"Urban biodiversity, human health and well-being"

Sustainable Built Environment and Urban Transition, Linnaéus University, Växjö, October 13th, 2023

Image credits https://www.nordic-holidays.de/de/2720-1/Scandic-Hotel-Vaexjoe-Vaexjoe.aspx

Francesco Ferrini
University of Florence– National Biodiversity Future Center – EUniwell Consortium

What we really mean by URBAN BIODIVERSITY?

WERNER AND ZAHNER (2009) defined the urban biodiversity as the animals and plants living within the settled areas of a city.

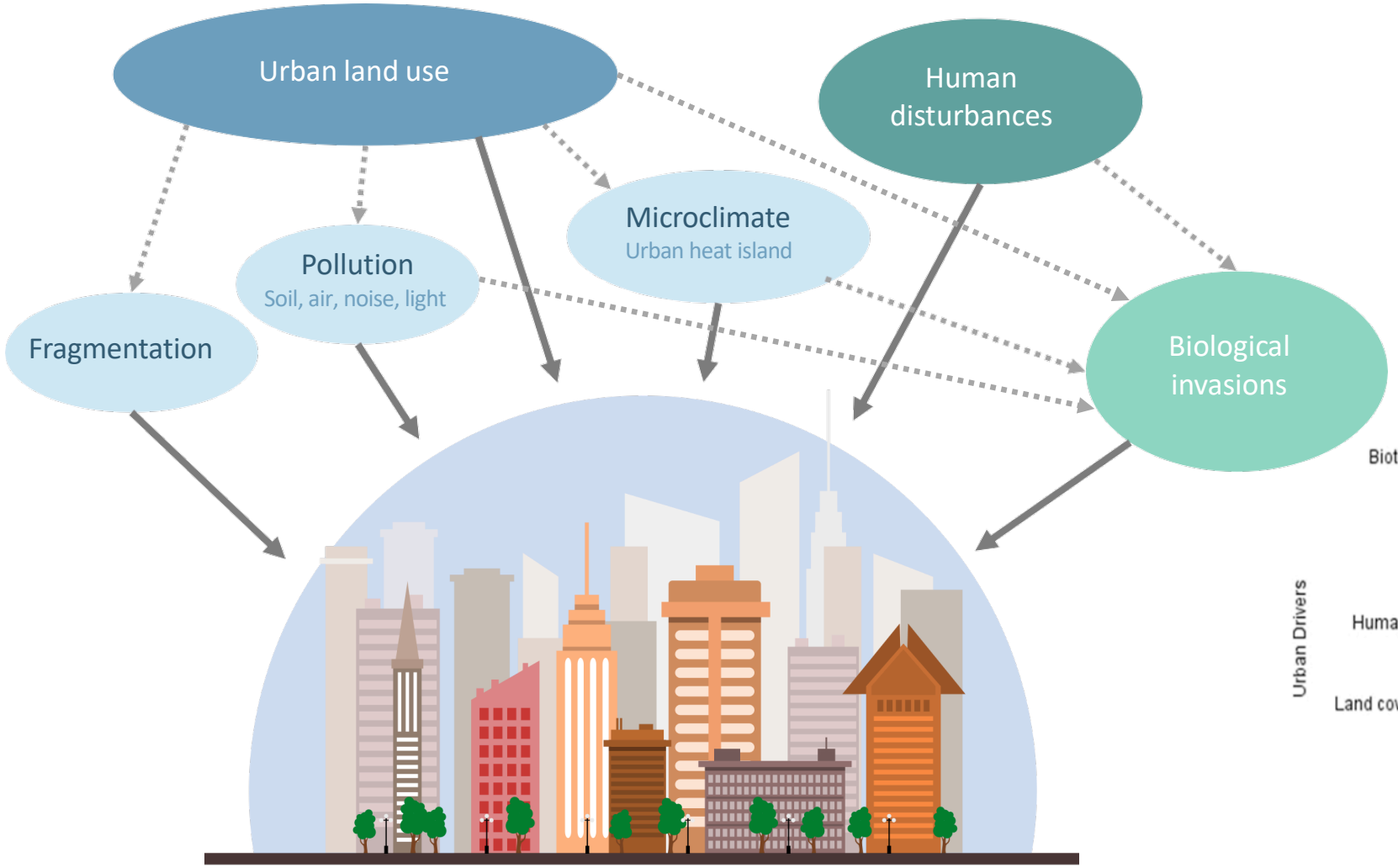
MAMROT (2013): Urban biodiversity refers to the variety of living organisms, including their genetic variations, as well as the multiplicity of habitats in and around dense human settlements.

PUPPIM et al. (2014) Urban biodiversity refers to the variety and variability among living organisms found in a city and the ecological systems in which they occur

Image credits https://www.intechopen.com/chapters/45423

How do cities filter plants?

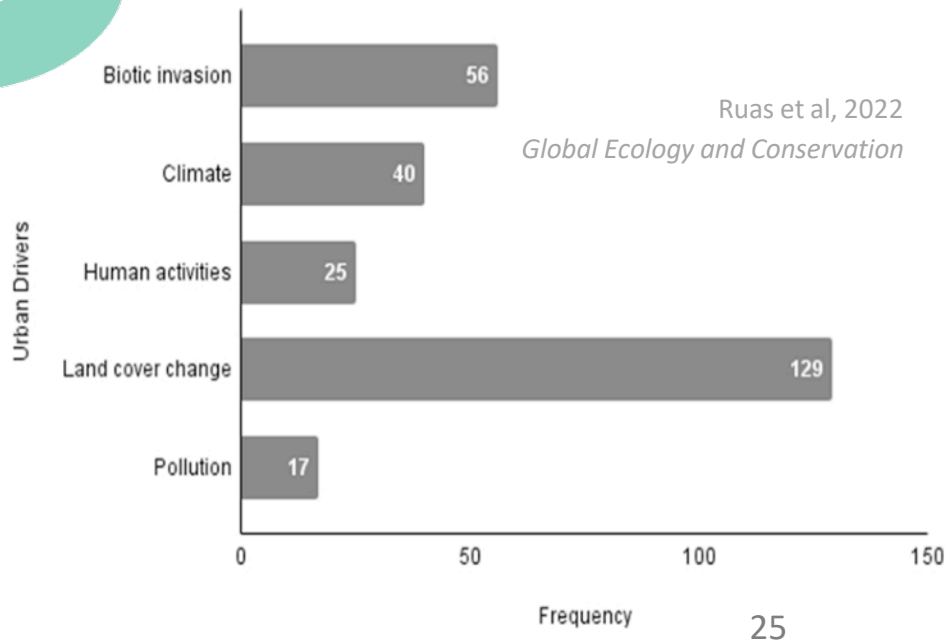
Abiotic novelty



Biotic novelty

= Multiple novel selection pressures

- Filtering of species & genotypes
- Rapid evolution & adaptation
- Influence ecosystem functioning



Ruas et al, 2022
Global Ecology and Conservation

Biodiversity in the city

Parco delle Cascine (Florence)

However, it has been proven that urban areas not only contain a high degree of species biodiversity, but they also are indispensable for the conservation of some key species (around 8%) (*Jim e Liu, 2001; Cornelis e Hermy, 2004*).

Homogenization: it has been observed that the large metropolises of the three northern continents host species that are similar to each other

Foto F. Ferrini. 2019

Urban biotic homogenization hypothesis

Global scale

Urban vegetation tends to be similar between cities

- Cities share similar habitats
- Same urban alien plants everywhere (so-called Urbanophilic species
- Local extinction of rare native species

City scale

Urban vegetation tends to be similar within cities

- Urban land use creates artificially similar habitats
- Invasive alien plants are everywhere (i.e. Ailanthus, Paulownia, Reynoutria, etc.)
- Local extinction of rare native species vs. generalists

Although diversity at local or regional scales may increase with the introduction of exotic species, overall biodiversity at global scales decreases.

From Bernard-Verdier, 2022 modified

Why biodiversity is so important?

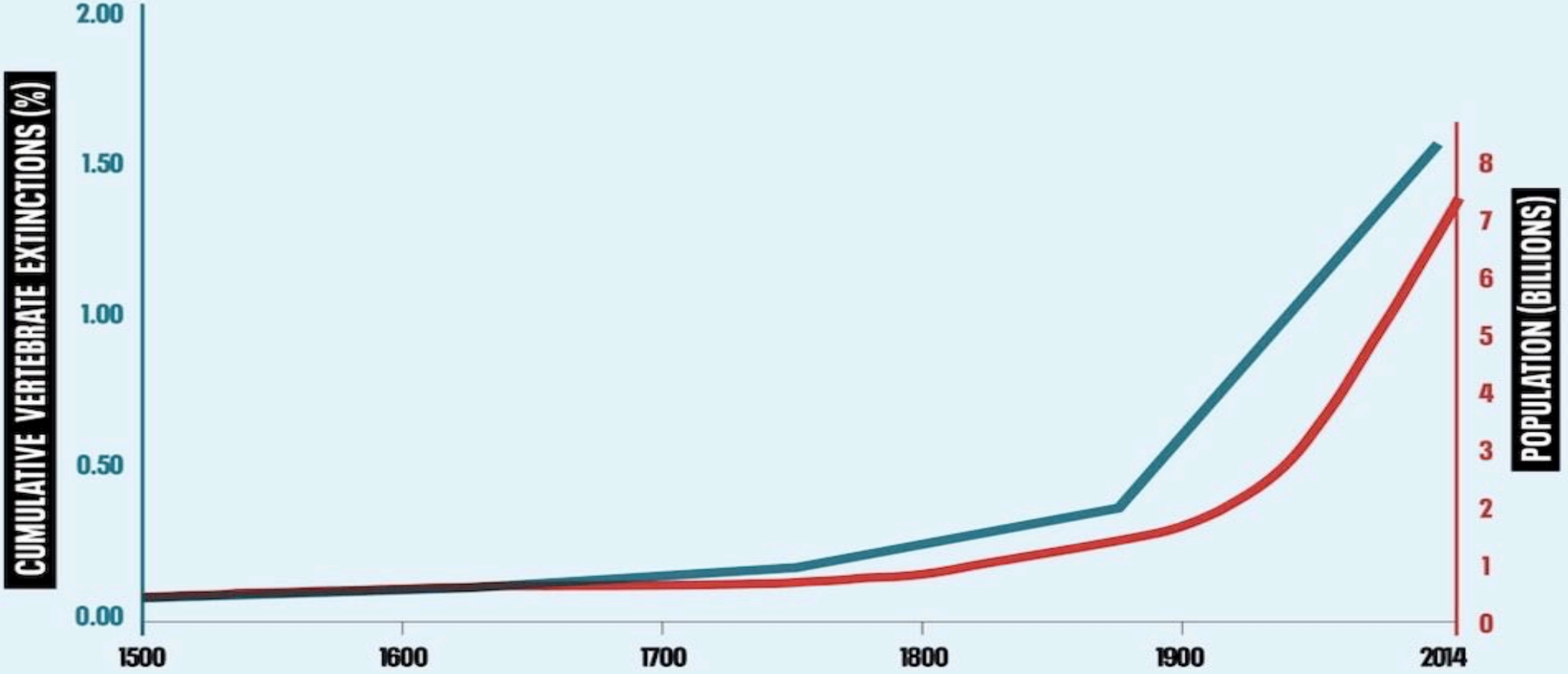
Image credits https://www.sugiproject.com/blog/what-is-biodiversity

"If one link in nature's chain might be lost, another and another might be lost, till this whole system of things should evanish by piece-meal." (Thomas Jefferson, 1799).

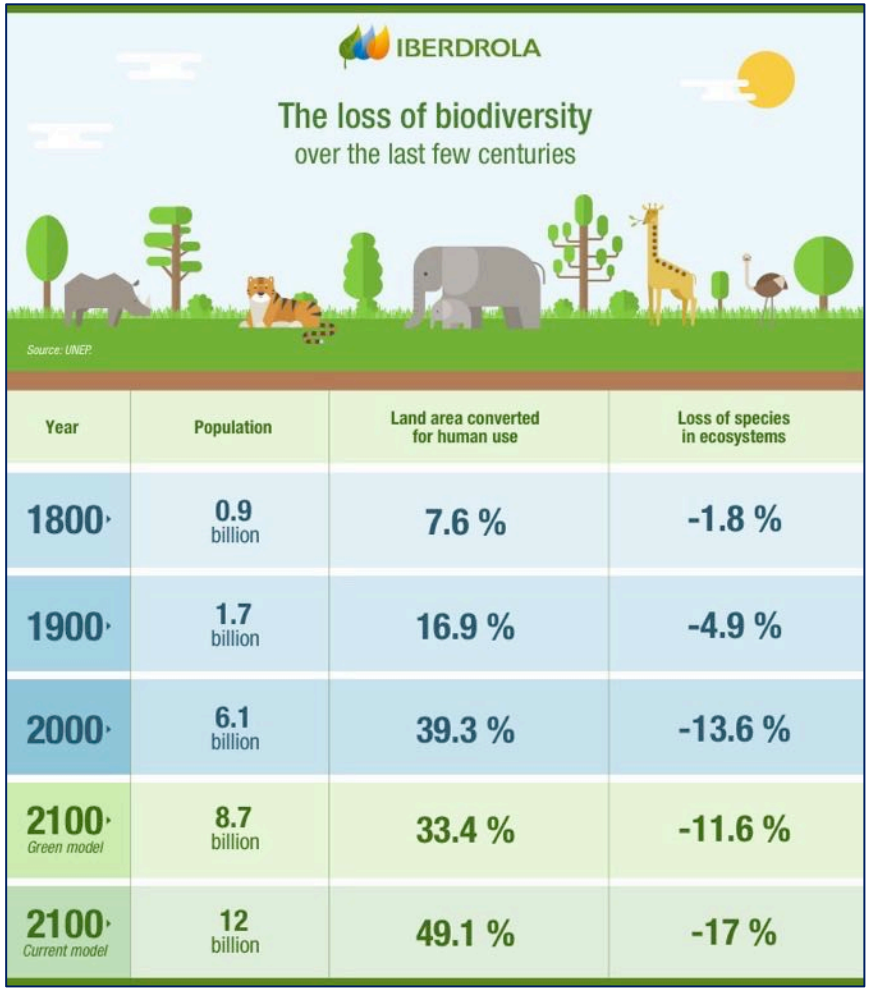
Loss of Biodiversity. Is this the biggest threat?

