

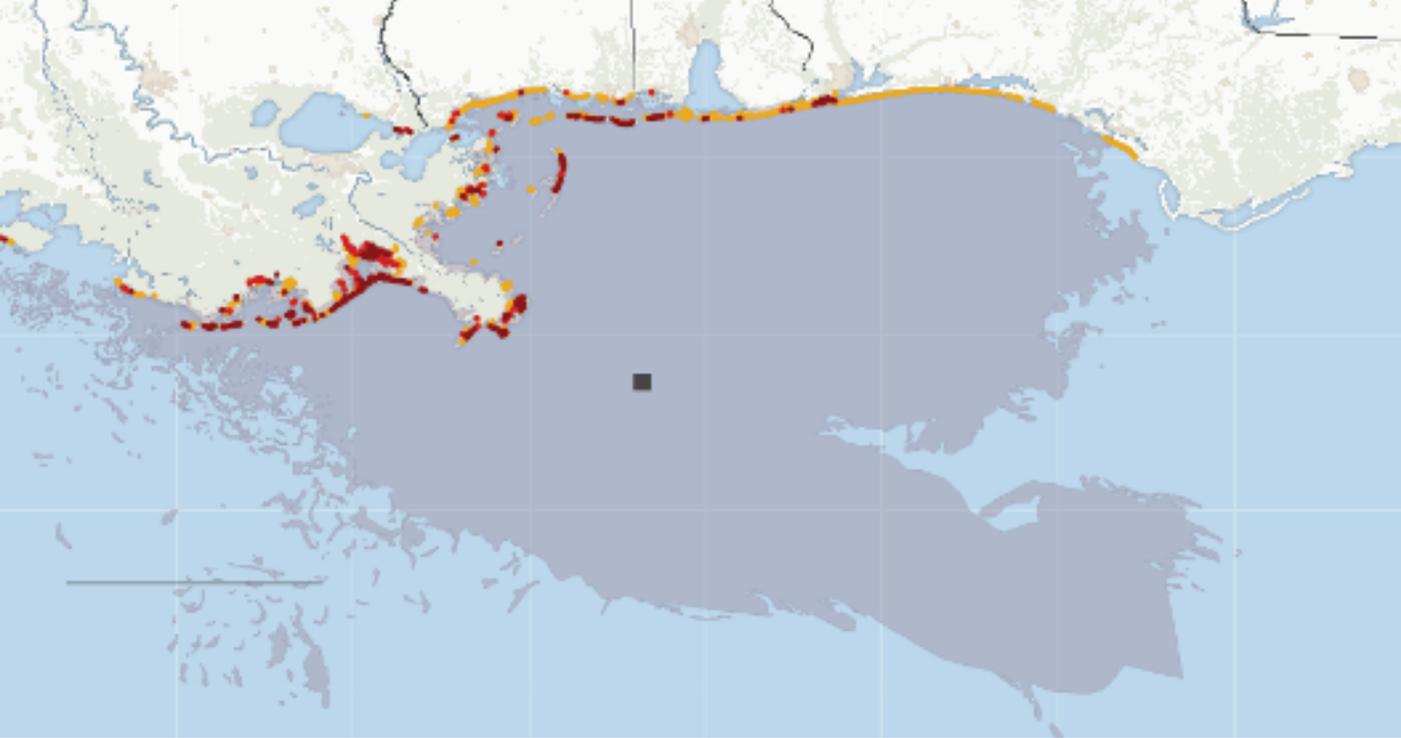
# Invisible landscape

Jorg Sieweke

Associate Professor

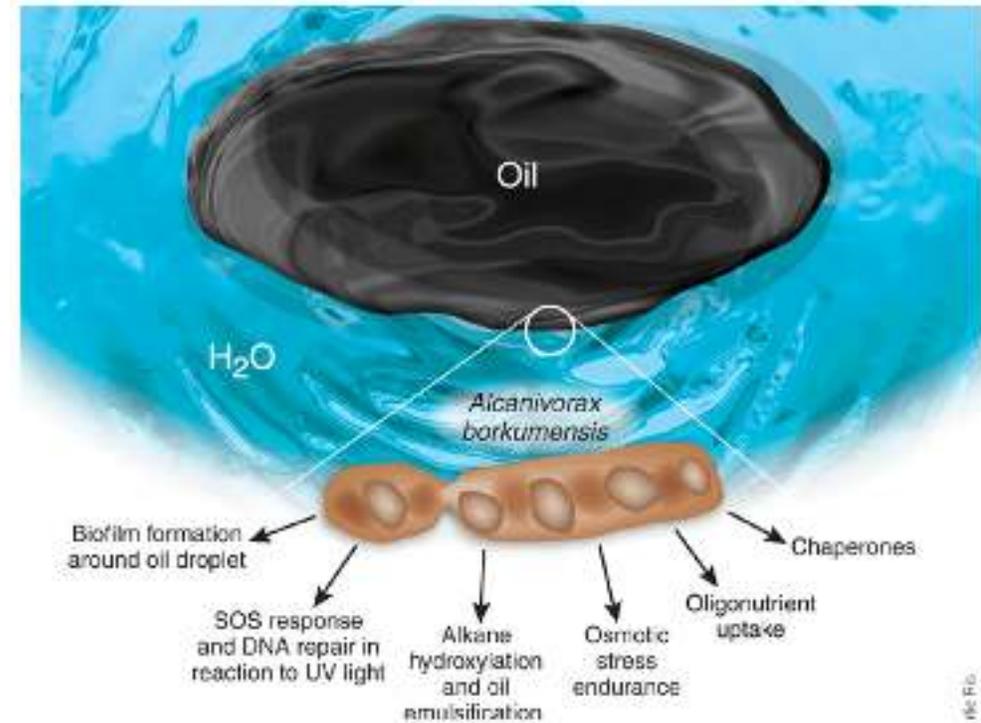
Norwegian University of Life Science

NLA\_URU Oslo, 21.04.23



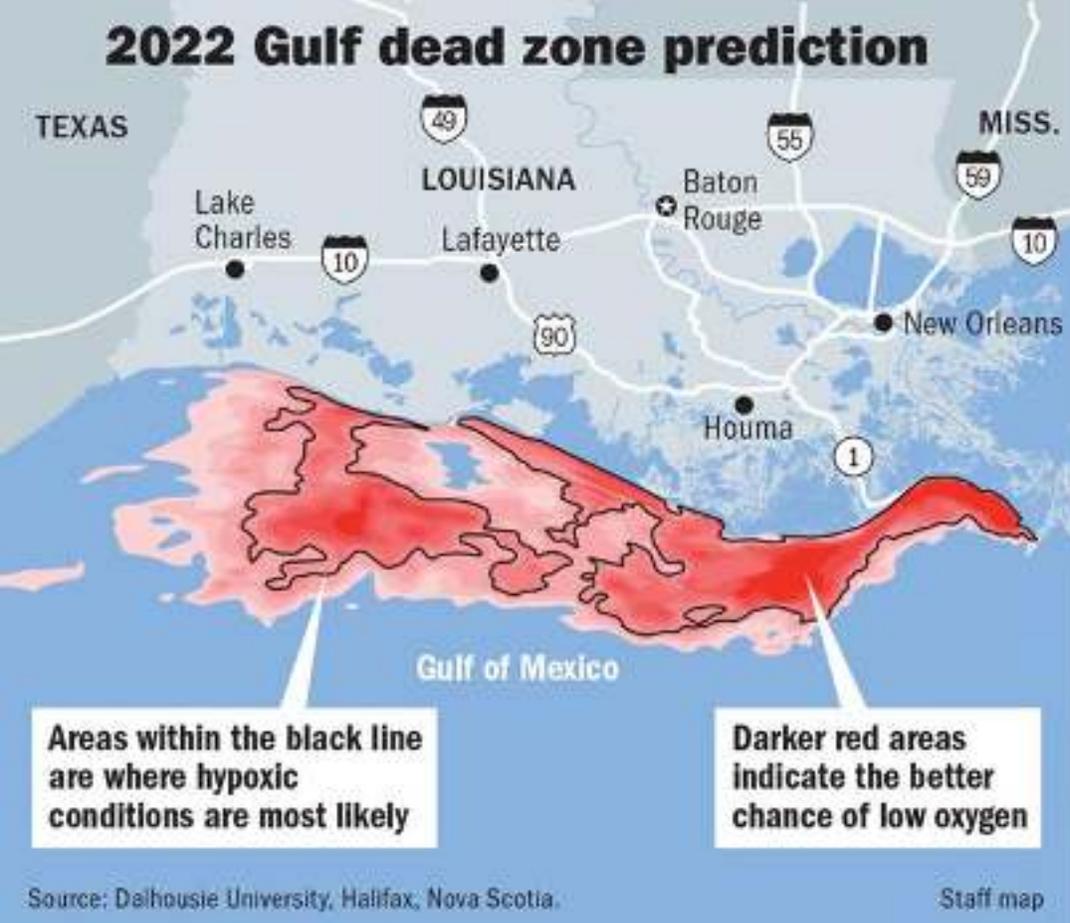
Deep Water Horizon, 2010  
est. 143 -203 Million gallons crude oil

