U-Care

TECHNISCHE UNIVERSITÄT BERLIN

Building Health Lab

University of Cyprus

CHALMERS UNIVERSITY OF TECHNOLOGY

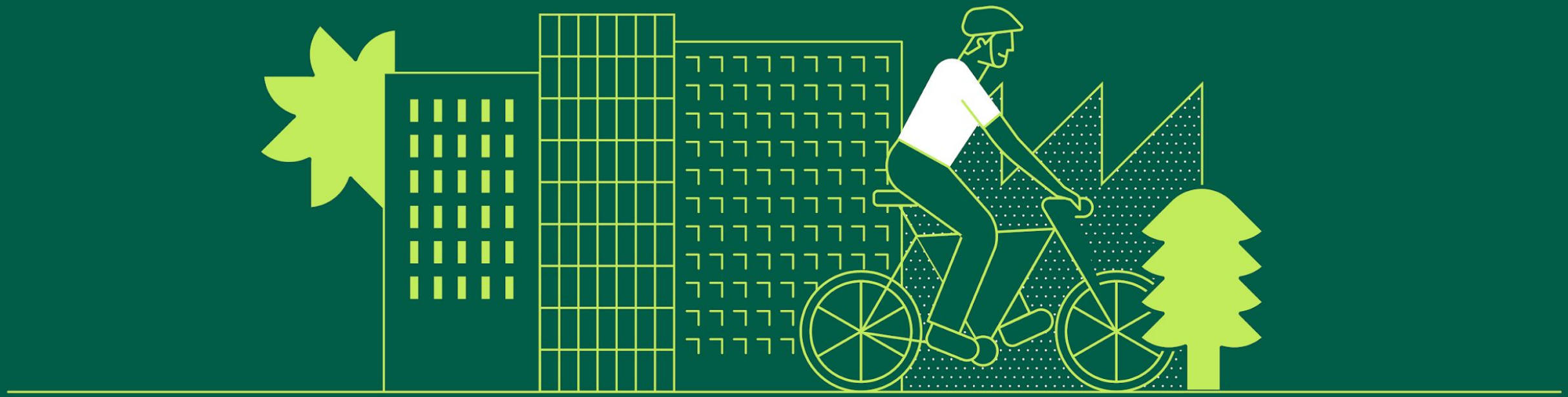
UNIVERSITÀ DEGLI STUDI FIRENZE

RSET

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
