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Community-led Nature-based Adaptation in Tallinn City, Estonia

Bog Restoration as a Nature-Based Urban Climate Adaptation Action

Inclusive governance, adaptive infrastructure, and nature-based solutions can reduce climate risks, manage stormwater, restore biodiversity, and strengthen community ownership. Pääsküla Bog now functions as a carbon sink, stormwater buffer, biodiversity haven, and cooling refuge for residents.

Key Learnings

- **Community participation strengthens resilience:** Inclusive public engagement, primarily through volunteer work, involved students, scientists, and residents in building dams and wooden boardwalks. Hundreds of people contributed labour, knowledge, and logistics. This fostered public ownership, sustained momentum, and broadened climate awareness.
- **Evidence-based planning enables effective adaptation:** An engineering company and bog restoration experts conducted a two-phase water regime study to map ditch networks and analyse restoration feasibility. It informed dam placement with minimal off-site impact: adaptive structures and regular monitoring support long-term learning and responsiveness.
- **Adaptive design meets climate and ecological variability:** Hybrid solutions address extreme weather and active beaver populations: wooden boardwalks for year-round access and dams for responding to fluctuating water levels showcase nature-based adaptation in practice.
- **Restoration brings multiple co-benefits:** Once rewetted, the bog could remove up to 18 tonnes of CO₂ annually. Biodiversity is rebounding with around 300 plant and more than 140 bird species, while the site provides cooling, water regulation, and accessible nature trails, all boosting social and climate resilience.

About the region

Tallinn is the capital of Estonia, located on the northern coast of the country along the Gulf of Finland in the Baltic Sea region. Covering approximately 159.2 km², Tallinn is Estonia's largest city and, as of 1 May 2025, home to 461,094 inhabitants – nearly one-third of the national population. The city lies on the North Estonian limestone plateau, with a varied terrain of glacial plains, a low-lying coastline, and stepped relief. Its landscape features extensive forests, wetlands, and diverse habitats. More than 13% of Tallinn's territory is under nature protection, forming a well-connected green network that supports biodiversity and enhances climate resilience. Northern Estonia is known for its large bogs and marshes, shaped by glacial processes – Pääsküla Bog among them. Tallinn's coastal location yields a humid, cool-temperate climate with relatively small seasonal temperature extremes compared to more continental areas. Winters are typically cold and snowy, while summers are mild, reflecting the city's position in the transition zone between maritime and continental climates.



Climate Hazards

Extreme Heat, Storms, Flooding

Sector

Water Management, Urban, Biodiversity protection

Key system

Ecosystem and Nature Based Solutions, Water Management, Health and Wellbeing

Climate Threats

In the last two decades, Estonia has seen a marked rise in extreme heat, with the five warmest years on record occurring between 2008 and 2024. In the past 60 years, the number of days with temperatures reaching more than 30 °C has increased by almost nine days per year. The duration of heatwaves is now roughly one week longer than in the mid-20th century. A new study finds that Baltic heatwave frequency

has roughly doubled in the last 30 [years](#). Climate models project even stronger future increases. According to the [Climate Change Adaptation Development Plan until 2030](#) (2015), climate models project even stronger future increases; under mid- and high-end scenarios, heatwaves in Estonia are expected to become significantly more frequent and intense by mid-century, with summers much hotter than today.

In recent decades, Estonia has experienced a slight increase in rain and snowfall. Compared to previous decades (1961–1990), the total precipitation has increased by about 6% on average. Winters have become much wetter, while autumns are a bit drier. Short, heavy rainfalls have become more frequent and can lead to flooding. Predictions estimate that precipitation will increase even more in the future, possibly by about 20% by 2100. Most of this increase is likely to happen in winter, while summer rains may decrease. When it rains heavily in a short period, the risk of urban flooding increases, especially if city authorities do not upgrade stormwater systems to handle the additional water.

Predictions estimate that flash floods – sudden local inundations after intense rain – will become more frequent as storms grow more extreme.

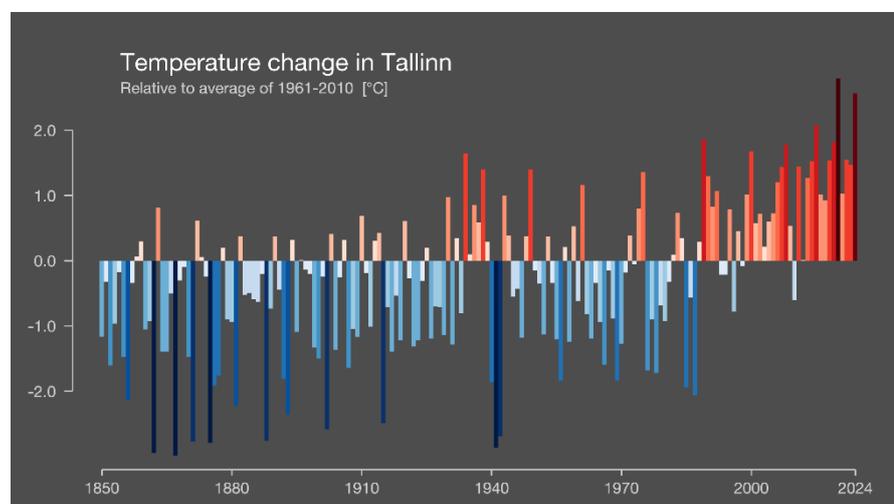


Figure 1: Figure 1: Temperature change in Tallinn relative to the average of 1961-2010 [°C]. Image Credit: [#ShowYourStripes](#).

