

# SOIL AGGREGATES AND HUMUS SYSTEMS

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**ESSC 2016**  
European Society for Soil Conservation CONFERENCE  
Cluj-Napoca • Romania • June 15-18



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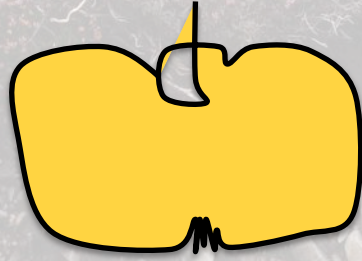


Romanic aggregates

SOIL IS a great  
DIGESTIVE system  
in EVOLUTION

an ECOSYSTEM  
structured in  
AGGREGATES

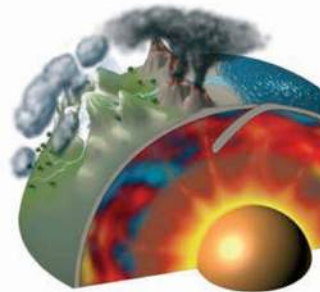
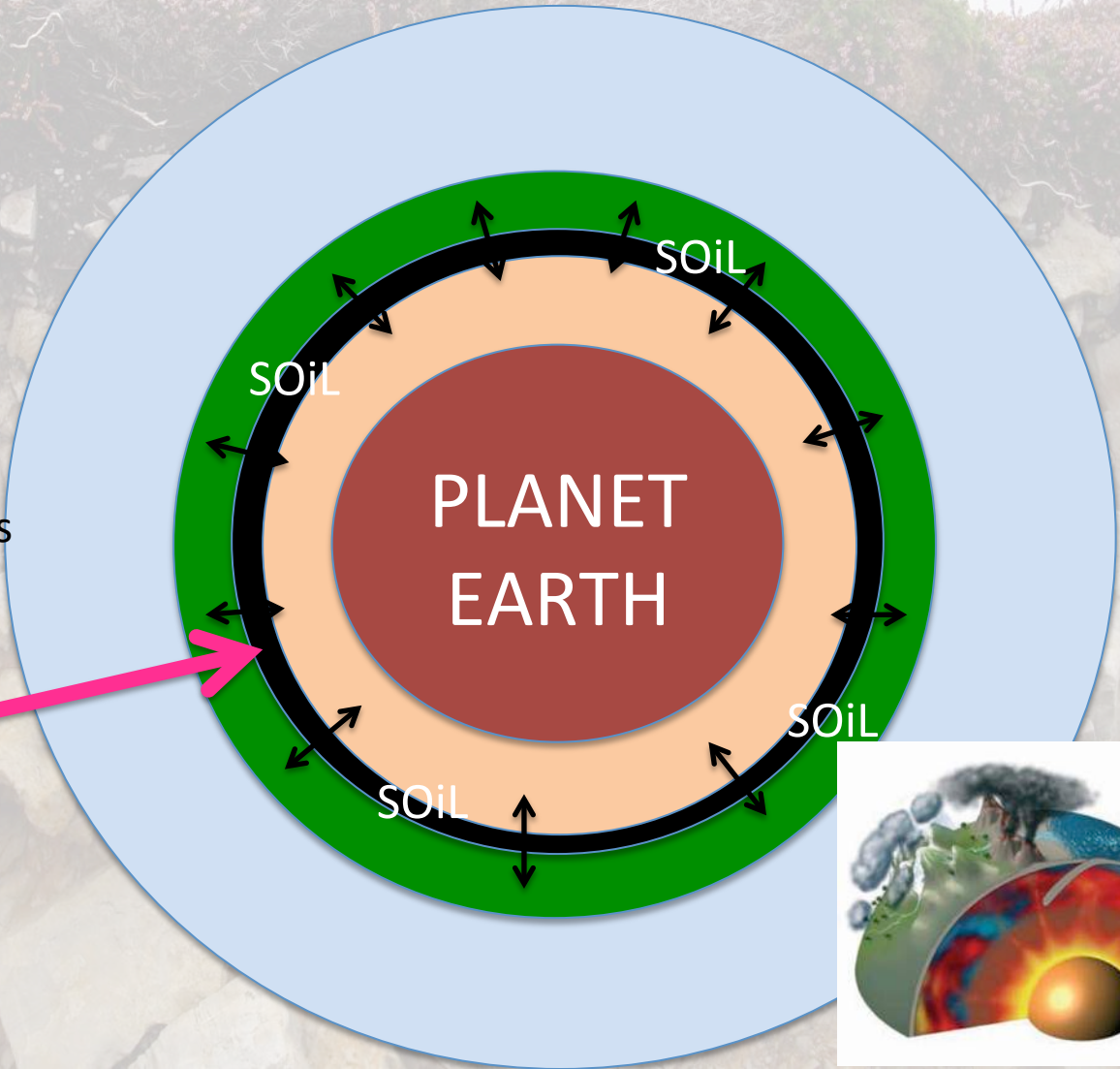
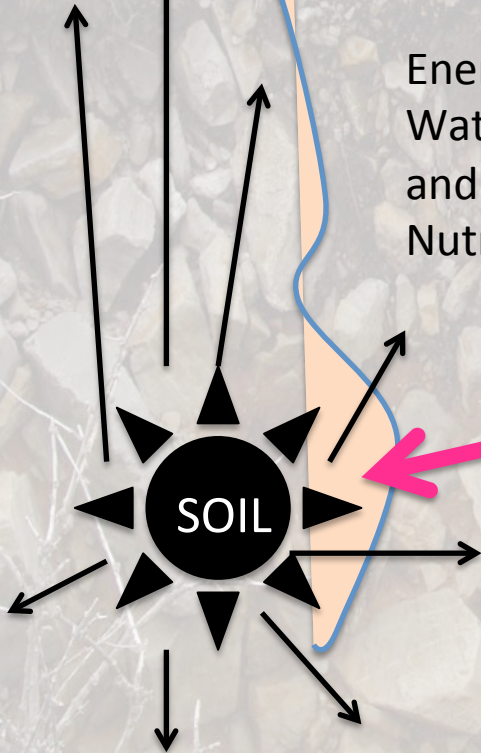
AGGREGATES  
are mandatory for  
sustainable  
AGRICULTURE

