Circular Economy Lab & Observatory

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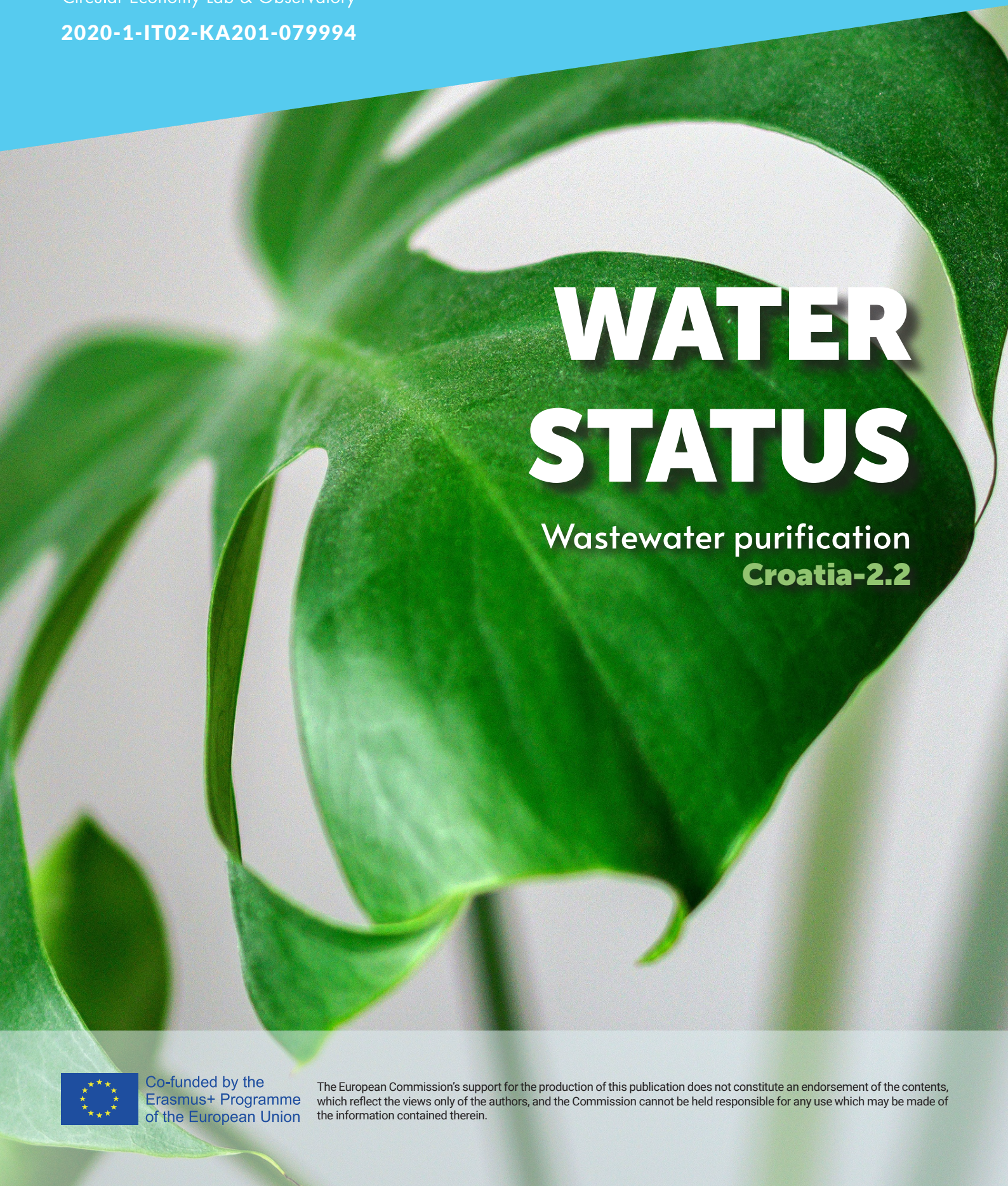

WATER STATUS

Wastewater purification

Croatia-2.2

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One of the world's biggest problems which is also the main cause of dying nature is pollution. Pollution is the introduction of very harmful materials called pollutants into the environment. Pollutants could be natural like volcanic ash, or they could be the product of factories and human influence. Pollution and the effects of human negligence can be spotted all over the world as it has impact on the air, soil, ozone layer and water. Pollution of water is one of the main concerns as this widespread issue is jeopardizing our health and the health of other living beings.

