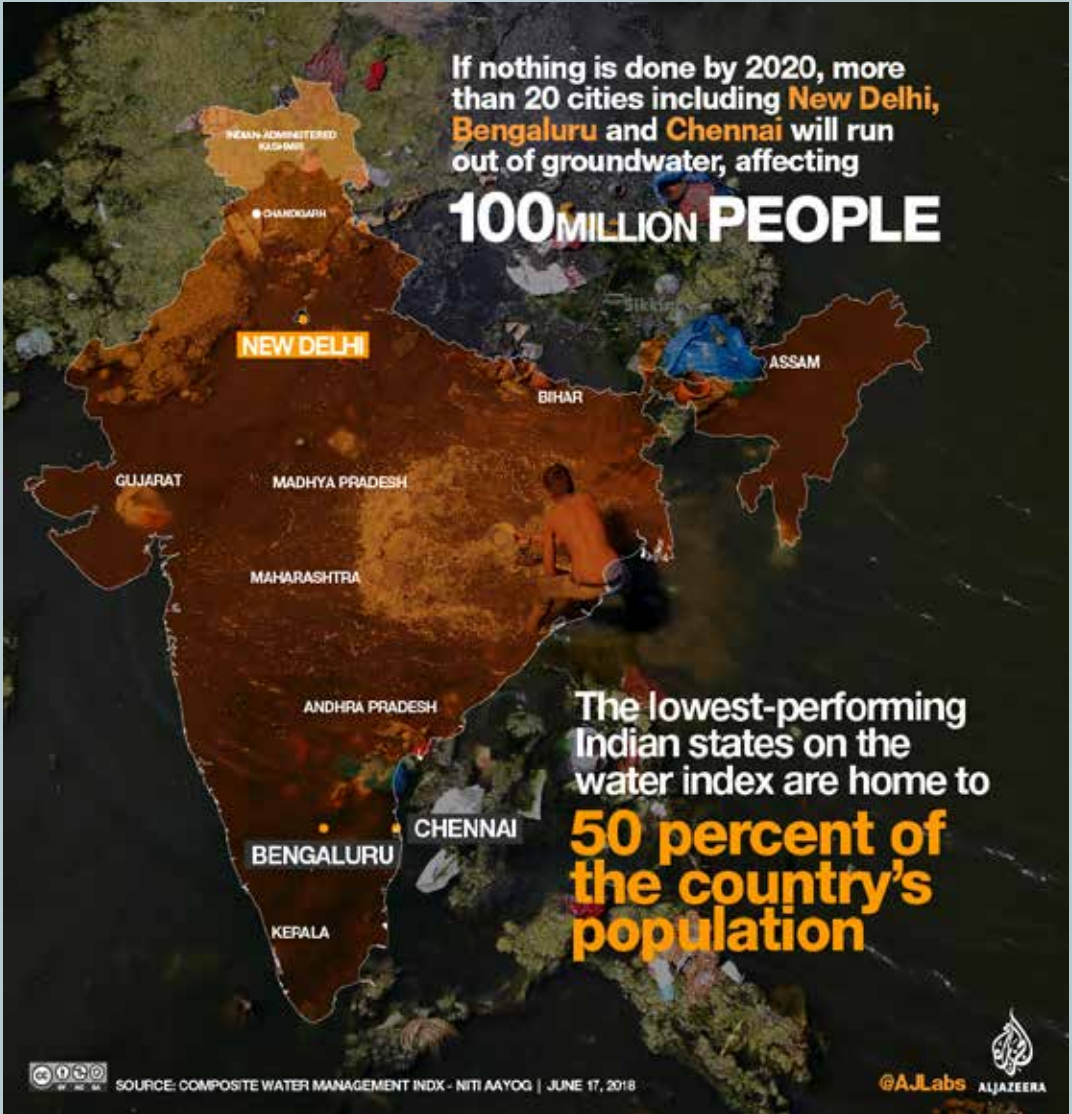


Water Resource Management-

Water Crisis and its Underlying issues



a Global Problem



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This paper reviews a range of the underlying issues and trends emerging globally adversely affecting our water resources and supply mechanisms. Finally in summary the paper introduces a few solutions that will potentially aid positive water resource management. First let's review the statistics. We should all recognise that fast expanding Cities need a sustainable supply of usable water. However with global water resources remaining constant but its access, quality and its management deteriorating, water is mankind's nemesis. Put into context, it is established that 97.5% of all water on Earth is salt water, leaving only 2.5% as fresh water of which less than 1% (approximately 0.007% of all water on earth) is accessible for direct human uses.

