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Urban Ecosystems and Sustainability

Good morning everyone, I am Nicola Palmieri from the association Il Pianeta Naturale, partner of the Wave KA 210 project. Today I will tell you a story that concerns us all: that of urban ecosystems.



The Urban Ecosystem

Cities as Urban Ecosystems

Every city is a unique ecosystem. It doesn't matter whether it is

a thousand-year-old historic center, a technological

metropolis, an industrial city, or a tourist city: they all

share a fundamental challenge. How do we balance human needs and the natural environment?





The Urban Ecosystem

Stressed Cities

On one side we have stressed and unlivable cities, where the presence of concrete and asphalt is so overwhelming that it takes your breath away and where it is difficult to find natural habitats

Livable Cities

On the other side we have livable and resilient cities, with green spaces that invite relaxation



The Urban Ecosystem

What underlies the difference between these two types of cities **is the different level of integration between the urban fabric and the natural one.**

Urban ecosystems will be able to make the most of nature's benefits if they are more integrated.



What Cities Lack

What truly distinguishes an urban ecosystem from a natural one? If we think of a forest, where everything is interconnected, and then of a city, we will see that the urban context lacks several fundamental pieces of the puzzle.

... What Cities Lack

Local production

almost no city produces its own food or raw materials; we depend entirely on outside sources.

Biodiversity

urban habitats are fragmented like separate islands, preventing animals from moving and plants from reproducing naturally.

