Morpho-functional classification of humus systems and soil biological functioning

Augusto Zanella, Stefano Guercini, Jean-François Ponge

1 - What's soil ?

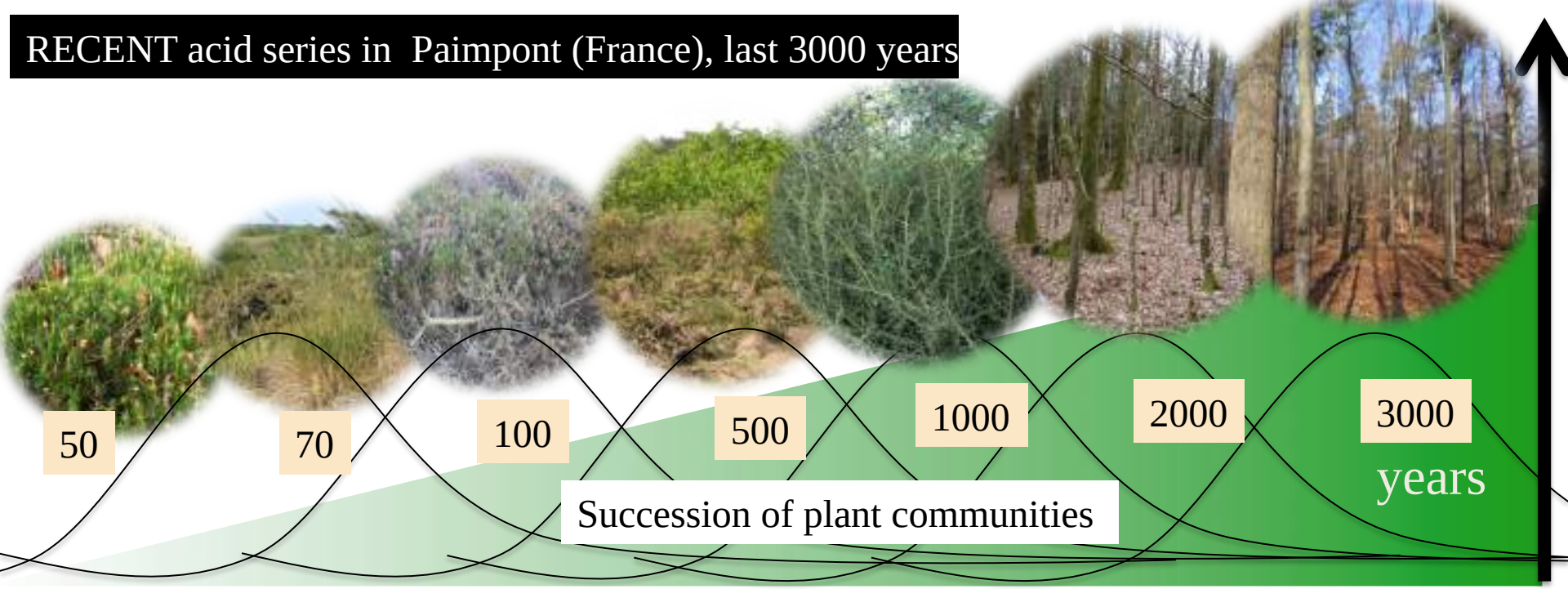
2- An attempt of biological soil classification

HUMUS GROUP

3 - The FUTURE of the soil classification

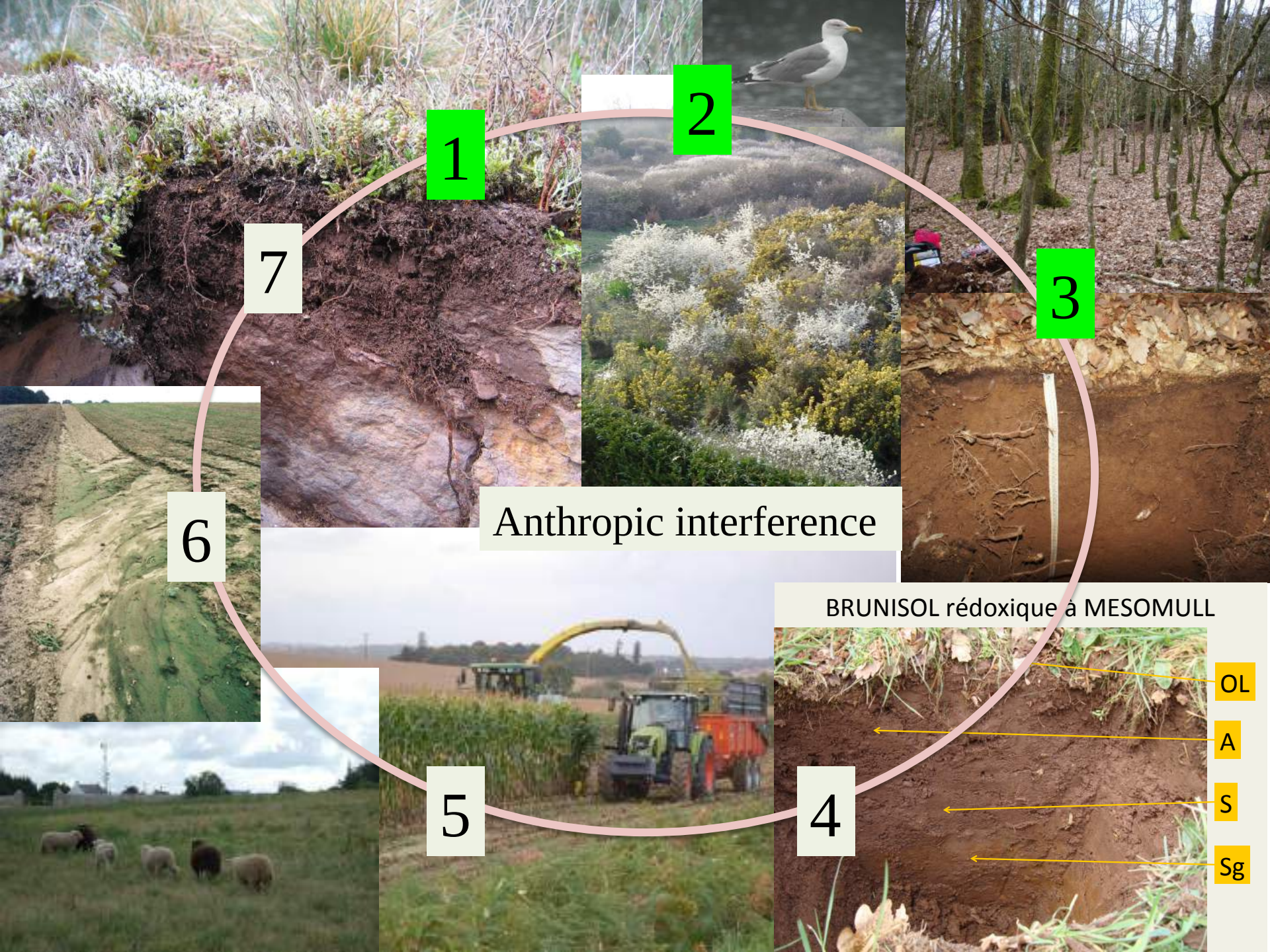

today
10 millions
100 millions
200 millions
LIVING ORGANISMS and SOIL CO-EVOLUTION IN A CHANGING HABITAT
3 billions years ago
500 millions
400 millions
300 millions

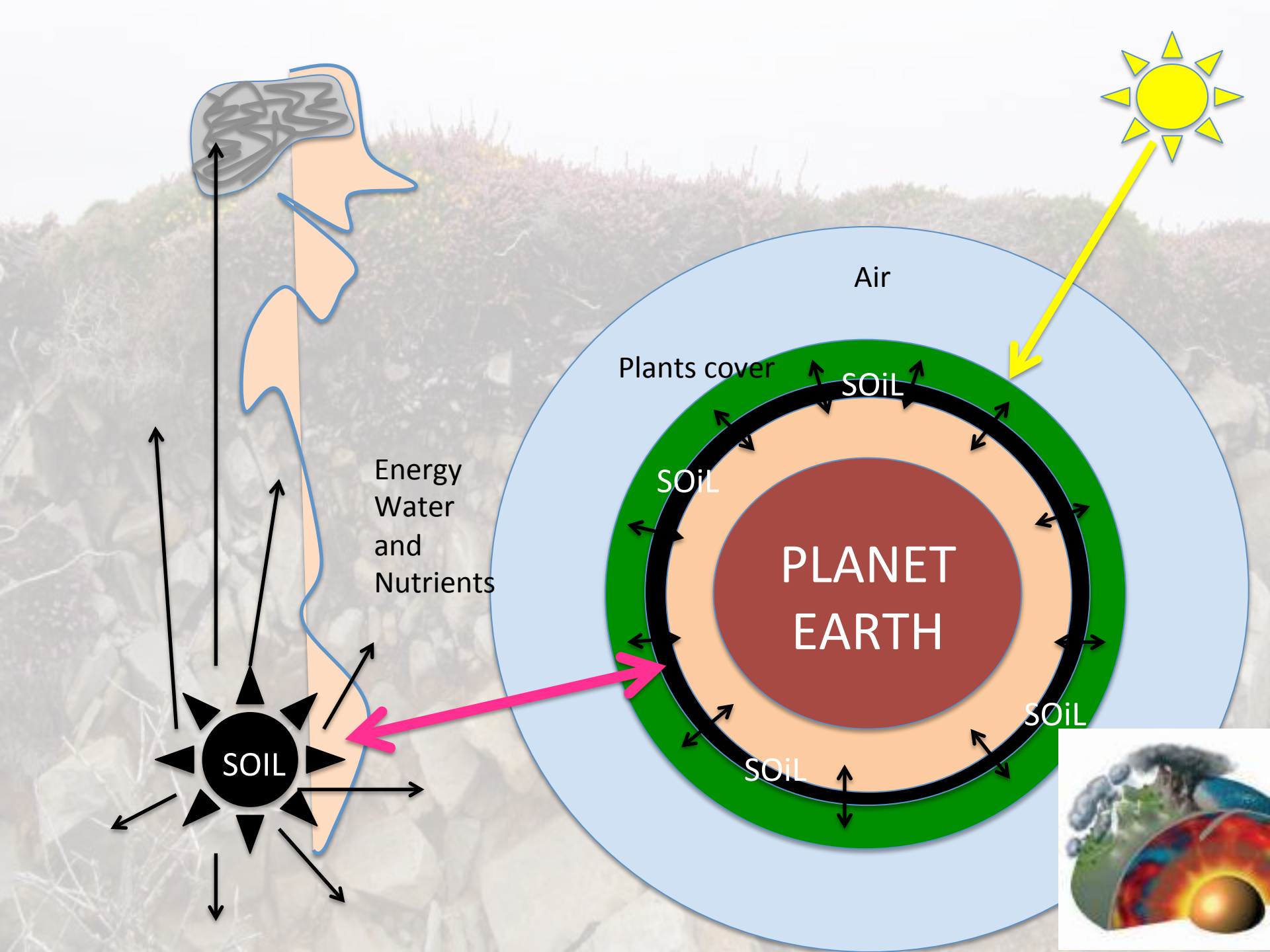
RECENT acid series in Paimpont (France), last 3000 years



