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Water Scarcity and the Right to Safe Drinking Water: A Critical Review

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Abstract
Water is the base of human life. We need it every day for drinking, cooking, cleaning, farming, and health. The Earth looks like a "water planet", but most of that water is salty and cannot be used directly. Only a small part is fresh, and an even smaller part is easy to reach in rivers, lakes, and shallow groundwater. At the same time, many people still do not have safe drinking water at home. Global reports show that billions of people are still without safely managed drinking-water services. "Safely managed" does not mean "some water somewhere"; it means water from an improved source that is on the premises, available when needed, and free from faecal and priority chemical contamination .
So, water scarcity is not only about "not enough water." It is also about not enough safe water. In many places, water becomes unusable because it is polluted or contaminated. Two important chemical contaminants are fluoride and arsenic, which can naturally enter groundwater depending on local geology. When they are above safe limits, they can cause serious long-term health problems such as dental and skeletal fluorosis (fluoride) and skin lesions and cancers (arsenic) . In India, government replies and reports show that many districts have reported groundwater contamination by fluoride and arsenic in different pockets.
Another reason for scarcity is unorganized and wasteful water use. Groundwater is heavily used for agriculture, and in many areas irrigation is still done using "flood" or surface methods that lose a lot of water compared to more efficient methods like drip and sprinkler systems . Climate change, fast urban growth, industrial pollution, weak sewage treatment, and low rainwater harvesting also reduce the amount of safe water available . This paper critically reviews these causes and then examines the right to safe drinking water under international law and the Indian constitutional and judicial framework, and finally highlights key gaps between legal recognition and real delivery of safe water to all.
Keywords- *Water Scarcity, Safe Drinking Water, Right to Water, Groundwater Contamination, Fluoride and Arsenic, Climate Change and Water Security, Constitutional and Human Rights Law*

I. Introduction

1.1 Why water matters

Water is not optional for humans. A person can live weeks without food, but only a few days without drinking water. Water also protects health in a larger sense: it supports hygiene, sanitation, safe food preparation, and disease prevention. When water is unsafe, people suffer twice: first because they lack enough water, and second because the water they do get can make them sick.

In law and public policy, drinking water is not just a service like electricity or internet. Safe drinking water is closely tied to life, dignity, and health. That is why many international bodies treat safe drinking water as a human right and not only as a development goal[1].

1.2 If Earth has so much water, why do people face scarcity?

A basic scientific fact explains the paradox. Earth has a lot of water, but most of it is in oceans (salty). Only a small percentage is freshwater, and much of that freshwater is locked in ice, glaciers, or deep underground. The portion that is easily available in rivers, lakes, and accessible groundwater is limited[2]. This means that human societies must manage a *finite and unevenly distributed* supply.

Also, people do not need "any water." They need safe water. Global monitoring shows that billions of people still lack safely managed drinking-water services. The World Health Organization (WHO) explains that

[1] UN-Water, "Human Rights to Water and Sanitation", available at: https://www.unwater.org/water-facts/human-rights-water-and-sanitation (Visited on 16 December 2025).
[2] United States Geological Survey (USGS), "Water Distribution on Earth / How Much Water Is There on Earth?" (USGS Water Science School), available at: https://www.usgs.gov/special-topics/water-science-school (Visited on 16 December 2025).

safely managed drinking-water means an improved source that is on premises, available when needed, and free from faecal and priority chemical contamination . Even if a region has water in a technical sense, it can still face scarcity if the water is polluted, too expensive, or too far away to access.

1.3 What is "water scarcity"?

Water scarcity happens when people cannot reliably obtain enough water of acceptable quality to meet basic needs. UN-Water notes that water can be scarce for different reasons: demand may exceed supply, infrastructure may be inadequate, or institutions may fail to balance needs fairly . This is important because it shows scarcity is not only a natural problem. It is also a governance problem.

Research also shows that scarcity can be seasonal. A major scientific study estimated that billions of people live under severe water scarcity for at least one month each year . Climate change can make these seasonal shortages worse by increasing drought risk in some places and causing more extreme rainfall and floods in others .

