The Why Factory

Welcome to the BIOTOPIA

“We had shifted from a mere ecological crisis into what should instead be called a profound mutation in our relation to the world.”

Facing Gaia. Bruno Latour

“Responding to climate change by building hard infrastructures and favouring high-tech homogenous design, we are ignoring millennia-old knowledge of how to live in symbiosis with nature.”

Vaclav Havel in *LOTEK*. Julia Watson

“The inevitability of Total Urbanization must be questioned, and the countryside must be rediscovered as a place to resettle, to stay alive; enthusiastic human presence must reanimate it with new imagination.”

Countryside. Rem Koolhaas

“...polluted, bulldozed, machine-dominated, dehumanized, explosion-threatened world that is disintegrating and disappearing before our eyes.”

Design with nature. Ian Lennox McHarg

“From a biological perspective, nothing is unnatural…”

“Biology enables, culture forbids.”

Sapiens. Yuval Noel Harari

BIOTOPIA

Our aim is to propose a series
of design inventions with nature
(bioinventions) to compensate
for our excessive use of the Earth's
resources and restore Nature's balance.

table of contents

01

Before humankind

Earth‘s age

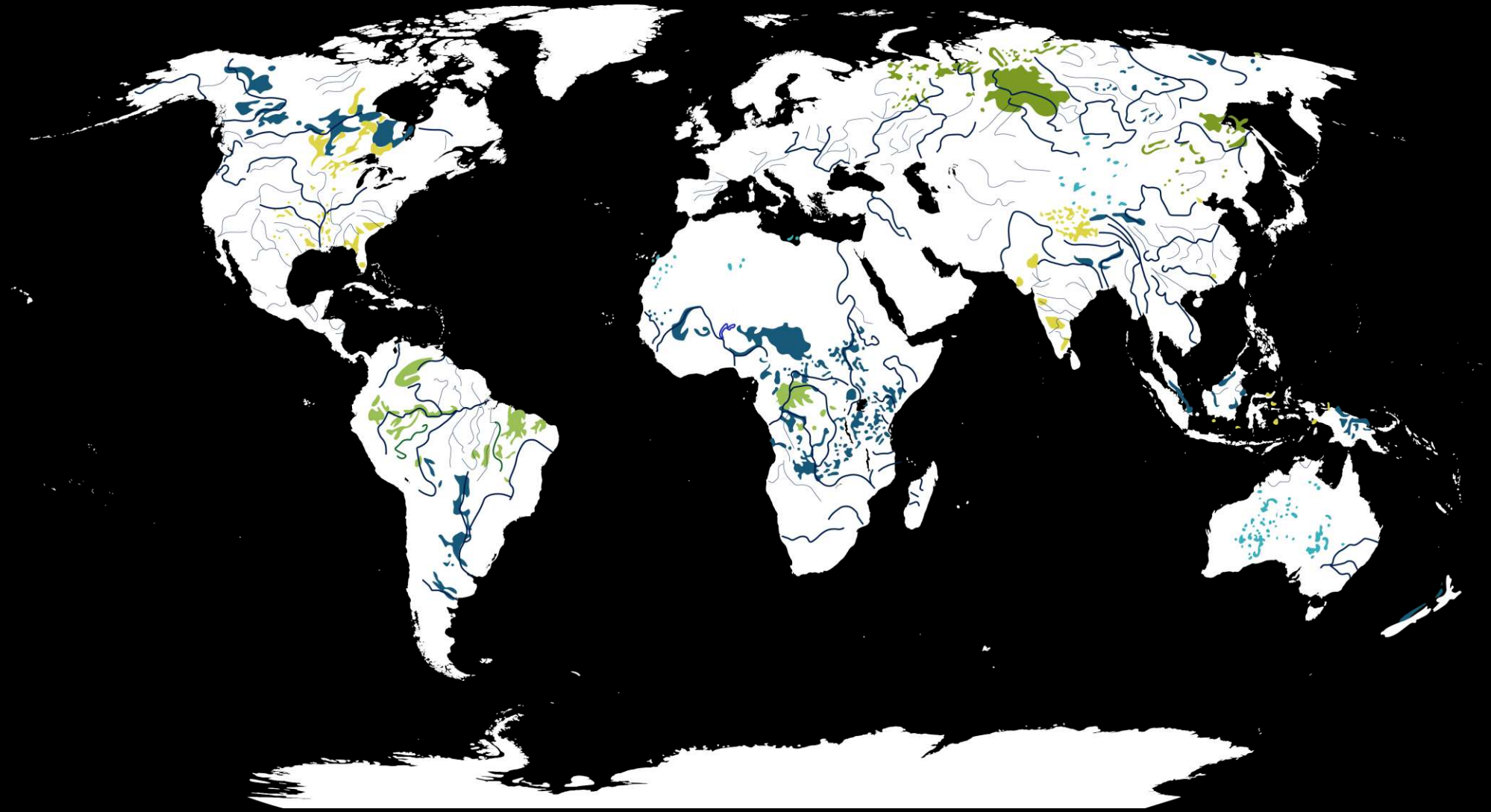
4.6 billion years

[NATIONAL GEOGRAPHIC]

What the Earth provides

Atlas of resources

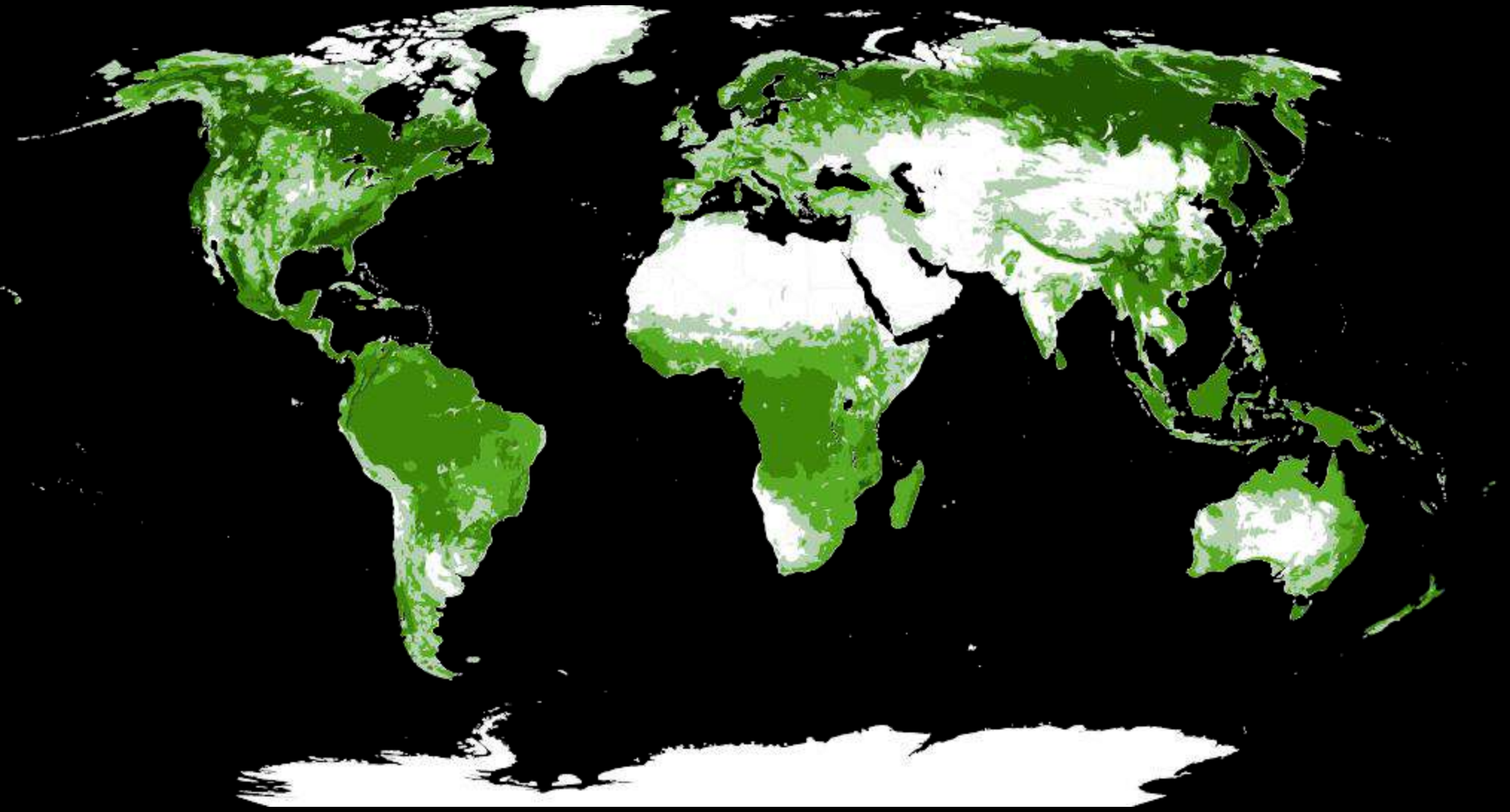
Rivers and wetlands



Types of wetlands and rivers

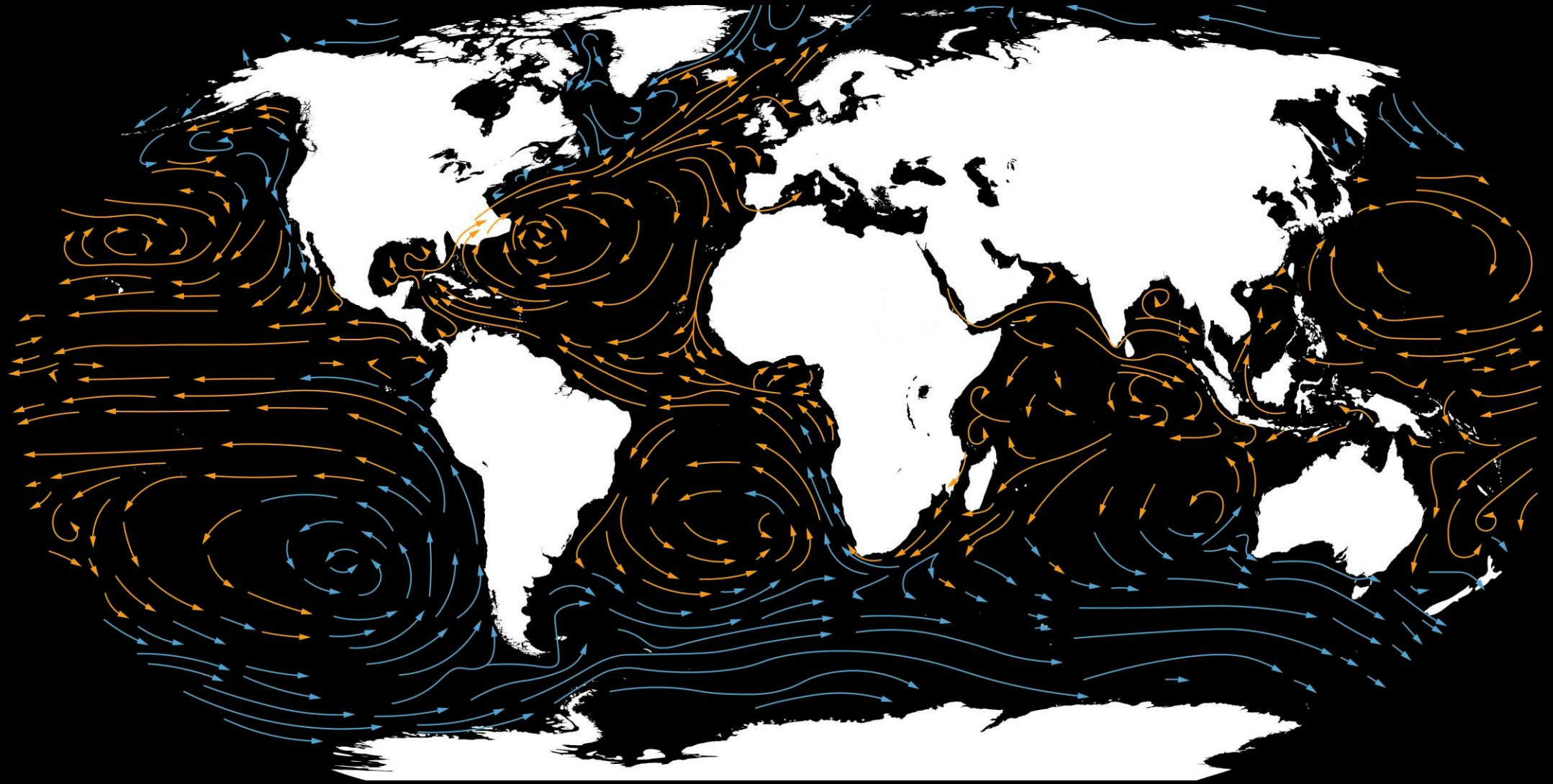
Forests

[VIVID MAPS]



Types of forests

Ocean currents

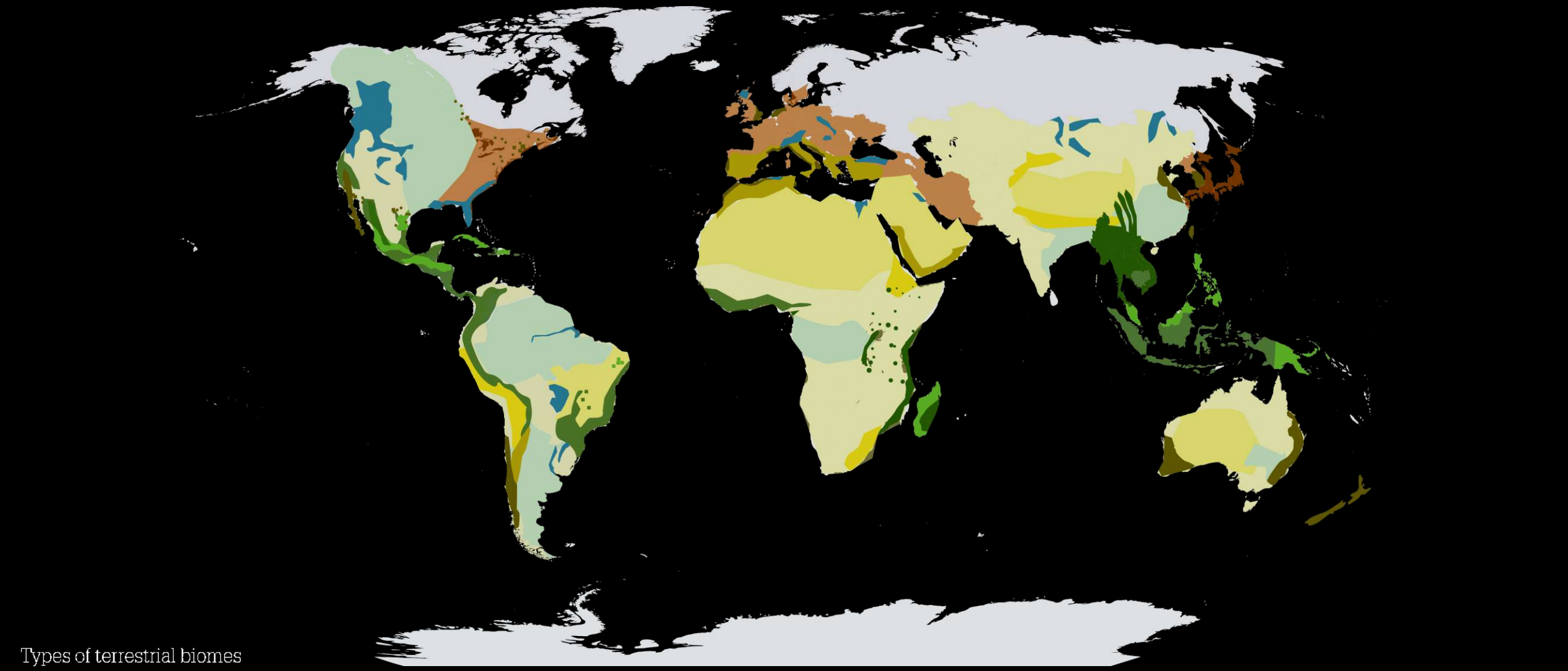


cool currents

warm currents

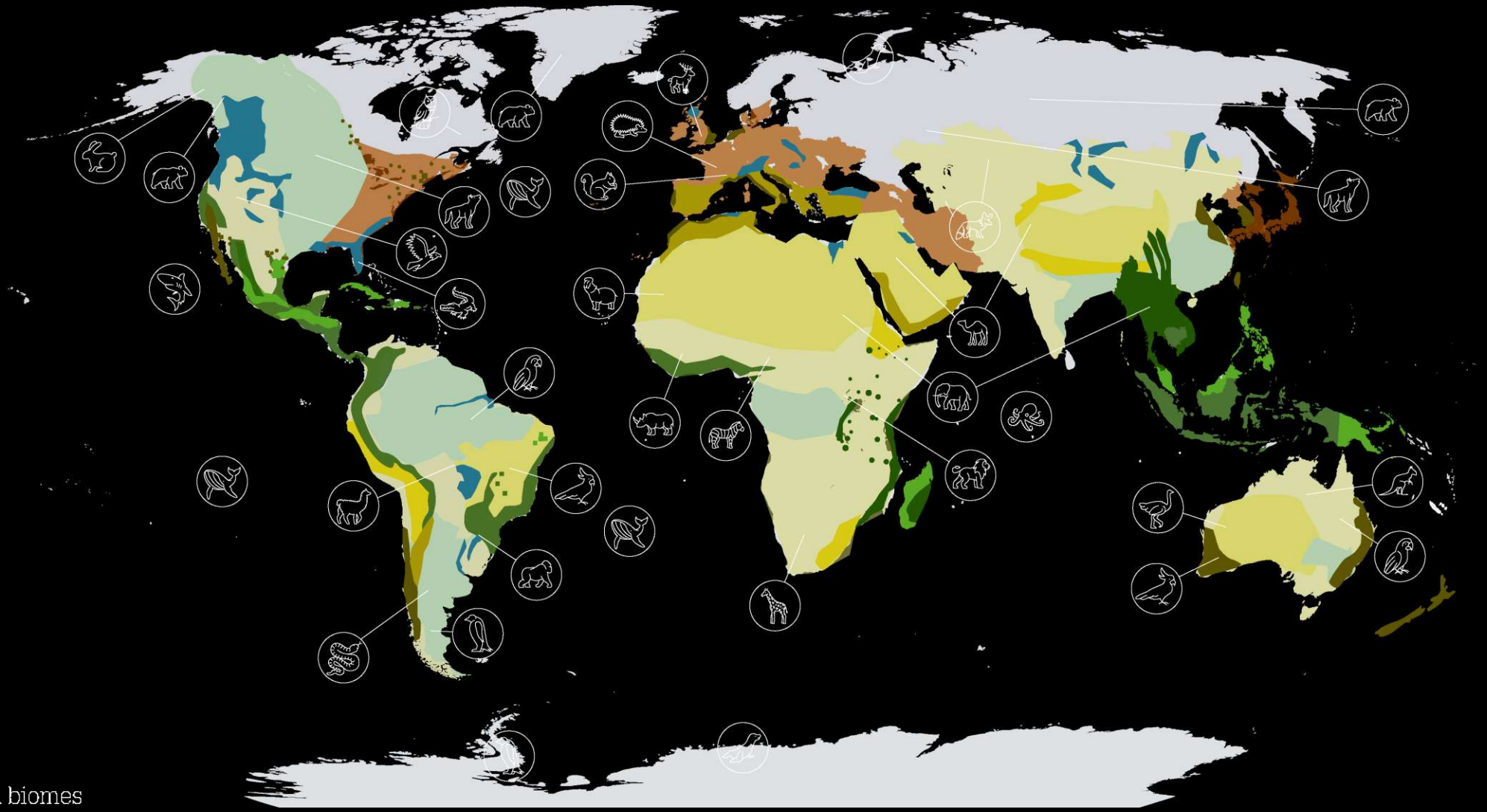
Types of currents

Biomes


Types of terrestrial biomes
Temperate Broadleaf & Mixed Forests
Montane Grasslands & Shrublands
Grasslands, Savannas & Shrub-lands miexed with Boreal Forest
Tropical and Subtropical Moist Broadleaf Forests
Tropical & Subtropical Coniferous Forests
Mediterranean Forests, Woodlands & Scrub
Deserts & Xeric Shrublands
Tropical & Subtropical Grass-lands, Savannas & Shrublands
Flooded Grasslands & Savannas
Boreal Forest/ Tajga
Tundra

Animal habitats

[OUR WORLD IN DATA]

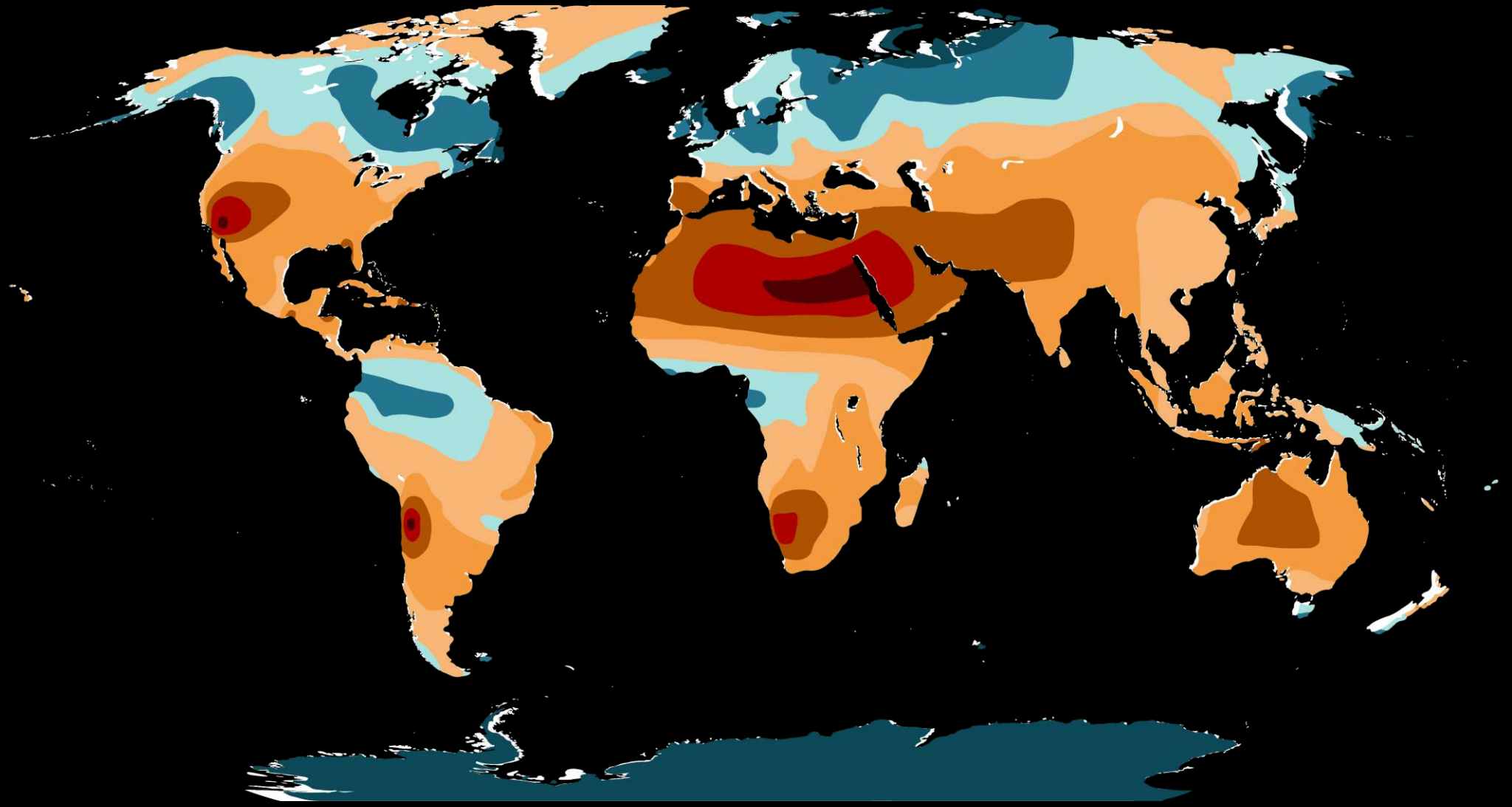


Types of terrestrial biomes

- Temperate Broadleaf & Mixed Forests
- Montane Grasslands & Shrublands
- Grasslands, Savannas & Shrublands mixed with Boreal Forest
- Tropical and Subtropical Moist Broadleaf Forests
- Tropical & Subtropical Coniferous Forests
- Mediterranean Forests, Woodlands & Scrub
- Deserts & Xeric Shrublands
- Tropical & Subtropical Grasslands, Savannas & Shrublands
- Flooded Grasslands & Savannas
- Boreal Forest/ Tajga
- Tundra

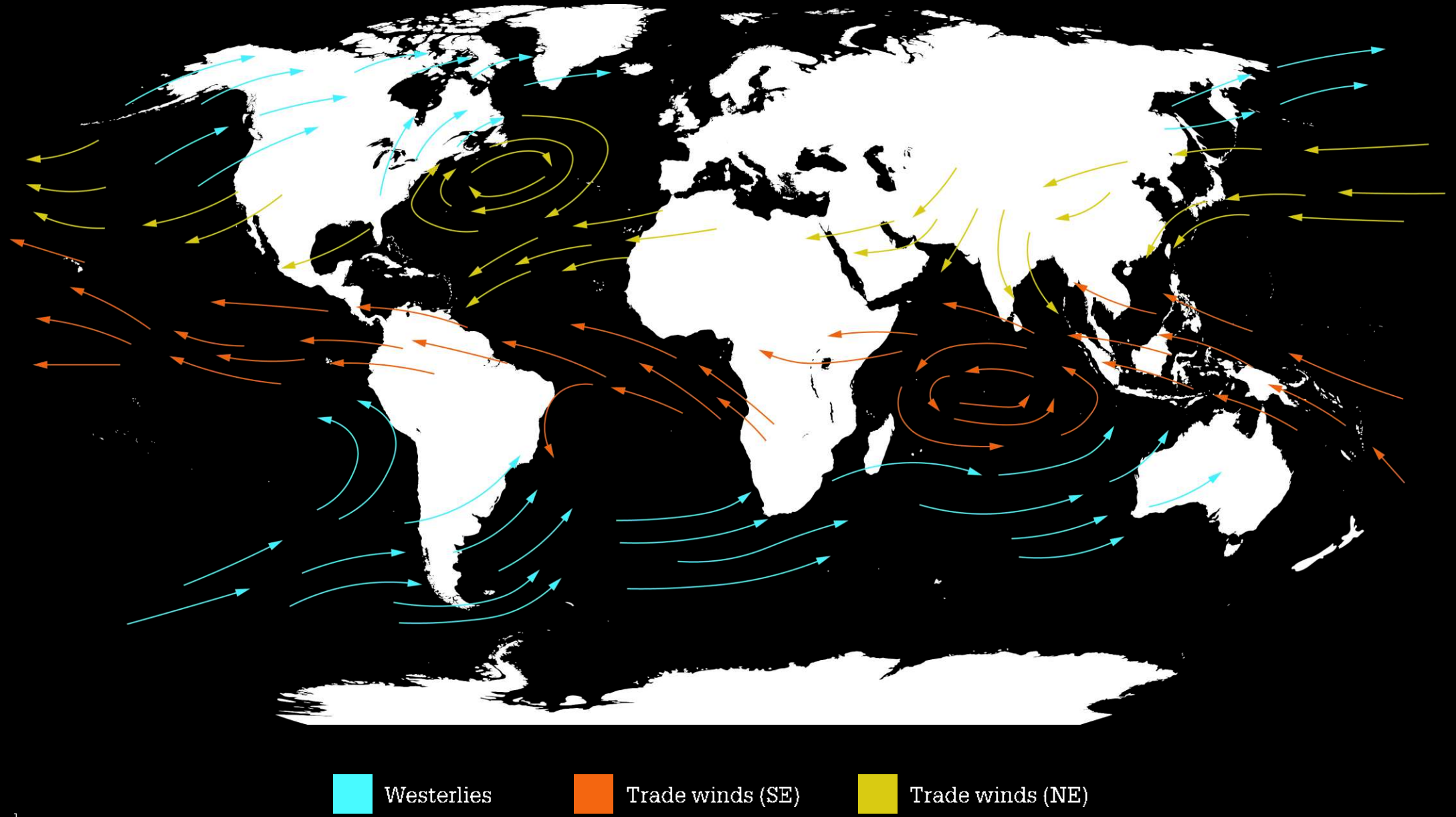
Annual sunny hours

[REDDIT]



Atmospheric currents

[BRITANNICA]



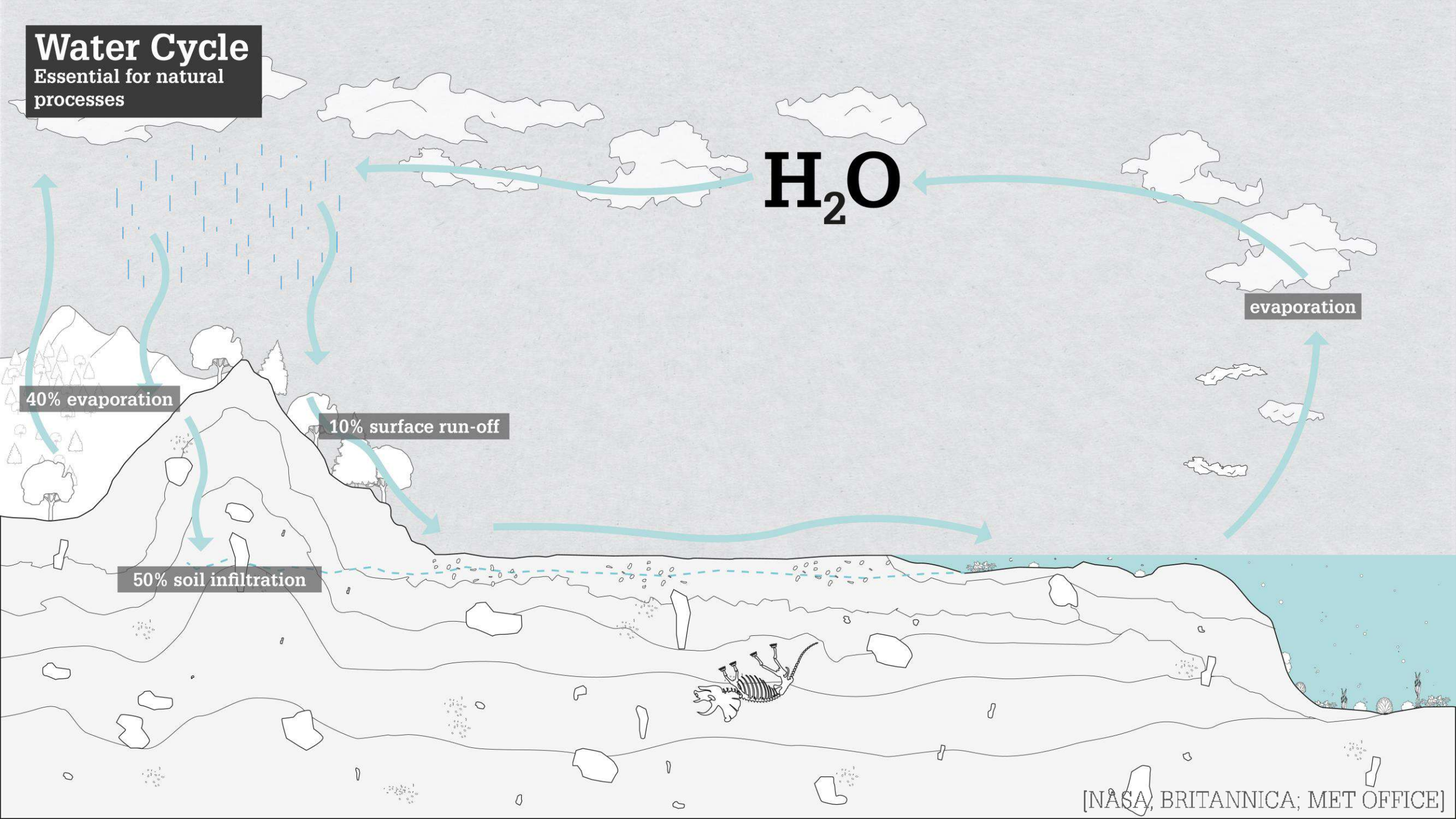
Types of winds

For a long time balance was kept

Natural cycles

Water Cycle

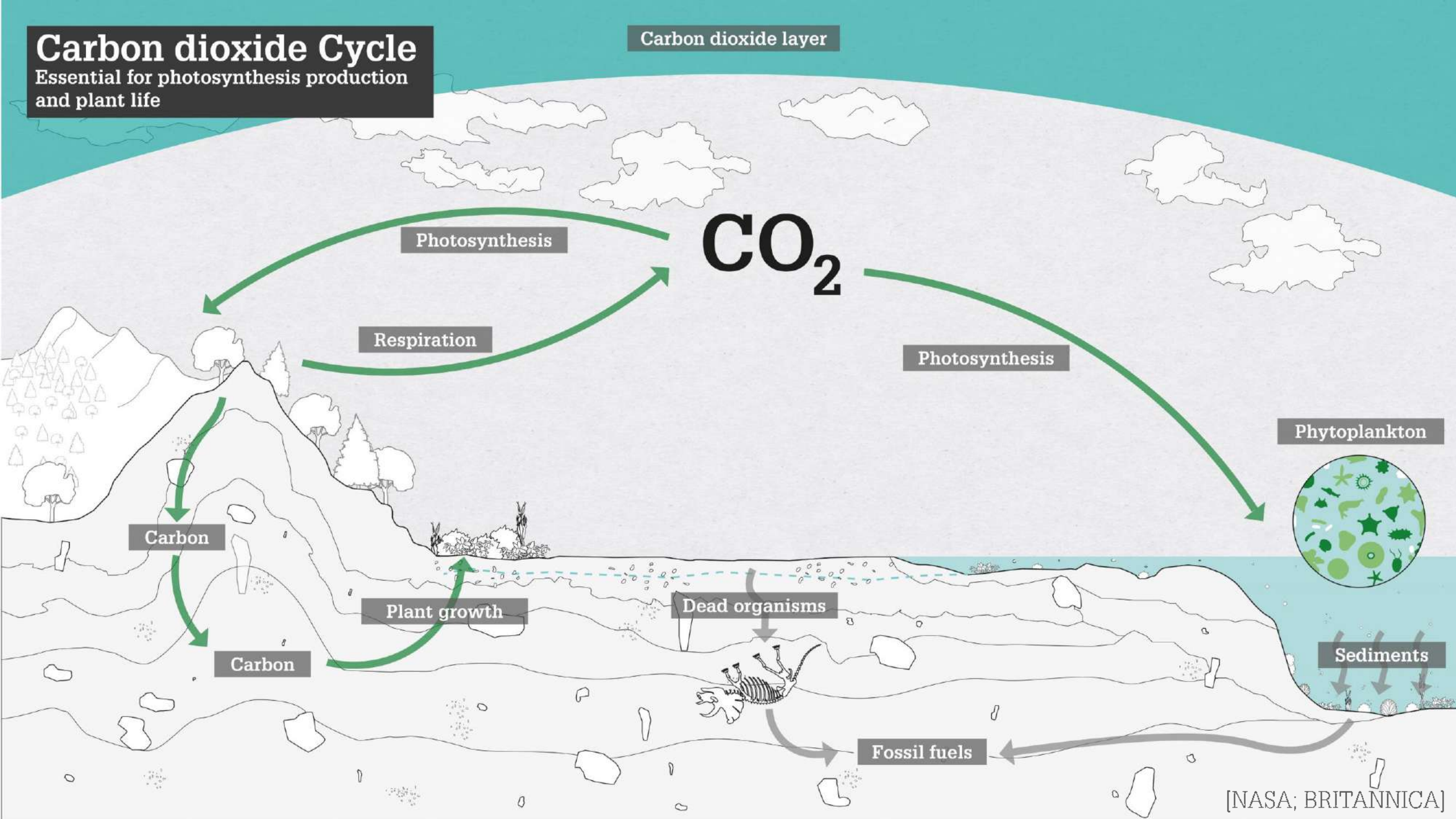
Essential for natural processes



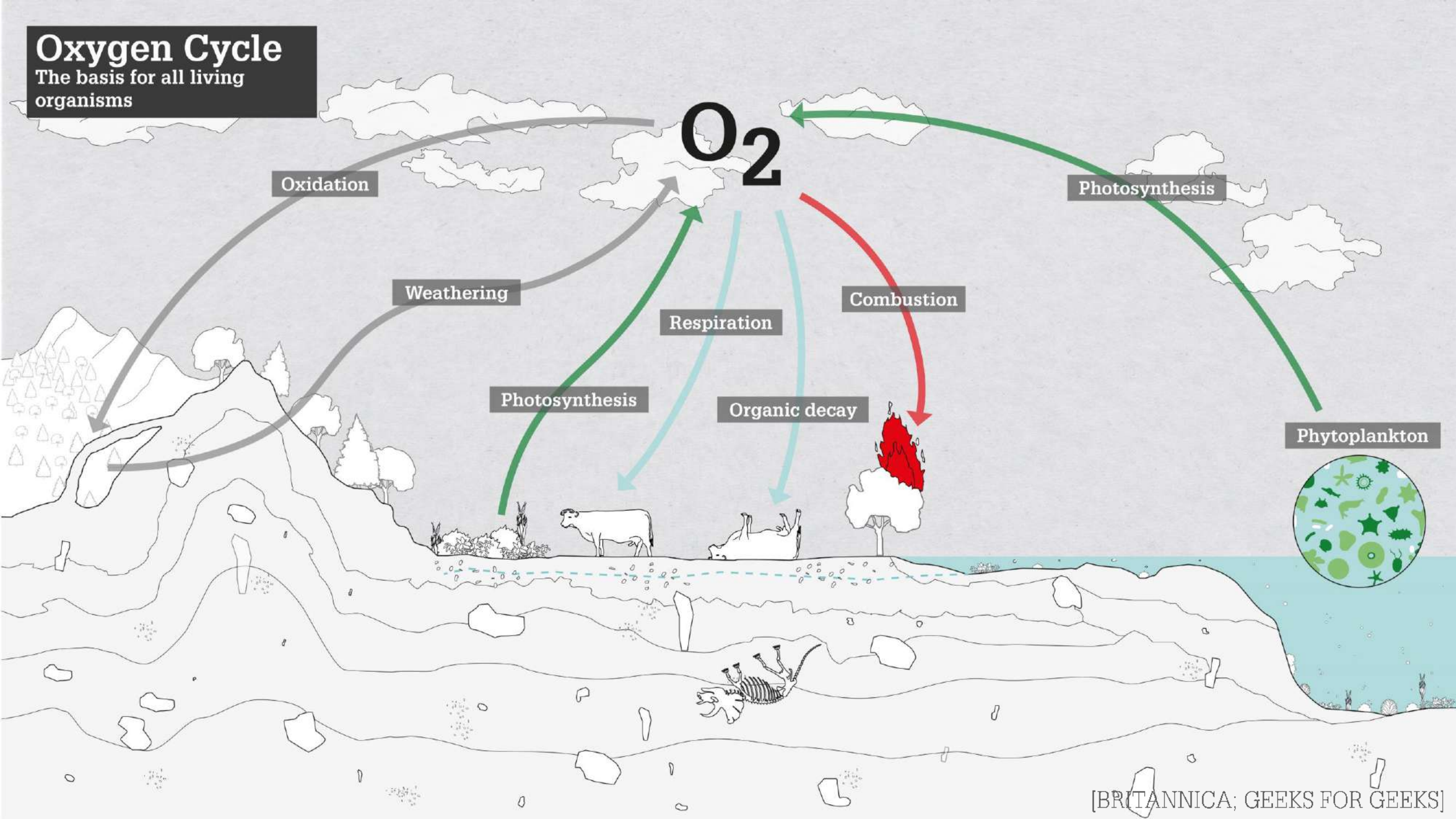
[NASA; BRITANNICA; MET OFFICE]

Carbon dioxide Cycle

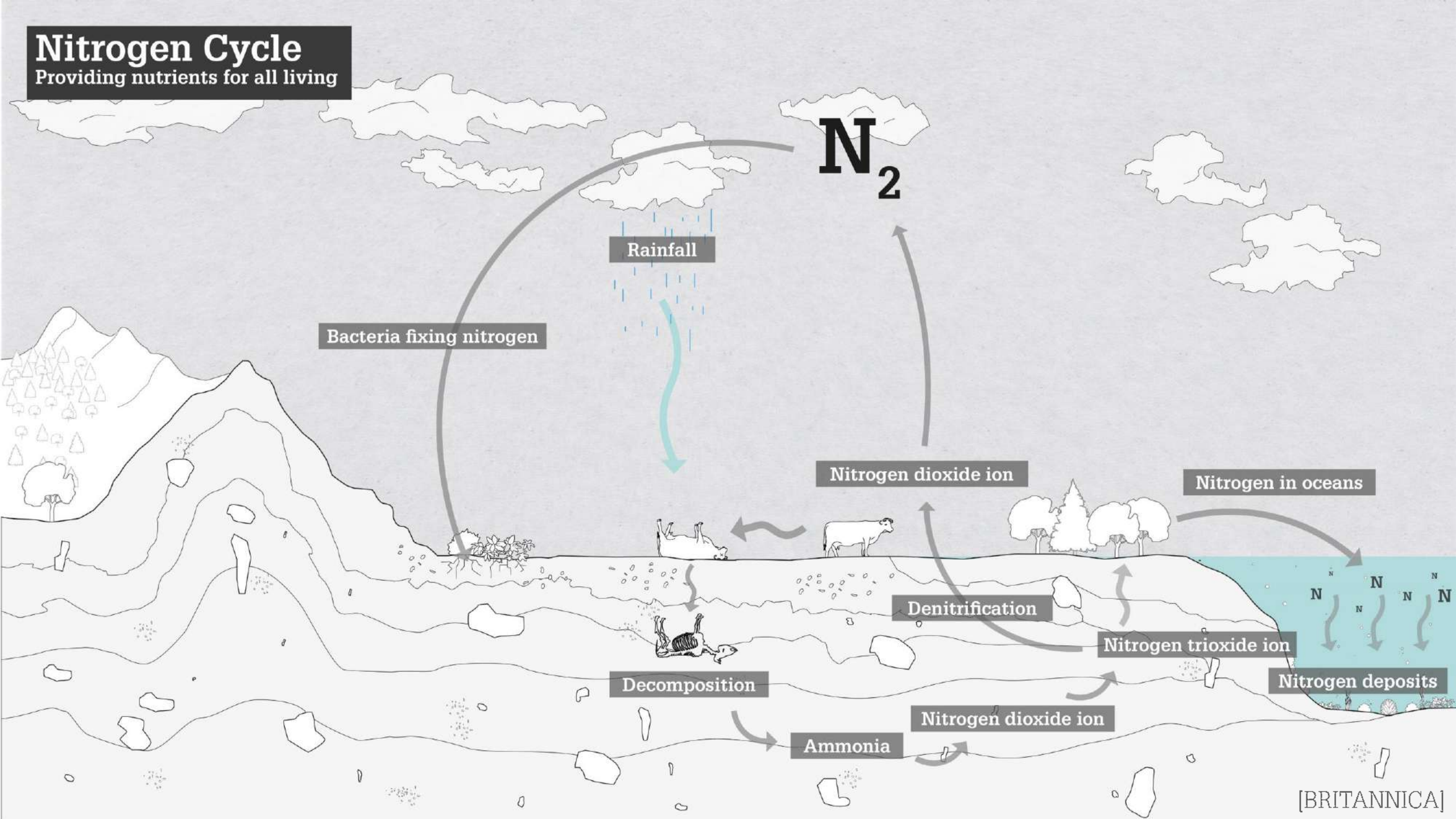
Essential for photosynthesis production and plant life

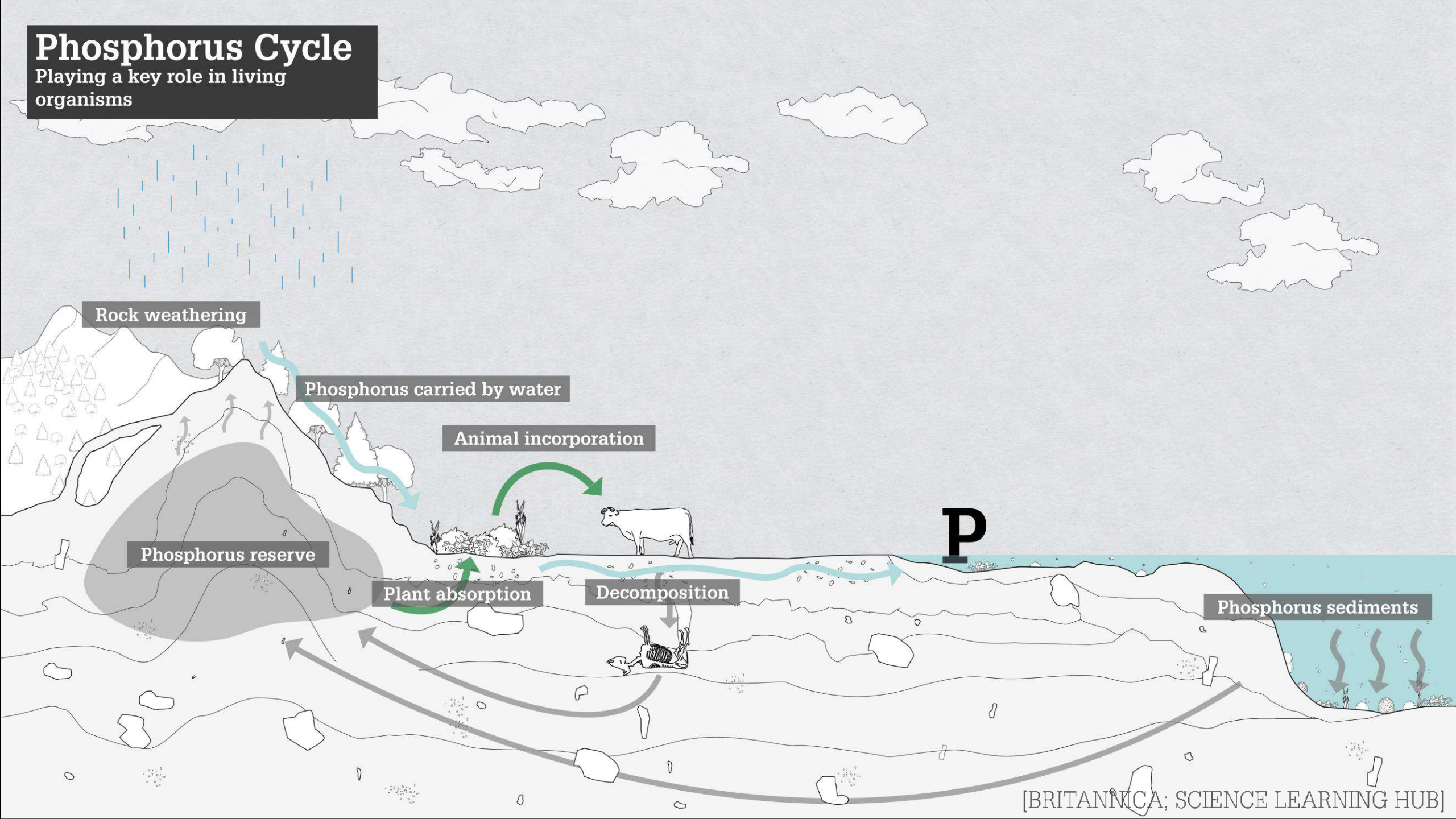


[NASA; BRITANNICA]



[BRITANNICA; GEEKS FOR GEEKS]


Nitrogen Cycle
Providing nutrients for all living
N_2
Rainfall
Bacteria fixing nitrogen
Nitrogen dioxide ion
Nitrogen in oceans
Denitrification
Nitrogen trioxide ion
Nitrogen deposits
Decomposition
Nitrogen dioxide ion
Ammonia
[BRITANNICA]


Phosphorus Cycle
Playing a key role in living organisms
Rock weathering
Phosphorus carried by water
Animal incorporation
Phosphorus reserve
Plant absorption
Decomposition
P
Phosphorus sediments
[BRITANNICA; SCIENCE LEARNING HUB]

Balance

Humankind

Act 02

200 000 years
of humankind

Big Bang

4.6 billion years

Now

4.6 billion years
=
24 hours

200 000 years
=
3 seconds

November 15th, 2022

[NATIONAL GEOGRAPHIC]

World population

8 billion

747 × The Czech Republic

467 × The Netherlands

171 × Spain

122 × France

24 × USA

5.8 × India

5.6 × China

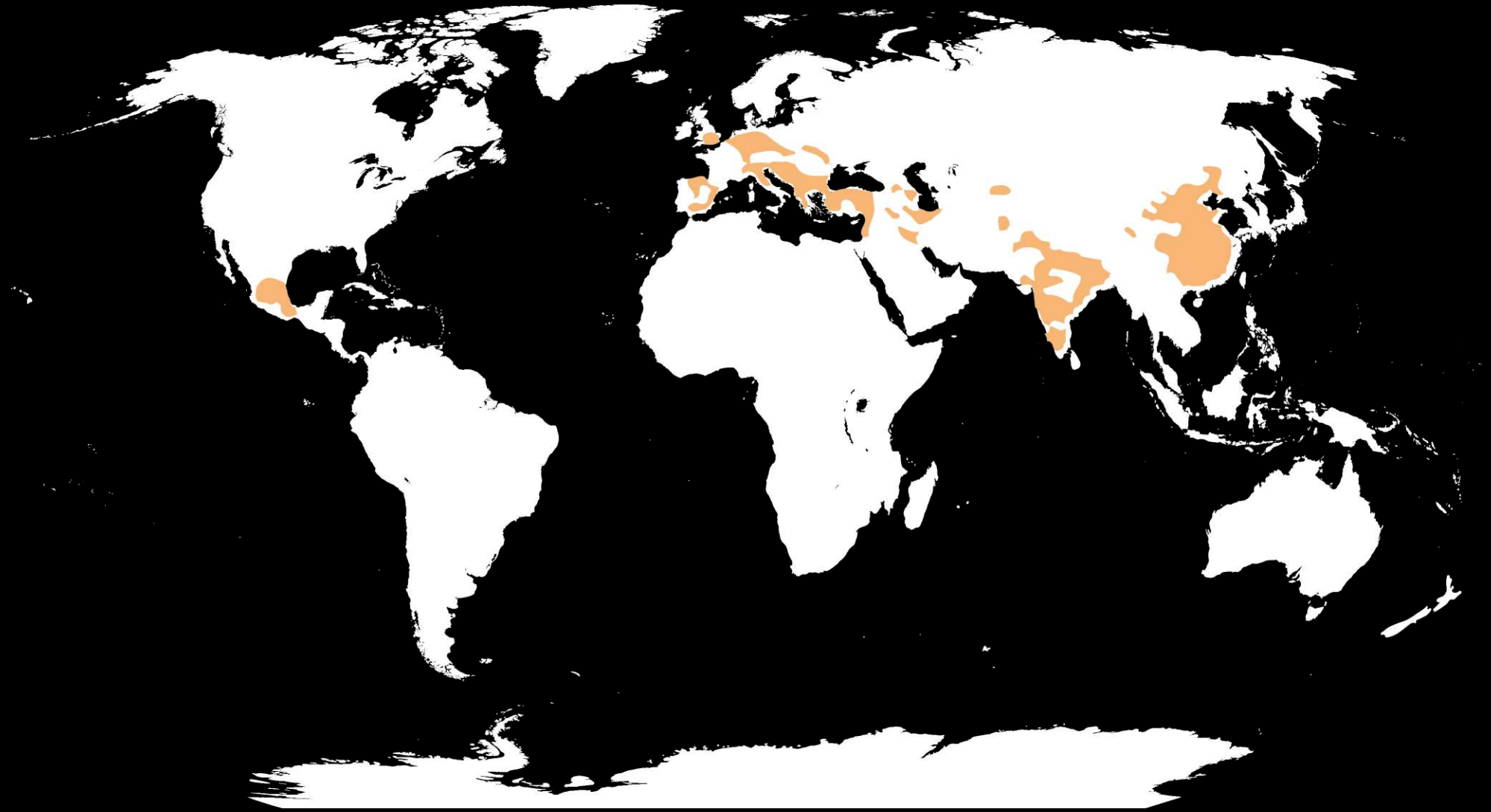
8 billion

[WOLFRAM ALPHA


PRESSURE

Population density in year 3000 BC

[OUR WORLD IN DATA]



Population density

< 1 person/km²

1 - 10

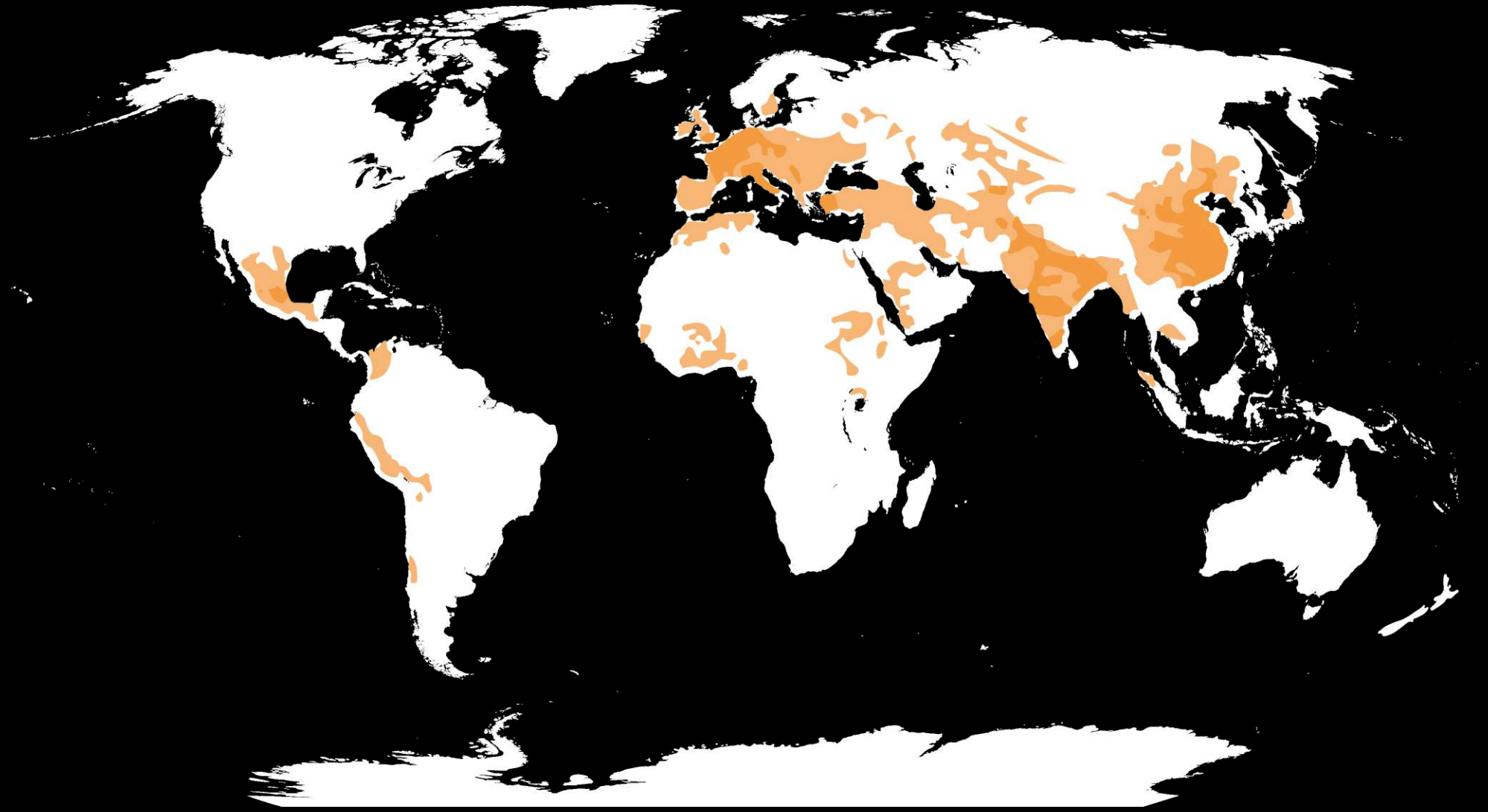
10 - 50

50 - 100

100 - 500

Population density in year 0

[OUR WORLD IN DATA]



Population density

< 1 person/km²

1 - 10

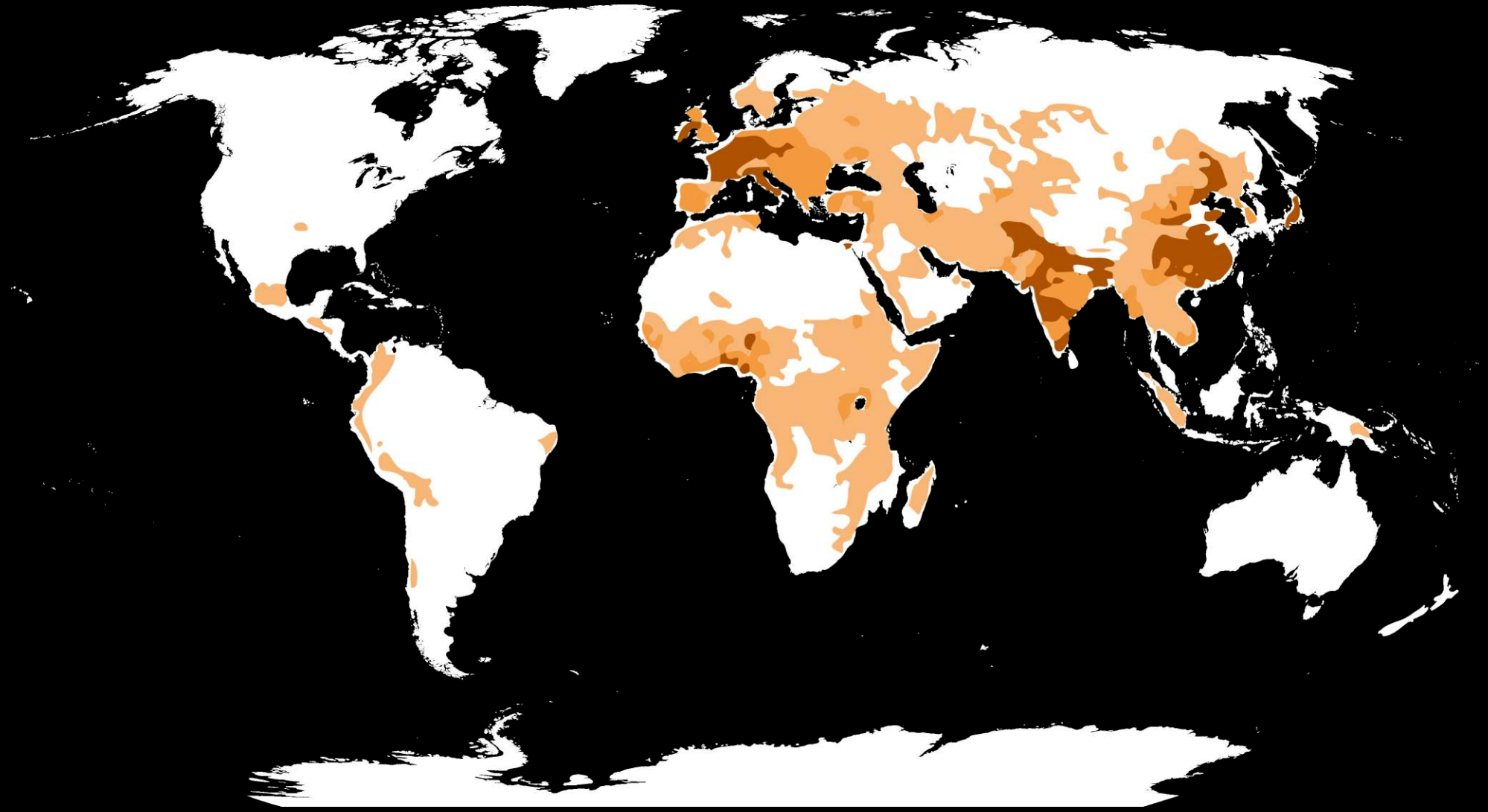
10 - 50

50 - 100

100 - 500

Population density in year 1600

[OUR WORLD IN DATA]



Population density

< 1 person/km²

1 - 10

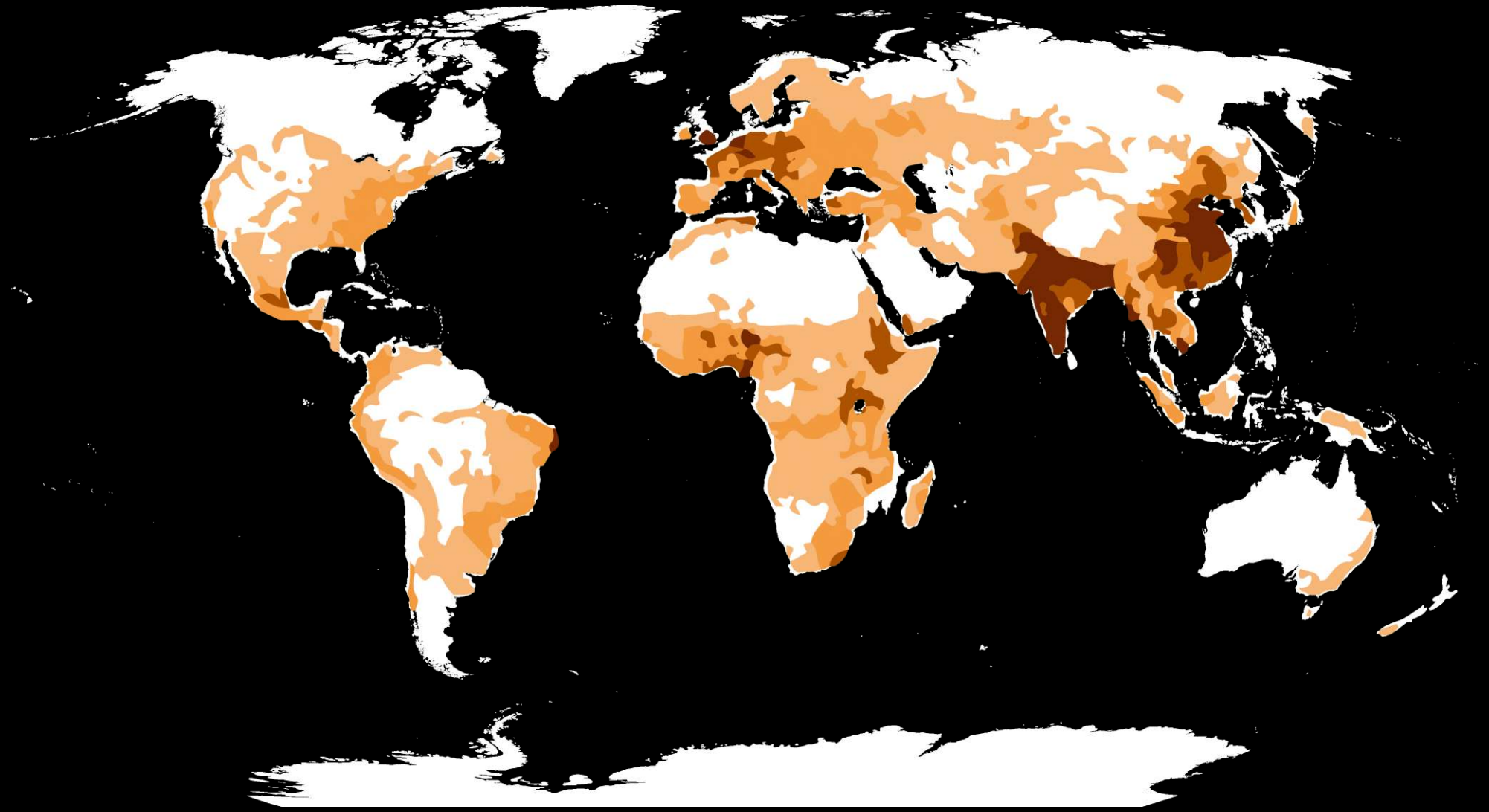
10 - 50

50 - 100

100 - 500

Population density today

[OUR WORLD IN DATA]



Population density

< 1 person/km²

1 - 10

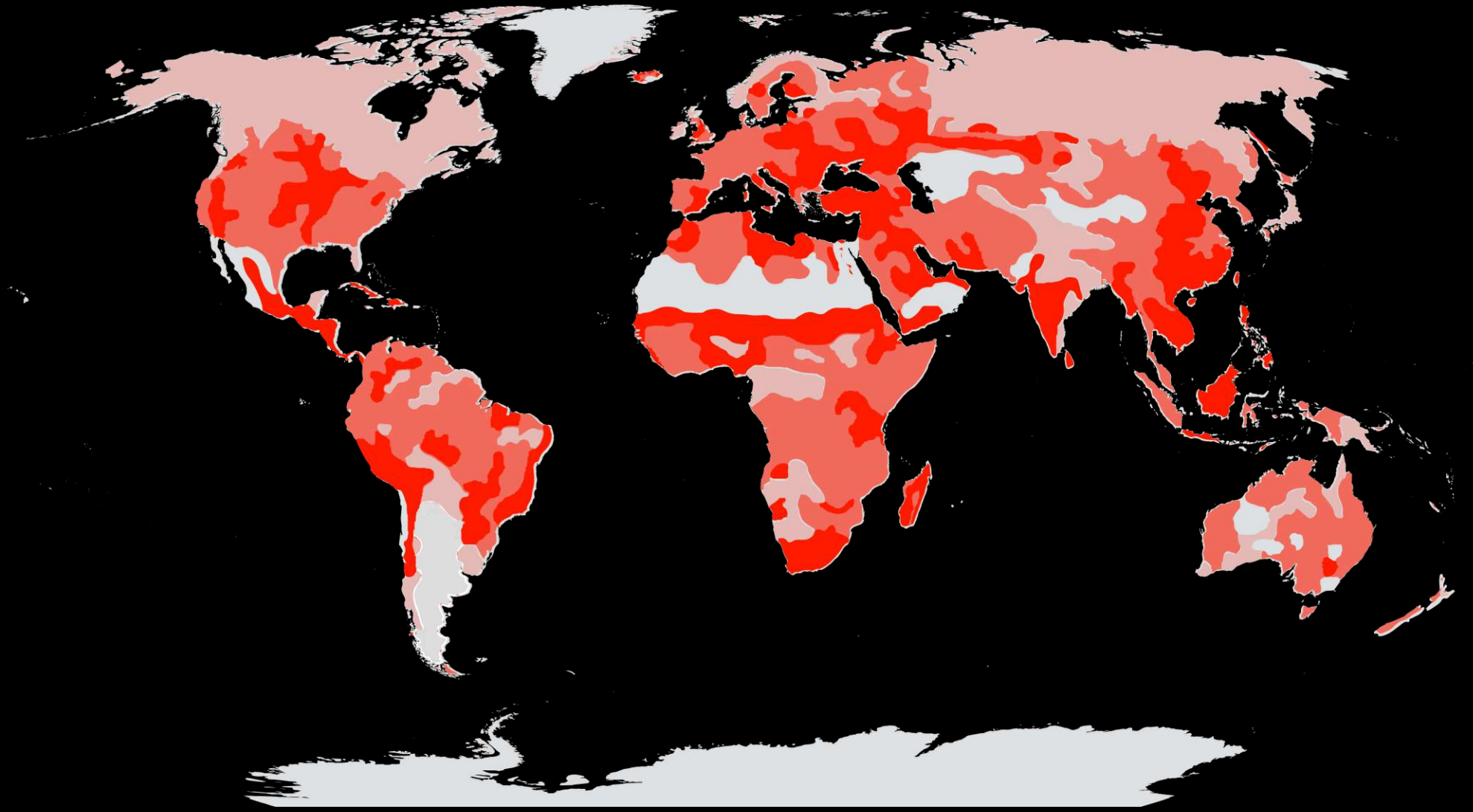
10 - 50

50 - 100

100 - 500

Land degradation

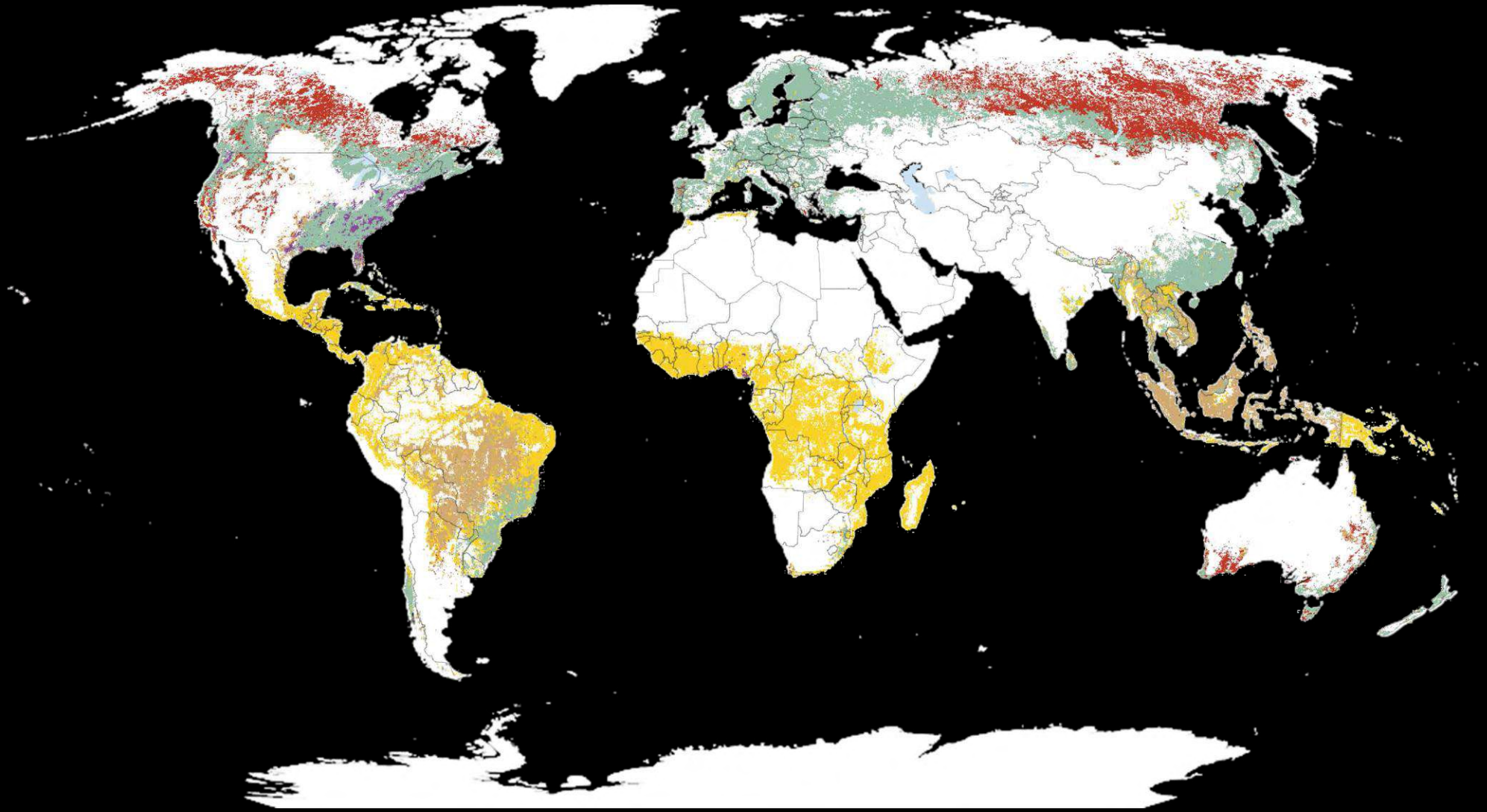
[MAPY CZ]



