LIFE ENVIRONMENT STRYMON

Ecosystem Based Water Resources Management to Minimize Environmental Impacts from Agriculture Using State of the Art Modeling Tools in Strymonas Basin

Διαχείριση των υδατικών πόρων στη λεκάνη του Στρυμόνα για τη μείωση των επιπτώσεων από τη γεωργία με τη χρήση σύγχρονων μεθόδων

LIFE03 ENV/GR/000217

Layman's Report

Εκλαϊκευμένη περιγραφή του έργου

THE GOULANDRIS NATURAL HISTORY MUSEUM
GREEK BIOTOPE / WETLAND CENTRE

Layman's Report

The area

Strymonas River basin is shared by Greece (37%), FYROM (9%), Serbia (4%) and Bulgaria (50%). The Greek part of Strymonas basin is located at the north of the region of Central Macedonia and covers an area of 6,400 km^2. Strymonas River and Lake Kerkini, an artificial lake fed by Strymonas, are the main surface water bodies in the basin, and enrich the aquifers with water. Lake Kerkini was constructed during 1933-36 mainly for protection against floods caused by Strymonas River. However, a unique wetland ecosystem has been developed, which is protected by the Ramsar Convention and by the Habitats and Birds Directives. The Strymonas River outflows to Strymonikos gulf whose coastal ecosystems are very important for biodiversity, fisheries and tourism.

Intensive agriculture takes place in the lower part of Strymonas basin, producing mainly maize, cotton, lucerne, sugar beet, rice, and expanding in 100,000 ha. The irrigation and drainage of this area is managed by the local Land Reclamation Service, through a dense network of canals and ditches. The Strymonas River discharge just after it crosses the Greek - Bulgarian border flows into the Lake Kerkini, where it is stored for irrigation. The gradual increase in the water level in the lake causes undesirable alterations to the hydroperiod, mainly suffocating its riparian forest. The water level in the lake is controlled by gates. Agriculture is the main source of income and employment in the basin and the majority of local population is employed in the sector. However, excessive use of water resources and agrochemicals are common externalities of agriculture.

