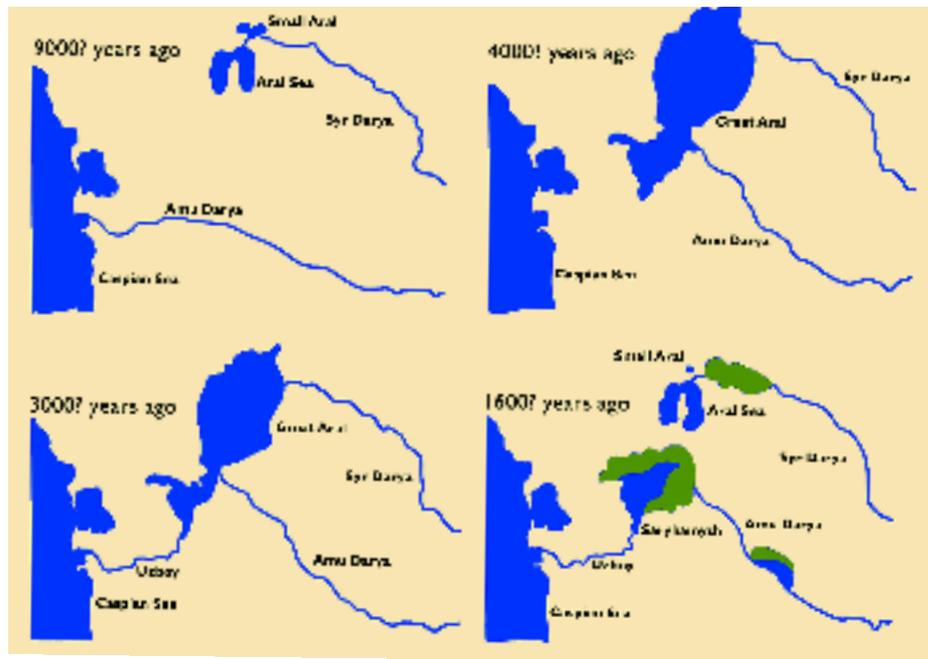


**A recent Unesco study observed that the Aral Sea basin has everything necessary for a bright future. Water availability is not a limiting factor for reaching the socio-economic development objectives in terms of health, nutrition and wealth. This article examines why.**

The Aral Sea basin belongs to the most ancient centres of civilisation, with irrigated agriculture existing already by 3000 BC. Two main rivers – the southern Amu Darya and the northern Syr Darya – empty their water in a large closed lake, the Aral Sea. Since World War II, highly wasteful irrigation has literally consumed 90 percent of the inflow, leaving only 10 percent to feed the Aral Sea, which has responded by losing 70 percent of its volume and 60 percent of its surface area.

The salinity has increased from 8 to 60% in the Aral Sea, and the lake has separated into three lakes: two larger and more saline southern lakes, and a less saline northern



*Early Holocene and late Holocene palaeohydrographical systems of Central Asia and Kazakhstan: A – Paskевич stage; B – the Great Aral stage; C – stage of the first natural discharge through Uzbey to the Caspian Sea; D – stage of the first antropogenic dessiccation. Areas of irrigation are shaded.*

# Aral Sea Basin Heads for a Brighter Future

lake. More than 80 species have disappeared from the water flora and fauna.

## The Aral Sea has dried up before

The Aral Sea owes its existence to a change in climate some 10,000 years ago which went from dry and cold to warm and damp. Through the millennia, both salinity and surface level have been controlled by climatic and hydromorphological factors, causing repeated changes in runoff as the climate has shifted between phases of abundant rain and aridity. Local tectonic activities have also contributed.

Historical investigations can't give a clear picture of the time table of all changes in connections between the Amu Darya and the Syr Darya, the Aral Sea and the Caspian Sea, but they indicate that the rivers temporarily began releasing waters in different directions starting 4000 years ago during an extended rainy period. At that time the Aral Sea was supposedly four to five times larger than in the mid 1900s. A similar deviation took place at least four times throughout history.

Later, human activities began to influence the inflow. Irrigation introduced by humans dried the Aral Sea even further than today and caused its first ecological crisis. In the 1600s, irrigation advances once more

caused the Aral Sea to lower and split into two lakes, causing the next ecological crisis.