The state of land

Deforestation

[WRI INDONESIA; NASA]



Commodity-driven deforestation

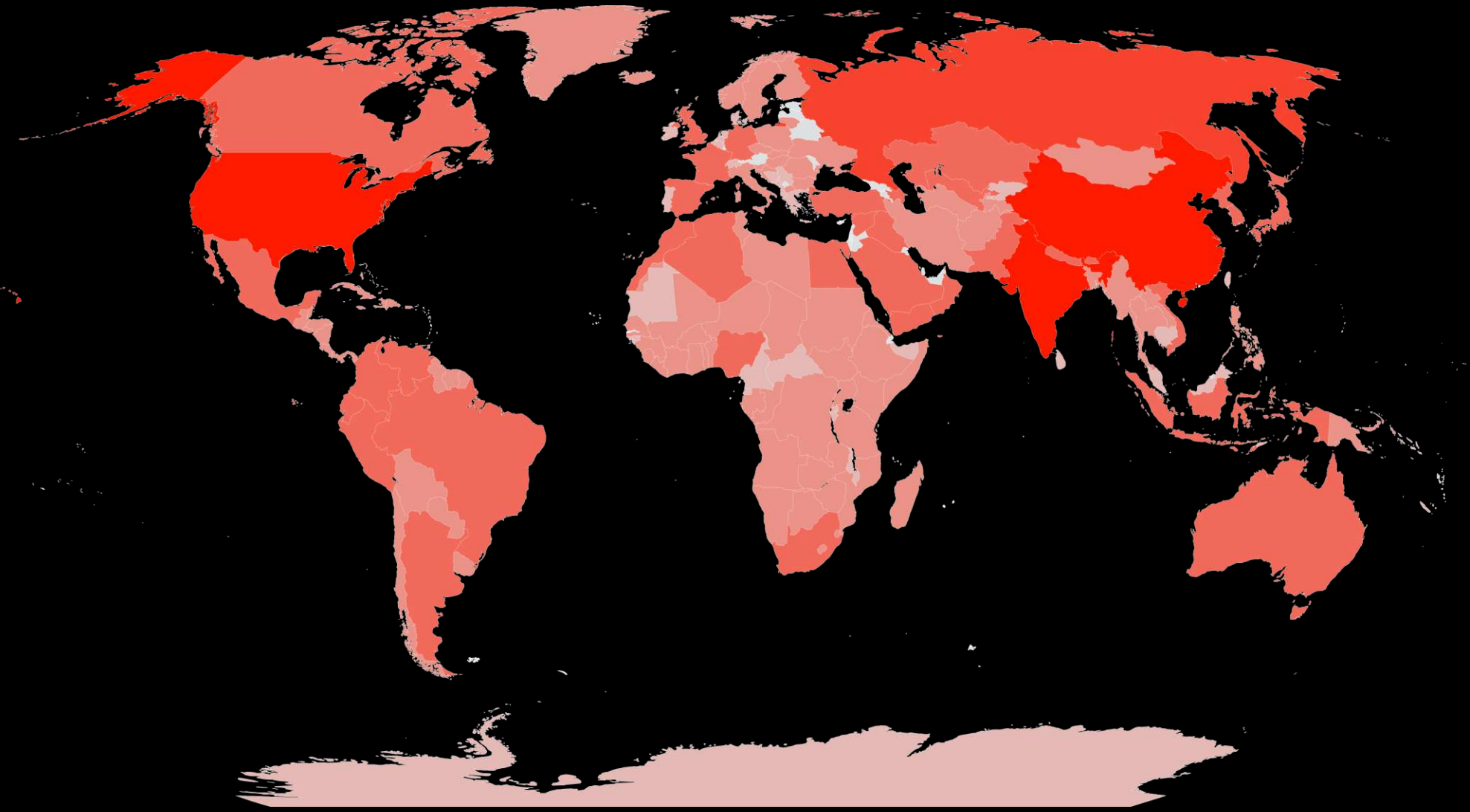
Shifting agriculture

Forestry

Wildfire

Main deforestation causes

CO_2 emissions



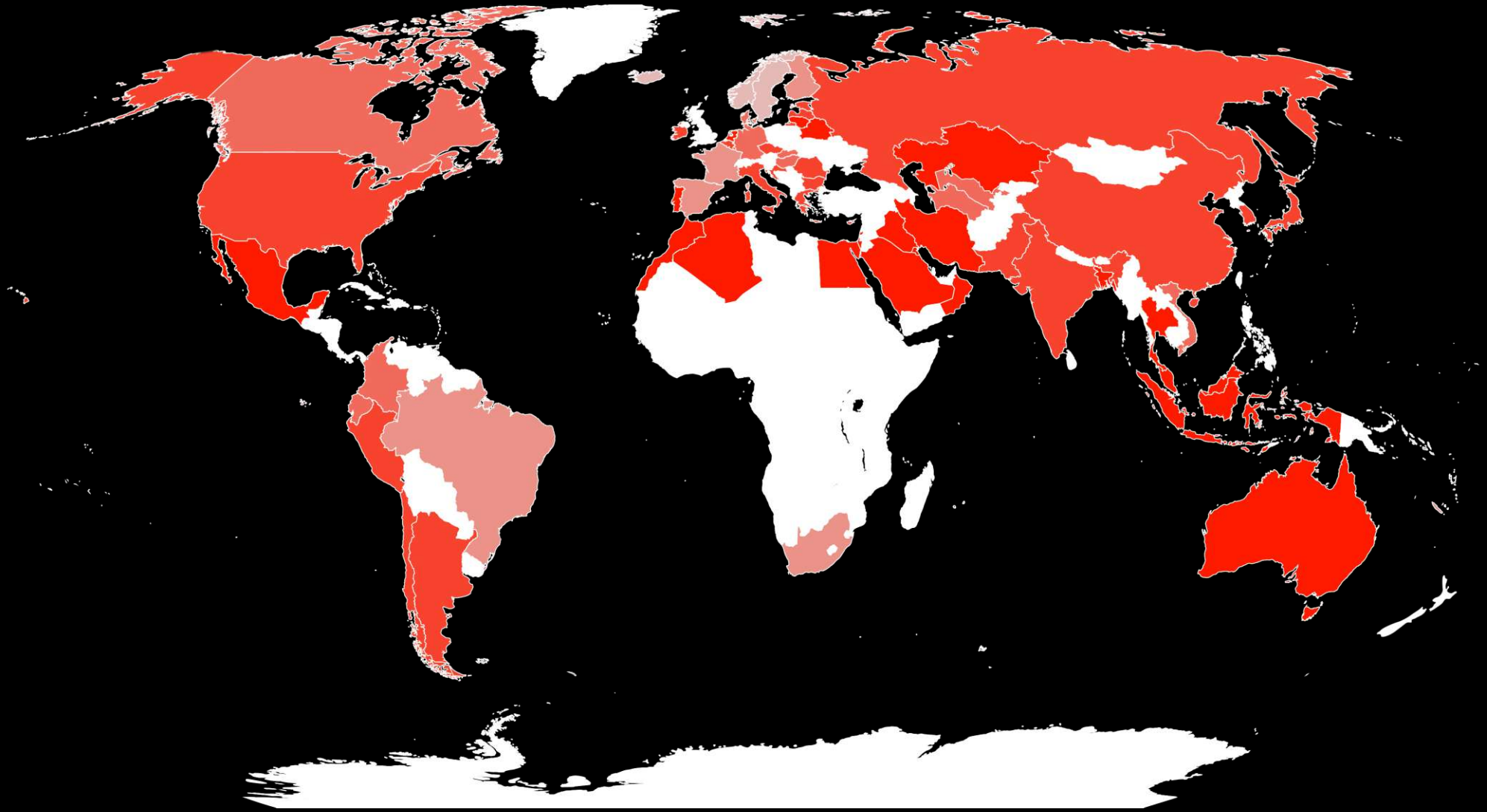
0 — 11 500 Megatons of carbon dioxide emissions (2020)

No data

Amount of CO_2 emissions produced by countries

Use of nonrenewable resources

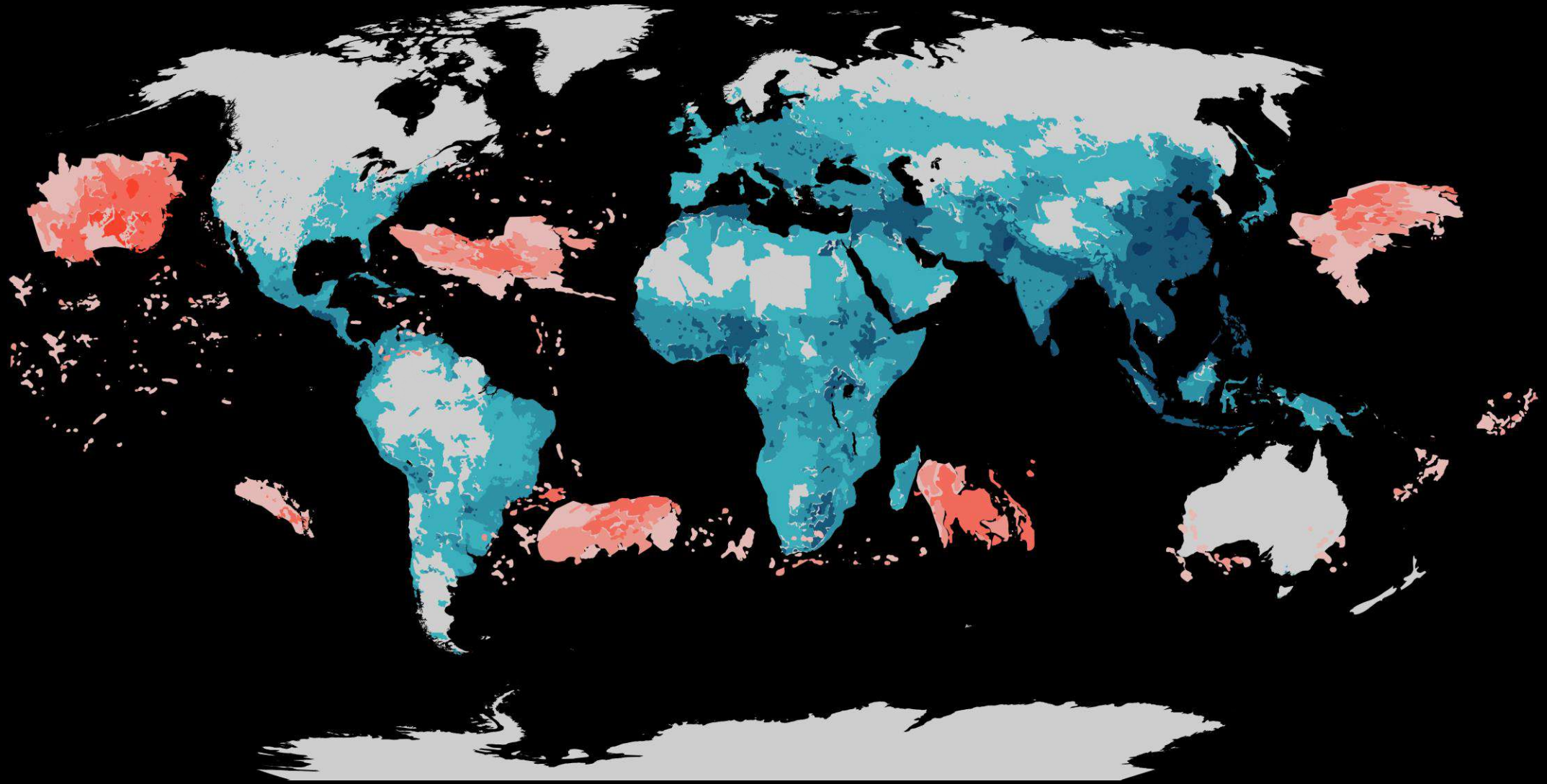
[OUR WORLD IN DATA]



Ratio of nonrenewables in net energy production

Plastic waste production

[NATIONAL GEOGRAPHIC]



Weight of produced plastic waste

<10 >10.000

t/year

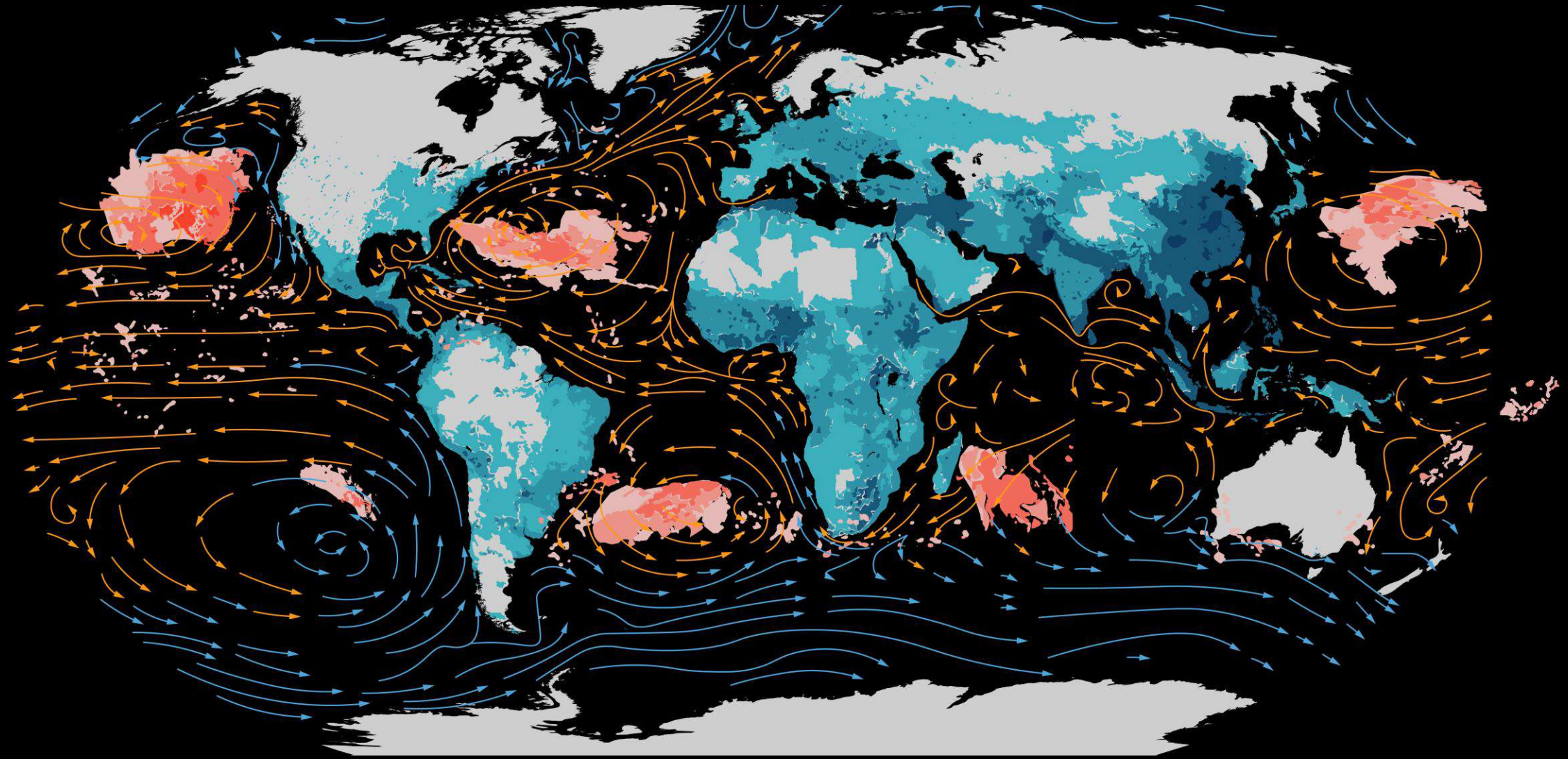
Weight of plastic waste stuck in the ocean

0.26 5.88

kg/km^2

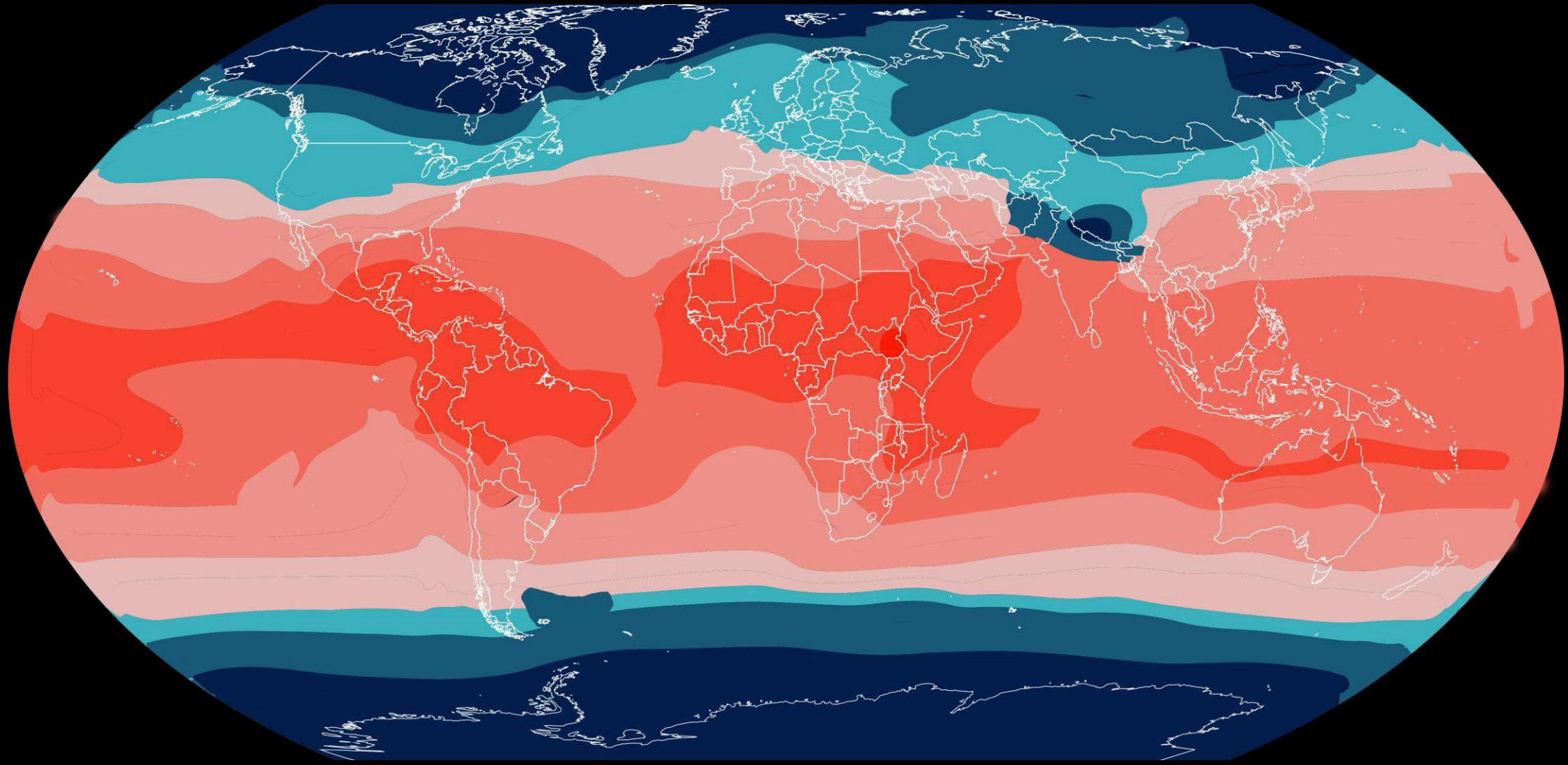
Plastic waste production

[NATIONAL GEOGRAPHIC]



Average temperature in year 1922

[WIKIMEDIA]

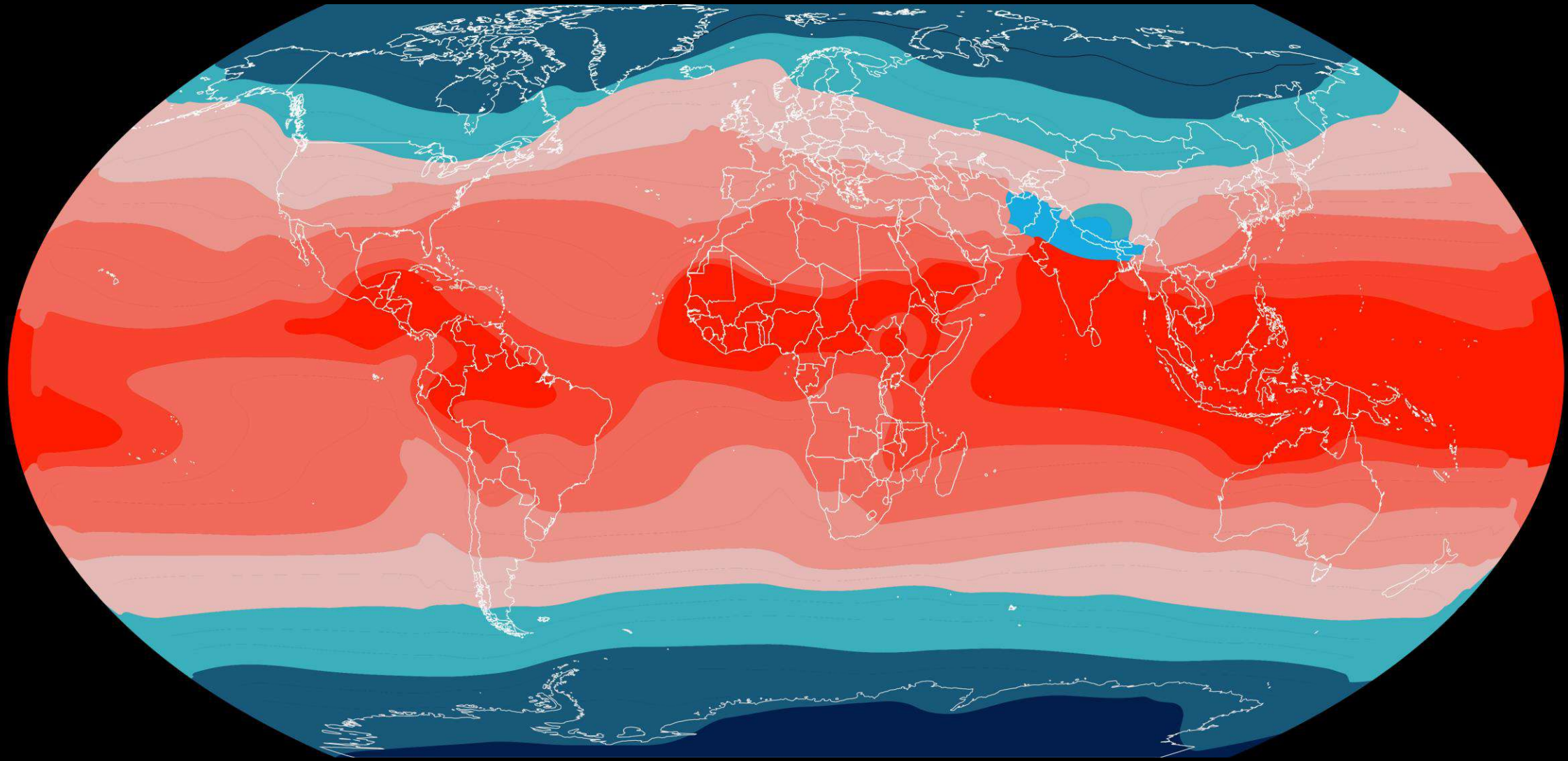


Temperature ranges

-50 to -15°C
-15 to -5°C
-5 to 5°C
5°C to 10°C
10 to 15°C
15 to 20°C
20 to 25°C
25 to 30°C

Average temperature now

[WIKIMEDIA]



Temperature ranges

-50 to -15°C
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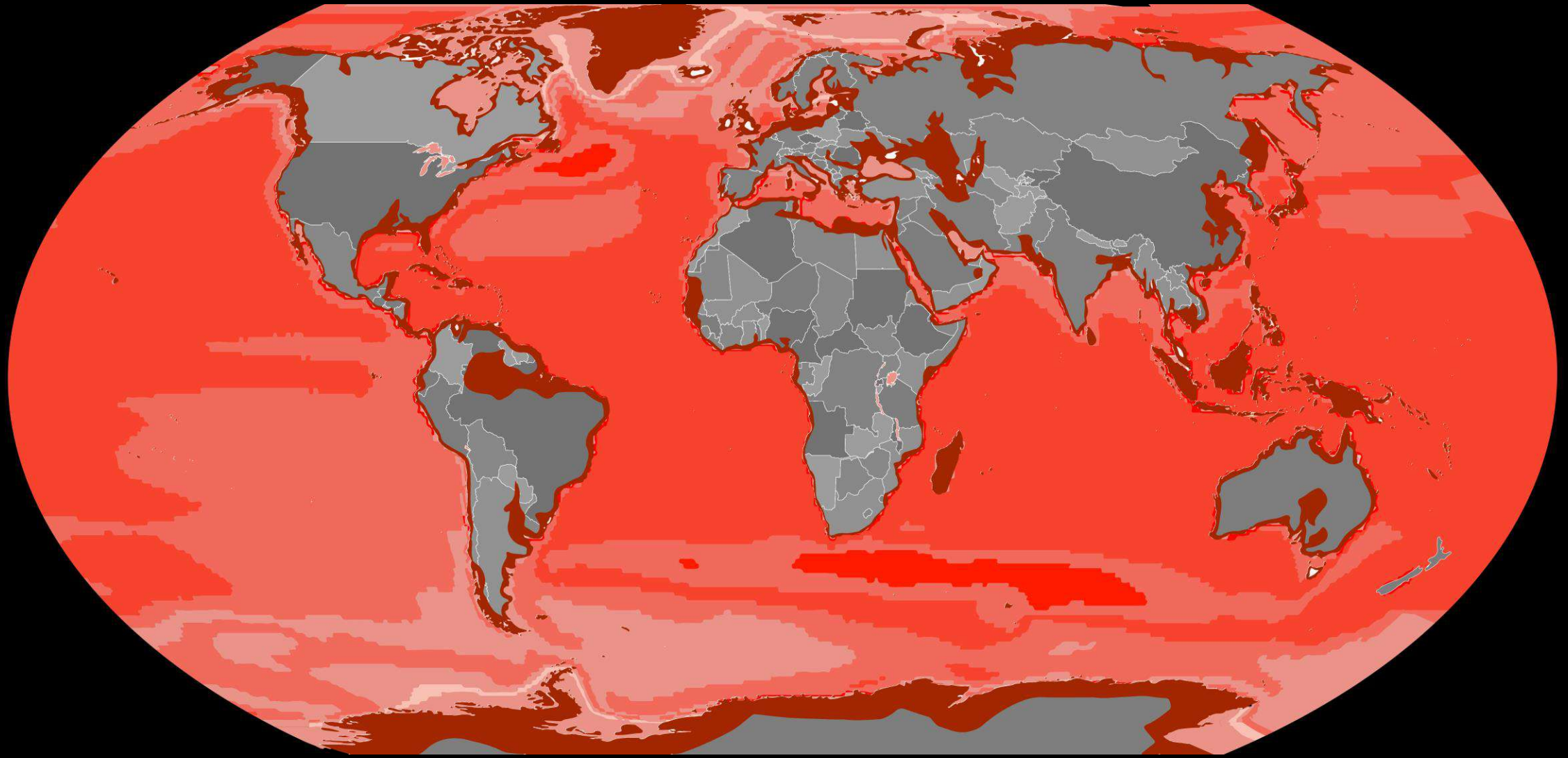
5°C to 10°C
10 to 15°C
15 to 20°C
20 to 25°C
25 to 30°C

Sea level rise

[NASA]



-6m +6m potential new seashore

Sea level rise per year

This is the way our planet fights us back

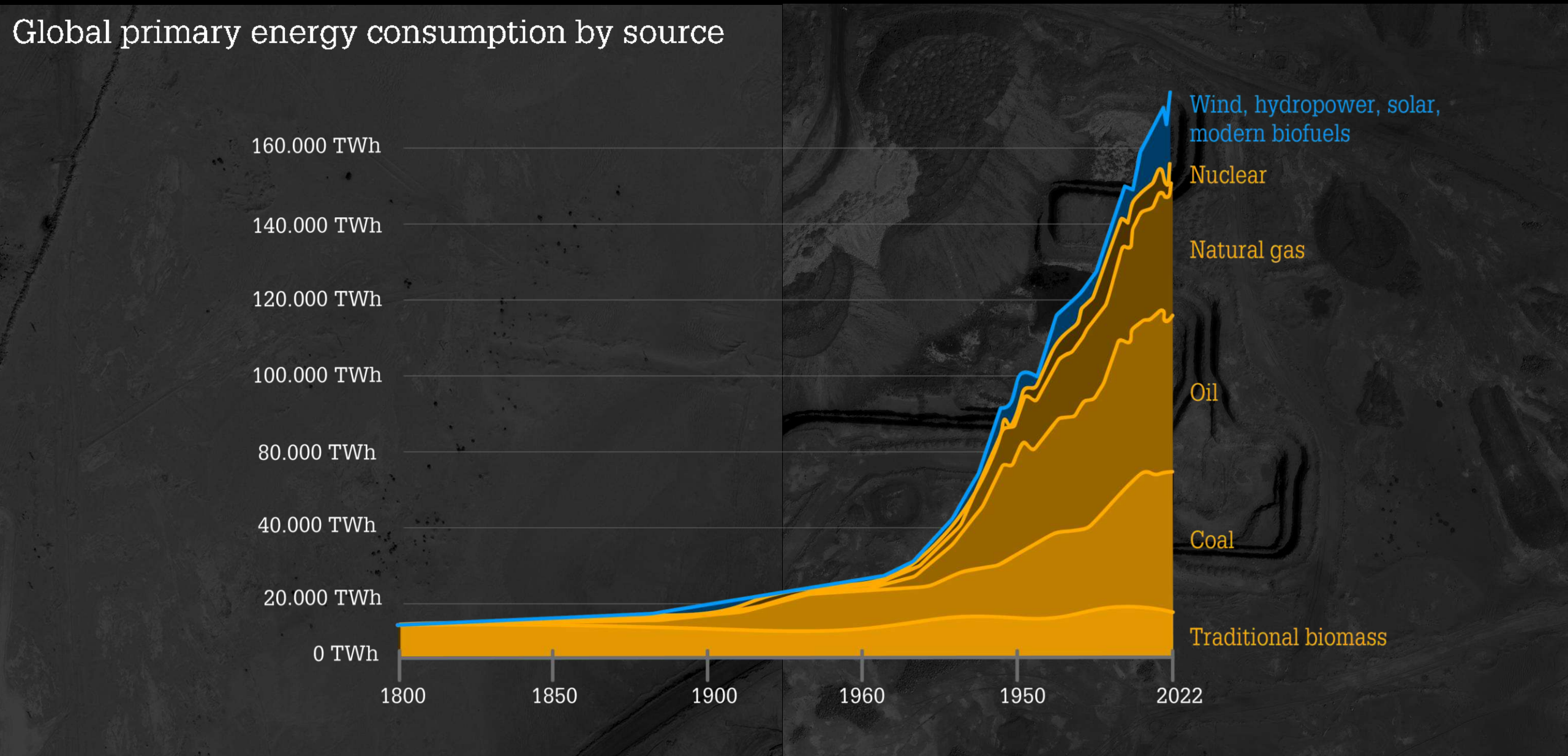
To further illustrate the scale of our impact, we introduce the urgencies

Urgencies

1. Use of nonrenewable resources
2. Waste
3. Environmental pollution
4. Access to safe water
5. Growing population

[OVERVIEW; OUR WORLD IN DATA]

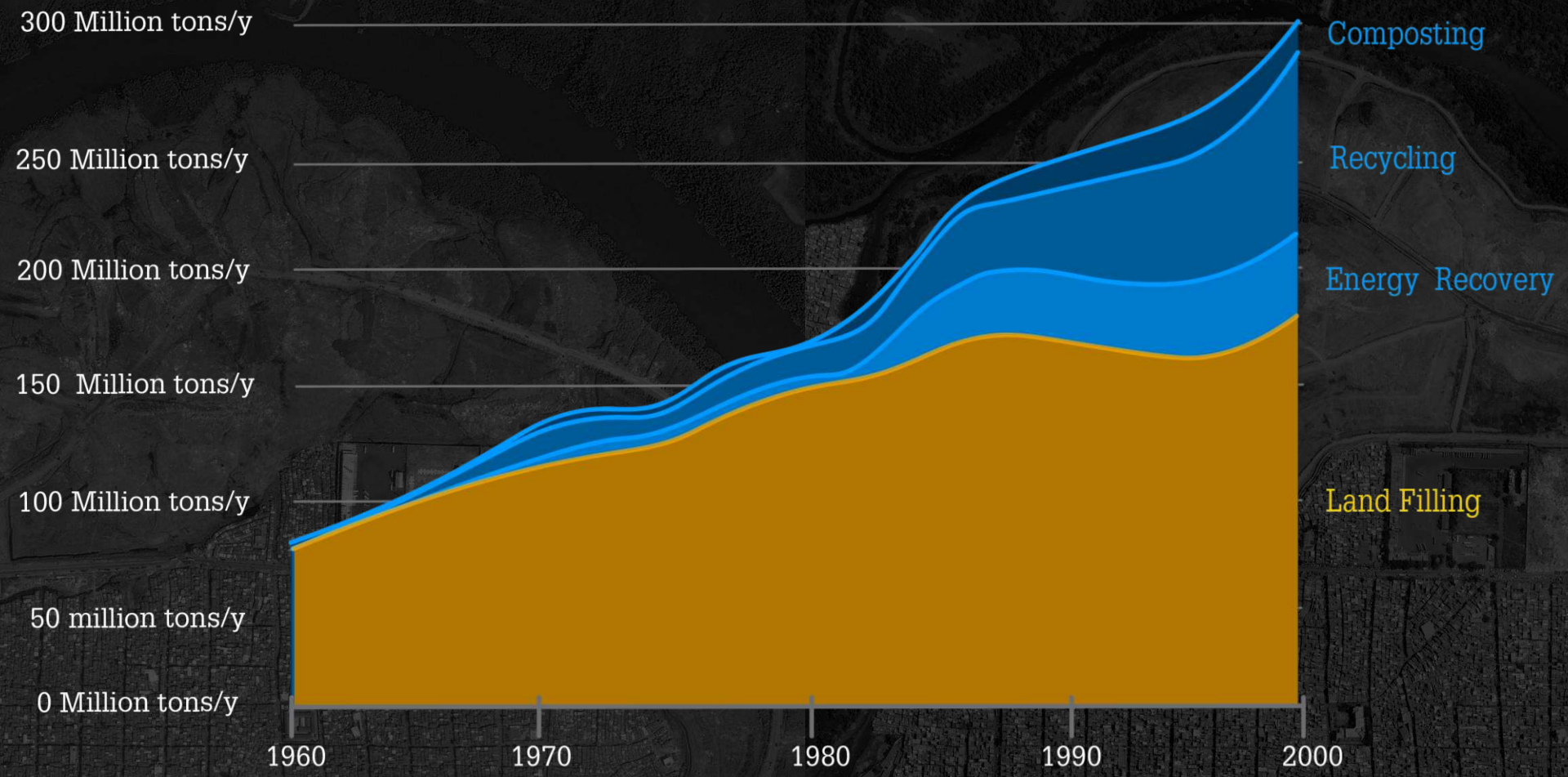
Use of nonrenewable resources



Use of nonrenewable resources

Waste

Discarded materials by the millionth ton from the years 1960-2005

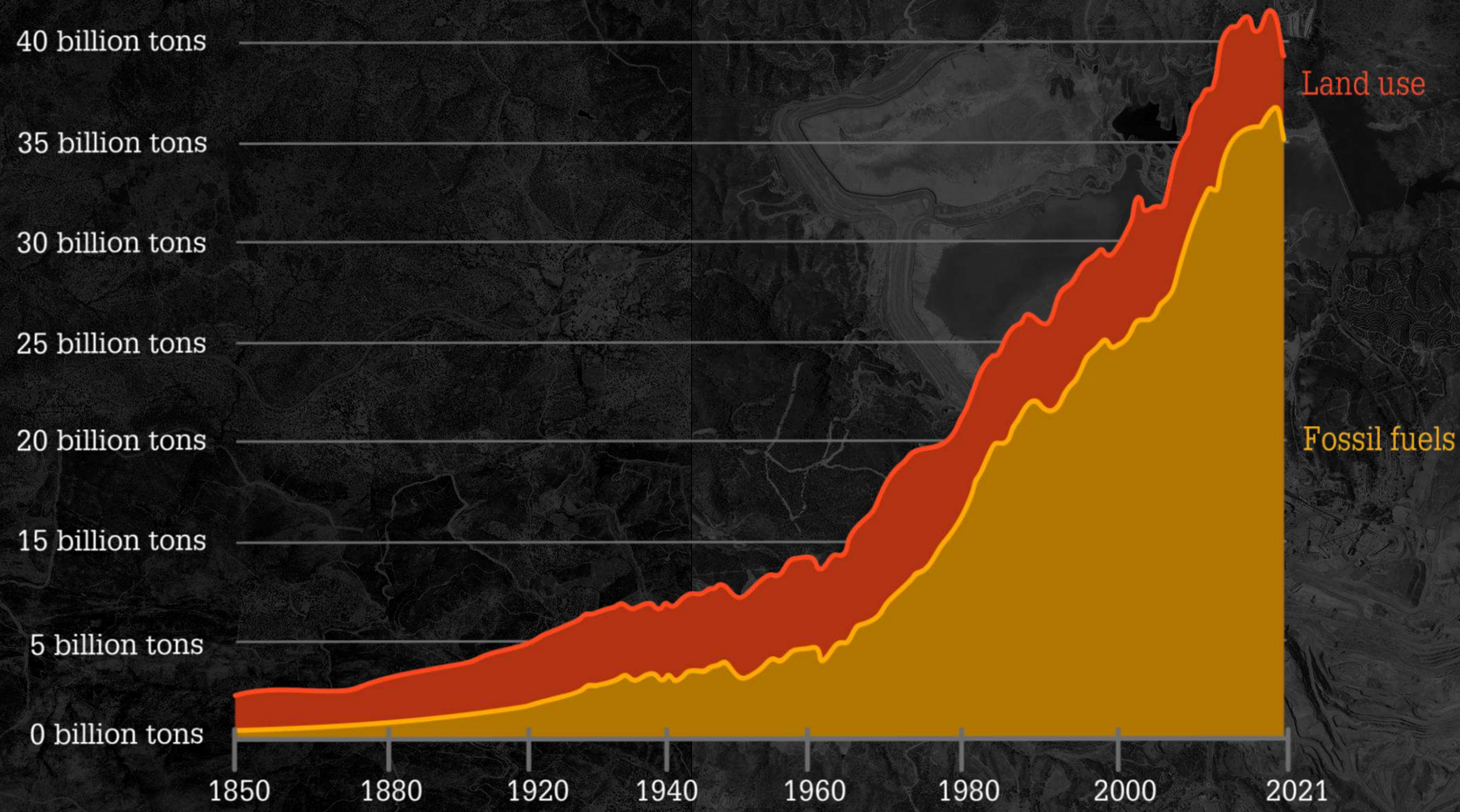


Waste

[OVERVIEW; OUR WORLD IN DATA]

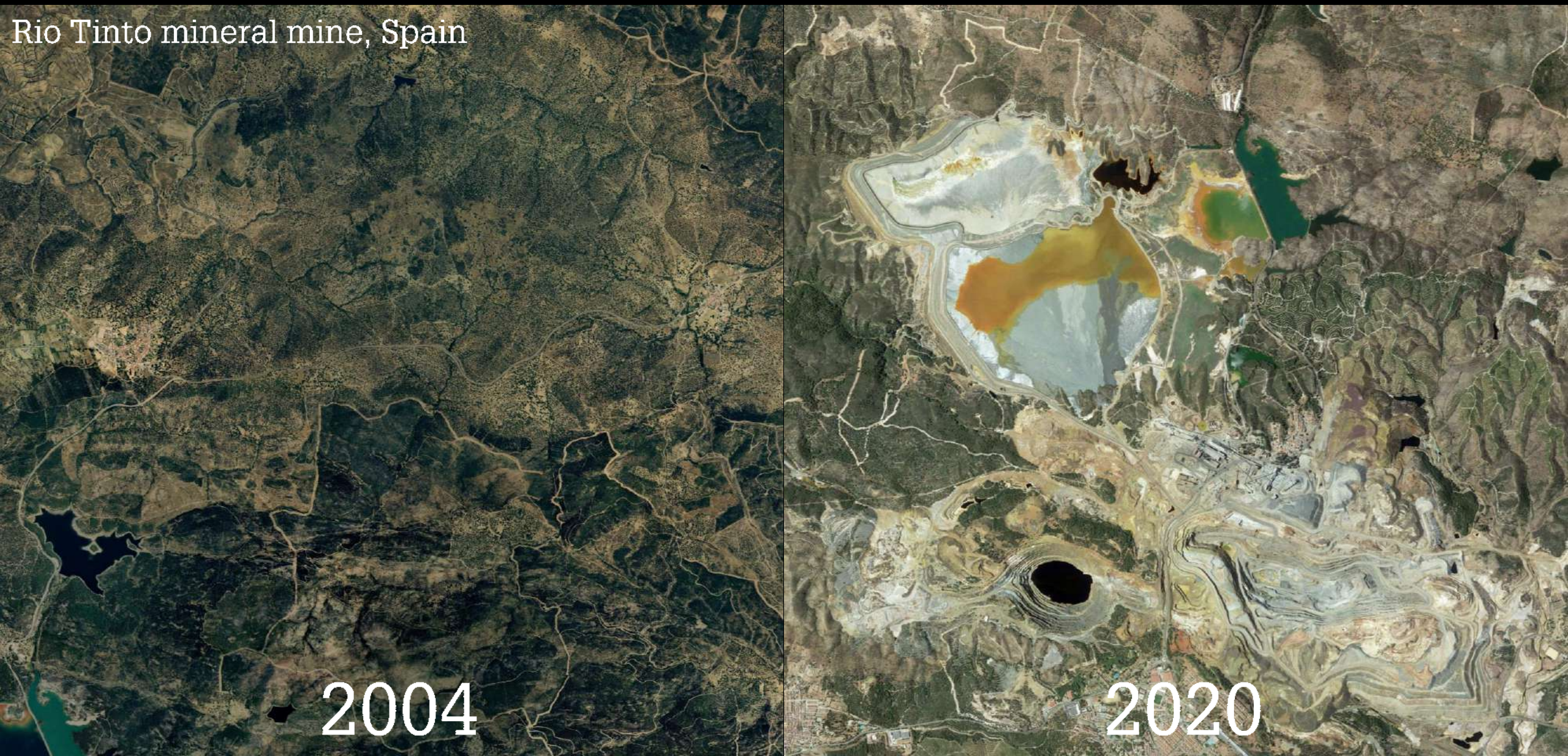
Environmental pollution

Global CO_2 emissions from fossil fuels and land use change, World



Environmental pollution

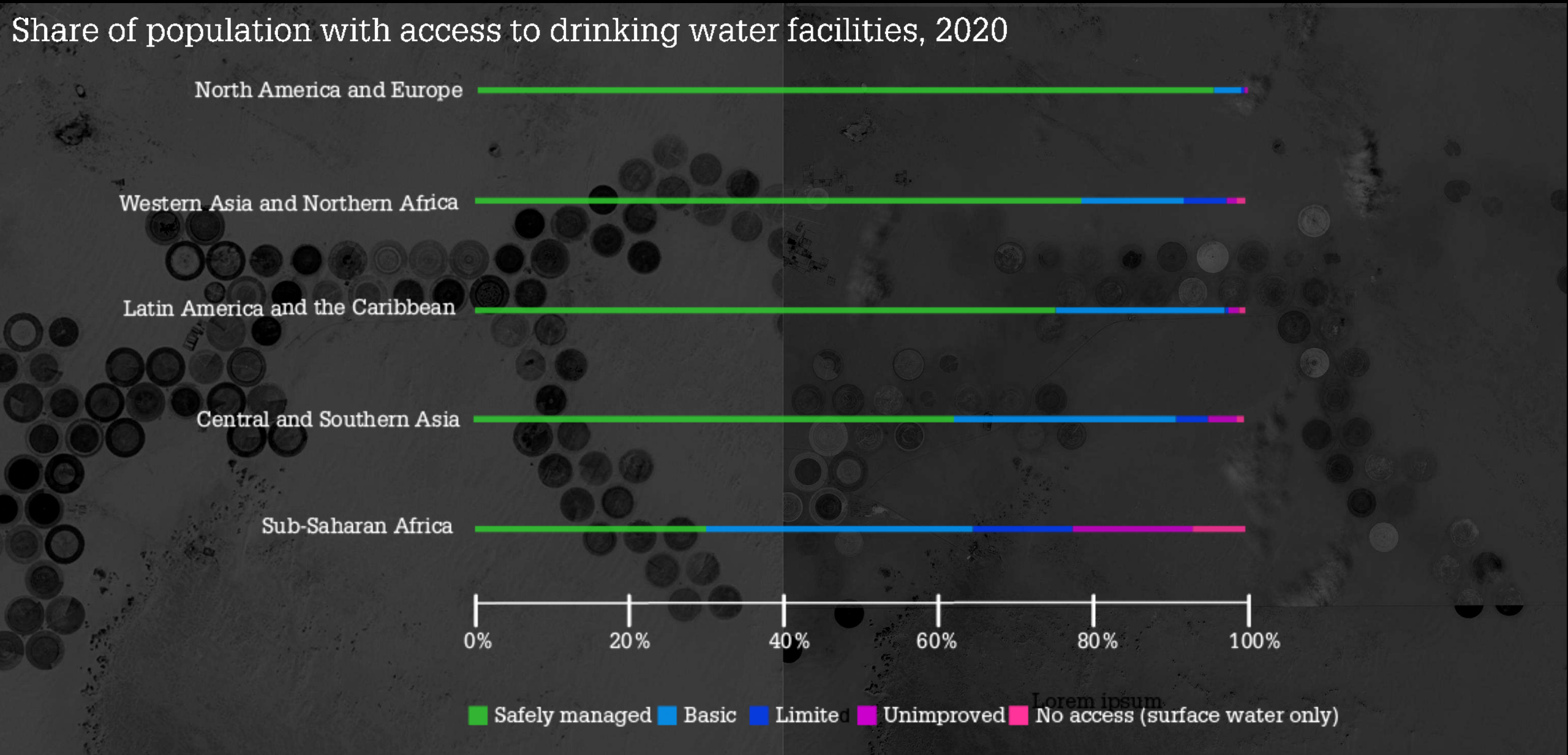
[OVERVIEW]



[OVERVIEW; WEFORUM]

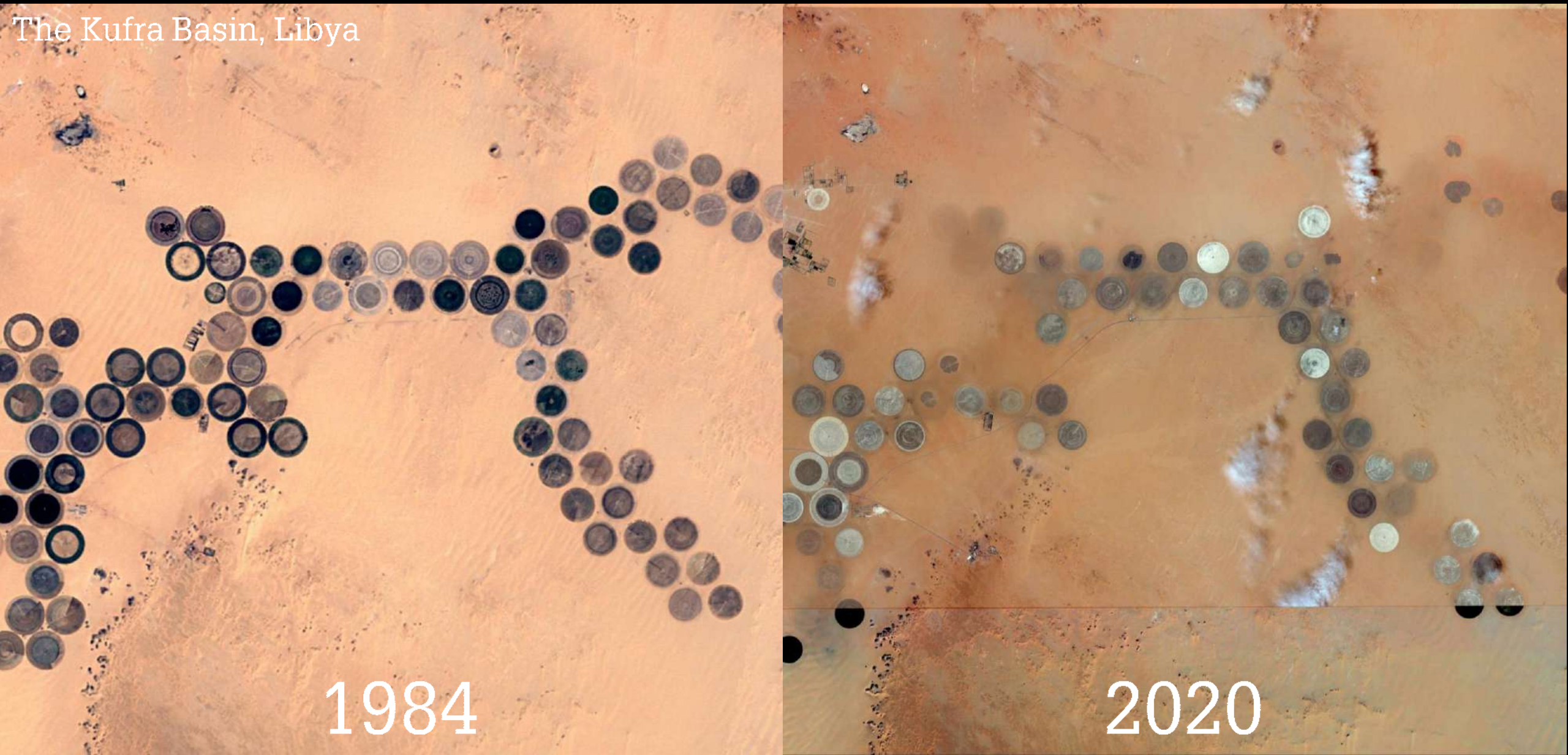
Access to safe water

Share of population with access to drinking water facilities, 2020



Lorem ipsum

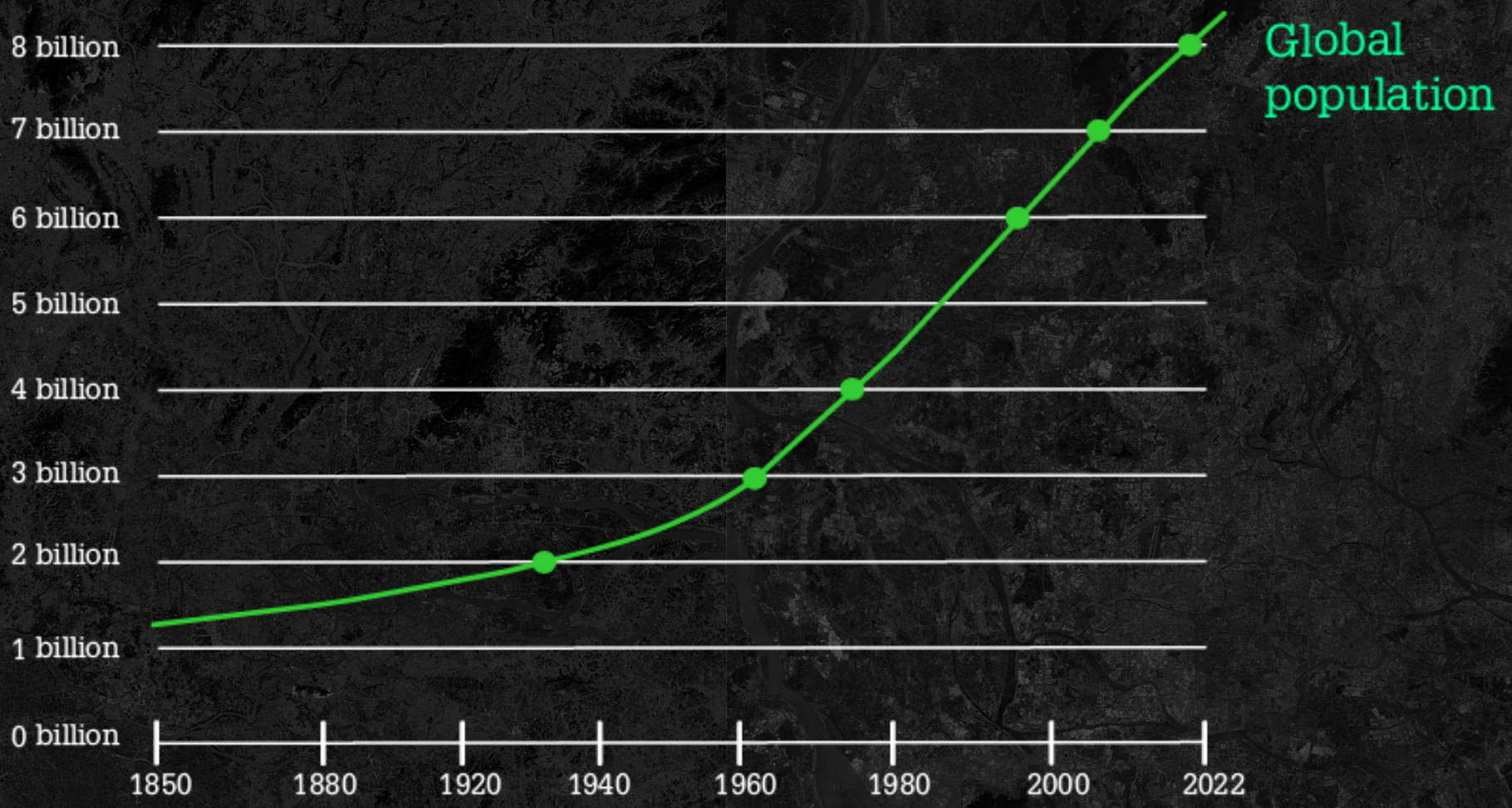
Access to safe water



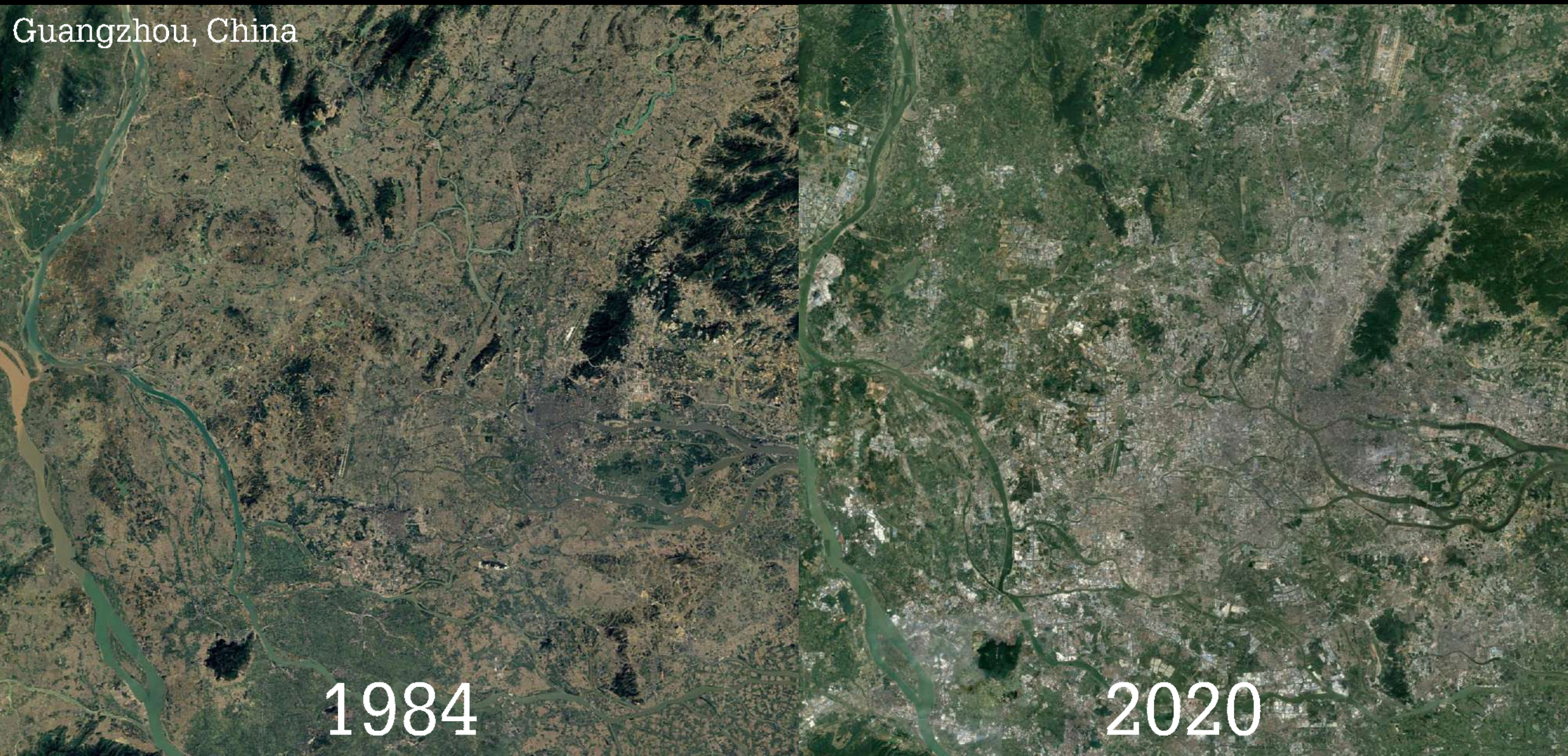
Growing population

[OVERVIEW; OUR WORLD IN DATA]

