THE SOVEREIGNTY OF THE DROP: INTERNATIONAL AND NATIONAL LAW FOR THE MANAGEMENT OF WATER RESOURCES IN AN AGE OF SCARCITY AND CONFLICTS

By Dr. Mohamed Kamal Arafa El-Rakhawi
Jurist, Author, Expert, Consultant, Researcher, and Professor of International Law

DOI: 10.5281/zenodo.21837711

DEDICATION

To the spirit of my pure mother and the spirit of my pure father, those two who taught me that a single drop of water is life itself, and that the blood of a nation is worth more than all the gold of the earth. May God prolong their light in their graves and make their abode a garden from the gardens of Paradise.

And to my beloved daughter, Sarah Sabrini, the Algerian, the Egyptian, who lives in a world where water has become more precious than gold. I dedicate this book to you as a legal weapon to protect your right to every drop of water in life.

INTRODUCTION

Water is no longer merely a renewable natural resource, but has transformed into the most sensitive strategic commodity of the twenty-first century, becoming the axis of geopolitical conflicts and international alliances, in conjunction with the exacerbation of the climate change crisis, the depletion of groundwater, and the increasing demand of the population and industry. The urgent need has emerged for a solid legal framework that regulates the use of water and prevents future wars over it.

This book comes as the first comprehensive legal encyclopedia that merges the principles of international water law with national legislation, the jurisprudence of sustainable management, and a deep analysis of conflict situations and peaceful solutions.

The objective of this work is the establishment of a new water jurisprudence that transcends the traditional concepts of absolute sovereignty over rivers, toward the concept of shared sovereignty, water security, and collective water justice. The book reviews international agreements, the jurisprudence of the International Court of Justice, and the challenges arising from the construction of massive dams and the desalination of water.

This book is directed to judges, lawyers, researchers, diplomats, and decision-makers, to serve as a golden reference for building a lasting peace based on justice in the distribution of the most important resources of life on planet Earth.

In an age where the drop of water has become a weapon, a currency, and a cause of war, this book stands as a legal fortress defending the right of every human being to clean water, and the right of every nation to manage its water resources with dignity, sovereignty, and justice. The drop of water is not merely a molecule of hydrogen and oxygen. It is the essence of civilization, the foundation of sovereignty, and the ultimate test of humanity's capacity for cooperation or destruction.

TABLE OF CONTENTS

Chapter One: Water as a Fundamental Human Right and a Strategic Commodity in International Law

Chapter Two: The Evolution of International Water Law from Territorial Sovereignty to Reasonable Utilization

Chapter Three: The 1997 United Nations Convention as a General Framework and Binding Rules

Chapter Four: The Principle of Equitable and Reasonable Use: Standards of Application and Balance

Chapter Five: The Obligation Not to Cause Significant Harm to Co-Riparian States

Chapter Six: Prior Notification and Consultation on New Water Projects

Chapter Seven: Protection of the Water Environment and Ecological Systems of Rivers

Chapter Eight: Transboundary Groundwater: Legal Gaps and Challenges of Sustainability

Chapter Nine: Large Dams and Reservoirs between National Development and Transboundary Harm

Chapter Ten: Case Studies of International River Conflicts: The Nile, the Tigris and Euphrates, and the Jordan

Chapter Eleven: The Role of the International Court of Justice and International Arbitration in Resolving Water Disputes

Chapter Twelve: National Water Security, Legislation, and Resource Management

Chapter Thirteen: Management of Shared Basins through River Commissions and Regional Agreements

Chapter Fourteen: Water Pollution and International Responsibility for Environmental Harm

Chapter Fifteen: Water Scarcity and Climate Change: New Legal Challenges

Chapter Sixteen: Desalination and Water Reuse: The Legal and Economic Framework

Chapter Seventeen: Privatization and the Role of the Private Sector in Water Management and Public Guarantees

Chapter Eighteen: Armed Conflicts and the Protection of Water Installations under Humanitarian Law

Chapter Nineteen: The Future of Water Law toward a New World Constitution for Shared Resources

Chapter Twenty: Conclusion: A Legal Strategic Vision to Ensure Global Water Peace

CHAPTER ONE: WATER AS A FUNDAMENTAL HUMAN RIGHT AND A STRATEGIC COMMODITY IN INTERNATIONAL LAW

We begin with the establishment of the unique legal status of water. In 2010, the United Nations General Assembly recognized the right to water and sanitation as a right among the fundamental human rights. We analyze the apparent contradiction between considering water a non-disposable right and considering it an economic commodity subject to the laws of the market in some liberal models.

This chapter establishes the philosophical and legal foundation upon which the entire work rests. Water is not merely a substance. It is the precondition of all life, the foundation of all civilization, and the sine qua non of human existence. The recognition of water as a fundamental human right represents a revolutionary shift in international legal thinking, moving water from the domain of property and commerce into the domain of dignity and survival.

We demonstrate how the deprivation of any people from its water constitutes a grave violation of international law that may amount to a crime against humanity in cases of siege or deliberate destruction. The deliberate cutting of water supply to civilian populations, the poisoning of wells, the destruction of irrigation infrastructure during armed conflict, these are not merely acts of war. They are crimes against the very possibility of human existence. International humanitarian law, the Geneva Conventions, and the Rome Statute of the International Criminal Court all converge on the principle that water is a protected civilian object whose destruction constitutes a war crime.

We discuss the concept of water security as an inseparable part of national security, and how water scarcity may become a primary driver of irregular migration and armed conflicts. Water security is not merely a technical question of supply and demand. It is a question of sovereignty, of dignity, of the right of a people to exist. When a nation's water is threatened, its very existence is threatened. When a river is dammed upstream without consultation, the downstream nation faces not merely economic loss but existential risk.

This chapter aims to consolidate the idea that the protection of water is the protection of human dignity and of existence itself, which imposes supreme legal and moral obligations on states and on the international community. The protection of water sources, the guarantee of equitable access, the prohibition of water weaponization, these are not optional policies. They are legal imperatives grounded in the fundamental structure of international law.