*What does the largest oil spill and  
the largest hypoxia zone in history have in common?*

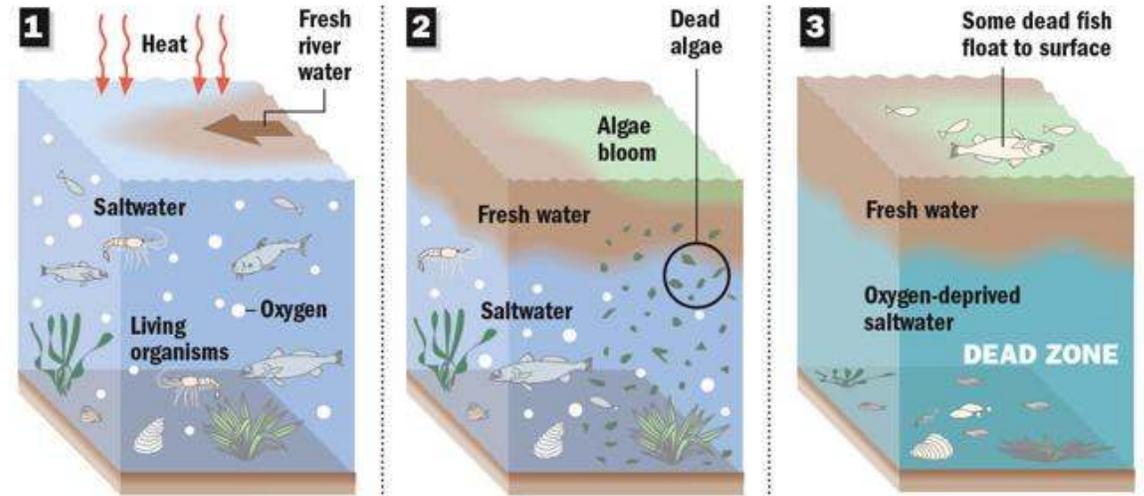


Naturally occurring oil-eating marine bacterium called *Alcanivorax Borkumensis* consumed about half of the oil spilled, producing a wide variety of very efficient oil-degrading enzymes.

# 2022 Gulf dead zone prediction



## HOW THE DEAD ZONE FORMS



Graphic by DAN SWENSON

Hypoxia: oxygen depleted areas in the sea.

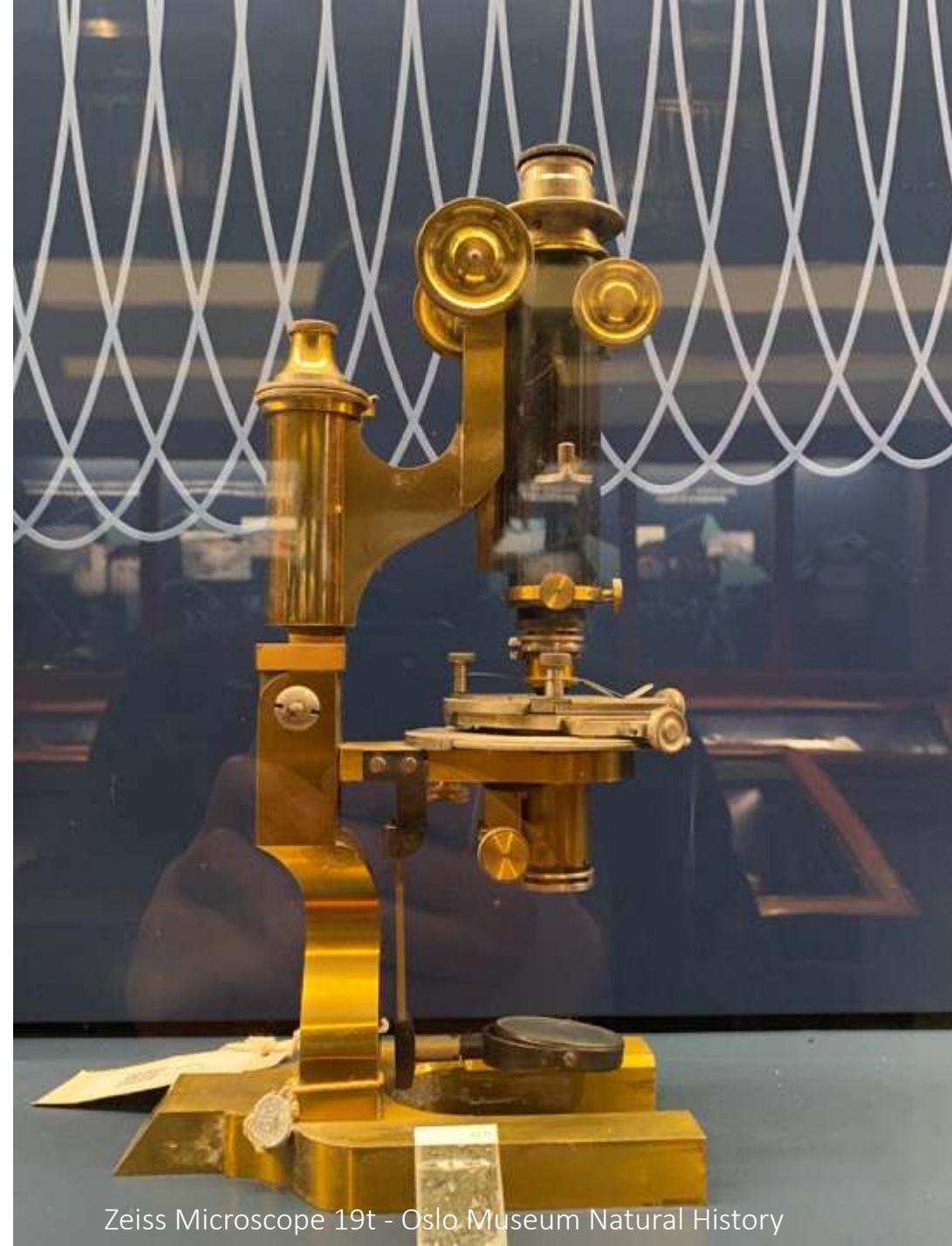
Causes marine life to die or flee.

> Eutrophication from watershed

> Excess algae and plankton growth

> Bacterial decomposition consumes oxygen

Invisible landscape - an oxymoron?  
Why does Landscape architecture  
rarely address microbiology?



Zeiss Microscope 19t - Oslo Museum Natural History

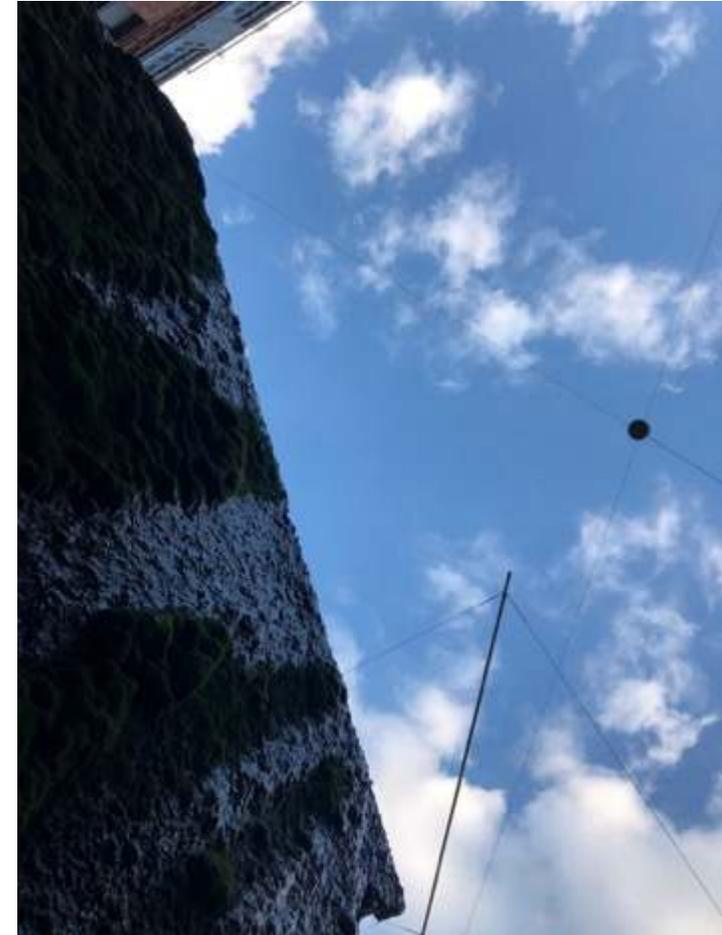
Fountain sculpture inducing erosion and nurturing microbial growth



Narva Höfe: Berlin Oberbaum-City,



Prof. Gustaf Lange



Photos: Jorg Sieweke, 2021

## Germ theory



Science photo library Streptococcus bacteria. Computer artwork

Robert Koch (1876) showed connection between specific microorganisms and the occurrence of particular diseases: e.g. cholera



Thomas Murner (1512)

## Hygiene Hypothesis

Today's increase in sanitization is directly linked to growing rates of health problems

Allergies, Asthma, Cancer, etc.

