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## Monthly Scientific Digest on Water Issues in Central Asia: November 2017

*Dear members of the Academic Teachers' network in Central Asia,  
the current monthly issue gives a short overview of recent research trends in the field of  
Water Resources in Central Asia*

### Scientific articles

#### [1] [Tree Shelterbelts as an Element to Improve Water Resource Management in Central Asia](#)

Niels Thevs, Eva Strengé, Kumar Aliev, Maksat Eraaliev, Petra Lang, Azim Baibagysov,  
Jianchu Xu



Water 2017, 9(11), 842

Link to the article: <https://doi.org/10.3390/w9110842>

#### Abstract

In Central Asia, agriculture, notably irrigated agriculture, is the largest water consumer. Currently, flood and furrow irrigation are the dominant irrigation methods in Central Asia, in particular in the post-Soviet countries. Against the background of current and increasing competition for water—e.g., through reduced river runoffs in the course of climate change—water consumption of agriculture needs to be reduced. On the field plot level, improved irrigation technologies, like drip irrigation or plastic mulch, can reduce water consumption substantially. Alternatively, tree lines as wind breaks (shelterbelts) also can reduce crop water consumption, as shown by research from many drylands around the world. As previous research has concentrated on crop water consumption and not on tree water consumption, this paper brings the two together, in order to approach a more holistic picture, in how far shelterbelt systems, including the trees, may have the potential to save water or not. Crop water consumption was assessed through the Penman–Monteith approach for corn, wheat, potato, barley, and pear under open field conditions and under an assumed influence of a tree shelterbelt. Tree water consumption was investigated through sap flow measurements. Crop water consumption was reduced by 10–12% under influence of a shelterbelt compared to open field conditions. When water consumption of shelterbelts was added, a slight reduction of water consumption of the whole crop-shelterbelt system

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was found for corn, potato, and pear under the assumption 25 ha (500 × 500 m) field sizes. Under an assumption of 4 ha (200 × 200 m) field size, water consumption of the whole crop-shelterbelt system was higher for all crops investigated except for pear. The results suggest that shelterbelts may play a role in improving water resource management in Central Asia in the context of water demanding crops, like corn or cotton. In further research, other effects of shelterbelts, like increased crop yields and additional income from trees, need to be investigated

## [2] [Impacts of Climate Change in Central Asia](#)

B. Mannig , F. Pollinger, A. Gafurov , S. Vorogushyn , K. Unger-Shayesteh



Reference Module in Earth Systems and Environmental Sciences 2017

Link to the article: <https://doi.org/10.1016/B978-0-12-409548-9.09751-7>

### Abstract

The five Central Asian states face transboundary water issues: agriculture in semiarid areas is dependent on irrigation which relies on river flow formation in the Tien Shan and Pamir mountains. Climate change will aggravate the already severe water stress in the region. Anticipated precipitation changes are minor and uncertain, but temperatures are projected to rise by 2–6°C during the 21st century. This increases the risk of droughts and heatwaves and furthermore affects snow and glacier melt, and hence glacierized areas and runoff. In the long term, river runoff regimes will change from glacio-nival to pluvio-nival, with increased runoff during spring and early summer and decreased runoff during midsummer.

## [3] [Environmental Changes in Central and East Asian Drylands and their Effects on Major River-Lake Systems](#)



Daniel Karthe

Quaternary International, Available online 1 March 2017, In Press, Corrected Proof

Link to the article: <https://doi.org/10.1016/j.quaint.2017.01.041>

### Abstract

Even though the drylands of Central and Eastern Asia are among the most continental regions of the world, they are also home to some of the largest rivers and lakes in the world. Because of a low population density, many of these water bodies have remained in relatively pristine condition until the mid-20th century, when urbanization, intensive agriculture and mining activities began to leave massive footprints on the regional environment. In more recent decades, water bodies in the region have been massively modified by both water

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withdrawals and pollutant influxes. At the example of the Lake Baikal, Aral Sea, and Tarim River basins, this paper provides an overview of the impacts of human activities on the large rivers and receiving (terminal) lakes in Central and Eastern Asian drylands. Finally, recent measures to at least partially restore their aquatic ecosystems are analyzed.

