

Climate adaptation – City of Prague

In recent years many extreme climatic events have grown worldwide. The frequency of weather fluctuations, torrential rains, extreme droughts, heat waves, freezes is still increasing. **To keep Prague a safe and attractive capital to live in, we need to prepare for situations that can limit the functioning of the city and the health of our citizens.**

Climate change symptoms in Prague are mainly related to **increase of the air temperature and weather extremes (droughts, storms, hailstorms, torrential rain and floods)**. There has been a significant increase in the number of tropical days and nights and frequency of extreme precipitation as well as the accumulation of precipitation and lack of opportunities for leakage of rainwater. In most of its territory, Prague is vulnerable to frequent floods, drainage, congestion of urban sewers and drought.

The City of Prague strategic objective is **to increase the long-term resilience and reduce the vulnerability of the city** to the impacts of climate change through the implementation of **adaptation measures** with the main objective to maintain **the quality of life of its citizens.**

High temperatures – Urban Heat Island

High temperatures and hot waves have a demonstrable negative impact on the health of the population; extreme temperatures decrease work efficiency and reduce the drivers' attention, which can lead to increased accidents. Extremely high temperatures can negatively affect the economic performance of the city and affect the quality of life.

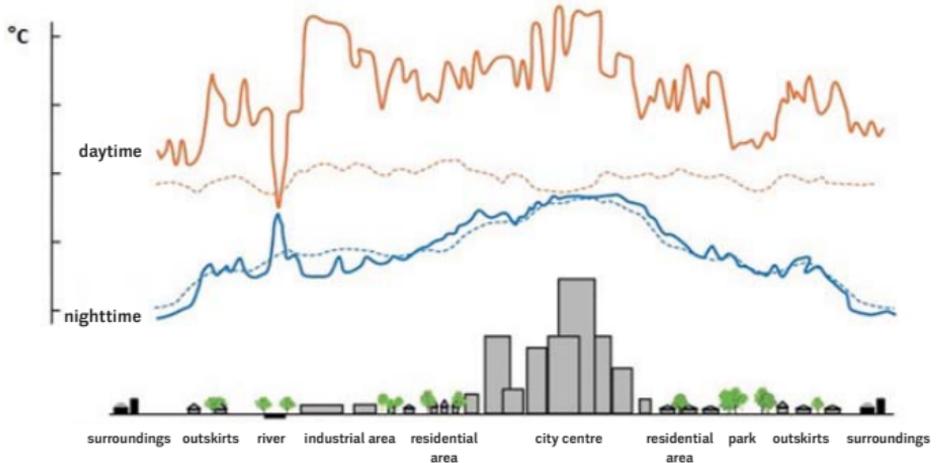
Temperature extremes and hot waves are currently most affected in the city centre areas - Prague 1, Prague 2, Prague 3, Prague 6, Prague 7 and some peripheral parts with industrial buildings, eg. Libeň or Štěrboholy.



**ADAPTAČNÍ
STRATEGIE
HL. M. PRAHY**

Urban heat island - daytime and nighttime temperatures (EPA revised: www.epa.gov)

— surface temperature (daytime)
- - - air temperature (daytime)
— surface temperature (nighttime)
- - - air temperature (nighttime)



Source: <http://www.opatreni-adaptace.cz/wp-content/uploads/2017/10/obr1.jpg>

What's happening

- health complications (heart attack)
- high number of energy consumption
- discomfort stay in the city
- drying out of the greenery
- lowering the water level, presence of cyanobacteria

How to adapt?

- permeable surfaces
- surface drainage depression
- larger area of parks and public greenery
- fountains, drinking spots
- solitaire trees and alleys in streets
- vertical greenery
- green roofs
- urban gardening
- outdoor facade shading
- passive cooling of buildings
- facade insulation
- water streams revitalisation
- establishing of small water bodies and ponds
- developing of suburban agriculture

How to act?