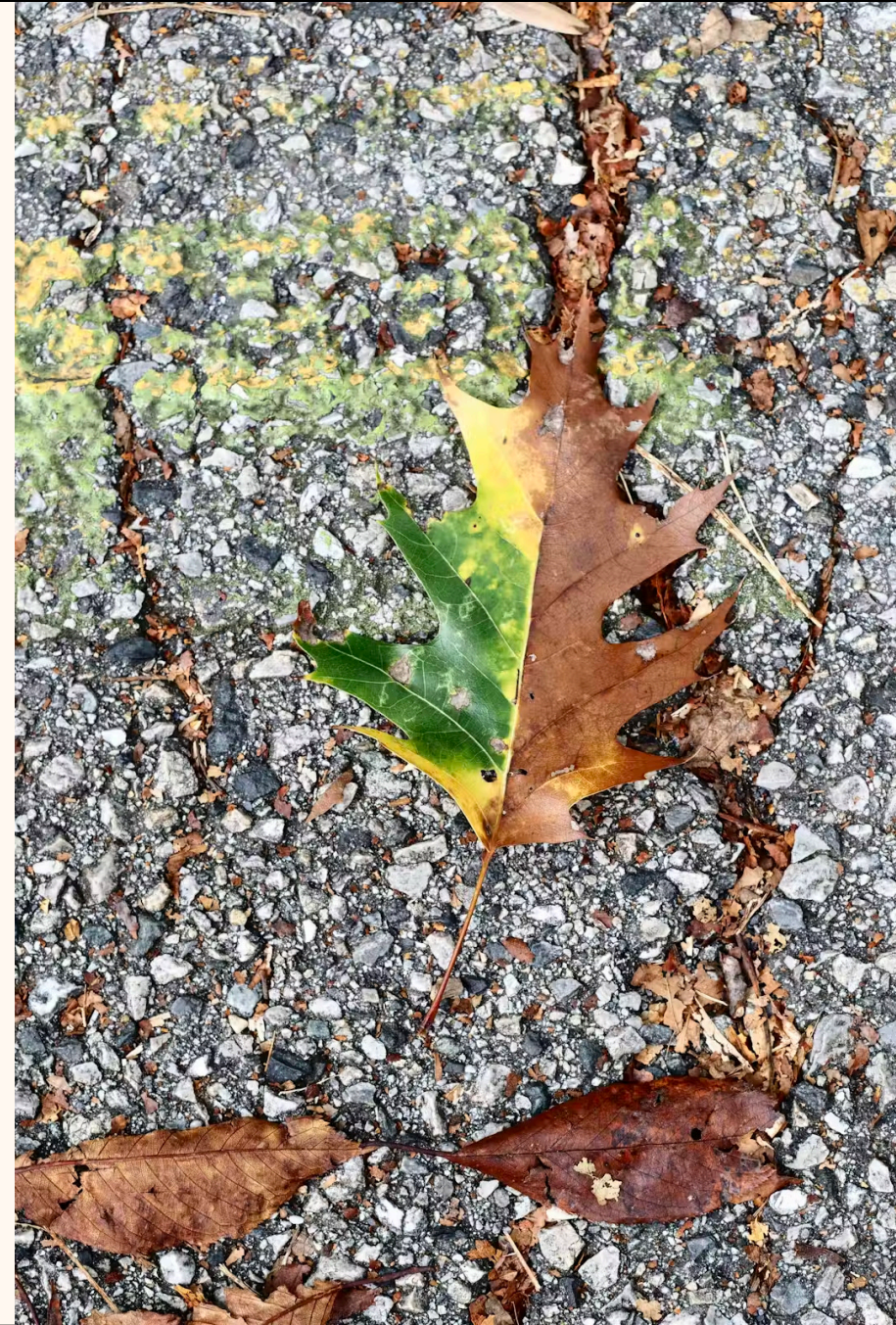
... What Cities Lack

Healthy soils

beneath the asphalt, soils are degraded; nutrient and water cycles are altered, and humus is almost nonexistent

Resilience

fragile cities that amplify floods, droughts, and heat waves instead of absorbing their impacts.





... What Cities Lack

Natural processes:

predation, decomposition, and ecological succession are missing,

which are essential for maintaining balance in natural ecosystems



But there are also positive signs:

many abandoned urban areas spontaneously transform into new "wild" zones with high biodiversity



Ecological Succession

Nature, left to its own course, rebuilds an ecosystem from scratch starting with pioneer organisms, reaching climax communities through **ecological succession**.

This shows the regenerative capacity inherent in natural systems, even in degraded urban contexts.

The Emergency of Urban Heat Levels

Urban heat islands represent an urgent problem.

In summer, in cities with more than 50,000 inhabitants, the temperatures can exceed those of nearby rural areas by **10-15°C**.



Urban Heat Islands

The phenomenon is due to asphalt and concrete, which absorb heat during the day and release it at night, to the lack of vegetation and to air conditioners that cool the inside but heat the outside.

The poorest neighborhoods suffer these effects the most.





Natural Solutions

01

GREEN CORRIDORS

Create corridors to ensure biological connectivity between the **fragments** of urban natural ecosystems

02

PLANT TREES

Plant trees and create parks, transforming empty spaces into green lungs.

03

GREEN BUILDING

Encourage green building to better insulate buildings.

...Natural Solutions



Reflective Materials

Use light-colored, reflective materials for sidewalks, buildings, and roads, capable of repelling heat.

Cairo is cooler than the surrounding desert thanks to the presence of greenery.



Water Effect

Design fountains and water features that, thanks to **evaporation**, bring relief.