**[4] [Resilience and resistance of zooplankton communities to drought-induced salinity in freshwater and saline lakes of Central Asia](#)**



**Elena Ginatullina, Lisa Atwell, Laurel Saito**

Journal of Arid Environments Volume 144, September 2017, Pages 1-1

Link to the article: <https://doi.org/10.1016/j.jaridenv.2017.04.010>

**Abstract**

Effects of drought-induced salinity changes on aquatic communities are less studied in lentic than in lotic systems. We present changes in zooplankton assemblages from five arid lakes before, during, and after a supra-seasonal drying event in which lake inflow ceased in 2001. We catalogued zooplankton communities in fresh and saline lakes of the Sudochoye wetland in Central Asia. During this record low flow period, salinity increased in the lakes. Zooplankton species richness was inversely correlated with salinity. Linear regression using species richness indicated that zooplankton communities in the two least saline lakes were strongly correlated with changes in salinity. Post-drought recovery of species richness suggested resilience to this perturbation. Both saline lakes' zooplankton communities had low correlation with changes in salinity, suggesting greater resistance than the freshwater communities. The fifth lake showed a hybrid response, beginning in the fresh range, but experiencing higher salinities than the other fresh lakes. In the fifth lake species-richness was similarly correlated to changes in salinity as compared to the saline lakes, correlation of % halotolerant species was intermediate between saline and fresh communities, and post-drought species richness was similar to the fresh lakes, which could indicate a “resilient” recovery of species richness

**[5] [Afghanistan's aspirations for energy independence: Water resources and hydropower energy](#)**

**Mir Sayed Shah Danish, Tomonobu Senjyu, Najib Rahman Sabory, Sayed Mir Shah Danish, Gul Ahmad Ludin, Ahmad Samim Noorzad, Atsushi Yona**



Renewable Energy Volume 113, December 2017, Pages 1276-1287

Link to the article: <https://doi.org/10.1016/j.renene.2017.06.090>

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## Abstract

This paper presents the historical developments (since 1893) and opportunities for the future direction of water resources and hydropower in Afghanistan. The importance of water resources for hydropower energy production and irrigation, to ensure national security and prosperous socioeconomic development, is also addressed. At present, Afghanistan relies heavily on electricity imported from neighboring countries (80%, Breshna Sherkat, 2016). However, Afghanistan is endowed with substantial renewable energy resources. Among these, water potential is the main clean source available for electricity generation and irrigation. The water resources of Afghanistan mainly comprise five major basins (36 sub-rivers), and the rivers of three of these basins flow into neighboring countries, which has caused water resource trans-boundary disputes and is a challenge for the government of Afghanistan. The lessons learned from past trends, and recommendations for future development related to Afghan water resources and hydropower, are discussed. The establishment of sustainable development practices that account for social, technical, technological, political, and environmental concerns for long-term sustainability is evaluated. In the future, renewable energy technology exploitation will contribute to emerging economies. This study is the first of its kind to address water resources and hydropower development in Afghanistan.

## [6] [The water-energy-food nexus in Kazakhstan: challenges and opportunities](#)

**Marat Karatayev, Pedro Rivotti, Zenaida Sobral Mourão, Dennis Konadu, Nilay Shah, Michèle Clarke**

Energy Procedia Volume 125, September 2017, Pages 63-70

Link to the article: <https://doi.org/10.1016/j.egypro.2017.08.064>



## Abstract

The concept of the water, energy, food nexus is extremely relevant to Kazakhstan as the country faces population growth, economic progress and environmental challenges such as water scarcity, desertification, and climate change. Furthermore, poor sectoral coordination and inadequate infrastructure have caused unsustainable resource use and threaten the long-term water, energy and food security in Kazakhstan. This study presents the key elements required to implement a nexus-based resource management approach in Kazakhstan, by identifying linkages between water resources, energy production and agriculture. A case study illustrates how this methodology can be applied to quantify linkages between the water and energy sectors.