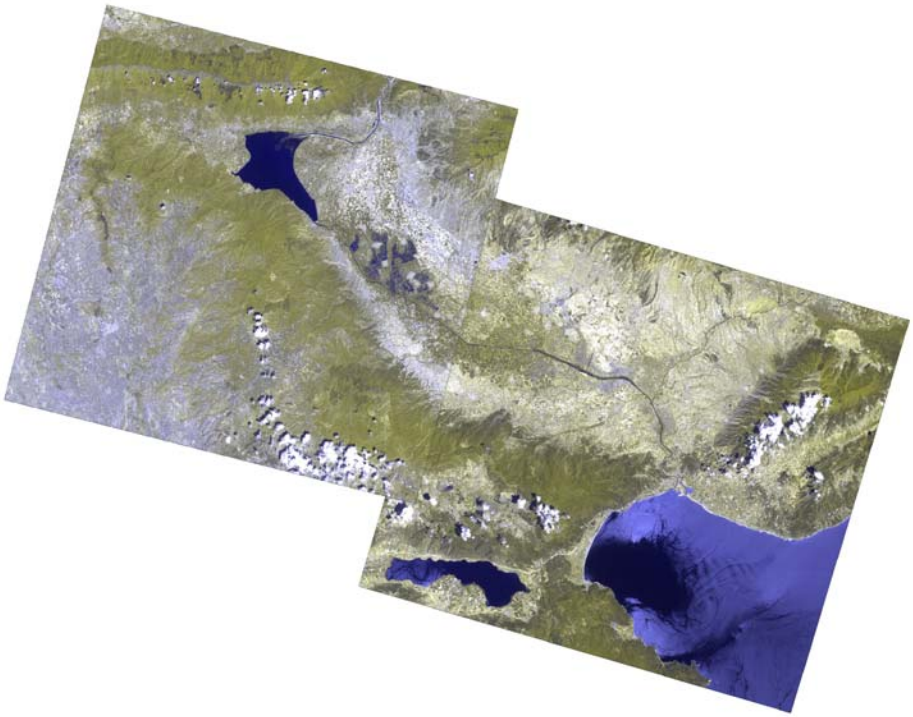

Fig. 1. The Strymonas basin**.**

Fig. 2. Lake Kerkini

The problems

The main problems in the area were a) Loss of water due to incomplete or damaged irrigation distribution network. b) Salinization of downstream agricultural soils. c) Undesirable alterations in the hydroperiod of Lake Kerkini, affecting habitats and species. d) High concentration of surface waters in nutrients (NO_3-N and PO_4-P) e) Intrusion of the sea into Strymonas River during the irrigation period.

The project

A feasible solution to the aforementioned problems could be produced only through comprehensive management of water resources and agroecosystems at the river basin level.

An extensive series of factors need to be investigated towards this direction such as: availability of water resources in the catchment and water needs of ecosystems, applied management practices of irrigation water and their level of effectiveness, crop pattern, agricultural practices and the resulting pressure on water resources and natural ecosystems, stand and prospects of local communities.

The Greek Biotope/Wetland Centre (EKBY), in collaboration with the Prefectural Authority of Serres, Direction of Land Reclamation, the Development Agency of Serres S.A. and the Association for the Protection of Lake Kerkini, implemented in the Greek section of Strymonas river catchment a LIFE ENVIRONMENT project entitled: *Ecosystem Based Water Resources Management to Minimize Environmental Impacts from Agriculture Using State of the Art Modelling Tools in Strymonas Basin*

In order to study and address effectively the above problems, the project used modern technologies and scientific methods. In particular, it:

- used state of the art simulation models that assess the impacts of agriculture on surface waters and groundwater in the basin;
- developed and used modern tools to monitor water quantity in the Strymonas basin;
- used optimization methods, in order to propose plans for the development of agriculture, compatible with sustainable water management.

The project lasted four years starting September 2003 until August 2007. It was financed by the European Commission, EKBY, and project partners.

The actions and the results

In the first stage, the project described in a quantitative manner the prevailing conditions regarding the natural environment. For this purpose, modern hydrological simulation tools, satellite imagery analysis and monitoring devices for quality and quantity of the water balance were used. The water quality monitoring network provided data to assess the pressure exerted by imported pollution and intensive agriculture on its surface water.

AN INNOVATIVE TOOL TO MONITOR RIVER DISCHARGE - Development of prototype discharge measuring system at Strymonas River

In the course of the project, an innovative automatic system was designed, developed and installed to take real-time discharge measurements at the Strymonas River. It offered valuable data to help calibrate and validate models that were used to estimate water volume required for agriculture. Sun power helped the system running.

