Antimicrobico-resistenza: cure e ambiente #7

Nulla è costante, se non il cambiamento

CONVEGNO ECM - **Crediti: 7**

19 giugno 2024 ore 9.15-17.30
Auditorium di Sant'Apollonia via S. Gallo, 25/a - Firenze

crea

Microbiota del suolo e cambiamenti climatici

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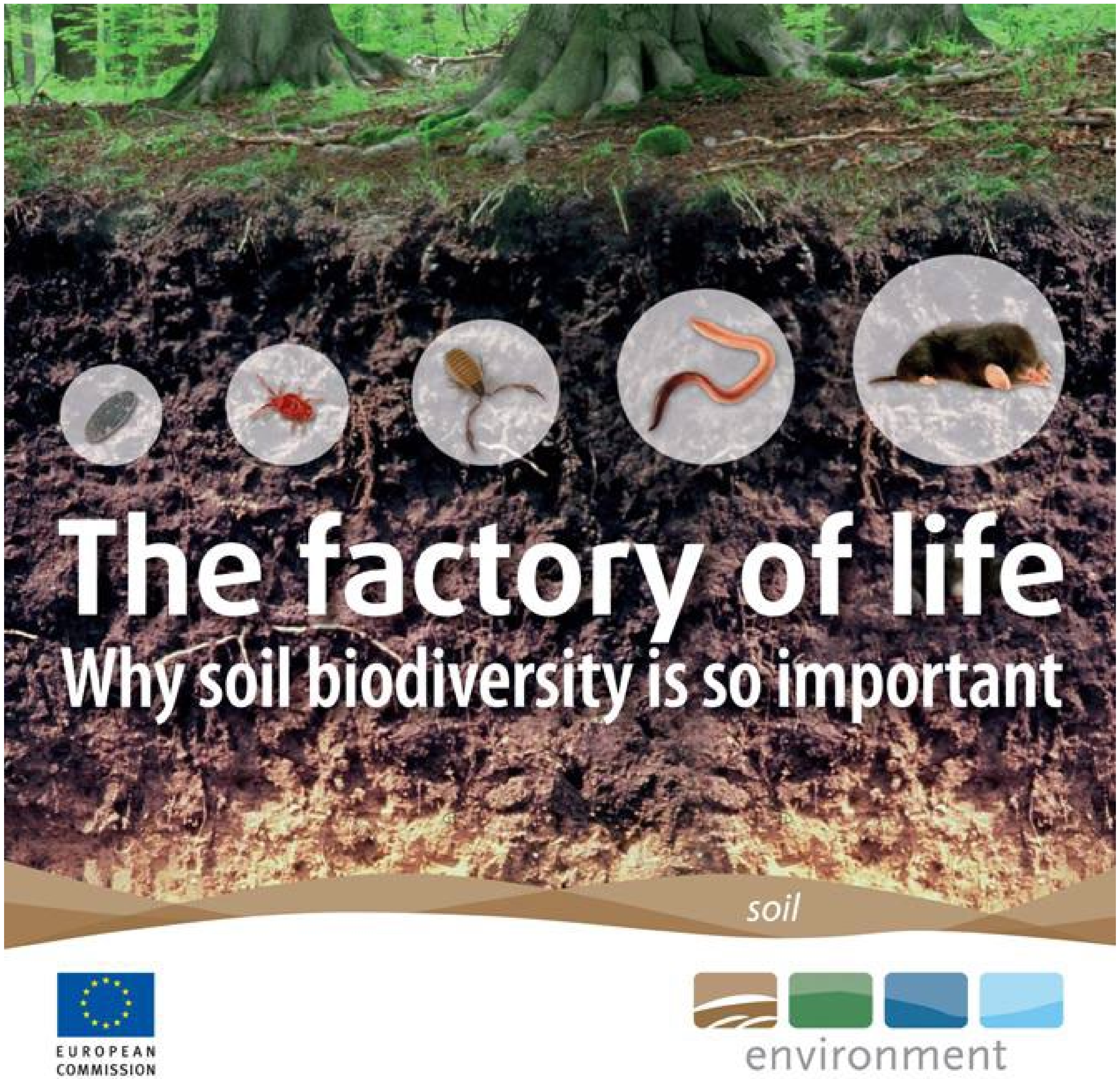
La biodiversità del suolo



Sotto i nostri piedi si nasconde un'enorme quantità di biomassa «invisibile» che svolge un dei servizi fondamentali per la sostenibilità del nostro pianeta. Il suolo, infatti, **contiene circa il 60% di tutta la biodiversità del pianeta** ma ne conosciamo meno del 1%!