The strategic dimension of water cannot be separated from its human rights dimension. Water is simultaneously a right and a resource, a necessity and a commodity, a local concern and a global challenge. The jurist who addresses water law must hold all these dimensions in tension, recognizing that no single legal framework can capture the full complexity of water's role in human civilization.

CHAPTER TWO: THE EVOLUTION OF INTERNATIONAL WATER LAW FROM TERRITORIAL SOVEREIGNTY TO REASONABLE UTILIZATION

We trace the historical journey of legal thought surrounding water at the international level, beginning with the old Harmon doctrine, which granted the source state absolute sovereignty over river waters without consideration for neighbors. We analyze the radical transformation toward the territorial integrity doctrine, which gave each state the right to the flow of water in its territory without diminution.

The Harmon Doctrine, articulated by United States Attorney General Judson Harmon in 1895 in the context of the Rio Grande dispute with Mexico, represented the most extreme assertion of territorial sovereignty over shared waterways. Under this doctrine, a state could do whatever it wished with waters flowing through its territory, regardless of the consequences for downstream states. This doctrine was ultimately rejected by the international community as incompatible with the principles of good neighborliness and equitable utilization.

The territorial integrity doctrine emerged as a counter-position, primarily advocated by downstream states, asserting that each riparian state has the right to the natural flow of the river undiminished and unimpaired in quality. While more protective of downstream interests than the Harmon Doctrine, this approach was ultimately recognized as equally extreme, denying upstream states any right to develop their water resources.

Then stability settled on the principle of equitable and reasonable utilization, which is the middle ground and the most just. We study how the works of the International Law Commission,

subsidiary to the United Nations, contributed to the formulation of these principles through decades of debate. The International Law Commission, under the rapporteurship of distinguished jurists including Stephen McCaffrey, worked for over four decades to codify the law of international watercourses, culminating in the 1997 Convention.

We discuss how international custom evolved from principles of cooperation and non-harm to become binding rules for all states, even until those that did not anticipate specific agreements. The principles of equitable utilization, no significant harm, prior notification, and cooperation have achieved the status of customary international law, binding on all states regardless of treaty ratification.

This chapter aims to understand the philosophical foundations of the current law and why the logic of integration triumphed over the logic of conflict in modern international jurisprudence. The evolution from absolute sovereignty to shared sovereignty represents one of the most significant developments in international legal thought, reflecting the growing recognition that in an interconnected world, no state can achieve its interests at the expense of its neighbors without ultimately harming itself.

CHAPTER THREE: THE 1997 UNITED NATIONS CONVENTION AS A GENERAL FRAMEWORK AND BINDING RULES

This chapter is devoted to the analysis of the most important document in the history of international water law, which is the Convention on the Law of the Non-Navigational Uses of International Watercourses. We explain the general structure of the convention, its scope of application in terms of geography and time, and the mechanism of state accession and entry into force.

The 1997 Convention represents the culmination of decades of work by the International Law Commission and the Sixth Committee of the General Assembly. It entered into force on August 17, 2014, after the required thirty-five ratifications were obtained. The Convention establishes a comprehensive framework for the management of international watercourses, balancing the rights and obligations of all riparian states.

We analyze the fundamental articles that crystallize the principles of use, equitable utilization, no harm, and organized cooperation. Article Five establishes the principle of equitable and reasonable utilization as the cornerstone of the Convention. Article Seven establishes the obligation not to cause significant harm. Article Eight establishes the general obligation to cooperate. Articles Eleven through Nineteen establish procedural obligations including notification, consultation, and environmental impact assessment.

We discuss the controversy over whether this convention currently reflects binding international customary rules, as confirmed by the International Court of Justice in subsequent cases. The Gabčíkovo-Nagymaros Project case between Hungary and Slovakia, decided in 1997, affirmed

many of the principles codified in the Convention even before its entry into force. The Pulp Mills case between Argentina and Uruguay in 2010 further reinforced the obligation of environmental impact assessment and prior notification.

The reservations of some states on certain articles and their impact on the dynamics of regional negotiation are examined in detail. The Convention's requirement of thirty-five ratifications meant that it took seventeen years to enter into force, reflecting the sensitivity of water sovereignty issues. Some major watercourse states, including Turkey, China, and Ethiopia, have expressed reservations about certain provisions, particularly regarding the relationship between equitable utilization and the no-harm rule.

This chapter aims to provide the reader with precise interpretive tools for understanding the texts of the convention and applying them to the complex realities of international rivers. The Convention is not a static document. It is a living framework that must be interpreted in light of evolving circumstances, new scientific understanding, and the changing dynamics of international relations.

CHAPTER FOUR: THE PRINCIPLE OF EQUITABLE AND REASONABLE USE: STANDARDS OF APPLICATION AND BALANCE

We enter into the core of the most complex legal criterion, which is equitable and reasonable utilization, and we unpack the factors determined for it in Article 6 of the 1997 Convention. We analyze how to balance between disparate factors such as the population on the river, economic and social needs, the effects on other states, and the preservation of resources.

The principle of equitable and reasonable utilization is the cornerstone of international water law. It requires that each watercourse state utilize an international watercourse in an equitable and reasonable manner, taking into account the interests of other watercourse states. The determination of what is equitable and reasonable requires a comprehensive assessment of all relevant factors and circumstances, without any single factor being given inherent priority.

We discuss the problematic of giving priority to uses in cases of severe scarcity. Basic human needs, particularly drinking water and sanitation, must be given priority over agricultural or industrial uses in situations of extreme scarcity. This hierarchy of uses reflects the fundamental principle that the right to life takes precedence over economic interests. The question of how to allocate water among competing uses when there is not enough to satisfy all demands is one of the most challenging questions in water law.

We present the jurisprudence of international courts in applying this principle on the ground and the method of estimating equitable shares for each riparian state. The International Court of Justice, various arbitral tribunals, and regional courts have all grappled with the question of how to translate the abstract principle of equitable utilization into concrete allocations. Mathematical

models, hydrological data, socioeconomic indicators, and environmental considerations all play a role in determining what constitutes an equitable share.