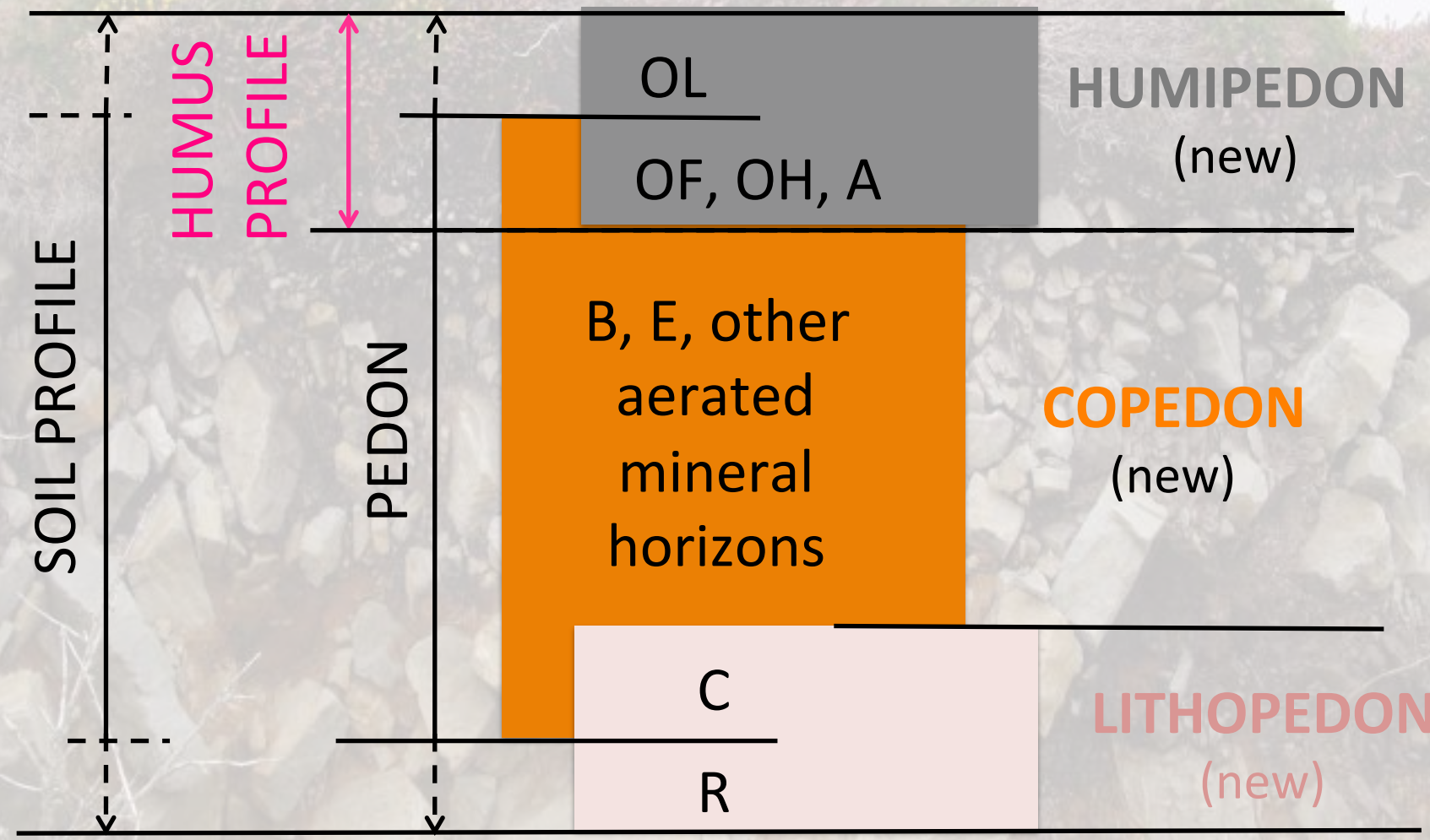
organic matter ↑, energy ↑, water ↑, biodiversity ↑ ↓