Agriculture across Asia extracts nearly 80% of its' accessible fresh water for irrigation. Industry continues to dump, disproportionately polluting the vast potential water resources, desperately needed to sustain our cities. We must listen to the indicators, warnings and alarms.

“By the year 2030 the World Economic Forum calculates that there will be a 40% deficit in the available fresh water “ [3]. UNHABITAT have stated in 2016 that within the next 30 years, the present urban footprint will double from what we have achieved in the last 10,000 years. In 30 years! That's an incredulous rate of growth. However this was warned ten years previously [5].

We have witnessed Cities virtually running out of water already in the last two years, in South Africa and this year Chennai [6]. Recent reports even suggest that India with 1.3 billion people, will have almost zero access to drinking water by the year 2040; and even sooner in 2020-21 cities across India will have exhausted their ground water reserves. [1][7] As recognised in a report from South Africa News24 recently, this suggests not only a lack of water but equally a 'governance crisis' where institutions have failed to build resilience and adapt to changing conditions [20].

India faces 'worst-ever' water crisis: report by Zeenat Saberin 2018 [21]. Consequently this is no longer just a National Problem, but a GLOBAL problem. Why? Because if a country literally runs out of water, it will naturally look towards the next easiest source of water, such as neighbouring countries. This could happen by nego-

tiation; but lets assume their water supplies are ebbing away too, then we have the prospect of conflict, if not instigated by the administration, then by the desperate people; first seen as mass migration, next as pure anarchy as communities literally fight for survival.

Equally smaller communities are also realising that they can hold the greater majority of the population to ransom by accessing and restricting supplies as was recently experienced in New Delhi in 2016 by a sector being disgruntle with Government policy, thus they forcibly closed the inlet gates to the Munak Canal, one of Delhi's main water sources, over a weekend, causing seven water treatment stations to shut down [15].

The fact remains that Humans require water daily. On average a human can survive only three days without any moisture before there is irreversible damage to their internal organs, often leading to terminal illness during the following few years. Five days of zero moisture and you can guarantee for the majority of the population it means death[2].

The primary purpose of this article is to highlight some key disturbing adverse trends affecting us all globally, from shortages to politics, to commercialism to emerging 'climate apartheid' demonstrating that our present course of political, economic and educational strategy for use of water has been wrong; where country States create restrictive legislation for the use of rain water in favour of utility companies' commercial rights.

Millions of people within cities are presently denied access to free water as identified by a WIN report in 2016[16], enabling the emergence of water mafias. New cities continue being built with no long term water sustainability. Older cities water supply dissipates through antiquated infrastructure and archaic agricultural irrigation practices thus reducing the potential supply by up to 80%. There is no single causation, although mismanagement through ignorance is a key issue; equally there is no silver bullet solution, but we could start by a more coordinated approach. Let's review some of the potential critical causations along with adverse trends being witnessed in recent years.

Causation one: Reservoirs globally are drying up, primarily because their capacity cannot



meet the increasing need of water supply to satisfy cities potable water usage, often initially used for hydroelectric to power our cities and then enroute siphoned to irrigate our farms that feed our cities. In order to develop a Resilient Cities strategy, we must look to where water derives from and understand how we need to build a Resilient Water Resource Management policy to support those managing the catchment and distribution of water from within the rural communities.

Basically we are using beyond the capacity of our present centralised resources, which do not have the ability to replenish fast enough. Originally the reservoirs catchment capacity sustained the supply to maintain levels matching demand even throughout the dry seasons. Now catchment zones have either been decimated by human initiated environmental change with deforestation, urban development encroachment or agricultural diversification or simply the reservoir no longer has the capacity to meet its originally designed demand [7].

Causation two: climate change is altering our traditional precipitation rates and the zones in which rain has traditionally fallen[7], thus our present catchment zones and their reservoirs are becoming naturally obsolete, being no longer in right place or capable of sustaining the required capacity.

In order to build resilience, we need to adapt. Does this mean we build more large reservoirs in different locations or somehow expand the catchment zones? Large reservoirs are vulnerable and as seen from research in Thailand create

indefinite challenges and disruption, seemingly solving one component but creating many more [13].