We present legal and mathematical models for the distribution of water based on these criteria to ensure objective evaluation. These models must be flexible enough to accommodate changing circumstances, including climate change, population growth, and technological development. A rigid allocation formula that does not adapt to changing conditions will inevitably become unjust over time.

This chapter aims to transform the theoretical principle into a practical tool applicable to measurement and negotiation in the sharing of water. The principle of equitable utilization must not remain an abstract ideal. It must be operationalized through concrete mechanisms, transparent procedures, and accountable institutions. Only then can it serve its purpose of preventing conflict and promoting cooperation.

CHAPTER FIVE: THE OBLIGATION NOT TO CAUSE SIGNIFICANT HARM TO CO-RIPARIAN STATES

We focus on the preventive aspect of water law, embodied in the obligation not to cause significant harm to other states in the use of shared waters. We distinguish between simple or ordinary harm that may be acceptable within the framework of mutual utilization, and significant harm upon which international responsibility is triggered.

The obligation not to cause significant harm is a fundamental principle of international environmental law applied to the water context. It requires states to take all appropriate measures to prevent the causing of significant harm to other watercourse states. The determination of what constitutes significant harm requires careful analysis of the specific circumstances, including the nature of the harm, its duration, its reversibility, and the availability of mitigation measures.

We analyze the burden of proof required to establish a negative causal relationship between a water project in a source state and the occurrence of harm in an afflicted state. The question of causation in transboundary water harm is particularly complex because of the multiple factors that may contribute to water scarcity or degradation. Climate change, overuse by multiple states, natural variability, and specific projects all may contribute to a harm that cannot be attributed to a single cause.

We discuss the measures that must be taken to prevent or mitigate harm, and the responsibility of the state for compensation in the event that harm occurs despite taking precautions. The obligation of due diligence requires states to conduct environmental impact assessments, to implement monitoring programs, and to take corrective action when harm is identified. The failure to exercise due diligence may itself constitute a breach of international obligations, even if the harm was not intended.

We link this principle with the polluter pays principle in international environmental law. The polluter pays principle, which requires that the costs of pollution be borne by those responsible for it, provides an economic framework for the allocation of responsibility for water harm. It creates incentives for prevention and ensures that the costs of environmental damage are not externalized to innocent downstream communities.

This chapter aims to establish clear limits for national sovereignty to prevent unilateral exploitation of shared resources that threatens the stability of the region. The sovereignty of a state over its water resources is not absolute. It is limited by the rights of other states, by the needs of the environment, and by the interests of future generations. The recognition of these limits is not a diminution of sovereignty but a maturation of it.

CHAPTER SIX: PRIOR NOTIFICATION AND CONSULTATION ON NEW WATER PROJECTS

We address the vital procedural obligations that precede the execution of any water project that may affect other states, embodied in prior notification and good faith consultation. These procedural obligations are not mere formalities. They are the practical expression of the principles of cooperation, good faith, and mutual respect that underlie international water law.

We explain the content that must be provided in the notification plan, the reasonable time period for response, and the mechanisms of negotiation in the event of objection by the receiving state. The notification must include sufficient technical data and information to enable the notified state to evaluate the potential effects of the planned project. The time period for response must be reasonable, taking into account the complexity of the project and the need for thorough analysis.

We analyze the consequences of proceeding in the project without completing the notification and consultation procedures, and how that is considered a procedural violation that entails in itself the invalidity of the act. The failure to notify and consult is not merely a procedural defect. It is a substantive violation of international obligations that may render the entire project unlawful, regardless of its technical merits. The International Court of Justice affirmed this principle in the Pulp Mills case, holding that the failure to conduct an environmental impact assessment and to notify the other party constituted a breach of international obligations.

We discuss the role of mediation and conciliation in resolving disputes arising from objections during the consultation period. When negotiations fail, third-party mechanisms including mediation, conciliation, and arbitration may provide a pathway to resolution. The establishment of standing conciliation commissions, as provided for in the 1997 Convention, represents an important institutional mechanism for the peaceful resolution of water disputes.

We present practical models for notification protocols that ensure transparency and build trust between riparian states. These protocols should include clear timelines, standardized formats for information exchange, provisions for technical assistance to developing states, and

mechanisms for public participation. The transparency of the notification process is essential for building the trust necessary for successful cooperation.

This chapter aims to prevent conflicts before they arise through organized diplomatic and legal channels that guarantee the right of every party to express its concerns. Prevention is always preferable to cure in water disputes. The costs of a water conflict, whether measured in economic loss, environmental damage, or human suffering, far exceed the costs of prevention through early notification and good faith consultation.

CHAPTER SEVEN: PROTECTION OF THE WATER ENVIRONMENT AND ECOLOGICAL SYSTEMS OF RIVERS

We move to a modern and important dimension in water law, which is the protection of the environment of the river not as a mere channel for water transport but as an integrated living system. The river is not a pipe. It is an ecosystem, a living community of plants, animals, microorganisms, and physical processes that together create the conditions for water to be clean, abundant, and sustainable.

We analyze the legal obligation to protect ecological systems, prevent the introduction of alien invasive species, and preserve water quality from pollution. The obligation to protect and preserve the ecosystems of international watercourses is a fundamental duty under international water law. It requires states to take all appropriate measures to prevent the degradation of river ecosystems, to maintain water quality at levels suitable for human use and ecological health, and to prevent the introduction of species that may disrupt the ecological balance.

We discuss the concept of ecological flow, which is the minimum necessary for the continuation of the life of the river, and how it has become a legally binding criterion in planning for projects. The ecological flow is not a luxury. It is a necessity. Without adequate environmental flows, rivers die. They become stagnant channels, breeding grounds for disease, unable to support the ecosystems upon which millions of people depend for their livelihoods. The legal recognition of ecological flows as a binding requirement represents a fundamental shift from treating rivers as mere water delivery systems to treating them as living entities with their own rights.

