Monitoring of summer crops under changing irrigation practices

A Remote Sensing Study in the North-western Nile Delta for the Irrigation Improvement Project 1995-2002

Location	Nile Delta, Egypt
Contractor	KfW
Period	2002 – 2003

Scope of the project

The Irrigation Improvement Project (IIP) aims at increasing crop production and farmers income by improving irrigation efficiencies and a more equitable distribution of water by establishing continuous flow and on-demand access to water resources.

In order to strengthen the field monitoring program, this remote sensing study described the spatial changes induced by the modification into continuous flow. The advantage of using satellite imagery is twofold. Firstly, satellite imagery will give an aerial overview for the whole region with sufficient detail to identify individual mesquas and parcels. Secondly, the situation before the start of the project can be identified using satellite imagery from 1995 in a retrospective manner.

Study approach

An analysis of satellite imagery obtained for the summer crops of 1995 and 2002 will be performed. The years have been chosen to reflect the situation before the start of the IIP (1995), and to reflect the current situation (2002). For the two years the following analyses have been performed:

- a crop-classification has been performed, in order to identify the differences in cropping patterns between the different years.
- Seasonal actual evapotranspiration has been calculated for both years, together with a yield estimate for the major crops in the region.
- A head-tail analysis for selected command area units has been performed for both years, focusing on cropping pattern, actual evapotranspiration, and crop yield
- A map of soil salinity for the 2002 season has been computed.

The IIP project comprises of three sub-projects located in the Nile delta:

- Mahmoudia
- Manaifa
- El Wasat

Results

The remote sensing analysis showed that cotton is being substituted by rice as the major summer crop during the period 1995-2002. With regard to rice for the Manaifa and El Wasat sub-project the cropping patterns objective of the IIP-project are met, whereas for the Mahmoudia sub-project no significant change has been detected. The anticipated change in cotton has not been realised in any of the three sub-projects, in Manaifa even an increase in cotton was detected.

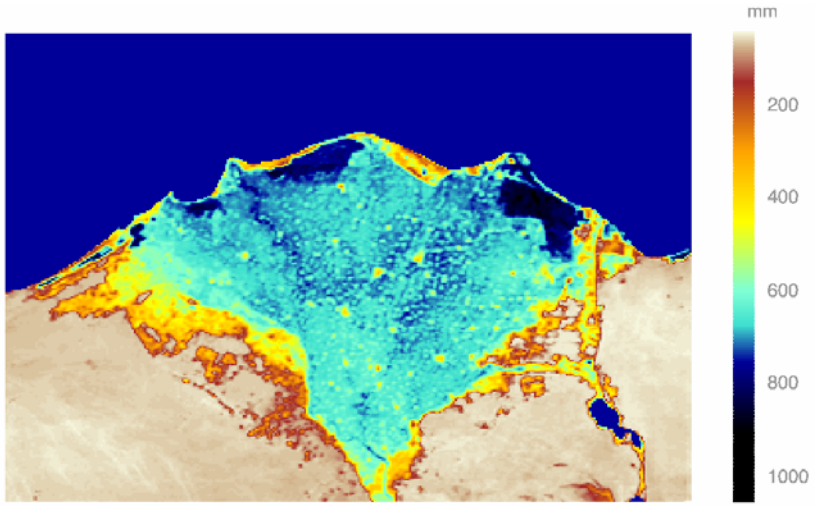


Figure 1: total accumulated actual evapotranspiration from May 15 until September 30, 2002