## Sick from lack of germs



If you've always gotten sick even from a young age, it's not too late to build a stronger immune system. There are some very easy and safe ways for your body to begin rebuilding the good bacteria inside:

### SIMPLE WAYS TO BUILD YOUR IMMUNE SYSTEM



#### GET OUTSIDE

Nature is a great place to begin your exposure to germs, mold, and bacteria. Bonus: Get a healthy dose of Vitamin D.



#### EAT PROBIOTICS

Foods rich in good bacteria can help to replenish your microbiome and create a healthy gut.



#### SKIP THE SCRUBBING

Buy organic and you won't need to scrub your produce to death. Keep a little of nature's bacteria on there to promote a stronger immune system.



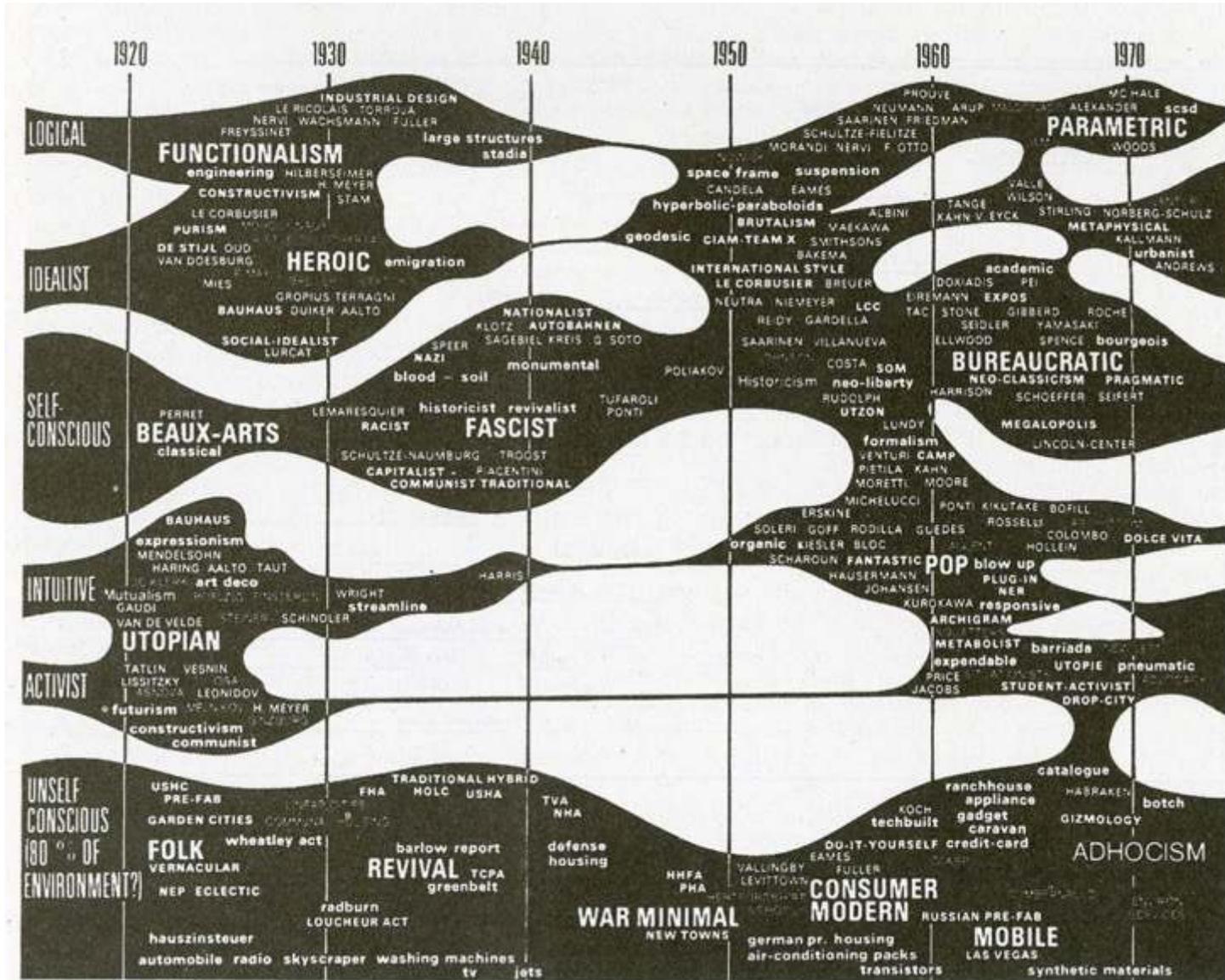
#### TRY LOCAL HONEY

A trusted remedy for helping with seasonal allergies, eating local honey will help your body acclimate to the bacteria in your area.

Early modern  
SANITATION

URBAN HYGIENE

GERM THEORY  
ROBERT KOCH 1876



Late modern  
OVER-SANITATION

MULTI-RESISTANCY

ALLERGIES  
ASTHMA

Charles Jencks, "The Evolutionary Tree" from Modern Movements in Architecture, 1973.



## Microbiology - Definitions

**Microbe:** a microscopic organism

**Microbiota:** a group of microbes

**Microbiome:** the entire collection of microbes in a given environment and their theatre of activity

**Cryptogam:** fern, moss, alga, or fungus: a plant or plant-like organism reproducing by spores and not producing visible flowers or seed.

**Holobiont:** Discrete ecological unit through symbiosis

**Omnipresent:** *'Everything is everywhere'*

*two nested layers of biodiversity ...*

## 1. Human Microbiome

Microorganisms of the inner layer – human gut, skin, airways

## 2. Environmental Microbiome

Microorganisms of the outer layer – soil, waters, plants, animals

Human bodies are colonised by microbes from the outer layer

Only 0.00001% of microbial species are human pathogens

# 1. Human Microbiome

Microorganisms of the inner layer – human gut, skin, airways

Human Microbiome individually unique

A balanced Microbiome defines health

Recent findings on digestive and nervous system interaction

# Microbiome

## IN NUMBERS

**100 Trillion**

sybiotic microbes live in and on every person and make up the human microbiota

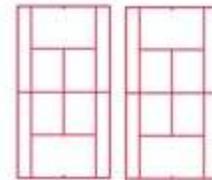
The human body has more microbes than there are stars in the milky way

**95%**

of our microbiota is located in the GI tract

**150:1**

The genes in your microbiome outnumber the genes in our genome by about 150 to one



The surface area of the **GI tract** is the same size as 2 tennis courts

You have **1.3X**

more microbes than human cells

**>10,000**

Number of different microbial species that researchers have identified living in and on the human body

**2kg**

The gut microbiota can weigh up to 2Kg



Interfacing Food & Medicine

The microbiome is more medically accessible and manipulable than the human genome

**90%**

It is thought that of disease can be linked in some way back to the gut and health of the microbiome

**5:1**

Viruses:Bacteria in the gut microbiota



**2.5**

The number of times your body's microbes would circle the earth if positioned end to end

Each individual has a unique gut **microbiota**, as personal as a fingerprint



# 1. Human Microbiome

Gut microbes could drive and potentially cure brain disorders  
That might lead to better and easier treatments for brain diseases.

