Regenerative agriculture and landscape regeneration

Thorsten Arnold, PhD

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Educator & consultant for

- **Soil Health**
- **Regenerative Agriculture**
- **Regenerative food systems**
- **Regenerative design principles**
- **Climate resilience**
- **Biosphere regeneration**

- **Holistic Management**

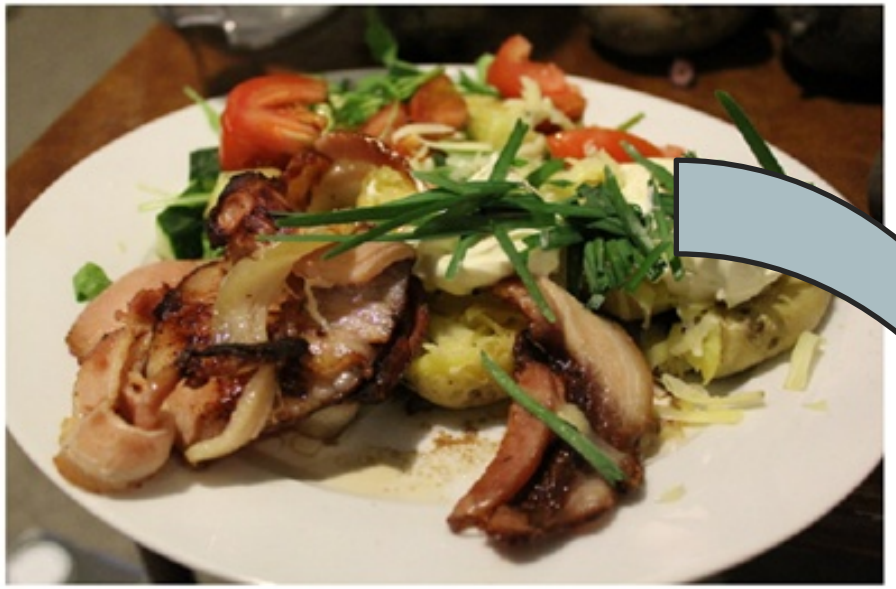
For diverse audiences.

www.ThorstenArnold.com

DR. THORSTEN ARNOLD

CLIMATE AND WATERSHED RESILIENCE
REGENERATIVE FOOD SYSTEMS

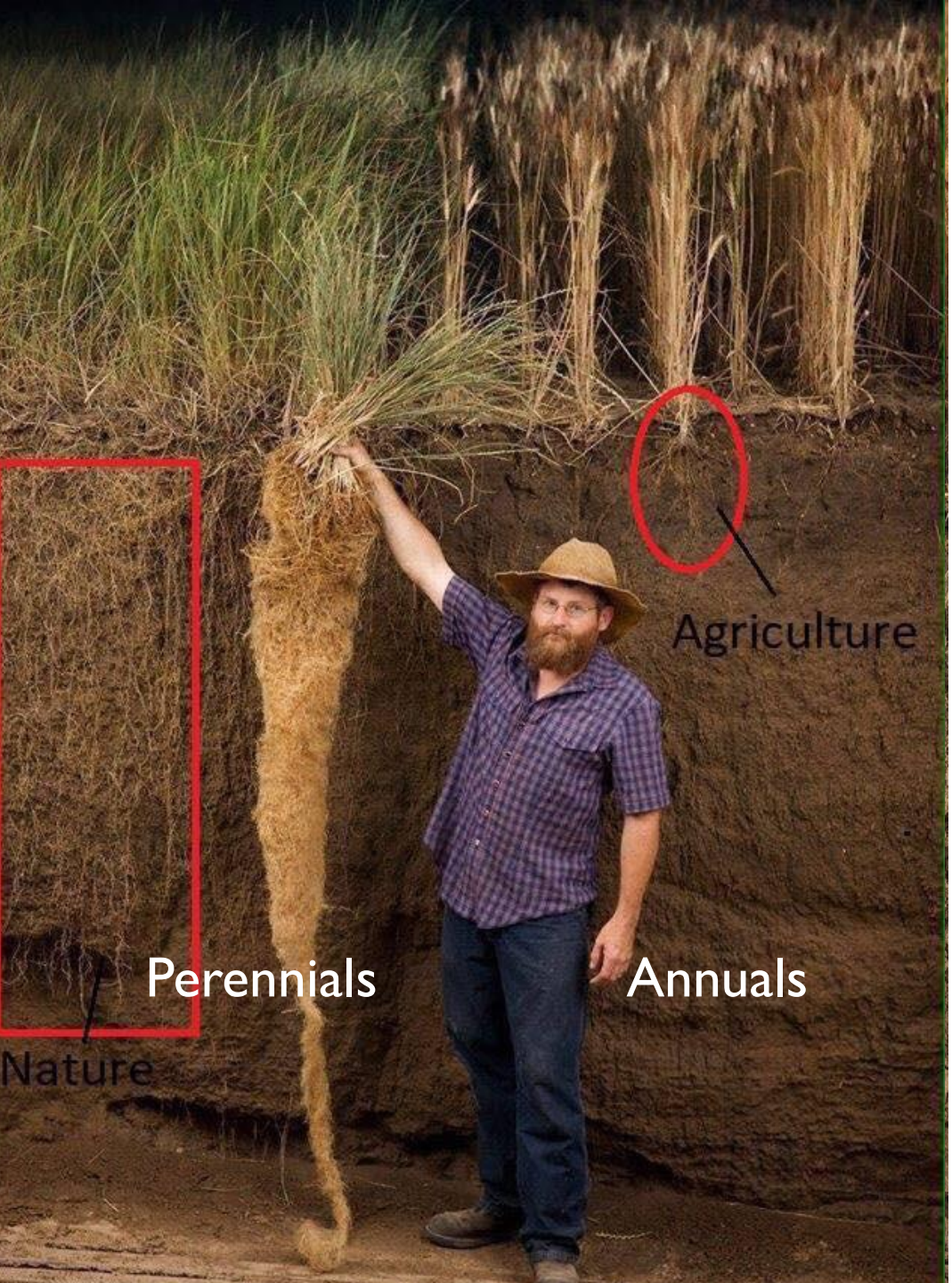
FOOD DETERMINES LANDSCAPES



Overview

- Soil health & Regenerative Agriculture
- Soil health & Watershed functions
- Soil health & climate resilience
- Policy options for resilient landscapes

WHAT IS SOIL HEALTH?



