In memory of Nora Salazar, whose dedication to work and love for nature has set a valuable example for those who wish a better planet and are committed to improve it.
For the last eight years, the countries of the Region of the Americas have commemorated the Inter-American Water Day on the first Saturday of October.

The starting point of this celebration is the Declaration signed by the Pan American Health Organization (PAHO), the Inter-American Association of Sanitary and Environmental Engineering (AIDIS) and the Caribbean Water and Wastewater Association (CWWA). Within the framework of the XXIII Inter-American Congress of AIDIS (November 1992) and the Rio Declaration on Environment and Development (June 1992), these entities decided to create a special day to highlight the importance of water for the well-being and economic development of the society.

Every year this event has been supported by local authorities, nongovernmental organizations, municipalities, private sector, community organizations, water utilities and schools pulling together the community to promote water conservation efficiency, drinking water quality and protection against water-borne diseases.

The theme for this year, Water, each drop counts: let’s use it wisely emphasizes the lack of water availability due to high demand increase, pollution problems, limited sector investment and water shortage. In this regard, individual responsibility is fundamental to advance towards better water management at the national and regional levels.

On this special occasion, local authorities, technicians, educators and the media are called upon to set a space for reflection and action. This working guide contains summarized and up-to-date information to foster the sound use of a social and economic good shared by all: water.

Sincerely

Dr. Mauricio Pardón
Director, Division of Health and Environment
Pan American Health Organization
1  chapter I  Water for the XXI century in the world and our region
13  chapter II  Comprehensive water management
17  chapter III  Water and agricultural and industrial activities
21  chapter IV  Water in household activities
25  chapter V  Contributions of authorities and technicians to sound water management
31  chapter VI  Contributions of educators and the media to appropriate use of water
35  chapter VII  Water campaigns
chapter I

WATER FOR THE XXI CENTURY IN THE WORLD AND OUR REGION
First there was water, everything was dark
There was no sun, no moon, no people, no animals, no plants
Water was everywhere
Water was the mother
The mother was not the people, nothing nor anything
She was the spirit to come
and she was thought and memory.

Kogui community
Sierra Nevada de Santa Marta, Colombia

Life and water are intertwined. No living organism can subsist without water. Therefore, water determines our possibilities to live with other species on planet Earth.

Being crucial for life, water is the articulating axis between nature and society.

How much water does a person need?

Water represents approximately 70% of the human bodyweight. If a person loses 10% of water, his life is at risk. A loss of 20% could be mortal.

A person must drink daily a volume representing at least 3% of his weight, thus, the average quantity a person needs is approximately 2 liters per day.

What water do we need?

Although the whole planet has approximately 1,386 million km$^3$ of water, less than 3% (barely some 35 million km$^3$) is fresh water.

The advantage of fresh water is that it does not contain salts, which is a characteristic of seawater. It is, therefore, appropriate for human use and consumption. However, its availability is restricted compared to seawater and population needs.
Where is fresh water found?

Fresh water is found in polar and glacial caps (79%), in the subsoil as groundwater (20%), and only 1% as surface water easily available.

In lakes, 52% is found, 38% in soil moisture, 8% as vapor in the atmosphere, 1% in rivers, and 1% in living organisms.

From the 110,000 km³ of rain and snow that fall every year on the continents, a significant amount returns to the atmosphere through evaporation or is absorbed by plants, while the 42,700 km³ of water that fall on the Earth represent the worldwide river stream. The group of lakes and rivers of the planet barely represents 93,000 km³ of fresh water.

In addition to being the main component of all living organisms, water is the principal climate regulator. It also purifies wastes through rain and runoff, and is the support of vital systems such as lakes, gorges, rivers, marshes, and seas.

Unequal distribution of water in the continents

Water is distributed unequally in the planet. There are areas where the resource is abundant and others where it is scarce.

Surface water is distributed in the following way among the continents:

South America 10,533 km³/year
North America 8,199 km³/year
Africa 4,573 km³/year
Asia 14,443 km³/year
Europe 3,217 km³/year
Oceania and Australia 2,397 km³/year
Antarctica 2,302 km³/year

In addition to being the main component of all living organisms, water is the principal climate regulator. It also purifies wastes through rain and runoff, and is the support of vital systems such as lakes, gorges, rivers, marshes, and seas.

