Invisible landscapes

Jorg Sieweke
School of Landscape architecture
Associate Professor
Norwegian University of Life Science

SPARE PARTNER

Tekna, Oslo 25.02.26

Norwegian University
of Life Sciences

Invisible landscape - an oxymoron?

Why does Landscape architecture

rarely address microbiology?

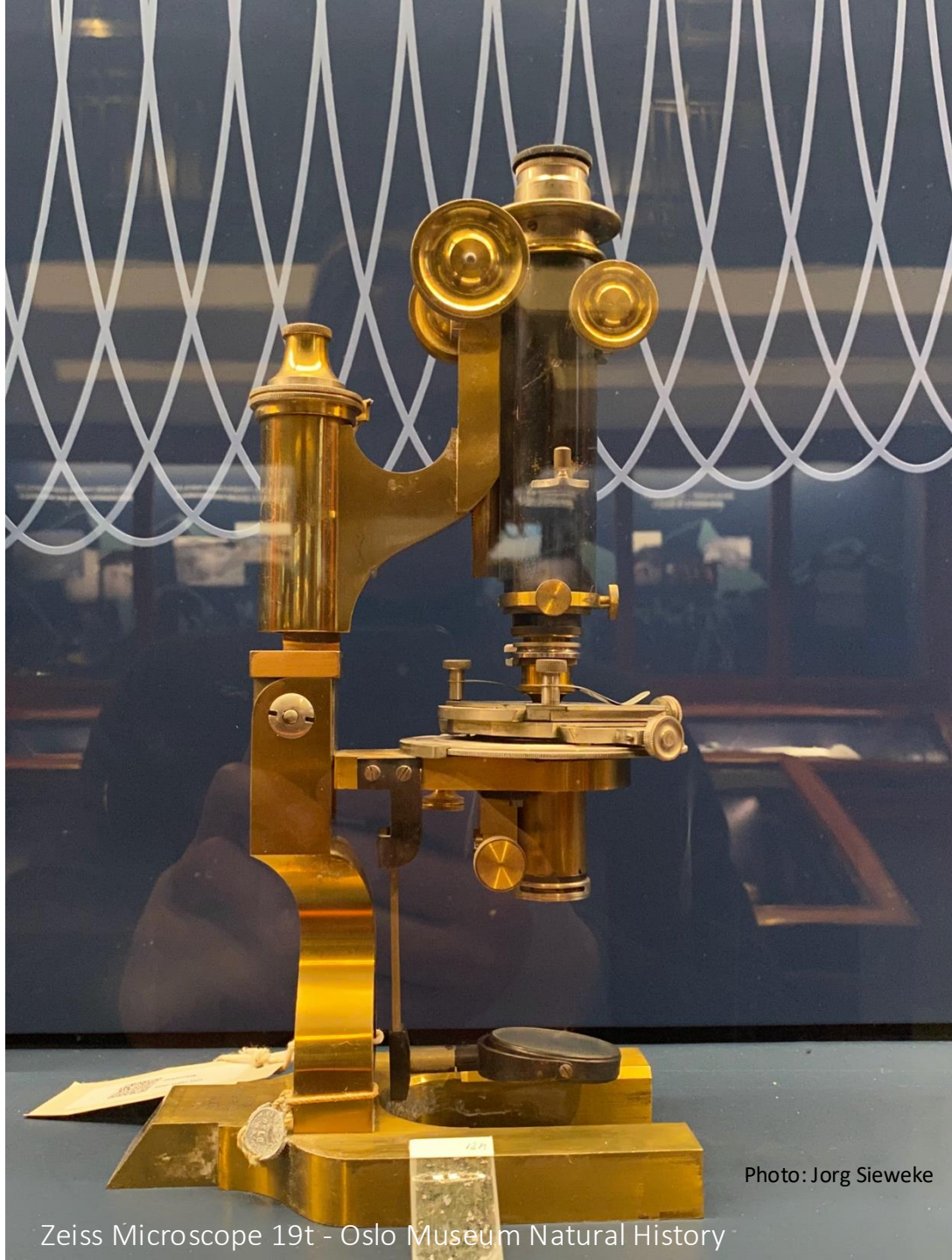


Photo: Jorg Sieweke

Zeiss Microscope 19t - Oslo Museum Natural History

Germ theory

Science photo library Streptococcus bacteria. Computer artwork

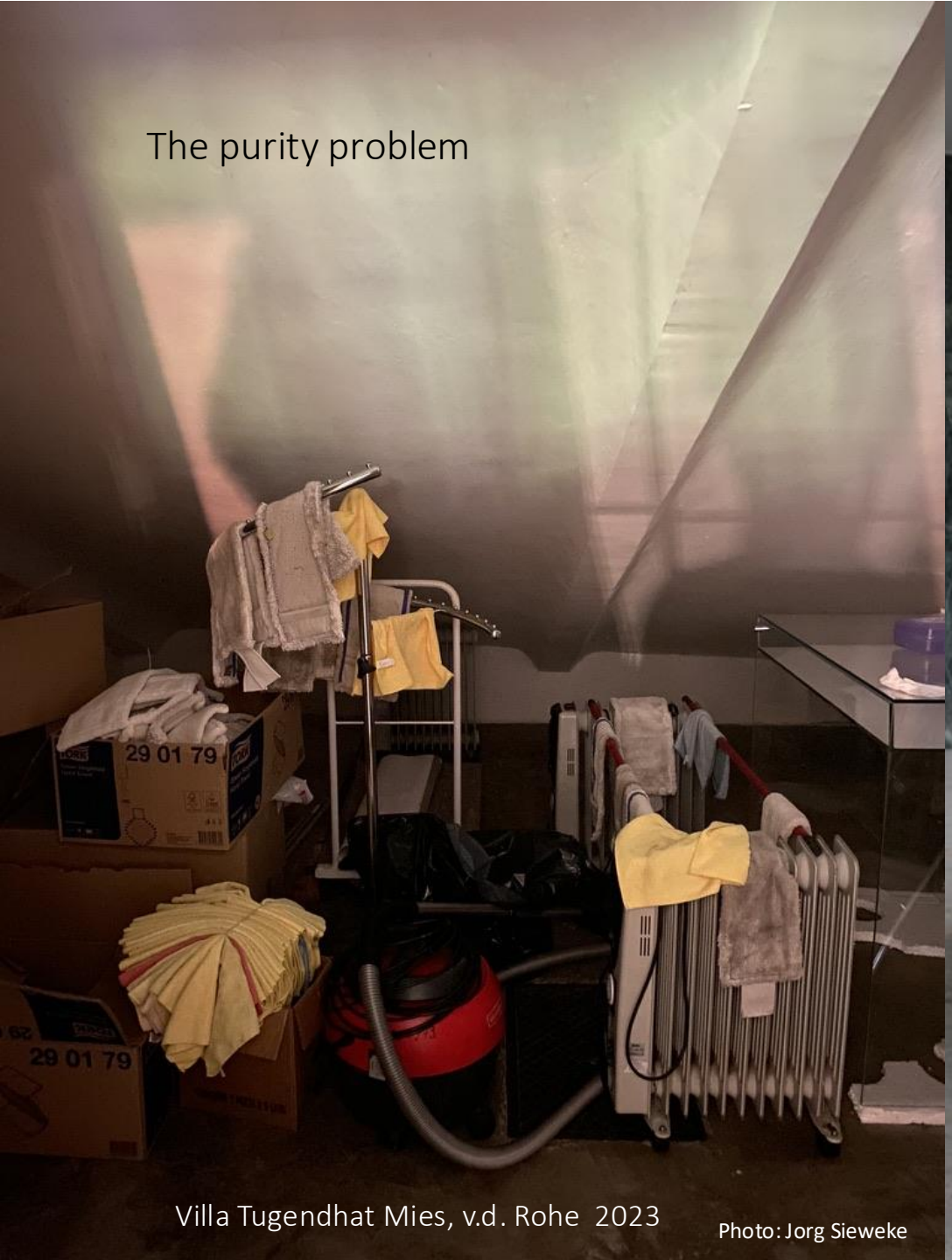
Thomas Murner (1512)

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

Hygiene Hypothesis

Today's over-sanitisation is directly linked to growing rates of health problems Allergies, Asthma, Cancer, etc.

Sick from lack of germs

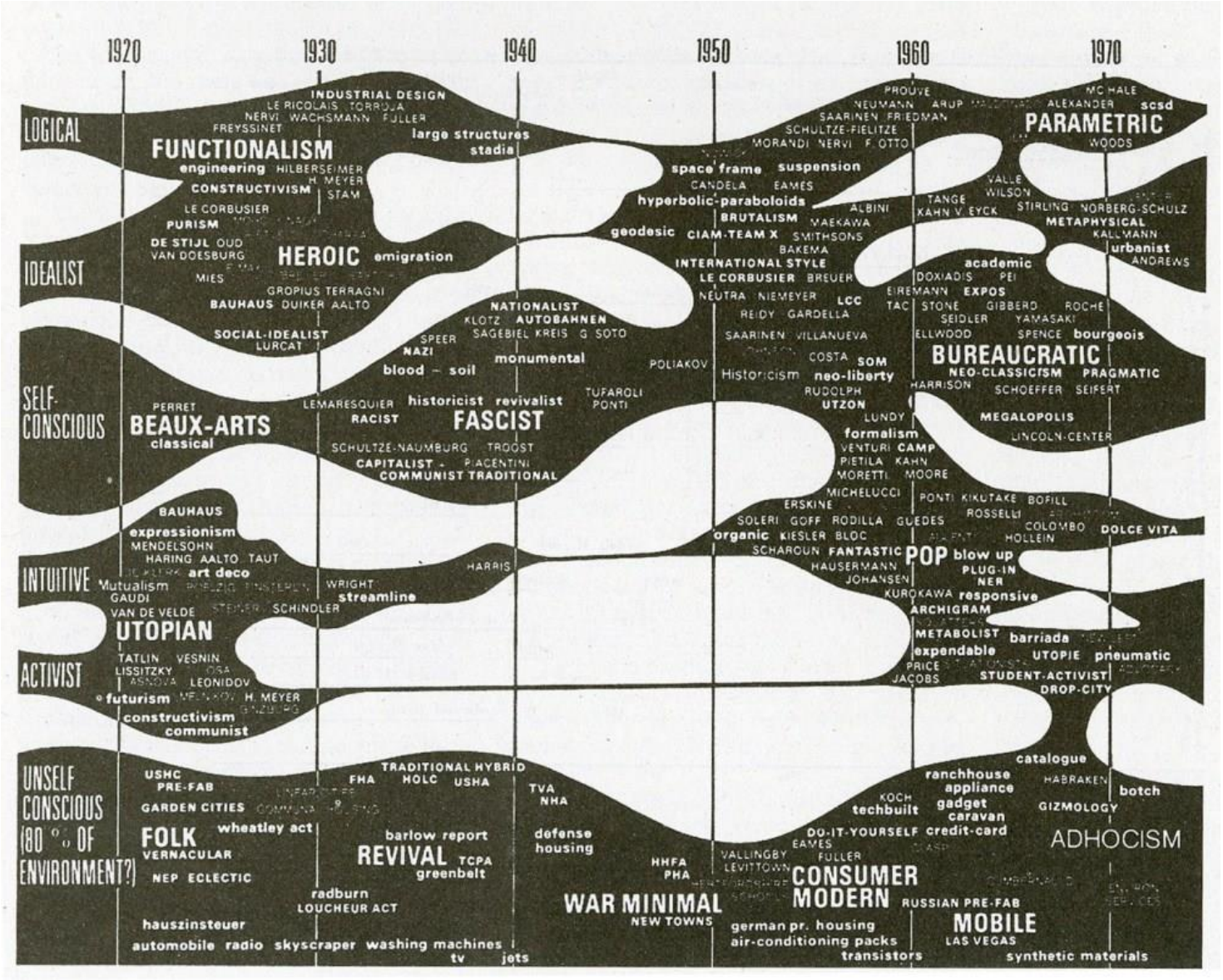

The purity problem
29 01 79
29 01 79
Villa Tugendhat Mies, v.d. Rohe 2023
Photo: Jorg Sieweke