Amazing root systems hidden from our eyes

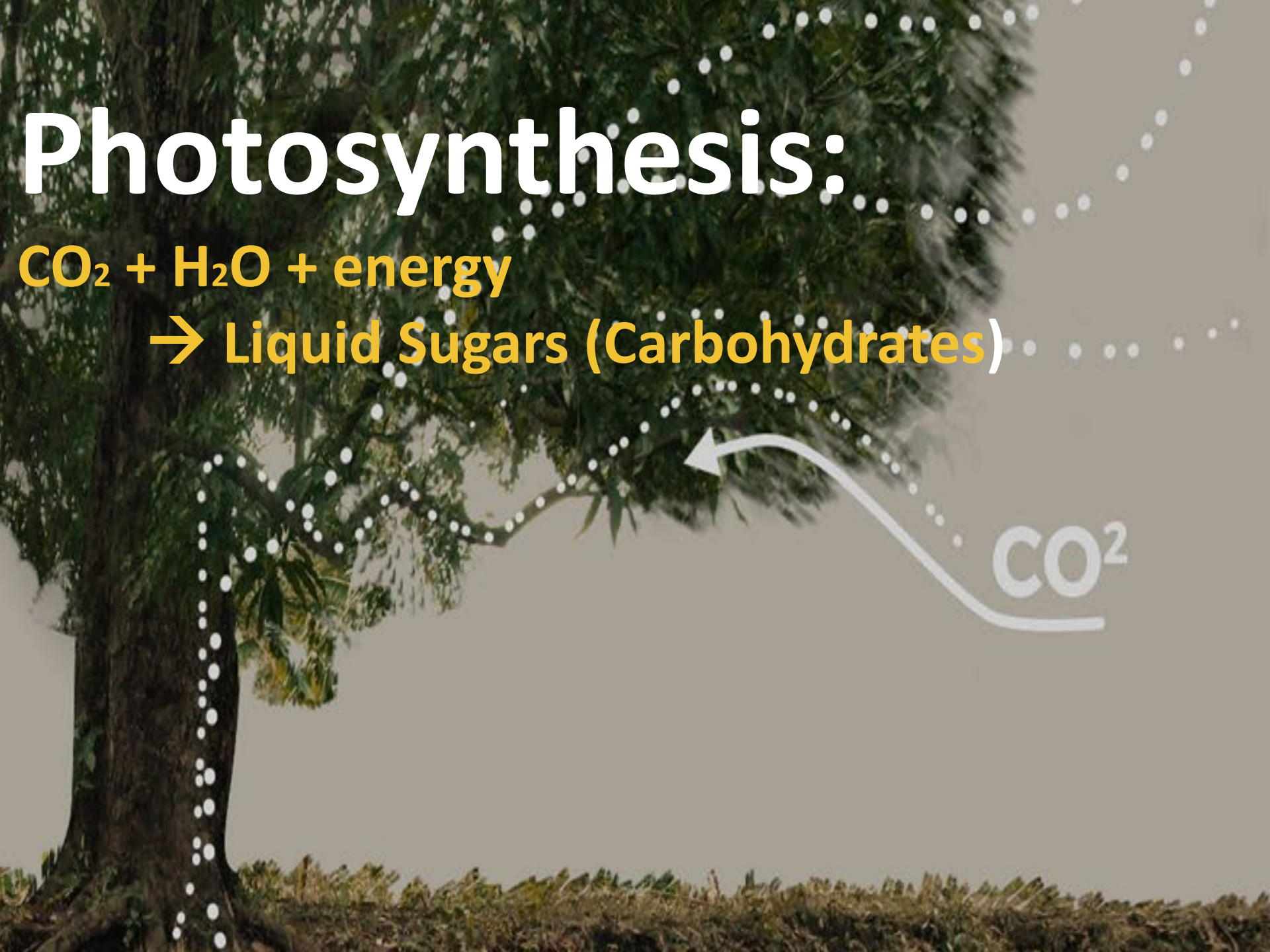
Where Do Plants Come From?


Plants Are Built
From Thin Air
CO2

Photosynthesis:

$CO_2 + H_2O + energy$

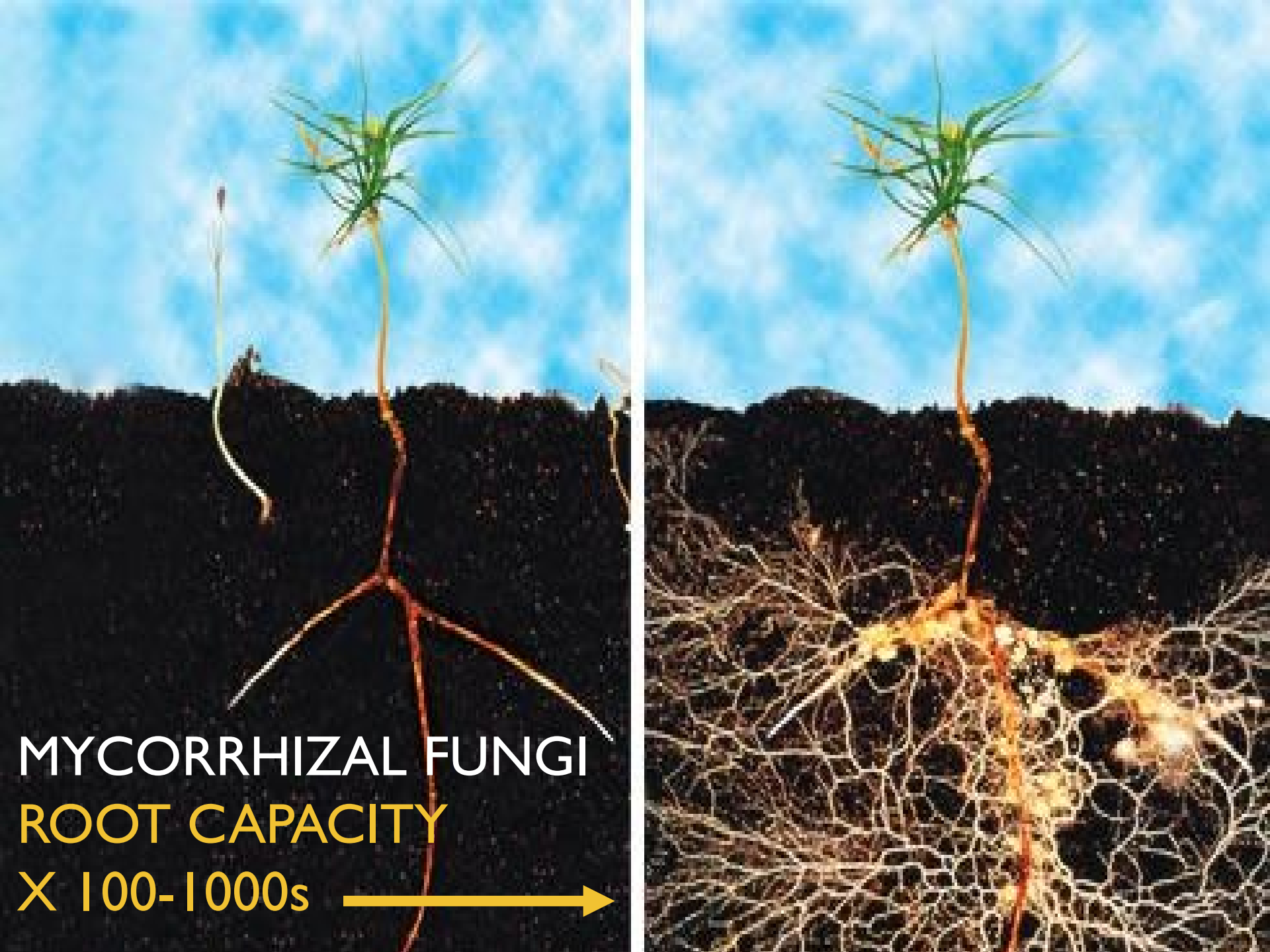
→ Liquid Sugars (Carbohydrates)