Difficult water access

The existence of water resources in the continents does not ensure easy availability. In Latin America and the Caribbean, for instance, from a total of 500 million population, 27% do not have access to drinking water nor sewerage system.
## Estimation of water and sanitation deficit in the Region of the Americas

### Updated version to September 30, 2000

<table>
<thead>
<tr>
<th>Country/Territory</th>
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<tr>
<td>St. Vincent &amp; the Grenadines</td>
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<td>(vi) 4.0</td>
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<td>Trinidad and Tobago</td>
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<td>Virgin Islands (USA)</td>
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</tbody>
</table>


(i) There is no distinction between urban and rural population. It is considered totally urban
(ii) NA - Data not available
(iii) Data from Colombia are referred to drinking water and sewerage house connections exclusively
(iv) Data on drinking water and sewerage still need revision and confirmation
(v) Data on sanitation are pending on confirmation
(vi) There is no distinction between urban and rural population. It is considered totally rural
**Increase in water consumption**

Water consumption is increasing rapidly throughout the world, threatening the future availability of this important resource.

While in 1950, 1,360 km$^3$ were consumed annually, in 1990 it reached 4,130 km$^3$. By the year 2000 more than 5,000 km$^3$ will be used.

Consumption rise is due to:

- population increase
- rapid urbanization process
- higher industrialization
- expansion of irrigation lands
- uncontrolled use of water.

**Water loss in high consumption sectors**

High consumption areas include:

- agriculture, which consumes 93.4% of water
- industry, which consumes 3.8%
- municipalities, which consume 2.7%.

The estimated losses indicate that:

- agriculture loses an average of 70% of the water used
- industry loses 20% of the water used in its processes
- municipalities lose approximately 10% of water.

**Consumption increase and its causes**

Water consumption has multiplied by six in a century while population has grown three times. In other words, water demand has raised twice the population. The determinant factors are the increasing use of irrigation to achieve food safety, greater use of water in industrial processes, and more per capita consumption of water in household activities. Nowadays, loss of water due to evaporation in reservoirs is important.
Water is scarce in a country when annual availability is lower than 1,000 m³ per person. Currently, it is calculated that 230 million people live in water shortage areas.¹

The following Worldwatch graph (1993) shows an annual estimate of water used worldwide, as a whole and by sectors.

**GRAPH 1:**
**World annual estimate of water use**
**Total and by sector**

![Graph showing water use](image)


### Impact of water demand increase

The global increase in demand puts pressure on water resources of many regions due to overexploitation, which can lead to scarcity.

The growing demand has led to intensive aquifer exploitation since people wrongly believe that water resources are permanent, renewable, and inexhaustible. This has increased its use and is causing aquifer depletion because extraction rates are higher than those of recharge.

Other effects include land subsidence, pollution, water-table recession and seawater intrusion along coastlines, which produces groundwater salinization.

### Water shortage

Shortage is produced when water extraction from lakes, rivers, or ground aquifers is so large that supply sources are not enough to meet human or ecosystem needs.

Shortage appears in regions with high rate of population growth and low water availability per capita. The situation worsens when consumption rise increases per capita demand.
Water is scarce in a country when annual availability is lower than 1,000 m³ per person. Currently, it is calculated that 230 million people live in water shortage areas.¹

**Groundwater resources**

Some experts indicate that groundwater availability ranges between 4 and 60 million km³. However, water can be located at great depth making its use almost impossible.

The water quantity that can be used is considerably low; i.e., groundwater must be at least less than 4,000 meters of depth to be available, thus, the available quantity would range between 8 and 10 million m³. Still, there are technical and economic constraints to achieve its adequate exploitation.

On the other hand, groundwater has different recharge rates, sometimes it recovers slowly, and sometimes regularly.

Agricultural land expansion has also increased groundwater use, in addition to the usual surface sources. All over the world there are cases of groundwater depletion due to overexploitation for irrigation purposes.

In some places, groundwater depletion has produced the subsidence of soils located on aquifers, as in Mexico City and in California, United States, as well as in other countries.

**Water pollution and health**

Polluting water is like polluting life itself since all the reproductive, biological and food cycles of humans, flora, and fauna species may be affected.

Besides the fact that water is an ever-increasing scarce resource, it is becoming a good that cannot be used for all human activities due to its pollution levels.

Most rivers and natural and artificial reservoir have been polluted in the 20th century.

Rapid industrial development and urbanization, as well as agroindustrial activities, generate wastes that are dumped into rivers, lakes, and oceans with the consequent pollution. Agricultural and industrial activities and municipality wastes, such as wastewater, have affected surface water quality in many countries.

Groundwater has a serious impact despite the natural processes of purification and filtration through soils. It is known that the slow movement of water through or into the different layers of soil serves as a natural filter that blocks the passage of chemicals and bacteria.

But these processes are useless when contaminants are filtered into the watertable. At present, fertilizers and chemical pesticides used in agricultural activities are polluting groundwater sources.

Sanitary landfills, garbage dumps, as well as gasoline leaks from storage tanks and chemicals and hazardous wastes applied in productive activities also contaminate water.

The consumption of polluted surface and ground waters has serious health effects. To analyze this situation briefly, it is important to make a difference between two types of compounds that contaminate water: inorganic and organic pollutants.