Andre Jacque: Phantom M

Early modern
SANITATION

URBAN HYGIENE

GERM THEORY
ROBERT KOCH 1876



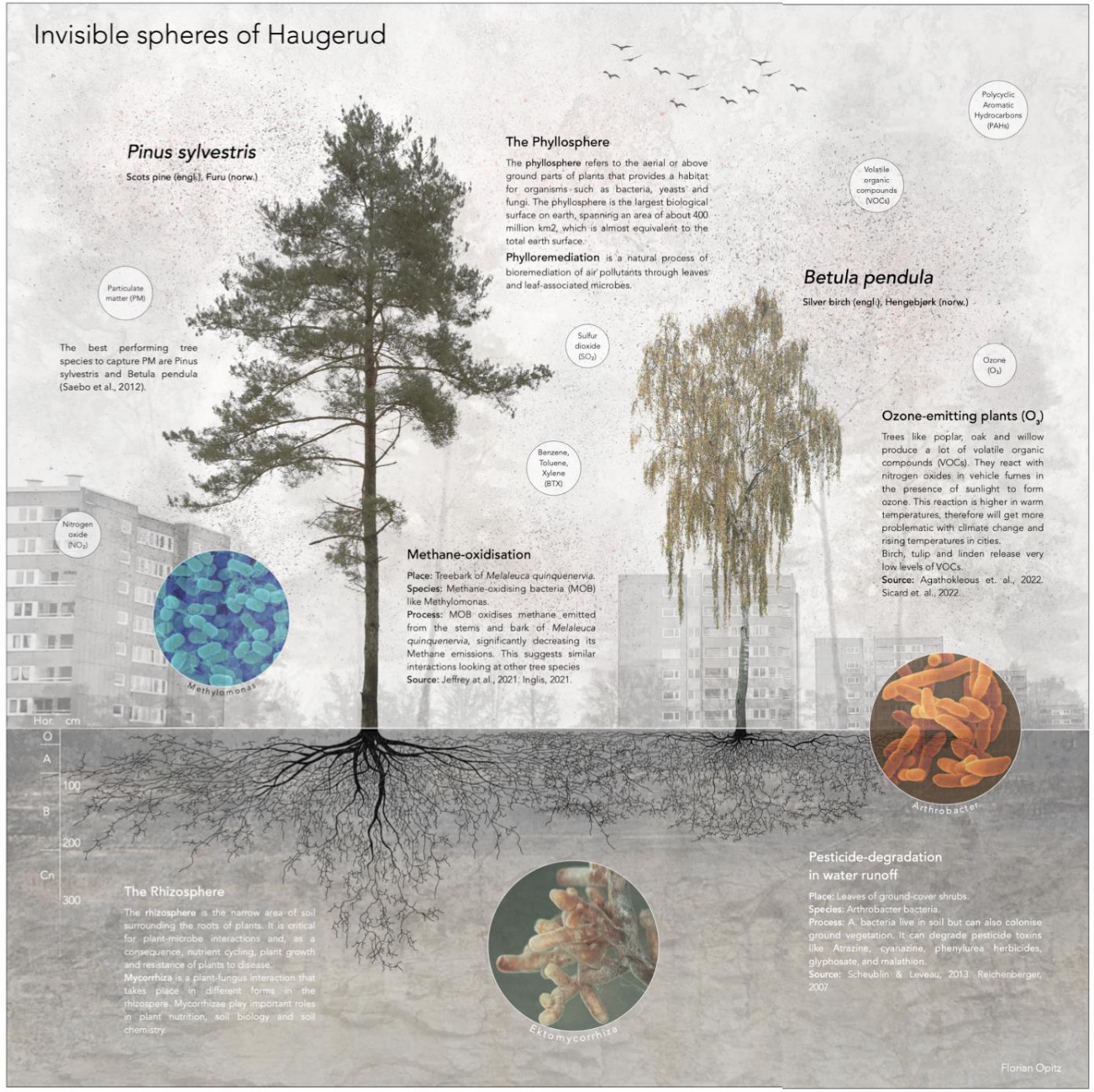
Charles Jencks, “The Evolutionary Tree” from Modern Movements in Architecture, 1973.

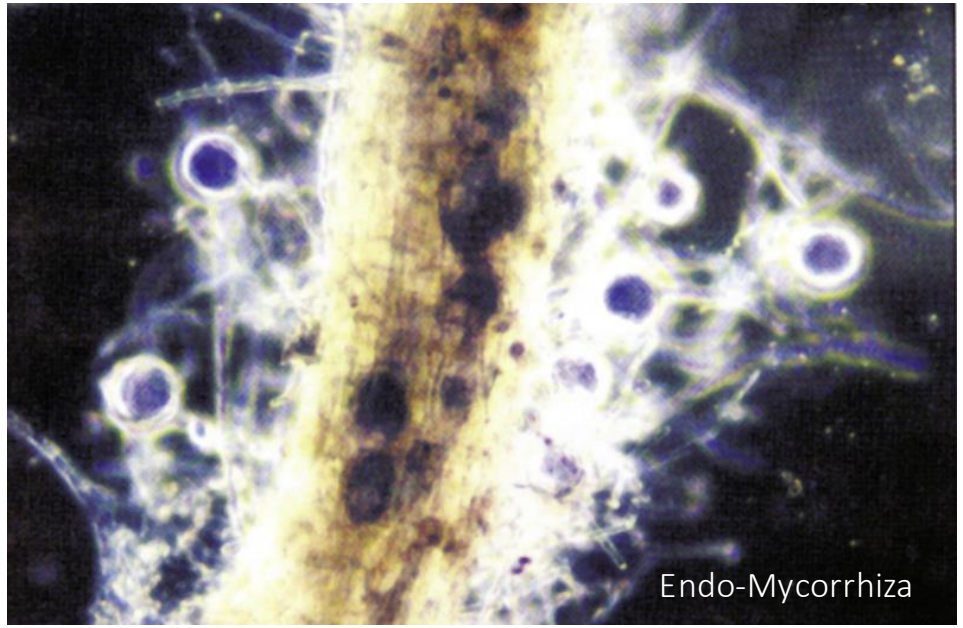
Late modern
OVER-SANITATION

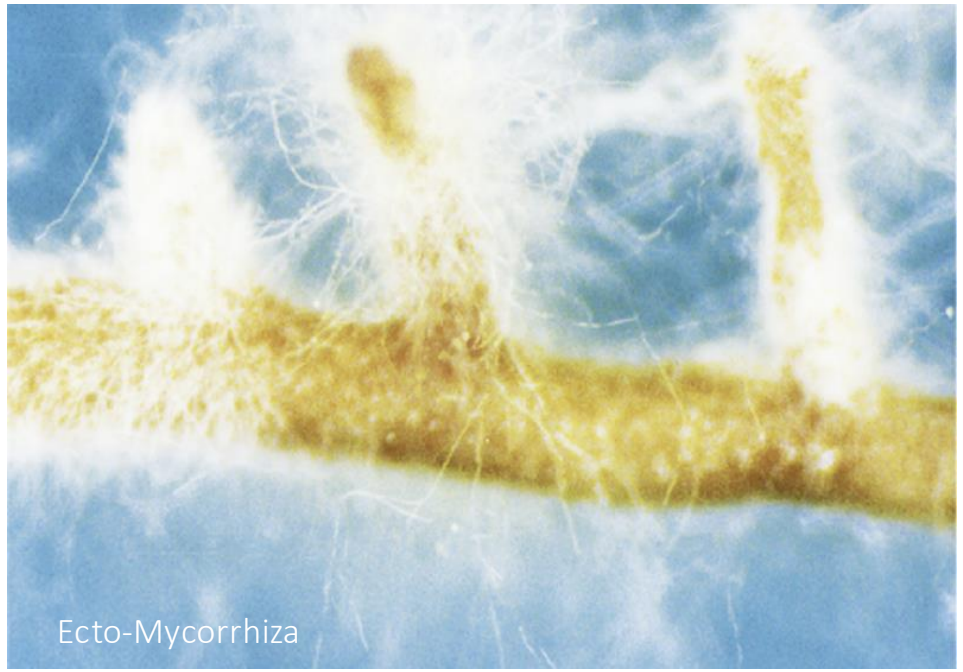
MULTI-RESISTANCY

ALLERGIES
ASTHMA

Rhizosphere and Mycorrhizosphere







WOOD-WIDE-WEB

in Douglas-fir forests, Canada.

In–situ tracing of sugar and water exchange

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.

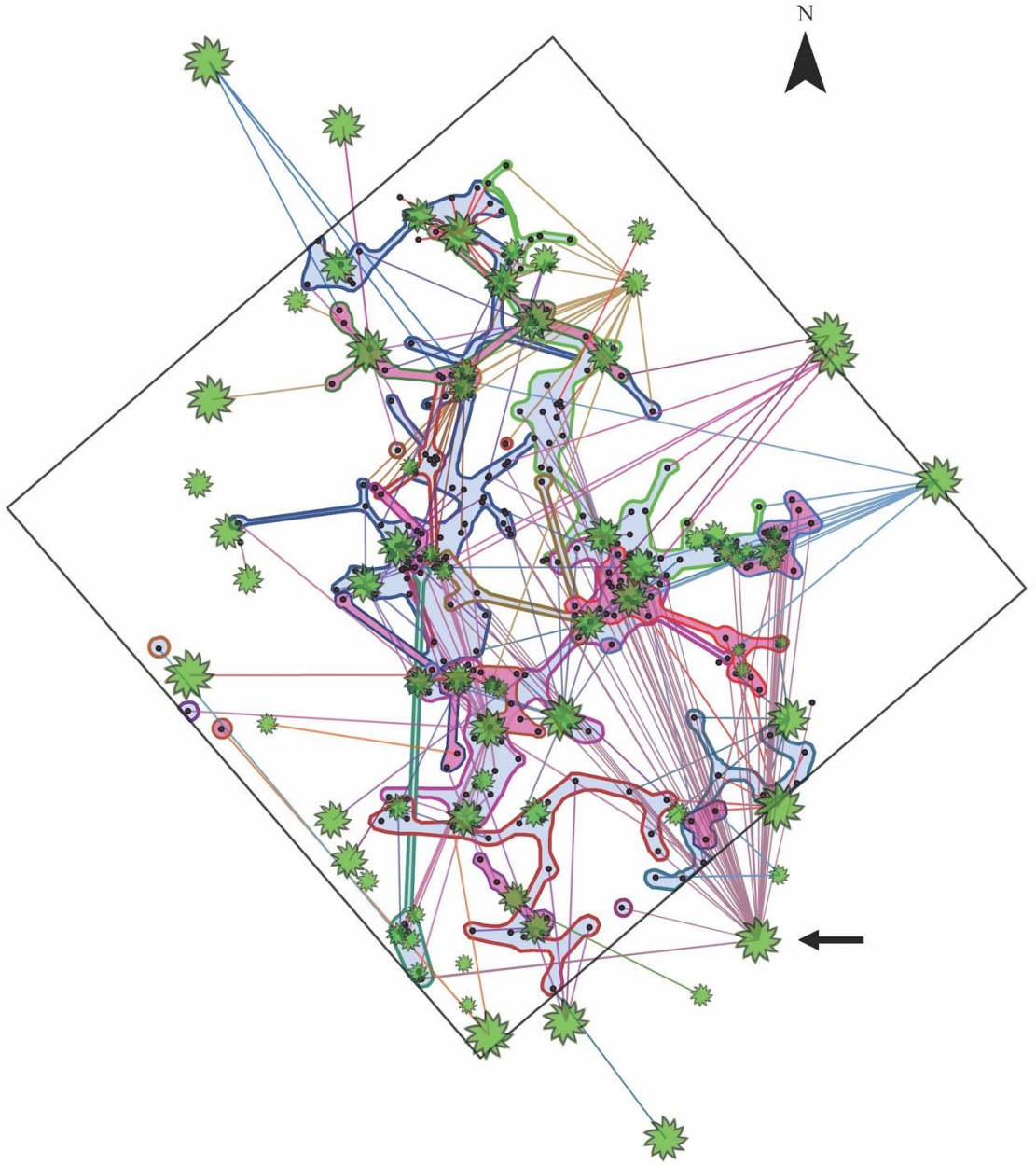
black dots 338 sample locations

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.