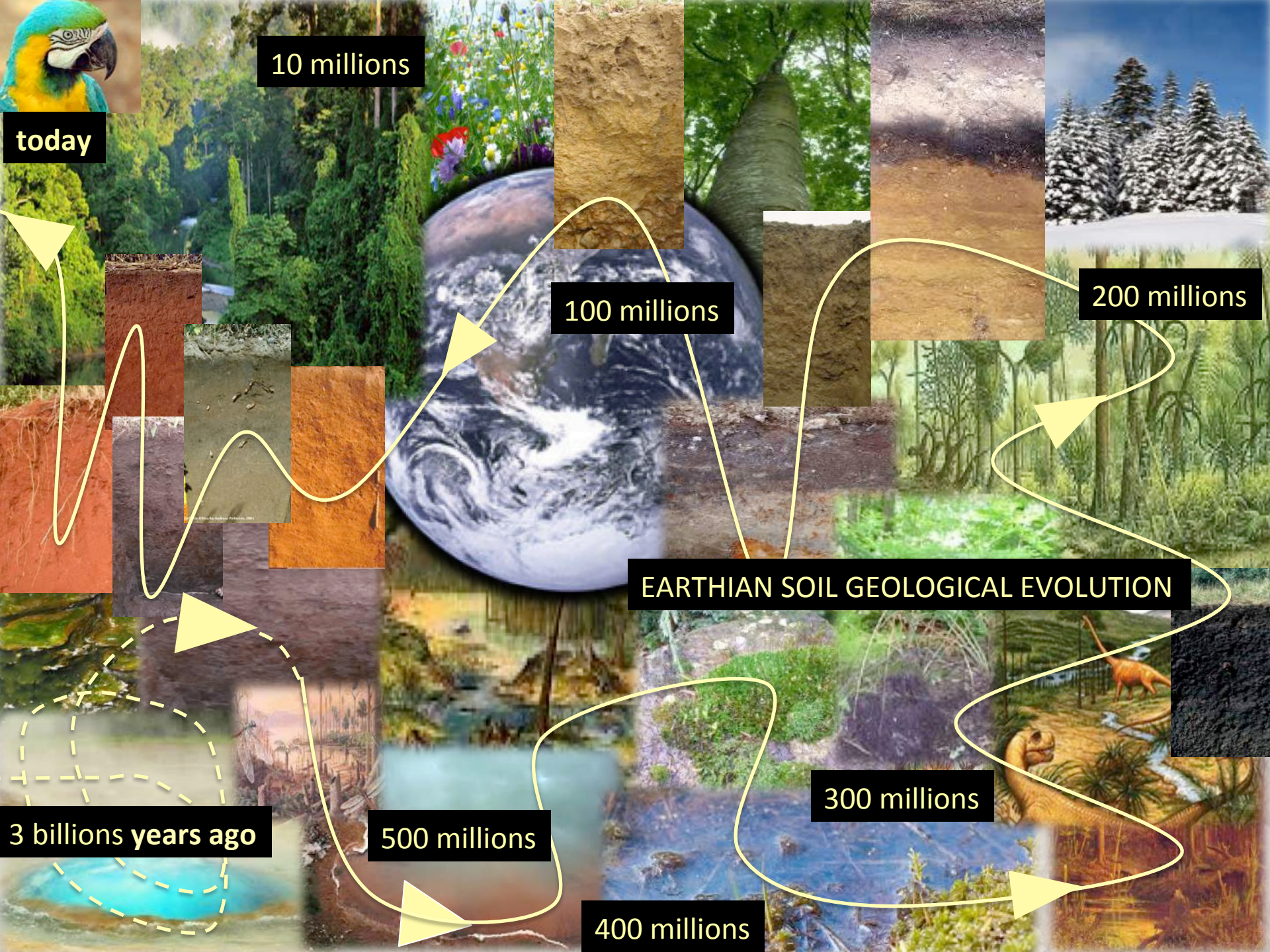


What's soil?

