

FITDigit

A Green Future in the Digital World - *FitDIGIT*

[2022-1-FR01-KA220-SCH-000084947]

*Educational materials for teachers
and exemplary lessons for pupils
based on story telling (5)*

How cities combat climate change

Project Result 1
Digital stories for Environmental Education-Handbook
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Introduction

“A Green Future in the Digital World” is an Erasmus+ project designed especially to support the innovative digital educational curricula supporting environmental and digital education in schools all around Europe. Implemented by six partners, it gives a strong educational boost to support sustainable green environmental awareness.

One part of the project (WP3) was designed to create an interdisciplinary pedagogical model and educational tools to help teachers and their pupils to gain cognitive skills in environmental change with “real life” application. As a result, a huge bunch of educational materials has been created, which are divided into two Parts:

Part 1. Digital Stories for Environmental Education.

Part 2. E-coding curriculum for Environmental Education.

This Handbook is the 1st element of the first Part of the educational materials, and it provides insightful and innovative information about the local initiatives to help to fight climate change in cities.

These educational materials are divided into the following parts:

- Theoretical part - presenting theoretical materials on how cities can help combating negative effects of climate change- for teachers;
- Practical part - presenting local initiatives mitigating the negative effect of climate change in cities. This is a story telling exercise, which can be used by teachers during their classes;
- The third part presents the lesson plan, and it is supported by Quizzes, and Exemplary video materials and games to be used during classes;
- The Handbook is supported by interactive presentations in Canva, supporting teachers in their daily activity.

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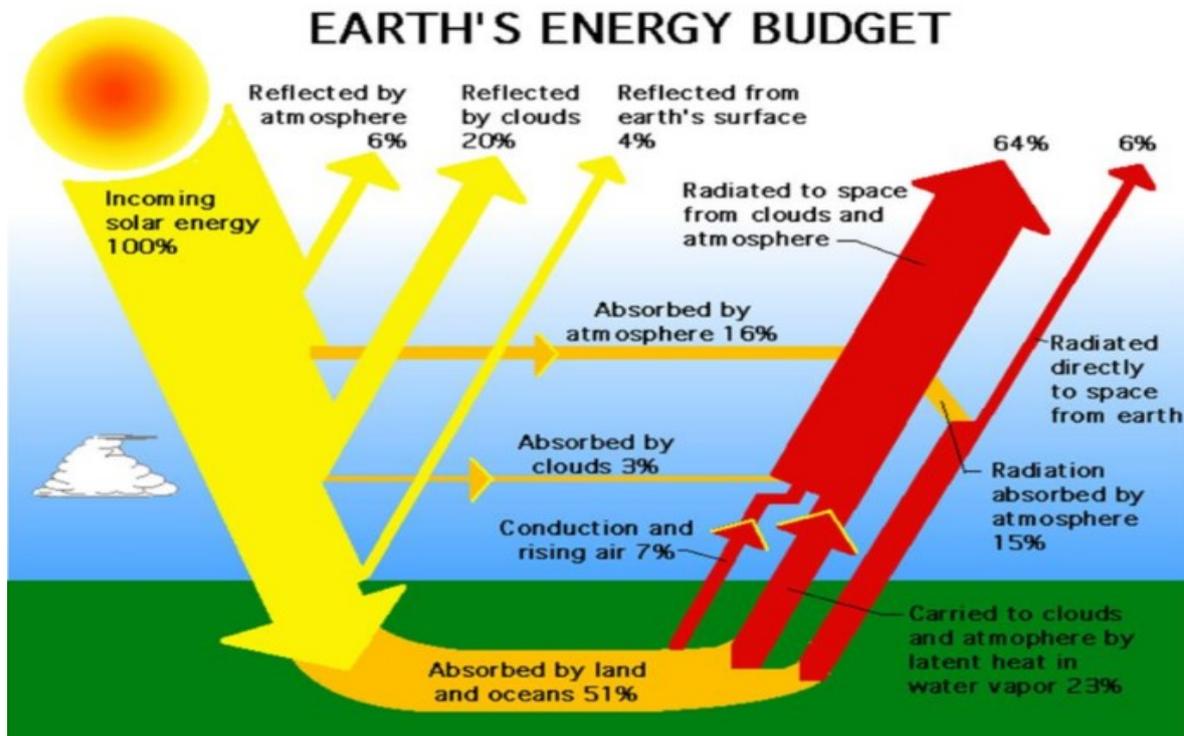


At the end of the lesson pupils should acquire the knowledge, skills, and competencies on the sustainable initiatives supporting fight with excessive trash production, green skills related to food saving, composting, and social community skills.



THEORETICAL PART

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[\(200\) Climate Science in a Nutshell #4: Too Much Carbon Dioxide - YouTube](#)

Rapid urban growth and an constantly increasing proportion of the population living in urban areas characterise the modern world. Due to their concentrated human activity and altered landscapes cities significantly impact Earth's energy budget. Urbanisation affects this balance through land conversion, air pollution and loss of green space. Understanding this budget is key to tackling climate change.

So what is an energy budget?

The Earth's energy budget works similarly to a balance sheet, it represents the balance between incoming solar energy and outgoing radiation. Solar radiation feeds the Earth's climate system, while longwave radiation is emitted back into space.

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Sunlight is the energy provided to us by the sun. This energy reaches the Earth through space. The Earth's surface, ice, and clouds all reflect some of this energy back into space. The Earth's surface and atmosphere absorb the remaining energy.

The Earth warms as a result of absorbing this energy. The Earth warms up in the same way as we do when we stand in the sun. After that, the heat energy from this warmth is released back into the atmosphere. While part of this heat energy is retained in the Earth's atmosphere, some of it is sent back into space.

The greenhouse effect is the term used for this process of heat trapping. It's similar to how a sweater prevents your body heat from escaping on a cold day. Composed primarily of gases such as carbon dioxide and methane, the Earth's atmosphere functions as a kind of blanket, absorbing some heat and preventing global cooling.

The climate of our planet depends on a balance between the energy entering from the sun and the energy leaving it. The earth warms when there is more energy entering the atmosphere than leaving it, which can cause ice caps to melt and sea levels to rise. Weather patterns may change when there is a net loss of energy and an increase in its return.

To understand how much energy is coming into and leaving our planet, as well as how it impacts it, scientists analyze the Earth's energy budget. They can forecast weather patterns, learn about climate change, and discover methods to use energy more wisely by comprehending this balance.

Rising temperatures have several of major worldwide effects on the environment, most of which are being caused by human activity like greenhouse gas emissions. Among these effects are the following:

Climate change

Climate change has been accelerated by rising temperatures, resulting in severe natural disasters like heatwaves, droughts, hurricanes, and torrential rainstorms becoming more frequent and powerful. Events such as these have

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the potential to destroy infrastructure, change ecosystems, and endanger human life.

Melting ice caps and rising sea levels

Higher temperatures melt glaciers and ice caps, resulting in rising sea levels. This endangers coastal populations, raises the risk of flooding, and accelerates coastal erosion. It also threatens ecosystems and habitats, particularly in low-lying locations.

The loss of biodiversity

Rising temperatures may have the potential to destabilize ecosystems and reduce biodiversity. Many species are susceptible to temperature fluctuations, and warming can harm their habitats, food sources, and reproductive behaviors. This can lead to species extinction and upset ecological balance.

Ocean acidification

The oceans absorb more carbon dioxide from the atmosphere as a result of rising temperatures. Because carbonic acid is formed from the absorbed CO₂, this causes ocean acidification. Marine life, especially those with calcium carbonate shells like shellfish and coral reefs, can be harmed by acidic waters.

Ecosystem changes

Ecosystem composition and distribution can change as a result of rising temperatures. While some species may find it difficult to adapt or face increased competition for resources, others may find their ranges shifted towards cooler regions. This may interfere with pollination, upend food chains, and have an effect on forestry and agriculture.

Health impacts

Increased temperatures can directly affect human health in a number of ways, including the spread of diseases carried by vectors like mosquitoes, respiratory issues resulting from poorer air quality, and heat-related illnesses. For populations that are more susceptible and have less access to healthcare in developing nations, these health risks are especially serious. In terms of waste

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production and resource consumption, cities have a big impact on the environment.

These figures illustrate how cities affect the environment:

Energy consumption

The International Energy Agency estimates that cities produce 60-70% of global greenhouse gas emissions and consume around 78% of the world's energy.

Carbon footprint

Approximately 75% of the CO₂ emissions in the world come from urban areas. This large carbon footprint is a result of the high concentration of industries, transportation, and buildings in cities.

Air pollution

Because of energy use, industry, and automobile emissions, air pollution is frequently higher in urban areas. According to estimates from the World Health Organization, 91% of people on Earth reside in locations where air quality is below recommended standards, with metropolitan areas being severely affected.

Waste Generation

Cities generate massive volumes of trash. According to the World Bank, global municipal solid waste generation is set to rise by 70% between 2016 and 2050. Improper garbage management in cities can pollute the land, water, and air.

Water consumption

Urban regions require a lot of water for a variety of uses, including domestic, industrial, and agricultural. This can put a pressure on local water resources and lead to water deficit in some areas.

Urban heat island effect

The urban heat island effect causes cities to be warmer than their surrounding rural areas. This effect is generated by the high concentration of buildings,

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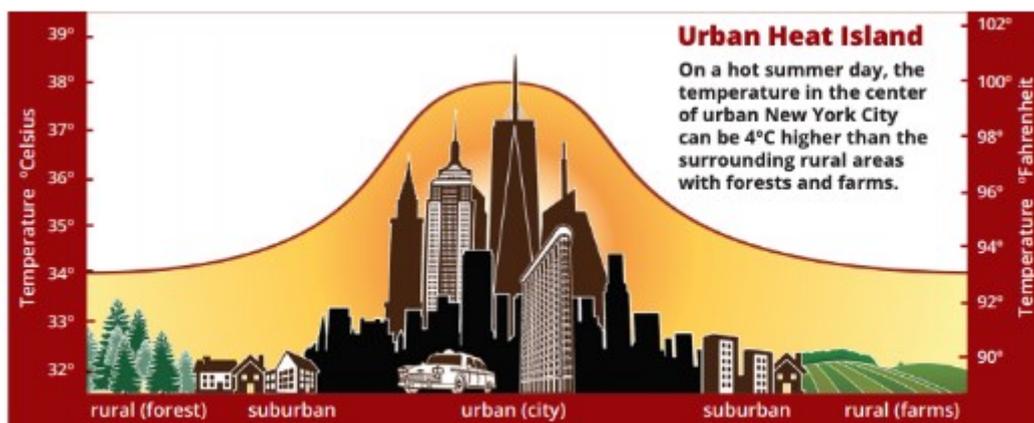
asphalt, and concrete, which absorb and hold heat. It has the potential to raise energy demand for cooling while also severely impacting human health.

Biodiversity loss

Urbanization frequently causes habitat loss and fragmentation, which leads to a fall in biodiversity. As cities grow, natural spaces are transformed into developed settings, displacing and disturbing ecosystems and species.

The major element influencing a city's climate is global or regional. However, cities have an impact on the local climate, which is defined as the temperature, precipitation, and humidity in the area.

WHAT IS URBAN HEAT ISLAND?