Image credits: https://www.lifewatchitaly.eu/en/2019/04/22/biodiversity-loss-and-extinction-crisis/

HUMAN POPULATION AND EXTINCTIONS

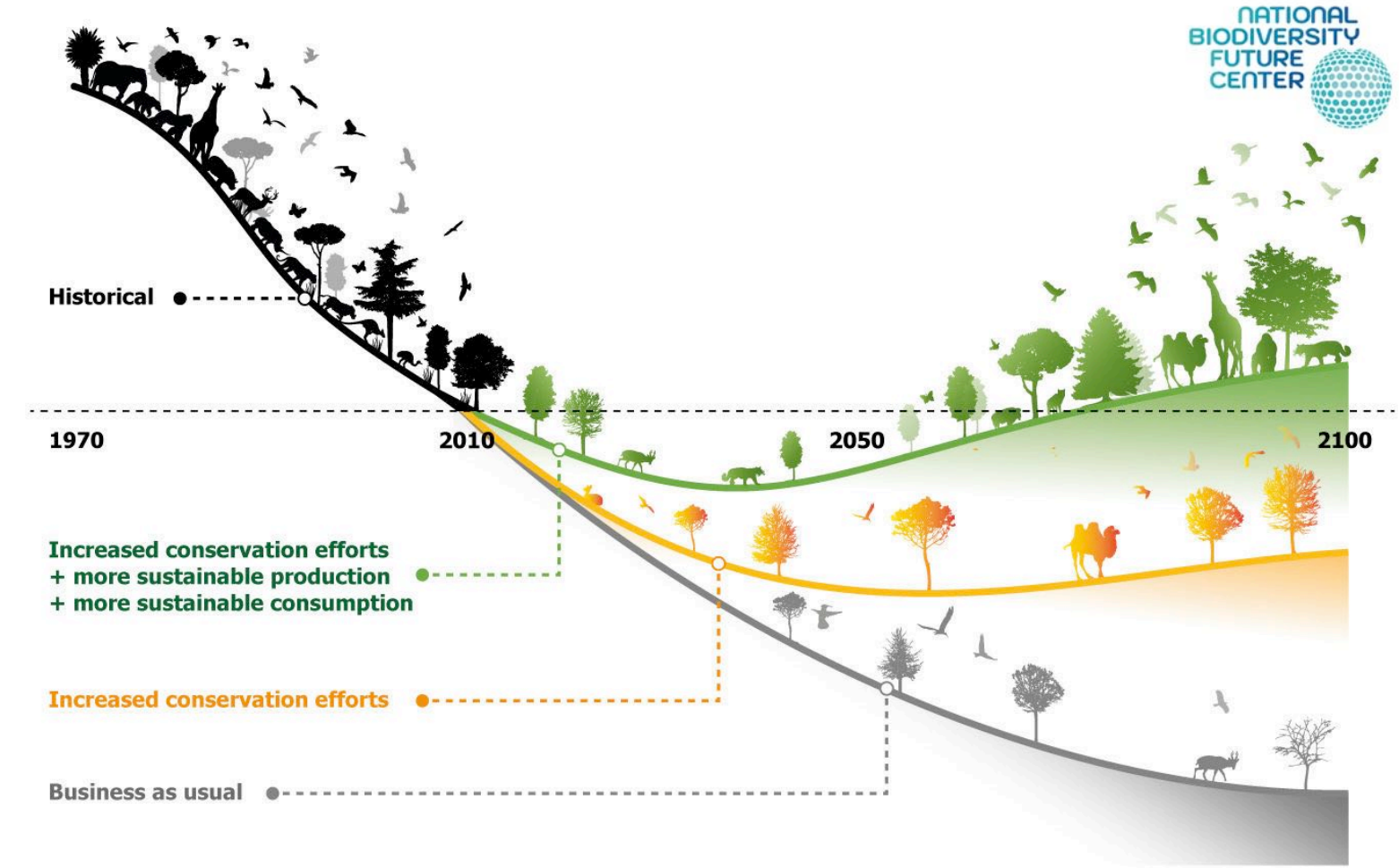


Source: Ceballos et al, 2015/IUCN/Roser, 2017



Year	Population	Land area converted for human use	Loss of species in ecosystems
1800	0.9 billion	7.6 %	-1.8 %
1900	1.7 billion	16.9 %	-4.9 %
2000	6.1 billion	39.3 %	-13.6 %
2100 Green model	8.7 billion	33.4 %	-11.6 %
2100 Current model	12 billion	49.1 %	-17 %

https://www.iberdrola.com/sustainability/biodiversity-loss



This artwork illustrates the main findings of the article, but does not intend to accurately represent its results (https://doi.org/10.1038/s41586-020-2705-y)

https://www.unep-wcmc.org/news/strategy-for-halting-and-reversing-biodiversity-loss-revealed

The costs of inaction on biodiversity loss are high. It is estimated that from 1997 to 2011, land cover changes caused losses of EUR 3,500-18,500 billion per year in ecosystem services globally and that land degradation cost EUR 5,500-10,500 billion per year. year: more precisely, biodiversity loss reduces agricultural yields and fish catches, increases economic losses due to floods and other disasters, and deprives us of potential new sources of medicines

REVIEW

NRC Research Press

The effects of modern war and military activities on biodiversity and the environment

Michael J. Lawrence, Holly L.J. Stemberger, Aaron J. Zolderdo, Daniel P. Struthers, and Steven J. Cooke

Biodiversity is the Silent Victim of War

April 12, 2023

'There are no winners in war but only losers'. We have heard this repeatedly. Conflicts come with agony, losses and immense tragedies. Everyone is aware of the human and economical cost of war but are we neglecting its effects on nature completely? As usual, have we taken mother earth for granted here as well? Surely, conflicts and violence between species is natural but the scale and intensity with which conflicts between humans are fought, are unprecedented. Because of new technologies, conflicts have turned into catastrophic events. Therefore, there is a need to look at its effects on nature too.

UN environment programme

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06 NOV 2018 | STORY | DISASTERS & CONFLICTS

Why we need to protect biodiversity from harmful effects of war and armed conflict

The New York Times

Russia-Ukraine War › | Photos | Maps | Ukraine's Elite Troops | A Strike's Toll on a Village | Who's Gaining Ground?

A 'Silent Victim': How Nature Becomes a Casualty of War

Research on past conflicts suggests that the war in Ukraine could have a profound environmental impact.

Biodiversity loss & climate crises: two sides of the same coin

The loss of biodiversity will affect us all. Reversing this will only be achieved if our behaviours will embrace more sustainable growth models

“Climate change is a primary driver of biodiversity loss. And climate change depends on biodiversity as part of the solution. So clearly the two are linked, and cannot be separated.”

***Elizabeth Mrema**, Executive Secretary, United Nations Convention on Biological Diversity*

Progress in Physical Geography 30, 1 (2006) pp. 73–98

Climate change, biodiversity and the urban environment: a critical review based on London, UK

Robert L. Wilby[1]* and George L.W. Perry[2]

Solecki, W., and Marcotullio, P. J. (2013). Climate change and urban biodiversity vulnerability. In: T. Elmqvist, et al.editors. *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities.* Dordrecht: Springer. doi: 10.1007/978-94-007-7088-1_25

5

Urban Biodiversity and Climate Change

David J. Nowak

USDA Forest Service, Northern Research Station, Syracuse, NY

Nowak, 2010. in Urban Biodiversity and Design Edited by Norbert Müller, Peter Werner and John G. Kelcey. © 2010 Blackwell Publishing Ltd. ISBN: 978-1-444-33266-7

Chapter 25
Climate Change and Urban Biodiversity Vulnerability

William Solecki and Peter J. Marcotullio

Check for updates

Regenerative living cities and the urban climate–biodiversity–wellbeing nexus

The expansion of urban environments contributes to climate change and biodiversity loss. Implementing nature-based strategies to create 'regenerative living cities' will be critical for climate change mitigation and adaptation and will produce measurable biodiversity and wellbeing co-benefits.

M. Pedersen Zari, M. MacKinnon, K. Varshney and N. Bakshi

NATURE CLIMATE CHANGE | VOL 12 | JULY 2022 | 596–606 | www.nature.com/natureclimatechange

On December 2022, 196 countries signed an agreement promising to "live in harmony with nature" by 2050 and to "halt and reverse biodiversity loss" by 2030.

THE CONVERSATION

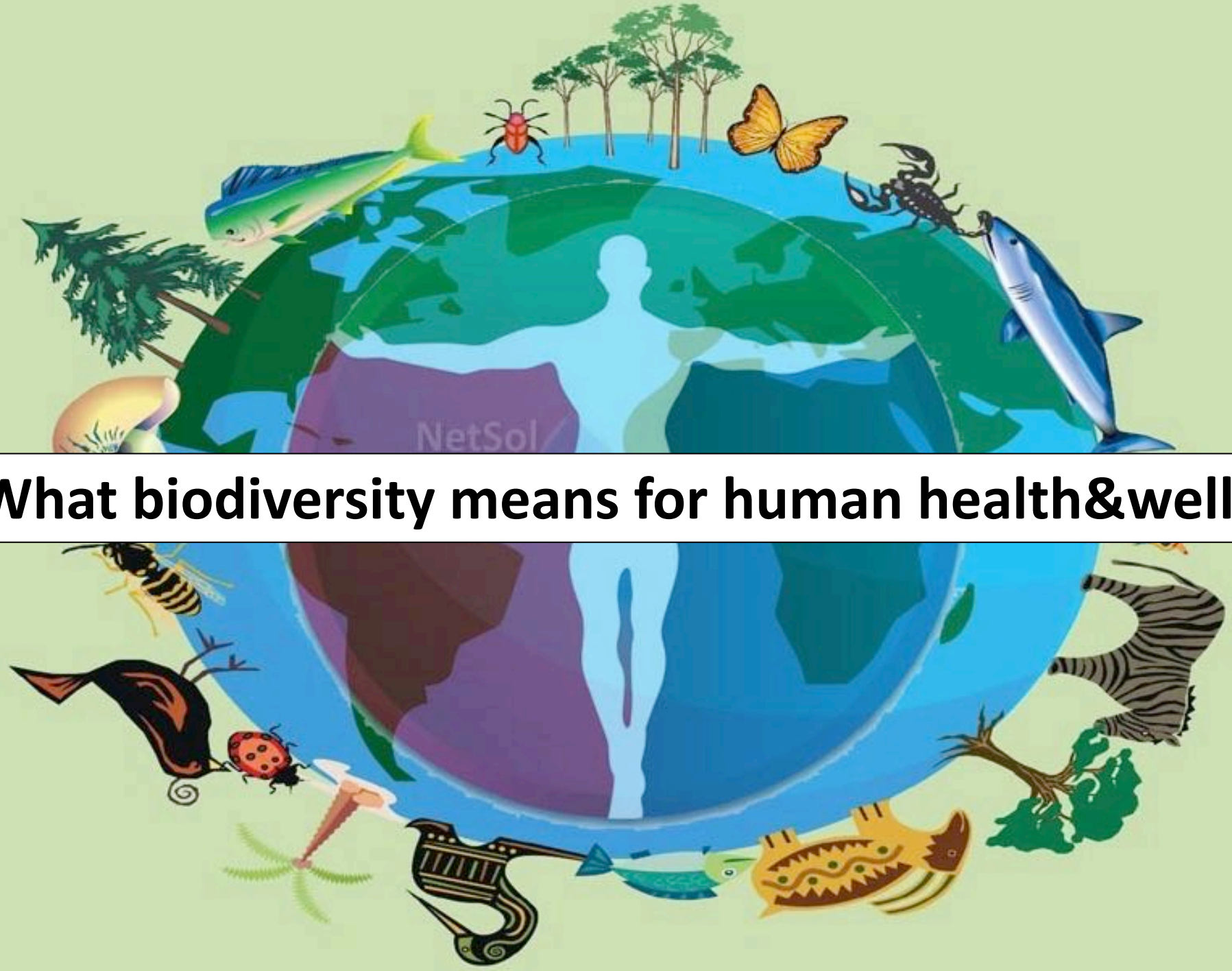
Academic rigour, journalistic flair

Search analysis, research, academics...

We must go beyond simple commitments and translate them into effective measures that actively restore and conserve biodiversity.

2030 nature targets agreed in December may already be slipping out of reach

Published: April 19, 2023 5.58pm CEST



What biodiversity means for human health&wellbeing?

Biodiversity and human health

Research show that biodiversity-rich nature has particular positive benefits for mental wellbeing. Multisensory elements such as the sounds of birds or frogs or the smells of wildflowers have well-documented beneficial effects on mental restoration, calm and creativity

"Human well-being is so strongly dependent on the interaction network of living species, so much so that we take it for granted."

Current Environmental Health Reports (2021) 8:146–156
https://doi.org/10.1007/s40572-021-00313-9

BUILT ENVIRONMENT AND HEALTH (MJ NIEUWENHUIJSEN AND AJ DE NAZELLE, SECTION EDITORS)

Biodiversity and Health in the Urban Environment

Melissa R. Marselle[1] · Sarah J. Lindley[2] · Penny A. Cook[3] · Aletta Bonn[4,5,6]

Accepted: 6 April 2021 / Published online: 12 May 2021

Abstract

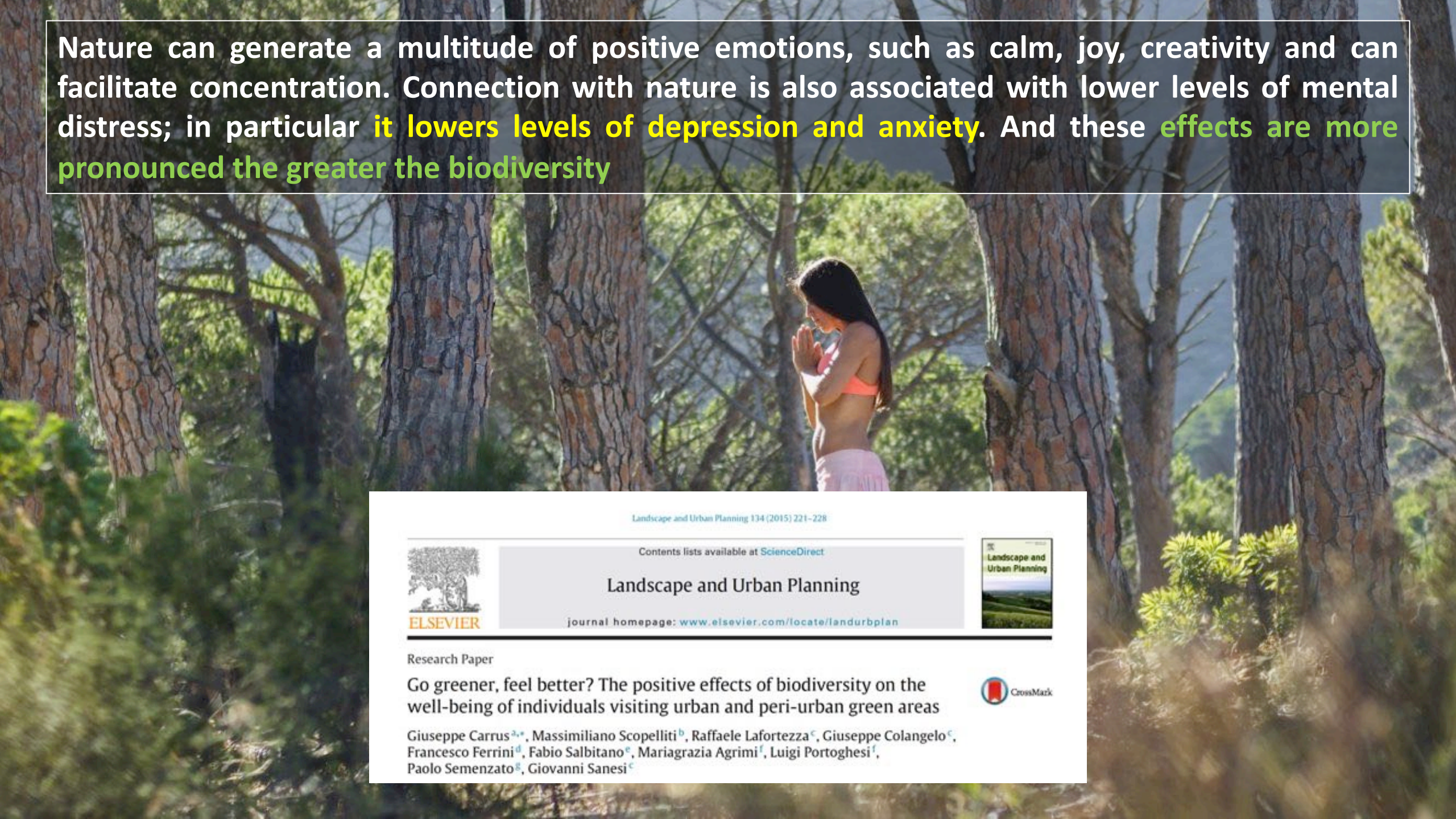
Purpose of review Biodiversity underpins urban ecosystem functions that are essential for human health and well-being. Understanding how biodiversity relates to human health is a developing frontier for science, policy and practice. This article describes the beneficial, as well as harmful, aspects of biodiversity to human health in urban environments.

Recent findings Recent research shows that contact with biodiversity of natural environments within towns and cities can be both positive and negative to human physical, mental and social health and well-being. For example, while viruses or pollen can be seriously harmful to human health, biodiverse ecosystems can promote positive health and well-being. On balance, these influences are positive. As biodiversity is declining at an unprecedented rate, research suggests that its loss could threaten the quality of life of all humans.

Summary A key research gap is to understand—and evidence—the specific causal pathways through which biodiversity affects human health. A mechanistic understanding of pathways linking biodiversity to human health can facilitate the application of nature-based solutions in public health and influence policy. Research integration as well as cross-sector urban policy and planning development should harness opportunities to better identify linkages between biodiversity, climate and human health. Given its importance for human health, urban biodiversity conservation should be considered as public health investment.