Lead and mercury are among the hazardous inorganic contaminants derived mainly from mining activities, and as heavy metals, they can cause life threatening diseases. Cadmium, arsenic, copper, silver, selenium, zinc, and chromium also cause severe health problems.

The presence of nitrates in water from fertilizers, wastewater, and animal wastes are also highly detrimental to human health.

Organic contaminants appear in water as a result of pesticides and industrial activities. They also come from natural sources, such as decaying leaves and animal matter.

In many countries of Latin America, water-borne diseases are very common and are increasing morbidity and mortality rates.

Water-borne diseases have various origins and are caused mainly by bacteria, virus or parasites.
Cholera, a bacterial disease that was considered eradicated, reappeared in 1991 with a serious outbreak in Peru. Since that date, 391,000 cases have been registered in the America and 19,295 were fatal.

Diarrheal diseases caused more than 3 million deaths in the world in 1995, of which nearly 80% were children under 5 years old.

Approximately 200 million people in Latin America, Asia, and Africa have symptoms of intestinal infections by Giardia. Approximately 500,000 severe cases appear every year and most of them are children.
In developing countries, drinking water deficiencies give rise to 80% of reported diseases and 33% of deaths. Almost 65% of hospital admissions and 80% of outpatient visits are due to diseases related to lack of or unsafe water and sanitation.

There are 16 million cases of typhoid fevers every year, which cause 600,000 deaths. Almost 80% of them occur in Latin America and Africa.

In developing countries, drinking water deficiencies give rise to 80% of reported diseases and 33% of deaths. Almost 65% of hospital admissions and 80% of outpatient visits are due to diseases related to lack of or unsafe water and sanitation.

Some preventive measures that should be considered to avoid water-borne diseases are:

- to improve water quality and avoid the accidental use of inadequate water sources;
- to increase the quantity of available water and to make it more accessible in order to enhance hygienic conditions of lower-income sectors;
- to educate people on the appropriate use of water, personal hygiene habits, and food handling and preparation;
- to monitor surface and ground waters permanently and to avoid and control the appearance of insect breeding sites.

Previsions for the year 2050

A global evaluation of fresh water resources made jointly by various international organizations and the United Nations\(^2\) indicates that water is not sustainably used in many developing and developed countries.

It is clear that the world will face local and regional problems related to water quantity and quality as a result of unequal water distribution, inadequate use, and lack of adequate strategic planning.

According to that evaluation, previsions concerning water use will be related to several factors:

- Population size will increase water needs for different purposes. According to the United Nations, the population will reach 8,300 million in 2025, which would represent an increase of approximately 2,000 million people compared to present figures. Population will continue to be concentrated on urban areas and water resources will be under great pressure and overexploited.

\(^2\) Evaluación general de los recursos de agua dulce del mundo
• If current consumption trends continue, industrial water use will double and industrial pollution will be multiplied by four. New technologies may contribute, in some extent, to reduce polluting processes and wastes.

• Water for food production will follow an increasing trend and some countries will have serious difficulties in achieving food self-sufficiency.

• To maintain the current coverage of water supply and environmental sanitation in highly urbanized regions, investments over 1% of the gross domestic product (GDP) will be needed.

• If carbon dioxide and other harmful gas emissions continue, high temperature could alter precipitation and increase sea level, which might affect water availability all over the world.

• If current trends were maintained, water resources would be overexploited by more than two-thirds of the world population. Almost half of the population would not be able to tackle this situation adequately due to lack of financial resources.

• Water will no longer be a free available good and will become in some cases a commodity. If competition for water availability increases among various users, such as municipalities, industries, power plants and irrigation, water price will rise.

These considerations reveal the urgency to take measures in various social and economic sectors in order to stop negative trends and reorient water use and distribution.

The New Delhi Declaration, approved at the Global Consultation on Safe Water and Sanitation for the 1990s, formally recognized the need for promoting sustainable access to drinking water in sufficient quantities and the establishment of adequate sanitation services for all. It also emphasized the principle “some for all rather than more for some”.

This commitment is strengthened in the Agenda 21 through its chapters and especially through the third one, where the right to development is recognized so as to equitably meet the developmental and environmental needs of present and future generations.
Chapter 18, referred to protection of the quality and supply of fresh water resources, proposes the following program areas with their respective basis for action, objectives, activities, and implementation means:

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>· integrated water resources development and management</td>
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</tr>
<tr>
<td>· water resource assessment</td>
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<td>· protection of water resources, water quality and aquatic ecosystems</td>
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<td>· drinking water supply and sanitation</td>
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<td>· water for sustainable food production and rural development</td>
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<tr>
<td>· impacts of climate change on water resources.</td>
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</table>
chapter II

COMPREHENSIVE WATER MANAGEMENT
Atmospheric, surface and ground waters constitute a system that makes the hydrologic cycle possible.

