Interreg Baltic Sea Region

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ENERGY TRANSITION
Climate-4-CAST

Green Lungs of Bytom 2030

From Satellite Data to Real Climate Action

Understanding the Carbon Wealth of a City

Robert Białas · City of Bytom, Department of Environmental Engineering · rbialas@um.bytom.pl

Bytom, Poland | March 2026

02

Why This Matters

Bytom is a post-industrial city with enormous, previously unmapped green potential.

Natural carbon stores were long invisible in the urban data blind spot.

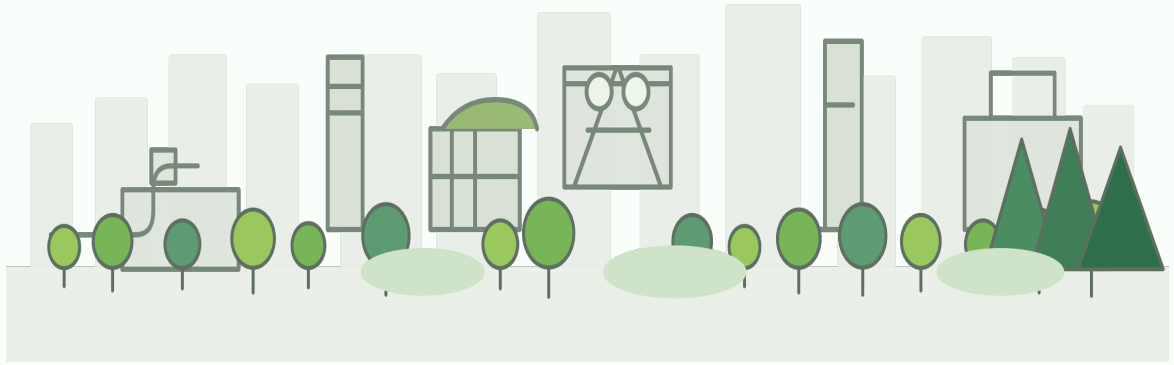
- Carbon sinks rarely appear in urban policies as a recognised asset.
- Carbon resources are left idle — time to translate them into planning and investment decisions.
- Connecting analytics with daily city management is urgent.

Potential

A post-industrial city often has more green assets than appear in standard infrastructure reports. Previous land use created unexpected ecosystems.

The Decision Moment

Measure first, protect second, invest third — the reverse order is the most expensive. Data must precede decisions.



03 Objective

Conducting a comprehensive carbon sequestration assessment for the entire city.

The audit was not meant merely to describe green spaces. It was meant to convert them into quantifiable decision capital.

01

Asset Inventory

Creating a full inventory of the city's green capital — carbon asset — across the entire area of Bytom.

Entire city

02

Absorption Capacity

Identifying which ecosystems absorb CO_2 fastest and which store it most durably.

Ecosystem by ecosystem

03

Actionable Measures

Identifying concrete, achievable climate actions ready to be integrated into city procedures.

From data to decisions

04

Method — 'Space-to-Soil'

Innovative, precise integration of satellite imagery with field surveys.

1

Satellite Data

Copernicus: Sentinel-1, Sentinel-2 and EuroDEM as the starting point for reading land cover.

2

ML Classification

Machine Learning algorithms distinguish 15 land-cover classes — from green spaces to built-up zones.

3

Field Validation

Signal from space verified through a 'space-to-soil' logic: soil samples, biomass, local conditions.

4

Carbon Balance

Final result: total carbon stored in soil and full biomass combined.

From satellite signal to the city's carbon budget — a fully reproducible, updatable methodology

05 Data Sources & Standards

A pioneering analytical method — Bytom is setting an urban standard in Poland.

Data Sources

- ESA CCI Biomass global dataset
- NDVI satellite vegetation indices
- Polish Geological Institute (PIG) — soil data
- Copernicus Land Service
- MGGP Aero — field verification

Methodological Advantages

✓ Suitable for periodic updates — a monitoring tool, not a snapshot

✓ Transferable: applicable to other post-industrial cities

✓ Integrates orbital, ML, and soil-validation data layers

Quality Control 2025

Soil data confirmed through laboratory analysis and further field validation by MGGP Aero. Methodology approved for replication in other cities with complex post-industrial landscapes.

Key tags: ESA CCI · NDVI · PIG · ML Classification · Field Validation · Carbon Stock · Replicability

Total Carbon Stock

4.84

MILLION TONNES CO_2

Total volume of CO_2 stored in Bytom city ecosystems — soil + biomass

× 3.67

Stoichiometric factor converting carbon (C) to CO_2. Gives the result its real climate dimension.