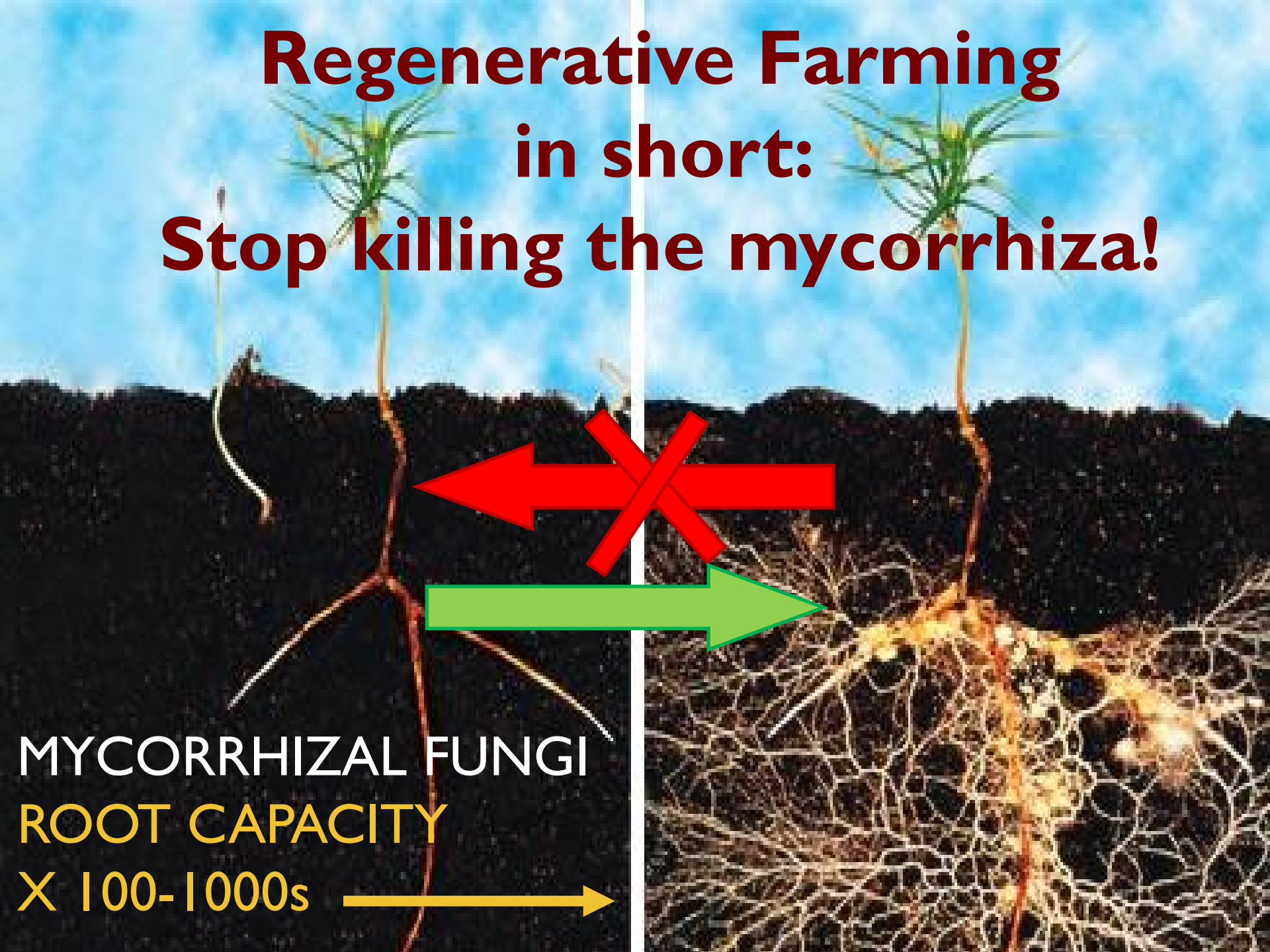

CO2
CO2
Healthy Soil Is
Also Built
From Thin Air!

Documentary:
Kiss The Ground (Netflix)


THE BIG EXCHANGE
Carbohydrates for
Minerals & Water

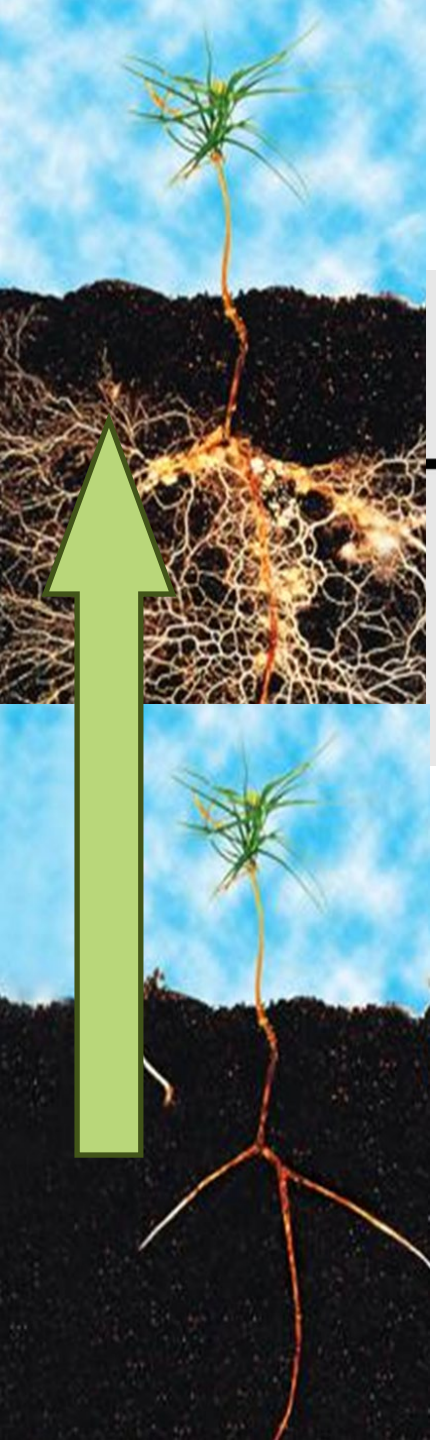

MYCORRHIZAL FUNGI
ROOT CAPACITY
X 100-1000s

Regenerative Farming in short: Stop killing the mycorrhiza!

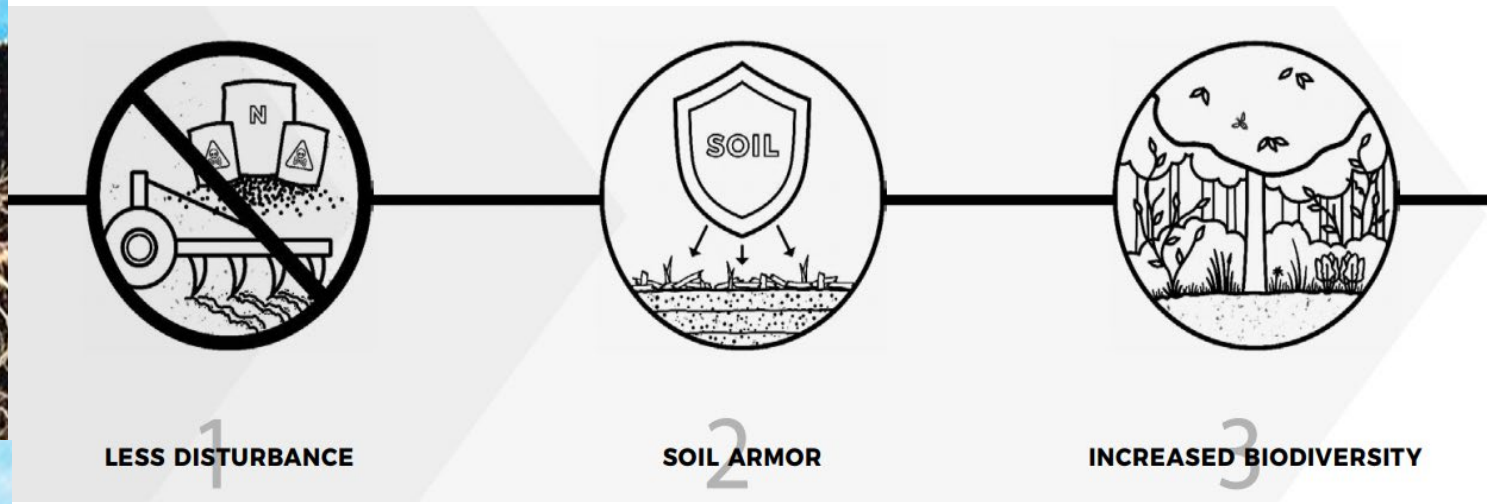


Destroying mycorrhiza

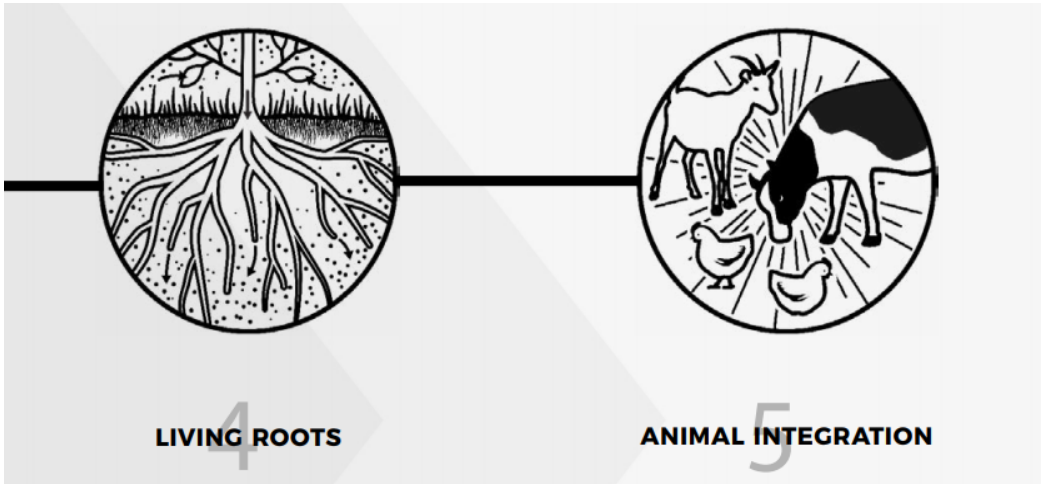
Driver	Pathway
Fallow field	starvation
Ploughing & cultivation	physical shredding
Fungicides	chemical extermination
Fertilizers (esp. phosphate)	biological inhibition → starvation