**Hydrologic or water cycle**

Atmospheric, surface and ground waters constitute a system that makes the hydrologic cycle possible.

Water evaporated by solar energy from large marine surfaces rises to the atmosphere and is condensed into clouds. Then, it precipitates on continental areas and flows from high summits through rivers and back to the ocean. Water reaches the atmosphere through the phenomenon known as evaporation; through precipitation, it returns to the soil and back to its liquid state.

Water flowing down from snow-capped peaks to the sea is called runoff. Besides running on the land surface, water has other options: to penetrate the soil through infiltration or to be taken by living organisms becoming a fundamental part of its metabolism to be further expelled through different functions.

Water problems occur when people interrupt the hydrologic cycle or part of its processes.

**Hydrographic basins**

A hydrographic basin is a specific topographical area where continuous or intermittent ground and surface waters flow toward a natural central spot that drains into a main river, a natural water basin, or the sea. A basin is separated by a summit line called water divide.

A comprehensive hydrographic basin management is fundamental to achieve sustainable management and adequate use of natural resources, including water as the primary resource.

This comprehensive management involves the interrelationship of various natural, socioeconomic and cultural factors. It means that basin management and protection strategies should be in accordance with national planning, including regional, local and global aspects. The concept of sustainable development and resource conservation with an intersectoral vision should be ingrained in planning.
Basin Authority

All countries recognize large hydrographic basins as the most appropriate territories to carry out comprehensive water resources management, including water use, planning and management.

In a basin, nature forces to recognize needs, problems, and risks leading to the establishment of priorities, common goals, and principles of responsibility and solidarity for the control and preservation of natural resources.

For a comprehensive water management, it is necessary to define responsibilities and assign authority to a representative group known as the basin authority, which can:

- formulate and carry out programs to improve efficient resource management and use, especially water;
- promote the establishment of national and local plans within a rational and sustainable perspective;
- strengthen decentralization processes of functions, programs, and resources;
- help preserve and restore hydrographic basins.

Hydrographic basin components

A basin includes the following components:

Physical components: geological (land stability, related risks, etc.), geomorphologic (geographic features and its processes), climatic (winds, temperature, rain, moisture), water resources (water sources, quality and quantity in the region) and soils (agro-ecological classification, use, management, and conservation).

Biological components: related to flora (vegetation), fauna (types of fauna and microfauna), and ecosystems.

Socioeconomic and cultural components: population (demographic factors, population dynamics, life quality, etc.), educational activities (education level and local knowledge), health (basic sanitation conditions, mortality, and morbidity), economic activities (resources, production, development model), landscape (potential and present use of landscape resources), ethnic groups, cultural traditions and its relation with resources, etc.
Integrated water management is part of the comprehensive hydrographic basin management and considers the permanent presence and interaction of the physical, biological, socioeconomic, and cultural components of the region.

Irrational water consumption creates the urgent need to know more about the hydrographic basin behavior to plan its sustainable use in benefit of both human activities and life conservation on the planet.
chapter III

WATER IN AGRICULTURAL AND INDUSTRIAL ACTIVITIES
Agriculture

The agricultural sector consumes 93.4% of the water used for all human activities around the world; i.e., it is the highest consumption sector.

Furthermore, water losses in agriculture account for 70.1% of global losses in the planet. The gap between consumption and loss is so high in this sector that it has to be dealt with in any program for sustainable water use.

Food demand increases according to population growth, which requires the expansion of crop areas that multiply water needs.

In 1900, 50 million hectares were irrigated and an estimate of 252 million are expected for the year 2000. In a century, irrigated surface has grown five times.

Moreover, agriculture permanently pollutes water due to uncontrolled infiltration, precipitation, and runoff.

Intensive agriculture, manure, and the increasing use of agricultural chemicals represent a permanent threat to water quality. The main agricultural contaminants are pesticides, herbicides, and other chemicals.

All of them, together with animal wastes and nutrients, are transferred into surface waters and may also affect groundwater.

Latin America uses more pesticides and chemicals than industrialized countries. Brazil, with an annual consumption of 150,000 tons, is one of the five countries with higher rates worldwide.

Water contamination follows the same pattern in the Region.

On the other hand, crops in slopes or hills increase sediments in waters and cause problems on soil, biodiversity, and water quality.

Ineffective irrigation methods have led to serious losses and unsustainable water use.
To tackle this situation, the agricultural sector should take urgent measures to stop the uncontrolled use of water, as well as water losses and pollution. The following recommendations should be followed:

- to avoid flood irrigation;
- to seek better alternatives, such as drip or sprinkle irrigation;
- to line channels in order to prevent losses;
- to save water by combining different crops;
- to use both surface and ground waters;
- to use treated wastewater for irrigation;
- to apply alternative pest control and plant nutrients;
- to introduce ecological and ecosystem management practices in agriculture;
- to become involved in the comprehensive hydrographic basin management where the agricultural area is located.