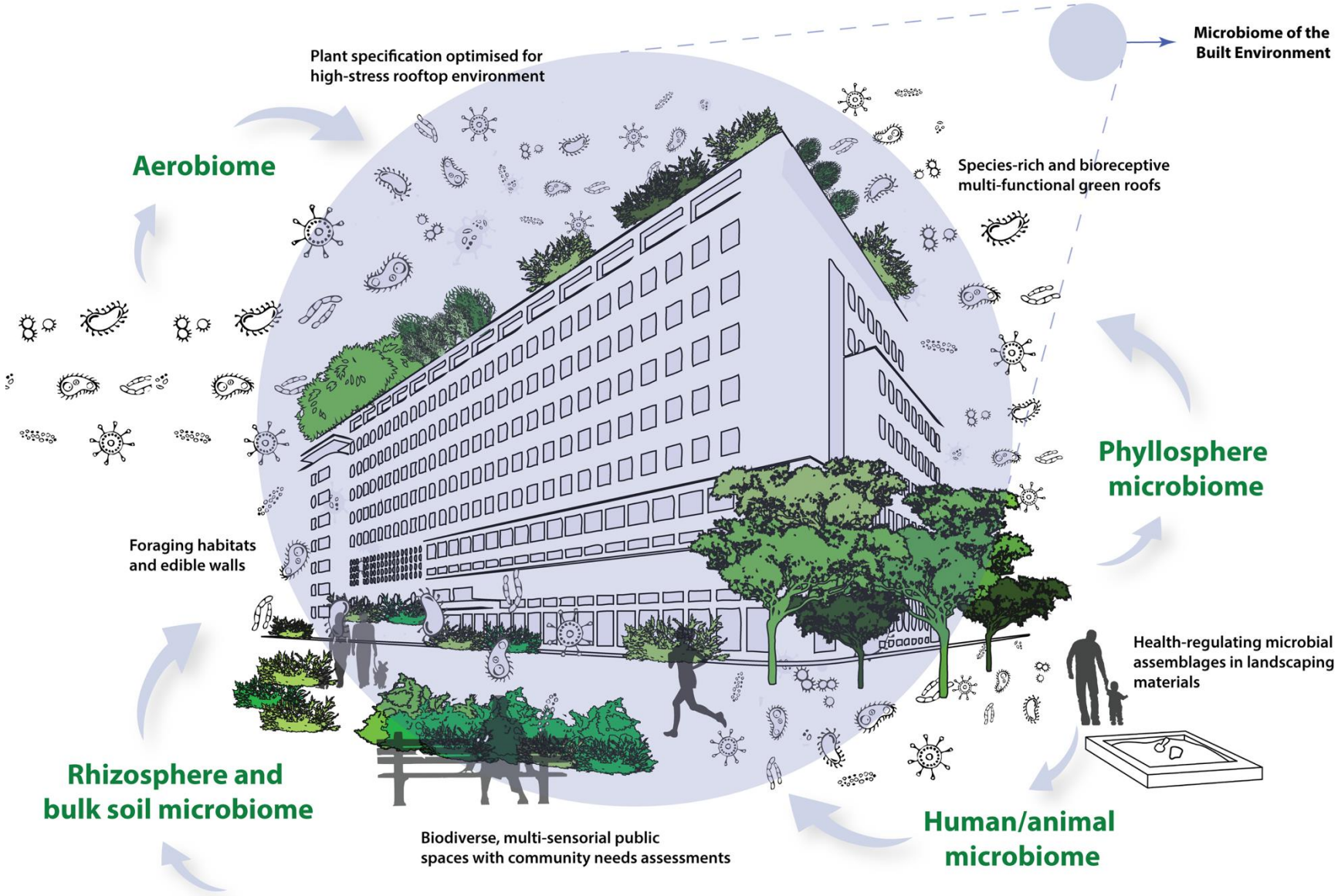


Beiler, K.J., Simard, S.W. (2015),

Topology of tree–mycorrhizal fungus interaction networks in Douglas-fir forests.

2. Environmental Microbiome

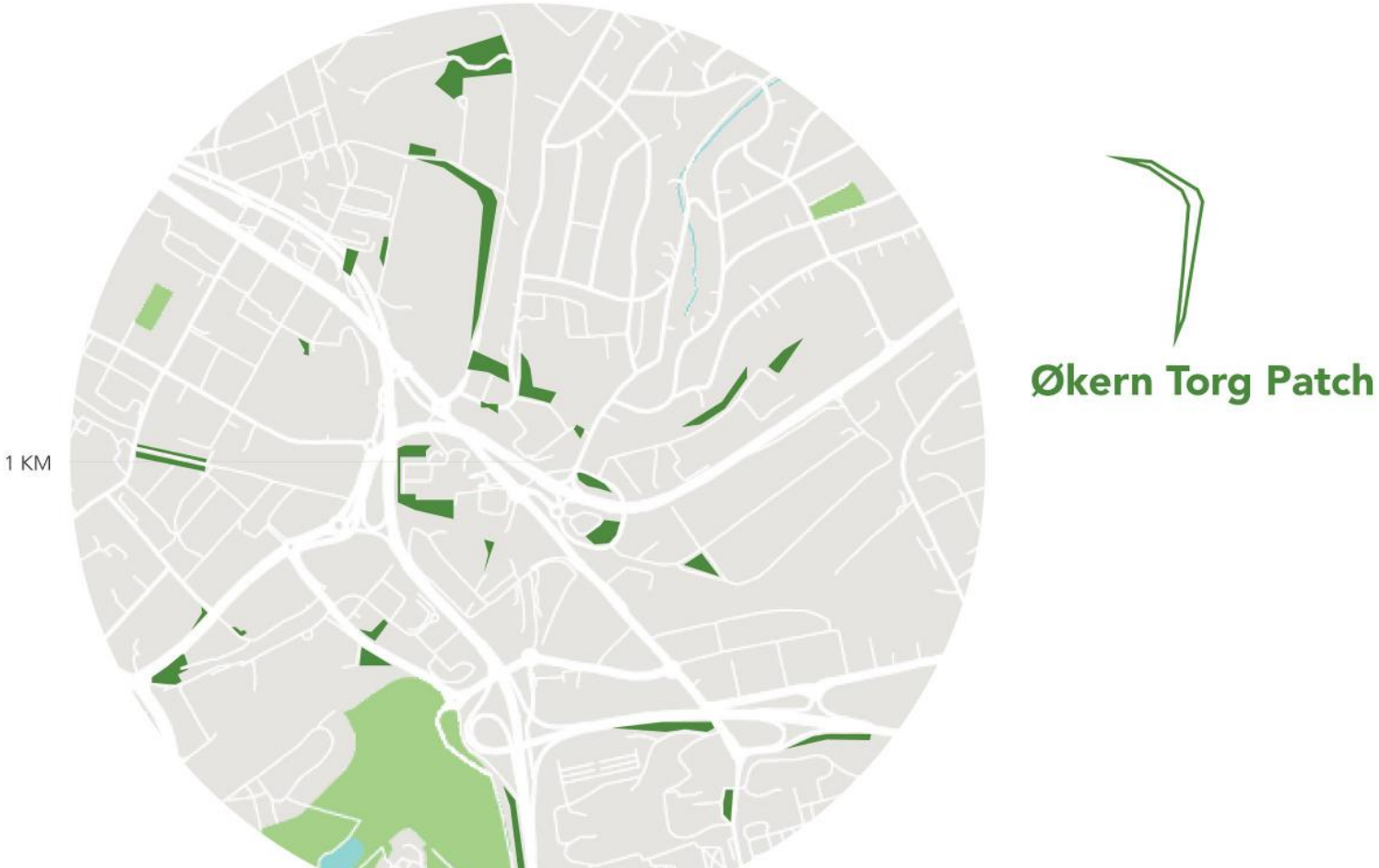
Can we design and restore urban ecosystems with explicit considerations for the microbiome
to enhance both human health and ecosystem functionality?



Microbiome-Inspired Green Infrastructure (MIGI) Jake Robinson, PhD

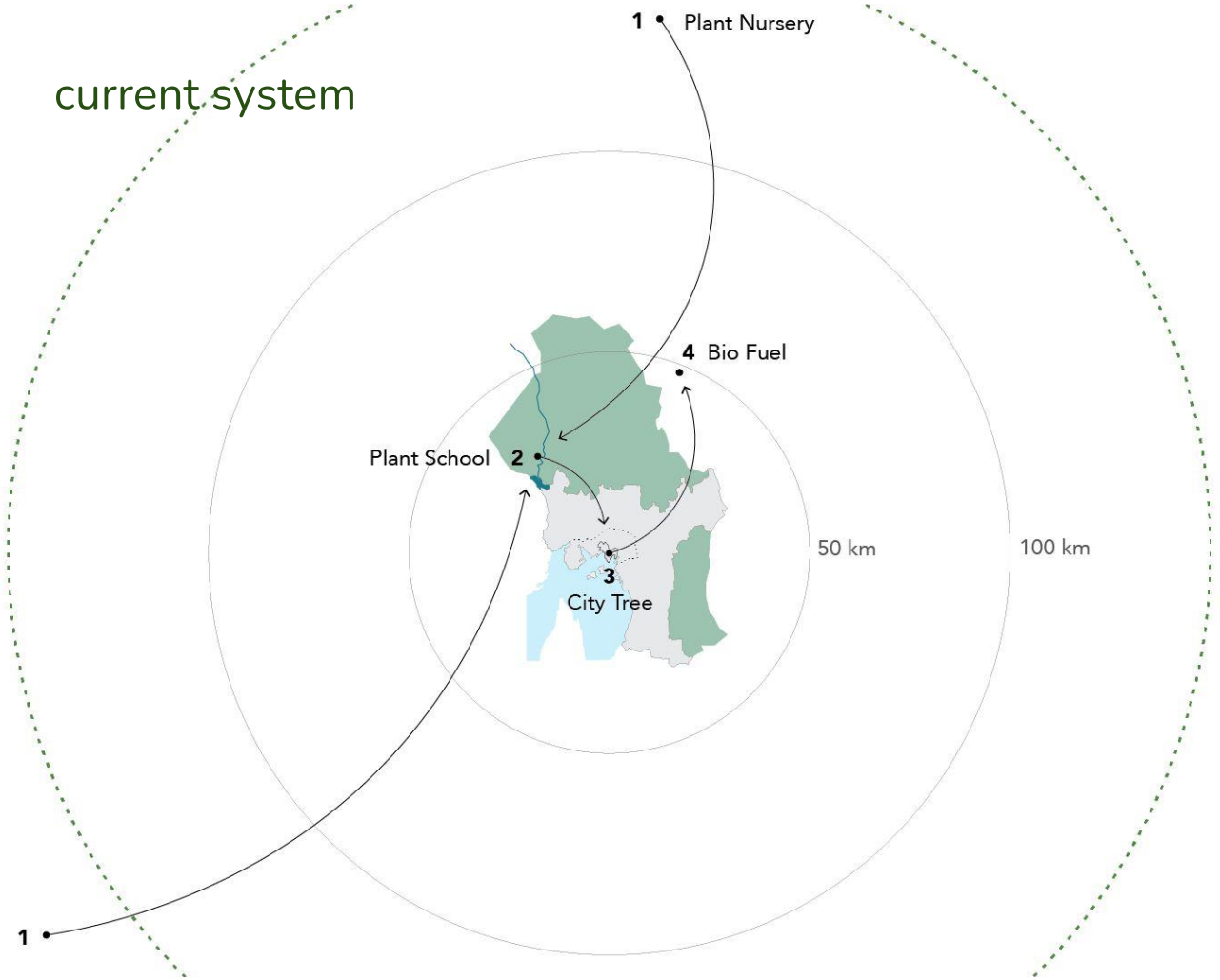
Microbiome Rewilding Hypothesis

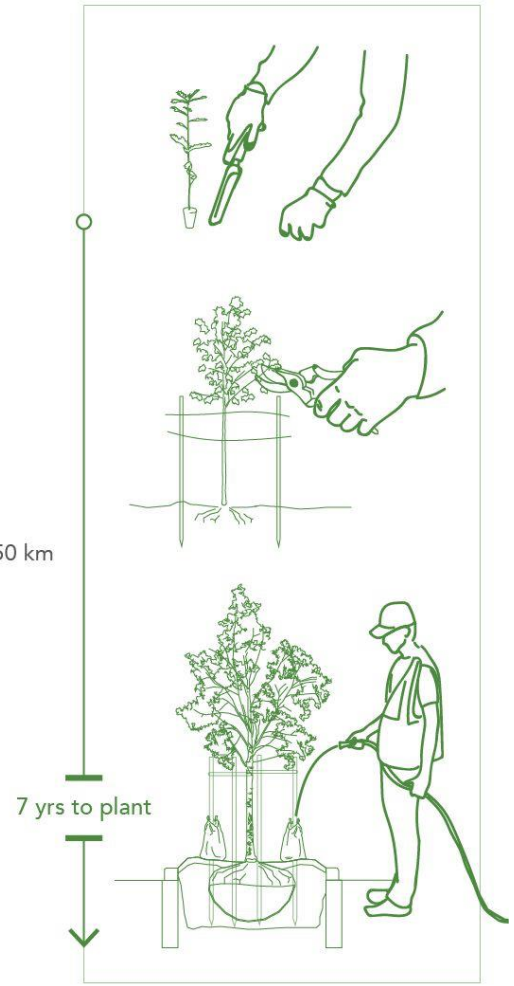
Urban habitat restoration provides human health benefits through microbiome rewilding.



“Skogflekk”, City Studio Oslo, 2020

Domesticated, sterile clones from nurseries





“Skogflekk”, City Studio Oslo, 2020

Experience shows that without on-going 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.