Image credits https://www.treehugger.com/milan-urban-forestry-greening-project-5201037

Nature can generate a multitude of positive emotions, such as calm, joy, creativity and can facilitate concentration. Connection with nature is also associated with lower levels of mental distress; in particular it lowers levels of depression and anxiety. And these effects are more pronounced the greater the biodiversity



Landscape and Urban Planning 134 (2015) 221–228

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

Research Paper

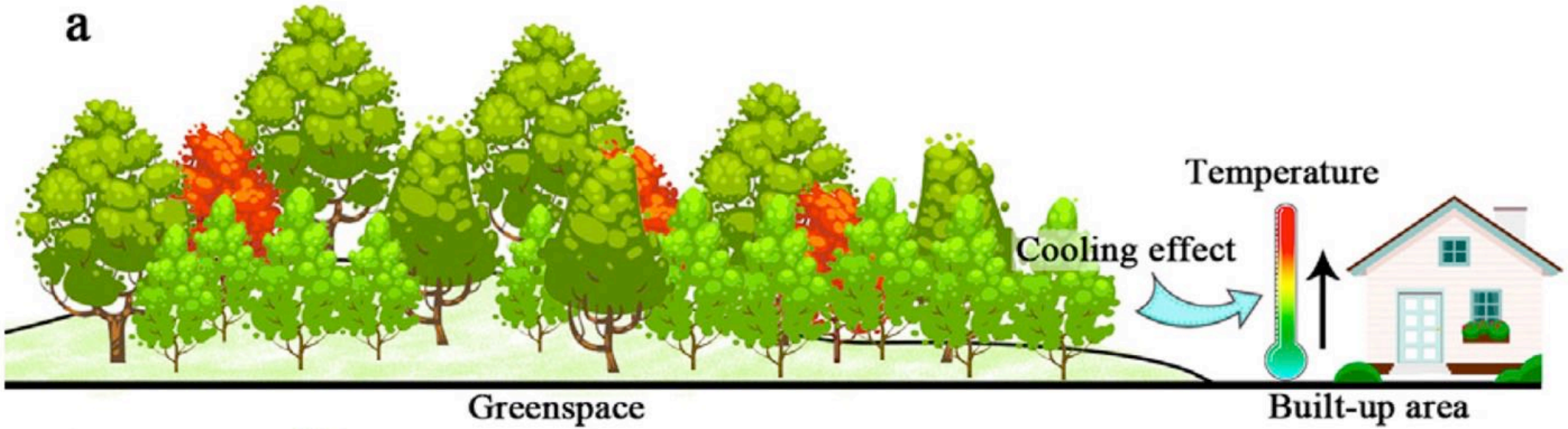
Go greener, feel better? The positive effects of biodiversity on the well-being of individuals visiting urban and peri-urban green areas

Giuseppe Carrus[a,*], Massimiliano Scopelliti[b], Raffaele Lafortezza[c], Giuseppe Colangelo[c], Francesco Ferrini[d], Fabio Salbitano[e], Mariagrazia Agrimi[f], Luigi Portoghesi[f], Paolo Semenzato[g], Giovanni Sanesi[c]

Planning of Urban Green Spaces: An Ecological Perspective on Human Benefits

(From Semeraro et al., 2021)

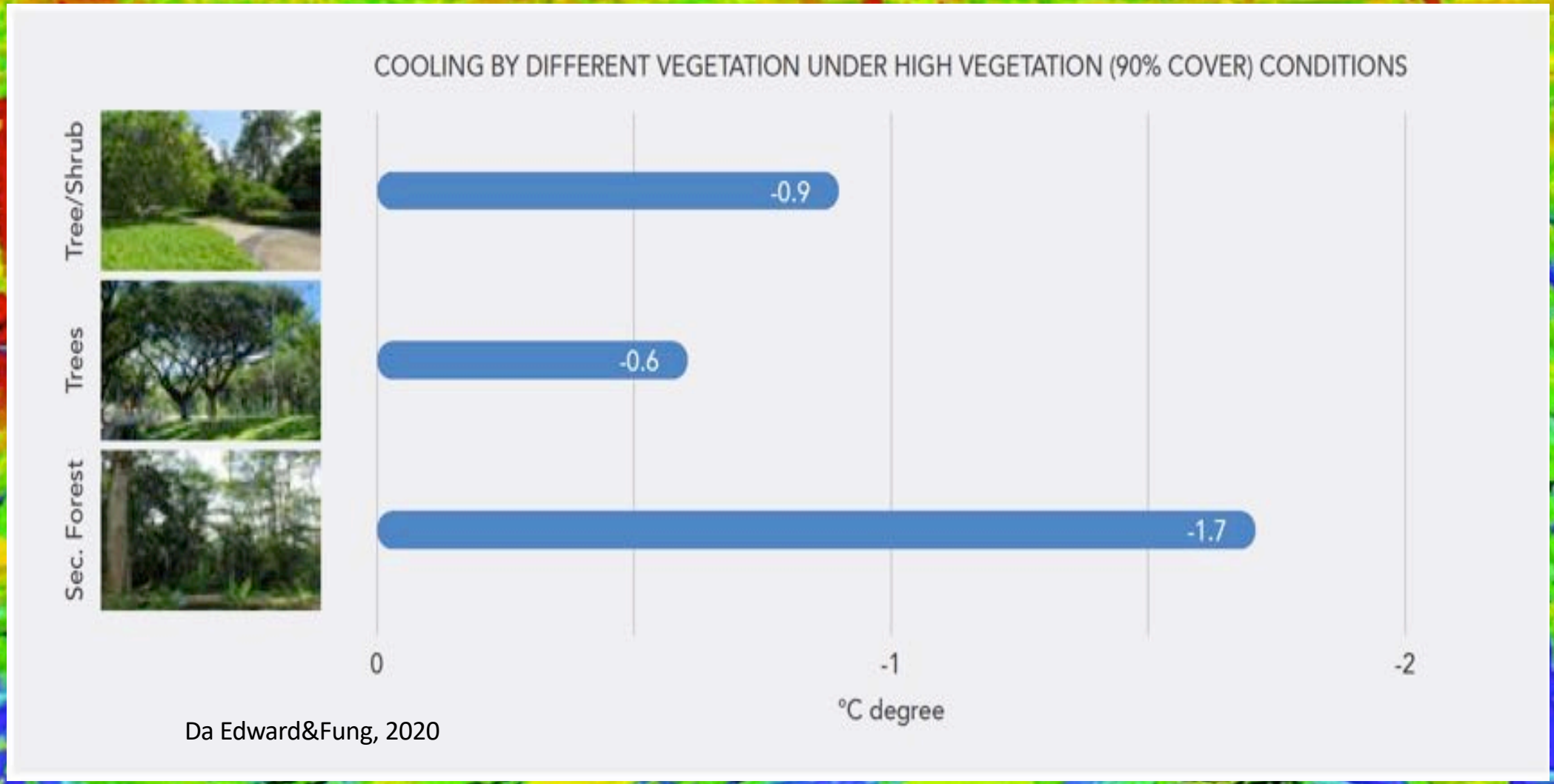
Image credits: https://www.urbandesignmentalhealth.com/blog/the-case-for-trees-in-urban-design-5-tools-to-support-better-planning



Greenspace (b) has a higher tree diversity. It provides a greater cooling effect than greenspace (a).

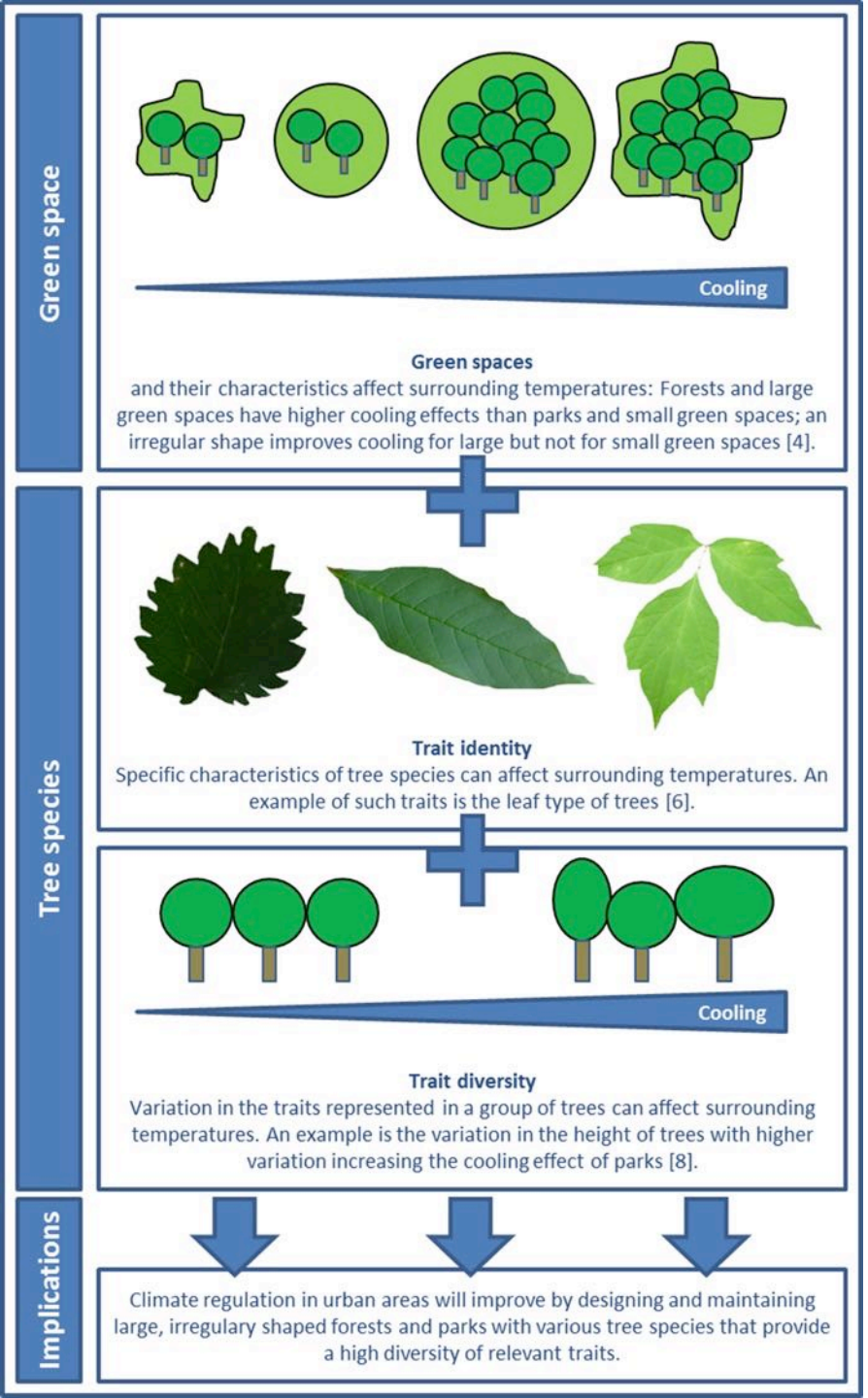
Not only the tree cover, but also biodiversity was positively correlated with the extent of cooling (da Wong et al, 2021)

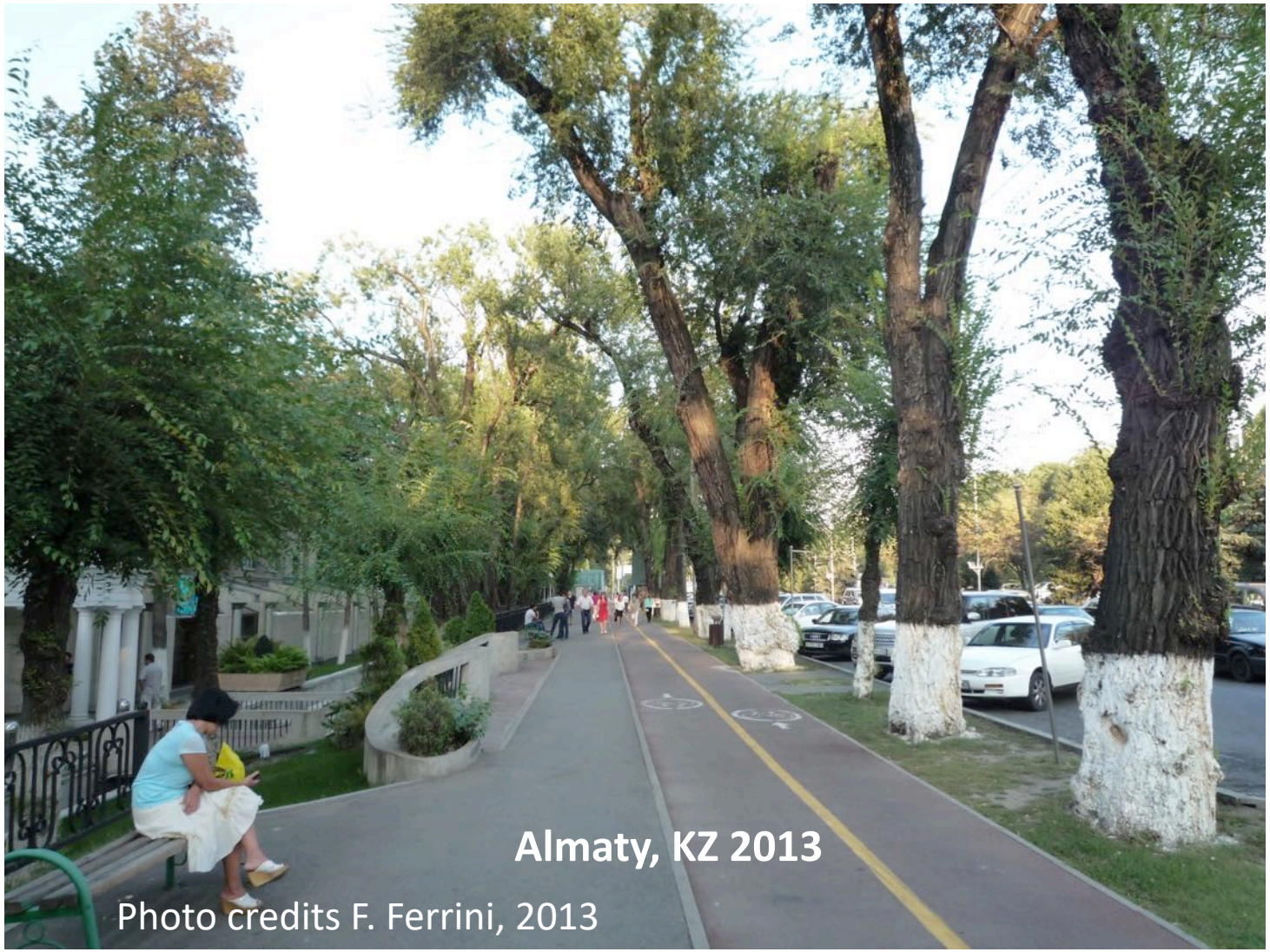
Image credits Coutts&Tapper, 2017



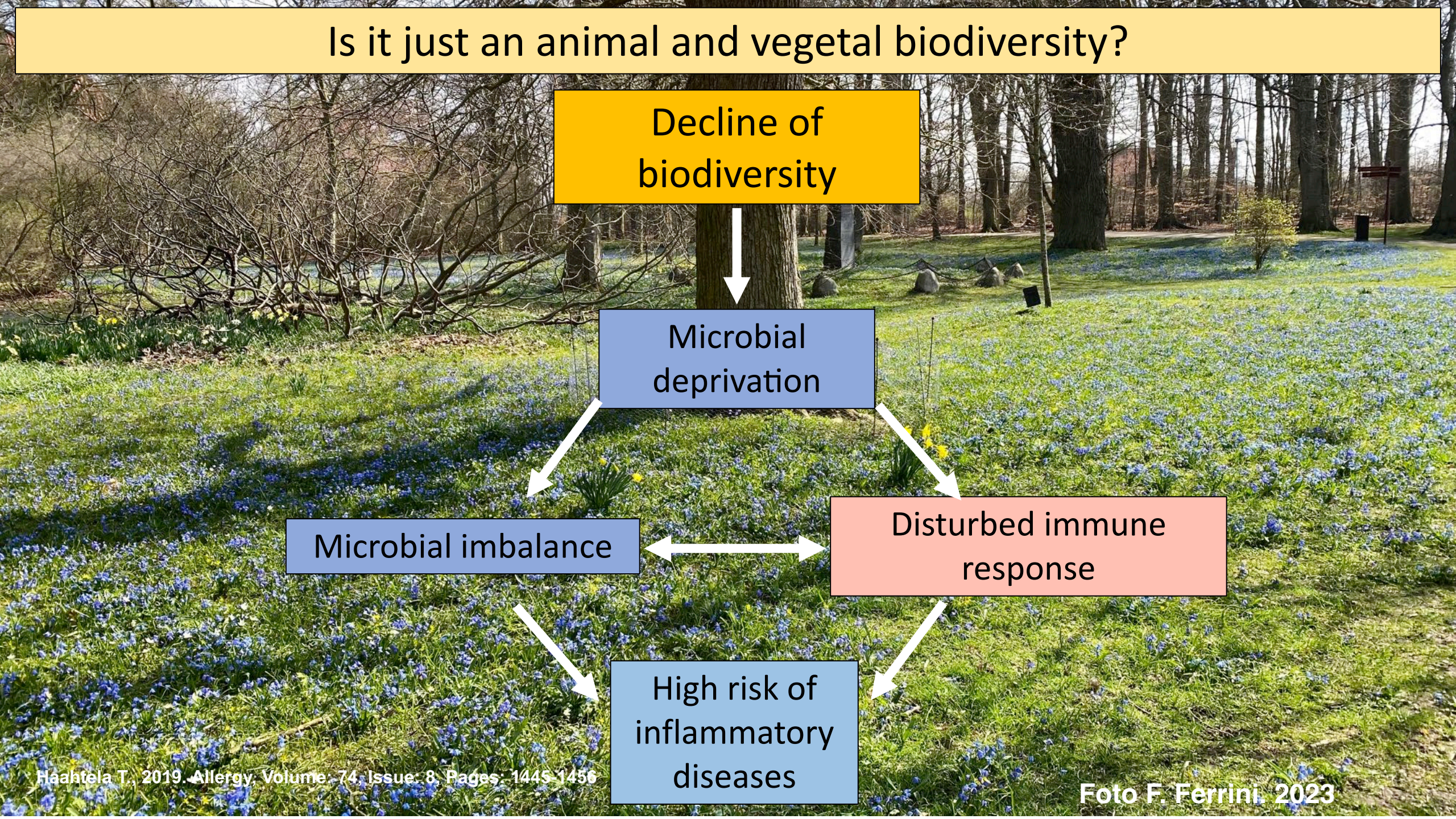
Da Edward&Fung, 2020

Summary of findings on the effects of green space configuration and tree diversity on climate regulation that should be considered when creating new urban green spaces (da Knapp et al., 2019)





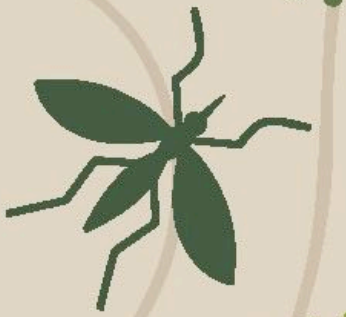
Is it just an animal and vegetal biodiversity?