**Industry**

Industrial activities use large quantities of water for its productive processes. Water demand for production is calculated as follows:

- To produce 1 ton of cement: 3,500 liters of water
- To produce 1 ton of steel: 250,000 liters of water
- To produce 1 ton of paper: 220,000 to 380,000 liters of water

Water consumption in industrial activities represents 3.8% of all consumption throughout the world. Water losses, however, represent 20% of total losses, which indicates that water saving measures are being neglected in industrial processes.

On the other hand, industrial wastes discharged directly into rivers, streams, seas, or sewerage systems pollute surface and ground waters and have a negative impact on health and the sewerage system itself.

Industrial activities can also create accidental chemical spills or leaks that affect watercourses, sewerage, soil, and groundwater.

Industrial pollutants vary according to production, from chemicals to non-treated wastewater.
Agenda 21, approved at the Summit on Environment and Development called upon by the United Nations in Rio de Janeiro in 1992, proposes industries to consider environmental management as one of its main priorities and to handle their productive activities ethically. They should adopt measures to reduce solid wastes and chemicals that affect health and should support the sustainable use of natural resources, including adequate water management.

Pollution prevention is the main strategy of any environmental management approach to advance towards eco-efficiency among industrial activities.

In this regard, the standards ISO 14000 represent a valuable environmental management tool for all companies willing to compete in a responsible manner.

These standards of voluntary application allow an organization to formulate its policy and objectives based on legal requirements and information regarding the significant environmental impact that can be controlled by the organization. They enable the corporate sector:

- to implement, maintain, and improve its environmental management systems;
- to keep coherence with the environmental policy and demonstrate its consistency to third parties;
- to certify its environmental management system;
- to perform periodic self-evaluations and provide feedback for continuous improvement.

The concept of eco-efficiency proposes an ecologically sustainable economy producing more with less. It implies the use of less natural resources and energy in production processes in order to reduce wastes and minimize contamination.

Industry can contribute significantly to water saving and pollution prevention through sound management of the following production factors:

- sustainable use of natural resources or raw materials
- promotion of non-toxic, solvent-free and non-polluting materials
- pollution prevention throughout the process
- reduction of emissions and effluents
- reuse of wastes and by-products
- control of the productive water cycle
- water recycling
- establishment and control of the total life cycle of industrial products.
chapter IV

WATER IN HOUSEHOLD ACTIVITIES
A great quantity of water is consumed in household activities. Water is frequently wasted by neglect or ignorance. Some people disregard the importance and real value of this resource, especially when it reaches households through pipelines.

People without access to water at home endure many hardships and their quality of life become deteriorated. Thus, everybody should be advised on the importance of water rational consumption so that it could be widely supplied and preserved for the future.

An estimate of water used in households is presented below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shower</td>
<td>90</td>
</tr>
<tr>
<td>Bath</td>
<td>350</td>
</tr>
<tr>
<td>Teeth washing without closing the faucet (1 min.)</td>
<td>6</td>
</tr>
<tr>
<td>Washing 10 kg of clothes</td>
<td>140</td>
</tr>
<tr>
<td>Dish washing without closing the faucet (15 min.)</td>
<td>90</td>
</tr>
<tr>
<td>Car washing without closing the faucet (25 min.)</td>
<td>150</td>
</tr>
<tr>
<td>Hands washing during 1 min.</td>
<td>6</td>
</tr>
<tr>
<td>Shaving without closing the faucet (3 min.)</td>
<td>18</td>
</tr>
<tr>
<td>Toilet flush, 1 time</td>
<td>15 - 20</td>
</tr>
</tbody>
</table>

It is calculated that a European consumes an average of 150 liters per day; an American 300 liters, but an Indian consumes 25 liters only.

These differences show that people are not aware of the excessive consumption and the precarious conditions of some groups all over the world. An important step toward rationalization is to use water coherently based on social equity and nature preservation values.

These basic recommendations should be followed to save water at home, work, school, public places (restaurants, clubs, parks, etc.):
In the kitchen and sink:

- When washing dishes, first soak with detergent and then open the faucet to rinse.
- If there is no running water, use two buckets, one to soak with detergent and the other one to rinse.
- To defrost food, do not use water, leave it at room temperature.
- Close the faucet tightly to avoid dripping.
- To wash vegetables, place them in a container with water instead of allowing it to run unnecessarily.
- Check pipes and faucets frequently to detect any dripping and solve the problem rapidly to prevent leaks.
- When cooking, use only the necessary amount of water and do not throw away the broth; use it for soups or other food.
- When washing clothes, do not throw rinse water away since it can be used to mop or wash the floor or for the garden.
- If you hand-wash, the last rinse water can be used to wash other clothes.
- If you use a washing machine, do not fill it completely, calculate the water required.

