

**"Water, water everywhere, not any drop to drink," laments the sailor in Samuel Coleridge's Rime of the Ancient Mariner.**

### **Growing Water Demand**

Is the world running out of water? With rise in population and demands on the world's water expanding, and as the argument runs, the future points to a "gloomy arithmetic" of shortage.

Water stress is reflected in ecological stress. River systems that no longer reach the sea, shrinking lakes and sinking groundwater tables are among the most noticeable symptoms of water overuse. The decline of river systems from the Colorado River in the United States to the Yellow River in China is a highly visible product of overuse. Less visible, but no less detrimental to human development is rapid depletion of groundwater in South Asia. In parts of India groundwater tables are falling by more than 1 meter a year, jeopardizing future agricultural production.

### **Population**

Water use has been growing much faster than population for at least a century and that trend is continuing. Over the past hundred years population quadrupled, while water use grew by a factor of seven. As the world got wealthier, it also became thirstier. This can be seen in the table on the right. But looking to the future, it is clear that the pattern of demand for water will continue to change, which also leads us to a question how will the world quench the thirst of another 2.4 billion adding to the present population of over 6 billion people by 2050 from a water resource base that is already under acute stress?

With many of the most water-stressed countries experiencing very high population growth rates, per capita availability is shrinking fast. By 2025 more than 3 billion people could be living in water-stressed countries and 14 countries will slip from water stress to water scarcity.

Changing water patterns in Sector with increasing population In 1900 industry used an estimated 6% of the world's water. It now uses four times that share. Over the same period municipalities' share of water tripled, to 9%.

Irrigated agriculture will remain the largest user of water it currently accounts for more than 80% of use in developing countries.

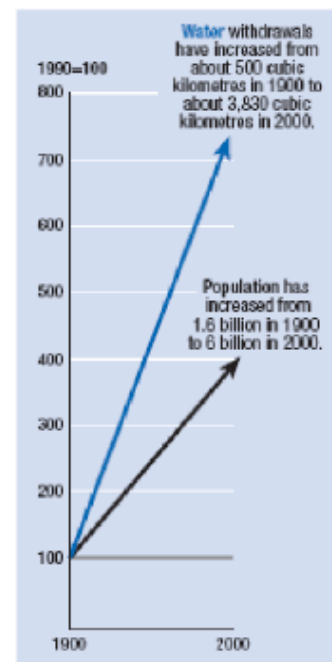
Looking to the future, it is clear that the pattern of demand for water will continue to change. As urbanization and the growth of manufacturing continue to gather pace, demand for water from industry and municipalities will continue to grow. At the same time population and income growth will boost demand for irrigation water to meet food production requirements.

The human pressure on fresh water supply is not only limited to increased water withdrawals. Increased human activities also destroy water. The quality of groundwater in industrialized countries has deteriorated due to nitrogen leaching from over-intensive agriculture. The state of affairs in developing countries is even more pressing. Close to 75% of all industrial waste and 90-95% of sewage in the developing world is discharged into surface waters without any treatment.

### **Stressed fresh water Supply**

Up to 40% of the world's population lives in water scarce regions. Scarcity of fresh water seen both in terms of rising demands or water depletion and pollution is a critical problem.

Steep increase in population, consumption, and the desire for better living has placed a greater strain on the security of fresh water supply. It is estimated that water use for human purposes has multiplied six-fold in the past 100 years. These projections translate into doubling of global water consumption every 20 years, more than twice the rate of human population growth.



Hydrologists typically assess scarcity by looking at the population-water equation. As noted, the convention is to treat 1,700 cubic meters per person as the national threshold for meeting water requirements for agriculture, industry, energy and the environment.

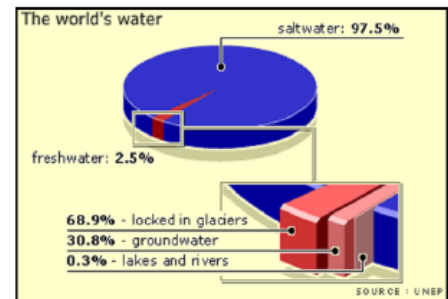
Availability below 1,000 cubic meters is held to represent a state of "water scarcity"-and below 500 cubic meters, "absolute scarcity".