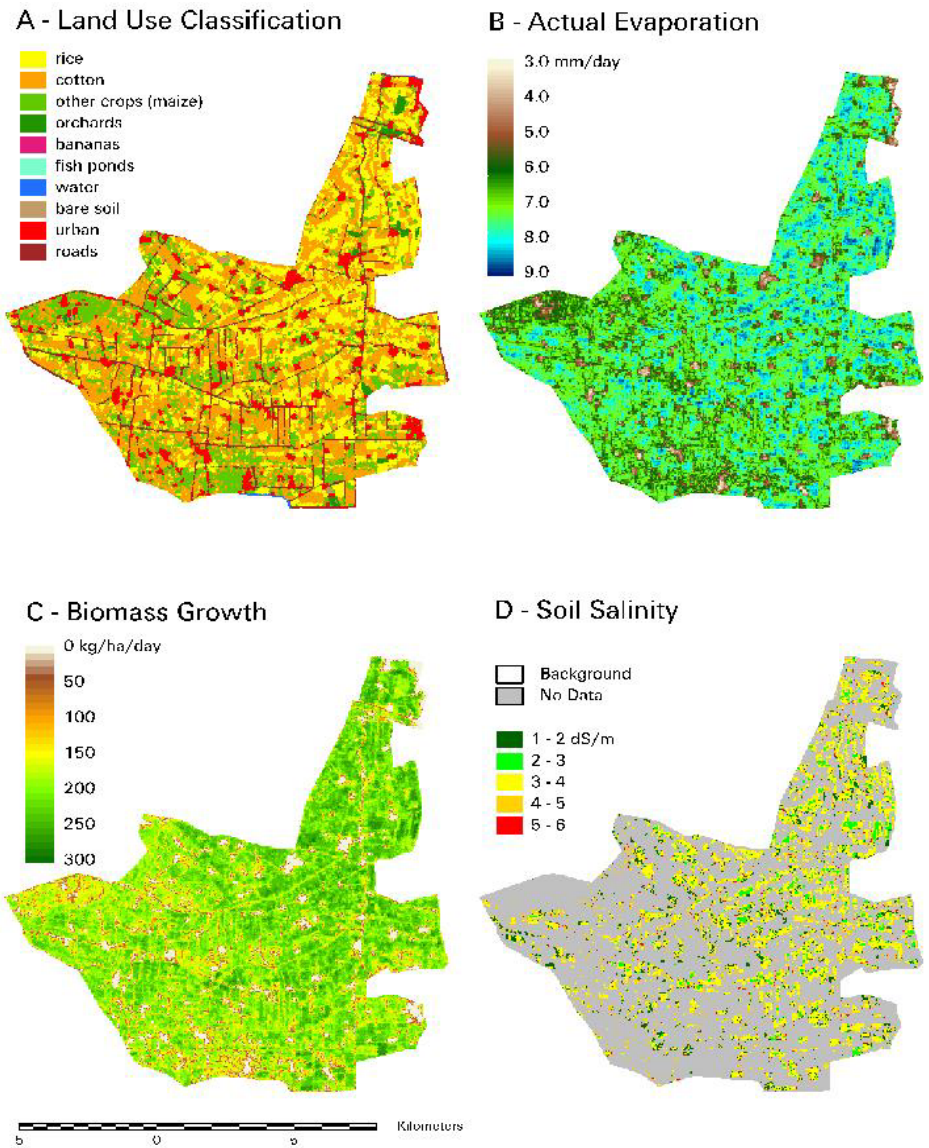
