

# Fragile Landscapes/Kırılğan Çevreler: sustainability of water resources in the Konya Plain, Türkiye

John Wainwright | Durham University

Michele Massa | Bilkent University

Davide Motta | Northumbria University

Ender Peker | Middle East Technical University & British Institute at Ankara

Anlı Ataöv, Middle East Technical University; Gianna Ayala, University of Sheffield, Matthew Jacobson, Swedish University of Agricultural Sciences; Dan Lawrence, Durham University; Faruk Ocakoğlu, Eskişehir Osmangazi University; Sila Ozkavaf, Middle East Technical University; Meltem Uçar, Mersin University; Lutgarde Vandeput, British Institute at Ankara; İlker Yiğit, Burdur Mehmet Akif Ersoy University; Maddie Boon, University of York; Luke Hartnett, Sam Lyons & Sasha McEaney, Northumbria University; Olgu Yurttaş, Ankara University; İsmail Yılmaz, Eskişehir Osmangazi Üniversitesi

The Fragile Landscapes project ran from March 2021 to August 2023, funded by the British Academy's Global Challenges Research Fund (GCRF). As with other GCRF projects, the aim was to foster partnerships to develop an understanding of and potential solutions to the United Nations Sustainable Development Goals. In our case, the goals related to the sustainability of water, and thus of food supplies and communities more generally. The underlying principle of the project was that to design present and future solutions to water scarcity, we need to understand how approaches to water management have evolved through time, and how they are embedded in the social and cultural development of a region. Given the limited scope of the GCRF grants, we intended Fragile Landscapes to be a pilot project to explore the potential of this idea in the study area (the Konya Plain), with a transdisciplinary approach that involved collaborating with academics from archaeology, history, anthropology, geography and hydrology, and with stakeholders from the study area.

The Konya Plain, a semi-arid region currently experiencing severe water stress, was chosen as an ideal example for this approach because it has been the focus of sustained archaeological, historical and palaeoenvironmental studies for more than 70 years, including BIAA-sponsored projects. The chronological focus spanned from 1518 CE, the date of the earliest preserved Ottoman tax register of the area, to 1912 CE, the year the largest irrigation system in Ottoman Anatolia was completed around Çumra. The whole period provided us with rich historical, archaeological and environmental archives to tap during our research.

The first strand of analysis focused on reconstructing the administrative structure of the water-management systems, the dynamics of land use (particularly as related to water) and the network of canals during the Ottoman period. This involved research by Meltem Uçar into legal and historical documents that depicted a system where a 'light touch', top-down approach to water governance was complemented by a structure of diffuse responsibility taken by large numbers of



The canalised River Çarşamba near the bridge at Kısıkyayla during the drought of 2021. Normally this channel would carry irrigation water to fields north of Çumra (photo M. Massa).

stakeholders – very different from the modern counterpart. The same research highlighted much continuity of the Ottoman water-management system from pre-existing structures.

İlker Yiğit translated several tax registers covering the whole area (dated 1518, 1584 and 1841 CE), and this incredibly detailed dataset shed light on the subsistence economy and land use in the Konya Plain. İlker's results show that cultivation of drought-tolerant wheat and barley dominated taxable activities across three centuries (over 80% of total tax revenues), in stark contrast with modern crop choices (see below). A broader analysis of the historical context also makes clear that most if not all Ottoman agricultural production was for domestic consumption, without export to other areas of the Empire, again contrasting with modern economic dynamics (see below).

Analysis of modern and historical (1960s–1980s) satellite imagery led by Michele Massa and Maddie Boon further revealed a dense network of ancient canals, which can be dated by their association with known surveyed settlements. While many predate the period under investigation, the correlation between these waterways and the toponyms from the

tax registers allowed us to define the area irrigated during the 16th to 19th centuries. A further result of this effort was the identification of numerous field systems that show the extent of agricultural activities around medieval/Ottoman villages.