Credit: NASA

<https://mydasdata.larc.nasa.gov/basic-page/urban-heat-islands>

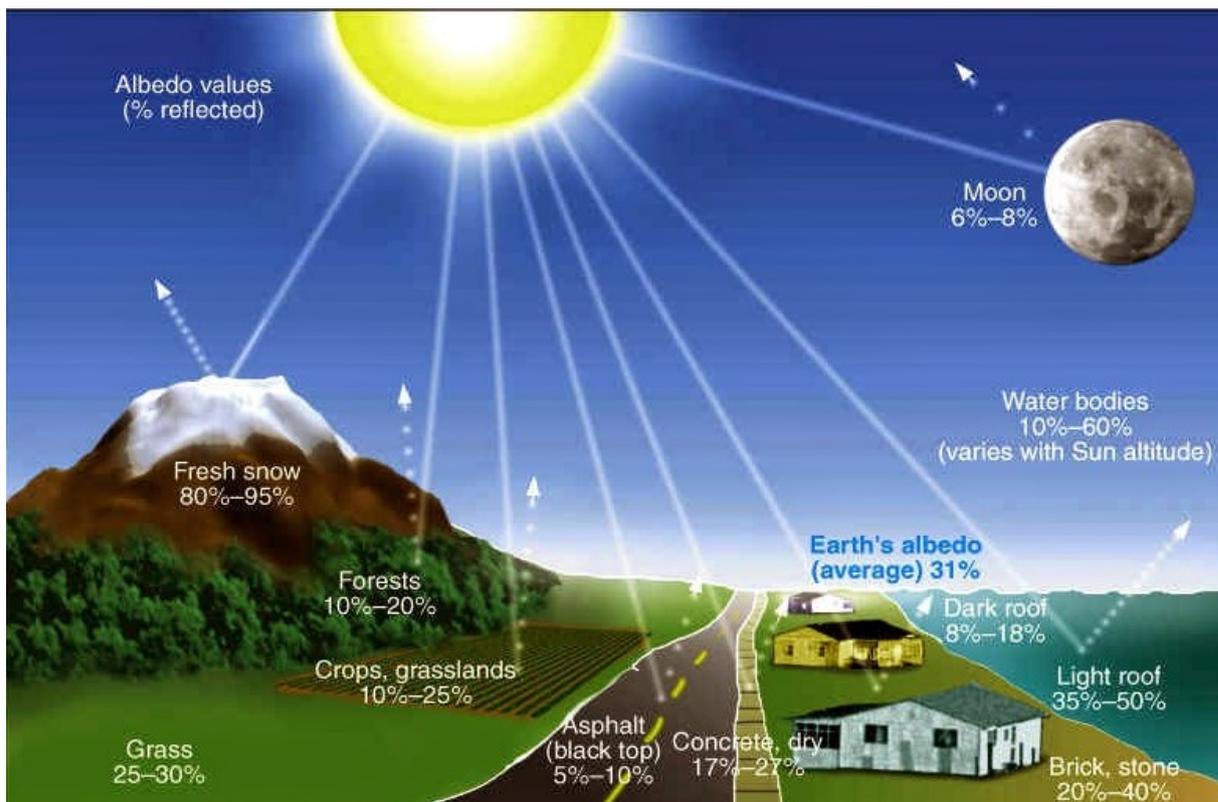
One of one of the most common examples of the city's impact on the climate is the so-called urban heat island, which refers to the relative rise in temperature in the city compared to the surrounding area.

This is a dynamic phenomenon that can be seen mostly on clear, cloudless nights, when energy exchange between the ground and the atmosphere, urban

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buildings, heat accumulation in the city, and a variety of other variables cause the temperature to rise substantially. Temperature differences can reach up to a dozen degrees Celsius, but they are normally between one and two degrees Celsius.

Such an event in the context of climate change has both positive and bad implications. The advantage is that less energy is required to heat houses during the winter. On the other side, the negative impacts of the so-called "urban heat island" are most noticeable during heat waves, which are becoming increasingly common as a result of global warming. The high temperatures also require more energy to run fans and air conditioning. This can cause power outages and pose a major risk to public health. The human body may not be able to rest from these heat waves because the temperature in the city at night is higher than outside.



[Albedo Planetario \(albedoplanetrio.blogspot.com\)](http://albedoplanetrio.blogspot.com)

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Albedo effect

Certain materials reflect more sunlight than others. This is largely determined by the surface color. It is commonly known that wearing black clothing in the summer keeps us warmer while white clothes keeps us cooler. This is the albedo effect.

Albedo means the percentage of incoming solar radiation (sunlight) reflected by a surface. The lower a surface's albedo, the more energy from sunlight is absorbed. So, if the Moon's albedo is 6%, 6% of the solar energy that reaches its surface is reflected, while the remaining 94% is absorbed by the surface.

Cities, like the warmest areas on Earth, are made mostly of dark and rocky surfaces such as asphalt, bricks, and concrete, which absorb heat during the day and release it at night. These materials are used to construct sidewalks, parking lots, highways, and sports fields in metropolitan settings. Urban heat islands form when humans replace cold surfaces with rocky surfaces.

These rocky and black surfaces contribute to the urban heat island effect because their low albedo increases the quantity of solar energy absorbed. They also have less water to evaporate, thus less of the absorbed energy is lost to evaporation and is instead used to heat the surface and release energy by conduction, convection or radiation.

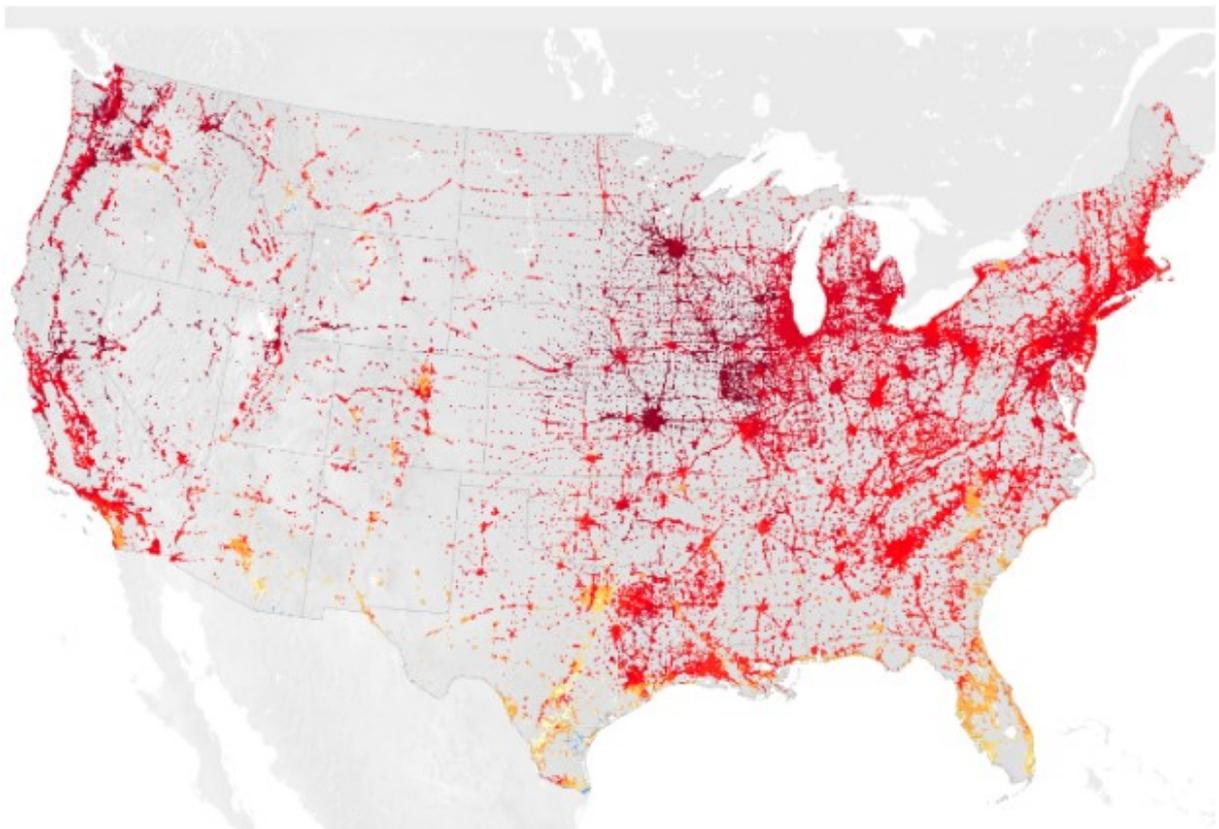
CITIES AND GREENHOUSE GAS EMISSIONS

Research indicates that cities are significant point sources of methane (CH₄) and carbon dioxide (CO₂) emissions into the atmosphere because to their high surface emissions.

As it happens, methane emissions from cities are about the same as those from the same-sized marshes. As the main land-based source of atmospheric methane emissions, swamps also serve as major sources of atmospheric

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emissions of carbon dioxide and another greenhouse gas, methane. While cities appear as sources of greenhouse gases, such as hot spots on a global map, and play a significant part in the exchange of these gases between the earth's surface and the atmosphere, this influence is not especially noticeable locally.



[Urban Heat Islands | MyNASAData](#)

Poor air quality in cities is frequently caused by pollution, with high concentrations of sulfur dioxide (SO₂), nitrogen oxides (NO_x), and particulate matter (PM). Through their effects on temperature regulation, precipitation patterns, and cloud formation, these pollutants can have both direct and indirect effects on the climate.

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Rainfall patterns can also be impacted by pollution in urban areas. Rainfall can be reduced in quantity and intensity as well as cloud formation altered by air pollution, especially from aerosols. Droughts and other water-related problems may result from this disturbance of the water cycle.

Pollution can lead to feedback loops that accelerate climate change. For example, black carbon emissions from the combustion of fossil fuels or biomass can settle on snow and ice surfaces, lowering their reflectivity (albedo) and causing them to absorb more sunlight. This causes accelerated melting of glaciers and ice caps, which contributes to global warming.

OZONE DEPLETION

Ozone depletion is a concern affecting the ozone layer in our atmosphere. The ozone layer acts as a screen, protecting us from the sun's harmful ultraviolet (UV) rays.

Ozone depletion occurs when compounds known as ozone-depleting substances (ODS) get released into the atmosphere. These compounds, including chlorofluorocarbons (CFCs) and halons, were utilized in air conditioners, refrigerators, and aerosol sprays. When these compounds are released into the atmosphere, they travel up to the ozone layer. Once they arrive, they break up the ozone molecules, lowering the amount of ozone in the layer. The lowering of the ozone layer is known as ozone depletion.

Because it makes it possible for more UV radiation to reach the Earth's surface, ozone depletion is a concern. A surplus of UV radiation can be harmful to people, animals, and plants. It can harm crops, hinder the survival of marine life, and cause skin cancer in humans.

ACID RAIN

Acid rain can occur as a result of pollution from industrial emissions, especially from nitrogen oxides (NO_x) and sulfur dioxide (SO₂). Infrastructure, vegetation,

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and ecosystems are all negatively impacted by acid rain. Additionally, it has the ability to change the pH of bodies of water, disrupting aquatic ecosystems and harming fish and other creatures. These ecosystem modifications may have an indirect effect on climate through changing greenhouse gas balances and carbon cycles.

Rain, snow, or any other type of precipitation that become more acidic than usual can be referred to as "acid rain." It occurs when pollutants in the atmosphere from human activities, such burning fossil fuels like coal and oil, combine with water in the atmosphere and come down as rain.

Sulfur dioxide and nitrogen oxides are released into the atmosphere when fossil fuels are burned for electricity and transportation. These gases have the ability to combine with clouds and travel long distances through the atmosphere. They combine with water vapor inside the clouds to create sulfuric and nitric acids. These acids fall with the precipitation when it rains or snows. The effects of acid rain on the ecosystem are numerous. Because it makes the soil too acidic for plants, trees, and agricultural products to thrive correctly, it can harm them. Moreover, it may raise the acidity of lakes, rivers, and streams to a point where fish and other aquatic life cannot survive.