A
B
C
D
E
F
G
H
I
J
K
L

Organismo	Numero per g di suolo
Acari	1-10
Nematodi	10-100
Protozoi	>100 mila
Alghe	>100 mila
Funghi	>1 milione (200m di ife)
Attinomiceti	>100 milioni
Batteri	>1 miliardo

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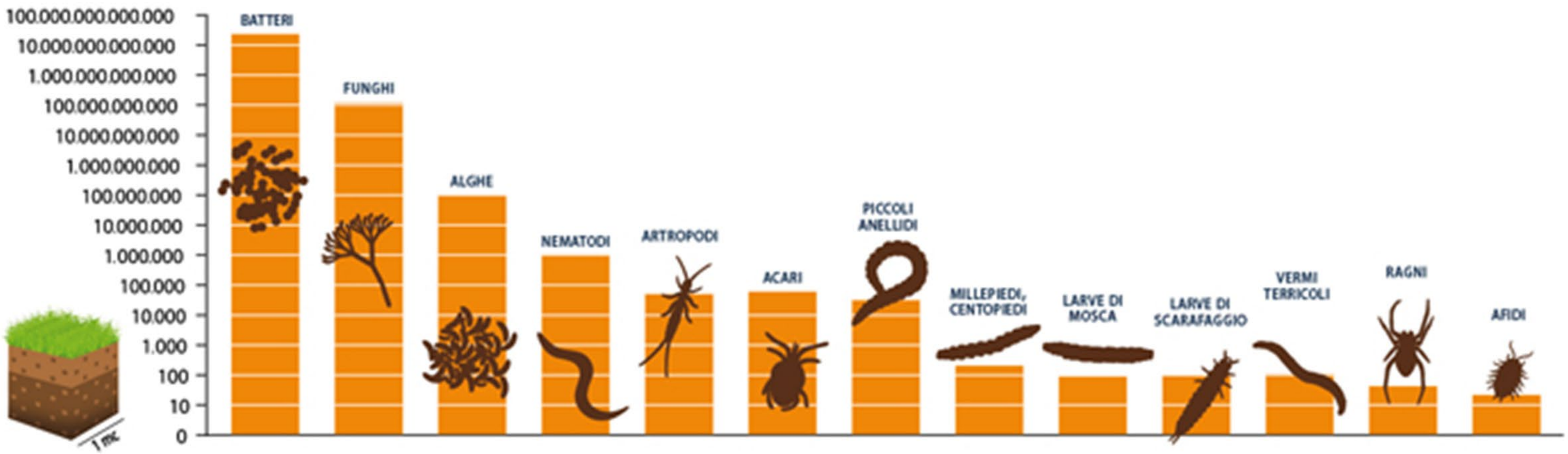
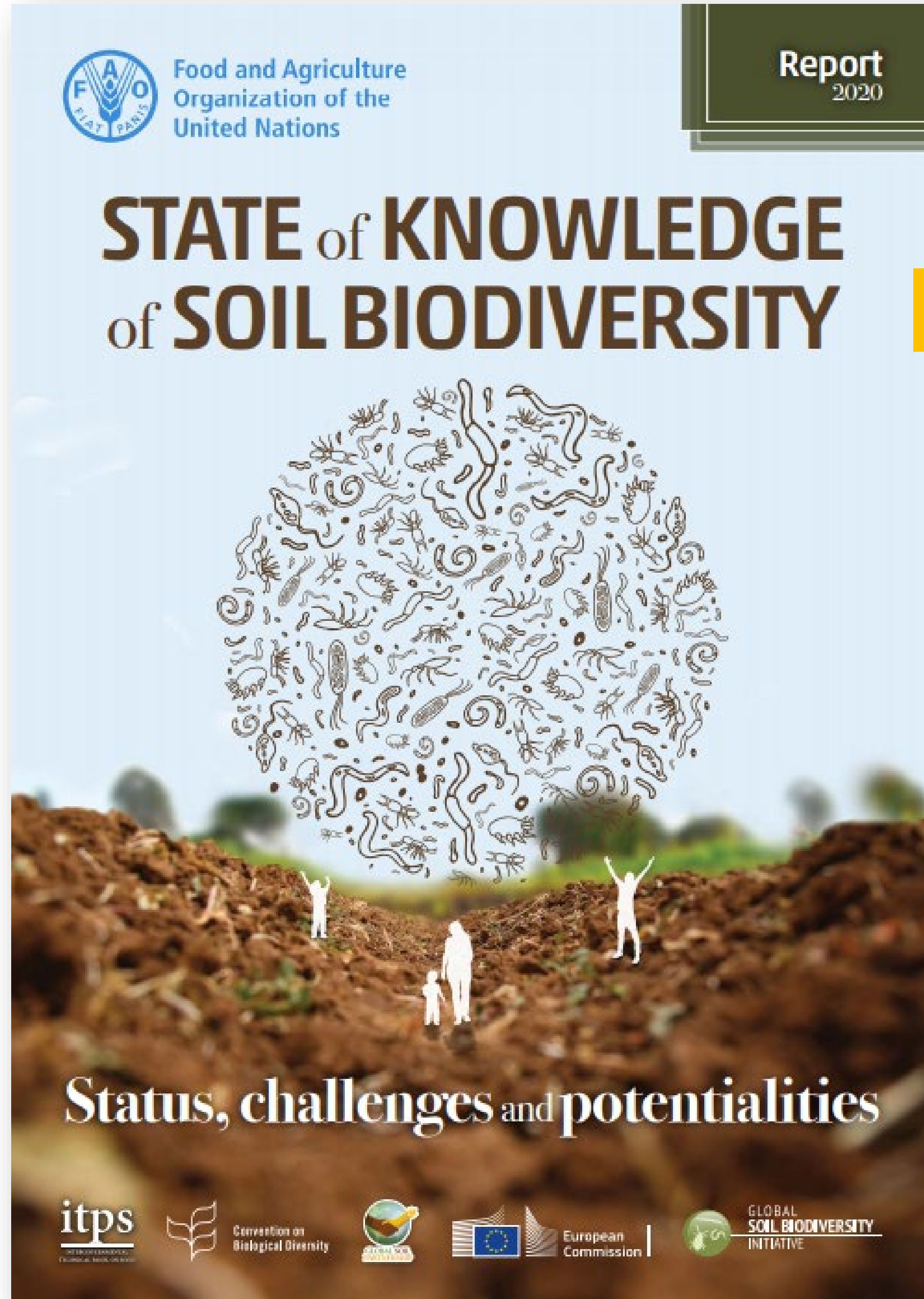