Engaging People, Restoring Nature, Adapting Together

The restoration of Pääsküla Bog addresses key urban climate risks – heatwaves, intense rainfall, and carbon emissions – through a scalable, Nature-based Solution. It also strengthens local biodiversity, reduces fire risk, and serves as an outdoor classroom for raising climate awareness. The measures demonstrate how targeted, evidence-based interventions in degraded urban peatlands can mitigate multiple climate risks. Importantly, the restoration area also acts as a stormwater buffer for nearby urban runoff, helping to slow flows and reduce the intensity of flash flood events. Located on the southern edge of Tallinn, the bog's peat served as a resource for heating and agriculture for over half a century. After peat extraction ended in the 1960s, the heavily scarred landscape with an extensive drainage system has contributed to carbon emissions, biodiversity loss, with natural afforestation of the peatland causing bog specialists to decline and forest species taking over, and increased fire risk ever since.

Between 2020 and 2025, the City of Tallinn, in partnership with national experts and NGOs, has been restoring 47 hectares of degraded peatland. The core action was the closure of 64 drainage ditches using peat dams. Identifying their appropriate location was based on hydrological modelling and ground surveys. This intervention aimed to raise and stabilise the water table close to the surface (0–20 cm), creating conditions for peat accumulation and long-term carbon storage. Vegetation monitoring and site design specifically supported the return of Sphagnum mosses, key agents in CO₂ removal.



Figure 2: Planned locations and types of dams under the hydrological restoration plan for the Pääsküla Bog nature reserve. Image Credit: ELF Ring OÜ, 2021.

In parallel, the project team implemented adaptive infrastructure to ensure year-round public access and ecological compatibility, thanks to floating boardwalks that cope with fluctuating water levels. The dam design works alongside active beaver populations, which naturally arrived.

Scientific assessments estimated that rewetting the bog would reduce CO₂ emissions by 0.8 to 3 tonnes per hectare and year. While short-term methane emissions may rise due to low-oxygen, waterlogged conditions, long-term climate modelling shows that the avoided CO₂ emissions more than make up for this. Only within two decades, the site could become a net carbon sink, and in the next 50 years, the ecosystems could have fully recovered.



Figure 3: Volunteer school students at the 2023 Pääsküla Bog workday together with Karmo Kuri, District Mayor of Nõmme; Lauri Klein, workday organiser and environmental protection expert; and workday leader Aleksander Tukk. Image Credit: Tallinn City Government.

One of the most important aspects is that the adaptation actions follow a participatory process. After developing the Pääsküla Bog Nature Reserve's Management Plan through a public engagement process, the locals and the authorities agreed upon two key aspects: all existing walking paths need to remain

accessible, and every bog restoration action needs to be done by hand, without using heavy machinery. Over 400 volunteers – including residents, students, and nature groups – participated in building the dams, removing invasive species, and environmental education days. The project is not only an investment for climate adaptation but also a shared community action to improve the urban quality of life.

The restoration of Pääsküla Bog addresses key urban climate risks – heatwaves, intense rainfall, and carbon emissions – through a scalable, nature-based solution. It also strengthens local biodiversity, reduces fire risk, and serves as an outdoor classroom for raising climate awareness. As such, it reflects Tallinn’s broader commitment to becoming climate-neutral by [2050](#) and aligns with the [EU Biodiversity Strategy 2030](#) and [Estonia’s national climate policy](#).

“The Pääsküla Bog nature reserve is one of Tallinn’s richest and most distinctive green areas. By restoring it, we are not only mitigating the impacts of climate change but also offering a rare opportunity for nature education and urban wilderness experience. We have both the opportunity and the responsibility to preserve and restore these landscapes where it is still possible.”,

Jüri-Ott Salm, Project Manager, Wetlands Programme Coordinator at the Estonian Fund for Nature (ELF)

Strategic Context

The restoration of Pääsküla Bog is embedded in Tallinn’s Sustainable Energy and Climate Action Plan ([2021](#)), which sets the city’s pathway toward climate neutrality by 2050. The plan identifies nature-based solutions as a key approach to reduce climate-related risks, enhance biodiversity, and strengthen resilience.

Rewetting 47 hectares of degraded peatland contributes to several priority areas:

- Climate adaptation – reducing risks from extreme rainfall, drought, and wildfires.
- Climate mitigation – decreasing CO₂ emissions from drained peat soils.
- Biodiversity and ecosystem services – restoring natural habitats and ecological connectivity.
- Community engagement – mobilising residents through volunteer action and environmental education.

The restoration supports Tallinn’s broader efforts to integrate green infrastructure, safeguard urban ecosystems, and foster inclusive, nature-based climate governance.

Summary

The restoration of Pääsküla Bog shows how nature-based solutions can reduce urban climate risks and support long-term resilience. By rewetting 47 hectares of degraded peatland and closing 64 drainage ditches, Tallinn improved water retention, reduced flood and fire risk, and restored ecological balance. The site is expected to become a net carbon sink within two decades, with annual CO₂ reductions of up to 3 tonnes per hectare. Over 400 volunteers contributed, making the project a shared civic effort. The restoration supports Tallinn's climate goals and reflects broader EU and national strategies on biodiversity and adaptation.

Further information

- Volunteer Work in Pääsküla Bog (2022) <https://www.youtube.com/watch?v=uWZB-bbIDbo>
- Volunteer Work in Pääsküla Bog, featured in the environmental TV program *Osoon*. <https://jupiter.err.ee/1609135118/talqud-paaskula-rabas>
- <https://www.tallinn.ee/en/news/local-and-international-volunteers-recognized-their-contributions-restoring-paaskula-bog>

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