HOW CITIES COMBAT CLIMATE CHANGE

Climate change creates issues for cities all around the world. As the effects of global warming become increasingly obvious, cities are seeing rising temperatures, severe weather events, and sea-level rise. In response, cities are implementing measures to reduce greenhouse gas emissions and adapt to climate change. Cities are working to develop more resilient and sustainable urban environments by investing in sustainable infrastructure, water management, collaboration and public awareness campaigns, urban planning and climate action plans. These initiatives are critical to guaranteeing the well-being of urban populations and a sustainable future in the face of climate change.

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Renewable energy transition

Renewable energy sources including solar, wind, and geothermal power can be used by cities. They can fund community-based renewable energy initiatives, stimulate the installation of solar panels on buildings, and invest in infrastructure for renewable energy. Making the switch to sustainable energy helps to combat climate change by reducing greenhouse gas emissions.

Energy efficiency measures

Energy consumption and carbon emissions may be significantly reduced by improving the energy efficiency of infrastructure, transportation, and buildings. Cities may stimulate the use of public transit, bicycles, and walking by implementing energy-efficient building rules, promoting energy-efficient appliances, retrofitting existing buildings, and so on. Energy-efficient methods lower emissions while also saving money and improving air quality.

Sustainable urban planning

Sustainable urban planning techniques may be used by cities, giving priority to green areas, efficient transportation networks, and compact and mixed-use development. This strategy decreases energy consumption, promotes active transportation, and reduces the need for long commutes. Creating cities that are resilient to climate effects like excessive heat, flooding, and storms is another aspect of sustainable urban development.



[URBAN PLANNING AND CLIMATE CHANGE: Anou al popom dan Metro pou get inondasion... | The Mauritian \(lemauricien.com\)](#)

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Waste management and recycling

Efficient waste management techniques may support a circular economy and lower greenhouse gas emissions. Cities may invest in waste-to-energy systems, promote composting, and establish recycling initiatives. Cities may limit methane emissions from landfills and preserve resources by minimizing garbage and managing it appropriately.

Climate adaptation strategies

To get ready for the consequences of climate change, cities can create and execute programs for climate adaptation. This includes taking steps to protect coastal regions, enhance urban green spaces to minimize the impact of the urban heat island effect, and improve water management systems and stormwater management through the use of green infrastructure. In order to deal with extreme weather disasters, cities can also create emergency response plans and early warning systems.

Flood mapping

Cities are dealing with increasingly catastrophic flooding occurrences as a result of rising sea levels and stronger tropical storms.

More than 7 million people were forced to flee their homes due to natural catastrophes like floods in the first half of 2019. A number of cities, including Jakarta, are preparing to move because the risk of floods is now too significant. To deal with rising flooding, other cities, like Miami, have spent billions on drainage systems. Mangroves are being planted in Guangzhou, commonly referred to as Canton, the capital and biggest metropolis of Guangdong province in southern China, in order to block the waves. To ensure the safety of shopkeepers, Venetians are elevating sidewalks.

Cities are investing in flood mapping systems at an increasing rate. They are better equipped to withstand natural disasters like heat waves, flooding, and droughts because to these efforts. In order to mitigate the effects of climate change, they aim to restore ecosystems, construct weather stations and early-warning systems, and invest in rainwater harvesting technology.

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Tree planting

There are many high-tech ways to fight climate change, but some of the best solutions involve no technology at all. In fact, a global effort to plant millions of hectares of trees could revitalize ecosystems, improve water systems, and shield countries from the consequences of climate change. It could also pull a significant amount of the carbon dioxide currently heating the planet out of the atmosphere. Although urban tree planting initiatives are not as widespread, they can still mitigate flooding, filter rainfall, cool the air, improve air quality and reduce stress.



[\(201\) bosco verticale | video drone 2017 - YouTube](#)

Heat Mapping

Concrete, asphalt, and other materials that absorb heat instead of reflecting it back into space are common in cities. Warm exhaust fills the air as cars and air conditioning do the same. These factors contribute to the "urban heat island effect," which is the phenomenon where cities are noticeably hotter than the surrounding region during heat waves.

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People living in cities are especially vulnerable to health problems as global temperatures rise, because buildings provide little shade and pavements become excessively hot.

Green infrastructure

Buildings are crucial to contemporary cities because they enable large numbers of people to live and work in constrained spaces. Buildings, however, pose a threat to the city's future, even as they enable metropolitan life. This is due to the fact that 40% of greenhouse gas emissions worldwide are caused by the construction of buildings and their continuous usage of heat and electricity. In the upcoming years, climate change will dangerously accelerate if these emissions are not controlled.

For a more sustainable future, cities are starting to modernize their buildings. They are spending money on energy-saving technologies like intelligent heating and cooling systems, better insulation, and green roofs and siding. In order to maintain building lighting without producing greenhouse gas emissions, cities are also investing in sustainable energy sources.

Water security measures

Worldwide freshwater depletion is causing cities to declare states of emergency as a result of water shortage. In order to deal with this reality, cities are investing in a range of water security strategies, including wetlands restoration, aquifer restoration, water pollution prevention, and wastewater reuse.

Cities have the potential to be centers of innovation and sustainable growth, but they also contribute significantly to greenhouse gas emissions, therefore it is critical that they take proactive steps to counteract climate change.

For this reason, lots of creative solutions have been introduced globally to help cities adjust to climate change. One option is to have light-colored roofs on buildings to lessen the quantity of solar radiation that enters a metropolis. In southern Europe, historic districts can be recognized by structures that provide greater shade to some regions by maintaining a suitable ratio between the width of the streets and the height of the buildings. More thermally inert

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materials are being used, which slows down the rate at which houses heat up or cool down.

Easy methods would be suitable for adjusting cities to climate change. An increase in severe rainfall may indicate that communities should upgrade their sewage systems to accommodate more water flow. Increasing the size of green spaces is another method to stop water from merely running down the streets and give it somewhere to soak in. Adapting cities to the urban heat island is a more complicated problem. When we put air conditioning in buildings during a heat wave, for example, the heat it absorbs from inside the structure has to escape outside. And climatologists claim that this leads to an additional rise in outdoor temperature.



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Another ways to adapt cities to climate changes are for example:

- Drainage of water through permeable areas that infiltrate the rainfall;
- Temperature control through shading and heat absorption by vegetation;
- Resilient orchards that provide an alternative food source and use drip irrigation and/or rainwater harvesting;
- Provision of quality water for human consumption thanks to ability to regulate the forests;
- Erosion control and landslide prevention in riparian zones and on vegetated slopes;
- Reducing the risk of sea level rise, high tides or coastal erosion through mangroves and coral reefs.

Here are some practical solutions used by cities to reduce climate change and its impact on cities.

Water retention ponds

Retention ponds, often referred to as stormwater ponds or detention ponds, are artificial bodies of water created with the purpose of gathering and storing extra rainfall or runoff from the surrounding region. Usually, they are built in urban or metropolitan areas to assist control rainwater and avoid floods.

Bioretention basins

Dense vegetation areas known as bioretention basins catch and filter rainwater as it passes through several layers. After that, in the case of heavy rain, the water filters into the ground or goes into neighboring storm drains or waterways. Public spaces frequently have bioretention tanks installed. They work well in places with limited surface permeability that are vulnerable to polluted runoff, require stormwater management techniques, or are close to cold water streams.



[Soak Up the Rain with Green Infrastructure - EPA - Green infrastructure - Wikipedia](#)

Bioswales

Bioswales are vegetated ditches with many layers that absorb surface runoff water, slow it down, filter it, and reduce the impact on conventional sewage systems. Typical drainage features like concrete sewage pipes are replaced by bioswales, for example in parking lots and beside paths used by bicyclists and pedestrians.

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[Meridian Hill Bioswale - Bioswale - Wikipedia](#)



[Percolation trench - Percolation trench - Wikipedia](#)

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Infiltration trenches

Infiltration trenches are small ditches filled with stone or rubble to improve the natural drainage capacity of the soil. Through physical filtration, adsorption on the materials in the ditch and biochemical processes induced by micro-organisms in the soil or on the fill, they remove pollutants and sediments from surface run-off water by various methods.

Green bus stops



Białystok, Poland, Project Greek bus stops, zieloneprzystanki.pl

Green bus stops have several functions. In addition to providing more green space for humans and wildlife, they may retain runoff. Local flooding, stormwater sewage system overload, and the urban heat island effect are all reduced with the installation of a green bus stop. Because it gives insects a "stepping stone" and reduces the likelihood of birds colliding with the glass, it also promotes local biodiversity more than conventional bus stops.

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Green roofs



The *oikostegi*, a green roof on the Treasury building in Athens

[The Treasury - Syntagma - Green roof - Wikipedia](#)

Green roofs are areas on top of buildings covered in vegetation, planted in a growing substrate. They are becoming a more and more common way to provide additional vegetation to heavily populated places.

Green roofs enhance the urban microclimate and lessen the impact of the urban heat island by cooling and humidifying the surrounding air. They bind dust and harmful particles, improving the quality of the air. On green roofs, vegetation sequesters and retains carbon.

Buildings with green roofs have better energy efficiency because they provide thermal insulation in both hot and cold weather. They also improve the retention of rainfall. When used more widely, they can lower building construction costs (for pipes and drains) and even the cost of maintaining the

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sewage network by up to 90%. They can also cut runoff from the roof by up to 90%.

Other benefits include creating usable open space, reducing noise, extending the life of roof materials and offering habitat for wildlife and a place to grow food.

Green facades and walls



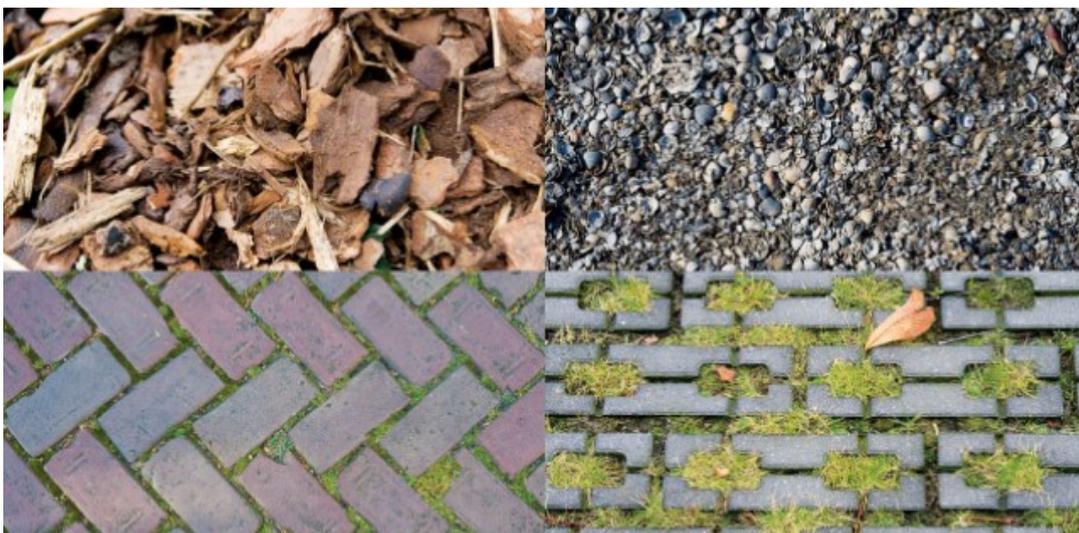
A wall of living plants designed by Patrick Blanc at Caixa Forum near Atocha station, Madrid; CaixaForum Madrid 1 - Green wall - Wikipedia

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Vertically growing plants over a wall or a building facade creates green facades and walls, which can be partially or fully covered with greenery. Because they help regulate temperature and lessen the demand for heating and cooling, green walls have several potential for mitigating climate change in city environments. Through shade, they lessen evapotranspiration and reflected heat, which together help reduce the impact of the urban heat island effect. They both absorb and release less heat, which improves the building's thermal insulation. Furthermore, by absorbing and holding onto airborne pollutants, green walls enhance the quality of the air both inside and outside. They also act as sound absorbers, enhance aesthetics, and can lessen the harm that UV rays and temperature changes can do to a building's structure. Since they occupy little space on the ground, green walls may be utilized to add additional vegetation to areas that are populated heavily. By giving birds and insects a place to live, they support biodiversity.