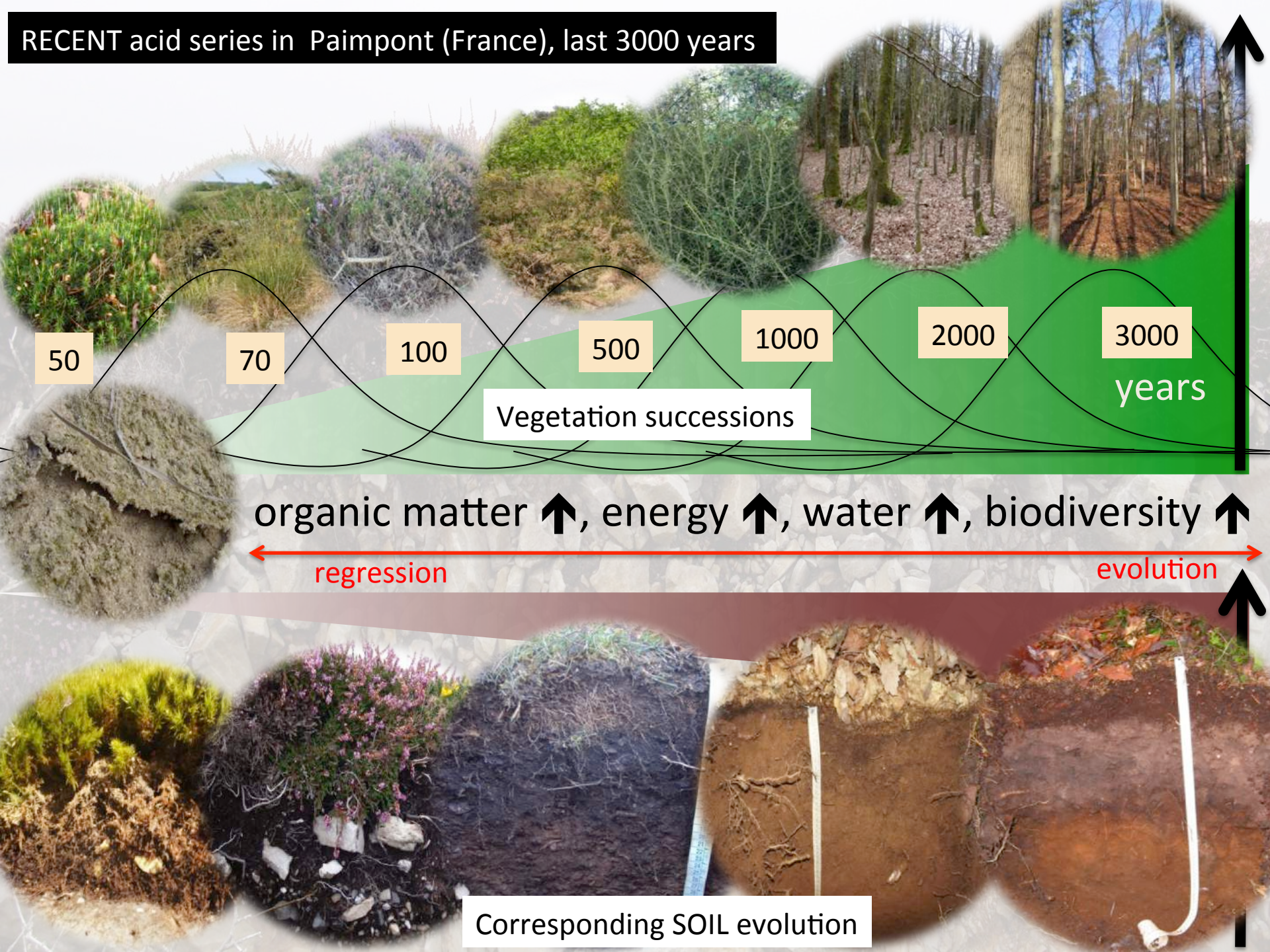


Energy  
Water  
and  
Nutrients





# RECENT acid series in Paimpont (France), last 3000 years



50

70

100

500

1000

2000

3000

years

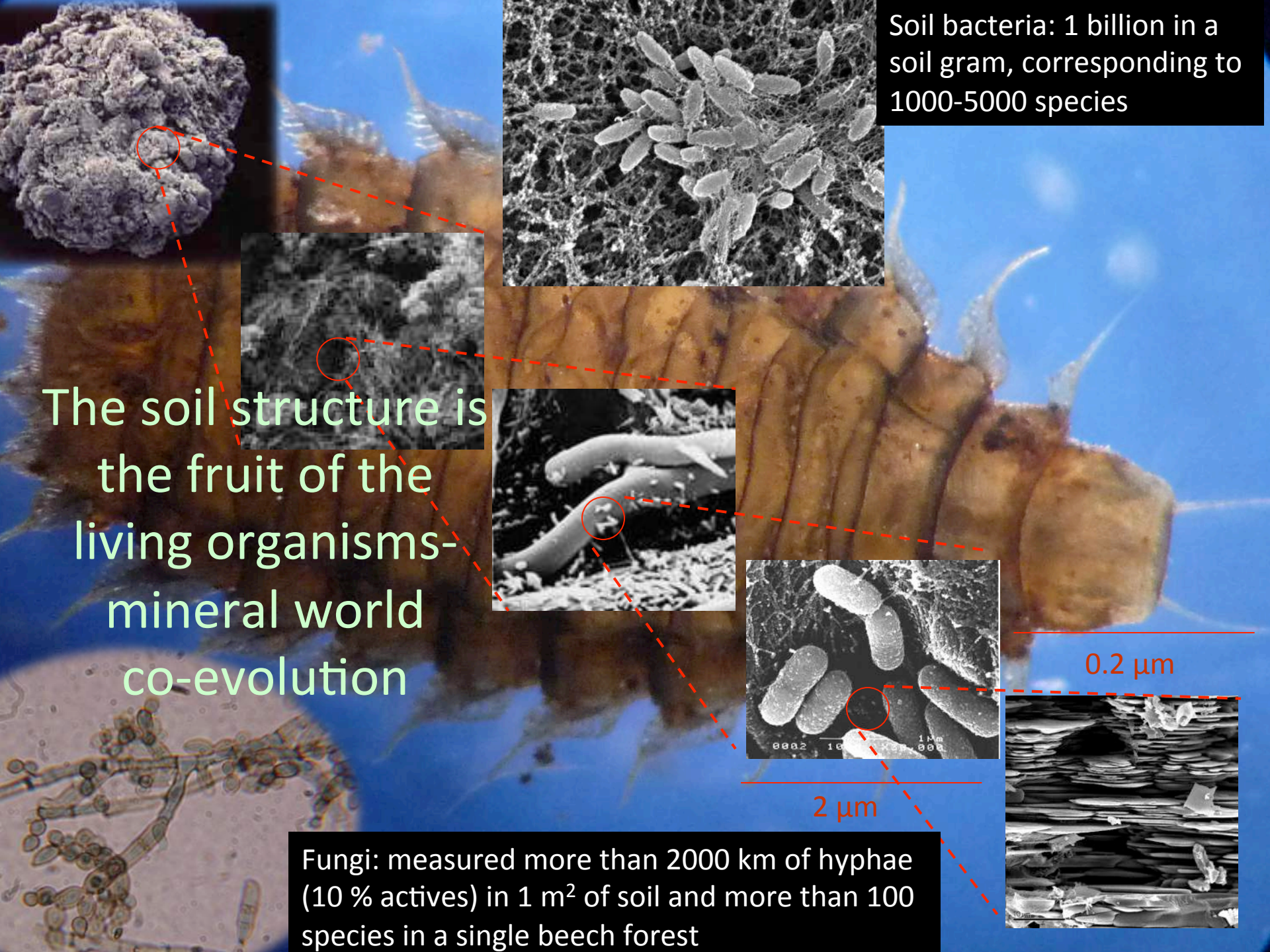
Vegetation successions

organic matter ↑, energy ↑, water ↑, biodiversity ↑

regression

evolution

Corresponding SOIL evolution



Soil bacteria: 1 billion in a soil gram, corresponding to 1000-5000 species

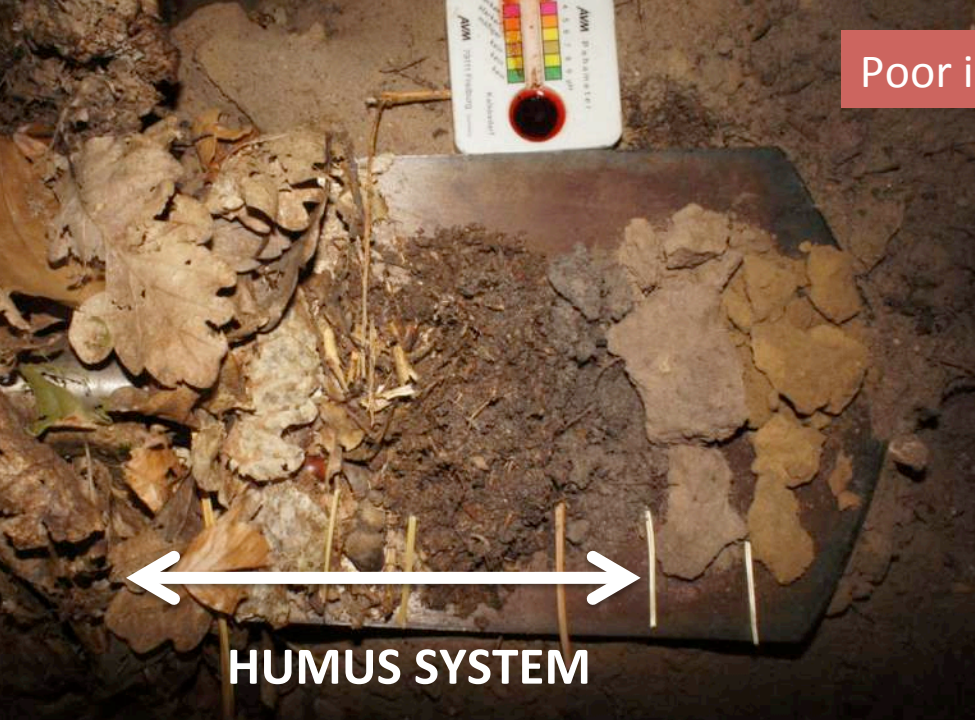
The soil structure is the fruit of the living organisms-mineral world co-evolution

