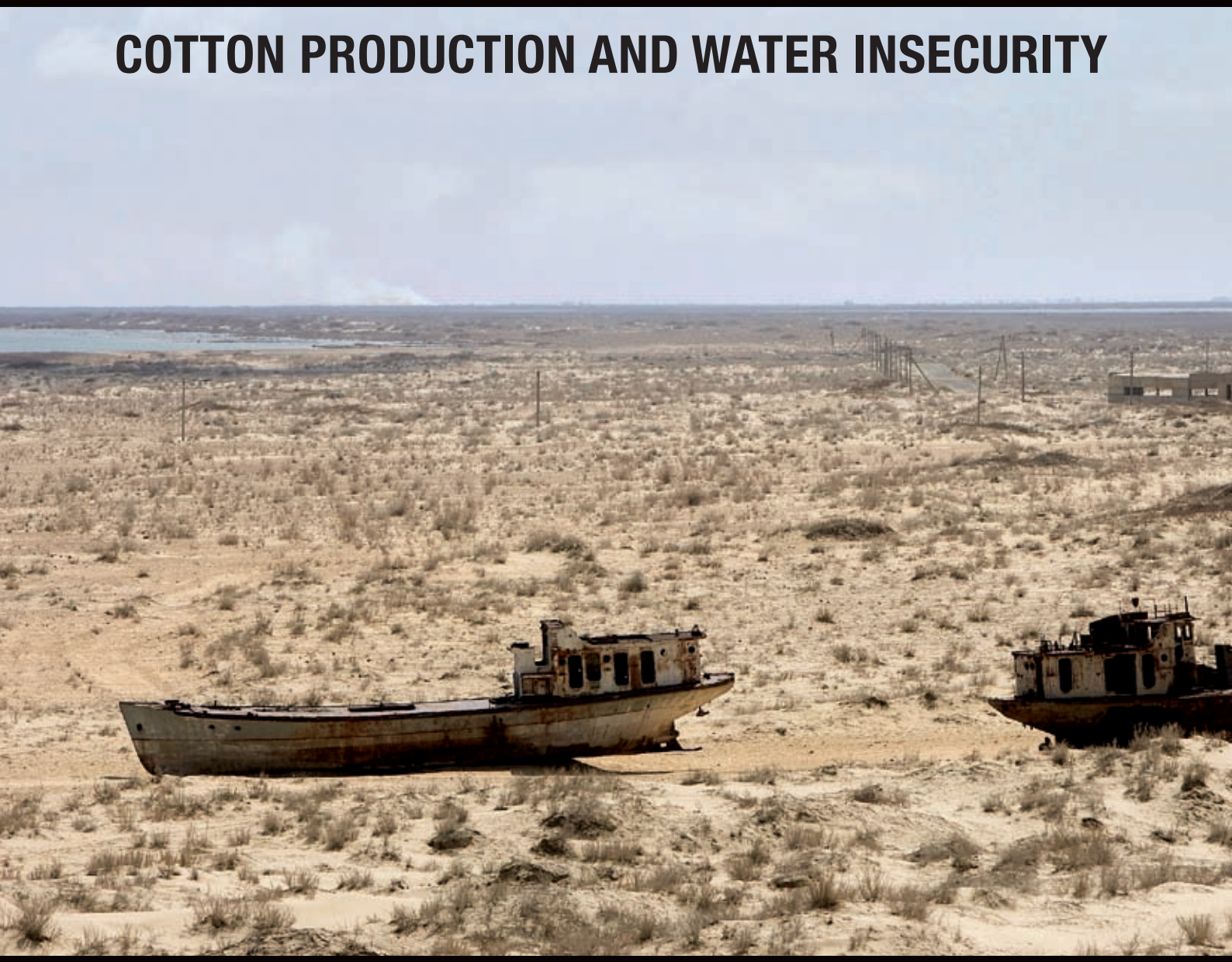
THE TRUE COSTS OF COTTON:

COTTON PRODUCTION AND WATER INSECURITY



A REPORT BY THE

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Executive summary

- This report presents summary information highlighting the massive mismanagement and abuse of fresh water resources in cotton production, with a special focus on Central Asia and Uzbekistan in particular. It makes recommendations to the Government of Uzbekistan for fundamental reform in its cotton producing sector to eradicate the use of forced labour and chronic water misuse and wastage. It highlights the pressing need for better collaboration between Central Asian countries to manage fresh water resources and calls on governments and international organisations worldwide to review water management policies and practices, and institute changes to ensure the sustainable and equitable management of fresh water resources. The report urges consumers to insist on cotton from sources proven to be ethically and sustainably produced, avoiding products where this cannot be guaranteed.

- Cotton production can be a pathway to development and is an important livelihood option for millions of people. However, production can have unintended social and environmental impacts, in particular this report outlines the role that it plays in contributing to water insecurity.

- Cotton is one of the thirstiest crops in the world. Each year 198 cubic gigametres (Gm^3) of water are used just to grow cotton and even more is used in processing it. 'Cheap' cotton is fuelling unsustainable production, and consumers commonly do not pay a price which reflects these costs. More than 80 percent of the water footprint of cotton consumption in EU member states is located outside Europe, in countries such as China, Pakistan, and Uzbekistan.

- The draining of the Aral Sea in Central Asia stands as one of the most damning examples of unsustainable cotton production. The Aral Sea was once the fourth largest inland sea in the world, stretching across an area of 66,000km^2. In less than a generation, it has shrunk to 10 percent of its former volume.

- The diversion of water for cotton began during the Soviet era, but has continued after its collapse. Today, Uzbekistan is the world's fifth largest producer of seed cotton, through one of the most water-intensive and wasteful cotton production systems in the world. More than 1.34 million hectares of land are under cotton cultivation, and cotton farms today consume around 16 billion cubic metres (m^3) of water each year.

- There is chronic overuse and misuse of water across Central Asia. Water losses due to mismanagement and obsolete technologies account for as much as 37 percent of the total water supplied. In Uzbekistan, wastage is particularly acute and an estimated 60 percent of water diverted into the country's 28,000 kilometres of canal and pipelines for agriculture never reaches the fields.

- As a result of the decline in the Aral Sea, species have disappeared and critical habitats have been lost. In 1996, for example, the Aral Sea stock of the ship sturgeon was declared extinct. Uzbekistan's Tugai forests amount to just 10 percent of their former area. Capture fisheries have declined – with catches dropping from 50,000 tonnes in 1959 to 2,650 tonnes in 2009.

- Some of the worst impacts of this ecological crisis have been felt in Karakalpakstan. Once a region with thriving industries, residents now suffer from intense livelihood insecurity as a result of declining freshwater availability, soil salinity, reduced labour productivity and climate change. With limited options open to them, an estimated 100,000 people have been forced to leave the area.

- Nationwide, Uzbekistan loses an estimated $31 million each year because of land degradation through salinisation (e.g. as yield reductions). The proportion of irrigated land suffering from increased salinity rose from 48 percent in 1990 to around 64 percent in 2003. This represents over 2.75 million hectares of land damaged through poor water management.

- The water demands of Central Asian countries are diametrically opposed to one another. Policies promoting water-intensive crops (like cotton) force competition with those in other countries that promote the generation of electricity through hydropower. Small-scale skirmishes have already taken place, and experts warn that regional instability due to competition over shared water resources is possible.

- Cotton production in Uzbekistan has been described as one of the most exploitative industries in the world. Known for its use of state-sponsored forced child labour and beset with multiple human rights and environmental abuses, it represents a powerful example of how damaging cotton production can be. However, multiple other examples of substantial damage to both the environment and people can be taken from other cotton producing countries. Globally, there are widespread problems over the misuse of water resources in cotton production.

- This report considers examples of unsustainable cotton production in the Indus River Basin, China and the Murray-Darling Basin, calling for urgent action before the Aral Sea crisis is replicated elsewhere.

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Introduction

It takes about 2,720 litres of water to produce one cotton t-shirt[1], equivalent to what an average person might drink over three years. It is enough to sustain a family of four for nearly nine months in one of the 43 countries that currently suffer from water scarcity[2].

The surface of our planet is predominantly covered by water, yet less than three percent of that is fresh water[3]. Of that 83 percent is frozen, meaning 0.5 percent of all water must supply all ecological and human needs. Like numerous other natural resources, freshwater is not distributed equally around the world and many countries suffer from water scarcity with insufficient water to meet the needs of their population and economies.

Agriculture is the human activity with by far the biggest water usage, accounting for 70 percent of all water consumption[4]. Most of this water is used on only a handful of different crops. Cotton is one of the thirstiest crops in the world, and the only 'non-food' crop in the top 10 water users. Each year, 198 cubic gigametres (Gm^3) of water is used in its production[1], equivalent to 16 times the annual water usage of the UK. In many countries cotton yields can only be sustained through the heavy use of irrigation.