Systems known as "productive facades" are being tested in several cities; they have the potential to produce food or electricity. This includes moss voltaic panels, which generate electricity through microbial processes that occur naturally, and biophotovoltaic panels.

Permeable paving



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Because permeable pavements are made of porous materials or have open sections, water running down the surface can soak into the ground. They have several advantages, including lowering surface temperatures, removing surface runoff, recharging groundwater, retaining suspended particles and pollutants and reducing the need for retention basins and water storage areas.

Green corridors



[Green corridors: Ventilation corridors network, Stuttgart | Oppla](#)

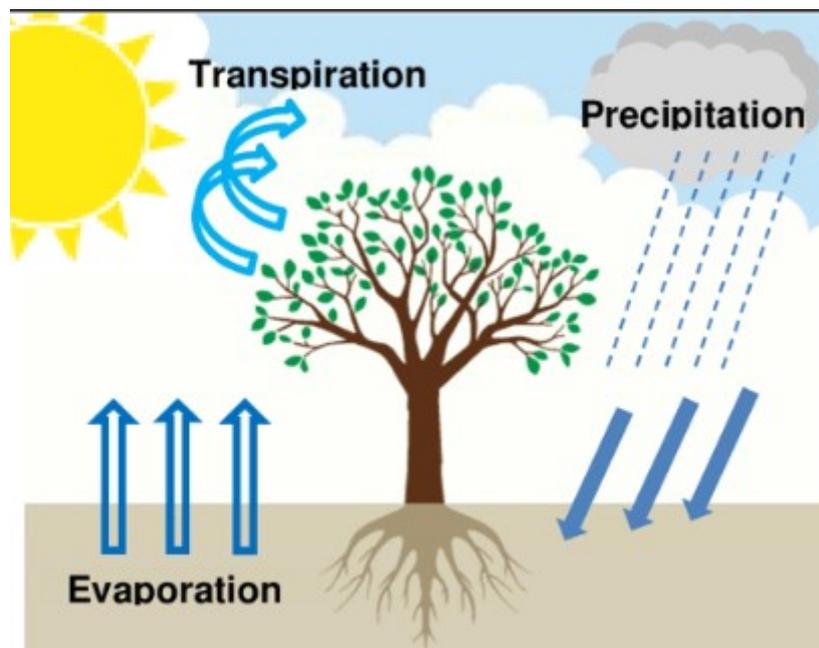
Animals and plants are able to travel along ecological corridors, often referred to as green corridors. In addition to providing ecosystem services, enhancing biodiversity, protecting species, helping with climate change adaptation, and providing recreational and educational possibilities.

This idea was adopted by the city of Stuttgart and widely used throughout the entire city. Due to its valley location and low wind speeds, the city is

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vulnerable to both poor air quality and the urban heat island effect. Stuttgart developed a natural green corridor plan to build passageways for winds to come down from the hills and ventilate the city in order to get around these problems.

WHY ARE PLANTS AND TREES AREAS SO IMPORTANT IN THE CITIES?



[\[PDF\] The thermal effects of green roofs and walls : experimentation on the performance of vegetated building envelopes in the UK | Semantic Scholar](#)

Through their roots, plants draw water from the soil. The water is then stored in the leaves and stems. The water then moves to the tiny openings on the underside of the leaves. There, the liquid water evaporates and is released into the atmosphere as water vapour. This process is called transpiration.

Plants cool themselves and their surroundings by releasing water. The process of water evaporation absorbs and transfers energy from a heated item, just like perspiration does for the human body. Rather than heating the plant,

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promoting convection, and releasing infrared radiation, the majority of the solar energy collected by plants is lost through transpiration. Furthermore, high transpiration rates in forests and big grasslands can raise atmospheric concentrations of water vapor, leading to increased precipitation and cloud cover in the affected area. Because more clouds reduce sunlight, cooling is frequently improved.

As can be seen, plants play a key role in reducing the impact of the urban heat island.

Here are some ways in which they help prevent and reduce urban heat island effects:

Shade and canopy cover

The amount of direct sunlight that reaches the ground is decreased by the shade provided by trees and other tall plants. This shade helps in cooling the surfaces and air around it. Strategic tree planting in urban areas can produce a canopy cover that blocks solar radiation from buildings and roadways.

Evapotranspiration

The process by which trees release moisture is known as evapotranspiration. As water evaporates from plant surfaces and leaves, this action cools the air. The immediate environment's temperature may be lowered by the moisture that plants release.

Reduced surface temperature

In comparison to paved surfaces like concrete and asphalt, vegetation absorbs less heat. An urban area's overall surface temperature can be considerably lowered by replacing green areas—such as parks, gardens, and green roofs—for hard surfaces.

Wind channels and airflow

Better ventilation and cooling are made possible by plants' ability to generate wind channels and increase airflow. In urban areas environments, trees and

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other vegetation may function as natural windbreaks, guiding and channeling breezes that promote air circulation and heat dissipation.

Heat absorption

By the process of photosynthesis, plants absorb sunlight and transform it into energy. By lowering the quantity of solar radiation received by structures and other surfaces, this method aids in reducing the accumulation of heat.

Carbon sequestration

During photosynthesis, plants absorb carbon dioxide (CO₂), which lowers the atmospheric concentration of greenhouse gasses. Urban heat island effects are caused in part by climate change, which is mitigated by this.

To maximize the cooling effects of plants and prevent urban heat island effects, cities can implement various strategies:

- Establishing urban forestry initiatives that prioritize planting and maintaining a variety of trees in key areas to optimize shade and cooling effects ;
- Planting a wide variety of trees, bushes, and other plants in public areas such as parks and roadways ;
- Creating more green space to urban areas by incorporating vertical gardens and green roofs on buildings ;
- Implement policies and regulations that require developers to include green space in new building projects ;
- Educating people about the value of urban green areas and motivating them to grow gardens and plant trees on their own properties.

Cities may create more pleasant and sustainable urban environments by implementing these measures, which can efficiently harness the cooling power of plants and lessen the urban heat island effect.

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PRACTICAL PART

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THE STORY OF DORTMUND AND NICE

Dortmund had occurred as a coal, iron, and beer metropolis during the industrial revolution in 1875. Due to a variety of economic ups and downs, the city once again lost some of its mid-century locational advantages versus rivals on the Rhine, Westphalia, and Ruhr in the late 19th century.

Dortmund saw turbulent expansion throughout the prosperous years, particularly from 1893 to 1913. During the late nineteenth-century industrial boom, the Ruhr region prospered.



[\(200\) New Coal Mines For The Ruhr \(1946\) - YouTube](#)

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Like many other German industrial towns, Dortmund experienced severe pollution problems in the 1960s. Because the city was so dependent on the mining of coal, the manufacturing of steel, and other heavy industries, there was a lot of pollution in the air and water.

Dortmund was well-known for its heavy industrial operations at this period, which included the manufacture of chemicals, steel, and coal. The city's water and air quality has been significantly impacted by these enterprises.

The main sources of air pollution in Dortmund in the 1960s, according to historical data, were emissions from coal-fired power plants, industrial facilities, and residential heating. Particulate matter, nitrogen oxides (NO_x), sulfur dioxide (SO₂), and other pollutants were generated during the combustion of coal and other fossil fuels (PM). These contaminants had negative impacts on human health, decreased visibility, and created smog.

Dortmund was likewise concerned about water pollution at this time. Without being properly treated, industrial waste—including chemicals and heavy metals—was frequently dumped into rivers and streams. The water was dangerous to drink due to the pollution, which also had an impact on aquatic ecosystems.

The German government and municipal governments invested in cleaner technology and tightened environmental rules in order to solve these problems. Dortmund's environmental conditions have greatly improved over time, with lower pollution levels and better air and water quality.

After a century, it faced economic difficulties. The required change happened on an unprecedented scale and moved very quickly. The Ruhr city is currently the biggest cultural hub in Europe.

Even the smallest of the 53 cities in the region, home to more than 5 million people, is seeing the consequences of the changes, although the major five centers—Duisburg, Oberhausen, Essen, Bochum, and Dortmund—are undoubtedly playing the biggest role.

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Photo: energy complex in Bottrop in the Ruhr region a few years before closure, Frank Vincentz, CC BY-SA 3.0, Wikimedia Commons

[Belchatów 2050 - Zagłębie Ruhry, czyli nauczki z niemieckiej transformacji \(belchatow2050.pl\)](https://belchatow2050.pl)

Dortmund was home to many coal mines that employed thousands of miners during the 20th century. But the need for coal declined as other energy sources proliferated and the world's energy environment shifted. Numerous mines in Dortmund were closed as a result of this downturn and the high cost of mining in the area.

Over the course of several decades, the Dortmund mines were gradually closed. The Zeche Minister Stein, the city's last operational coal mine, closed in 1987. This signaled the end of an era for the mining sector in Dortmund.

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A purified world

Dortmund has concentrated on revitalizing former mining regions and turning them into parks, recreation areas, or cultural hubs in recent years. For instance, the large lake known as The Phoenix See was formed from a former coal and steel manufacturing facility. It is now a well-liked location for events and recreational activities.

The transition from industrial to cultural uses benefited the environment as well. Three tributaries of the Rhine cross the Ruhr area's territory: the Emscher, the Lippe, and the Ruhr River, which gives the region its name even though it only forms its southern boundary. The origins of the middle one are close to Dortmund. It was known as the dirtiest river in Germany as long as the industry was operating at full capacity. The process of its reclamation is now under progress, as it is known in the industry. Fish, birds, and luxuriant vegetation return to the water and shorelines. The Ruhr region's landscape is undergoing significant change as a result of related events.

