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# Learning from the Desert

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**Abstract:** Many lessons can be learned from research in deserts whether they concern earth history, arid ecology, human adaptations, changing environments or application of technologies. Several key lessons stand out. These include the essential role of a communication platform to enhance understanding and knowledge exchange among scientists, communities living in the deserts and policy makers influencing implementation. Another key lesson to be learned from a variable environment is that identifying technology applications is easy, while ensuring acceptance and appropriate management is the challenge.

**Keywords:** Appropriate management, Communication platform, Variable environment

## 1. Introduction

Deserts have attracted scientists for centuries. They followed in the footsteps of the many people who lived in and around deserts for millennia. The earliest inhabitants in deserts used resources in a manner that is now known as hunting and gathering. This meant that they had the essential knowledge and were well attuned to variable rainfall and the resultant growth patterns of plants and animals as well as ephemeral sources of water (Seely, 2006).

Today, instead of being mobile hunters and gatherers, most desert dwellers are either semi-nomadic or sedentary, occupying localities for shorter or longer periods of time where water and other necessary resources are available if not abundant. With growing populations, this has meant introduction of a variety of management approaches and innovative technologies to sustain livelihoods. This review provides several examples of innovative management and technology developments introduced in deserts and the lessons they have taught those supporting or using them.

## 2. Materials and Methods

This keynote paper presents an overview of a variety of experiences of learning from deserts in Namibia and surrounding countries. The methodologies are presented in detail in the publications cited (Henschel, 2007; Klintenberg *et al.*, 2007; Manning and Seely, 2005; Mtuleni *et al.*, 1998; Seely, 2006; Seely *et al.*, 2008; Stringer *et al.*, 2007).

A common element in all methodologies was the involvement of local communities in all stages of research and technology application activities ranging from problem identification, planning the objectives of the research and technology applications to gathering of data, monitoring, discussion and interpretation of the results and outcomes. The commonalities of these diverse research and application activities include:

- investigations of the existing biophysical and socio-economic situation, technical designs, technology options and experiences of technology applications in similar situations,
- mobilization of communities for introductory discussions and planning of research and technology implementation,
- in-depth discussions and planning with user communities concerning, *inter alia* as appropriate: community organization and institutions, management, ownership, benefits, monitoring and evaluation, support systems, location, construction, maintenance, usage, job opportunities, cost and funding sources, security,
- ongoing documentation from community, research and technology application perspectives for monitoring, evaluation and adjustment, and
- ongoing focus to integrate policy and decision makers at all levels of research and technology application.

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**3. Results and Discussion**

Two pivotal management approaches have been introduced to local rural communities in Namibia, the Forum for Integrated Resource Management (FIRM) and local, farmer driven monitoring of the environment (LLM). FIRM was developed to strengthen community-based organisations' abilities to plan and make informed decisions together with their service providers. In terms of rangeland and water management, the Forum for Integrated Resource Management (FIRM) has been tested with six communities and an estimated 500 people and 20 different service organizations (Klintenberg *et al.*, 2007). The result of this intervention has enhanced these communities' capacity to take the lead in their development, although with variable success. Five of these communities and approximately 80 people have used the local level monitoring approach. The LLM system used is based on measurements and observations of rainfall, livestock condition, rangeland condition and bush encroachment as indicators of rangeland productivity. Application of these management and monitoring approaches to rangeland and water resource use in arid areas has been shown to contribute to enhanced livelihoods and environmental sustainability (Klintenberg *et al.*, 2007).

As part of an ongoing project to support Integrated Water Resource Management in central northern Namibia, aimed at improving supply of fresh water to selected farming communities, a review of desalination experiences was undertaken (von Oertzen and Schultz, 2008). Based on information from nine different large and small-scale desalination plants operated in southern Africa, a number of key lessons were learned. To successfully introduce village-level desalination, six key issues requiring consideration were identified.

- For future village-scale plants situated in remote areas, the question of who owns the plant and is responsible for its operation and upkeep needs to be addressed in the early planning. The example of water point committees formed to manage rural water points could be followed. Roles and responsibilities must be clarified amongst service providers and users and the degree of decentralization established
- User needs and expectations require attention. Affordability and willingness to pay depend on the user's priorities and long-term acceptance of the technology.
- Managerial, technical and operational capacity to support the technology is essential. Retention of trained staff is difficult and absence of local capacity results in dependence on service providers.
- Ongoing maintenance is also dependent on capacity but also access to spare parts, tools and know how. Support from service providers should be at a level affordable to the community while maintaining plant operation.
- Energy requirements are an important consideration whether on or off grid. Theft of off grid energy sources, especially solar panels, is a key consideration together with maintenance capacity.
- Upfront and long-term costs are a key consideration when technology is used in deserts and other arid environments. If the cost of water from sophisticated desalination plants is higher than people are used to, subsidies or cross-subsidies must be considered.

With respect to fog water harvesting in the Namib desert, at a series of sites situated up to approximately 70 km from the coast, it was found that on average, throughout the year, 1 litre per square meter per day of fog water can be collected. The maximum amount in one day was over 15 litres per square meter of fog screen (Henschel, 2007; Mtuleni *et al.*, 1998). These quantities of fog water far exceed the amount of rainfall received in this area, which is less than 20 mm per annum. It was found that several fog-collecting screens of 50 $m^2$ each connected to a reservoir would provide as much as 50% of the water needs of the small rural settlements living in the desert, each with approximately 30 residents. The availability of fog varies seasonally, however, and fog can only serve as part of a water supply hybrid system in which groundwater sources are continuing to play a central role. Experience has shown that fog water supply systems require relatively simple technology and low-cost materials, but require constant attention by a resident caretaker. Community members are capable of taking care of the daily operation but wear and tear of the infrastructure due to frequent sandstorms turned out to be very challenging. Although the quantity of water available is sufficient for domestic use, the quality of water requires further management or sophisticated technology applications. For instance, the variable salinity of the fog water washed from the fog screens requires further treatment to ensure potability. In combination with the difficulties experienced with durability of materials, the need to treat the water placed this technology beyond the managerial and financial capability of the rural community.

## 4. Conclusions

Extensive experience with community mobilization and integration of service providers to enhance rangeland management indicates that the more coherent the community organization is the greater the capacity available to take up innovations, whether they be management oriented or technology based (Klintenberg *et al.*, 2007; Manning and Seely, 2005; von Oertzen and Schultz, 2008). This coherency also provides the platform upon which communication with researchers or providers of innovations and with relevant policy makers is carried out (Seely and Klintenberg, 2006; Seely *et al.*, 2008). Community based formulation of management plans and indicators to be used to track implementation of innovations and learning outcomes is also an essential element (Klintenberg and Seely, 2005; Klintenberg *et al.*, 2007).

Similarly, experience with fog harvesting and introduction of technology into the community revealed that development and elaboration of the technology is not the obstacle (Henschel, 2007). Instead, the main hindrance to implementation is the involvement of the community to ensure potable water. This research indicated that either a highly sophisticated technology is required so that little or no management is required by the beneficiary community or enhanced, hands-on management is required that does not necessarily fit into the current livelihoods of the community.

The challenges experienced with these technologies are being addressed with further studies and further analyses of the technology – community interface. It is clear, however, that identifying appropriate technologies for application in deserts together with the beneficiaries is comparatively easy while ensuring their acceptance and appropriate management is the key challenge.

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