Haahtela T., 2019. Allergy, Volume: 74, Issue: 8, Pages: 1445-1456

Foto F. Ferrini. 2023

Soil biodiversity



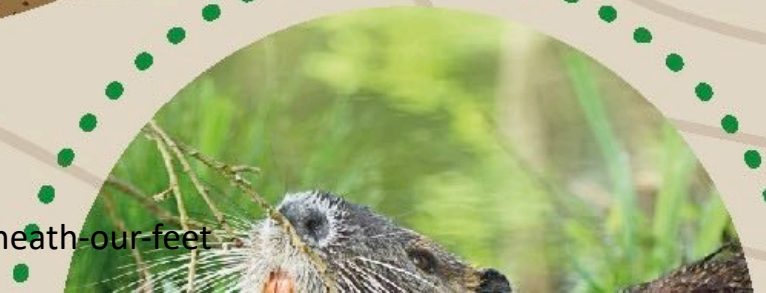
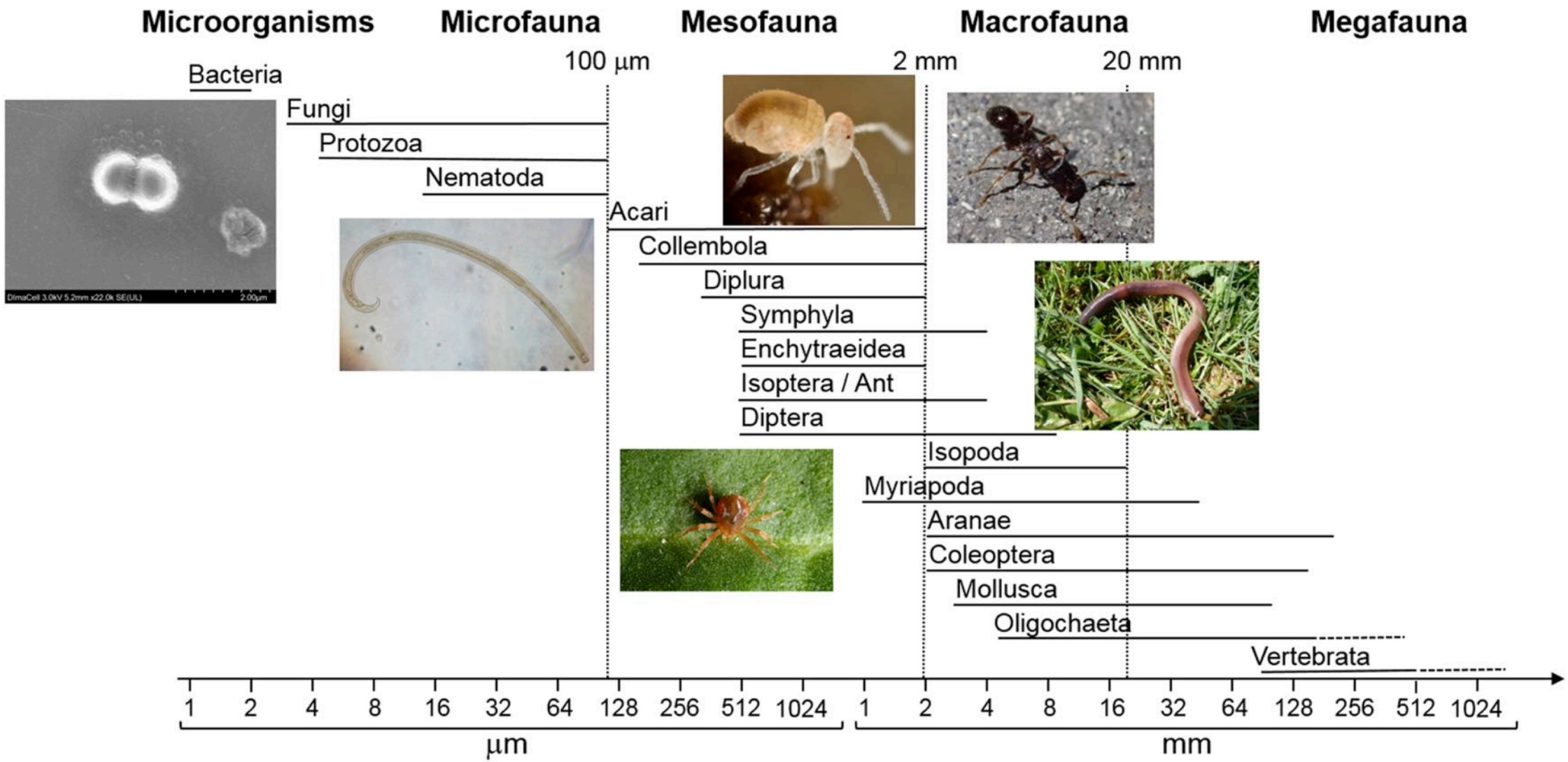


Image credits https://academy.europa.eu/courses/soil-a-burst-of-life-the-hidden-world-beneath-our-feet



Classification of soil organisms based on their size (modified from Swift et al. 1979). Photo credit: Bacteria: L. Ranjard, Nematoda: C. Menta, Mites: K. Fjellheim, Collembola: A. Murray, Ant: A. Vergnes, Earthworm: A. Dewisme. This figure illustrates the wide range of forms covered by the diversity of living organisms in the soil. From Guilland et al., Environmental Chemistry Letters (2018) 16:1267–1282 https://doi.org/10.1007/s10311-018-0751-6

European Journal of Soil Science

European Journal of Soil Science, January 2018, **69**, 196–215 doi: 10.1111/ejss.12518

Special issue article

Urban soil and human health: a review

G. Li[a,b], G.-X. Sun[c], Y. Ren[a], X.-S. Luo[d] & Y.-G. Zhu[a,b,c]

[a]*CAS Key Laboratory of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, 1799 Jimei Road, Xiamen 361021, China,* [b]*Ningbo Urban Environmental Observatory and Research Station, Institute of Urban Environment, Chinese Academy of Science, 88 Zhongke Road, Ningbo 361021, China,* [c]*State Key Laboratory of Urban and Regional Ecology, Research Center for Eco–Environmental Sciences, Chinese Academy of Sciences, 18 Shuangqing Road, Beijing 100085, China, and* [d]*International Center for Ecology, Meteorology, and Environment, Nanjing University of Information Science & Technology, 219 Ningliu Road, Nanjing 210044, China*

Highlights

- Research evidence indicates the importance of urban soils for maintaining human health.
- Urban vegetation and antibiotic resistance genes in urban soil have implications for human health.
- The bioavailability of pollutants and antibiotic resistance genes should be taken into account for human risk assessment.

Trees as ecological niches

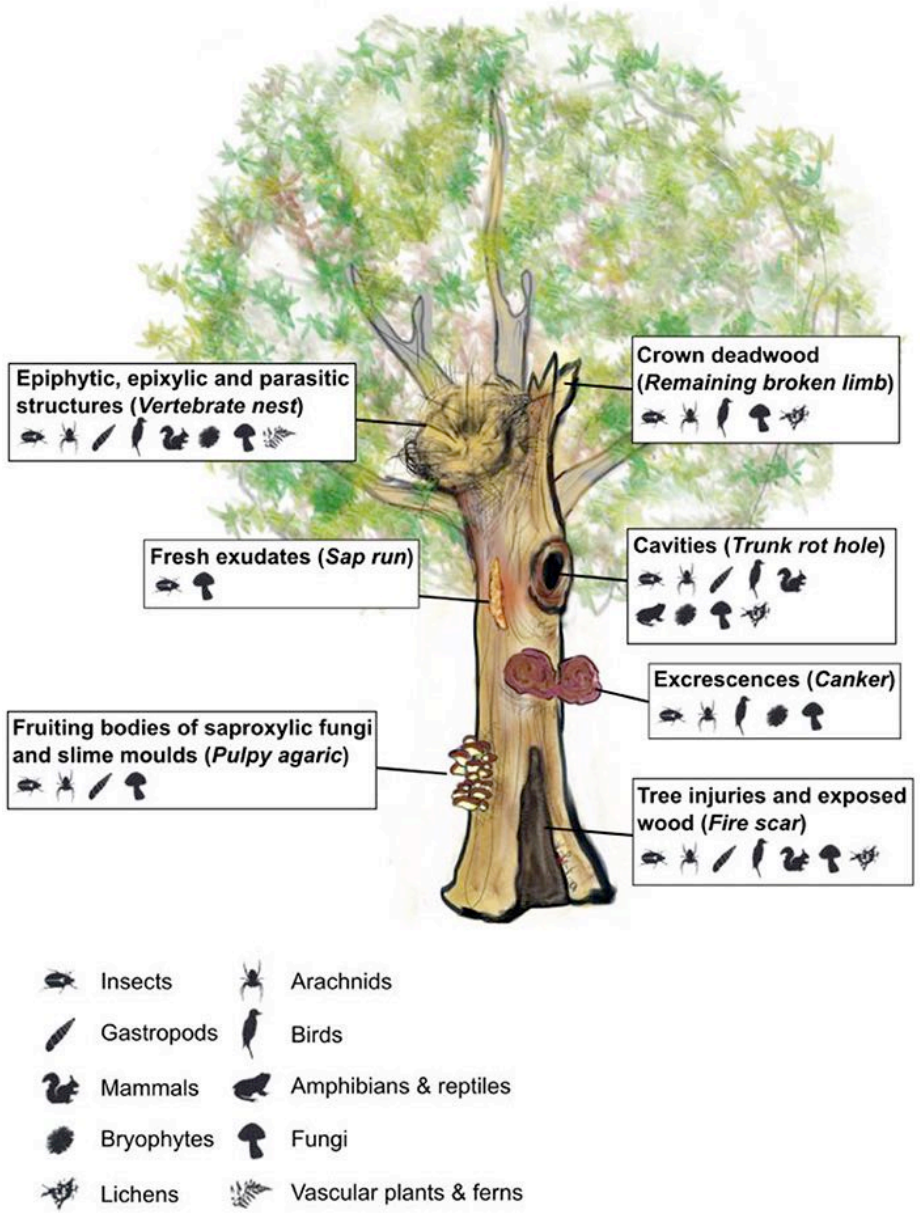
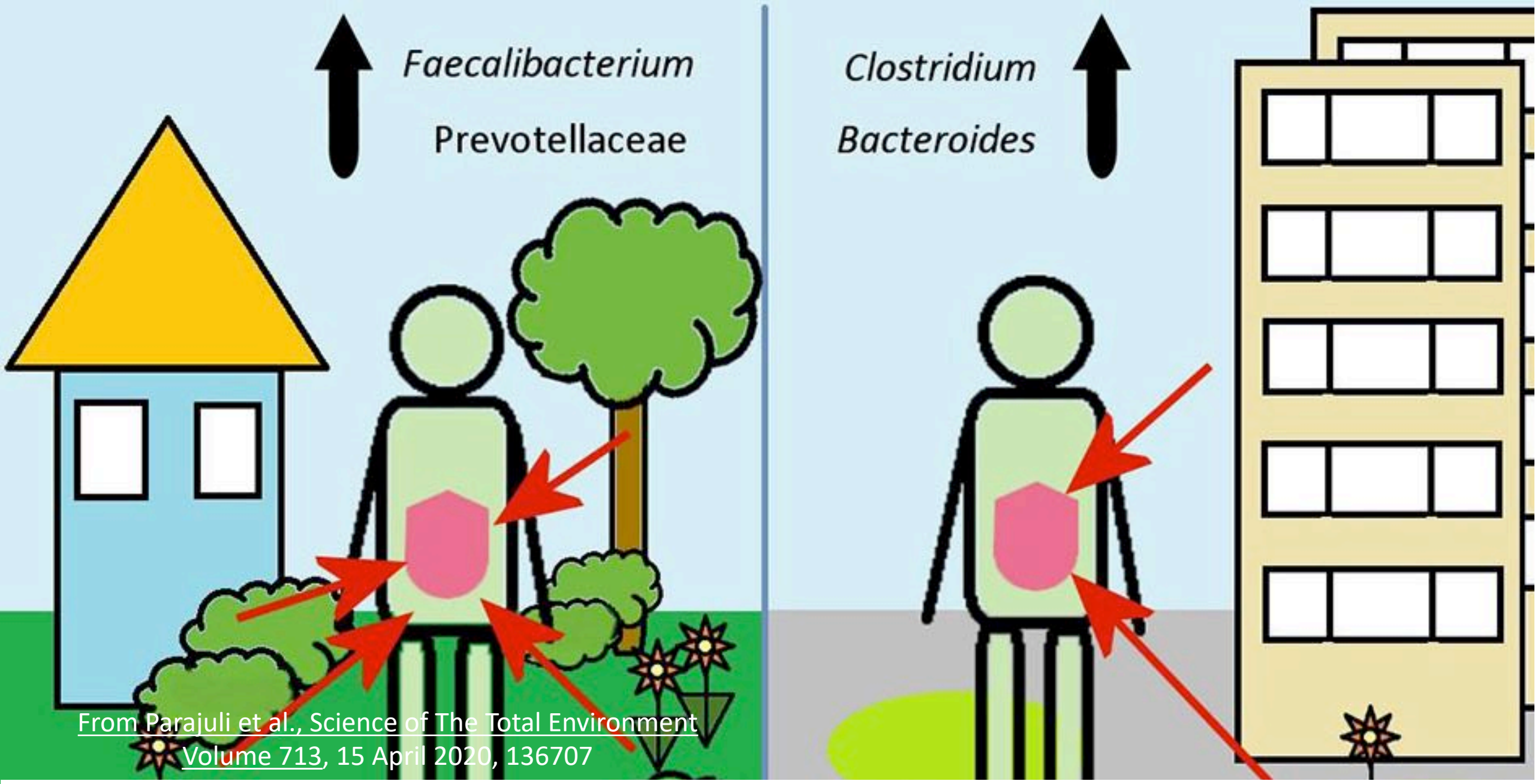


Illustration of the seven tree-related microhabitat forms defined by Larrieu et al. (2018b) and linkage between tree-related microhabitat forms and taxa in temperate and Mediterranean European forests. Italicized text in parentheses indicates the specific types of microhabitats related to the trees represented here. The images of the taxa indicate that several species of the taxonomic group are present; these species are not necessarily closely associated with the arboreal microhabitat group. Adapted from Larrieu et al. (2018b) and Butler et al. (2020).



From Parajuli et al., Science of The Total Environment Volume 713, 15 April 2020, 136707

The alterations of the microbiota recorded in the natural context have demonstrated a positive correlation with the increase in the immune response, suggesting alternative prophylactic approaches for the prevention and/or treatment of these pathologies.

WORLD RESOURCES INSTITUTE

NATIONAL BIODIVERSITY FUTURE CENTER

Protecting biodiverse forests can reduce risks of zoonotic and vector-borne diseases.