Maybe we need think outside of the traditional box by considering a multitude of alternatives, from controllable rain enhancement technologies to encouraging the creation of smaller community managed storage at a capacity to suit their sustainable local needs, ensuring independence and resilience. Unclear policy along with confusing legal and institutional frameworks governing basin areas, makes it difficult to effectively implement 'basin management', as discussed in a research document deriving from Thailand [14].

The continuity and consistency of message and best practice is essential when creating regional strategies. Often communities themselves generate simple solutions if empowered and allowed some autonomy.

With the value and importance of water increasing annually, large reservoirs simply are unsustainable to be our only source of water. They are vulnerable for a variety of reasons including; water security, easily contaminated through mistake, neglect, conflict and terrorism. The dams remain potential targets, where a large proportion of a resource is accumulated behind one manmade structure. Equally if one sector of society causes a dominant extraction, other sectors become deprived with limited alternatives for supplementing their needs, having been reliant upon a centralised supply.

But even with its reservoirs, as quoted within





a World Bank report in 2009 “India can still store only relatively small quantities of its fickle rainfall. Whereas arid rich countries (such as the United States and Australia) have built over 5,000 cubic meters of water storage per capita, and China can store about 1,000 cubic meters per capita, India’s dams can store only 200 cubic meters per person. Moreover, India can store only about 30 days of rainfall, compared to 90 days in major river basins in arid areas of developed countries”[27].

Because of the reliance upon these mega storage structures, when waters dwindle to 40% capacity and less, replenishment requires not only ‘above average’ supply to replenish to sustainable supply levels, but additional continuous supply due to increased depletion rates to serve the growing population and increased industrial and agricultural water demand during the dry season when sectors requirement for water increases, in a Catch 22 scenario.

Causation three: non regulated ad hoc ground water extraction. The land is similar to a sponge. It requires hydration. This is fed from both the sky in the form of rain onto the land and into rivers, plus from the subsurface aquifers absorbed upwards. Consequently if the rains alter in pattern, then the land relies more upon its water table and deeper aquifers. But with the unregulated extraction through bore wells to meet the ever growing demand of intensive farming and potable water for growing populations and industrialisation during economic growth, ground water is being contaminated and the aquifers themselves are becoming depleted and

in fact as quoted in one example, 21 Cities with in India expect to have depleted their aquifers by 2020 next year![1].

It is a spiralling vortex of mismanagement cascading to disaster, beyond anything we have experience within any other type of natural disaster, drought now emerging within green pasture and forested lands, normally only experienced within semi-arid and desert environments. And when this happens within the back yard of our mushrooming cities, water depletion will certainly be our nemesis.

Causation four: mismanagement and greed and corrupt political manipulation by corporates, monopolies and tycoons is an even greater threat than depletion by exhaustive use. Examples are surfacing globally, where either antiquated historical rights or present manipulative lawyers are subdividing plentiful waters away from traditional smaller land owners, isolating them from the resource that they rely upon, literally drying them out of their lands.

A prime example is California’s complicated and often unjust 100-year-old fight over water rights. Where “The state’s laws were designed to settle the frontier, and under the “first in time, first in right” rule, the most “senior” water claims are the last to be restricted in times of drought.

This means some farmers are still able to flood their fields to grow cattle feed, even as residents of towns such as Okieville and East Porterville have to truck in water and shower using buck-

ets”. [19] The California Water Boards explain the modern interpretation in an article on their present website [18]. However the subject of water is often used as apolitical scaremonger football with exaggerations of intended legislation, such as in California spawning from their five year drought, explained in an article written by Bill McCarthy June 7th, 2018 aptly titled “Is it illegal to shower and do laundry on the same day in California?” [17].

Causation Five: Water as a resource cannot be offered for free in today’s society, where everything has a value to corporates and state administrations. It bares a cost to service and to supply. And for corporates it is a component source of their endless generation of profits and dividends needs for shareholders. We are now seeing commercialism wake up to the fact that water is the new gold, which the rich will afford and poor will become slaves to those with water.