Project number: 2023-1-ES01-KA220-HED-000155347

U-Care



UrbanCare Session 4: Urban Biotope Diagnostics and Value Creation

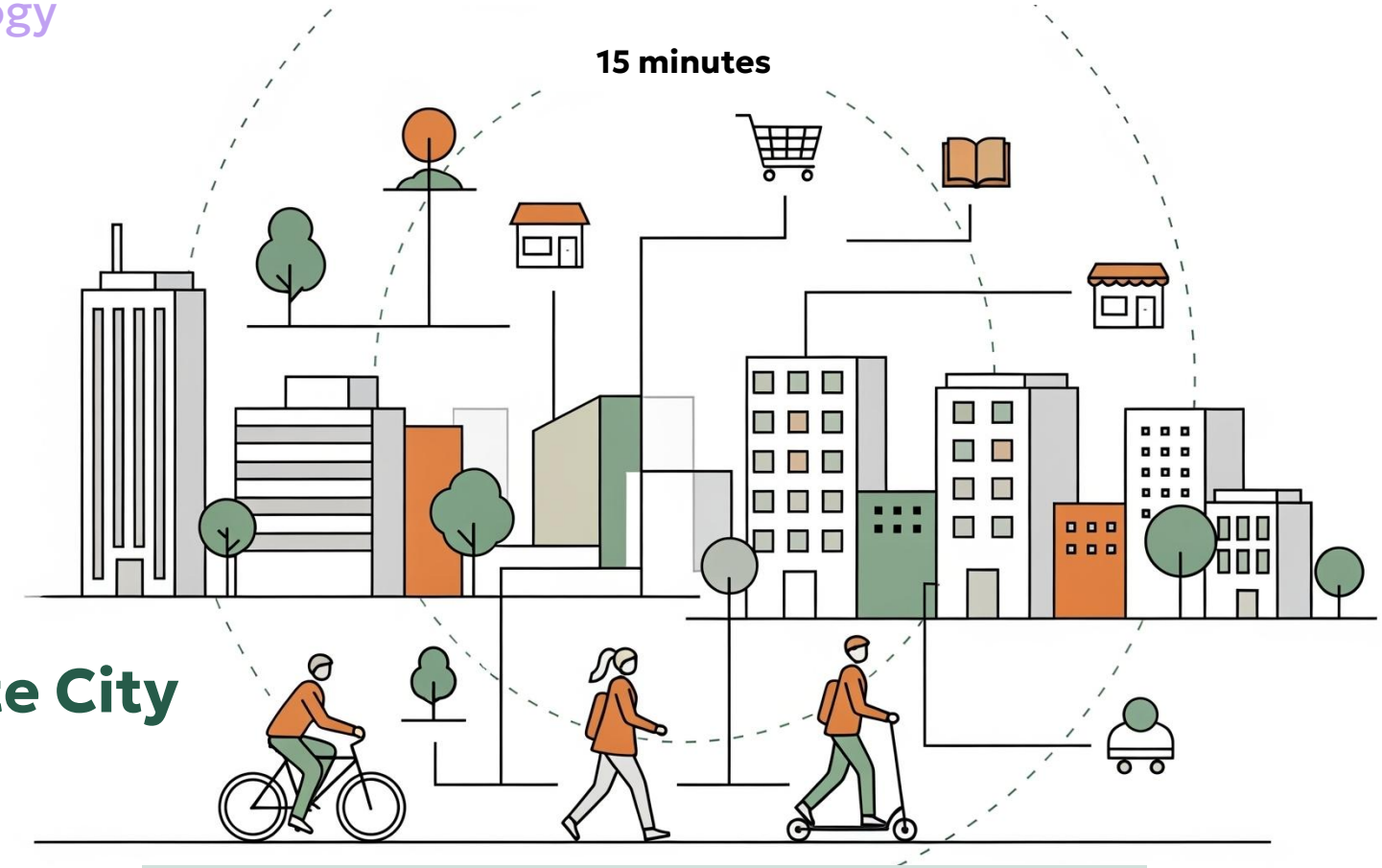
by **Alvaro Valera Sosa** | November 2025

