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Could our future be a thirsty one?

Our planet is a magnificent blue planet with its size, the tilt of its axis, its position in the solar system, the speed at which it travels and the parameters of its orbit in relation to the sun, constituting the exact conditions that make life on its surface possible.

For without these essential preconditions, Earth would be like freezing Mars with its violent storms of red dust or hellish Venus with its massive greenhouse scorching – an inhospitable planet devoid of oceans, oxygen or life.

It was Earth's distance from the sun that first allowed liquid water, an essential prerequisite of all life on this planet, to form.

Not near enough for solar heat to sear away cloud formation or too far away for clouds not to form at all, Earth, third planet from the sun, was positioned ideally for a surface temperature that allowed water vapour to condense and clouds to grow, falling as rain onto the hot, primitive land surfaces of the young Earth.

Much of this primeval rain vapourised on contact with the hot crust but eventually the land surfaces cooled sufficiently for streams and then seas to form. Earth's gravitational force, a result of its size, allowed it to retain this liquid water.

A tiny fraction

Today, three-quarters of the planet's surface is covered by water, however most of it is held in deep ocean basins with only 3% of the Earth's water being fresh.

Of this tiny fraction, almost 70% is frozen in glaciers, permanent snow cover, ice and permafrost with the Antarctic and Greenland ice sheets having the bulk of it, while 30% is found in the hidden caverns of underground aquifers such as the Ogallala aquifer in North America which stretches from Texas to South Dakota, providing an estimated third of all US irrigation water.

This leaves less than 1% of the world's fresh-water reserves available for the combined usage of people, animals, birds and plants.

Lakes and rivers together contain a little over one-quarter of all fresh water on the planet with lakes holding 20 times more freshwater than all the rivers combined.

Although the Great Lakes of Africa's Great Rift Valley, Lake Malawi, Lake Tanganyika and Lake Victoria are three of the largest lakes in the world, Lake Baikal, which is situated in a remote region of southeastern Siberia, holds one-fifth of the planet's fresh surface water, an amount approximately equivalent to the combined volume of all five of the North American Great Lakes making it the largest (23 600km³), deepest (1 637m) and oldest (25 million years) reservoir of freshwater on Earth.

Super rivers

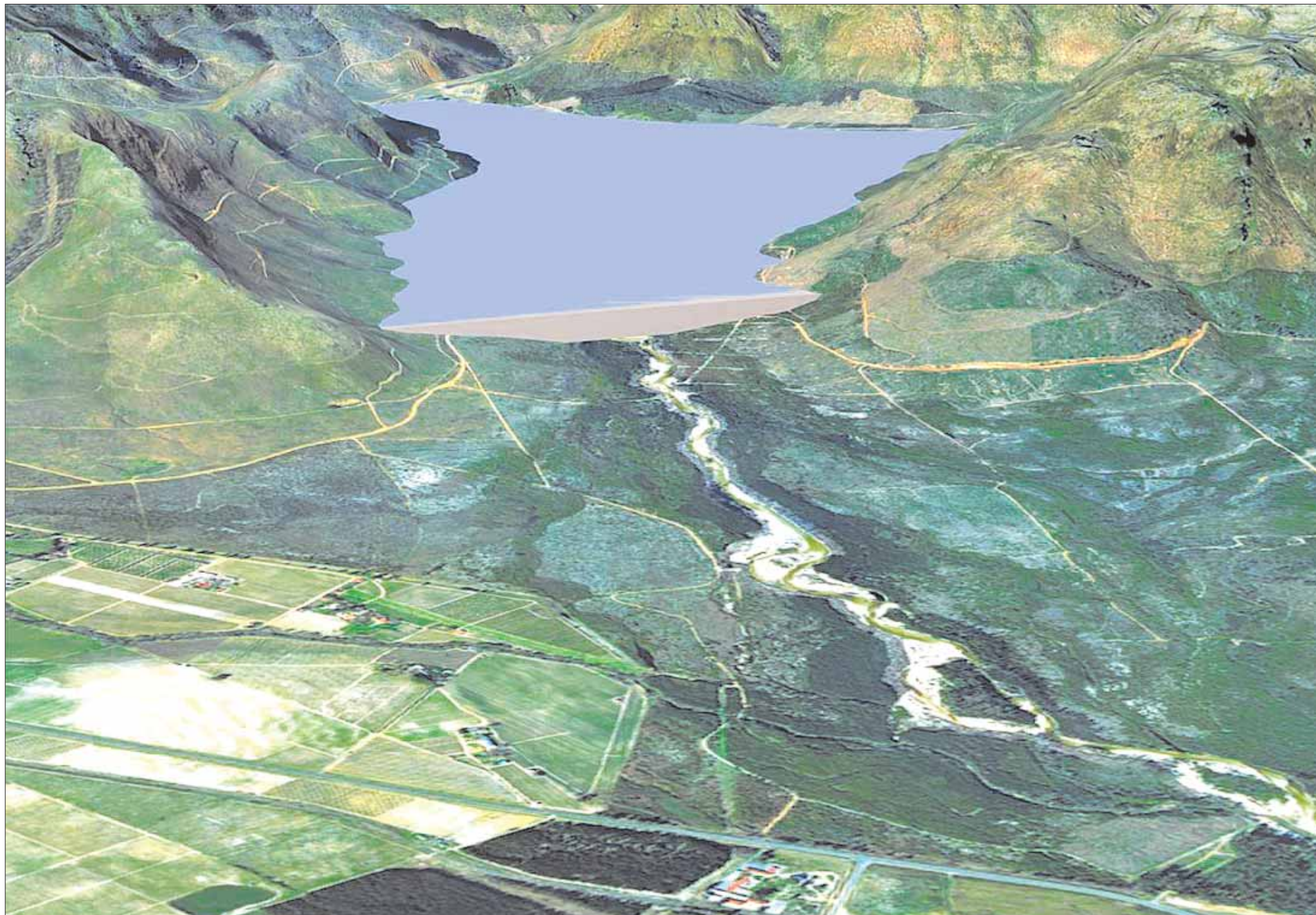
Driven by gravity, rivers are the most erosive forces on the planet, capable of wearing down mountains and carrying them to the sea.