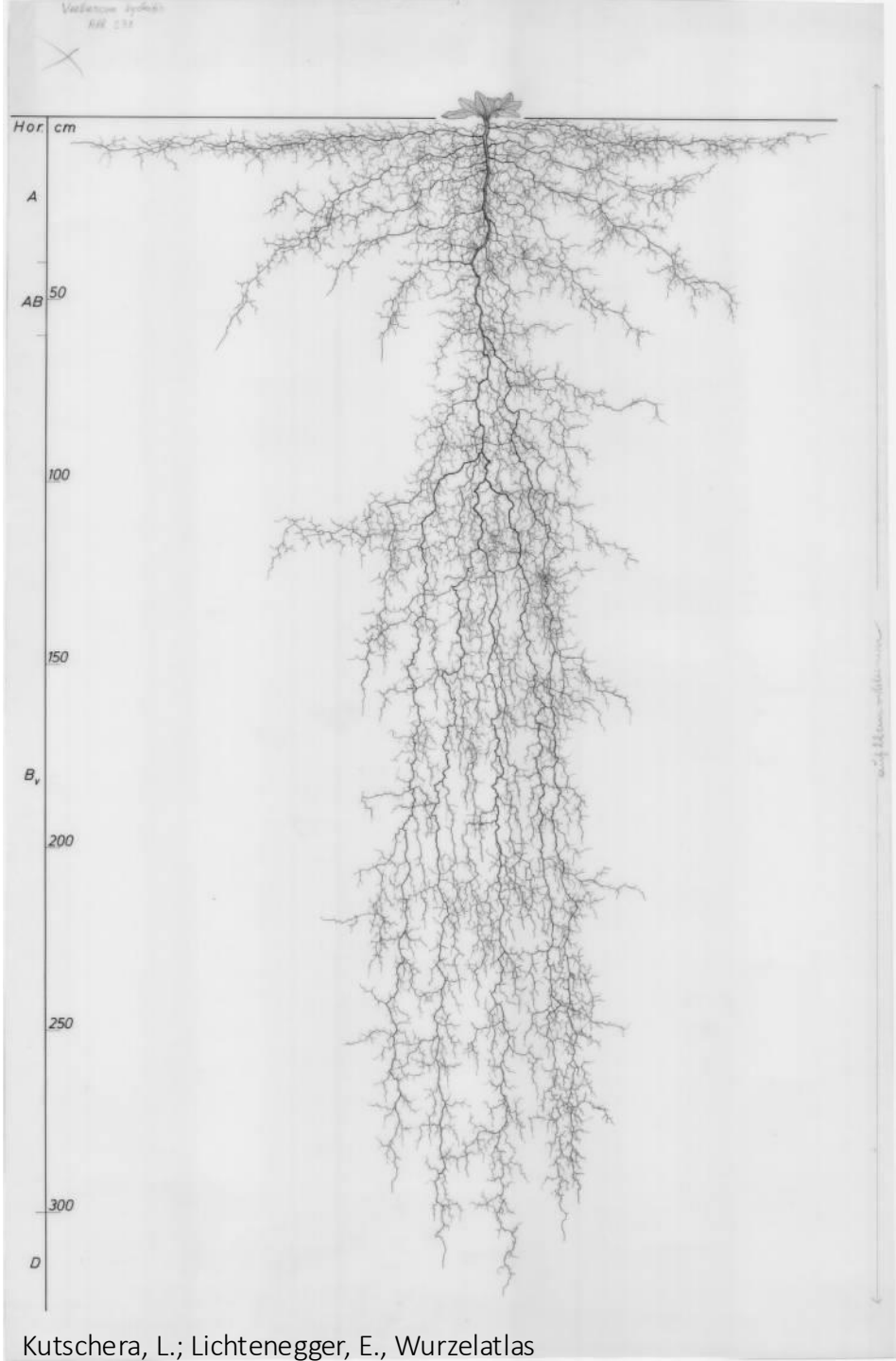
Peter Del Tredici, 2010

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

Ingo Kowarik, 2005

Verbascum
Proved to remediate
PAH from Tar Oil

Dezember, 2024



Kutschera, L.; Lichtenegger, E., Wurzelatlas

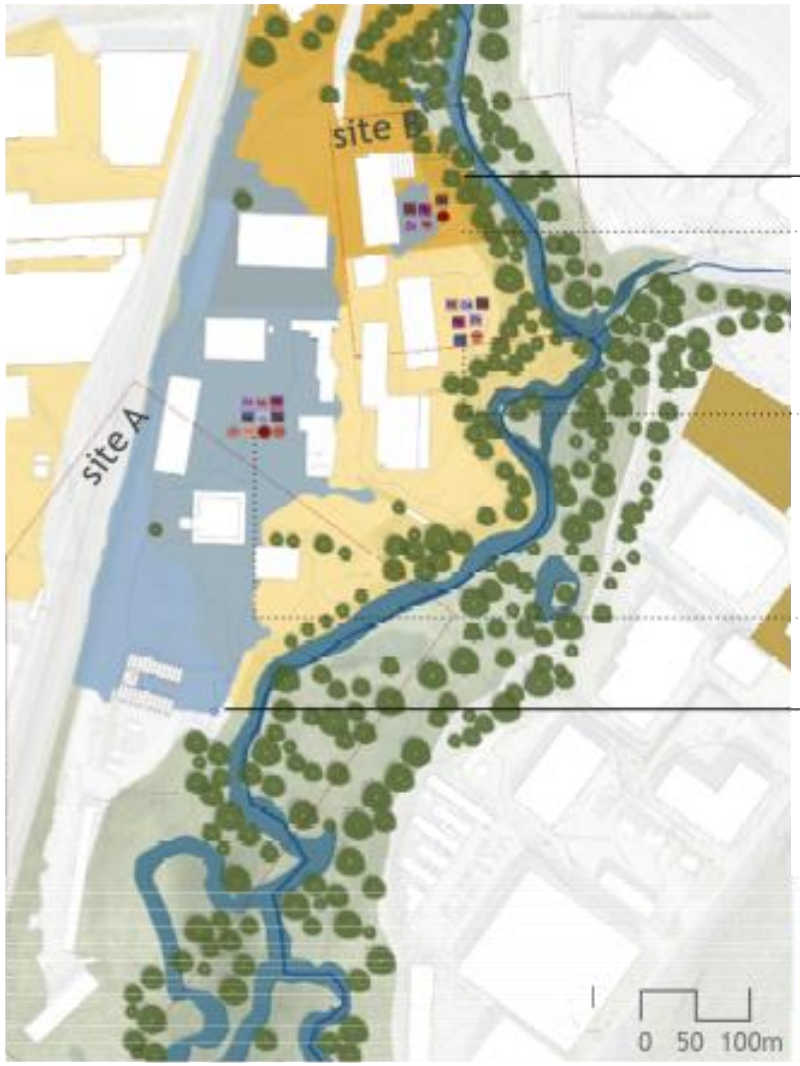
FIG.01: PROJECT SITE

City's development plan

FIG.07: DEVELOPMENT PLAN BREIVOLL (OSLO KOMMUNE, 2016)

FIG.08: PRINCIPLE DRAWINGS OF DEVELOPMENT PLAN (OSLO KOMMUNE, 2016)

Selection of detail sites



site B

point B
upstream area 667 m²
rain 40mm: runoff 27 m²

Cu Zn Pb Ni ALC

Cu Zn Pb Ni Cd Cr3 PAH

Cu Zn Pb Ni As Hg ALC PAH POP VOC

site A

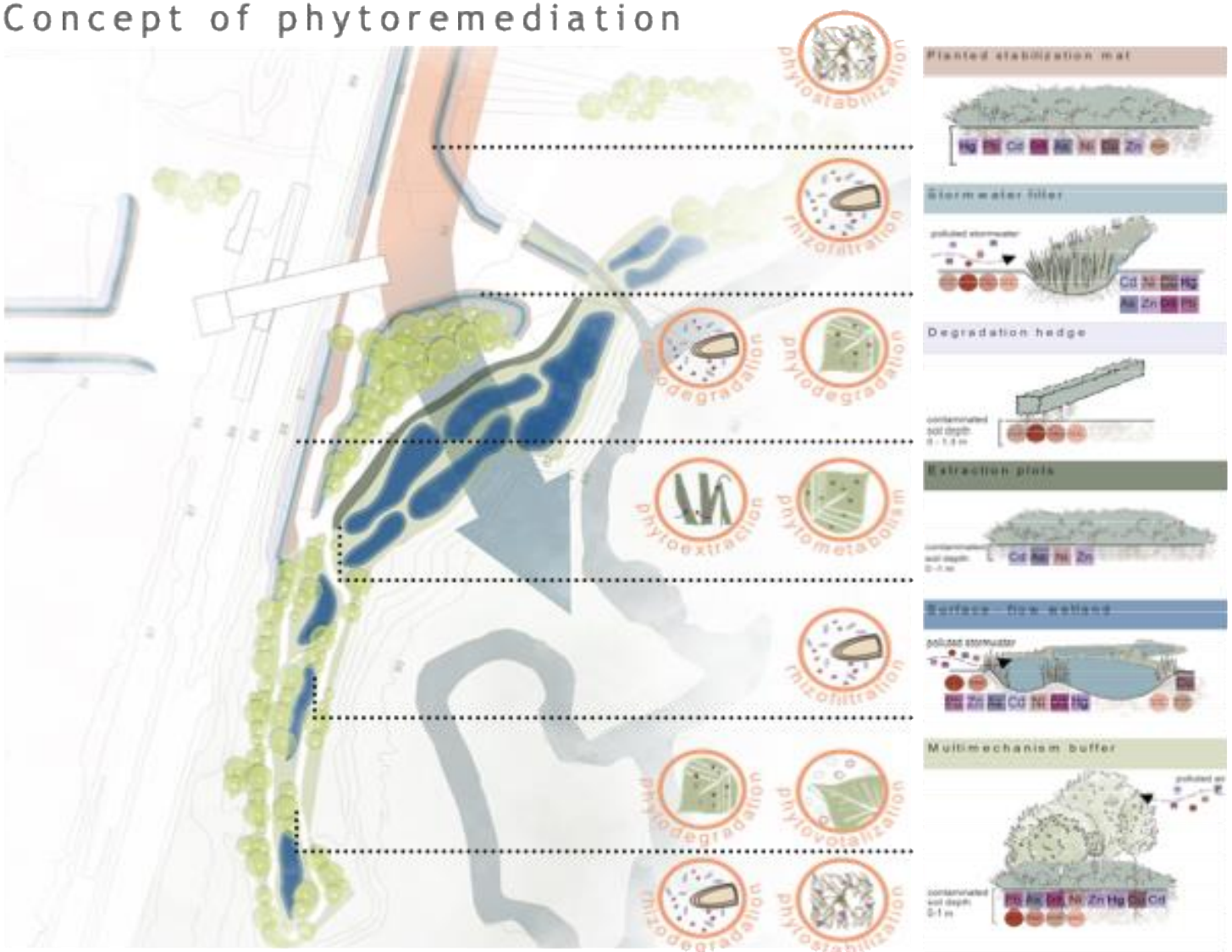
point A
upstream area 20.500 m²
rain 40mm: runoff 793 m²

few information on soil contamination
moderate soil contamination
severe soil contamination
stormwater catchment areas

anorganic pollutant
organic pollutant

FIG.09: ANALYSIS OF CONTAMINATED GROUND AND FLOOD PATHS

Concept of phytoremediation



- anorganic pollutant
- organic pollutant

- Festuca arundinacea
- Trifolium repens

- Festuca arundinacea
- Panicum virgatum
- Trifolium fragiferum
- Eleocharis acicularis

- Salix exguia

- Achillea millefolium
- Agrostis tenuis
- Festuca rubra 'Merlin'
- Marrubium vulgare
- Silene paradoxa
- Silybum marianum
- Sinapis arvensis