Nature: 3. February, 2021



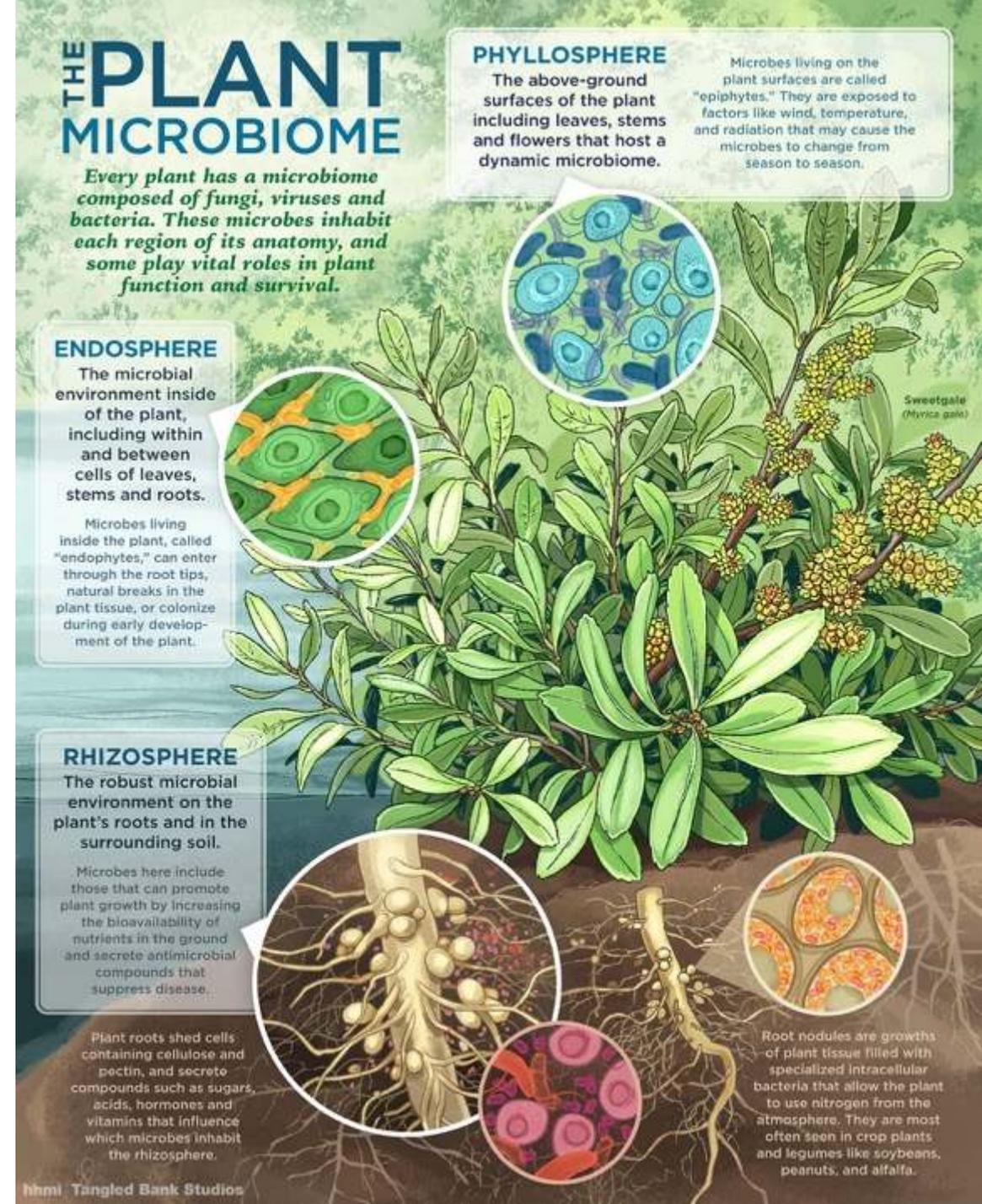
Illustration by Fabio Buonocore

## 2. Environmental Microbiome

Plants have several Microbiome

Inside every plant is a world of microbial life.

Microscopic organisms like fungi, viruses, and bacteria inhabit every region of the plant's anatomy.



# Human Microbiome & Environmental Microbiome

Immunoregulation for human health

If a walk in the woods feels healthy,  
There is now growing evidence  
of beneficial microbial exchange and composition.

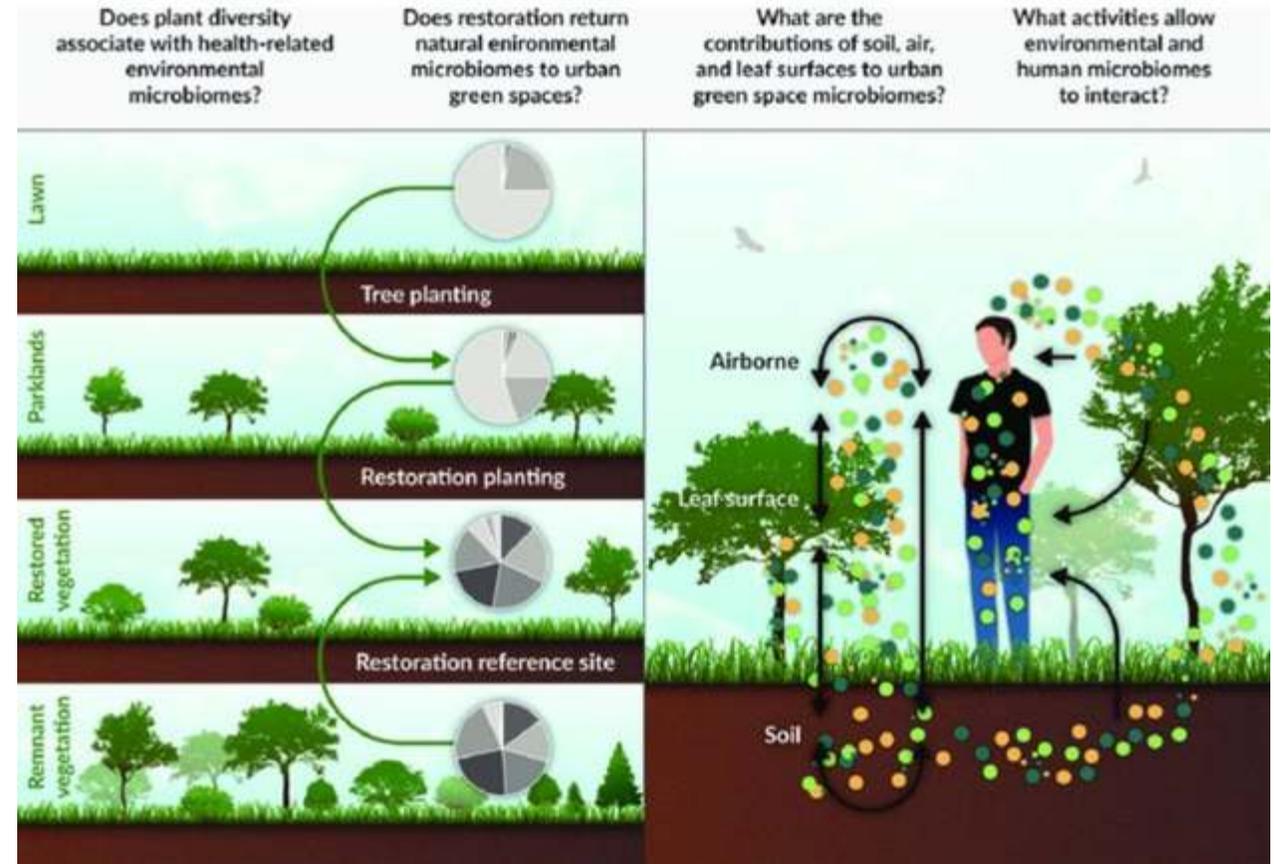


Fig. Some key knowledge gaps of the Microbiome Rewilding Hypothesis



## WOOD-WIDE-WEB

in Douglas-fir forests, Canada.

Rhizopogon: spatial topology of tree–mycorrhizal fungus interaction 30×30m plot containing 67 trees.

DNA markers indicate network of two ectomycorrhizal fungal species, *R. vesiculosus* and *R. vinicolor*.