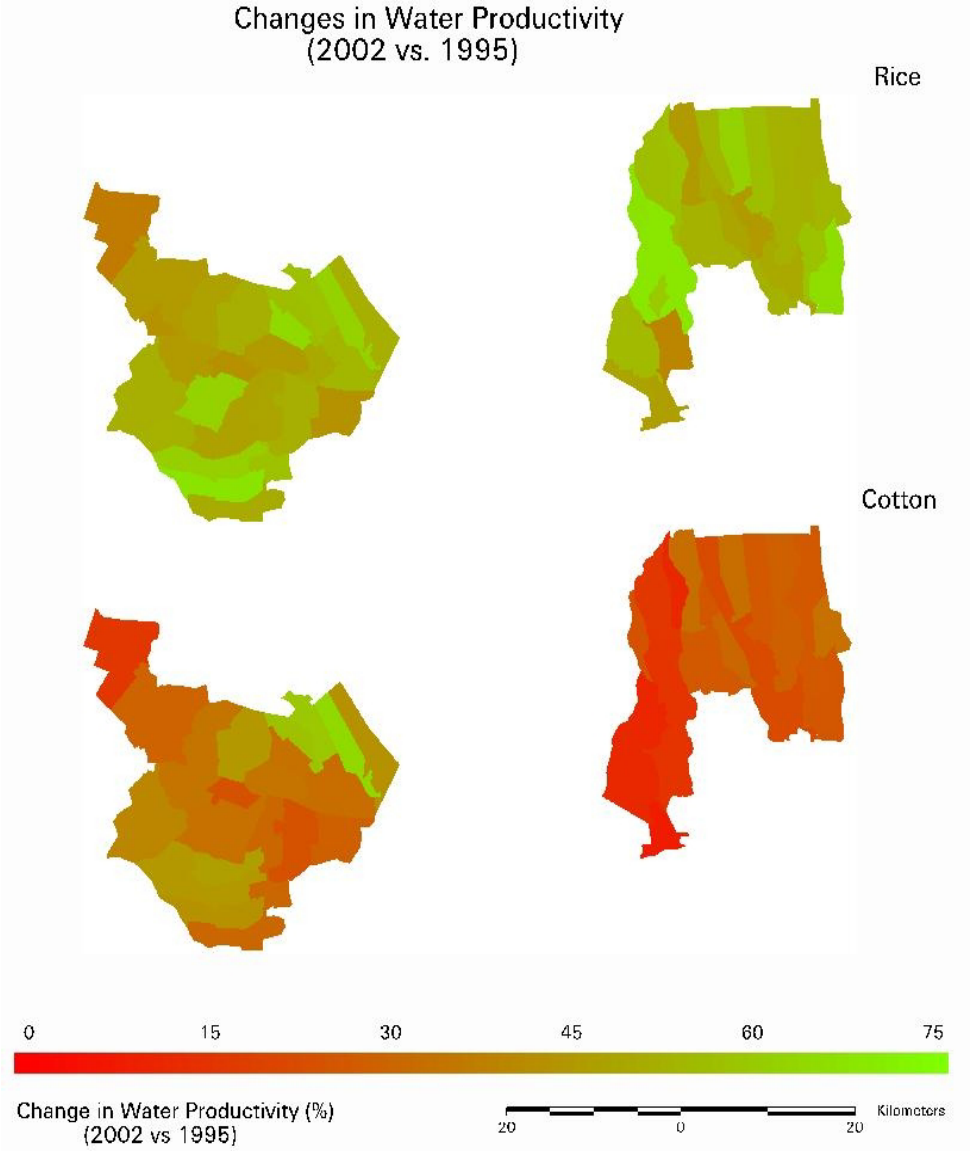