In a report by Philip Alston, a UN special reporter, it suggests that the likely hood of ‘Climate Apartheid’ is already on the horizon. ‘Climate apartheid’ to push 120 million into poverty by 2030, UN says... as extreme weather events such as droughts, floods and hurricanes become more frequent, the world’s poorest people will be forced to “choose between starvation and migration,” the report warned. “We risk a ‘climate apartheid’ scenario where the wealthy pay to escape overheating, hunger and conflict while the rest of the world is left to suffer.” Philip Alston concluded on extreme poverty and human rights “the difference between how climate change affects the wealthy and the poor is already apparent” [4].

Causation six: A significant failure has been not to recognise the need to manage flood waters as a positive commodity. Allowing billions of gallons of water to simply wash through our communities

and agriculture into river basins and out to sea, often leaving isolated lakes of unusable brackish water. Our cities and especially new urban developments still rely upon storm water disposal into the rivers, which often cause flooding further down stream amongst the farms and villages.

We must learn to harvest this flood water, store, treat and retain for irrigation, alleviating demand upon potable water supplies..

Causation seven: Commercial agendas to gain control of ‘God water’. Whilst some weakly suggest that because of the their commercial agendas, that the age old harvesting of rain water from a building roof now retains contaminants and therefore ought be controlled; others counter this argument by suggesting that initiating green roof policies help enhance and filter rain waters [10]. Water butts and rain harvesting has been the traditional method for a community and household garden sustainability. However commercial agendas present counter policy to manipulate legislation which leads onto the most disturbing control of water trend globally.

It is recognised that three days of absolute zero access to water brings a population to its knees, 8 days guarantees mass human extermination. Whole sectors of society potentially being purposefully held to ransom via withdrawal of water, contamination of water and disturbingly...legislature, where already we potentially see the fledgling practices of creating legislature to support restriction or even banning and fining people for using rainwater run offs, as some call it in California ‘God water’.

Legislature being developed and coerced into existence, which could be perceived by many, as initiated by individuals or bodies with hidden agendas for gaining control of our water [11]. It is agreed that Utility companies globally have



Vast volumes of water are waste during flood run offs.....
Some will reach aquifers...
Most flows out to sea



Mae Chang reservoir, Northern Thailand, March 2016



Photo by Srin Swaminathan, Chembarambakkam reservoir 2018

needed to reassess their control of surface and precipitation water, especially where they are deemed responsible to supply quality and sufficient water, but Governments are now having to review control of water access as humanitarians, as society struggles to maintain access to a sustainable supply of water[12].

In addition to the California scenario, every country experiences the Soft Drinks Industries, simply sucking dry the ground water and aquifers with their unquenchable thirst of water to sustain our desire for cold fizzy drinks. Communities across Asia, in fact globally have witnessed significant water resource depletion when these industries establish or expand. Accusations in India are widespread [22].

Water is the new oil and access to it is the kingpin for mega corporations or indeed individuals wishing to exert influence over government and communities as per a case in California [19]. This pattern is not new but now it seems to be becoming an increased trend within every nation. This trend which will not reverse itself by a few placards outside city hall. It needs a comprehensive central government policy change and indeed in the long term a UN directorate, if we are to avoid water wars Armageddon.

Causation eight: Political manipulation of water supplies. Some governments try using water as a political tool within sectors of urban communities by refusing to extend designed supply infrastructure in the hope of dissuading emerging slums [16]; this backfires and simply encourages the water mafias to take control as highlighted by Aman Sethi in 2015[23].

“At the Mercy of the Water Mafia. Pumping wells in the dark of night, criminal bosses rule the liquid economy in one of the world’s busiest cities. Can anyone stop them?”; The same mafias that purportedly already supply drugs and illicit materials to some sectors, now realise that all sectors need water. A golden handshake to organised crime, funding potential terrorism and anarchical propaganda. Water is in fact the guaranteed WMD, if manipulated in a clandestine manner.

Causation nine: Apathy and Complacency within the wealthy Arid Regions and within communities of previous plentiful water supply. They are being too slow to appreciate potable water being sacrosanct for the purpose to supply to kitchen and wash faucets and critical industries. In many communities their original water storage lakes and ponds have been forgotten,



Illicit supplies during day time to the marginalized
Photographs by Sanjit Das



At night a man fills a tanker while another drills a borehole at an illegal water-filling point in Delhi



Stench, vermin from sewage-filled lakes rile Kukatpally residents

Officials remain indifferent as Pragati Nagar Lake, Amber Cheruvu are filled with garbage and filth.[24]

neglected or filled in, communities more recently relying upon the now failing centralised dams and decaying distribution and supply infrastructure.