1.4 Water scarcity in India: examples from cities

India has faced repeated warnings about a major water crisis. A well-known government report (NITI Aayog's Composite Water Management Index) warned that India's water demand could exceed supply significantly in the coming years and also noted that 21 major cities were expected to run out of groundwater by 2020, based on estimates of replenishment and extraction (with certain limits in the method noted by the government) . The point is not that every city literally became waterless on a single day. The point is that many cities have reached dangerous levels of groundwater stress and have faced "near day-zero" situations.

Real events support the seriousness of these warnings:

- **Chennai (Tamil Nadu)** experienced a major crisis in 2019 when its main reservoirs went extremely low and the city depended heavily on water tankers and emergency arrangements .
- **Shimla (Himachal Pradesh)** faced serious shortage and public disruption during its crisis (widely reported around 2018), showing that even hill cities can face extreme scarcity when demand rises and supply systems fail .
- **Delhi** regularly faces severe summer stress, conflict over river water sharing, and shortages that push people to depend on tankers; news reports have described acute shortages during heat periods .

These examples show a simple truth: modern cities can "run out" of *reliable safe supply* even when water exists somewhere in the wider region. Scarcity becomes visible as empty taps, long queues, higher prices, and public conflict.

Causes for Water Scarcity

Water scarcity has many causes that work together. A city may face shortage because rainfall is low, because groundwater is over-pumped, because the river is polluted, because pipes leak, or because management is weak. In India and globally, the major causes can be explained clearly as follows.

1.5 (a) Scarcity due to contamination by fluoride and arsenic (quality-driven scarcity)

(i) Why contamination creates "scarcity" even when water exists

If water is unsafe, it is not truly available for drinking. A village may have a handpump, but if the groundwater is contaminated with arsenic or fluoride above safe limits, that water is not safe for daily drinking. People then must search for other sources, buy water, or risk disease. In this way, contamination reduces the *usable* supply, creating scarcity.

WHO also tracks "safely managed drinking-water" partly by whether the water is free from *priority chemical contamination*, including arsenic and fluoride[3]. So, quality is built into the global definition of safe access.

(ii) Fluoride contamination

Fluoride in small amounts can help protect teeth, but too much fluoride over a long time can cause dental fluorosis (damage to tooth enamel) and skeletal fluorosis (bone and joint damage) . These harms matter because they reduce health, working capacity, and quality of life. Fluorosis is often slow and long-term, which means poor communities may not notice the danger until damage becomes serious.

India has reported fluoride contamination in many areas. Government replies and monitoring note the presence of fluoride in groundwater in several districts and states in "pockets" (meaning not everywhere, but in significant local zones) . If a community depends on groundwater and has no alternative treated supply, fluoride becomes a direct barrier to the right to safe drinking water.

[3] World Health Organization (WHO), "Drinking-water" (Fact Sheet, 13 September 2023), available at: https://www.who.int/news-room/fact-sheets/detail/drinking-water (Visited on 16 December 2025).

Safe limits matter. India's drinking-water standard (BIS IS 10500) sets limits for many chemicals, including fluoride and arsenic . When groundwater crosses these limits, treatment or alternative supply becomes necessary.

(iii) Arsenic contamination

Arsenic is a toxic chemical that can enter groundwater naturally. WHO states that long-term exposure to arsenic in drinking water can cause skin lesions and is linked with cancers and other serious health impacts . This is not a small risk; it is a major public health issue in many regions where groundwater is the main drinking source.

In India, arsenic contamination has been reported in multiple districts and states, again often described as occurring in specific pockets . When a community has only arsenic-contaminated groundwater, the practical result is "scarcity of safe water." People may travel far to find safe sources or may drink unsafe water due to lack of options.

(iv) "Death and disease" (health burden) from contaminated water

The outline mentions death and disease. It is important to speak carefully here. Not every contaminated-water problem has a clear death count, but the **disease burden** is well documented. WHO explains serious long-term effects from arsenic and fluoride exposure . These illnesses are preventable if safe water is delivered consistently. So, contamination is not just a scientific issue; it is also a rights issue.