Emscher river before

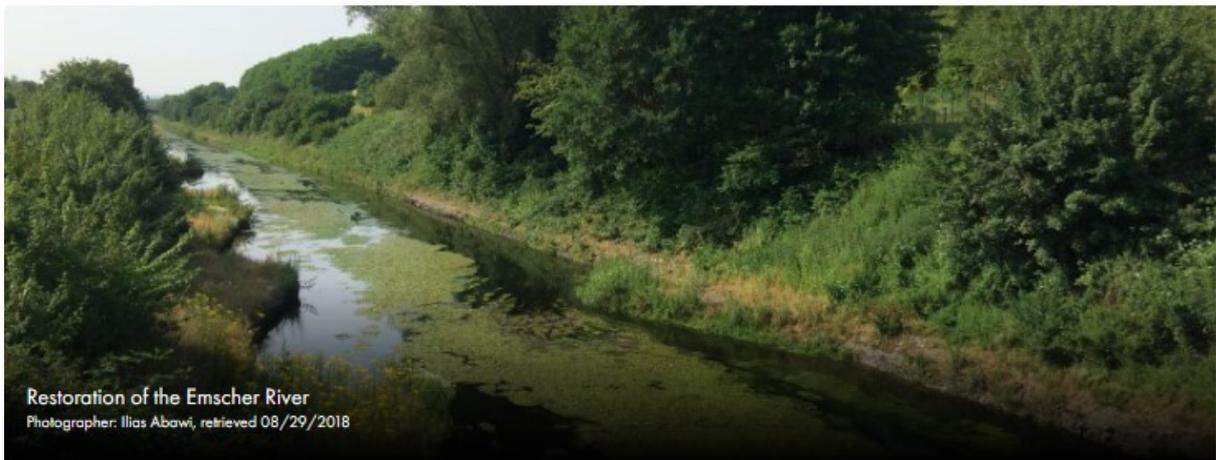


[A fresh re-start for the Emscher river ecosystem \(eib.org\)](https://www.eib.org)

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Emscher River now



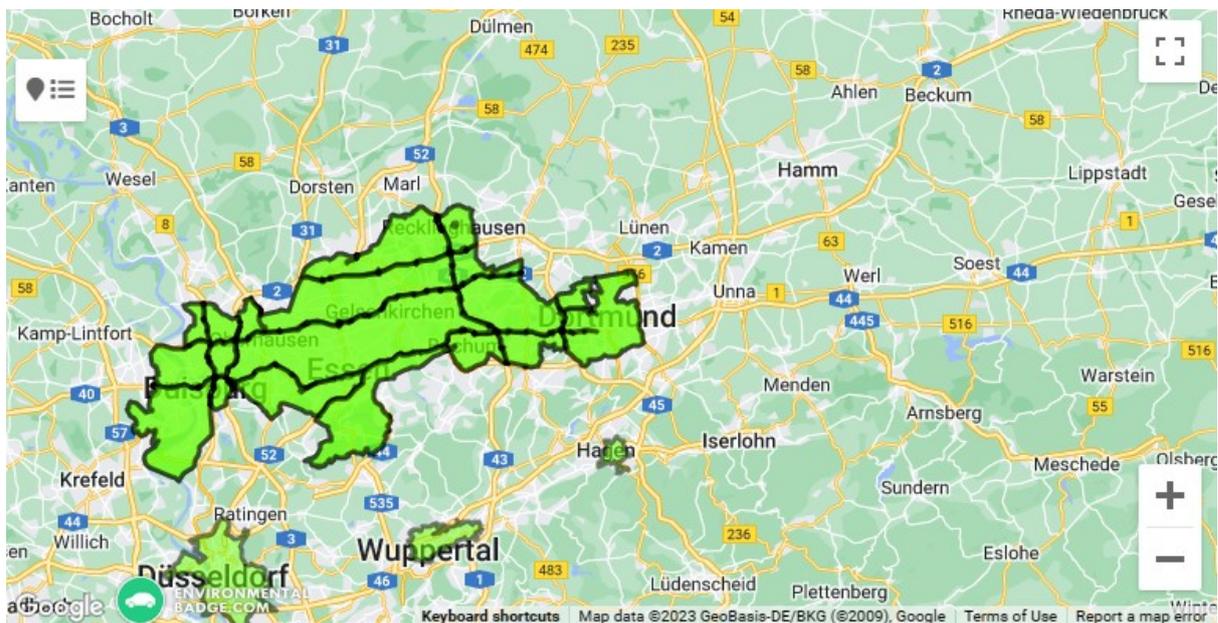
[Restoration of the Emscher River | Urban Nature Atlas \(una.city\)](#)



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LOW-CARBON ZONE IN DORTMUND



[Dortmund - Low Emission Zone - Green Zone Germany \(environmentalbadge.com\)](https://www.environmentalbadge.com/)

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Dortmund was among the first German cities to get a low-emission zone on October 1, 2008. This area has been a part of the wider Ruhr Area Low Emission Zone since January 1, 2012.

To maintain low levels of noise and clean air, the city steadily imposed admission restrictions. automobiles with red, yellow, or green stickers may enter starting on 1.10.2008; from 1.1.2013, this was limited to automobiles with yellow or green stickers. Finally, as of 1.7.2014, only the greenest vehicles - those with an environmental emblem - have been permitted admission into the city; automobiles bearing a yellow environmental badge are no longer permitted.



[\(200\) Climate Action Award for Local Government - 2013 - City of Dortmund - YouTube](#)

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Between 1990 and 2018, Dortmund reduced its carbon footprint by 32 percent. Dortmund's 2018 carbon footprint showed how the city was reducing its CO2 emissions, partly due to a decrease in the amount of energy used by individual houses. The carbon footprint of the business and private sectors was gradually decreasing.

However, it stayed at the same level in the transportation sector, thus the city included this region in its Mobility Master Plan. The city of Dortmund has set a target to cut CO2 emissions by 40% from 1990 levels by 2020 through its climate action program. According to the 2018 balance sheet, CO2 emissions decreased by 32% from 1990 levels.

To reduce the impact of transportation on the environment, the city is now putting the second part of this plan – the Mobility Master Plan 2030 – into practice.

There are two strategies being used. In this sense, Dortmund will become one of the leading cities in the world of electric mobility. On the one hand, it is about promoting alternative driving technologies. On the contrary, the goal is to encourage a change in behavior and to promote local public transportation, bicycling, and pedestrian traffic.

Increased knowledge of saving energy, energy-efficient building renovations, and more efficient equipment have all contributed to a steady decline in the private and public sectors' influence on the environment.

Dortmund is now working with a range of stakeholders, including companies, the community, and government organizations, to achieve its environmental goals.

EXAMPLES OF NEW IDEAS IMPLEMENTED IN DORTMUND

Electric vehicles are embraced by Dortmund's trash management for a better future.



[Dortmund's waste management embraces electric vehicles for a cleaner future | Mayors of Europe](#)

To reduce the impact of noise and greenhouse gas emissions, EDG, a waste management company in Dortmund, has increased the number of electric vehicles in its fleet.

EDG predicts that the acquisition of four electric street sweepers will cut CO2 emissions by around 100 tons per year. The business emphasizes that noise pollution will also be decreased by this action. Authorities from the city noted

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that the new sweepers may operate at night because of the reduced noise emissions, which would also benefit drivers.

Dortmund announced plans to support car-sharing



Dortmund incorporates plans to encourage car sharing in order to reduce the environmental impact of transportation. 24 parking spaces have been designated by the city for car-sharing usage, and it is important to note that parking in these spaces is free. A unique traffic sign identifying the parking places as dedicated for car-sharing vehicles is posted in each location.

Through the car sharing concept of transportation, people can access and use a car for a short while in exchange for a charge. It is a substitute for conventional auto ownership that gives consumers convenience and flexibility while lowering the number of private automobiles on the road.

A fleet of cars is made available for use by clients or registered members in a car-sharing system. Users can rent these cars for a certain amount of time,

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from a few minutes to several hours, and they are usually parked in specific areas of a city or neighborhood.

In cities with few parking spaces and a focus on shared resources and sustainability, car sharing has grown in popularity. Car-sharing services are provided by a number of businesses and organizations, and the features and availability may change based on the region.

About 5,000th photovoltaic systems in a private household was connected to the grid in the German city of Dortmund.



[Dortmund's 5000th home solar system inaugurated | Mayors of Europe](#)

With an overall output of around 63 megawatts, the 5,000 Dortmund systems may generate about 56 million kilowatt-hours on the rooftops of individual

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homes, businesses, or governmental buildings in an average year. This is sufficient to provide power to about 13,500 families with four people. This places Dortmund among the top cities in North Rhine-Westphalia for the quantity of photovoltaic systems that have been installed.

Tiny homes - big living, a village of small homes is planned in Dortmund.



A reduced carbon footprint, a simpler lifestyle, or financial freedom are some of the factors that influence people's decisions to reduce their living space. In

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Dortmund, the tendency toward tiny houses is also quite important. Dortmund is the second German town where small houses are going to be constructed, after Hanover.

The first little community will be constructed on the old Emschertal School sports field in Sölde. The building site and the necessary building rights will be provided by the city of Dortmund. The Tiny Village in Sölde will contribute to Dortmund's climate protection goals. With a small house, the typical Dortmund home's 40 square meters of living area per person may be down to 25 square meters. Another benefit to the ecology of smaller living quarters is the reduced need for fuel for heating.

Green IT helps city save 35,000 tones of CO2

In this age of climate change, "green IT," meaning environmentally friendly IT operations, is a field that is expanding significantly. Although digitalization presents great potential, it is also linked to increased energy use and greenhouse gas emissions.

As one of the first local governments that has done so, the City of Dortmund is a pioneer in this area, having incorporated the idea of green IT into its climate protection plan as early as 2011.

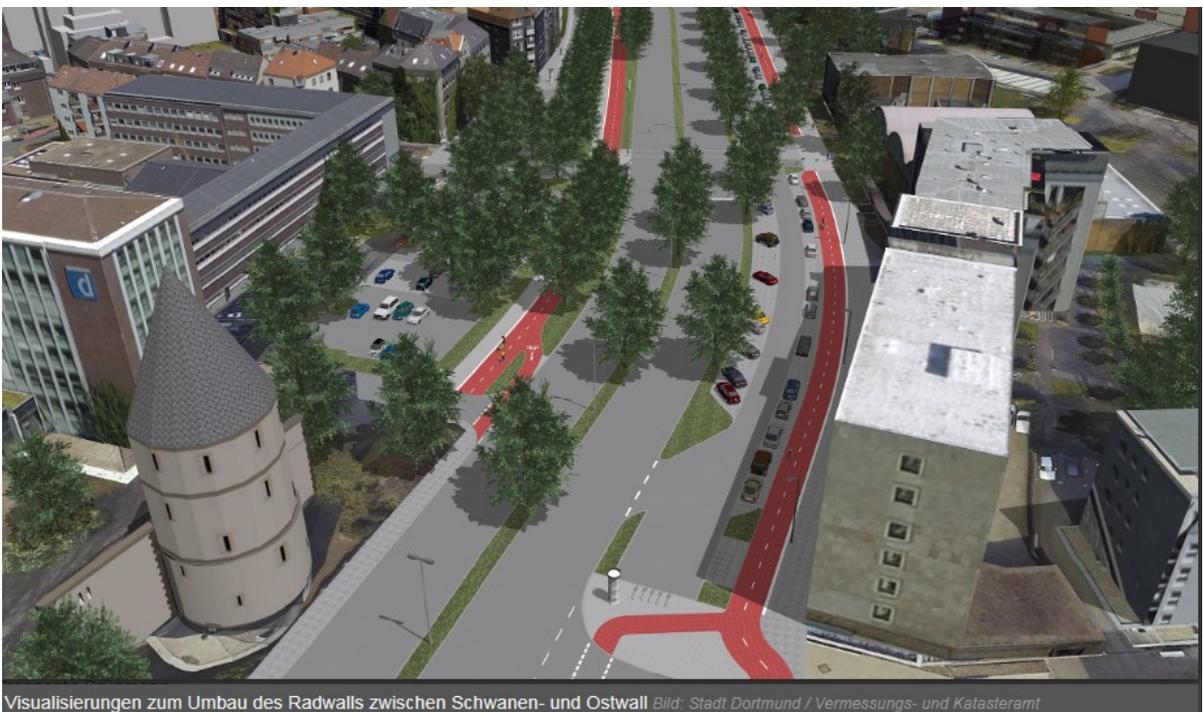
Examples of adopted actions include:

- Automated energy management, which makes sure that inactive devices' power consumption is reduced;
- When it comes to purchasing IT equipment, power consumption is also a crucial selection criteria;
- Underutilized infrastructure components can be combined into smaller, more efficiently used devices through the use of virtual environments (server virtualization);

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- Special doors installed on server racks maximize airflow and minimize temperature fluctuations ;
- Making duplex printing standard has also resulted in a reduction of CO2 emissions and paper use.