Figure 2: Basic remote sensing products for the Kenawia canal command area

Overall, water consumption has gone up, which can partly be attributed to the increased area under rice. New varieties of rice with a shorter growing season were introduced, and since the daily water consumption of the new varieties is larger, the total water consumption remained the same due to their shorter growing season as compared to the old varieties. The cotton water consumption increased with 12% for the total IIP project area.

The uniformity of the water consumption (ET_a) for the different crops in both years was equally low (CV rice: 0.07, CV cotton: 0.09). The water consumption of the different crops at the tail end never decreases more than 5% as compared to the head end. The uniform water consumption should be linked to existing cropping patterns. A steady decrease of the area under rice could be noted towards the tail end (see figures 4 and 5). This is especially true for the larger command areas. Therefore the cropping pattern is likely being linked with water availability, more than to water consumption.

Crop yields have increased significantly (figure 3). The rice yields rose by 53% and the cotton by 41% in a time span of 7 years. Without exception, all IIP target yields for the 3 sub-projects have been met. Also the uniformity of the crop yield within the canal command areas has improved. The high crop productivity together with the normal consumptive use values found, classifies the rice to be very productive and among the world leaders in water productivity. The water productivity values for cotton are below average, and continued attention to he increase in cotton water productivity should be given.



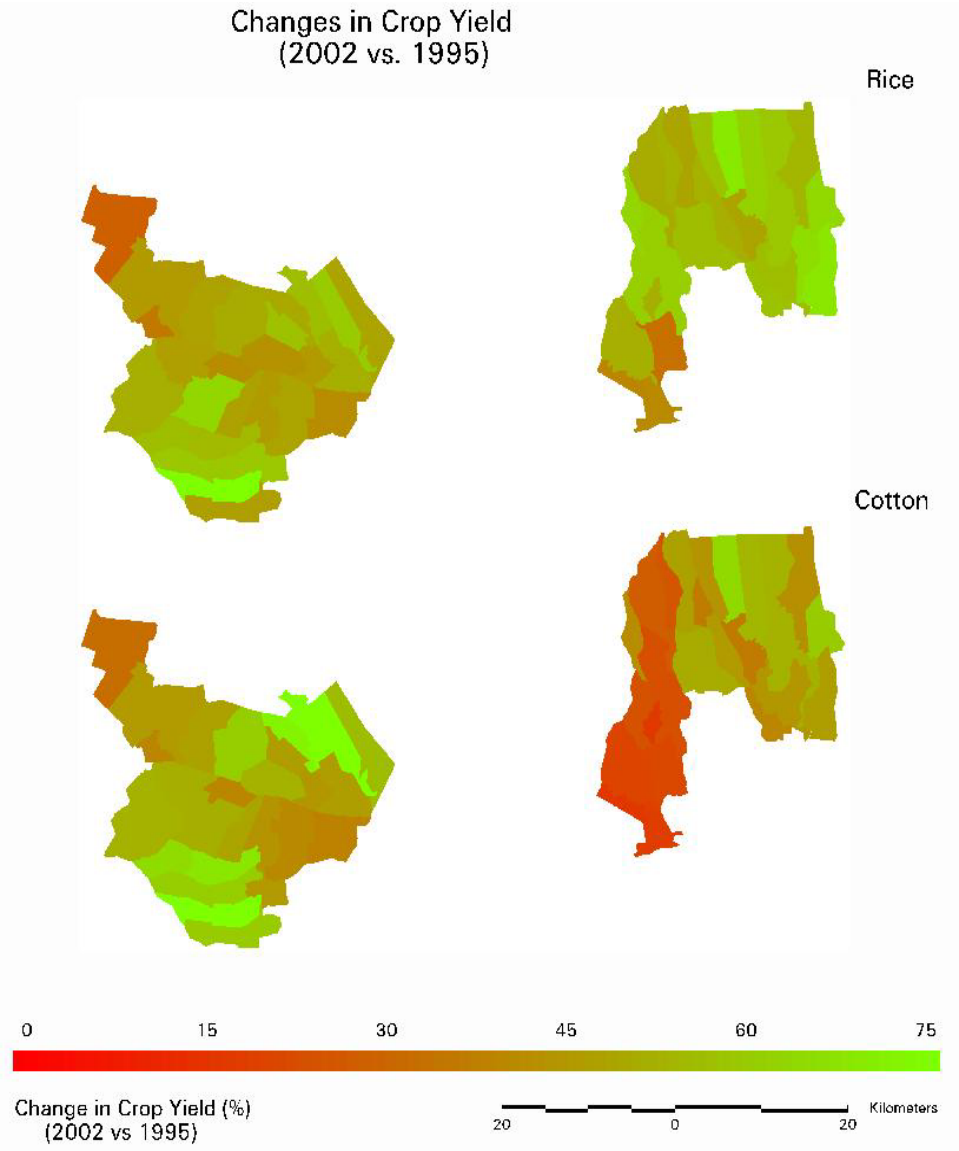


Figure 3: changes between 1995 and 2002 in water productivity and crop yield for rice and cotton in the three sub-projects