We link between water protection and biodiversity, and how the destruction of aquatic organisms may constitute a violation of other international agreements such as the Biodiversity Convention. The Convention on Biological Diversity, the Ramsar Convention on Wetlands, and various regional agreements all impose obligations related to the protection of aquatic ecosystems. The violation of these obligations in the context of water management may trigger state responsibility under multiple legal regimes simultaneously.

We present a vision for how to integrate environmental considerations into the core of water sharing agreements to ensure sustainability of resources for future generations. Environmental impact assessment, strategic environmental assessment, cumulative impact analysis, and

adaptive management are all tools that must be integrated into water management frameworks. The failure to integrate environmental considerations is not merely an environmental failure. It is a legal failure that undermines the long-term viability of water allocation agreements.

This chapter aims to raise the level of protection from merely meeting human needs to preserving the cosmic ecological balance upon which life depends. Water law must evolve beyond an anthropocentric framework that views water solely as a resource for human consumption. It must embrace an ecocentric perspective that recognizes the intrinsic value of aquatic ecosystems and the rights of future generations to inherit healthy rivers.

CHAPTER EIGHT: TRANSBOUNDARY GROUNDWATER: LEGAL GAPS AND CHALLENGES OF SUSTAINABILITY

This chapter is devoted to one of the most provocative areas for legal challenge, which is transboundary groundwater that does not permanently fall under the same rules as surface rivers. Groundwater represents a massive and largely invisible resource that is critical to the water security of many nations, yet it remains largely unregulated by international law.

We analyze the materials of the International Law Commission regarding groundwater aquifers crossing borders and the extent of their acceptance as customary law. The International Law Commission's Draft Articles on the Law of Transboundary Aquifers, adopted in 2008, represent the first comprehensive attempt to codify the law governing shared groundwater resources. However, these Draft Articles have not yet been adopted as a binding convention, leaving a significant gap in international water law.

We discuss the challenges of monitoring and extracting these waters, the difficulty of determining the limits of a shared reservoir between multiple states, and the problem of unjust exploitation of non-renewable fossil groundwater. Unlike surface water, groundwater is invisible, difficult to measure, and slow to respond to extraction. The over-extraction of a shared aquifer may not be detected until irreversible damage has occurred. The legal framework must address these unique challenges through monitoring obligations, extraction limits, and the precautionary principle.

We shed light on the problem of unjust exploitation of water for future generations and present the legal and moral responsibility toward them. Fossil groundwater, accumulated over thousands or millions of years, is a non-renewable resource. Its extraction represents the consumption of a finite inheritance. The legal framework must recognize the rights of future generations to this resource and establish limits on current extraction that preserve the resource for those who will come after us.

We advance proposals for a binding legal framework governing the extraction of groundwater and preventing the race toward pumping it into the depths of the earth. This framework should include mandatory monitoring and data sharing, extraction limits based on recharge rates,

protection zones around wells, dispute resolution mechanisms, and provisions for the protection of groundwater quality. The absence of such a framework represents a dangerous legislative gap in a field that constitutes a looming strategic threat of depletion.

This chapter aims to close the dangerous legislative gap in the field of hidden waters that constitute a strategic reserve threatened by depletion. The invisible nature of groundwater makes it particularly vulnerable to overexploitation. What cannot be seen is easily forgotten. What is easily forgotten is easily destroyed. The law must make the invisible visible, must give legal voice to the silent aquifers beneath our feet.

CHAPTER NINE: LARGE DAMS AND RESERVOIRS BETWEEN NATIONAL DEVELOPMENT AND TRANSBOUNDARY HARM

We address one of the most controversial issues in water law, which is the construction of massive dams on international rivers and the balance between the right of the state to development and the rights of neighbors. The construction of large dams represents one of the most dramatic exercises of water sovereignty, with the potential to transform the hydrology of entire river basins and to affect the lives of millions of people downstream.

We analyze the legal criteria for evaluating the impact of dams on water flow, water quality, sediment transport, and ecological systems in downstream states. The impact of a dam extends far beyond the simple question of water quantity. Dams alter the timing of flows, trap sediment that downstream ecosystems and agriculture depend upon, change water temperatures, block fish migration, and transform the entire ecological character of a river. The legal assessment of dam impacts must encompass all these dimensions.

We discuss issues of filling reservoirs during drought periods and mechanisms of joint operation of dams to ensure the occurrence of floods or droughts. The filling of a large reservoir represents a particularly sensitive period during which downstream flows may be significantly reduced. The legal framework must establish clear rules for the timing and rate of filling, for the sharing of data during filling, and for the adjustment of filling schedules in response to hydrological conditions.

We present case studies of cases where dams have triggered international disputes and how their management was legally and politically handled. The construction of the Aswan High Dam, the Southeastern Anatolia Project in Turkey, the Grand Ethiopian Renaissance Dam, and numerous other dam projects have all generated significant international controversy. Each case reveals the complex interplay between technical, legal, political, and environmental factors that characterizes dam disputes.

We present a legal framework for operating dams that depends on shared data and joint technical committees to transform dams from potential sources of war into tools of cooperation and regional resource management jointly. The transformation of dams from instruments of

unilateral control into instruments of shared management requires legal frameworks that mandate data sharing, joint operation, benefit sharing, and dispute resolution. When dams are managed cooperatively, they can become engines of regional integration rather than sources of conflict.

This chapter aims to transform dams from potential sources of war into tools of cooperation and regional resource management jointly. The choice between conflict and cooperation over dams is not determined by hydrology. It is determined by law, by institutions, and by political will. The legal framework presented in this chapter provides the tools for choosing cooperation.

CHAPTER TEN: CASE STUDIES OF INTERNATIONAL RIVER CONFLICTS: THE NILE, THE TIGRIS AND EUPHRATES, AND THE JORDAN

We delve into a deep analysis of the most prominent river basins in the Arab world and the region that witness water tensions, applying the legal principles previously discussed. These case studies provide the empirical foundation for the theoretical framework developed throughout the book, demonstrating how abstract legal principles operate in the complex reality of actual water disputes.