- avoid direct sunlight, improve the ventilation, reduce body weight
- sufficient water drinking
- wear light clothing made of natural materials
- do not mow the grass
- fire prevention

Torrential rains

Short-term heavy precipitations in small areas can cause **torrential or flash floods**. Insufficient soaking of precipitation water is a frequent cause of lightning floods, small watercourses and drainage can be impacted clogged, especially in areas with a high proportion of impermeable asphalt surfaces.

The high vulnerability to extreme collisions is related mainly to the areas of the active zone of Vltava river, Botič and Rokytka streams, as well as to the heavily built areas of Prague 2, Prague 3 and Vysočany, Klíčov, and the area around Vltava and Berounka confluence - Velká Chuchle, Prague 16, Zbraslav and Lipence.

What's happening?

- flooded cellars
- landslides
- disruption of transport infrastructure
- disruption of the sewerage system
- failure of electricity
- reducing the flow capacity of the river beds
- tree falls, collapsing bridges
- floods follow in case of long-lasting rains

How to adapt?

- water streams revitalisation
- create small water reservoirs (retention and storage), ponds, lakes
- water retention and further use (dressing, flushing)
- permeable surfaces
- surface drainage depression
- green tramway belts
- larger area of parks and public greenery
- green roofs
- vertical gardens

How to act?

- prepare an evacuation bag and follow safety instructions
- cooperation with the integrated rescue system (fire brigade, police, municipal representatives, flood authorities)
- not to enter into deep water
- no car drive over flooded bridges and communications
- protect own property

Floods

Unlike the torrential, **flash floods** on smaller streams in Prague, which are caused by short-term precipitation of high intensity and affecting relatively small areas, are so-called **river floods** caused by long-term regional rainfalls in the spring and summer periods, are usually on the Vltava and Berounka rivers.

Scientific forecasts predict a more frequent occurrence of floods across the whole Czech Republic.

After floods in 2002, the capital city of Prague built flood protection, which is made up of more than 19 km of flood barriers, compound from reinforced concrete, ground embankments and mobile flood walls in length almost seven kilometres. An integral part of the flood protection are measures in the sewerage networks.

What is happening?

- spillage of water outside the river beds
- endangering lives and health of humans and animals
- environmental damage (damage and pollution of water sources)
- damage to public and private property
- outage of utility networks
- disruption of urban infrastructure (public transport, bridges, roads, railways)

How to adapt?

- create small water reservoirs (retention and storage), ponds, lakes
- non-built-up areas in floodplains
- meanders
- floodplain forests in front of the city
- conservation of the areas of spillage for its purpose
- flood meadows at the upper parts of the river
- parks by the river
- dry polders
- protection and restoration of permanent stands on the banks of watercourses and ponds
- restoration of natural channels and valleys, restoration of water flow functions in natural sites and urban landscape
- restoration of wells and springs
- flood protection on the Vltava River where it is effective

How to act?

- watching mass media
- prepare evacuation baggage
- cooperation with the integrated rescue system (fire brigade, police, municipal representatives, flood authorities)
- follow the evacuation instruction
- do not approach the watercourse
- do not enter closed areas

Drought and fires

Drought occurs as a result of a long-lasting rainfall deficit when higher temperatures result in higher water vapour. In the summer, it is possible to temporarily reduce flow in streams and reduce the quality of water in watercourses and tanks. In the dry season, the availability of soil and groundwater for vegetation is also reduced. Due to drought and high temperatures, is also increased the risk of fires.

Drinking water supply for Prague is provided by water treatment plants Želivka, Káraný and as a backup source water treatment plant Podolí. As a result of drought, it is possible to temporarily reduce the supply of surface and ground water intended for drinking water treatment, or its quality may be compromised.

What's happening?

- increased dustiness and allergenicity
- trees and greenery destruction
- risk of fires
- water shortage
- worsening of water quality in wells and springs
- soil and marshlands drying out
- groundwater warming - algal, cyanobacteria
- soil erosion

How to adapt?