Every single person on the planet has a water footprint, which is the total water they have consumed directly or used indirectly. Many consumers are unaware of just how big this footprint is, and what impact this level of consumption actually has. When it comes to cotton, Europeans in particular have physically distanced themselves from these impacts. Average annual water consumption related to cotton products in EU member states is around 1,532 Mm^3/yr, and more than 80 percent of the total EU water footprint is located outside Europe in countries such as China, Pakistan, and Uzbekistan[1].

This report highlights the hidden costs of unsustainable cotton production; the costs that consumers often do not see, but that people mainly in developing countries must pay in their place. Whilst cotton production can be a pathway for development, poor agricultural practices, low state investment in irrigation systems, weak or corrupt governance and human rights abuses can trap people in a cycle of poverty, potentially destabilizing whole regions, while the unsustainable use of scarce water resources has the potential to ignite conflicts, something that is perhaps especially true in the Central Asian region.

The environmental and social impacts of unsustainable cotton production are most clearly demonstrated by the demise of the Aral Sea in Central Asia. This inland sea has almost disappeared as a direct result of intense cotton production under the former Soviet Union and its decline is continuing today. Although this particular example is driven by a unique set of political and economic factors, the ever growing demand for cotton globally could trigger future ecological crises and with these economic down-turn, increased poverty, forced migration and violent conflict, both nationally and between nations.

Better global water management in cotton production is urgently needed. Around 1.4 billion people live in river basins in which water use exceeds recharge rates[5]. By 2030, nearly half of the world's population will be living in areas of high water stress[6]. Improved efficiency in irrigation is one means to conserve water[7]. However, some production systems are undoubtedly unsustainable and should not continue. Both retailers and consumers have a role to play through choosing to only sell and buy cotton produced according to clear ethical and sustainable standards. Certainly all should avoid any products from Uzbekistan, where forced child and adult labour, combined with the needless creation of an ecological catastrophe have devastated whole communities and a vast inland sea.

Irrigation for cotton, one of the world's thirstiest crops © EJF

Draining a sea? How cotton emptied the Aral

All © NASA

Decline of the Aral Sea 1973 1989 2003 2010

The Aral Sea was once the fourth largest inland sea in the world; an oasis set amidst the great deserts of Central Asia. Resource rich, the surrounding area prospered on the trade that flowed along the Silk Road. In less than a generation, however, the Aral Sea shrunk to 10 percent of its former volume[8] leading to the widespread destruction of ecosystems and the livelihoods that were built upon them. Its demise is one of the greatest ecological disasters in modern history, and it is entirely man-made[9].

Only around fifty years ago the Aral Sea stretched across an area of 66,000km^2, surrounded by smaller lakes and biologically diverse marshes and wetlands. But overexploitation (primarily for agriculture) has drained this precious resource. By 1987, the Aral Sea had split into two separate bodies of water, the Small and Large Aral, and the latter split again two decades later. More than 54,000km^2 of the former sea floor, an area bigger than the whole of Denmark, is now exposed as dry mud flats, contaminated with salt and pesticide residues that are deposited over a 350km radius by toxic dust storms. Over a span of about three decades, more than 95 percent of the marshes and wetlands have given way to sand deserts and fifty delta lakes have dried up[10].

The decline of the Aral Sea began during the Soviet era, but mismanagement continues today. Indeed, since independence, the situation has markedly declined. What little sea water remains is now far more saline than ever before: what survives of the Large Aral (with over 100g of salt per litre of water) is now more than three times as saline as the world's oceans[11]. Native brackish-water fish have been largely eradicated by the rapid change. Once the region's fishbasket, what remains of the Aral's barren waters now lies at the centre of a 400,000km^2 ***zona ekologicheskogo bedstviya*** or ecological disaster zone[12]. The Aral fishing fleet, which once landed 50,000 tonnes of fish every year and supplied the largest fish processing plant in the Soviet Union, is now stranded on the former sea bed[13].

A chronology of decline[14/15]

Year	Water level (m asl)	Surface area (km^2)	Average volume (km^3)	Average salinity (g/l)
1960	53.4	67,499	1,089	10
1971	51.1	60,200	925	12
1976	48.3	55,700	763	14
1989* **Total**		39,734	364	
(Southern) Large	*39.1*	*36,930*	*341*	*30*
(Northern) Small	*40.2*	*2,804*	*23*	*30*
2000 **Total**		24,003	173	
Large	*32.5*	*21,003*	*149*	*67*
Small	*38.6*	*2,700*	*17*	*18*
2009** **Total**		8,409	84	
(West Basin) Large	*26.5*	*3,702*	*56*	*>100*
(East Basin) Large	*26.5*	*857*	*0.64*	*>200*
Small	*42*	*3,487*	*27*	*10–14*

NOTE: In 2010, a slight growth in area from 2009 levels could be observed in both the East and West basins. This is thought to be the result of a combination of international measures by Kazakhstan and the heavy flow year on the Amu Darya. In 2011, both basins started to decline again because of the return of much drier conditions[15/16].

* *In 1987, the Aral Sea split into two separate bodies of water, the Small and Large Aral, to the North and South respectively.*

** *By 2005, the Large Aral had split into two separate Western and Eastern basins.*

A history of unsustainable use

Uzbekistan is estimated to account for more than half of the total regional water demand

Intense cotton production in Central Asia began during the Soviet era © EJF

The Aral Sea is a terminal lake fed by the Amu Darya and Syr Darya rivers that originate in the Tajik-Afghan mountains and flow northwest across the plains of Uzbekistan. These giant waterways together once carried more water than the Nile, covering a total area of nearly two million square kilometres and extending over six countries[18/19]. Before the 1960s, the level of the Aral Sea was relatively stable[19]. It's demise since then can be almost exclusively attributed to the program of extensive irrigation development that has taken place in Central Asia.

The expansion of the irrigation system in the Aral Sea Basin during the Soviet era was rapid and dramatic, increasing in area from about 4.5 million hectares (ha) in 1960 to almost 7 million ha in 1980[10]. During this period, ninety-four water reservoirs and 24,000km of channels were constructed along the Amu Darya and Syr Darya rivers, and the total water withdrawal almost doubled to 120km^3 [13/10]. More than 90 percent of this was used for agriculture, compared to the rest of the world where the requirement for agriculture averages at around 70 percent of total water used[19].

Cotton has been a significant drain on water resources in the region. This began as a deliberate Soviet policy action – promoting intensive cotton production in a drive for self-sufficiency[20]. At its peak, 16 percent of the total irrigated crop area in the Soviet Union was covered by cotton and almost all of this was in Central Asia, where cotton represented the second largest area of irrigated crops within the region[19]. By the mid-1970s, the Soviet Union was producing a quarter of the world's cotton[21]. The former Government of the Soviet Union saw it as 'white gold'. Since the collapse of the Soviet Union, all of Central Asia's cotton producers continue to rely on the Amu Darya and Syr Darya rivers as a source of water for irrigation[22], but none to the extent of Uzbekistan – the largest water user in the region[23]. It alone is estimated to account for more than half of the total regional demand[24].

© UN

"The demise of the Aral Sea in Central Asia remains one of the most iconic global images of mismanaged agriculture policies and highlights the interconnectivity between such policies and water scarcity."

Majority Staff Report
Prepared for the Use of
the Committee on Foreign Relations
United States Senate, 2011[17]

For the greed of a few

In Uzbekistan, an estimated 60 percent of water diverted into the country's 28,000 km of canal and pipelines for agriculture never reaches the fields © Carolyn Drake

Uzbekistan produced one million tonnes of cotton in 2010/11, which accounted for 11 percent of the total value of the country's exports[25]. State-controlled cotton production is worth around $1.6 billion[26]; essential funds required to prop up the regime under President Islam Karimov, the first and only president since 1990. Labelled one of the most exploitative industries in the world, with endemic environmental and human rights abuses[27], cotton production in Uzbekistan is also one of the most water-intensive[1].

More than 1.3 million hectares (ha) of land are under cotton cultivation in Uzbekistan[28], requiring around 16 billion cubic metres of water each year[29]. Almost 20,000 litres of water are withdrawn for every kilogramme of cotton harvested[30]. The massive overuse of water in Uzbekistan's cotton industry is largely due to the continuation of the Soviet policy that diverts much of the Aral's waters into large areas cultivated for cotton. Since independence the Uzbek Government has done little to provide incentives for improved efficiency in water usage. The main reason for water mismanagement remains a dependence on a system that seeks to maximise short-term production while minimising state investment.

