

Location	Kingdom of Saudi Arabia
Contractor	United Nations Development Program (UNDP)
Period	2006

Scope of the project

Basic knowledge on irrigation practices and groundwater resources was recognized as a missing element for building the Water Sector Strategy and Action Plan (WSSAP) of the Kingdom of Saudi Arabia (KSA). A fundamental understanding and quantitative description of the agricultural water resources is a pre-requisite for any future aquifer exploration and well permitting plan in KSA. This remote sensing study assessed the historic irrigation expansion and abstraction between 1975 and 2004 independent from existing and available census data of the Ministries in Riyadh.

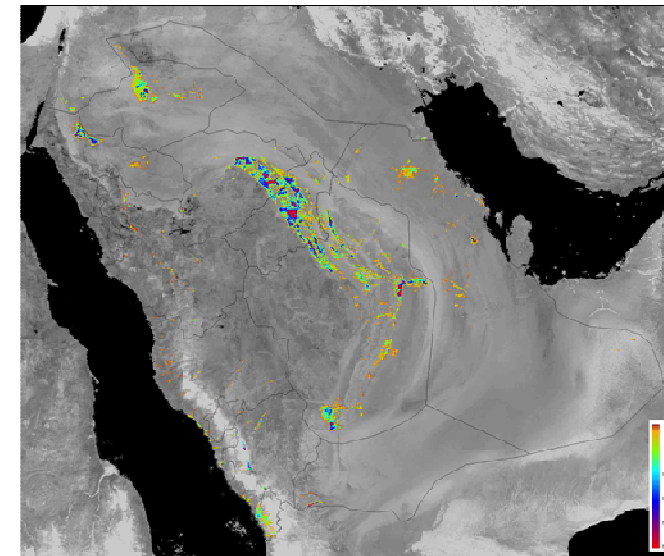
Study approach

Low resolution NOAA satellite images have been used to determine (i) irrigated areas in winter and summer seasons, (ii) annual crop consumptive use and (iii) annual groundwater abstractions. To calibrate the NOAA images cropped areas in various years and season were estimated with high resolution Landsat images. Also SPOT-Vegetation imagery with 10-day intervals was included. With the help of calibration curves from Landsat imagery, winter and summer season crop areas for all years between 1982 and 2004 have been assessed. This observatory ensures standardized data collection across all years and regions.

Results

The crop consumptive use of the irrigated crops has been computed with SEBAL for 8 sample years, i.e. 1979, 1982, 1986,

1990, 1993, 1996, 2000 and 2003. The annual total crop consumptive use for the entire KSA has increased from 2.9 km³/yr in 1979 to 11.3 km³/yr in 1993 at its peak, and it subsequently dropped to 9.7 km³/yr in 2003. The total accumulated agricultural crop water consumption (ET) in KSA is 221 km³ from 1975 to 2004 (30 year total). Efficiencies are required to convert ET into abstractions. The irrigation efficiency in the summer season is found to be double the efficiency observed for the winter season, because severe over-irrigation occurs during the winter season.



Accumulated ground water abstraction from 1975-2004

Conclusions

Significant water savings can be achieved by better matching abstractions with reference ET and reduced irrigation water requirements during the winter season. The total groundwater abstraction for the agricultural sector in the entire KSA between 1975 and 2004 is 463 km³. A national groundwater reduction plan including elements such as (i) improved on-farm irrigation efficiency from 45 to 55%, (ii) introduction of regulated deficit irrigation for diminishing percolation losses and (iii) reuse of percolation losses by abstractions from shallow alluvial aquifers needs to be launched. Low-resolution remote sensing imagery can facilitate the monitoring of future abstractions and verify compliances to permitted withdrawals. High-resolution imagery (30 m) can be helpful to detect both crop types and irrigation efficiencies at a sub-regional scale for better understanding the mechanisms behind the current low performance of the irrigation sector.