*Numero di microrganismi viventi in **1 mc di terreno fertile** in clima temperato (scala logaritmica).*

La biodiversità del suolo

"La biodiversità del suolo e una gestione sostenibile del suolo sono i presupposti per il conseguimento di numerosi Obiettivi di sviluppo sostenibile"

Maria Helena Semedo, 04-12-2020
(vicedirettore generale della Fao)



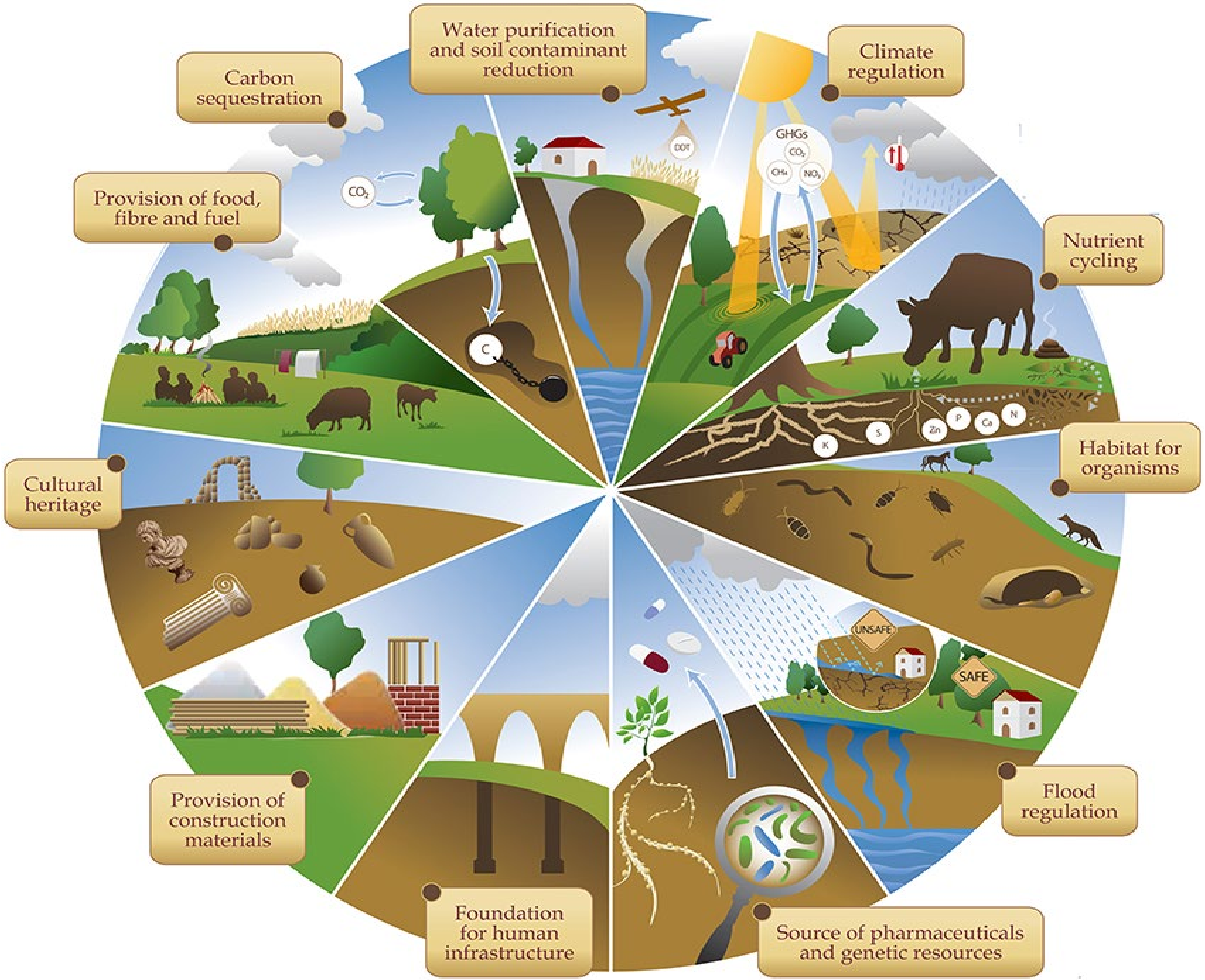
2020

http://www.fao.org/documents/card/en/c/CB1928EN