Global population growth, 1850 - 2022

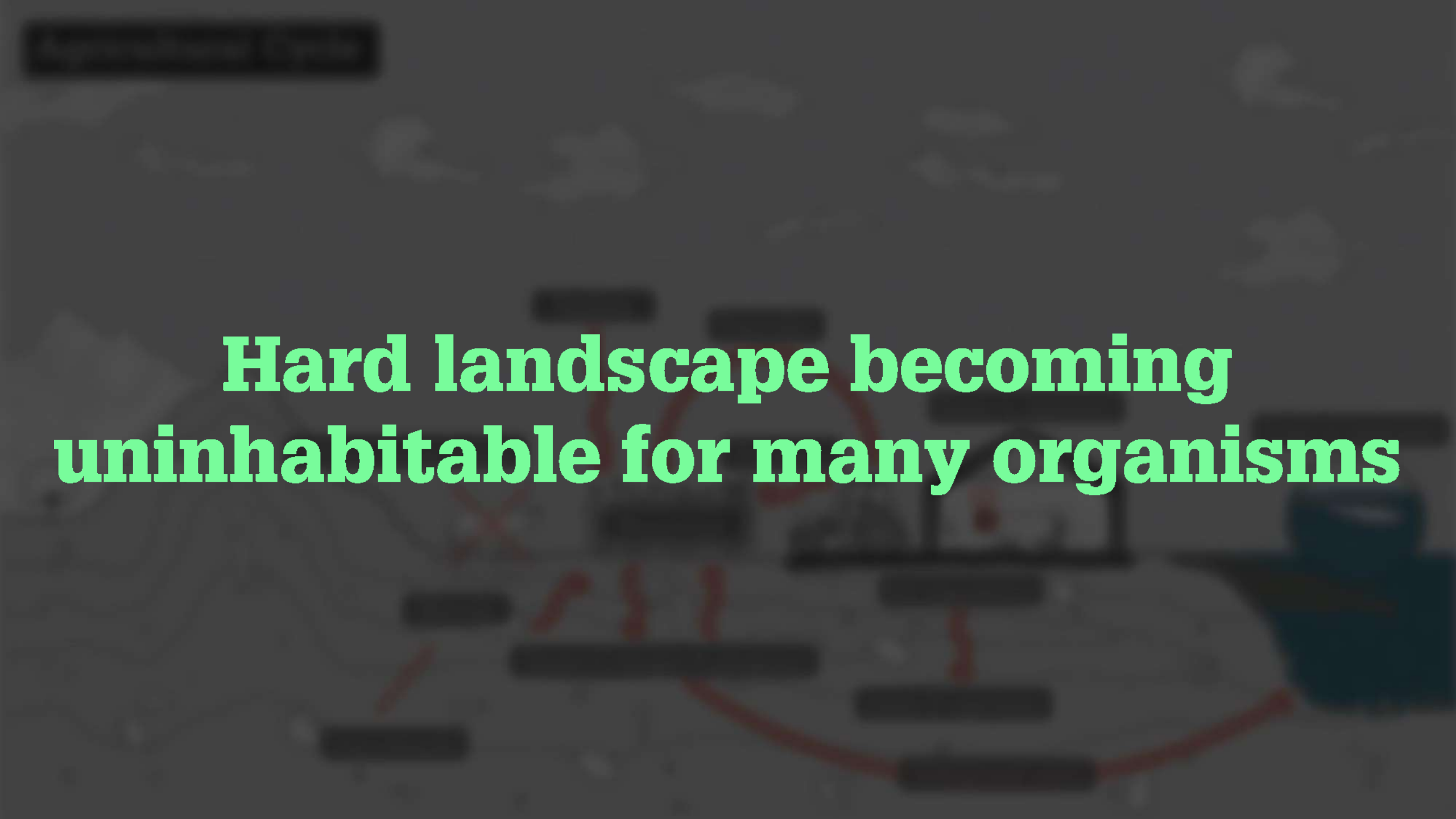


Growing population

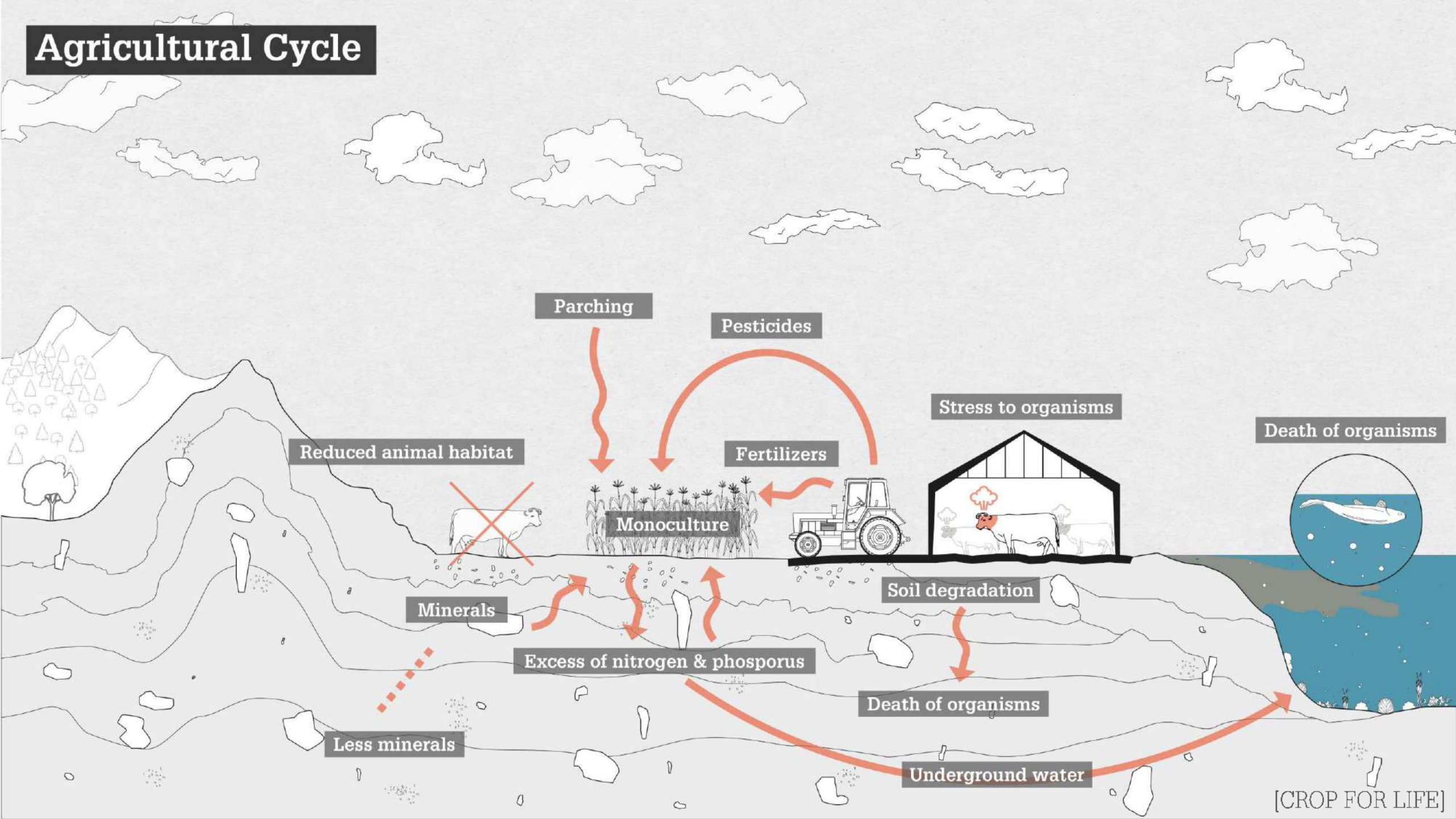


The urgencies illustrate the consequences of the pressure we put on the Earth

Humankind disrupted the balanced cycles

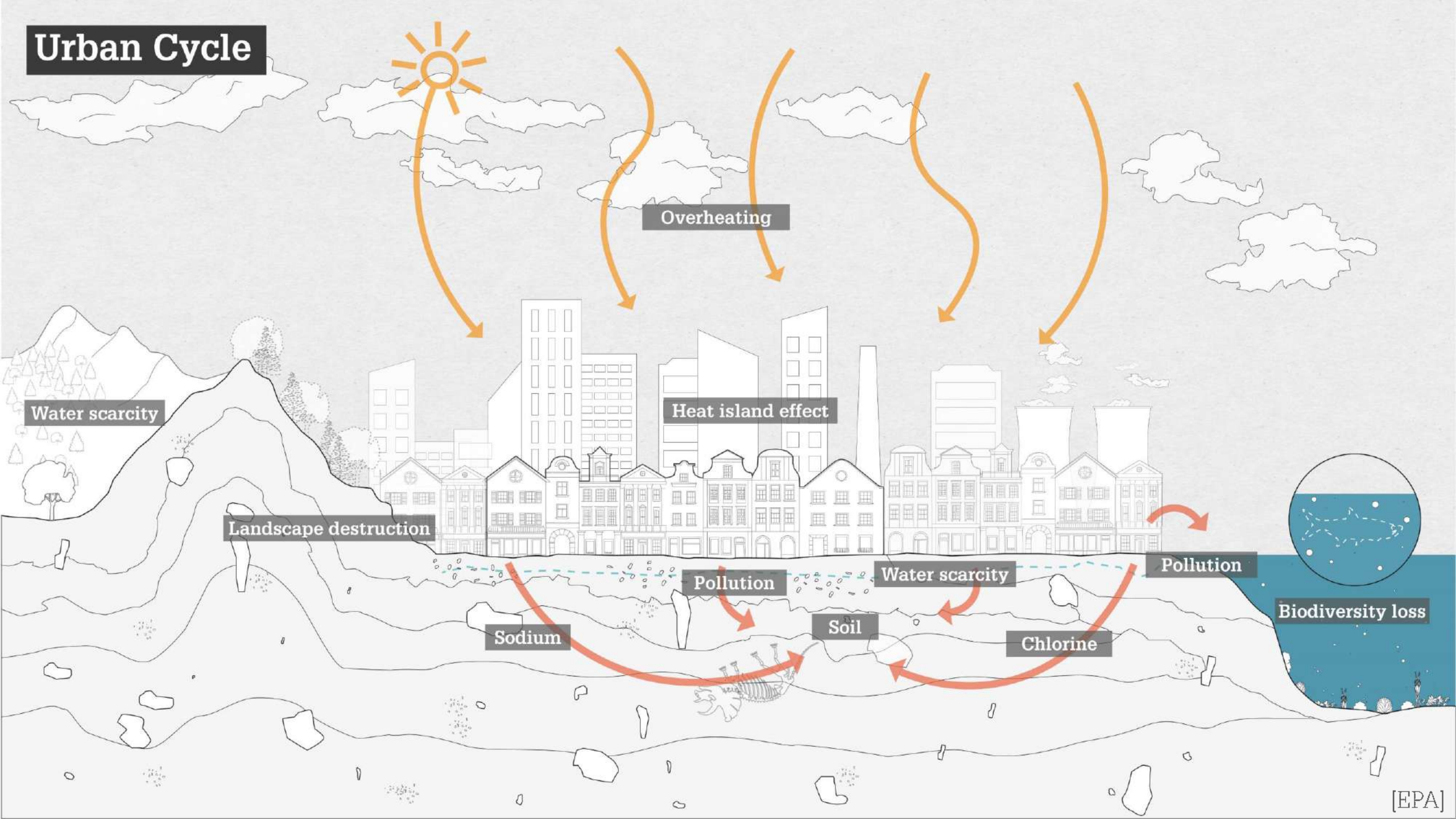

Hard landscape becoming uninhabitable for many organisms

Agricultural Cycle

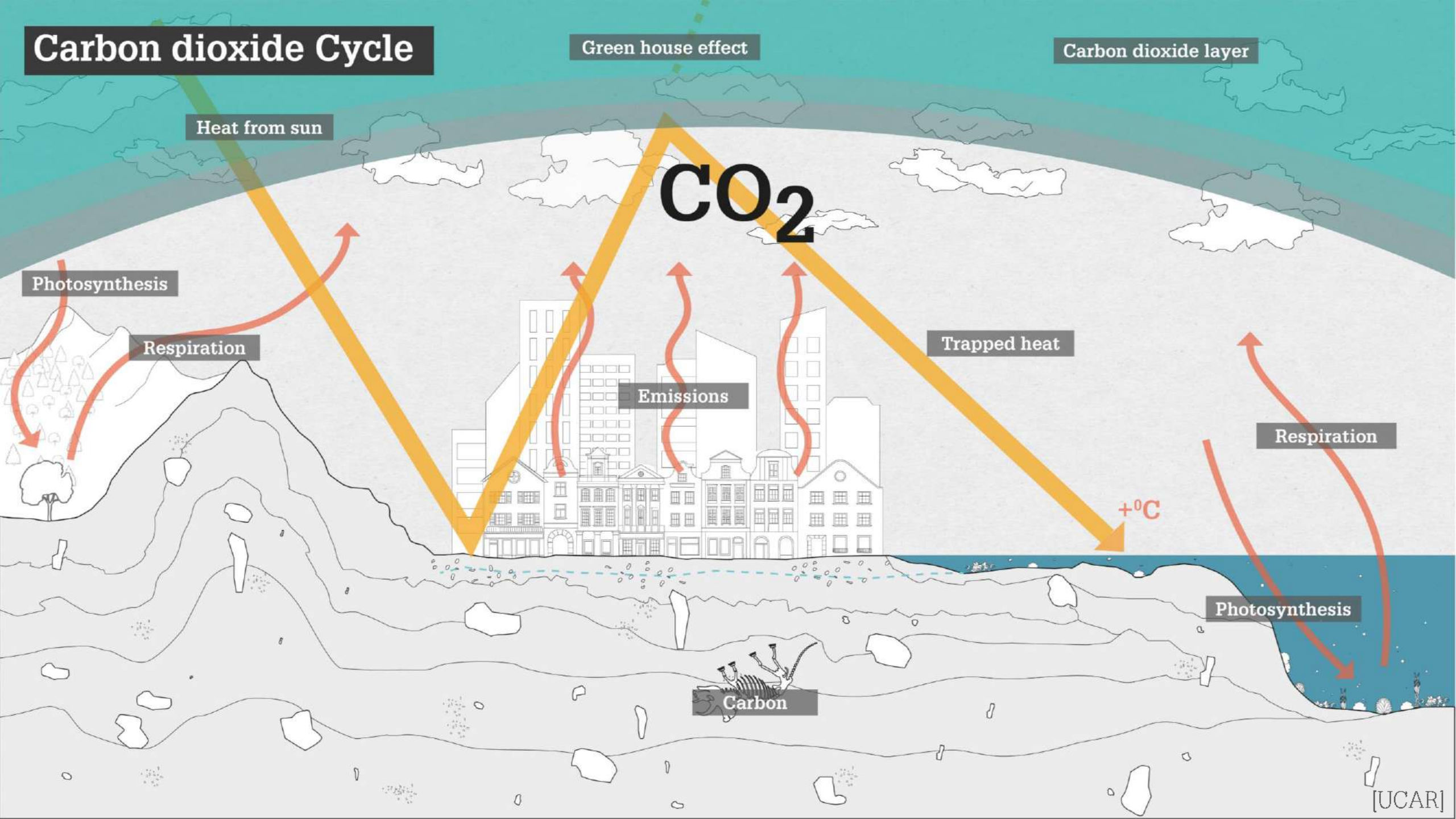


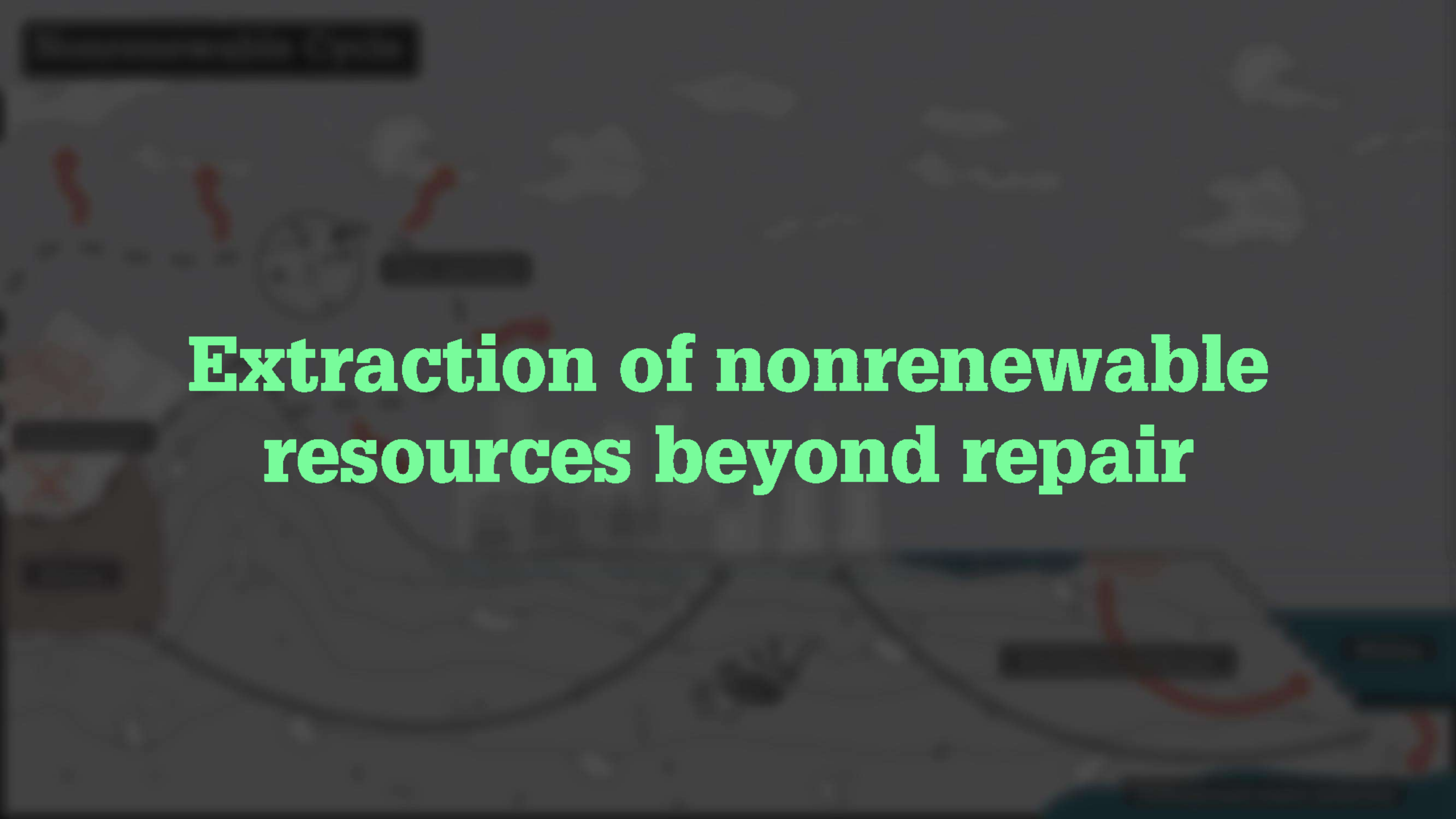
[CROP FOR LIFE]


Human-made overproduction causes permanent damage to soil

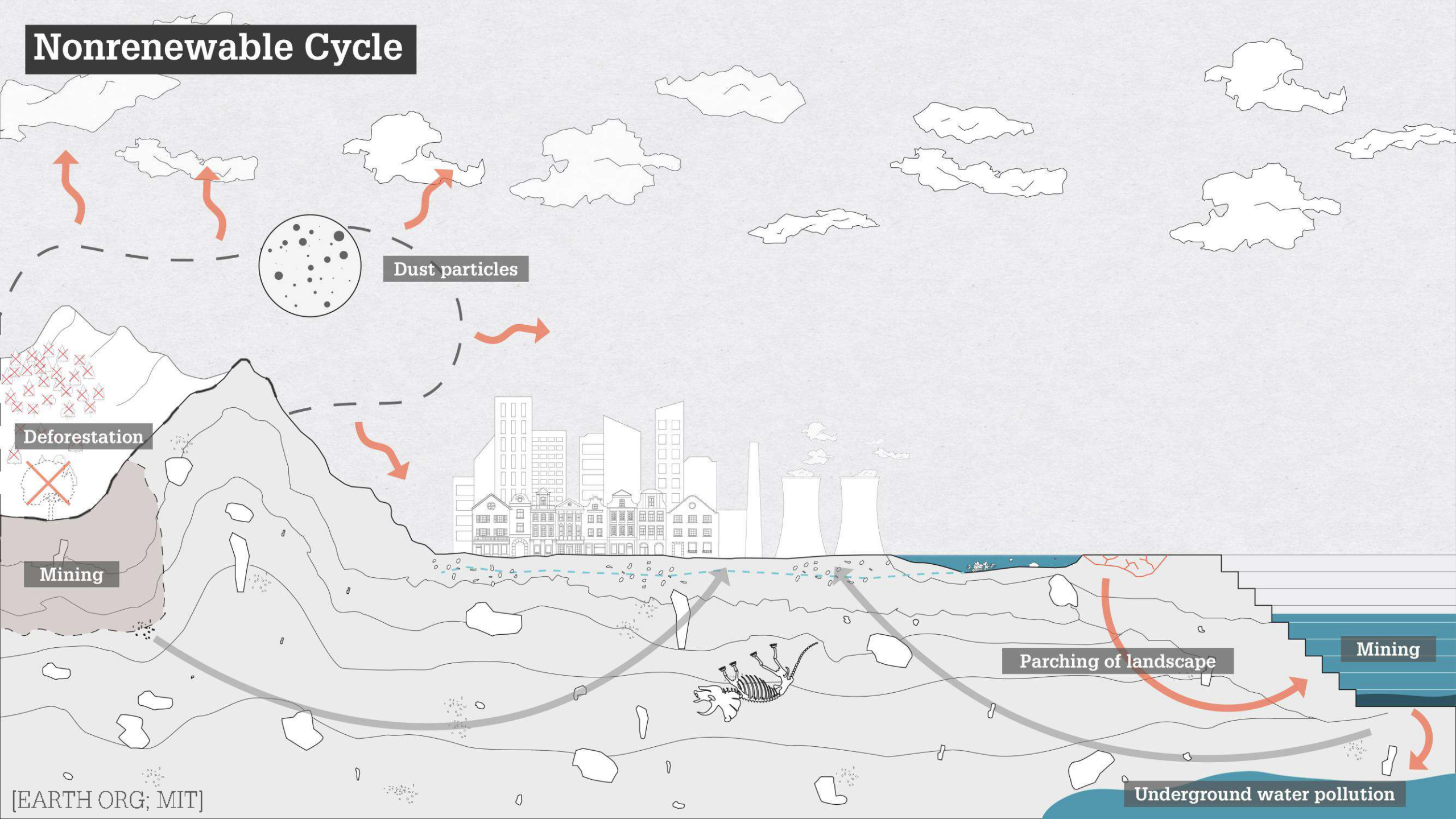

Urban Cycle
Overheating
Water scarcity
Heat island effect
Landscape destruction
Pollution
Water scarcity
Pollution
Biodiversity loss
Soil
Sodium
Chlorine
[EPA]

Overproduction of carbon dioxide is responsible for global warming

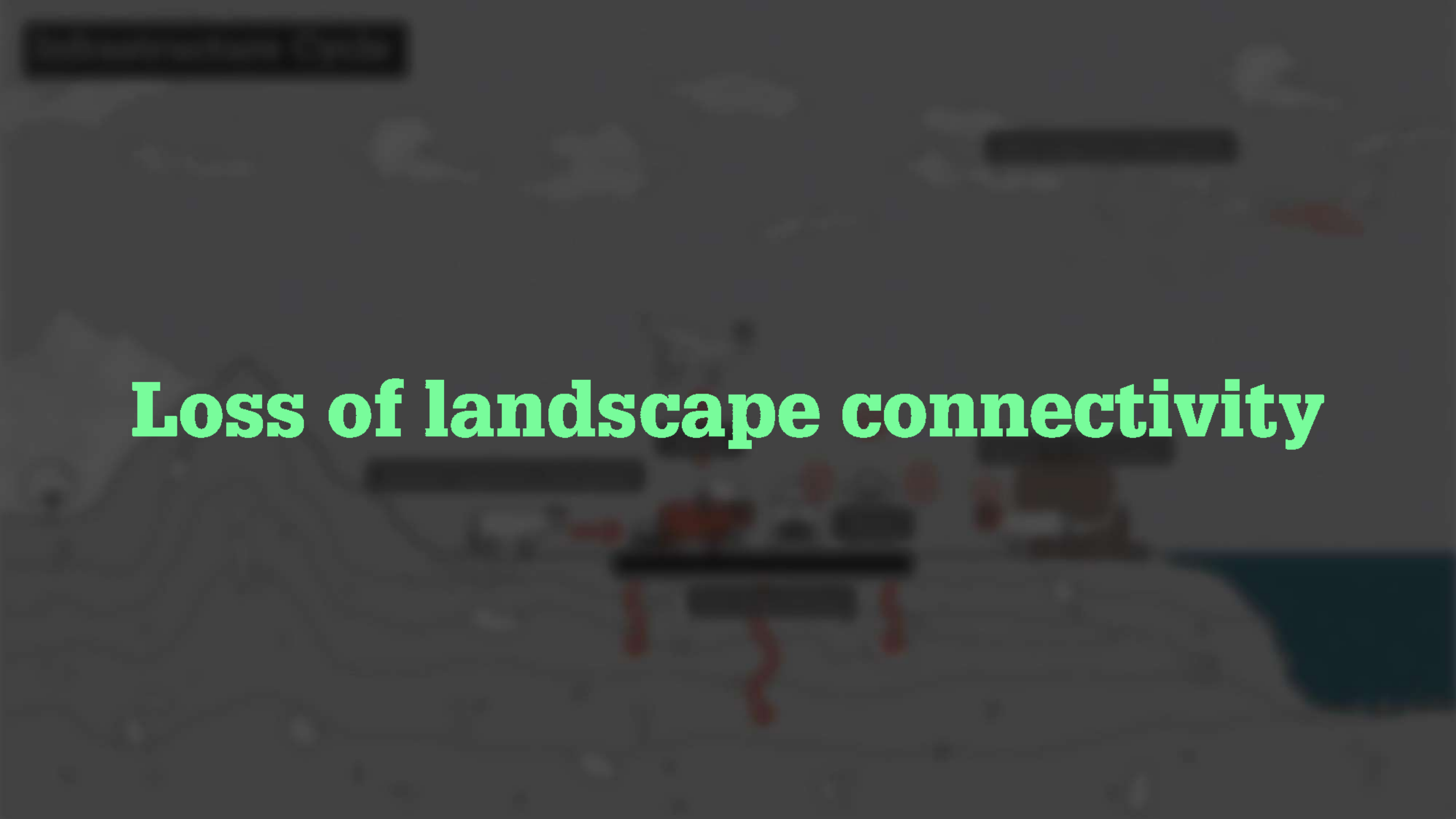

Carbon dioxide Cycle
Green house effect
Carbon dioxide layer
Heat from sun
CO_2
Photosynthesis
Respiration
Trapped heat
Emissions
Respiration
+⁰C
Photosynthesis
Carbon
[UCAR]


Extraction of nonrenewable resources beyond repair

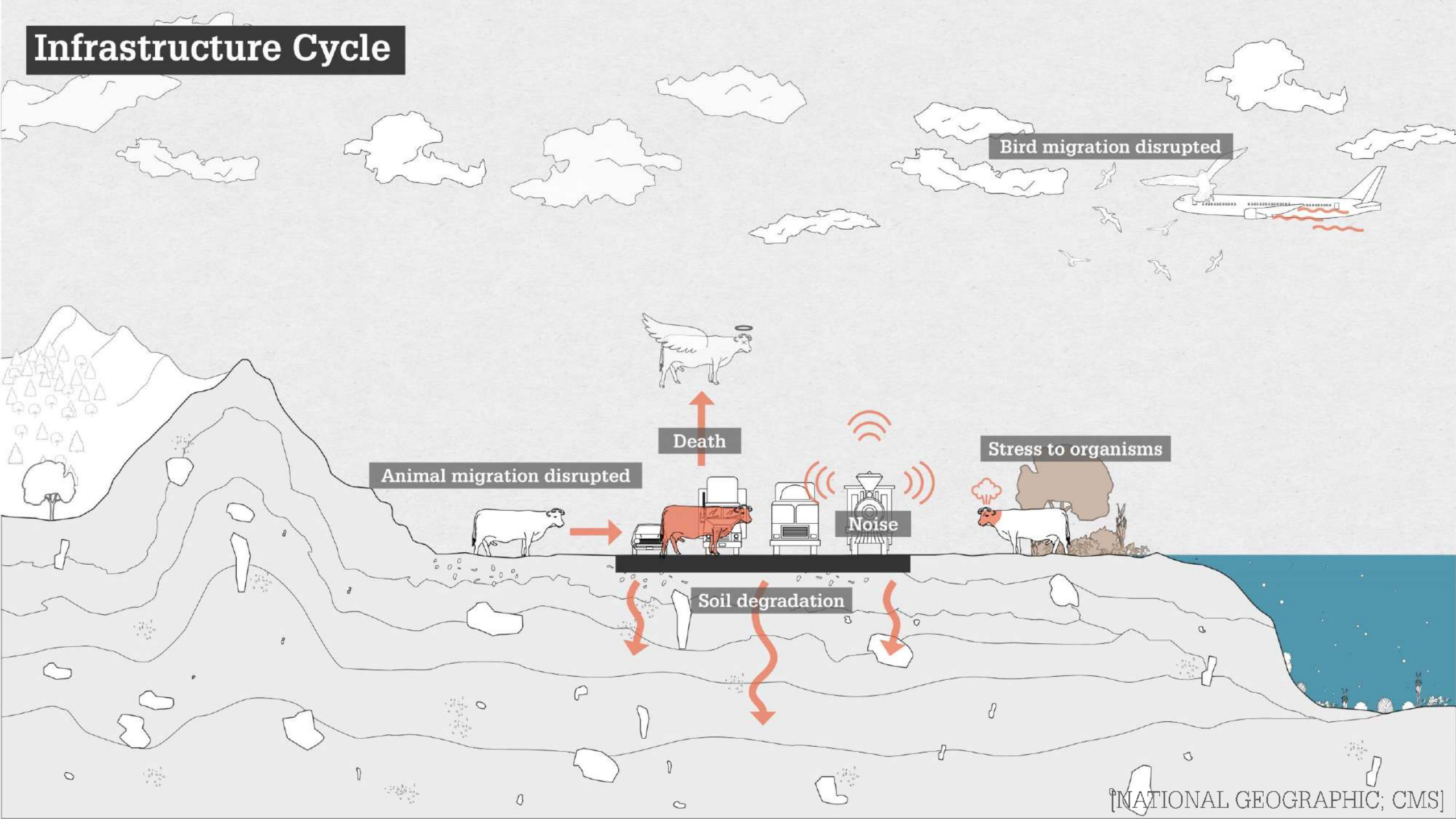
Nonrenewable Cycle



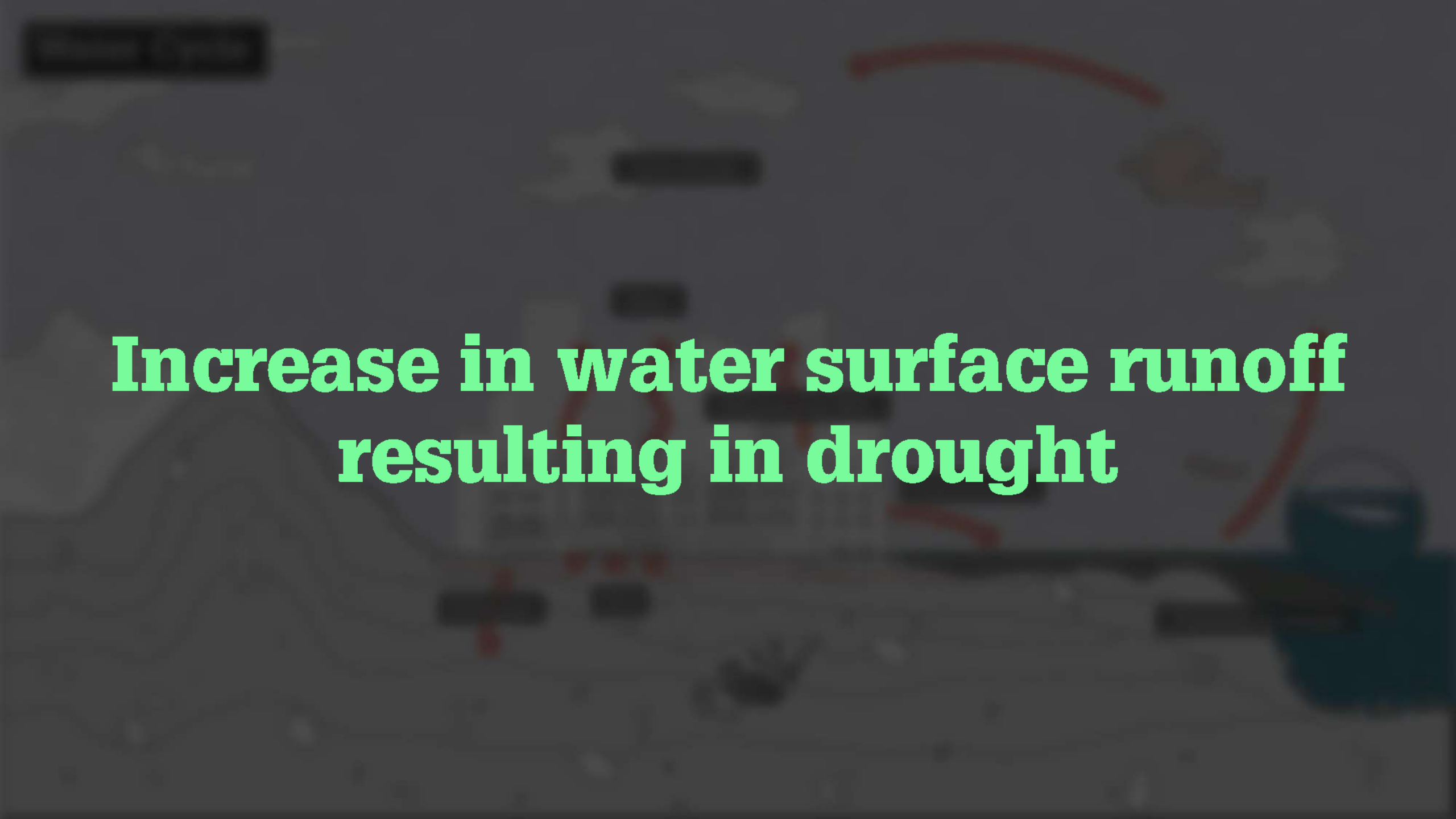
[EARTH ORG; MIT]

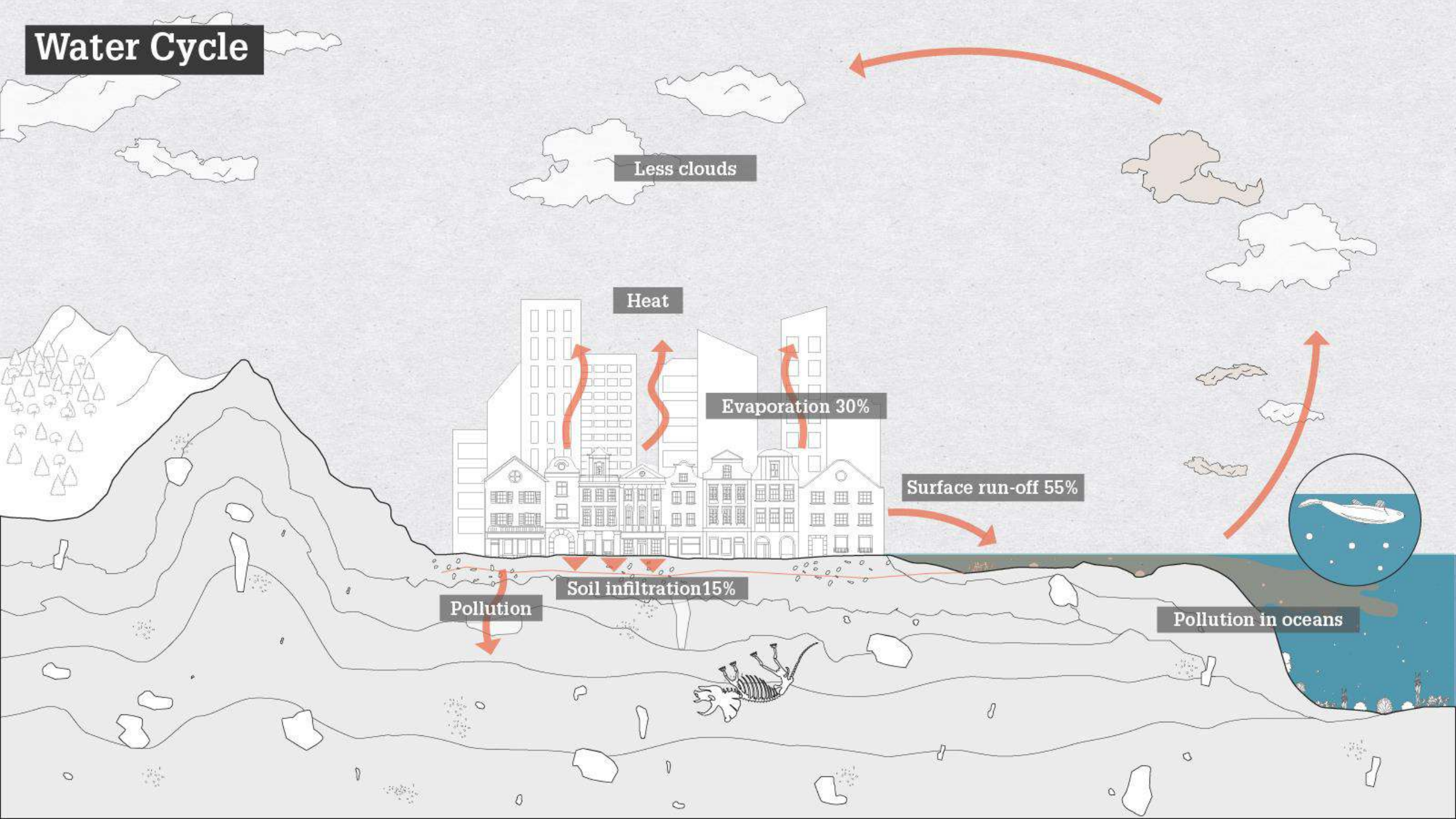

Loss of landscape connectivity

Infrastructure Cycle



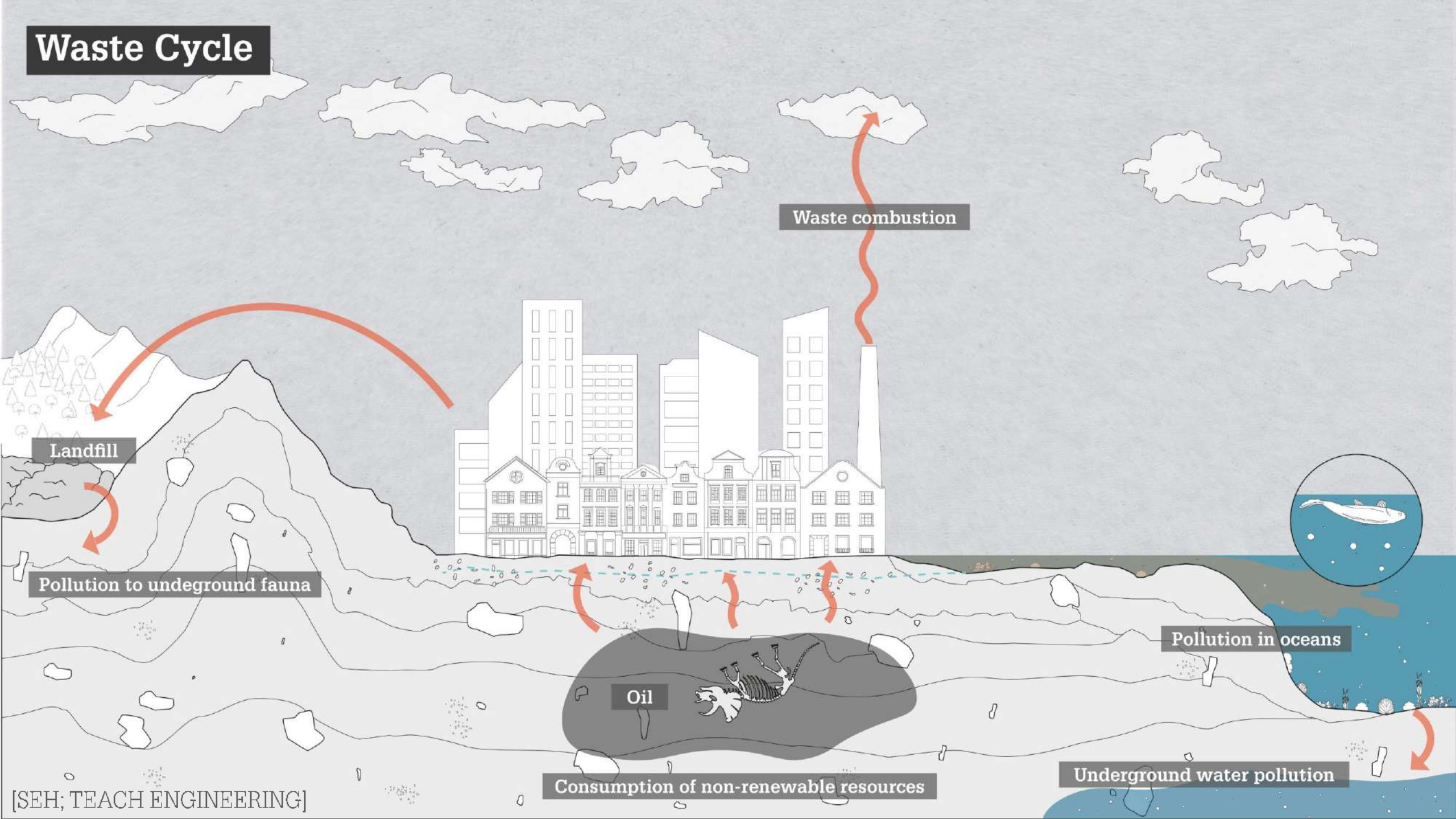
[NATIONAL GEOGRAPHIC; CMS]


Increase in water surface runoff
resulting in drought


Water Cycle
Less clouds
Heat
Evaporation 30%
Surface run-off 55%
Soil infiltration15%
Pollution
Pollution in oceans


Drowning in our own waste

Waste Cycle



[SEH; TEACH ENGINEERING]

We must stop disruption

And we must do it with nature

But how do we quantify disruption?

To set a brief, we focus

on global planetary metrics

03

Biocapacity

the Earth

2022

Urgencies	**Metrics**
Use of nonrenewable resources	Amount of energy
Waste	Mass of waste
Environmental pollution	Mass of CO_2 emissions
Access to safe water	Volume of water
Growing population	Area of agriculture
	Area of infrastructure
	Area of buildings

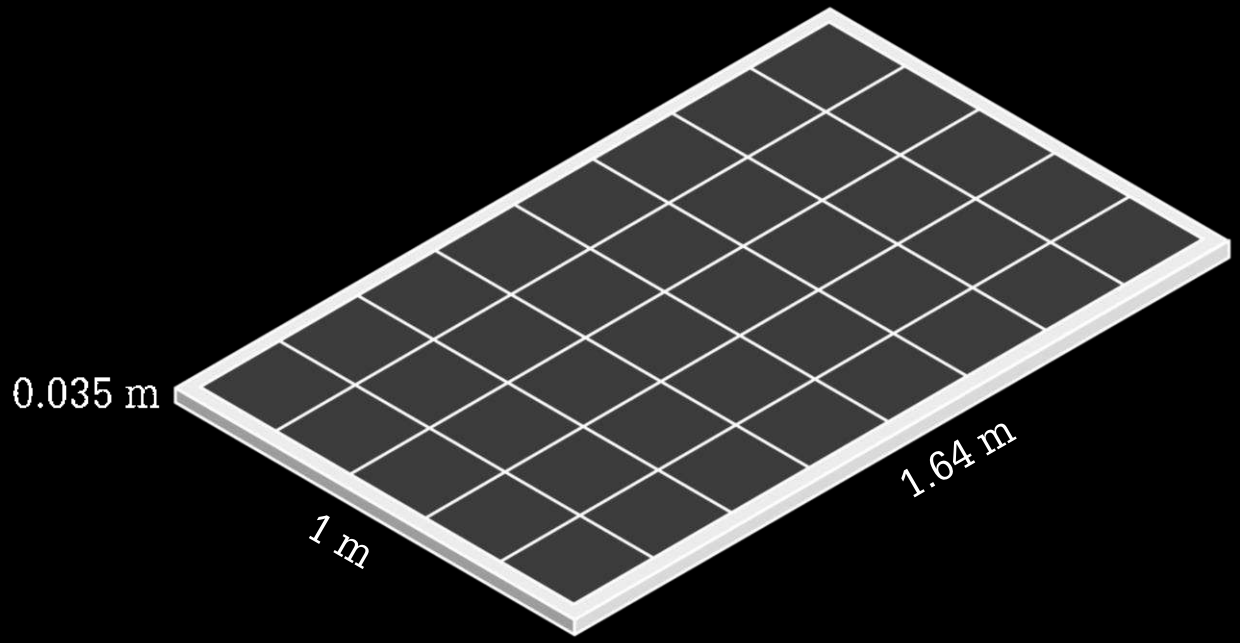
Global amount in 2022

Metric	Amount/year
Amount of energy	176 431 000 000 MWh
Mass of waste	2 000 000 000 t
Mass of CO_2 emissions	5 981 000 000 t
Volume of water	10 894 289 156 627 m^3
Area of agriculture	48 760 000 000 000 m^2
Area of infrastructure	800 000 000 000 m^2
Area of buildings	1 060 000 000 000 m^2

Conversion to m^3

Energy

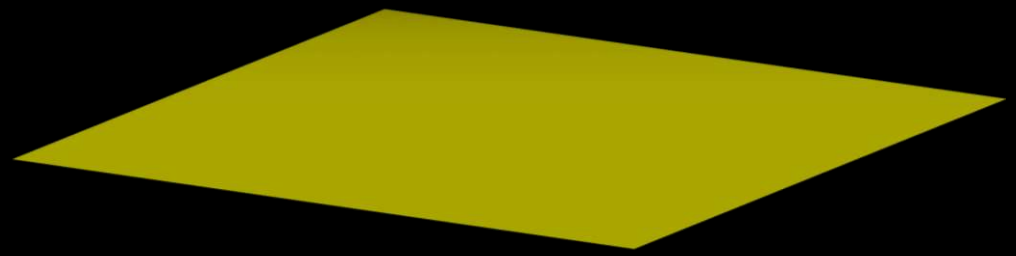
Global amount 2022 (MWh)		m^3 of solar panels of 1MWh		Energy (m^3)
176 431 000 000	×	0.105	=	18 283 000 000



[WORLDOMETERS; OUR WORLD IN DATA]

Energy

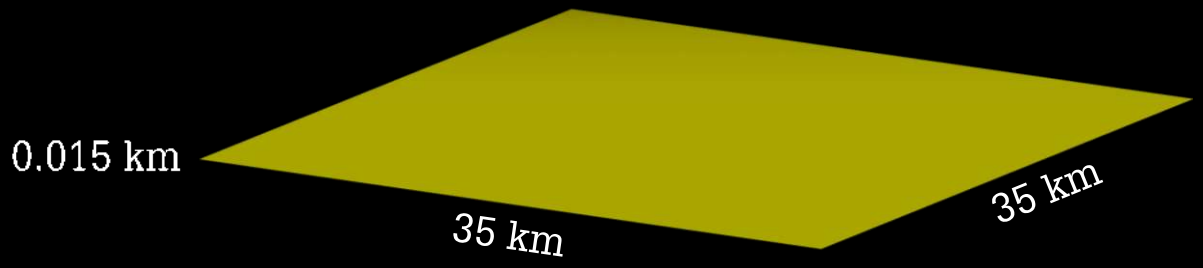
Global amount 2022 (MWh)		m^3 of solar panels of 1MWh		Energy (m^3)
176 431 000 000	×	0.105	=	18 283 000 000



[WORLDOMETERS; OUR WORLD IN DATA]

Energy

Global amount 2022 (MWh)		m^3 of solar panels of 1MWh		Energy (m^3)
176 431 000 000	×	0.105	=	18 283 000 000



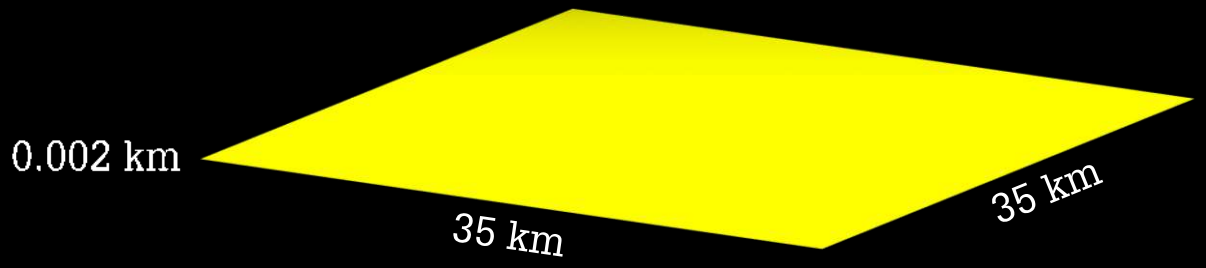
=

0.8 of water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

Waste

Global amount 2022 (t)		m^3 of waste of 1 tonne		Waste (m^3)
2 000 000 000	×	1.136	=	2 266 000 000



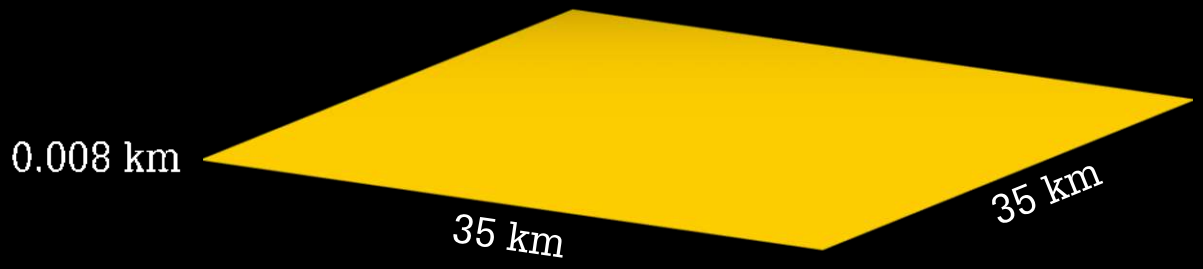
=

0.1 of water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

CO_2 emissions

Global amount 2022 (t)		m^3 of 1 tonne of CO_2 emission		CO_2 (m^3)
5 981 000 000	×	1.67	=	9 968 333 333



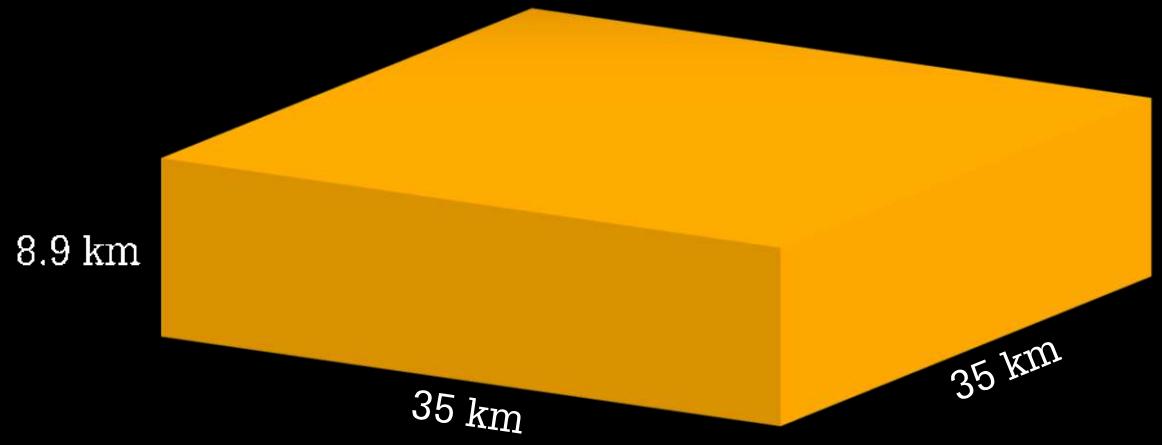
=

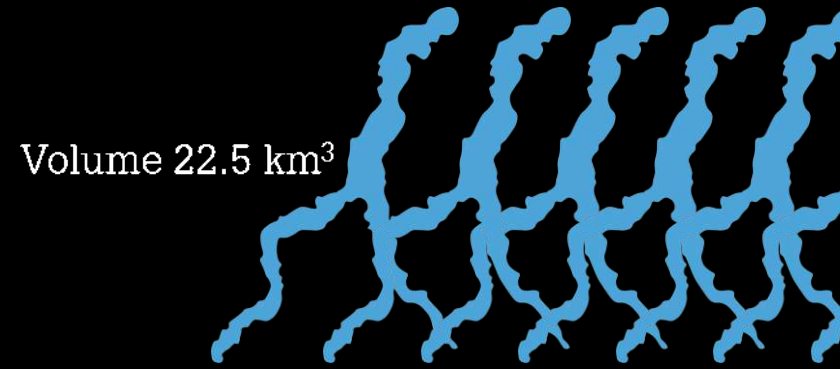
0.44 of water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

Water

Global amount 2022 (m^3)		m^3 of water		Water (m^3)
10 894 289 156 627	×	1	=	10 894 289 156 627



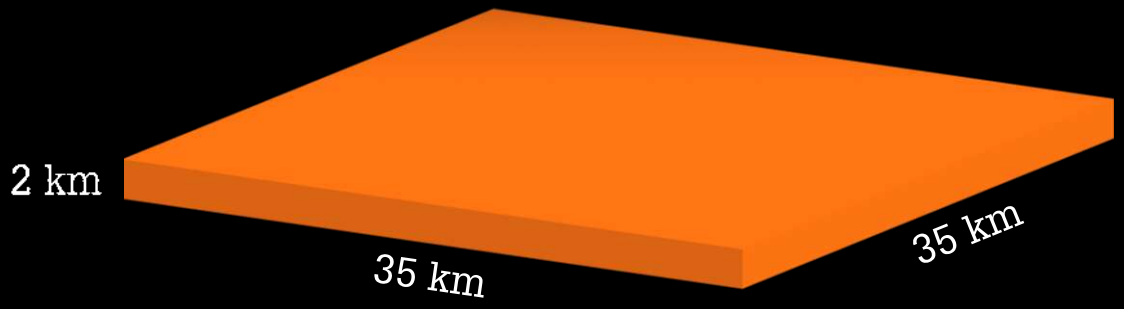


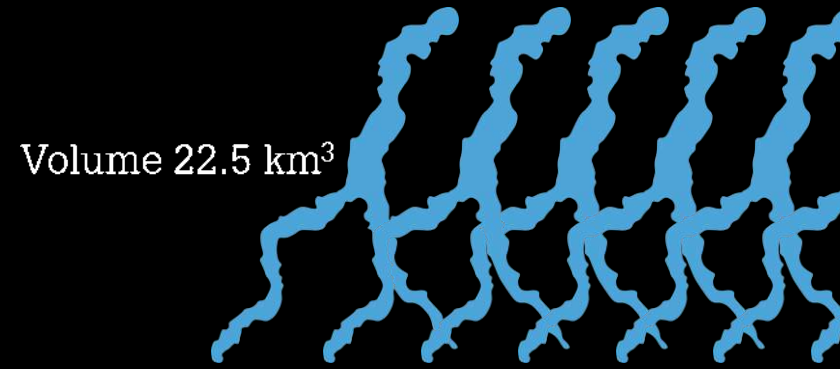
484 x water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

Infrastructure

Global amount 2022 (m^2)		3 m of floor height		Infrastructure (m^3)
800 000 000 000	×	3	=	2 400 000 000 000



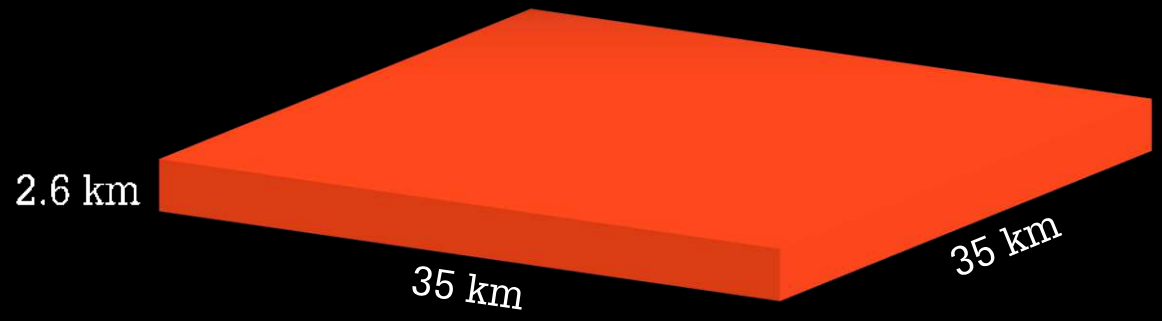


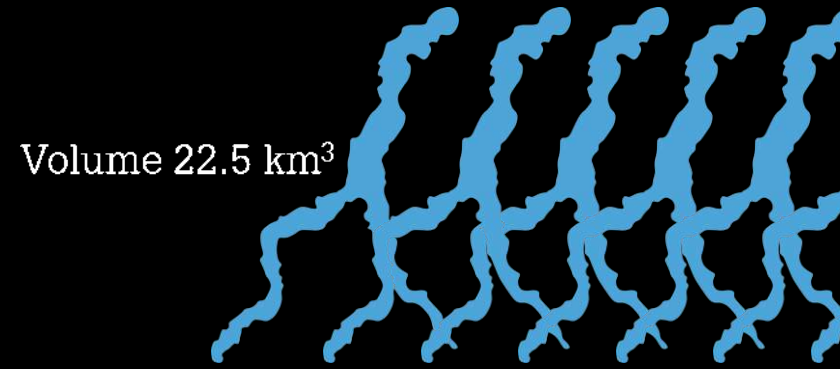
107 x water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

Buildings

Global amount 2022 (m^2)		3 m of floor height		Buildings (m^3)
1 060 000 000 000	×	3	=	3 180 000 000 000



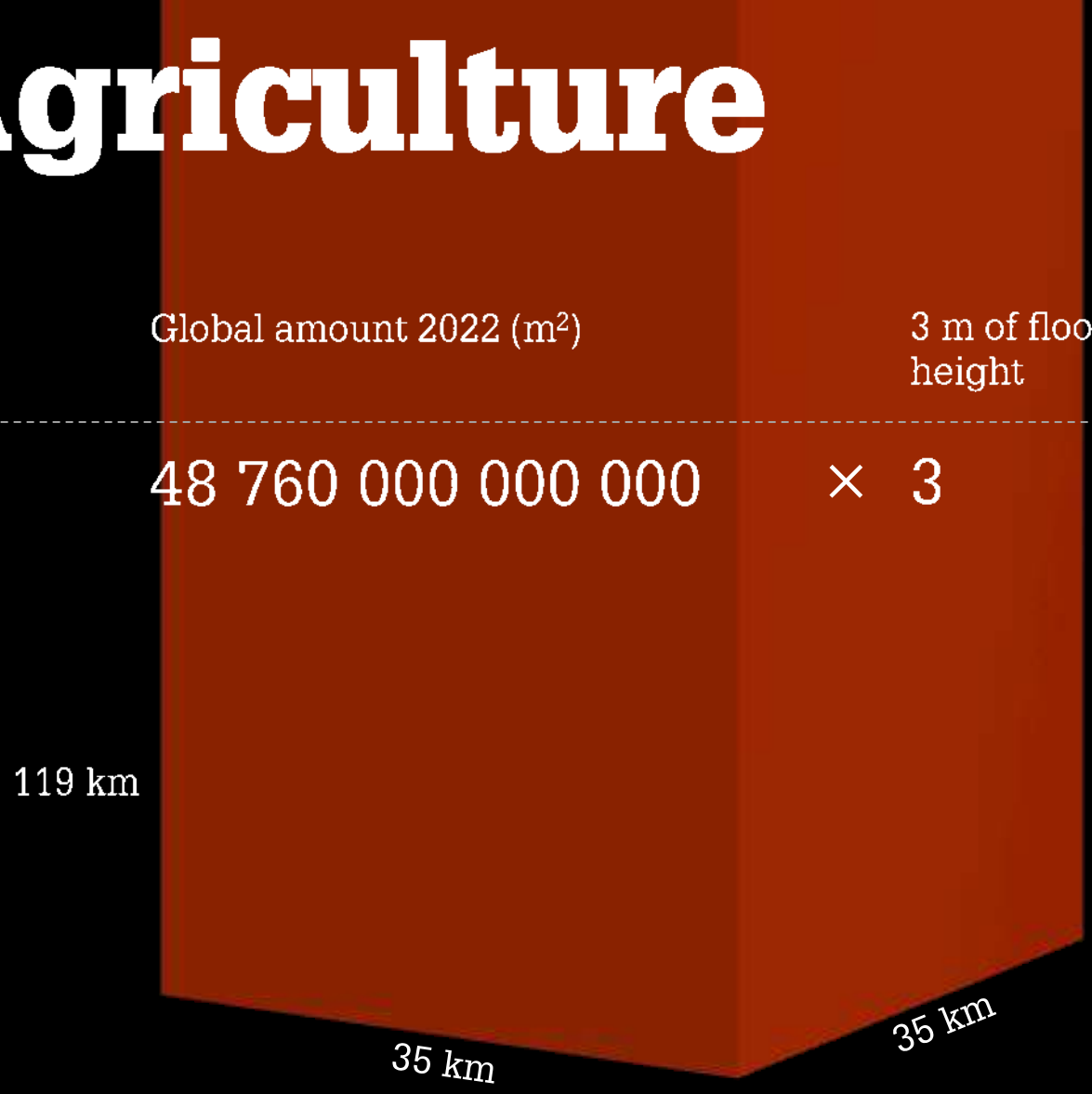


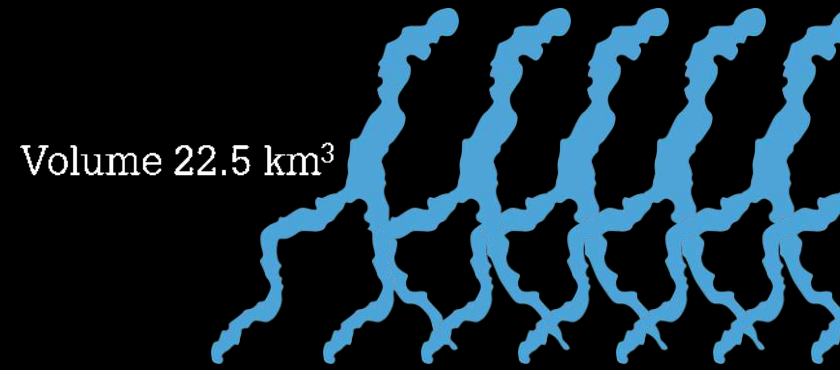
141 x water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

Agriculture

Global amount 2022 (m^2)		3 m of floor height		Agriculture (m^3)
48 760 000 000 000	×	3	=	146 280 000 000 000



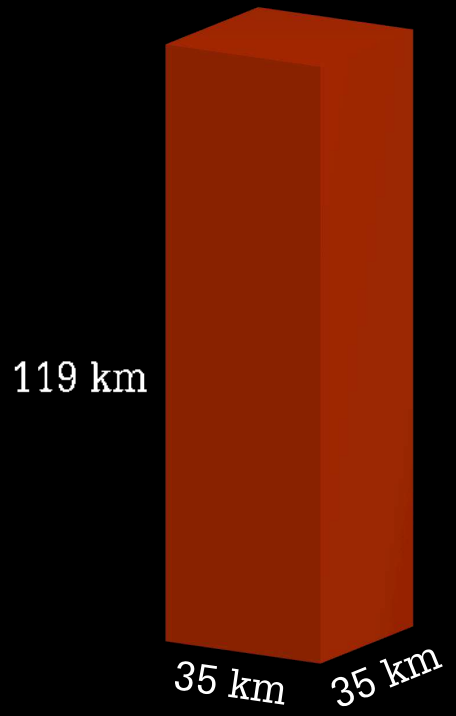


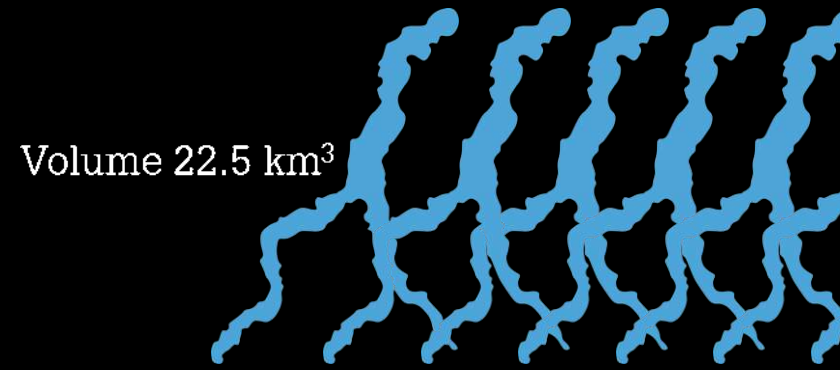
6 501 x water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

Agriculture

Global amount 2022 (m^2)		3 m of floor height		Agriculture (m^3)
48 760 000 000 000	×	3	=	146 280 000 000 000





6 501 x water volume of Lake Como

[WORLDOMETERS; OUR WORLD IN DATA]

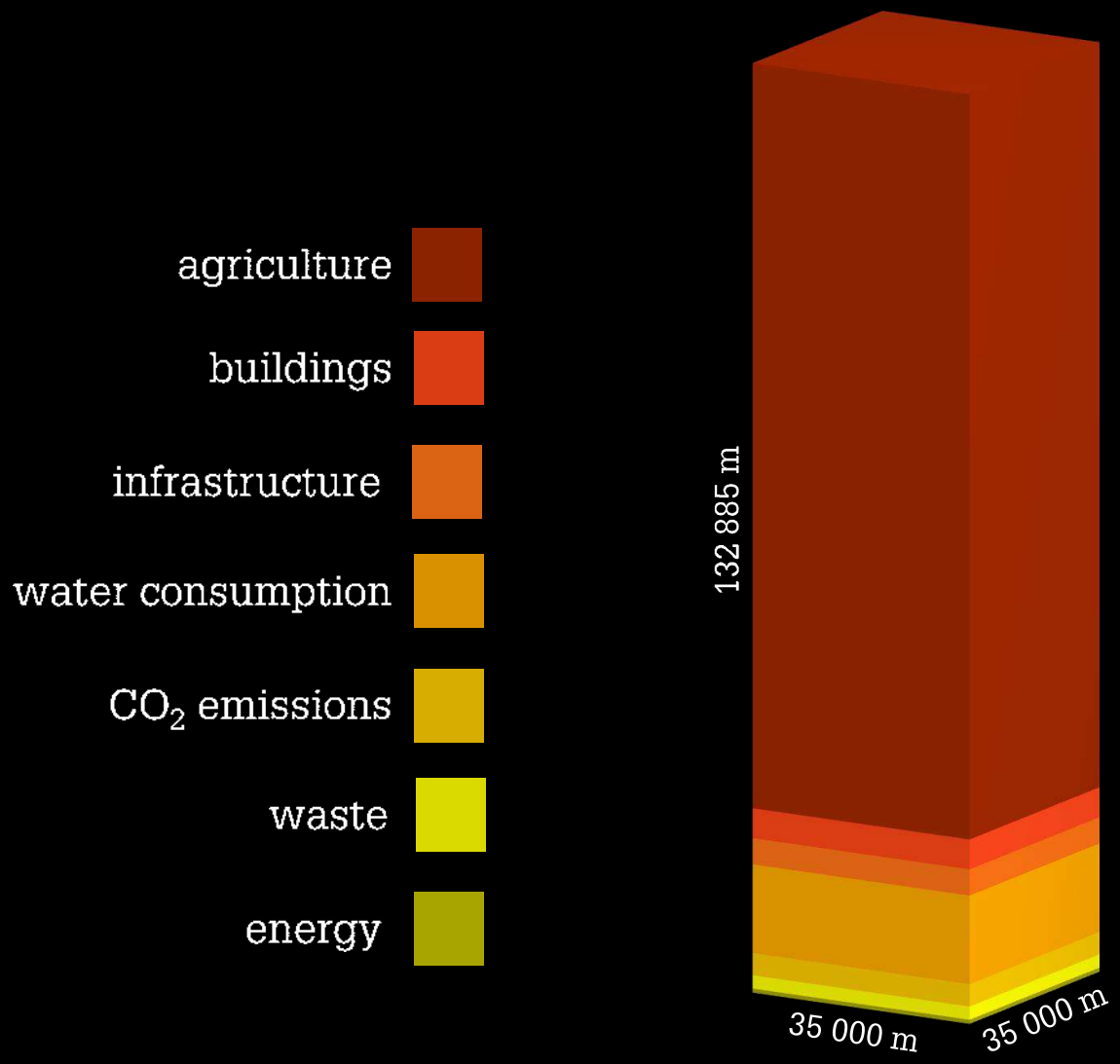
Global amount in 2022

Metric	Amount/year
Amount of energy	176 431 000 000 MWh
Mass of waste	2 000 000 000 t
Mass of CO_2 emissions	5 981 000 000 t
Volume of water	10 894 289 156 627 m^3
Area of agriculture	48 760 000 000 000 m^2
Area of infrastructure	800 000 000 000 m^2
Area of buildings	1 060 000 000 000 m^2

Global amount in 2022

Metric	Amount/year	Amount/year
Energy	176 431 000 000 MWh	18 283 000 000 m^3
Waste	2 000 000 000 t	2 266 000 000 m^3
CO_2 emissions	5 981 000 000 t	9 968 333 333 m^3
Water	10 894 289 156 627 m^3	10 894 289 156 627 m^3
Agriculture	48 760 000 000 000 m^2	146 280 000 000 000 m^3
Infrastructure	800 000 000 000 m^2	2 400 000 000 000 m^3
Area of buildings	1 060 000 000 000 m^2	3 180 000 000 000 m^3

Global amount in 2022



[WORLDOMETERS; OUR WORLD IN DATA]

Global amount in 2022

Volume: 162 784.8 km^3

[WORLDOMETERS; OUR WORLD IN DATA]

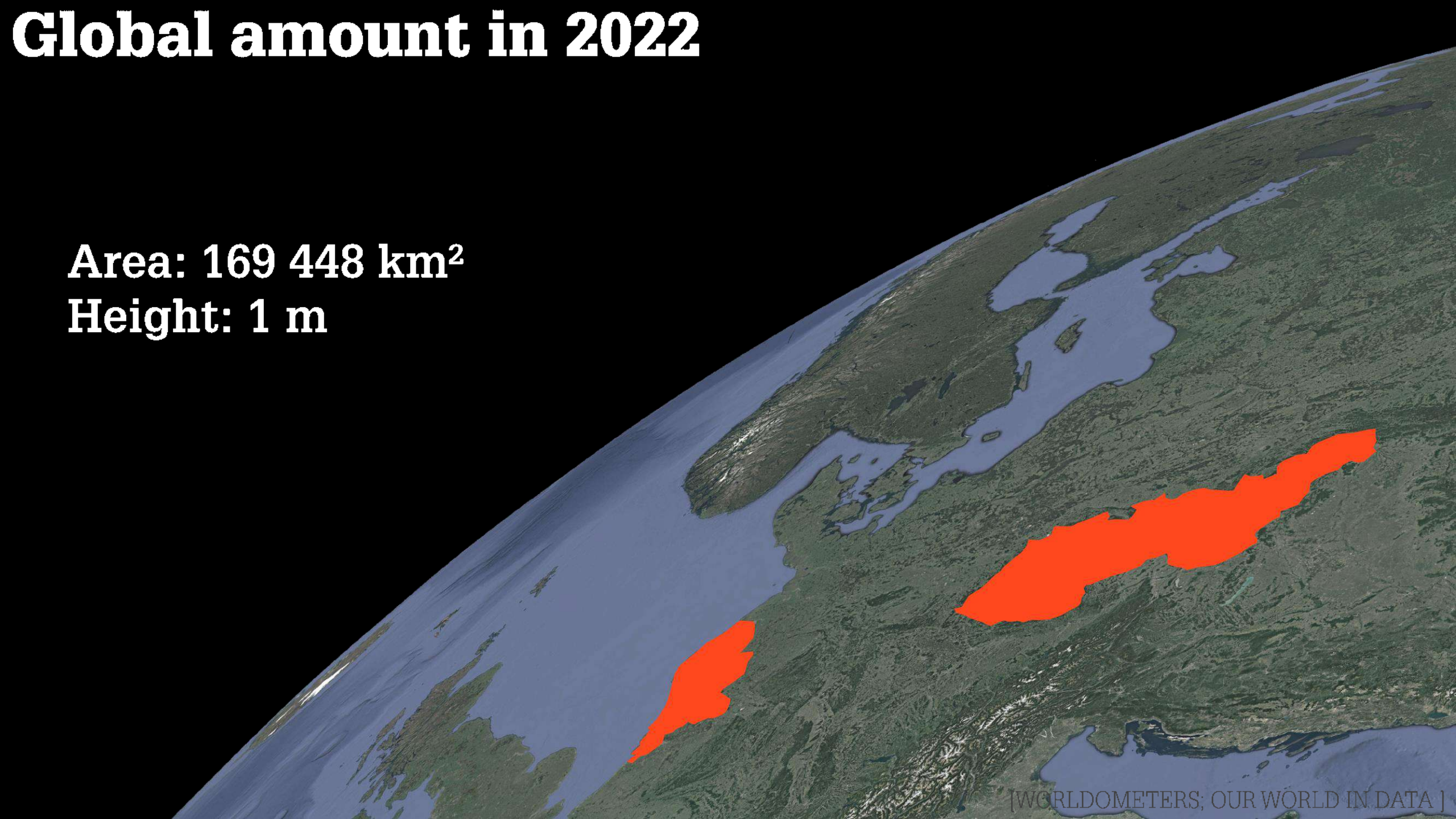
Global amount in 2022

Volume: 162 784.8 km^3

[WORLDOMETERS; OUR WORLD IN DATA]

Global amount in 2022

Area: 169 448 km²
Height: 1 m



[WORLDOMETERS; OUR WORLD IN DATA]

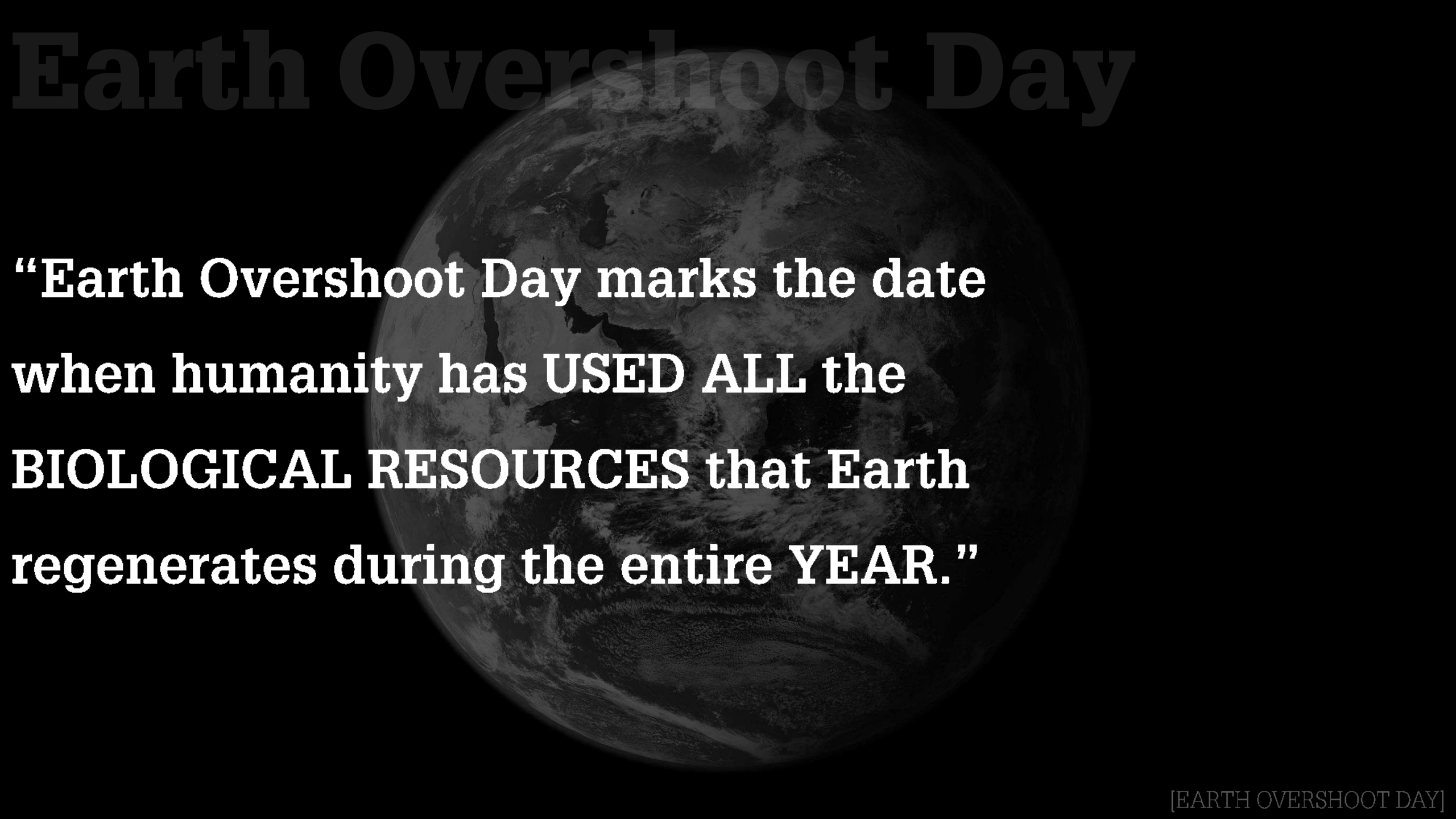
But this does not represent

our true problem yet

So we introduce a concept of…

Earth Overshoot Day

Earth Overshoot Day



“Earth Overshoot Day marks the date when humanity has USED ALL the BIOLOGICAL RESOURCES that Earth regenerates during the entire YEAR.”