Uzbekistan has responded to international pressure with token gestures towards liberalisation; introducing Water User Associations (WUAs) and dividing large state-run farms into smaller private enterprises while maintaining strict central control over cotton output and prices. However, this provides none of the benefits that liberalisation could provide if market prices for cotton were attainable to farmers, producing cotton using water paid for at a cost that reflects scarcity. Instead, these reforms actually reduce the efficacy of the irrigation system, forcing a larger number of smaller-scale farms to compete for water received at little or no cost, while removing any incentive for investment by forcing the excessive use of water to meet high cotton quotas[31]. The quota system dictates the methods, amount, and most wastefully, the area dedicated to cotton by each farm. Farmers are not permitted to grow other crops on land allocated to cotton even if they meet their quota volumes[30/32].

Self-funding WUAs are non-governmental organizations, introduced in 2000, made up of water users in a particular locality set up to manage infrastructure and water allocation in return for a fee from farmers. Whilst in principle they are an important step towards improving water use through more equitable water allocation, so far they remain institutionally weak as a result of the continuing core problem of central procurement of the harvest at fixed low prices[31]. WUAs charge farmers in order to generate funds to pay for irrigation improvements, yet low fixed prices for cotton and wheat mean farmers are unable to afford them. This leaves WUAs short of money needed to upgrade irrigation infrastructure. There is evidence that WUAs may be further undermined by a government determined to prioritise cotton production despite the breakup of state-run farms; reports suggest local administrators are instructed to allocate water to cotton fields before other crops[33].

For Uzbekistan's cotton farmers water can be a matter of individual short-term survival, leading to decisions that despite seeming rational at farm level are irrational on a wider scale. As the area under irrigation has increased, so has the risk that farmers will not receive sufficient water to prevent crops from failing[34]. Threatened with debt or punishment for failing to meet cotton quotas, an uncertain water supply and no incentive to invest in efficiency measures, some farmers block drainage outflows to hoard water and guard against future shortages[35]. Tackling this uncertain water supply will help encourage the uptake of technical recommendations for increased efficiency.

Chronic overuse and misuse of water in Central Asia

In 2003, a World Bank report warned that irrigation and drainage infrastructure in the Aral Sea Basin was falling apart. Canals were silted up or damaged, gates were broken, and pumps were being held together by improvised repairs and parts cannibalised from other machinery[36]. Water losses due to mismanagement and obsolete technologies account for as much as 37 percent of the total water supplied to countries in Central Asia[37]. In Uzbekistan, an estimated 60 percent of water diverted into the country's 28,000 kilometres of canal and pipelines for agriculture never reaches the fields[38/14].

Even though only 10 percent of the 444,000km² of arable land is irrigated, this level of inefficiency means that water demand for agriculture accounts for 93 percent of overall annual water consumption in the country[39]. Such misuse of water means that per capita water consumption in Central Asia is on average twice that of developed countries[37]. Yet, on the ground, the number of people with access to safe, clean water is declining[40]. Uzbekistan is one of the very few countries where the proportion of people with access to clean water has fallen - from 94 percent in 1990 to 82 percent in 2004[40].

There are systematic environmental and human rights abuses in cotton production in Uzbekistan © EJF

A mural depicting irrigation and exhorting the benefits of Uzbek independence © Sarah Olmstead

The real price of white gold

"As a result of the desiccation of the Aral Sea and degradation of wetlands in the Amu-Darya and Syr-Darya deltas, the richest biological resources in this region were destroyed."

Elena Kreuzberg-Mukhina, Institute of Zoology of Uzbekistan Academy of Science[41]

The extensive extraction of water for cotton production has almost completely drained the Aral Sea and, as a result, has left a legacy of irreversible ecological damage. The Aral Sea itself is almost biologically dead. Before the expansion of intensive cotton production in the region, the Aral Sea was home to 24 native species of fish[42]. These included 12 species of bream, carp, and barbel which were exploited commercially[43]. In an attempt to boost domestic fisheries, further species were introduced in the 1950s and by the end of the decade the Aral Sea's fisheries were landing around 50,000 tonnes of fish a year[13]. However, declining water levels increased the salinity within the sea, and by the 1970s the salinity was so high that most native fish species could not survive.

This brought an end to most of the fisheries activities in the region[44], with catches dropping to 200 tonnes by 2004[15]. The limited commercial fisheries activities ongoing today are restricted to the Small Aral and this is primarily due to a 13km embankment, a co-funded project of the Government of Kazakhstan and the World Bank, which regulates the flow from the Small to Large Aral Seas and has enabled some recovery in biodiversity[15]. However, at 2,650 tonnes in 2009, catch sizes remain at only a fraction of past levels[45].

Falling downstream water availability and increased salinity have also reduced surrounding marshes and wetlands by up to 95 percent of their former areas, and more than fifty lakes have dried up[10]. These valuable ecosystems represented a prime habitat for a variety of wildfowl[46], and their loss is resulting in the widespread disappearance of native flora and fauna[47]. As desertification continues, endemic plants are now being replaced by invasive species more suited to the dry, saline environment[48].

Uzbekistan's Tugai forests have been particularly badly affected. These unique riparian communities of reeds, gallery forests and drought-resistant bushes and grasses once stretched along the length of the Amu Darya, covering an estimated 100,000 hectares (ha)[49/12]. Populated by 576 plant species, including 29 endemic to Central Asia[50], the Tugai provided a habitat for amphibians, reptiles and birds, as well as reed cats, jackals, foxes, badgers, voles, wild boars and deer[46]. However, the change in the hydrological regime of Amu Darya, the water deficit, the rising salinity, and human activities such as illegal logging have reduced Uzbekistan's Tugai forests to just 10 percent of their former area[49]. Attempts are now underway to protect the last remaining forest fragments[49].

The state of the environment in the Aral Sea Basin[51/52/39/53]

Many fish species are extinct or under threat of extinction as a result of the demise of the Aral Sea.

- The ship sturgeon (Aral Sea stock) is now Extinct, the Aral sea trout (Aral Sea and Amu Darya River stock) is now Critically Endangered, and the wild common carp (Black, Caspian and Aral Sea stock) and shorthead barbell are Vulnerable to Extinction.

Migratory bird species have lost a critical habitat.

- At the beginning of the 20th century, the Aral Sea and its neighbouring territories supported 319 bird species, 179 of which were nesting. However, by 2002, only 230 bird species were recorded, of which only 68 were nesting.

Plant species are as vulnerable as animals.

- Twenty-three tree species in Central Asia are Critically Endangered, including some, such as the ***Calligonum triste***, which are declining as a direct result of ongoing degradation in the Aral Sea area.

Credit: UN/Eskinder Debebe

The Tungai forests now cover just 10 percent of their former area
© David Richardson/Karakalpak.com

* The process by which a body of water acquires a high concentration of nutrients, such as phosphates and nitrates, promoting the excessive growth of algae. This leads to a depletion of oxygen available in the water, causing the death of other organisms, such as fish.

Climate change and the decline of the Aral Sea[54/55/43]

The environmental impacts of the draining of the Aral Sea extend far beyond its immediate surrounds. Changes to the natural hydrology of the Aral Sea area have had an impact on the climate system. Localised climate change has seen the summers become shorter and drier, the winters become longer and colder, and annual rainfall decrease. Recent research indicates that global wetland ecosystems could store as much as 700 billion tons of carbon; approaching the amount found in the atmosphere. Whilst most of this is trapped in peatlands, the importance of all wetland environments in tackling climate change should not be underestimated. By that token, the significant declines in wetland areas associated with the demise of the Aral Sea represent a significant release of emissions.

Global climate change is predicted to exacerbate existing environmental problems in the region. Experts believe that it will increase evaporation rates, salt migration, exhaustion of underground water resources, and mineralization of stagnant lakes, as well as accelerating eutrophication in water-storage reservoirs and decreasing soil fertility. They also warn that longer-term projections show a decrease in the flow of the Amu Darya and Syr Darya rivers as glaciers shrink.*

The salt crisis

"If salination trends persist, most agricultural land in river basins will become unsuitable for irrigation farming within a few decades and salinisation of rivers will preclude their use as sources of drinking water."

European Community Regional Strategy Paper, 2007[56]

More than 60 percent of irrigated land in Uzbekistan suffers from salinity
© Sarah Olmstead

According to experts, there are 89 critical environmental situations, 22 emergency environmental situations and one environmental catastrophe zone in Uzbekistan[57]. Water is at the heart of many of these problems. Poor water management has led to country-wide degradation, and now as much as 80 percent of Uzbekistan's land area affected by desertification[56]. This is symptomatic of the whole of the region, where 13 percent of land in Central Asia has been degraded to the point of 'no possible reclamation at farm level'[58].