Sources of water pollution(https://www.filterwater.com/images/upload/waterpollutionsources.jpg)

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Our planet's surface is 71% water and less than 1% of it is safe for ingesting. Water pollution occurs when chemicals, microorganisms and other harmful substances find their way to a river, lake, stream, ocean, or any body of water, degrading its quality and making it a health hazard and toxic if someone was to ingest it. There are many types of water pollution. Groundwater pollution is caused by pesticides and fertilizers which make their way to the water in the earth cracks that are filled with rainwater.

Surface water pollution occurs when the oceans, rivers, lakes, and other waters are endangered because of the nitrates and phosphates which are the consequences of farm waste, fertilizer runoff (the draining away of water or substances carried in it) and industrial junk that is released.

When this happens, the water is unsafe for swimming, fishing, and drinking. Ocean water pollution mainly originates on land from where contaminants such as heavy metals, different chemicals and nutrients are carried from land to the bays and estuaries. Pollution can also occur from a point source which means it originates from a single source legally or illegally, from a specific factory, oil refinery, leaking septic system...

In contrast to a point source, water can be contaminated from a non-point source as well. It is often caused by agricultural or stormwater runoff or debris from land, and it is very difficult to regulate since there is no definable culprit. This is the main cause of water pollution in US waters for example.

There is also transboundary pollution which is caused when a contamination from the water in one country, travels by rivers and streams to a water in a different country.

Themost common pollution types are agricultural, oil pollution, radioactive substances, and wastewater.

[1] Wastewater, also known as sewage, is the most common type of contamination as it is a term for used water. It comes from our sinks, showers, toilets and from agricultural, industrial, and commercial activities.

After the water is used, around 80% of it flows back into the environment while endangering the surrounding wildlife.

The pollution of seas and oceans with a large amount of plastic (https://www.history.com/.image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cfl_progressive%2Cq_auto:good%2Cw_1200/MTU3ODc5MDgINjI5OTA4Mjk3/nature-pollution.jpg)

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Pathogens are disease causing microorganisms that are commonly found in the domestic sewage. When the sewage is released into the wild, water contaminated with pathogens comes in touch with the clean surface and underground water. Pathogens in water are extremely dangerous when in contact with nature or living beings as it causes them harm.

Waste collected from the water (photo by Tonko Brebrić)

They are found in feces so all the sewage water from cities contains them and is a huge risk for public health. With pathogens, putrescible decaying organic matter is also a threat to water quality. As bacteria and other microorganisms decompose the organic matter, the dissolved oxygen level of the water is reduced. High oxygen levels are essential for the marine life because the fish and other aquatic organisms need it for breathing.

Sewage is also a major source of nitrates and phosphates which are plant nutrients. Excessive plant nutrients in the water are the cause of rapid algae growth also known as algal glooms. They produce oxygen but when they die, oxygen levels start rapidly reducing. The cause of it are microorganisms that use oxygen to digest the dead algae during decomposition.

After decomposition, anaerobic organisms metabolize the organic waste and produce very harmful gases such as methane and hydrogen sulfide which are a huge threat to other aerobic beings that rely on oxygen for survival.

The process of turning lakes from a clean aquatic nutrient-free community to a nutrient- rich and algae- filled state and in the end into an oxygen-deficient environment is called eutrophication. Eutrophication is inevitable and when it is accelerated by humans it is called cultural eutrophication.

It has dramatic consequences on freshwater resources, fisheries, and other bodies of water as it causes extreme degradation which is the result of hypoxia. Hypoxia is a condition that results in extremely low oxygen levels in the bottom waters.

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The problem of hypoxia is very visible in the Black Sea where it has killed massive amounts of fish and is a big threat to the food chain. Excess loading of carbon, nitrogen and phosphorus caused cultural eutrophication in numerous coastal marine environments.

Several US estuaries such as Chesapeake, Delaware Bay, Gulf of Mexico have been severely polluted by the sewage water runoff.

The main cause of the hypoxic "dead zones" and dying marine life is wastewater. [2] Shockingly, 80% of the global sewage is released into the environment untreated.

The percentage of treated wastewater varies from 90% in North America, 66% in Europe, 35% in Asia, 14 % in Latin America and sadly <1% in Africa. The sewage is left untreated and uncared for in mainly undeveloped and poor countries, which then affects the others as the waste travels by rivers and streams.

Waste collected from the water (photo by Tonko Brebrić)

As untreated wastewater causes extremely serious problems and pollution, humans need to do something about it. Luckily, some saw the seriousness of the effects on the marine life and decided it was time for a change. Drainage systems have existed from the earliest ancient cities and a notable example is ancient Rome. People invented surface conduits that were connected to a large channel called the Cloaca Maxima or the "Great Sewer" which carried sewer water to the Tiber River.

It is built of stone and is one of the oldest monuments of Roman engineering. As the technology evolved, new drainage systems were invented but they were usually connected to cesspools and not to sewers. A huge problem emerged in England when the cholera outbreaks appeared because the water was contaminated with waste from cesspools.