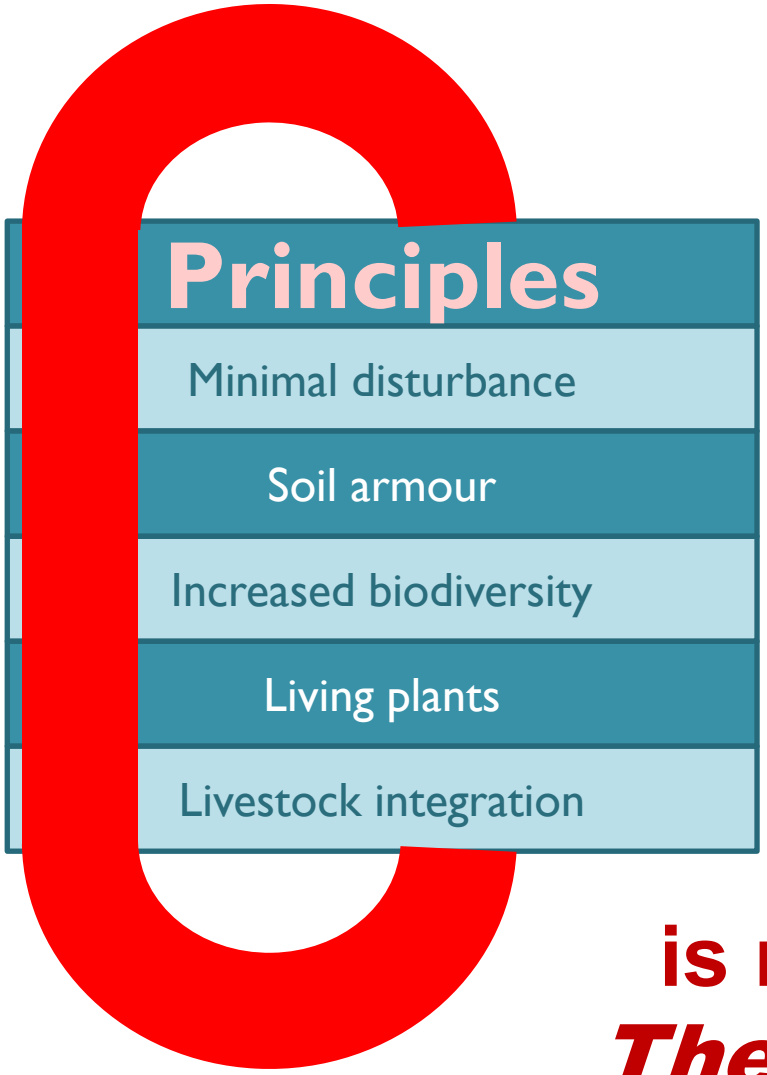
Managing for living mycorrhiza



5 principles for regeneration



Regenerative Agriculture



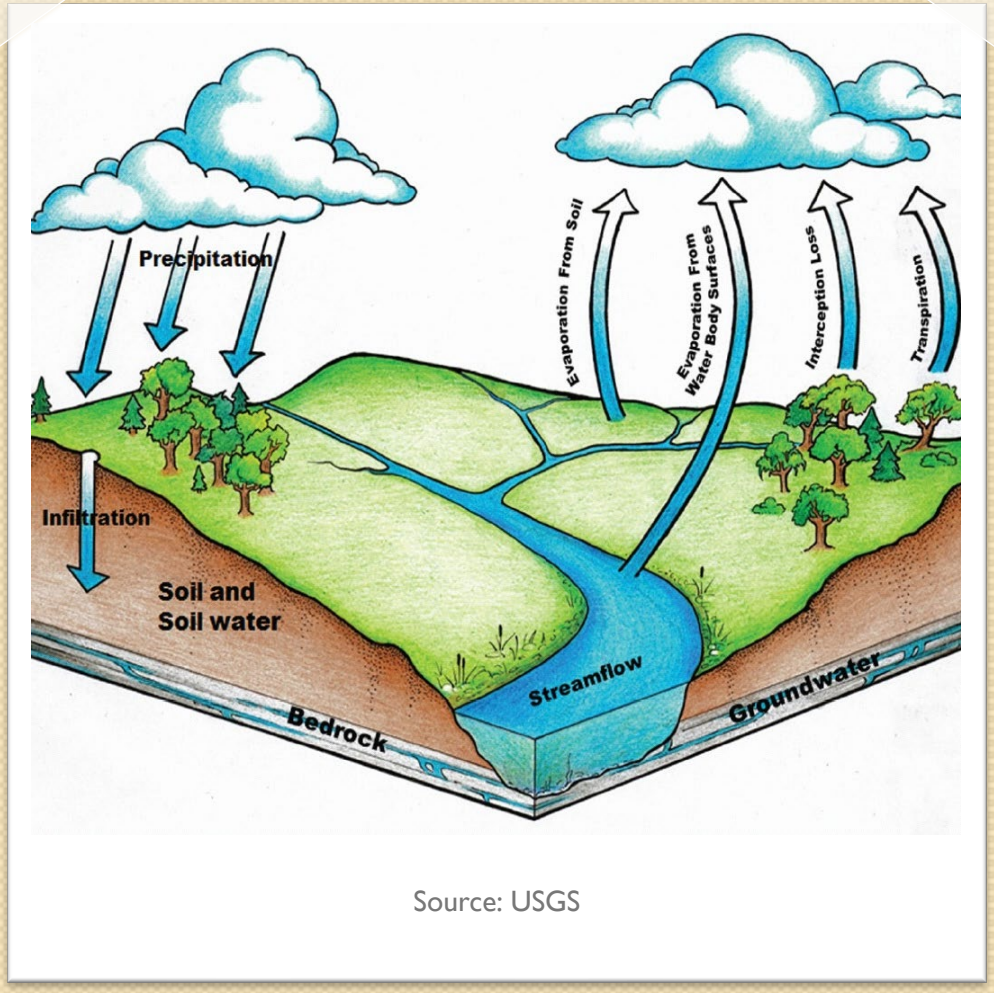
Management
ties principles together

- Context considerations
- Knowledge & skills
- Farm priorities
- Actions: Tools & practices
- Outcome monitoring

Regeneration
is not a best practice.
There's no blue-print!