Fungi: measured more than 2000 km of hyphae (10 % actives) in 1 m<sup>2</sup> of soil and more than 100 species in a single beech forest

0.2 μm

2 μm

1 μm



Poor in bases soils



digestive systems



Rich in bases soils



*Deciduous forest*



*Coniferous forest*



*Mediterranean forest*



OL



OF



OH



maA



miA



meA



TANGEL

# European forest humus systems

MOR

AMPHI

MULL

MODER

Periodically DRY climate and base-rich parent material

COLD climate and base-poor parent material

TEMPERATE and NEUTRAL

Organic RESTS

zoOF

zoOH

CaCO<sub>3</sub>

OH

meA

BioMESO

Organic RESTS

ORGANO-MINERAL AGGREGATES

nOL

maA

BioMACRO

miA

OH

E

BioMICRO

Organic RESTS

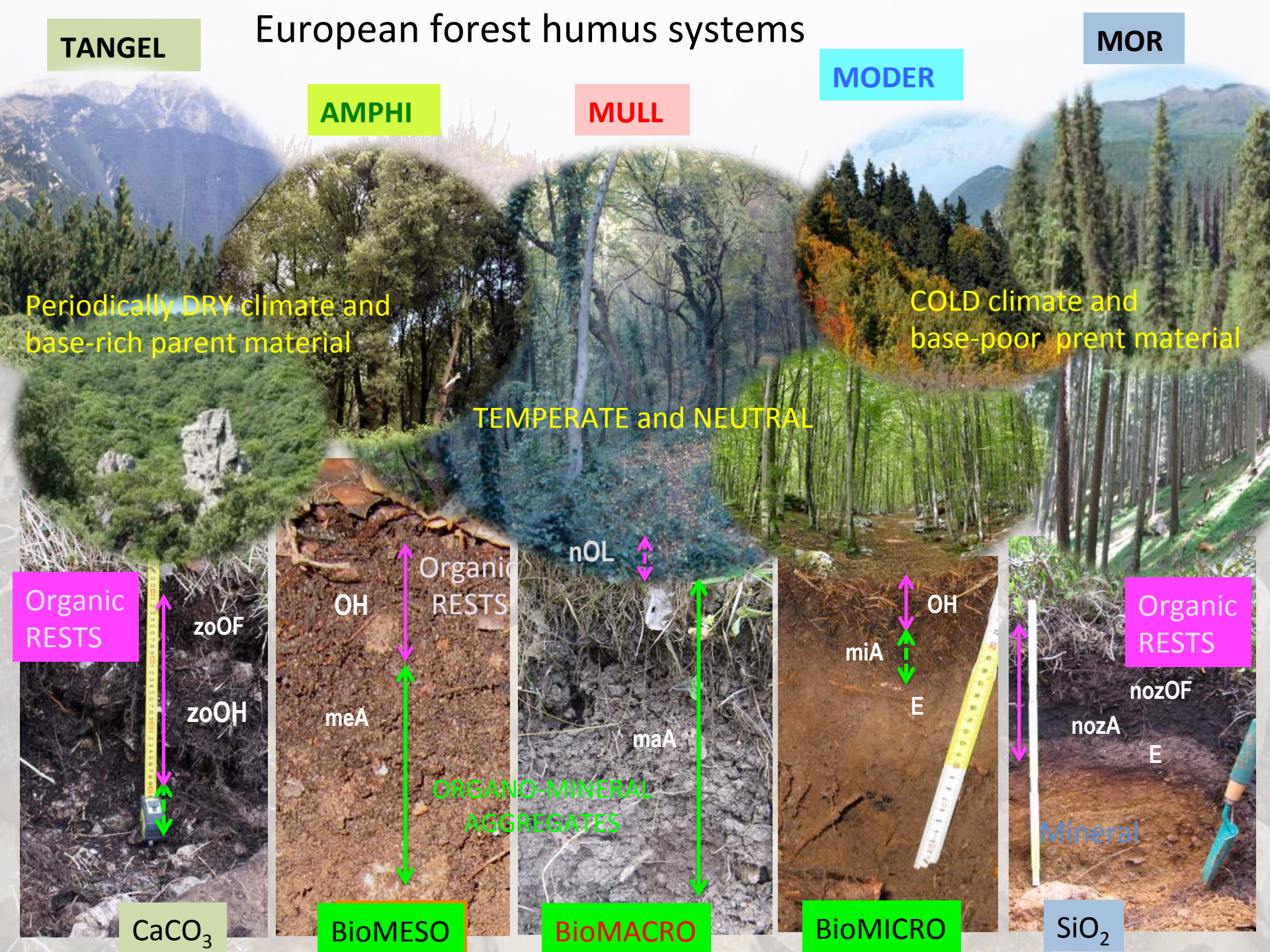
nozOF

nozA

E

Mineral

SiO<sub>2</sub>



TANGEL

AMPHI

MULL

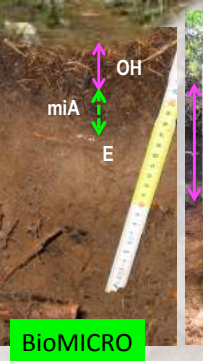
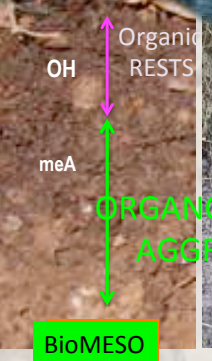
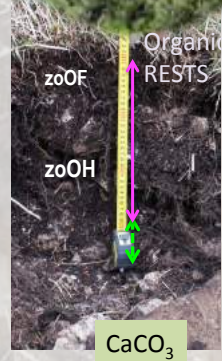
MODER