A second thread of the project, carried out by Ender Peker, Anlı Ataöv and Sila Ozkavaf, concerned the development of agriculture in the Plain over the last few decades. This work involved three main components: the evaluation of statistical data on changing land-use patterns; discussions with farmers and other stakeholders involved in water use and management; and policy analysis. Land use in the Konya Plain evolved rapidly in the 20th century, not least because of the successful completion of the canal linking the Beyşehir-Suğla Lake system to the River Çarşamba in the southeast of the plain in 1912. Previous attempts to make this link had only been temporarily successful, but a string of severe droughts in the mid-19th century emphasised the need for it. From the 1960s on, there was significant construction of infrastructure, based on a channel system supplied principally from water stored in the Apa and May dams. These developments all provided a more consistent water supply. Together with the digging of deep wells, this supply has been used to develop more extensive irrigation agriculture: today, almost a third of the 1.9 million ha of agricultural land on the plain are irrigated, a proportion that is predicted to increase in the future. Wild irrigation is only rarely used as more efficient sprinkler and drip irrigation methods are increasingly employed. Over the last 15 years, crop types have changed from being dominated by wheat, barley and some sugar beet to being dominated by maize, sugar beet and sunflowers. All of these crops have significant water demand. They reflect changing decisions about crop types in relation to national and international markets since, in contrast with the Ottoman period, the agricultural sector is now integrated into a global system of production. Detailed discussions with farmers in several villages provided insight into the decision-making process underlying these major changes, and also demonstrated an appreciation of how rapidly water supplies are being depleted in the area. Water levels in some wells have dropped over 120m since the turn of the millennium, largely due to unregulated use of deep wells tapping into the groundwater table. The growing demand for water has been met by policy developments that attempt both to supply more water, for example, through inter-basin water transfers, and to encourage more sustainable practices.

The third strand of the project attempted to estimate past and present water demand with a view to predicting sustainability in the future. Led by Davide Motta, this part of the project required the integration of information from the first two parts of the project to produce land- and water-use estimates together with evaluations of past climate variability. At the core of this approach lies the idea of quantitatively assessing water availability and water consumption (in essence, a water budget) at different time slices, taking water

surplus as one of the possible proxies to evaluate sustainability of water-management practices. Computer simulations of water resources were carried out to look at the overall budget of water availability. For the 16th-century scenario, water use seems to have been largely in balance with the amount of water available. However, it may be that the resource was exploited to its practical limit, so that when climate variations, coupled with other social and political changes, occurred in the 17th century, it was no longer as sustainable. Several settlements that appear in the 1584 CE tax records are no longer in existence, but whether this was due to resource overexploitation and other factors will require further detailed analysis. The simulation of the present-day water budget shows a stark contrast with the Ottoman period. Water use significantly exceeds water supply, and the extraction of groundwater to meet this deficit has led to continued drops in the water table. A further set of scenarios were simulated to look at how projected climate change to 2050 will affect water availability and responses. This analysis suggests that land-use decisions are more critical than changing rainfall patterns, but even the use of historically sustainable approaches will no longer be sufficient to meet changing demands.

Due to the COVID pandemic, our planned approach of involving local and regional stakeholders at different stages of the project became more restricted than we would have liked, but we did hold a meeting with a broader group at the British Institute at Ankara in August 2023. This was a very successful event, attended by over 30 participants from regional and national government, and water managers. It provided invaluable guidance about how we can develop further dialogue to use our research to support sustainability in the Konya Plain, and to make our results more widely relevant for people in other dryland environments.

More details about the project can be found on our website at <https://fragilelandscapes.net> or <http://kirilgancevreler.net>.



The closing dissemination meeting of the project *Fragile Landscapes: Past, Present, and Future of Sustainable Water Management on the Konya Plain* was hosted by the BIAA in Ankara. Delegates from national, regional and local authorities discussed policies for sustainable water use on the plain.