[EARTH OVERSHOOT DAY]

Earth Overshoot Day

Our planet has a specific biocapacity

Earth Overshoot Day

Biocapacity to regenerate the biological resources we use/measure in one year

Earth Overshoot Day

Prior to 1970 there was no “Earth Overshoot Day“

Earth Overshoot Day

0%

100%

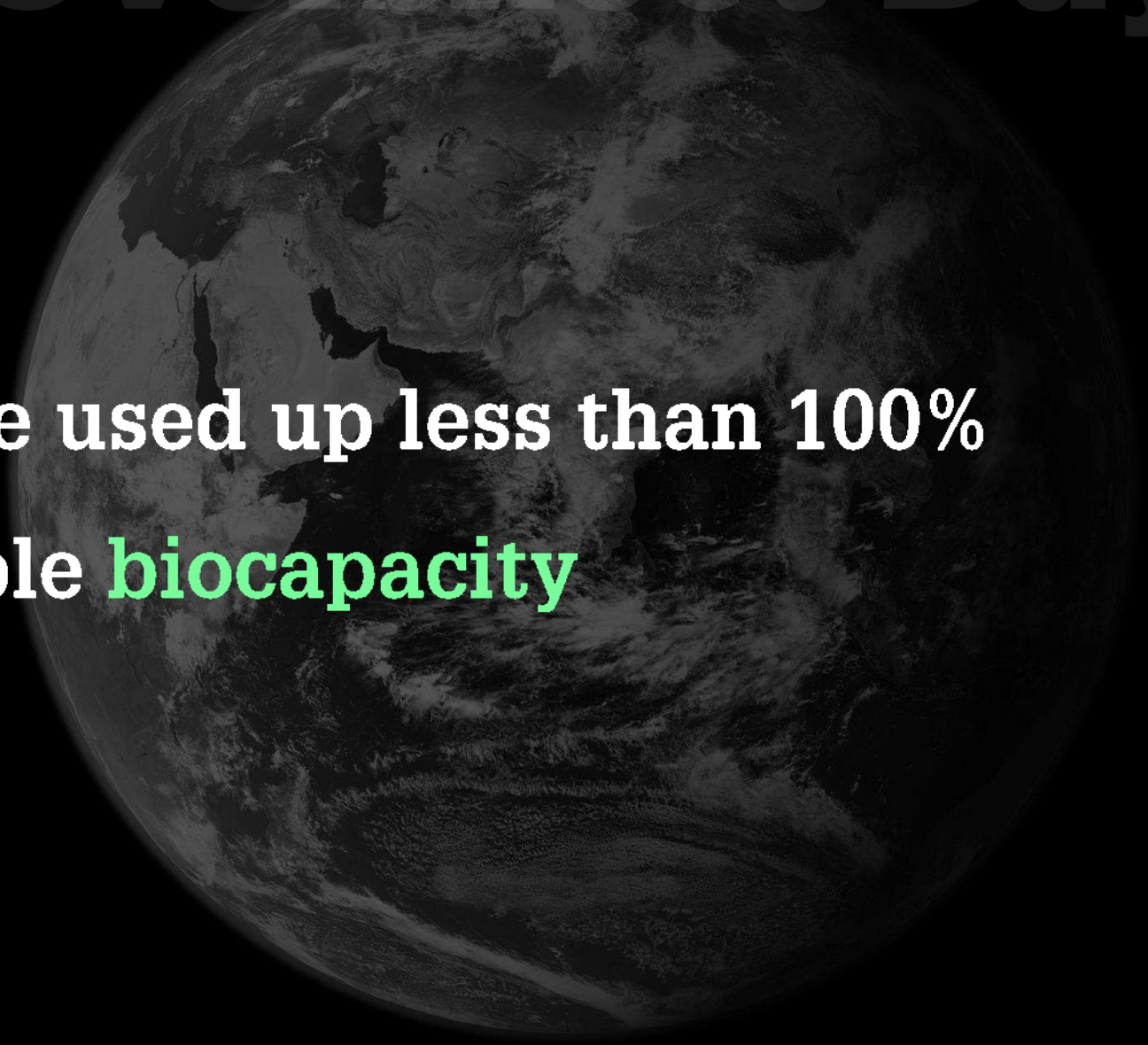
BIOCAPACITY

January 1st

1970

December 31st

Earth Overshoot Day



Until then, we used up less than 100%

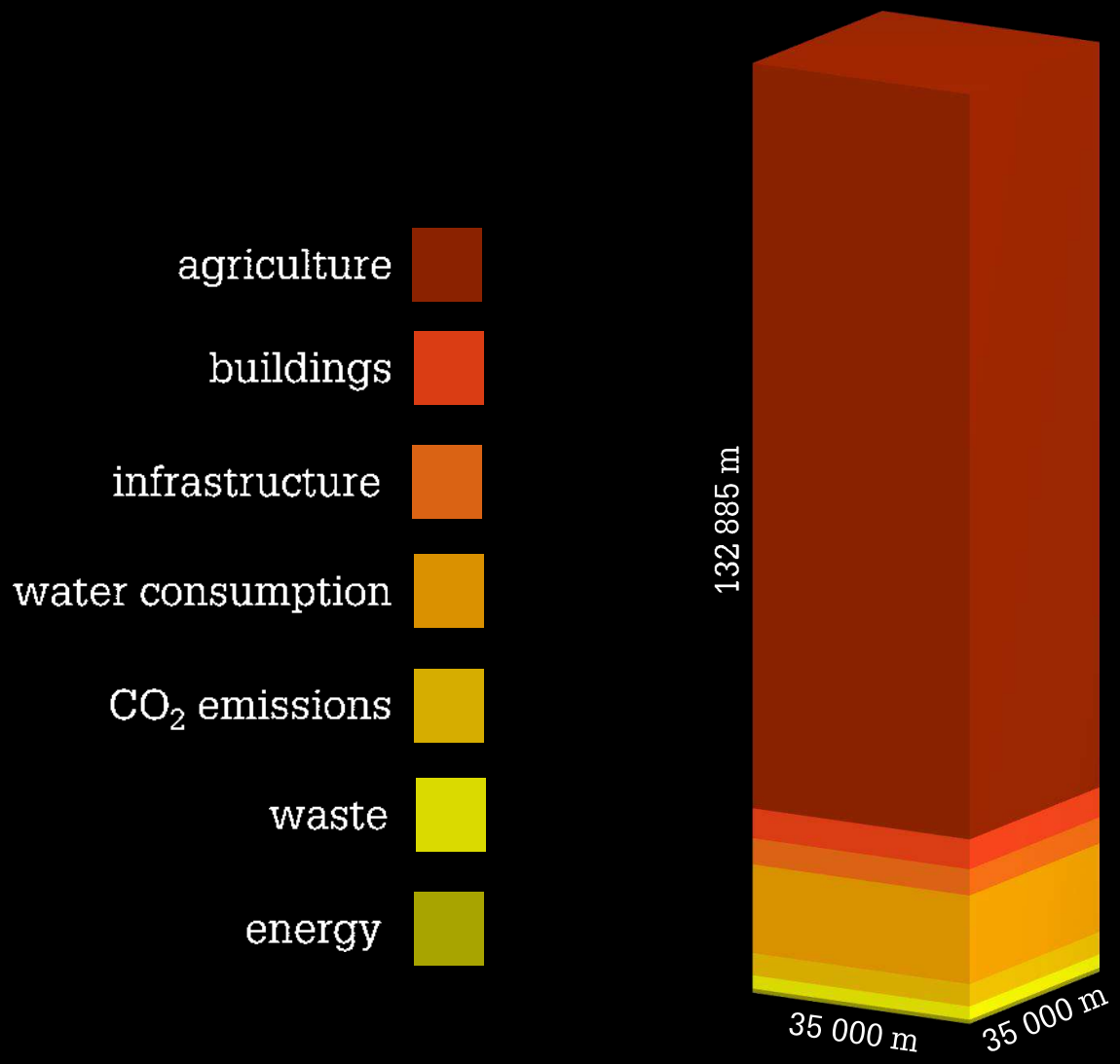
of the available biocapacity

Earth Overshoot Day

Since 1970 we are using more biological resources than available: excess

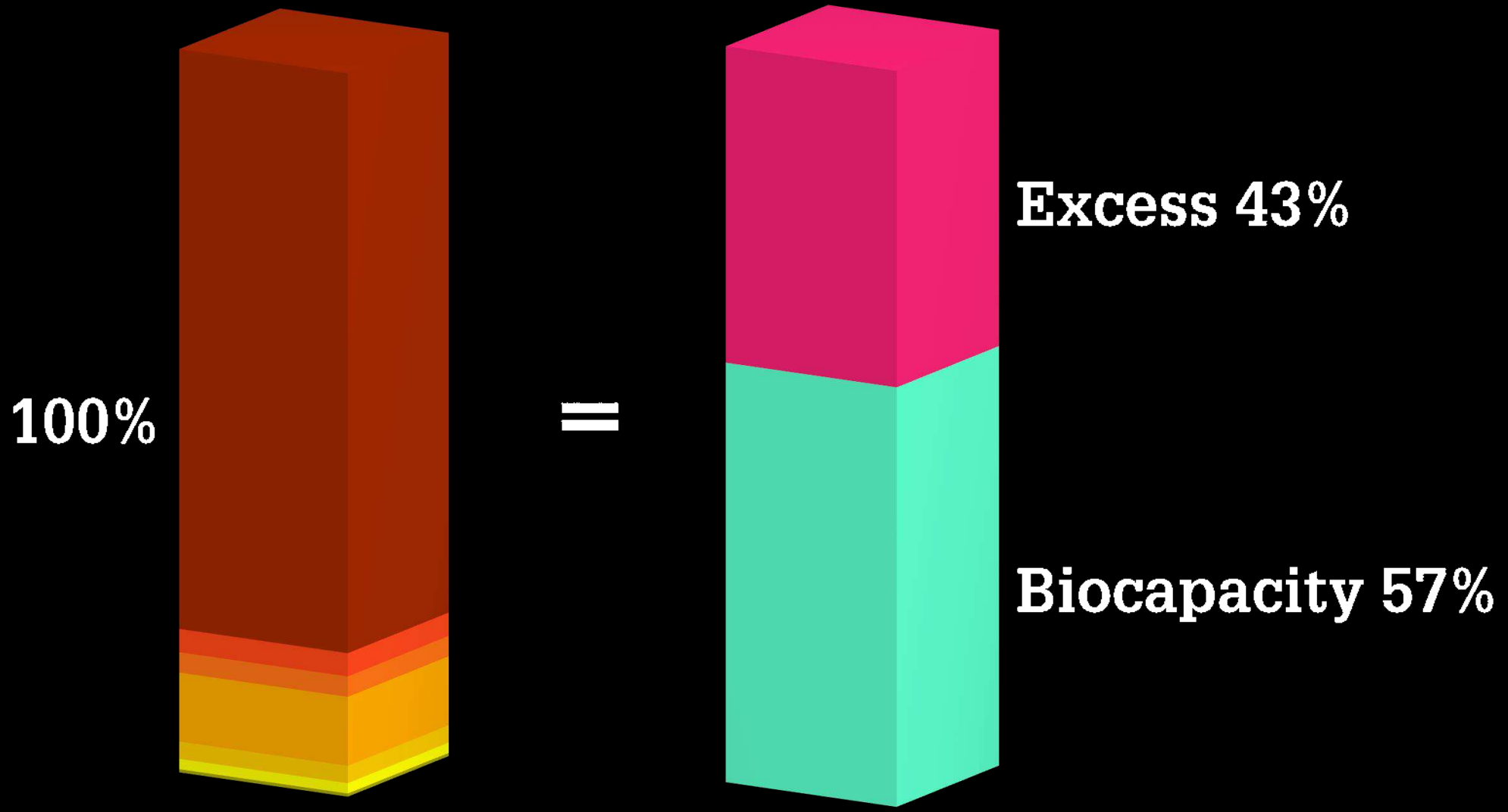
Earth Overshoot Day

Global amount in 2022



[WORLDOMETERS; OUR WORLD IN DATA]

Global amount in 2022



[WORLDOMETERS; OUR WORLD IN DATA]

And these amounts show the global scale

However we decided to narrow down our scope and look at a more local scale

Prague

2022

Czech Overshoot Day

Czech Overshoot Day

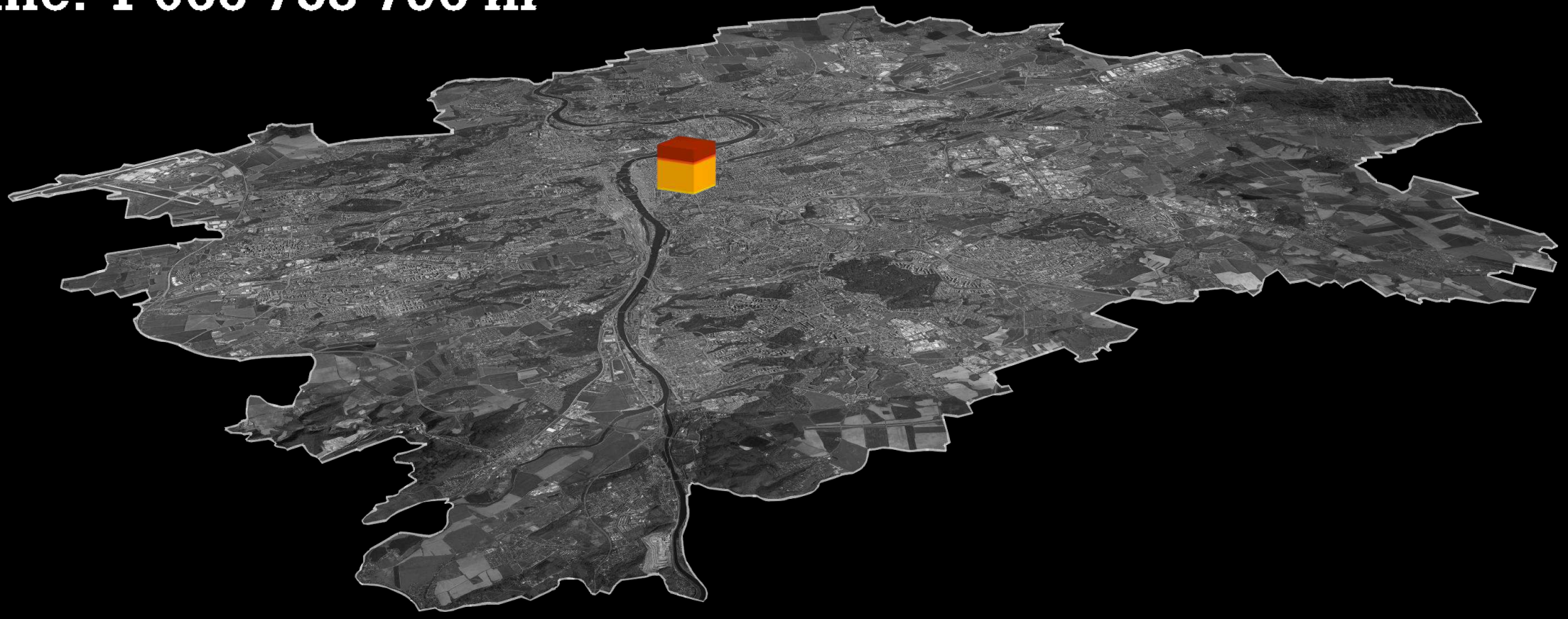
Amount for Prague in 2022

Metric	Amount/year
Energy	809 167 m^3
Waste	4 071 479 m^3
CO_2 emissions	40 698 581 m^3
Water	654 950 722 m^3
Agriculture	304 500 000 m^3
Infrastructure	21 249 000 m^3
Area of buildings	40 373 100 m^3

[THE WORLD COUNTS, GEOPORTAL PRAHA]

Amount for Prague in 2022

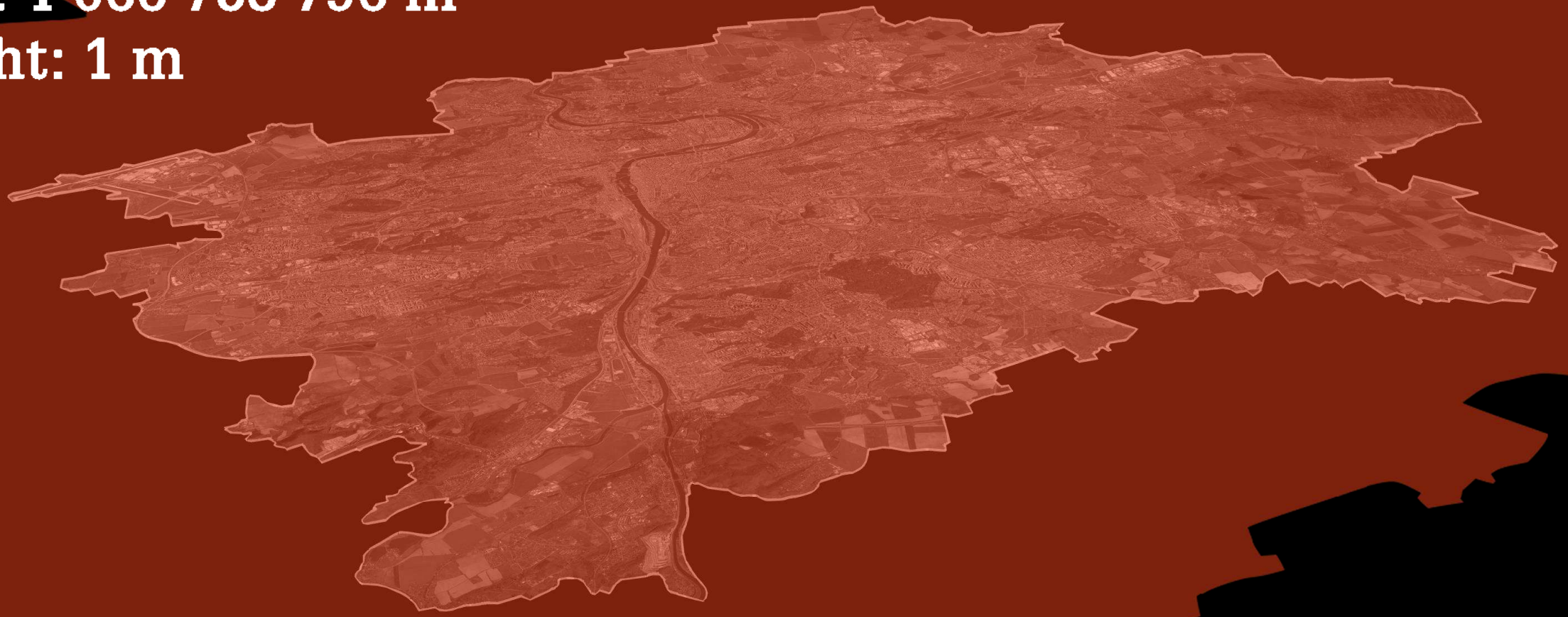
Volume: 1 066 758 796 m^3



[THE WORLD COUNTS, GEOPORTAL PRAHA]

Amount for Prague in 2022

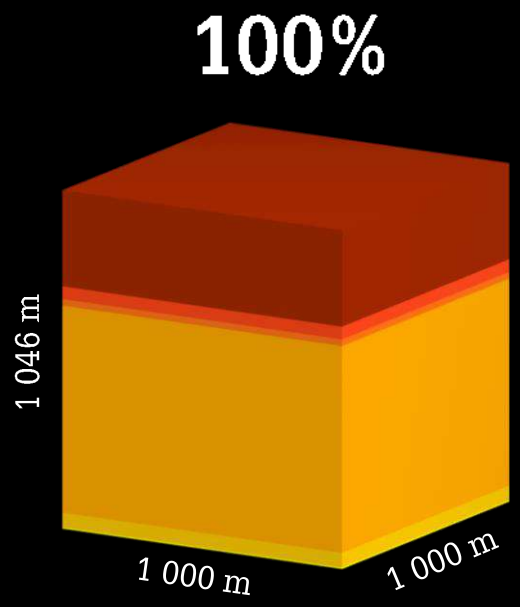
Area: 1 066 758 796 m²
Height: 1 m



[THE WORLD COUNTS, GEOPORTAL PRAHA]

Amount for Prague in 2022

agriculture
buildings
infrastructure
water consumption
CO_2 emissions
waste
energy



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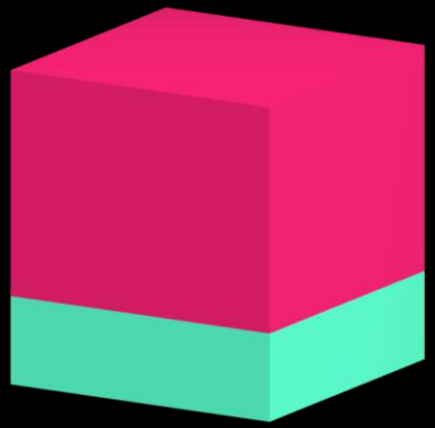


Excess 72.1%

Biocapacity 27.9%

[THE WORLD COUNTS, GEOPORTAL PRAHA]

1 km² of Prague

2022

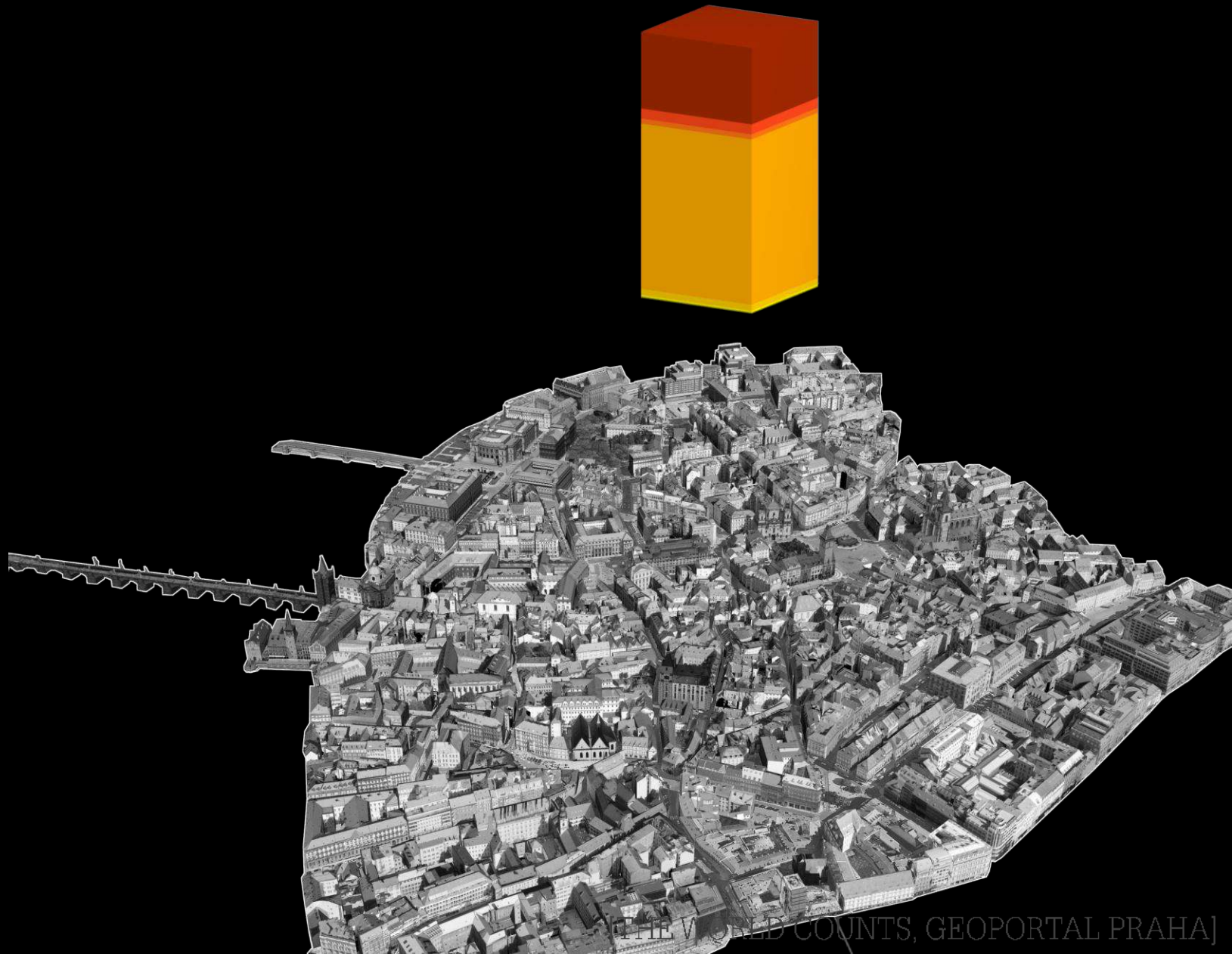
Amount for 1km^2 of Prague in 2022

Metric	Amount/year
Energy	1 847 m^3
Waste	8 209 m^3
CO_2 emissions	82 054 m^3
Water	1 320 465 m^3
Agriculture	613 911 m^3
Infrastructure	42 841 m^3
Area of buildings	81 397 m^3

[THE WORLD COUNTS, GEOPORTAL PRAHA]

Amount for 1km² of Prague in 2022

Volume: 959 724 m³



[THE WORLD COUNTS, GEOPORTAL PRAHA]

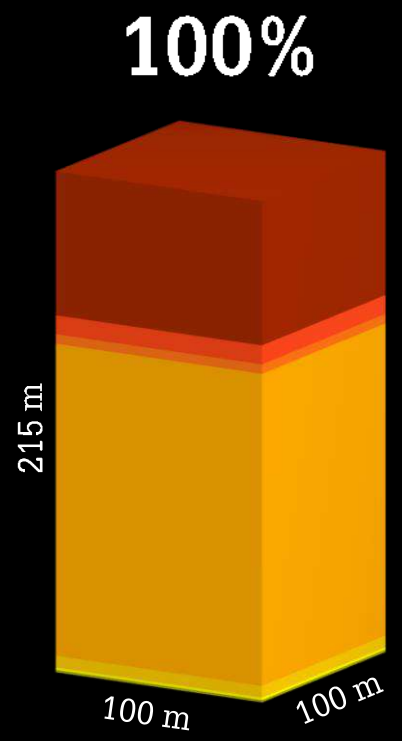
Amount for 1km² of Prague in 2022

Area: 2 148 877 m²
Height: 1 m

[THE WORLD COUNTS, GEOPORTAL PRAHA]

Amount for 1km² of Prague in 2022

agriculture
buildings
infrastructure
water consumption
CO_2 emissions
waste
energy



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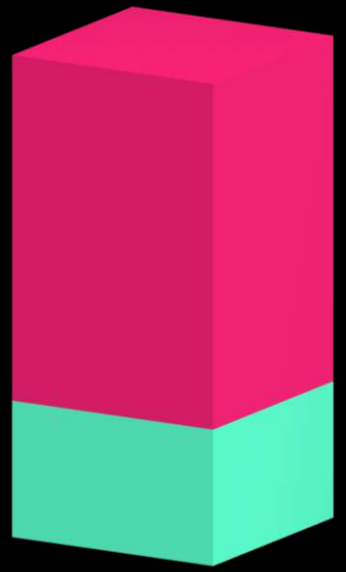
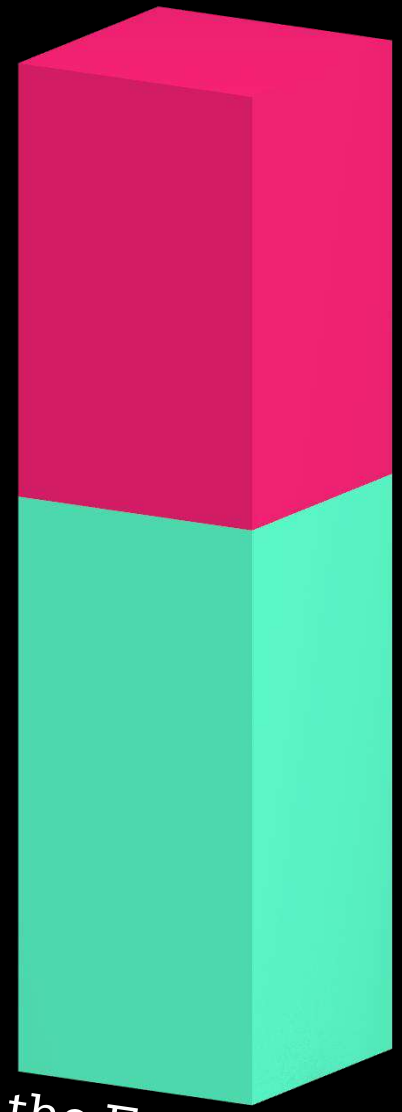


Excess 72.1%

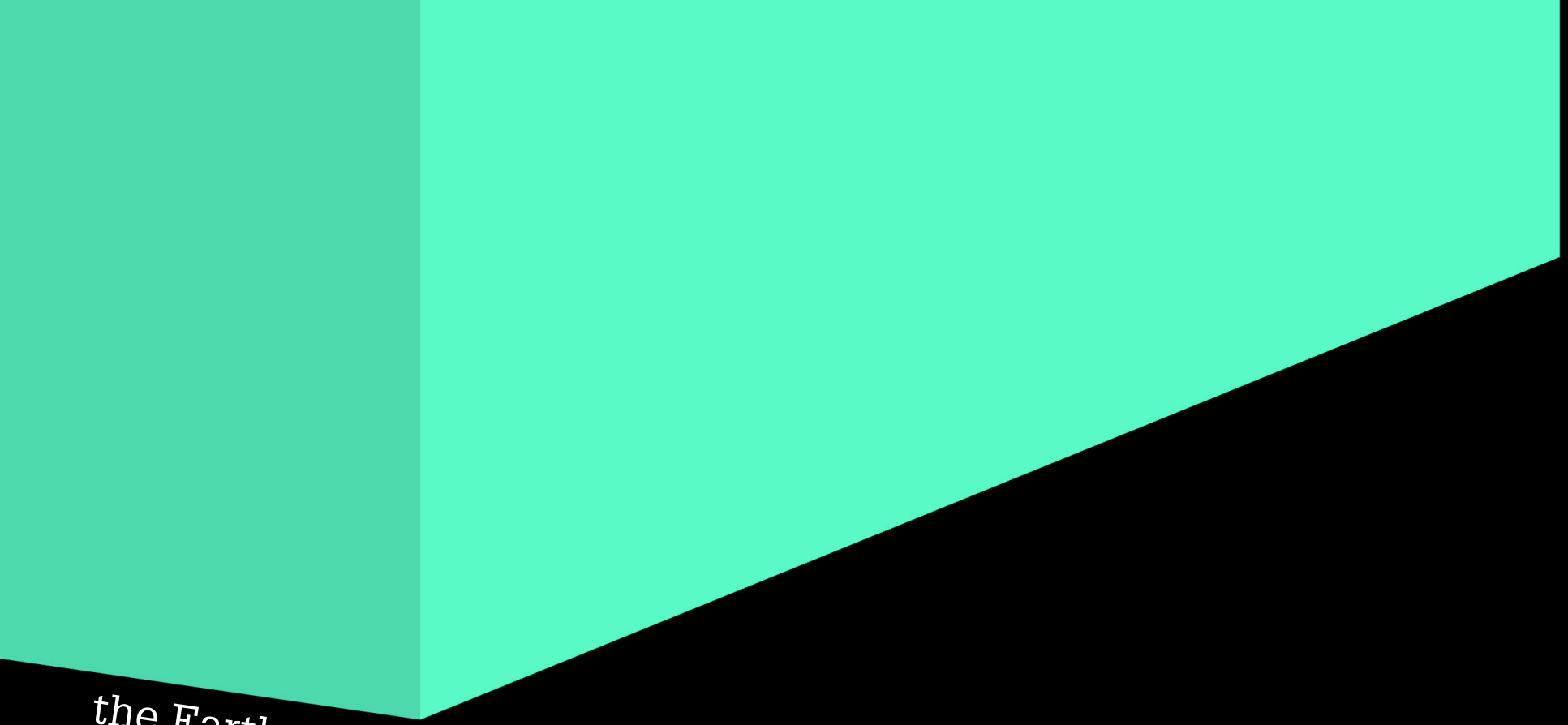
Biocapacity 27.9%

[THE WORLD COUNTS, GEOPORTAL PRAHA]

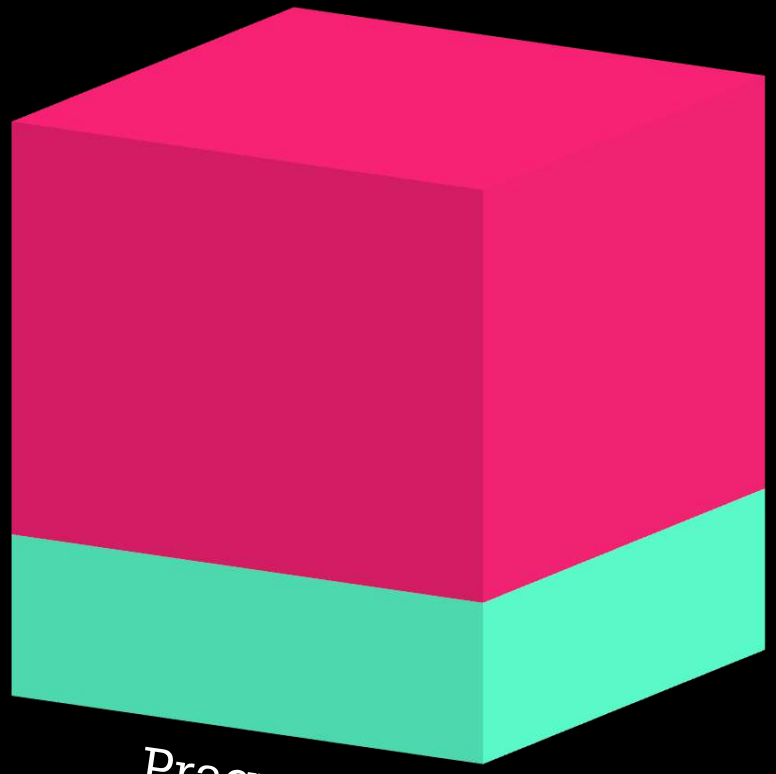
Comparison of cubes



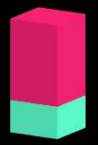
Comparison of values cubes



Comparison of values cubes

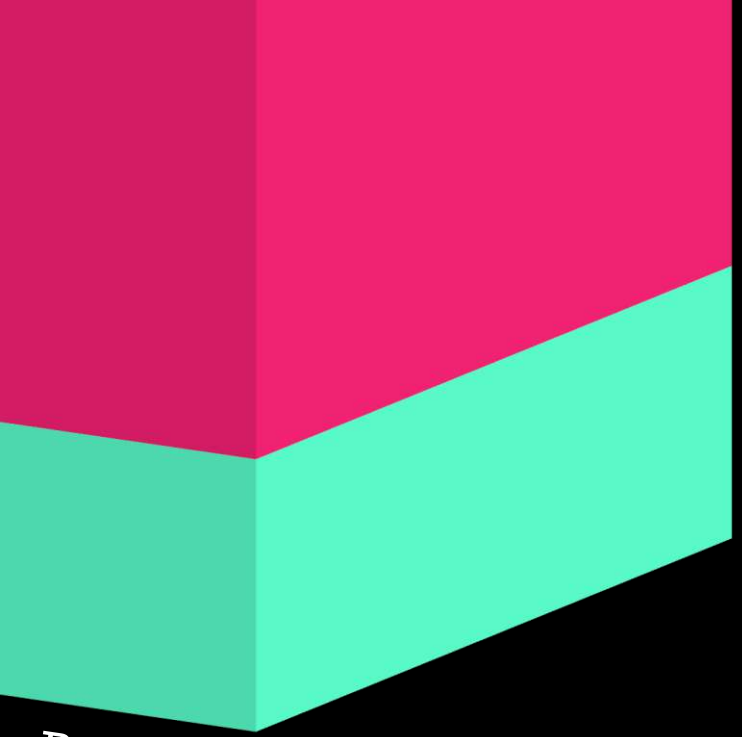


Prague

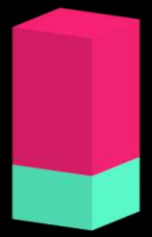


1km^2 of Prague

Comparison of values cubes



Prague



1km² of Prague

Comparison of values cubes

1 km² of Prague

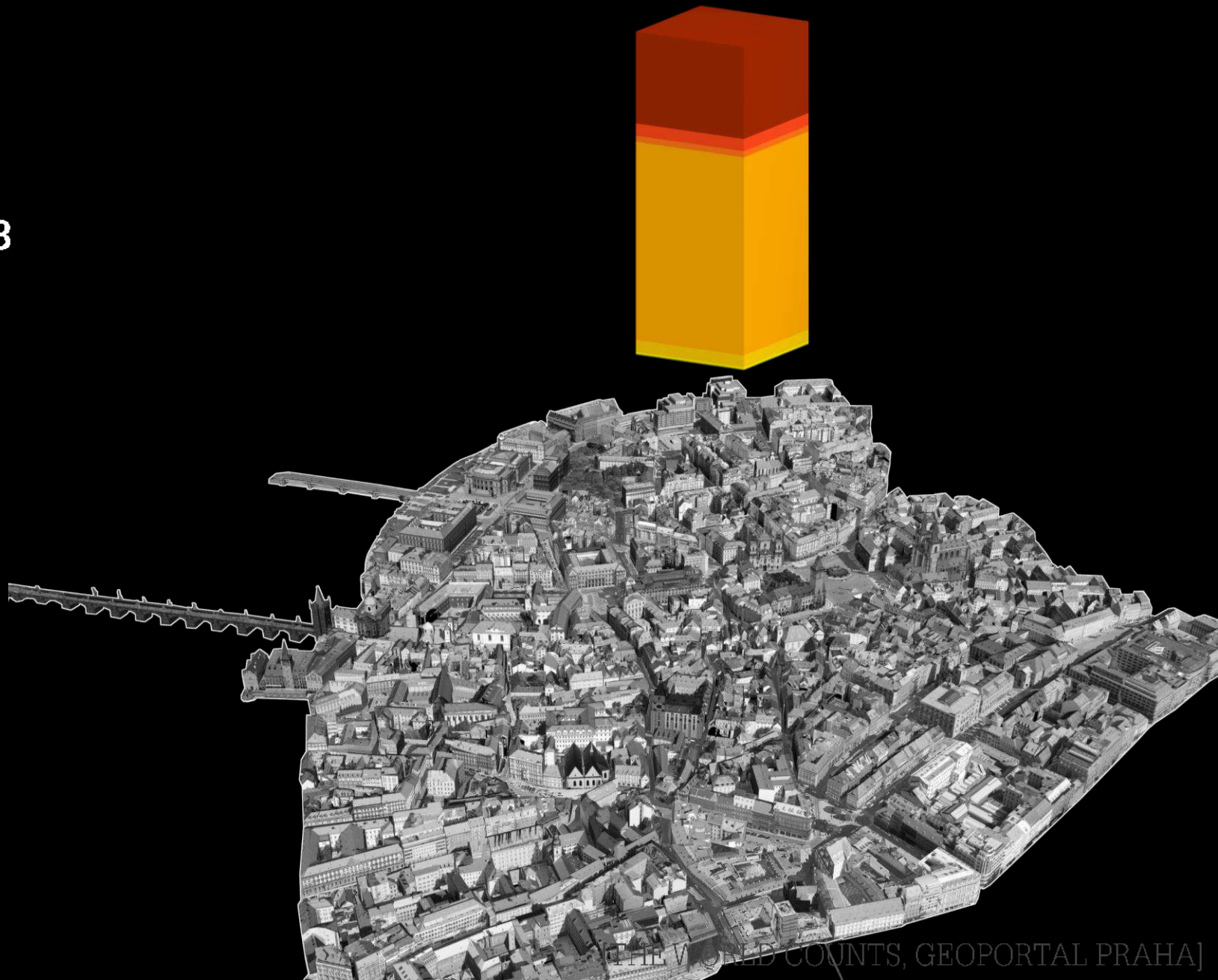
2122

Amount for 1km² of Prague

Metric	Pop. 1.27 million in 2022/year	Pop. 1.55 million in 2122/year
Energy	1 847 m^3	2 268 m^3
Waste	8 209 m^3	10 080 m^3
CO_2 emissions	82 054 m^3	100 762 m^3
Water	1 320 465 m^3	1 620 788 m^3
Agriculture	613 911 m^3	753 883 m^3
Infrastructure	42 841 m^3	52 608 m^3
Area of buildings	81 397 m^3	99 956 m^3

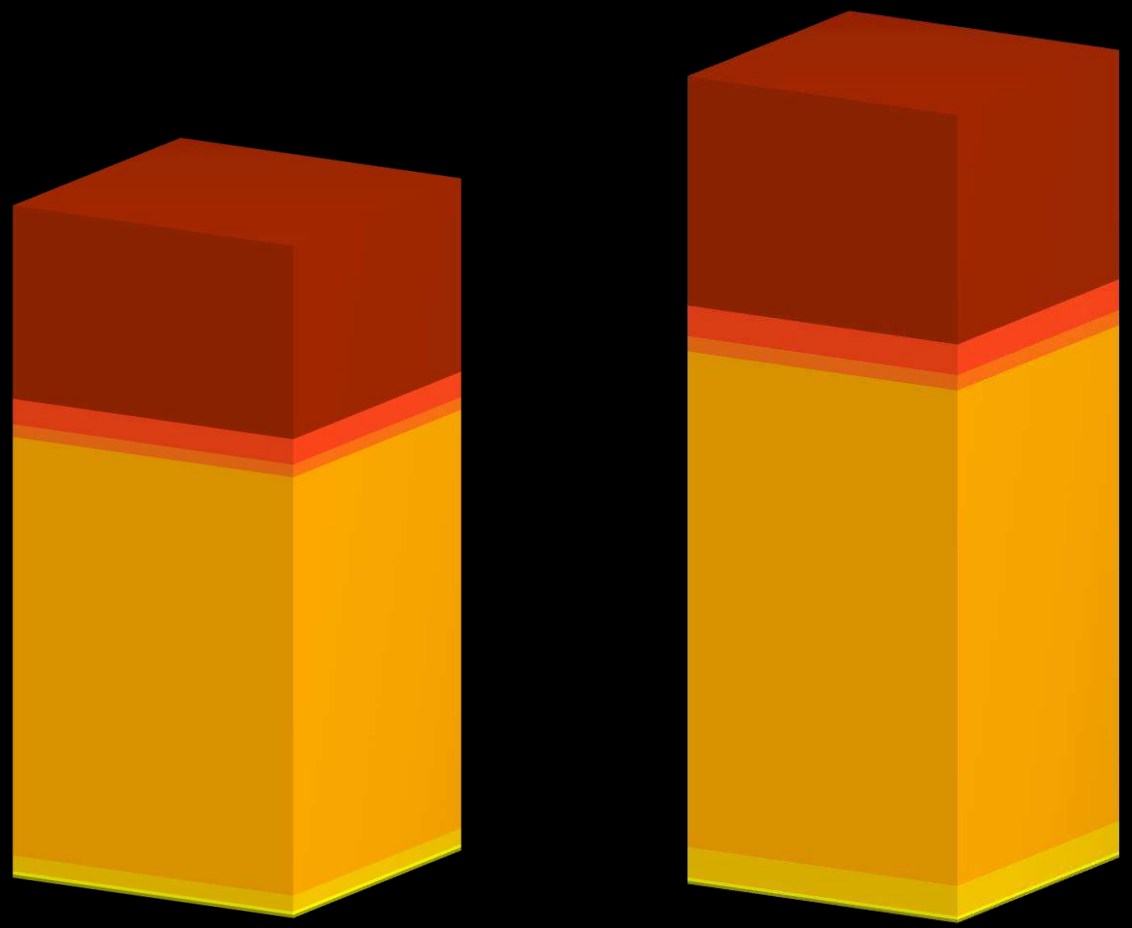
Amount for 1km² of Prague in 2122

Volume: 2 640 345 m³



[THE WORLD COUNTS, GEOPORTAL PRAHA]

Amount for 1km² of Prague



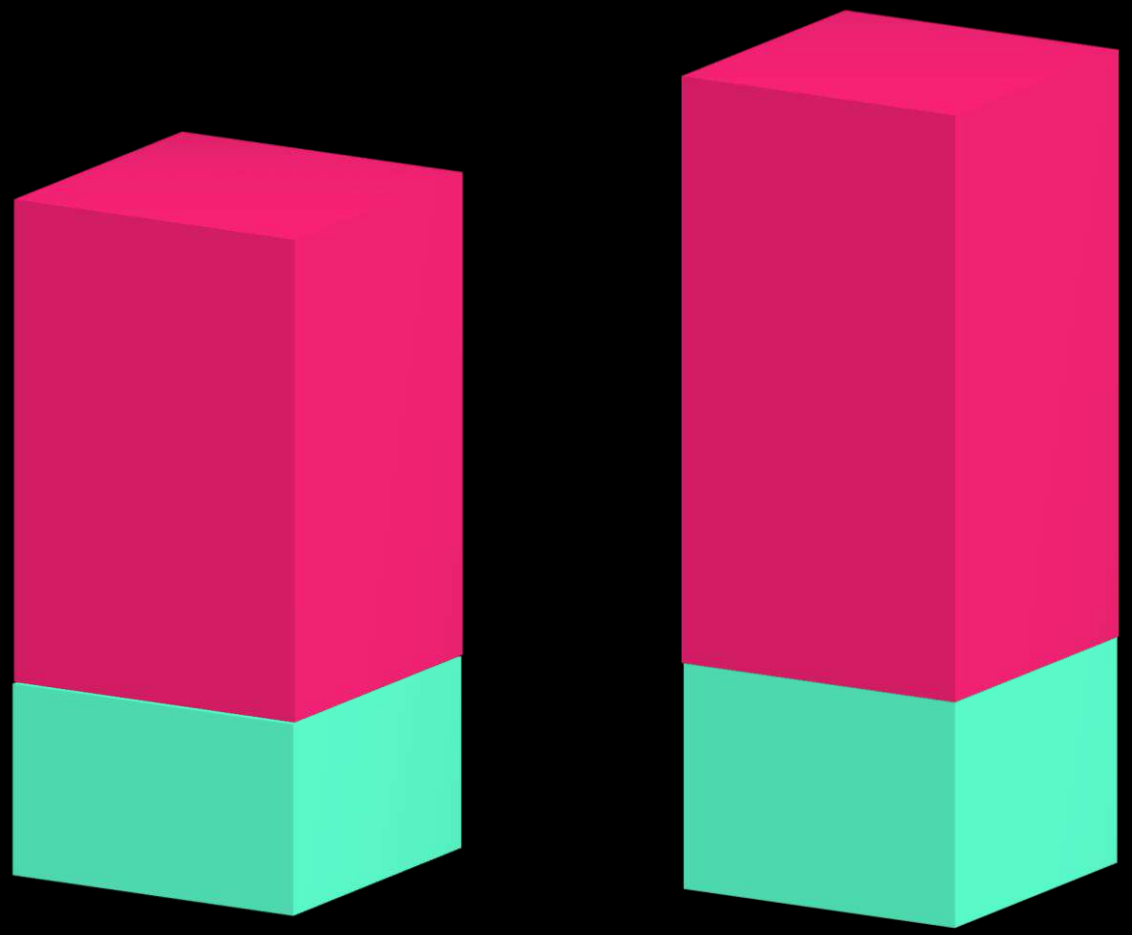
2022

2122

If we act the same

[CONNECT 4 CLIMATE, THE WORLD COUNTS]

Comparison of excess and biocapacity

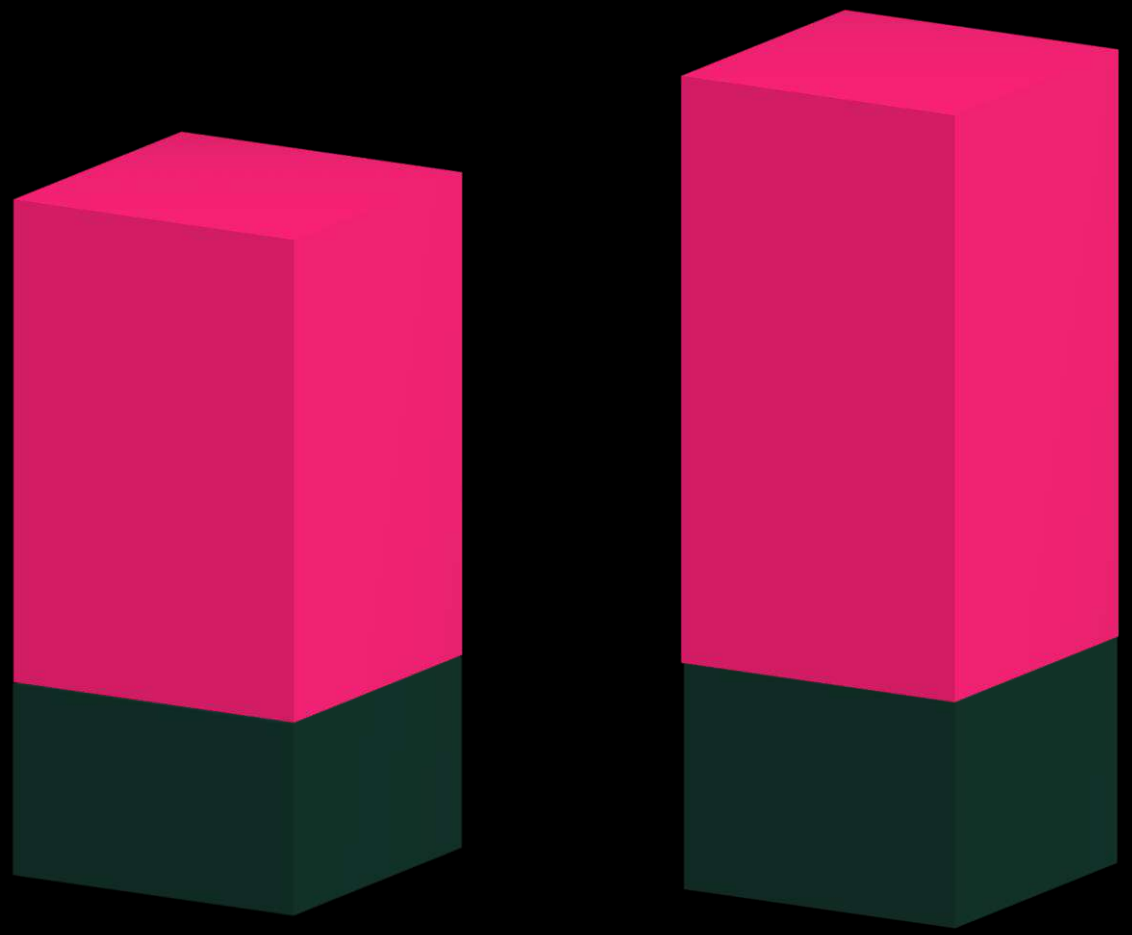


2022

2122

If we act the same

Excess



2022

2122

If we act the same

You see that if we act the same,

the excess will keep growing

But there are ways we can change our behaviour to mitigate this excess

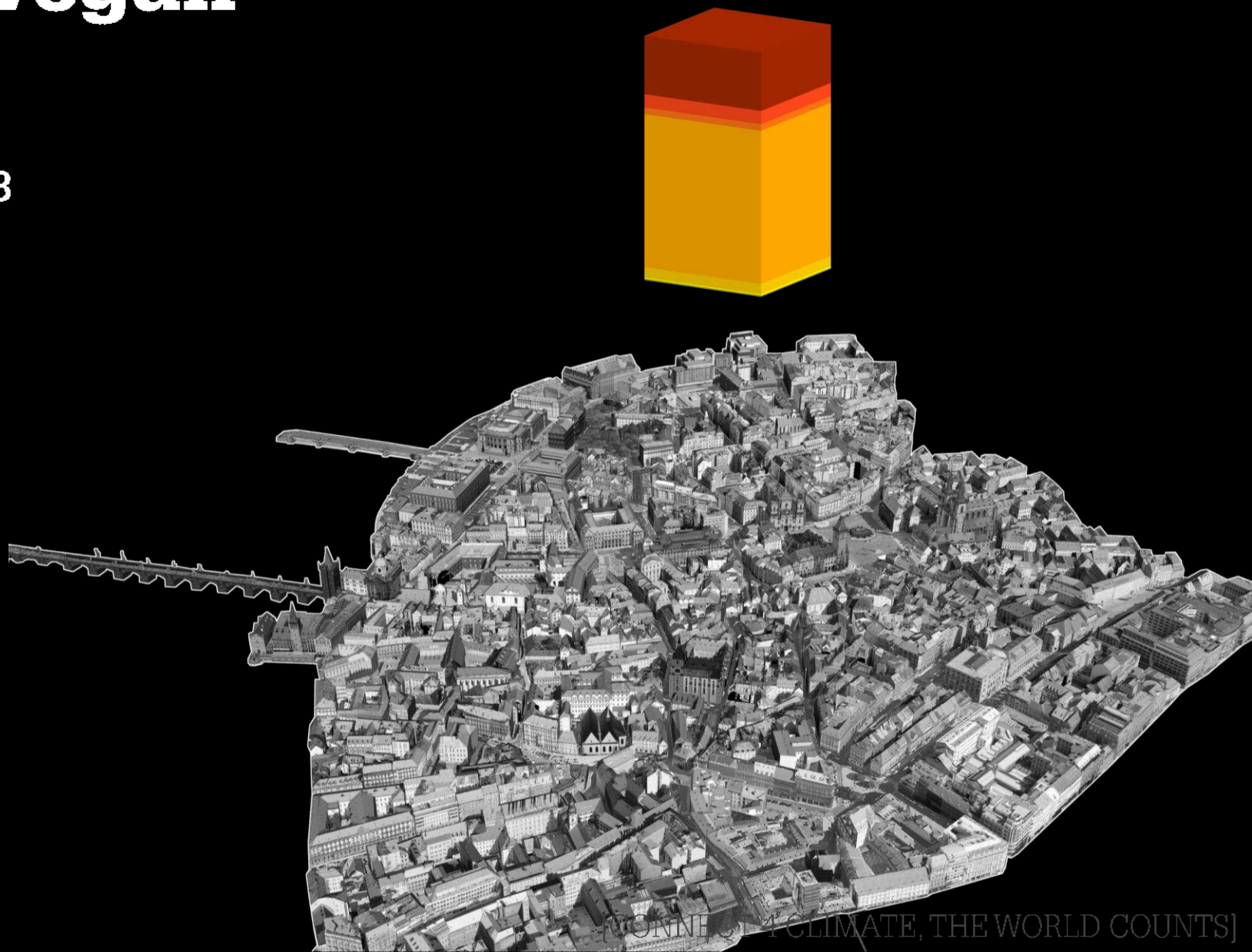
One of which is reducing the intake of animal products in our diet

Amount for 1km² of Prague

Metric	Pop. 1.27 million in 2022/year	Pop. 1.55 million in 2122/year	If everyone eats vegan in 2122/year
Energy	1 847 m^3	2 268 m^3	2 211 m^3
Waste	8 209 m^3	10 080 m^3	9 922 m^3
CO_2 emissions	82 054 m^3	100 762 m^3	96 758 m^3
Water	1 320 465 m^3	1 620 788 m^3	1 161 781 m^3
Agriculture	613 911 m^3	753 883 m^3	422 175 m^3
Infrastructure	42 841 m^3	52 608 m^3	52 608 m^3
Area of buildings	81 397 m^3	99 956 m^3	99 956 m^3

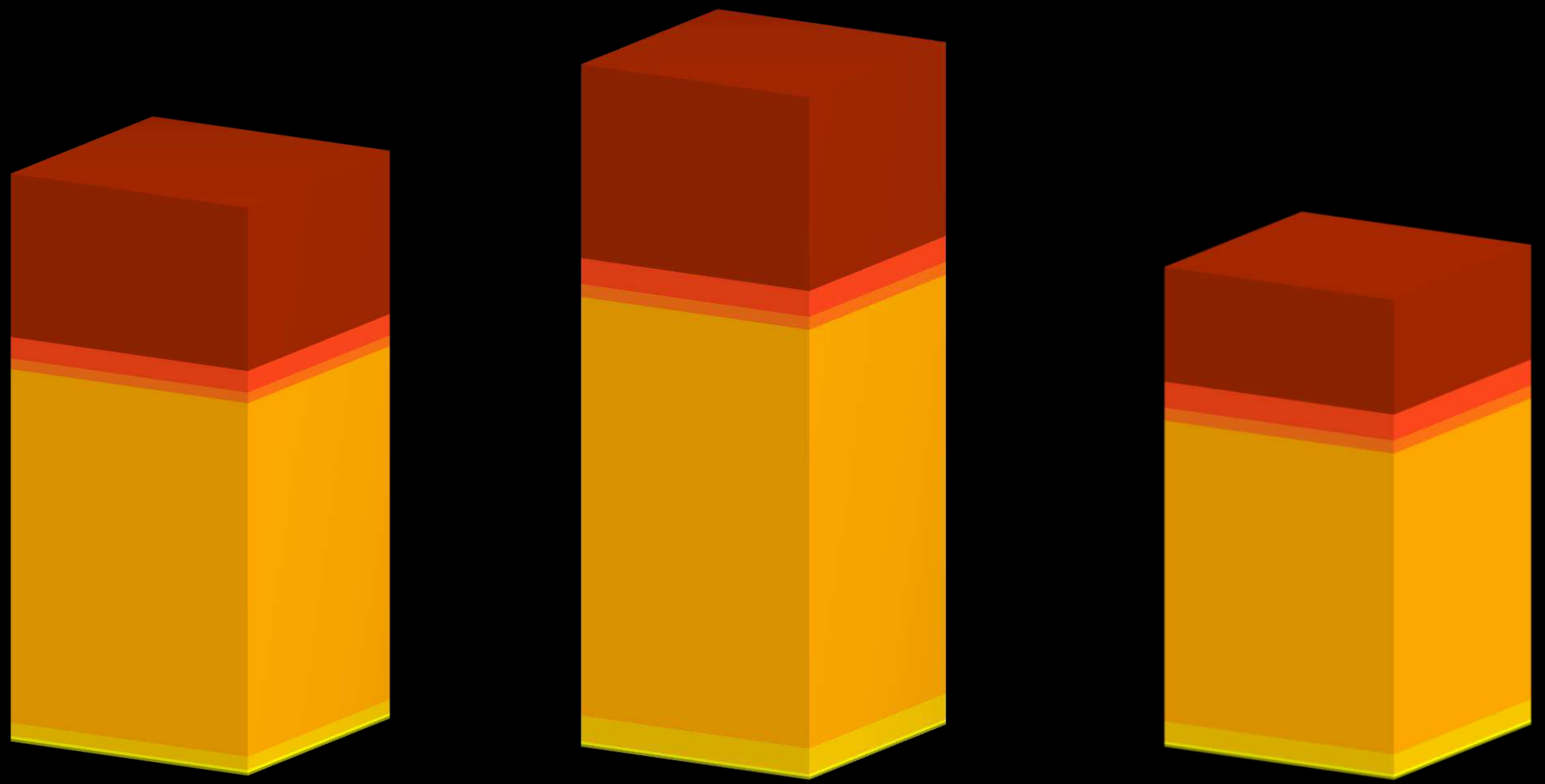
Amount for 1km² of Prague in 2122 if everyone eats vegan

Volume: 1 845 411 m³



[CONNECT CLIMATE, THE WORLD COUNTS]

Amount for 1km² of Prague



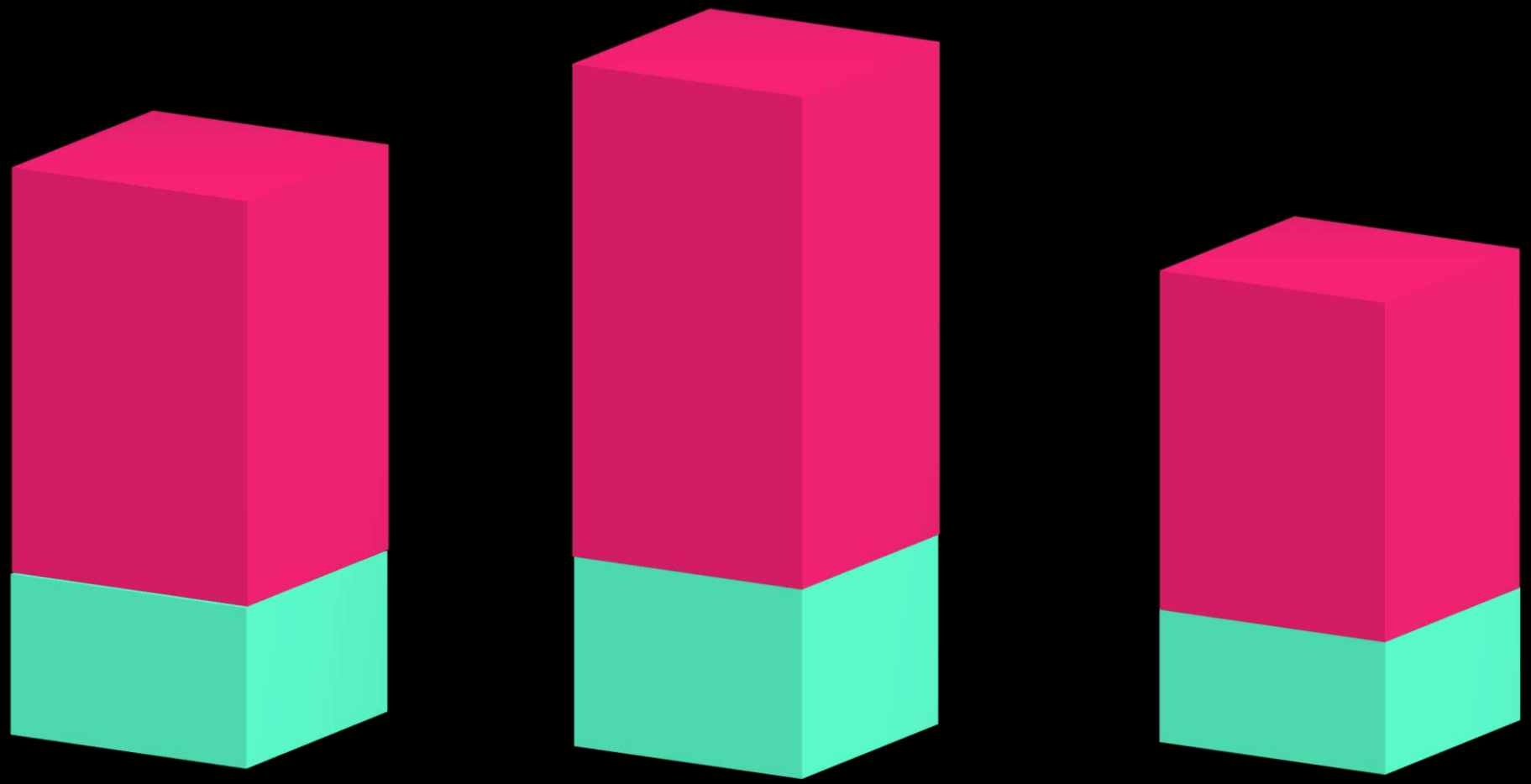
2022

2122
If we act the same

2122
If everyone eats vegan

[CONNECT 4 CLIMATE, THE WORLD COUNTS]

Comparison of excess and biocapacity



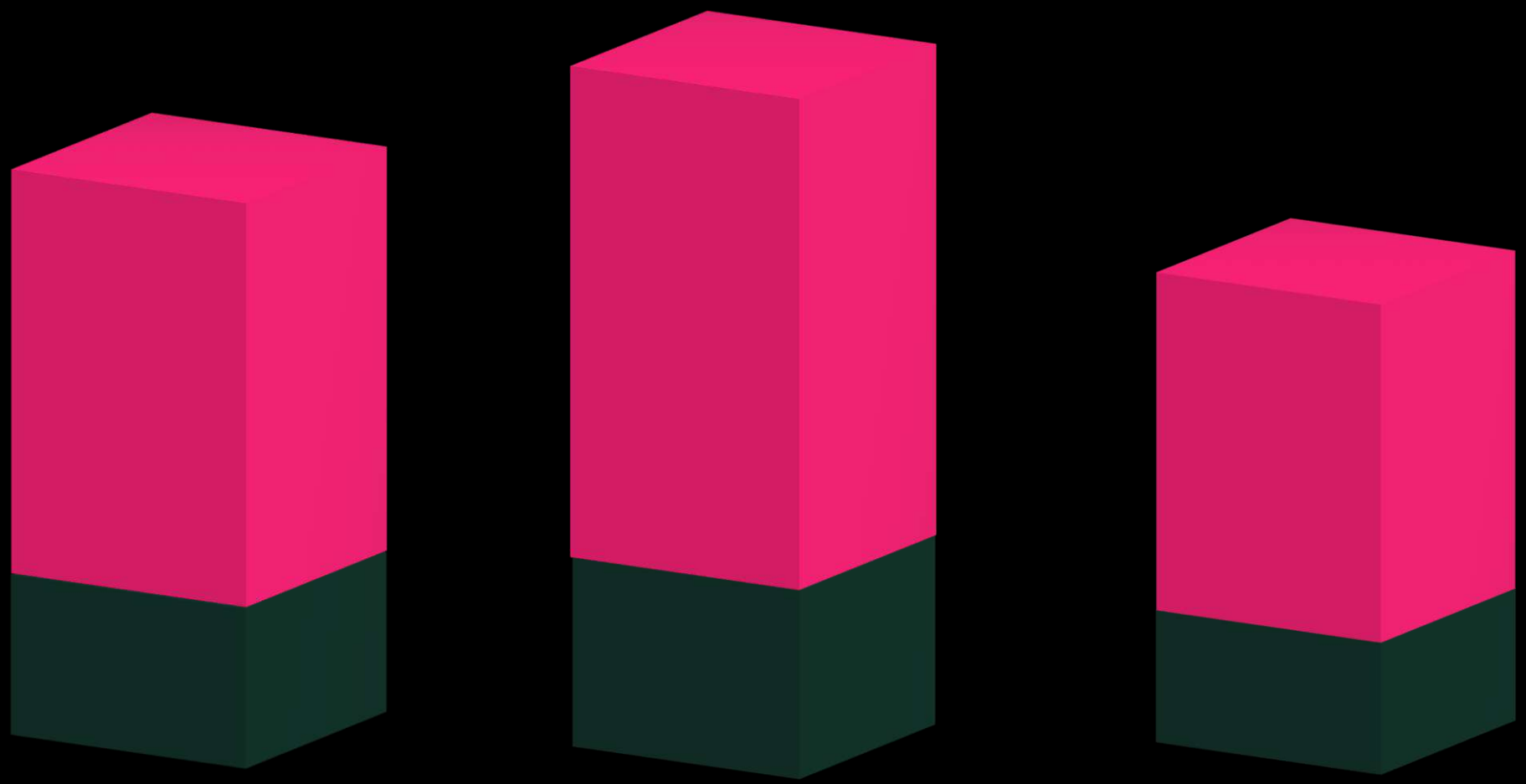
2022

2122
If we act the same

2122
If everyone eats vegan

[CONNECT 4 CLIMATE, THE WORLD COUNTS]

Excess



2022

2122
If we act the same

2122
If everyone eats vegan

[CONNECT 4 CLIMATE, THE WORLD COUNTS]

Other behavioural changes include the reduction in consumption of resources such as water or materials

Or sourcing resources strictly locally and cutting on emissions from long haul transport

Changing our behaviour is not enough

There are countries such as Benin or Jamaica with low excess and therefore the overshoot day is later or none

These countries tend to have low GDP and high poverty rate, almost 80% of people in Benin live on less than 5 euros per day

Is this the only way to get the excess to zero?