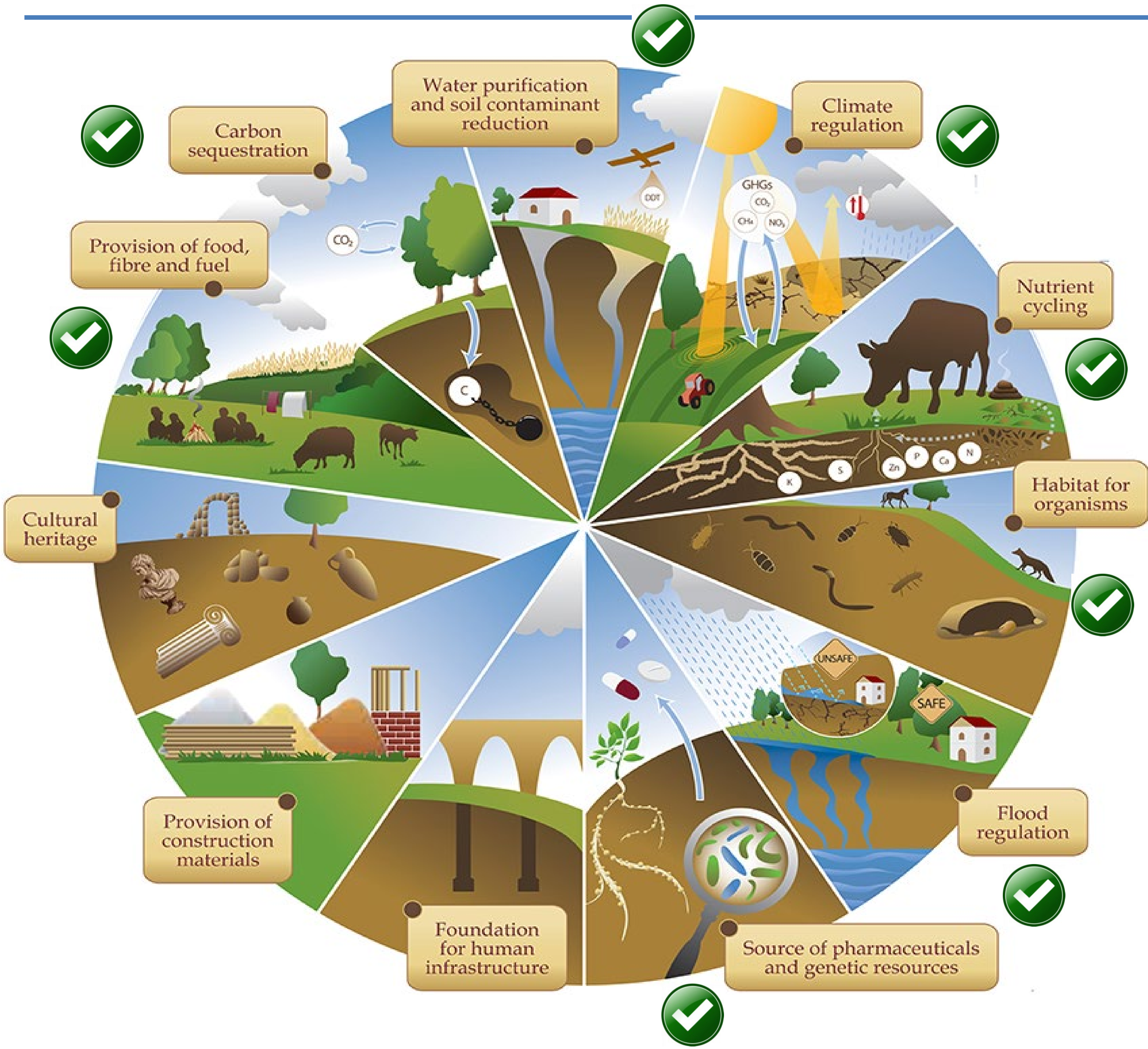
Obiettivi di sviluppo sostenibile (Agenda 2030)

Circa la metà degli obiettivi di sviluppo sostenibile individuati dall'ONU (Agenda 2030) dipende dal **suolo**

I servizi ecosistemici del suolo



I servizi ecosistemici del suolo



La maggior parte dei servizi ecosistemici del suolo dipende dalla biodiversità microbica

Perché la biodiversità del suolo è così importante?