In the bath:

- While brushing your teeth, close the faucet. Then open it again to rinse.
- In the shower, close the faucet while soaping; then open it again to rinse.
- Check the toilet to detect any leak and repair it immediately.
- Verify if the toilet uses water in excess and try to reduce the flush volume.
- Use the toilet only when necessary. Do not flush to eliminate wastes such as cigarette butts, tissue paper, etc.

In the yard, garden, and family orchard:

- Water your plants when the sun is not strong, early in the morning or preferably at night. Use only the water required; there is no need to flood the garden.
- Choose plants that consume little water and adapt well to local conditions.
Water used in the kitchen can be reused to water plants.

Control hose leaks.

Use sprinklers for lawn.

Use rainwater for the garden and other uses.

Prepare fertilizers with plant wastes. Place a layer of dung and straw around trees and plants so they can hold more water.

Avoid pesticides and other toxics.

If these recommendations are followed collectively, both at home and at the places we go to, they can reduce consumption significantly and we can contribute to the preservation of such an important resource.
chapter V

CONTRIBUTIONS OF AUTHORITIES AND TECHNICIANS TO SOUND WATER MANAGEMENT
Authorities, decision-makers, and technicians should rationally focus their activities on comprehensive water management with an intersectoral vision for regional basin management.

Authorities can make positive contributions to sustainable water supply management in their respective sectors to meet the social and economic demands in terms of adequate water quality and distribution.

To make progress in this direction, authorities together with technicians, should carry out the following tasks:

- program environmental management actions through comprehensive basin management;
- establish within that framework the protection of water sources and wetlands;
- prevent and reduce water source contamination;
- promote among the population and productive sectors the rational and efficient use of water;
- improve water supply in the different sectors involved;
- ensure equity in drinking water supply and quality. Box 1 presents a methodological approach to establish priorities in order to control environmental threats to human health;
- further water inventories and assessments at the local, regional, and national levels;
- support research, studies, and analysis of various conditions in the region, country, or town;
- take sound measures for the protection of river banks and coastal areas;
- facilitate the recovery and conservation of ecosystems and biodiversity;
- seek solutions to deforestation and promote reforestation;
- support clean technologies and industrial eco-efficiency;
- establish partnership mechanisms between the State and the private sector to rationally use and share experiences and knowledge about water.

Authorities can make positive contributions to sustainable water supply management in their respective sectors to meet the social and economic demands in terms of adequate water quality and distribution.
The participation of technicians to assist authorities is essential. Informed decision making should be supported by serious studies and research to guarantee adequate water management actions.

Likewise, technology development and improvement of agricultural and industrial processes as well as recovery and decontamination activities, are essential inputs that could be provided by professionals from different areas.

Within the institutional, local, and regional management it is necessary to consider the need to:

¨ design local water policies within the framework of regional and national policies considering the special characteristics of every sector;

¨ strengthen at the local and regional levels the authorities in charge of water management and to take basin management as a reference axis;

¨ represent the different groups of the population in the leading institution that deals with local water matters and to relate them with the same organizations at the regional level;

¨ organize users to participate in the formulation and execution of water management plans with the support of governmental organizations and the cooperation of technicians;

¨ promote the participation of women in water management, as well as in other actions to improve health and sanitation conditions of the population;

¨ support the participation of the organized population and users for the adequate management of natural resources, especially water.

Finally, since many watersheds and aquifers pass through international borders, authorities must facilitate cross-border cooperation in basin management, sign new agreements, and put into force international agreements.
Several of those agreements promote the equitable use of common water resources, including plans for integrated water development as well as pollution control in shared aquifers.

To set these mechanisms and activities in motion will enhance a global vision of water management and will further cooperative actions in a crucial topic for human sustainable development.

Community participation plays a key role in all the above mentioned activities. Therefore, authorities and technicians should put into practice different alternatives promoting the active participation of the population in water management on a permanent basis.

Indeed, if the population is aware of this valuable resource and is called to participate in various institutional and intersectoral instances, then, they will support sustainable water management at the local, regional, and national levels.

Community participation plays a key role in all the above mentioned activities. Therefore, authorities and technicians should put into practice different alternatives promoting the active participation of the population in water management on a permanent basis.
The relationship between human health and environment is complex and furthermore each of the health-environment aspects is linked to several economic and social development issues. The DPSEEA model facilitates the analysis of such a complex relationship.