Twenty percent of the world's fresh river water runs through the Amazon, Earth's super river, and its waters transport more than a billion tons of sediment each year.

The Amazon's waters also hold 3 000 described fish species, more than are found in the whole of the Atlantic Ocean.

Freshwater is one of the life-saving services that nature provides, making rivers a vitally important part of the water cycle, and, with climate change models predicting declines in the flows of major rivers around the world, resulting in the disconnection of the services they provide, free flowing, healthy rivers will become even more valued resources in the future than they are today, especially as many countries are moving towards the hydrological edge.

Water is one of the most critical resources to be affected by the world's changing climate



ECOLOGICALLY ADVANCED: An artist's impression of the Berg River Dam. Like electricity, access to water is a major factor in social and economic development.

PICTURE SUPPLIED BY DWAF

Climate change and world rainfall

There is only one way that the planet's freshwater reserves can be replenished and that is through rainfall. It has been calculated that the Earth's water may have been through the water cycle over a million times since the oceans first formed.

This recycling of water is a recurrent theme in both nature and the densely populated urban centres that characterise our modern world for rainfall is not distributed evenly over the planet's surface.

Africa's Sahel region, a broad swathe of sub-Saharan savannah that stretches across the northern part of the continent from the Atlantic Ocean in the west to the Red Sea in the east, has not seen rain for more than four decades and it is believed that this arid area has gone from a drought to a change in climate that could tip the region into a perpetual rainfall deficit.

It was once thought that the cause of this rapid shift to a drier climate was land desertification brought about by the over-use and over-grazing of pastoral land, which destroyed much of the region's vegetal cover, changing the albedo of the area.

However, scientific studies have revealed that rising sea-surface temperatures in the Indian Ocean, the most rapidly warming ocean on Earth, have resulted from an accumulation of greenhouse gases that have weakened the conditions that generate the Sahelian monsoon, causing the climate shift.

Despite the fact that in some parts of the world rainfall is increasing, and it has been estimated that for every degree of



FOOD FOR THOUGHT: It takes 2 000 litres of water to grow enough food for one person for one day.

warming we create, our planet will experience an average 1% increase in rainfall, the dramatic climate shift experienced by the Sahel region could be emblematic of the situation faced by the world as a whole as climate systems are interconnected over great distances and long time scales.

And, as carbon-induced climate change becomes amplified through powerful positive feedback loops that cause water volumes stored in glaciers and snow cover to decline, and droughts of greater intensity and longer duration to increase, water is, and will continue to be, one of the most critical resources to be affected by the world's changing climate.

Scarcity and conflict around the world

As increasing global temperatures alter the world's water cycles, with too much rain appearing in some places and too little or none at all in others, no continent is immune from the effects of water scarcity.

And, as water tables fall, underground aquifers are pumped dry, lakes and dams dwindle and wetlands disappear, the social, political, economic and ecological impacts of water scarcity are becoming destabilising factors in many parts of the globe, with trans-boundary water issues threatening regional stability.