U-CARE

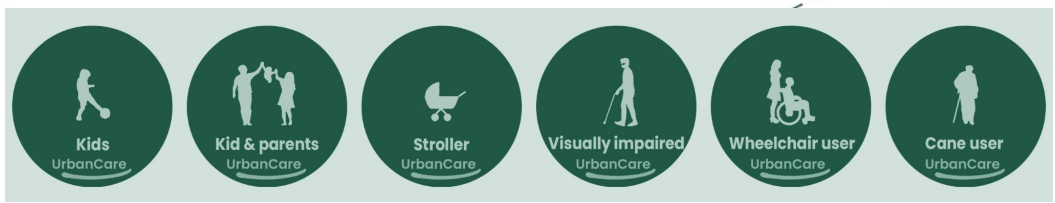
UrbanCare Methodology

UrbanCare

U-Care



15-minute City



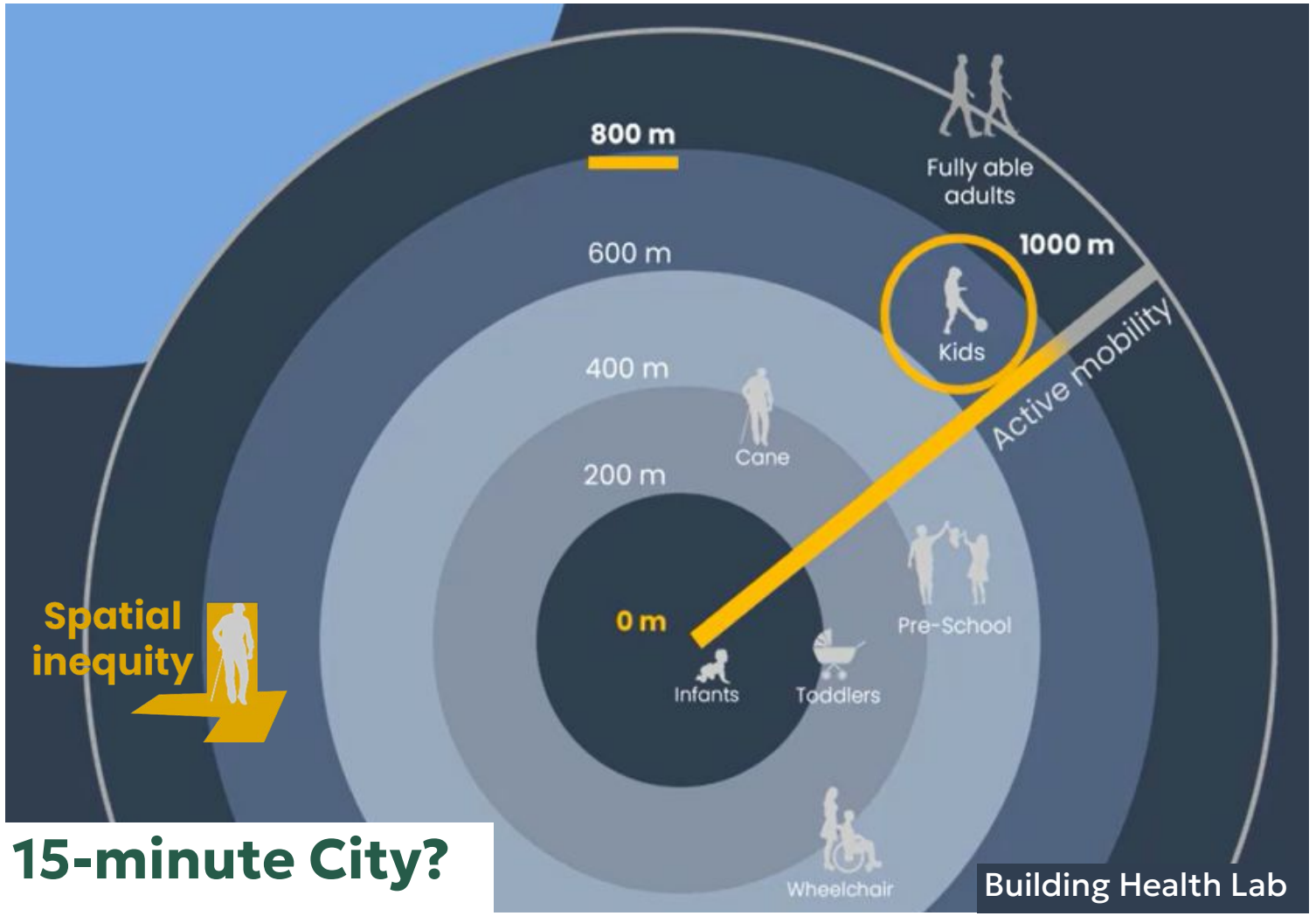
How far do slower paced groups travel in 15-minute Cities?

U-CARE

UrbanCare Methodology

UrbanCare

U-Care



Effort

Walkability

Runoff

Heat

Exposure

Biotope

15-minute City?

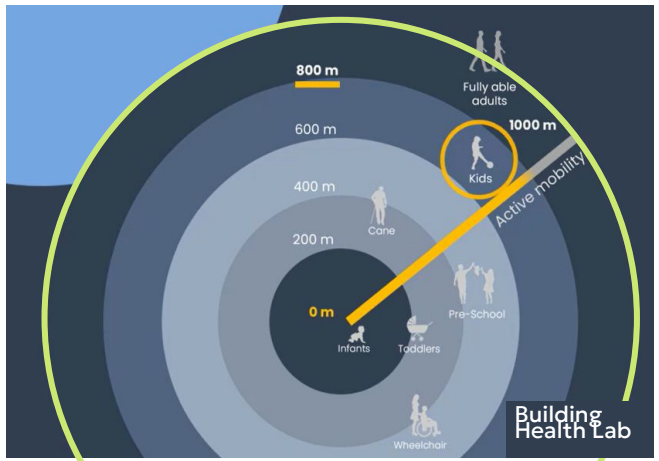
What happens to slower paced groups in 15-minute Cities?