More space for cyclists thanks to wider bike paths on Schwanenwall and Ostwall.



Visualisierungen zum Umbau des Radwalls zwischen Schwanen- und Ostwall Bild: Stadt Dortmund / Vermessungs- und Katasteramt

[Radwall - Maßnahmen - Emissionsfreie Innenstadt - Verkehr - Leben in Dortmund - Stadtportal dortmund.de](https://www.stadtportal.dortmund.de/radwall-ma%C3%9Fnahmen-emissionsfreie-innenstadt-verkehr-leben-in-dortmund)

The main goal of the project is to provide an uninterrupted, user-friendly connection around the Dortmund inner ring road.

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The three-year funded project's goal is to create an eye-catching, continuous path that makes it simple and safe for bicycles to travel around the inner ring road. Additionally, making it easier and safer for people to walk will be a priority. The outer ring road's primary traffic lanes will stay exactly as they are, while the surrounding sections will be renovated.

Priority to electro taxis

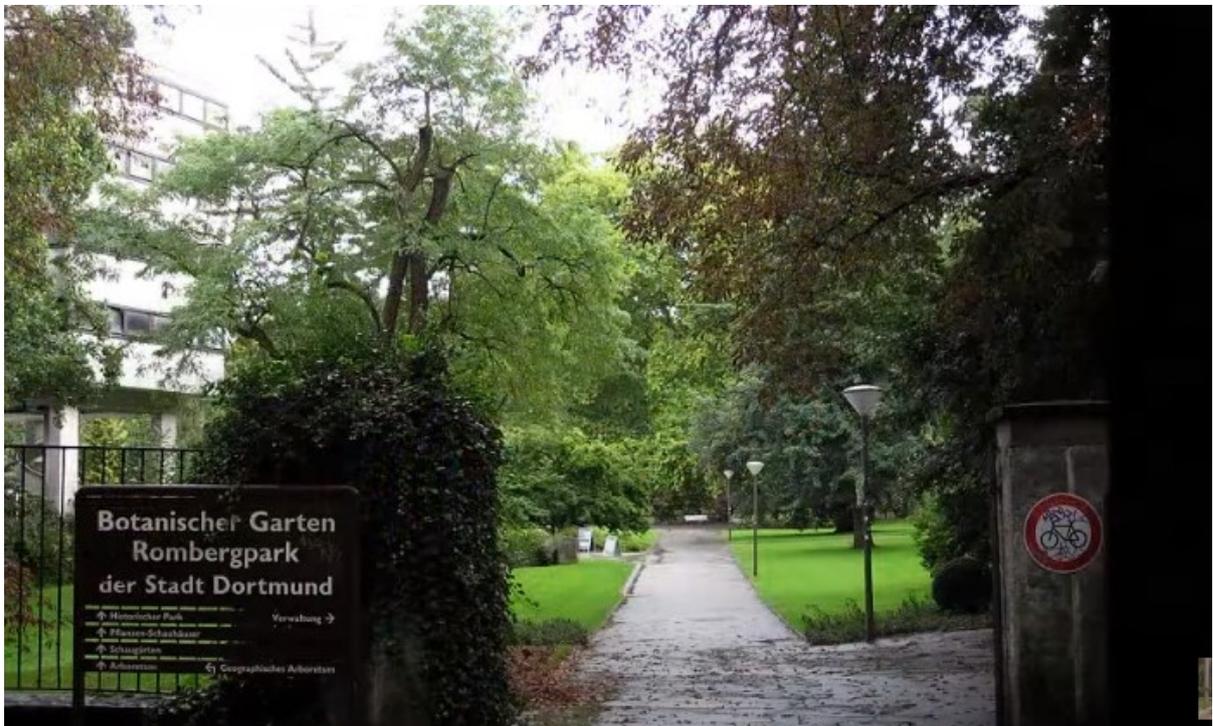


The City of Dortmund is introducing a digital vehicle recognition and display system that will give preference to electro taxis in the drop-off/pick-up zone at the main entrance of the train station, demonstrating its commitment as one of the first local authorities to support electromobility.

Dortmund has the highest percentage of electric vehicles in the region.

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Rombergpark: an innovative approach to one of the biggest botanical gardens in the world.



[\(200\) Places to see in \(Dortmund - Germany \) Botanischer Garten Rombergpark - YouTube](#)

The Rombergpark Botanic Garden is one of the biggest in the world, covering over 68 hectares. It was established in 1822 as an English-style landscape garden and was later named a botanical garden in 1927. Since then, it has steadily increased the size of its scientific collection. A wide range of botanical highlights and uncommon plants from faraway continents wait for the visitor, along with a variety of birds, rodents, and insects that are fascinating to watch in their natural habitat, all set against a background of a fascinated lake and paths that meander between majestic trees.

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Dortmund is one of the greenest cities in Europe and, after Hamburg, the greenest city in Germany, with 70.7% of its land reserved to open spaces.

In parks and other public areas, as well as on Dortmund's streets, there are 150,000 trees. The German Rosarium at the Westfalenpark is one of the biggest rose collections in the world, with over 3,000 varieties. With 1,690 hectares, the 26 conservation areas in Dortmund take up 10% of the city's total surface area.

THE STORY OF NICE

Nice was a medium-sized Mediterranean city until 2008. The sea's color, blue, was the most prevalent color here. The city's focus is now shifting to green while still adhering to its historical affinity for blue.

A long-term plan that has resulted in the creating of new parks, the planting of trees, the installation of tram lines to link the airport and explore the suburbs, and has laid the groundwork for the green revolution, which is transforming the city into a place to live in addition to visit.

The Promenade du Paillon, which inaugurated in 2013, served as a turning point for Nice's environmental movement. 12 hectares of green space in the heart of the city, taking the place of a massive surface parking lot and bus terminal. The Promenade du Paillon, where architecture and nature coexist, is currently one of France's most visited parks.

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[Promenade du Paillon - Relax in a Tree-Lined Green Space With a Reflecting Pool and Play Area - Go Guides \(hotels.com\)](#)

Planting trees

Since 2021, Nice has created about 33 hectares of green space and planted nearly 70,000 trees. In the last fifteen years about one hundred educational gardens, seven community gardens, and sixteen new parks and gardens have been constructed.

With almost 200,000 inhabitants and 34% of its land covered by trees, Nice is the greenest city in France, according to Kermap satellite data analytics. Since 2021, almost 70,000 additional trees have been planted, and by 2026, 280,000 trees will be planted total.

The city approved an ambitious environmental plan in 2019 with the goal of planting one tree per resident by 2026 and creating an extra 70 hectares of

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green space. Among other benefits, making Nice greener will improve air quality, boost CO2 absorption, and reduce the heat island effect.

Additionally, the change will improve the quality of life in the city by lowering noise levels, increasing space for pedestrians, and creating chances for leisure and recreation.



[A futuristic, ecological district is being built in Nice: Construction - Inzynieria.com \(inzynieria.com\)](https://www.inzynieria.com)

Nice keeps investing in energy transition and circular economy

The region of Provence-Alpes-Côte d'Azur and ADEME (the French Environment and Energy Management Agency) have established a new partnership in Nice with the aim of working together to address ecological concerns.

In addition to promoting resource conservation, this partnership should advance multimodality, streamline logistical processes, and define a path reaching carbon neutrality by 2050.

Established in 2018, the Recyclerie des Moulins is a prime example of a circular economy in Nice. This well-known Côte d'Azur beach city has

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effectively regenerated a whole neighborhood. The project's main focus is recycling and giving broken and outdated items a second chance at life.

An economic system called the "circular economy" strives to do away with waste and encourage the continuous use of resources. It is predicated on the ideas of minimizing waste and pollution, extending the useful life of materials and goods, and preserving natural systems.

Vegetation on roofs

Restoring the natural elements that urbanization destroyed is the city's problem. According to an Ernst & Young research done for the city, planting vegetation on rooftops improves biodiversity and the living environment while also allowing for thermal insulation, rainfall retention, and climate change adaption. Construction references like the Grenelle Environment Forum have been a powerful motivator to stick to these protocols in Nice for a number of years.



https://jp.media.france.fr/sites/default/files/document/press_kit/Press_kit_Nice%20green%20city_EN.pdf

Reciprocators

Nice is gradually obtaining environmentally friendly materials, such reciprocators, that allow for automated upkeep of public areas while adhering to the Zero Pesticide Charter.

The "ÉCO-PHYTO" plan

By putting the National Eco-Phyto Plan into practice, the city hopes to do away with the need for pesticides in public roads and gardens. The goal is to

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promote high water quality, cut down on pesticide use by fifty percent, and raise public awareness of the biological problems.



Nice Marina

[Nice, the new garden city of the Mediterranean – Article by Domusweb.it](#)

Controlling greenhouse gas emission

By encouraging the use of public transportation and the development of new positive energy buildings, as well as via trash recycling, the goal is to reduce gas emissions.

To give decision-makers an impartial measuring tool, Nice is now fully equipped with sensors that continuously monitor the city's air quality. Furthermore, the Port of Nice is known as Europe's first intelligent port and is among the Mediterranean ports most dedicated to the fight against air pollution. This port, which is mostly used by tourists, has electric connections installed so that yachts may turn off their engines and cut down on pollution.

A new model of public transport

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The city has been revitalized and made greener and more contemporary by the lovely tramways. It has three tram lines that operate from early morning till late at night, going north-south and east-west. Line 2's trams are battery-powered, while Line 1's is conventional and overground. In this way, the impact of the electrical infrastructure on the urban environment was avoided.

Nowadays, bike lanes and public green spaces occupy the remaining space on the majority of these roadways, with only one lane kept open for traffic. The opening of the new tram lines of which there are presently three, with a fourth currently under construction—made it feasible for buses to almost completely disappear and for protected bike routes to take the place of bus lanes.

Air quality has benefited directly from this plan, which is summed up in the slogan "1 tree for every 5 inhabitants." With the introduction of tram line 2, traffic on the Promenade des Anglais has decreased by 10%, and along the Avenue de la Californie, it has decreased by 22%. As a result, emissions of CO₂ and particulates have decreased by 65%.

Space for bicycles

Bus lanes have been replaced by protected cycle lanes and underground parking spaces have been replaced by cycle stations. Vélo Bleu, a public bike rental service, has more than 1,500 bikes and 2,000 docking stations. A large number of those have been converted into electric bicycles: e-Vélobleu.

To promote this mode of transport, there are frequently organized events and possibilities for partnerships with companies, associations and schools. As a result, it is common to see students arriving at the schools on a rented Vélo Bleu.

Auto Bleue

With 210 vehicles spread over 70 stations, Nice Côte d'Azur is the first community in France to have fully adopted an electric car-sharing program. Each station includes an urban electrical recharging point and parking spaces designated for these kinds of cars.

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Eco-labelled hotels

Some hotels in Nice are environmentally conscious, socially conscious, and certified with the European Eco Label, allowing them to reduce their impact on the environment. Businesses that meet certain environmental standards for their equipment are also awarded additional international labels.

Reduction of noise

Although it cannot be seen, noise pollution does exist, particularly in France, which places third in the world for urban noise levels, behind the US and Italy. Many acoustic radars, called "jellyfish" because to their form, will be installed in Nice. These gadgets include microphones that record the noise levels that automobiles, scooters, and mopeds make. If the parameters are exceeded, the noncompliant vehicles will be fined and photographed. Over 68 decibels need to be eliminated from the urban environment in the next five years.