(v) Why this is also a governance problem

Because fluoride and arsenic can be natural, the solution is often not simply "stop pollution." The solution is monitoring, treatment, safe piped supply, and source planning. This requires government capacity. When monitoring is weak, people may not even know their water is unsafe. That is why quality-based scarcity is closely linked to the right to safe drinking water, not only the right to "some water."

1.6 (b) Non-availability of water

Quality is one side. Quantity is the other. Quantity scarcity occurs when the available renewable supply is low or when extraction exceeds recharge. In India, heavy reliance on groundwater creates risk because groundwater can be pumped faster than it refills.

The NITI Aayog Composite Water Management Index raised strong warnings: it discussed severe water stress, risks to millions, and the possibility of demand far exceeding supply[4]. A government reply also repeated the report's warning that 21 major cities were expected to run out of groundwater by 2020 based on estimates used at that time (with stated limitations) . Whether or not every detail is exact for every city, the direction is clear: unsustainable extraction creates future non-availability.

Non-availability is worsened by:

- depletion of shallow aquifers, leading to deeper drilling;
- falling water tables that increase pumping costs;
- seasonal variability (dry months) combined with high demand.

When water becomes physically unavailable, households suffer first, and poor households suffer most because they cannot buy private tanker water easily.

1.7 (c) Climate change

Climate change affects water through rainfall patterns, heat, drought, floods, and melting glaciers. The IPCC (the main global scientific body assessing climate risk) reports that climate change affects the water cycle and increases risks for human and natural systems . These changes are not uniform: some places may get heavier rainfall (causing floods), while others may get longer dry spells (causing drought). Both can reduce safe drinking-water availability. Floods can contaminate wells and damage pipelines; droughts reduce surface water and groundwater recharge.

The World Meteorological Organization's reporting on global water resources has also highlighted worsening stress and large numbers of people facing water shortages, with projections increasing in future decades . In South Asia, climate-related variability can amplify existing management weaknesses: if a city already depends on tankers in summer, then more heat and less predictable rainfall can make the situation worse.

In India's context, climate change also intersects with glacier and snow melt in the wider region and with monsoon variability. Even if the details vary by basin, the general risk is clear: a more unstable water cycle makes planning harder and increases scarcity risk.

[4] NITI Aayog, "Composite Water Management Index" (June 2018), available at: https://www.niti.gov.in/sites/default/files/2023-03/CompositeWaterManagementIndex.pdf (Visited on 16 December 2025).

1.8 (d) Urbanization

Urbanization increases water demand in three main ways:

1. **More people** concentrated in one place.
2. **Higher daily use** (more bathrooms, more washing, more services).
3. **More hard surfaces** (roads and buildings) that reduce groundwater recharge because rainwater runs off instead of seeping into soil.

Urbanization also changes land use. Lakes and wetlands may be encroached, reducing natural storage. Stormwater drains may carry polluted runoff into water bodies. These changes reduce both quantity and quality.

Even when a city has a river or reservoir, the distribution system may not deliver equal access. Poorer communities often have less reliable supply, fewer connections, and higher dependence on tankers. In that sense, scarcity is also about unequal access and unequal power, not only about rainfall. UN-Water's discussion of scarcity recognizes that infrastructure and institutions matter, not only physical supply[5].

1.9 (e) Industrialization

Industrialization affects water scarcity in two big ways:

(i) High water demand

Many industries use large volumes of water (for cooling, processing, cleaning). If industry draws heavily from groundwater, local water tables can fall faster.

(ii) Pollution

Industrial effluents can contaminate rivers and groundwater, reducing usable water. But in many Indian cities, an even bigger pollution source is not only industry-it is untreated sewage.

India's pollution control authorities have reported a large gap between sewage generation and treatment capacity. For example, CPCB-linked figures and government replies have described urban sewage generation of about 72,368 million litres per day (MLD) against available treatment capacity of about 31,841 MLD, leaving a major gap . NITI Aayog's urban wastewater documents also note that actual treatment is far below what is generated . When sewage is untreated, rivers and lakes become unsafe, and downstream communities must look for other sources-again producing scarcity of safe water.

