Irrigation management

Orange-Senqu Basin, South Africa

water scarcity impact

Reduced withdrawal	●
Reduced consumption	
Improved water quality	
Increased productivity	●
Net basin benefit	●

volumetric impact
13 200 000 m^3/yr

programme cost
$250 000

estimated unit cost of water
<5 ¢/m^3

Water Stress
Orange-Senqu Basin, South Africa

- Arid & low water use
- Low (<10%)
- Low to med (10-20%)
- Med to high (20-40%)
- High (40-80%)
- Extremely high (>80%)
- No data available

Water Stress Map:
Gassert, F., M. Landis, M. Luck, P. Reig, and T. Shiao. 2013. "Aqueduct Global Maps 2.0."

Confidence level
Low Medium High

Water Scarcity Impact Key
Main Minor

Credits
We wish to acknowledge the input of Nic Knoetze of Orange-Reit Water User Association in the preparation of this case study.

Project Overview

Most of the Orange-Senqu Basin, shared by Lesotho, South Africa, Botswana and Namibia is arid to semi-arid. It is one of the largest basins in southern Africa and also one of the most developed. Irrigation is a major consumer of water using approximately 2.5 bilion m^3/year, corresponding to 20% of the virgin mean annual runoff and 54% of total consumptive demand excluding environmental requirements. The sector is often accused of being both wasteful and relatively unproductive.

The Orange-Riet Water User Association (WUA) is situated in the Upper Orange River catchment in South Africa with the main user being the 17 050ha Orange-Riet irrigation scheme. The main crops grown are wheat and lucerne (63%), potato, groundnut, maize, oats and barley; these are difficult to grow profitably. At formation, the WUA had a major challenge to ensure the financial survival of the farmers. Difficult institutional reform combined with the application of a combination of technological and managerial best practices have left the irrigation scheme much stronger and more efficient than before. Compared to the prior situation, annual abstraction has been reduced by 7% without major capital investment by the WUA (estimated at $250 000). Limited on-farm interventions were carried out by individual farmers following the implementation of institutional and managerial reforms of the WUA.

Key Elements

- Legal and institutional reform driving the establishment of a self-sufficient Water User Association.
- High level of stakeholder consultation and participation.
- Establishment of clear rules and regulations and strict enforcement of water allocations, and scheduling.
- Advanced metering and establishment of a virtual water bank to incentivise farmers to sell unused water allocations.
- Farm led modernisation of irrigation infrastructure (centre pivot and overhead) and management systems.
- Weather forecast led scheduling and monitoring of soil moisture content.

Key Outcomes

- Improved productivity in terms of crop per drop with average yield across the scheme increasing by approximately 25% since implementation of the WUA.
- Long-term financial sustainability of the irrigation scheme is more assured and is reflected by lower rate of turnover in farm ownership and/or farmer occupancy.
- Total annual irrigation water demand reduced by 7%, down from 187 600 000m^3 to 174 400 000m^3.
- Development of skills and influence of those involved in the WUAs, with increased understanding of water issues within local decision making.

Orange-Senqu Basin, South Africa

Intervention Features

- Irrigation metering
- Irrigation scheduling
- Sprinkler irrigation systems
- Fertigation systems
- Water entitlement trading
- Enforcement of quotas
- Institutional reform

Project Levers

(1) Institutional Reform:

As a result of the 1998 National Water Act, once state-owned and managed, irrigation schemes are gradually being privatised and run by WUAs. These are cooperative associations of water users that must be financially sustainable and cover the full costs of providing access to water. This can only be achieved through increasing farm productivity and improving irrigation efficiency at both the scheme and farm level.

(2) Water Management Plan:

WUAs are required to prepare annual business plans. Most significantly, these must include a Water Management Plan (WMP), which is central to implementing water conservation and water demand management. The Orange-Riet WUA's WMP sets out benchmarks, best management practices and a manageable and affordable programme of implementation by both the water user association and irrigators.

(3) Stakeholder participation and enforcement of regulations:

A key factor behind the success of the Orange-Riet has been the high level of stakeholder participation combined with the enforcement of clear rules and regulations, accepted by all members of the WUA. Key regulations include i) making irrigators responsible for setting, opening, closing and locking of sluices and taking only their allocation; failure leading to imposition of heavy on-the-spot fines; ii) obligation of irrigators to submit annual plans; iii) recording of all crops and yields.

(4) Metering, Quotas, Water Banks:

On many schemes in South Africa farmers pay for an allocation of water according to their irrigated land. There is little incentive to save water. At the Orange-Riet all off-takes are metered. While the farmer's allocation of water is based on his licensed irrigable land at 11 000m^3/ha/year, he pays according to the water used and thanks to a virtual water bank managed by the WUA can sell his unused allocation back to the WUA.

The WUA sells a portion of this on at a premium of 30% to farmers requiring more water. Accurate metering is one of the keys to improving efficiency irrigation and reducing wastage. This is essential if water banks are to function.

(5) Irrigation Scheduling:

Transfer of the irrigation scheme to a self sufficient WUA has forced farmers to become much more efficient. The single biggest development is the widespread use of irrigation scheduling. Since most irrigators have little on-farm storage, this is only possible because the WUA operates a computerised daily water ordering system. Flows in the canal systems including the amount taken off at source are all monitored and controlled through a state-of-art telemetric system. In order to facilitate accurate scheduling there has been a move away from flood irrigation, with 90% of land now under centre pivot or fixed overhead systems. Many irrigators operate fertigation systems, have installed lysimeters and make use of customised on-line weather reports and forecasts in an effort to perfect their scheduling. The private sector plays a major role in providing technical support and credit facilities. Improved scheduling has resulted in major increases in productivity and since irrigators can sell their unused allocation back to the WUA, there is an added incentive to be water efficient. Records kept by the WUA of yields since its inception, together with detailed figures available from some farms indicate that irrigation scheduling, improved application of fertiliser and a widespread use of overhead irrigation systems have led to an overall increase in productivity of around 25%.

Outcomes and Challenges

Other impacts of the project included:

- A reduction in water consumption largely due to the presence of a virtual water bank.
- Greater accountability resulting from volumetric metered payment system.
- Increased level of awareness and expertise amongst irrigators.
- Demonstration of best practices which can be taken up by other water user associations.

"...the farmer pays according to the water used and thanks to a virtual water bank... can sell his unused allocation back to the WUA."