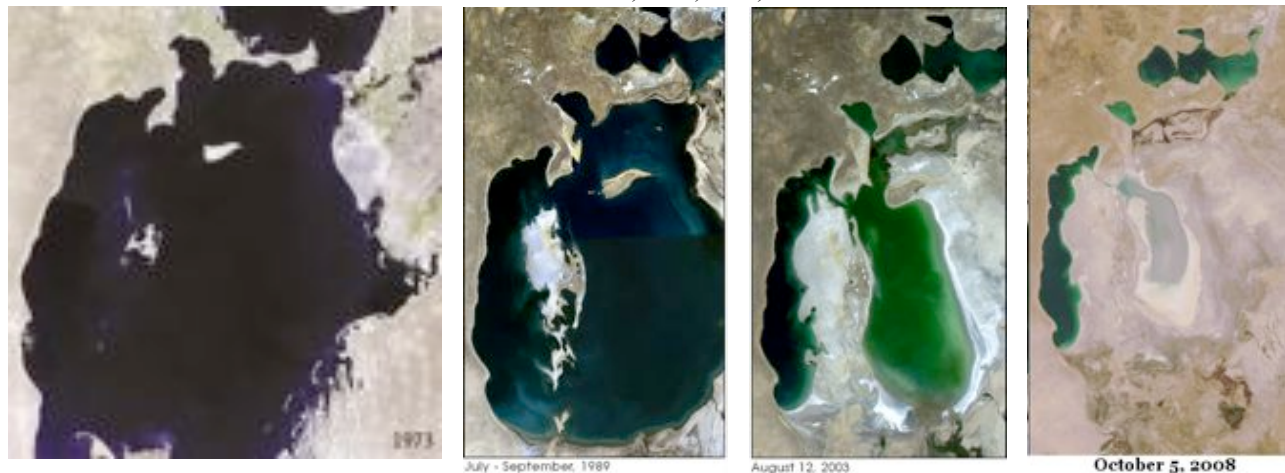


Ecosystem Services Case Study: The Social, Environmental, and Economic Impacts of Unsustainable Cotton Production in the Aral Sea

The degradation, dessication, and near total destruction of the Aral Sea has been called “one of the planet’s worst environmental disasters” (by the UN Secretary Generalⁱ). Driven by unsustainable cotton production and its thirst for resources in a water-scarce region, the world’s fourth largest lake has been almost completely drained over the past 50 years, destroying entire ecosystems and their inhabitants. The resulting loss of ecosystem services has caused billions of dollars of environmental and social damage to the surrounding communities. This case study will explore the economic and social costs of this striking example of ecosystem degradation.

In 1960, the Aral Sea was the world’s fourth largest inland sea, and was situated between the nations of Kazakhstan and Uzbekistan in Central Asia (formerly part of the Soviet Union). A conscious decision was made by the Soviet government to expand irrigation and cultivate cotton for exportⁱⁱ, which generated a degree of short-term economic gain at the expense of significant long-term ecological and social costs. In 1956, the first major cotton irrigation canal was opened (the Kara Kum Canal) which resulted in the diversion of a significant amount of water from the Amu Darya River (one of two major tributaries to the Aral Sea). By 1987, the water level had dropped enough to cause the Sea to split into two water bodies: a small Aral Sea in the North and a larger Aral Sea in the South, accompanied by drastic increases in salinity of what used to be a freshwater lake. By 2008, the Aral Sea’s surface area had declined from over 26,300 square miles to less than 2,600 square miles (6,700 km²), and the environmental impacts (due to the disappearance of wetlands, lakes and forests once fed by the Aral Sea) are felt over 150,000 square miles (400,000 km²) of the surrounding regionⁱⁱⁱ:

The Aral Sea in 1973, 1989, 2003, and 2008^{iv}



Ecosystem impacts:

The diversion of water from the Amu Darya and Syr Darya rivers (the 2 main tributaries to the Aral Sea) towards cotton irrigation deprived the regions’ lakes and wetlands of their life source: In the Amu Darya delta, wetlands that had covered some 1,300,000 acres (550,000 hectares) in 1960 were reduced by 95% or to about 67,900 acres (27,500 ha) in 1990, replaced by sandy deserts, while more than 50 delta lakes, covering some 148,000 acres (60,000 ha), simply dried up. Similarly, the lakes of the Syr Darya delta shrank from about 190 square miles (500 km²) in 1960 to 15 square miles (40 km²) in 1980. The Tugai forests, which covered about 240,000 acres (100,000 ha) in 1950, were reduced to just 50,000-75,000 acres (20-30,000 ha) by 1999^v.