We begin with the Nile Basin, analyzing the colonial-era agreements, the 1929 agreement between Egypt and Britain, the 1959 agreement between Egypt and Sudan, and the Ethiopian Renaissance Dam crisis from the perspective of international law. The Nile Basin represents one of the most complex water governance challenges in the world, involving eleven riparian states with vastly different needs, capacities, and legal positions. The colonial-era agreements, negotiated without the participation of upstream states, are contested by those states as illegitimate impositions. The construction of the Grand Ethiopian Renaissance Dam has brought these tensions to a head, creating an urgent need for a new legal framework that accommodates the legitimate development aspirations of upstream states while protecting the vital water security of downstream states.

We move to the Tigris and Euphrates Basin, examining the impact of Turkish projects on Iraq and Syria, the extent of Turkey's commitment to customary law, and its refusal to sign specific agreements. The Tigris-Euphrates system is dominated by Turkey's Southeastern Anatolia Project, a massive development program involving twenty-two dams and nineteen hydroelectric plants. The downstream impacts on Iraq and Syria have been severe, with reduced flows, increased salinity, and degraded water quality. The absence of a comprehensive basin agreement makes the management of this system particularly challenging.

Then we analyze the Jordan River Basin, the water conflict as part of the Arab-Israeli conflict, issues of water theft and appropriation of sources. The Jordan River Basin illustrates the intersection of water and territorial conflict in its most acute form. The occupation of the Golan Heights, the diversion of the Jordan River, the over-extraction of the Mountain Aquifer in the

West Bank, and the unequal distribution of water resources between Israelis and Palestinians all demonstrate how water can become both a weapon and a victim of territorial conflict.

We extract practical lessons from these studies on the failure and success of water diplomacy in the region. The central lesson is that water conflicts cannot be resolved through technical solutions alone. They require political will, legal frameworks, institutional mechanisms, and a genuine commitment to the principles of equity and cooperation. The absence of any of these elements dooms water negotiations to failure.

This chapter aims to present an accurate legal diagnosis of the Arab reality and propose paths for resolving existing conflicts based on solid legal foundations. The Arab world is the most water-scarce region on earth. Its water challenges are existential. The legal framework presented in this book is not an academic exercise. It is a survival manual for a region facing the most severe water crisis in its history.

CHAPTER ELEVEN: THE ROLE OF THE INTERNATIONAL COURT OF JUSTICE AND INTERNATIONAL ARBITRATION IN RESOLVING WATER DISPUTES

We review the judicial mechanisms available for resolving water disputes when diplomatic negotiations fail. The judicial resolution of water disputes represents the ultimate guarantee of the rule of law in international water relations. When diplomacy fails, when negotiations reach an impasse, when the stronger party refuses to compromise, the court provides a peaceful alternative to force.

We analyze the jurisdiction of the International Court of Justice in looking into water issues and review its historical judgments in cases such as the Gabčíkovo-Nagymaros Project case between Hungary and Slovakia, the Pulp Mills case between Argentina and Uruguay, and the San Juan River case between Costa Rica and Nicaragua. These cases have established fundamental principles of international water law, including the obligation to conduct environmental impact assessments, the duty to notify and consult, the principle of equitable utilization, and the obligation not to cause significant harm.

We discuss the advantages and disadvantages of resorting to specialized international arbitration for complex technical issues related to water. Arbitration offers the advantages of flexibility, expertise, and confidentiality. The parties can select arbitrators with specific technical expertise in hydrology, engineering, or environmental science. The proceedings can be adapted to the specific needs of the dispute. However, arbitration also has disadvantages, including cost, the absence of appellate review, and the potential for inconsistent outcomes.

We shed light on the res judicata in international judgments and how to execute them. The binding nature of international court judgments is a fundamental principle of international law. However, enforcement remains a challenge in the absence of a centralized enforcement mechanism. The execution of international water judgments requires the cooperation of the

parties, the support of the international community, and the establishment of institutional mechanisms for monitoring compliance.

We present guidance to states on how to prepare water claims and how to present technical and legal evidence convincing to the judiciary. The preparation of a water case requires the integration of legal argument, scientific evidence, technical data, and expert testimony. The successful presentation of a water case before an international court requires a team that combines legal expertise with scientific and technical knowledge.

This chapter aims to clarify that international justice is the ultimate refuge for untangling intractable disputes and ensuring the supremacy of law over the force of arms. In a world where water conflicts threaten to escalate into armed confrontation, the availability of peaceful judicial mechanisms is not a luxury. It is a necessity for the preservation of international peace and security.

CHAPTER TWELVE: NATIONAL WATER SECURITY, LEGISLATION, AND RESOURCE MANAGEMENT

We move from the international level to the national level, analyzing how states translate their international obligations into internal laws that protect their water security. The international legal framework is only as effective as its implementation at the national level. Without strong national legislation, international water law remains a collection of noble principles without practical effect.

We study models of national legislation that organize the licensing of water use, the protection of source areas, and the punishment of aggressors on water installations. Effective national water legislation must establish clear rules for the allocation of water rights, the licensing of water use, the protection of water sources, the regulation of water quality, and the enforcement of compliance. The legislation must be comprehensive, covering all aspects of water management from source to tap.

We discuss the concept of national water security in constitutions and laws, whether water is considered public property of the state or private ownership, and we analyze the mechanisms of administrative and criminal oversight to preserve it. The constitutional recognition of water as a public resource, as a human right, or as a national asset provides the legal foundation for all subsequent water legislation. The classification of water determines the legal regime that governs its use, its protection, and its allocation.

We present proposals for developing Arab legislation to be more flexible and capable of facing modern challenges such as climate change and population growth. Arab water legislation must evolve to address the challenges of the twenty-first century. The rigid, supply-oriented approaches of the past must give way to flexible, demand-oriented approaches that incorporate climate adaptation, water efficiency, ecosystem protection, and public participation.