REVIEW

doi:10.1038/nature11148

Biodiversity loss and its impact on humanity

Bradley J. Cardinale[1], J. Emmett Duffy[2], Andrew Gonzalez[3], David U. Hooper[4], Charles Perrings[5], Patrick Venail[1], Anita Narwani[1], Georgina M. Mace[6], David Tilman[7], David A. Wardle[8], Ann P. Kinzig[5], Gretchen C. Daily[9], Michel Loreau[10], James B. Grace[11], Anne Larigauderie[12], Diane S. Srivastava[13] & Shahid Naeem[14]

The most unique feature of Earth is the existence of life, and the most extraordinary feature of life is its diversity. Approximately 9 million types of plants, animals, protists and fungi inhabit the Earth. So, too, do 7 billion people. Two decades ago, at the first Earth Summit, the vast majority of the world's nations declared that human actions were dismantling the Earth's ecosystems, eliminating genes, species and biological traits at an alarming rate. This observation led to the question of how such loss of biological diversity will alter the functioning of ecosystems and their ability to provide society with the goods and services needed to prosper.

In the past 20 years remarkable progress has been made towards understanding how the loss of biodiversity affects the functioning of ecosystems and thus affects society. Soon after the 1992 Earth Summit in Rio de Janeiro, interest in understanding how biodiversity loss might affect the dynamics and functioning of ecosystems, and the supply of goods and services, grew dramatically. Major international research initiatives formed; hundreds of experiments were performed in ecosystems all over the globe; new ecological theories were developed and tested against experimental results.

Here we review two decades of research that has examined how biodiversity loss influences ecosystem functions, and the impacts that

its role in ecosystem and landscape processes[5]. Building on early studies of the effects of biodiversity on ecosystem processes, DIVERSITAS, the international programme dedicated to biodiversity science, produced a global research agenda[6].

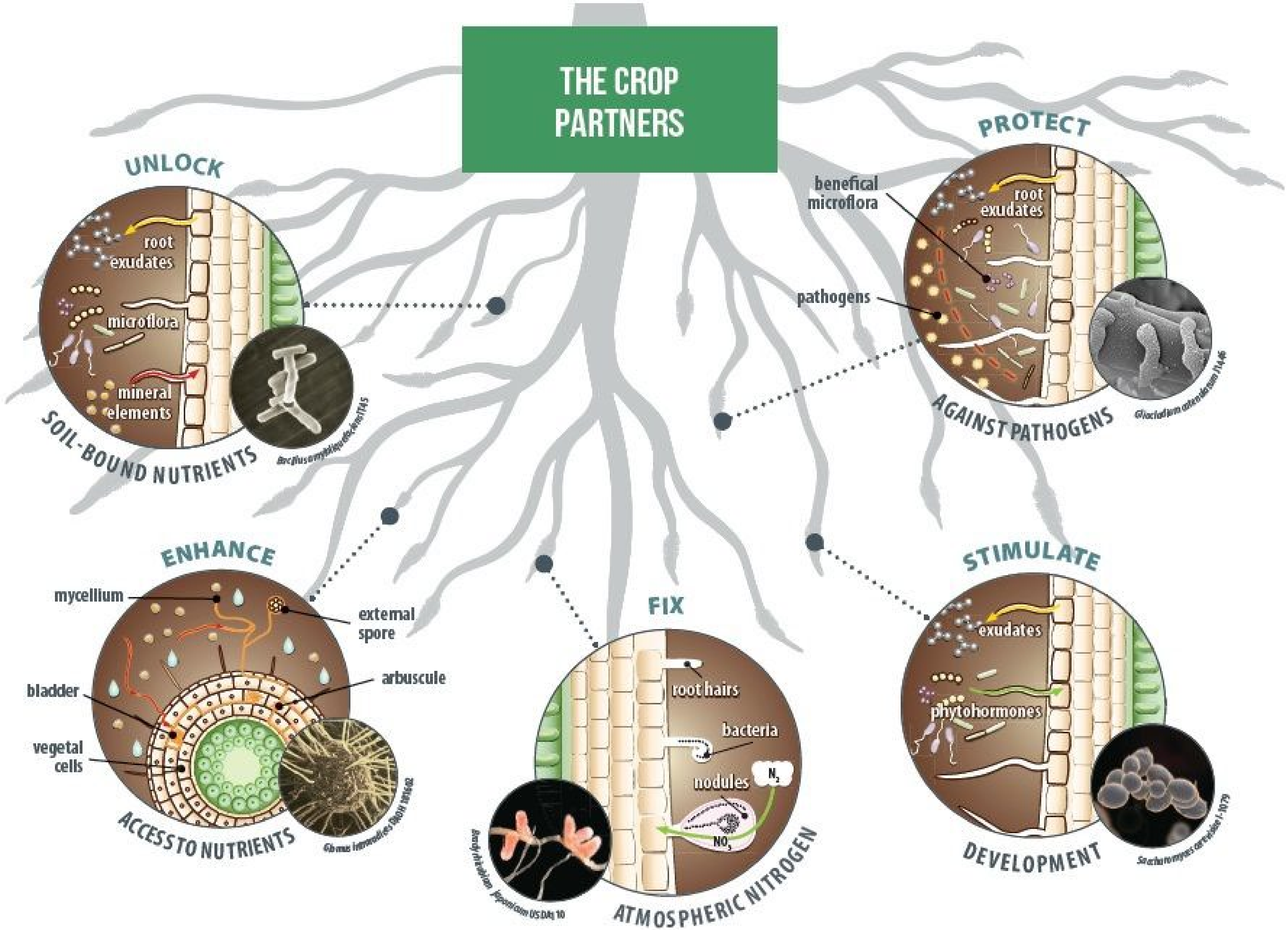
By the mid-1990s, BEF studies had manipulated the species richness of plants in laboratory and field experiments and suggested that ecosystem functions, like biomass production and nutrient cycling, respond strongly to changes in biological diversity[7-10]. Interpretation of these studies was initially controversial, and by the late 1990s BEF researchers were involved in a debate over the validity of experimental designs, the mechanisms responsible for diversity effects, and the relevance of