U-CARE

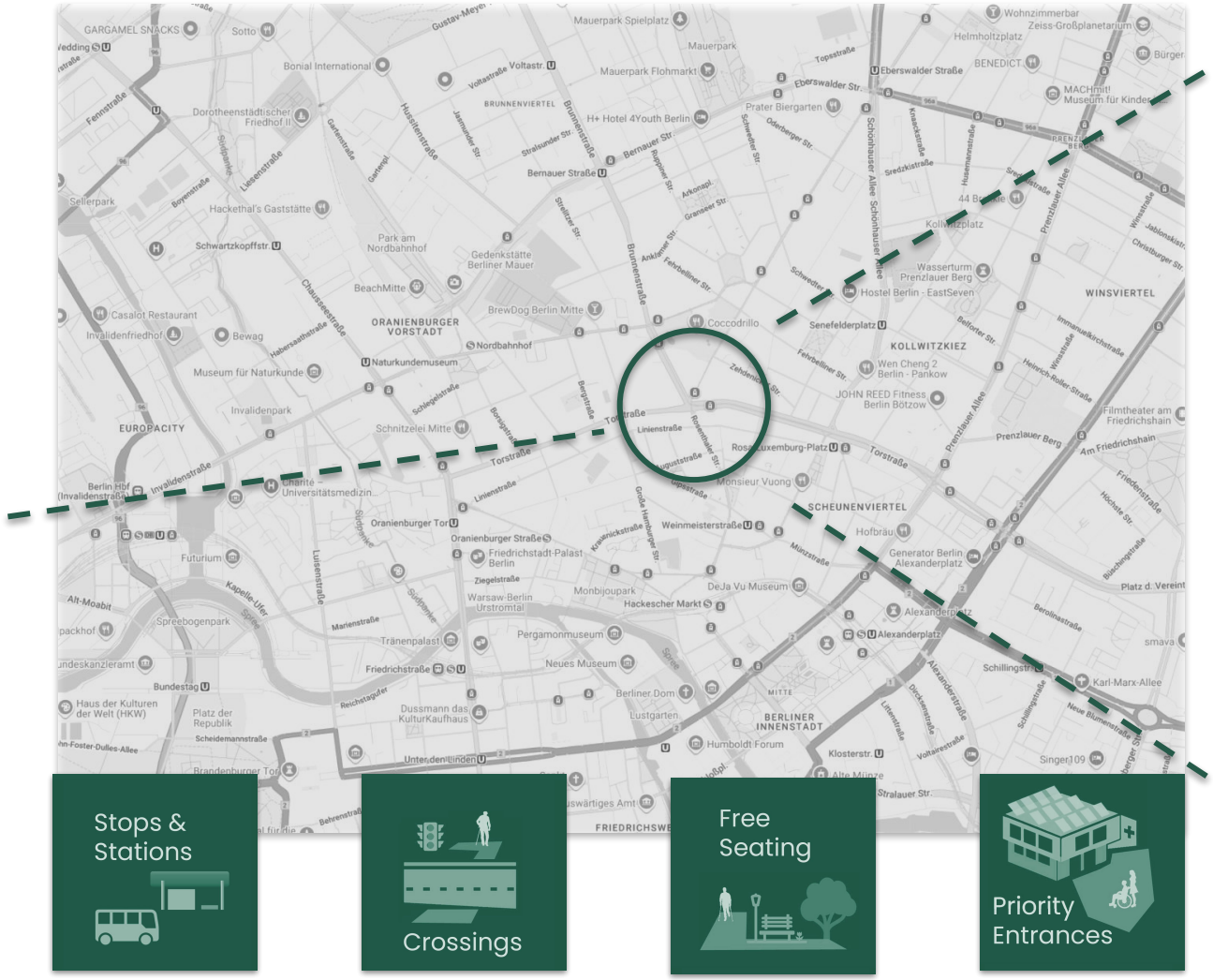
UrbanCare Methodology

UrbanCare

U-Care



Small problems here ...



Effort

Walkability

Exposure

Runoff

Heat

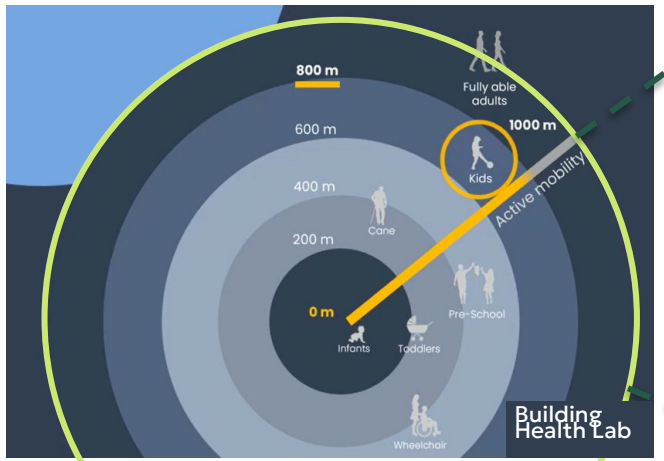
Biotope

U-CARE

UrbanCare Methodology

UrbanCare

U-Care



Effort

Walkability

Runoff

Exposure

Heat

Biotope

Small problems here ...

... and across the city, translates to enormous waste!

U-Care

Walkability

U-CARE

Walkability: **Definition**

Walkability Mechanisms

Walkability

Path Continuity?

Block-to-block Connectivity?

