

PAST, PRESENT AND FUTURE CONCEPTS FOR CONSERVATION OF THE RE-CONSTRUCTED LAKE KARLA (THESSALY)

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Abstract: Lake Karla (the ancient Lake Voiviis) occupied the lower depression plain of Thessaly region and was one of the most important wetlands in Greece until 1960's. It is well known that the former Lake Karla (Thessaly) was completely drained in 1962 and has experienced a number of anthropogenic impacts including wetland loss, significant drawdown of aquifer's water table, subsequent soil salinization, loss of ecological and aesthetic value. Restoration efforts have been started at 1980's, addressing to the re-establishment of a new functional wetland. At the present time, Lake Karla is almost refilled while restoration project of the wetland is still on going. This study highlight the limnological history of Lake Karla along with its present ecological profile. Since conservation of Mediterranean freshwater ecosystems requires new water management approaches that consider both societal and ecosystem needs in an integrated fashion, thus a critical review concerning the Karla's restoration project is also discussed. Through Karla's example, as a Mediterranean climate basin, an integrated environmental approach is presented here which could also meet agricultural water demands.

STUDY AREA

The re-constructed Lake Karla is located in the south-east part of Thessaly region of Central Greece and lies between latitude 39°26'49" to 39°32'03" N and longitude 22°46'47" to 23°51'50" E. It belongs to Lake Karla watershed, which occupies the east side of Thessaly region. The natural basin of Karla has a total extent of 1,663 km², but after the construction of complimentary works for the Lake Karla, the drainage area of the restored lake Karla has been 1171 km². Elevation ranges from 50m to more than 2000 m, and the mean elevation of the region is about 230 m. The plain is one of the most productive agricultural regions of Greece. The main crops cultivated in the plain area are cotton, wheat and maize whereas apple, apricot, cherry, olive trees and grapes are cultivated at the foothills of the eastern mountains. The climate is typical continental with cold and wet winters and hot and dry summers. Mean annual precipitation in Lake Karla watershed is about 560mm and it is distributed unevenly in space and time.

