and land to regenerate. This traditional grassland management system also contributed to conservation of gene pool of indigenous species.
Figure 4. Components of a village in Thar – Gangawas, District Barmer, Rajasthan

Figure 5. Types of open spaces

Figure 6. View of ‘Oran’ in desert landscape
5.2. Common water bodies

Depending on the nature of water available to tap, communities have built structures to harness the maximum available. Rain water and ground water are two main sources of supply, hence the structures were either rainwater harvesting/collection or those tapping underground water trapped between geological layers. Another type of water structures are those that are based on collecting condensed dew droplets, which is a common phenomenon in the Thar Desert due to extreme daily temperature variations.

![Figure 7. Mode of accessing water guided by substrata](image)

1. **Wells**: Dependent on underground water, some are richly adorned with paintings depicting religious theme, local life etc. Traditionally, ownership of well did not belong to a particular family or community. Historically, the contributions for the construction of the well was to be made in accordance to the proportionate use by various parties involved in its construction. Hence, the process was fair and equal. Further, distance between two well would be 12 kilometre, to protect catchment and allow runoff to recharge it. The new well could be dug within 1 km radius but not after that.

2. **Beris**: A beri is a pitcher–shaped shallow percolation well that stores water. It is about 1/2 a metre wide at the top and three to four metres wide at the bottom. The spot is strategically selected so that the percolated rainwater gets channelized towards the well. While setting up a beri, people stop digging once they encounter a layer of bentonite clay or gypsum. These layers prevent further percolation of the stored rainwater, while the narrow mouth prevents loss due to evaporation. Beris can hold up to 500,000 liters of water, sufficient to meet the needs of 10 families for a year.

3. **Kui**: They are 10–12 m deep pits dug near tanks to collect the seepage. Kui can also be used to harvest rainwater in areas with meagre rainfall. The mouth of the pit is usually made very narrow to prevent water from evaporating. The pit gets wider vertically downwards, to allow water to seep in into a large surface area. The openings of these entirely earthen structures are covered with wooden planks traditionally.

4. **Baori/Stepwell**: Built by the nobility usually for utilitarian, strategic and/or philanthropic reasons, stepwells are secular structures from which everyone could draw ground water. However, most of them are defunct today. Stepwell locations often suggest the way in which they would be used. A stepwell located within, or at the edge of a village was mainly used for utilitarian purposes and as a cool place for social gatherings. Stepwells located outside a village, or on trade routes, were often frequented as resting places. When stepwells were used exclusively for irrigation, a sluice was constructed at the rim to receive the lifted water and lead it to a trough or pond, from where it ran through a drainage system and was channelled into the fields.

5. **Talab**: Reservoirs- They may be natural or human-made, such the lakes. Talab serve irrigation and drinking purposes. When the water in these reservoirs dries up just a few days after the monsoon, pond beds are cultivated with rice.
6. **Naadi/Nada**: Nadis are village ponds used for storing water from an adjoining natural catchment during the rainy season. The site is selected by the villagers based on an available natural catchment and its water yield potential. Water availability from nadi would range from two months to a year after the rains. The location of the nadi had a strong bearing on its storage capacity due to the related catchment and runoff characteristics.

7. **Khadeen**: Surface drainage in dry, kankerised areas of Thar was traditionally managed through chain of khadeen or embankments. Khadeen tapped and dammed rainwater torrents, by creating low bunds to flood the fields enough to grow wheat, gram, vegetables and fodder in otherwise arid landscape.

![Figure 8. Traditional water bodies in the study area](image)

5.3. **Land – Architecture and planning**

The structures in the Thar desert showcase how locally available materials and form & design can be adapted to suit the harsh climatic conditions. Residential units called bunga are constructed with principal framework of locally available trees such as babool (acacia nilotica) branches and mesh of rohili and kheep (Leptadenia pyrotechnica) twigs. Both interior and exterior surface are then plastered with a mixture of earth, cowdung, lime (in some cases) and locally available grasses. The roof cover is made of dried kheep. For larger structures such as forts or water bodies, locally available stone was used and it was set in lime mortar. Therefore, the construction is low energy consuming and bio degradable, which once disused can disintegrate without harming the environment and infact the vegetation remains will enhance humus content of the soil. Mud and lime based construction is more appropriate, sustainable and has less carbon footprint. Such renders and mortar are vapour permeable and allow buildings to breathe. This reduces the risk of trapped moisture and consequent damage to the building fabric. Porous and open textured materials such as lime plasters, help to stabilize the internal humidity of a building by absorbing and releasing moisture. This makes for a more comfortable environment and reduces surface condensation and mould growth. Mud and lime mortars, plasters, renders and limewash have been used to create hygienic surfaces and improve comfort conditions within buildings for thousands of years. Further, both mud and lime has less embodied energy than cement.

Both adobe and stone blocks are used as core masonry material, which require greater wall thickness to be structurally stable. Greater wall thickness acts as an insulation and therefore, the houses are conducive and thermally comfortable in the extreme weather conditions. Further circular design protected the structures from strong winds and earthquakes.

![Figure 9. Traditional clustering and construction of jhompa (circular huts)](image)
6. Conclusion
In a desert region such as Thar, where water is scarce for daily consumption, animal husbandry and farming and high saline content in soil does not support agriculture, it is logical that such resources are protected, conserved and judiciously used by the people. The process of understanding natural resources such as land, water and existing flora and fauna as a whole – in relation to each other and the role of communities/human also as part of this network enables native communities to create balance towards sustenance without exploitation of nature. People have institutionalised these arrangements during the course of time by attaching sacred value to it, to make collective management easy and long-lasting. Sacred groves and traditional water bodies are the result of a complex ethno-scientific thinking of the local communities.

The paper brings forth similarities in modern discourse on sustainability and values & aims of traditional practices of the native communities in Thar. Both line of thoughts propagate sustainable development as a kind of development that meet the needs of the present without compromising the ability of future generations to meet their own needs. While documents and charters guide the thinkers and practitioners at global level, baseline ethos of such discourses have been in practice by native communities for many generations. Their survival through centuries, in harsh conditions, is a proof of the relevance of these systems even today. Hence, it would be prudent to acknowledge and mainstream the existing local knowledge rather than merely overlaying them with modern concepts and models or dismissing them as unscientific or outdated.

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References
[1] Chapter 2- Towards Sustainable Development, Clause IV.1, One Common Future: Report of the World Commission on Environment and Development, 1987