This chapter aims to strengthen the legal sovereignty of the state over its internal resources in a way that is consistent with international standards. National water sovereignty is not contradicted by international water law. It is strengthened by it. The state that implements its international obligations through strong national legislation enhances its sovereignty by demonstrating its capacity to manage its resources responsibly and effectively.

CHAPTER THIRTEEN: MANAGEMENT OF SHARED BASINS THROUGH RIVER COMMISSIONS AND REGIONAL AGREEMENTS

We focus on the success of the institutional model in water management through the establishment of permanent joint river commissions. The institutional management of shared watercourses represents the most effective mechanism for translating legal principles into practical cooperation. A permanent institution provides continuity, expertise, and trust that ad hoc negotiations cannot achieve.

We analyze the organizational and legal structures of these commissions, such as the Mekong River Commission, the Senegal River Commission, and other successful experiences. The Mekong River Commission, established in 1995, provides a model of institutional cooperation among Cambodia, Laos, Thailand, and Vietnam. The Senegal River Commission, established in 1972, represents one of the most successful examples of joint river management in Africa. The Rhine Commission, the Danube Commission, and the La Plata Basin Commission provide additional models of institutional cooperation.

We discuss the importance of the existence of an independent technical secretariat, and the collection of data and hydrological monitoring as a foundation for mutual trust. The technical secretariat of a river commission serves as the institutional memory, the source of shared data, and the facilitator of cooperation. Without a strong technical secretariat, a river commission cannot fulfill its mandate. The collection and sharing of hydrological data is the foundation upon which all other cooperation is built.

We shed light on the role of these commissions in planning integrated management of the basin, coordinating dam policies, and managing cases of drought and floods. River commissions serve multiple functions including data collection and sharing, joint planning, coordination of operations, dispute resolution, and emergency response. The most effective commissions integrate all these functions into a comprehensive management framework.

We present a guide for the establishment of effective river commissions enjoying legal personality and financial independence. The establishment of a river commission requires a legal instrument that grants it legal personality, defines its mandate, establishes its governance structure, provides for its financing, and creates mechanisms for dispute resolution. The commission must be independent of the political fluctuations of the moment to serve as a genuine guarantor of water security.

This chapter aims to demonstrate that permanent institutions are the true guarantor of stability for water far from the fluctuations of momentary political relations. Political relations between states may fluctuate. Treaties may be renegotiated. Governments may change. But a well-designed river commission can maintain cooperation through all these changes, providing the continuity and stability that water management requires.

CHAPTER FOURTEEN: WATER POLLUTION AND INTERNATIONAL RESPONSIBILITY FOR ENVIRONMENTAL HARM

We address the dark side of water management, which is transboundary pollution resulting from industrial, agricultural, and sanitary discharge across borders. Water pollution represents one of the most serious threats to water security, degrading water quality, destroying ecosystems, and threatening human health. The transboundary dimension of pollution makes it a matter of international law as well as national law.

We analyze the legal rules for international responsibility for environmental harm resulting from pollution of shared watercourses. The obligation to prevent transboundary pollution is a fundamental principle of international environmental law. States are required to take all appropriate measures to prevent, reduce, and control pollution of international watercourses. The failure to fulfill this obligation may trigger state responsibility, including the obligation to cease the harmful activity and to provide reparation.

We discuss water quality standards that must be complied with and the mechanisms of joint monitoring over pollution sources. The establishment of water quality standards provides the benchmark against which compliance is measured. These standards must be scientifically grounded, legally binding, and effectively enforced. Joint monitoring mechanisms, including shared sampling stations, data exchange protocols, and joint inspection teams, are essential for the effective implementation of water quality standards.

We study issues of compensation for health, environmental, and economic harm resulting from pollution and the difficulty of establishing causation in chronic cases. The establishment of causation in pollution cases is particularly challenging because of the multiple sources of pollution, the cumulative effects of different pollutants, and the long latency periods between exposure and harm. The legal framework must address these challenges through presumptions of causation, burden-shifting rules, and epidemiological evidence.

We present a vision for strengthening cooperation to treat sanitary and industrial discharge water before its discharge into international rivers. The prevention of pollution is always preferable to its remediation. The treatment of wastewater before discharge, the regulation of industrial effluents, the control of agricultural runoff, and the management of hazardous substances are all essential elements of a comprehensive pollution prevention strategy.

This chapter aims to protect the health of the millions who depend on shared rivers and to make pollution a crime that international law punishes firmly. The pollution of a shared river is not merely an environmental harm. It is an assault on the health, the livelihoods, and the dignity of millions of people. The law must treat it with the seriousness it deserves.

CHAPTER FIFTEEN: WATER SCARCITY AND CLIMATE CHANGE: NEW LEGAL CHALLENGIES

We confront the bitter reality of climate change and its direct impact on water cycles and what results from unprecedented legal challenges. Climate change is transforming the global water cycle, altering precipitation patterns, accelerating glacial melt, intensifying droughts and floods, and fundamentally changing the availability and distribution of water resources. These changes create legal challenges that existing frameworks were not designed to address.

We analyze how current law can be applied in the shadow of changing rainfall patterns and the drying of seasonal rivers. The legal framework for water management was developed in an era of relative hydrological stability. The assumption of stationarity, that historical patterns of rainfall and flow would continue into the future, underlies most water allocation agreements and management frameworks. Climate change has shattered this assumption, creating a fundamental challenge for water law.

We discuss the concept of climate refugees and the legal protection required for them. As water scarcity intensifies, millions of people may be forced to migrate in search of water. These climate refugees currently lack specific legal protection under international law. The development of a legal framework for the protection of climate refugees is an urgent priority.

We study the need for developing flexible adaptation mechanisms in water treaties that allow the redistribution of quotas in cases of exceptional drought as a force majeure. Water treaties must include provisions for adaptation to changing circumstances. Fixed allocations that do not adapt to changing hydrology will become sources of conflict as conditions change. Flexible mechanisms including variable allocations, drought protocols, and climate adjustment clauses are essential for the long-term viability of water agreements.