- Deschampsia cespitosa
- Festuca arundinacea
- Phragmites australis

- Celtis occidentalis
- Salix viminalis
- Pinus taeda
- Betula pendula

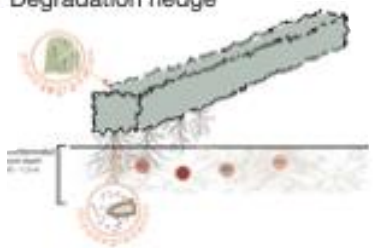
- Festuca arundinacea
- Lolium perenne

FIG.16: CONCEPT OF PHYTOREMEDIATION

Detail site A - phase 01

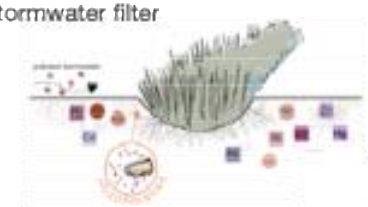
Planted Stabilization Mat

Degradation hedge



Extraction plots

Stormwater filter



Multimechanism buffer

Surface-flow wetland

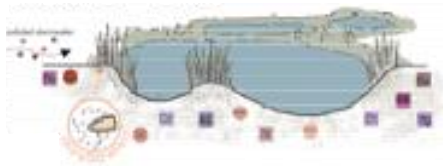


FIG.19: SITEPLAN A PHASE 01

Detail site A - phase 02

FIG.20: SITEPLAN A PHASE 02

Detail site A - phase 03

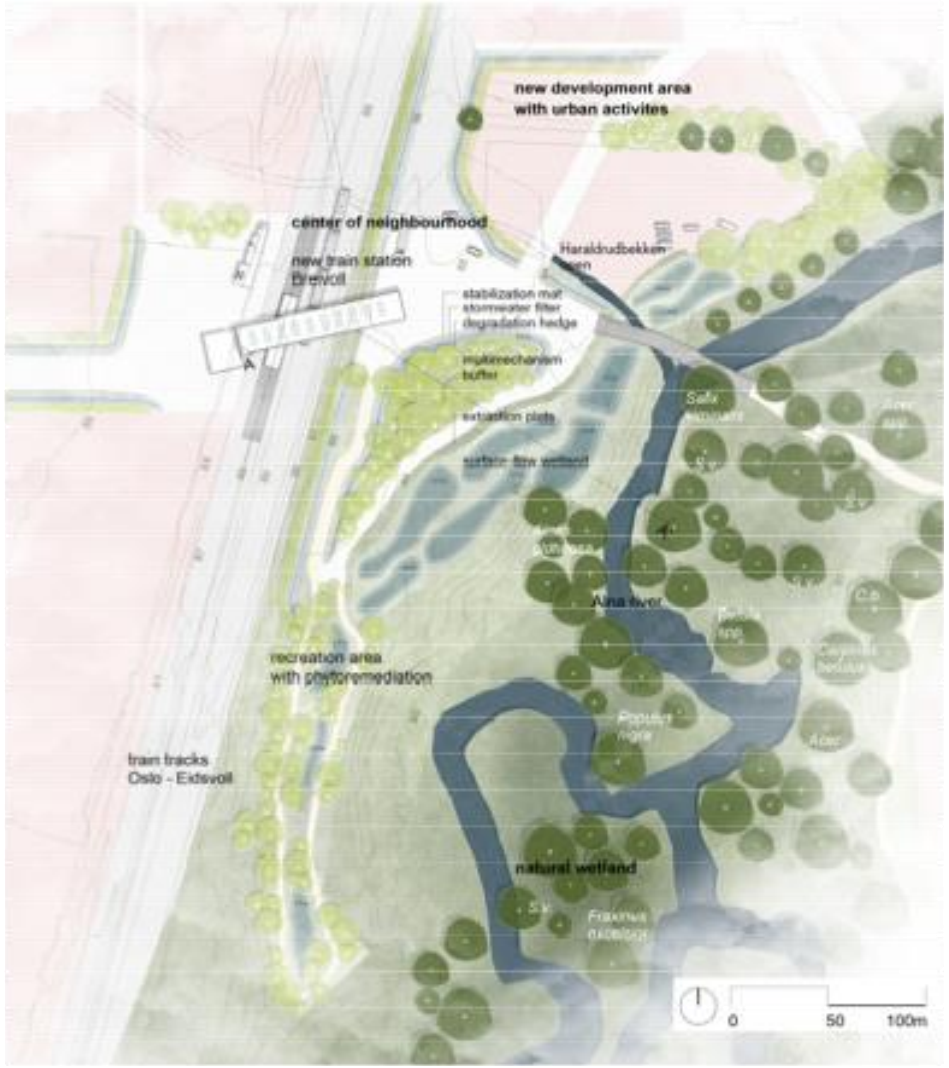


FIG.21: SITEPLAN A PHASE 03 - IMPLEMENTATION OF CITY'S DEVELOPMENT PLAN

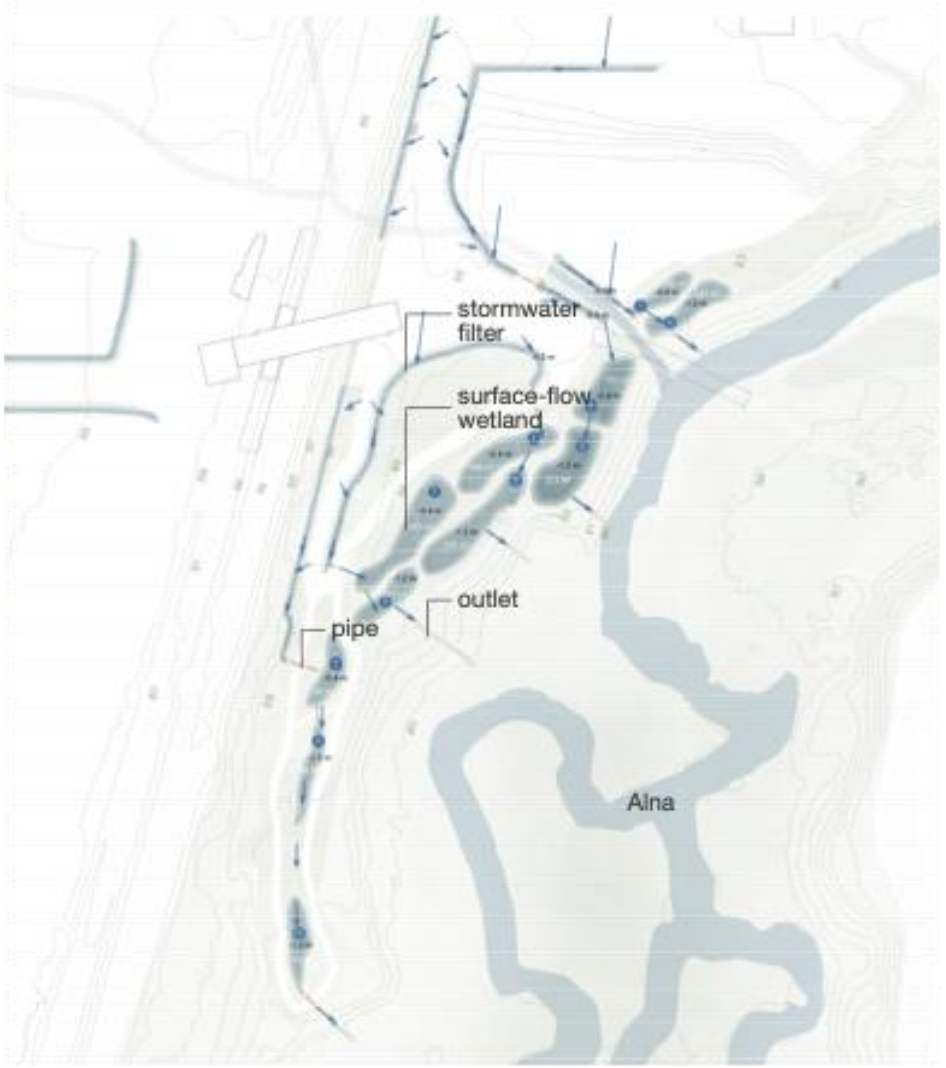


FIG.22: STORMWATER FLOW

Detail site A - future situation

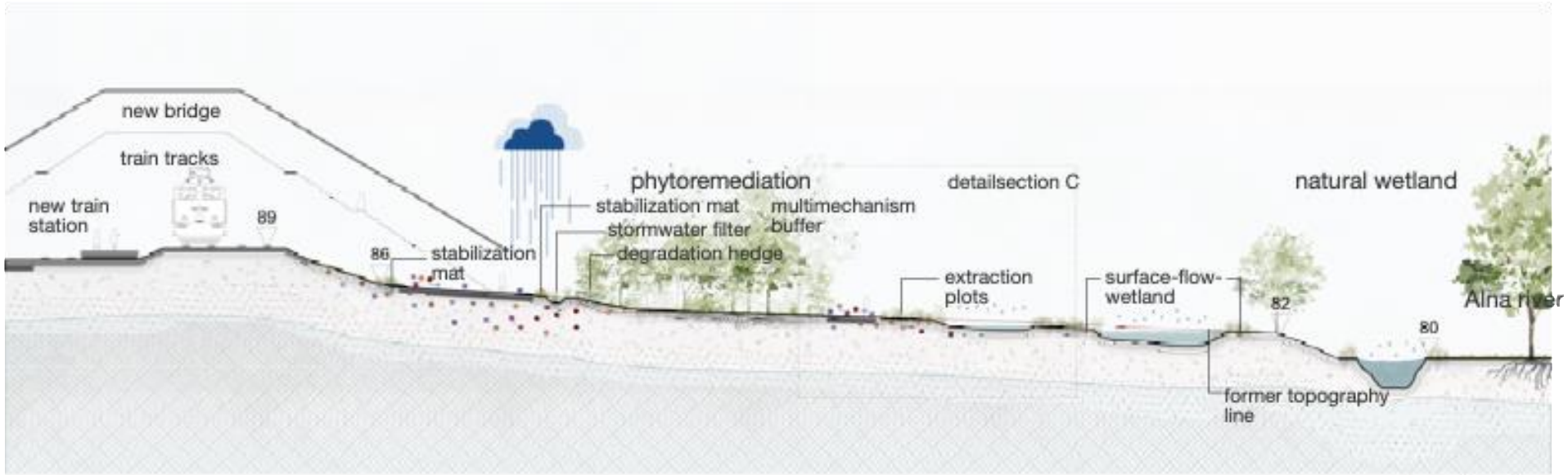


FIG.23: SECTION A-A' FUTURE SITUATION

Detail site A - future situation

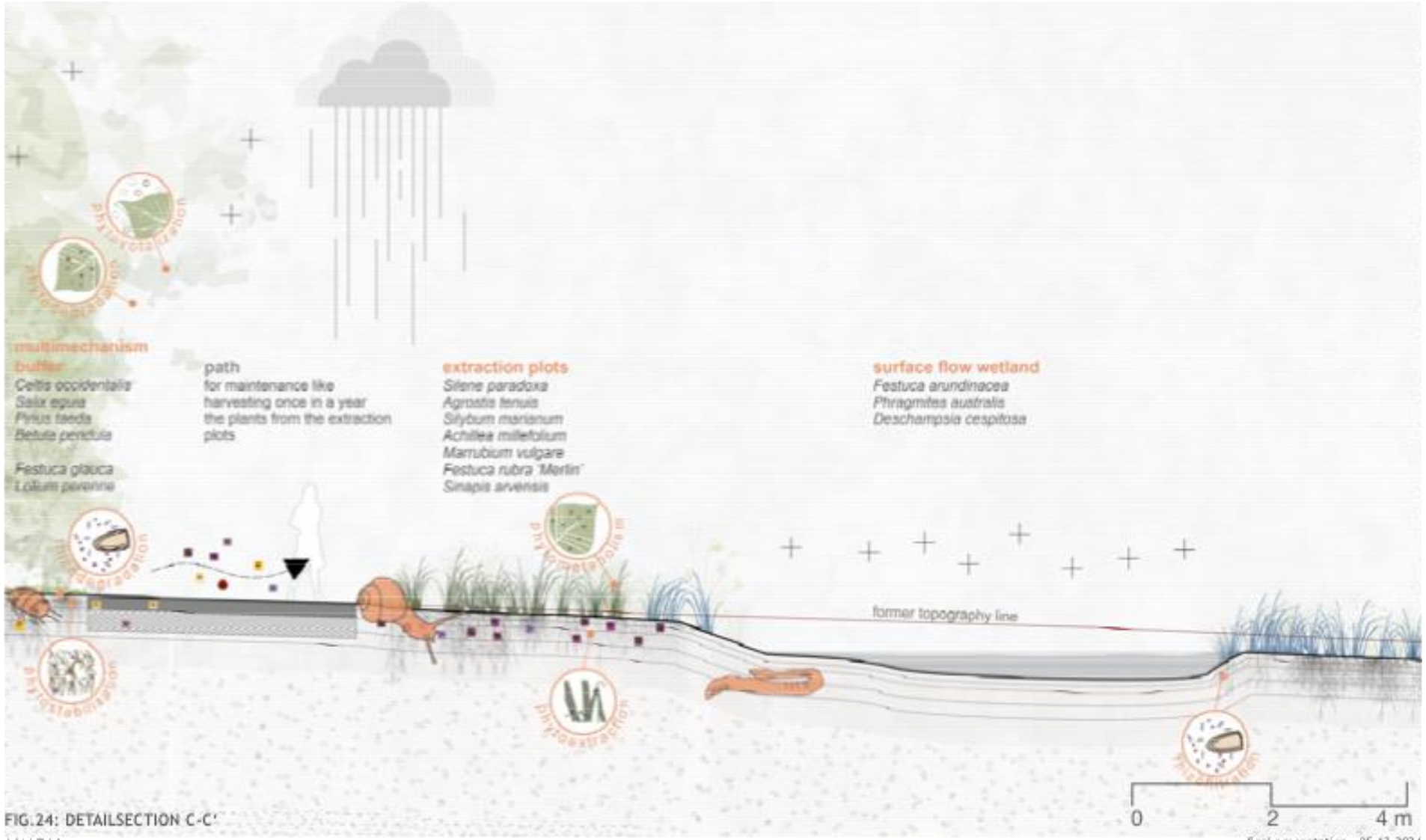


FIG.24: DETAILSECTION C-C'

final presentation - 05.12.2024
brelvoll attenuation: ADAVANCING NATURAL REMEDIATION
Paula Kuhn, Zofia Sobolewska

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).