DPSEEA is the result of WHO’s adaptation of the United Nations Development Program (UNDP) model developed to monitor progress towards sustainable development. DPSEEA proposes a six level cause-effect framework as a basis for analyzing environmental health situations, assisting decision-makers and policy-makers, and for increasing focus on the health aspects of human sustainable development. This cause-effect framework is known as DPSEEA from the six initials of its levels: Driving force, Pressure, State, Exposure, Effects, and Actions.

This framework is a methodological approach and is a response to Chapter 40 of the Agenda 21 (Information for Decision-making). It is intended to be used for setting priorities for action of traditional and modern environmental threats to human health.

The Driving force is the first and broadest level of the framework and refers to the general factors that motivate and drive the environmental process such as population growth and economic development.

The existing driving forces generate human occupation or exploitation of the environment, resulting in a Pressure on the environment, which is the second level of the framework.

The continuing pressures on the environment modify its original condition, generating the third level of the framework: the State of the environment such as the balance of the natural components and the level of pollutants in its media.

The different conditions of the environment and the presence of contaminants can be an environmental hazard for humans if they generate an Exposure, which is the fourth level of the framework.

If an exposure exists a health effect is expected which is the fifth level of the causal-chain. Health Effects call for immediate Action, but the solution of the problem needs Actions at all levels of the causal-chain. Using the DPSEEA framework to orient these Actions is critical for the health sector and other sectors to achieve sustainable development. Figure 1 shows DPSEEA dynamics and internal relations.
FIGURE 2:

Framework for decision making to mitigate inequities in hygiene and water supply for human consumption

Driving force
Population growth
Economic development
Technology

Pressure
Production
Consumption
Waste release

State
Natural hazards
Resource availability
Pollution levels

Exposure
External exposure
Absorbed dose
Target organ dose

Effect
Wellbeing
Morbidity
Mortality

Action
Economic policy
Social policy
Clean technology
Hazard management
Environmental improvement
Education awareness raising
Treatment

Source: PAHO. Environmental protection and development: framework for actions to reduce inequities in safe drinking water. PAHO, Division of Health and Environment, 1999.
CONTRIBUTIONS OF EDUCATORS AND THE MEDIA TO APPROPRIATE WATER USE
Educators from preschool to university, including non formal education, play a key role on broadening understanding among their students about the importance of water and its adequate use.

Water is an interdisciplinary topic and the contents of the courses help educators fulfill that role. In addition, schools can program specific activities to promote better water management by students, parents, and the population.

Also, the media and social communicators, who can reach major population groups, can become prominent leaders in the adequate use of natural resources. In this regard, they should contribute to addressing the current global situation and disseminate solutions to achieve sustainable development.

Agenda 21, approved by the countries that attended the Rio de Janeiro Summit in 1992, points out in chapter 36, Promoting Education, Public Awareness, and Training, that all nations should:

- guarantee education on environment and development to all people of all ages;
- deal with the concepts of environment and development, including the problems of societies, in all educational programs and analyze the problems and its causes. Special attention should be given to the training of decision-makers;
- involve schoolchildren in local and regional studies on environmental health, including safe drinking water, sanitation, food, and economic and environmental impact of resource use;
- work together with the media, popular theater groups, and advertising companies to promote more active discussion among the population;
- value indigenous and native experiences to improve education and training. Encourage all sectors of society, such as industry, universities, governments, non-governmental organizations, and community groups to include training on environmental management;
- offer trained technicians to advise local communities according to the services they require and the basic principles to protect natural resources.
Educators in learning institutions and communicators in mass media should be advised that water management is ruled by some principles, which can serve as reference for the actions they want to carry out.

In 1992, within the framework of the International Conference on Water and the Environment, held in Dublin, four fundamental principles were approved:

**THE DUBLIN PRINCIPLES FOR WATER:**

**Principle No. 1.** Freshwater is a finite and vulnerable resource, essential to sustain life, development, and the environment.

**Principle No. 2.** Water development and management should be based on a participatory approach, involving users, planners, and policy makers at all levels.

**Principle No. 3.** Women play a central role in the provision, management, and safeguarding of water.

**Principle No. 4.** Water has an economic value in all its competing uses and should be recognized as an economic good.

Following these principles, educators and communicators can develop local, regional and national capabilities to improve human and institutional conditions that may relieve problems related to water and its improper use.

To develop human and institutional capabilities, it is necessary to enhance education, raise awareness, and institutionalize the process of improving current conditions.

Among the strategies to make progress in this direction, key groups such as women, schoolchildren, young people, non governmental organizations, indigenous and native populations, and decision makers should participate in these educational and awareness raising processes.