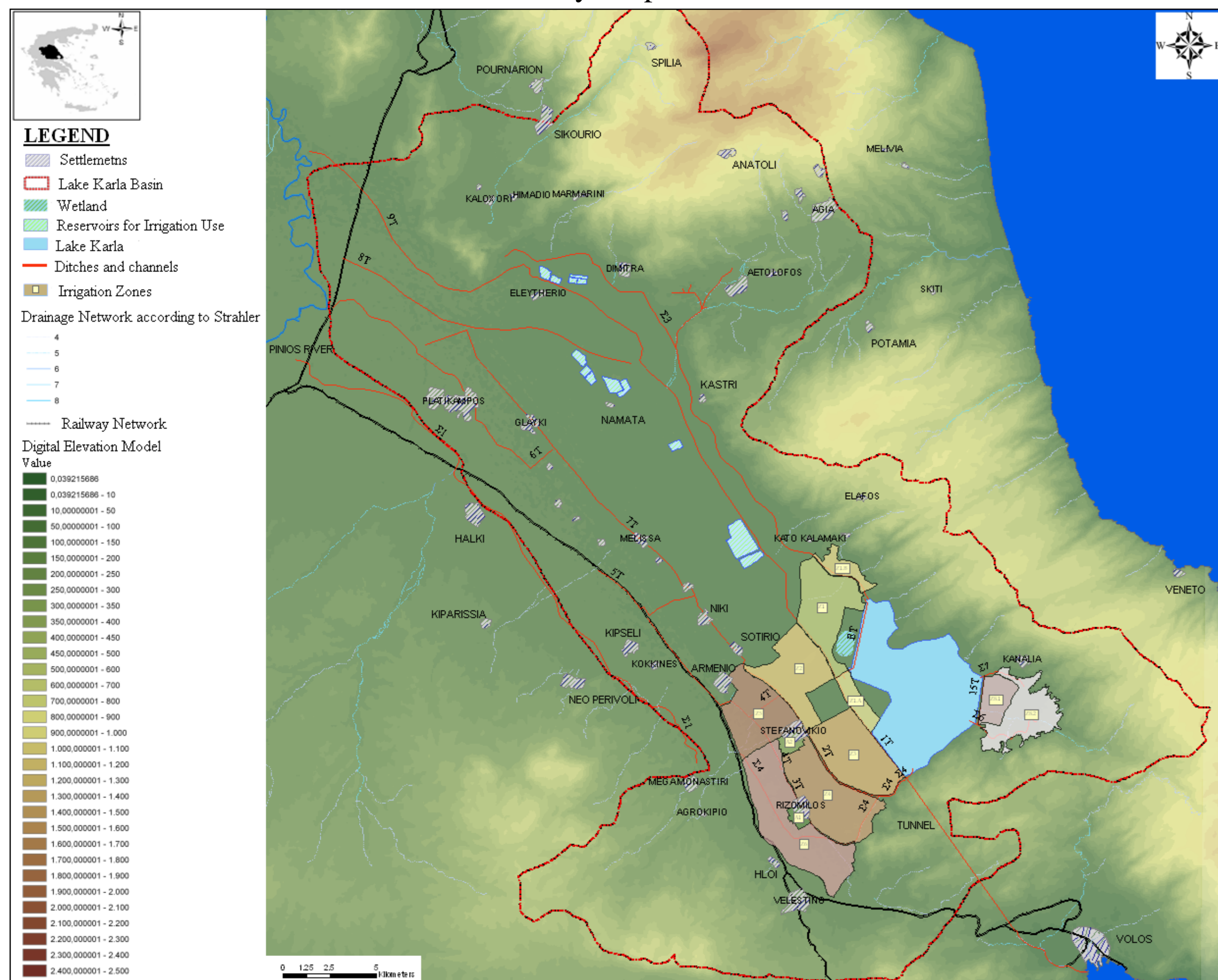


Figure 1. Lake Karla Watershed with Lake Karla restoration projects.

PAST

Lake Karla occupied the lowest part of Thessaly plain and was one of the most important wetlands in Greece until 1962. Surface runoff from the watershed and floodwaters of the Pinios River (discharging via the Asmaki ditch) supplied the lake with large quantities of freshwater. Endowed with a variety of habitats (pelagic, floating vegetation, shallow marshes with *Juncus sp.* and *Typha sp.*, emergent vegetation and rocks), Lake Karla supported rich fish and bird faunas. More than 143 bird species were registered, 55 of which are protected by EC directive 79/409. The area also was of primary importance for migratory birds including: *Phalacrocorax carbo*, *Platalea leucorodia*, *Anas strepera*, *Aquila chrysaetus*, *Ardea purpurea*. The structure and function of Lake Karla was intimately linked with the Pinios River. The river occasionally overflowed, and floodwaters rich in oxygen and nutrients drained into Karla. Because of its gently sloping bed, lake surface area fluctuated between 4000 and 18,000 ha, depending on the inflow-outflow balance. Much of the surrounding farmland was inundated when floodwaters were held in the lake, but today, the river is leveled to prevent flood damage.

Technical studies, recommended draining the lake via the Karla Tunnel and building a smaller reservoir instead of the natural lake for flood protection and for the revelation of agricultural fields. Although the lake was drained in 1962, the suggested reservoir was never built and only a small marsh was left. This delay has created a series of environmental problems with anthropogenic impacts including wetland loss, significant drawdown of aquifer's water table, subsequent soil salinization, loss of ecological and aesthetic value. The remaining small, temporary marsh was unable to support the aquatic food web, and numerous species were extirpated or emigrated. Furthermore, the remnant wetland still received discharge from a large part of the watershed, but it was too small for effective nutrient removal/transformation and sediment/toxicant trapping. These environmental problems direct affected the local economy through lower family income and higher social instability associated with reduced crop production and elimination of fisheries.