Preserving the biodiversity

It is essential that the infrastructure will be limited if urban green spaces are to remain. The protection of the maritime environment is also included by this act. In addition to the sanctuary for marine creatures that are protected along the coast, the procedure involves monitoring the swimming waters and the Haliotis water treatment station.

The sustainable development observatory

The observatory specializes on the study and examination of water. It has to manage the resources of water, both fresh and salt, and develop the coastal areas in a sustainable manner. Long-term implementation and management of innovative environmental effect evaluation instruments are made possible by these studies.

Joia Méridia - a modern, resident-friendly and eco-friendly residential district is being built

A new residential neighborhood that is eco-friendly, contemporary, and oriented to residents is being constructed in Nice, the largest city on the French Côte

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d'Azur. The name Joia Méridia, which translates to "pleasure" from the Nice variety of the Provençal dialect, could serve as an inspiring illustration of the metropolis of the future.

How will it stand out from other districts?

The urban environment should be multipurpose and supportive of the adoption of solutions like shared workspaces, hybrid apartment buildings that include IT and energy-efficient features, or adaptable housing designs.

Every building in the area needs to have an environmental certificate, and there will be 4,000 m² of green space total—2,000 m² of which will be used for garden produce. Naturally, a power plant that uses geothermal energy will supply power.

Joia Méridia will occupy 73,500 square meters. In addition to several hotels, stores, offices, and service buildings, the zone will have 800 residences, 1220 private and public parking spots, and a municipal entertainment and recreation center.



[Joia Meridia, the new face of Nice | Pitch Immo](#)

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Joia Meridia leads the list of eco-districts in France in terms of energy performance. The district's energy usage will be 20% less than that of the RT 2012, thanks to the efforts of the public development organization Nice Eco-vallée. The energy used will come from renewable sources to the tune of about 25%. The installation of solar panels to feed the buildings and a geothermal power plant that can avoid the district's thermal needs have made this performance possible. Additionally, the enterprise includes 4,000 square meters of space devoted to urban agriculture.



[\(201\) The Oasis – Plot M6 of Joia Meridia - YouTube](#)

Nice has become the green city of the Mediterranean for a number of reasons. The measurable future targets are to phase out the usage of fossil fuels by 2050 and cut emissions by 55% across the city by 2030.

The city's environmental changes are becoming more apparent every day. Even more optimistically, all the eco-friendly investments and trees planted will pay off in the future.

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EXEMPLARY LESSON PLAN

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LESSON TITLE: PLANTING TREES IN CITIES

Objective: To educate children about the importance of planting trees in cities, their benefits, and how they can contribute to creating a greener and healthier urban environment.

Materials needed:

1. Whiteboard or flipchart
2. Markers
3. Printed images or props representing trees and urban environments
4. Worksheets or paper for individual or group activities
5. Gardening tools (optional)
6. Seeds or saplings for planting (optional)

Lesson Plan:

1. Introduction



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[\(200\) Why Do We Need Trees? | Eco Facts | One Tree Planted - YouTube](#)

- Begin by discussing the importance of trees in our lives
- Ask questions like: What do trees provide for us? Why are they important for the environment?



[\(200\) Trees | Educational Video for Kids - YouTube](#)

The Benefits of Trees in Cities

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<https://www.youtube.com/watch?v=0Wevbkcg43g>

Discuss the benefits of trees in urban environments.

- Highlight how trees provide shade, reduce the urban heat island effect, and conserve energy by lowering temperatures.
- Discuss how trees help reduce noise pollution and provide habitats for wildlife.
- Explain how trees help improve air quality by absorbing carbon dioxide and releasing oxygen.
- Explain the water cycle - evaporation, condensation, precipitation.

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<https://www.youtube.com/watch?v=y5gFI3pMvol>

Additional description:

Short explanation of the benefits of trees in the city for reducing pollution.

Cleaning the air - Trees act like natural air filters. They take in carbon dioxide, a harmful gas that cars and factories produce, and release oxygen, which is what we need to breathe. By doing this, trees help to make the air cleaner and healthier for us to breathe.

Absorbing pollutants - Trees have the amazing ability to absorb pollutants from the air, like smoke, dust, and chemicals. They trap these pollutants on their leaves and bark, preventing them from spreading in the city.

Reducing heat - Cities can get very hot due to buildings and roads absorbing the sun's heat. Trees provide shade and cool down the surrounding areas. They also release water vapor through their leaves, which helps to cool the air even more.

Preventing water pollution - When it rains, water can carry pollutants like oil and chemicals from the streets into rivers and lakes. Trees help to prevent

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this pollution by absorbing rainwater and filtering out harmful substances before the water reaches these bodies of water.

Providing homes for animals - Trees create habitats for animals like birds, squirrels, and insects. These animals help to keep the city's ecosystem balanced and healthy. By having trees in the city, we can provide homes and food for these creatures.

Making the city beautiful - Trees add beauty and greenery to the cityscape. They make the city more visually appealing and create a peaceful environment for everyone to enjoy.

3. Tree Identification

- Introduce different types of trees commonly found in urban areas.
- Show printed images or use props to represent different tree species.
- Discuss the characteristics and unique features of each tree, such as leaf shape, bark texture, or fruit.

Additional description and tips:

There are several types of trees that are well-suited for cities. Here's a short summary of some of the best trees for cities:

1. **Maple Trees:** Maple trees are known for their beautiful leaves that change color in the fall. They are strong and can tolerate different weather conditions. They provide good shade and are often found in parks and along streets.



[Bi-colored Maple Tree - Maple - Wikipedia](#)

2. Oak Trees: Oak trees are big and strong, with sturdy branches. They provide excellent shade and are home to many animals. Some oak trees can live for hundreds of years.

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[Oak - Wikipedia](#)

3. Dogwood Trees: Dogwood trees have pretty flowers in shades of pink, white, or red. They are smaller in size compared to other trees, making them suitable for smaller spaces like gardens or yards.



[Bgbo cornus kousa var chinensis ies - Cornus - Wikipedia](#)

4. Cherry Trees: Cherry trees are famous for their beautiful blossoms in the spring. They come in different colors like pink or white. They are often planted in parks and along streets, adding color and beauty to the city.

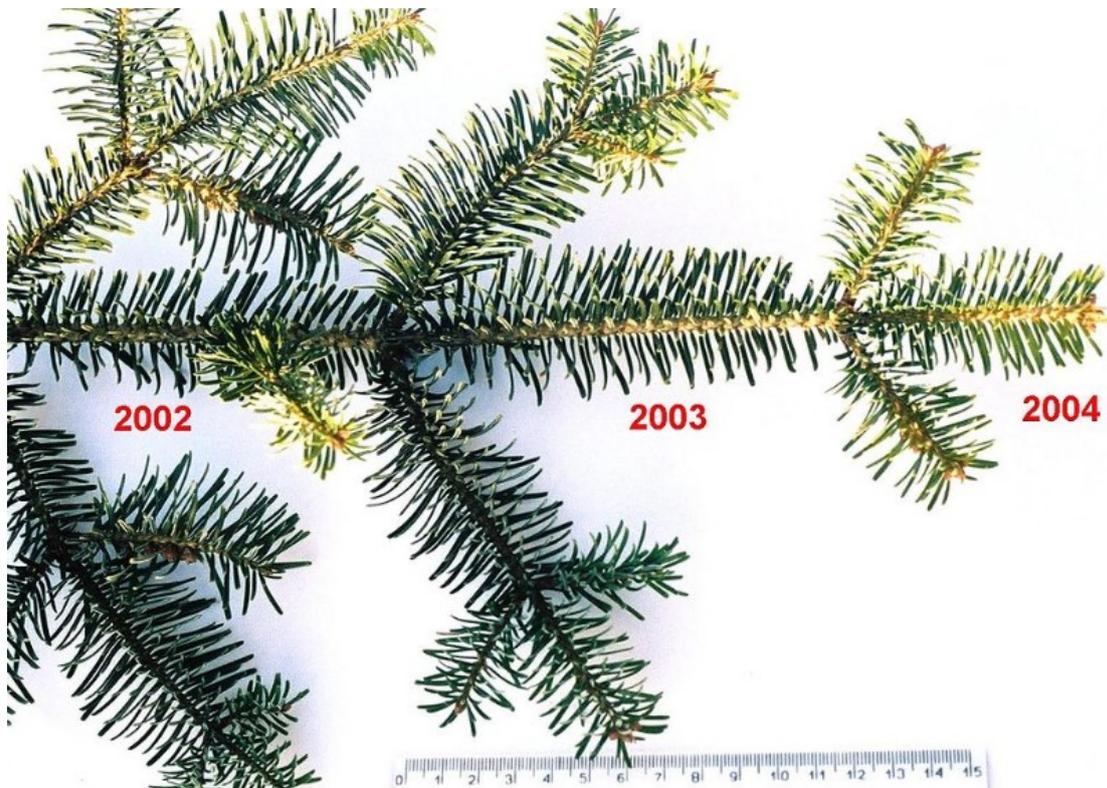
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[Stablo trešnje Germersdorfer u cvatu - Cherry - Wikipedia](#)

5. Evergreen Trees: Evergreen trees, like pine or spruce trees, stay green all year round. They are great for providing privacy and adding a touch of greenery to the cityscape, even during winter.

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[Abies alba 02 - Evergreen - Wikipedia](#)

Remember, when planting trees in the city, it's important to consider the space available, the type of soil, and the climate. It's also important to take care of the trees by watering them regularly and protecting them from damage.

4. Planting Trees in Cities

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<https://www.youtube.com/watch?v=SJfpnGEMrKM>

- Explain the process of planting trees in urban areas.
- Discuss suitable locations for planting trees, such as parks, school grounds, or community spaces.
- Explain the importance of selecting the right tree species for the local climate and soil conditions.
- Discuss the steps involved in planting and caring for a tree, including digging a hole, watering, and mulching.

5. Group Activity: Tree Planting Plan

- Divide the children into small groups.
- Provide worksheets or paper for each group and ask them to create a tree planting plan for a specific area in their school or community.
- Instruct them to consider factors like suitable tree species, location, and care requirements.
- Encourage creativity and collaboration within the groups.

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6. Sharing and Discussion

- Allow each group to present their tree planting plan to the class.
- Facilitate a discussion about the different ideas and strategies presented.
- Discuss any challenges or concerns that may arise when planting trees in urban areas and brainstorm solutions.

7. Taking Action

- Discuss how the children can take action to plant trees in their school or community.
- Explore opportunities for tree planting initiatives, such as organizing a tree-planting event or partnering with local organizations.
- Encourage the children to discuss and implement their ideas for planting trees.

8. Conclusion

- Summarize the main points discussed during the lesson.
- Emphasize the importance of trees in cities and the role children can play in creating a greener and healthier urban environment.
- Encourage the children to share their knowledge and inspire others to plant trees.

Note: The duration of each section may vary depending on the level of engagement and discussion. Incorporating visuals, hands-on activities, or field trips to local green spaces can enhance the learning experience.

ADDITIONAL MATERIALS:

EXAMPLES OF TREES:

Trees that remain green throughout the year and do not lose their leaves are called perennial trees or plants. They maintain their foliage all the time due to mechanisms of adaptation to lower temperatures or drought. Some examples of trees that remain green throughout the year include:

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- Fir - is a tree with perennial needles, which maintains its foliage throughout the year.
- Spruce - is another evergreen tree with needles that stay green even in the coldest areas.
- Juniper - this tree has needle-like leaves and stays green all year round.
- Laurel oak - this is a tree with lance-shaped leaves that remain green throughout the year and thrives in the Mediterranean climate.
- Magnolia - some magnolia species are perennial, retaining their foliage throughout the year.