black dots 338 sample locations

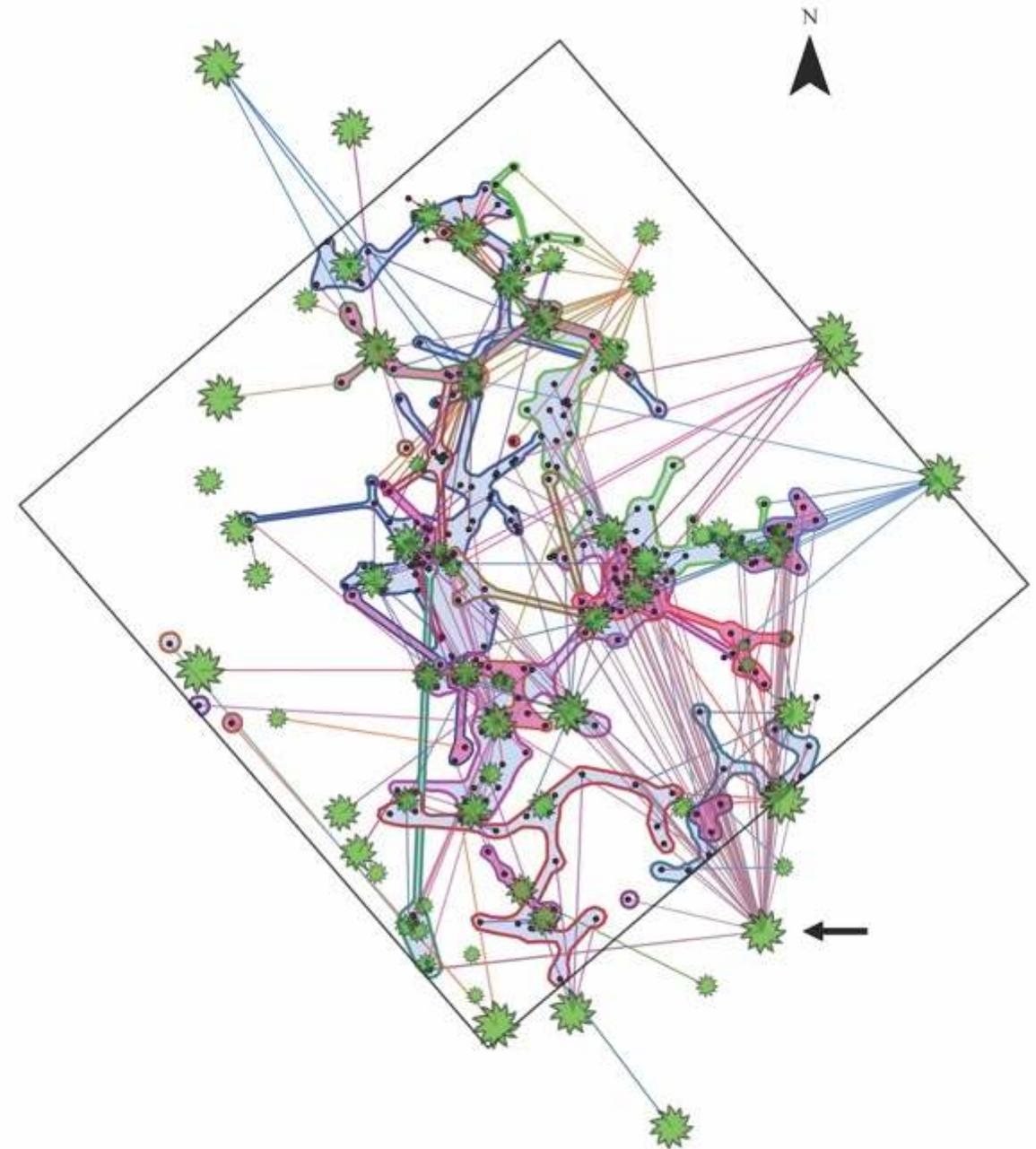
*Rhizopogon vesiculosus* network blue background,

*Rhizopogon vinicolor* network with pink.

Lines illustrate the linkages between tree roots encountered in

*Rhizopogon* ectomycorrhizas

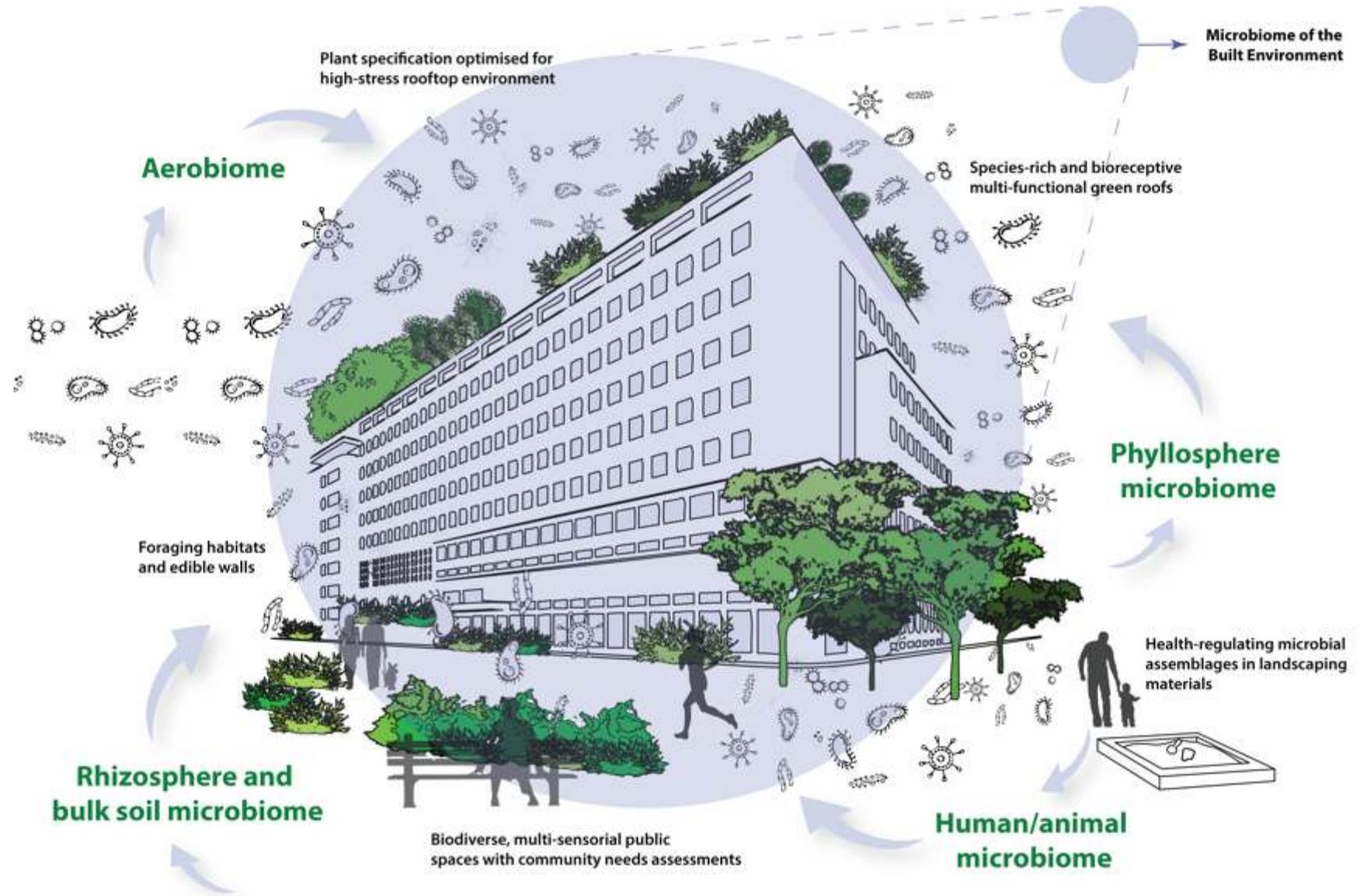
“Mother Tree” with 47 links: by eight *R. vesiculosus* and three *R. vinicolor* networks.



