トルコ・セイハン河下流平野の灌漑環境の長期変化

Long-term change in irrigaion environment of the Lower Seyhan Irrigation Project in Turkey

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1. Introduction

Lower Seyhan Irrigation Project (LSIP) is one of the largest irrigation projects in Turkey which extends on the delta plain of Seyhan River Basin. In the past 25 years, this irrigation project has undergone many structural changes such as diversification of the cropping pattern, turn over of the management responsibility from the government to water users associations, deterioration of the infrastructure, etc. This brought increase in water use without substantial improvement in irrigation efficiency. Donma et al. (2006) analyzed shallow water table fluctuation of the area and reported that salinity risks have decreased over the past 25 years, while high water table still remained to be problematic. In this paper we tried to examine the effect of spatial distribution of cropping pattern on shallow water table fluctuations in each decade.

2. Material and method

For the hydrological record, cropping pattern and shallow water table obaservation data, we used archive data kept by State Hydraulic Works (DSİ). Two sets of data from each decade (1984, 1985, 1992, 1993, 2002 and 2003) were chosen for analysis. After verifying that decadal change being much more significant than inter-annual variation, 3 sets of data (1985, 1993 and 2003) were chosen for analysis. LANDSAT TM images for the summer of 1985, 1993 and 2003 were used for land use classification. Actual cropping pattern records in the small areas were used as ground truth points.

3. Results and discussion

3.1 Classified land use

Figure 1 shows the classified land use from each decade. In large, the main crop shifted from cotton in 1985 to maize in 1993. In 2003, cropping pattern was more diversified with increase in cultivated area of citrus trees. Table 1 shows the actually cropped area and accuracy of classification made by remote sensing. In the LSIP second crops are sown after harvest of wheat in late May to early June. Identification was dificult for the crops which had similar phenology such as cotton soybean and maize in the early growing stage. For 2003, two satellite images (early June and mid August) were available and classification was fairly accurate. For 1985 and 1993, single image in late July was available for each year and accuracy of classification was very low. Second crops at early growing stage could not be distinguished from bare land and this resulted under-estimation of plated area.

Table 1 Planted area and acccuracy of classification.

Year		1985	1993	2003
Planted area (statistics) (ha)	Maize	9,845	70,298	67,250
	Citrus	2,742	8,846	14,615
	Cotton	58,314	15,657	9,015
	Soybean	16,420	2,147	2,111
Accuracy (RS derived/ statistics)	Maize	2.21	0.57	0.90
	Citrus	8.68	2.18	1.29
	Cotton	0.65	0.48	0.73
	Soybean	0.32	0.70	0.71

3.2 Occurance of peak months and the range of fluctuation for shallow water table

Figure 2 shows the spatial distribution of months when minimum levels of shallow water table were observed in each well. Figure 3 shows the range of annual fluctuation. In 1985, minimum depths were observed either in mid summer

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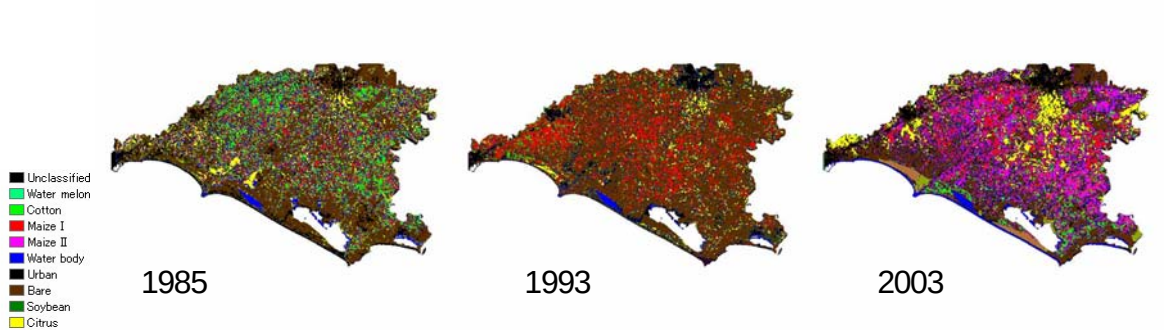

Fig. 1 Land use classified through image analysis for the LSIP in 1985, 1993 and 2003.

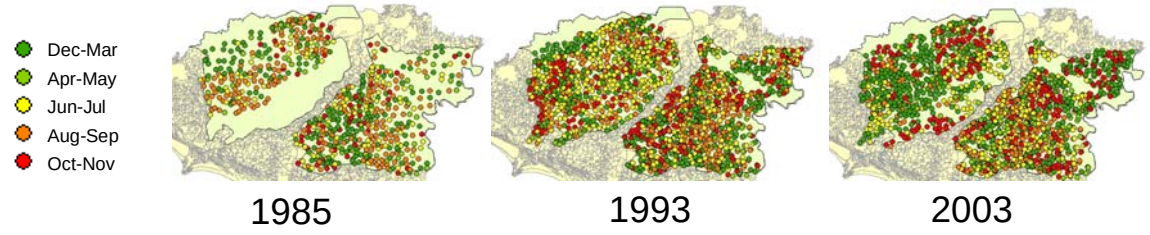

Fig. 2 Months for the occurance of mimimum depth of shallow water table in the LSIP.

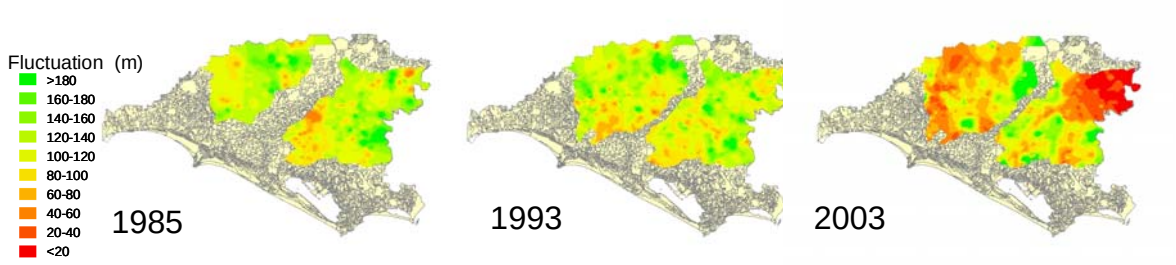

Fig. 3 Annual fluctuation range of shallow water table in the LSIP.

(dominantly in cotton fields) or around January in the most of the area and the degree of fluctuation was quite large. In 1993, new peaks appeared in June-July (mainly in maize fields) and in November-December (mainly in harvested maize fields). In 2003, large area on the right bank had peaks in winter and left bank had no outstanding peaks. The range of fluctuation was very narrow. Water table fluctuation seems to have lost clear seasonal trend with diversified cropping pattern and substantial increase in irrigation. The effects of land uses at exact location of the observation wells was not clearly detected.

4. Concluding remarks

At the implementation of the project, a good network of open drainage channels was created in the LSIP. The mean eucridian distance between observation wells and open drainage channels was 250m, suggesting relatively intense density of open drainage channels. In the fields, additional subsurface drainages were installed at 1.5m depth and at 100m intervals. Although subsurface structure must have deteriorated after more than two decades, it seems to be still functioning, contributing for quick drainage of excessive water from saturated zone to nearby open drainage channels at the time of irrigation.This would explain why water logging is still avoided with increased irrigation and low irrigation efficiency today.

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References: Donma et al. (2006): Long-term Changes of Shallow Groundwater Level and Salinity in the Lower Seyhan Plain, Turkey: 農業土木学会全国大会要旨集