Knock-on impacts of water diversion include:

- With the shrinking of the Aral Sea, the climate of the surrounding region has become more continental, with shorter, hotter, drier summers and longer, colder, snowless winters.
- The region's humidity has dropped by 25%, resulting in a loss of pasture productivity^{vi}.
- The growing season has been reduced to an average of 170 days per year, while dust storms occur on average on more than 90 days per year.
- Prior to 1960, over 70 species of mammals and 319 species of birds lived in the river delta, while by 2007 only 32 mammal species and 160 bird species remained.
- The number of fish species occurring in the lakes dropped from 32 to 6 due to increased salinity and loss of spawning and feeding grounds.
- Poor water management and derelict infrastructure have led to declining soil fertility, including soil erosion, which threatens 19% of irrigated land.

Social and economic impacts^{vii}:

- Commercial fisheries that produced some 40,000 metric tons of fish in 1960 were wiped out by the mid-1980s, with the loss of over 60,000 jobs.
- The evaporation of the lake has left behind 100 million tons of salt-laden dust (which can be carried by the wind as far as Scandinavia and Japan^{viii}), and the cotton industry's increased use and runoff of pesticides and fertilizer has resulted in the pollution of surface and groundwater with significant human health impacts:
- In the last 15 years there has been a 3,000% increase in reported chronic bronchitis, anemia, tuberculosis, kidney and liver diseases, respiratory infections, allergies, and cancer, while arthritic diseases have increased by 6,000%.
- The infant mortality rate is among the world's highest, and 1 in every 20 babies is born with abnormalities (5x higher than European countries).^x
- Average life expectancy in the region has decreased from 65 to 61 years.
- Cotton yields have measurably declined in the region due to erosion, water quality and soil problems (especially salinity) linked to irrigation. The dollar value of the reduced yield is \$1.4 billion annually (1/3 of total potential output).
- One study, published in 1990, examined the cost of measures to redress some of the negative environmental consequences, suggesting that the minimum damage to the environment as result of unsustainable agricultural and irrigation practices in the Aral Sea was at least US\$1.4 billion, taking into account measures to prevent polluted drainage water from entering rivers, reconstruction of the irrigation system, introduction of new plants and irrigation techniques, and stabilization of the sea floor.
- In addition, the cost to improve sanitary, hygienic and medical services, to create new jobs, and reform the economy was estimated at over US\$3.49 billion.
- Other estimates examine the cost of constructing two canals to redirect water from the Volga, Ob and Irtysh rivers in order to restore the Aral Sea to its former size over a 20-30 year period, estimated at over US\$30 billion.

The Aral Sea was once home to a thriving waterborne industry and is now known as the 'ship's graveyard,' home to grazing camels^{ix}



Economic costs of damaged ecosystem services:

The above dollar estimates do not take into account the ecosystem services damaged by the Aral Sea tragedy. Recent valuations of the ecosystem services damaged by the loss of 522,500 hectares of wetlands (over the period 1960-1990) conservatively estimate annual economic losses of around US\$100 million (each year)^{xi}. The ecosystem services impacted include:

- Flood control
- Water supply
- Water quality
- Habitat & nursery
- Recreational hunting
- Recreational fishing
- Non-consumptive recreation (boating, wildlife watching, etc.)
- Biological raw materials
- Fuel wood
- Amenity values
- Biodiversity

Lush wetlands and forests have been replaced by salt piles and sand dunes^{xii}



Business and the global cotton supply chain

The clothing industry consumes over 60% of the worldwide cotton supply. The global textiles supply chain connects to issues of dependence and impact on local water resources (primarily water consumption and pollution, during both cultivation and processing). Cotton production accounts for 2.6% of global freshwater consumption and demands about 2,900 gallons (11,000 liters) for every 2.2 pounds (1kg) produced^{xiii}. In Uzbekistan (the primary consumer of water that was once destined for the Aral Sea), inefficient irrigation methods cause local cotton production to consume almost double that amount (5,200 gal/20,000L per kg of cotton). Uzbekistan is the world’s second largest exporter of cotton - due to limited local capacity for textile production, over 70% of the country’s cotton is sold on the world market, with the European Union being the single largest consumer of Uzbek cotton.

Former shipping port in Aralsk, Uzbekistan^{xiv}



About Landen Consulting

Landen Consulting is a management consulting firm that helps leaders increase revenue, reduce risk, and drive positive change by optimizing the performance of environmental, organizational, and human capital. Landen Consulting provides specialized expertise in helping organizations address their strategic dependence and impact upon ecosystem services.

For more information, call us at 847.604.8697, or visit us at www.landenconsulting.com.

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