SUMMARY

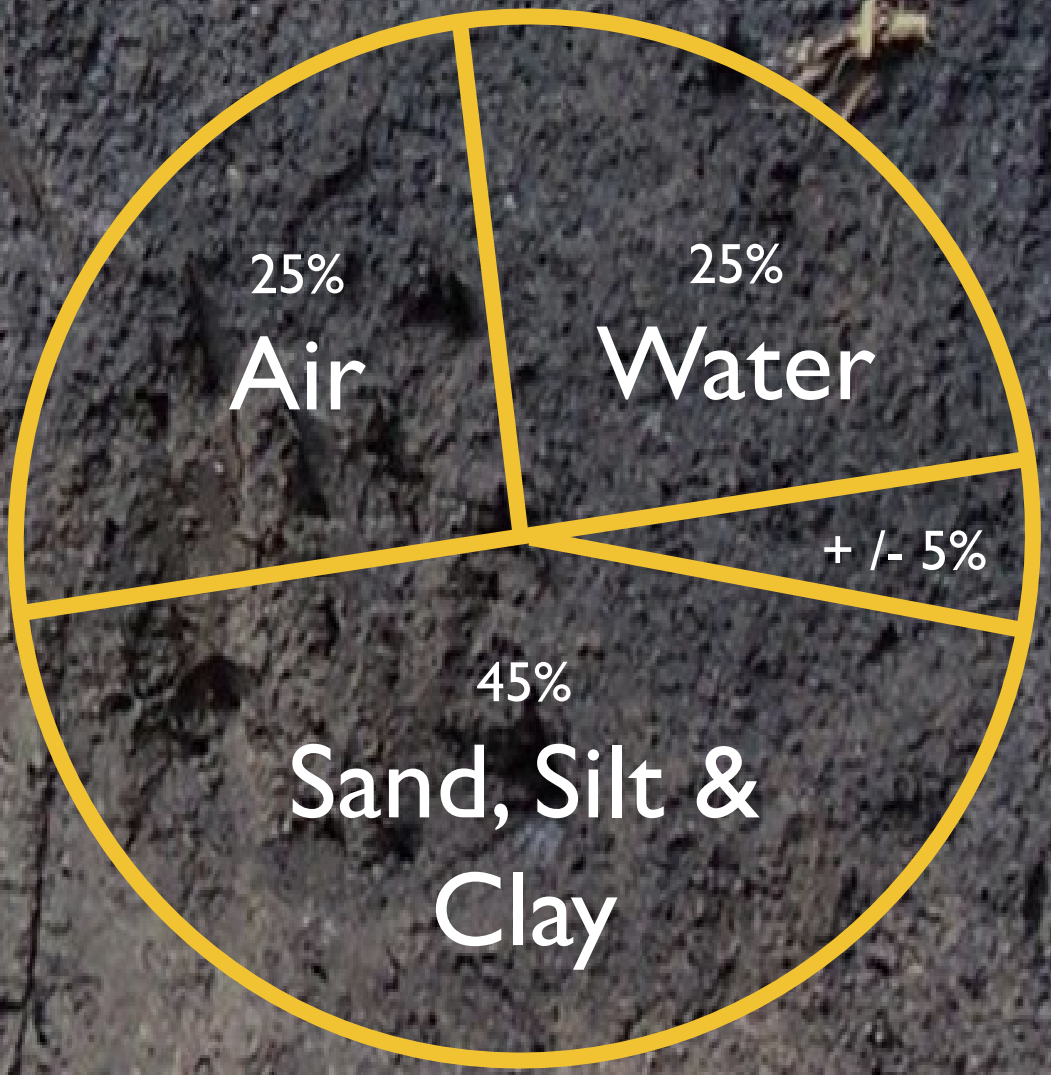
- In Regenerative Agriculture, plants grow in **living, mycorrhizal soils**
- Regenerative Farmers recognize soil as a **complex living system**
- Regenerative Farming is a **management style** that fosters living, mycorrhizal soils.
- **Principles, context & priorities** determine practices.