Cardinale et al., 2012. Nature, 486: 59-67

La perdita di biodiversità riduce la capacità del biota del suolo di procurarsi risorse essenziali (es. acqua, nutrienti, luce, ecc.), di produrre biomassa, di decomporre e riciclare nutrienti essenziali per i sistemi biologici, …

Servizi ecosistemici

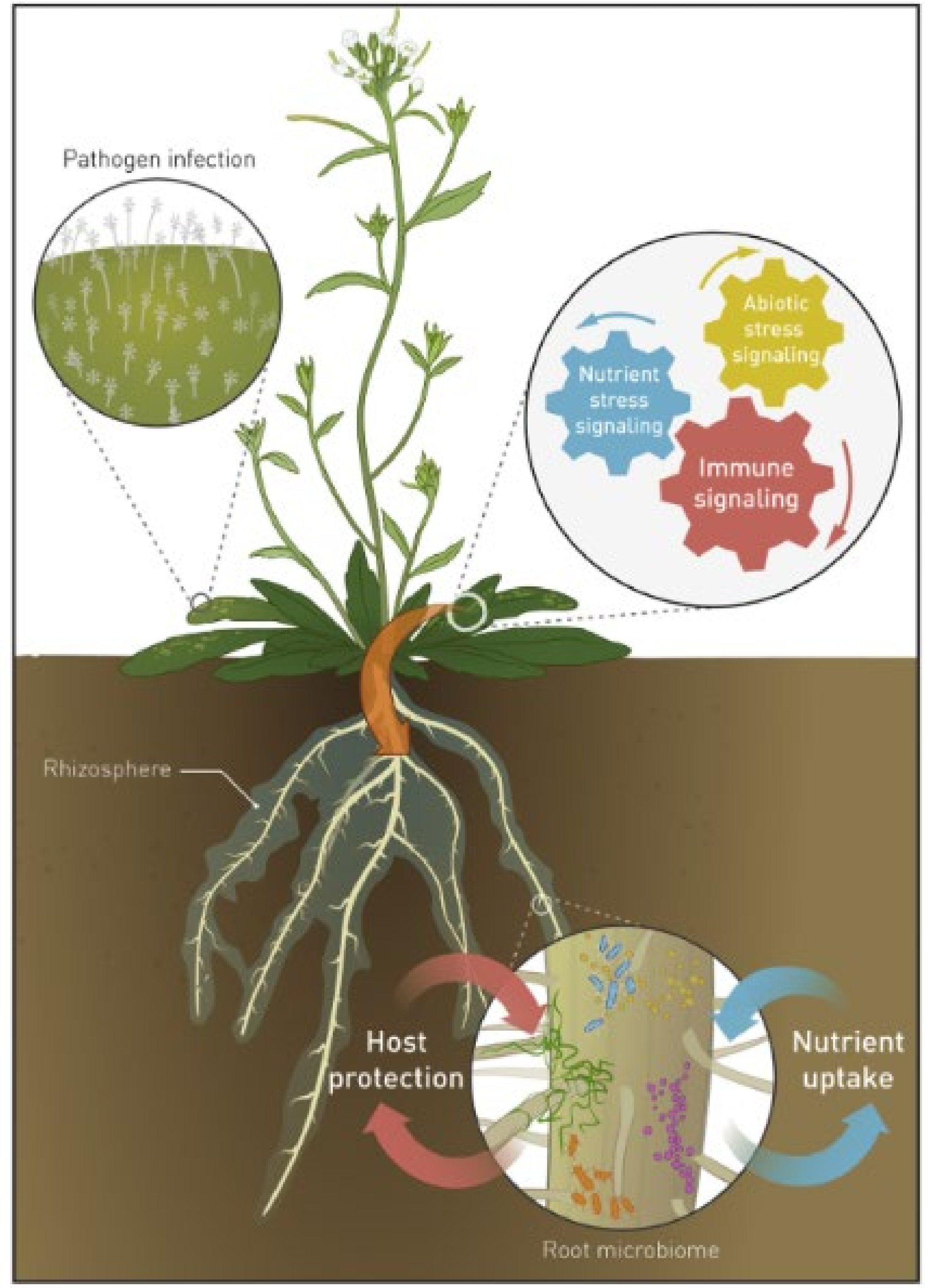
Interazioni benefiche piante-microrganismi