MOR

Periodically DRY climate and base-rich parent material

COLD climate and base-poor parent material

TEMPERATE and NEUTRAL



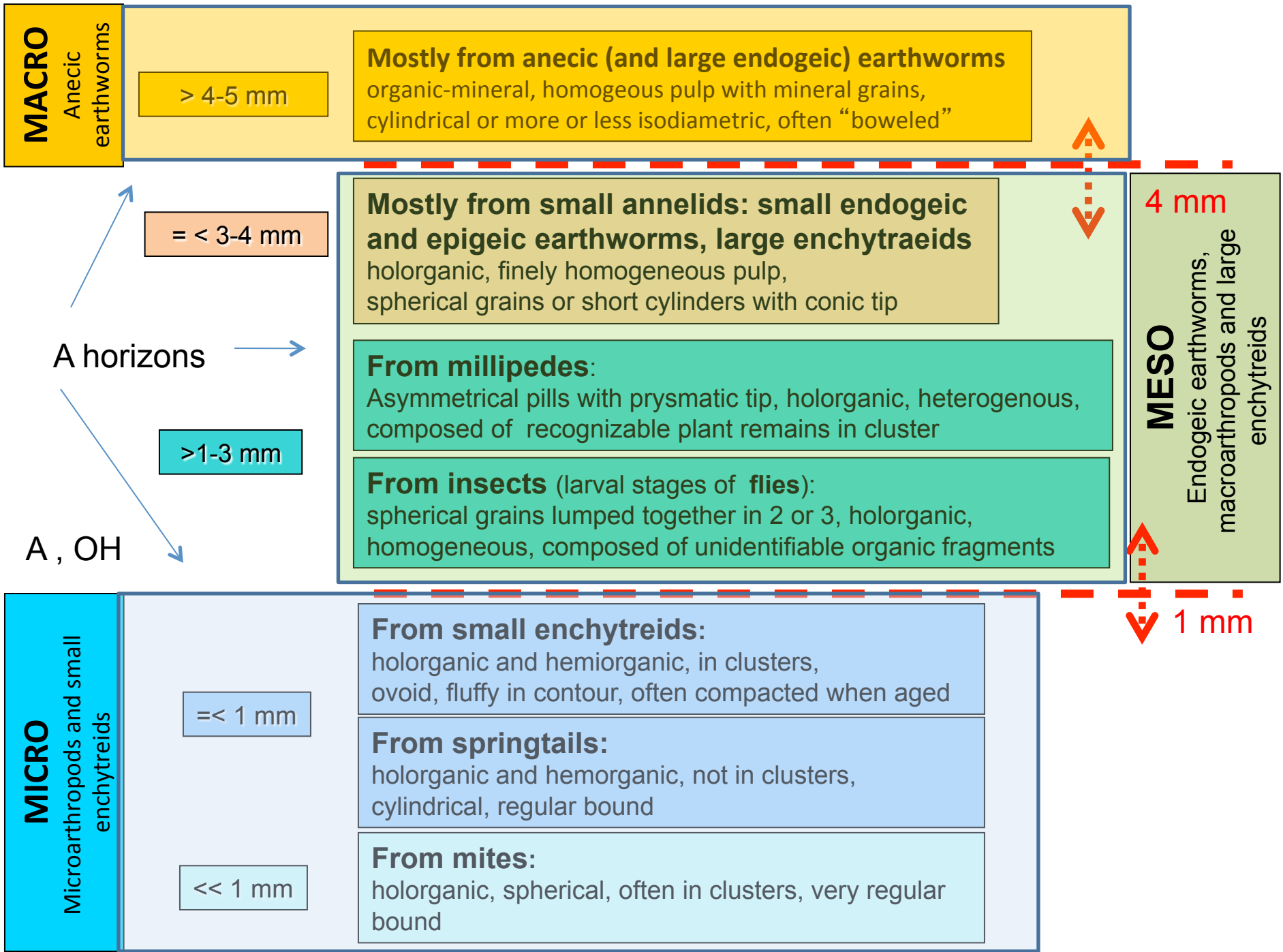
ORGANO-MINERAL AGGREGATES

Few to many years

LITTER disappears in less than 1 year

Few to many years





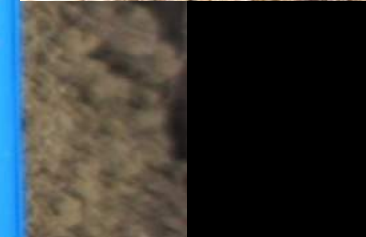


other possible micropeds

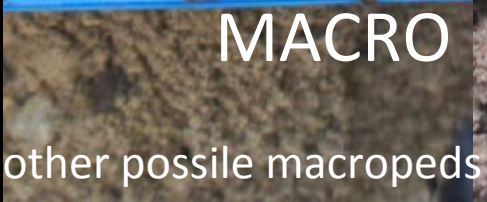


Temperate conditions

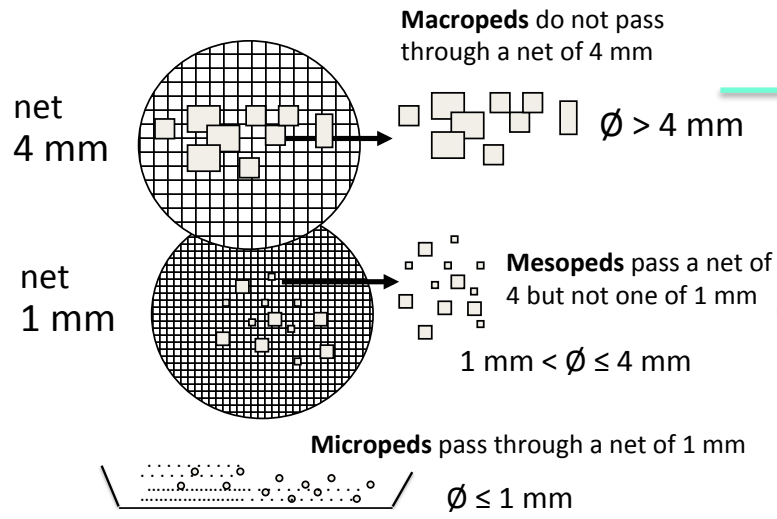
MICRO



A common natural  
A HORIZON



each HORIZON can be decomposed in

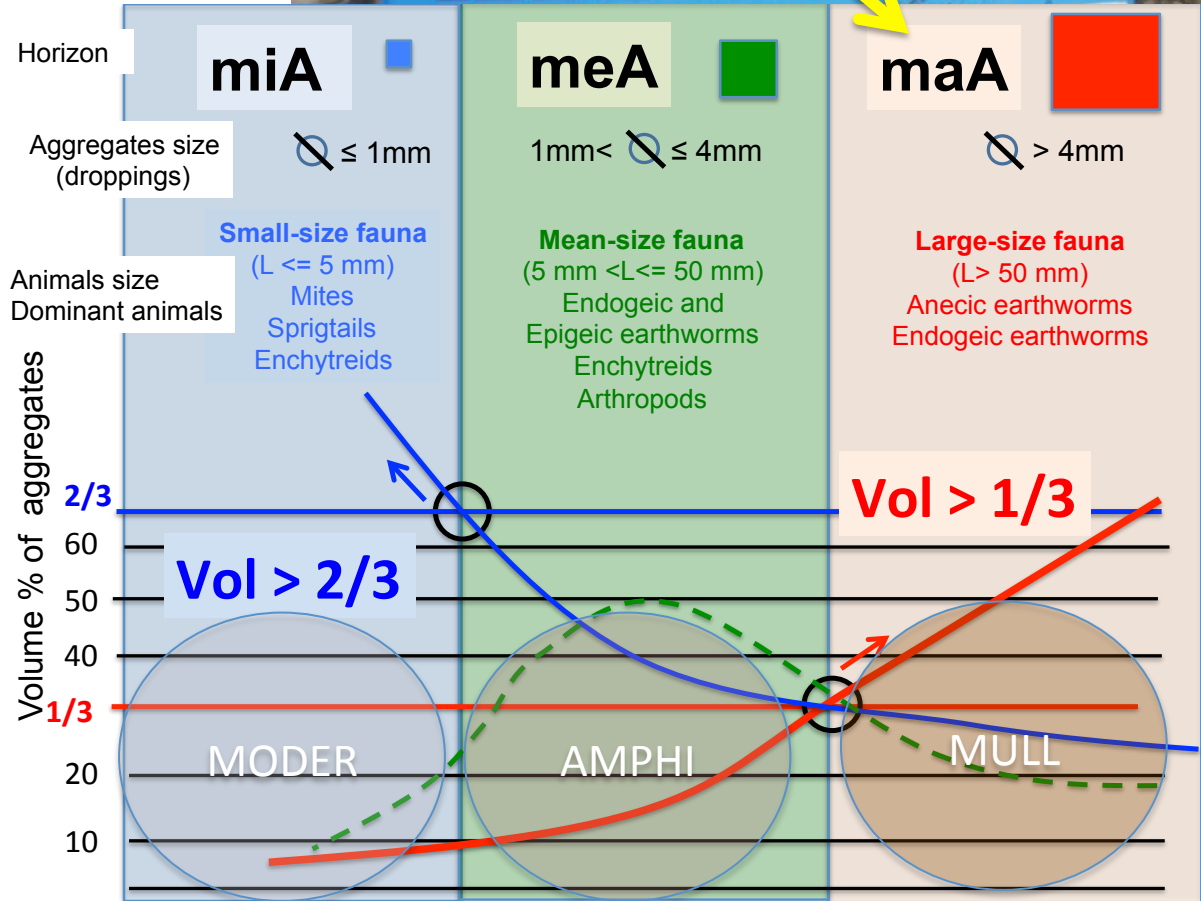


ORGANIC-MINERAL structures

ORGANIC structures