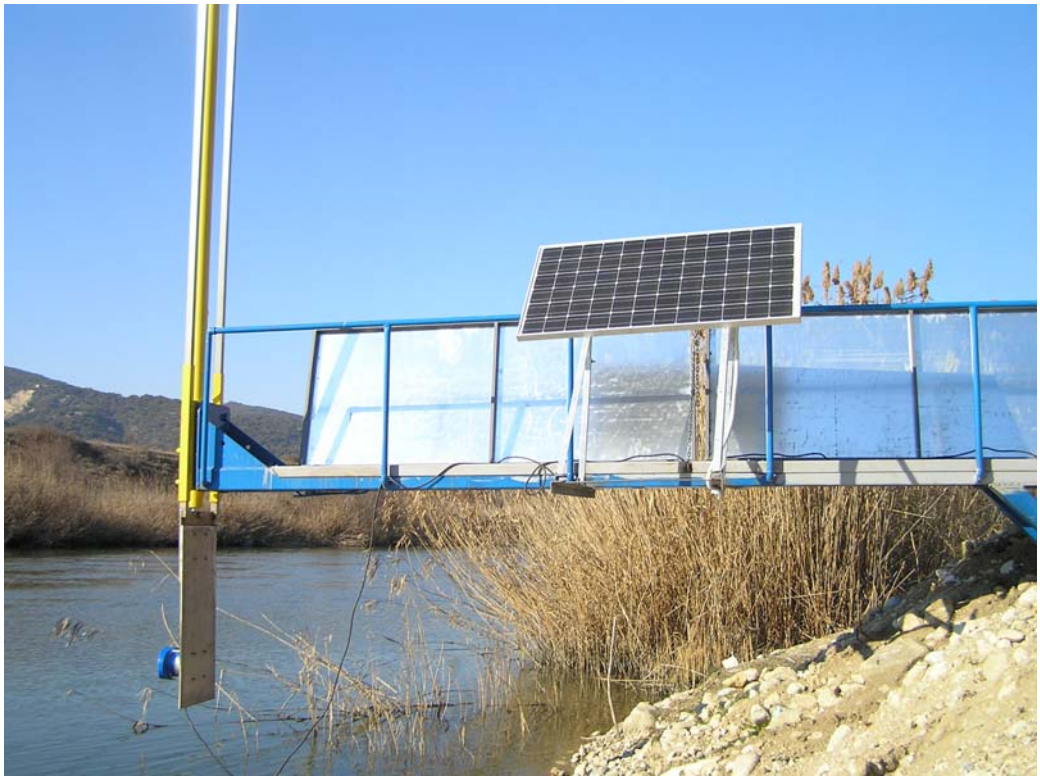

Fig. 3. Prototype discharge measuring system.

With regard to the crops in the basin, their identification early in the summer gives indispensable information on the water use during July and August, when demand for irrigation water is at its annual peak. We can use this information to design a detailed water distribution plan based on the crops water demand and on the available water resources.

In addition, a needs analysis for the major stakeholder groups, was run and a technical and economic analysis of the use of agro-ecosystems with farm management survey were carried out. The latter examined alternative agricultural plans regarding changing the cropping pattern, retaining existing crops and current farming practices. This is a rather interesting issue, given the pattern of Mediterranean agriculture, consisting of a relatively large number of crops. The project studied this issue using a multi criteria analysis technique. It was demonstrated that alternative cropping patterns vary substantially in terms of environmental and economic performance. Two of the proposed solutions were valuated as the most appropriate, following consultations with the stakeholders of the Strymonas basin.

When data from resulting from measurements, satellite imagery and the two agricultural plans were fed into the simulation model, the model calculated the water required for irrigation. In both plans, consumption of water for agriculture was much lower (by around 20%) than the volume currently required.

The hydrology-hydraulic modelling tool was successfully established at the premises of the Land Reclamation Service of Serres that is responsible for the water resources management in the agricultural areas of Strymonas basin, in order to apply it for the sustainable water management.

Personnel from the Service were trained and will use the model to drive only the exact amount of water that is required in the irrigation network and at the right time. This, in turn, will lift the pressure on the Ramsar site Lake Kerkini, that acts as an irrigation reservoir during summer.

Project targets, applied methods, modern tools and current results were freely disseminated to all interested parties, the public and researchers following the original plan. All meetings were carried out; a reporting leaflet at the beginning of the project was issued to inform the stakeholders and a technical report booklet has been produced to disseminate the knowledge of the project to the scientific community. In addition, the WWW site of the project (in ekby.gr) also presents project features, including on line measurements of Strymonas River discharge.

The main environmental benefits resulting from the project are:

a) Reduction in the amount of water used for irrigation.

b) Reduction in the pressures to the habitats and species of Lake Kerkini by reducing the extreme peaks in the lake hydroperiod.

c) Reduction in the non-point pollution in the basin.

d) Increase in the discharge of Strymonas River during summer and respectively contribution to the reduction of sea intrusion at the river mouth.

The methods and tools of this project could be easily transferred to other hydrological basins.