U-CARE

Walkability: Urban Health **Impacts**

U-Care

Walkability

1. Health:

lower physical activity; exclusion and reduced social interaction; higher chronic disease risk; accidents leading to physical trauma

2. Climate:

increased car dependence; higher emissions; reduced active mobility uptake; weakened potential for climate-adaptive streets; more heat from traffic volumes

3. Economy:

increased healthcare expenditure from chronic disease and traffic-related injuries; productivity losses from limited active mobility and travel delays; higher transport costs; reduced footfall for local businesses; higher maintenance and operational costs from car-reliant infrastructure

U-CARE

Walkability: Planning & Design **Approach**

Walkability

1. Convenience:
directness and efficiency of pedestrian environments without detours or interruptions

2. Safeness:
protection of pedestrians from traffic conflicts and environmental hazards

3. Comfort:
physical quality of the walking experience

4. Attractiveness:
elements that make routes inviting and engaging

Convenience

Safeness

Comfort

Attractiveness

U-Care

Surface Runoff

U-CARE

Surface Runoff: **Definition**

Surface Runoff

1. Hortonian runoff (infiltration-excess)
Rainfall exceeds the soil's infiltration rate.

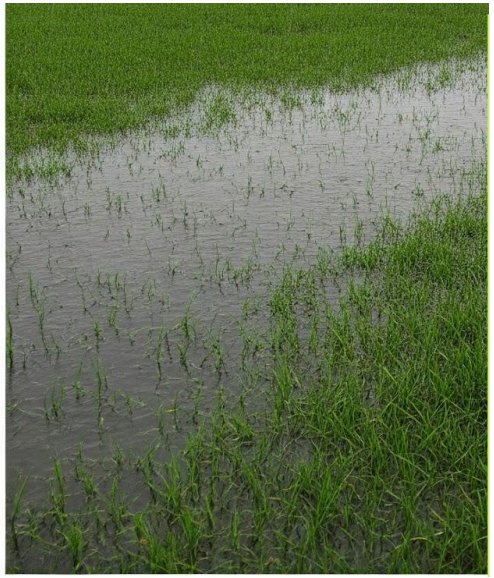
2. Saturation runoff (soil fully saturated)
Rainfall exceeds the soil's storage capacity.

3. Impervious-surface direct runoff
Where infiltration can't occur, such as roofs, asphalt and concrete.

4. Return flow (subsurface → surface)
When infiltrated water travels laterally underground and resurfaces downslope.

Hortonian Runoff

Saturation Runoff



Impervious-surface Runoff

Return Runoff

U-CARE

Surface Runoff: Urban Health **Impacts**

U-Care

Surface Runoff

1. Health:

flood exposure; mobility disruption for vulnerable groups; injury risks at crossings; contamination from combined sewer overflow; mold and dampness in buildings; water-borne and vector-borne diseases from contaminated floodwater

2. Climate:

increased stormwater peaks; reduced infiltration and groundwater recharge; altered local humidity; erosion risk; degraded soil moisture balance

3. Economy:

healthcare and productivity losses from water-related illnesses and injury events; damage to infrastructure; maintenance and drainage costs; avoidable water treatment costs; business interruption; emergency response costs; insurance and repair costs