## The present ecological crisis is the third one

What distinguishes the present third ecological crisis from the two earlier ones is the involvement of chemical pollution from mineral fertilisers, insecticides, pesticides, defoliants and even military contamination. While ecological problems are not new to the Aral basin, what is new is the chemical pollution which severely reduces the usability of the river water. The collector network for drainage water from irrigated areas brings pollutants back to the rivers, which are polluted already when they enter in Kazakhstan and Uzbekistan, where the deterioration escalates further. Since the rivers are used as the main source of drinking water supply, the health of the population reflects a disastrous situation which is especially severe for maternal health and infant mortality.

The depleted inflow to the Aral Sea results from extremely wasteful irrigation due to trench irrigation in 97 percent of the irrigated area, and is reflected in a per capita water use of over 2,500 m<sup>3</sup> per year. Irrigation was vastly expanded in Soviet times, when huge steppe areas like The Fergana

were irrigated. The Fergana is an arid area in the midstream Syr Darya basin and belongs to the central cotton zone – from time immemorial the place for settled farming and ancient culture of local tribes. By 1985, almost all the fertile lands of the valley had been brought under irrigation. It had by then become one of the most densely populated areas in Central Asia. The situation was similar in the Amu Darya River, where the Karakum canal command area in Turkmenistan, Karshi, and the Bukhara system in Uzbekistan were developed for agricultural production.

## Twin challenges

Large efforts are now ongoing to increase by 10 percent the inflow into the Aral Sea by minimising unproductive water losses. The plan is to develop a green ribbon of wetlands along the coast. The general goal is to reduce the total water demands in the next 25 years by some 20 percent, irrespective of the population growth. In reality, this means bringing per capita use down from the present 2,570 m<sup>3</sup> per year to some 1,600m<sup>3</sup> per year. In the Aral Sea, a dam is planned between the lakes by which the northern lake can be protected from further salinisation.

What adds strongly to the enormous challenges is the unexpected collapse of

the Soviet Union in 1991, which overnight transformed the national basin into a transnational river basin. Today, it is shared between five countries: the Amy Darya basin is shared by upstream Tadjikistan, midstream and downstream Turkmenistan and Uzbekistan, and the Syr Darya basin is shared by upstream Kyrgyzstan, midstream Uzbekistan and Tadjikistan and downstream Kazakhstan. Each country now faces a deep socio-economic transition through shifting from a centrally planned to a market-oriented economy.

Just one year later, in 1992, the countries agreed to respect the historical uses of water. The two existing river basin authorities for the subbasins would continue to operate, but now under the control a new Interstate Commission of Water Coordination (ICWC). The Aral Sea itself and its deltas were defined as an independent sixth riparian with its own water rights. All transboundary water has been declared the ob-

ject of common ownership by all riparians, and its development, protection and use should be carried out on the basis of interstate agreements according to national requests and regional interests.

### Future outlook

Importantly, there is no physical water shortage in the Aral Sea basin. The river basin is 1 million km<sup>2</sup> large and hosts a population of 42 million, expected to increase to 60 million already by 2020. The renewable blue water resources amount to 130 km<sup>3</sup> per year, which means a water crowding level of 320 people per million m<sup>3</sup> per year (3100 m<sup>3</sup> per year), the equivalent of many European countries. The climate, however, is arid in large parts of the basin, which means that agriculture has to be irrigated.

Pilot plot experiments by ICWC suggest that the wastewater water consumption in trench irrigation can be reduced by 20%. That would allow an additional water re-

lease to the sea coast of 10 km<sup>3</sup> annually. But, the agricultural dominance of the basin societies makes it unrealistic to restore the Aral Sea to pre-1960s state.

ICWC is currently involved in an interstate water management program, the Aral Sea Basin Management Program (ASBMP), which enjoys strong political support from top-level officials in the new states. All five states aim at finding economically suitable and environmentally acceptable common approaches towards stable water supply. Hydrologically-based models of 44 planning zones are under development.