What if we reduced the excess with nature?

What if we could replace the *excesscube* with a *biocube*?

We need to invent!

04

Bioinventions

From inventions to bioinventions

Electric cars

Paper based materials

Retention tanks

Wind power plants

Vertical cities

Vertical farms

Tiny houses

Electric cars

Paper based materials

Retention tanks

Wind power plants

Vertical cities

Vertical farms

Tiny houses

Artificial products

Linear process

Not biodegradable

Electric cars

Paper based materials

Retention tanks

Wind power plants

Vertical cities

Vertical farms

Tiny houses

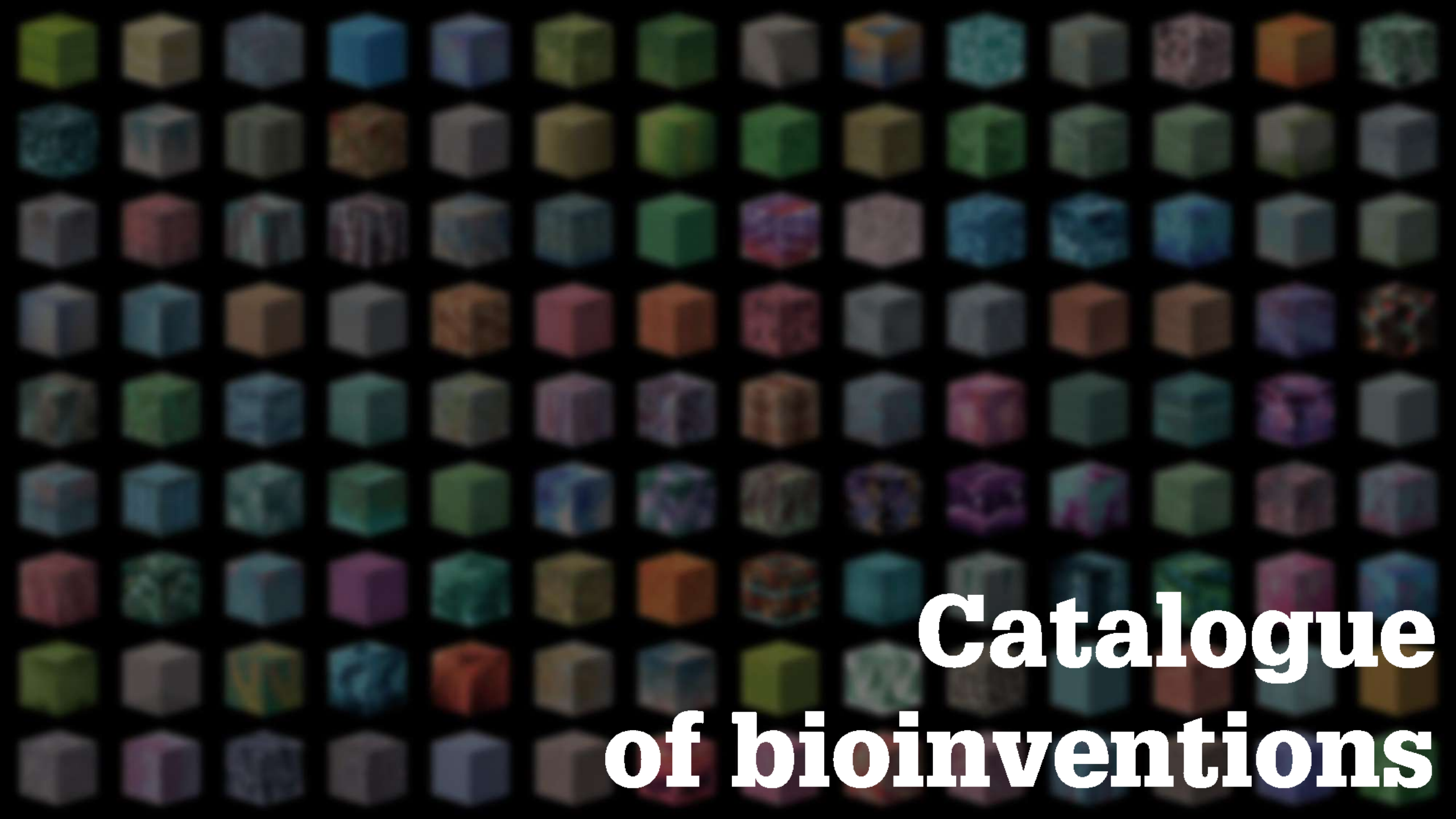
Artificial products

Linear process

Not biodegradable

Disruption of cycles

Bioinventions



Catalogue of bioinventions

Material categorisation

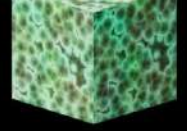
Metrics categorisation

Timeline categorisation

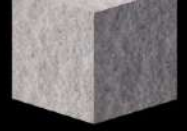
now


surface greenifier
algae
algae brick
algae wall
algae purifying wall
algae tiles
algae window
algae lamp
algae fuel
algae packaging
hydroponic farms
plants
moss
tree
grown chair
grown table
grown bed
grown wall
glowing bacteria
glowing fungi
aerogel
aerogel insulation
luffa
coffee grounds
mogu
mogu wall
soil
rammed earth wall
bamboo structure
coral
water filter
air plants
recyclable plastic
chitin
salt crystals
salt crystal cladding
salt crystal tiles
termite farms
shell sensor
trout sensor
bacteria
citrus fabrics
citrus shirt
fuel from waste
wall from waste
biocement
bioconcrete
hemp brick
hemp wall
hemp fabrics
corn insulation
natural rubber latex mortar
natural rubber latex fabrics
natural rubber latex sealant
sand battery
sponge filter
graphene

now



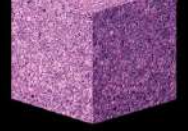
corn insulation



natural rubber latex mortar

natural rubber latex fabrics

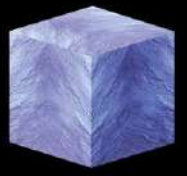
natural rubber latex sealant



sand battery

sponge filter

graphene

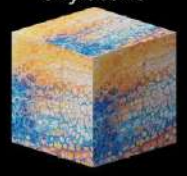


+100 years

mycelium megastructure

water retaining sponge

water collecting spidersilk

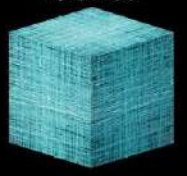


photonic crystals

pigment electricity generator

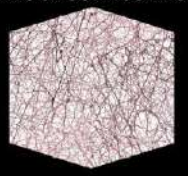
mycorrhizal network

indoor biofarms



spiderweb fabrics

spidersilk reinforcement

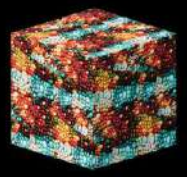


spidersilk medical items

glowing tree

glowing wall

glowing chair



glowing soil

glowing air particles

coffee ground tiles

coffee ground wall

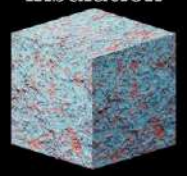
pigmented clothes

modified plants

modified insects

mycelium chair

mycelium bed



mycelium insulation

mycelium pipes

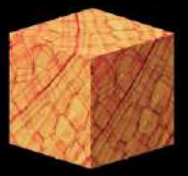
mycelium farms

mangrove foundations

bat sensor

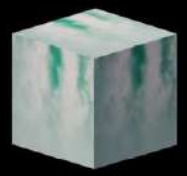
aloe vera packaging

soil sponge



citrus shading

nourishing wall



fog catcher

luffa wall

luffa bed

plankton ponds

chlorophyll O2 generator

cellulose reinforcement

cellulose-aerogel ultralight material

cellulose fabrics

bacterial-cellulose leather

eggshell wall

eggshell furniture

eggshell tableware

plastic composter

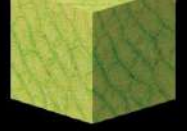
+100 years

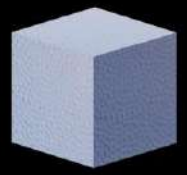
eggshell wall

eggshell furniture

eggshell tableware

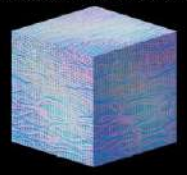
plastic composter



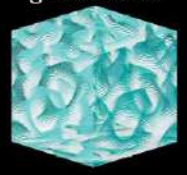


+500 years

regenerative flexible structure

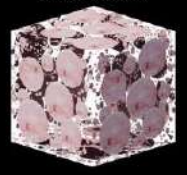


cloud generator



noise utilizer

transportation bubbles



glowing skin

flying plant particles

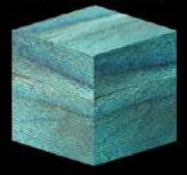
regenerative table

regenerative wall

regenerative bed

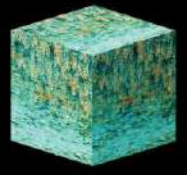
power-plant

chitin shading membrane

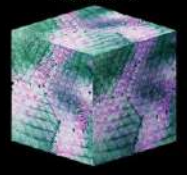


cleansing mist

flying biomes



rain catcher island



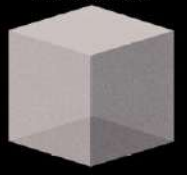
forest clouds

CO2 crystals

biomemory material

keratin net

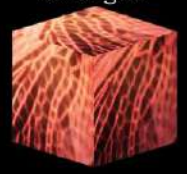
noise cancelling material



photonic structure

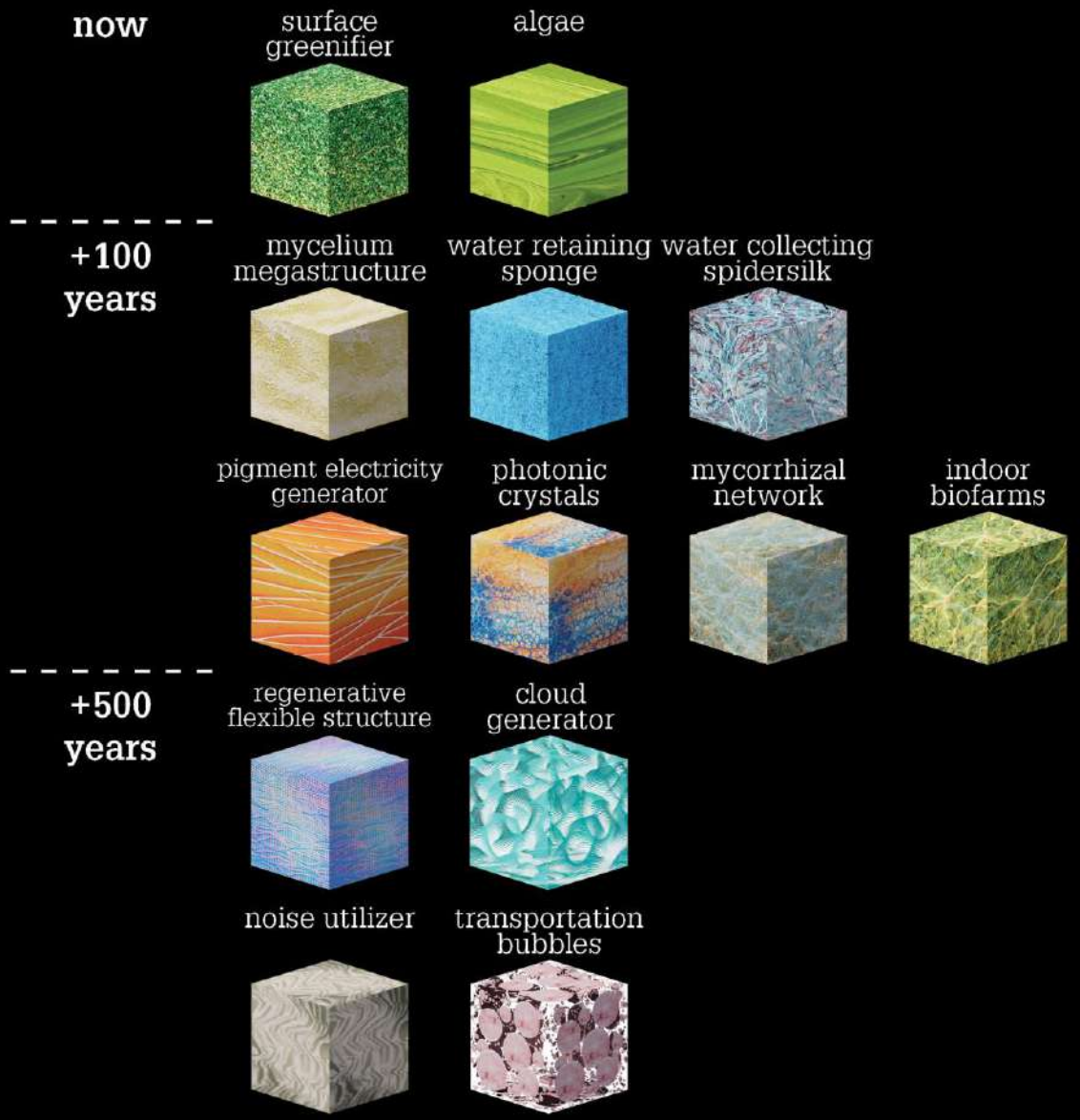
topas charger

xanthopterin charger



biochip

rain generator


now
surface greenifier
algae
+100 years
mycelium megastructure
water retaining sponge
water collecting spidersilk
pigment electricity generator
photonic crystals
mycorrhizal network
indoor biofarms
+500 years
regenerative flexible structure
cloud generator
noise utilizer
transportation bubbles

now

surface greenifier

algae

Surface greenifier

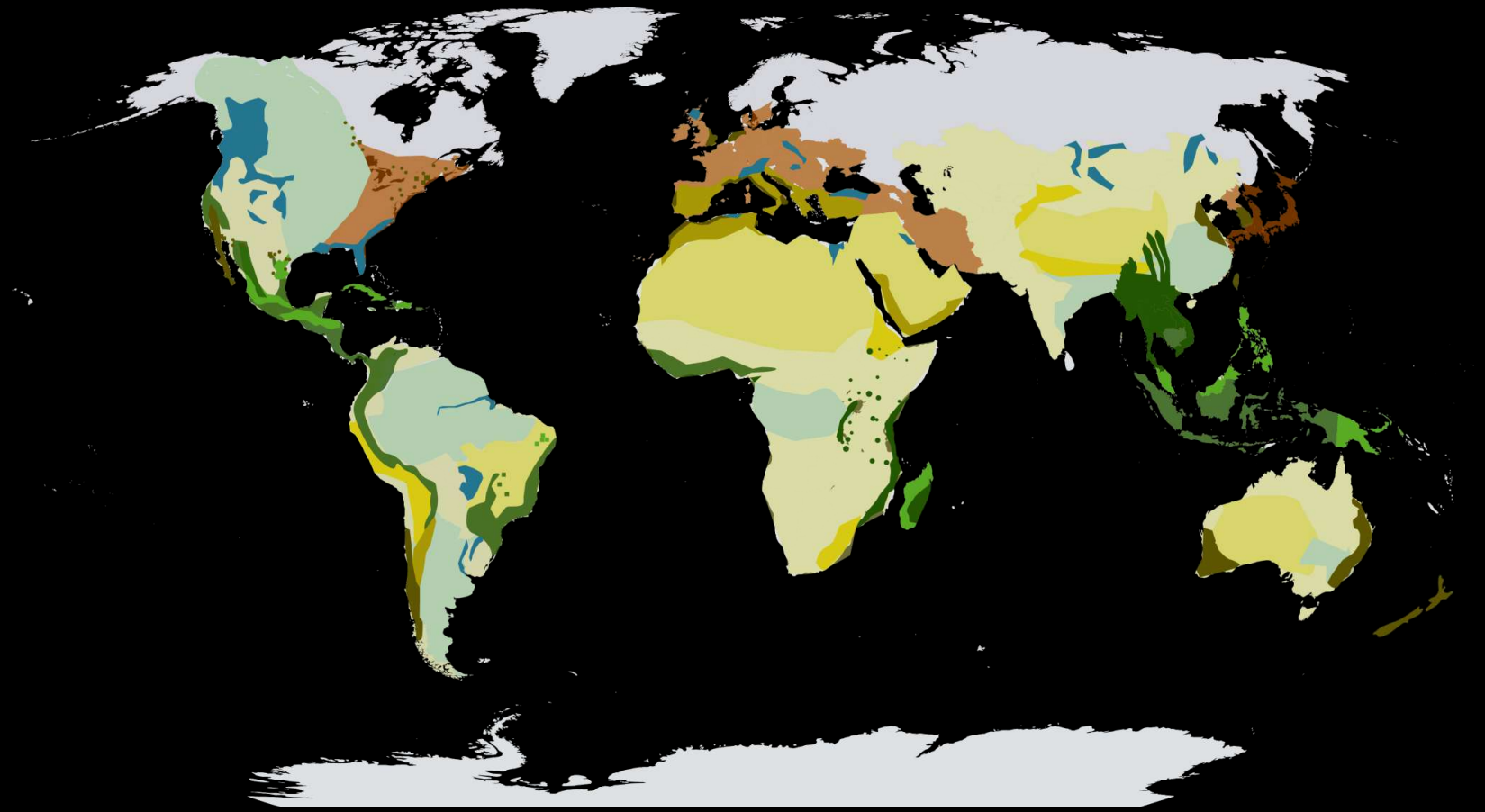
Covering all the surfaces
with vegetation based
on their specific biome.

Surface greenifier

Surface greenifier

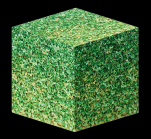
What ?

Terrestrial biomes



Types of terrestrial biomes

- Temperate Broadleaf & Mixed Forests
- Montane Grasslands & Shrublands
- Grasslands, Savannas & Shrub-lands miexed with Boreal Forest
- Tropical and Subtropical Moist Broadleaf Forests
- Tropical & Subtropical Coniferous Forests
- Mediterranean Forests, Woodlands & Scrub
- Deserts & Xeric Shrublands
- Tropical & Subtropical Grass-lands, Savannas & Shrublands
- Flooded Grasslands & Savannas
- Boreal Forest/ Tajga
- Tundra

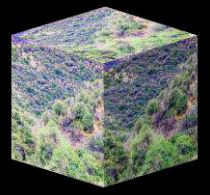


Surface greenifier

What ?

Terrestrial biomes

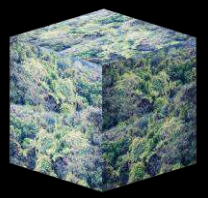
Identified by characteristic dominant trees and plants



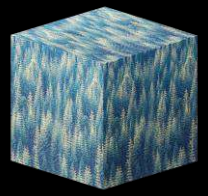
Mediterranean forests

Montane grasslands

Savannas with forests

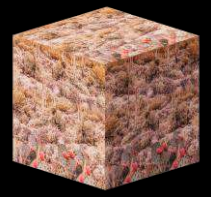


Tr./subtr. broadleaf forests



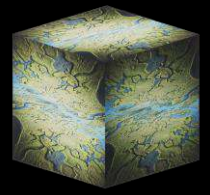
Coniferous forests

Broadleaf mixed forests



Deserts, shrublands

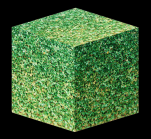
Tr./subtr. savannas



Flooded grasslands

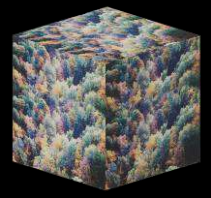
Taiga

Tundra



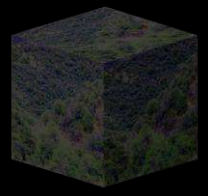
Surface greenifier

What ?

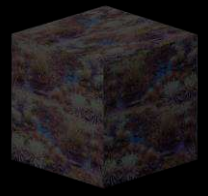


Broadleaf mixed forests

Temperate broadleaf and mixed forests occur in areas with distinct warm and cool seasons that give them moderate annual average temperatures — 3 to 23 °C



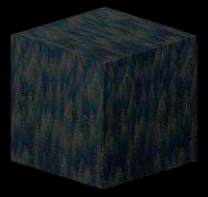
Mediterranean forests



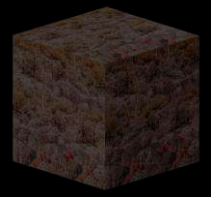
Montane grasslands

Savannas with forests

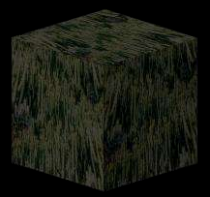
Tr./subtr. broadleaf forests



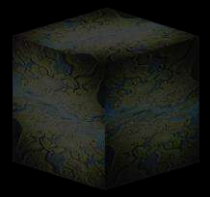
Coniferous forests



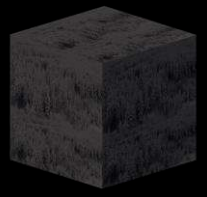
Deserts, shrublands



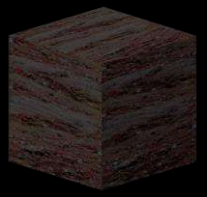
Tr./subtr. savannas



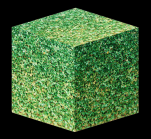
Flooded grasslands



Taiga

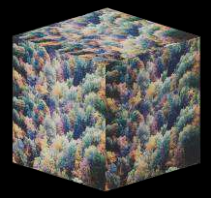


Tundra

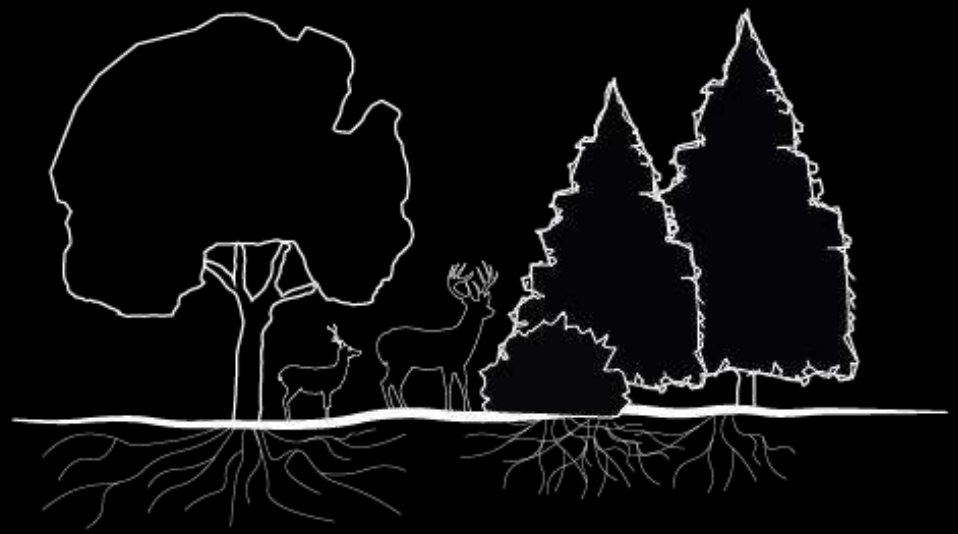


Surface greenifier

What ?



Broadleaf mixed forests



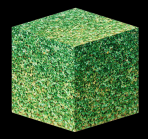
Canopy
tall trees 30 – 60 m

Sub-canopy
Smaller mature trees 30 – 60 m

Shrub layer
Low growing woody plants

Herbaceous layer
Most diverse

[APPROPEDIA; GARDEN CITY HARVEST]



Surface greenifier

Why ?

to reduce

CO_2 emissions

to create

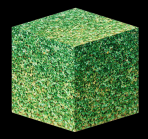
cooling effect

to maintain

biodiversity

reinforcement of

the soil



Surface greenifier

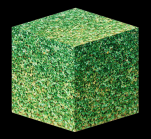
Why ?

to reduce

CO_2 emissions

The Czech Republic produces 96.2 million tons of CO_2 per year.

[MACROTRENDS]

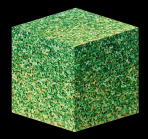


Surface greenifier

Why ?

The average temperature in the Czech Republic will

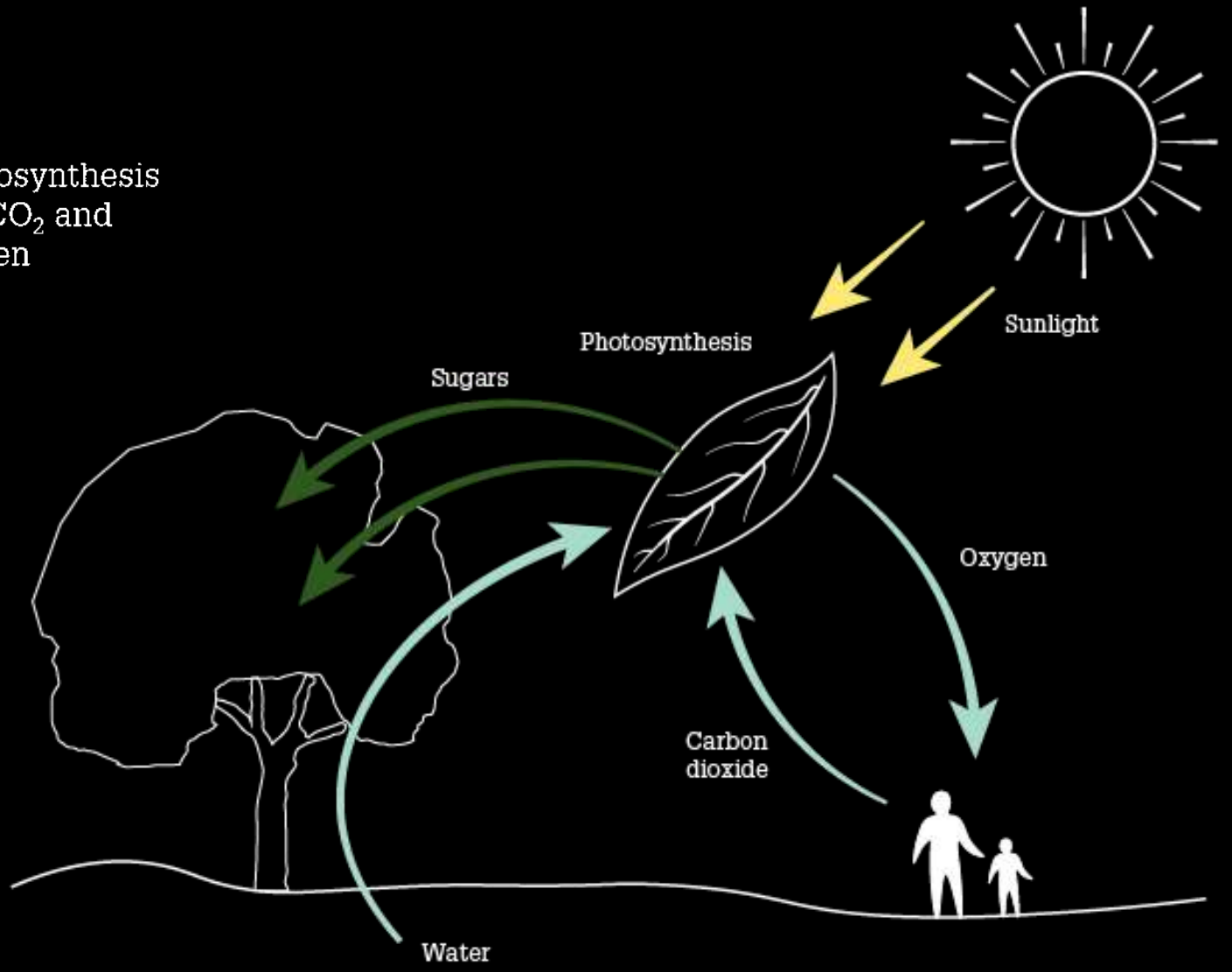
increase by 10°C in 100 years



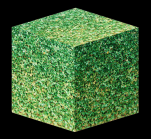
Surface greenifier

How ?

Through photosynthesis trees absorb CO_2 and produce oxygen



[BRITANNICA]



Surface greenifier

How ?

A human being breathes about

9.5 m^3 of O_2 per year

that equals to oxygen production of

8 trees per year

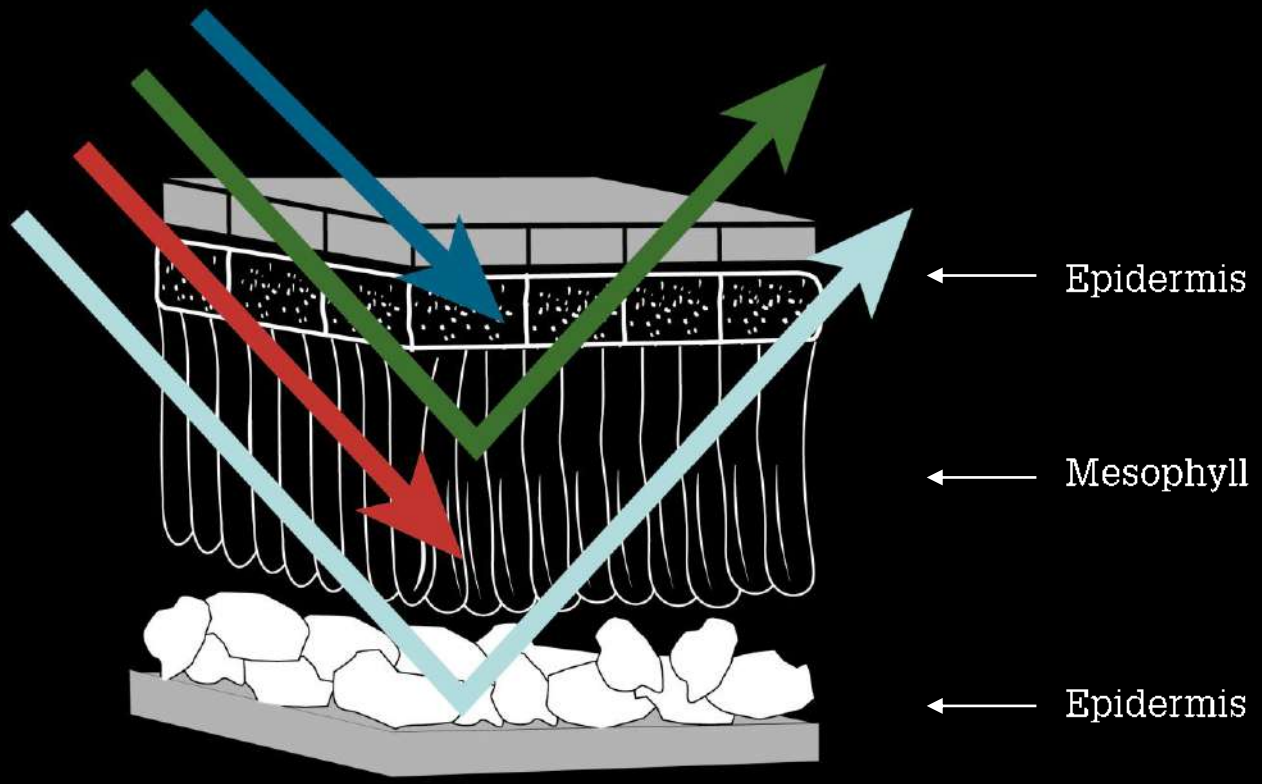
[WORLDOMETERS; THE CONSCIOUS CLUB]

Surface greenifier

How ?

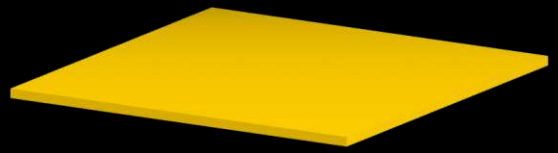
The mesophyll part absorbs the infrared radiation which has

a cooling effect



[NASA]

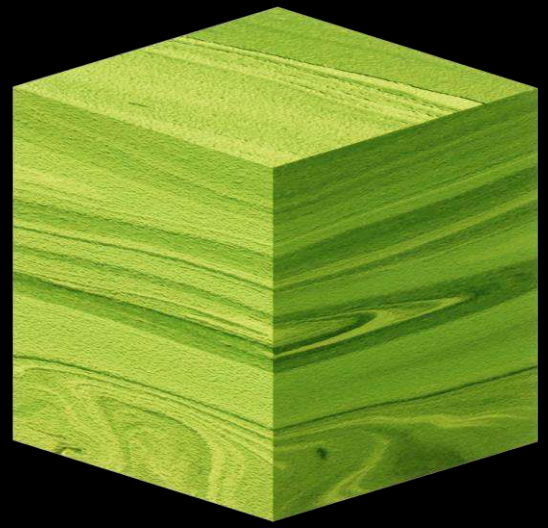
-29 581 m^3 of CO_2 emissions



1km^2 of Prague excess

+1 139 831 m^3 of surface greenifier

Algae lamp



Bioluminescent algae that generates electrical currents to emit light.

Algae lamp

Algae lamp

Why ?

to decrease the use
of nonrenewable

energy

to reduce

CO_2 emissions

to reduce

waste production

Algae lamp

Why ?

to decrease the use
of nonrenewable

energy

Lighting represents almost 20%
of the world's total energy consumption.

[UNEP]

Algae lamp

Why ?

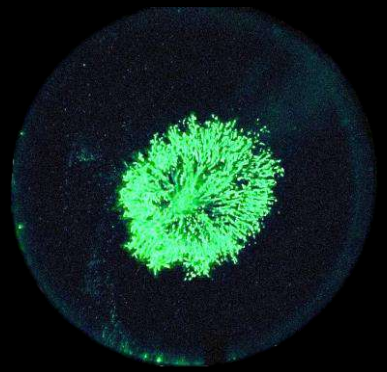
Cities use **60-80% of the world's** annual light energy needs.

[UN-HABITAT; VUSUAL CAPITALIST]

How ?

Illuminance and energy

Variety of microalgal luminescence generates electrical currents that can be utilized as a power source



→ Stored power

Algae lamp

How ?

Blue-green microalgae

+ water

→ photosynthesis → charging process → **Stored power** → **LIGHT**

DAY + NIGHT

[INPUT; AZO CLEAN TECH]

Algae lamp

How ?

1 404 156 m^3

CO_2 emissions by traditional lighting

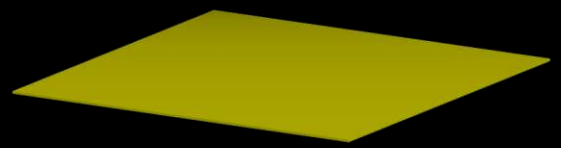
=

- 141 810 m^3

CO_2 emissions by algal lighting

[AZO CLEAN TECH; OUR WORLD IN DATA; SAVING LIGHT BULBS]

-333 m^3 of energy



1km^2 of Prague excess

+63 251 m^3 of algae lamp

+100 years

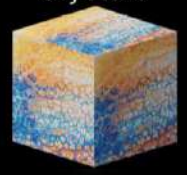
mycelium megastructure

water retaining sponge

water collecting spidersilk

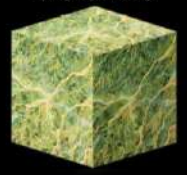
pigment electricity generator

photonic crystals



mycorrhizal network

indoor biofarms



Mycelium megastructure

Mycelium megastructure

Mycelia are fibres of fungi that can grow on various substrates to form composites which can be used as construction material.

Mycelium megastructure

Why ?

to reduce
the construction area of

buildings

to reduce

construction waste

to save

energy for heating

to reduce

CO_2 emmisions

Mycelium megastructure

Why ?

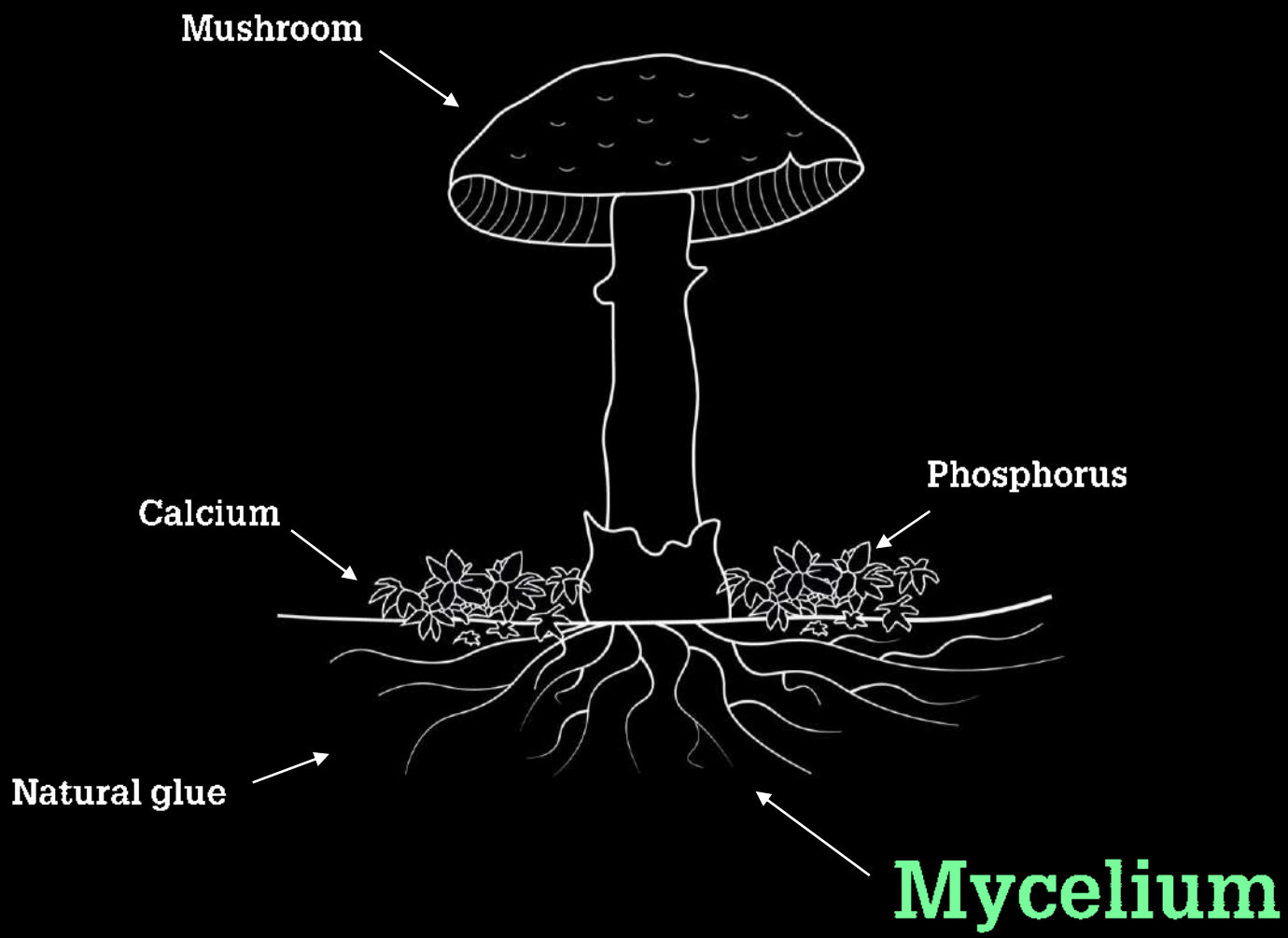
to reduce
the construction area of

buildings

In 2022, the number of buildings constructed in European urban areas is 500 000.

Mycelium megastructure

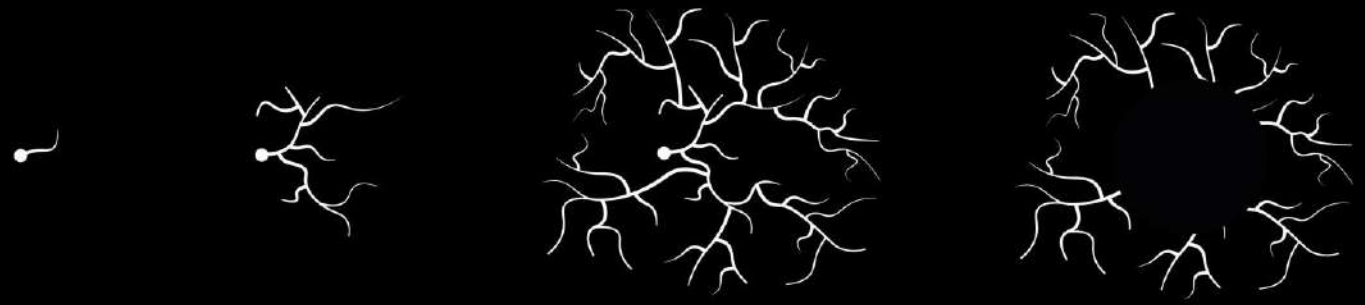
How ?



Mycelium megastructure

How ?

Mycelium megastructure will **regenerate** itself

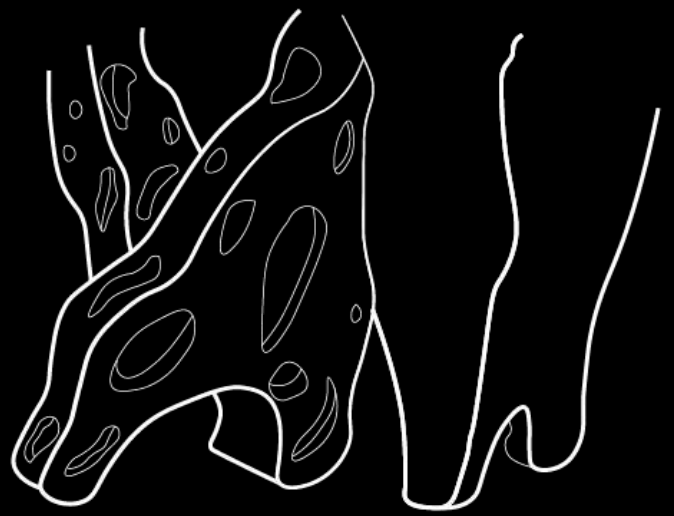


[SCIENTIFIC AMERICAN]

Mycelium megastructure

How ?

Porosity



Adhesion

main building material
has capability to act
as natural glue.

durable + **resistant**

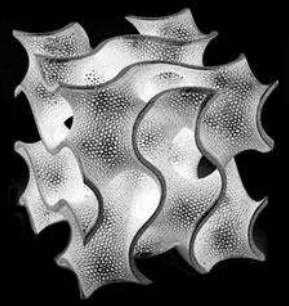
[SCIENTIFIC REPORTS; THE CONVERSATION]

Mycelium megastructure

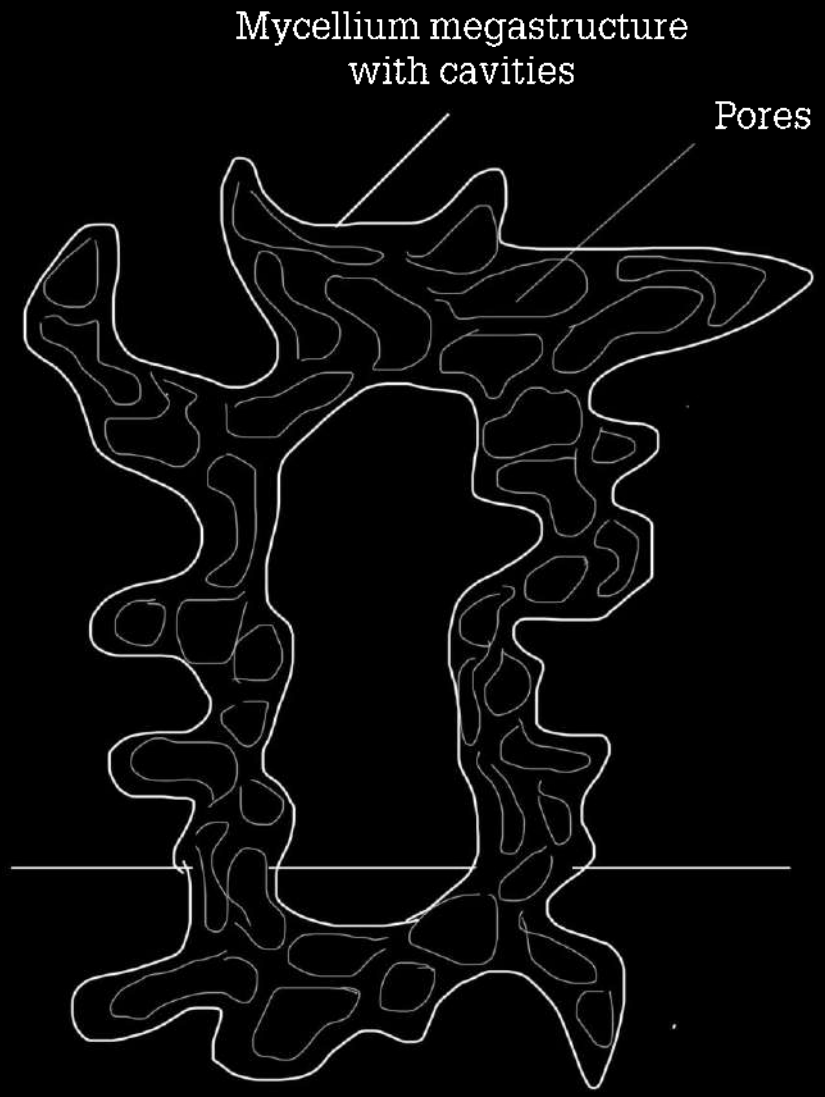
How ?

Living in density

The megastructure allows to build highly dense vertical cities thanks to intertwining of **pores and cavities**



taking inspiration from gyroid

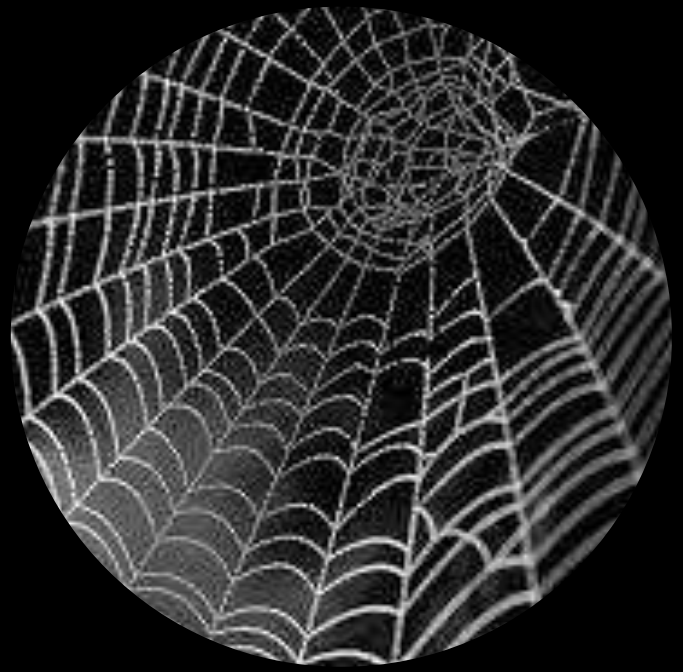


[WOLFRAM MATH WORLD]

How ?

Reinforcement

Spider silk could serve as reinforcement for other structures improving their strength, reducing the volume needed, the weight and also reducing waste.

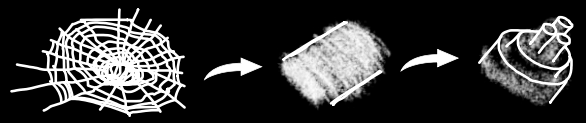


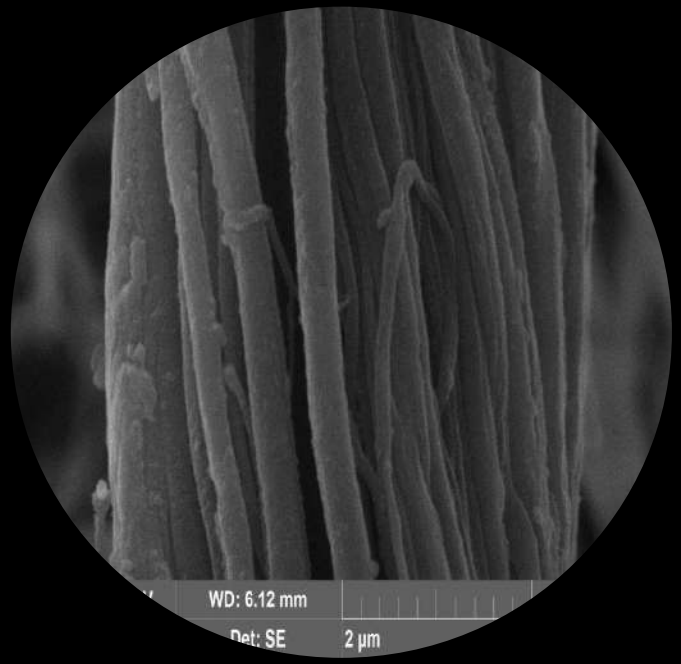
Mycelium megastructure

How ?

Spidersilk reinforcement

A strand of spider silk is made up of many smaller strands which improves the durability and strenght of the silk.

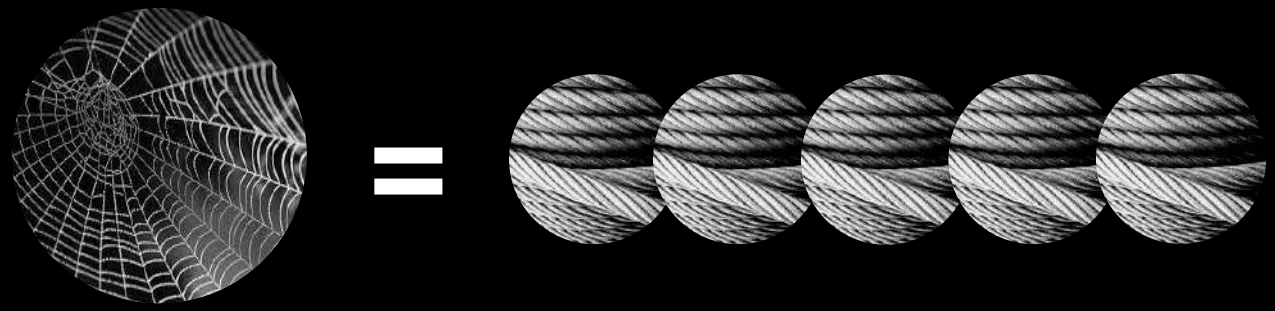




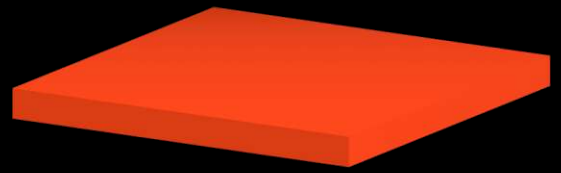
Mycelium megastructure

How ?

Spider web is by weight **5 times stronger** than steel.



-58 688 m^3 of
buildings

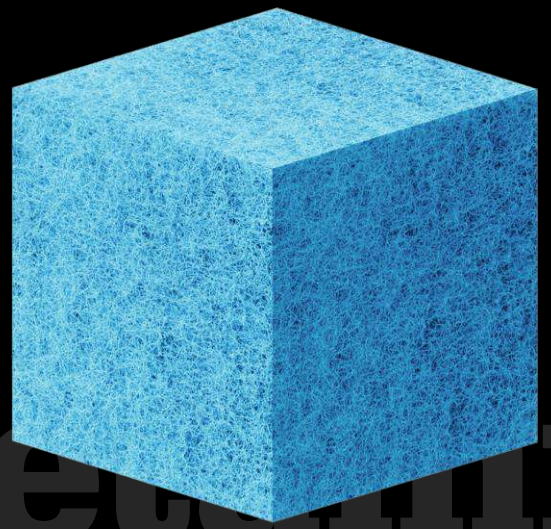


1km^2 of Prague excess

+951 230 m^3 of
mycelium megastructure

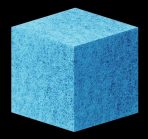
Water retaining sponge

Water retaining sponge



Porous self-sufficient and self-grown organism with retaining and water purifying capacities.

[ADOBE STOCK]



Water retaining sponge

Why ?

acces to

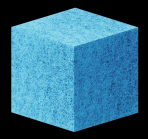
safe water

to limit

droughts

to prevent

floods



Water retaining sponge

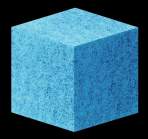
Why ?

acces to

safe water

1 of 3 people do not have access to safe water

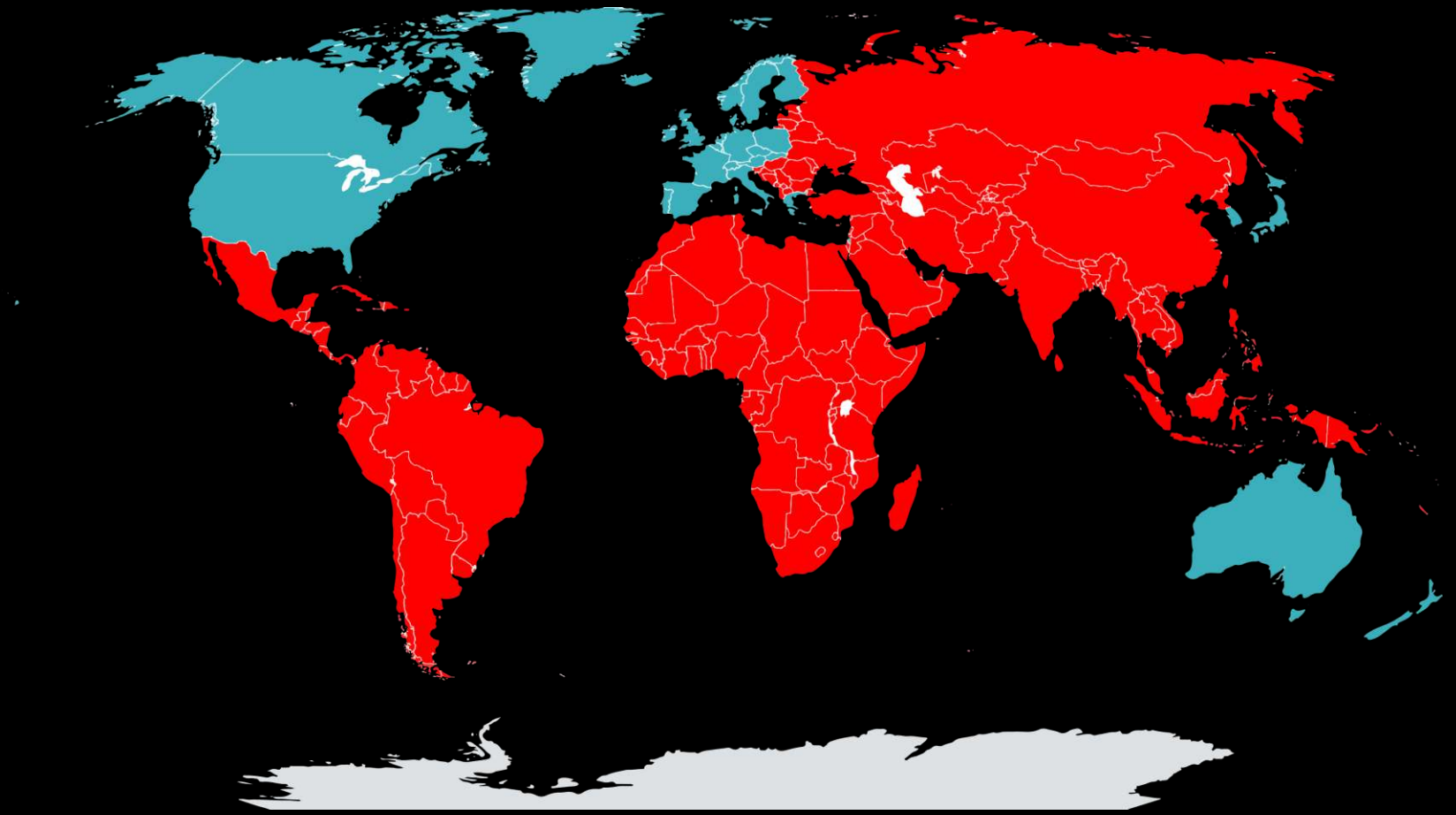
[OUR WORLD IN DATA; UNITED NATIONS]



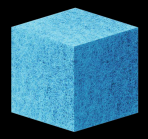
Water retaining sponge

Why ?

Countries with safe water



[VOX]

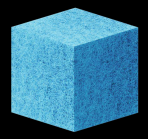


Water retaining sponge

How ?

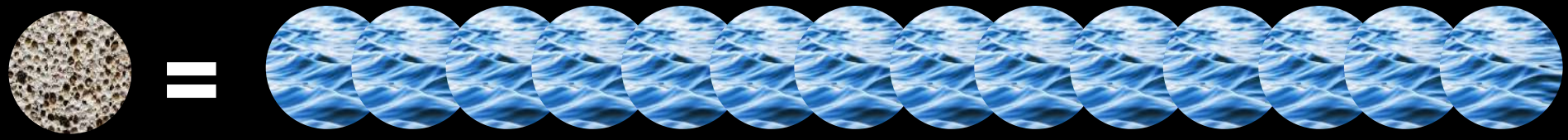
Sponges are known for their **exceptional ability to accumulate water.**

[PHYS]



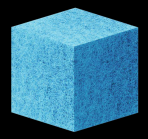
Water retaining sponge

How ?



Sponge can accumulate up to **14 times** its weight

[PHYS]

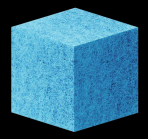


Water retaining sponge

How ?

Water is **filtered** as it flows inside the **pores and channels** of the sponge.

[WIKIPEDIA]



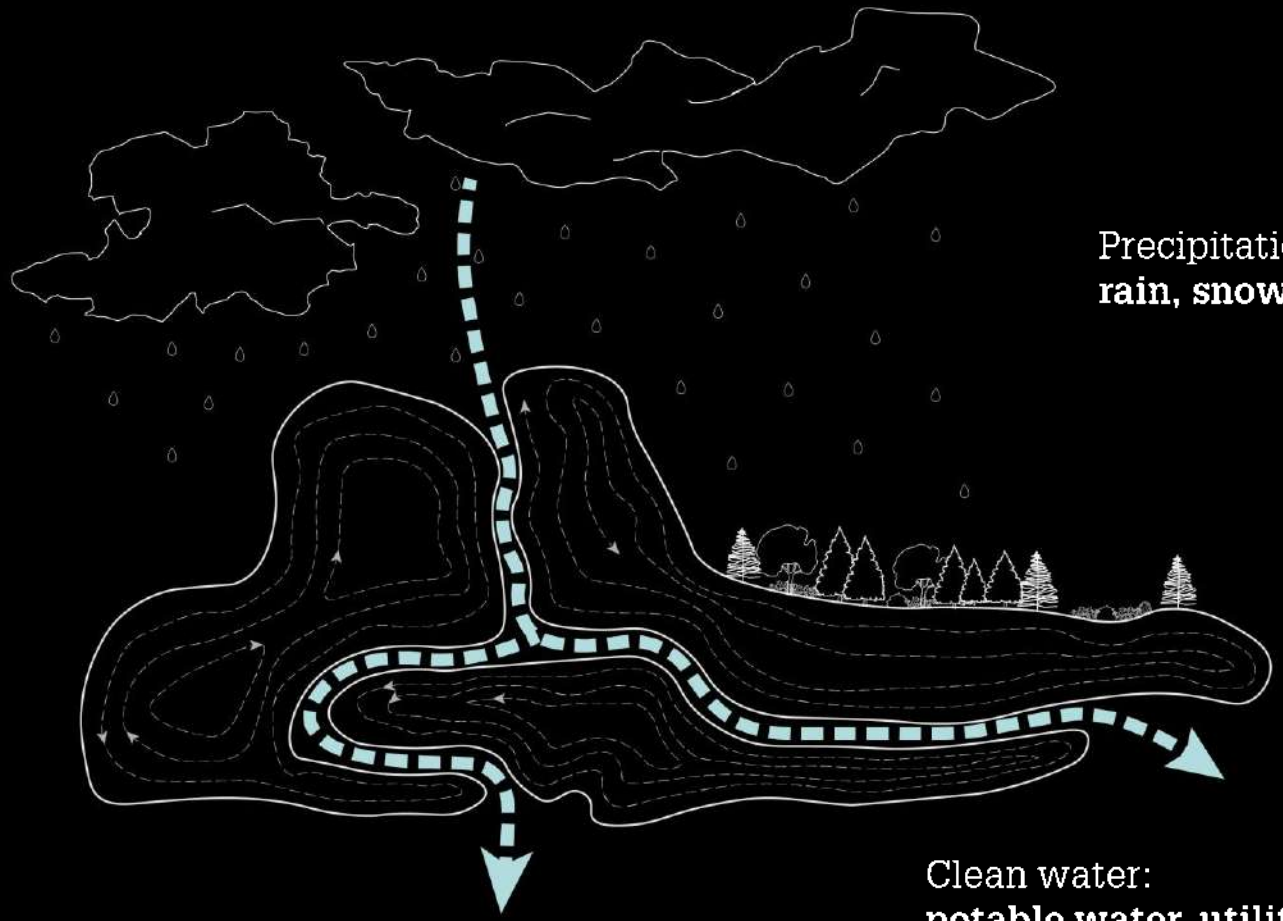
Water retaining sponge

How ?

Porous organic layer of sponge

Excessive water is retained inside.

Water droplets flow through the retaining sponge.

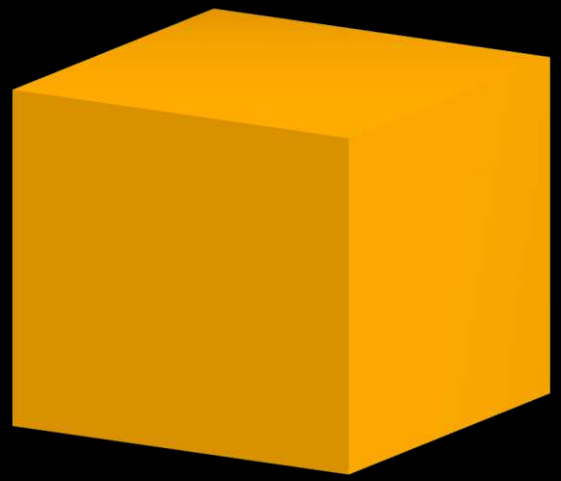


Precipitation:
rain, snow, fog, hail

Clean water:
potable water, utility water

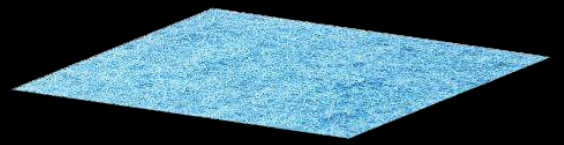
[PINTEREST; DREAMSTIME]

-317 352 m^3 of water



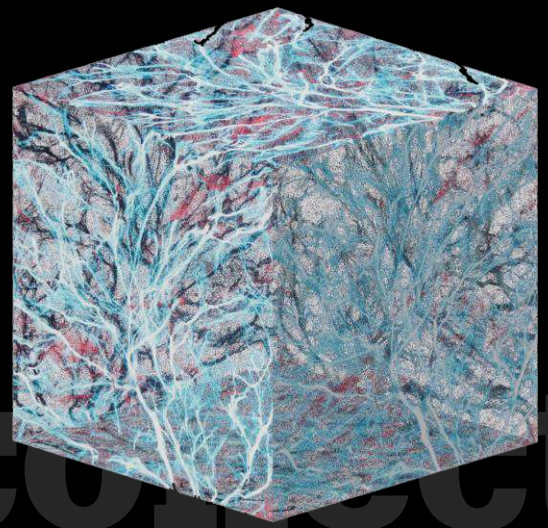
1km^2 of Prague excess

+0.2 m^3 of water
retaining sponge

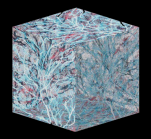


Water collecting spider silk

Water collecting spider silk



Spider silk is a strong structure with an ability to capture water from the air.



Water collecting spider silk

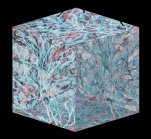
Why ?

to collect

water

to reduce

waste



Water collecting spider silk

How ?

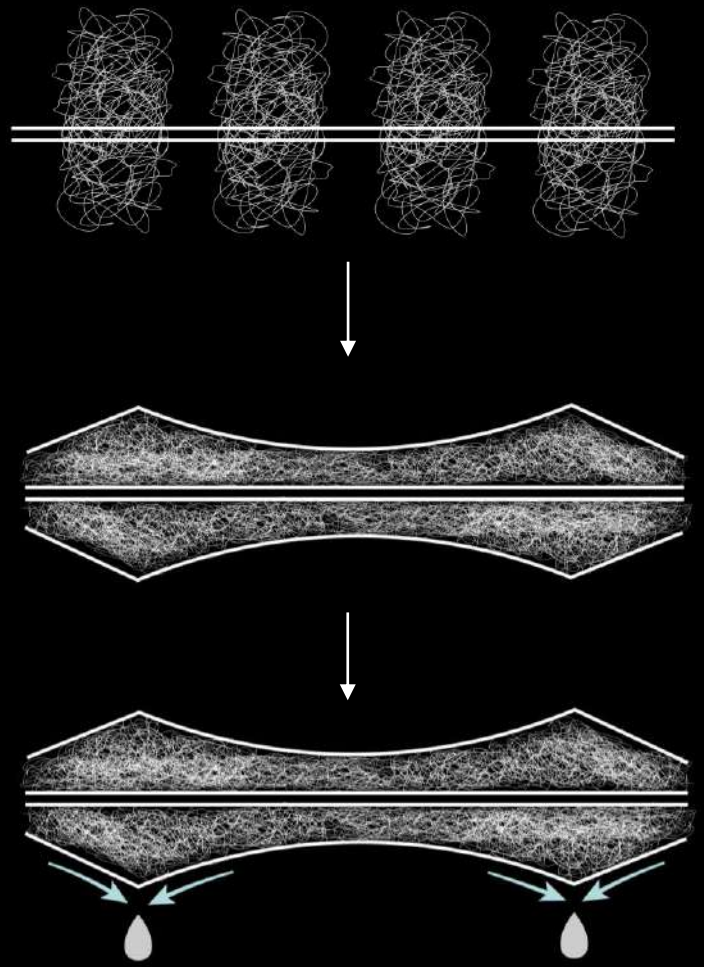
Dry silk thread

Wet silk thread

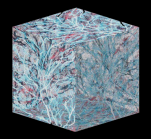
Condensation of water from air creating droplets

=

WATER COLLECTOR



[RESEARCH GATE]



Water collecting spider silk

How ?