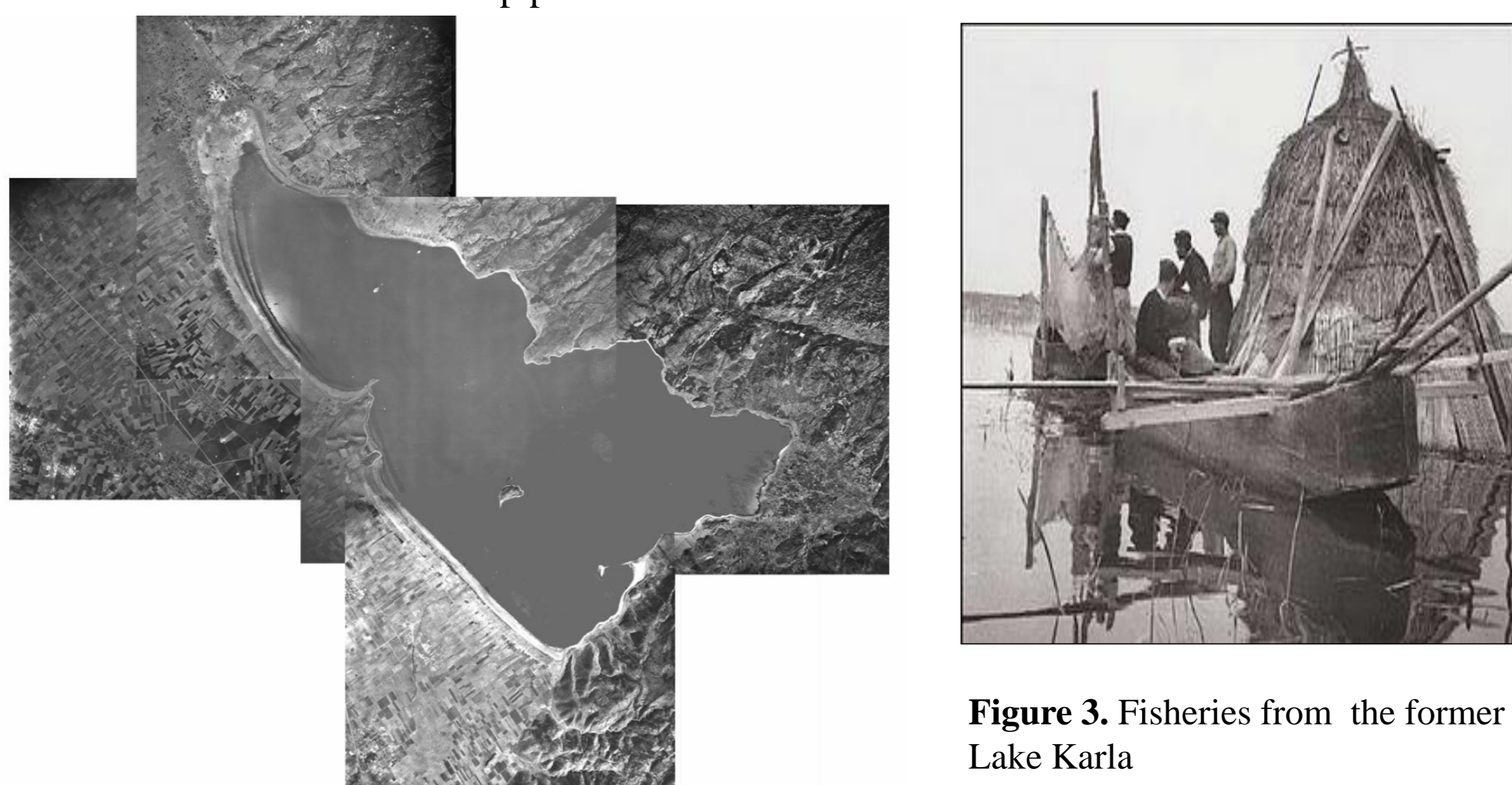


Figure 3. Fisheries from the former Lake Karla

PRESENT-RESTORATION PROJECT

Fulfilling Ramsar's restoration plan and Natura 2000 requirements, a national program has been established setting restoration of Lake Karla among the first priorities. The partial restoration of the former Lake Karla is one of the most important environmental projects in Greece that has been planned to reverse the adverse environmental conditions, caused by the lake drainage. The restoration plan included the establishment of a Management Body for the area, which is responsible for the implementation of the restoration plan, the monitoring program, and the application of adaptable management principles according to local needs. The decision to restore part of the former lake has been taken in the early 1980's but the construction works started few years ago. The suggested plan proposes the creation of a reservoir in the lowest depression plain of the former lake Karla that will occupy a maximum area of about 38 km², through the construction of two embankments, one in the eastern part and one in western part of the lake. Two main ditches will transfer the flood runoff of Pinios river to the reservoir, as happens to the past with the old Lake Karla, as it is located in the lower part of Karla basin. Also, four collector channels will concentrate the surface runoff from the higher elevation zones of the watershed and directly divert it into the reservoir. The surface runoff of the lower elevation areas will be pumped into the reservoir. So, the maximum allowable volume of reservoir will reach up the 180 hm³, but only the 60 hm³ will be available to cover the irrigation needs of the surrounding agricultures because of the environmental restraints, as the reservoir will be also a wetland. The project, today, is near completion. All the necessary works that have to do with the construction of reservoir have been completed. The works that are in abeyance are the drilling of the new supply wells which will cover the needs of Volos city and the irrigation network.

From ecological point of view, the impressive return of many species of birds in the re-constructed Lake Karla (128 species among them: *Egretta garzetta*, *Egretta alba*, *Ardea cinerea*, *Falco naumanni*, *Emberiza melanocephala*, *Tringa glareola*, *Philomachus pugnax*) shows that the lake tries to regain its high ecological value.

However, the point and non point sources of pollution, recorded in the wetland, comprise hazards for the function of the ecosystem. Moreover, eutrophication signals (hypertrophicated conditions along with high abundance of toxic cyanobacteria) reported in the reconstructed Lake Karla, show the need for water quality monitoring in order to protect the reconstructed ecosystem from the degradation of its ecological value.