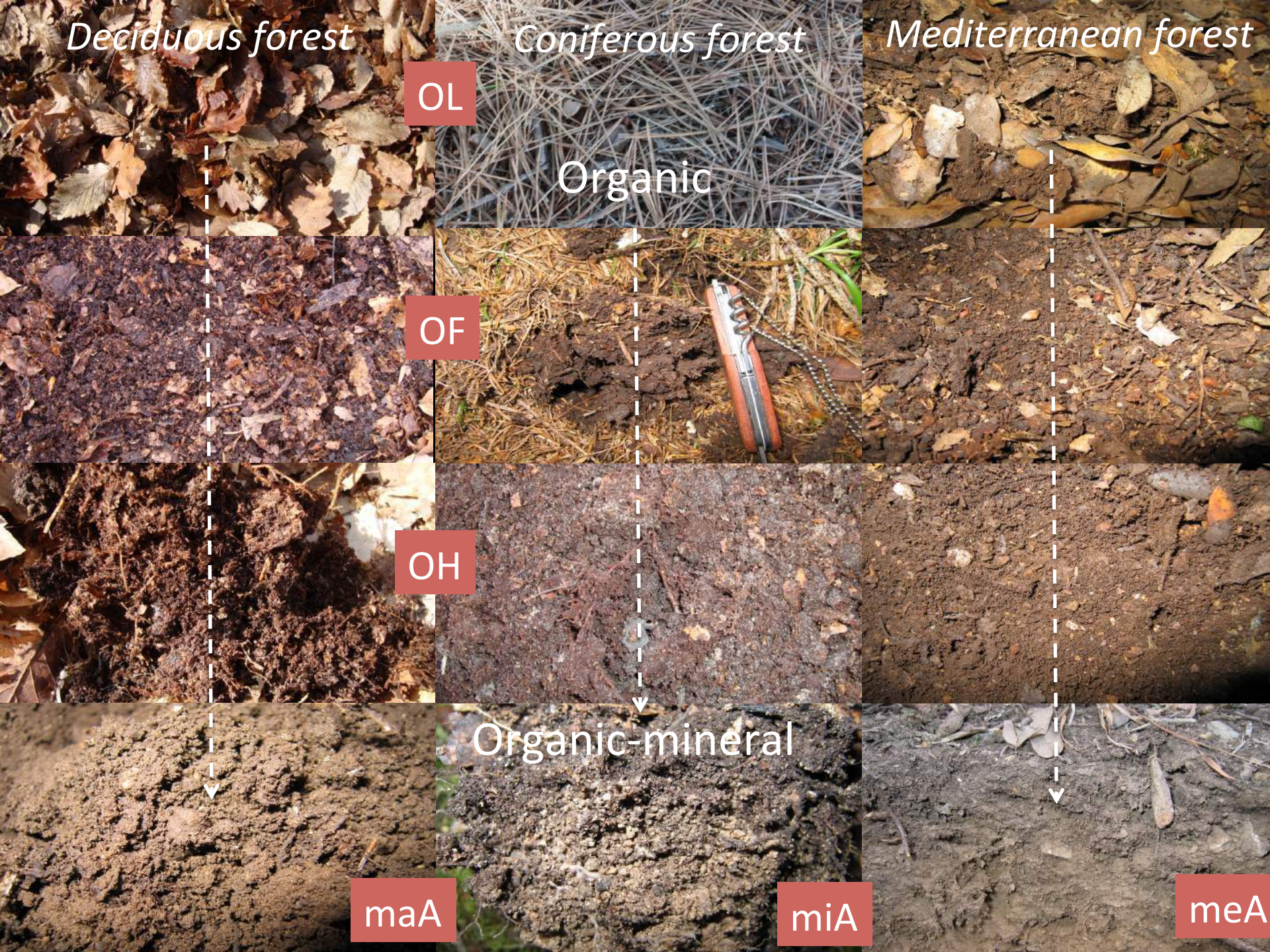
regression ⟵ ⟶ evolution

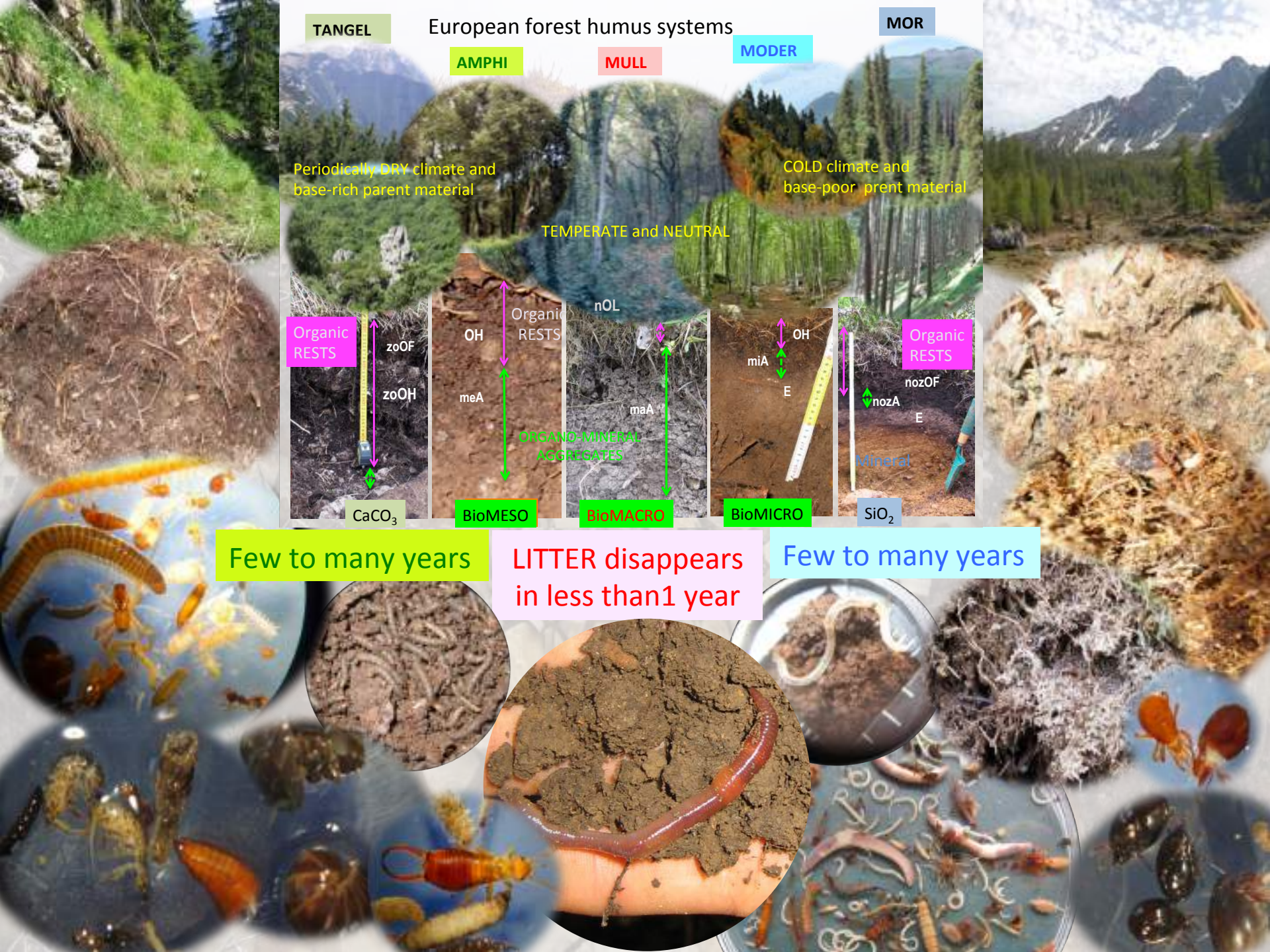

1
2
3
4
5
6
7
Anthropic interference
BRUNISOL rédoxique à MESOMULL
OL
A
S
Sg

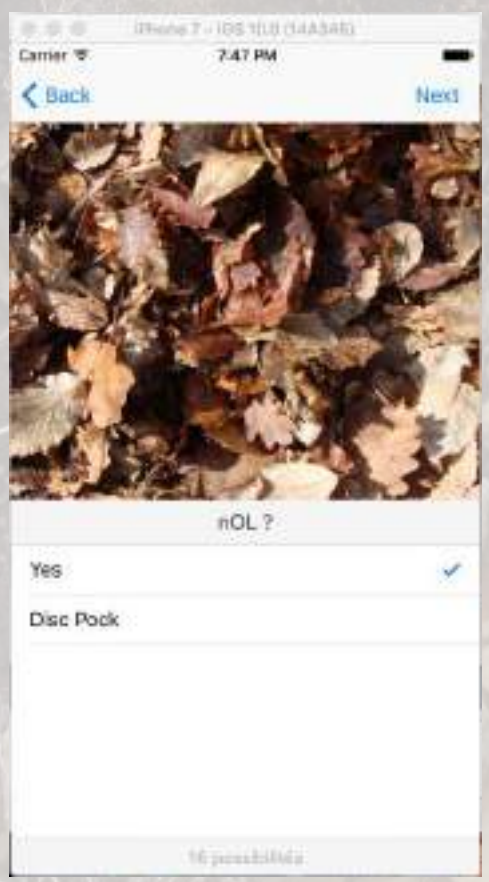

Air
Plants cover
SOiL
SOiL
PLANET
EARTH
SOiL
SOiL
Energy
Water
and
Nutrients
SOIL

IS IT USEFUL TO PART THE SOIL IN THREE ?




Deciduous forest
Coniferous forest
Mediterranean forest
OL
Organic
OF
OH
Organic-mineral
maA
miA
meA


TANGEL
European forest humus systems
AMPHI
MULL
MODER
MOR
Periodically DRY climate and base-rich parent material
COLD climate and base-poor prent material
TEMPERATE and NEUTRAL
Organic RESTS
zoOF
zoOH
OH
Organic RESTS
meA
ORGANO-MINERAL AGGREGATES
nOL
maA
OH
miA
E
Organic RESTS
nozOF
nozA
E
Mineral
CaCO3
BioMESO
BioMACRO
BioMICRO
SiO2
Few to many years
LITTER disappears in less than1 year
Few to many years


Carrier
7:47 PM
Back
Next
nOL ?
Yes
Disc Pock


Carrier
7:29 PM
Back
Next
VOL ?
Disc Pock
Yes


Carrier
7:32 PM
Back
Solution
End
Dysmoder

i APP

in the West wing of the Alpine chain **Amphi** was found as the richest in OC (Bonifacio et al. 2011)

Moder was at the **first place** in the Centre (Sartori et al., 2007, Garlato et al., 2009, Ascher et al., 2012) and East (Garlato et al., 2009) of Alpine chain

AMPHI

MODER

The highest SOC values were similar = 80-100 t ha^{-1}

MULL

In Mediterranean forests, **Mull had the highest stock** of OC, **near to Amphi** and decidedly more (2.5 x) than Moder (Andreetta et al., 2011, De Nicola et al. 2014)