The country also faces threats posed by waterlogging, causing aquifers that supply drinking water to become contaminated with salts and agrochemicals, and salinisation. These problems are now so advanced that up to 20,000 hectares (ha) of agricultural land are lost every year[59]. For the country's 17 million rural inhabitants, many of whom survive on produce grown on household plots[60], failing soil fertility is a serious issue for food security and living standards. At a national level, an estimated $31 million is lost each year due to land degradation through salinisation (e.g. as yield reductions), while the cost of severely salinized agricultural land taken out of production amounts to $12 million[58].

The salinisation problem alone is so significant that some commentators have described it as a 'salt crisis'[14]. As a former Senior Ecologist at the World Bank explains, *"The main agricultural problem in the Aral Sea region is salinization of the soil, caused by lack of drainage. An adequate drainage system has not been installed because it would have made cotton production much more expensive. It was easier and cheaper to move to another plot of land once salinization occurred"*[61]. The result is that over-irrigated soils have accumulated excessive amounts of water capable of liberating salt locked deep beneath the soil surface[62]. Once freed, these minerals move upwards where they have a negative effect on soil fertility[14]. The proportion of irrigated land suffering from increased salinity rose from 48 percent in 1990, to around 64 percent in 2003[63]. This represents over 2.75 million ha of land damaged through poor water management[62]. The problem is particularly serious in the downstream regions of Navoi, Bukhara, Surkhandarya, Khorezm, and Karakalpakstan, where salinisation is said to affect between 86 and 96 percent of land under irrigation[64].

The final paradox is that the demands for water and subsequent increases in soil salinity now threaten the very survival of Uzbek agricultural production. Deteriorating environmental conditions have resulted in significant declines in fisheries and agricultural productivity, with some crop yields declining by as much as half[39]. This has been an economic disaster for almost 3 million people (including those in areas of Turkmenistan and Kazakhstan near the Aral Sea) whose main source of income is agriculture[39]. Cotton, in particular, is very sensitive to salinity both during germination and the seedling stage[65]. Increased salinity leads to a reduction in yields and decreased fibre quality. Consequently, Uzbekistan could find that its cotton production becomes its downfall.

Central Asia's salt crisis[66]

	Total irrigated area (ha)	Area affected by salinisation (ha)	Percentage soil affected
Kyrgyzstan	424,000	122,000	28.8%
Tajikistan	747,000	280,000	37.5%
Uzbekistan	4,248,000	2,801,000	65.9%
Kazakhstan	786,000	629,000	80.0%
Turkmenistan	1,714,000	1,661,000	96.9%
Central Asia	7,919,000	5,493,000	69.4%

Karakalpakstan

> ***"In Moynaq I visited an abandoned fish processing factory. Production had long since ground to a halt as the town's commercial fisheries have all long gone out of business… The loss of the Aral has left the Karakalpaks high and dry. Without the water, they have no jobs, no income and no future."***
>
> G. Bukharbaeva, Journalist, Tashkent[67]

Karakalpakstan once attracted as many as 50,000 tourists a year
© Sarah Olnstead

The environmental consequences of intense cotton production pose a threat to people throughout Central Asia. Yet nowhere has the impact been more acute than in Karakalpakstan, an autonomous region home to an estimated 1.5 million people[68]. Indigenous Karakalpaks have lived on the shores of the Aral Sea for over 2,000 years, and have watched as their livelihoods have disappeared in less than a generation[69]. With the basis of their former livelihoods absent, unemployment is estimated to have peaked at 70 percent[69]. As a direct result, an estimated 50 to 70 percent of Karakalpaks have been pushed into poverty, with 20 percent living in severe poverty[70]. Their lives are further blighted by acute health problems, the direct result of the localised accumulation of salt and pesticides associated with upstream cotton production.

Abandoned ships in Karakalpakstan © Thomas Grabka

Livelihoods lost

Livelihoods in Karakalpakstan have traditionally been built around the Aral Sea and surrounding lakes and wetlands. There were once thousands of fishermen in the region and many others worked in fish processing or canning[71]. Before the 1960s, active fisheries existed in the Aral Sea, Lake Sarykamysh and the wider area of the Amu Darya delta. At its peak, the regional fisheries industry was landing around 50,000 tonnes of fish a year[13]. However, with declining water levels and rising salinity, quantity and quality of catches began to decline and fish prices rose.

As commercial fisheries began to collapse, urgent efforts were implemented by the Soviet Government to try and salvage the fish processing industry around Moynaq. Fish were transported overland from Lake Sarykamysh, the Far East and Baltic states to try and sustain the cannery operations near the Aral Sea, but this incurred additional costs due to transportation. The net cost of one thousand cans of fish increased 1.6 times between 1964 and 1984. The industry was losing $10.85 million a year. After the collapse of the Soviet Union this became untenable, and now only a small proportion of fisheries activities and fish processing remain[72].

Other important livelihoods have also been lost. The decline in wetland ecosystems limits livestock rearing, the local muskrat hunting and pelt industry, and cane processing for forage and mats. Tourist revenue has dried up along with the Aral Sea. The northern town of Moynak once boasted a popular sanatorium and, during good years, as many as fifty thousand tourists would visit the area for short breaks and boost the local economy through recreational activities like fishing and hunting[71].

These declines have driven up the level of unemployment and pushed many into subsistence farming. Currently, more than a third of the rural population in Karakalpakstan depend on small plots of land for their livelihoods[73]. These are livelihoods that suffer from intense insecurity as a result of declining freshwater availability, soil salinity, reduced labour productivity and climate change. If they choose to stay within the region, people have little chance of improving their position.

Commercial fishing and fish processing has largely ended
© David Richardson/Karakalpak.com

More than 70 percent of the irrigated land in Karakalpakstan is now affected by salinity and the combined effect of these factors has as much as halved some agricultural yields[68].

The alternative to this is for people to leave the worst affected areas, an option that many have already been forced into. Peak migration from Karakalpakstan coincided with the worst economic declines during the 1970s and 1980s, when about 14,500 people moved[71]. The total number of 'environmental refugees' due to the loss of the Aral Sea is not known, but it is likely that more than 100,000 people have been displaced within affected regions in Kazakhstan, Turkmenistan and Uzbekistan as a result[74]. Those leaving the area are often the most highly skilled[69], representing a significant loss of regional human resources which may further jeopardise the future of the Aral Sea population. The extent of Karakalpak emigration is a testimony to the scale of environmental degradation inflicted on the region. The Aral delta, once so rich that it drew thousands towards its shores, is now so barren that it pushes them back into the desert.

Figure 1. Estimates of losses incurred as a result of The Aral Sea decline[71]

Economic activity	Direct losses in the Aral Sea area (USD million per year)
Irrigation farming	6.6
Fisheries and fish breeding	28.6
Muskrat hunting	4.0
Cattle breeding	8.4
Recreation and tourism	11.2
Agriculture, total	**58.7**
Fish processing industry	9.0
Muskrat pelt processing	18.0
Cane processing	12.6
Transportation losses	1.0
Industry, total	**40.6**
Production, total	**99.3**

The legacy on human health

Between 1983 and 1988, the number of cases of chronic bronchitis increased by 3,000 percent © Thomas Grabka

The serious health concerns facing the population of the Karakalpakstan region demonstrate the consequences of an agricultural policy that has systematically failed to account for social and environmental costs. Based on the most recent data available from the area, it is clear that the population struggles with health problems that are more severe than anywhere else in the country, very likely linked to poverty, water scarcity and contamination by pesticides.

The high levels of salt washed down the Amu Darya have left 40 percent of the Karakalpak population with no access to safe drinking water[69] and most sources of drinking water fail to comply with water standards[68]. In Karakalpakstan, drinking water can contain up to 3.5g of salt per litre. The situation is particularly acute in the North where few schools and hospitals are able to provide safe drinking water. Chronic exposure to salty drinking water may account for the high incidence of hypertension and diseases of the kidney and urinary tract[69].

Karakalpaks also suffer the brunt of the region's toxic dust storms. Being south of the saline mud flats, in a region with a prevailing northerly wind, Karakalpakstan receives much of the 43 million tonnes of salt, sand and pesticide-laden dust deposited each year[69]. The salt pollution is decreasing the available agriculture area, destroying pastures, and creating a shortage of forage for domestic animals[75].

Agriculture in Uzbekistan has relied on chronic overuse of pesticides and other agrochemicals. During the 1980s, farmers in Karakalpakstan were using considerably more than their contemporaries elsewhere; applying 72kg of pesticides per hectare compared with 1.6kg per hectare applied by US farmers[68]. Pesticides, herbicides and defoliants applied on the cotton farms throughout Uzbekistan leach from fields into soils and freshwater sources, where some can enter the food chain and accumulate in organisms through accidental ingestion.