Soil + Biomass

Full balance: not only above-ground vegetation but also the underground carbon reservoir — the most durable storage.

⚠ This asset must be unconditionally protected. If disturbed, stored CO_2 returns to the atmosphere faster than the city can recover it.

Carbon wealth should not serve as a green alibi for new emissions.

Where Is the City's Carbon Hidden? — Carbon Stock by Ecosystem

Soil is the primary and critical reservoir. In the landscape, wetlands and forests dominate.

The largest carbon stores are not always the most visible. Carbon is quiet: it hides in wetlands, soils, and mature forests.

1,387

t CO_2/ha

Wetlands / Reed beds

Highest per-hectare efficiency

1,122

t CO_2/ha

Deciduous Forests

Largest total area storage

<50

t CO_2/ha

Urbanised Areas' Greenery

Near-zero storage capacity

Key insight: Wetlands achieve the highest values because the bog soil layer accumulates carbon over millennia and is far more effective than any above-ground biomass. Urbanisation nearly always loses to soil and wetland in any comparison of carbon density.

08

Annual CO_2 Absorption Forecast to 2030

Trend extrapolation shows the powerful absorption potential of young vegetation.

17.70

t CO_2/ha/year

Young Forest Plantations

Highest growth dynamics; fastest absorption of new carbon.

INVEST PRIORITY

7.97

t CO_2/ha/year

Deciduous Forests

Solid foundation of urban sequestration system.

STABLE BASE

4.00

t CO_2/ha/year

Managed Green Spaces

Parks and squares — important in the city's annual carbon balance.

URBAN FABRIC

- Total annual sequestration: **~23,548 t CO_2/year** across the entire city
- Deciduous forests: **59.6%** of all absorption despite lower per-hectare rate (largest area)
- Investment in young forests = fastest way to increase absorption by 2030

Action: Protect High-Carbon Areas

Protection of the city's most carbon-rich 'lung patches' must become a planning priority.

Forests

Largest area carbon assets and the primary filter of the urban landscape.

Wetlands & Reed Beds

Most CO_2-dense patches per hectare — easy to destroy, nearly impossible to restore.

Post-Industrial Nature

Unique habitats on former industrial sites — a strategic asset, not a land bank for development.

What to protect?

- Forests — largest carbon assets
- Wetlands — highest CO_2/ha concentration
- Post-industrial spontaneous nature — hidden climate value

How to protect?

✓ Include high-carbon areas in planning and investment priorities

✓ Limit soil disturbance, draining, and hard transformation

✓ Treat these sites as strategic assets — not land reserves

Key Conclusions from the Carbon Audit

Stored carbon is an asset — not a 'buffer' to justify new emissions.

Sequestration ≠ Neutrality

Green assets do not automatically offset emissions. Even a significant natural stock does not justify new emission sources if the city is not cutting the root causes.

Soil Is Key

The most important element of the carbon balance lies underfoot. Soil is less photogenic than a treetop, but climatically it is often more important.

An Emission Budget Is Necessary

The city needs an emission budget because green assets are limited, slow-growing, and easy to lose. Data must become limits.

From Data to City Decisions

Hard data from the audit must feed directly into planning and financial procedures.

Urban Planning

MPZP + Carbon Assets

Include high-carbon green areas as ecological priority zones in Local Spatial Development Plans. No major land-use change without a carbon impact assessment.

Climate Budget

Policy = Numbers + Limits

Base climate policy on a real emission budget — not declarations. Annual tracking by sector. Green assets are part of the balance sheet, not a rhetorical device.

Investments

Investments Without Destroying Stock

Conduct all city investments so they do not destroy the city's carbon assets. Require carbon balance screening at project design stage.

Invitation to Cooperate

Robert Białas

City of Bytom
Department of Environmental Engineering

rbialas@um.bytom.pl

Climate budgeting since 2023

Developing decentralized local energy solutions and creating urban innovations innovations

Actively searching for collaborators and peer exchange

Presenter and contact for the Green Lungs of Bytom 2030 project within the Climate-4-CAST / Interreg Baltic Sea Region programme.

Our competences

- Carbon sinks measurement & monitoring
- Climate budget development & tracking
- Decentralised local energy solutions

We are actively seeking

- Peer exchange on climate budgeting methodology
- Partners for transferring the Space-to-Soil approach
- Collaboration on sequestration monitoring tools

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Climate-4-CAST is a co-funded project by the Interreg Baltic Sea Region Programme 2021–2027 · interreg-baltic.eu/project/climate-4-cast/