On the North American continent,

the American southwest is experiencing the driest conditions for more than 700 years, which is affecting many farmers in the Texan High Plains.

The largest seawater desalination plant in Europe has been built along Spain's Mediterranean coast to provide water for its parched southeastern region after a public outcry prevented the River Ebro from being diverted.

Israel's main reservoir, the Sea of Galilee, has experienced such a drop in water level that there are fears it could become salinated.

As Israel supplies water to the West Bank and Jordan, tensions have become heightened by the lake's falling water line, forcing Israel to buy water from

Turkey to help ease the crisis.

Israel is no stranger to conflict over water as the Six Day War of June 1967 was sparked when the Israelis attacked diversion works in Syria that would have significantly reduced their water supply.

Africa's Lake Chad, once a huge lake straddling the borders of Chad, Cameroon, Niger and Nigeria, provides water for 20 million people in the region. It has shrunk by 95% since the mid 1960s prompting fears it could disappear in the 21st Century.

Rights to the remaining water has caused strained relations between the countries that border the lake, with violence breaking out between the farmers, herders and fishermen who rely on the lake for their livelihoods.

The world's longest river, the Nile River, which stretches from East Africa to the Mediterranean, shares its watercourse with 10 nations and all 10 riparian states have been involved in negotiations over development of the basin.

Despite the talks, securing access and usage rights to the Nile has been a contentious process.

In the past, Cairo has said it would be ready to use force to protect its access to the Nile, which has sustained Egyptian civilisation since ancient times.

The Aral Sea of Central Asia, once the world's fourth biggest lake, has been shrinking since the 1960s as the rivers that feed it, the Amu Darya and the Syr Darya, were diverted by the Soviet Union for irrigating cotton.

Today the volume of this saline lake has decreased by 75% and there is a nearly fivefold increase in salinity that has killed most of its animals and plants.

The region surrounding the lake now

has one of the highest infant mortality rates in the world, and with toxic chemicals blowing off the dried seabed anaemia and cancers are common.

Australia's southwestern region has experienced an average 15% decrease in rainfall. While climate models indicate that about half the decline results from global warming which has pushed the temperate weather zone southward, Australian climatologists think that the other half results from destruction of the ozone layer, which has altered stratospheric cooling and drawn the southern rainfall zone even further southwards.

By the middle of this century, with many countries having significantly enlarged their water footprints due to increases in population, industrial development, energy generation and agricultural consumption, at best two billion people in 48 countries, and at worst, seven billion people in 60 countries could face water scarcity.

Unless there is social and political mobilisation towards equitable sharing of diminishing water supplies, tensions at national, regional and international levels could intensify, making this a century of water wars.

More important than oil

Water has been called "blue gold". It has also been described as a liquid more important than oil and this is especially so if we compare past consumption rates with future needs.

While the world's population tripled in the 20th Century, the use of renewable water resources grew six-fold.

Within the next 50 years, despite a slowing down of birth rates, the world population is estimated to increase by 40% to 50%, skyrocketing from 6.6 billion people today to an estimated 9.4 billion people.

This population growth, coupled with widespread industrialisation and urbanisation, will result in an increasing and unsustainable demand for water that could result in a global water crisis "that lies at the heart of our survival and that of our planet Earth" as warned by the United Nations Educational, Scientific and Cultural Organization's (Unesco's) Director-General Koichiro Matsuura.

Water stress results when there is an imbalance between water use and water reserves, with an inverse ratio between what is withdrawn against what is available in terms of total renewable resources. It is characterised by a person having less than 1 700m³ of water yearly, with water scarcity being set at less than 1 000m³ a person yearly.

Physical scarcity occurs when water resources cannot meet the demands of a population, whereas with economic scarcity, although water resources could be abundant relative to water use, there is a lack of infrastructure and unequal distribution of water.

Water shortages, therefore, may be a combination of ecological, institutional and socio-political factors.

Like electricity, access to water is a major factor in social and economic development. There are large disparities in terms of consumption between countries, between urban and rural dwellers, between population groups and between the affluent and the poor, with usage varying widely between US citizens who consume on average 578 litres of water a person daily at the top end of the spectrum and people in Africa who use on average just 47 litres per person per day.

As this implies, the greater the access to water, the greater the consumption, as when people spend a large proportion of their day fetching and carrying water they tend to be extremely conservative with its use.

Water is also both a poverty and gender issue. In many societies it is traditionally the female members of a household who collect water, which in the case of young girls, means that there is little or no time for schooling.

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We took electricity for granted. Let's avoid the same with water.

It is predicted, in the next 20 years, the quantity of water available to everyone will decrease by 30%. Save our future. Save water.