"Karakalpakstan is far worse off than the rest of Uzbekistan. The water is dirtier here than other regions. There is more anemia and tuberculosis than other parts of Uzbekistan… Karakalpakstan just isn't coping… the collapse of the Soviet Union and the Aral Sea environmental disaster has been so devastating on every level, it has just beat us".

Local doctor, Nukus, Karakalpakstan[69]

In some regions of the Aral Sea, 50 percent of all reported deaths are respiratory[69]. There is an increased incidence of obstructive lung disease and bronchial asthma in the Aral Sea area; particularly in Karakalpakstan[76]. Between 1983 and 1988, the number of cases of chronic bronchitis increased by 3,000 percent, with significant increases also in kidney and liver disease, especially cancer, and a 6,000 percent increase in arthritic diseases[10]. The chemical pollutants may also explain the high levels of human reproductive pathologies (such as miscarriages, complications during pregnancy and birth, and infertility), and why one in every 20 children is born with an abnormality – a figure five times higher than the European average[68].

Water and politics

The Soviet plan for the development of Central Asia was very much focused on agriculture, and water resource development projects across the whole region were prioritized to meet irrigation needs. Some hydropower infrastructure was in place at the time, but this could not match the GDP contribution of agriculture and was therefore a secondary concern. This changed after the collapse of the Soviet Union, and it was after independence that interstate water management problems began to surface[39].

The fall of Communism brought an end to centrally-planned water management: the division of Central Asian water resources is now largely determined by the individual actions of five separate national governments, each intent on fostering its own individual prosperity[14]. Despite the establishment of the Interstate Coordinating Water Commission (ICWC), under which states agreed to retain the Soviet system of water allocation[77], tensions over water continue to run high. Today, governments routinely accuse one another of breaching water quotas[77].

The most serious regional tensions exist amongst Uzbekistan and its two upstream neighbours, Kyrgyzstan and Tajikistan. Combined, these three nations account for almost 80 percent of the total run-off in the Aral Sea basin[22]. Kyrgyzstan and Tajikistan lack regional hydrocarbon resources and so seek to use water resources within their borders to generate hydroelectricity, an ambition diametrically opposed to the demands of Uzbek cotton production. The two upstream states need to divert water into reservoirs during the summer – thereby limiting the water available downstream for cotton during the growing season. During the winter, when energy is most in demand, water from their reservoirs is put to use powering the turbines but can cause flood damage to downstream irrigated cropland.

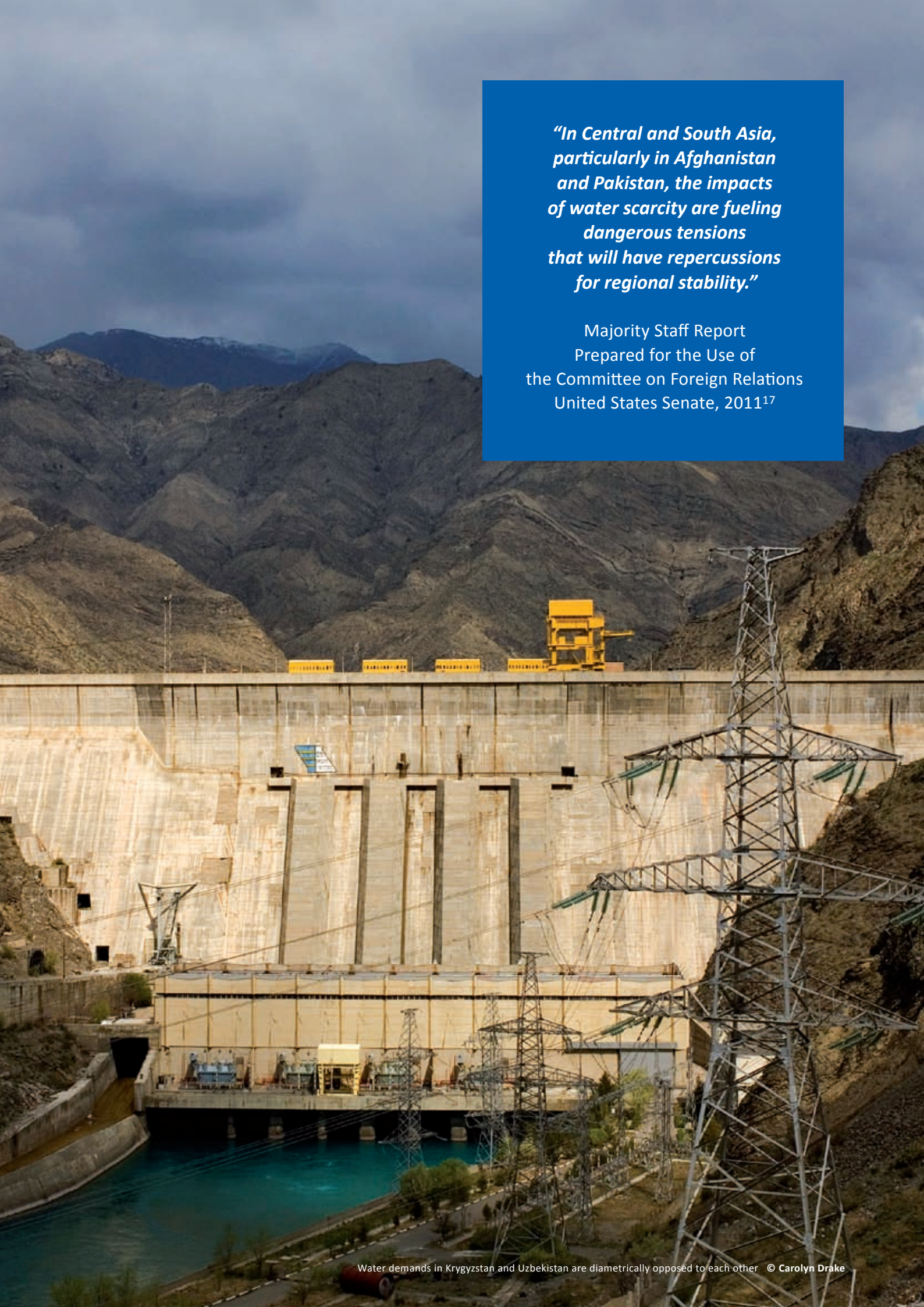
Fierce competition for water has led to disputes between Uzbekistan and Turkmenistan[78]. The Karakum Canal, the world's longest irrigation canal, diverts around a fifth of the Amu Darya's waters into Turkmenistan's vast desert every year to irrigate cotton, sometimes in breach of water sharing agreements between the two countries[79]. This is reported to have led to cross border skirmishes between Turkmen and Uzbek farmers attempting to disrupt irrigation infrastructure. Localized pockets of armed violence appear to have already occurred: once when Uzbekistan troops took control of water installations on the Turkmenistan bank of the river by force, and again in 2001 when an unknown number of Uzbek troops were reportedly gunned down in Turkmenistan[80].

Being the furthest downstream of the three countries along the Syr Darya, much of the Kazakh water supply is heavily salinated as a result of upstream mismanagement. An estimated 7.6km^3 of salt-laden water is released into the Syr Darya every year as Uzbek farmers divert spent irrigation water back into local river systems[22]. By the time the Syr Darya reaches Sharadara, (just north of the Uzbek border) its salinity ranges from 1.24 to 1.46g per litre[22]. Even further north the salt concentration rises above 1.5g per litre, a level that can affect human health[81/82]. The seriousness of the situation has led Kazakhstan to declare water as a matter of national security[83].

Kazakhstan is not the only country to discuss water insecurity in these terms; scarcity and competition has become a very real regional and international concern. President Karimov of Uzbekistan and President Berdimuhamedov of Turkmenistan both highlighted the importance of water security in their addresses at the 2010 High-Level Plenary Meeting of the United Nations General Assembly (UNGA) on the Millennium Development Goals (MDGs). President Berdimuhamedov made the pointed statement that regional water disputes must be resolved through the "norms of international law" and with the active involvement of the UN[84].

Such is the strategic importance of the region that both the EU and the US Senate have acknowledged the security threat posed by competition over water, both within the region and also to their own interests. In a joint progress report, the Council and the European Commission concluded that water management has become the most sensitive environmental issue in Central Asia, and that failure to address it could develop into "a serious security threat for the entire region in the medium term"[85]. Meanwhile a majority staff report prepared for the Committee on Foreign Relations in the US Senate, entitled 'Avoiding Water Wars', warned that "the impacts of water scarcity are fueling dangerous tensions that will have repercussions for regional stability and U.S. foreign policy objectives"[17].