TANGEL

CALCAREOUS
RICH in BASES
WARM

AMPHI

MULL

TEMPERATE
NEUTRAL

MODER

COLD CLIMATE
POOR in BASES
SUBSTRATES

MOR

FREE Organic Matter

HARD to biodegrade OM

Recognizable rests in ORGANIC horizons

Relatively **easy** to "eat" by soil organisms

It needs plant-bacteria-fungal **cooperation**

A horizon made by EARTHWORMS

root

hyphae

fixed invisible organic matter

free organic rests

very small free organic rests

clay

bacteria

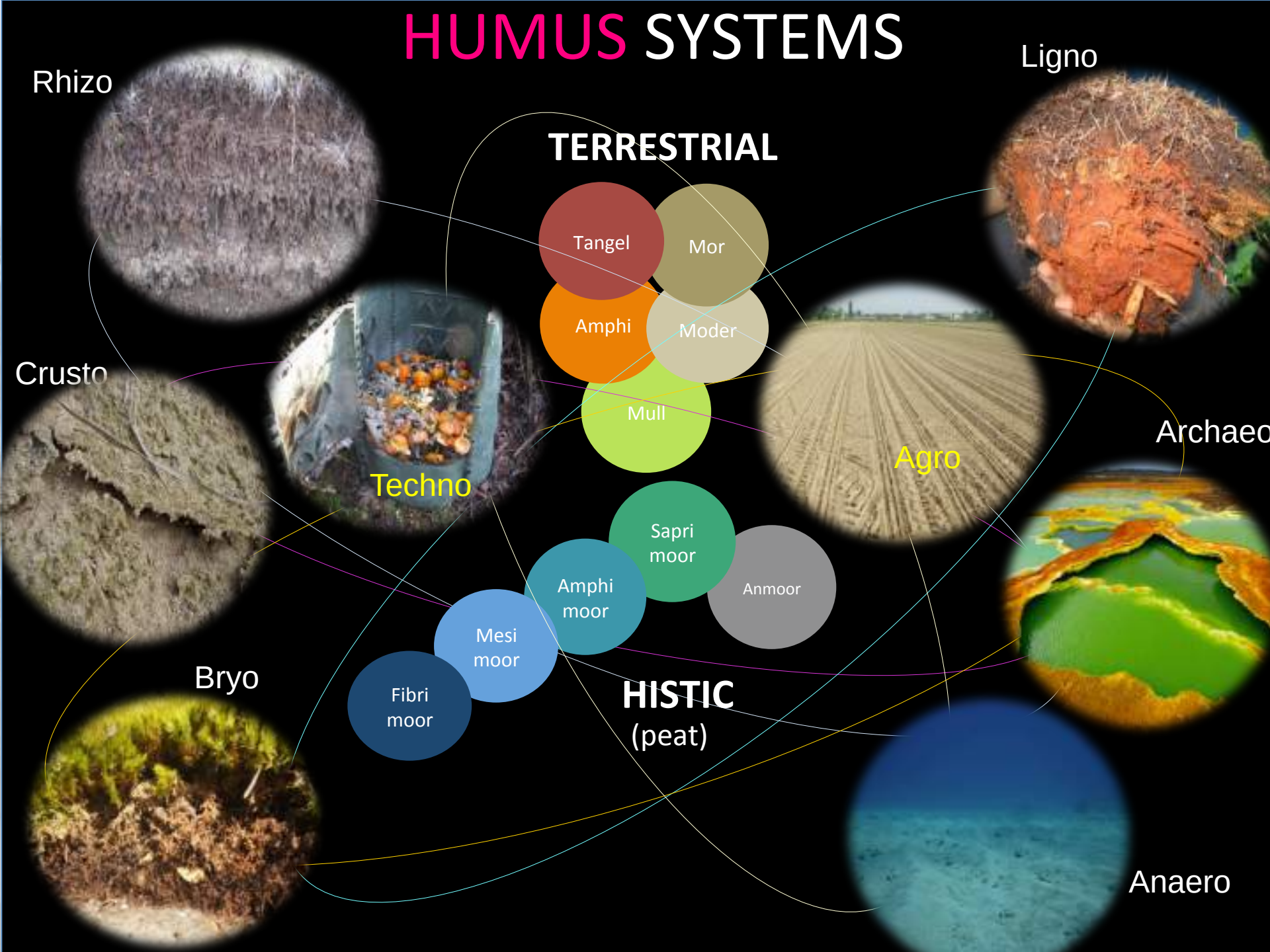
Ø = 1 mm

SOIL AGGREGATES

Ø = 0,1 mm

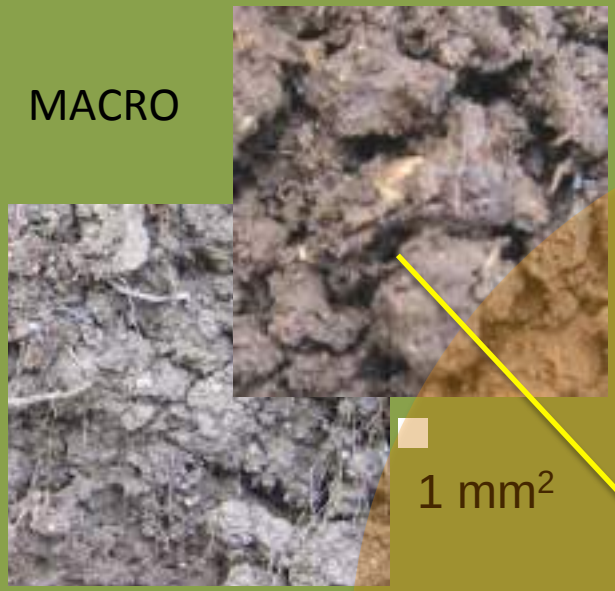
Ø = 0,001 mm

HUMUS SYSTEMS



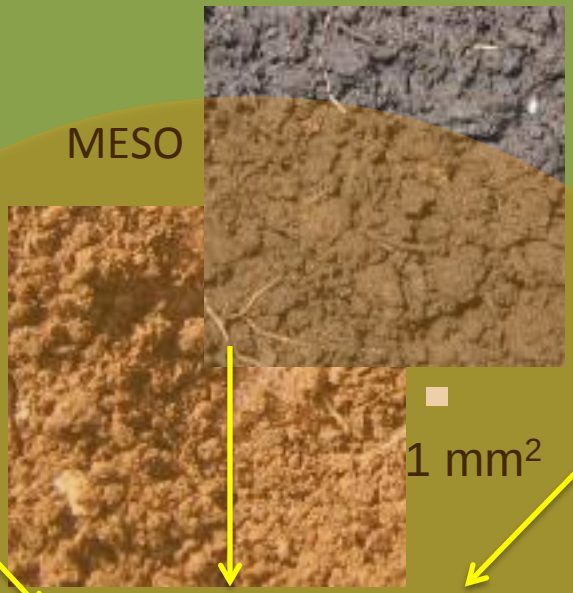
ZOOGENIC NATURAL STRUCTURES

MACRO



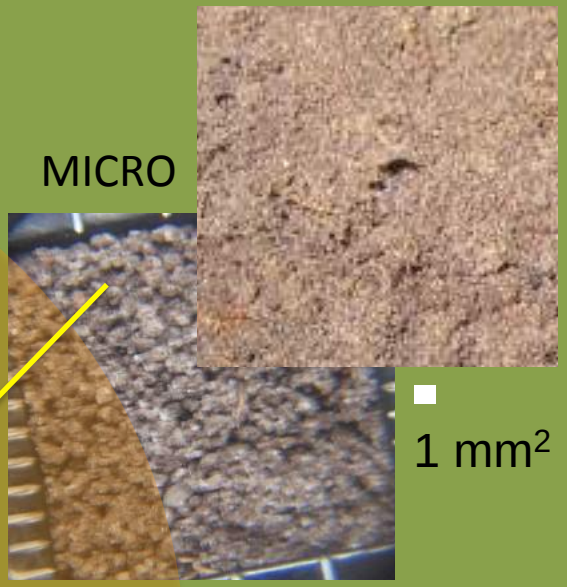
1 mm²

MESO



1 mm²

MICRO



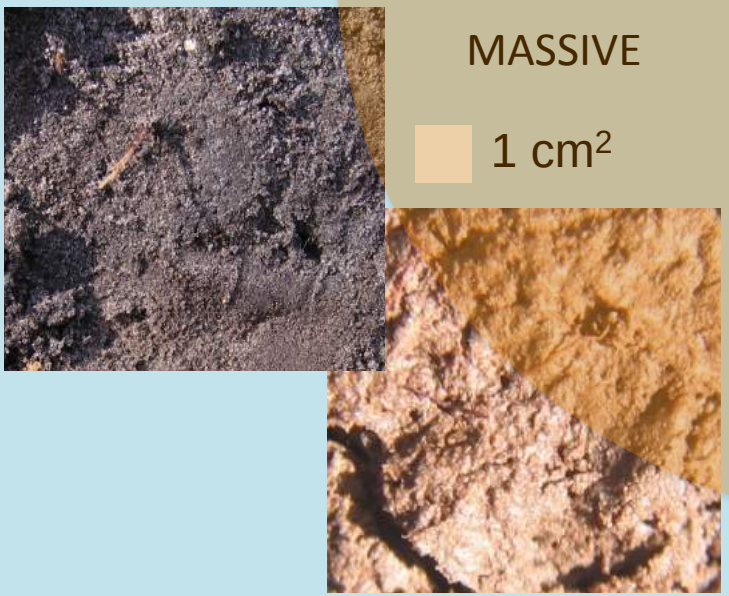
1 mm²

AGRO

NON ZOOGENIC

MASSIVE

1 cm²



SINGLE GRAINED

1 cm²

1 mm²

After traditional agriculture

GRANULAR, FINE GRANULAR = BIOMACROSTRUCTURED MATERIALS

NATURAL

Old/transformed earthworm dropping in a POORLY ZOOGENIC AGRO soil

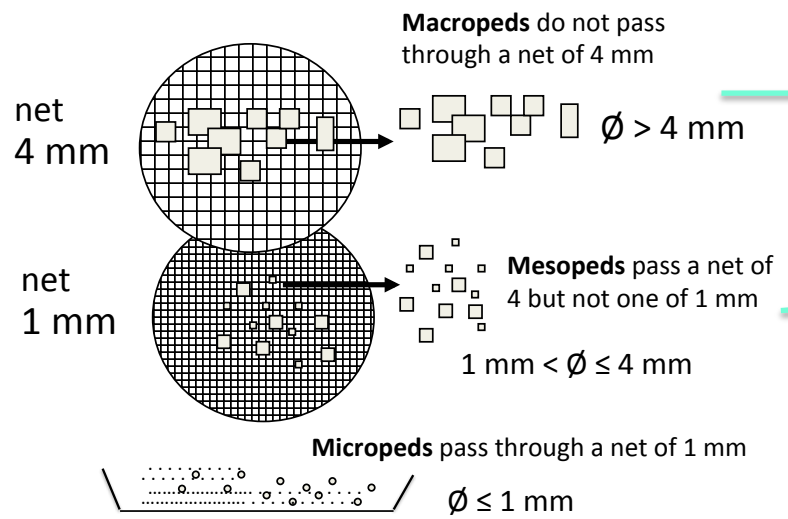
anecic earthworms

NATURAL fresh droppings

endogeic earthworms

Photographs: Topoliantz S. & Ponge J.F.

ANTHROPOGENIC TECHNO HUMUS SYSTEM



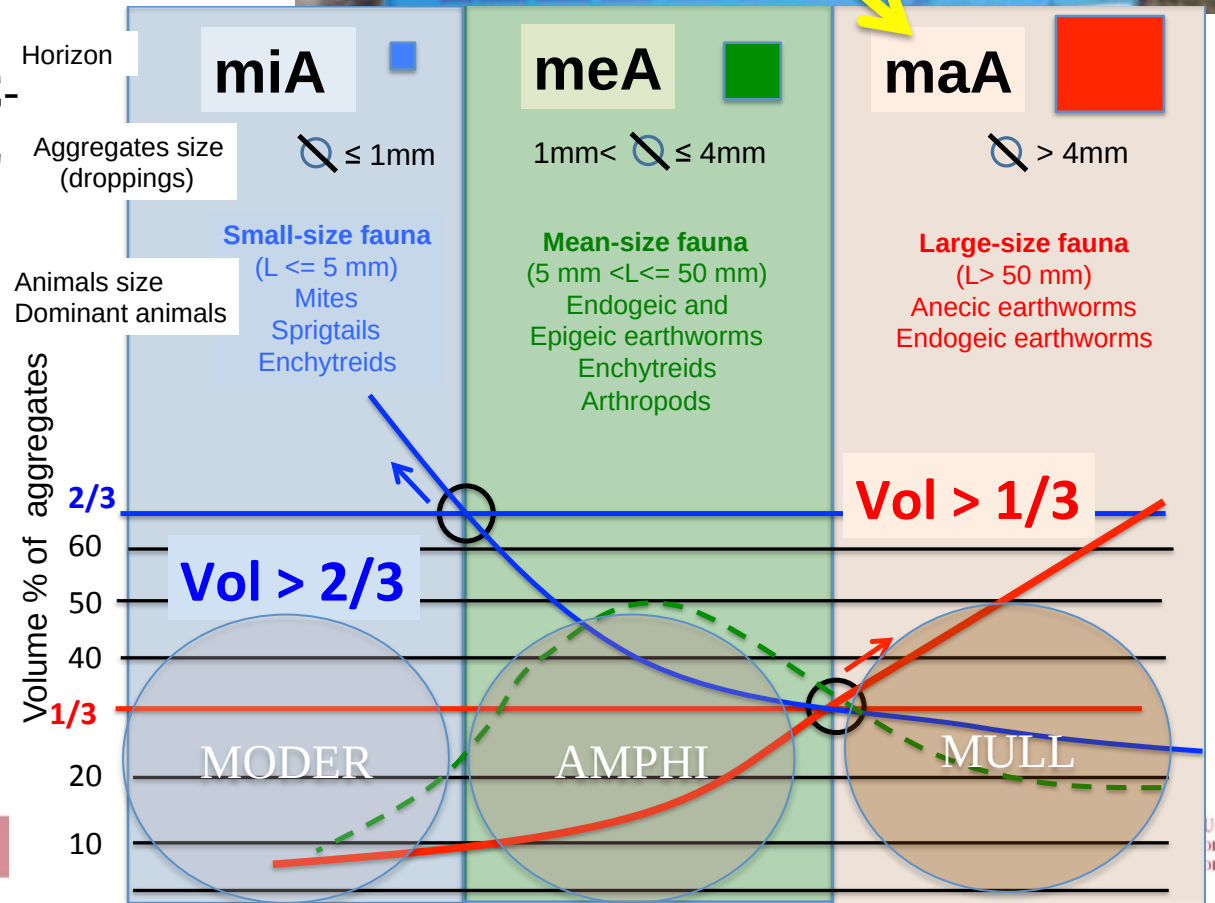
ORGANIC structures

MOR

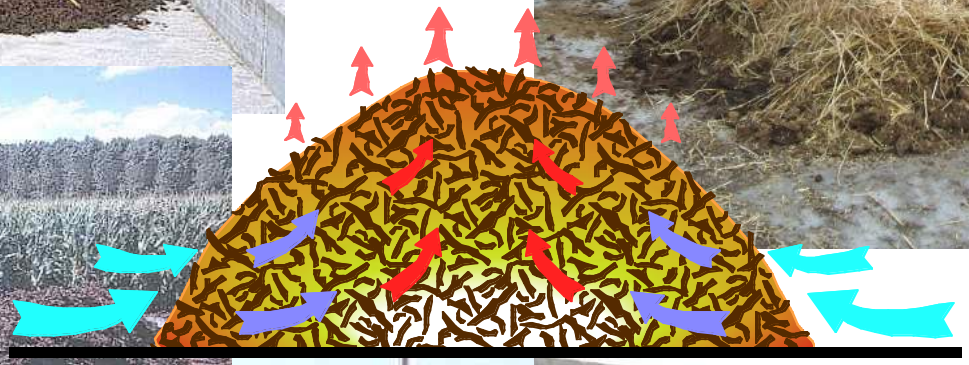
Harsh conditions

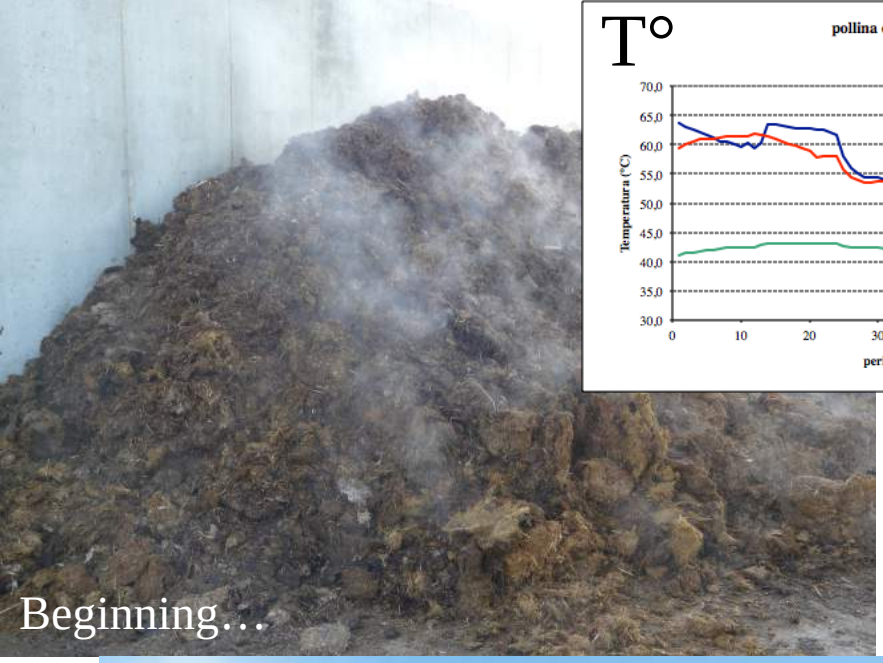
TANGEL

ORGANIC-MINERAL structures



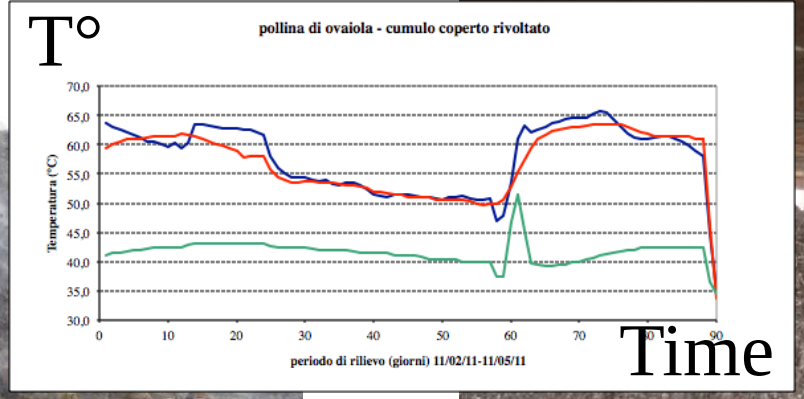
Guercini et al. experiments on different types of leavings as agricultural and urban residues, cows and chicken manures…Outdoor, indoor, shape of the pile.....