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It became necessary for water to be connected to the storm sewers which resulted in transferring sewage from the ground near houses to nearby bodies of water which led to the pollution of the water surface. Some people used to say, “the solution to pollution is dilution” and it was believed that a natural process of stream self-purification can dilute all the waste.

Drainage system is crucial for a safe environment (photo by Tonko Brebrić)

But the process of selfpurification does not work in densely populated areas, so we had to come up with a new way of purification and it was water treatment. Wastewater treatment is a process that removes as much of the suspended solids as possible before the remaining water finds its way back to the environment and pollutes it. There are three stages of the treatment. The first or primary stage focuses on the larger materials in the water and removes them.

Secondary treatment works on a deeper level and substantially degrades the biological content of the waste. It can be done in one of three ways. Biofiltration ensures that any additional sediment is removed with sand filters, contact filters or tricking filters. Aeration is a very effective but lengthy process which increases oxygen saturation by introducing air to wastewater.

Oxidation pond is a method that uses microorganisms such as bacteria an algae to treat the water in ponds (shallow waters) through interaction with sunlight.

After completing secondary treatment, water is safe to release into the local environment. During the tertiary treatment, pathogens are removed from the water, which makes it safe for drinking and raises the quality of water to domestic and industrial standards. Although wastewater treatment is very effective, it cannot solve all of our problems.

Wastewater treatment before returning to the environment (photo by Tonko Brebrić)

It can be useless if the sewage pipes are not correctly built or are old and made from a poor-quality material. For safe disposal and purification of sewage water we need to ensure all the wastewater systems are long-lasting and leak-tight because it is crucial for healthy communities and a safe environment.

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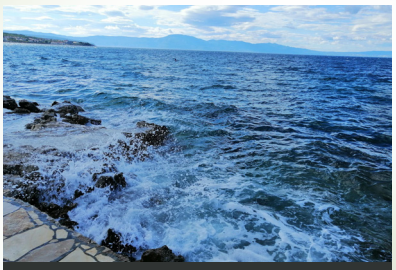
Earth is referred to as a "blue planet" because 71% of its surface is covered with water. Shockingly, only around 1% of it is fresh and usable. Luckily, some people realized that they need to change their habits in order to save the life on land and the marine life. Through the years, people founded some organizations in order to stop the pollution and the number of them grows every year. Organizations tend to help us bring the problem to the public and show people the effect we have on the world.

Veolia Environment is a global provider of environmental services, water, and wastewater, waste management, energy services... It is based in the suburbs of Paris, France.

They offer a range of solutions in sustainable water recovery and water purification and provide technological solutions for industrial and science research companies. With Veolia, the French utility firm SUEZUEZ, which has its geographic presence on almost all continents, offers water supply, wastewater treatment and waste management.

Establishing organizations and informing people about the water problem in the world (photo by Tonko Brebrić)

They provide water distribution and treatment services to individuals and industrial clients. ITT corporation is a firm that produces specialty components for the transportation, aerospace, energy and industrial markets.



The sea is still clear in Croatia, at first sight at least... (photo by Lara Šteković)

Part of this company that is focused on water technology is called Xylem Inc. In Xylem they focus on the manufacture, design and service of engineered solutions for water and wastewater. They have new upgraded wastewater treatment techniques offering UV and ozone disinfection systems for oxidizing contaminants present in wastewater. It has a big impact on the water quality because it removes bacteria, viruses, odor-causing compounds and other harmful microorganisms found in sewage water. [4]

Oceana is a conservation and advocacy organization based in Washington D.C. It is the largest organization which is exclusively working to clean, save and restore the oceans trough targeted policy campaigns. Oceana is also trying to stop the major sources of ocean pollution such as oil, mercury, wastewater and many others.

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They protect vulnerable places in the oceans, including the Arctic, the Aleutian Islands, the Mediterranean and Chile's Juan Fernandes Islands and many others.

Croatia also participates in projects for the purification of waste water on Earth.

In order to enable ecological standards in the City of Zagreb, the Zagreb Biological Wastewater Treatment Plant (ZOV) was built. ZOV is a device aimed at improving water quality in the Sava River.

ZOV takes care of the mechanical and biological purification of water and its canals. In order to save the Earth and its nature we need to make a change.

A lot of people think that they cannot make a change as individuals, but that mindset is wrong. The least we could do is recycle and try to stop the overuse of plastic so we can replace it with biodegradable products. In order to stop wastewater pollution, we can use our voices. We could make protests in order to stop the illegal sewage dumps in the ocean and donate to organizations that specialize in water purification.

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