The Senate report explicitly acknowledged the role that cotton had played in destabilizing the region. Assessing water scarcity issues in Central and South Asia, it observed that agriculture was the biggest single drain on water resources. Policies promoting water-intensive crops (like cotton), are considered to be ones which create water security issues. In order to stabilize the area in this particular regard, the paper advocated a strategy of improved information gathering and sharing of hydrological data and management of existing water infrastructure. Echoing the calls of President Berdimuhamedov, the paper also argued for international co-operation, where regional water management could be considered as an important type of conflict management[17].



"In Central and South Asia, particularly in Afghanistan and Pakistan, the impacts of water scarcity are fueling dangerous tensions that will have repercussions for regional stability."

Majority Staff Report
Prepared for the Use of
the Committee on Foreign Relations
United States Senate, 2011[17]

Water demands in Krygyzstan and Uzbekistan are diametrically opposed to each other **© Carolyn Drake**

The global water footprint of cotton

"The impacts of cotton production on the environment are easily visible and have different faces."

UNESCO-IHE report, 2005[7]

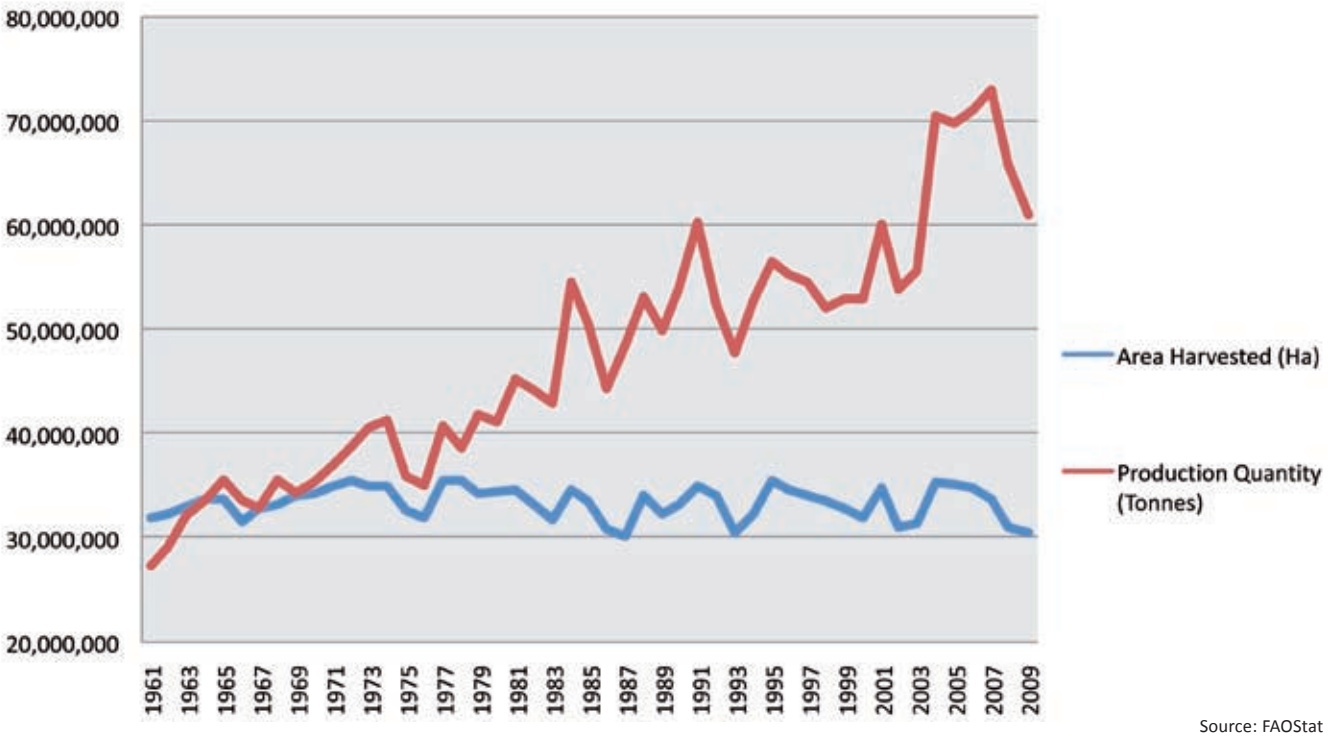
The demise of the Aral Sea represents a worst-case scenario of water management for cotton production. However, it is not the only area that has experienced serious socio-economic, political and environmental consequences as a result of unsustainable cotton production. Cotton production, both large and small scale, can be done sustainably. However, too often production coincides with existing water scarcity. Production in these cases could be considered an inappropriate use of land and water resources and could ultimately be to the detriment of an area or country even though revenue is being generated in the short-term.

Better governance and management of global freshwater resources are urgently needed. The UN Development Programme (UNDP) suggests that global water use has grown almost twice as fast as the world population in the last century and will continue to do so in the future[5]. Some 1.4 billion people now live in river basins in which water use exceeds recharge rates[5]. By 2030, nearly half of the world's population will be living in areas of high water stress[6].

Responsibility for better water management is not the sole responsibility of cotton producing countries, however. Uzbekistan's cotton industry, for example, may be inherently inefficient and exploitative, but it cannot be ignored that the final destination for most of its cotton is the EU[87]. Export demand for cotton globally has a large role to play in creating and perpetuating scarcity, through the 'embedded' water within cotton products that are traded internationally. Cotton is a thirsty crop[6]. Each year, it takes 198Gm^3 to produce the world's cotton crop, and about half of that is provided by irrigation[1]. With world cotton consumption increasing every year by an average of two percent, its water footprint is growing[87].

The global trade in cotton is worth $32 billion[86] © EJF

Global cotton production, 1961-2009



Source: FAOStat

Each year it takes 198Gm^3 to produce the world's cotton crop, 70 percent of which is produced with irrigation water © EJF

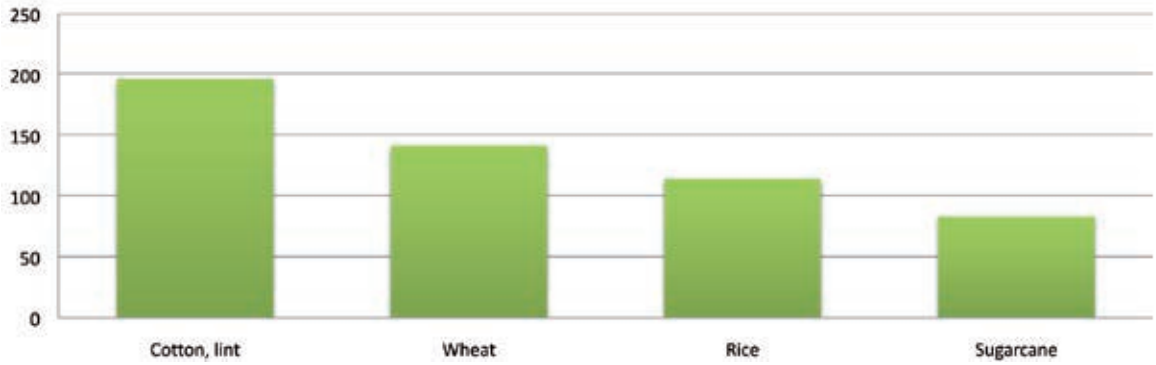
Global cotton production[86/1/3]

- More than 100 countries produce seed cotton.
- China, USA, India, Pakistan and Uzbekistan account for nearly 70 percent of the world's production.
- More than 70 percent of cotton is produced using irrigation.
- Globally, between 15-35 percent of all irrigation withdrawals are estimated to be unsustainable.
- About 44 percent of the global water use for cotton growth and processing is for commodities that are exported.
- Consumption of cotton products represents 2.6 percent of the global water footprint of consumed goods and services.

The Indus Basin, Pakistan

Cotton is one of Pakistan's most valuable agricultural products and best earning exports, directly contributing about 3.2 percent of the GDP[88/89/90]. Millions of farmers are dependent on cotton, as well as millions more people who are employed along the entire cotton value chain[90]. Its economic importance stems from the dramatic expansion in production that has occurred over recent generations; an increase of nearly 200 percent over the last thirty years[91]. These higher yields can be linked to the increase of the area under cotton crop cultivation, by the equivalent of nearly 800,000 football pitches between 2002 and 2006 alone[90]. This expansion has enabled Pakistan to rise up in the ranks of world producers, now occupying a spot as the fourth largest cotton producer in the world[92].