So, industrialization + weak wastewater treatment = less safe surface water + higher pressure on groundwater, which then becomes over-extracted and sometimes contaminated.

1.10 (f) Improper methods of irrigation

Agriculture is usually the largest water-using sector. When irrigation is inefficient, scarcity increases quickly.

Many farms still use surface (flood) irrigation methods where water flows across the field. These methods can waste water through evaporation, runoff, and uneven distribution. Drip irrigation, by contrast, applies water more precisely to the root zone and can be much more efficient in delivering water to crops . Indian government sources (citing ICAR) have stated that micro-irrigation (including drip) can have very high water-use efficiency compared to conventional flood irrigation[6].

This matters because groundwater is heavily used for irrigation in many parts of India. If irrigation uses most of the extracted groundwater, then cities and rural drinking needs compete with farm use. When irrigation wastes water, that competition becomes sharper.

However, a critical point is also needed: adopting drip systems is not automatic. Farmers need financial support, training, maintenance, and appropriate crop choices. Programs like PMKSY's "Per Drop More Crop" focus on improving on-farm water-use efficiency through micro-irrigation . But scaling such programs fairly and effectively remains a challenge.

1.11 (g) Non-friendly cropping pattern

A "cropping pattern" means what crops are grown in what areas. Some crops need much more water than others. If a water-intensive crop is grown in a dry region (or in a region that depends on falling groundwater), then scarcity can become severe.

Sugarcane is a common example of a water-intensive crop. Scientific research notes high water requirements for sugarcane cultivation under many conditions . If large areas grow such crops using groundwater in water-stressed zones, the result can be falling water tables and future scarcity.

Cropping pattern is not only a farmer decision; it is shaped by:

[5] UN-Water, "Water Scarcity", available at: https://www.unwater.org/water-facts/water-scarcity (Visited on 16 December 2025).

[6] Press Information Bureau (PIB), Government of India, "Adoption of drip irrigation and sprinkler system" (4 December 2025), available at: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2198945 (Visited on 16 December 2025).

- minimum support price signals,
- electricity subsidies for pumping,
- local markets,
- agro-climatic advice,
- and social habits.

So, improving cropping patterns requires policy reform, not only "awareness."

1.12 (h) Lack of rainwater harvesting

Rainwater harvesting (RWH) means collecting rainwater (often from rooftops) and storing it or letting it recharge groundwater. RWH is important because it:

- reduces runoff and flooding,
- improves groundwater recharge,
- creates local buffers for dry months.

In India, RWH has been adopted in some places as a legal requirement. Tamil Nadu, for example, introduced legal provisions making rainwater harvesting compulsory for buildings through its municipal law amendment ordinance (2003)[7]. Such measures show that law can be used to support conservation.

But in many places, rainwater harvesting is still limited due to weak enforcement, cost, lack of space, or poor maintenance. A common issue is that structures are built for compliance but not maintained, so they stop working. Rainwater harvesting cannot solve all scarcity (especially in years of extreme drought), but it is a strong supporting measure that reduces pressure on groundwater and improves resilience.

II. Right to Safe Drinking Water

The idea of a "right to water" comes from a simple moral point: without water, a person cannot live with dignity. But law requires clear standards: what exactly does the right include, and what must the State do?

This section explains the right under international documents, the Indian constitutional framework, and key judicial decisions.

2.1 (a) Under international documents

(i) Recognition as a human right

The Office of the UN High Commissioner for Human Rights (OHCHR) states clearly that access to safe drinking water and sanitation are internationally recognized human rights, derived from the right to an adequate standard of living under Article 11(1) of the ICESCR . This is important because it connects water to broader human dignity and living standards.

The UN General Assembly (UNGA) adopted Resolution 64/292 in 2010, recognizing the right to safe and clean drinking water and sanitation as a human right essential for the full enjoyment of life and all human rights . After that, the UN Human Rights Council (HRC) adopted Resolution 15/9 (2010), affirming and clarifying that the human right to safe drinking water and sanitation is derived from the right to an adequate standard of living and is linked to the right to health . UN-Water also summarizes this development and links UNGA 64/292 and HRC 15/9 together as part of the modern human-rights recognition of water and sanitation[8].