Harsh conditions



# ZOOGENIC NATURAL STRUCTURES

MACRO



MESO



MICRO



1 mm<sup>2</sup>

1 mm<sup>2</sup>

1 mm<sup>2</sup>

# AGRO

MASSIVE

1 cm<sup>2</sup>

1 cm<sup>2</sup>

SINGLE GRAINED

# NON ZOOGENIC

1 mm<sup>2</sup>



**GRANULAR, FINE GRANULAR =  
BIOMACROSTRUCTURED MATERIALS**



An old earthworm dropping  
in a POORLY ZOOGENIC soil



anecic



NATURAL  
fresh  
droppings



endogeic

# VERY FINE GRANULAR, BIOMESOSTRUCTURED AND BIOMICROSTRUCTURED MATERIALS

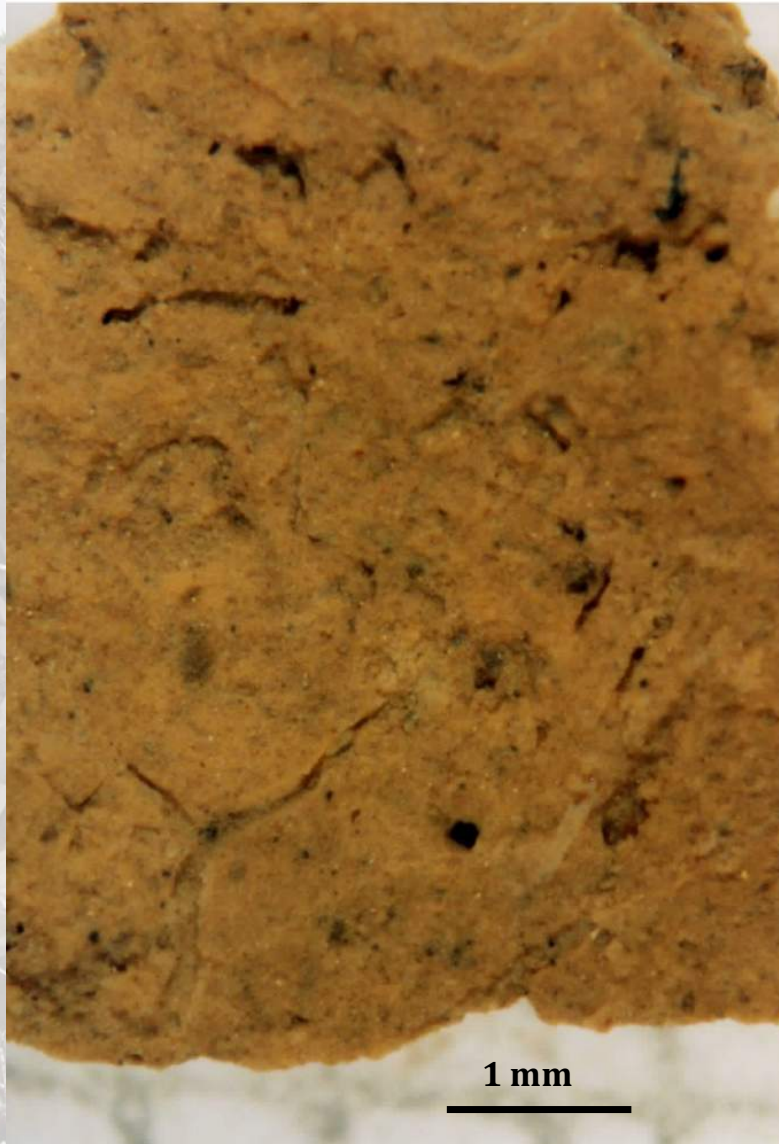




*Soil under anthropic pressure: porosity is limited to some poorly developed root channels*