These are just a few examples of trees that remain green throughout the year, but there are many other species of perennial plants that retain their leaves even during winter or drought periods.

There are several plants that have developed special mechanisms to adapt to drought conditions and can survive prolonged periods of water deprivation. These plants are called xerophils or succulents and evolved in arid or semi-arid areas where water is a limited resource.

Some examples of drought tolerant plants include:

- Cacti - these are among the most well-known succulent plants and are able to store water in their stems and leaves.
- Aloe vera - this succulent plant can survive in extreme drought conditions as it can store water in its thick leaves.
- Lavender - this aromatic plant needs little water and thrives in dry, well-drained soils.
- Yucca - this plant has a strong root system and can survive in areas with little water.

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- Sage - this plant has dense leaves and grows well in dry areas, being also used in medicine due to its antioxidant properties.
- Thyme - this aromatic herb has small, dense leaves and can withstand drought conditions and poor soils.

These are just a few examples of plants that can withstand drought, but there are many other species that have developed a mechanism to adapt to extreme environmental conditions. It is important to choose the right plants for the environment we live in, to minimize water consumption and protect the environment.

The northern areas of the Earth have cold and harsh climate, characterized by long, cold winters with very low temperatures and heavy snow. Under these conditions, the trees that grow in these areas must be adapted to extreme temperatures and poor and acidic soils.

Some examples of trees found in northern areas:

- Spruce - is a tree that grows in the boreal forests of Canada, Russia, Scandinavia and Alaska. It has evergreen needles and adapts well to low temperatures.
- Fir - is a common tree in northern forests and is traditionally used in the production of paper and timber. It can grow at high altitudes and adapts well to extreme environmental conditions.
- Pine - is a tree that grows in the boreal areas of Europe, Russia and Canada. It has persistent needles and adapts well to poor soils and low temperatures.
- Aspen - is a tree that grows in wet and swampy areas in northern regions. It is able to survive low temperatures and poor soil conditions.
- Maple - this tree is found in the forests of northern areas and is able to adapt to low temperatures and poor soils.

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These are just a few examples of trees found in northern areas. Other trees that can survive these harsh conditions include birch, hazel, lime, and maple.

The subpolar area is a region characterized by cold temperatures, long winters and short summers. In these conditions, the trees that grow in this area must be adapted to low temperatures and extreme environmental conditions.

Some examples of trees that are found in subpolar areas:

- Siberian spruce (*Picea obovata*) - is a deciduous tree that grows in the subpolar areas of Northern Asia and Europe. This is one of the most important commercial trees in the region, being used in the production of lumber and paper.
- Siberian larch (*Larix sibirica*) - is a tree that grows in the subpolar regions of Siberia, Russia. This is one of the few trees that sheds its leaves every fall.
- Tundra maple (*Acer spicatum*) - is a tree that grows in the subpolar regions of North America. This is a small tree with small, glossy leaves that change color in autumn.
- Polar willow (*Salix polaris*) - is a small tree that grows in the subpolar areas of Canada and Greenland. This is one of the few trees that can survive the extreme conditions of this region.
- Siberian pine (*Pinus sibirica*) - is a tree that grows in the subpolar regions of Siberia. This is one of the most important commercial trees in the region, being used in the production of lumber and paper.

These are just a few examples of trees that are found in the subpolar regions. Other trees that can survive these conditions include birch, lime, and alder.



QUIZ: IMPORTANCE OF TREES FOR REDUCING CITY POLLUTION

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Instructions: Choose the correct answer for each question by selecting the corresponding letter (A, B, C, or D).

1. Trees help to reduce city pollution by:
 - A) Absorbing carbon dioxide and releasing oxygen
 - B) Absorbing noise pollution
 - C) Filtering water pollution
 - D) Creating shade for people to relax in

2. How do trees contribute to cleaner air in the city?
 - A) By emitting harmful gases
 - B) By trapping pollutants on their leaves and bark
 - C) By increasing the amount of carbon dioxide in the air
 - D) By reducing the oxygen levels in the air

3. What is one way trees help to reduce heat in cities?
 - A) By providing shade
 - B) By emitting cool air
 - C) By releasing water vapor
 - D) By reflecting sunlight

4. Trees can help prevent water pollution in cities by:
 - A) Absorbing rainwater and filtering out pollutants
 - B) Releasing harmful chemicals into water sources
 - C) Increasing the flow of pollutants into rivers and lakes
 - D) Attracting more water pollution to the area

5. What role do trees play in providing habitats for animals in the city?
 - A) They provide food for animals

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- B) They create a safe place for animals to live
- C) They scare away animals from the city
- D) They compete with animals for resources

6. How do trees contribute to the beauty of the city?

- A) By emitting pleasant fragrances
- B) By providing colorful flowers
- C) By adding greenery and visual appeal
- D) By attracting birds and insects

Answers:

- 1. A
- 2. B
- 3. A
- 4. A
- 5. B
- 6. C

Note: It's important to review the answers and explanations with the children after completing the quiz to reinforce their understanding of the importance of trees for reducing city pollution.

ADDITIONAL VIDEOS AND GAMES:

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(200) Kids vocabulary - Growing a Tree - Learn English for kids - English educational video - YouTube

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Photosynthesis diagram labeled Game Quiz



[Photosynthesis diagram labeled Game Quiz \(ecosystemforkids.com\)](https://ecosystemforkids.com)

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[Deforestation Game Quiz Online \(ecosystemforkids.com\)](https://ecosystemforkids.com)

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<https://youtu.be/1BYyV8e4vq8>



[\(201\) What Is The Ozone Layer? | Ozone Layer Depletion | Dr Binocs Show | Kids Learning Video|Peekaboo Kidz - YouTube](#)

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[\(200\) What is Acid Rain? | National Geographic - YouTube](#)

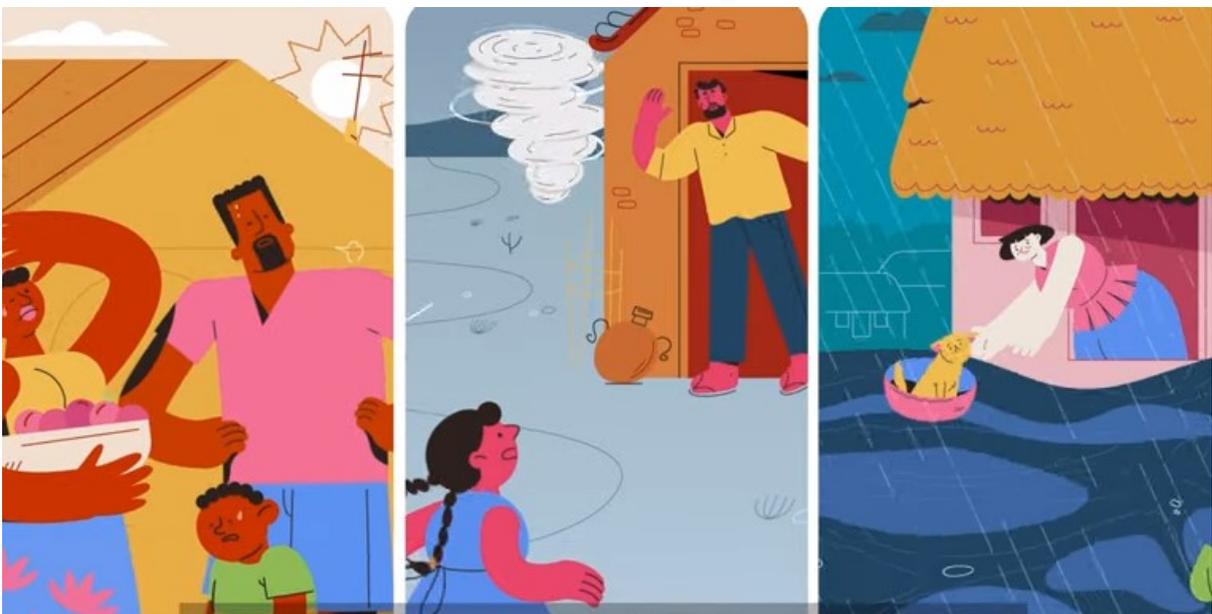


[\(200\) EU Cities Mission: Meet the Cities - YouTube](#)

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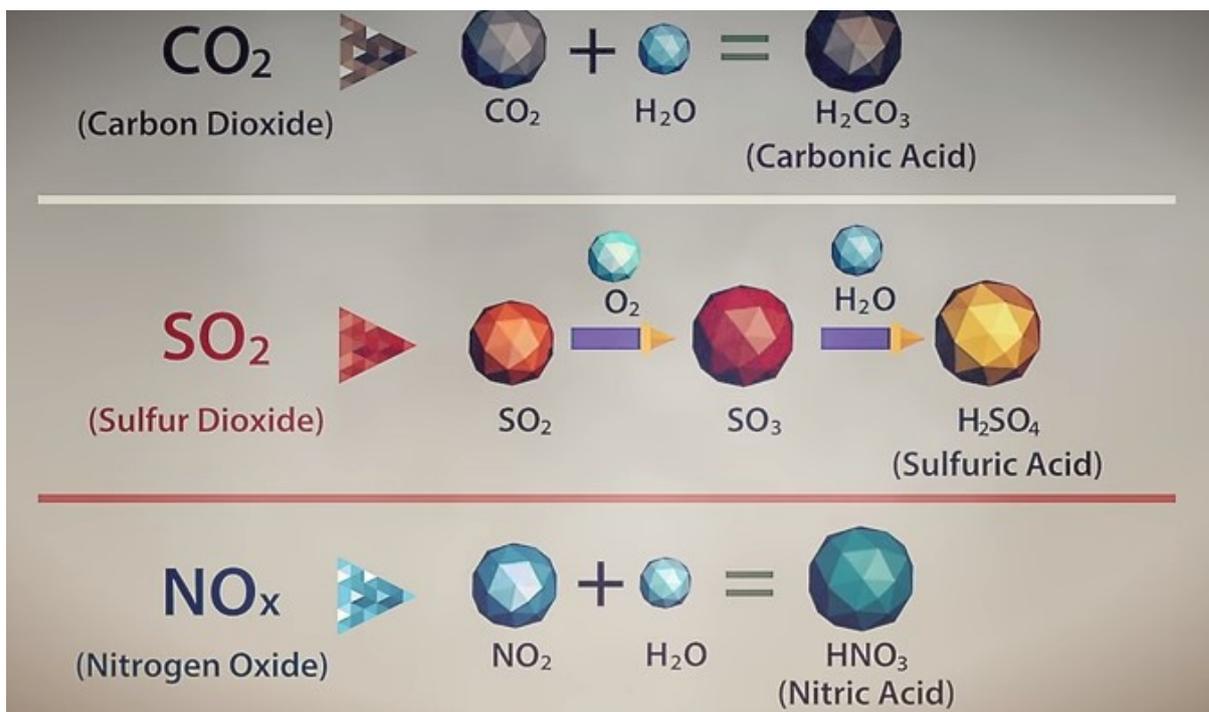


[\(201\) Explaining the Circular Economy and How Society Can Re-think Progress | Animated Video Essay - YouTube](#)



<https://www.youtube.com/watch?v=qVVwjHqWCl8>

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[\(200\) Acid Rain \(Animation\) - YouTube](#)



<https://www.youtube.com/watch?v=6x8luJlcXTk>

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<https://www.youtube.com/watch?v=szjE8e18NAM>



[\(201\) Evaporation - Elementary Science - YouTube](#)

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[\(200\) Building Integrated Photovoltaics - YouTube](#)

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