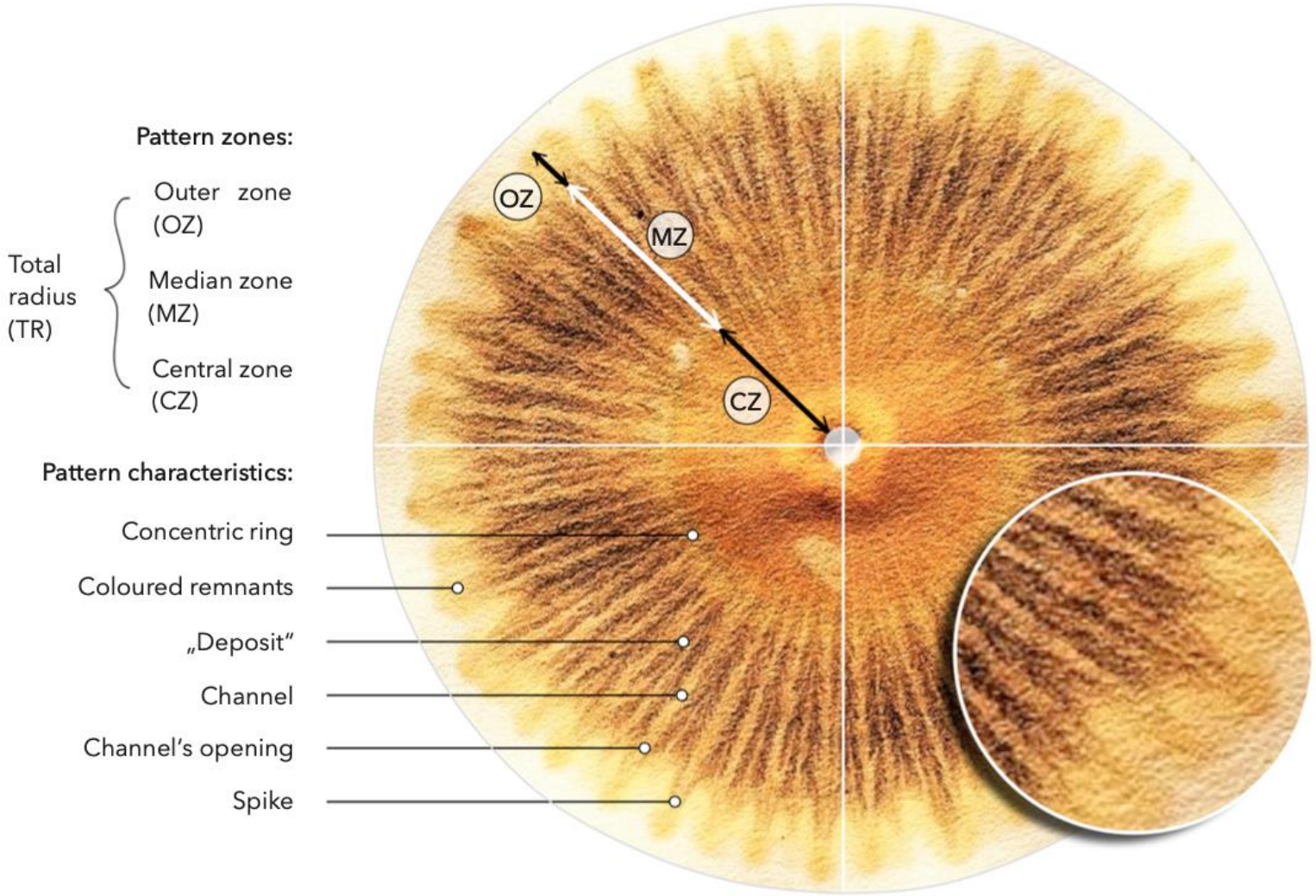
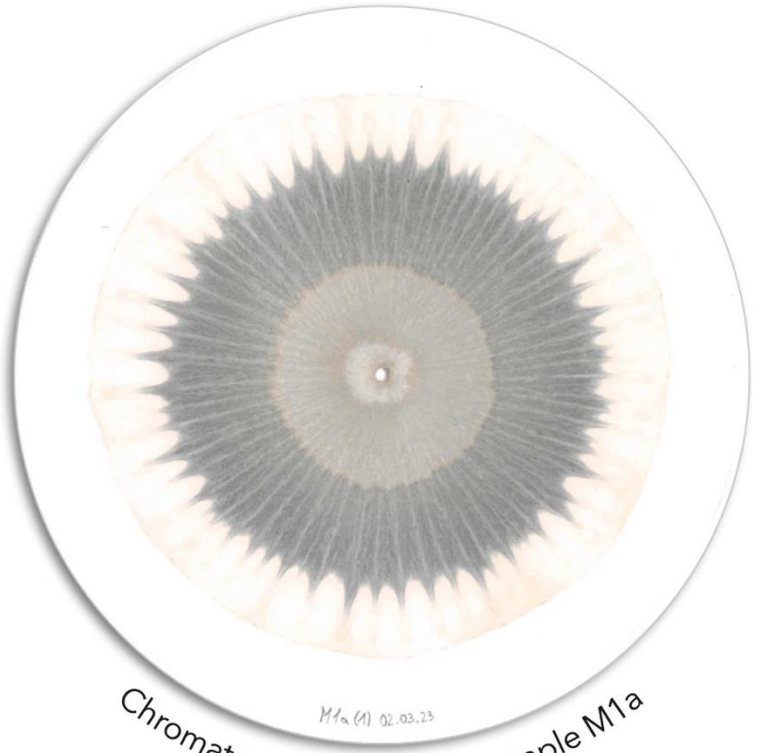
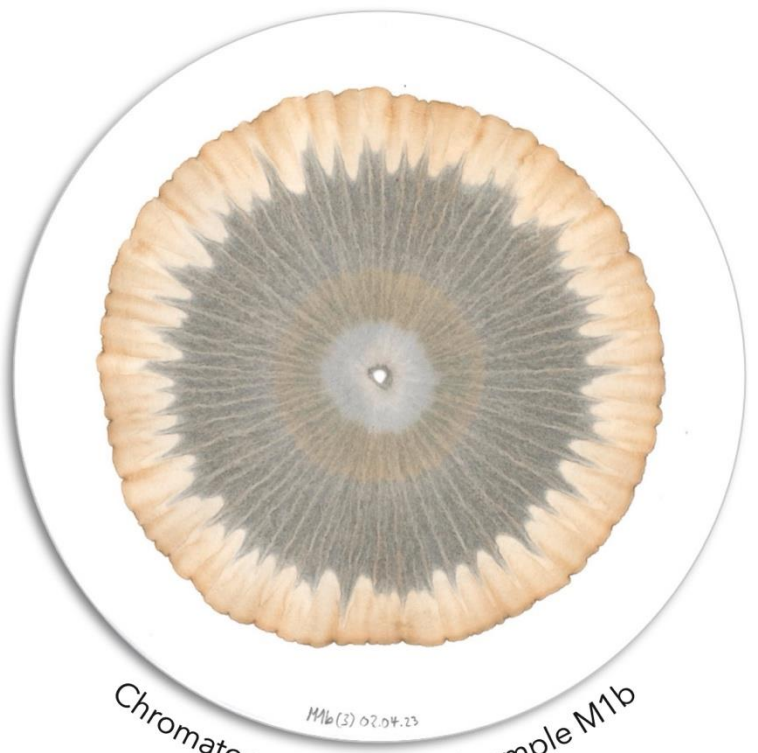


Figure X. Chromatogram features based on Ford et al. (2021) and Kokornaczyk et. al. (2017). *Graphic: Opitz, 2023. Underlaying photo: Bischof Pian, 2017.*



Chromatogram of the soil sample M1a



Chromatogram of the soil sample M1b

Pfeifer's Paper Chromatography

Florian Opitz Thesis Work
Master in Lanndscape Architecture, GLA NMBU 2023

The critical Zone
Bruno Latour et al.

FRAMING
the Critical Zone

The Critical Zone is Earth's livability; the thin layer of our planet that sustains life through interactions between physical, chemical and biological processes.

The term comes from interdisciplinary effort to understand these interactions, and how our human actions affect this connectivity.

Critical Zone Observatories (CZO) are interdisciplinary collaborative research projects with the purpose of understanding the **chemical, physical, geological, and biological** processes that both shape the surface of Earth and support terrestrial life.

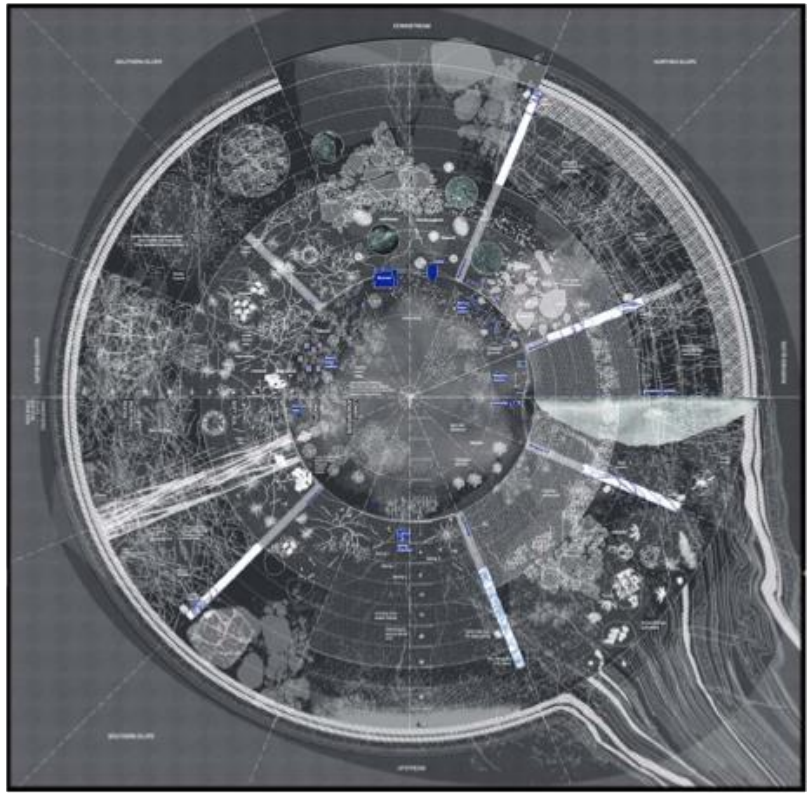


Illustration: Soil map of the Strengbach Critical Zone Observatory, Alexandra Arenes (2017) Oberserving the observer

RELATED DISCIPLINES

Earth systems sciences

Geology

Earth History

Pedology

Soil Taxonomy

Soil Science

Soil Health

Soil Microbiology

Biochemistry

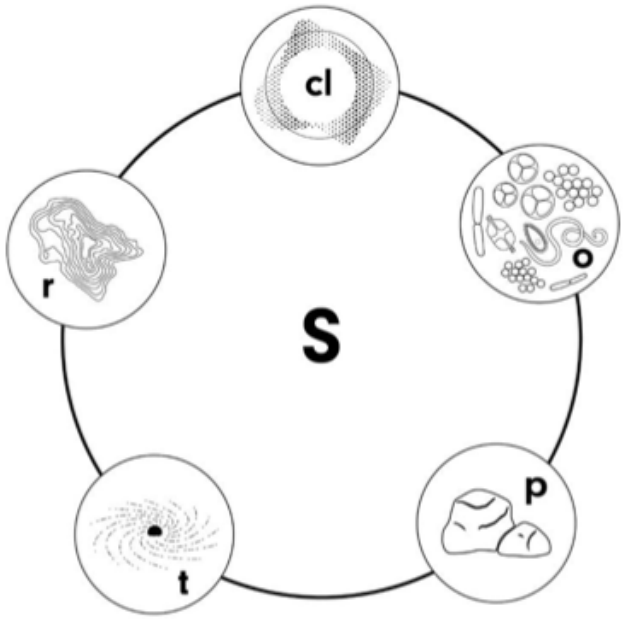
Cultural History

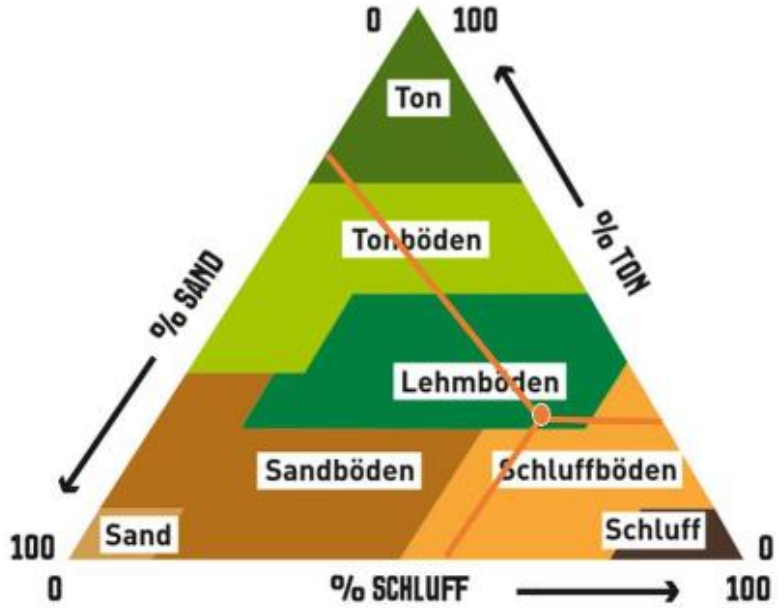
Water Management

FRAMING

Soil Genesis

The origins of soils and soil formation process can be summed up by Jenny's Equation. Internationally recognized in 1941 when Hans Jenny published his book 'Factors of Soil Formation'. The equation helps determine the properties of soil based on independent factors and is used to identify a soil's contents and usefulness.
Also known as pedogenesis