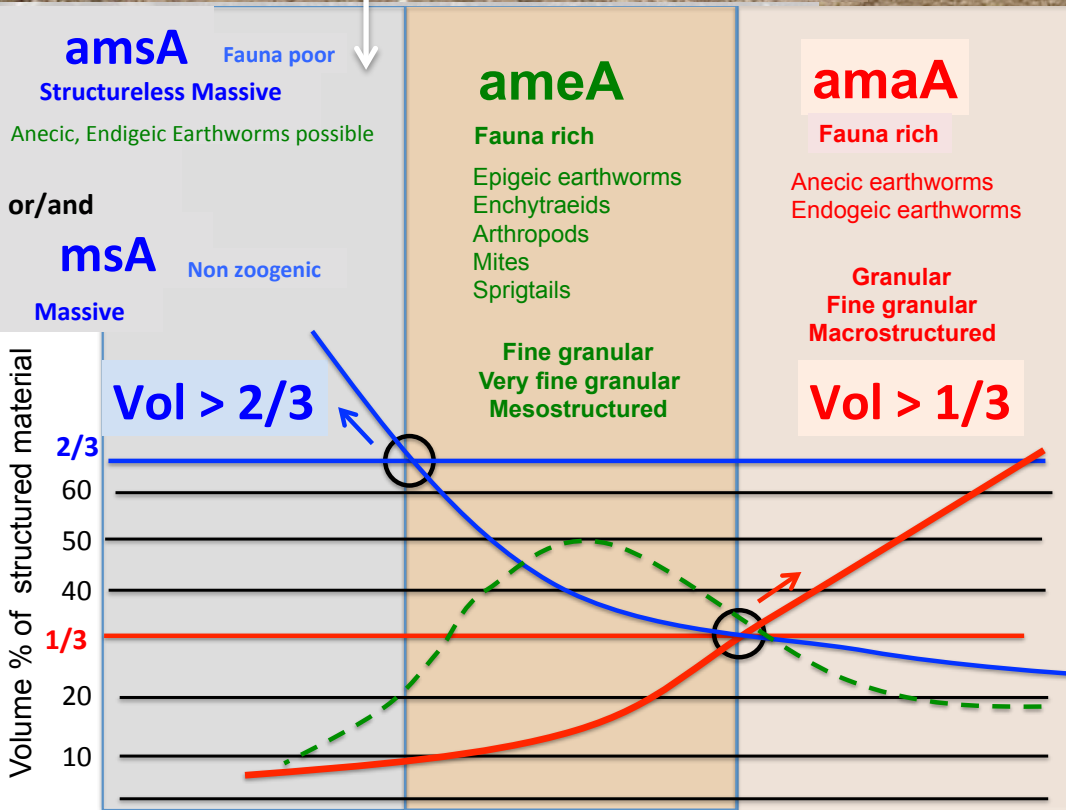
**NON ZOOGENIC  
STRUCTURELESS  
MASSIVE MATERIAL**

*compact  
superficial  
"crust"*





MASSIVE Agromull





### MESO and MACRO Agromull

**ameA**

Fauna rich

- Epigeic earthworms
- Enchytraeids
- Arthropods
- Mites
- Sprigtails

Fine granular  
Very fine granular  
Mesostructured

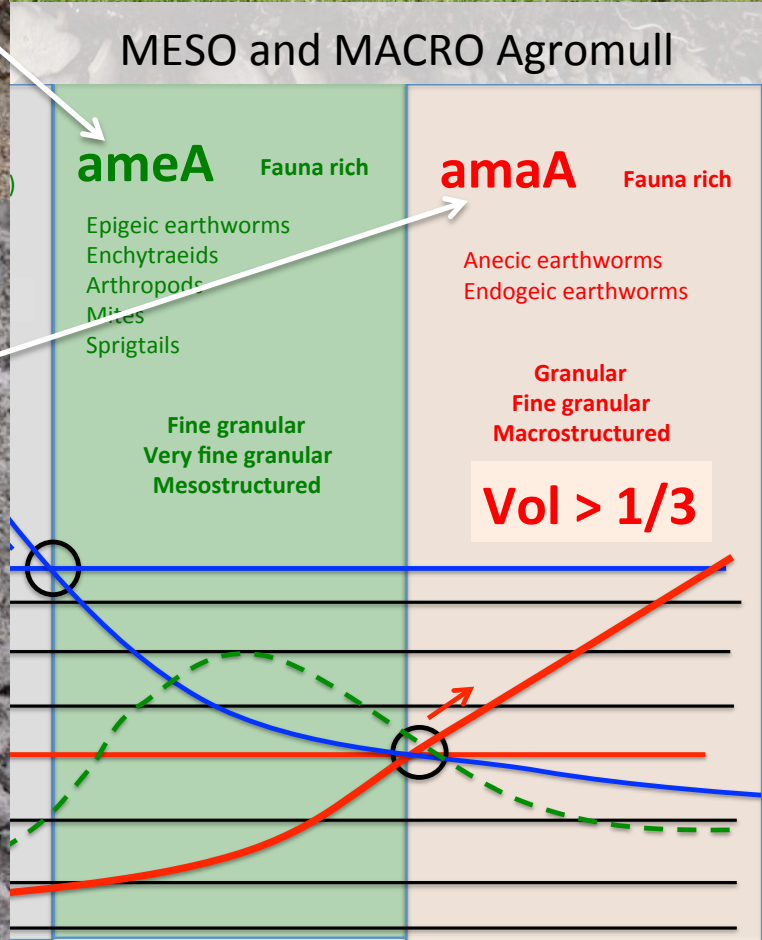
**amaA**

Fauna rich

- Anecic earthworms
- Endogeic earthworms

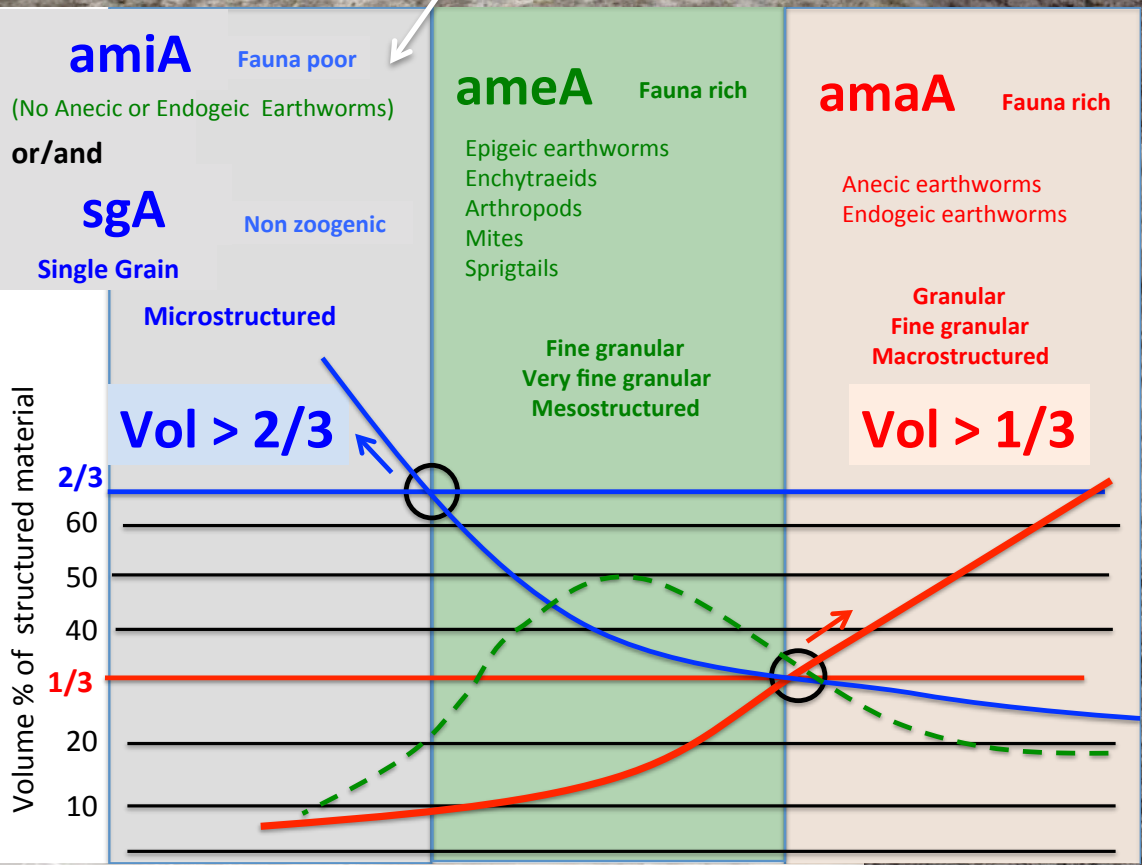
Granular  
Fine granular  
Macrostructured