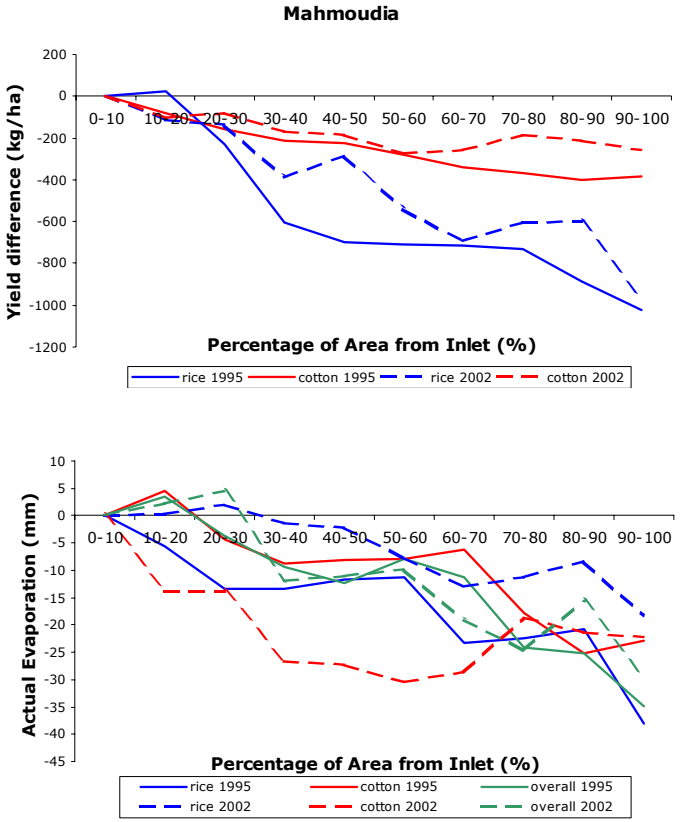


Figure 4: head-tail analysis of yield and accumulated crop water consumption during the growing season for Mahmoudia sub-project

The patterns of soil salinity are stable, which suggest that the irrigation system is environmentally sustainable. The soil salinity increases in the direction of the Mediterranean Sea, but there seems to be sufficient leaching taking place for preventing the salt tong to move inland. No signs of water logging could be identified, which implies that the drainage systems are working properly.

Therefore, it is concluded that the irrigation system in 2002 is efficient to leach salts, is very productive and is uniform in terms of water consumption and crop yield. Cropping patterns indicate a decrease in cropped rice area from head to tail for many canal commands.

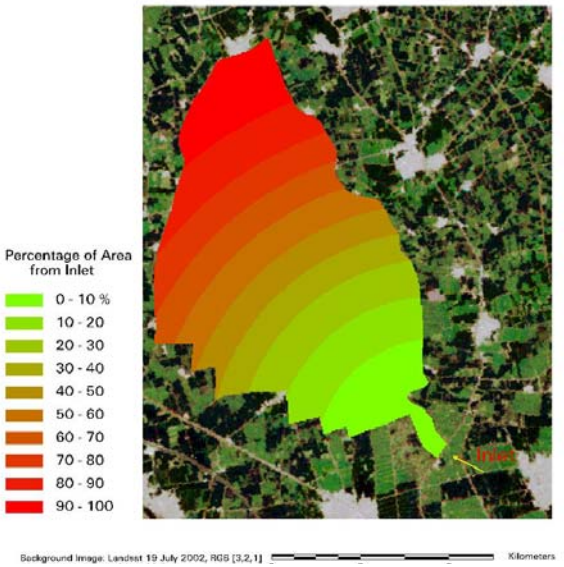


Figure 5: Example of a slicing of distances from the main inlet for a given canal command area. The areas have been sliced so that each area occupies 10% of the total area.

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