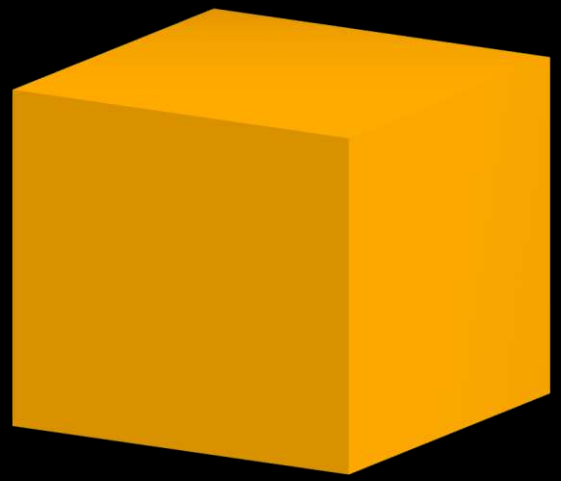
1 g of spider web can hold

160 g of water

1 m^3 of spider web can hold

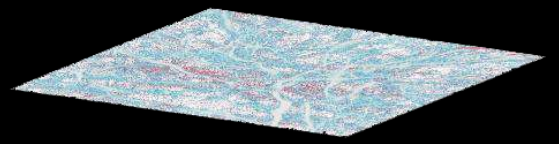
1 m^3 of water

-317 352 m^3 of water

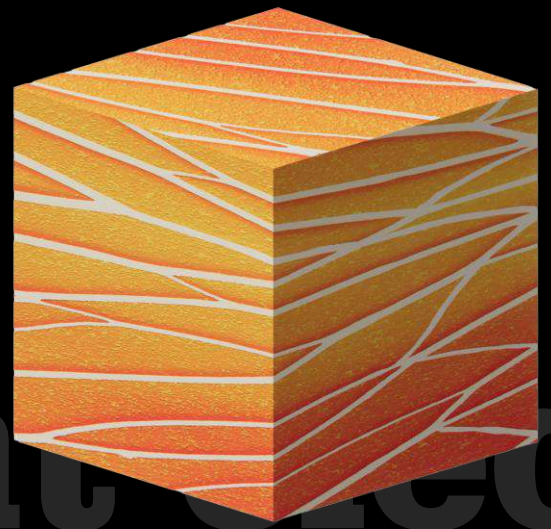


1km^2 of Prague excess

+58 m^3 of water
collecting spider silk

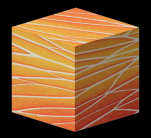


Pigment electricity generator



Special pigment which
can harvest energy
from the Sun.

Pigment electricity generator



Pigment electricity generator

Why ?

more effective
use of solar

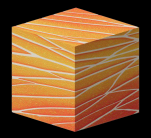
energy

get rid of

fossil fuels

reduce solar panels

waste



Pigment electricity generator

Why ?

more effective
use of solar

energy

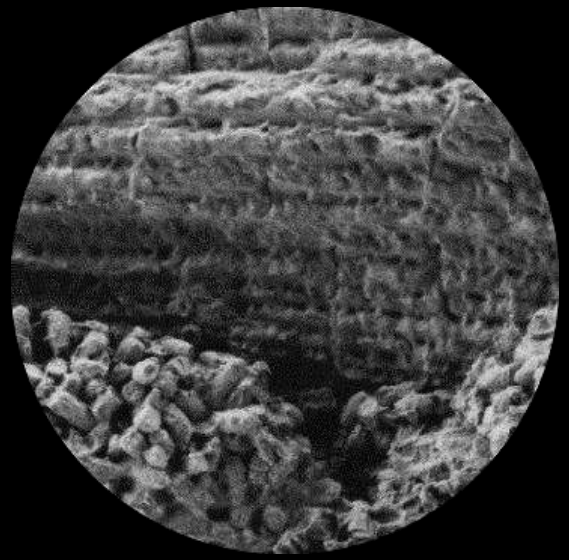
To power up Prague for one day by solar panels, we need 37 km^2 of land, which is 27 × Old Town Square.

Pigment electricity generator

How ?

Special pigment molecule called xanthopterin can harvest

energy from the sun.



[NATIONAL GEOGRAPHIC]

Pigment electricity generator

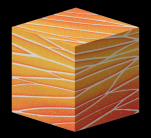
How ?

Xanthopterin

is found in bodies of Oriental hornet.

The **yellow** stripe is made from pinhole depressions – contains xanthopterin.

[NATIONAL GEOGRAPHIC]



Pigment electricity generator

How ?

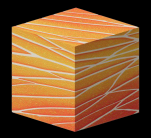
Xanthopterin

Solar energy → Absorb → Produce → Electrical energy

How ?

Implementation

We can implement this pigment into the mycelium megastructure.



Pigment electricity generator

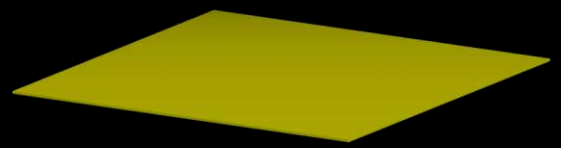
How ?

67 515 m^3 = **500 m^3**

solar panels = pigment molecules

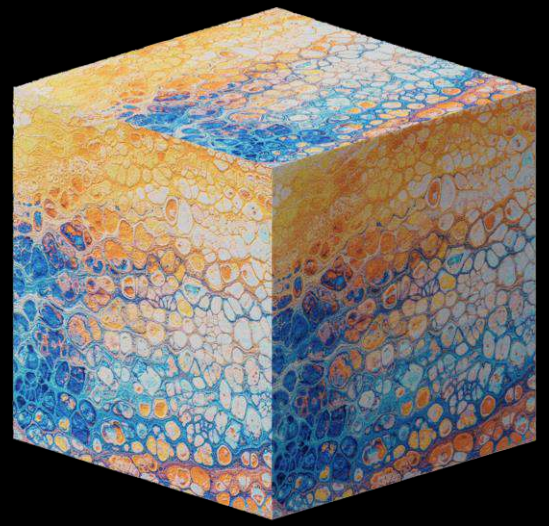
-333 m^3 of energy

+2 733 m^3 of pigment electricity generator



$1km^2$ of Prague excess

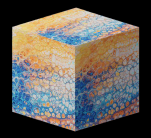
Photonic crystals



Nanostructures found
in animal skin that can either
reflect or absorb the light.

Photonic crystals

[NATIONAL LIBRARY OF MEDICINE]



Photonic crystals

Why ?

to decrease nonrenewable

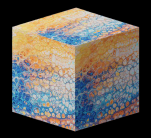
energy

to provide

sunlight

to store

energy



Photonic crystals

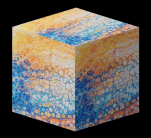
Why ?

to decrease
nonrenewable

energy

Energy needed for the lightning demands in Prague makes up to 496 gWh per year

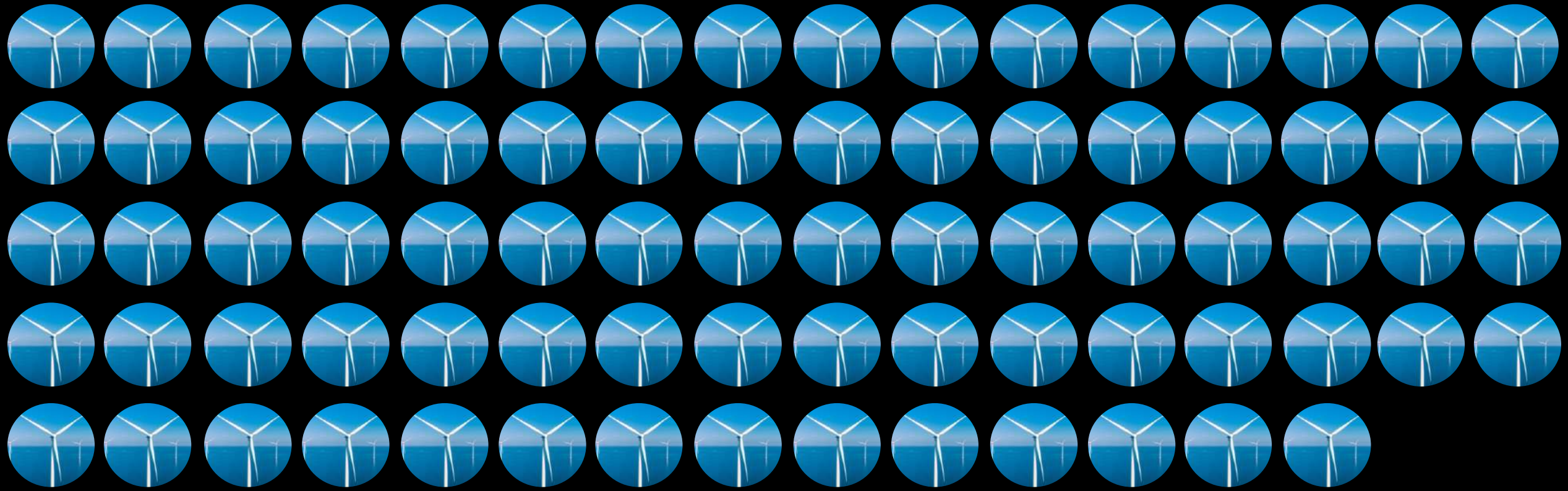
[QUORA]



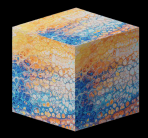
Photonic crystals

Why ?

496 gWh = production from 83 wind turbines per year



[GOOD ENERGY; QUORA]



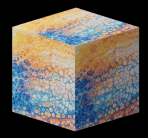
Photonic crystals

How ?

Photonic crystals have the ability to respond to sunlight differently according to their wavelengths.

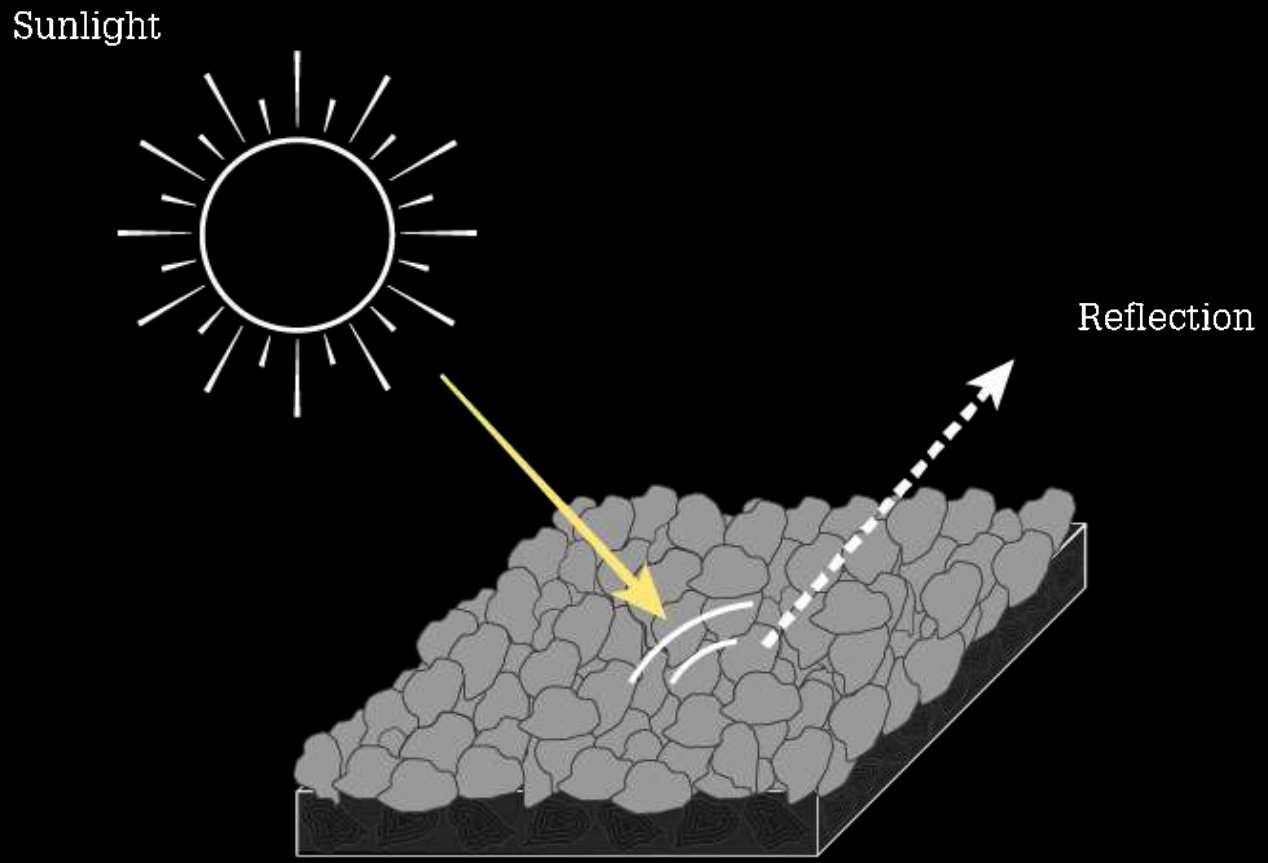
It can either **reflect or absorb the photons.**

[OSTI]



Photonic crystals

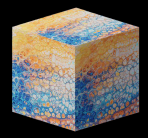
How ?



In nature we can mainly observe the **reflectivity** of crystals.

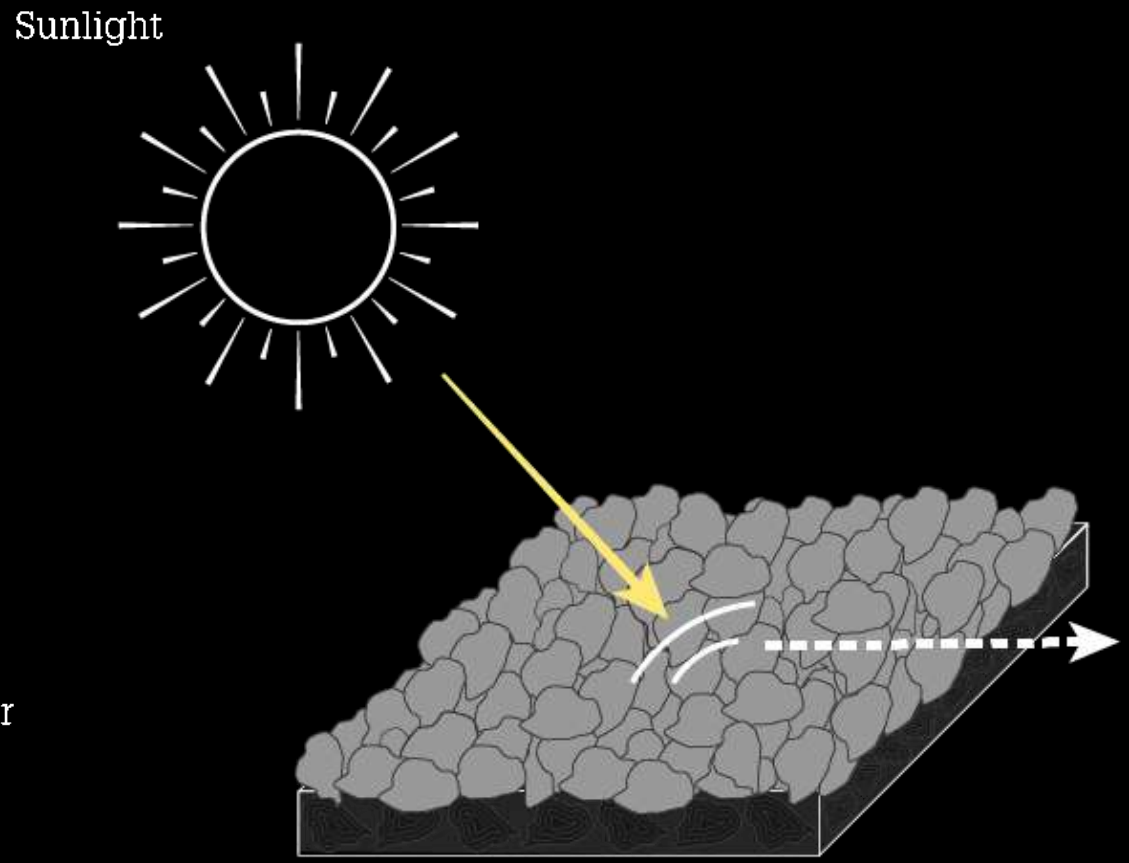
Which causes skin **coloration** and the ability of **camouflage**.

[RESEARCH GATE]



Photonic crystals

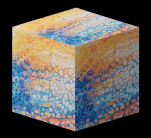
How ?



For the biotopia the main use is absorption of sunlight.

Photonic crystals are able to imitate certain wavelengths of light with their structure, which allows them to **transport photons.**

[RESEARCH GATE]



Photonic crystals

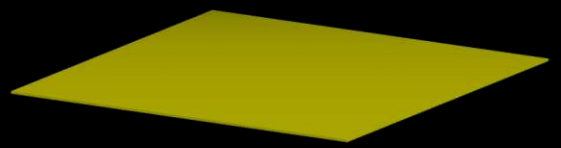
How ?

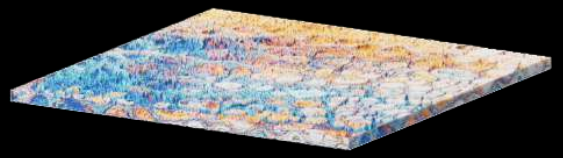
Sunlight —½ of the waves→ **Photonic crystals** —Transport of photons→ **Indoor biofarms**

[RESEARCH GATE]

-333 m^3 of energy

+32 050 m^3 of photonic crystals



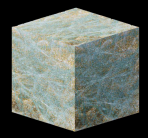


$1km^2$ of Prague excess

Mycorrhizal network

Network that connects fungi and plants, allowing them to transfer essential nutrients between the participants.

Mycorrhizal network



Mycorrhizal network

Why ?

to store

CO_2

to connect

ecosystem

to reduce

infrastructure

Mycorrhizal network

How ?

The plants and fungi are in

symbiosis.

Mycorrhizal network

How ?

Trees and plants

- providing substances and information

Mycelium

- fungi roots are transporting the substances

Mycorrhizal network

How ?

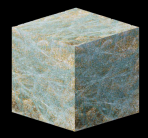
Interconnecting channel

- through the support system

Nutrition source

- for the indoor farms

[RESEARCH GATE]

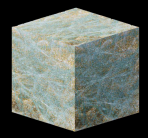


Mycorrhizal network

How ?

How to connect?

[RESEARCH GATE]



Mycorrhizal network

How ?

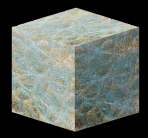
Biosensors

the way to connect

Elastomers

They work as **sensors** in the network, transforming its **form** in reaction to light, change of temperature, magneticity and electricity

[RESEARCH GATE]

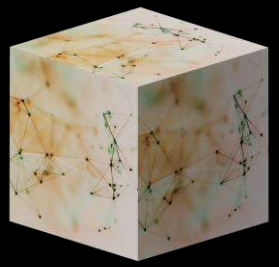


Mycorrhizal network

How ?

Biological chip

inserted into us



Biochip

Connection between humans and mycorrhizal network

Mycorrhizal
network

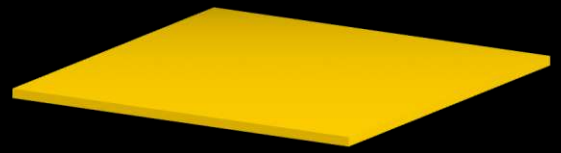
How ?

Biological chip

connection with the network

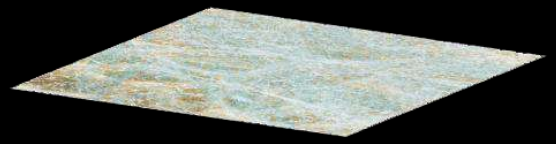
[RESEARCH GATE]

-29 581 m^3 of
CO_2 emissions

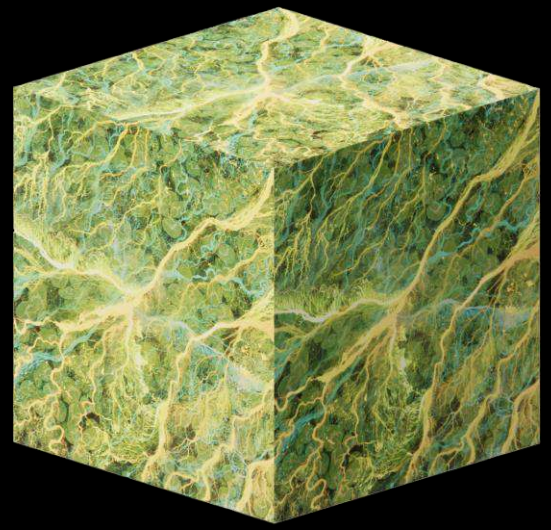


1km^2 of Prague excess

+855 m^3 of
mycorrhizal network

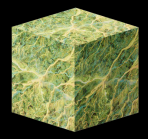


Indoor biofarms



Indoor farms for growing crops
which are integrated into
the mycelium megastructure.

Indoor biofarms



Indoor biofarms

Why ?

to reduce

agriculture

to increase

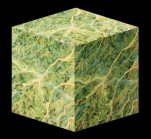
biodiversity

to reduce

deforestation

to reduce

CO_2



Indoor biofarms

Why ?

to reduce

agriculture

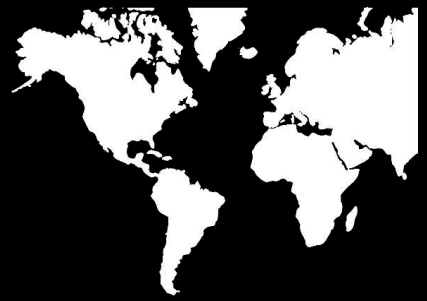
Which now uses 46% of habitable land.

[OUR WORLD IN DATA]

Indoor biofarms

Why ?

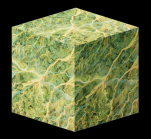
Land
100%



Habitable Land
71%

Growing and breeding
46%

Growing
23%



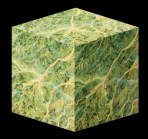
Indoor biofarms

Why ?

Because of it we are **losing the nature**

and 24 000 species are at **risk of extincion**

[UNEP]



Indoor biofarms

Why ?

The world produces **4 billion tons** of food per year.

[BLOOMBERG]

Indoor biofarms

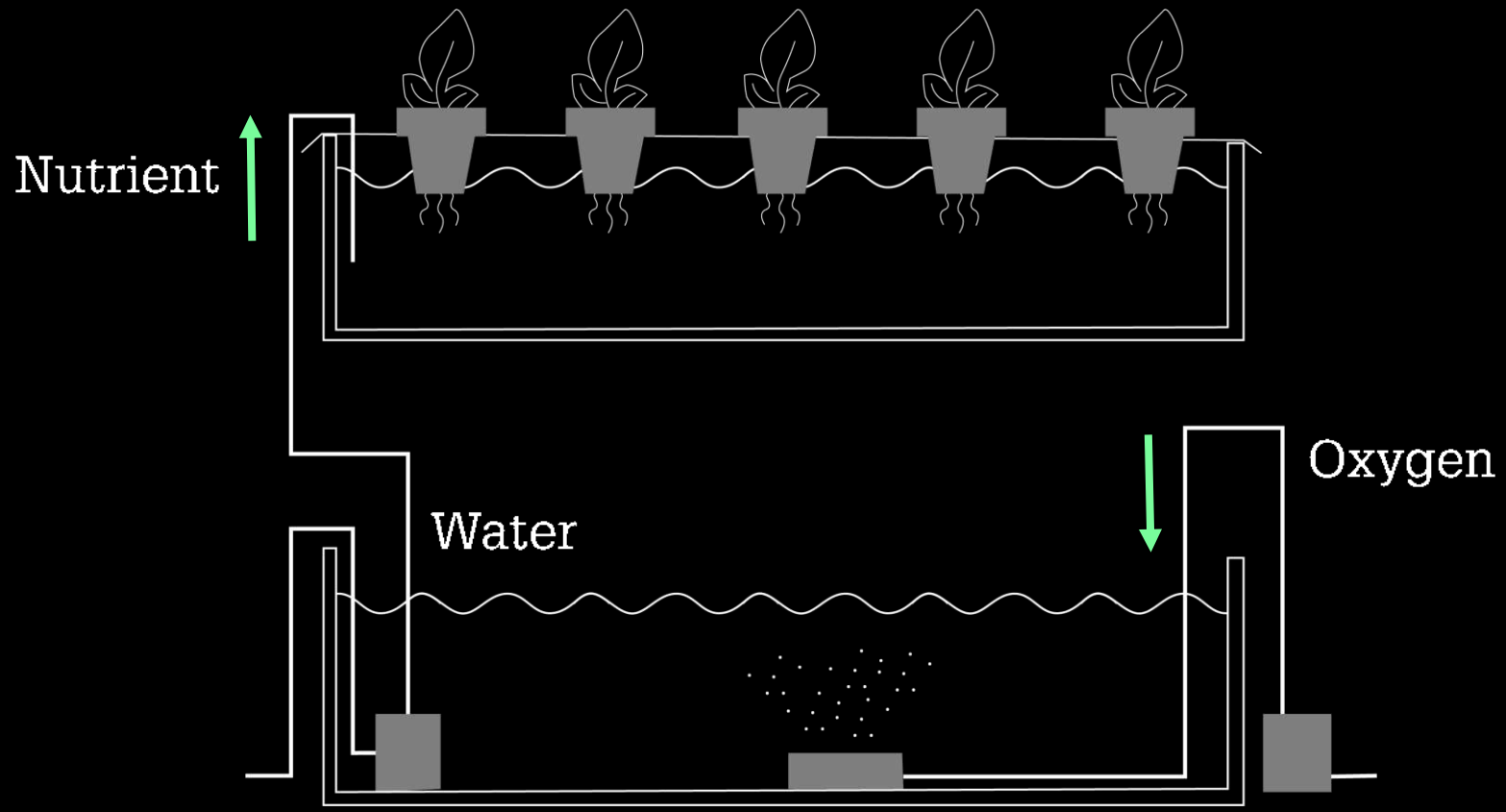
Why ?

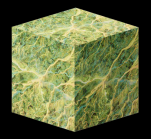
That's weight of **18 000** cargo ships.

[UNSPLASH]

How ?

Hydroponic principle

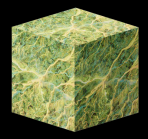




Indoor biofarms

How ?

Hydroponic plants are **30% more productive** than plants growing in soil.

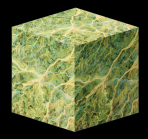


Indoor
biofarms

How ?

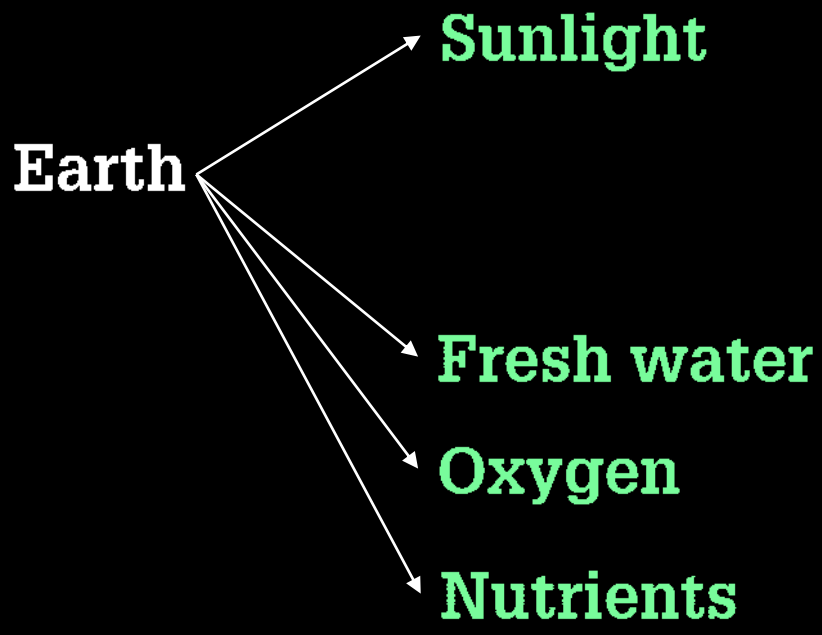
Earth

What do we have?

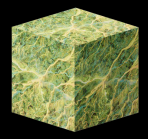


Indoor
biofarms

How ?



What does it provide?



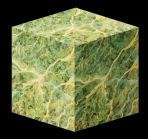
Indoor
biofarms

How ?

Earth

- Sunlight → Photonic crystals
- Fresh water → Mycorrhizal network
- Oxygen → Mycorrhizal network
- Nutrients → Mycorrhizal network

What do we invent?



Indoor
biofarms

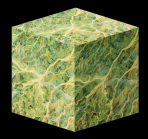
How ?

Earth

- Sunlight → Photonic crystals → Photosynthesis
- Fresh water
- Oxygen
- Nutrients

→ Mycorrhizal network → Root support, Growth

What does it do?



Indoor
biofarms

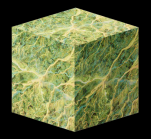
How ?

Earth

- Sunlight → Photonic crystals → Photosynthesis
- Fresh water
- Oxygen
- Nutrients

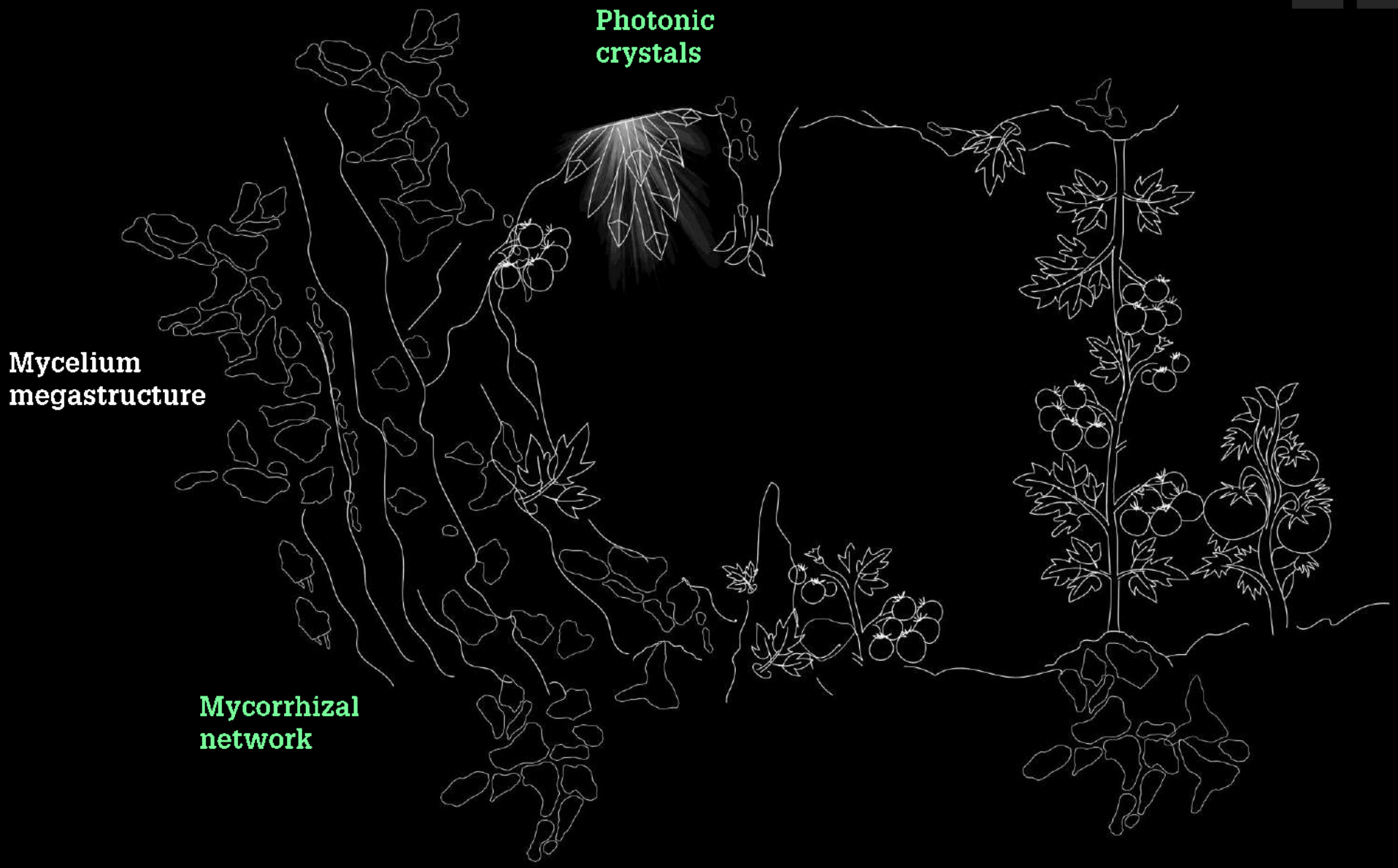
→ Mycorrhizal network → Root support
Growth

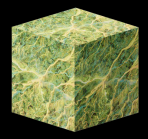
→ Indoor biofarms



Indoor biofarms

How ?





Indoor biofarms

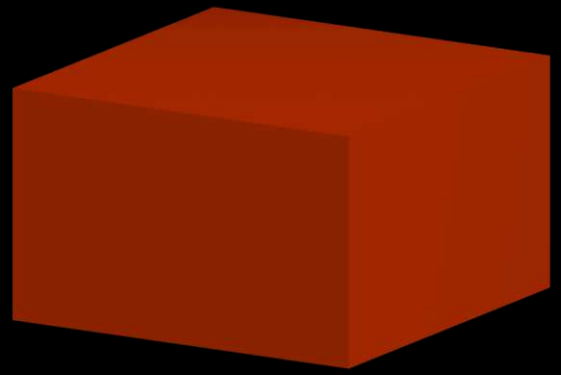
How ?

54 000 m³
soil

=

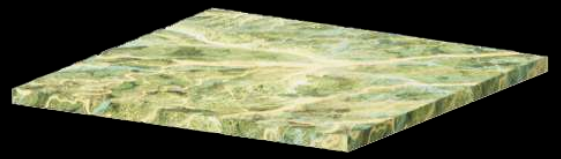
6 000 m³
mycelium

-442 630 m^3 of agriculture



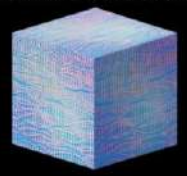
1km^2 of Prague excess

+43 845 m^3 of indoor biofarms



+500 years

regenerative flexible structure

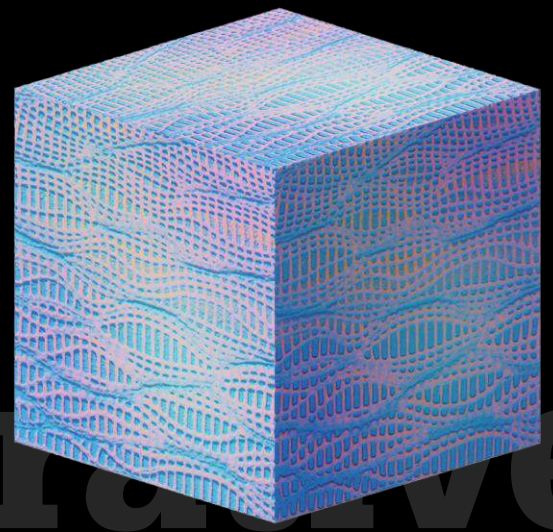


cloud generator

noise utilizer

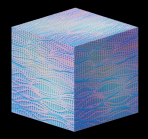
transportation bubbles

Regenerative flexible structure



Flexible and adaptable
structure made of
a biocomposite material
with regenerative features.

Regenerative flexible structure



Regenerative flexible structure

Why ?

to reduce

waste

to reduce

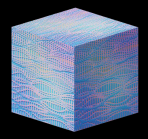
built up space

to reduce

CO_2 emissions

to reduce

water



Regenerative
flexible structure

Why ?

to reduce

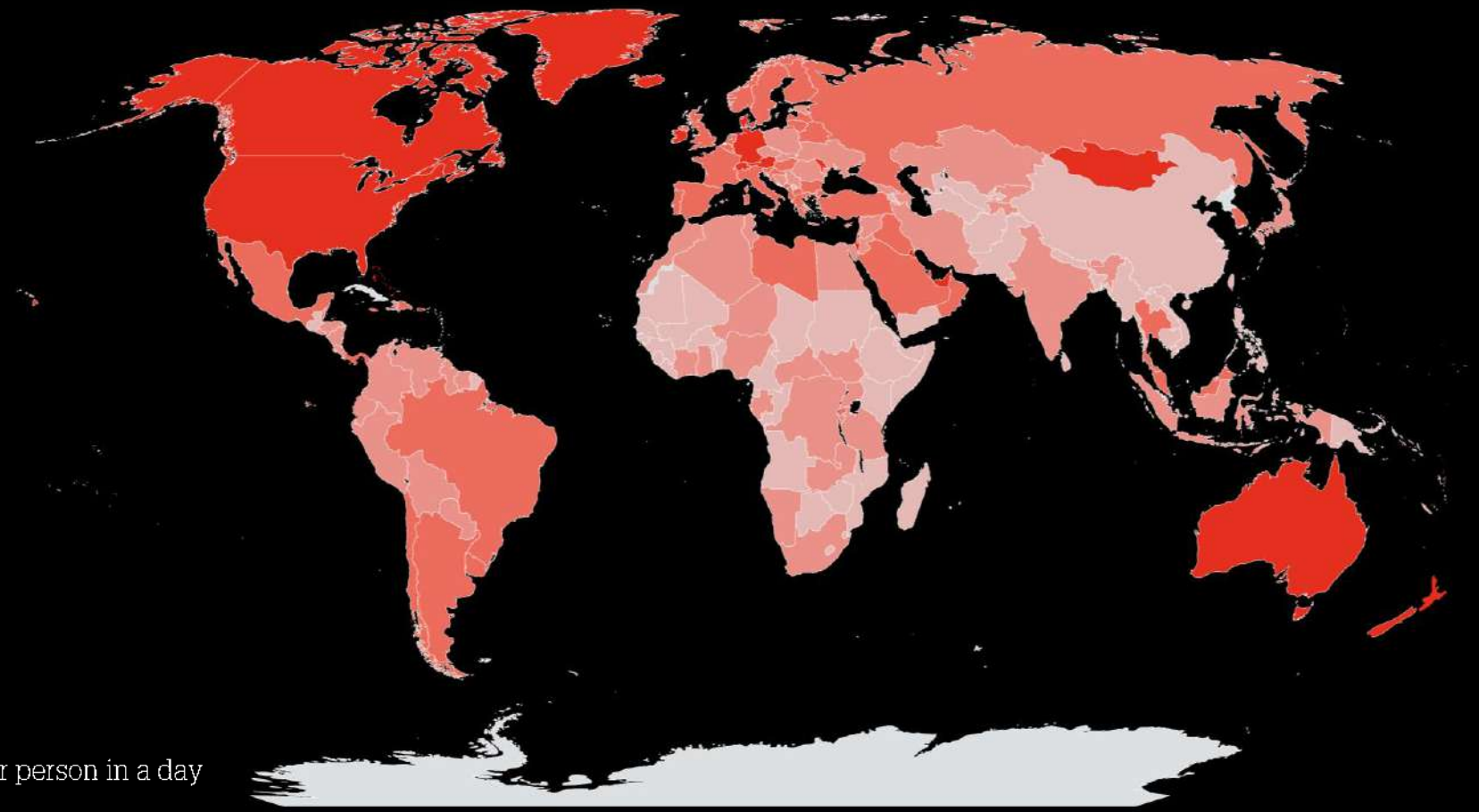
waste

The construction sector is responsible
for almost 33% of total waste.

[EUROSTAT]

Why ?

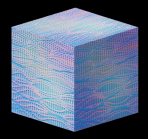
Annual municipal solid waste



Amount of waste produced per person in a day

No data | 0 – 0,5 kg/capita/day | 0,5 – 1 kg/capita/day | 1 – 1,5 kg/capita/day | greater than 1,5 kg/capita/day

[THE WORLD BANK]



Regenerative
flexible structure

Why ?

Czech Republic produces

3 650 000 tons of waste per year

which is the weight of

11 Empire State Buildings

[THE WORLD BANK]

How ?

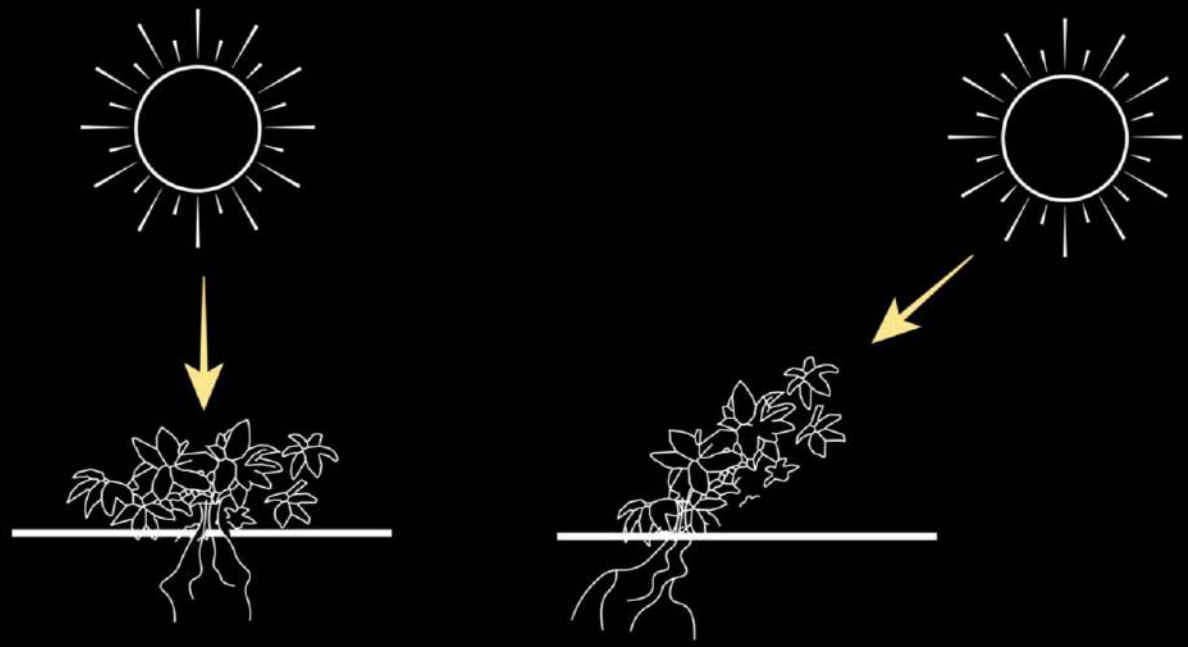
Shape flexibility

Neri Oxman generates 3D printed structures that allowe the transition from beam to mesh, and to windows, if scaled larger.

[SCULPTEO; OXMAN]

How ?

Shape flexibility by itself



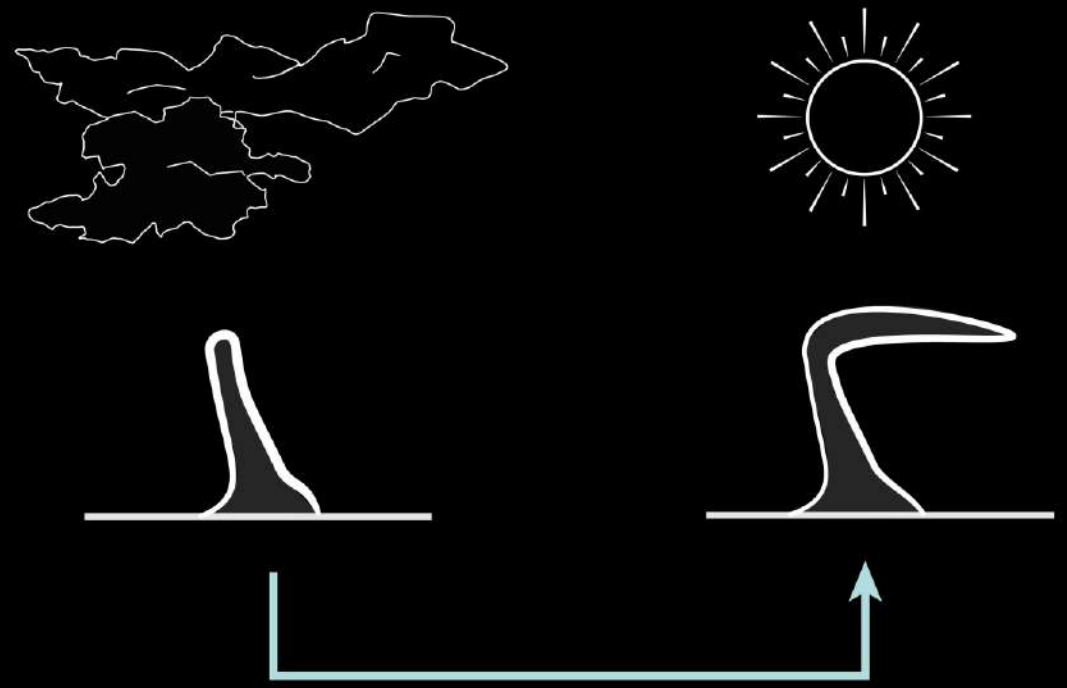
Phototropism

[SCIENCE DIRECT]

Regenerative
flexible structure

How ?

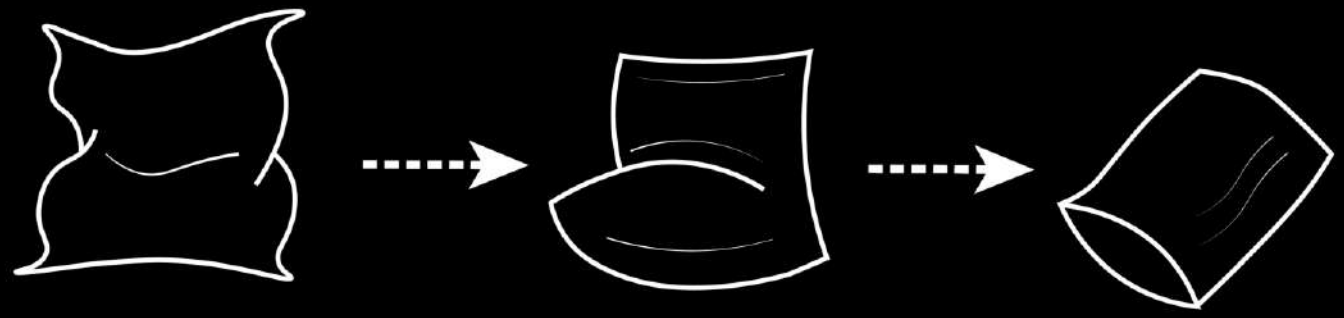
Shape flexibility by itself



Creating shade if needed

How ?

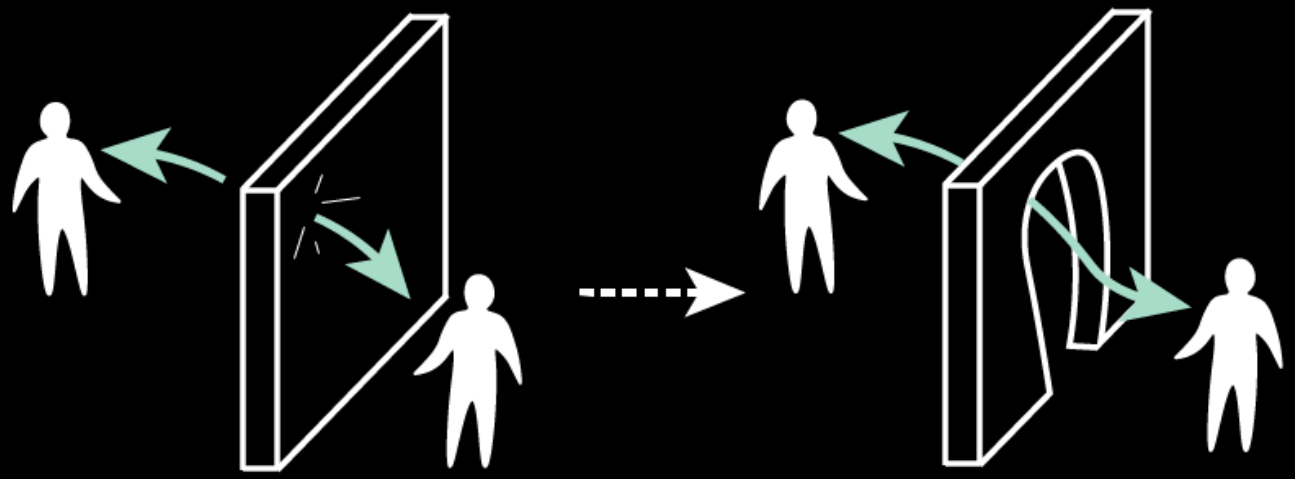
Shape flexibility by itself



Flexible chair

How ?

Shape flexibility with biochip

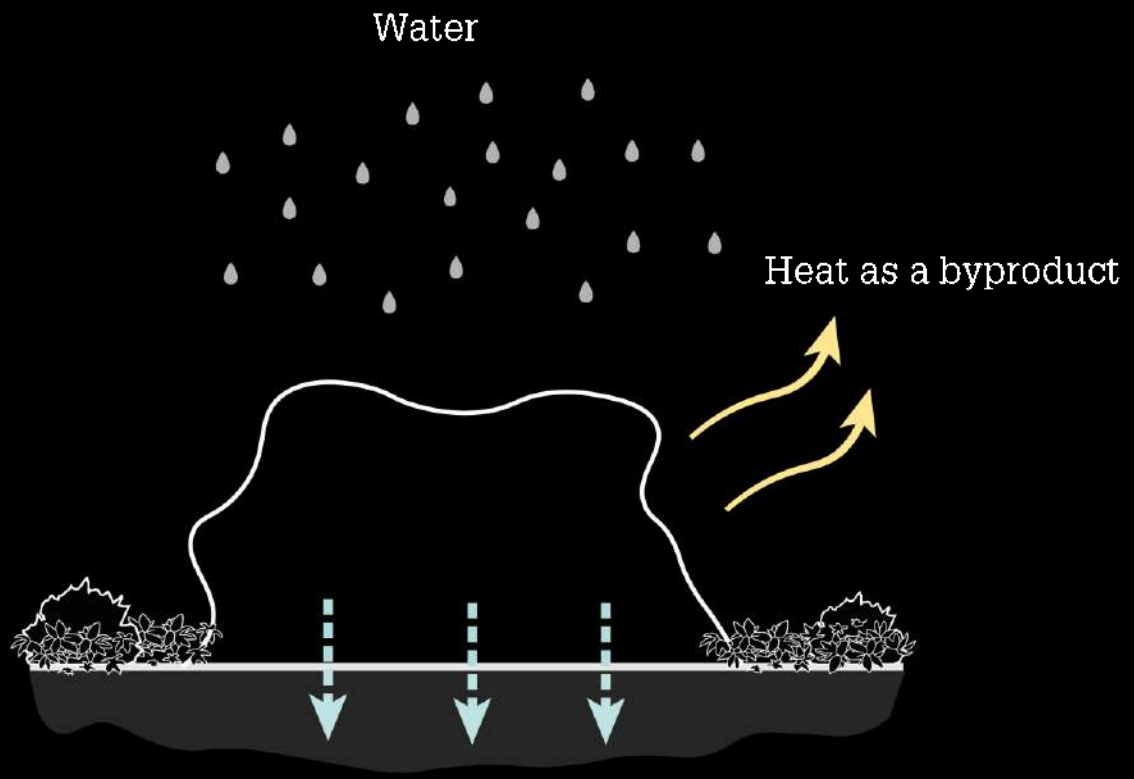


Stiff wall
without water

Malleable wall
with water

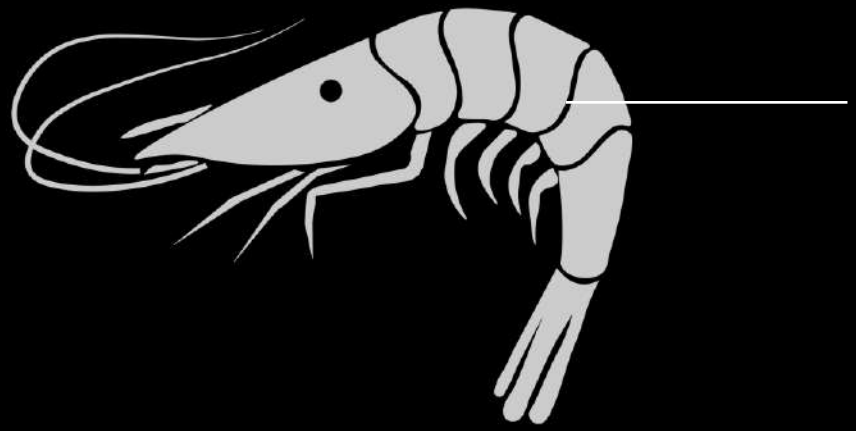
How ?

Decomposability



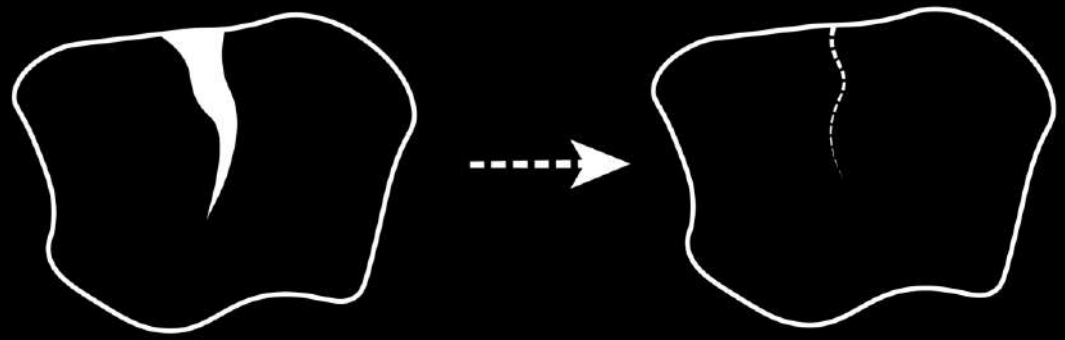
How ?

Decomposability



How ?

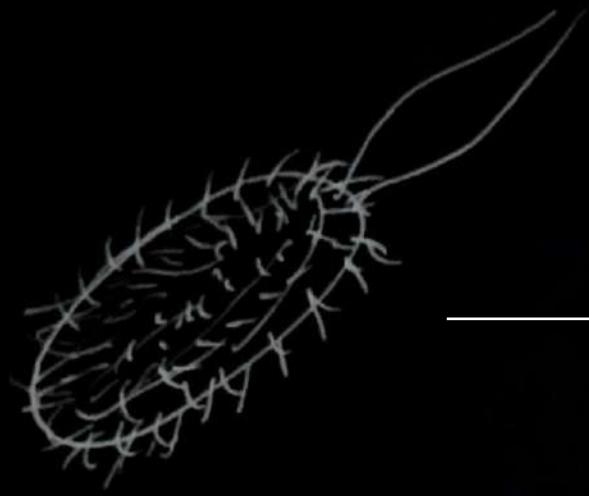
Regeneration



Regenerative process

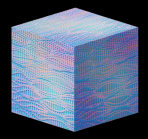
How ?

Regeneration



Adding bacteria

Regenerative ability



Regenerative flexible structure

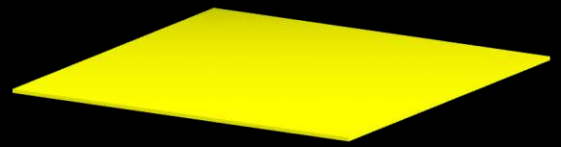
How ?

30 m³
building structure and furniture

=

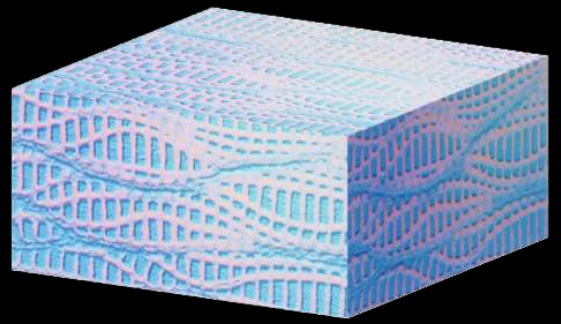
10 m³
regenerative flexible structure

-5 918 m^3 of waste

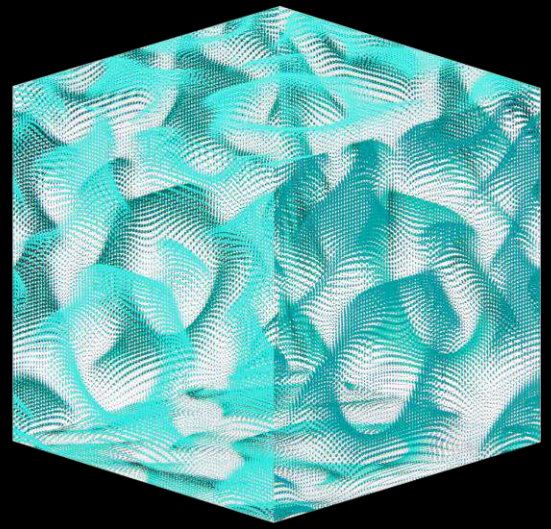


1km^2 of Prague excess

+475 615 m^3 of regenerative flexible structure

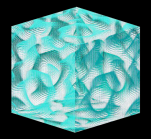


Cloud generator



Cloud generator combines water droplets with aerosol, resulting in a more humid environment.

Cloud generator



Cloud generator

Why ?

to regulate

humidity

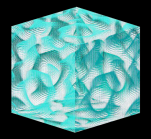
to reduce

UV rays

to regulate

temperature

[NATIONAL GEOGRAPHIC]

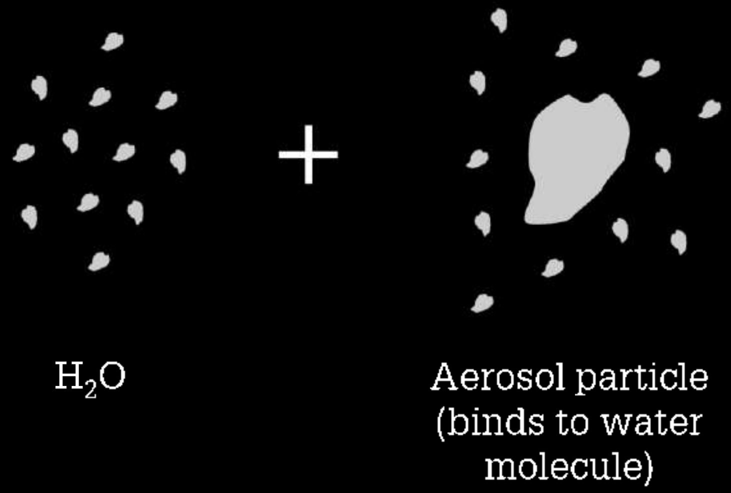


Cloud generator

Why ?

Keeping the **humidity** between **40-60%**
reduces the spread of droplet-borne **diseases.**

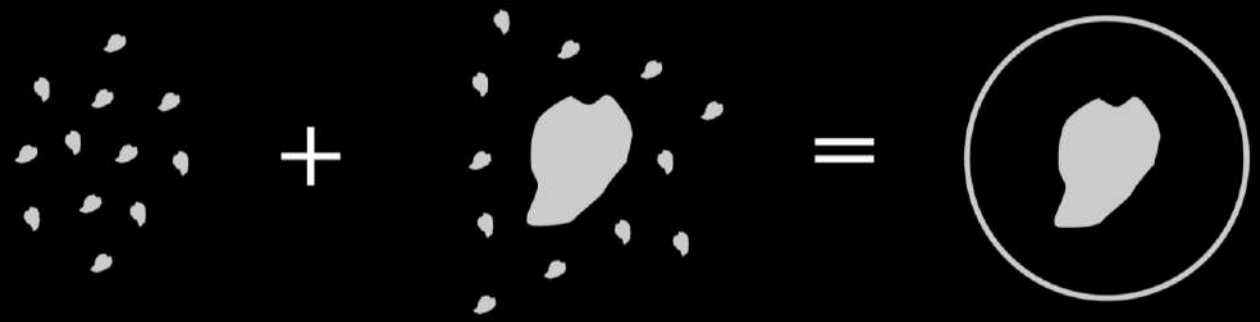
How ?



[NASA]

Cloud generator

How ?



H_2O

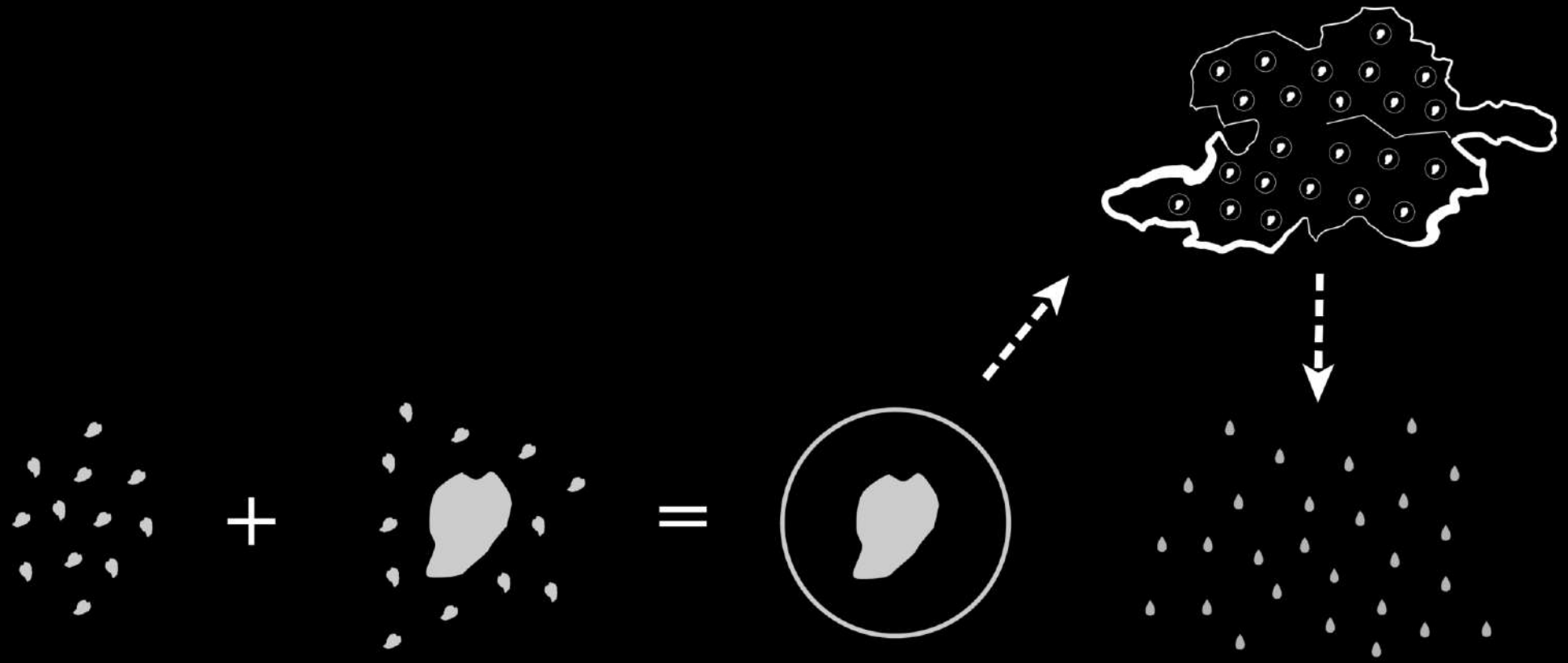
Aerosol particle (binds to water molecule)

Water droplet

[NASA]

Cloud generator

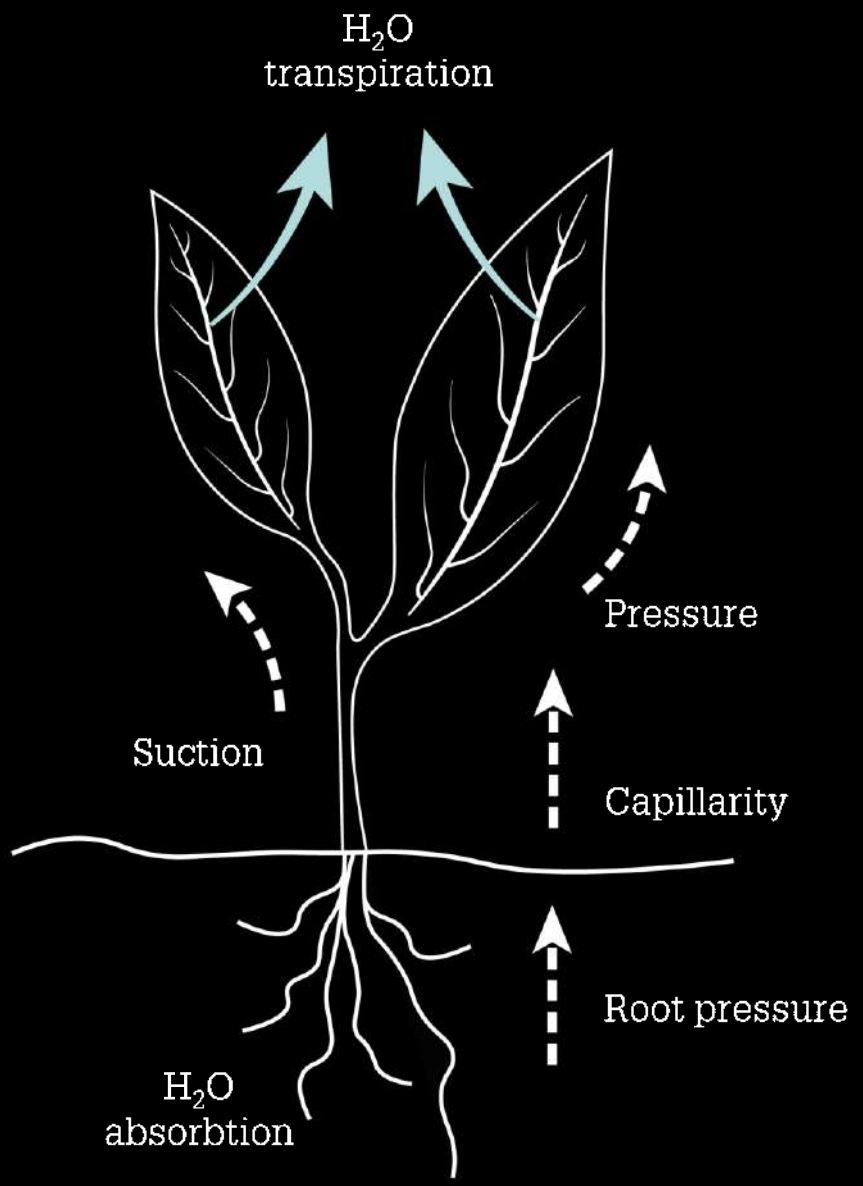
How ?



[NASA]

Cloud generator

How ?



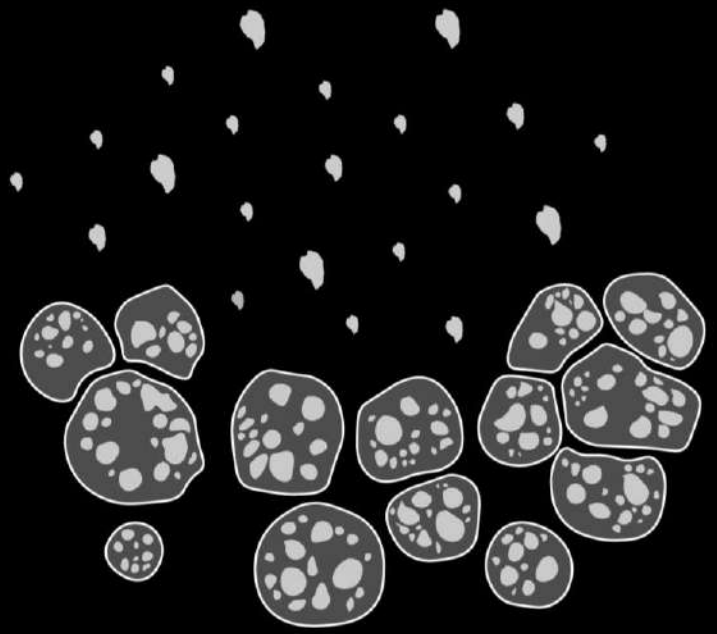
Plant **Calla Lily**
drops excessive amount
of water.

[SCIENCE DIRECT]

Cloud generator

How ?