**Reservoir of Water**

One of the largest concerns around the world today is Depletion of freshwater. Although water is one of the most common resources on the planet, only 2.5% of it can actually be consumed, and the rest is salt water. Of that 2.5%, two-thirds is confined to glaciers and permanent snow cover. Only a fraction of the world's water is liquid freshwater, and it is increasingly the subject of conflict and strife as it becomes less available with increasing population.

**Availability of fresh water**

Unlike oil or coal, water is an infinitely renewable resource. In a natural cycle rainwater falls from the clouds, returns to the salty sea through freshwater rivers, and evaporates back to the clouds. The cycle explains why there will always be water, but supply is finite. Planet Earth's hydrological system pumps and transfers about 44,000 cubic kilometers of water to the land each year, equivalent to 6,900 cubic metres for everyone on the planet. A large part of this flow is accounted for by uncontrollable floodwaters, or water too remote for effective human use. Even so, the world has far more water than the 1,700 cubic metres per person minimum threshold that hydrologists by convention treat as the amount needed to grow food, support industries and maintain the environment.



At one level the world's water is like the world's wealth. Globally, there is more than enough to go round but the problem is that some countries get a lot more than others. Almost a quarter of the world's supply of fresh water is in Lake Baikal in sparsely populated Siberia. Differences in availability across and within regions further highlight the distribution problem. With 31% of global freshwater resources, Latin America has 12 times more water per person than South Asia. Some places, such as Brazil and Canada, get far more water than they can use; others, such as countries in the Middle East, get much less than they need.

Today, about 700 million people in 43 countries live below the water-stress threshold. With average annual availability of about 1,200 cubic metres per person the Middle East is the world's most water-stressed region; only Iraq, Iran, Lebanon and Turkey are above the threshold. Palestinians, especially in Gaza, experience some of the world's most acute water scarcity about 320 cubic metres per person. Sub-Saharan Africa has the largest number of water-stressed countries of any region. Almost a quarter of Sub-Saharan Africa's population lives in a water-stressed country today and that share is rising. With many of the most water-stressed countries experiencing very high population growth rates, per capita availability is shrinking fast.

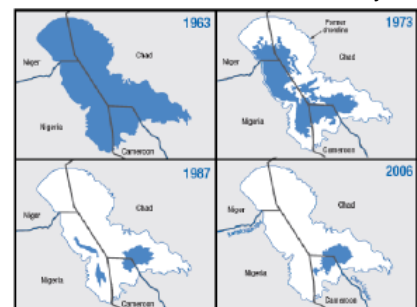
In some areas, water withdrawals are so high, relative to supply that surface water supplies are literally shrinking and groundwater reserves are being depleted faster than they can be replenished by precipitation. This can translate into increased costs of water supply for economic activities and for daily human needs.

**Shrinking Lakes, Drying Rivers**

Mismanagement of international water basins threatens water security in some very direct ways. Shrinking lakes and drying rivers affect livelihoods in agriculture and fisheries, deteriorating water quality has harmful consequences for health, and unpredictable disruptions in water flows can exacerbate the effects of droughts and floods.