Deforestation, forest degradation and associated wildlife trade has been linked with the spread of diseases that jump from animals to humans, including Ebola virus, yellow fever, malaria, Zika virus and corona viruses such as COVID-19. Conserving tropical forests and sustaining their high levels of biodiversity can decrease transmission of some infectious diseases to humans.

EXPLAINER

Conserving Biodiversity to Mitigate Pandemic Risks

Thousands of undiscovered viral species of mammals and birds have the capacity to transmit diseases to humans. Photo credit: F. Ricciardi.

https://development.asia/explainer/conserving-biodiversity-mitigate-pandemic-risks

The link between biodiversity loss and the increasing spread of zoonotic diseases

Policy Department for Economic, Scientific and Quality of Life Policies
Directorate-General for Internal Policies
Authors: Frank VAN LANGEVELDE, Hugo René RIVERA MENDOZA, Kevin D. MATSON, Helen J. ESSER, Willem F. DE BOER et Stefan SCHINDLER
PE 658.217 - December 2020
EN

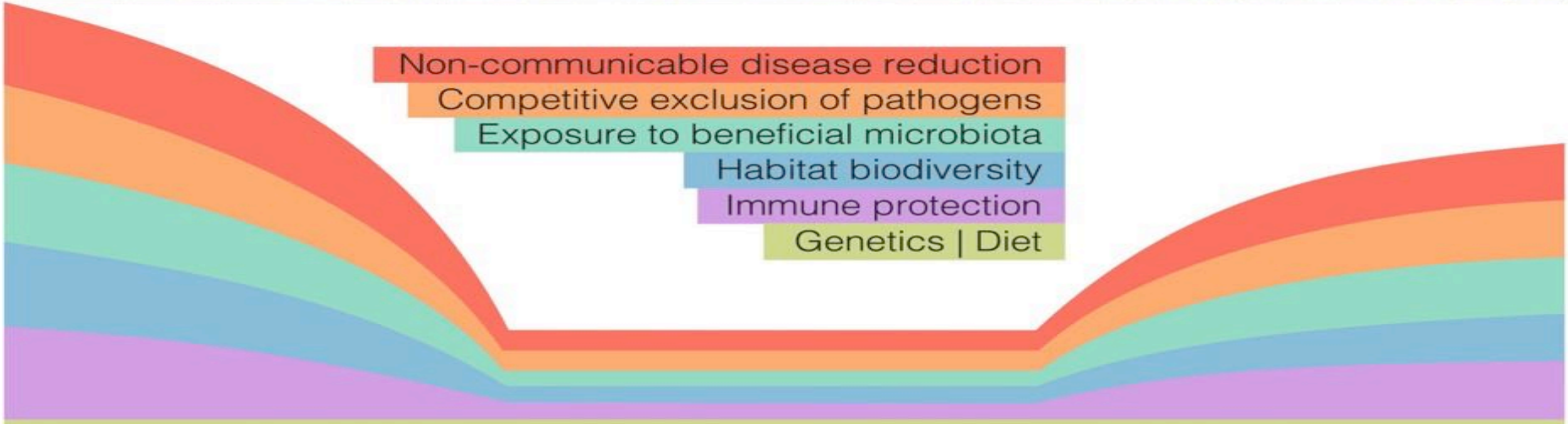
- Strengthen infrastructure planning and design especially in areas rich in biodiversity.
- Governments and infrastructure planners need to be trained with targeted capacity building sessions to strengthen their understanding of the environmental, social and public health implications of their choices.
- Road, rail and other transportation projects need to be better planned, incorporating green infrastructure design to preserve natural habitats and biodiversity.

Natural/Rural
Immune-protective habitat, rich in biodiversity and with a useful microbic

Industrial/urban
Habitat poor in biodiversity, not immuno-protective due to altered microbial exposure

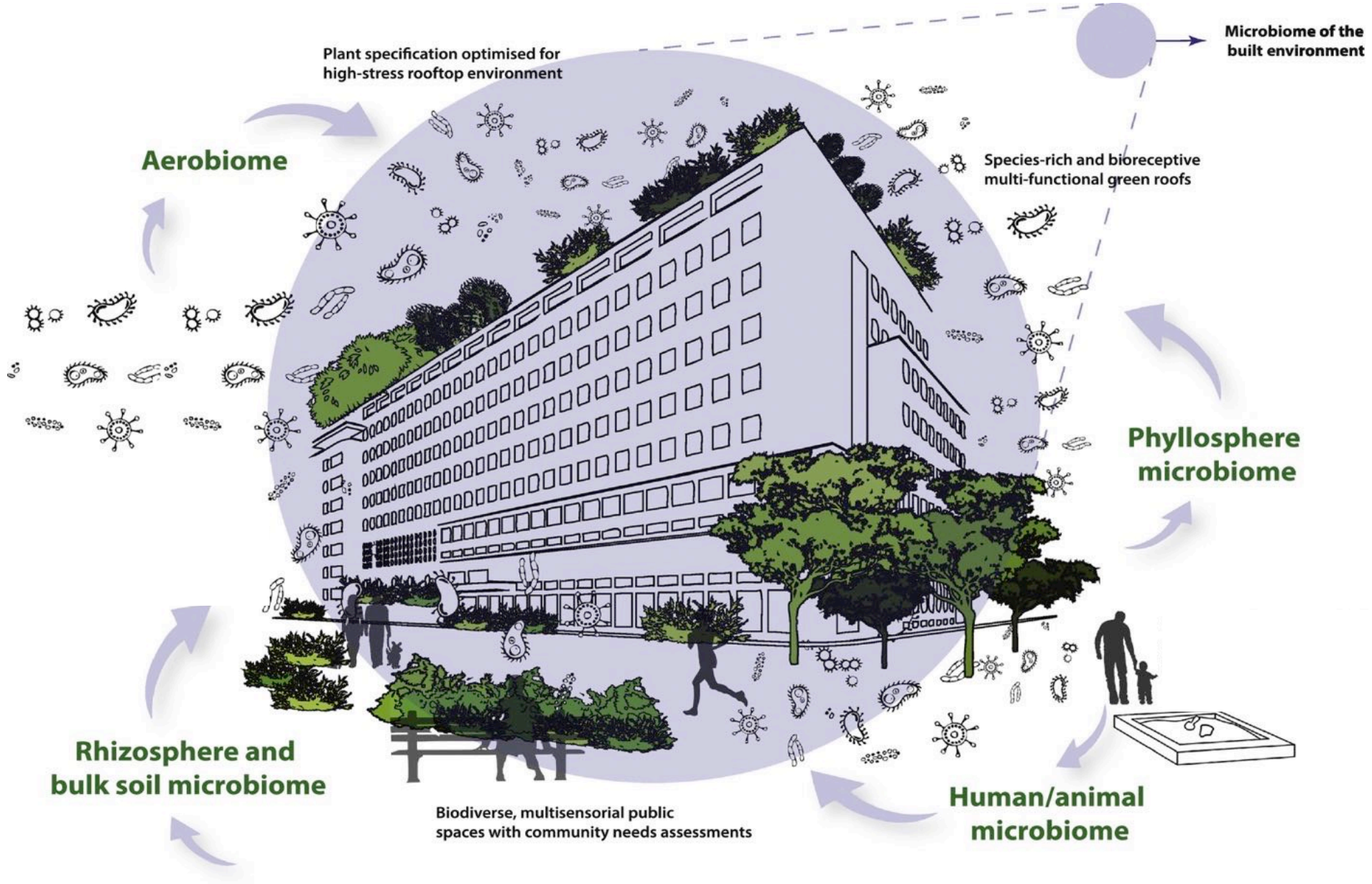
«Renaturalized» urban
Habitat that provides immuno-protection thanks to microbial exposure thanks to the recovery of biodiversity

The urban (anthropized) habitat has a reduced macro and microbial biodiversity and limits contact with beneficial environmental microbiota. These factors, along with diet, antibiotics and others, are associated with the spread of non-communicable diseases in modern societies. Restoring urban microbial biodiversity and microecological processes through microbiome reconditioning can benefit the health of holobionts and help limit their spread.



Mills et al., 2019. Relating Urban Biodiversity to Human Health With the 'Holobiont' Concept. Front. Microbiol., 26 March 2019 | https://doi.org/10.3389/fmicb.2019.00550 (ridisegnato)

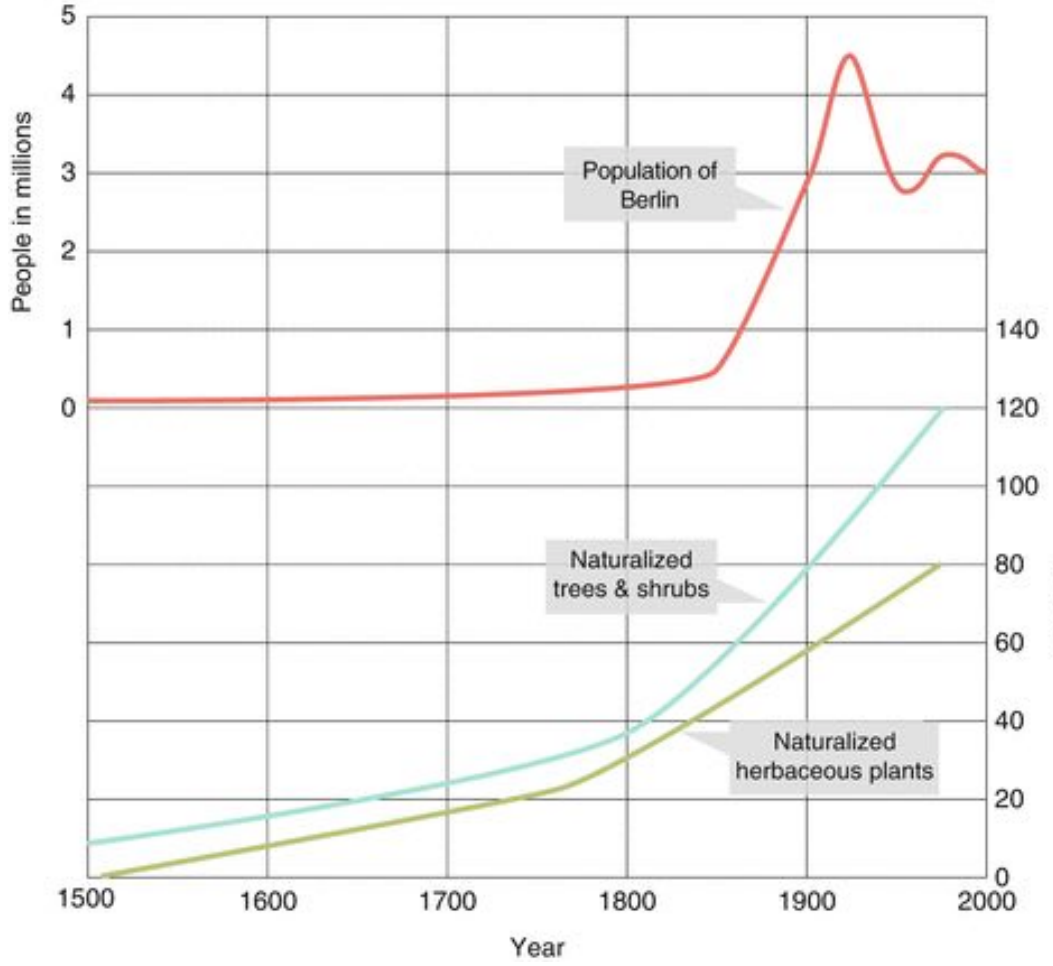
A vision for the future: microbiome-inspired green infrastructure (MIGI) and multi-sensory green spaces or even biodiverse green spaces (BUGS), multiculturally inclusive and also suitable for food production (from Robinson et al., 2018; Flies et al., 2017)



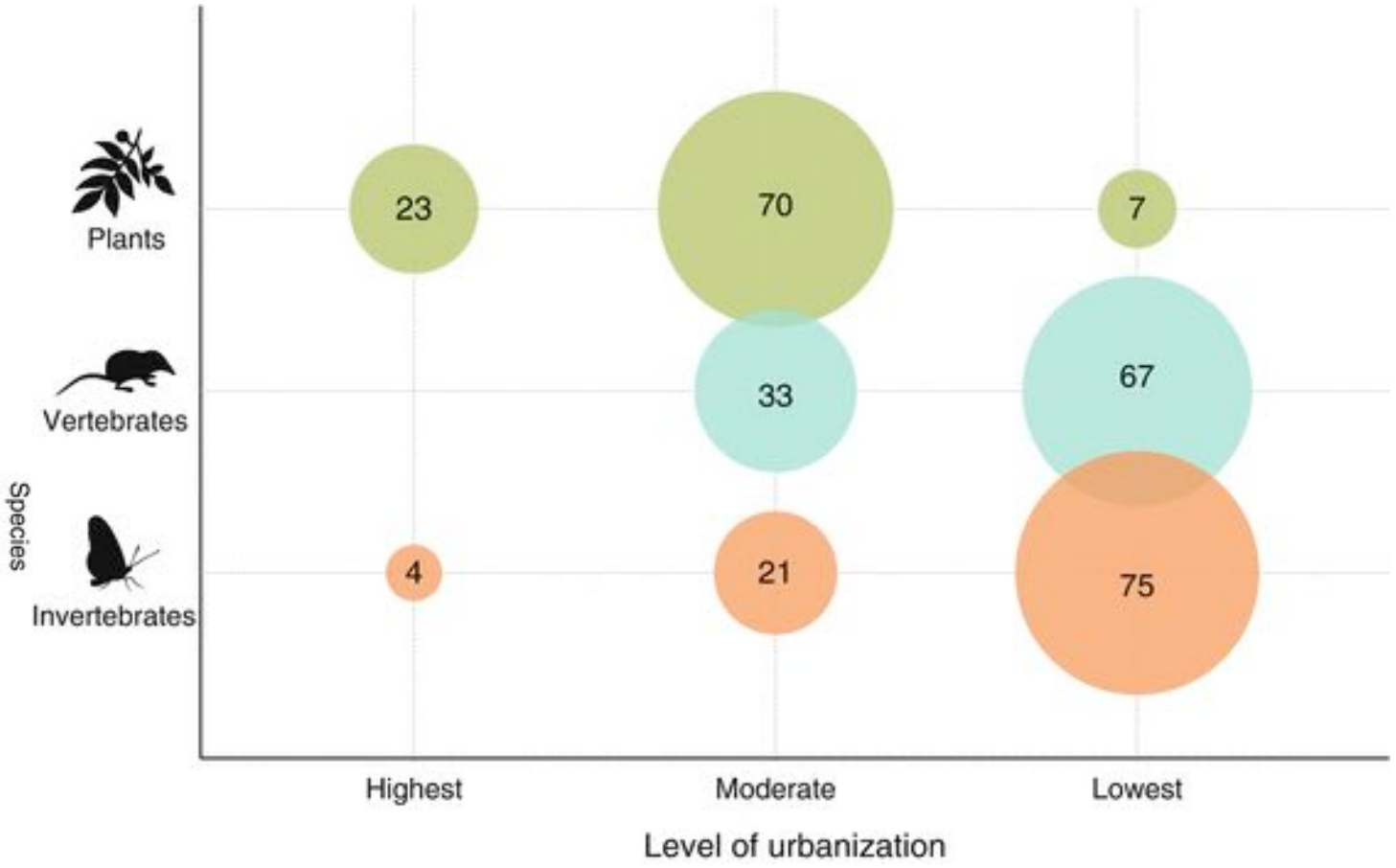
Modified from Watkins et al., Trends in Biotechnology, December 2020, Vol. 38, No. 12