Source: USGS

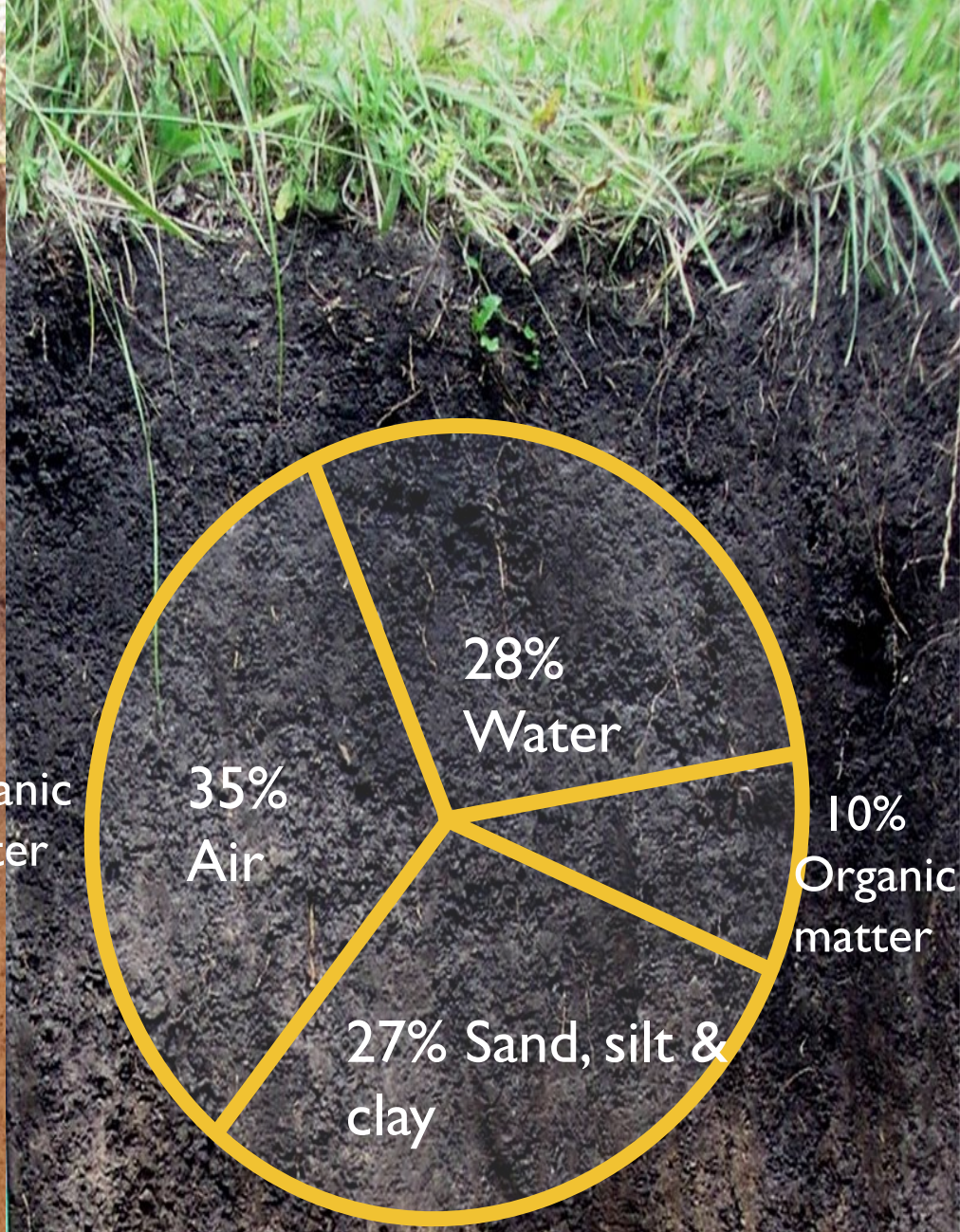
Soil health & Watershed functions

TYPICAL SOIL

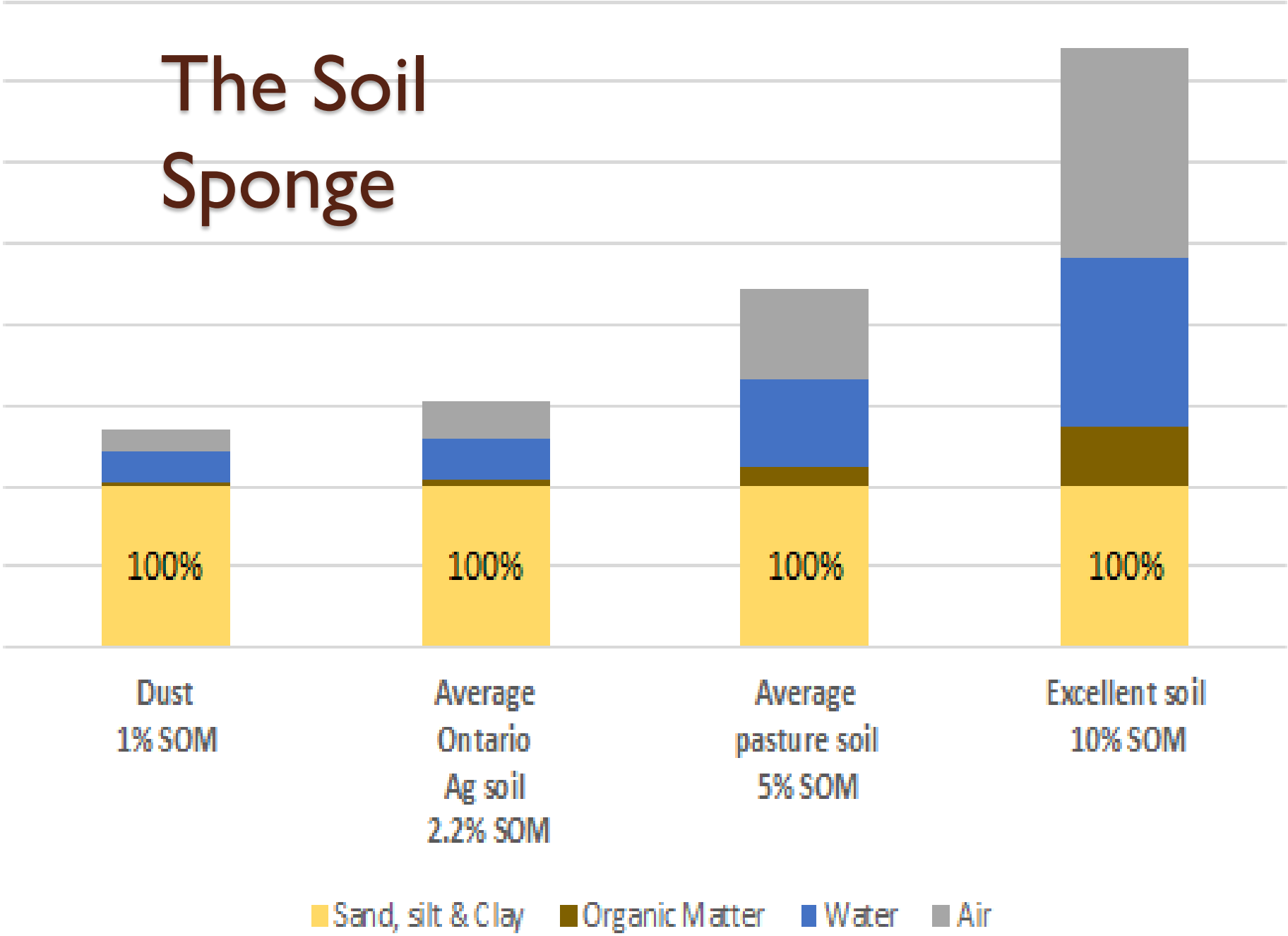


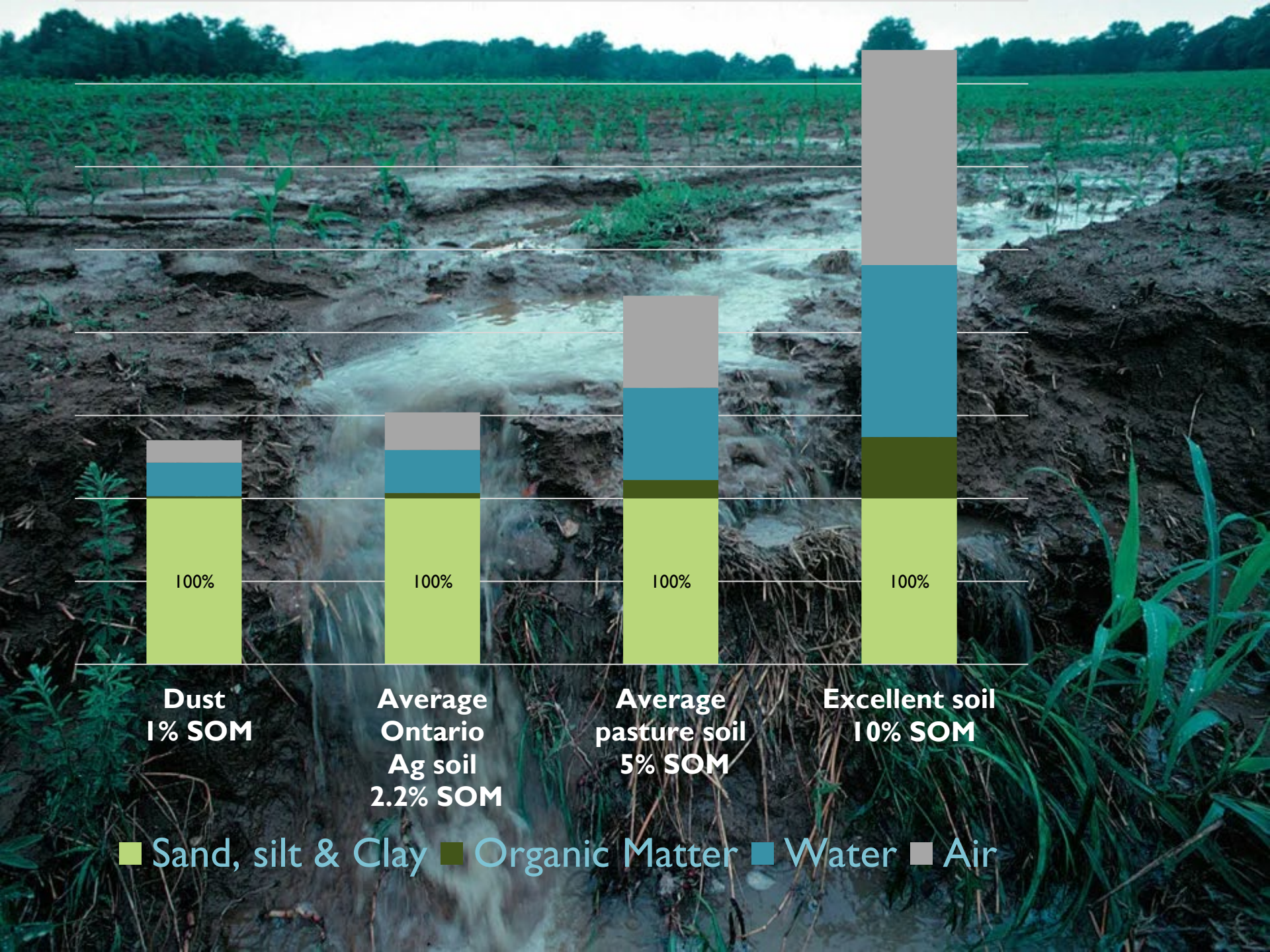

What happens if
Soil Organic Matter
CHANGES?