U-CARE

Surface Runoff: Planning & Design **Approach**

Surface Runoff

1. Infiltration:
water enters soil or permeable surfaces to reduce surface runoff

2. Retention:
water is held temporarily and released slowly to lessen peak flows

3. Detention:
water is stored long-term on-site to delay or prevent downstream flooding

Infiltration Retention Detention

U-Care

U-Care

Urban Heat

U-CARE

Urban Heat: **Definition**

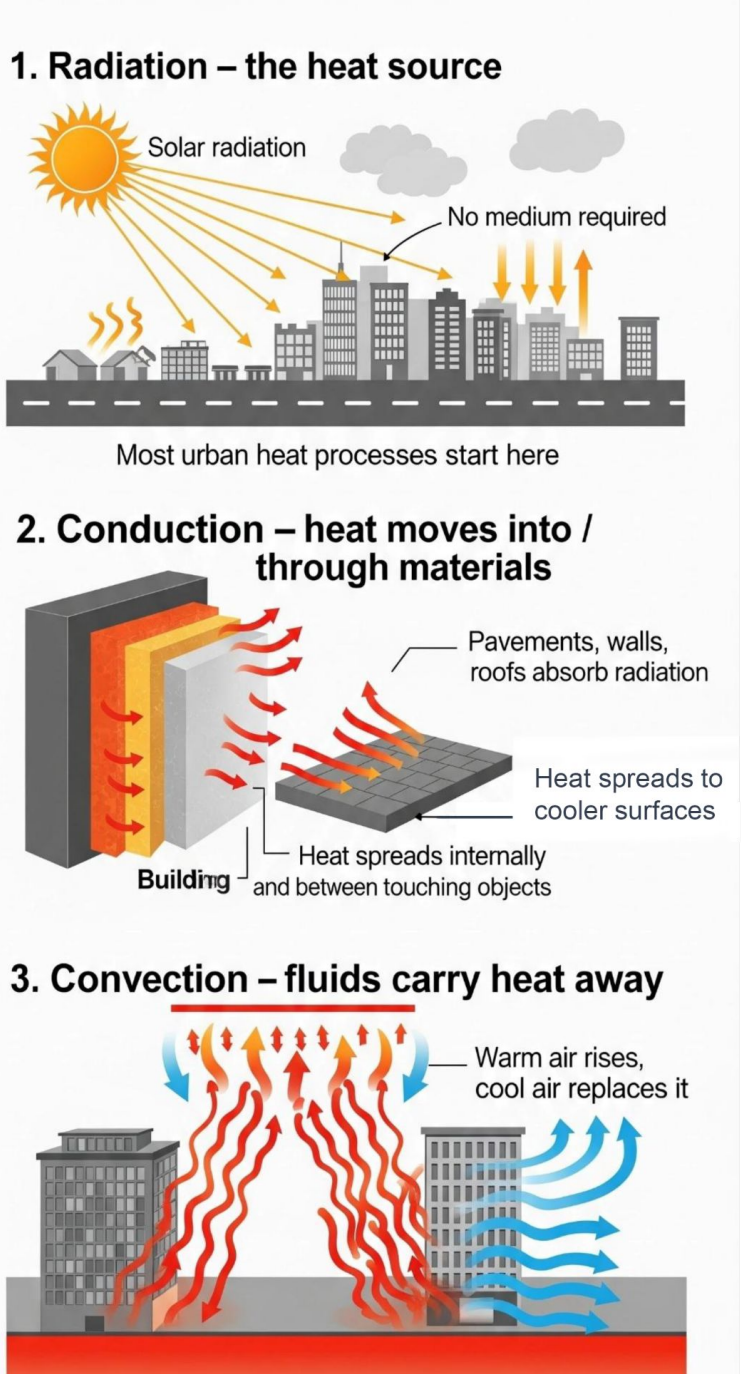
Heat Transfer Mechanisms

Urban Heat

1. Radiation:
solar energy is absorbed by urban surfaces and increases surface temperatures

2. Conduction:
heat moves and is stored within materials and spreads to adjacent surfaces

3. Convection:
heated surfaces warm surrounding fluids and transfer heat into the air



U-Care

U-CARE

Urban Heat: Urban Health **Impacts**

U-Care

Urban Heat

1. Health:

heat stress; cardiovascular strain; dehydration; sleep disturbance; respiratory burden from ozone and particulate concentrations; heightened vulnerability for elderly, children and people with chronic conditions

2. Climate:

higher surface temperatures; intensified urban heat islands; reduced nighttime cooling; altered humidity; stress on vegetation and urban ecosystems

3. Economy:

healthcare and productivity losses from heat-related illnesses and reduced functional capacity; increased cooling energy costs; productivity loss in workplaces and schools; infrastructure degradation from thermal expansion; operational delays in mobility and service disruptions