Treated sewerage effluent [TSE] is now becoming predominantly used for irrigation which remains essential not only to maintain the aesthetics of the city but for their combating desertification, land degradation and agricultural production of produce. But it has health risks if treatment standards are not maintained. It is not free water.

City and national heads openly declare that they need meet that UNHABITAT prediction of doubling their urban footprint if they are to sustain economic growth. This directly conflicts with what we witness within present water resource supply and management capabilities. This alone suggests strife and conflict ahead.

Causation ten: Heavy reliance upon inefficient technologies coupled with the lack of infrastructure investment. In recent decades we have witnessed heavy reliance upon desalination and Reverse Osmosis as the only options to convert sea water and treat brackish or contaminated waters, but because of up to 50% of intake is discharged as with excessive mineral residual, it is raising coastline sea temperatures, bleaching the local sea bed ecologies and traditional fishing grounds. It's causing a vicious demise

of resources and importantly the coastal environment. Reverse osmosis systems are equally destructive of the ground water and aquifer reserves, where similarly RO plants dump up to 50% residual waters containing extreme levels of extracted minerals as salt and other contaminants, which contribute to agricultural productivity demise.

However, even with desalination and RO systems within our developed well established cities, water sustainability is dramatically failing, where they are literally running out of sufficient access to water, for many of the previously discussed reasons but also because their failing infrastructure is outdated, so even if they can increase supply, the existing pipes, storage and treatment can not cope with processing and distributing the extra capacity, witnessed within America [25] to Europe [26] to India [28].

A significant contributor to waste is agriculture, with up to 40% of irrigation water failing to reach the plant, within cities it is estimated that between 20 and 40% of water is lost due to leaks through antiquated supply pipes. The lack of investment has been disastrous globally. Apathy at its worst.

You see a pothole and demand it to be fixed for comfort of travel. When we see a puddle from a subsurface leak pipe, we ignore it, yet that's our lifeblood wasting away, leaking 24/7 potentially





A worker rummages through plastic waste filling a “river” in the Taimur Nagar district of New Delhi, on June 12, 2018. The waste will be washed away by rains and eventually reach the Indian Ocean through the Ganges River. (Mainichi)

losing millions of valuable litres of treated water, creating sinkholes and danger to motorists and surrounding properties, before it is fixed.

Causation Eleven: Disrespect for water. Resilient Cities require Resilient Water Resource Management and as yet we really don’t understand water. Its been abused. We are good at joining pipes, sometimes, at engineering mechanical infrastructure to satisfy human needs, most of the time, but we still have little understanding of what the actual water needs in order for it to present its self as usable. That has been our fundamental mistake, taking water for granted.

This approach to understand water is critical if we are to maximize this dwindling life resource. Disposal of waste, especially plastics into water courses has increased dramatically in recent years. Many streams and tributaries blocked with debris or in fact flowing wall to wall with discarded plastic. Water needs respect after all its the lifeline to mankind’s sustainability.

To conclude on a few positive initiatives. There is a glimmer of hope in the medium long term for water sustainability. Multiple initiatives are being developed globally, with some new ideas and some common sense initiatives taking control of their national water resources. It needs a combination of efforts.

There remains one in-exhaustive reservoir of purified distilled water; enough to satisfy global needs and certainly capable to supplement our ground water supplies and rains for centuries. More water than four months of all the land mass run offs, which instantly replenishes itself, purifying the water during its process. And this is no longer concept but operational.

The breakthrough is efficient Atmospheric water extraction[29].

Purified evaporation into our atmosphere of which we all breath. Even water from the saline oceans evaporates into purified distilled drinking water. And water from the most contaminated surface waters purify in the evaporation process. Potentially this can in fact replace local Reverse Osmosis plants and long term replace Desalination systems, using the same source of water, the sea, without creating the 50% residual discharge of extreme contaminated water. Another positive initiative is in the Gulf Regions[31], where the UAE are now taking the difficult decision to ban new subsurface extraction and in some regions not renew licence or force closure of existing bore wells, having once relied upon plentiful aquifer water supplies. They now pipe water 150kms across the deserts from neighbouring emirates or indeed from their neighbouring country Oman. The deep aquifers are deemed now as a sacrosanct supply and storage for times of dire need. Restrictions are also being implemented to control supply of the previously plentiful TSE [treated sewerage effluent] to irrigation programs.