We present proposals for drafting climate clauses in all water agreements for the future. Every new water agreement should include climate provisions addressing adaptation, mitigation, data sharing, and dispute resolution in the context of changing conditions. The integration of climate considerations into water law is not optional. It is essential for the survival of water governance in the twenty-first century.

This chapter aims to update water law to be more resilient in the face of the greatest existential threat that humanity faces in the current century. Climate change is not a future threat. It is a present reality. The legal framework must adapt now, before the impacts become irreversible.

CHAPTER SIXTEEN: DESALINATION AND WATER REUSE: THE LEGAL AND ECONOMIC FRAMEWORK

We explore alternative technological solutions such as seawater desalination and treated water reuse and the legal framework regulating them. As conventional water sources become increasingly scarce, alternative sources including desalination, wastewater reuse, and rainwater harvesting become essential components of water security strategies. The legal framework must facilitate the development of these alternatives while ensuring environmental protection and public health.

We discuss the effects of desalination plants on the marine environment, particularly brine discharge, and intellectual property rights for desalination technologies. The environmental impacts of desalination, including energy consumption, brine discharge, and marine ecosystem disruption, must be addressed through environmental impact assessment, best available technology requirements, and marine protection standards. The intellectual property dimensions of desalination technology, including patents on membrane technology and energy recovery systems, raise questions about technology transfer and access.

We discuss the legal regulation of treated water use in agriculture and industry and the required health safety standards. The reuse of treated wastewater represents a significant potential source of water in water-scarce regions. However, its use raises public health concerns that must be addressed through rigorous treatment standards, monitoring requirements, and public education. The legal framework must balance the need for water with the need for safety.

We study models of partnerships between the public and private sectors in large desalination projects and guarantees of continuity of service. Public-private partnerships in desalination raise complex legal questions regarding ownership, operation, pricing, quality standards, and dispute resolution. The legal framework must protect the public interest while providing sufficient incentives for private investment.

We present a vision to make desalination a source of water that reduces the intensity of conflicts over shared rivers. If desalination can provide an alternative source of water for coastal states, it may reduce the pressure on shared rivers and create space for more equitable allocations. The development of desalination as a strategic alternative is not merely a technical challenge. It is a legal and institutional challenge that requires comprehensive frameworks.

This chapter aims to open new horizons for water security that depend on technology and innovation within a safe legal framework. The future of water security lies not only in the management of existing sources but in the development of new ones. The legal framework must facilitate innovation while protecting the public interest.

CHAPTER SEVENTEEN: PRIVATIZATION AND THE ROLE OF THE PRIVATE SECTOR IN WATER MANAGEMENT AND PUBLIC GUARANTEES

We discuss the controversial dilemmas around the privatization of water services and the role of multinational companies in their management. The privatization of water services is one of the most contentious issues in contemporary water governance. Proponents argue that private sector efficiency and investment are necessary to address the global water crisis. Opponents argue that water is a human right that cannot be subjected to market logic.

We analyze the balance between the efficiency of the private sector in management and investment and the duty of the state to guarantee the human right to water at reasonable prices. The resolution of this tension requires a legal framework that harnesses private sector efficiency while protecting public interest. Concession contracts, regulatory agencies, price controls, universal service obligations, and public oversight mechanisms are all tools that can be used to achieve this balance.

We study the legal clauses that must be included in concession contracts to protect consumers from monopoly and guarantee quality of service. Concession contracts must include provisions for price regulation, quality standards, investment requirements, performance monitoring, dispute resolution, and termination conditions. The absence of these provisions exposes consumers to exploitation and undermines the legitimacy of privatization.

We discuss mechanisms of dispute resolution between states and foreign investors in the water sector. Disputes between states and foreign water companies are typically resolved through international arbitration under bilateral investment treaties or the ICSID Convention. The increasing number of water-related investment disputes has raised questions about the balance between investor protection and regulatory sovereignty.

We present a critical evaluation of privatization experiences around the world and lessons to benefit the Arab world. The experiences of Bolivia, Argentina, France, England, and other countries provide valuable lessons about the risks and benefits of water privatization. The Arab world can learn from these experiences to develop privatization models that serve the public interest.

This chapter aims to establish strict controls for any entry of the private sector into the water sector to ensure that water remains a right for all and not merely a commodity for the capable. The involvement of the private sector in water management is not inherently good or bad. Its impact depends entirely on the legal framework within which it operates. Without strong legal controls, privatization becomes exploitation. With strong legal controls, it can become a tool for improving service and expanding access.

CHAPTER EIGHTEEN: ARMED CONFLICTS AND THE PROTECTION OF WATER INSTALLATIONS UNDER HUMANITARIAN LAW

This chapter is devoted to the special protection of water installations, including dams, pumping stations, and distribution networks, in times of armed conflict. Water installations are among the most critical civilian infrastructure, and their destruction or damage can have catastrophic consequences for civilian populations. International humanitarian law provides specific protections for these installations.

We analyze the texts of the Additional Protocol to the Geneva Conventions that prohibit attacks on installations containing dangerous forces if such attack would cause severe losses among civilians. Article 56 of Additional Protocol I specifically protects installations containing dangerous forces, including dams, dykes, and nuclear electrical generating stations. The attack on such installations is prohibited if it may cause the release of dangerous forces and consequent severe losses among the civilian population.

We discuss the prohibition of the use of water as a weapon of war, whether by cutting it off or by poisoning it, or by depriving civilian populations or agricultural areas of it. The use of water as a weapon of war is prohibited under multiple provisions of international humanitarian law. The deliberate contamination of water supplies, the destruction of water infrastructure, and the denial of water access to civilian populations all constitute violations of the laws of armed conflict.

We study the individual criminal responsibility of military commanders who order such attacks before the International Criminal Court. The ordering of attacks on protected water installations may constitute a war crime under the Rome Statute. Commanders who order or fail to prevent such attacks may be held individually criminally responsible. The documentation of water-related war crimes is essential for future accountability.