Trends in Biotechnology

Urban Green Planning and Biodiversity

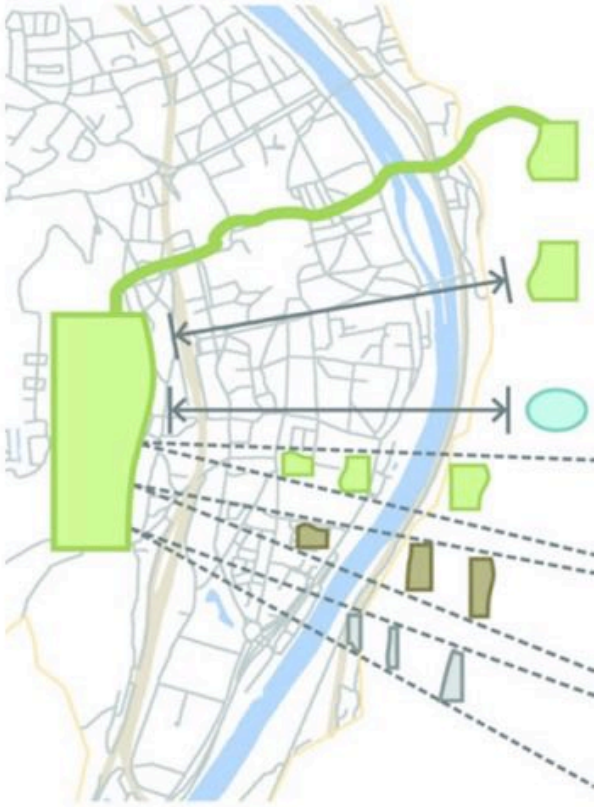


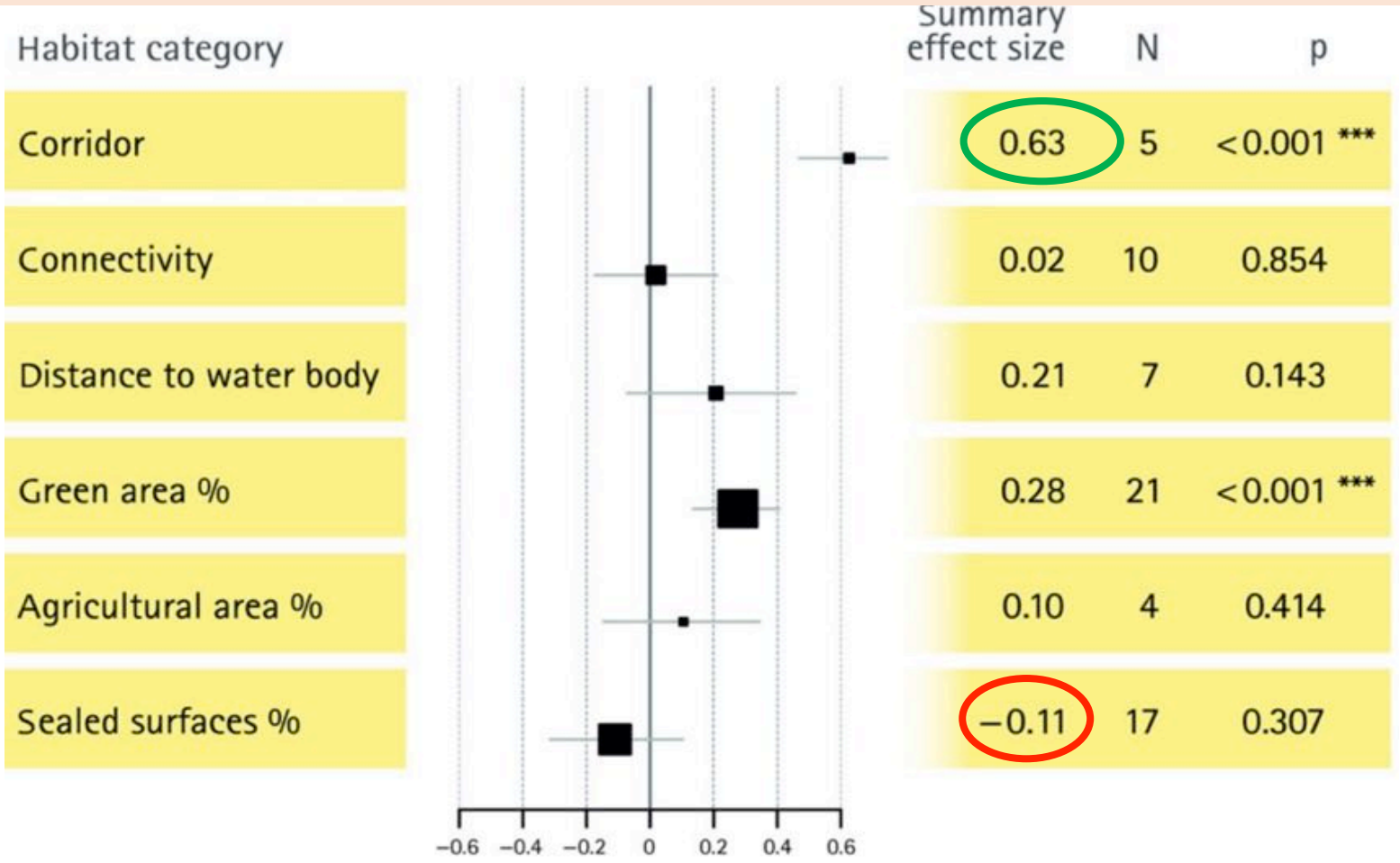
Correlation between human population growth and naturalized exotic plants in Berlin (From Müller, 2013, Modified from Sukopp and Wurzel 2003.



Percentage of studies, by group, showing peaks in species richness at three levels of urbanization (From Müller, 2013, Modified from McKinney 2008, p. 166.)

Green areas planning and animal biodiversity





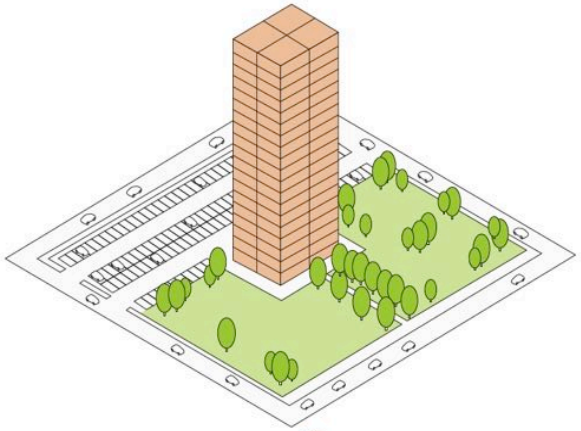
Two factors are fundamental in determining biodiversity in cities: **AREA SIZE AND ECOLOGICAL CORRIDORS**. Greater diversity was associated with larger surface areas, a result that supports the validity of the species-area relationship in urban landscapes. Corridors have also proven extremely effective in supporting urban biodiversity. This suggests that corridors may be more effective at promoting species richness than **stepping stones**, which reduce the distance between areas but do not provide a functional corridor. From Beninde, J., M. Veith, and A. Hochkirch. 2015. Biodiversity in cities needs space: a meta-analysis of factors determining intra-urban biodiversity variation. Ecology Letters

Well-planned density is very different from overcrowding, a condition that is related to social exclusion with increased infection and mortality rates.

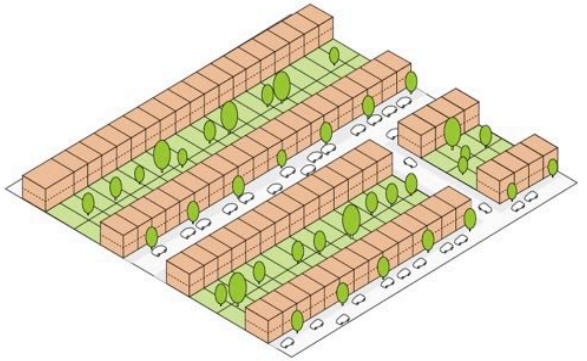
https://unhabitat.org/sites/default/files/2022/06/wcr_2022.pdf

Density configuration in one hectare

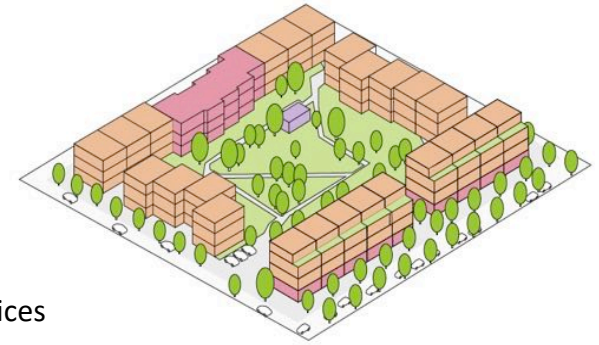
Density: 75 dwellings / 0.01 square kilometres
High building height
Low plot coverage



Density: 75 dwellings / 0.01 square kilometres
Low building height
High plot coverage



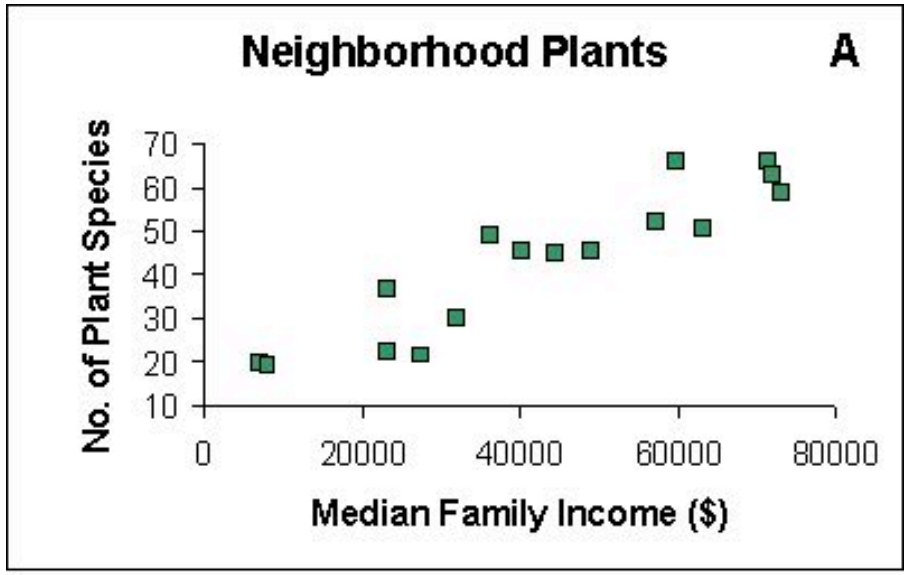
Density: 75 dwellings / 0.01 square kilometres
Medium building height
Medium plot coverage

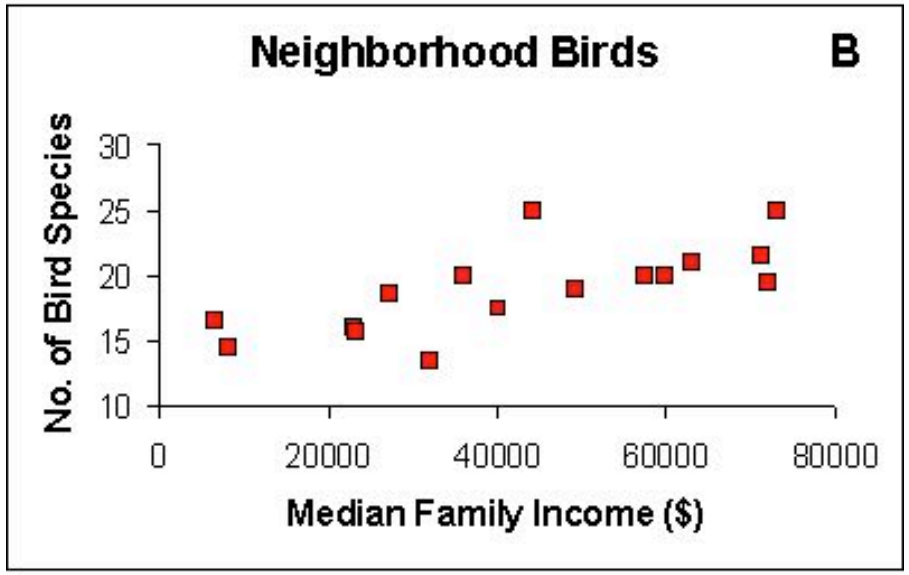


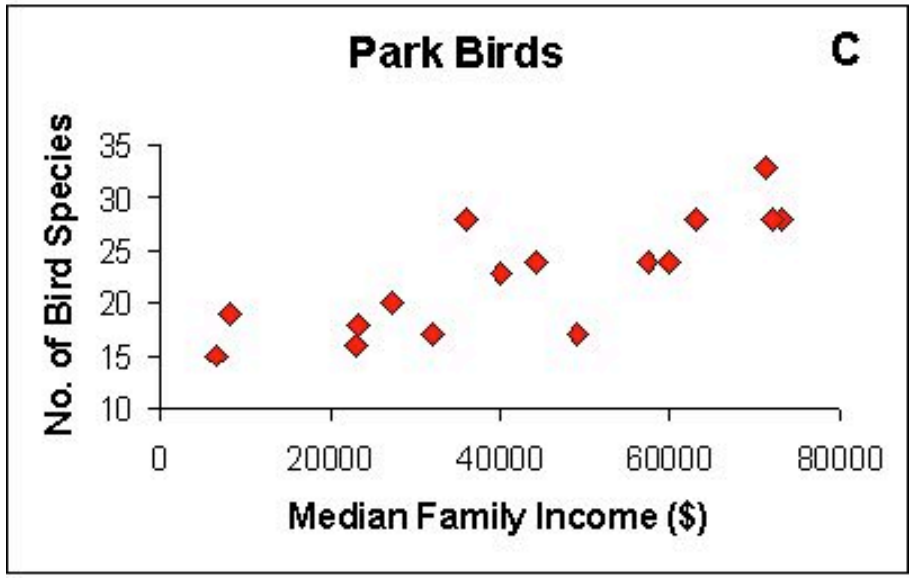
Residential
Commercial and Offices
Public Facilities

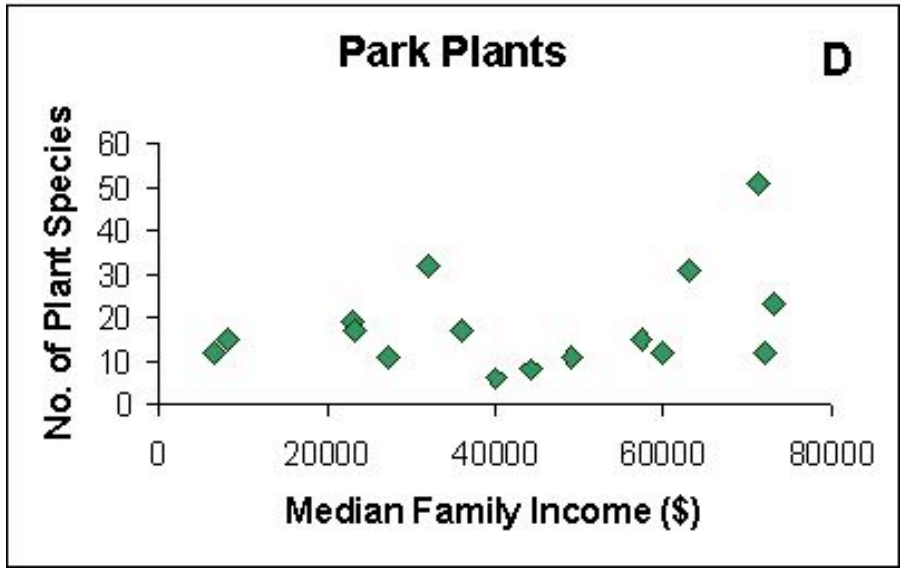
Source: UN-Habitat, 2012

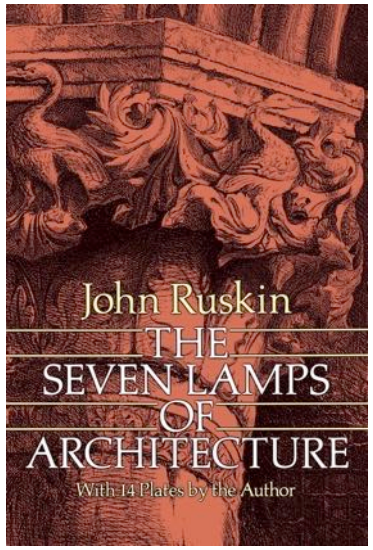
Socioeconomic structure plays an important role; as economic affluence status increases, species diversity generally increases. Although the effect was not significant for plant diversity in the parks (from Kinzig et al., 2005)











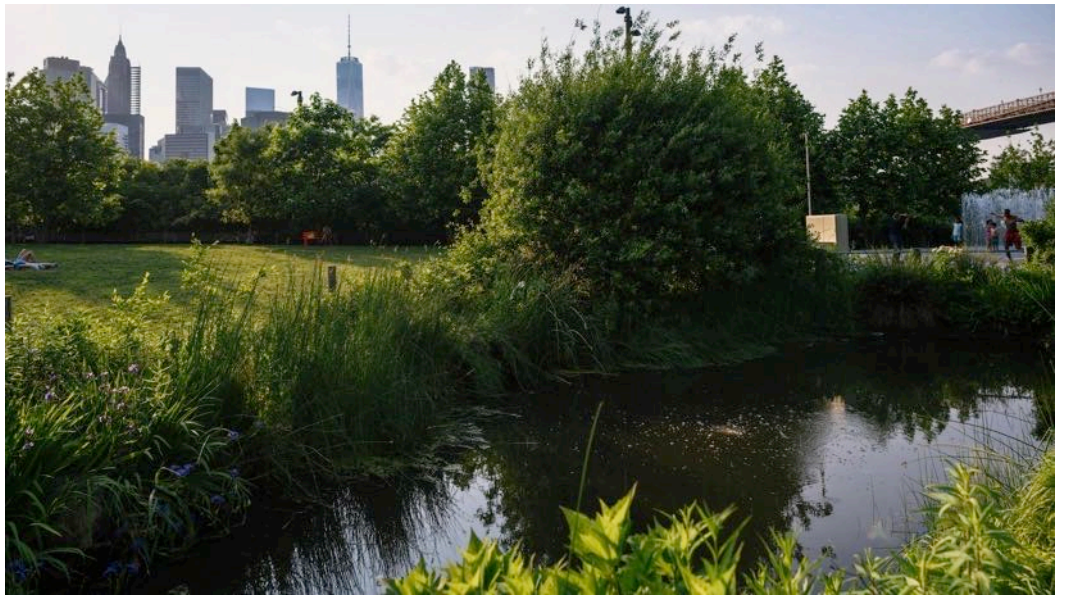
We have to switch on the Seven lamps of biodiversity