Percentage increase in key crop production in Pakistan btween 1979 and 2009 (tonnes)



Source: FAOStat, production statistics

It would be impossible for Pakistan to produce its cotton by relying on rainfall alone. In fact, the country's average rainfall is not enough to grow any crop of economic significance[93]. As a result, the state has built one of the largest irrigation schemes in the world in the Indus Basin – covering an area three times the size of Switzerland[94/93]. This one irrigated area generates 90 percent of all crop yields in the country[95].

Cotton grows on the Himalayan foothills during the summer growing season along with rice, sugarcane, and maize[95]. It is drought-tolerant and its water requirement is generally considered to be about the same as other crops like millet and sorghum[90]. However, the dramatic expansion of cotton production in the region has added pressure on freshwater resources already stretched by poor management and the demands of a growing population. On top of this, experts now believe that cotton's water requirement for cotton production has also increased in recent decades alongside the change in climate[90].

The Indus River Basin irrigation system is extremely inefficient. It currently uses over 90 percent of the water abstracted from the Indus River and its tributaries, however, only an estimated 30-35 percent of the water reaches crops[96]. The rest is lost as a result of groundwater seepage, evaporation and as run-off from fields[96]. Water scarcity in the river basin is now a major problem, particularly in downstream coastal and marine regions. Upstream abstractions are so great that by the time the river reaches the Kotri Barrage, which is still 200km from the Arabian Sea, river flow is insufficient to sustain the ecosystems found within these regions[97].

The river basin is a unique and diverse area of ecological importance. Almost all of the mangrove forest in Pakistan is located in the river basin, and it is home to thousands of species including the Dalmatian pelican, humpback dolphin and finless porpoise, which are all vulnerable to extinction[98]. Reduced flow into the Indus delta as a result of poor management has compromised the health of its mangrove forest, leading to a decline in biodiversity as well as significant hardship for those that depend on these ecosystems for their livelihoods[96]. In a study of 30,000 households across three Talukas (administrative divisions within a district) in the Thatta District of Sindh Province, researchers found that rising salinity as a result of reduced river flow has resulted in average annual losses of $70,000 in crop damages and $45,000 from reductions in fish catches[97]. Around 80 percent of the five million people who once earned a living from fishing have now left the area, most moving to the city of Karachi[96].

Unsustainable cotton production in Pakistan – the facts

- **Pakistan has the highest irrigated to rainfed agricultural land ratio in the world. The country's vast irrigation network includes three major storage reservoirs, 19 barrages or head works, 57,000 km of canals, and 89,000 watercourses[97].**
- **Agriculture currently uses over 90 percent of the water abstracted from the Indus River and its tributaries, but only around 30-35 percent of it reaches the intended crops[96].**
- **16 percent of Pakistan's agricultural land is covered with cotton fields. It is one of the thirstiest crops in Pakistan – using around 51,427m^3 of water a year[94].**
- **In 2008, 2,890 billion litres of water was used in Pakistan to grow the cotton needed just to make products sold by the homestore Ikea – equivalent to the volume of drinking water consumed in Sweden over 176 years[99].**
- **Reduced river flows have had devastating environmental and social impacts downstream. In a survey of 30,000 households, rising salinity as a result of reduced river flow was found to have caused annual losses of $70,000 in crop damage and $45,000 from reduction in fish catches[97].**

Encouraging good practice

There are already successful, small-scale projects that demonstrate the huge water savings that can be made through good practice. The 'Better Management Practices (BMPs) for Water Thirsty Crops' Project, funded by the European Commission and developed by WWF Pakistan, has trained almost 2,500 cotton farmers in T. T. Singh, Muzafar Garh and Rahim Yar Khan and Nawabshah and Sanghar in Pakistan to reduce their use of fertilizers, pesticides and irrigation water. These practices were used to cultivate nearly 46km^2 of land, producing 342,472 mounds of BMP cottonseed during the project period. In four years, cotton farmers who integrated these practices into their work reduced their average water use by 38 percent and pesticide use by 47 percent compared to farmers using conventional practices[96].

A confluence of the Indus River

"There is little space for resolving the conflict between agriculture water demand and ecological water demand in the [Yellow River] basin, if the current practices of water use continue. Strong tradeoffs exist between irrigation water use and ecological water use and the tradeoffs will become more intensive in future years with population growth, urbanization and industrial development, and food demand increases."

Ximing Cai and Mark Rosegrant in the Journal of Water Resources Research[100]

Cotton production in China

An irrigation pump in China © FAO

China is the world's top producer of many agricultural products including rice, wheat, oilseed and cotton[101]. Historically agriculture has always been the biggest single drain on water resources, and it still accounts for about 70 percent of national usage[102/103]. Despite being home to some of the largest river systems in the world, China is actually a water-poor country. Freshwater resources are not distributed equally in the country, for example Southern China has six times the available water of the North[102]. Because of this scarcity, tensions have developed where limited resources are required to meet the needs of industry, urban uses, agricultural production and the environment[103]. With year-on-year increases in urban water consumption[104], alongside the need to feed and provide livelihoods to a rapidly growing population, water scarcity is creating a significant national pressure point.

Cotton is one of China's most important cash crops. It accounts for about four percent of the total crop planting area and three percent of the total agriculture output[105]. Grown across the country, the major producing areas are the Yangtze River Basin, the Yellow River Basin, and the Northwest (predominantly in Xinjiang). These three areas account for 98 percent of the country's total production, and 24, 40 and 34 percent of total production respectively[106]. In Xinjiang alone there are seven million farmers engaged in cotton production, and cotton provides livelihoods for more than half of the rural population[105].

Unsustainable cotton production in China – the facts

- **Cotton is one of the most water-demanding crops in China. It uses more water than soybeans, despite the fact that the area under soybean cultivation is considerably larger[94].**
- **75 percent of the total annual cotton crop water requirement (around 10 billion m^3) in China is met by irrigation[102/1].**
- **Xinjiang produces the largest share of national cotton production (22 percent)[1]. Almost all surface water resources in Xinjiang (in the northwest) have been utilised, and nearly 85 percent of water flowing through the smaller rivers in the region is being diverted for irrigation each year[106].**
- **In Hebei, the sixth most important cotton producing region, the rate of groundwater extraction has already surpassed the rate of replacement[1/106].**
- **Excessive water withdrawals and falling watertables have already caused land subsidence in rural counties of Hebei such as Henshui, Ren, and Quzhou[107].**
- **Competition for water is going to increase as China's urban population continues to grow rapidly. Urban uses of water in the Yellow River basin, for example, increased by 245 percent between 1980 and 1993[104].**

Much of China's cotton growing area is not actually suited to intense production. Although the Yangtze River and Yellow River regions generally maintain a stable water supply they can experience severe and prolonged floods and droughts. The Xinjiang region (where a large proportion of cotton is grown) suffers significant water stress with seasonal drought, flooding and water shortages[106/105]. Country wide, annual cotton yields require around 10 billion cubic metres of irrigation water to grow[1]. This is a high water requirement. Cotton uses more water in total than soybeans, for example, despite the fact that the area under soybean cultivation is considerably larger[94]. Meeting the water needs for this kind of production, and also stabilising the water supply, requires exploitation of both surface and groundwater supplies as well as good water management. However, it is clear that present rates of extraction in China are not sustainable and that the infrastructure is not equipped to support current agricultural methods.

Almost all surface water resources in Xinjiang (in the northwest) have been utilised, and nearly 85 percent of water flowing through the smaller rivers in the region is being diverted for irrigation each year. In the Yellow River Basin, where water is provided predominantly by groundwater supplies, provinces such as Hebei have reached exploitation rates near to or even surpassing the rate of replacement, and as a result the watertables are falling. This makes it harder to extract water and also has serious adverse effects on the environment[106].

Similar to Uzbekistan, much water is wasted in the crumbling architecture of China's irrigation system. Most of it was originally built in 1950s and 1960s to low standards and has received minimal investment in maintenance or renovation since then. Experts estimate that 10 percent of irrigation projects fail to function and 60 percent are damaged to some degree. Between 1999 and 2008, twenty reservoirs collapsed because of defects or other quality problems, and today more than 40 percent of all reservoirs in China are considered dangerous[106].

"A frenzy of dam building and land clearing has turned the Condamine-Balonne river system into a slave to cotton."