This is an indication of concern, as they continue infrastructure construction across the desert, for planned future urban development to maintain much desired economic growth; all of which will require not only potable water supplies to homes but also 365 daily irrigation for amenity tree and soft landscape planting. Thus it’s a difficult decision to protect aquifers, as in the short term, until efficiencies are found elsewhere, water supply will remain limited. But long term, by protecting the aquifers the nations realise that they will maintain independence and a secure backstop during any potential crisis.

China pioneers the coastline ‘sponge city’[9] This is another positive initiative for water sustainability addressing the retention of coastline

storm waters by cities affected by typhoons with excessive rains and simultaneous storm surges. “In the case of China, the sponge strategy requires that 80% of all urban land is capable of absorbing or reusing 70% of storm water. The goal is to repurpose and retrofit cities – including public spaces, schools and residential areas – so that they can absorb more water during floods as opposed to creating excessive run offs. Candidate cities are investing in permeable pavement, artificial ponds and wetlands and rain gardens that store excess rainfall in underground storage tanks and tunnels. Water is only discharged into rivers after rains or surges have receded”.

But there is no reason that this mechanism can not be used for inland cities in conserving and retaining flood waters in storage and controlled ground hydration for future irrigation, recycling and grey water needs, reducing demand upon existing potable water extraction.

The treatment of brackish water [30] is another recent development by converting it from worthless unusable water to beneficial irrigation water, by a simple low cost inline process of magnetisation, converting the molecular structure of the salts to an absorbable state, transporting the much needed minerals beneficially throughout the plant. Brackish water has been a growing blight upon agriculture for decades, generated by farmers extracting high mineral bore well and river waters allowing the salt minerals to build a saline residue within the soil to such an extent that the land becomes totally contaminated and encrusted, consequently becoming non productive. Millions of hectares globally have been affected already and this increases dramatically annually. This could now be reversed.

In summary, this paper with its goal to avoid water conflict, water mafias emerging and wa-

ter monopolies holding communities to ransom, recommends that we must review global and national strategies targeting the development of water resource management if we are to curtail human disaster, which consequences are potentially far beyond the wildest nightmares of present administrations.

The DRR Disaster Risk Reduction sector must embrace ‘water resource management’ within its scope, prioritising and embracing key element assessments within its indicator strategies to prevent emerging crisis and disaster.

Critical action plans need include:

- Establishment of a National water resource strategy
- Reviewing every component of water resource cycles
- Creating interstate collaborations and contingency plans
- Establishing a new approach strategy to Catchment and storage
- From direct rain fall
- From consequential flooding
- Review of Agricultural irrigation methodologies
- Reducing their present 80% of fresh water consumption
- Create an action plan to counter agriculture contamination
- Create an action plan to counter industry contamination
- Improve strategies for water treatment and recycling
- Review new technologies and scientific approaches to generate water

Water crisis must not be reviewed as just a local or regional periodic adverse phenomenon such as drought and flood, or as a siloed component addressed only by humanitarian donor WASH strategy, but be respected as an imminent and evolving global transborder catastrophe, re-



alising that “there is not enough to go around now for our ever increasing population needs”. UNICEF water strategy for children through their WASH programme applaudably targets the front line issues as a donor [8], but each Government needs a stand alone Department for their holistic water strategy, outside of the standard, often privatised, Utilities Services, with a Minister of Water and full proactive Secretariat. Each State needs its own Water Commission to initiate assessments, risk management, continuity and recovery strategies, protecting water from Political and Commercial manipulation whilst simultaneously seeking and engaging best practices.

The UN must embrace water within an autonomous proactive Secretariat functioning 365 creating more than just its UN advisory Water Agency; it, observing and investigating trends and emerging flash-points where tolerated thresholds are broken. Water should not be siloed off into non transparent political agenda committees or delegated to within unaccountable single agenda humanitarian Agencies. The UN with an independent Water Secretariat, as it does for Food and Health, would monitor, coordinate international response and advise regulation and governance, identifying best practice for Sovereign states to consider embracing within their national strategies.

Water access is a fundamental right for all life. However due to mal practice, mismanagement, commercialism and political agenda, water is emerging as and remains our nemesis.

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