10%
Air
15%
Water
1%
Organic
Matter
74% Sand, silt &
clay


28%
Water
35%
Air
10%
Organic
matter
27% Sand, silt &
clay

The Soil Sponge



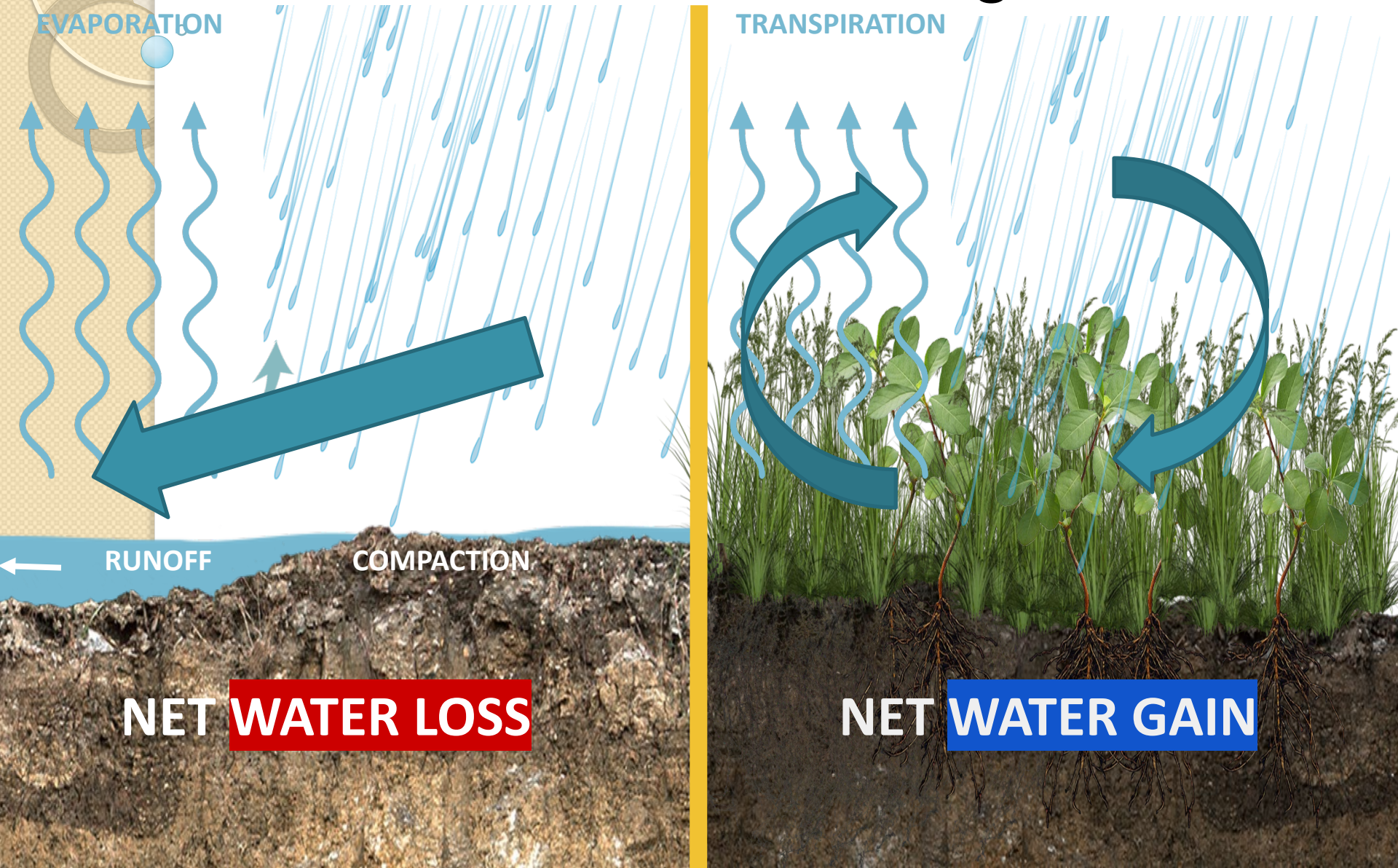

100%
100%
100%
100%
Dust
1% SOM
Average
Ontario
Ag soil
2.2% SOM
Average
pasture soil
5% SOM
Excellent soil
10% SOM
Sand, silt & Clay
Organic Matter
Water
Air

WHAT ½ INCH/HOUR INFILTRATION LOOKS LIKE

What happens when rain hits soil?

Source: Didi Pershouse: Soil Health and Watershed Function

Two meals, two landscapes, two soils … And two watershed regimes



Soil Health & Climate Resilience

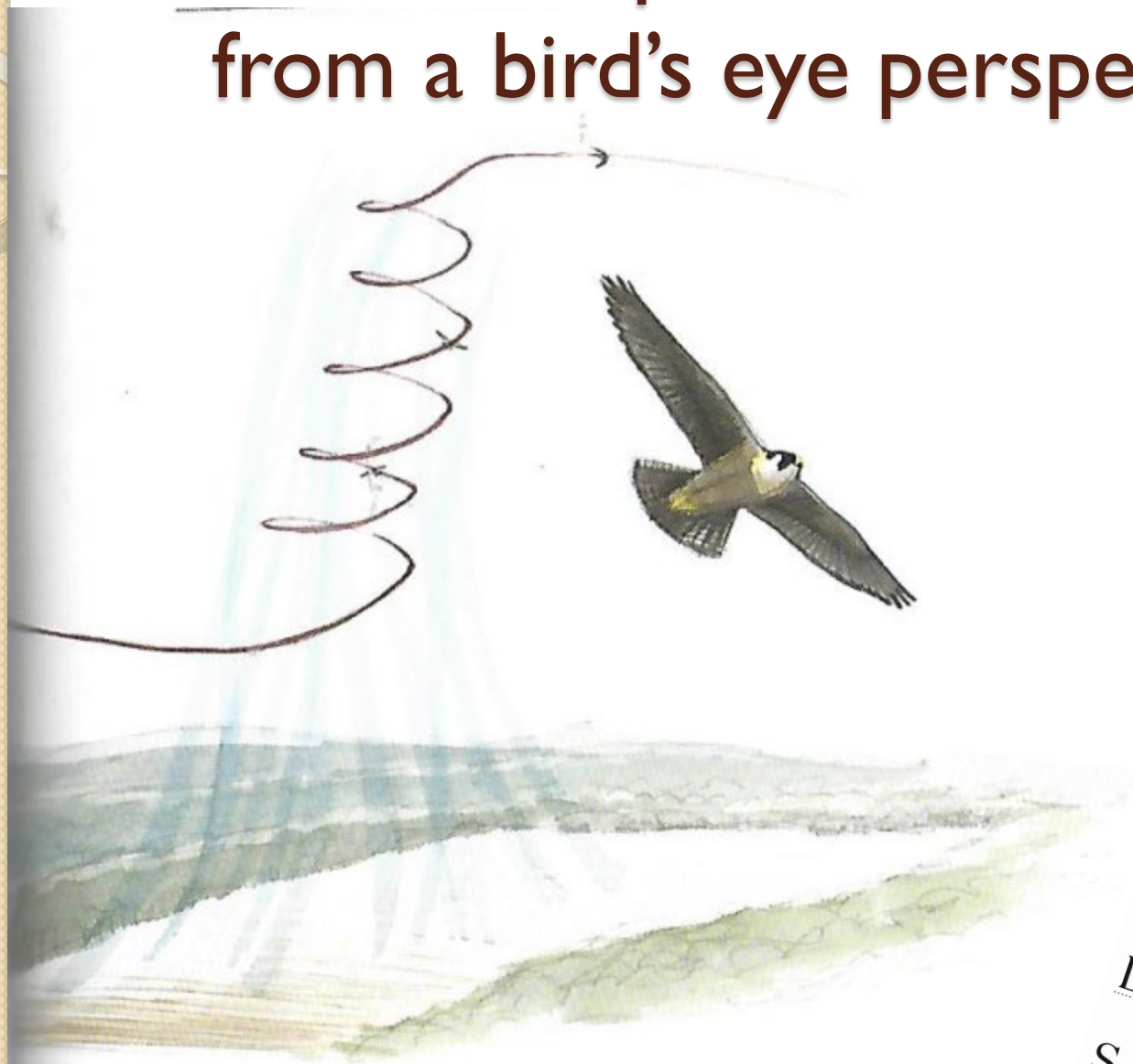
TWO HUMAN DRIVERS OF CLIMATE CHANGE

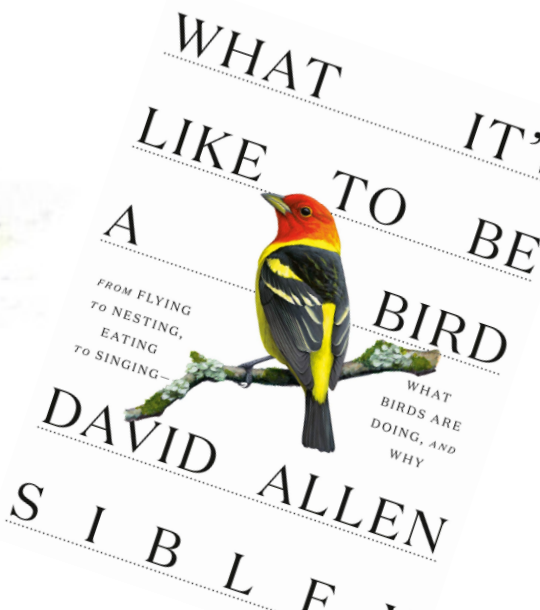
1. **Greenhouse effect & global warming**
   → **Mitigation & Adaptation !!!**