Jenny's Equation

$$S = f(cl, o, r, p, t, \ldots)$$

S
Soil Formation

f
Factors

cl
Climate

o
Organisms

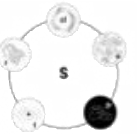
r
Relief (topography)

p
Parent Material

t
Time

...
New factors to be added

GREFSENKOLLEN
Soil profile



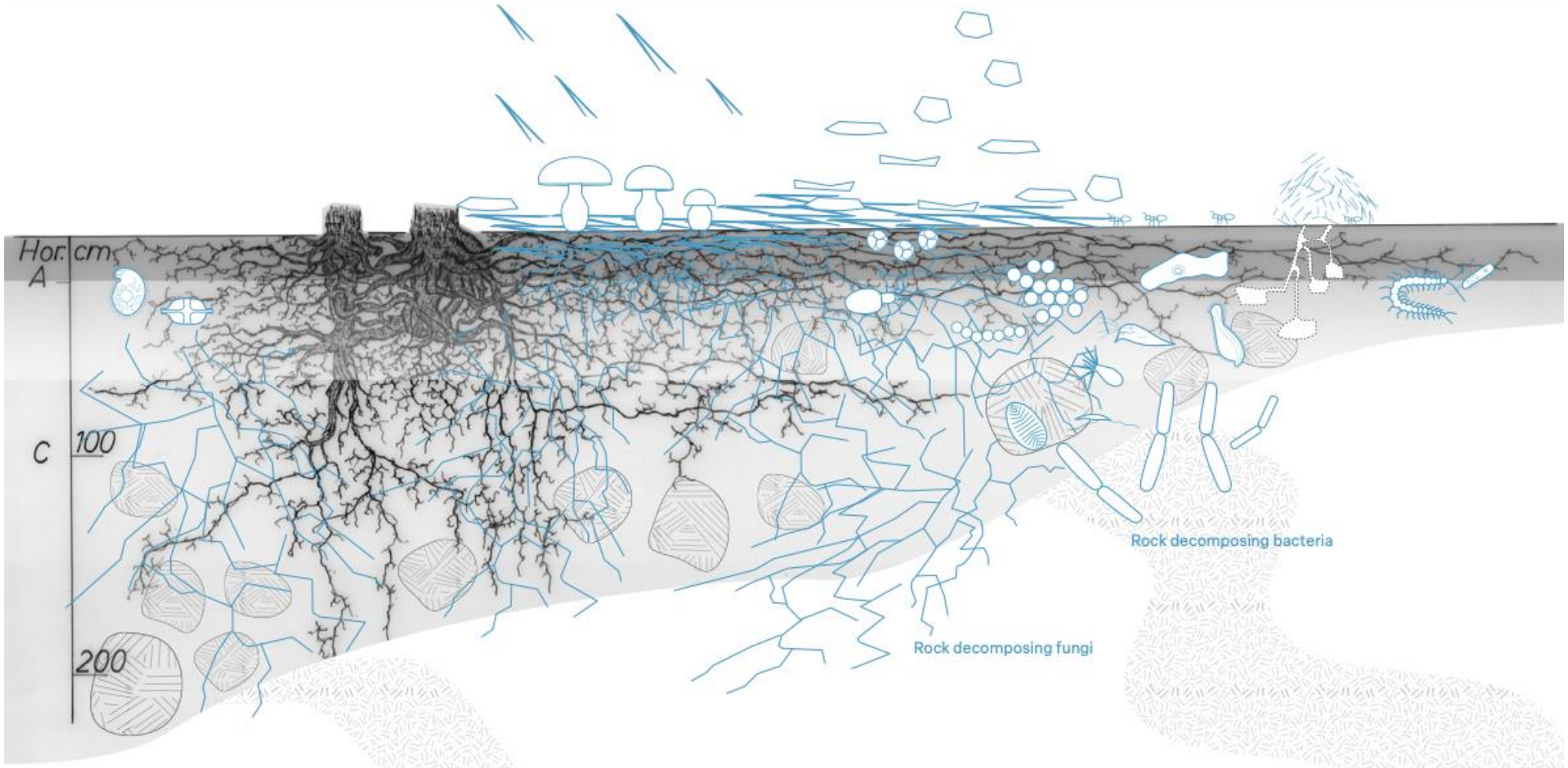
SEDIMENT

- Ocean & fjord deposit
- Marine beach deposit
- Ocean, fjord & beach deposit
- Moraine thick
- Moraine thin
- Peat & bog
- Thin humus & bog
- Bare mountain

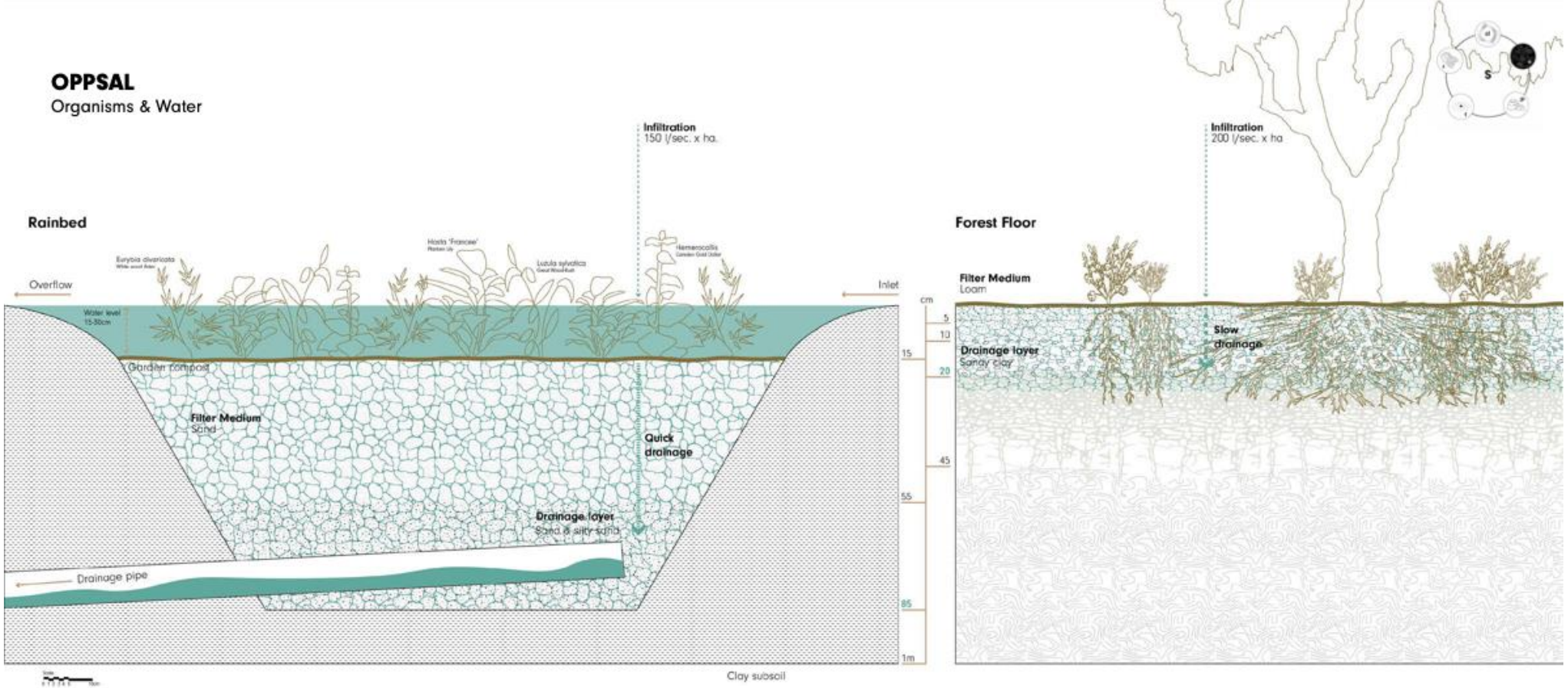
BEDROCK

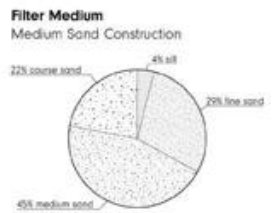
- Shale
- Sandstone
- Volcanic breccia
- Claystone
- Syenite
- Rhomb porphyry
- Basalt
- Alkali feldspar granite

Organisms


Hor.
cm
A
C
100
200
Rock decomposing bacteria
Rock decomposing fungi

OPPSAL
Organisms & Water

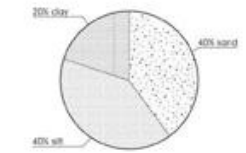




Sand
Good drainage - regular watering
Poor moisture retention
Doesn't allow water to pool around roots
Good aeration
Easy to cultivate

Silt
Larger particles
Mainly inorganic in nature

Clay
Hard, tiny particles - easily compacted
Compaction makes soil difficult to work with
Able to hold onto roots of plants - stable environment
Beneficial nutrients for plant growth
Poor infiltration for water, air and plant roots



Loam
Equal parts sand and silt, a little less clay
Sand particles largest

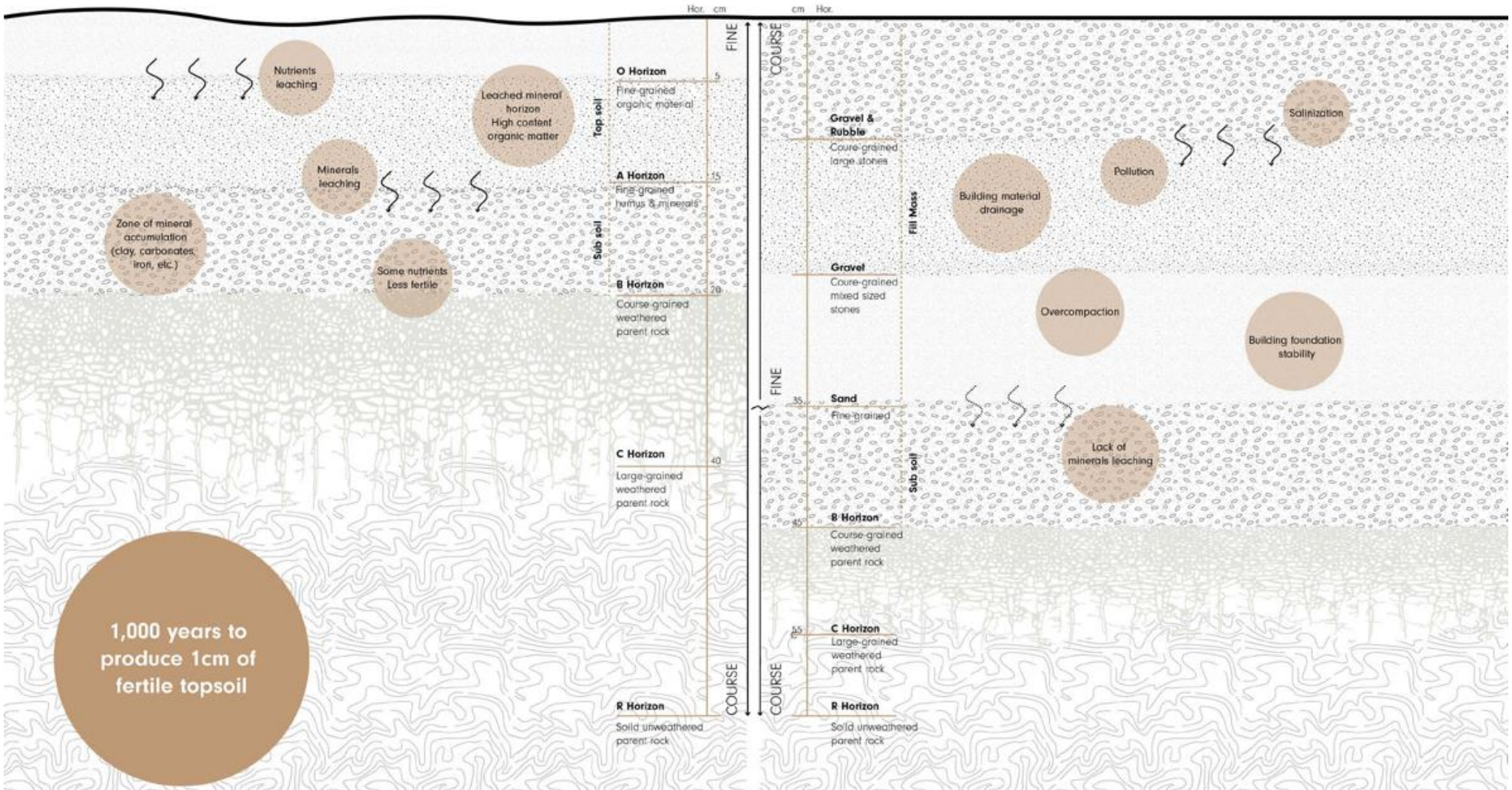
Sand
Good drainage - regular watering
Poor moisture retention
Doesn't allow water to pool around roots
Good aeration
Easy to cultivate