Aerosol particle



Microalgae

Emits particles such as aerosol

Cloud generator

How ?

H_2O + aerosol = water droplets

Mycelium structure

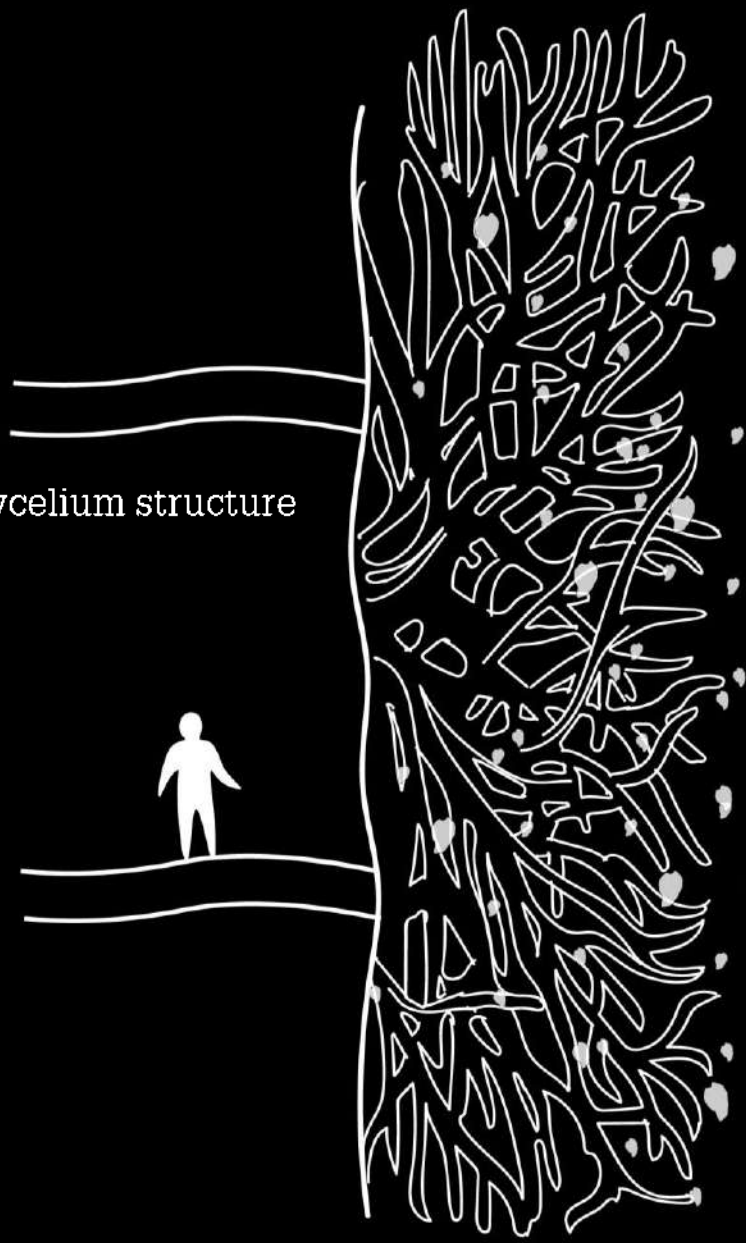
Microalgae
growing through mycelium

Plant **Calla Lily**
growing through the mycelium structure

[NASA]

Cloud generator

How ?



Mycelium structure

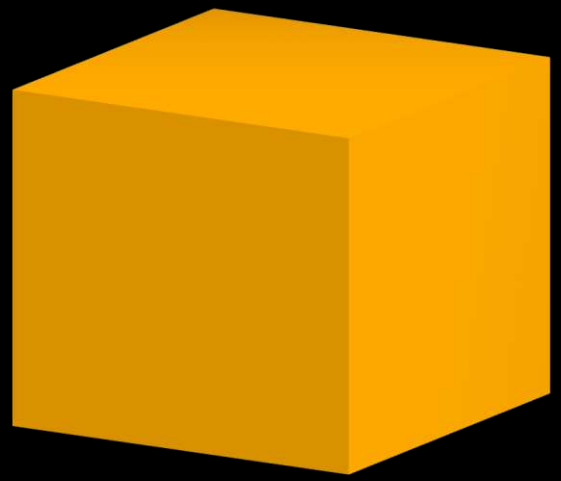
Rising air
cools and condenses
to form
clouds

Aerosols with bounded water melocules

Once the droplets are too heavy, they start to fall down

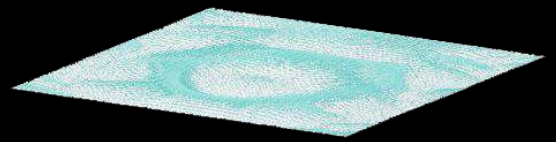
[WEATHER]

-317 352 m^3 of water



1km^2 of Prague excess

+7 398 m^3 of cloud generator



Noise utilizer

Noise utilizer uses noise as a source of energy to generate electricity while reducing the noise pollution.

Noise utilizer

Noise utilizer

Why ?

to produce renewable

energy

to save

biodiversity

to reduce and utilize

noise pollution

to reduce

CO_2

Noise utilizer

Why ?

to produce renewable

energy

The world generates over 66%
of the electricity from fossil fuels.

[INTERNATIONAL ENERGY AGENCY]

Noise utilizer

Why ?

Noise levels (dB)

30	Leaves, whisper
40-50	Quiet suburb
60	Human conversation
70	Background urban life
80	Heavy traffic
90	Subway
100	Motorcycle
110	Chainsaw
120	Sirens
130	Trains
140-160	Jet take of

~0,6 Pa
~12 V
lightbulb

[WIKIPEDIA; THE NCBI]

Noise utilizer

How ?

Piezoelectric materials, a type of “smart” material that generates electricity in response to vibrations.

This principal is used in **transducers.**

Crystalline **nano cellulose** works as a **biotransducer layer.**

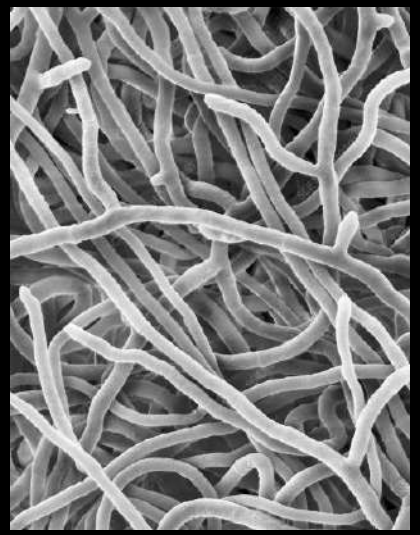
[AZO NANO; THE NCBI]

Noise utilizer

How ?

When sound waves enter the pores,

sound energy is caused
by vibration of the air contained inside.

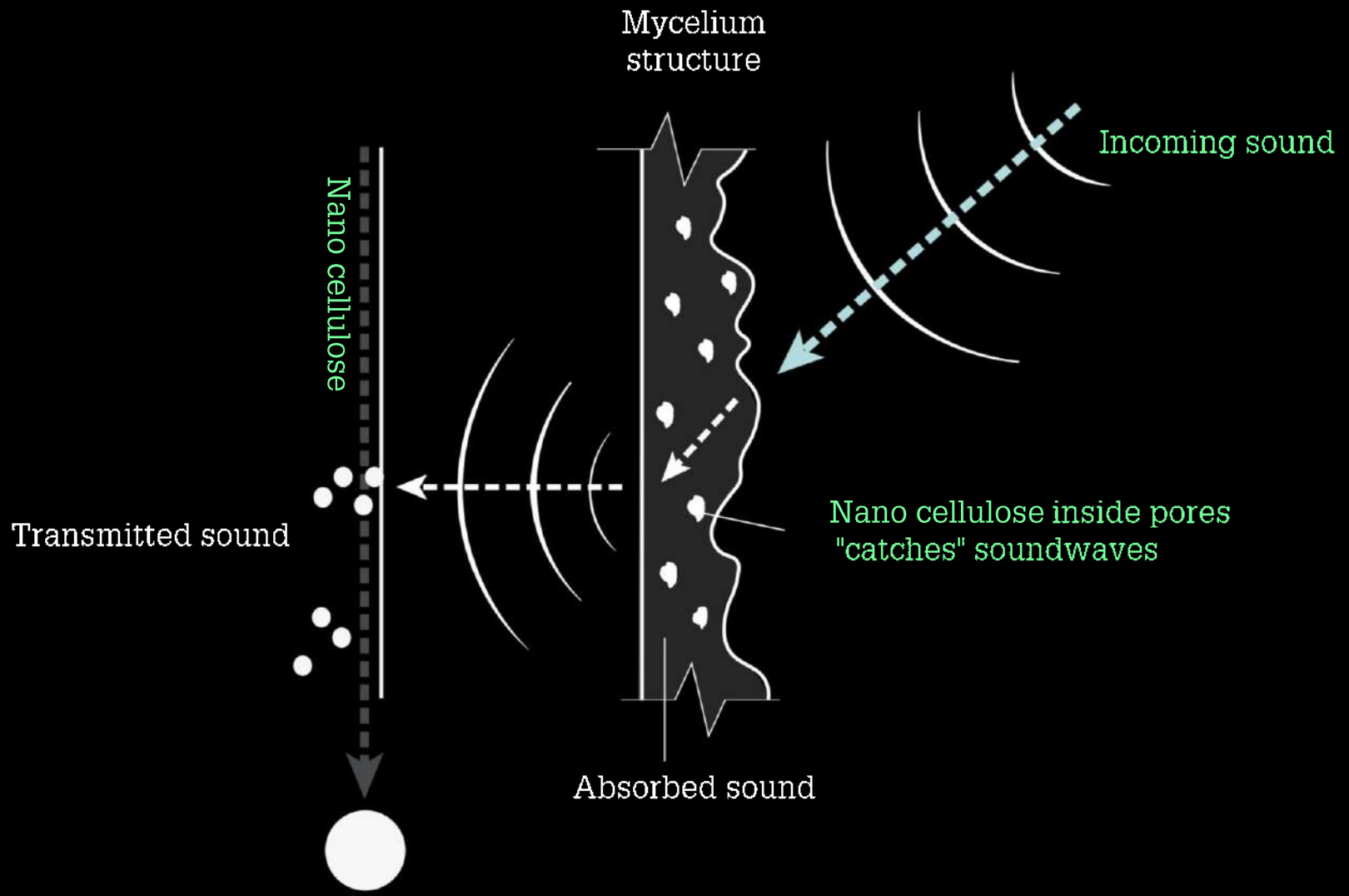


Hypha – mycelium structure

[AZO NANO; THE NCBI]

Noise utilizer

How ?



[THE NCBI]

Noise utilizer

How ?

Incoming sound

Acoustic energy

Pores of mycelium megastructure

Transmitted sound

Nano cellulose

Electrical energy

Energy storage and supply

Electrical energy

City

[MDPI]

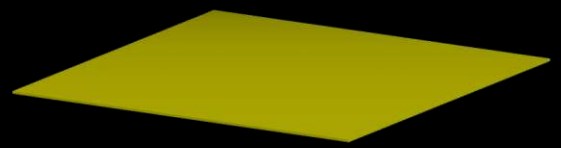
Noise utilizer

How ?

1 m^2 of noise utilizer = 500 lightbulbs

-333 m^3 of energy

+214 m^3 of noise utilizer



1km^2 of Prague excess

Transportation bubbles

Transportation bubbles

Flying bubbles which are based on the electricity-generating cells of the electric eel.

Transportation bubbles

Why ?

to reduce

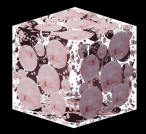
infrastructure

to reduce

CO_2 emissions

to reduce

noise pollution



Transportation bubbles

Why ?

to reduce

infrastructure

The Earth‘s surface is shattered by roads into more than 600 000 fragments, more than half of them are smaller than 1 km^2.

[PHYS]

Transportation bubbles

Why ?

Transportation takes **10%** of the surface **of Prague.**
Forests take **10.3%** of the surface **of Prague.**

[IPR]

Transportation bubbles

How ?

2 400 billion m^3
of infrastructure space

=

2 400 billion m^3
of free space

Transportation bubbles

How ?

Transportation bubbles

How ?

We can use eel's **electric cells** for creating a **membrane** that powers flying flocks.

Transportation bubbles

How ?

Electric eel produces a **100-600V** strong jolt.

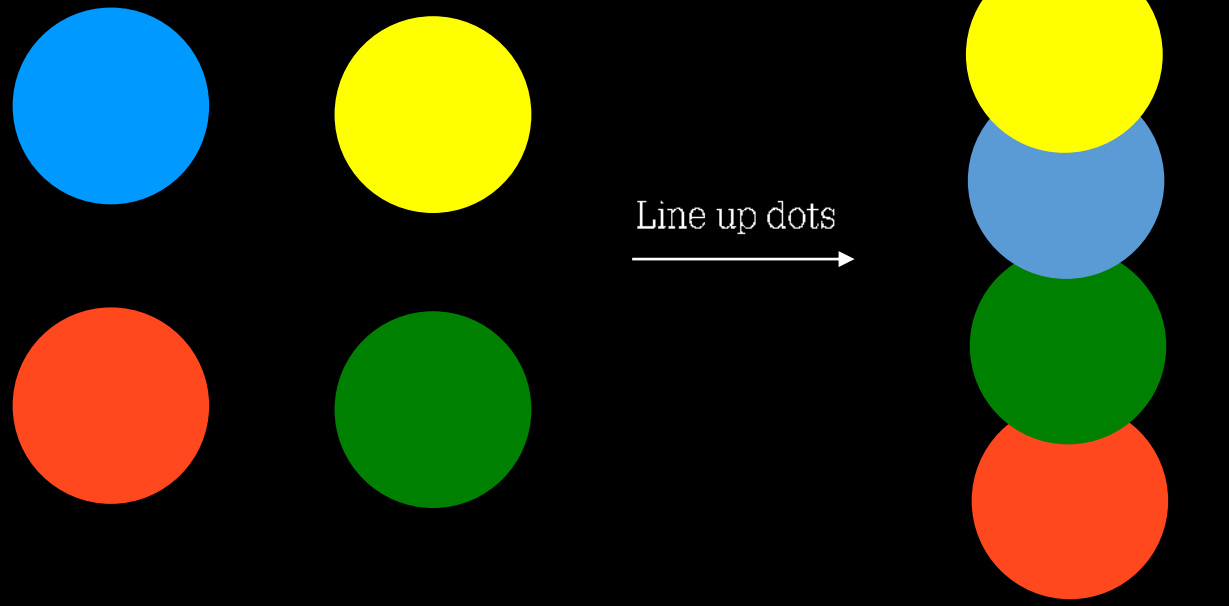
The same amount of electricity as **one socket.**

=

[PHYSICS WORLD]

Transportation bubbles

How ?



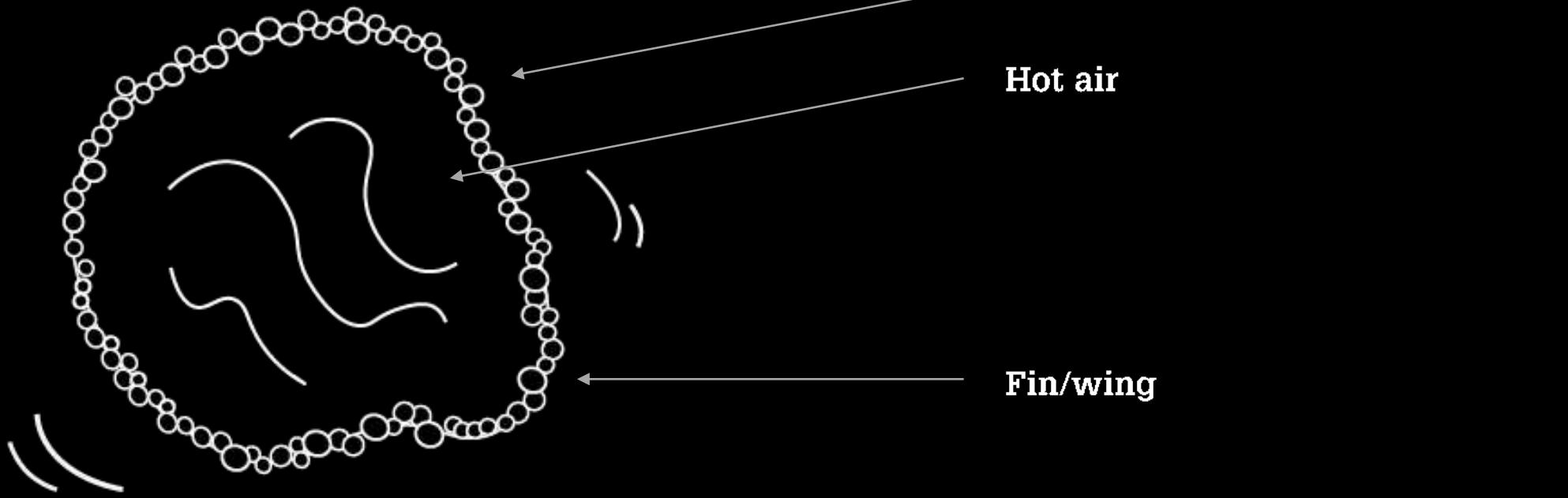
Electric jolt

Salt water — Positively charged particles

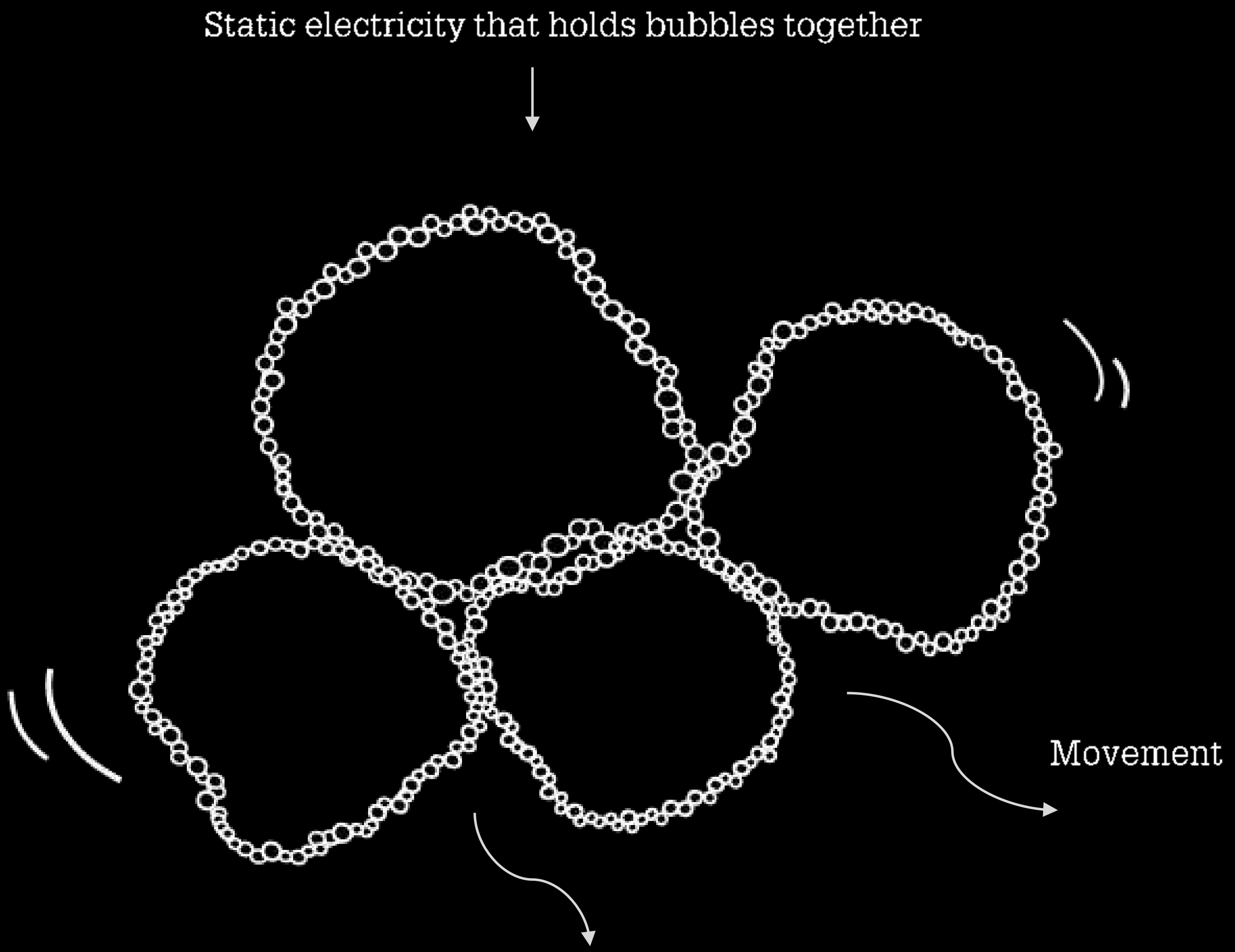
Fresh water — Negatively charged particles - IONS

Transportation bubbles

How ?



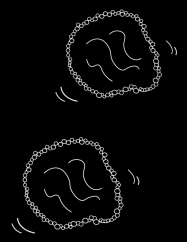
How ?



Transportation bubbles

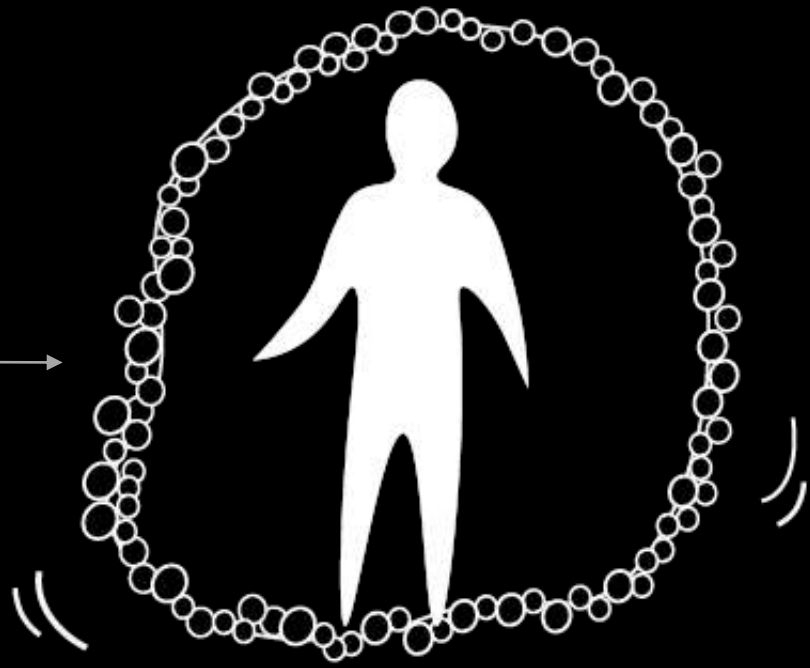
How ?

Connecting bubbles together



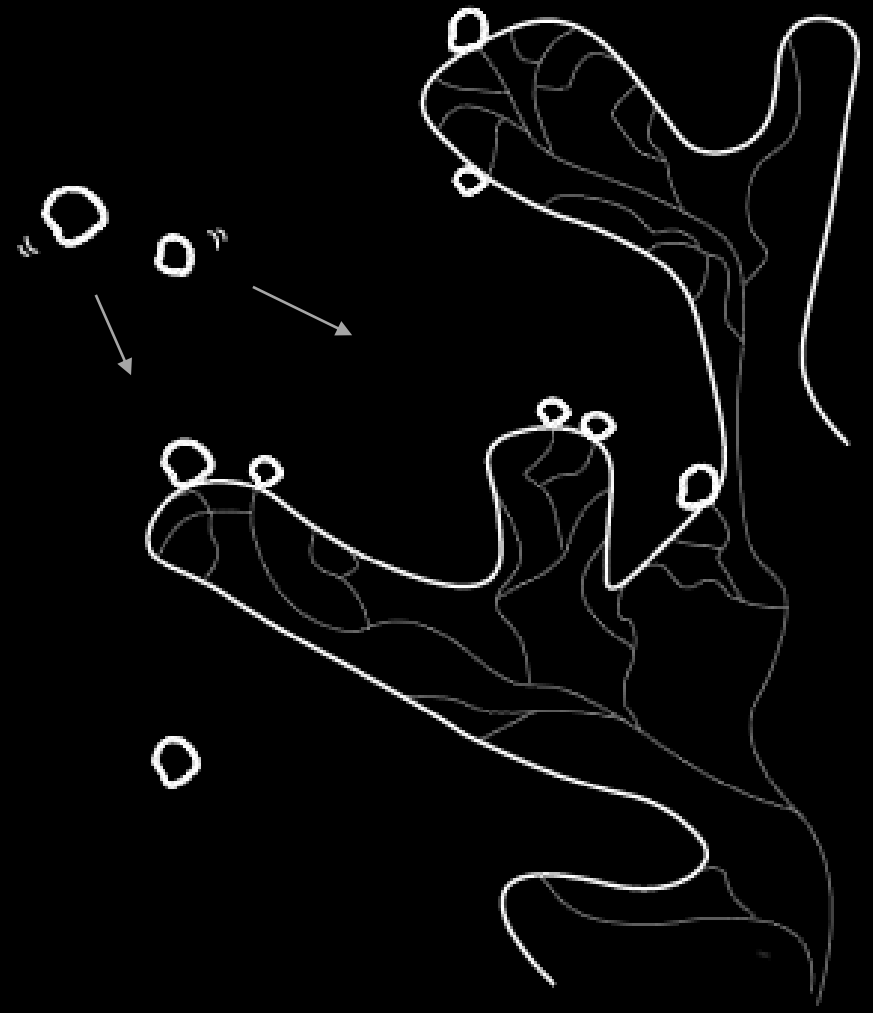
Flocks

By connecting flocks together we can transport heavy objects



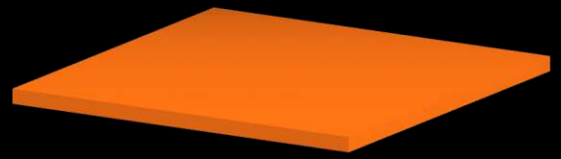
Transportation bubbles

How ?



Bubbles draw **nutrients** from the
mycorrhizal network
by connecting to the
mycelium megastructure.

-30 888 m^3 of infrastructure



1km^2 of Prague excess

+2 595 m^3 of transportation bubbles

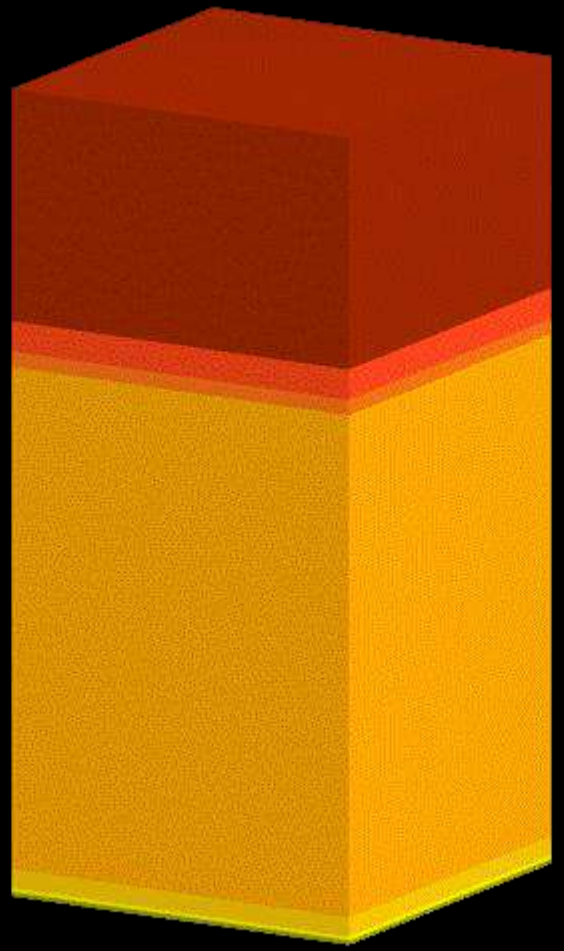
All the bioinventions
together form
a BIOCUBE

05

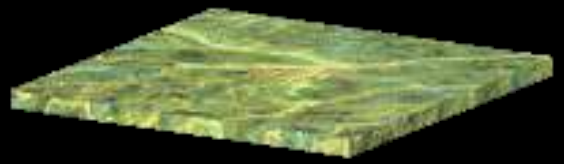
Biocube

All the bioinventions
together form
a BIOCUBE

BIOCUBE
represents specific
number of
bioinventions
to neutralize the excess



1km^2 of Prague excess

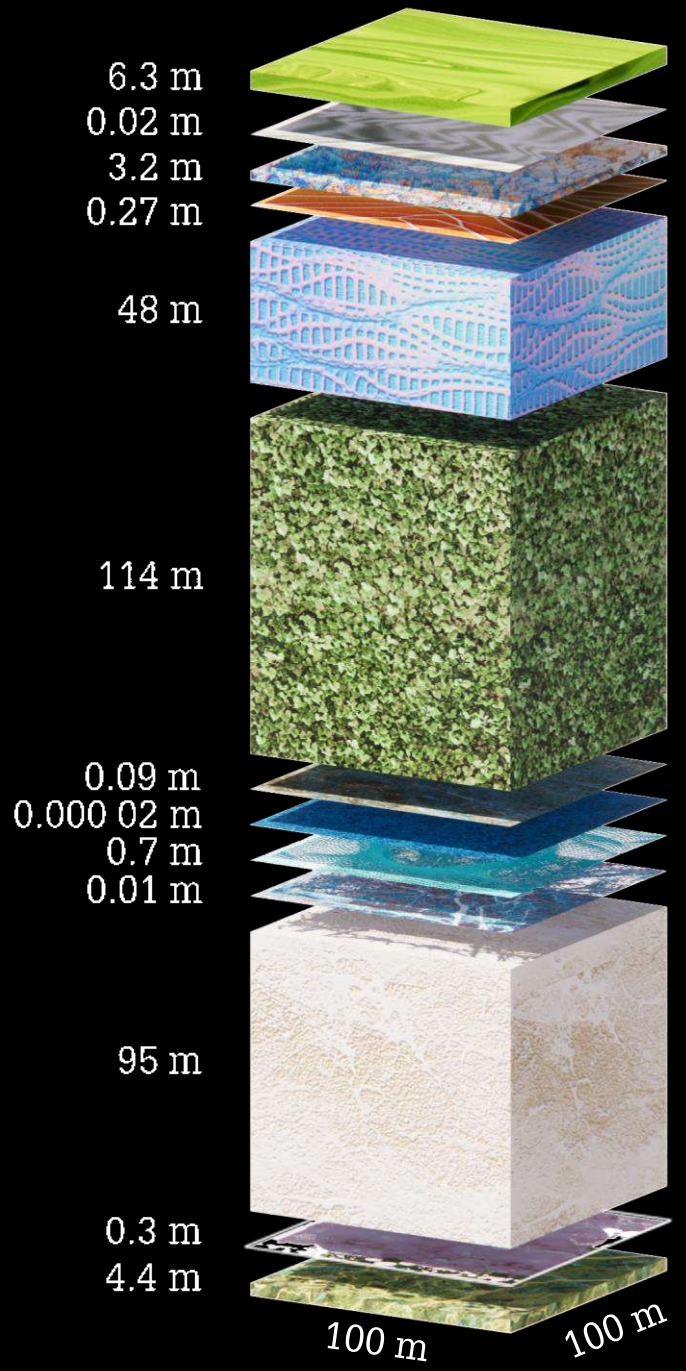


Biocube

Urgencies	Bionventions
Use of nonrenewable resources	Algae lamp Noise utilizer Photonic crystals Pigment electricity generator
Waste	Regenerative flexible structure
Environmental pollution	Surface greenifier Mycorrhizal network
Access to safe water	Water retaining sponge Cloud generator Water collecting spider silk
Growing population	Mycelium megastructure Transportation bubbles Indoor biofarms

[SEE SOURCES]

Bionventions	**m³**
Algae lamp	63 251
Noise utilizer	214
Photonic crystals	32 050
Pigment electricity generator	2 733
Regenerative flexible structure	475 615
Surface greenifier	1 139 831
Mycorrhizal network	855
Water retaining sponge	0.2
Cloud generator	7 398
Water collecting spider silk	58
Mycelium megastructure	951 230
Transportation bubbles	2 595
Indoor biofarms	43 845



[SEE SOURCES]

The biocube consists of complex blended bioinventions

How do we apply this complex system?

How do we apply this complex system?

How do we analyse it?

How do we apply this complex system?

How do we analyse it?

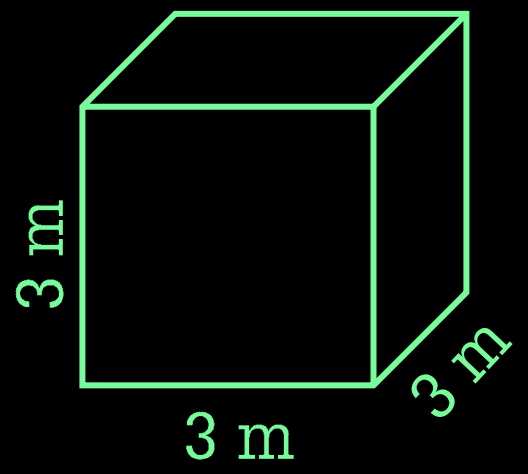
How do we visualize it and simplify it?

Voxels

Voxels

Term used in computer-based modelling or graphic simulation.

A notional **three-dimensional space**
consisted of elements of volume.



[OXFORD LANGUAGES]

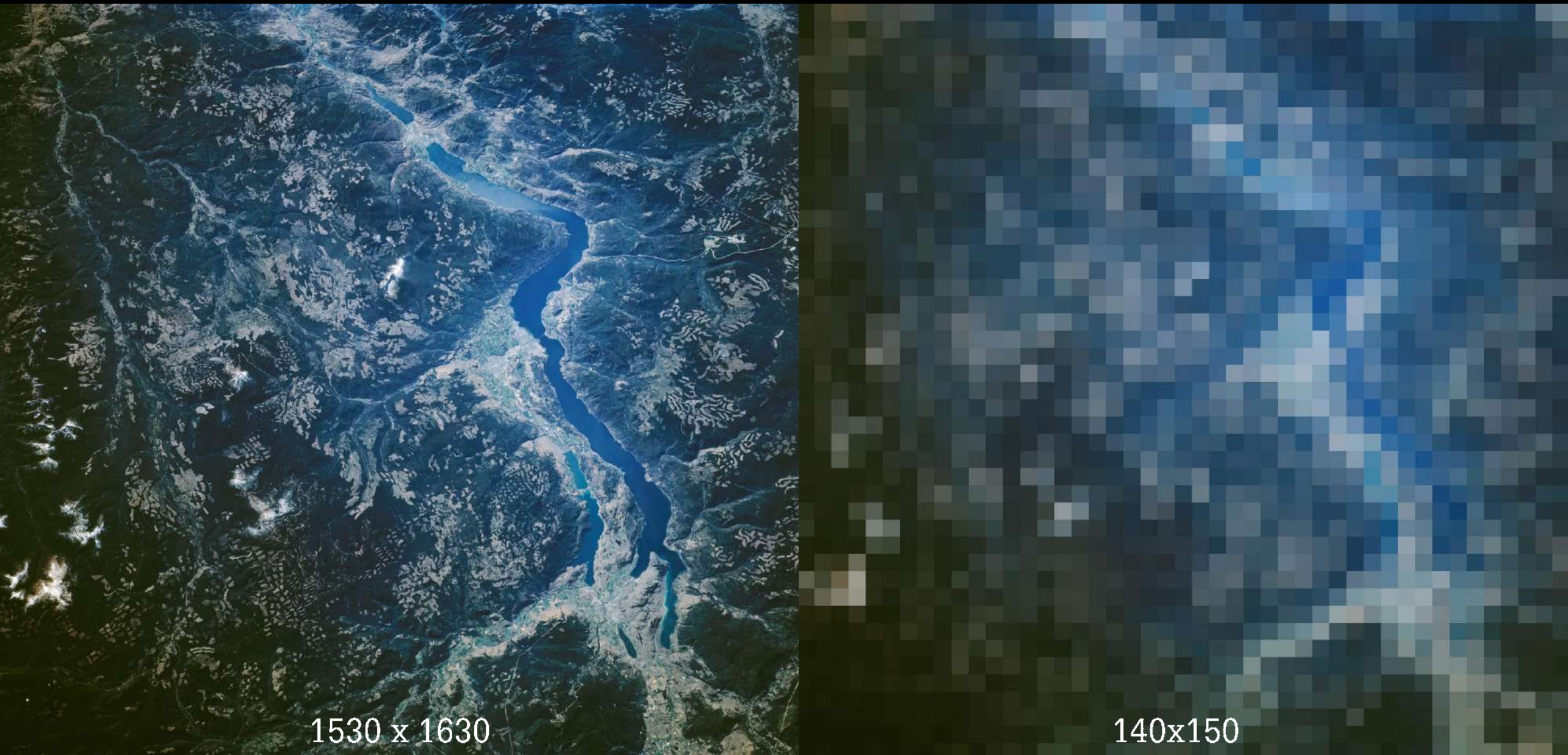
HOW?

Allows us to quickly determine volumetric data

And to compare the differences of otherwise very organic elements and innovations.

Pixels

[NASA]



Inventions	Amount of voxels
Algae lamp	2 343
Noise utilizer	8
Photonic crystals	1 187
Pigment electricity generator	101
Regenerative flexible structure	17 615
Surface greenifier	42 215
Mycorrhizal network	32
Water retaining sponge	0,006
Cloud generator	274
Water collecting spider silk	2
Mycelium megastructure	35 230
Transportation bubbles	96
Indoor biofarms	1 623

[SEE SOURCES]

06

Biocube distribution

1km² of Prague

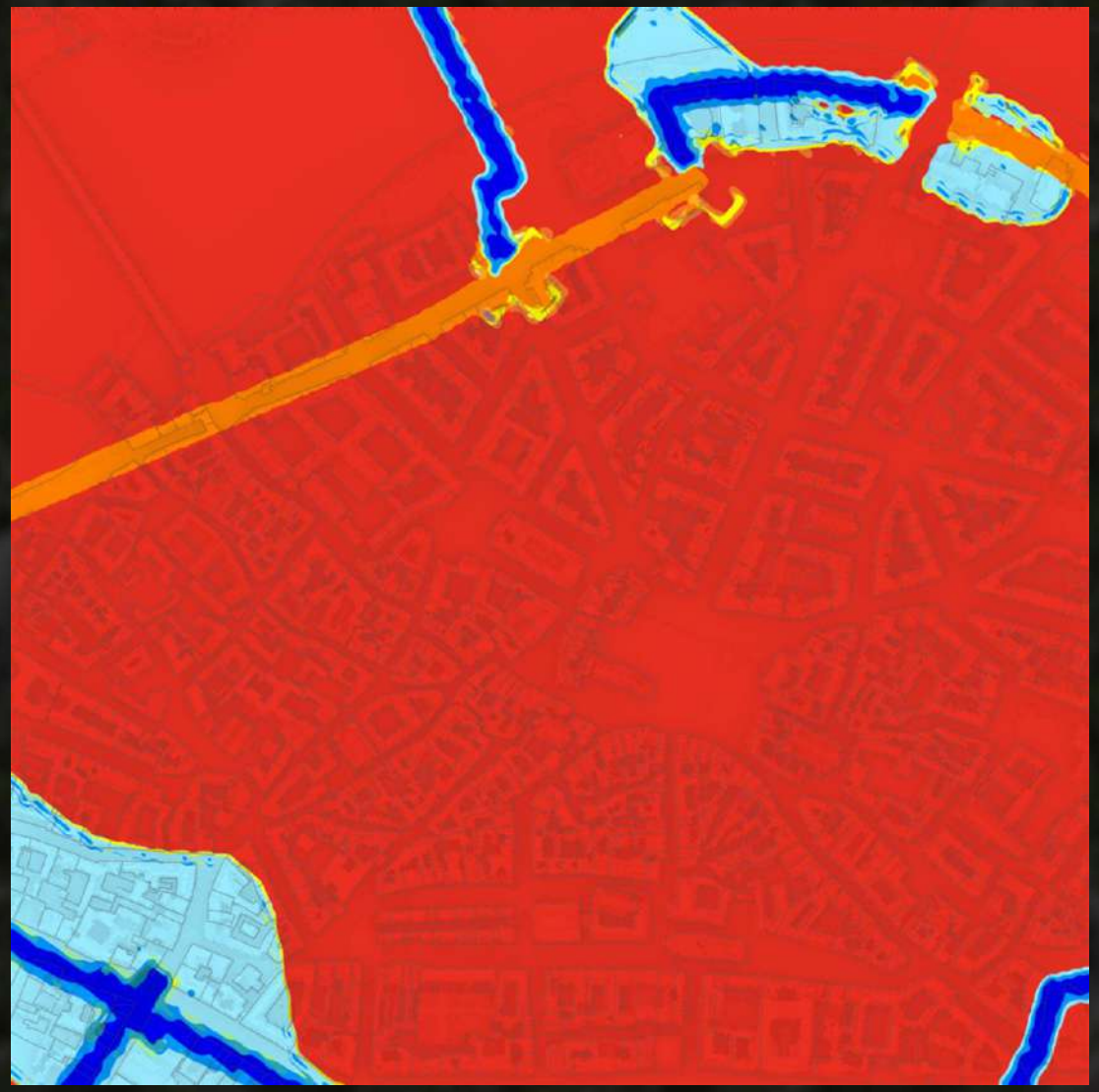
[GOOGLE EARTH]


1km² of Prague

Principles of distribution

Surface greenifier

Surface greenifier



Distributed on AIR
POLLUTED places

POLLUTION MAP

SO_2 annual average concentrations

- 3,8 - 3,85 µg/m³
- 3,85 - 3,9 µg/m³

Emissions of nitrogen oxides

- > 3 - 5 t/year
- > 5 - 10 t/year
- > 20 - 40 t/year

[IPR]

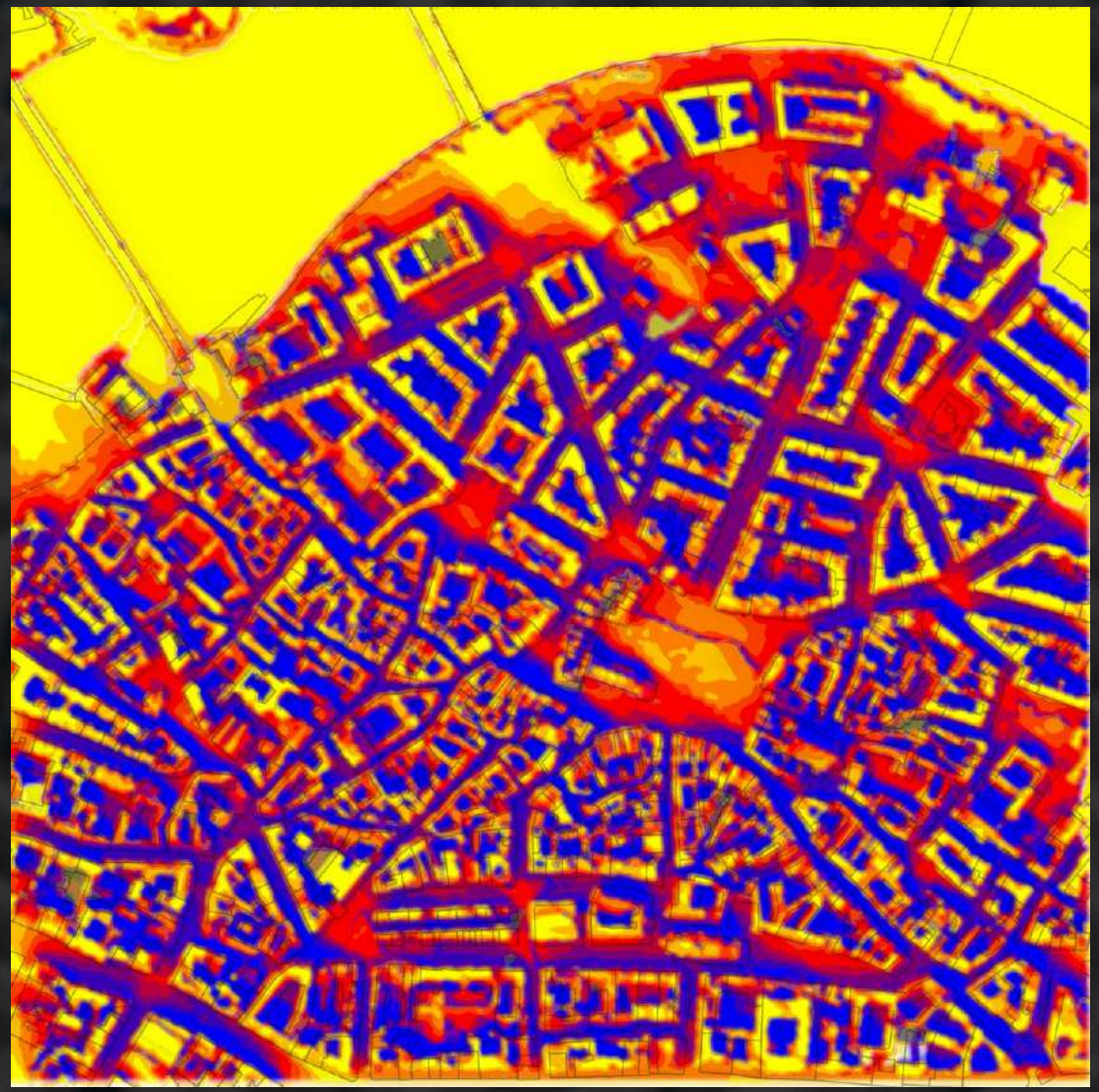
Algae lamp

Algae lamp

Distributed along the STREETS
and in PUBLIC AREAS

Water retaining sponge

Water retaining sponge



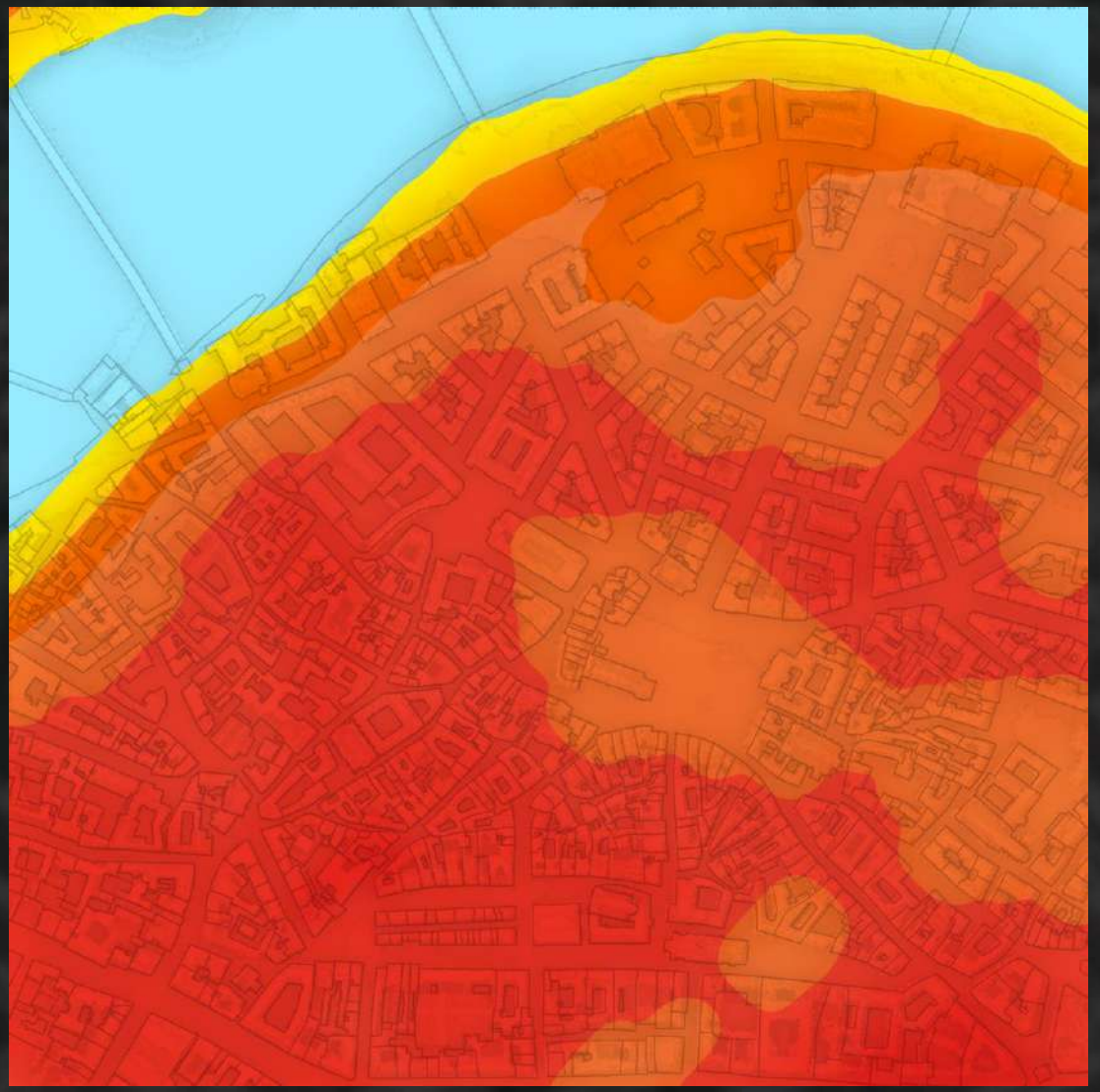
Distributed on
SHADED PLACES

SUN MAP

shade sun

Cloud generator

Cloud generator



Distributed on
HEAT ISLANDS

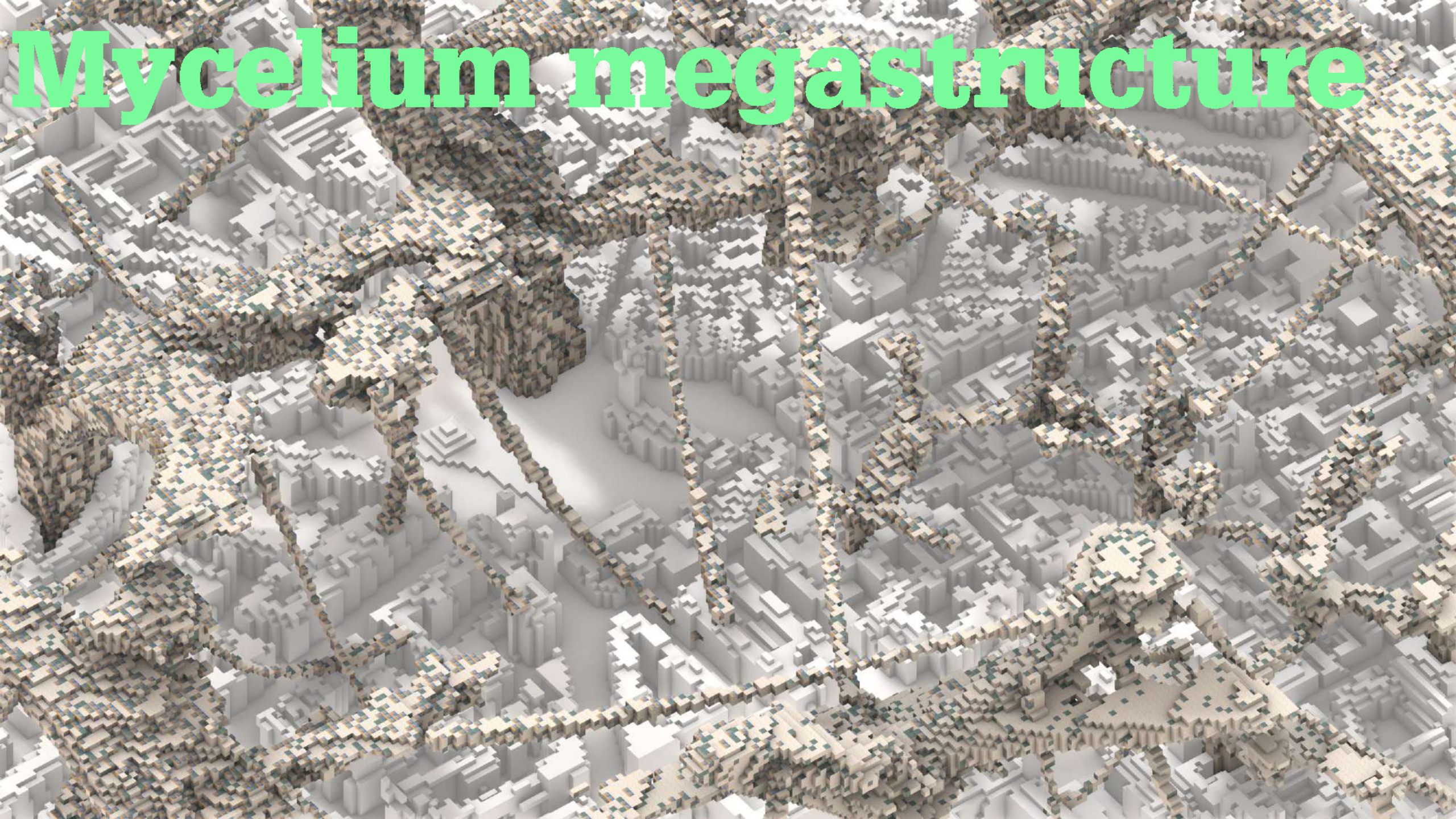
HEAT MAP

0°C 46°C

[IPR]

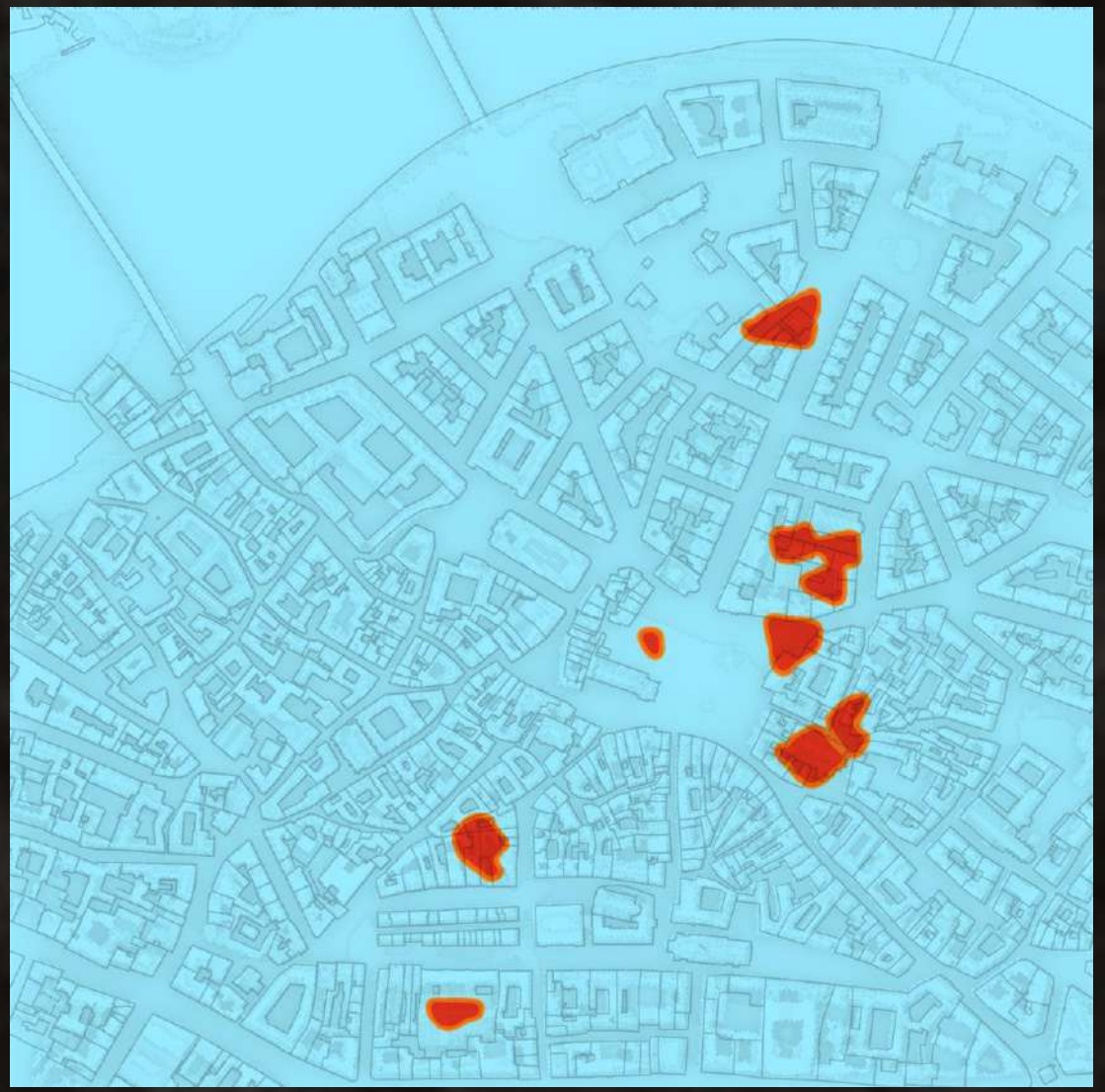
Mycelium megastructure


Mycelium megastructure


Mycelium megastructure


Mycelium megastructure

Mycelium megastructure



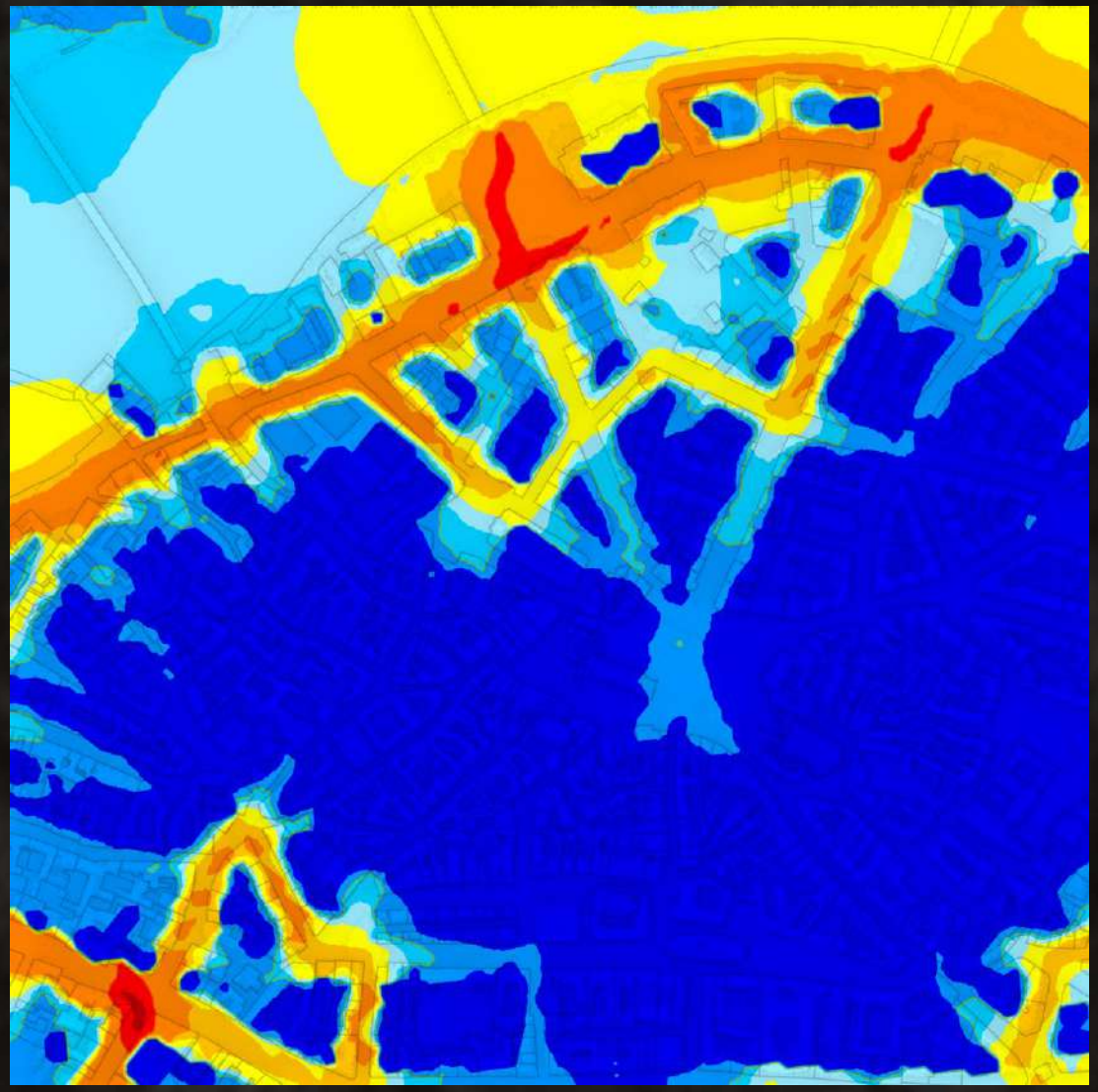
Grows out of ABANDONED and DESTROYED buildings

UNUSED SPACE MAP

unused used

[PRAZDNE DOMY]

Noise utilizer



Distributed on the NOISE POLLUTED places

NOISE MAP

- ≤ 40 dB
- > 40 - 45 dB
- > 45 - 50 dB
- > 50 - 55 dB
- > 55 - 60 dB
- > 60 - 65 dB
- > 65 - 70 dB
- > 75 - 80 dB
- > 80 dB

[IPR]