Educational and communication actions should be directed towards them to foster understanding of the real situation of water and natural resources in general and to create a willingness to assume responsibilities in their field of influence.
Educators and communicators can work in their own areas proposing reflection and interventions to their target audiences. They can also carry out joint actions, especially in public campaigns, where education and communication are substantial parts.
chapter VII

WATER CAMPAIGNS
A water campaign can be conducted within an educational center or be extended to larger groups of the population. In this regard, students can convey the message and, with the support of teachers and communicators, disseminate it to the rest of the population.

Regarding water, the best alternative is to include larger social groups to obtain better results.

Some of the possible topics for water campaigns can be:

- **Topic 1.** Water saving in schools, home, work, business, etc.
- **Topic 2.** Water saving in agricultural activities
- **Topic 3.** Water saving in the industrial sector
- **Topic 4.** Rainwater collection and reuse
- **Topic 5.** Water pollution prevention and control
- **Topic 6.** The concept of hydrographic basin and its relation with local and regional development
- **Topic 7.** Water excess and shortage in nature
- **Topic 8.** Water pollution and health
- **Topic 9.** Water resources around the world and future prospects

A key element to mobilize population is to raise awareness regarding the relationship between society and nature, the water situation at the municipal, local or regional levels and its relation to life quality and the real possibilities to attain sustainable development.

Campaigns should include public awareness activities opened to all groups.

A water campaign should motivate and raise population awareness. Specific local situations should be considered within a regional, national, and global framework and concrete actions should be proposed to solve problems.

This activity (or set of activities) should provide better information on one or more central subjects to motivate behavior change.

Once the campaign target audiences have understood the possible consequences of any negative action regarding water management, they will be able to decide consciously and act accordingly.

Campaigns should not be isolated activities within water management; on the contrary, they should be integrated into local and regional development. Therefore, they should be both comprehensive and coherent.

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Campaigns should not be isolated activities within water management; on the contrary, they should be integrated into local and regional development. Therefore, they should be both comprehensive and coherent.
There are some guiding criteria to achieve positive results in a campaign:

- the scope of the topic (in this case, water and the emphasis selected) should be comprehensive, including the relationship between society and nature and its articulation with sustainable development as the main concept of the whole campaign;

- the interests of adequate protection and management of nature and water should be articulated with the interests of survival and well-being of the population;

- the ideas to be used in the campaign should be integrated into actions developed by the various social sectors;

- those actions should be integrated to propose a clear convergence among sectors and not be just isolated activities.

For an environmental campaign to be coherent (good relationship among the parts and the whole), the following aspects should be addressed:

- coherence between what is requested and the real possibilities that people could make it (with regard to resource access, external means available, training or preparation);

- coherence between what is proposed and the reasonably attainable and measurable results;

- coherence between what is intended and the population interest;

- coherence between what it is proposed and the quality of the strategies to be used so that the media could achieve a good impact;

- coherence between efforts requested and benefits that would be obtained;

- coherence between the main target sector and the way of expression and communication means of that sector.

In conclusion, a campaign must have clear sustainability, i.e., it requires specific periods and goals that should be renewed as other priorities arise demanding solutions with the population. It is not enough to have specific actions today that will be forgotten later on. It is essential to persist, expand, and enrich creatively all communication options in every sector and population group.

Educators and communicators have the possibility to reach the various population sectors through educational and dissemination mechanisms to improve water management awareness.

They should transmit clear messages to the general public and the community by means of campaigns, courses, seminars, open activities, participatory workshops, messages through various media, such as radio, television, press,
advertising spots, or other alternative means (theater, puppets, pamphlets, presentation of experiences, etc.).

The celebration of the Inter-American Water Day, on the first Saturday of October of every year, is a special occasion for educators and communicators to join efforts. Cooperative action, with the participation of the population in a whole encompassing campaign, will further water quality and good practices in the various social and economic sectors.

For the year 2000, the motto of the Inter-American Water Day is WATER, EACH DROP COUNTS: LET’S USE IT WISELY.

Activities suggested to commemorate the Inter-American Water Day

Some proposals for the campaign are presented below:

For schoolchildren and community; it includes actions inside and outside the school:

- informative talks at the different educational and community levels on the proper use of water and its relation with health and life quality;
- projection of films or videotapes with further discussion on the subject;
- school project competitions for saving and using water properly;
- collective cleaning days;
- evaluation and repair of sanitary facilities;
- community program for leak detection;
- parades with banners prepared by students, teachers, and parents;
- guided visits to water treatment plants.

For the mass media:

- informative programs on the water situation and its impact on health and life quality;
- radio competitions promoting better consumption practices, payment culture, and information on water;
- advertisement to inform and motivate the population to participate in the Inter-American Water Day

For local authorities, experts and technicians:

- technical discussions on new water management prospects;
- meetings for analyzing and evaluating the sector;
- workshops to share experiences in local water management;
- support to community programs for water quality improvement;
- coordinated programs of water quality surveillance.