The Story of Medellín

An Example of What Transformation Can Achieve

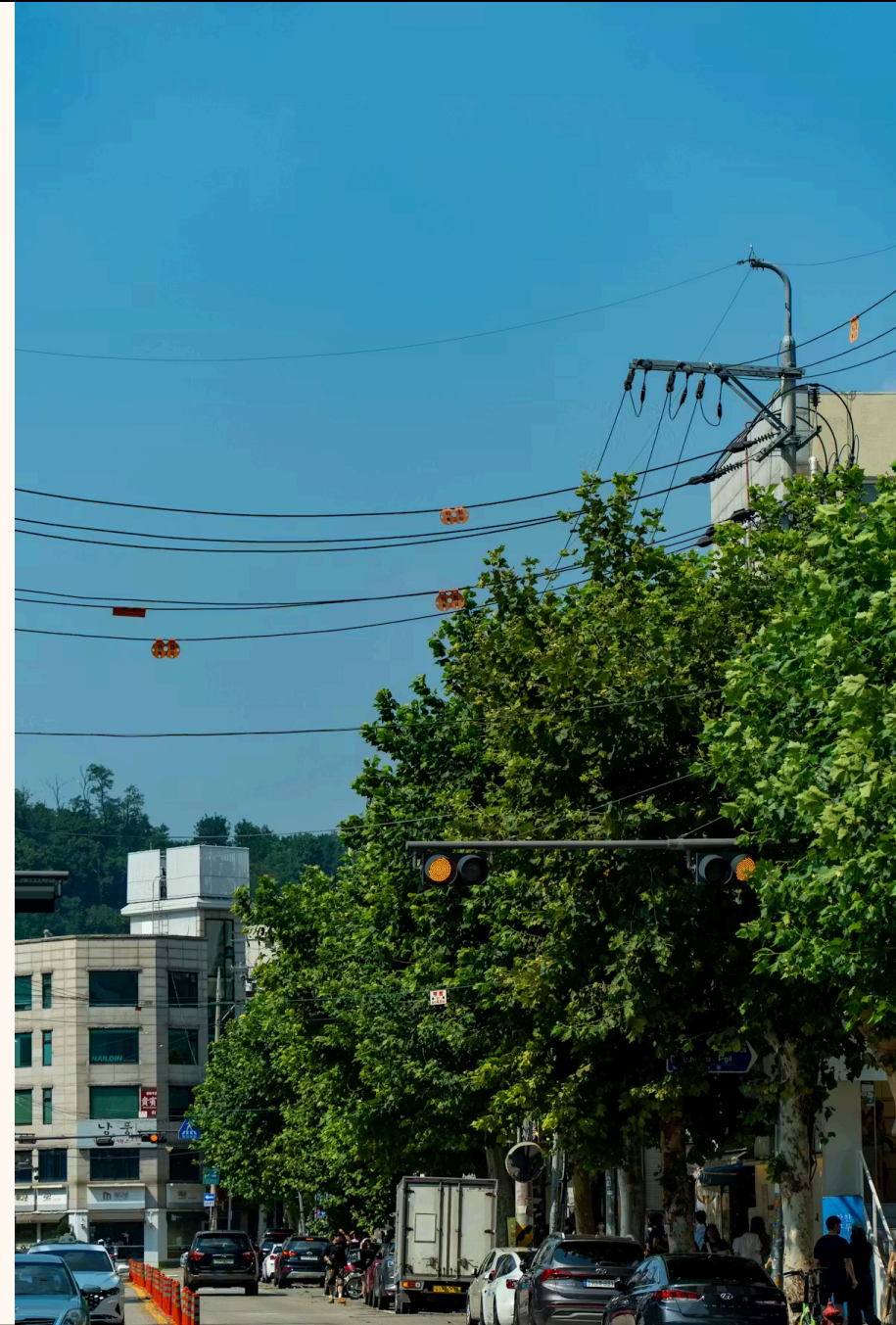
Medellín, in Colombia, shows that targeted interventions can improve livability and urban appearance. Strategies such as green corridors were adopted, reducing urban temperature by 2°C in just three years.



... The Story of Medellín

The urban geography was redesigned by planting trees, shrubs, and bushes along roads, waterways, and even on rooftops.