U-CARE

Urban Heat: Planning & Design **Approach**

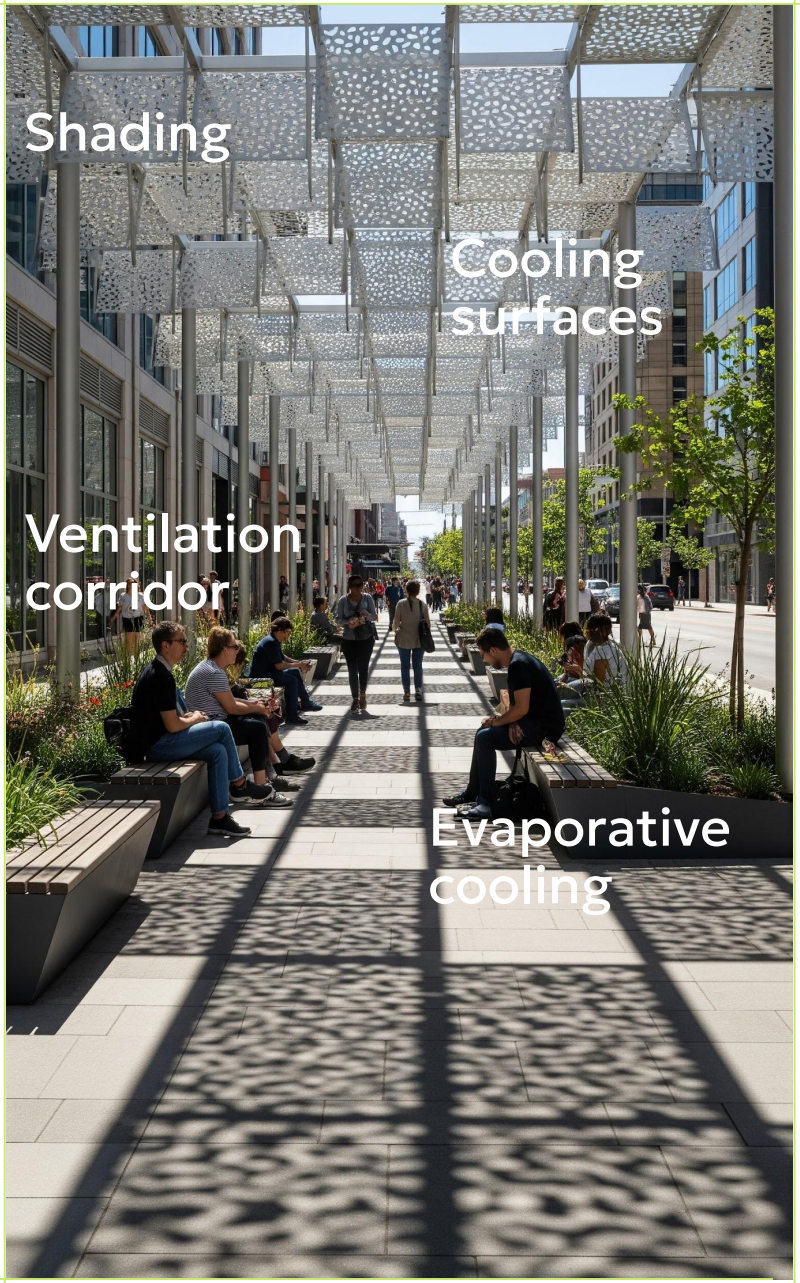
Urban Heat

1. Shading:
engineered shading against direct solar radiation

2. Cooling surfaces:
use of materials and coatings to reflect solar radiation, absorb less heat, and lower surface temperatures while reducing heat buildup

3. Ventilation corridors:
urban layouts that improve air movement to disperse stored

4. Evaporative cooling:
use of vegetation and water systems that cool air



U-CARE

Urban Heat: Planning & Design **Approach**

Urban Heat

1. Shading:
engineered shading against direct solar radiation

2. Cooling surfaces:
use of materials and coatings to reflect solar radiation, absorb less heat, and lower surface temperatures while reducing heat buildup

3. Ventilation corridors:
urban layouts that improve air movement to disperse stored

4. Evaporative cooling:
use of vegetation and water systems that cool air

U-Care

Biotope Loss

U-CARE

Biotope Loss: Definition

Biotope loss Mechanisms

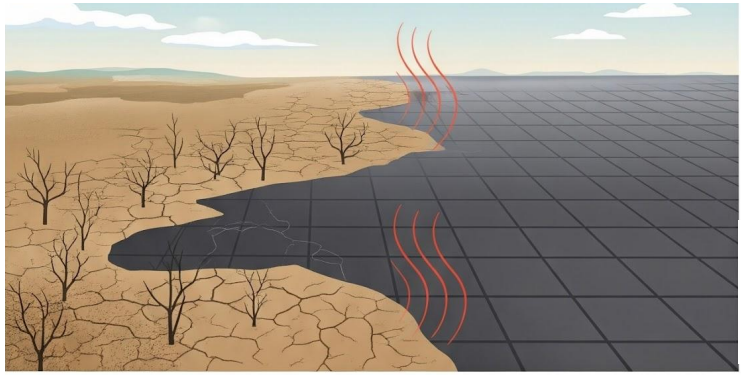
Biotope Loss

1. Habitat reduction:
ecological quality decline from urban environmental degradation

2. Linkage:
limited movement pathways for species by barriers and fragmentation

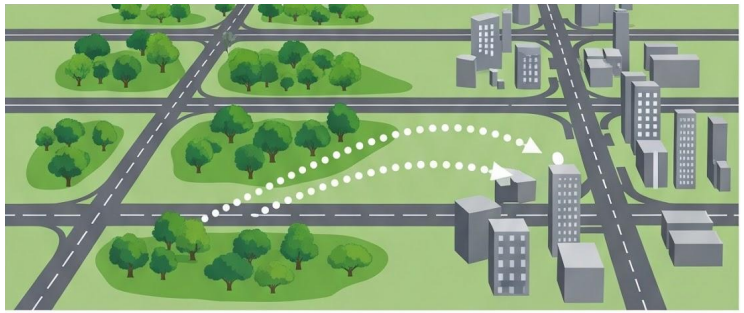
3. Ecological diversity:
reduced richness and variety of species and vegetation.