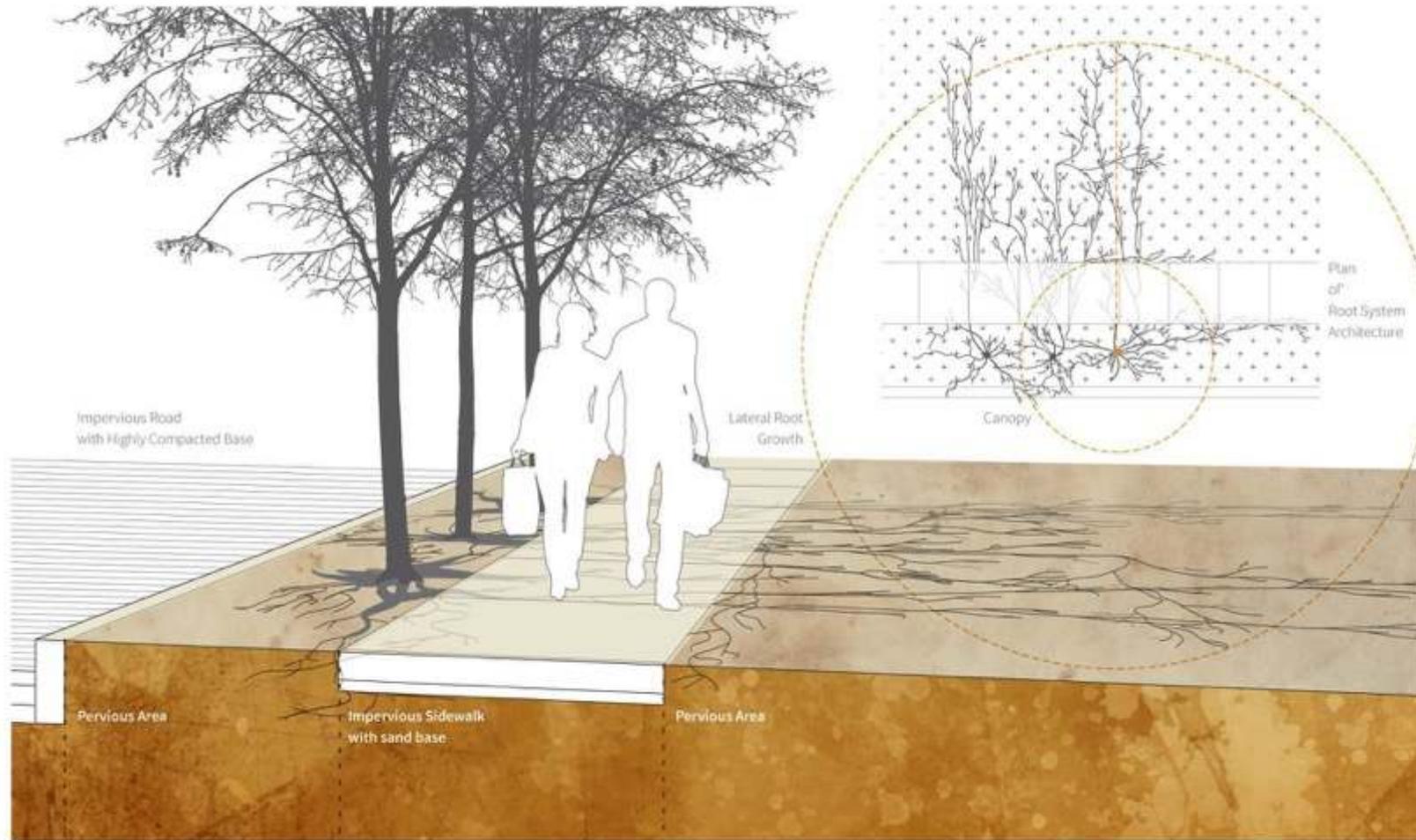
Ref: Beiler, K.J., Simard, S.W. (2015), Topology of tree–mycorrhizal fungus interaction networks in xeric and mesic Douglas-fir forests.

## 2. Environmental Microbiome

Can we design and restore urban ecosystems with explicit considerations for the microbiome to enhance both human health and ecosystem functionality?



## Challenges of a constraint urban site



ADAPTATIONS TO THE URBAN GROUND, ROOTS IN THE DESIGN PROCESS

Gwendolyn McGinn, Thesis Uva, 2015

# Microbiome Rewilding Hypothesis

Urban habitat restoration provides human health benefits through microbiome rewilding.

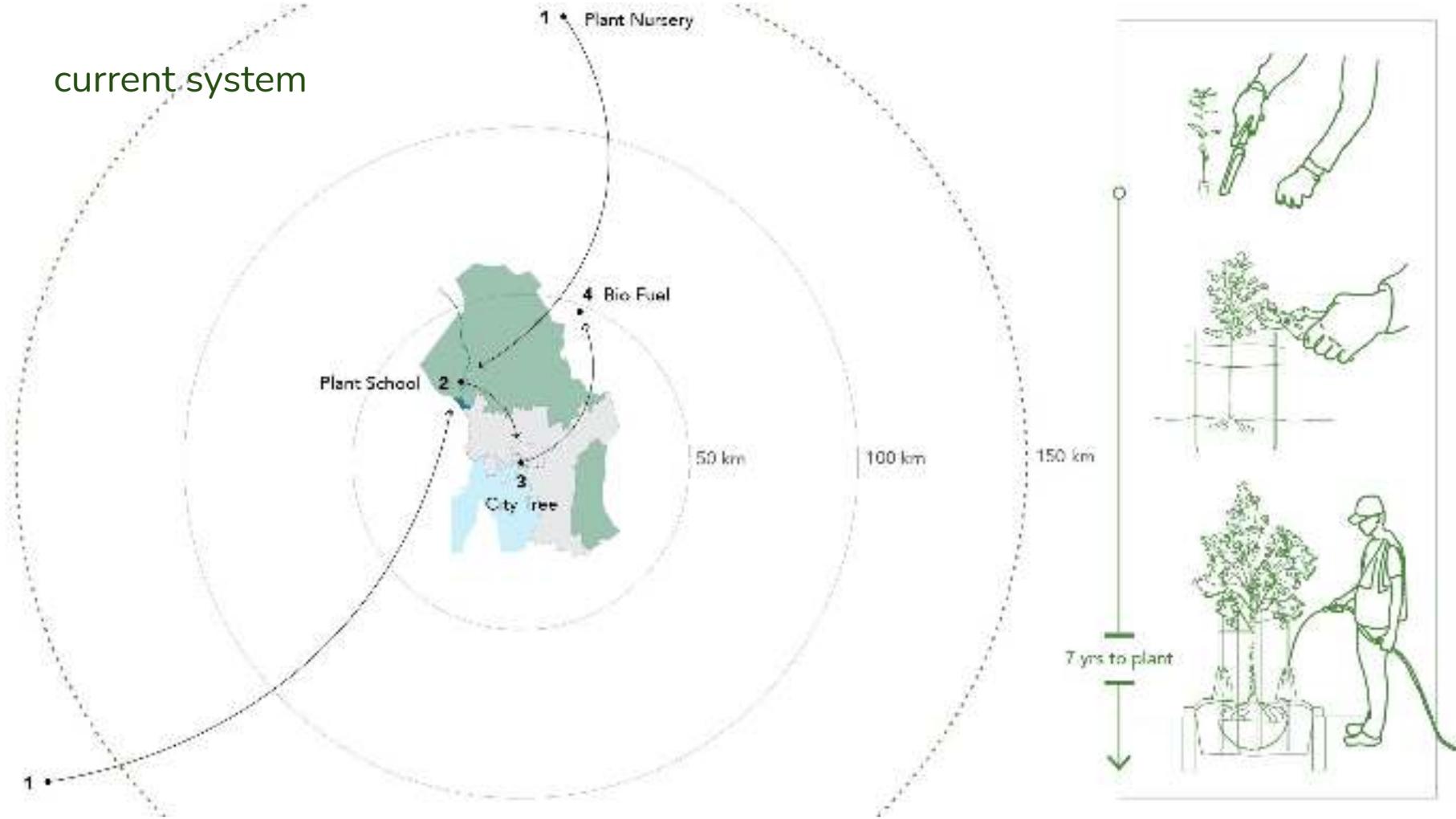


  
Økern Torg Patch



“Skogfleck”, City Studio Oslo, 2020

Domesticated, sterile clones from nurseries



“Skogfleck”, City Studio Oslo, 2020

The urban forest may already be there!?



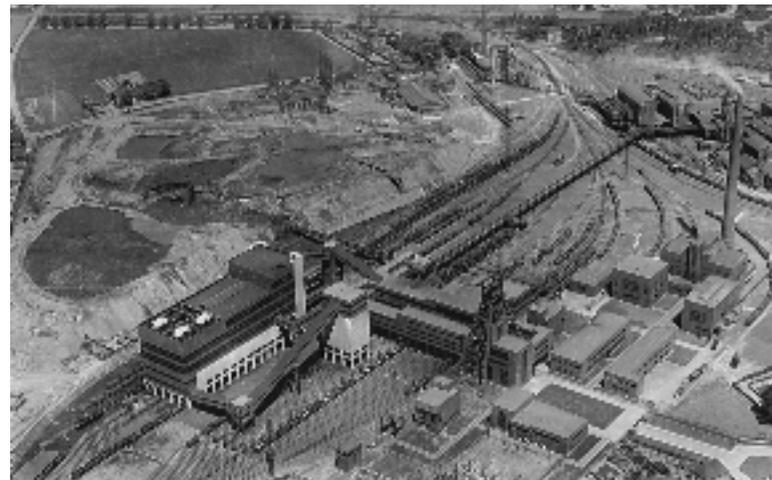
"Skogfleck", City Studio Oslo, 2020

# ZOLLVEREIN PARK

OUTDOOR FACILITIES OF THE UNESCO WORLD HERITAGE SITE OF THE ZOLLVEREIN COAL MINE AND COKING PLANT

Learning how to manage spontaneous urban vegetation to increase its ecological and social values may be a more sustainable strategy than attempting to restore historical ecosystems that flourished before the city existed.

Peter Del Tredici, 2010



The history of Zollverein Park dates back to the 1990's. Before the ending of coal extraction and the termination of coke production, the area around the winding towers and coke batteries was an unappreciated landscape, a forgotten space: a no-man's-land where flora and fauna were rather furtive; humans were to be found rarely, particularly since the former work place got fenced off, immured and secured against intruders: a restricted area in an urban environment.

Under these conditions nature began to grow: birches and shrubs, ferns and moss covered the area with a green-coloured carpet.