Beginning…

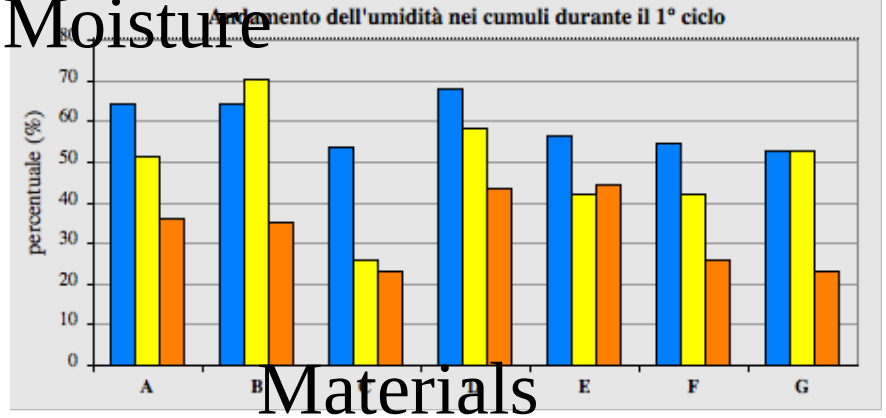
T°



Time

…end

Moisture



Materials

fresco
intermedio
maturo

A	Letame suino + stocchi di sorgo
B	Letame bovino + stocchi di sorgo
C	Lettiera avicola
D	Letame bovino
E	Letame suini + stocchi di sorgo
F	Letame bovini + lettiera avicola
G	Lettiera avicola

Guercini et al. experiments on temperature, moisture, periods, turning operations, conformity with current legislation…

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FUTURE 1

On the road
3 Special issues
in Applied Soil Ecology

VOLUME 1.

TERRESTIRIAL NATURAL HUMUS SYSTEMS and FORMS

VOLME 2.

HISTIC, PARA , AGRO, TECHNO HUMUS SYSTEMS and FORMS

VOLME 3.

SPECIFIC APPLICATIONS

and SHORT REVIEWS

FUTURE 2

Is it possible to make more practical the present SOIL classification WRB or USDA ?

Important event:

01., 02., 03., 04., 05., 06., 07. December 2016

IUSS Commission 1.4: Soil Classification Meeting

Bloemfontein, South Africa

Four day pre-congress tour and a three day congress

Website http://scc16.co.za

SUGGESTIONS are welcome, I can communicate all your ideas to the Commission: augusto.zanella@unipd.it

What's your meaning about parting the soil in THREE sub-units ?

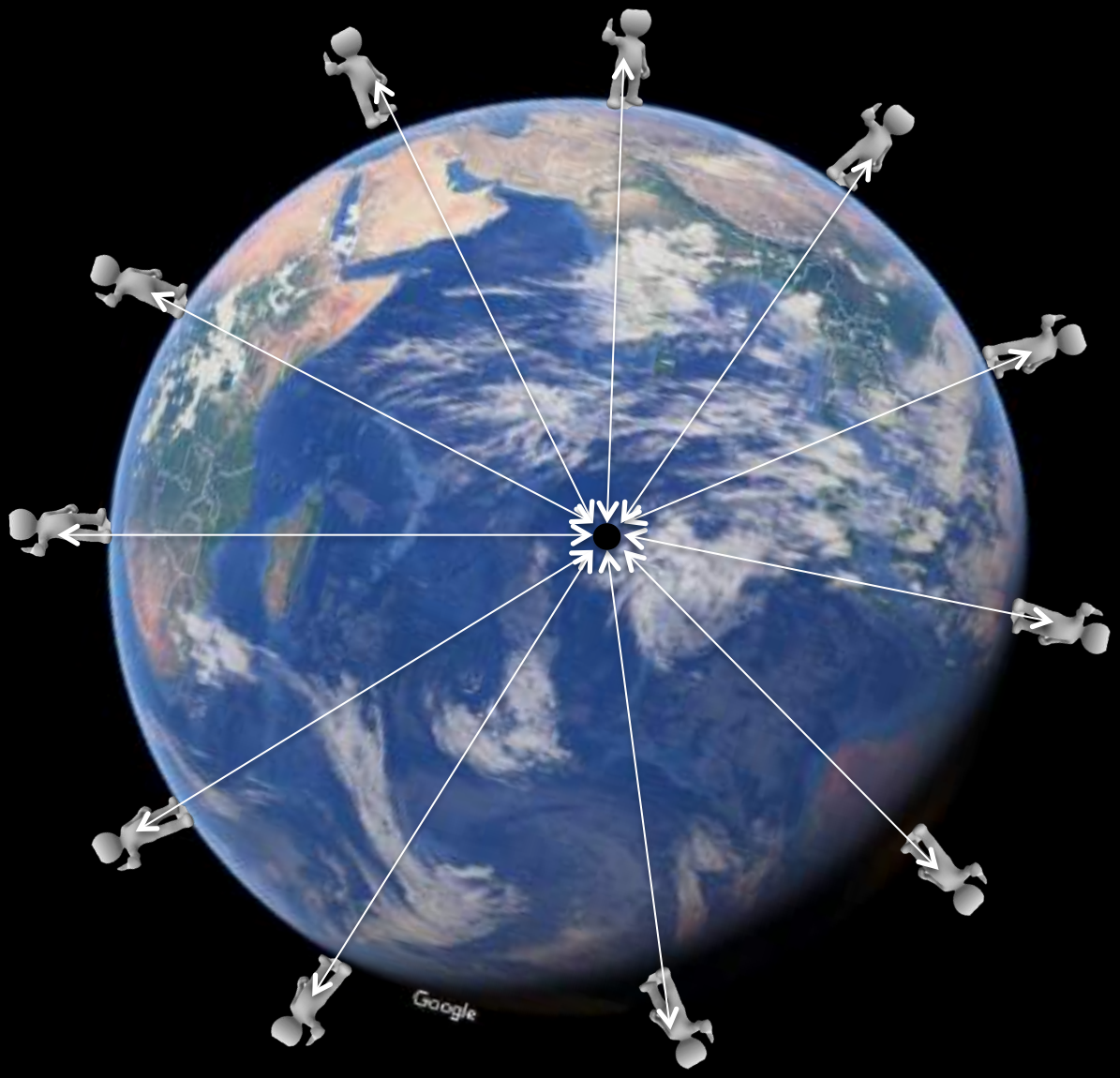
Humipedon – Copedon - Lithopedon: is it a good idea ?

FUTURE 3


ITALY
AUSTRALIA !
Google

How can Australians be living there without falling down ?

Ahhahhhh !



GRAVITY FORCE

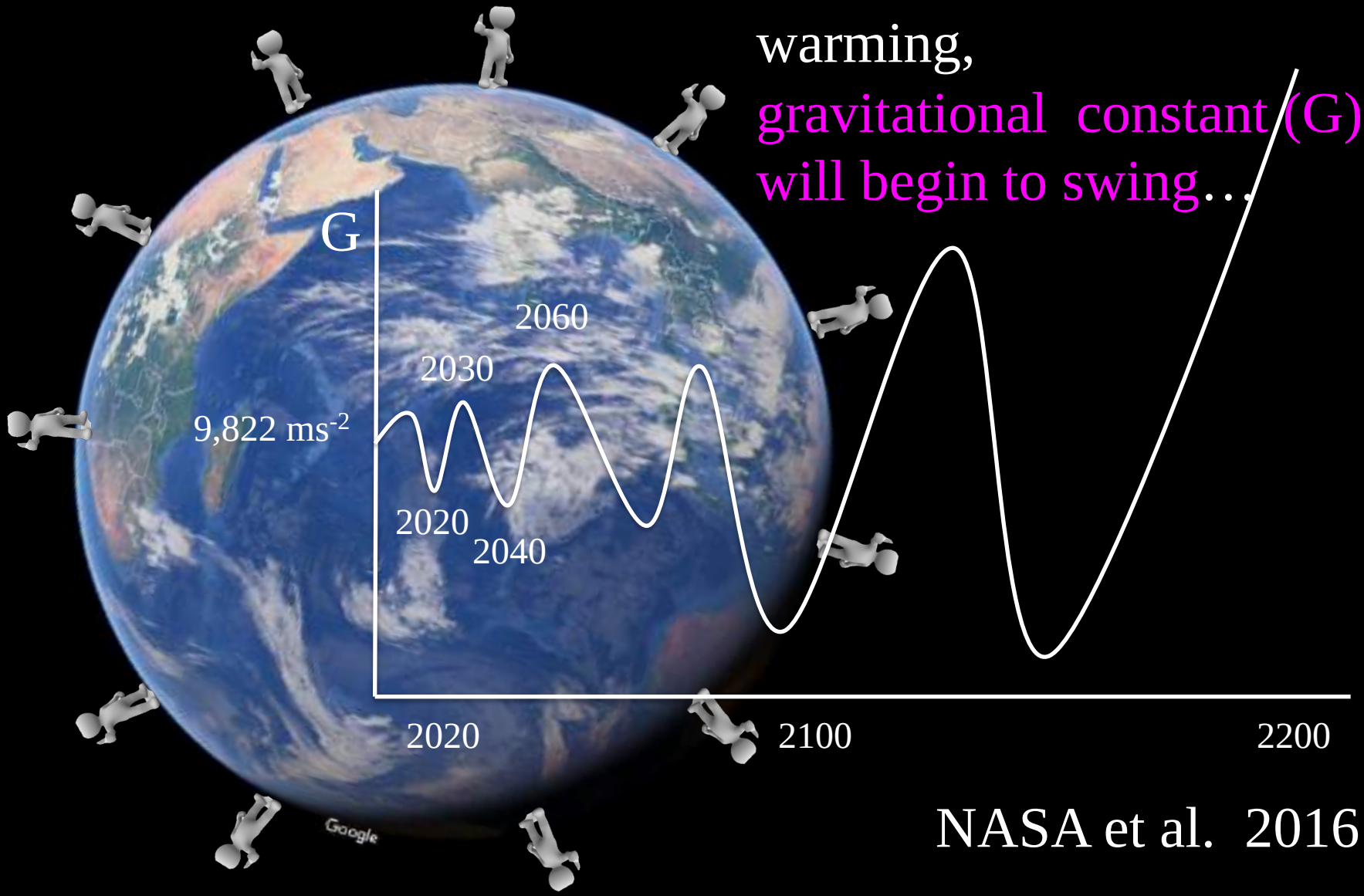
$$F_{A/B} = G \times \frac{m_A \cdot m_B}{d^2}$$