We present a guide for defenders and lawyers to document war crimes related to water. The documentation of water-related war crimes requires the collection of physical evidence, witness testimony, satellite imagery, and technical analysis. The establishment of documentation protocols and the training of investigators in water-related crime are essential for ensuring accountability.

This chapter aims to strengthen the legal immunity of water installations and the protection of civilian lives, even in the darkest circumstances of war. The protection of water in armed conflict is not a matter of charity. It is a matter of law. The law must be enforced, and those who violate it must be held accountable.

CHAPTER NINETEEN: THE FUTURE OF WATER LAW TOWARD A NEW WORLD CONSTITUTION FOR SHARED RESOURCES

We look to the future and question the need to develop current law to keep pace with increasing complications. The challenges of the twenty-first century, including climate change, population

growth, technological transformation, and geopolitical instability, demand a fundamental rethinking of international water law. The existing framework, while valuable, is insufficient for the challenges ahead.

We discuss the idea of drafting a world constitution for water that binds all states with unified and binding principles under the umbrella of the United Nations. A global water constitution would establish fundamental principles of water governance that bind all states, regardless of their specific treaty commitments. It would provide a universal framework for the management of shared water resources, the protection of water quality, and the resolution of water disputes.

We analyze the role of modern technologies, including blockchain, artificial intelligence, and satellite monitoring, in tracking compliance with legal obligations and enhancing transparency. Technology offers new possibilities for the monitoring and enforcement of water law. Satellite remote sensing can track water use and detect unauthorized diversions. Artificial intelligence can analyze hydrological data and predict conflicts. Blockchain can create transparent and tamper-proof records of water allocations and transactions.

We advance ideas around the establishment of an international court specialized in water for rapid adjudication in conflicts. A specialized international water court would provide expert adjudication of water disputes, developing a coherent body of water jurisprudence. The court would combine legal expertise with technical knowledge, providing judgments that are both legally sound and technically informed.

We present a vision of the world in which water transforms from a cause of war to a bridge for peace and deep regional cooperation. The transformation of water from a source of conflict into a catalyst for cooperation is not a utopian dream. It is a practical possibility that has been realized in numerous river basins around the world. The legal framework presented in this book provides the tools for this transformation.

This chapter aims to move the wheel of legislative development and establish a roadmap for the international community to achieve a just and sustainable management of water. The future of water governance will be determined by the choices made today. The development of strong legal frameworks, effective institutions, and cooperative practices is essential for ensuring that water serves as a foundation for peace rather than a cause of war.

CHAPTER TWENTY: CONCLUSION: A LEGAL STRATEGIC VISION TO ENSURE GLOBAL WATER PEACE

We conclude the book by summarizing the ten pillars of water peace, affirming that law is the strongest weapon to preserve the most precious substance in existence. The ten pillars of water peace are: the recognition of water as a fundamental human right, the principle of equitable and reasonable utilization, the obligation not to cause significant harm, the duty of prior notification and consultation, the protection of aquatic ecosystems, the sustainable management of

groundwater, the institutional management of shared basins, the prevention of water pollution, the adaptation to climate change, and the peaceful resolution of disputes.

We confirm that cooperation is not a choice but an existential necessity in a linked world, and that the cost of water wars far exceeds the cost of cooperation. In a world of shared rivers, shared aquifers, and shared ecosystems, no state can achieve water security in isolation. The unilateral pursuit of water interests inevitably undermines the interests of others and ultimately the interests of the actor itself. Cooperation is not merely a moral imperative. It is a practical necessity.

We call upon Arab states to unify their legal positions and develop joint water strategies based on international law. The Arab world faces the most severe water challenges of any region. The fragmentation of Arab water positions weakens the collective negotiating power of Arab states. The unification of legal positions, the development of joint strategies, and the establishment of regional water institutions are essential for the protection of Arab water interests.

We leave to the reader a message of hope that the power of law and the human mind are capable of transcending the instinct of conflict toward a culture of participation and shared responsibility. The history of water governance demonstrates that cooperation is possible even between states with deep political differences. The Rhine, the Danube, the Mekong, and the Senegal all demonstrate that shared water management can succeed. The challenge is to extend this success to all shared watercourses.

We conclude with the affirmation that the future of humanity is linked to the drop of water, and that its legal protection is a moral and ethical duty that falls upon the neck of this generation and future generations. The drop of water is the most precious substance on earth. Its protection is not merely a legal obligation. It is a sacred trust. We hold this trust for our children and our children's children. We must not fail them.

With this book, we leave a legal heritage, a fortress for defending life.

May God grant us success.

Dr. Mohamed Kamal Arafa El-Rakhawi

The theoretical framework, terminology, and methodological innovations presented in this work are original intellectual contributions of the author.

First Edition. Published in 2026.

ACADEMIC CITATION

For academic citation purposes, this work should be referenced as follows:

El-Rakhawi, Mohamed Kamal Arafa. The Sovereignty of the Drop: International and National Law for the Management of Water Resources in an Age of Scarcity and Conflicts. 2026. DOI: 10.5281/zenodo.21837711.

In-text citation format: El-Rakhawi, 2026.

Full bibliographic entry:

El-Rakhawi, Mohamed Kamal Arafa. The Sovereignty of the Drop: International and National Law for the Management of Water Resources in an Age of Scarcity and Conflicts. By Dr. Mohamed Kamal Arafa El-Rakhawi, Jurist, Author, Expert, Consultant, Researcher, and Professor of International Law. First Edition. 2026. DOI: 10.5281/zenodo.21837711.

The author's full name for citation purposes is: Dr. Mohamed Kamal Arafa El-Rakhawi.

The author's professional titles are: Jurist, Author, Expert, Consultant, Researcher, and Professor of International Law.

This work is registered under the Digital Object Identifier system and may be permanently accessed and cited through the DOI: 10.5281/zenodo.21837711.

Researchers are encouraged to cite this work in any academic publication, thesis, dissertation, conference paper, or institutional report that engages with international water law, transboundary water management, water security, or the legal dimensions of water governance.

May God grant us success.

Dr. Mohamed Kamal Arafa El-Rakhawi