Il microbioma delle piante

Le piante sembrano essersi co-evolute col microbioma associato (“olobionte”), adottando così una strategia adattativa volta a selezionare i microrganismi più utili a promuovere, ad esempio:

- Soppressività dei suoli
- Modulazione ormonale della rizosfera
- Resistenza a stress abiotici/biotici



The Soil-Borne Legacy

Peter A.H.M. Bakker,[1,*] Corné M.J. Pieterse,[1] Ronnie de Jonge,[1,2,3] and Roeland L. Berendsen[1]
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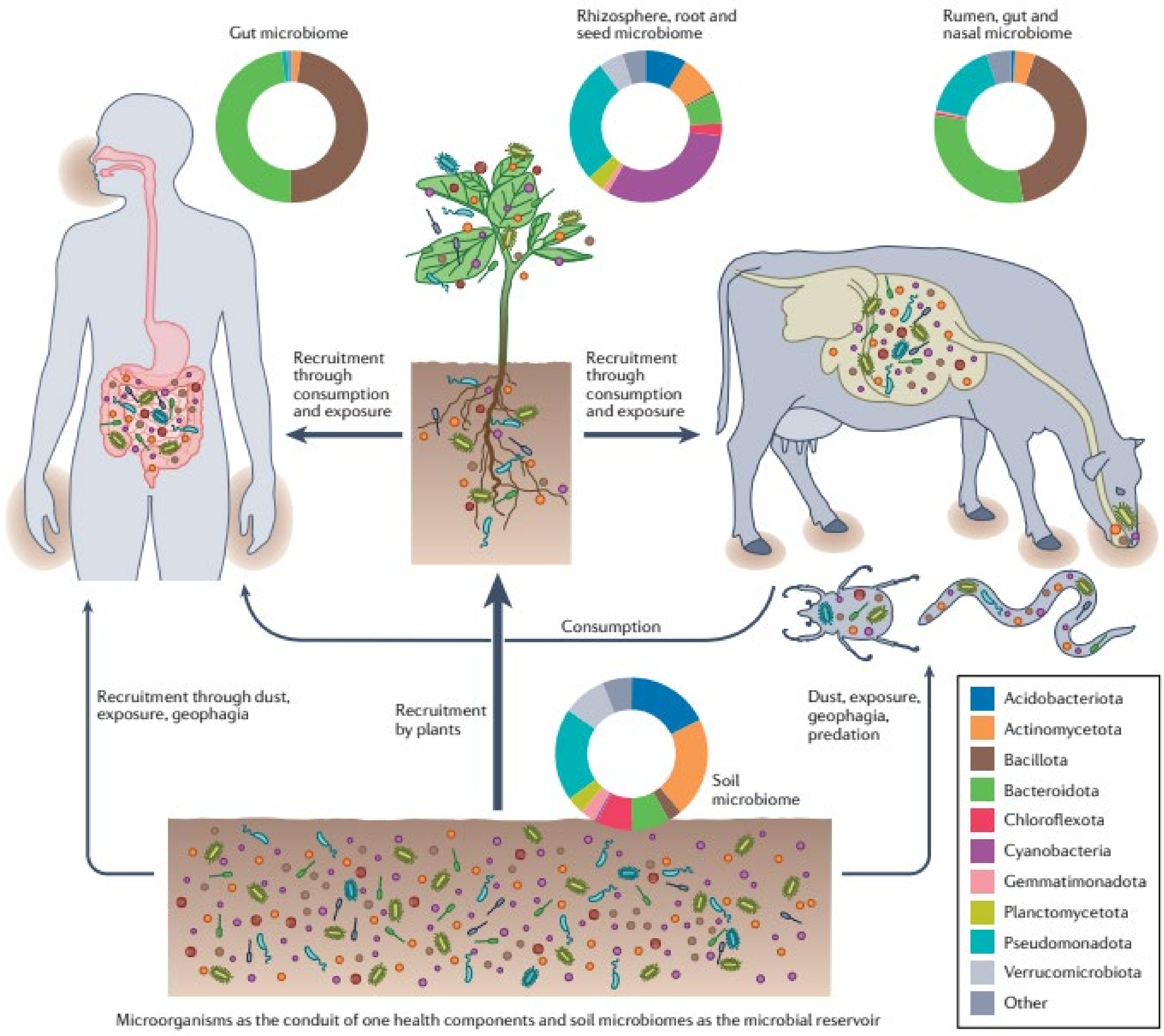
https://doi.org/10.1016/j.cell.2018.02.024