Sacrifice
Truth
Power
Beauty
Life
Memory
Obedience

From Parris et al., 2018

The first lamp: **protection**

The first principle or lamp of urban biodiversity is **to identify and protect areas of high biodiversity** (both current and potential) in and around cities



The second lamp: **connectivity**

The second principle of urban biodiversity is **to maintain or re-establish connectivity between different habitats** to allow the movement of animals and the propagation/reproduction of fungi and plants (spores, pollen and seeds) across the urban landscape

The third lamp: **construction**

The third principle of urban biodiversity is **to build ecological features** that can provide habitat for a wide range of plant and animal species. Urban development can result in both extensive habitat loss and a reduction in habitat complexity for many species of flora and fauna

The fourth lamp: **the cycles**

The cycle of water, nutrients and energy are fundamental to sustaining ecosystem services and biodiversity; on the contrary, the ecosystem services provided by these cycles (such as clean water and pollutant removal) depend on different biological communities

Photo credits https://www.pbslearningmedia.org/resource/nature-works-everywhere-urban-habitat-clip/nature-works-everywhere-urban-habitat-clip/ and www.Mycourse.aalto.f

The fifth lamp: **interactions**

Biological interactions, including competition for resources, symbiosis, herbivory, predation, pollination and parasitism are important processes that shape the biodiversity of a given place

The sixth lamp: **animal welfare**

An often overlooked aspect of urban ecology is **the importance of an urban form that supports animal biodiversity.** Urban infrastructure can have clear negative effects on biodiversity by increasing mortality (for example, due to wildlife collisions or birds hitting building windows), but in many cases the negative impacts are more subtle. For example, artificial light at night can interfere with circadian rhythms, sleep patterns and navigation in animals, while urban noise can hinder their acoustic communication, with significant cumulative impacts

The seventh lamp: **the novelty**

New ecological communities and new ecosystems are characterized by the presence of **new combinations of native and exotic species**, without historical analogues

From Parris et al., 2018

Ten actions to light the lamps of planning for biodiversity in the city

Action	Protection	Connettivity	Construction	Cycles	Interactions	Benevolence	Novelty
Design to preserve features of high biodiversity	X		X	X	X	X	
Preserve natural drainage lines (focus on the stream)	X	X	X	X	X	X	
Retain and use stormwater to enhance biodiversity	X			X	X	X	
Take advantage of urban turnover	X		X		X	X	X
Use temporary or neglected spaces				X			X
Community involvement	X		X	X	X	X	X
Coordinate public and private actions	X	X	X	X	X	X	X
Use carrots and sticks	X	X	X		X	X	
Incorporate biodiversity-sensitive practices into existing management				X			
Promote the "Green and Biodiverse City"	X	X	X		X	X	X

From Parris et al., 2018

«Green» Indicators

Malmö introduced the Green Space Factor (GSF) in 2001. The minimum GSF target was set at 0.5. Some vegetation qualities, such as type and size, are taken into account in the calculation method, and it is also possible to layer different types of surface cover to obtain a higher GSF. Refuges for birds and bats must also be included in the project proposal, favoring wild meadows and semi-natural biotopes rather than mowed meadows, making all roofs green or covering all walls with plants. Most of these interventions have a strong ecological character. It applies mostly to residential neighborhoods with multifamily buildings

Foto F. Ferrini, 15 Aprile 2023

The city of Stockholm has set it at 0.6 and differs from other examples by adding more detailed factors on biodiversity, social use of green space and climate adaptation (butterfly houses, fruit plants, nests, lawns suitable for ball games and games, food crops on balconies, multi-layered green roofs, playgrounds shaded by trees and pergolas)

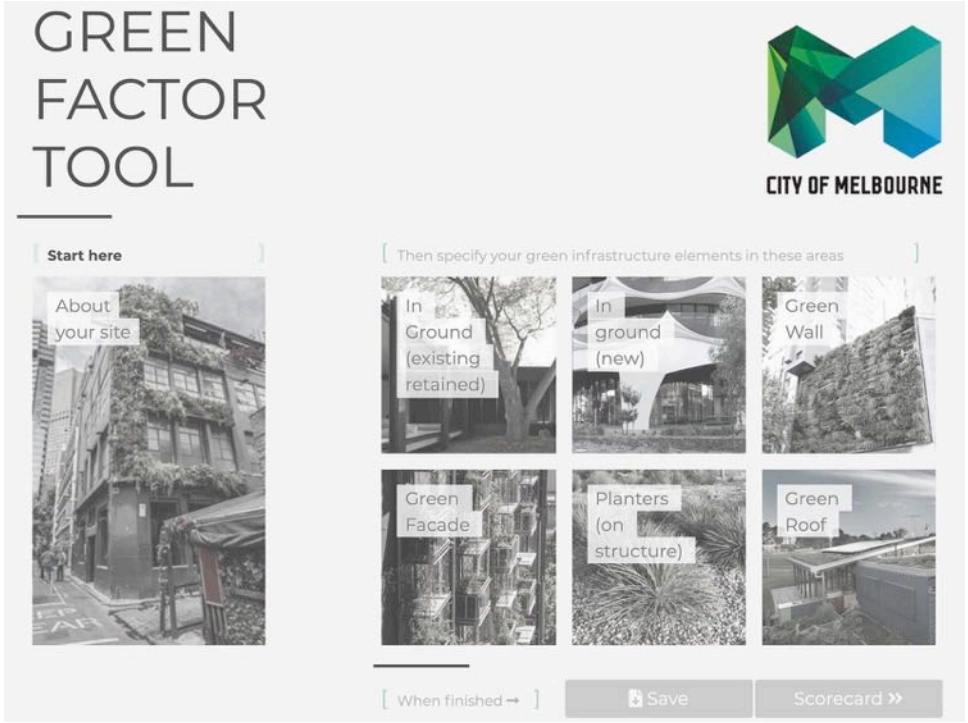
The green area factor is calculated per district and if more than one developer has received land allocations/land permits in the same district, they are obliged to collaborate on how to achieve the objectives for the green area factor

https://myclimateservices.eu/en/news/green-area-factor-supporting-urban-planners-sweden

Melbourne, in the face of the climate and environmental emergency, has developed its own Green Factor, a tool for assessing planned and existing green infrastructure at building scale which can have an impact at different levels and which should help provide the following benefits:

- reduction of the urban heat island effect
- **increase biodiversity and habitat provision**
- reduction of surface runoff of rainwater
- social services such as recreation and mental well-being (liveability)
- urban food production
- aesthetic values

To date, the use of this tool is a voluntary choice, strongly recommended by the Administration to understand the degree of "green factor" of a project, but in the near future it will be used to ensure that new projects comply with the requirements of planning for climate action.



City biodiversity index (CBI)

Purpose: Creation of a self-assessment tool, which aims to assist cities in benchmarking their biodiversity conservation efforts.

"The Singapore Index on Cities' Biodiversity", also known as the City Biodiversity Index or CBI (Chan and Djoghlaf 2009, Chan et al. 2010 and CBD, 2010) aims to:

(a) serve as a self-assessment tool;
(b) assist national governments and local authorities in benchmarking biodiversity conservation efforts in the urban context at the city level;
(c) help evaluate progress in reducing the rate of biodiversity loss in urban ecosystems;
(d) Help measure the ecological footprint of cities;
(e) Help develop guidelines to prepare a City Biodiversity Action Plan to achieve the three objectives of the Convention;
f) raise awareness among cities of important gaps in information on their biodiversity (Convention on Biological Diversity 2009)

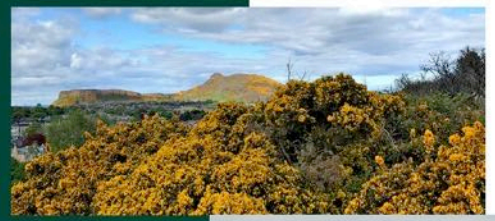
Secretariat of the Convention on Biological Diversity

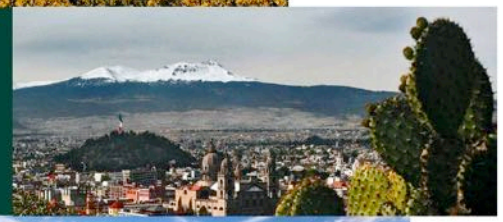
CBD Technical Series No. 98

98

HANDBOOK ON THE SINGAPORE INDEX ON CITIES' BIODIVERSITY

(also known as the City Biodiversity Index)





UN environment programme

Convention on Biological Diversity

NATIONAL PARKS
LET'S MAKE SINGAPORE OUR CITY IN NATURE

SINGAPORE INDEX ON CITIES' BIODIVERSITY

PART II – INDICATORS

Core Components	Indicators	Maximum Score
Native Biodiversity in the City	1. Proportion of Natural Areas in the City	4 POINTS
	2. Connectivity Measures or Ecological Networks to Counter Fragmentation	4 POINTS
	3. Native Biodiversity in Built Up Areas (Bird Species)	4 POINTS
	4. Change in Number of Vascular Plant Species	4 POINTS
	5. Change in Number of Native Bird Species	4 POINTS
	6. Change in Number of Native Arthropod Species	4 POINTS
	7. Habitat Restoration	4 POINTS
	8. Proportion of Protected Natural Areas	4 POINTS
	9. Proportion of Invasive Alien Species	4 POINTS
Ecosystem Services provided by Biodiversity	10. Regulation of Quantity of Water	4 POINTS
	11. Climate Regulation – Benefits of Trees and Greenery	4 POINTS
	12. Recreational Services	4 POINTS
	13. Health and Wellbeing – Proximity/Accessibility to Parks	4 POINTS
	14. Food Security Resilience – Urban Agriculture	4 POINTS
Governance and Management of Biodiversity	15. Institutional Capacity	4 POINTS
	16. Budget Allocated to Biodiversity	4 POINTS
	17. Policies, Rules and Regulations – Existence of Local Biodiversity Strategy and Action Plan	4 POINTS
	18. Status of Natural Capital Assessment in the City	4 POINTS
	19. State of Green and Blue Space Management Plans in the City	4 POINTS
	20. Biodiversity Related Responses to Climate Change	4 POINTS
	21. Policy and/or Incentives for Green Infrastructure as Nature-based Solutions	4 POINTS
	22. Cross-sectoral and Inter-agency Collaborations	4 POINTS
	23. Participation and Partnership: Existence of Formal or Informal Public Consultation Process Pertaining to Biodiversity Related Matters	4 POINTS
	24. Participation and Partnership: Number of Agencies/Private Companies/ NGOs/Academic Institutions/International Organisations with which the City is Partnering in Biodiversity Activities, Projects and Programmes	4 POINTS
	25. Number of Biodiversity Projects Implemented by the City Annually	4 POINTS
	26. Education	4 POINTS
	27. Awareness	4 POINTS
	28. Community Science	4 POINTS
	Native Biodiversity in the City (Sub-total for indicators 1-9)	**36 points**
	Ecosystem Services provided by Biodiversity (Sub-total for indicators 10-14)	**20 points**
	Governance and Management of Biodiversity (Sub-total for indicators 15-28)	**56 points**
	Maximum Total:	**112 points**

Biodiversity strategy for 2030

The EU Biodiversity Strategy 2030 is a comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems. The strategy aims to put Europe's biodiversity on the path to recovery by 2030 and includes specific actions and commitments.

The strategy includes specific commitments and actions to be achieved by 2030.

a) Creation of a broader network of protected areas at EU level on land and at sea

The EU will expand existing Natura 2000 areas, rigorously protecting areas with very high biodiversity and very high climate value.

b) Launch of an EU plan for nature restoration

Through concrete commitments and actions, the EU aims to restore degraded ecosystems by 2030 and manage them sustainably, addressing the main causes of biodiversity loss. As part of this plan, the Commission will propose binding nature restoration targets by the end of 2021.

c) Introduction of measures to enable the necessary radical change

- The strategy highlights unlocking funding for biodiversity and putting in place a new, strengthened governance framework to:
- ensure better implementation and follow up on progress
- improve knowledge, financing and investment
- ensure greater respect for nature in public and business decision-making.

Indicators for the “Florence” Project

1. Proportion of natural areas in the urban area considered

2. Fragmentation of green areas

3. Green areas vs. total neighborhood area

4. Crown coverage index

5. Relationship between native and exotic species

6. Number of vascular plant species

7. Proportion of invasive alien species

8. Calculation of the carbon stored in the areas considered

9. Proportion of permeable vs impervious areas

10. Presence of different types of fauna (especially avifauna)

CN5, National Biodiversity Future Center

AREA: RESOURCES
Activity 1: Biodiversity and ecology of urban forestry.
Activity 2: Soil biodiversity in an urban context.

AREA: INTEGRATED DESIGN
Activity 3: Urban Forestry: integrated and sustainable design

AREA: EFFECTS EVALUATION
Activity 4: Urban forestry and impacts on ecosystem support and regulation services: environmental level
Activity 5: Urban forestry and impacts on ecosystem support and regulation services: biological level

AREA: MONITORING, RESTORATION AND SUSTAINABLE MANAGEMENT
Activity 6: Ecological and environmental restoration
Activity 7: Management of interventions

Spoke 5. Urban Biodiversity
Coordinators Massimo Labra – Unimib, Maria Chiara Pastore - Polimi

Acer pseudoplatanus

Quercus robur

Tilia cordata

Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI

Trial PNRR 2023-2024

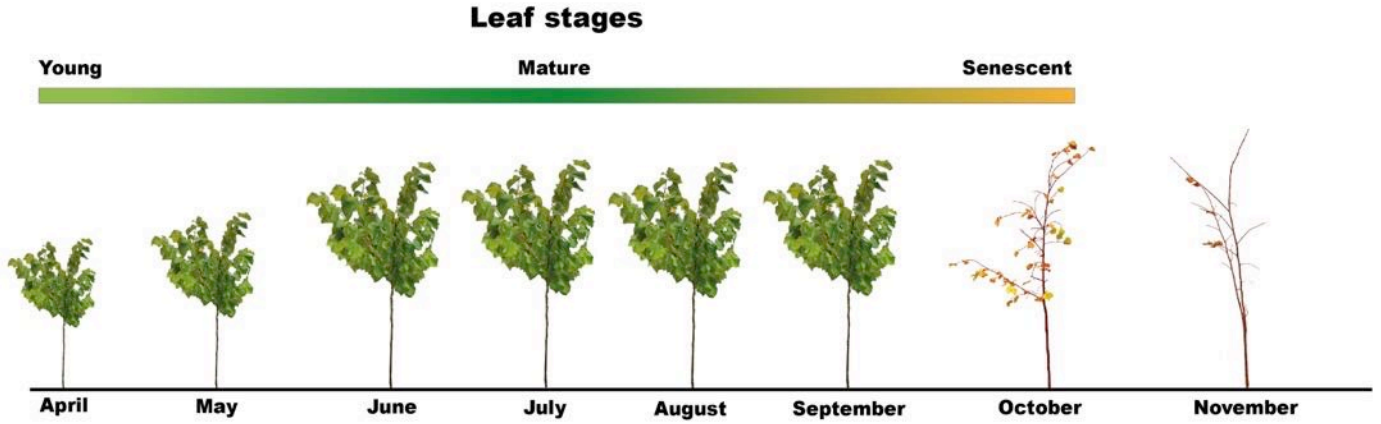
Two parallel experiments are being conducted:

- **The first experiment focuses on analyzing potential differences in growth rates throughout the whole vegetation period amongst tree species from different Italian sites.**
- **The second experiment seeks to assess how the geographical origin within a species might influence its resilience to common urban stressors such as drought stress.**

Acer pseudoplatanus

EXPERIMENT 1:

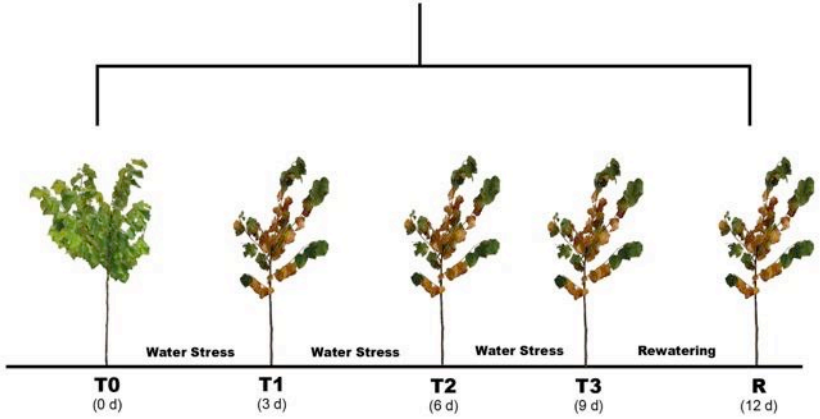
- Site 1
- Site 2
- Site 3
- Site 4
- Site 5 (*Quercus robur*)



Quercus robur

EXPERIMENT 2:

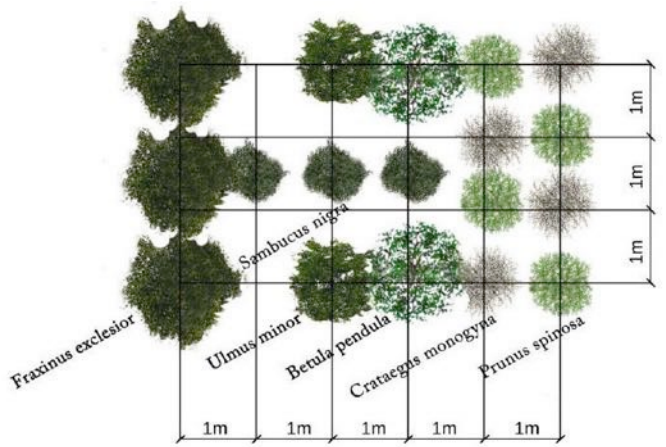
- Control
- Stressed



- Gas-exchange analyses
- Chlorophyll a fluorescence
- Chl, Flv, NBI, Ant
- Total biomass
- RWC
- Pre-dawn leaf water potential
- LMA, LT, LD

TRIAL 2024-2026 Task 6.3: Restoration ecology of degraded urban areas

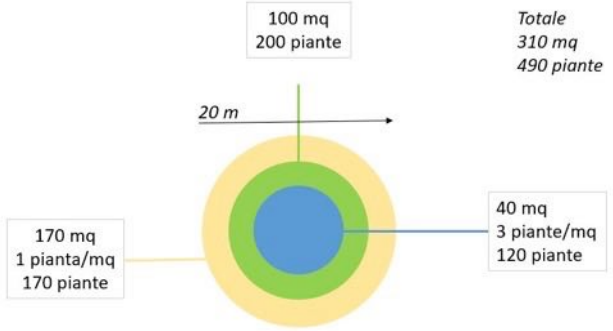
a) Planting scheme
b) There are 3 treatments and 1 control left to spontaneous succession
c) T_70_30 – Planting of 70% of trees and 30% of shrubs. Planting density: 1300 specimens/ha for a total of 56 trees and 24 of shrubs in each plot of 24X25 m
d) T_30_70 - Planting of 30% trees and 70% shrubs. 1300 specimens/ha for a total of 24 trees and 56 shrubs for each 24X25 m plot.
e) T_MS – Serial scrubland with a diameter of 10 (15) m, with modular planting density

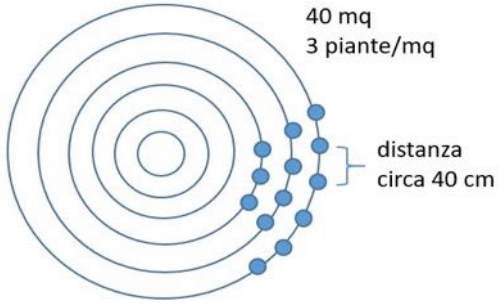


Native tree species

Native shrub species

Schema macchia centrale: A = nucleo centrale; B = prima fascia concentrica; C = seconda fascia concentrica

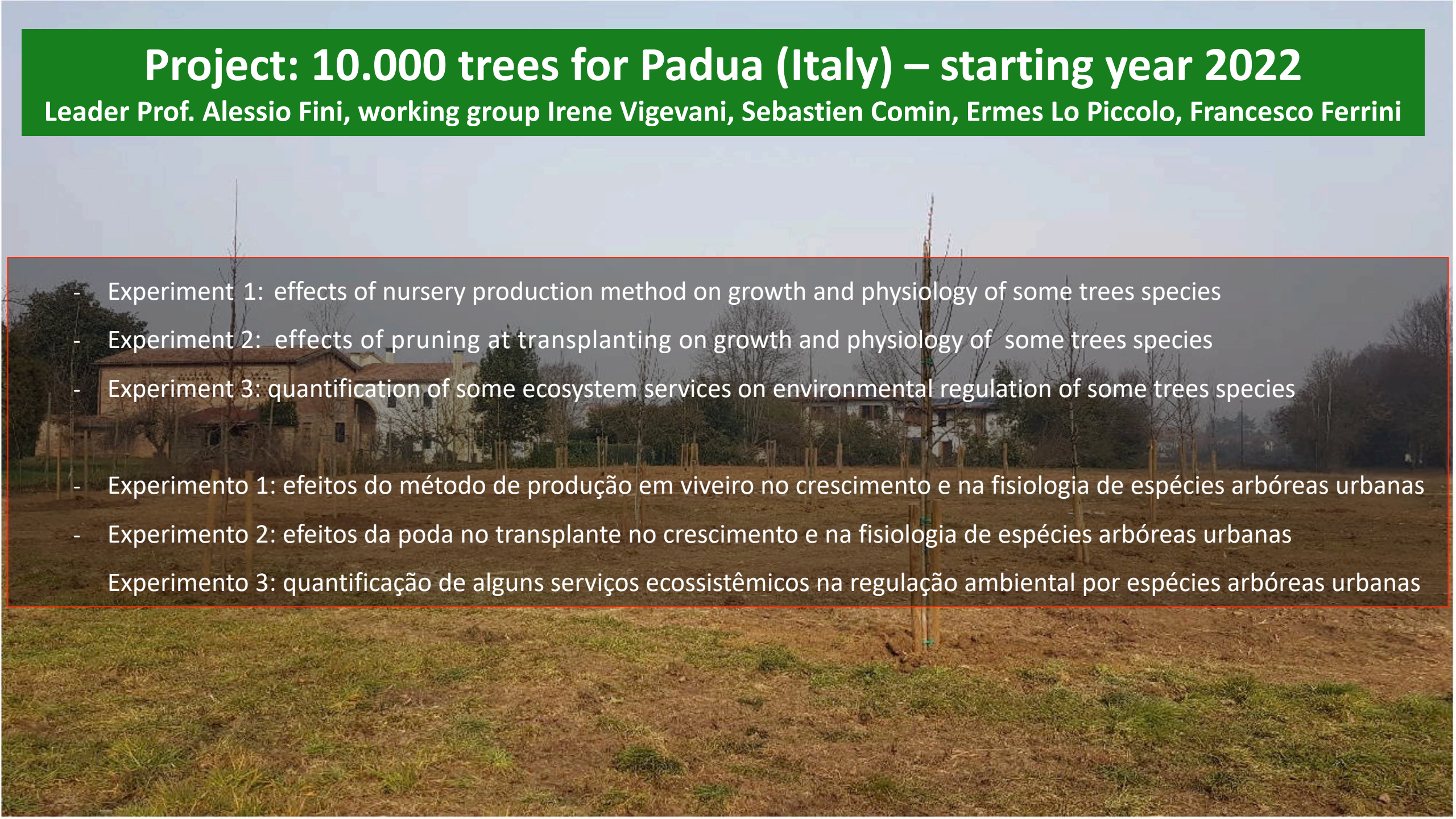




Planting scheme hypothesis for the central part of the spot

Project: 10.000 trees for Padua (Italy) – starting year 2022

Leader Prof. Alessio Fini, working group Irene Vigevani, Sebastien Comin, Ermes Lo Piccolo, Francesco Ferrini



- Experiment 1: effects of nursery production method on growth and physiology of some trees species
- Experiment 2: effects of pruning at transplanting on growth and physiology of some trees species
- Experiment 3: quantification of some ecosystem services on environmental regulation of some trees species

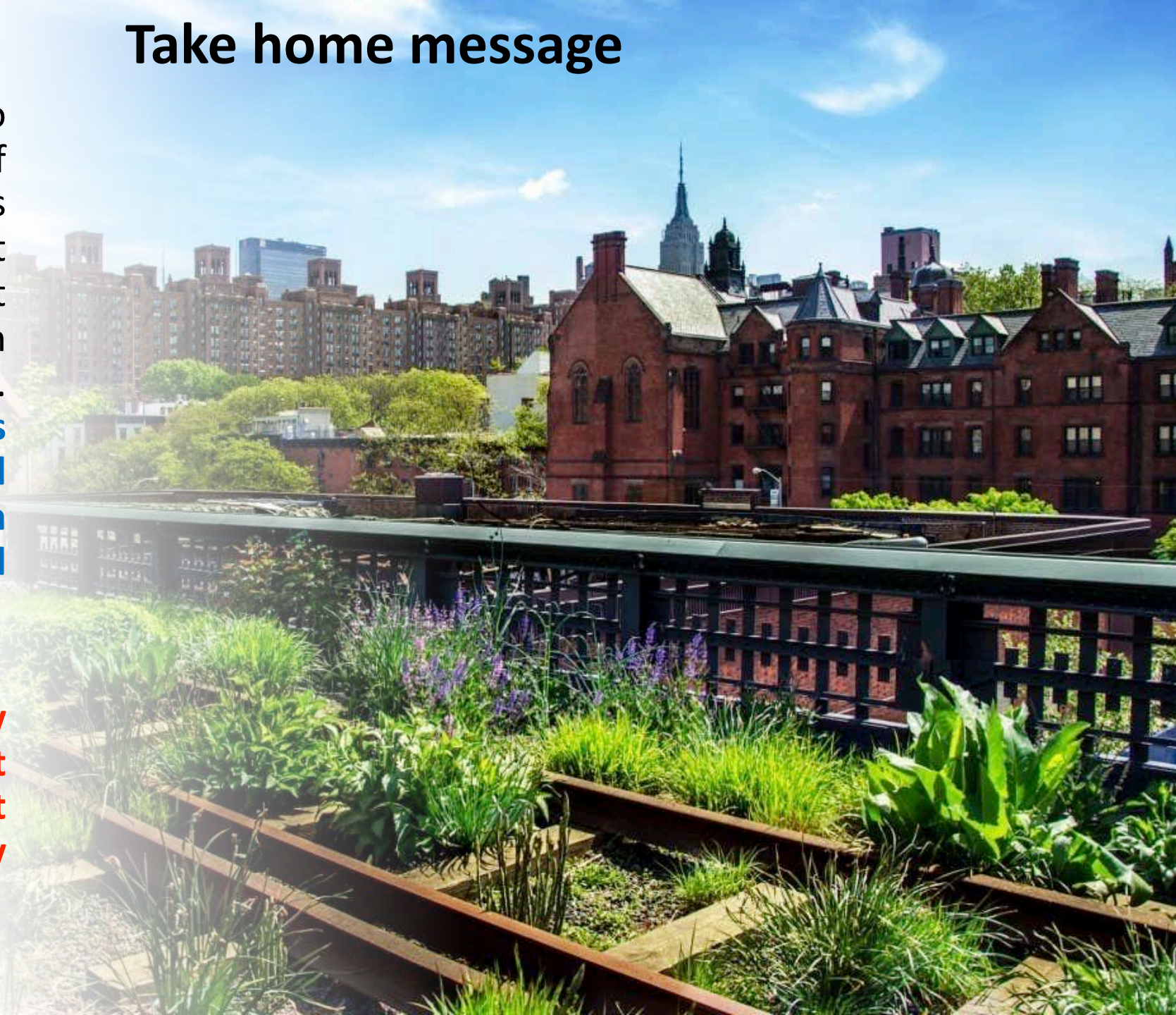
- Experimento 1: efeitos do método de produção em viveiro no crescimento e na fisiologia de espécies arbóreas urbanas
- Experimento 2: efeitos da poda no transplante no crescimento e na fisiologia de espécies arbóreas urbanas

Experimento 3: quantificação de alguns serviços ecossistêmicos na regulação ambiental por espécies arbóreas urbanas

Take home message

The **potential of urban areas** to host considerable amounts of **biodiversity** must be recognized as an **urban planning tool** so that management practices that preserve and promote such diversity can be pursued. Management options should **focus on increasing biodiversity in all aspects of the urban forest, from street trees, to urban parks and woodlands.**

In planning and designing the city and its components we must ALWAYS be clear about the fact that it is nature that hosts the city and not the other way around.



How biodiversity loss could cause bankruptcy in some countries

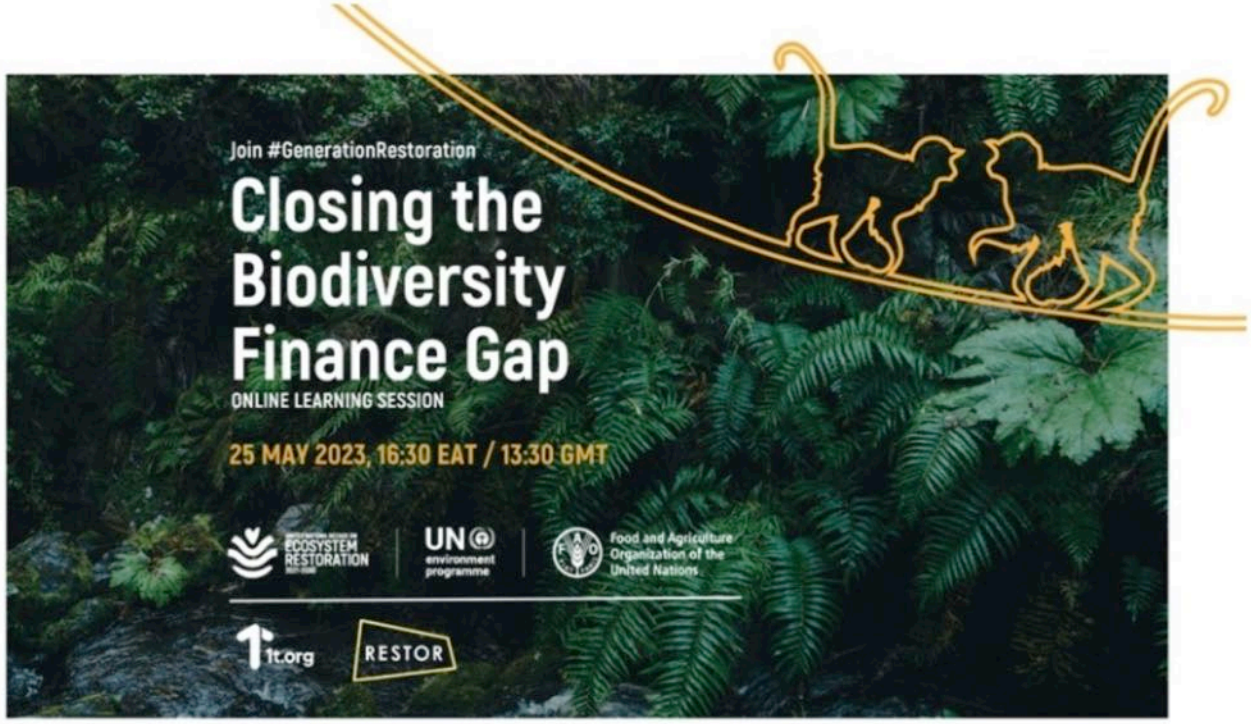
Economists at the University of Cambridge have developed what they say are the world's first biodiversity-adjusted sovereign credit ratings.

By **Stefan Ellerbeck** August 15, 2022

9 May 2023

4:37

Learning Session: Closing the Biodiversity Finance Gap



When: 25 May 2023, 4:30 PM - 5:30 PM GMT+3

Where: Online, **register here.**

Join us for this free online learning session on 25 May 2023. Explore innovative ways to mobilize private sector and philanthropic investments, closing the biodiversity gap and tackling the climate crisis. Let's make a lasting impact!

euni well European University for Well-Being

The New York Times

Let the Postpandemic City Grow Wild

May 9, 2023

Thanks for the attention

francesco.ferrini@unifi.it

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