Amanda Hodge, Journalist[108]

Cotton in the Murray-Darling Basin, Australia

The Condamine-Balonne river system Credit: Mattinbgn

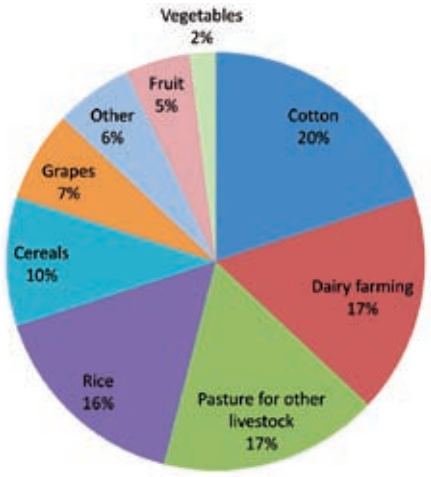
The Murray-Darling Basin is one of the most intensively farmed areas in Australia. Two million people, including more than 40,000 primarily dryland farmers, live within it and more than 80 percent of its total land area is farmed[109]. It is a region that has been dramatically altered by agriculture, and is one facing the challenges of water scarcity and degradation as a result. It serves as an important reminder that unsustainable agricultural practices can affect any country, developing or not.

There is huge climatic variability across the basin and some very water intensive crops are grown in the Murray-Darling Basin, generating a heavy demand for an irrigation system that can stabilize the supply year round. To meet this demand, the national government has constructed a series of dams, canals and pipelines enabling more than 80 percent of the volume of water in the basin to be diverted to water annual crops such as cotton, rice and perennials like vines and fruit trees[109].

Between 2005 and 2006, 7,720 GL of water was used for agricultural production in the basin, and the largest single share of this was consumed by cotton. In fact, between 2000 and 2006, cotton consistently ranked as the crop with the highest water usage. At its peak, water consumption for cotton was more than the total water used for dairy farming and the rice crop combined. Over time, cotton production has become more intense, so while the area under cultivation has seen a significant decline in recent years, the decline in yields has been far smaller[109].

Unsustainable cotton production in Australia – the facts

- **Australia is the world's fifth largest exporter of cotton lint, producing more than 300,000 million tonnes a year almost all of which is grown in one place – the Murray-Darling Basin (MDB)[114/115/109].**
- **In 2005-06, 7,720 GL of water was used for agricultural production in the MDB[109].**
- **Cotton has consistently been the crop with the highest water consumption in the MDB in recent years[109].**
- **Current water extraction in the MDB, which is mainly for irrigation, is unsustainable. Like the Yellow River in China, these two large rivers are now little more than small streams at their mouth[6].**
- **The impact of reduced flows on the environment has been significant. More than 50 percent of ecosystems in the basin are threatened[116].**
- **Around 90 percent of floodplain wetlands in the MDB have been lost due to altered river flows[116].**
- **Extractions have unbalanced fragile ecosystems in the basin. In the summer of 1991[2], an algal bloom emerged that extended along more than 1,000 km of the Darling River[117].**



Proportion of total agricultural water consumption in the Murray-Darling Basin

Source: Australian Bureau of Statistics, 2008

Six state governments officially co-govern water in the basin and this arrangement has worked adequately in the past[110]. However, over the last decade, environmental changes indicate that better governance is urgently needed. There has been rising salinity and water-logging in irrigation areas. Vegetation clearance has caused long-term salinity impacts in dryland areas. Wetland areas have experienced severe declines in health, size and biodiversity. Within the rivers there are now unhealthily high levels of nutrients and suspended sediments, as well as significantly reduced river flow[111/112].

Historically, states have fought over water in the Murray-Darling Basin, and transboundary agreements were intended to prevent conflict in the future by ensuring sustainable and equitable use. In practice, however, water scarcity continues to bring different stakeholders into competition. Indigenous groups in particular have voiced their concerns about the state of the environment and the lack of participation in decision-making on water management in the basin[113]. Stresses already apparent will be exacerbated by the impacts of climate change. Better governance is needed if water supply is to meet both the agricultural and ecological water requirements.

Conclusions

Water mismanagement has had profound social and environmental impacts both within Uzbekistan and in the wider Aral region. Surrounding marshlands, lakes and the country's Tugai forests have declined. There has been a tangible impact on biodiversity, and in turn this has reduced fisheries productivity so severely that most commercial fisheries in the region have collapsed. More widely, the diametrically opposed needs and demands of Central Asian countries for water have been recognized as a potential threat to regional stability.

Although unique in terms of the severity of its consequences, unsustainable cotton production is not confined to Uzbekistan, as demonstrated through case studies from India, China and Australia. These highlight the pressing need for all national governments to assess their domestic water consumption and, for many, to take action to ensure a more sustainable approach to water management. Many water sources are shared between countries, underlying the central importance of regional collaboration on management. There are examples of good agricultural practices, where cotton can be produced sustainably, and governments and the international community should support and encourage these.

This report sets out how the price that consumers pay for cotton products may not reflect the true costs of their production. Consumers must pick their cotton carefully. By doing so, consumers can help reduce their own water footprint whilst ensuring that they do not contribute to severe environmental degradation and loss of livelihood and poverty for some of the world's most vulnerable people.

An irrigation channel runs dry © EJF

Recommendations

The Government of Uzbekistan should

Undertake an immediate assessment of irrigation and drainage infrastructure with a view to ending the mismanagement of national water resources.

Reduce the inefficiencies in water use by repairing and replacing irrigation systems within a given time period, using a proportion of profits derived from the cotton sector.

Undertake systemic reform of cotton production, including revocation of production quotas.

Swift moves towards greater liberalisation and market reforms should be encouraged that promote more efficient use of water resources and encourage the growing of less water-intensive crops.

All Central Asian Governments should

Reform national agricultural and energy policies, and regional agreements on water to incorporate the environmental, economic and social benefits of restoring the Aral Sea.

Strengthen regional institutions concerned with water management by participating fully and meeting funding obligations. Support their efforts to develop basin-wide water management schemes that will alleviate the worst consequences of the Aral Sea crisis and reduce conflict. Improve water management and ease tensions over water supply by revising these institution's agreements on transboundary water and energy sharing to ensure they are equitable.

Prioritise reducing water demand in the cotton industry through agricultural policy reform and investment in irrigation infrastructure to reduce water scarcity, rather than increasing supply.

International Financial Institutions should

International Financial Institutions (IFIs), including the World Bank, Asian Development Bank and European Bank for Reconstruction and Development, with projects in Uzbekistan and the Aral Sea Basin, must ensure their funds do not support cotton production to the detriment of the Aral Sea. Conditions and incentives that support better water management should be devised and structured within all frameworks for rural development project funding, and benchmarks must be established to measure progress.

In addition to technical measures that address water saving in Uzbekistan, IFIs should promote lasting policy reforms that tackle the systemic problems in agricultural policy that cause water mismanagement.

Prevent conflict caused by uncertainty over water resources by supporting an Aral Sea Basin-wide assessment of water flows. This will also act as a baseline for greater cooperation over water use by providing accurate information on the impact of upstream dams and downstream agricultural withdrawals.

National Governments and the International Community should

Recognise that excessive water withdrawals to irrigate cotton have the potential to cause water scarcity, and therefore contribute to conflict over water resources in Central Asia and worldwide.

Undertake an immediate assessment of irrigation and drainage infrastructure within their own borders with a view to ending the mismanagement of national water resources.

Exert leverage on the Uzbek Government to take fundamental and immediate steps toward the economic liberalisation of cotton production, including the end to production quotas, and incentives for reduced and more efficient water use.

Refrain from using Uzbek cotton in their government supply chains (e.g. uniforms) until a time when cotton production in Uzbekistan no longer relies on the systematic infringement of human rights and mismanagement of water resources.

Support and encourage good agricultural practices, including organic production, that can reduce impacts on both water quantity and quality.

Consumers should

Reduce their overall consumption of cotton products.

Pick Your Cotton Carefully: consumers should be particularly aware of the unique and devastating consequences of cotton production, the damage it has caused to the Aral Sea, and the potential for it to contribute to conflict over water resources.

Demand labels on cotton clothing that show the country of origin for the cotton fibre, to enable informed buying choices regarding water intensive products such as cotton.

Raise their concerns with retailers, ask what their policy is on water use in cotton, and ask that they refrain from using Uzbek cotton in their products until the mismanagement of national water resources and the use of forced labour are halted.

Buy products with environmental accreditations, ensuring their consumer choices support production that is less water intensive. Particularly, consumers should seek to support sustainable cotton production in rainfed areas and buy products that have not been made with harmful chemicals that can leach into freshwater supplies.

Retailers and Cotton Traders should

Reject the use of Uzbek cotton. Companies should also make public their support for positive action and convey their disquiet and concern regarding water mismanagement directly to the Uzbek Government.

Implement a transparent supply chain for the cotton they buy and sell that will enable the identification of the country of origin for cotton products. They should ensure that suppliers at all levels of the supply chain commit to not using Uzbek cotton.

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