Subsequently, the area of the Zollverein colliery and coking plant took a rapid development. In 2001 Zollverein became UNESCO World Heritage, in 2002 a masterplan for the urban development of Zollverein was made by OMA/ Rem Koolhaas which was expanded by another masterplan for the so called "industrial nature" Zollverein by Agence Ter/Henri Bava in 2003. Finally, in 2005 our interdisciplinary team of landscape architects, artists, communication designers

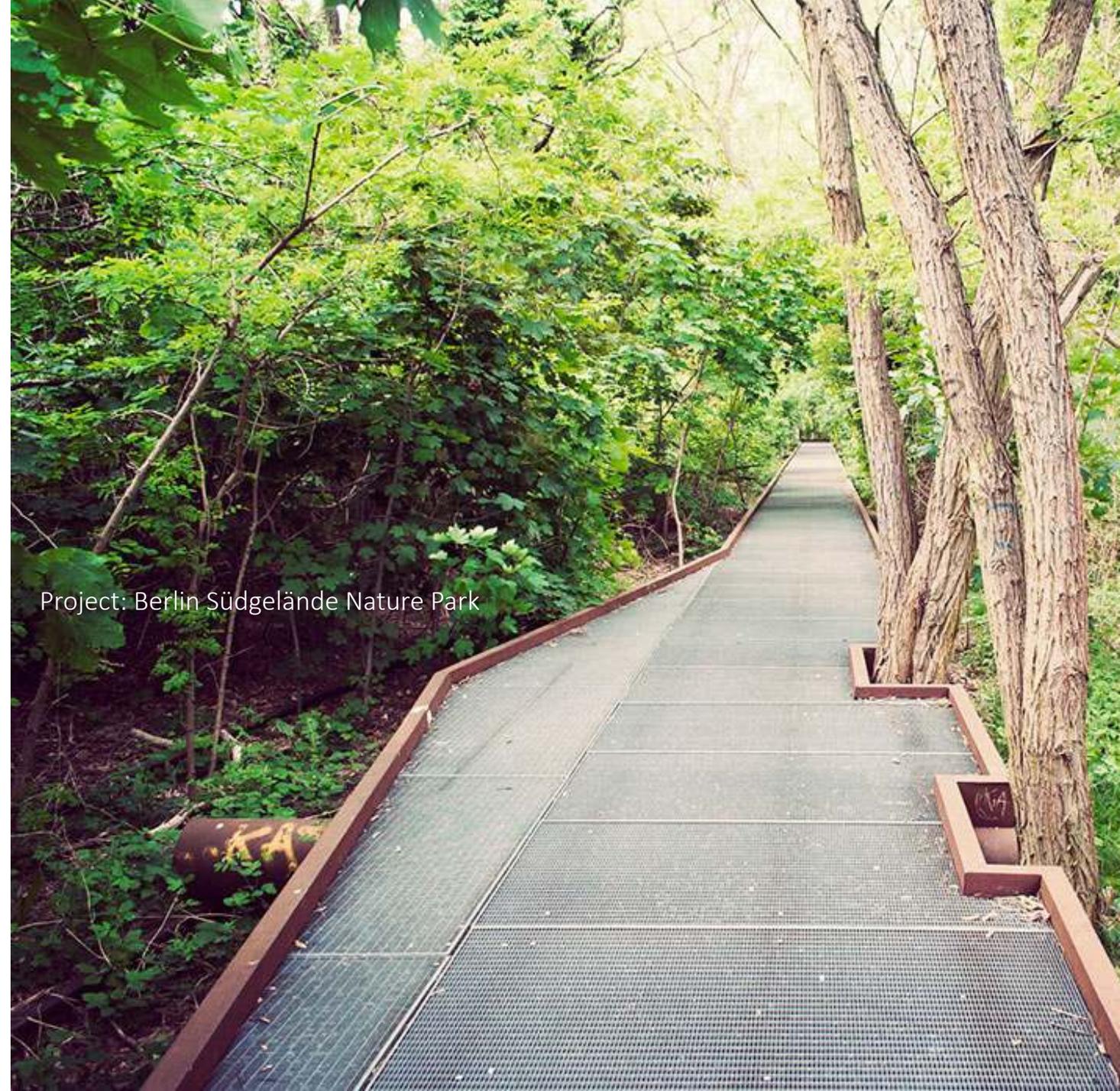


Experience shows that without ongoing management, the default vegetation of the vast majority of urban landscapes is a cosmopolitan assemblage of early-successional, disturbance-tolerant species that are pre-adapted to the conditions of the urban environment.

Peter Del Tredici, 2010

Inner-city areas with relatively old patches of spontaneous vegetation be actively conserved for urban biodiversity.

Ingo Kowarik, 2005



Project: Berlin Südgelände Nature Park

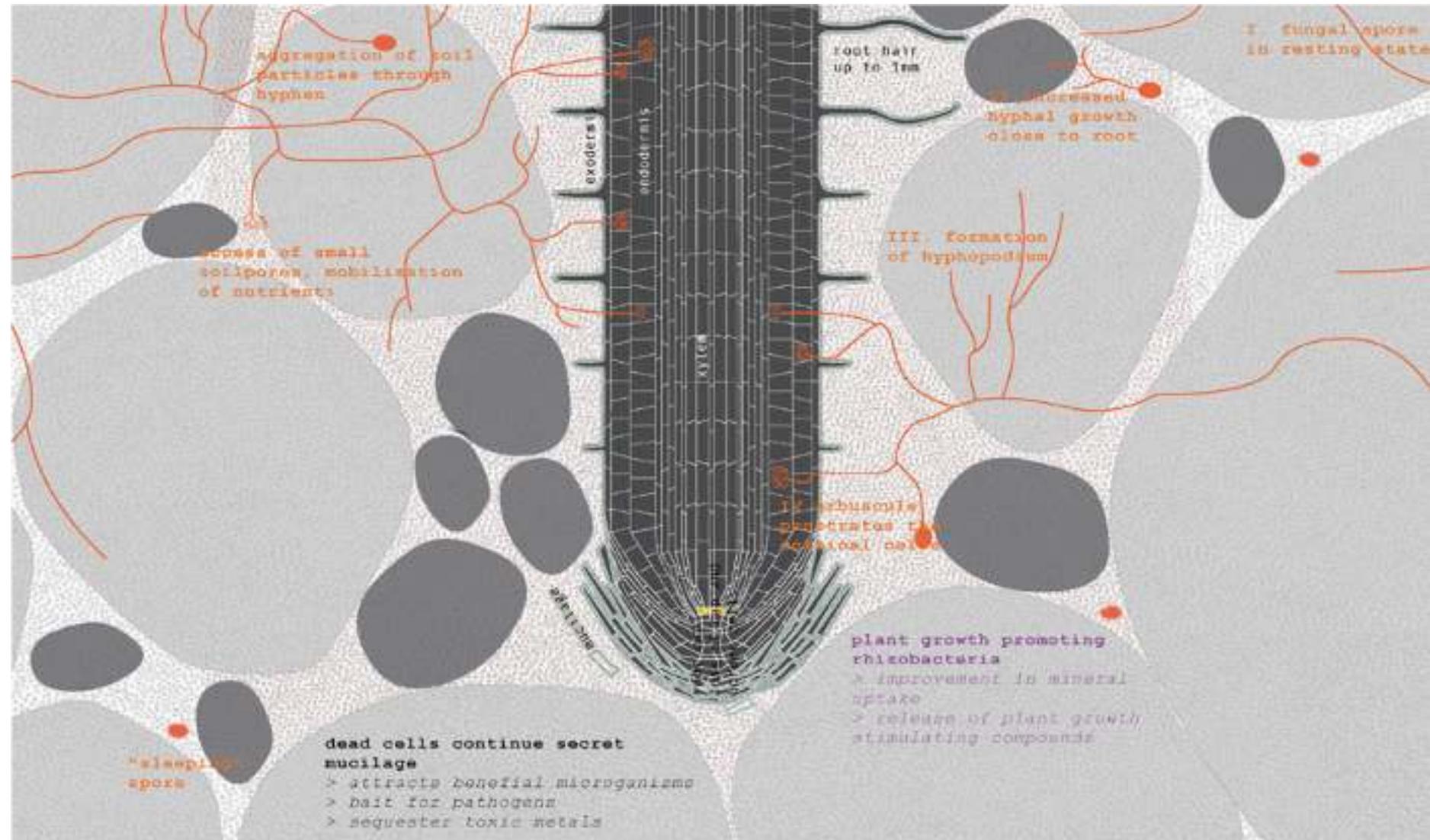
## Activation of soil microbial life in the rhizosphere.

### Rhizodepot Diagram:

Root growth with sugar-rich secretion activates dormant microorganisms.