Gravitational constant

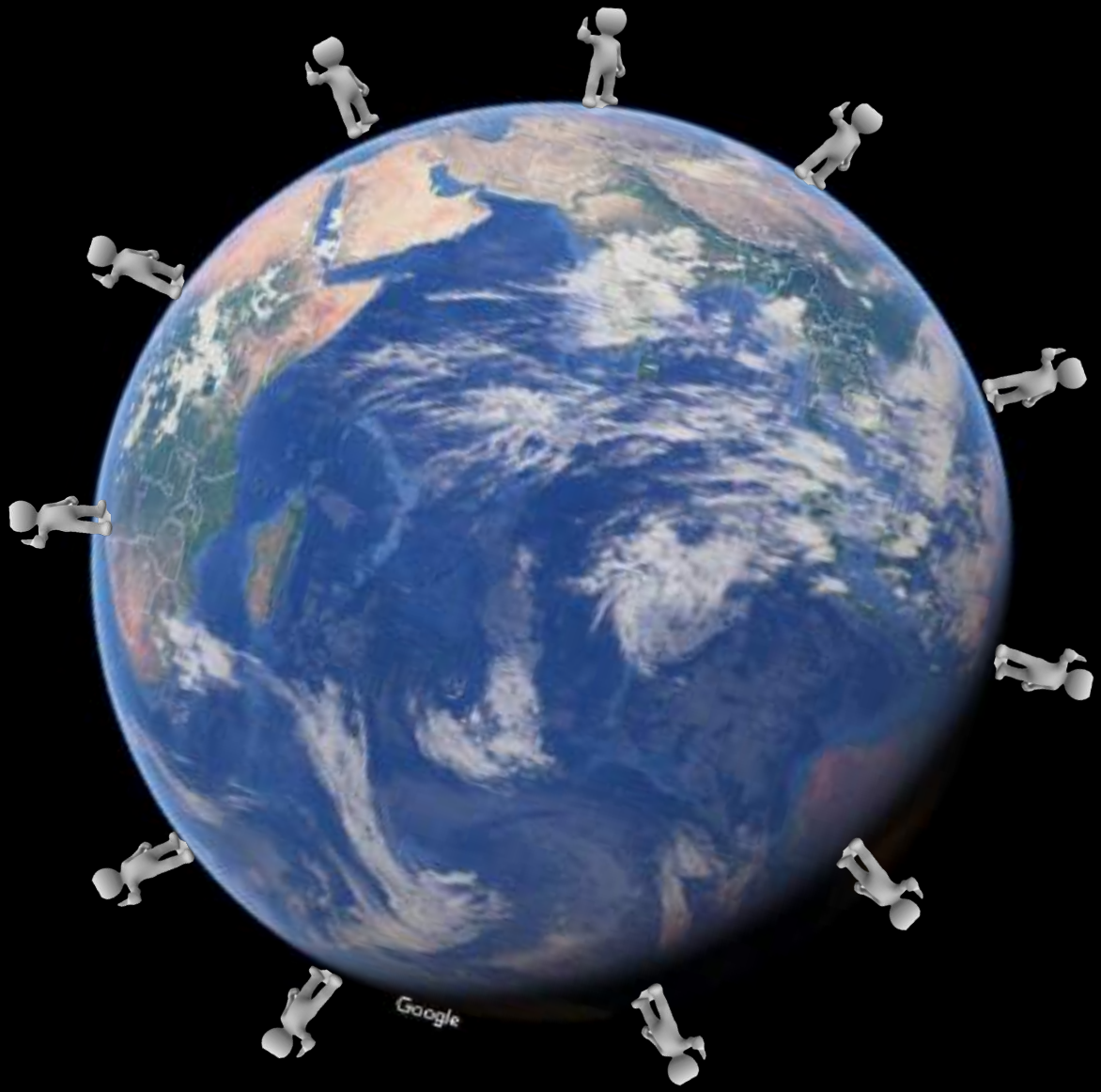
WE HAVE TO FACE A BIG PROBLEM…

Because of Global warming,

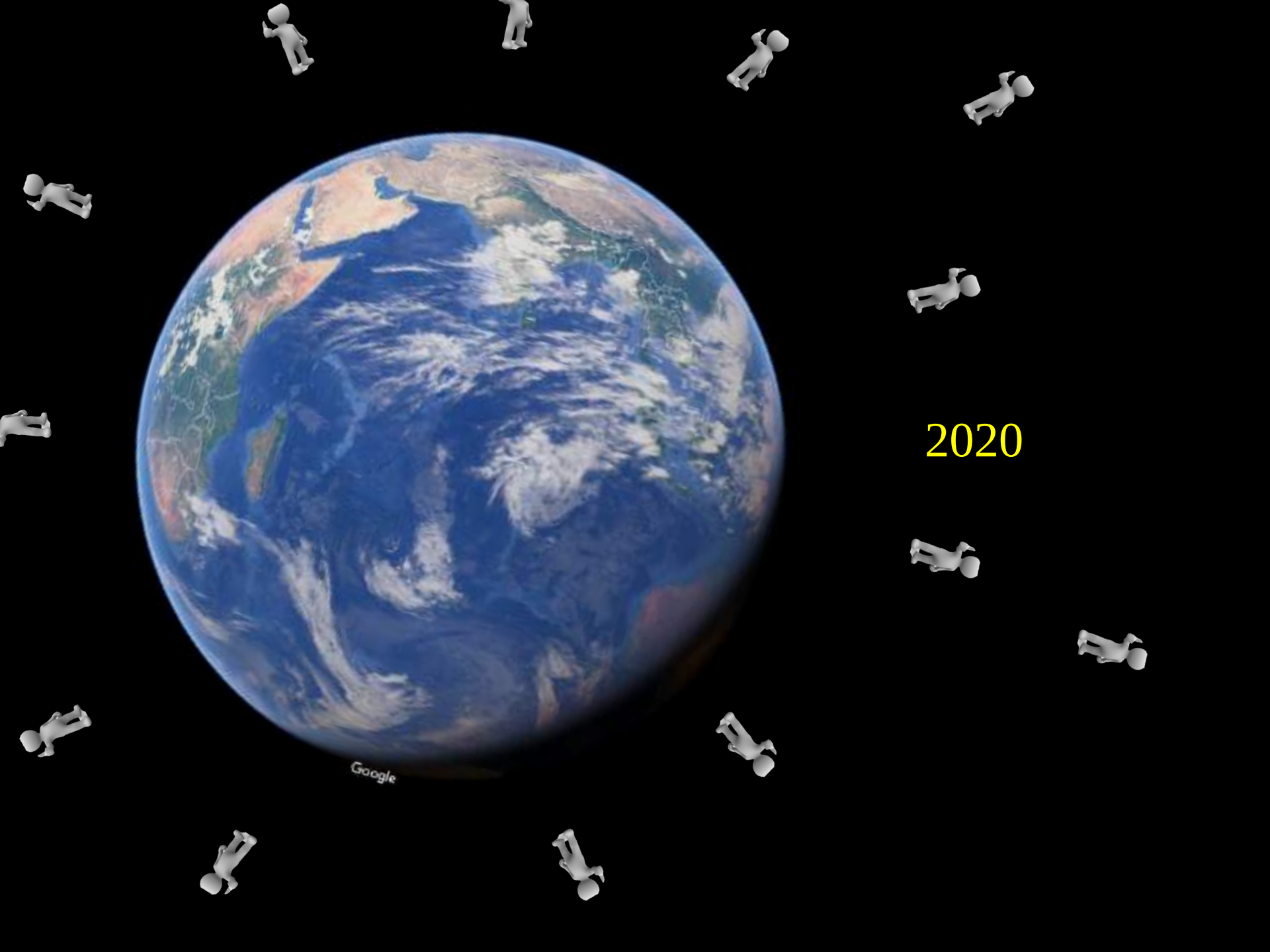
gravitational constant (G) will begin to swing…