So, in international law and policy, the right is no longer only an "idea." It is formally recognized in major UN bodies.

(ii) What does the "right to water" include?

A key legal explanation is the UN Committee on Economic, Social and Cultural Rights (CESCR) General Comment No. 15, which explains the right to water under Articles 11 and 12 of the ICESCR . It states that everyone is entitled to sufficient, safe, acceptable, physically accessible, and affordable water for personal and domestic uses. The General Comment also explains core factors such as:

- **Availability** (sufficient and continuous),
- **Quality** (safe, not harmful),
- **Accessibility** (physical and economic access without discrimination).

This framework matters for water scarcity debates because it tells us that "a tanker once in a while" is not enough. The right requires reliability, safety, and non-discrimination.

(iii) Water rights and development goals

[7] Government of Tamil Nadu, "Tamil Nadu Municipal Laws (Second Amendment) Ordinance, 2003 (Rainwater Harvesting Provision)" (19 July 2003), available at: https://cmwssb.tn.gov.in/ (Visited on 16 December 2025).

[8] UN-Water, "Human Rights to Water and Sanitation", available at: https://www.unwater.org/water-facts/human-rights-water-and-sanitation (Visited on 16 December 2025).

The Sustainable Development Goals (SDGs) include Goal 6 on water and sanitation. UN statistical reporting emphasizes that safe drinking water and sanitation are basic human rights and are central to sustainable development . WHO also clarifies the meaning of safely managed services and includes chemical contaminants like arsenic and fluoride in the definition of safe service monitoring .
So, international law and global monitoring connect rights and measurement: we do not just say "water is a right," we also define what "safe water access" means in practice.

2.2 (b) Under the Indian Constitution

(i) No explicit article, but strong constitutional support

The Constitution of India does not explicitly use the phrase "right to water" in the Fundamental Rights chapter. But the Constitution contains strong foundations that support a right to safe drinking water through interpretation:

- **Article 21** (Right to life and personal liberty) has been interpreted broadly by courts to include the right to live with dignity, which can include clean environment and safe water.
- **Article 47** (Directive Principle) places a duty on the State to improve public health.
- **Article 48A** directs the State to protect and improve the environment.
- **Article 51A(g)** places a duty on citizens to protect the natural environment (including rivers and lakes).

Also, local governance matters. Through constitutional schedules and decentralization, water supply becomes part of governance responsibilities in urban and rural local bodies (through local government functions). This matters because delivering drinking water is not only a "central policy"; it is also about local implementation.

(ii) Why constitutional interpretation matters for scarcity

If safe drinking water is part of Article 21, then scarcity is not only an administrative problem. It becomes a constitutional concern. But constitutional rights need real systems to deliver them: infrastructure, budgets, monitoring, and accountability.
This is where India's water challenge becomes complex. Water is also connected to federalism (different states, shared rivers) and different agencies. Even when courts recognize the right, implementation depends on executive action.
So, the Constitution provides moral and legal force, but it does not automatically provide water. Judicial interpretation is the bridge, which we discuss next.

2.3 (c) Judicial perspective

Indian courts have played a major role in turning environmental protection into enforceable rights. Several cases are especially important for the right to safe drinking water.

(i) Right to pollution-free water as part of Article 21

In Subhash Kumar v. State of Bihar, the Supreme Court stated that the right to life under Article 21 includes the right to enjoy pollution-free water and air (as part of a healthy environment)[9]. This case is often cited because it clearly links environmental quality with fundamental rights.

(ii) Scientific and precautionary approach to water quality

In A.P. Pollution Control Board v. Prof. M.V. Nayudu, the Supreme Court dealt with water pollution and emphasized the need for expert knowledge and precaution in environmental decision-making[10]. This case is significant because safe water questions often involve science (toxicity, long-term risks), and courts recognized that environmental governance must take such science seriously.

