

Identification of irrigated area and evapotranspiration of summer and winter crops in Sudan

Location	Irrigation schemes, Sudan
Contractor	Eastern Nile Subsidiary Action Program (ENSAP)
Period	2006

Scope of the project

Sudan's fertile alluvial soils, favourable climate and abundant water resources provide favourable conditions for irrigated agriculture. In a treaty between Egypt and Sudan they agreed on the division and use of the Nile waters, in which Sudan is entitled approximately 20 BCM of the 80 BCM of water that are available in an average year. Currently Sudan is not using its full share and plans to develop its water resources in the future. This study provided quantified data on water use in Sudan's major irrigation schemes for an average year.

Study approach

Ten major irrigation schemes were identified in Sudan using literature and satellite imagery. Five systems are large scale sugar plantations, and the other five systems have a s major crops cotton, sorghum, wheat and groundnuts. The irrigated area was classified using the NDVI values of MODIS 250-m satellite images, and corrected for mixed pixels using Landsat imagery. Monthly precipitation is derived from the TRMM sensor. Actual evapotranspiration is calculated using the SEBAL algorithm in combination with MODIS 1-km imagery. The annual evapotranspiration as result from irrigation activities (ETirr) was calculated by subtracting the evapotranspiration from a nearby rainfed area (ET_{rain}) from the gross evapotranspiration (ET_{gross}).

Monthly precipitation and the irrigation evapotranspiration in combination with an irrigation efficiency factor are depicted for the ten schemes in order to determine the irrigation water requirements.

Results

Evapotranspiration due to diversion of water for irrigation for all ten schemes equals 4.261 BCM and varies from 0.093 BCM (Assalaya Sugar Scheme and El



The location of the irrigation schemes in Sudan

Suki Scheme) to 2.601 BCM (Gezira-Managil). The total river diversion is estimated to be 7.866 BCM and, based on rough estimates of irrigation efficiencies, an amount of 3.605 BCM returns back to the rivers and aquifers. This number is substantially lower than the 20 BCM water depletion rights Sudan has.

Conclusions

The annual average total system efficiency for Gezira/Managil is 47%. Monthly discharge data are highly questionable because the flow data do not match with the gross irrigation requirements based on SEBAL and TRRM precipitation, and the agricultural seasons monitored with SPOT-Vegetation. Nevertheless, a monthly water balance is provided, which suggests that groundwater is abstracted in September to November.