Environmental degradation



Surface runoff & Urban heat

Linkage



Ecological diversity

U-CARE

Biotope Loss: Urban Health **Impacts**

U-Care

Biotope Loss

1. Health:

reduced restorative environments; decreased mental wellbeing; diminished cooling and shading benefits; reduced exposure to nature and beneficial environmental microbiota; higher risk of allergies, asthma and immune-related diseases

2. Climate:

weakened ecosystem resilience; reduced evapotranspiration; disrupted microclimate regulation; soil and habitat drying; lower carbon sequestration

3. Economy:

increased health and social care costs from allergy, asthma and other immune-related conditions; productivity losses from illness and fatigue; reduced ecosystem service value; higher irrigation and maintenance costs; lower property, tourism and recreation value

U-CARE

Biotope Loss: Planning & Design **Approach**

Biotope Loss

Nature-based Solutions Roadmap

1. Enhance:
directness and efficiency of pedestrian environments without detours or interruptions

2. Unseal:
protection of pedestrians from traffic conflicts and environmental hazards

3. Shade:
physical quality of the walking experience

4. Greenify:
elements that make routes inviting and engaging

U-CARE

Biotope Loss **Assessment**

U-Care

Biotope Loss

BAF+D =

Combined Ecological Score.

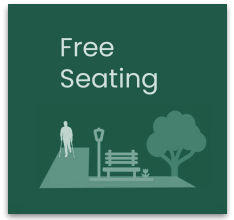
A higher combined score means the site has more ecological area (BAF) and greater ecological quality (D).

Applying BAF+D

BAF+D is a simplified method to assess biotope loss by measuring both the quantity and quality of ecologically active surfaces; suitable for street- and neighborhood-scale assessments.

BAF evaluates a site's green or permeable areas that support ecological function.

The Diversity Score (D) complements this by assessing vegetation richness, structural variety, and habitat quality.



U-CARE

Biotope Loss **Assessment**

U-Care

Biotope Loss

BAF = Biotope Area Fraction

BAF = A_{eco} / A_{total}

A_{eco}: area of vegetated or permeable surfaces

A_{total}: total site or block area

D = Diversity Score (Quality)

Range 0.0–0.3

0.0 = very low diversity

0.1 = moderate diversity

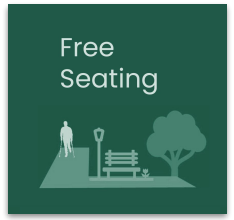
0.2 = good diversity

0.3 = high vegetation or species richness

BAF+D =

Combined Ecological Score.

A higher combined score means the site has more ecological area (BAF) and greater ecological quality (D).



U-CARE

Biotope Loss **Evidence Task**

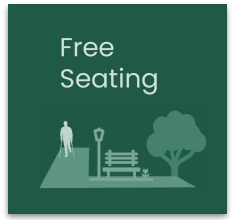
U-Care

Biotope Loss

Task A:

Select an Urban Scene type and map all surfaces and identify which count as ecologically active (vegetation, soil, water, green roofs, etc.).

- Calculate BAF by dividing ecological area by total area.
- Assign a Diversity Score (D) based on species richness or vegetation layers using the 0.0–0.3 scale.
- Compute the combined score BAF+D.
- Write a short interpretation (5–7 lines) explaining:
  - degree of habitat reduction,
  - linkage of green elements across the site,
  - level of ecological diversity,
  - and one intervention that could increase BAF+D.



U-CARE

Biotope Loss **Evidence Task**

U-Care

Biotope Loss

Task B:

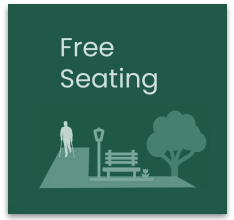
Find quick, reliable evidence showing how loss of biodiversity affects economic outcomes.

Identify 2–3 reliable sources that show how reduced habitat, low ecological connectivity, or declining species diversity relate to:

- increased healthcare costs from allergies and immune-related diseases
- reduced ecosystem services (cooling, shading, stormwater absorption)
- higher maintenance and irrigation costs
- lower property and recreation value
- productivity losses linked to poorer environmental quality

Deliverable:

- Write 3–5 sentences summarizing:
  - the main findings from your sources
  - how they relate to runoff conditions in your chosen Urban Scene
- Search keywords: “biodiversity loss economic impact”; “urban nature health benefits”; “ecosystem services value urban”



U-Care

Alvaro Valera Sosa

info@buildinghealth.eu