**Lake Chad**

The lake is one-tenth the size it was 40 years ago. Failed rains and

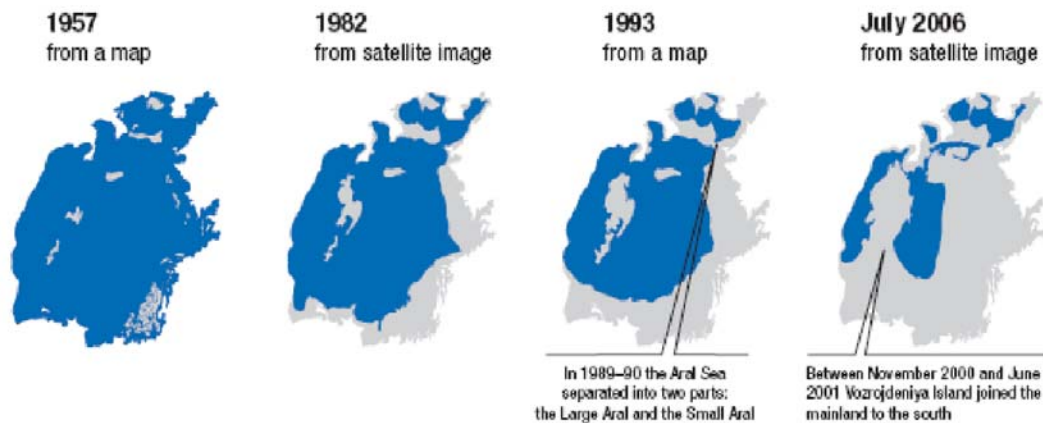


drought have been major factors but so has human agency. Between 1966 and 1975, when the lake shrank by a third, low rainfall was almost entirely to blame. But between 1983 and 1994 irrigation demands quadrupled, rapidly depleting an already shrinking resource and setting in train rapid losses of water. Weak cooperation among the Lake Chad basin countries offers part of the explanation. Environmental decline and the erosion of livelihoods and productive potential have gone hand in hand. Over fishing is now institutionalized, with scant regard to rules meant to regulate use among Chad, Cameroon, Niger and Nigeria. Badly planned irrigation projects have also contributed to the crisis.

The environmental consequences of unsustainable water use can eventually feed back to disrupt infrastructure investments.

**Diverting Rivers from Aral Sea**

Half a century ago technological ingenuity, ideological zeal and political ambition persuaded Soviet planners that the Syr Darya and the Amu Darya, the great rivers of Central Asia, were being wasted. These rivers were carrying the snowmelt from high mountains into the closed basin of the Aral Sea, then the world's fourth largest lake. Diverting the water into production was seen as a route to greater wealth, with the loss of the Aral Sea a small price to pay. As one contemporary authority put it: "The drying up of the Aral Sea is far more advantageous than preserving it, Cultivation of cotton alone will pay for the existing Aral Sea [and] the disappearance of the Sea will not affect the region's landscape.



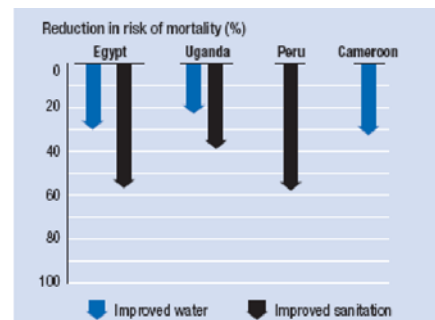
The diversion of water to support cotton through an inefficient irrigation system strangled the Aral Sea.

Lake Chad and the Aral Sea illustrate in an extreme way what happens when water flows are radically changed. In both cases water shortages have been a central part of the problem. However, water scarcity has been engineered literally in the Aral Sea through human intervention and diversion, highlighting the role of policies in fostering unsustainable water use patterns.

**Water War  
Water for Life**

The crisis here is about the widespread violation of the basic human right to water. That violation results in nearly 2m avoidable child deaths, huge gender inequalities and losses in wealth creation. Unclean water is trapping millions of the world's poorest people in cycles of deprivation.

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**Water for Livelihood**

Chronic water stress poses a huge threat to human development. That threat is visible in the collapse of ecological systems, intensifying competition for water, and crossborder tensions.

