



Tuzla Gölü (photograph by Çetin Şenkul).

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## Water management and resilience-building on the Konya plain

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The British Institute at Ankara (BIAA) is currently involved in two projects focused on water resources, water management and climate change on the Konya plain. Both build on the long tradition of BIAA-funded and facilitated research in this region and are linked to previous and ongoing research programmes on the Konya plain.

The first new project, *Fragile Landscapes: Past, Present and Future of Sustainable Water Management on the Konya Plain, Turkey*, is funded by the British Academy's Humanities and Social Sciences Tackling Global Challenges scheme. It is led by John Wainwright (Durham University) and is a collaboration between researchers based in Turkey, the USA and the UK: İlker Yiğit (Burdur Mehmet Akif Ersoy University), Meltem Uçar (Mersin University), Anlı Atäv and Sila Özkavaf (Middle East Technical University), Olgu Yurttaş (Ankara University), Faruk Ocakoğlu (Eskişehir Osmangazi University), Lutgarde Vandeput and Ender Peker (BIAA), Michele Massa (University of Chicago), Dan Lawrence (Durham University), Davide Motta (Northumbria University) and Gianna Ayala (University of Sheffield). The interdisciplinary project includes elements of archaeology, history, anthropology, geography and hydrology.

The second project, *Kuruyan Kara (dryland): Water Security in the Agricultural Landscapes of Turkey: Towards Improving the Resilience of Communities and Socio-Ecological Systems*, is funded by the internal Global Challenges Research Fund at the University of Plymouth. The project is led by Jessie Woodbridge (University of Plymouth) and is a collaboration with Lutgarde Vandeput (BIAA), Mehmet Şeremet (Van Yüzüncü Yıl University),

Çetin Şenkul (Anatolia Quaternary Research Centre at Süleyman Demirel University, Isparta), Claire Kelly (University of Plymouth) and Warren Eastwood (University of Birmingham). It brings together specialists in anthropology as well as human and physical geography.

Many of the areas of the central Konya basin have rainfall of less than 250mm a year, so management of water resources is critical, especially in periods of drought like that currently being suffered in the region. Such droughts are likely to become more frequent according to projected climate changes, which are predicted to result in increased drought, with semi-arid regions, such as the Konya plain, at high risk. Challenges surrounding water availability are intensifying, with consequences for crop productivity, and effective water use will become increasingly important over the coming decades. Although both projects are based on the Konya plain, they focus on different areas. *Fragile Landscapes* is focused mainly on the Çarşamba river basin area and other catchments feeding the western side of the basin, together with the outflow areas east and southeast of Konya, whilst the *Kuruyan Kara* project concentrates on three lakes – Gölünar-Kayı, Akgöl-Adabağ and Tuzla – located to the northeast of Konya, near Aksaray and Kayseri.

*Fragile Landscapes* aims to look at the use of water resources in the Konya basin, as a means of understanding the sustainability and resilience of settlements in dryland areas in Turkey, by investigating water use in three different time frames. For the period from the 16th to the 20th century CE, information from Ottoman taxation records is used to reconstruct past land use and thus estimate water requirements.

The record of 1584 provides a complete snapshot of the number of taxpayers and the balance of the different types of crops grown and animal husbandry used. The data from the 1584 records are supplemented with samples from the 1513 and 1841 records to estimate changing patterns through time. Court documents are used to reconstruct management regulations and structures. The picture that is starting to emerge is one of an integrated system, with devolved responsibilities for managing resources at village and individual levels. Satellite and other imagery are used to map past water-management features and to attempt to discover the locations of subsequently abandoned villages and water-harvesting features, supplementing and complementing the information from the Ottoman taxation records.

For the period from the 20th century to the present day, government records of land use are combined with an ethnographic approach to understand how and why water has been and continues to be used. Although infrastructural changes did occur throughout the Ottoman period in the Konya basin, they accelerated rapidly with major schemes initiated in 1912 and then from the 1960s onwards. New crop types have emerged and there has been an increasing shift towards irrigated agriculture. Interviews with local farmers and village leaders (*mukhtars*) have provided first-hand reflections on the nature of these changes and how they are driven by local, national and international conditions (see pages 22–23).

In order to look to the future, up to 2100, the team is using climate and socio-economic projections together with environmental data to predict how water use will change river flows and groundwater levels. To ensure confidence in these predictions, the hydrological model will be tested against estimates for the Ottoman period and the available measurements for the later 20th century.

Bringing together these different lines of evidence, the aim is to consider how past experience can be used to support a sustainable future use of water in the region.

The Kuruyan Kara project is exploring environmental change over multi-centennial timescales in order to capture socio-ecological system behaviour and so provide valuable information for maintaining environmental stability and building resilience to future challenges. The project focuses specifically on socio-ecological and community resilience to water-resource challenges, and the current pilot capacity-building project based in the Konya basin combines natural- and social-science methods.

In 2020 and 2021, project collaborators Çetin Şenkul and Mehmet Şeremet, along with their team members, undertook physical- and social-science fieldwork in the Konya basin.

Çetin's team has taken cores from lakes where sediment archives can be used to generate palaeo-environmental datasets. This work has taken place at three lakes within the region most at risk of drought (Gülpınar-Kayı, Akgöl-Adabağ, Tuzla). Analytical techniques employed on the collected samples include analyses of fossil diatoms (water quality/

quantity/climate indicators) and fossil pollen, to reconstruct landscape change over recent centuries, along with X-ray fluorescence (XRF) core scanning of lake sediments, which can be used to study changes in past environmental and climatic processes over a range of timescales by assessing the ratios of different elements. Sediments are being dated using radioisotopes. The results are then combined with meteorological and modern landscape data, remote-sensed imagery and aerial photos. The combined results are used to answer questions about how past land-use and water availability/quality have affected modern systems and what environmental or land-use conditions preceded the current desiccation and salinisation of the lakes.

Meanwhile, Mehmet and his team have identified community members and/or leaders (*mukhtars*) to join focus groups and engage in semi-structured interviews within villages and towns near the natural-science data collection locations (Gülağaç, Adabağ, Palas). The main areas of focus have revolved around the roles that cultural perceptions and local knowledge of catchments have played in water-resource use, the barriers to effective water-resource management and the scientific information that would support stakeholders to build sustainable water-management systems.

Both projects tackle the issue of dwindling water resources in the semi-arid region of the Konya plain and explore how human-induced factors are and have been involved in related processes. Their aim is to explore how, in view of predicted climate change and increasing aridity, local communities can build resilience to be (better) equipped for future challenges. They look at past environmental archives and practices to inform the present and the future. The projects each use their own set of methods and different disciplines are involved, but complementary results may be expected, mutually increasing their respective impacts. Although both projects have been severely impacted by the pandemic, it is hoped they will be able to share their results with the local communities, as well as using them to develop policy briefings that can be employed to support sustainable water use in dryland regions throughout the world.



Dryland agriculture (photograph by Mehmet Şeremet).