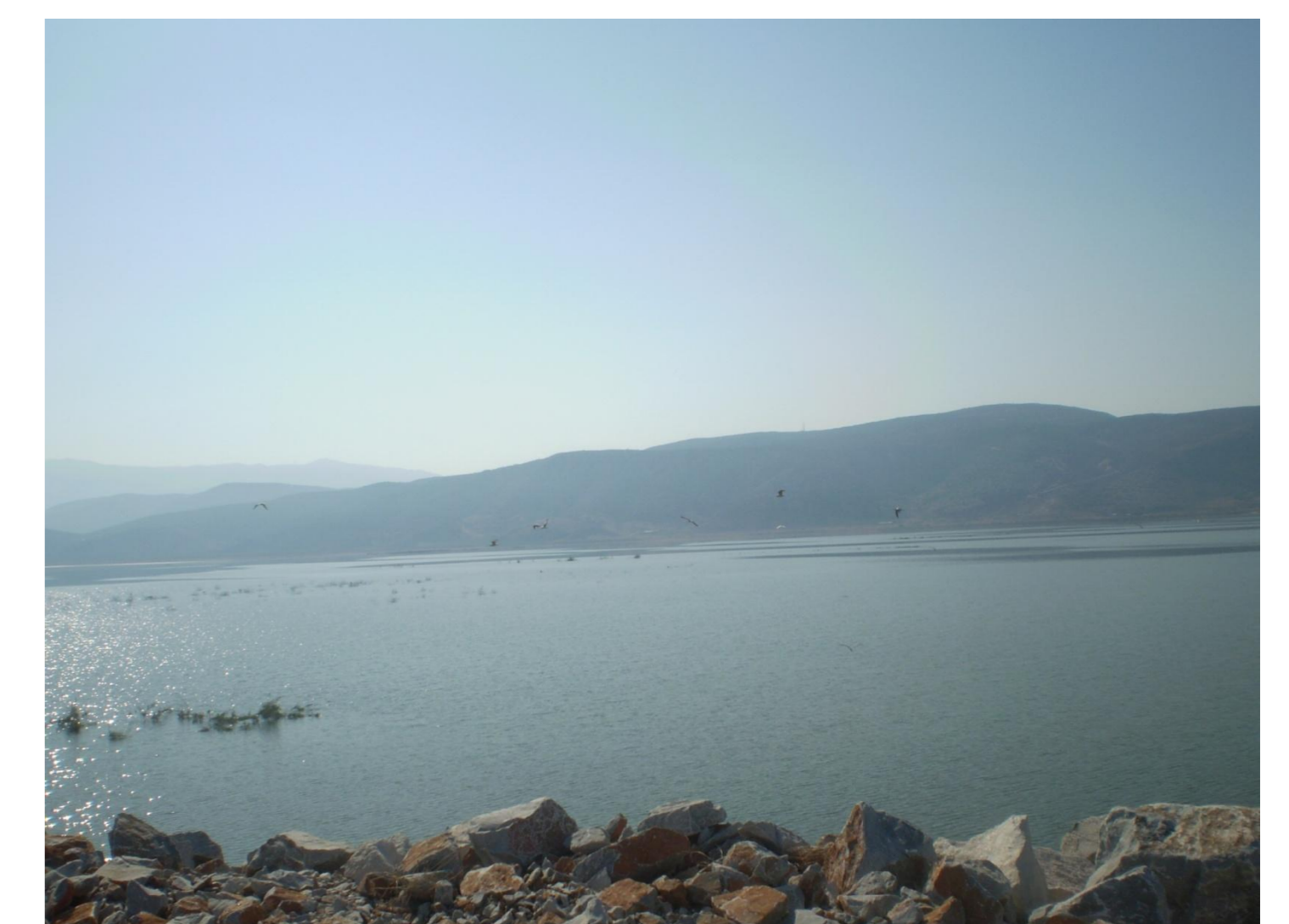


Figure 4. The re-constructed Lake Karla

FUTURE OPERATION

The re- construction of Lake Karla is expected to have both environmental and socioeconomic benefits for the area. The future operations include:

- Reclaim of pre-existed ecosystems' functions
- Enhancement of wild life, especially of birds (creation of wildlife habitats and enhancement of biodiversity)
- Support of a complex food web
- Increase of water resources in Thessaly (improvement of the quantity and quality of freshwater and groundwater)
- Improvement of climatic conditions in the area of Thessaly
- Decrease of erosion, trapping of sediments and creation of a standard landscape (Establishment of wetland buffer and riparian zones)
- Decrease of pollution in Gulf of Pagasitikos
- Agricultural benefits from the enhancement of irrigation
- Supply water benefits for the city of Volos and the nearby villages
- Enhancement of fish populations and establishment of alternative sources of income (construction of fish breeding site)
- Economical benefits from the enhancement of tourism (construction of (a) an information center, b) a museum of natural history and culture, c) observation posts in suitable positions, d) a network of suitable roads and paths,
- Improvement of landscape quality, development of areas for environmental education activities, linkage to neighboring areas of similar character and development of ecotourism infrastructure.
- Enhancement of local culture (enhancement of archaeological sites)

CONCLUSIONS

- The decisions of the drainage or the re-costruction of an ecosystem should be based on studies concerning the effects on environment, society and economy.
- The re-construction of Lake Karla will benefit the local area of Thessaly. Additionally the re-construction has European aspect, as the re-construction of Lake Karla is the first re-construction of a natural lake in Europe.
- To ensure sustainable restoration and use of wetlands, and to avoid adverse impacts, it is essential to identify the importance of cultural heritage, local practices, and societal needs. Thus, it is very important, local people to be a component of the re-constructed ecosystem and not only the receiver of the benefits.
- The re-constructed Lake Karla will success to regain its multiple functional role only if we respect the characteristics of the former Lake Karla in relation to present environmental and socioeconomic needs.

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