Silt
Larger particles
Mainly inorganic in nature

Clay
Hard, tiny particles which are easily compacted
Compaction makes the soil difficult to work with
Able to hold onto roots of plants better - stable environment
Beneficial nutrients for plant growth
Poor infiltration for water, air and plant roots

Oslo Kommune
Blågrønne Overvannsløsninger

Constructed soils



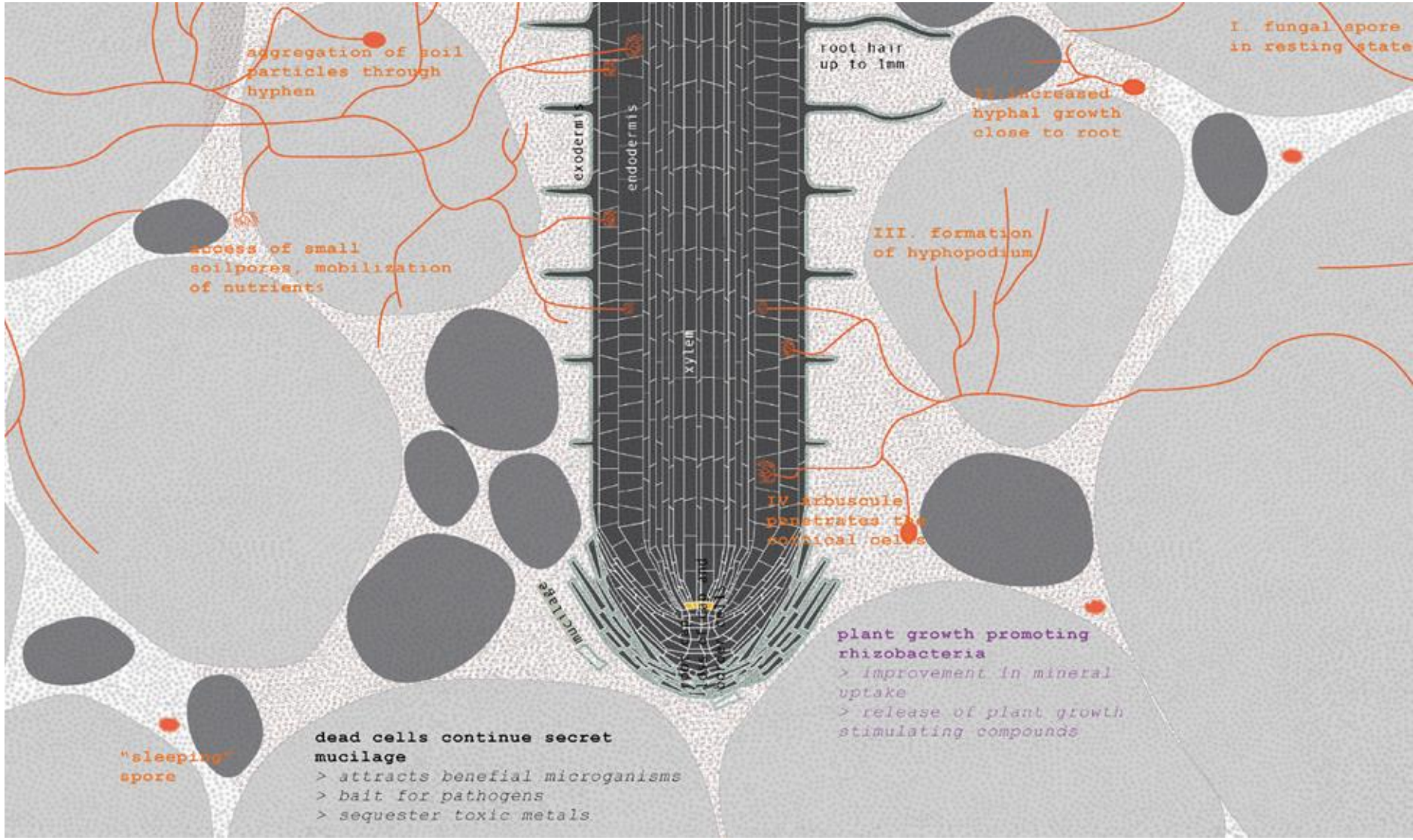
Activation of soil microbial life in the rhizosphere.

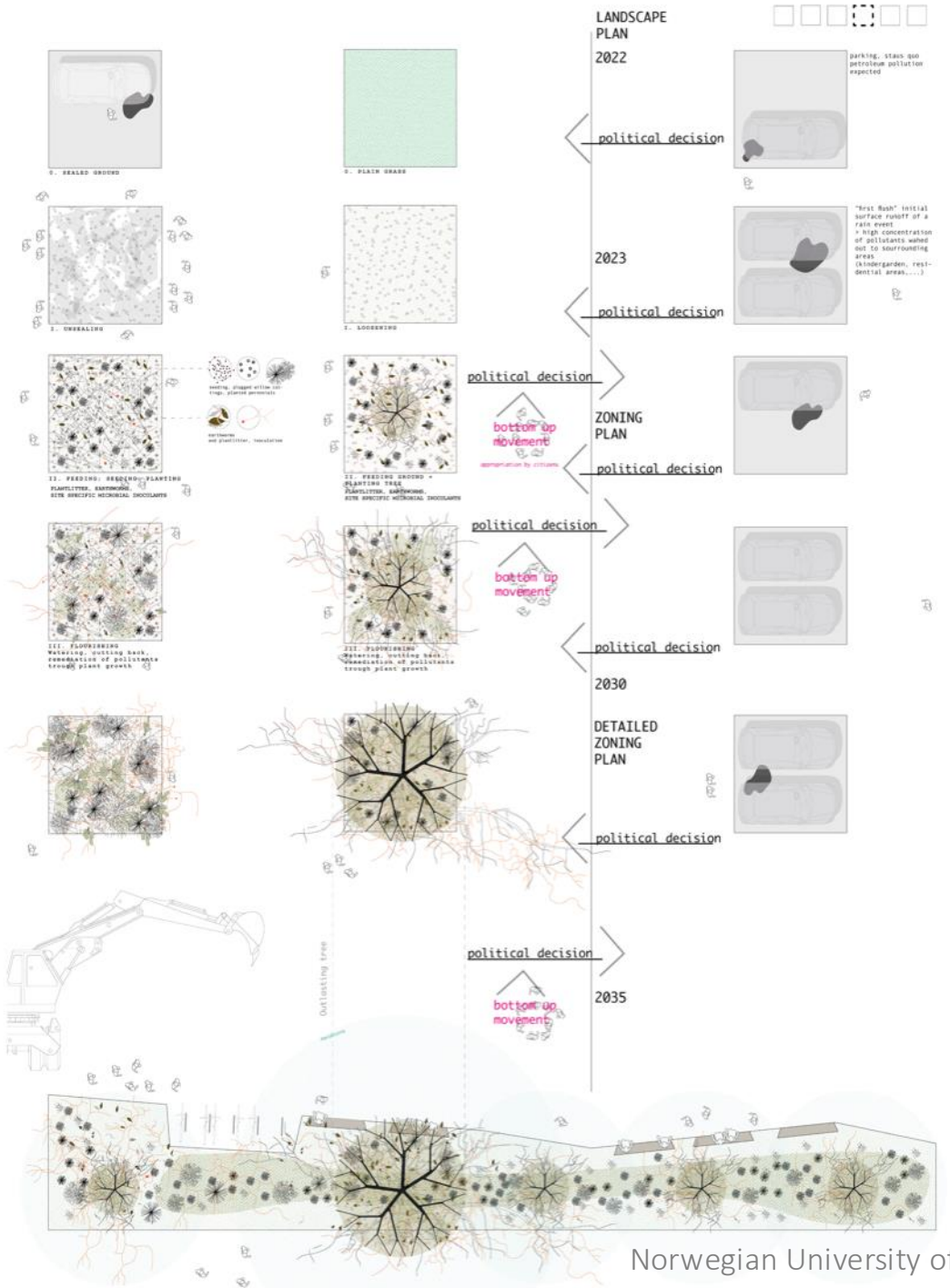
Rhizodepot Diagram

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





INTERMEDIATE HAUGERUD

MEANWHILE ON THE PARKING AREA

YEAR 1 UNSEALING: breaking up asphalt

YEAR 2 PLANTING: focus on petrochemical remediation species

YEAR 2-15 FLOURISHING: maintaining, production of biomass = remediation of petrochemicals

OUTLASTING or PASSING: influence on the planning process and on open space design of the neigbourhood

Mesocosm experiment

Different Soil treatments

GROUP 1

sterilized Oslo compost

GROUP 2

Marka soil

GROUP 3

Rain garden soil

GROUP 4

Urban soil

Mesocosm experiment I Willow cuttings (Salix caprea)

Willow cuttings: this years branches for best root and stem growth success, 15cm each

Independent variables

7 hours of light per day

20 °C

250 ml each second day

humidity 40%

pooling of collected soil

labeling of the different treatment groups

experiment setup in climate controlled greenhouse

Findings according vitality, root and stem growth

sterilized Oslo compost

Marka soil

Rain garden soil

Urban soil

Tab water

Mesocosm experiment

Different microbial treatments

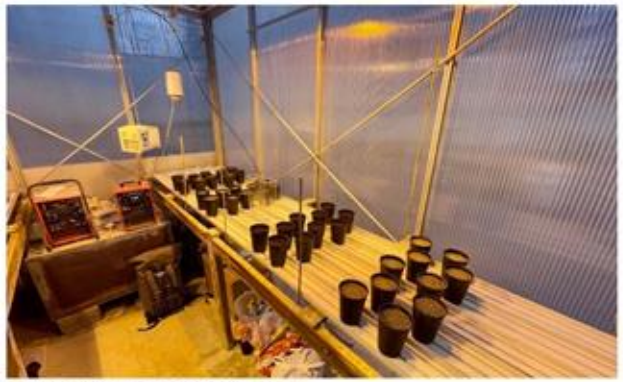

Marka soil


The temperature-regulated greenhouse where the experiment takes place


The raingarden soil from Lindum


The soil is not sterile


The soil distributed onto baking trays

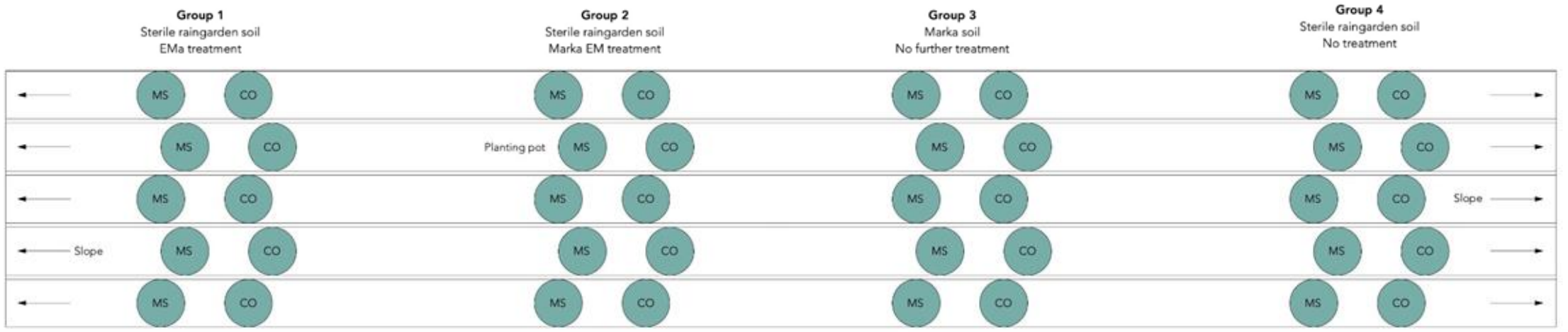

The experiment set-up inside the greenhouse


Making holes for the seeds


Oven for sterilisation

Sterilisation at 120 C°

Sterilised soil packed into plastic bags



Graphic: Florian Opitz