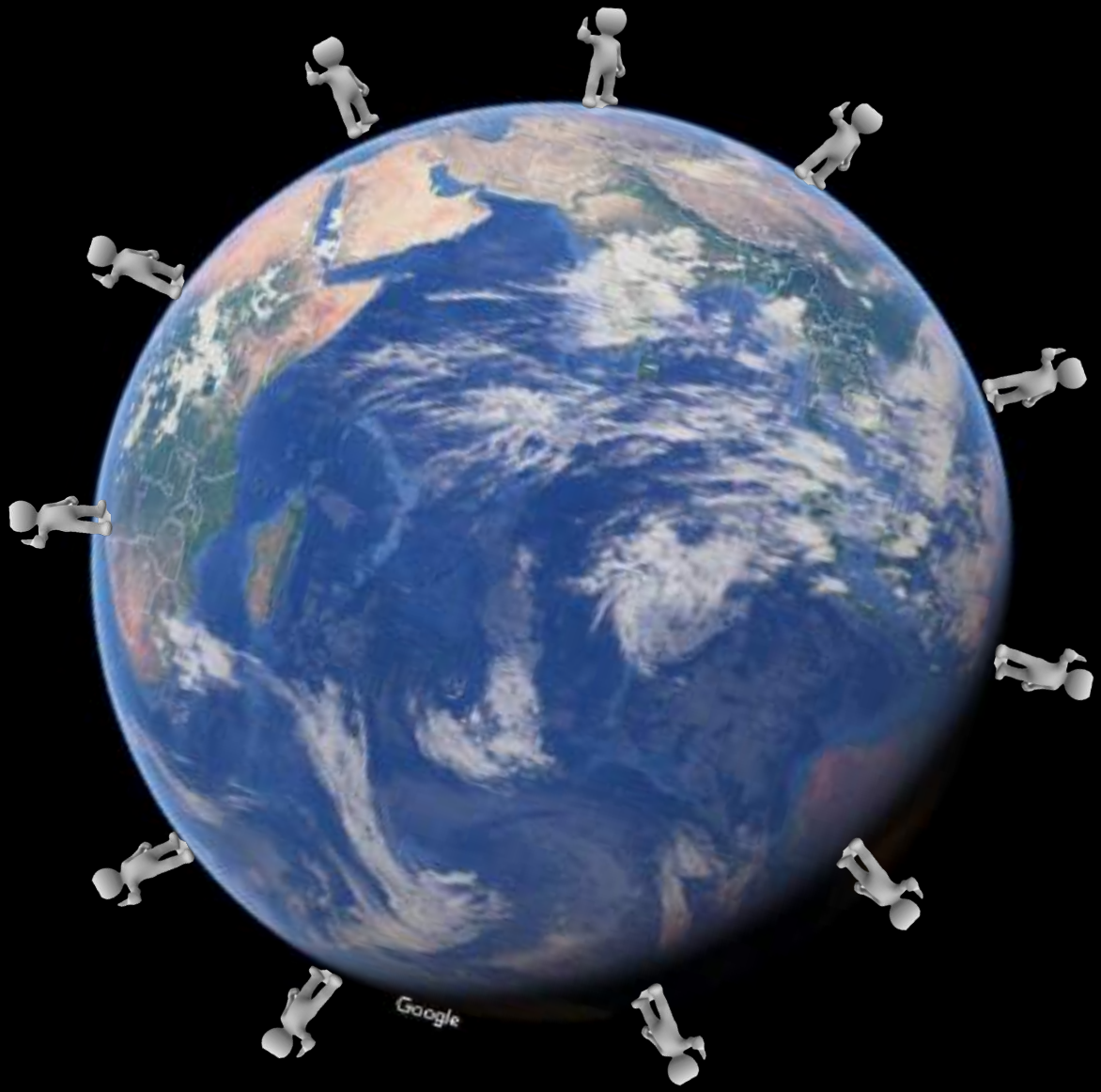


NASA et al. 2016



NOW

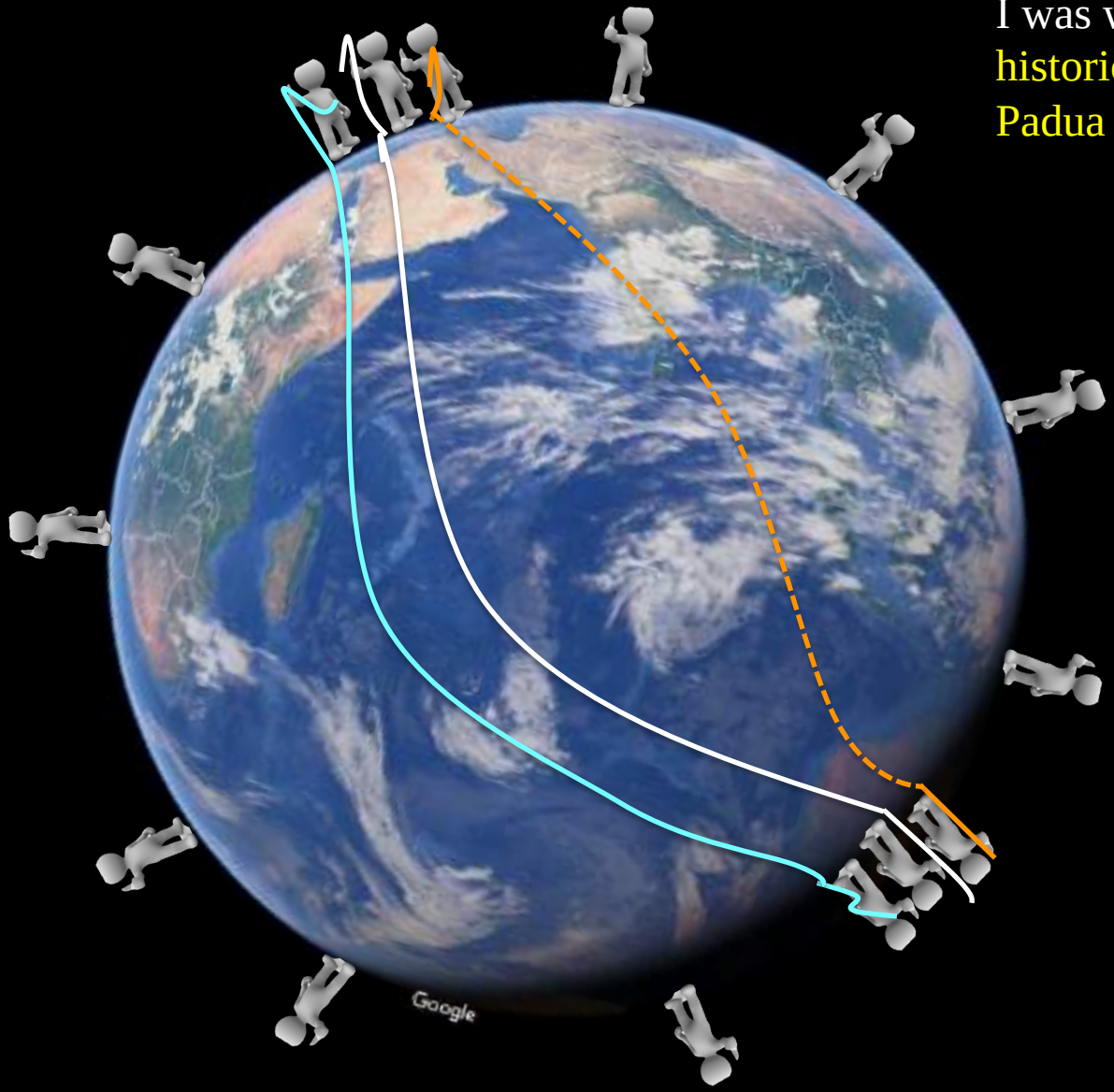

2020
Google



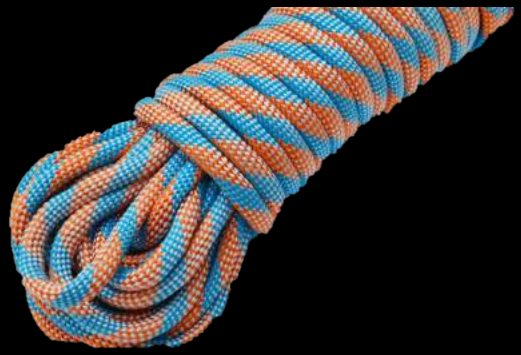
2030

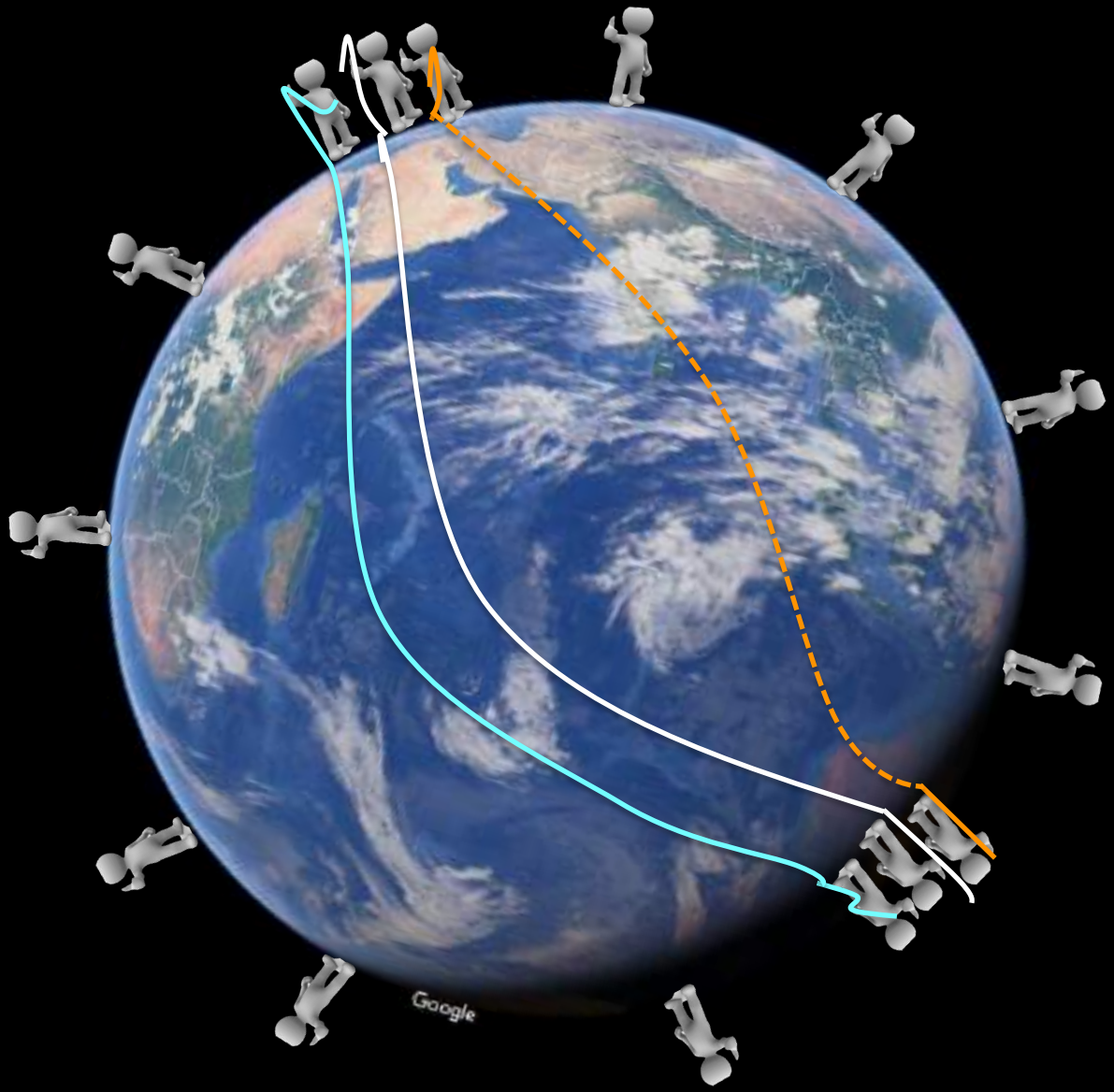
2040…
is there a solution?