**Climate change**

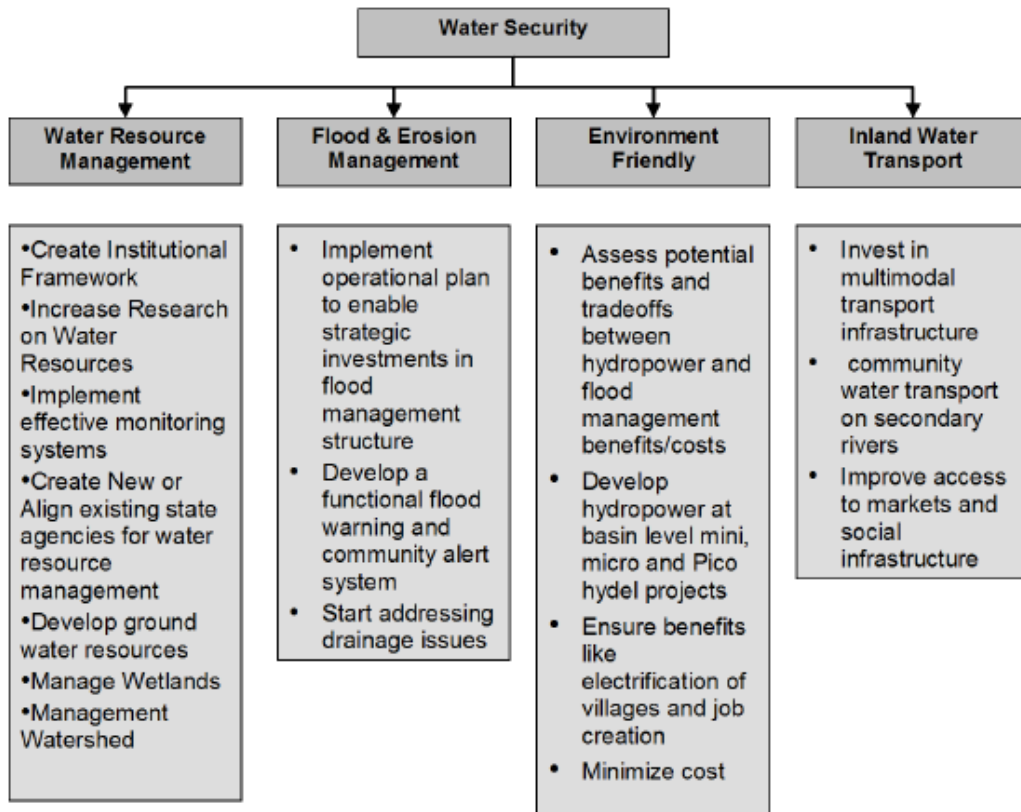
and Water Security Global warming may already be with us, but the much greater warming forecast for the 21<sup>st</sup> century will produce vast changes in evaporation and precipitation, allied to a more unpredictable hydrological cycle. Higher air temperatures will increase evaporation from the world's oceans, intensifying the water cycle. They will also mean faster evaporation of water from land, so that less rainfall reaches rivers. These changes will be accompanied by new rainfall patterns and more extreme weather events, including floods and droughts.

In many parts of the world glaciers act as water banks. They store ice and snow in the winter and release it slowly as temperatures rise, sending flows of water down to agricultural producers in lowland areas. Today, these banks are melting at an accelerating rate. And as glaciers retreat, water stocks are being depleted on a large scale. Rising sea levels will be among the most powerful determinants of water security for a large share of the world's population in the 21st century. Increased salinization could dramatically reduce freshwater availability for many countries, while coastal flooding threatens millions of livelihoods.

**Water Management the Naturenomics™ way...**

**Water Security**

The main idea is to create a framework that will allow us to securities water regions where it is in abundance and create optimal use that will benefit the regions economy. There is significant potential for renewable natural resources to generate benefits at the regional and local levels. However, these resources alone, without enabling institutional frameworks and an integrated vision, will not bring development. An initial effort has to be made to develop such an integrated view and to show how the different sectors are linked to each other, and also how the macro and micro levels are connected.



*NaturalGist*

- Growing Demand of water:** How will the world feed another 2.4 billion adding to the present population of over 6 billion people by 2050 from a water resource base that is already under acute stress?
- Population:** Water use has been growing much faster than population for at least a century and that trend is continuing. Over the past hundred years population quadrupled, while water use grew by a factor of seven. By 2025 more than 3 billion people could be living in water-stressed countries and 14 countries will slip from water stress to water scarcity.
- Availability of Freshwater:** Although water is one of the most common resources on the planet, only 2.5% of it is freshwater and of that also 2.5% can be used as the rest is locked in the form of ice gaps. Only a fraction of the world's water is liquid freshwater, and it is increasingly the subject of conflict and strife as it becomes less available.
- Inequitable water distribution:** At one level the world's water is like the world's wealth. Globally, there is more than enough to go round but the problem is that some countries get a lot more than others. For example almost a quarter of the world's supply of fresh water is in Lake Baikal in sparsely populated Siberia. Differences in availability across and within regions further highlight the distribution problem.
- Water Security:** A Water Security framework which will lead to Water Resource Management, Flood & Erosion Management, hydropower projects, in a Naturenomic way