2. **Biosphere self regulation of climates**
   → **Regeneration, Resilience**

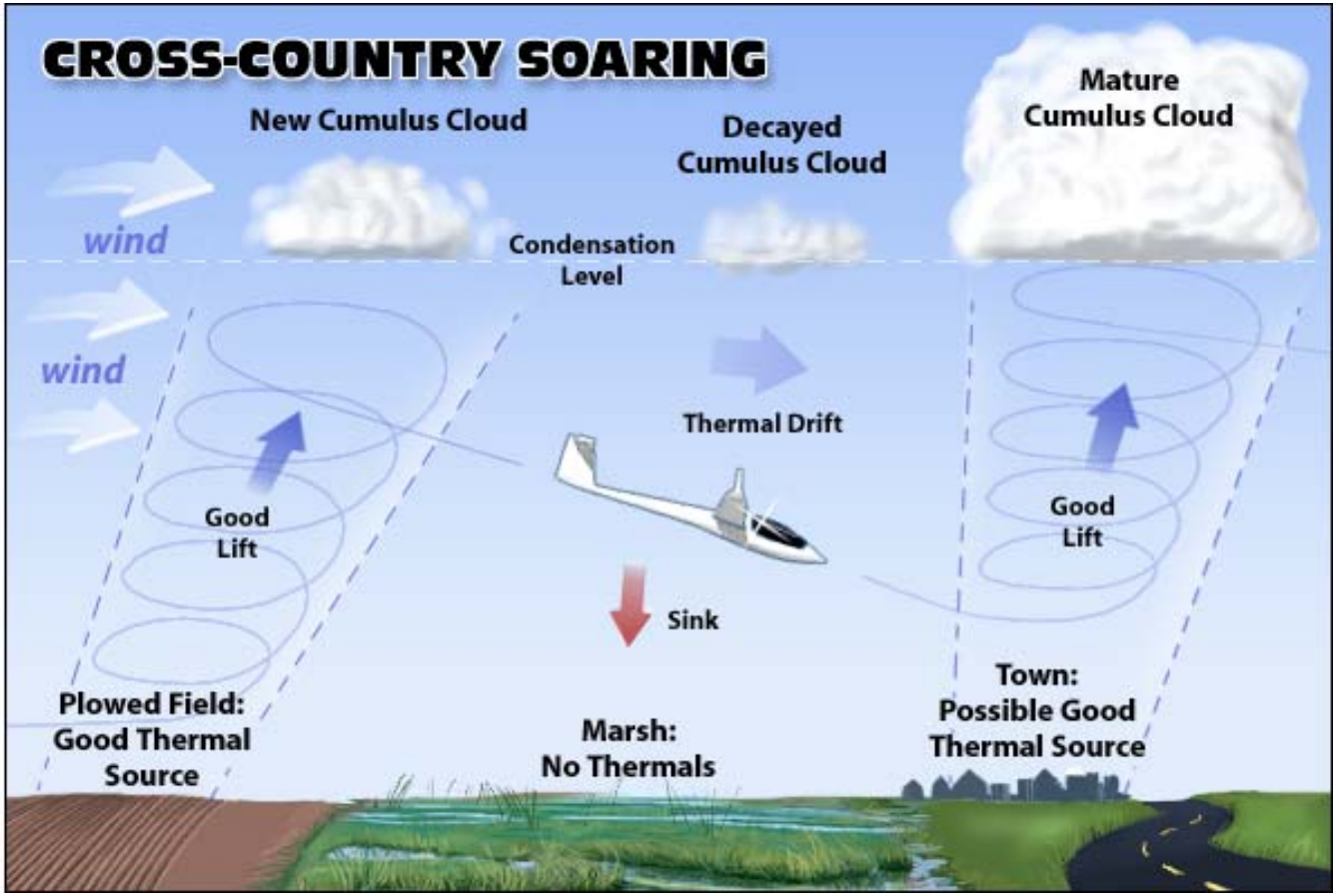

KISS
the
GROUND
MAGGIE EILEEN

Biosphere climate from a bird's eye perspective…





Biosphere climate from a pilot's perspective…



https://www.ssa.org/GliderLiftSources

2005 – several fields

2020 – same view, one field.

What does land use change mean for the local climate?


12/2016
Brampton
Toronto
Kitchener
Hamilton
St Catharines
Sarnia
London
Buffalo
Troy
Lake St Clair
Chatham-Kent
Detroit
Image Landsat / Copernicus
Erie
Lake Erie
Imagery Date: 12/30/2016 42°11'04.60" N 79°22'18.46" W elev

We can all do something for improving our landscape's watershed & climate functions

TWO CAUSES OF CLIMATE CHANGE

1. Greenhouse effect → Mitigation & Adaptation !!!

- Fossil fuel emissions
- Biosphere carbon emissions and sequestration
- Global Warming … 2 to 3 W/m2 everywhere on the globe

2. Biosphere self regulation of climates → Regeneration, Resilience

- Soil sponge & watershed functions
- The terrestrial (small) water cycle & microclimates
- Hydrological Cooling up to 1000 W/m2 locally

Putting Regenerative Agriculture for resilient landscapes in practice

OUR POLICY OPTIONS

… How could humankind remove carbon dioxide from atmosphere & oceans?

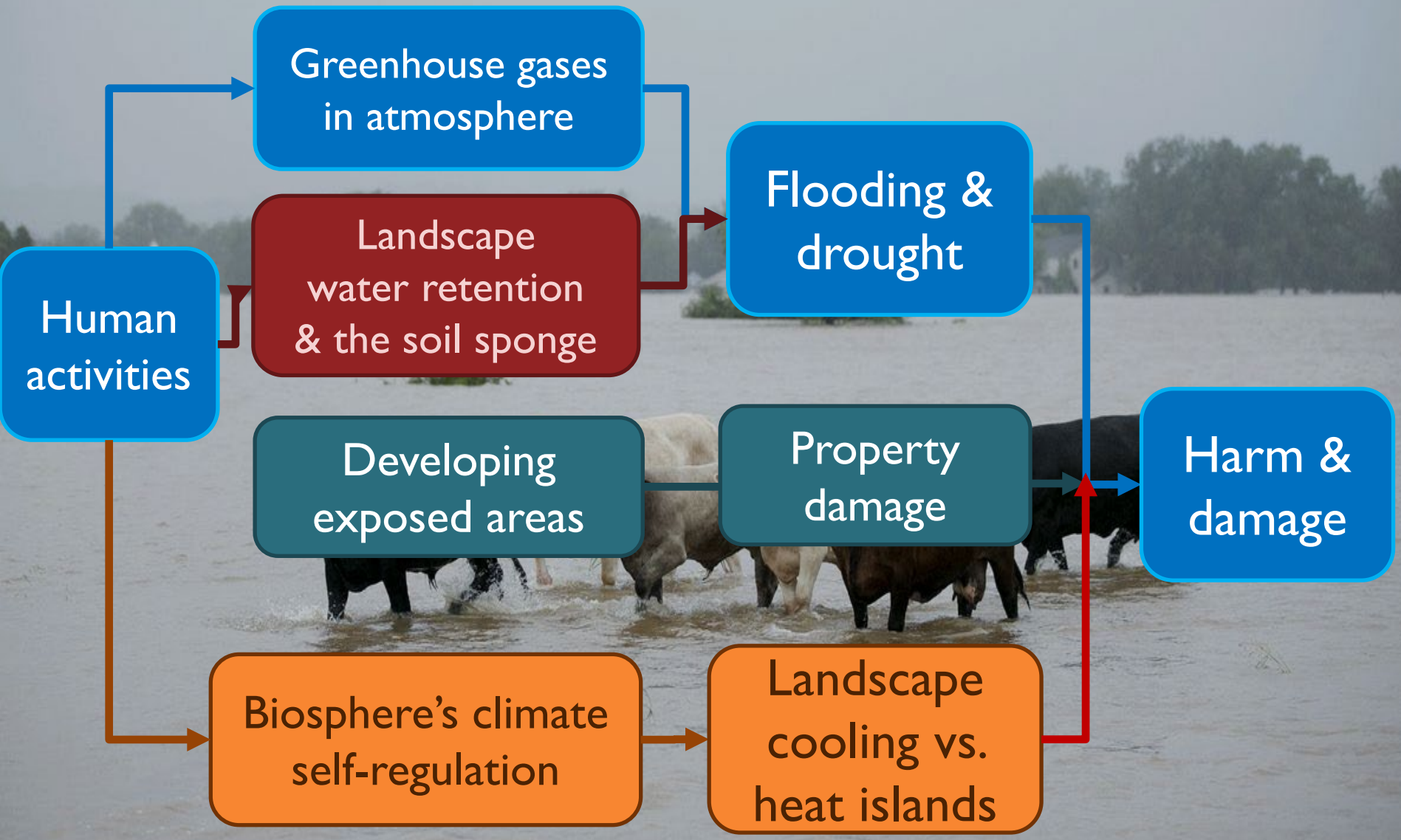
Elon Musk's $100 million prize

Geoengineering technology

A machine that uses renewable energy
&
removes carbon dioxide from the atmosphere
&
puts it into the ground.


Geoengineering
Years of development ….
About 500 Million, approximately …

Multiple leverage points for addressing climate change



THANK YOU!

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Part II:

Whole system management & policy making for landscape regeneration