I was wandering about a first…
historical act of collaboration between Padua and Sydney Universities

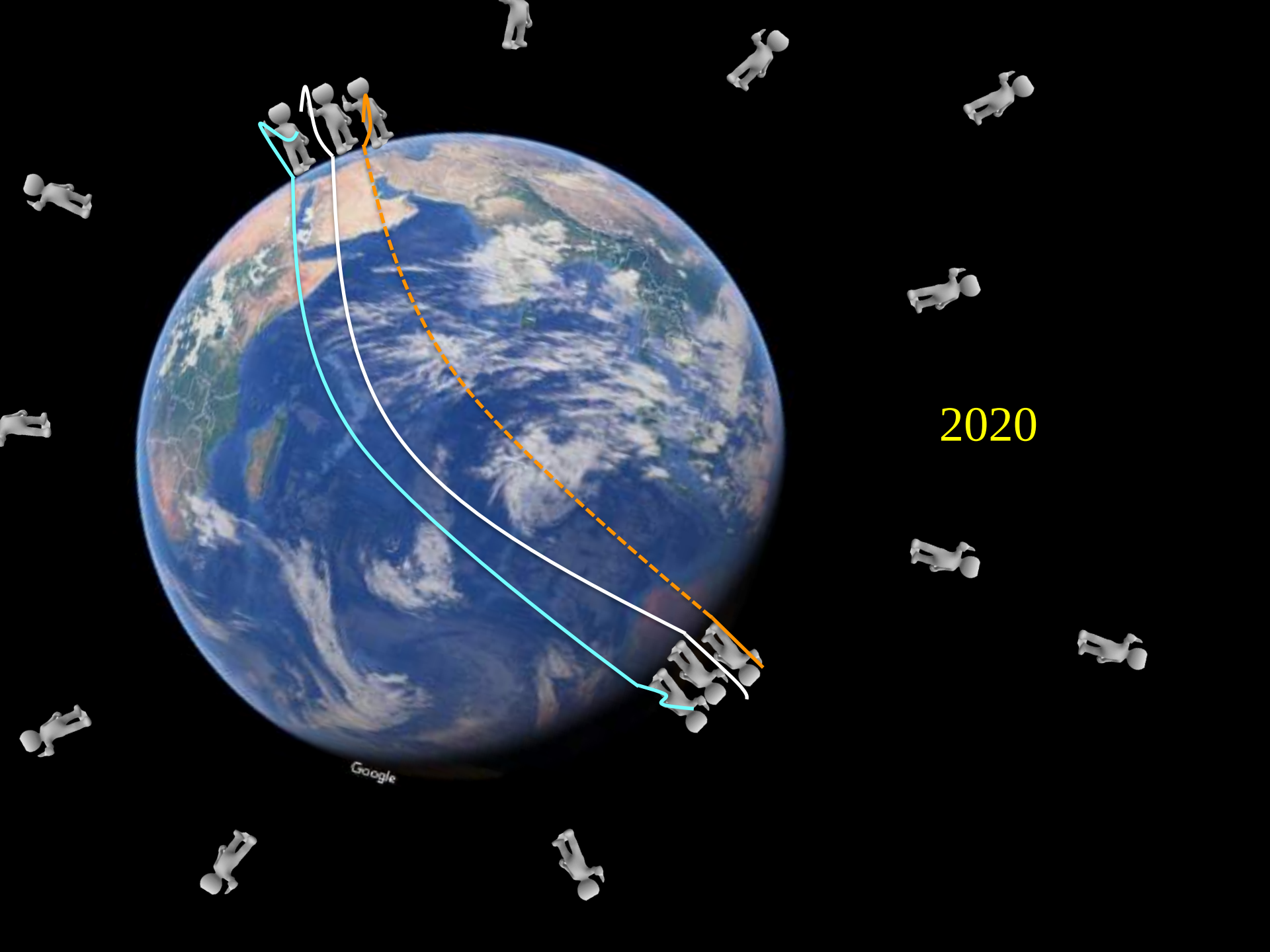


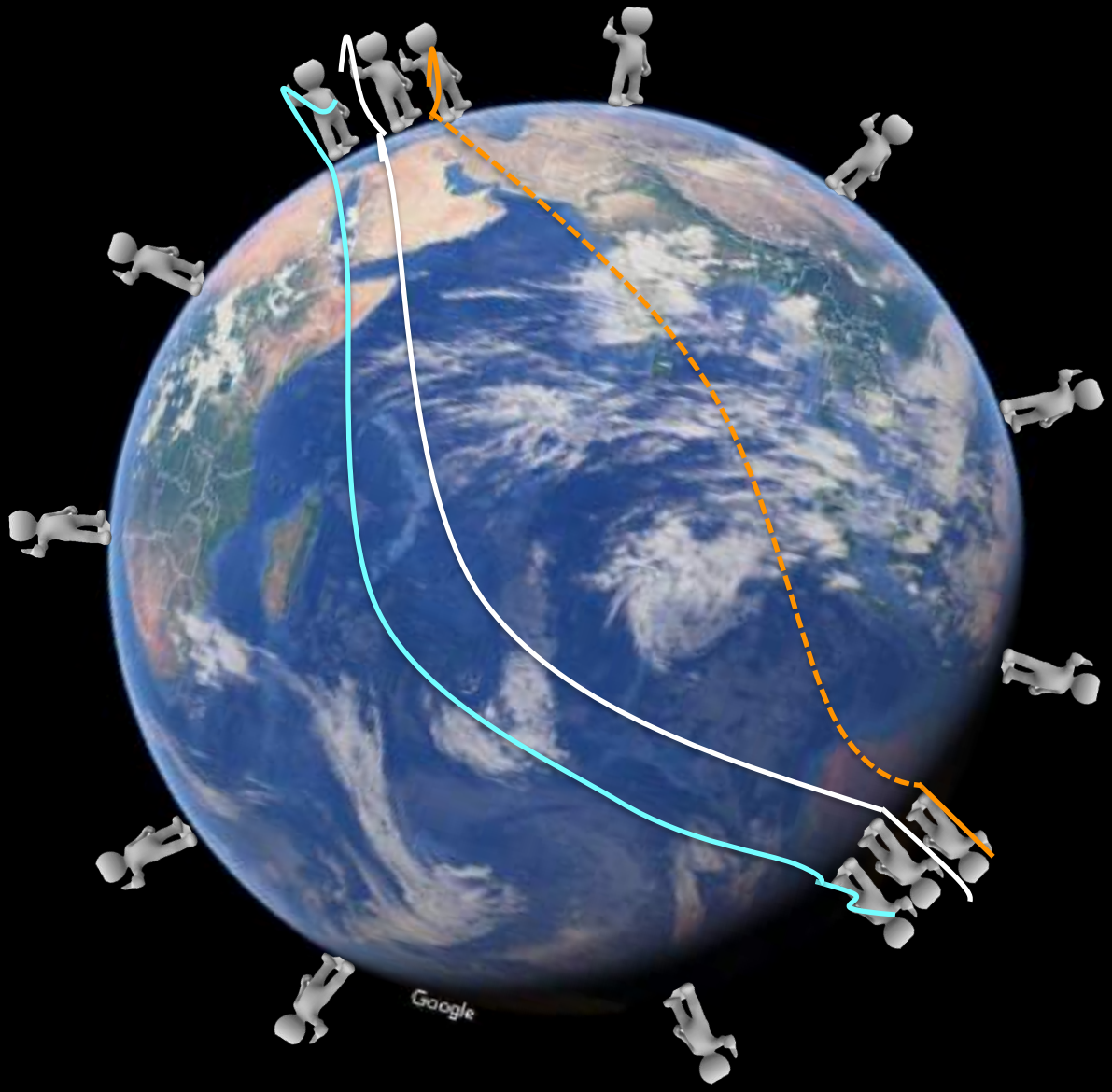
…tying each other with a mountain rope..



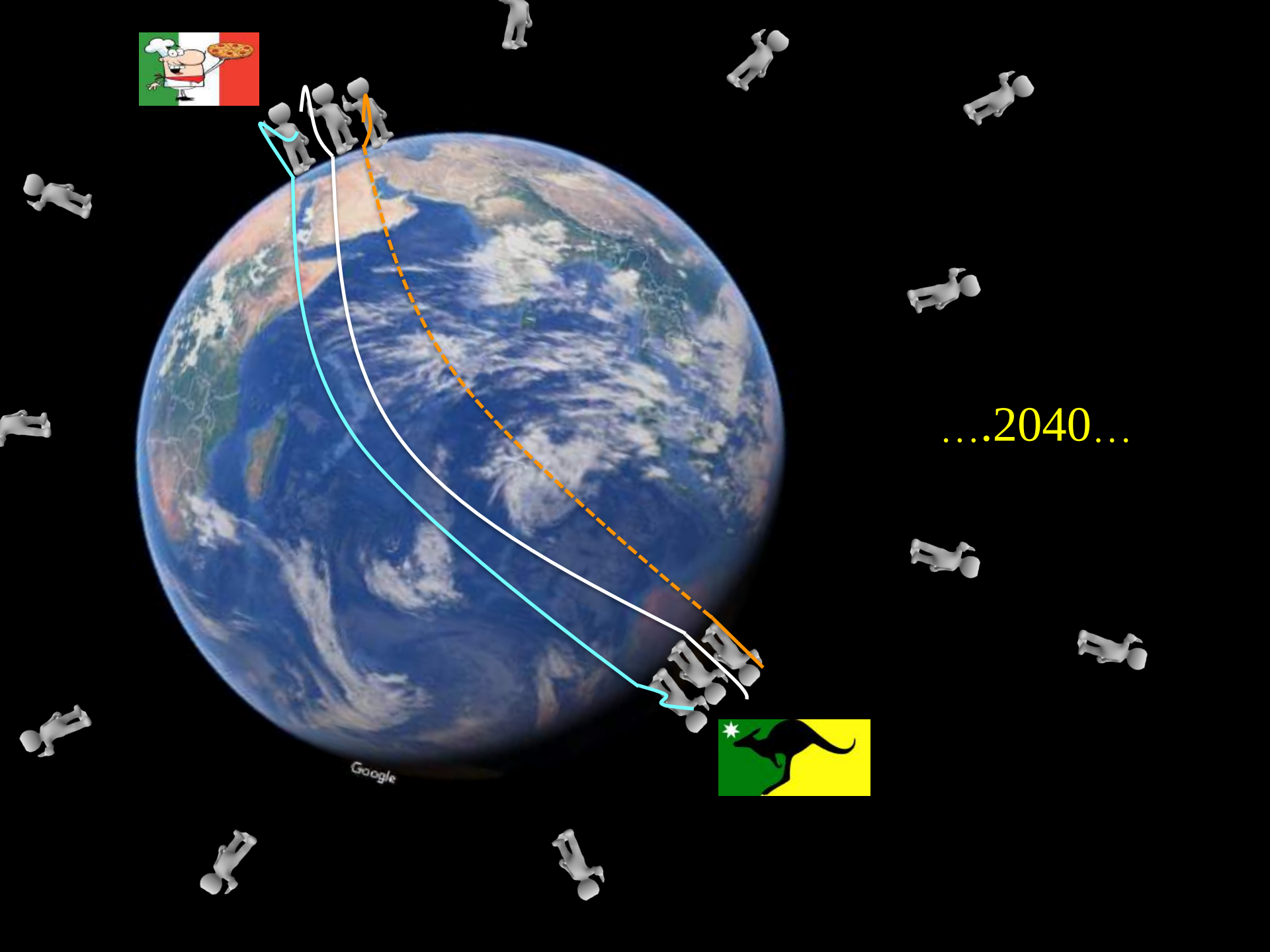


And be kept safe like this….


2020
Google



2030


….2040…
Google


even try to keep safe ….
CAMBISOL
PODZOL
GLEYSOL
FERRALSOL
ACRISOL
VERTISOL
……SOIL and …. HUMANITY !
Google