(iii) Sustainable development and protecting groundwater

In Vellore Citizens Welfare Forum v. Union of India, the Supreme Court strongly applied principles like "polluter pays" and sustainable development in a case involving pollution that affected water resources[11]. Even if the case context was industrial pollution, the logic matters for drinking water: polluting activities that destroy groundwater and surface water reduce safe access and violate constitutional values.

(iv) Public trust doctrine and water resources

In M.C. Mehta v. Kamal Nath, the Supreme Court applied the public trust doctrine, emphasizing that resources like waters and forests are held by the State in trust for the public and should not be given for private exploitation that harms public interest[12]. This doctrine is powerful in water governance because it frames water bodies not as property for private gain, but as resources that must serve public welfare, including drinking water needs.

[9] Subhash Kumar v. State of Bihar, (1991) 1 SCC 598 (Supreme Court of India).
[10] A.P. Pollution Control Board v. Prof. M.V. Nayudu (Retd.) & Ors., (1999) 2 SCC 718 (Supreme Court of India).
[11] Vellore Citizens Welfare Forum v. Union of India, (1996) 5 SCC 647 (Supreme Court of India).
[12] M.C. Mehta v. Kamal Nath, (1997) 1 SCC 388 (Supreme Court of India).

(v) Inter-state supply and domestic water as priority

In Delhi Water Supply & Sewage Disposal Undertaking v. State of Haryana, the Supreme Court addressed inter-state supply issues and directed that sufficient water be supplied for domestic purposes to Delhi[13]. This supports the idea that drinking and domestic water needs are core, even amid disputes.

(vi) High Court recognition of the "right to sweet water"

In Attakoya Thangal v. Union of India (Kerala High Court), the court discussed the right to "sweet water" (potable water) as part of the right to life[14]. The judgment is also notable because it linked groundwater management and rainwater harvesting ideas with protection of life.

(vii) Local governance and groundwater extraction conflicts

Cases like Perumatty Grama Panchayat v. State of Kerala (the Plachimada-related litigation) are often discussed in right-to-water debates because they involve conflict between community water needs and industrial extraction[15]. Even where courts differ on details across stages, the broader lesson is clear: when groundwater is treated like an unlimited private input, local drinking water security can collapse.

(viii) What courts can and cannot do

Courts can:

- declare safe water as part of Article 21,
- order pollution control,
- direct governments to act,
- enforce minimum standards.

But courts cannot run water utilities daily. They cannot substitute for long-term planning, financing, pipe maintenance, treatment plants, monitoring labs, and staff.

Rainwater harvesting is also closely linked to groundwater recharge. In cities with high concrete cover, recharge becomes difficult. So rainwater harvesting is not just "a tradition"; it is a modern urban necessity.

III. Conclusion

Water scarcity is one of the most serious challenges of our time, and it is growing because of both natural and human reasons. The Earth has water, but only a small share is usable freshwater. Globally, billions still lack safely managed drinking-water services. In India, real crises in cities like Chennai and Shimla and severe stress in Delhi show that urban water security is fragile . Scarcity is also driven by contamination-especially fluoride and arsenic-making water unsafe even when it exists . Wasteful irrigation, water-intensive cropping patterns, climate change, leakage in urban systems, and poor sewage treatment further reduce safe water availability .

International law now clearly recognizes safe drinking water and sanitation as human rights, supported by UN resolutions and explained by General Comment. Indian courts have also linked safe water and pollution-free environments to Article 21 and related principles . But the central challenge remains implementation: legal recognition must become reliable, safe, affordable water in every home.

A critical review leads to one clear message: the right to safe drinking water is real only when systems deliver safe water consistently. That requires strong monitoring, pollution control, groundwater management, efficient water use in agriculture, reduced urban leakage, sewage treatment, rainwater harvesting, and above all, fairness in access. Safe water is not just a resource; it is a condition for life with dignity.

[13] Delhi Water Supply & Sewage Disposal Undertaking v. State of Haryana, (1996) 2 SCC 572; AIR 1996 SC 2992 (Supreme Court of India).

[14] Attakoya Thangal v. Union of India, 1990 (1) KLT 580 (Kerala High Court).

[15] Perumatty Grama Panchayat v. State of Kerala, 2004 (1) KLT 731 (Kerala High Court).