**Vol > 1/3**





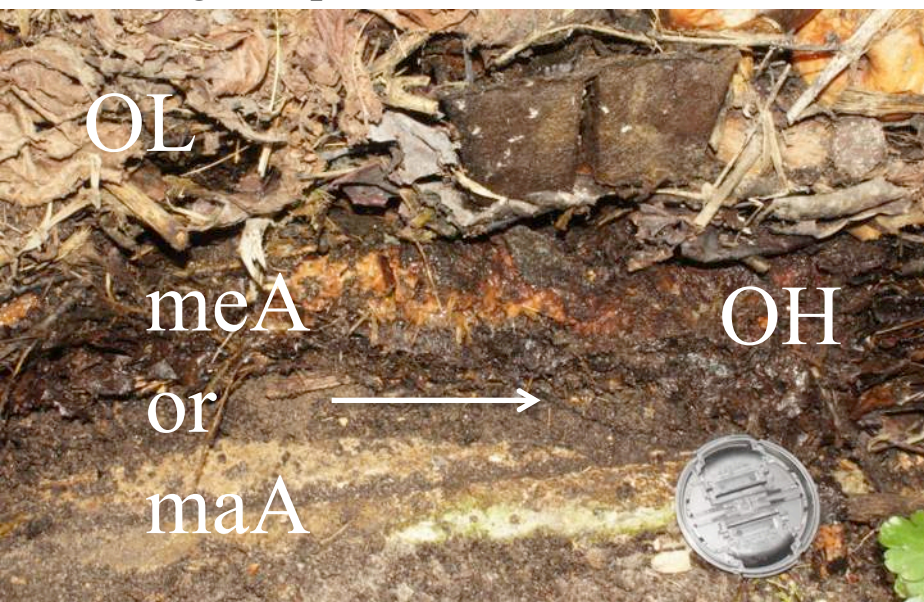
MICRO Agromull





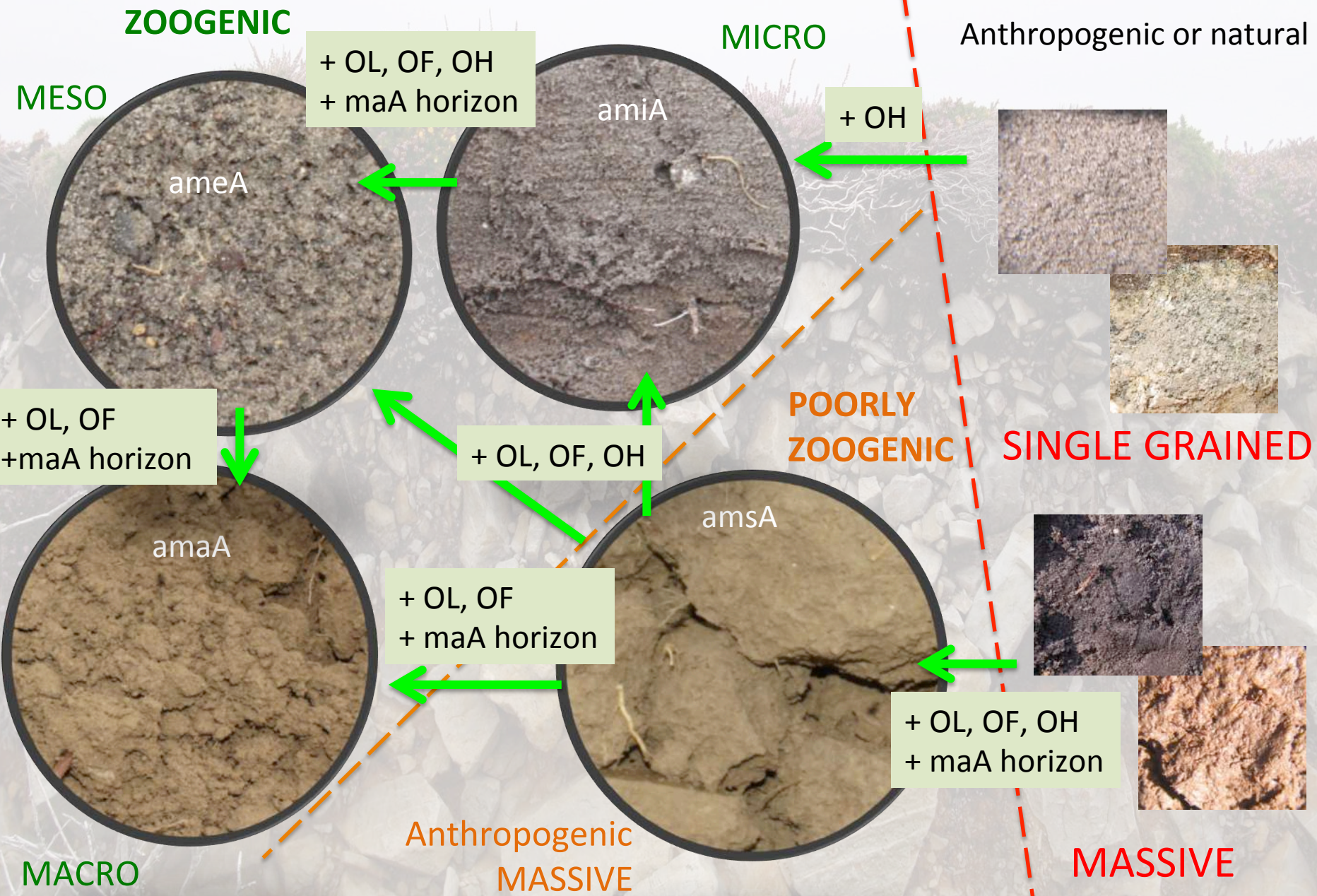
Macro Agroamphi

ANTHROPOGENIC HUMUS HORIZONS



# Restoring ANTHROPOGENIC structures

# NON ZOOGENIC





Restoring soil  
Restoring humanity  
Romanie examples



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- HUMUSICA

Thank you for your attention !!!

**TESAF** Dipartimento Territorio e Sistemi Agro-Forestali