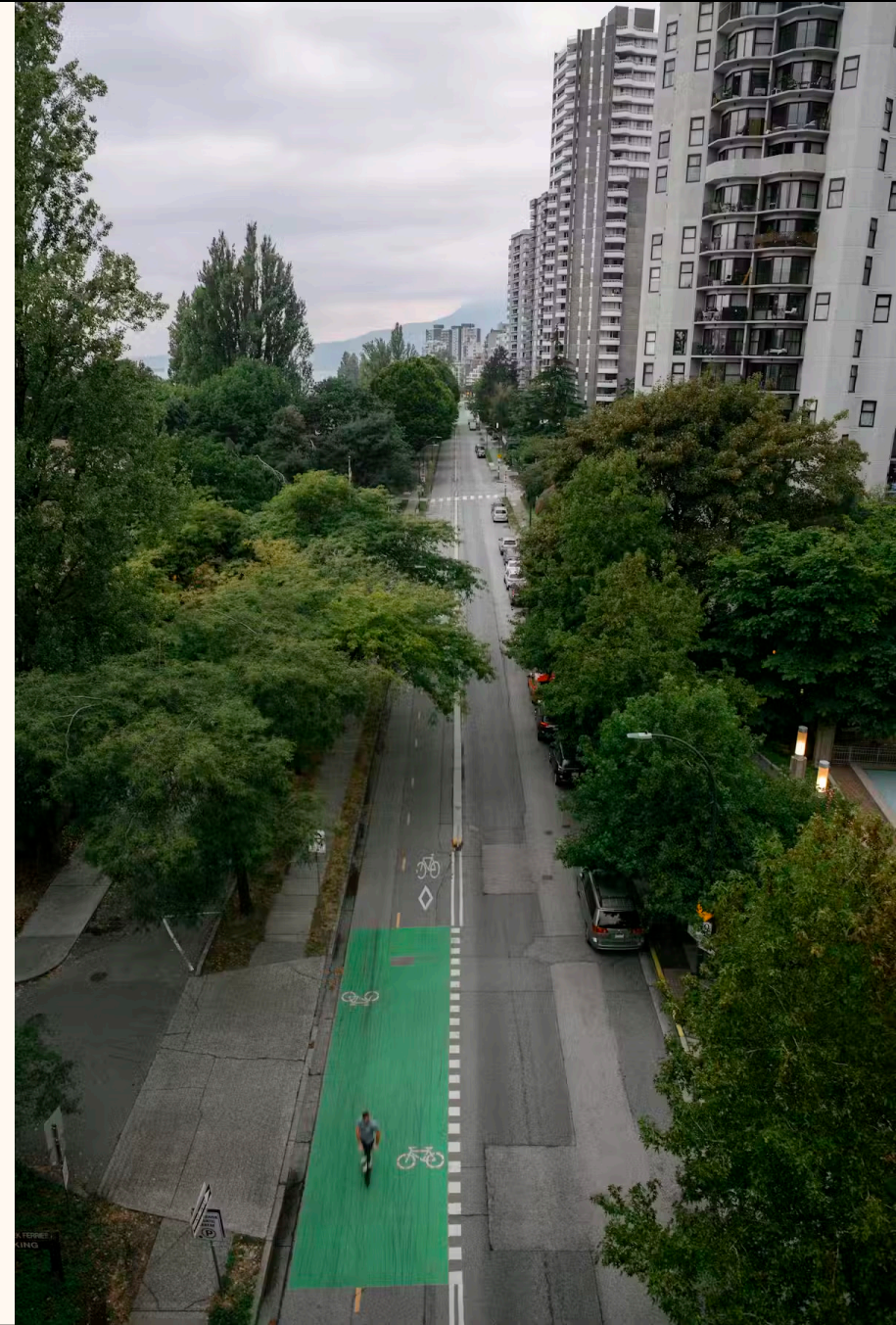
A green network was born that crosses the city connecting the center, residential neighborhoods, universities and offices.



... The Story of Medellín

The result is a porous and permeable city, walkable on foot or by bike. Architecture and nature live together harmoniously.

Commercial spaces, covered plazas, and sports areas
integrate biodiversity. Cleaner air brings well-being and reduces respiratory illnesses.



Medellín: Data and Results

Insights.



The average air temperature has dropped
From **31.6°C** to **27.1°C**



Surface temperature has decreased
From **40.5°C** to **30.2°C**



PM2.5

From **21.81** $\mu\text{g}/\text{m}^3$ to **20.26** $\mu\text{g}/\text{m}^3$



PM10

From **46.04** $\mu\text{g}/\text{m}^3$ to **40.4** $\mu\text{g}/\text{m}^3$

Medellín: Health Impact



OZONE has decreased $30.1 \rightarrow 26.32 \mu\text{g}/\text{m}^3$



Acute respiratory infections have decreased from **159.8** $\rightarrow$ **95.3** cases per thousand inhabitants.

Medellín is no longer a city people leave, but an international model.



A Possible Future

The European Union aims to make cities climate-resilient by **2050**.

More urban green space, sustainable water management, and innovative materials are needed. Reducing heat means less energy consumed and cities that are more livable for everyone.

A close-up photograph of a hand reaching upwards towards a green fern frond. The background is dark and out of focus, with some light filtering through the leaves, creating a soft, ethereal atmosphere. The text is overlaid on the image in a bold, orange font.

**Nature has always known how to
heal itself.**

It's time for our cities to learn that lesson too.