Pigment electricity generator

Distributed on
SUNNY PLACES

SUN MAP

shade sun

Indoor biofarms

Placed inside of MYCELIUM MEGASTRUCTURE

Photonic crystals

Placed inside of MYCELIUM MEGASTRUCTURE

Mycorrhizal network

Placed inside of MYCELIUM MEGASTRUCTURE

Regenerative flexible structure

Placed inside of MYCELIUM MEGASTRUCTURE

Transportation bubbles

Transportation bubbles

Position depends on actual needs

Biostructure

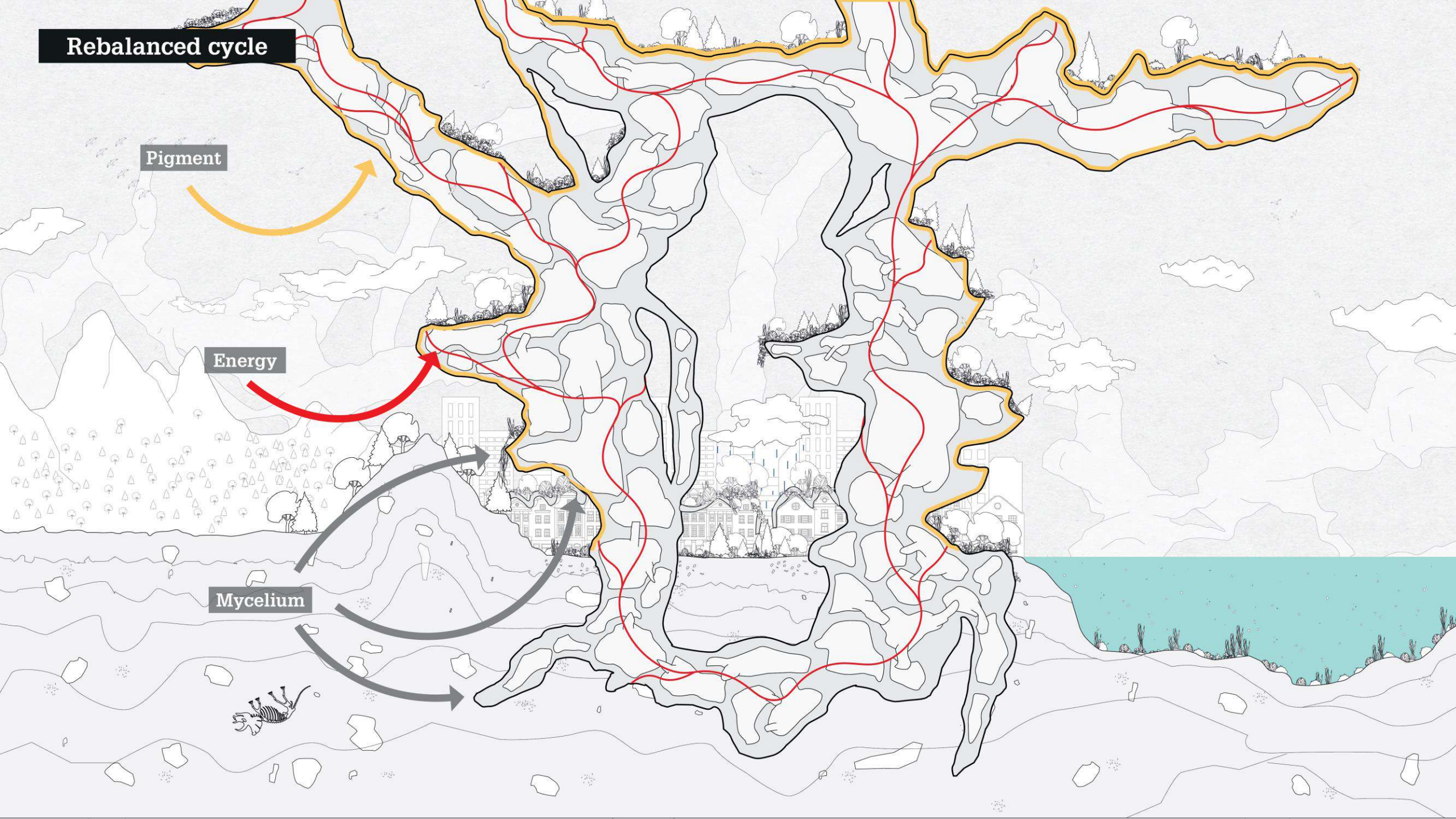
07

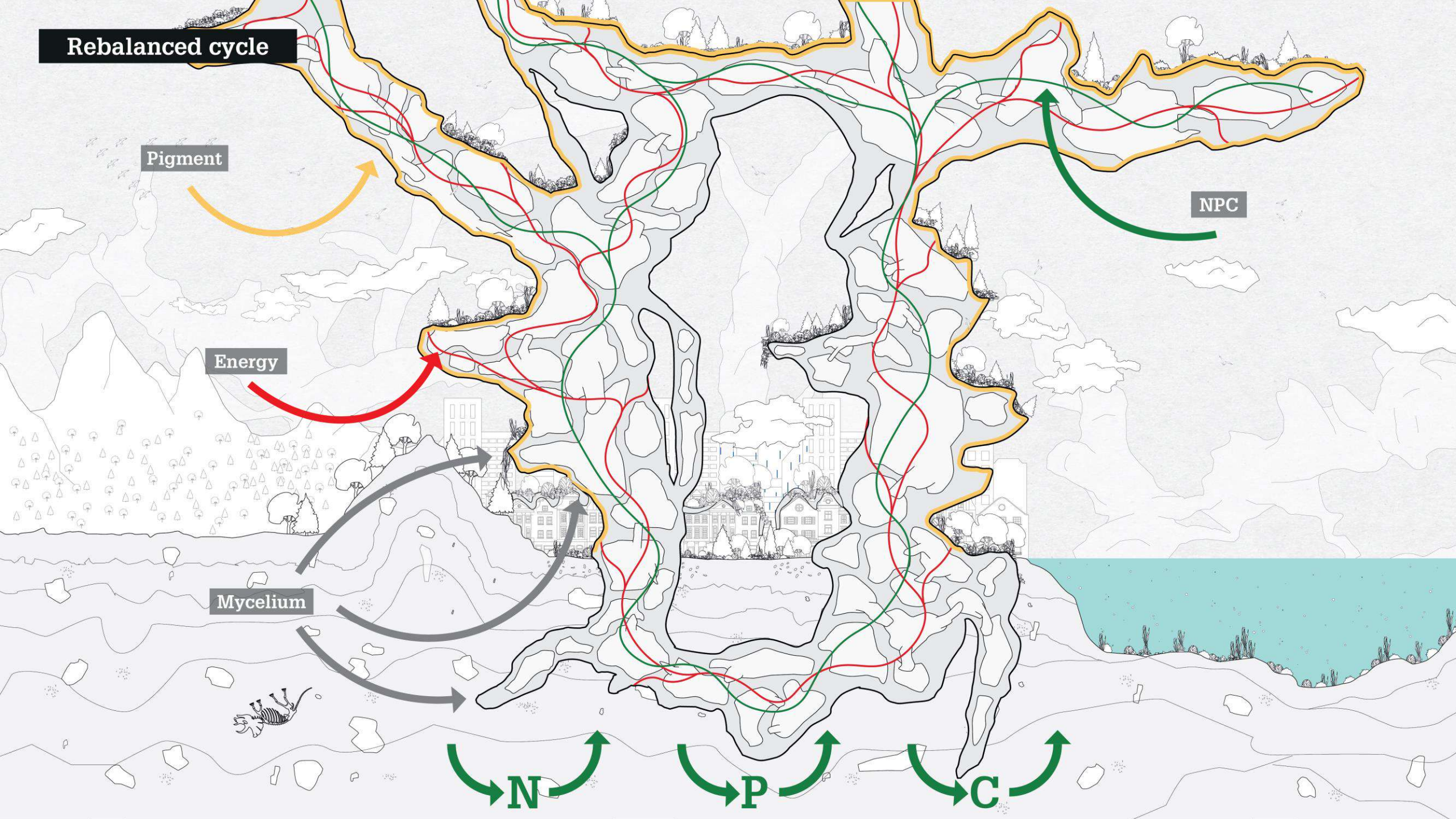
Biomatter

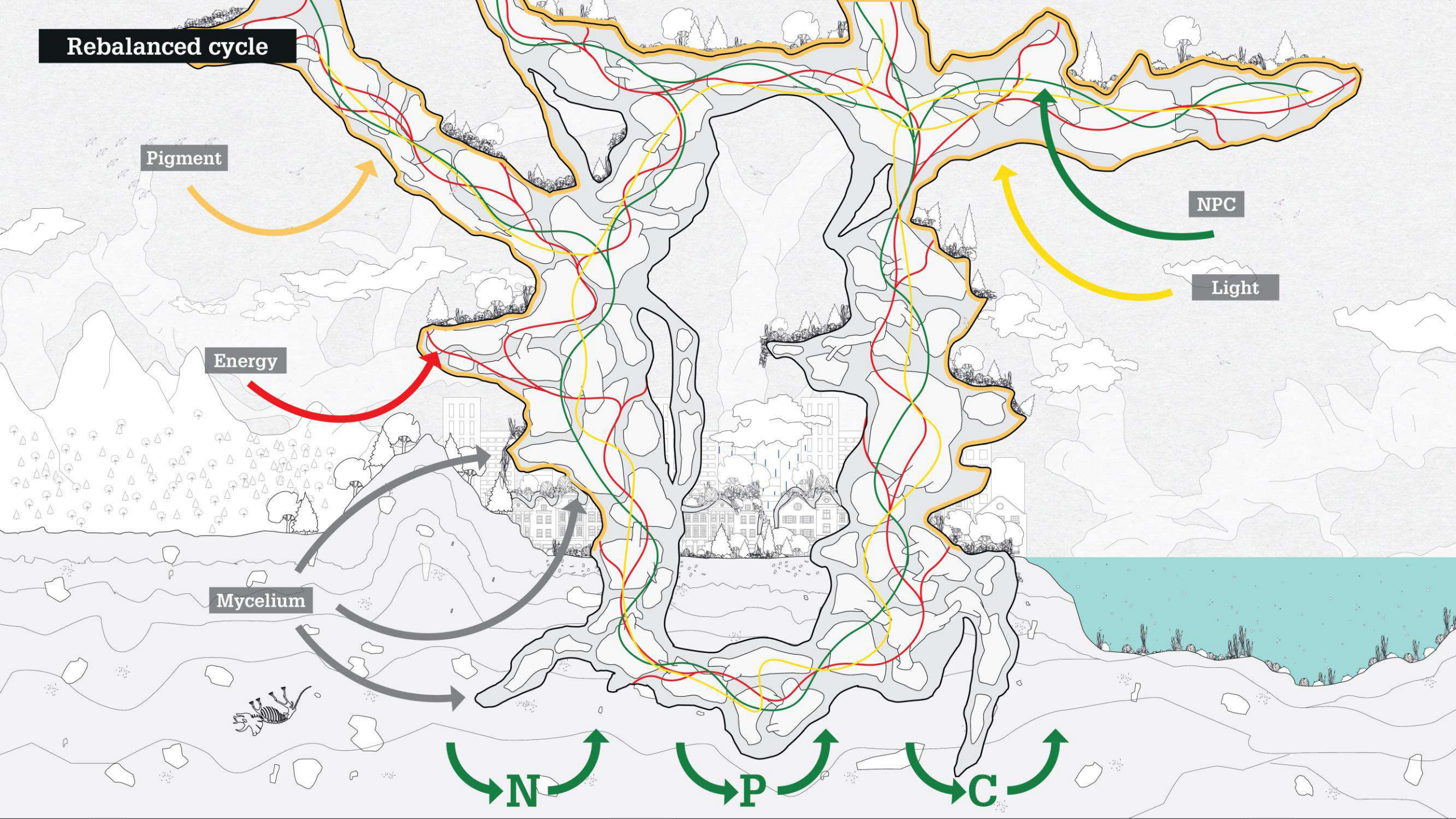

Rebalanced cycle

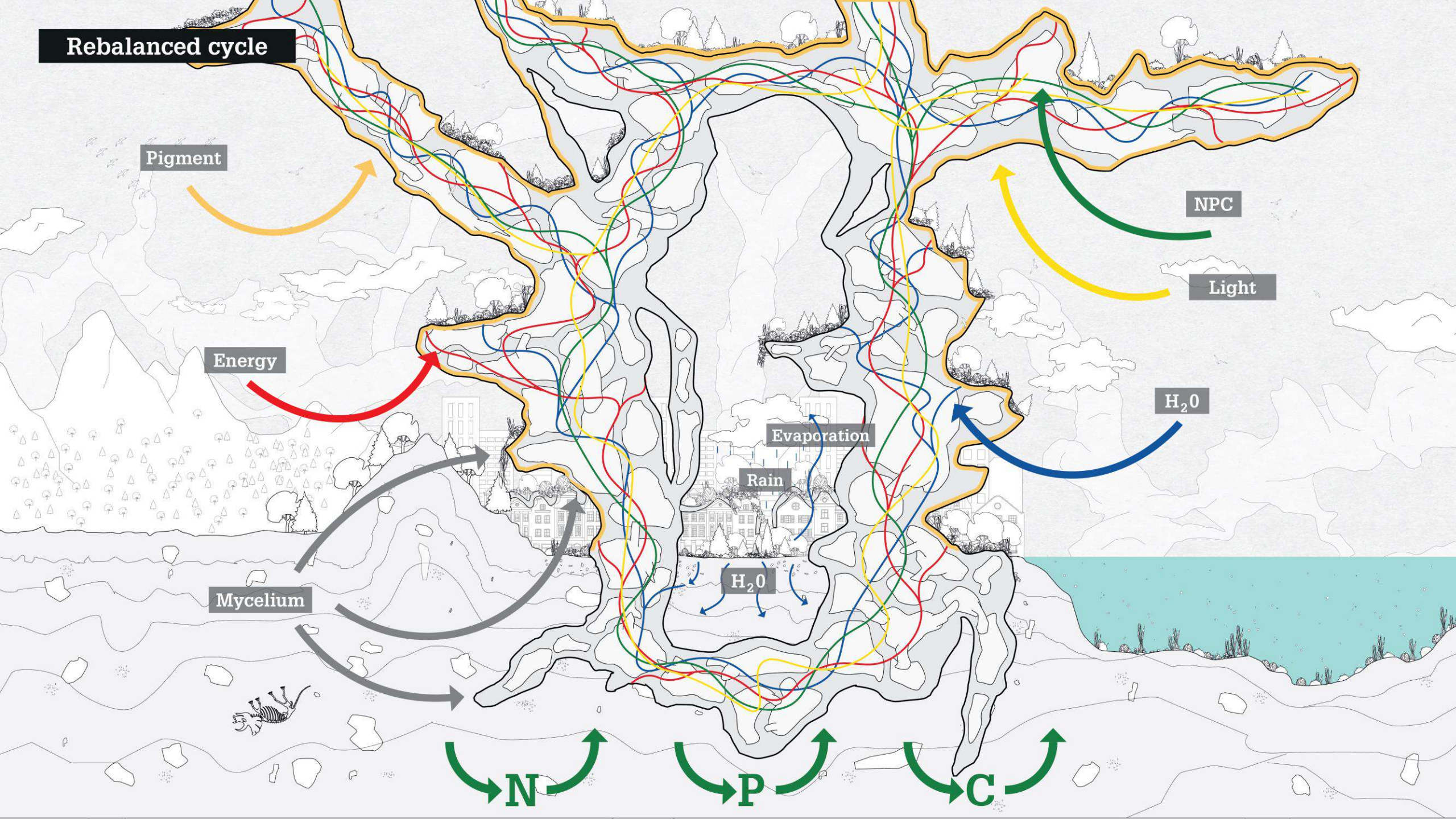

Rebalanced cycle
Mycelium

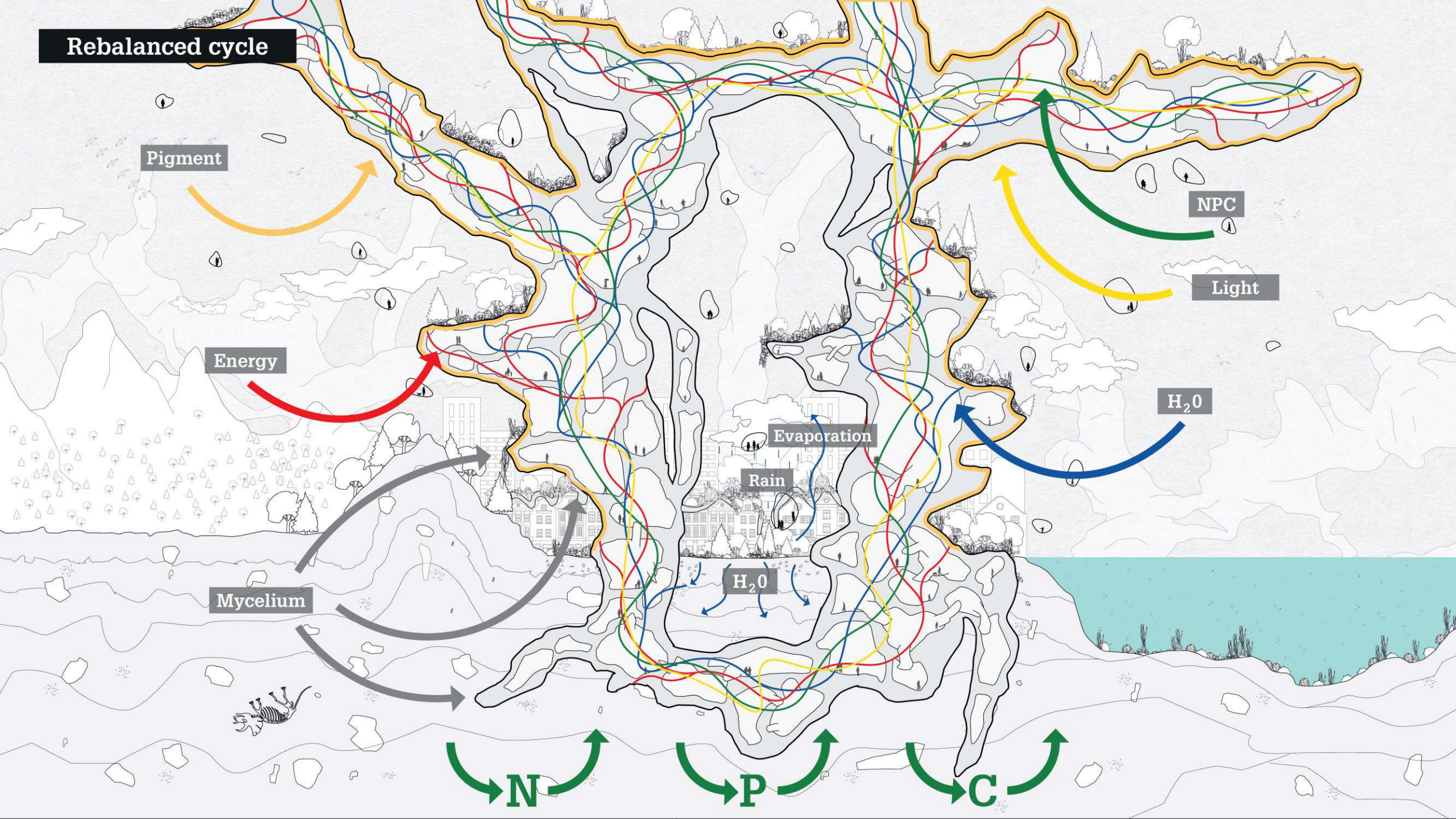

Rebalanced cycle
Pigment
Mycelium

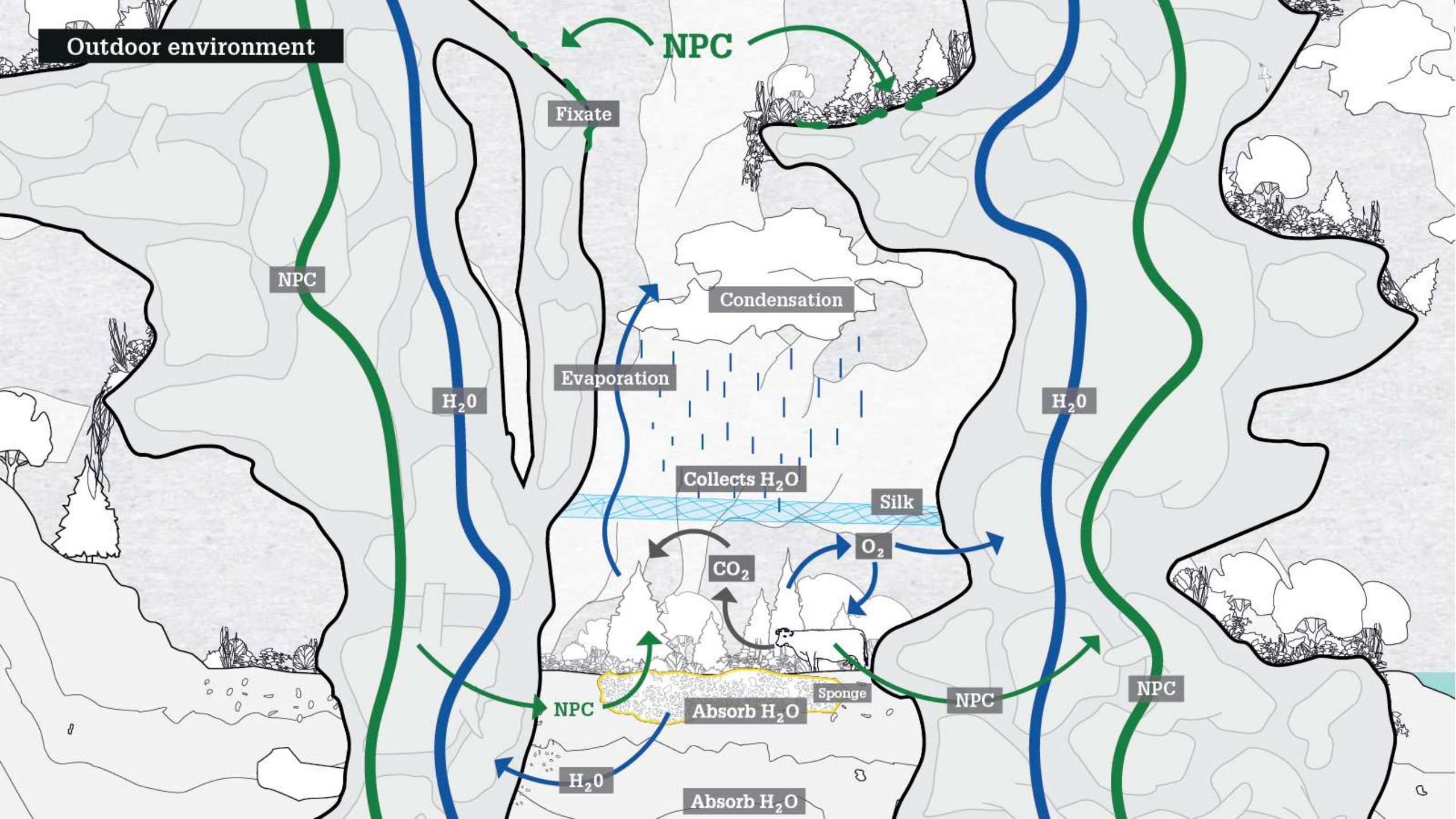

Rebalanced cycle
Pigment
Energy
Mycelium

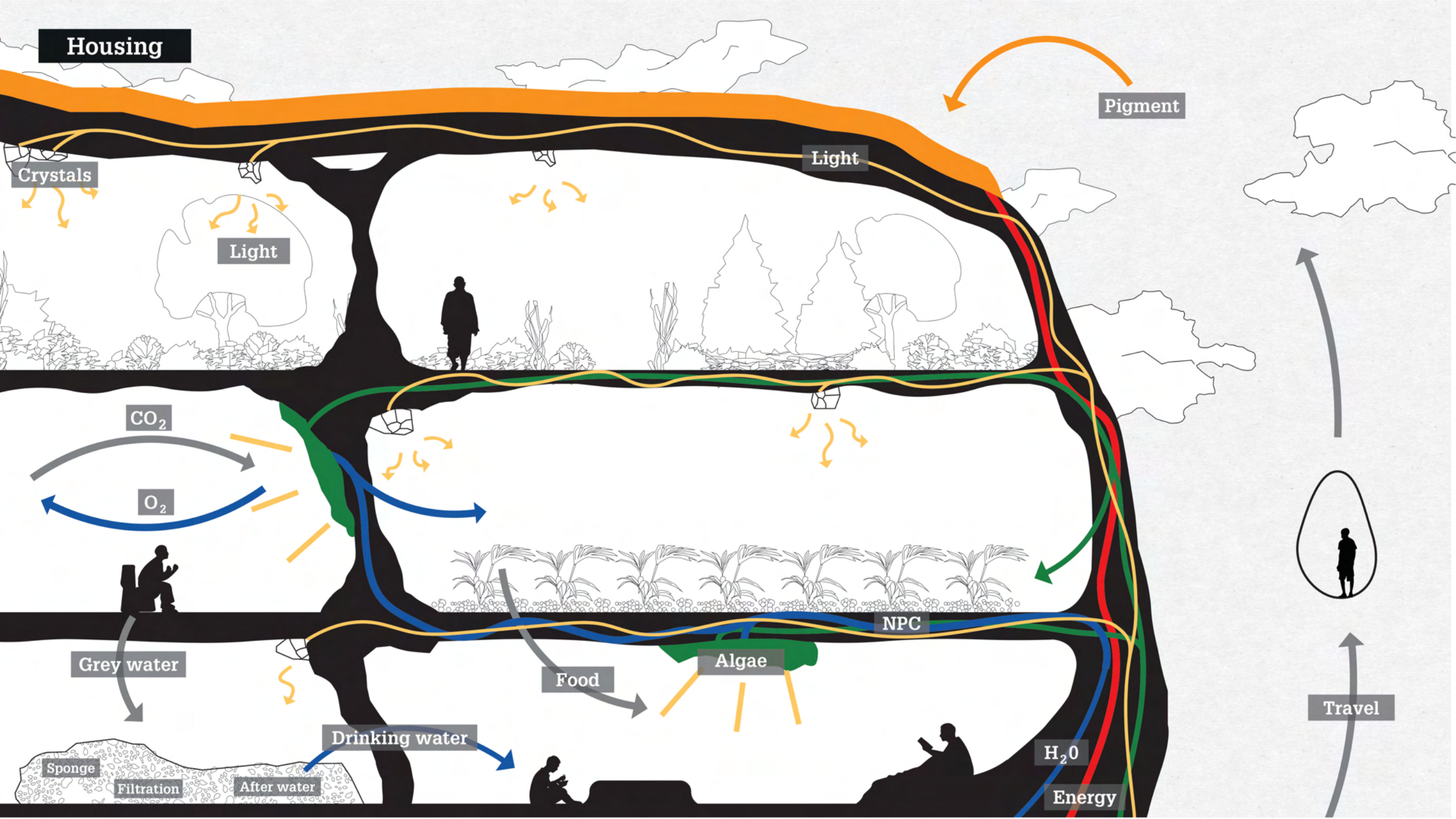

Rebalanced cycle
Pigment
Energy
Mycelium
NPC
N
P
C


Rebalanced cycle
Pigment
NPC
Light
Energy
Mycelium
N
P
C

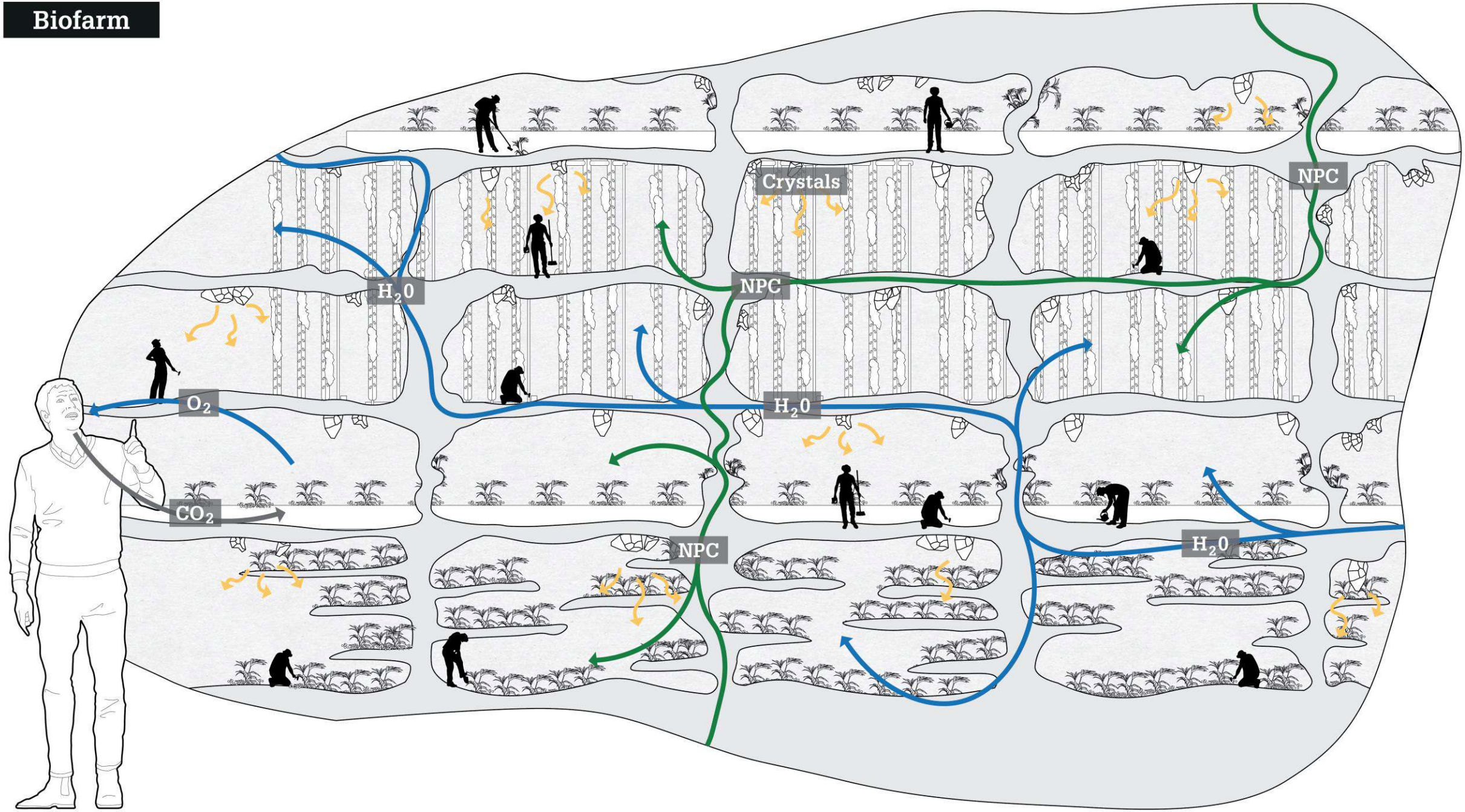

Rebalanced cycle
Pigment
NPC
Light
Energy
H_20
Evaporation
Rain
H_20
Mycelium
N
P
C

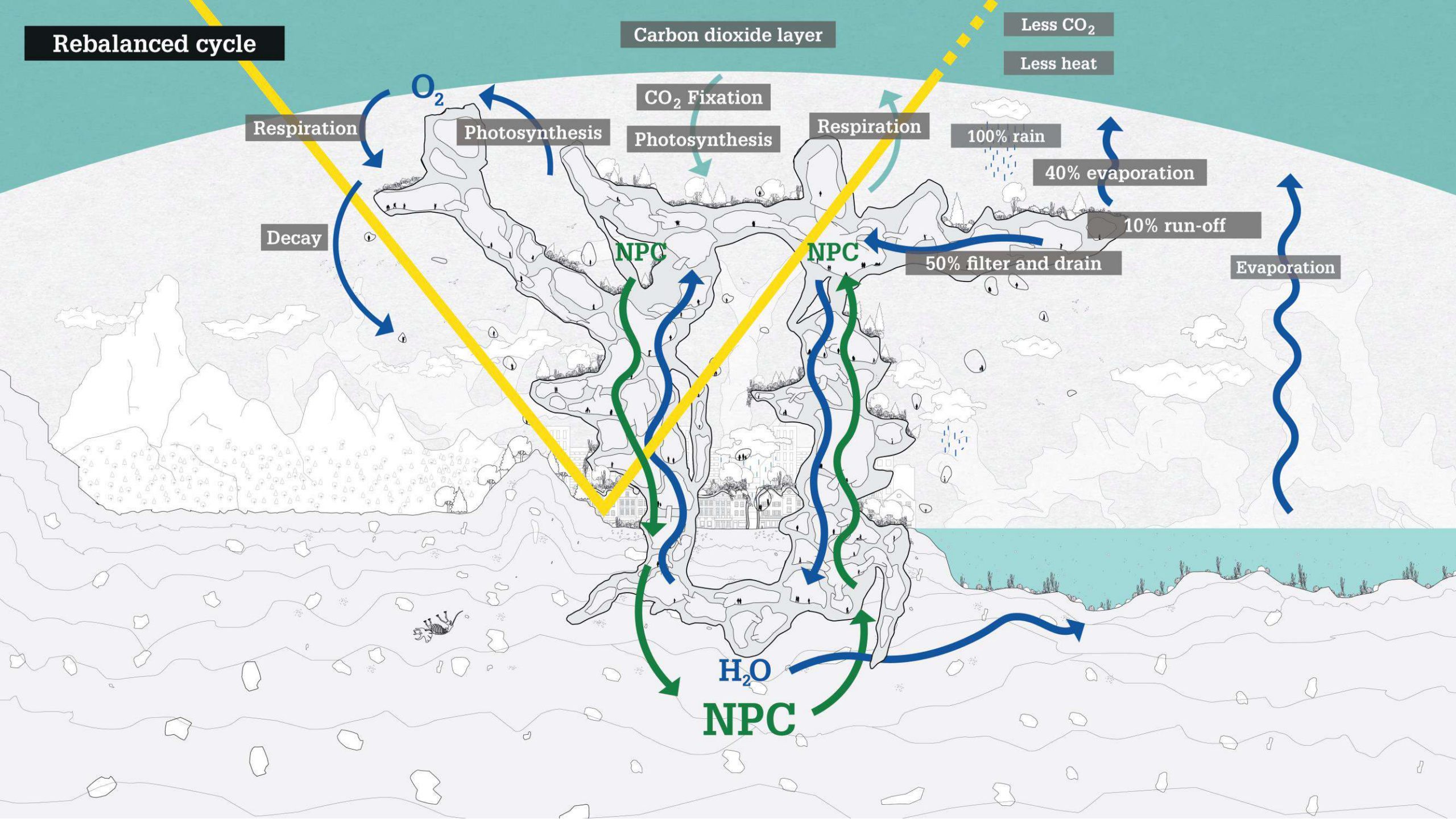

Rebalanced cycle
Pigment
Energy
Mycelium
NPC
Light
H_20
Evaporation
Rain
H_20
N
P
C


Outdoor environment
NPC
Fixate
NPC
Condensation
Evaporation
H_20
H_20
Collects H_2O
Silk
O_2
CO_2
NPC
Sponge
Absorb H_2O
NPC
NPC
H_20
Absorb H_2O


Housing
Pigment
Crystals
Light
Light
CO_2
O_2
NPC
Grey water
Food
Algae
Drinking water
Sponge
Filtration
After water
H_2O
Energy
Travel

Biofarm




Rebalanced cycle
Carbon dioxide layer
Less CO_2
Less heat
O_2
Respiration
Photosynthesis
CO_2 Fixation
Photosynthesis
Respiration
100% rain
40% evaporation
10% run-off
Decay
NPC
NPC
50% filter and drain
Evaporation
H_2O
NPC

08

The sponge

How would the life in the sponge look like?

How would the life in the sponge look like?

Adaptibility

Biodegradability

Outdoor conditions

Connectivity

Adaptability

Adaptability

Adaptability

How would the life in the sponge look like?

Adaptibility

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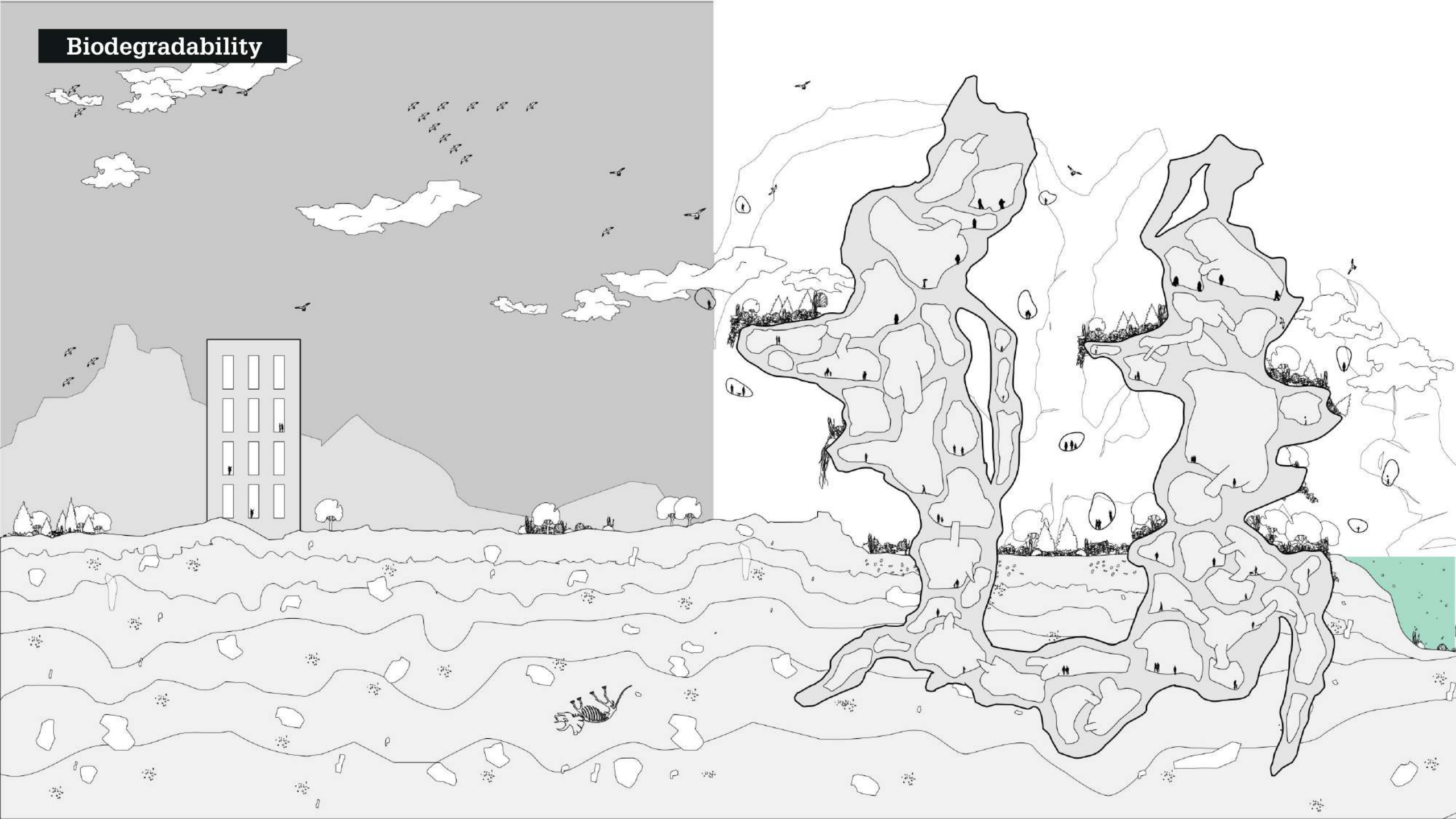
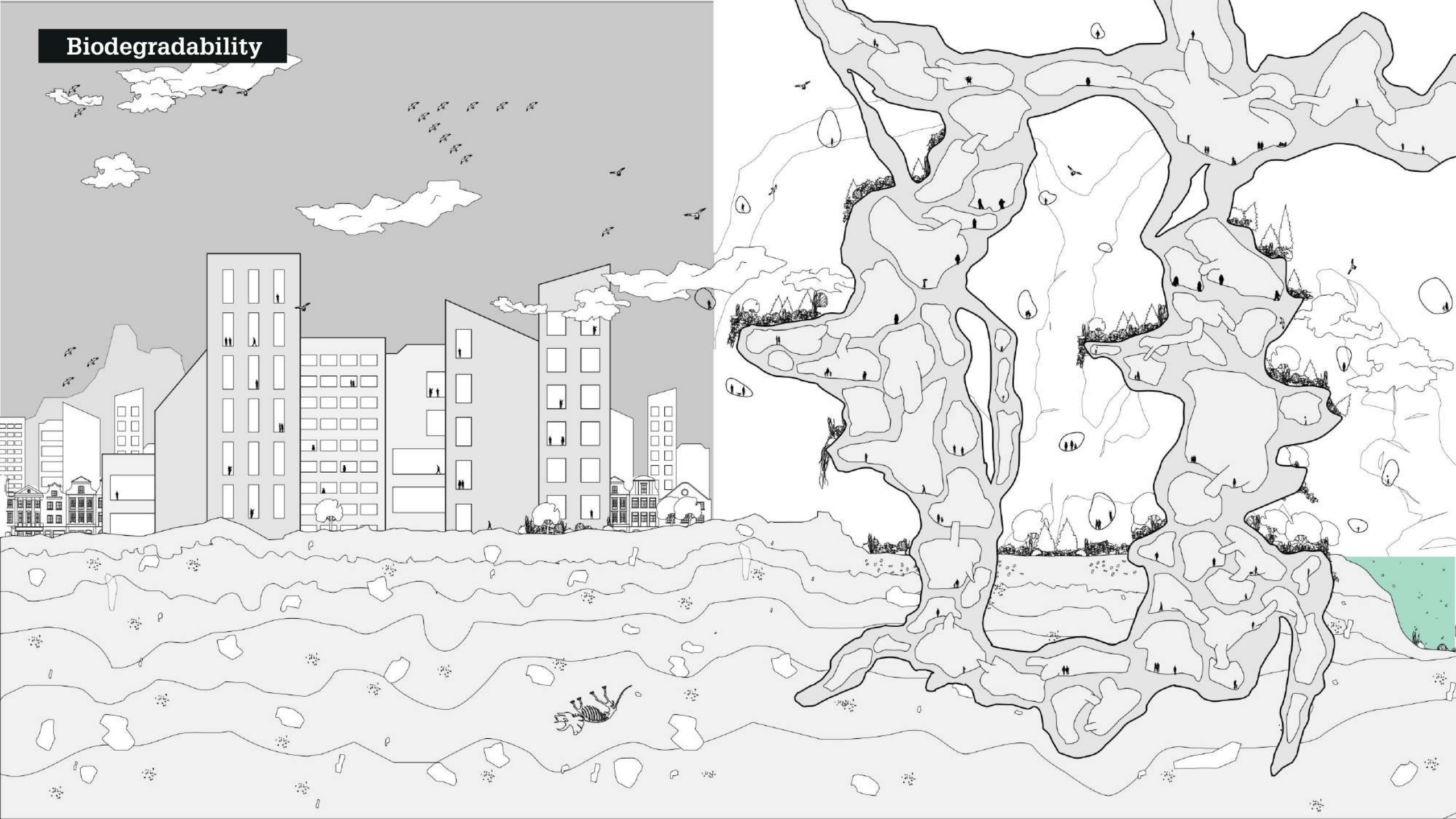
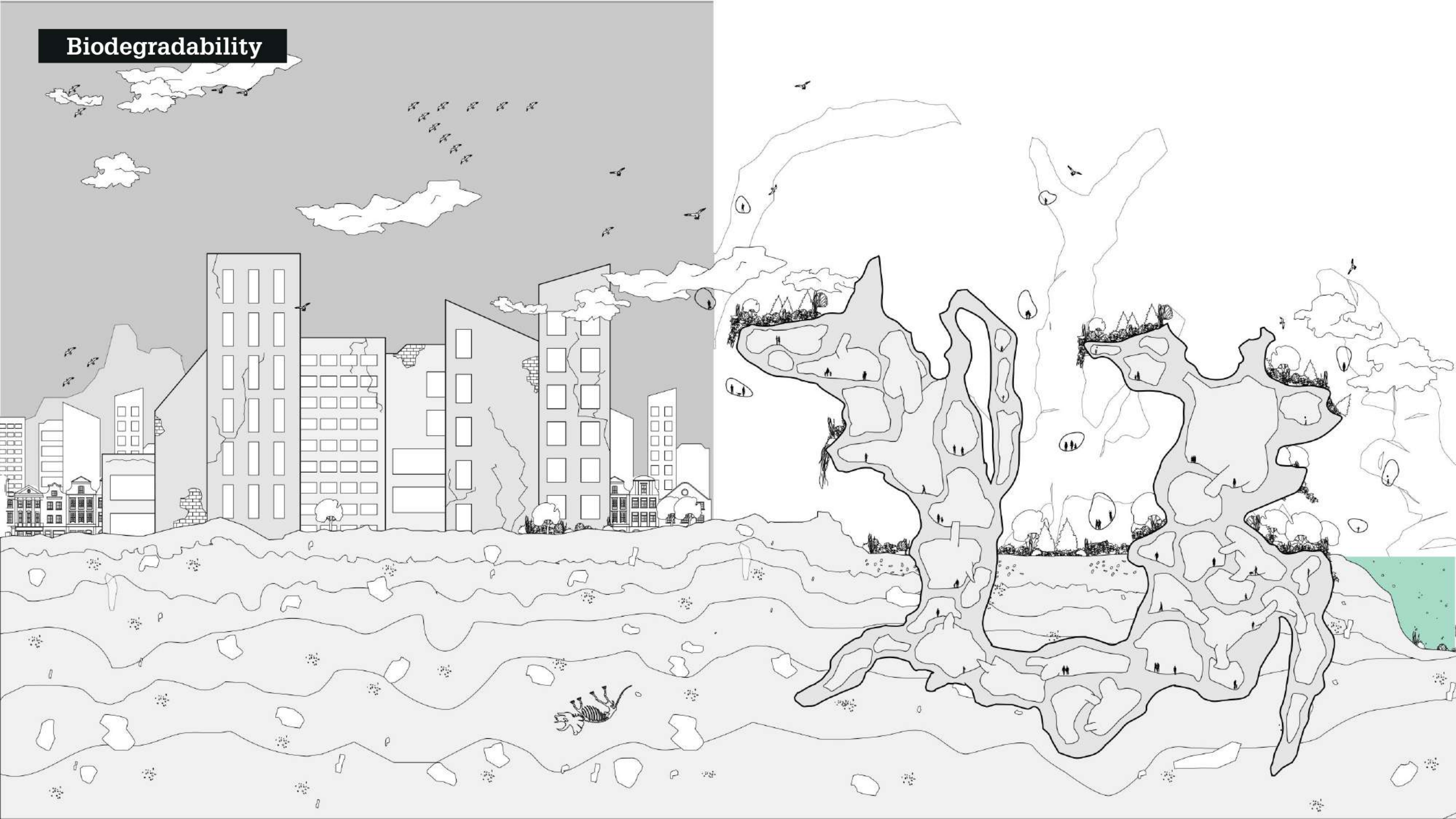
Biodegradability



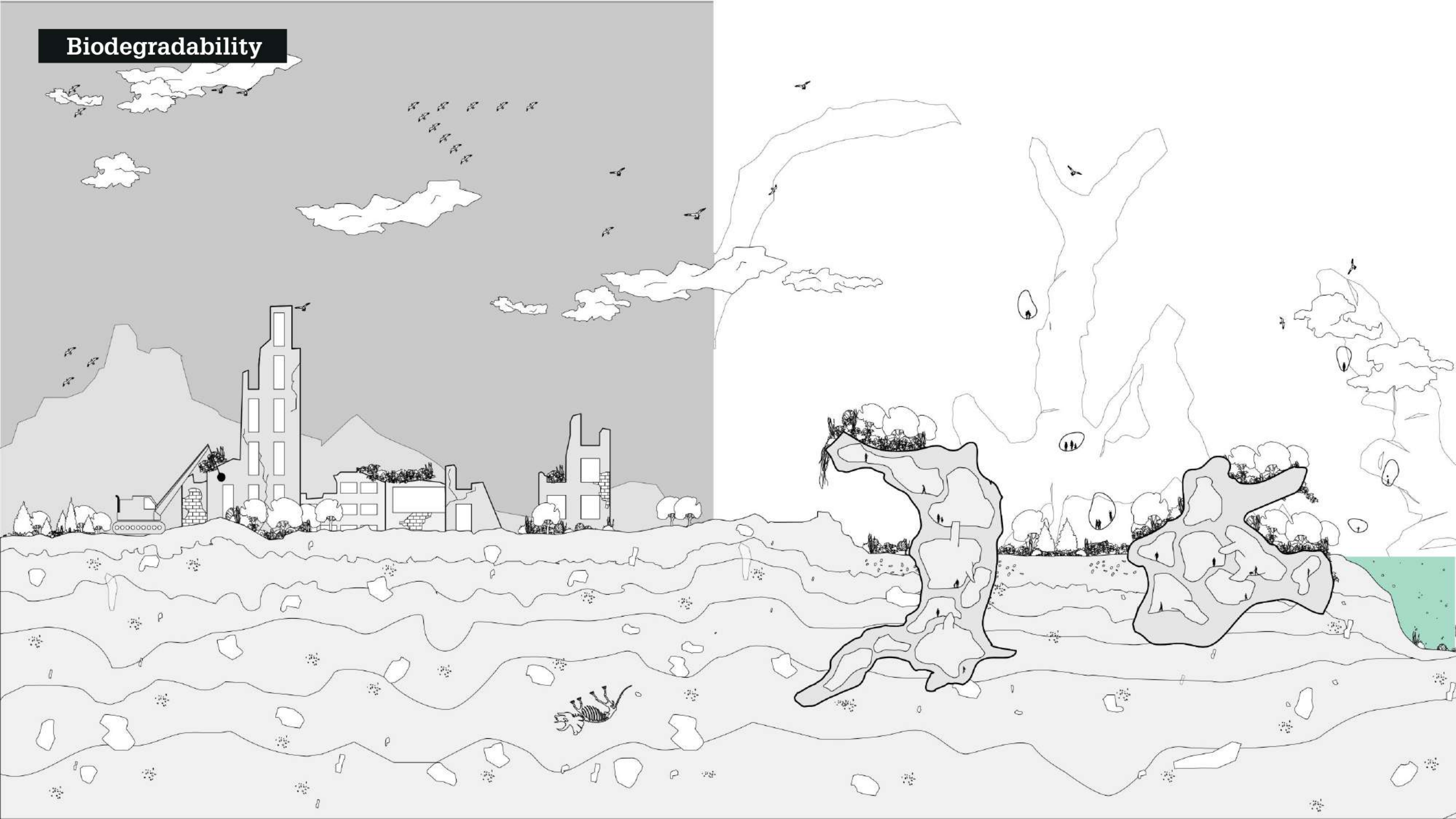
Biodegradability



Biodegradability



Biodegradability



How would the life in the sponge look like?

Adaptibility

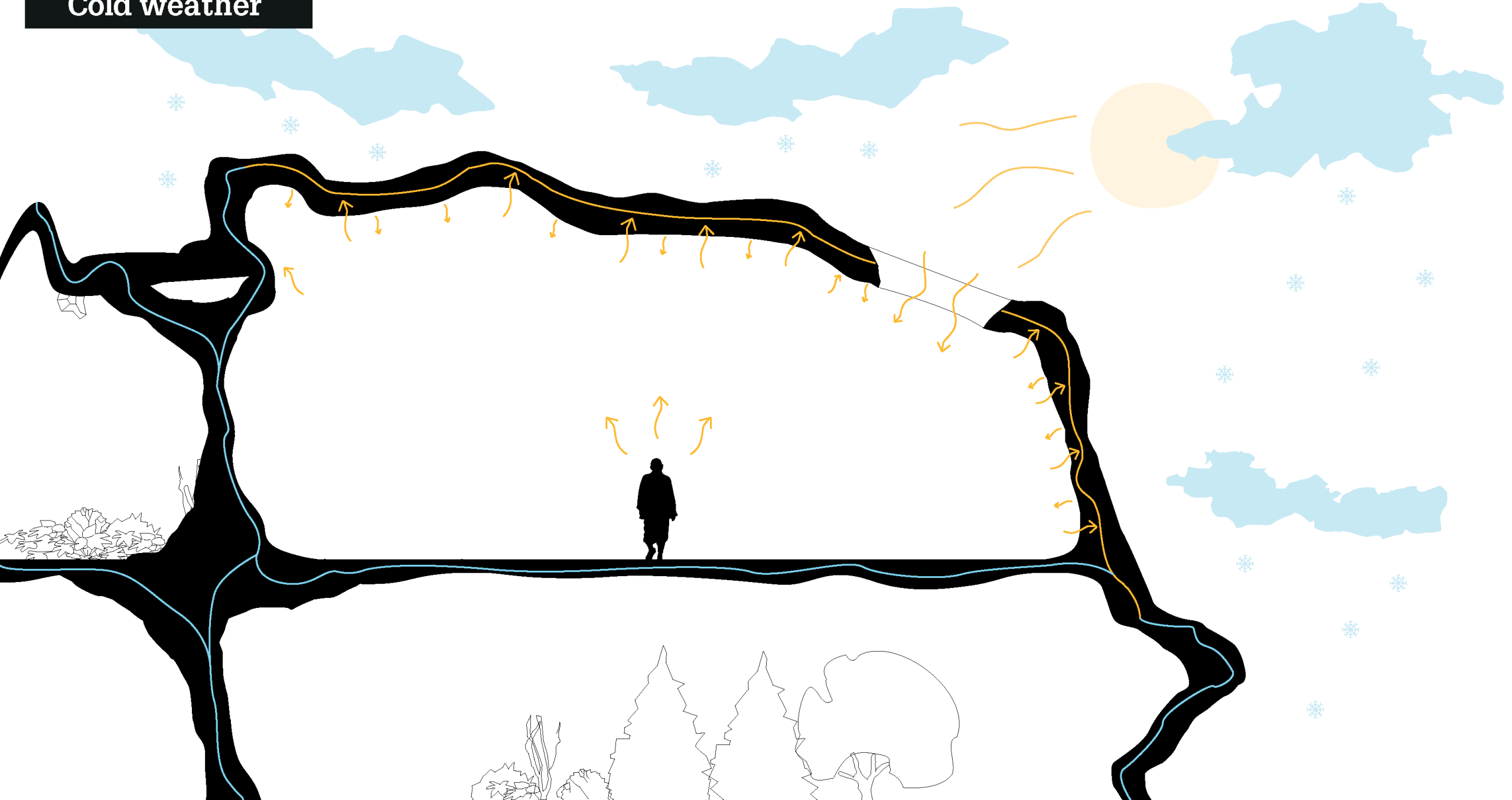
Biodegradability

Outdoor conditions

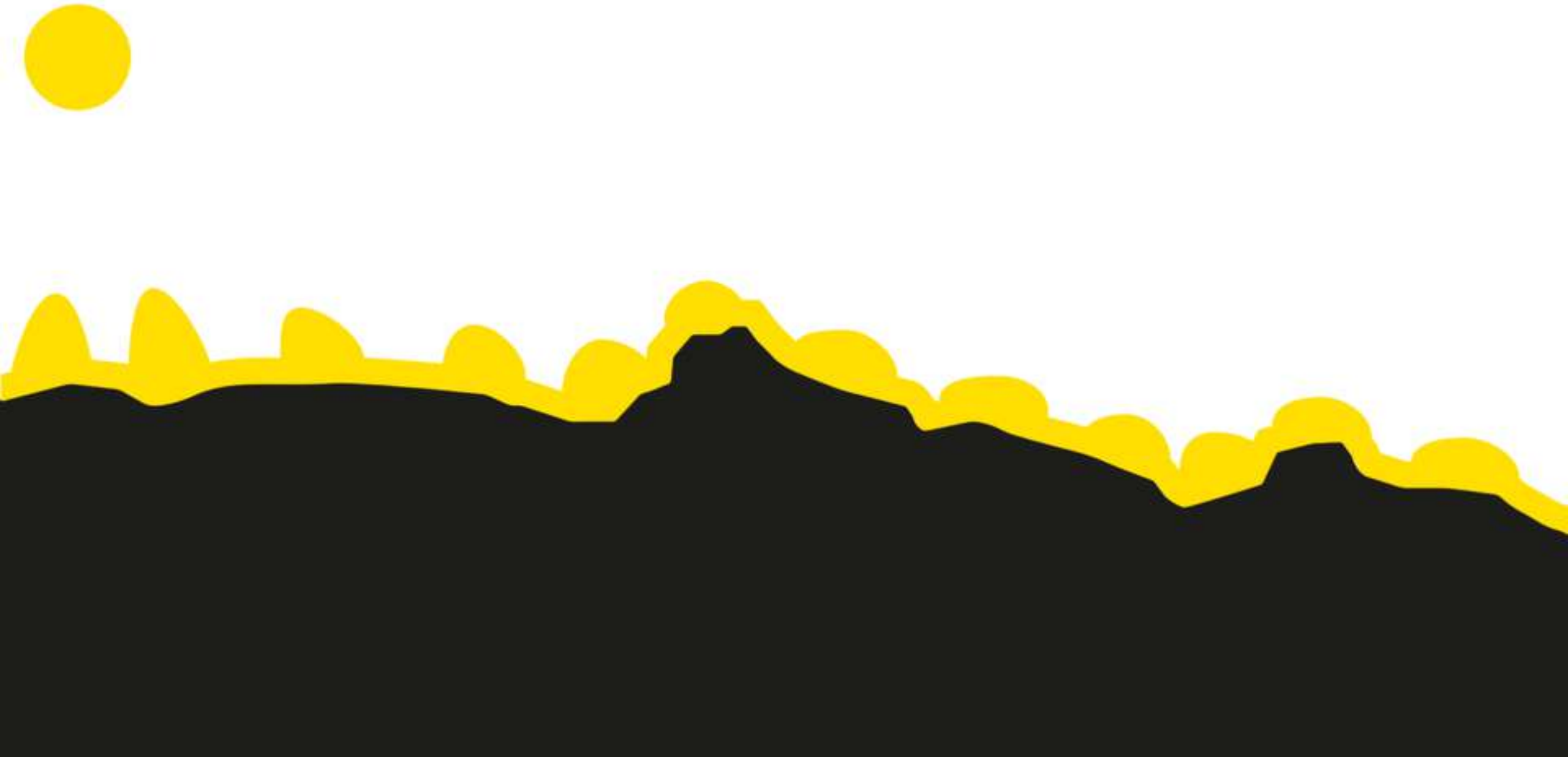
Connectivity

Warm weather

Cold weather



Photonic crystals



How would the life in the sponge look like?

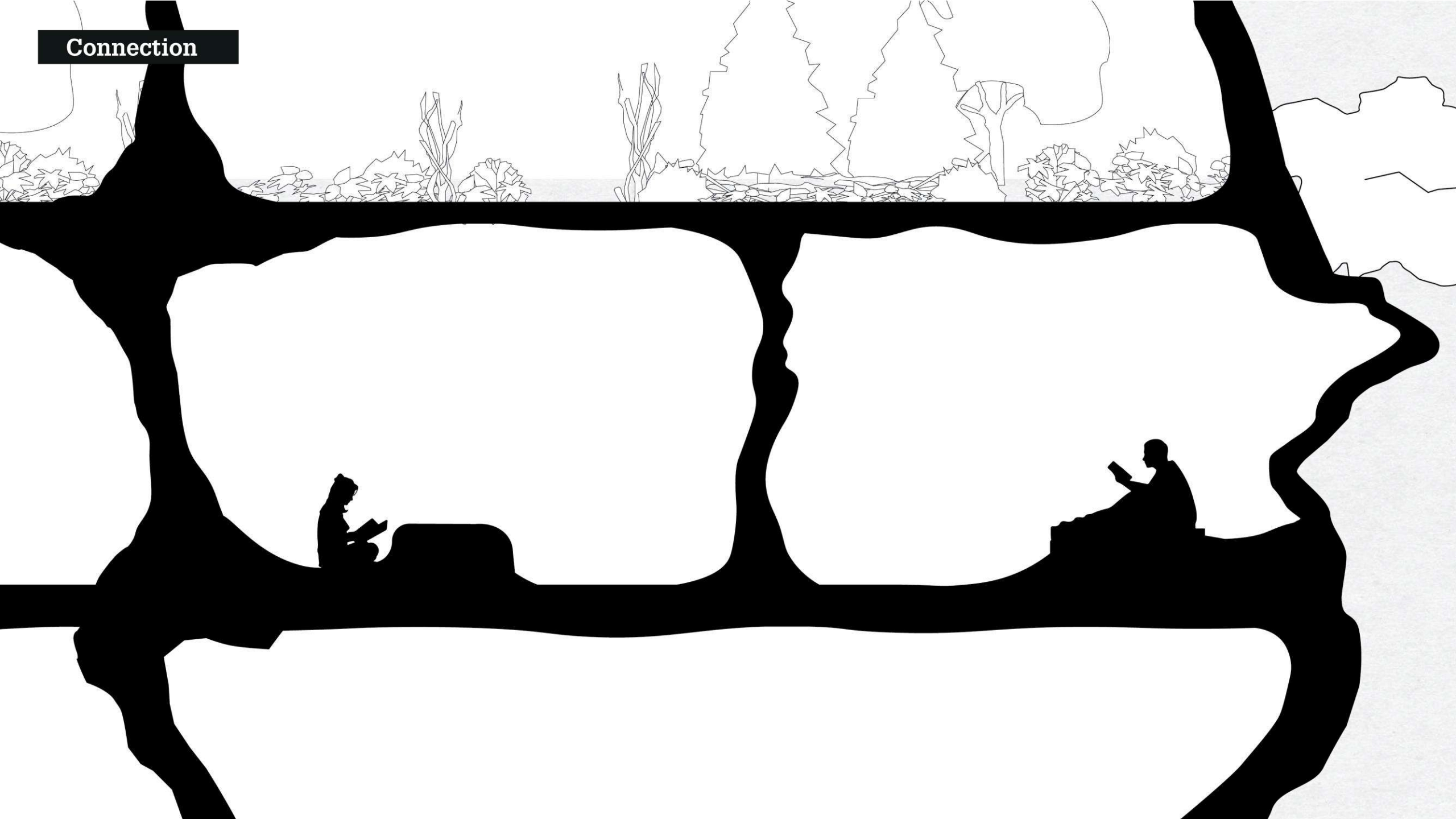
Adaptibility

Biodegradability

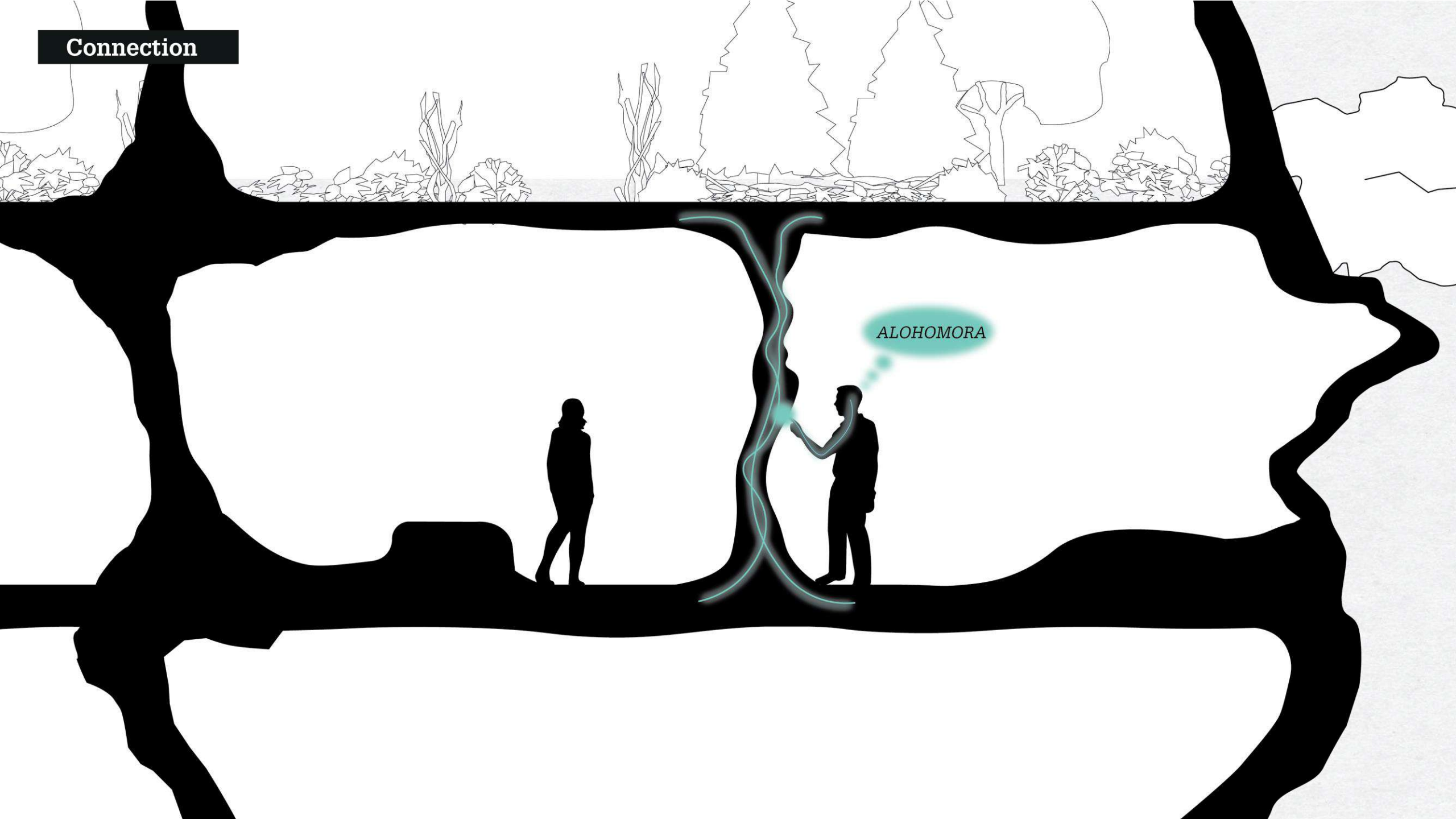
Outdoor conditions

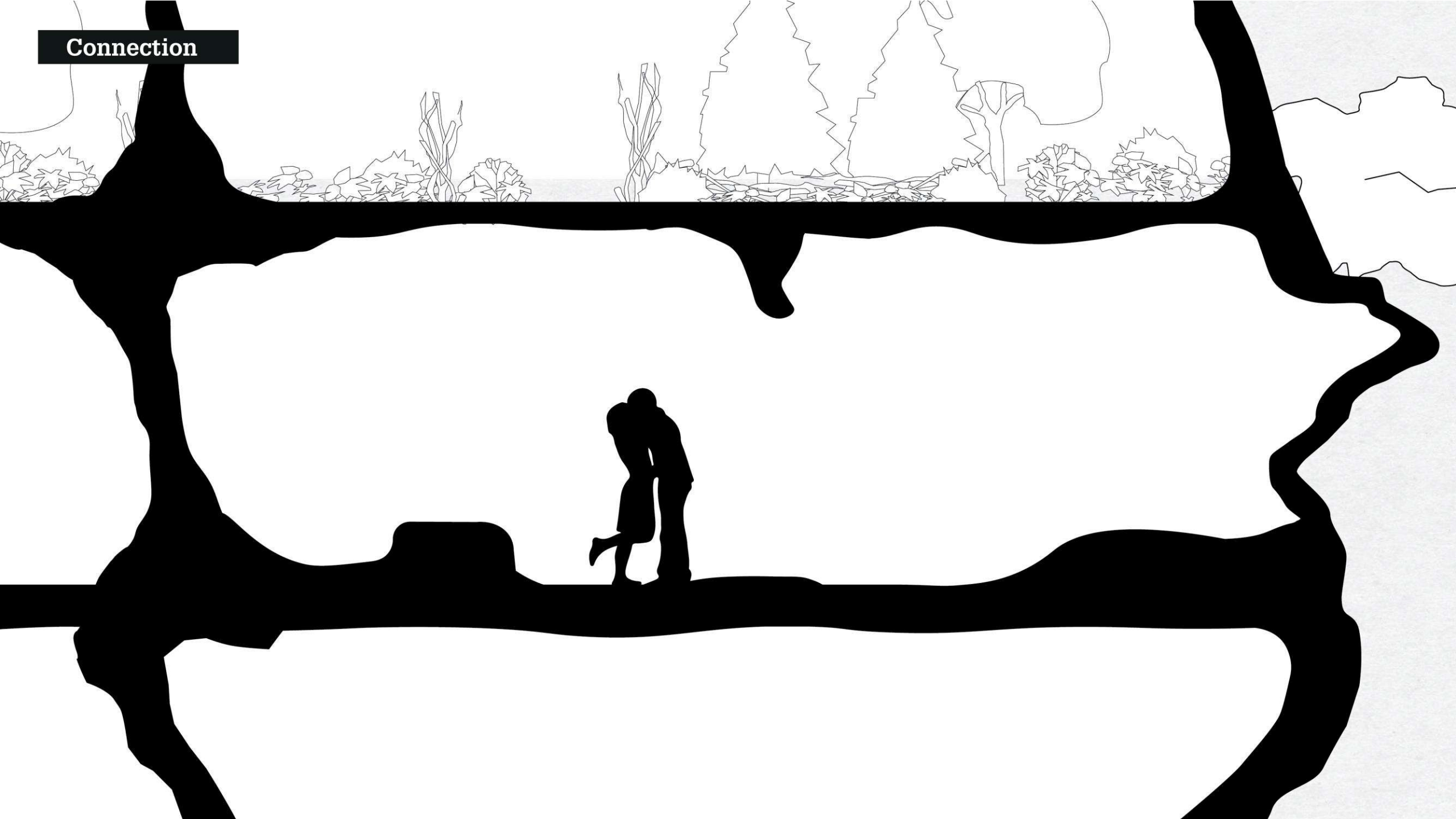
Connectivity

Connection

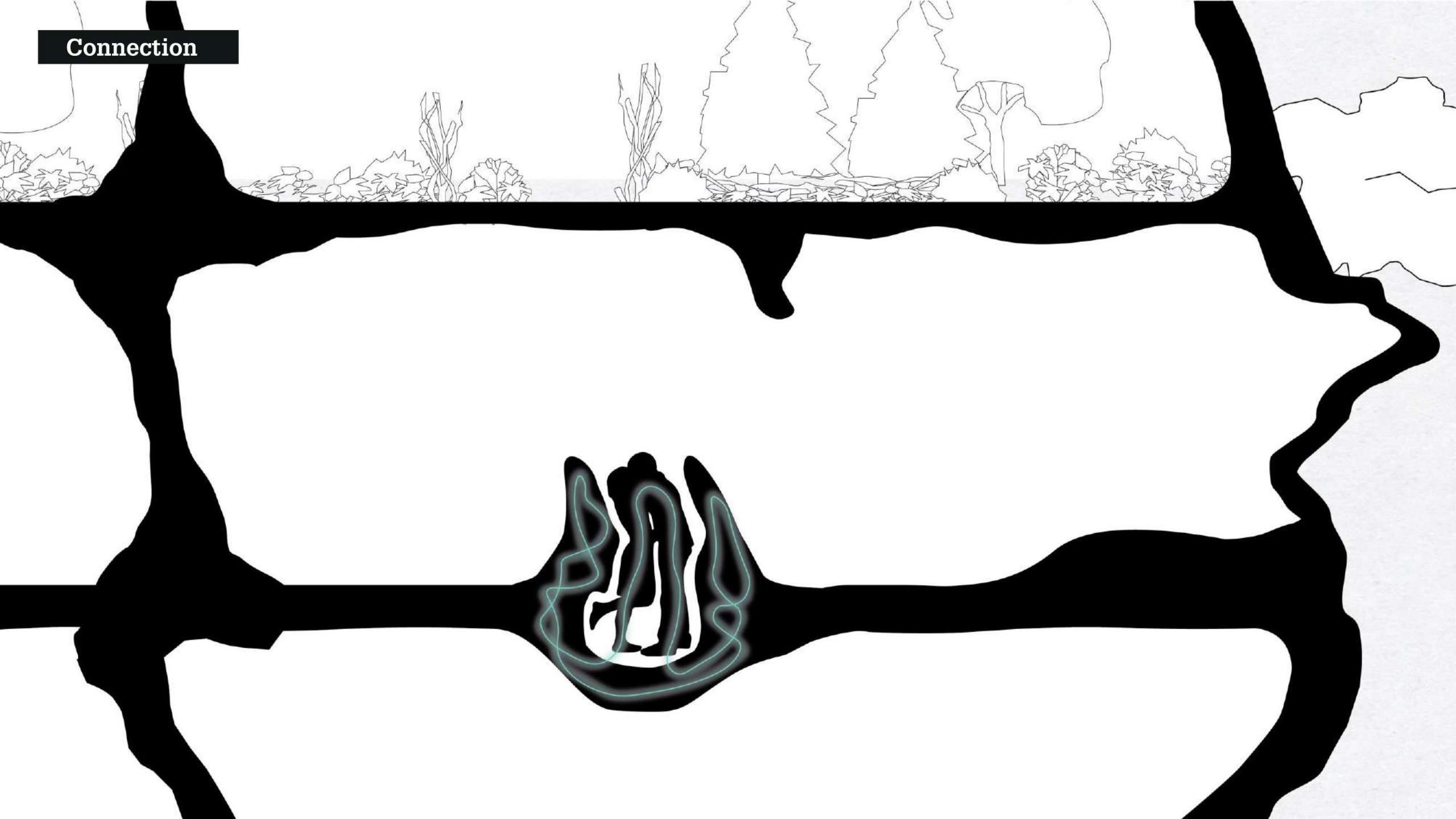


Connection




Connection

Connection



Life in the Sponge (The Film)

10 Outro

Our aim is to propose a series of bioinventions with nature to compensate for our excessive use of the Earth's resources and restore Nature's balance.

We witnessed the harsh impacts
of our presence on the Earth

We use the planet's resources in excess

Our target is to reduce this excess

To reduce the excess to zero

So have we achieved it?

On a given scale with a number of assumptions

On a given scale with a number of assumptions – we have

In a form of a complex ecosystem of blended inventions – The Sponge

We learnt that bioinventions are insufficient on their own

That we need to blend

into a biomatter

Which brought us back to concepts nature has taught us a while ago

Become part of a self-regulating system

Draw from millennia-old knowledge

In short: live in symbiosis with nature

It is our utopian vision of what the future can become

Our design vision

To which we would need the input from multiple professions

Where the real fruitful cross pollination could take place

To produce real life applicable solutions

This reasearch is a small fraction

of everything to be done yet

And include culture and society’s role within BIOTOPIA

BIOTOPIA

For centuries, design focused on objects with single meanings:

everything was architecture

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everything was architecture

More recently, we zoomed out to look for new meanings, at every scale, from the very small to the very large:

everything was urbanism

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everything was urbanism

Latterly, design has finally started to -timidly- understand the meaning of ‘green’:

everything was landscape

Latterly, design has finally started to -timidly- understand the meaning of ‘green’:

everything was landscape

Today -more than ever- *everything is Nature*

Today -more than ever- *everything is Nature*

Welcome to the era of biology

01 Introduction

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