- permeable surfaces
- surface drainage depression
- meanders and floodplain forests
- larger area of parks and public greenery
- dams
- rain gardens
- water streams revitalization create small water reservoirs (retention and storage), ponds, lakes
- water retention and further use (dressing, flushing)
- restoration of wells and springs
- to use non-phosphate materials

How to act?

- water savings
- do not use private swimming pools
- to prevent the emergence of fires
- low maintenance gardens

Adaptation measures – sustainable mobility

Individual traffic is the main source of air pollution and street warming in Prague. During the high temperatures, the ongoing chemical reactions increase air pollution and negatively affect citizens health.

How to adapt the city?

- use public transport, railways, electromobiles, pedestrian traffic and cycling
- use carbon-free energy sources

Adaptation measures for increasing energy efficiency and adaptation of buildings

Buildings consume about 40 per cent of all energy and are thus responsible for the greenhouse effect. Reducing the energy performance of buildings is, therefore, a step towards the city's resilience and reduction of its environmental footprint.

How to adapt the city?

- use of local renewable energy sources in buildings (eg. heat pumps, biomass boilers, solar collectors, photovoltaic panels)
- installation of low energy lighting systems
- building insulation
- facade shading systems
- passive cooling of buildings, controlled ventilation, night cooling
- vertical greenery, green roofs
- rainwater usage systems
- grey water usage systems



Picture – an example of building adaptation: Passive and low energy school building, Primary School and Nursery School Prague-Slivenec with extensive green roof and semipermeable pavement surface.

Examples of adaptation measures in Prague

Gravel bed and tree alley in Jičínská street, Prague 3

Realization of perennial planting and tree-growing increases the ability to absorb rainwater from surrounding paved areas - impermeable asphalt surfaces. Thanks to the gravel mulch, the belts are very effective in the immediate removal of larger precipitation into the lower layers.



Source: <http://www.prostranstvi.cz/Priklady-dobre-praxe/Databaze/Praha-Sterkove-zahony-v-ulicich.aspx>

Meander on the Rokytka stream

Regulated bed of the Rokytka stream was replaced in 2014 by more natural meanders allowing the water flow into the surrounding meadows. The meandering stream prevents devastating floods, and retain the water in the countryside during the dry period and high temperatures.



Source: https://prazsky.denik.cz/zpravy_region/rokytka-20181002.html

Dry polder Čihadla, Prague 14 – Hostavice

Polders are smaller waterworks in which is water temporarily accumulated during floods. The dry polder Čihadla was built in the 1980s on the site of a former pond and flows through Rokytka river, where the Svěpravický and Hostavický streams flow. The current state was built between 2007 and 2008 and the task of revitalization was the removal of concrete, straight streams and the creation of a natural, meandering stream with pools.



Source: <http://www.prahazelena.cz/suchy-poldr-cihadla.html>

Pond Lipiny, Prague 12 – Modřany

Pond Lipiny on the west end of Modřany Gorge, which was built by Prague City Hall (Forest administrative) in 2017, is filled with water from Libušský stream. The area of the pond at the full surface is over 5,000 m², which makes this construction one of the largest newly built water body in Prague. The capacity of retained water at the normal level is more than 8,500 m³.



Source: http://www.praha.eu/jnp/cz/o_meste/magistrat/tiskovy_servis/tiskove_zpravy/novy_rybnik_lipiny_rozsiri_cenne_uzemi.html

Extreme hydrometeorological events:

Extreme climatic events (**storms, strong winds, windstorms, hailstorms or snow blizzards**) can be quite dramatic and dangerous. The intensity of these events will increase with the upcoming climatic changes.

Sources:

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Prague City Hall,

Environmental Protection Department

www.praha.eu

<http://portalzp.praha.eu/ochranaklimatu>

Ekocentrum Koniklec, o.p.s.

Vlkova 2725/34, Praha 3, 130 00

www.ekocentrumkoniklec.cz

www.ekoporadnypraha.cz



ADAPTAČNÍ
STRATEGIE
HL. M. PRAHY