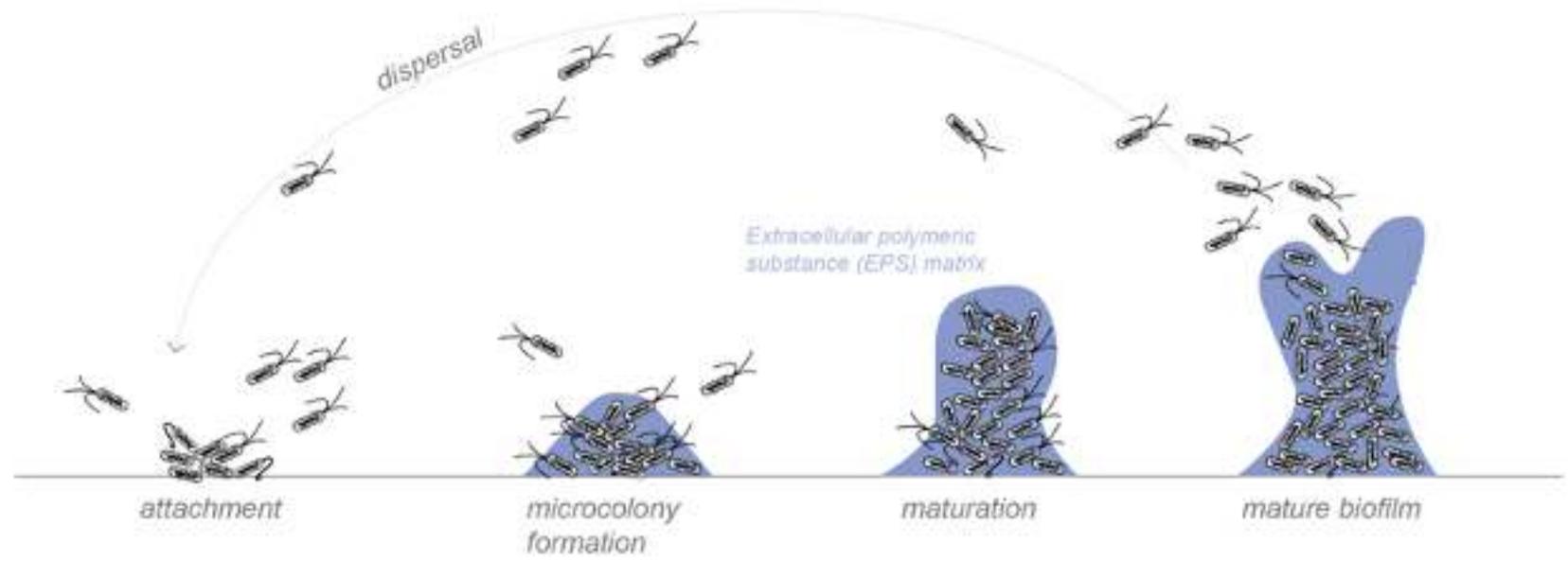
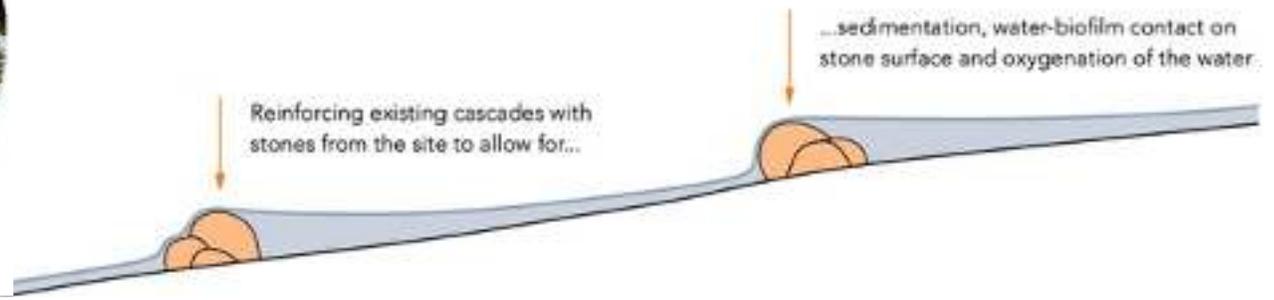
A process serving soil formation, aggregation, nutrition and increases water infiltration, and toxin breakdown.

McNear Jr., D. H. (2013) The Rhizosphere





### Reinforcing existing cascades to promote biofilm growth





Pfeifer's Paper Chromatography Experiment  
Sample: Current Studio Workshop, NMBU 2023



presented based on selected papers (Ford et al., 2019; Ford et al., 2021; Graciano et al., 2020; Kokornaczyk et al., 2017).

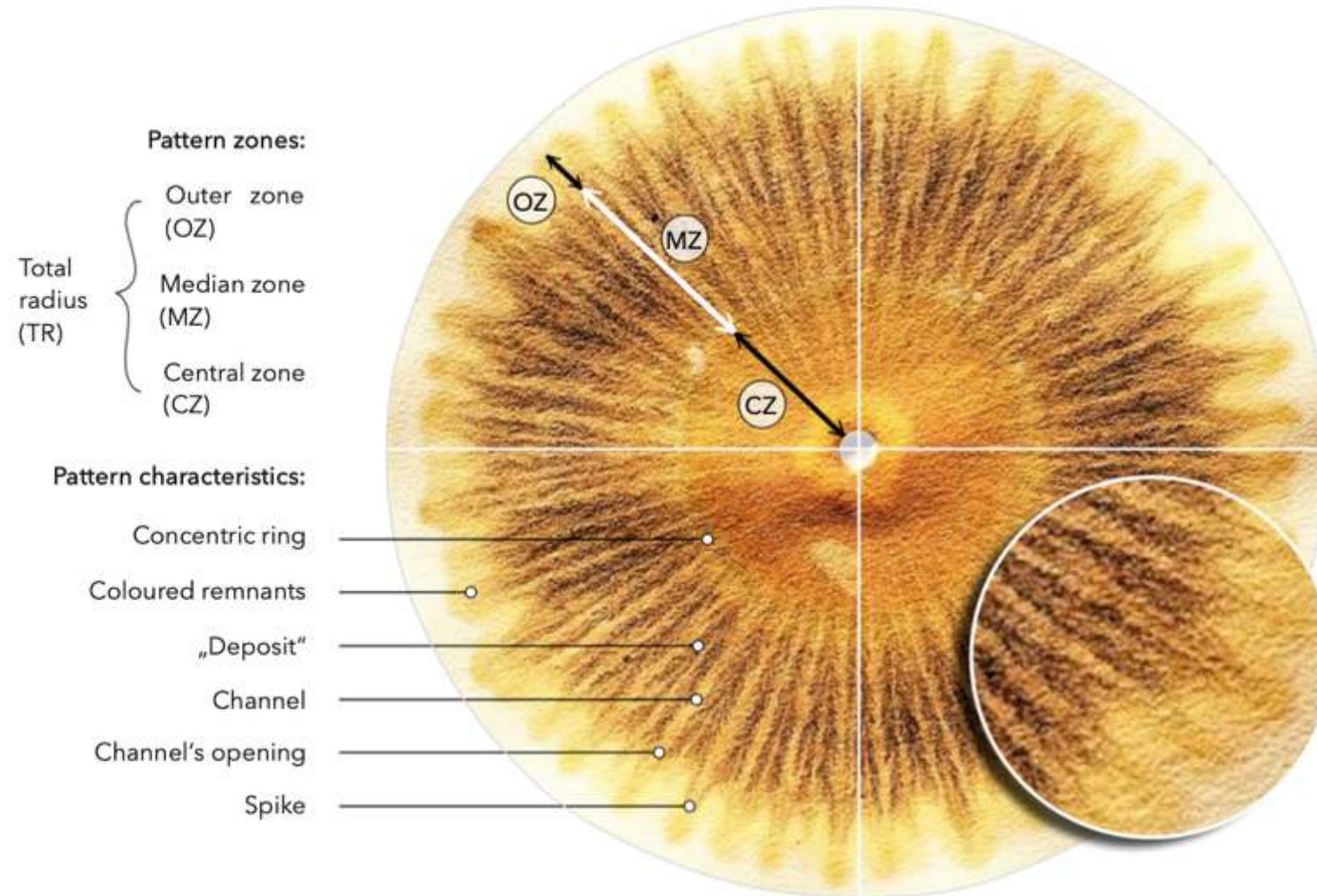


Figure X. Chromatogram features based on Ford et al. (2021) and Kokornaczyk et al. (2017). Graphic: Opitz, 2023. Underlying photo: Bischof Pian, 2017.



Rain Garden mesocosm re-use, NMBU