Professor Vladimir Dukhovny at the Scientific Information Centre of ICWC has proposed that the “ecologically permissible water withdrawal” – taken as the water withdrawal of the riparian countries in 1965 – will be seen as a guaranteed amount free of charge. Withdrawals above that level will have to be paid by each country to a common regional Fund of the Aral Sea Basin, the rationale being that this is what caused the present “harm”. In calculating the country shares, their respective water use will be compared to a potential water productivity. Other principles are also under discussion, such as providing incentives for water conservation, uniform water resources distribution, sharing of maintenance costs for the water infrastructure, etc.

### Final remark

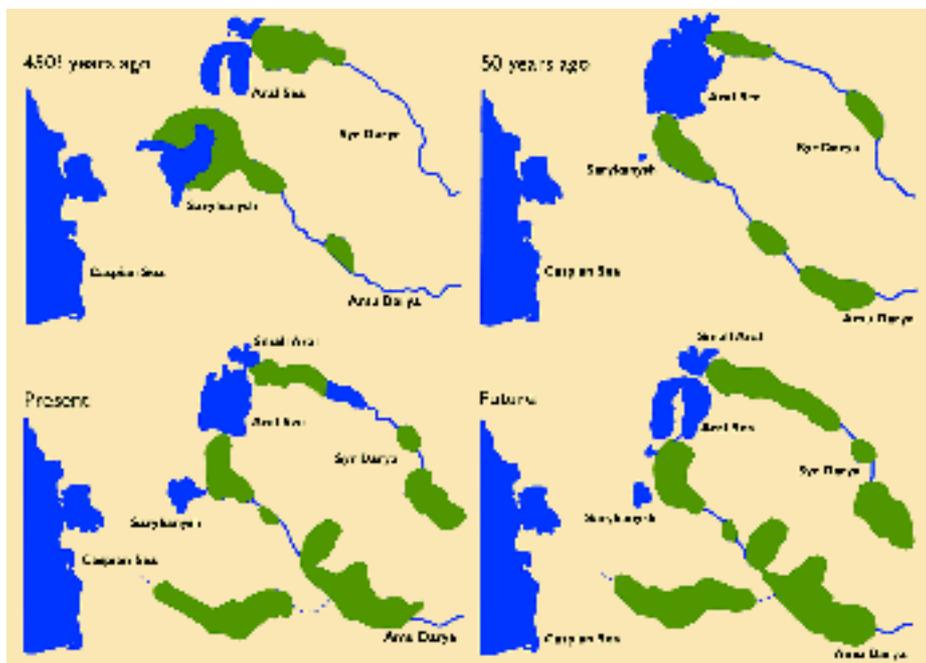
Since the area suffered severely under the Soviet regime and collapse, and the failure of land and water management in the area that followed, the goal is now a dramatic increase of water and land productivity along with expansion of industrial production. Reuse of return flow of drainage water will be an important component in the water conservation efforts.

Integrated water resources management, including public participation, hydrographic boundary management, and the creation of water user associations have started with the support of the Swiss development aid agency in Fergana Valley. Spreading IWRM in other parts of the Aral Sea basin will be important.

In the end, the efforts hope to achieve what the recent Unesco study observed: that the Aral Sea basin, indeed, has a bright future.

This article by Professor Malin Falkenmark of SIWI is the product of a close cooperation with Professor Vladimir Dukhovny and Professor Vadim Sokolov of the Interstate Commission of Water Coordination (ICWC).

Illustrations courtesy Nick Aladin, Russian Academy of Science



Medieval, in the middle of the 20th century, modern and possible future hydrographical systems in Central Asia and Kazakhstan. Areas of irrigation are shaded.

## More About the Aral Sea

Want to learn more about the Aral Sea? In August 2000, ongoing framework programs, research work and future-looking methodologies to reach water security in the Aral Sea region were presented at a seminar held during the World Water Week in Stockholm. The seminar was co-convened by the Swedish section of the United Nations Development Fund for Women (UNIFEM), the Royal Swedish Academy of Sciences, and the Stockholm International Water Institute. The seminar report is available free of charge as an Adobe Acrobat PDF document on SIWI's home page, [www.siwi.org](http://www.siwi.org).

To visit the Interstate Commission of Water Coordination home page, which has many freely available resources as well as links to other key programs and activities related to the Aral Sea, visit [www.icwc-aral.uz](http://www.icwc-aral.uz).