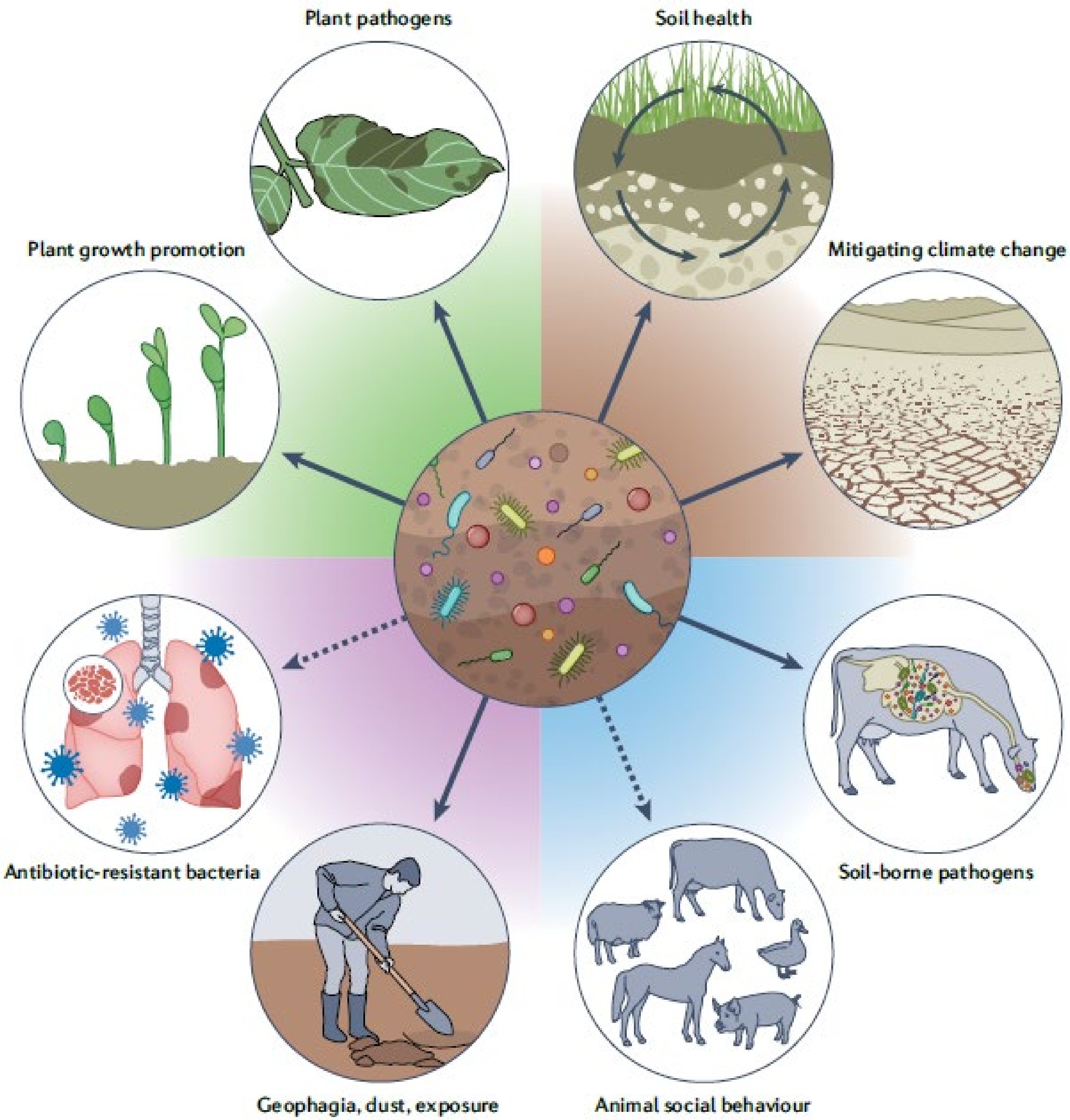
Plants greatly rely on their root microbiome for uptake of nutrients and protection against stresses. Recent studies have uncovered the involvement of plant stress responses in the assembly of plant-beneficial microbiomes. To facilitate durable crop production, deciphering the driving forces that shape the microbiome is crucial.

Microbioma del suolo come «olobionte»



Banerjee, S., & van der Heijden, M. G. (2022). Soil microbiomes and one health. *Nature Reviews Microbiology*, 1-15.

Il concetto di «one health»



Il concetto "**one health**" concepisce la salute e il benessere umano come parte inseparabile della salute degli altri componenti dell' ecosistema, come il suolo, piante ed animali

Banerjee, S., & van der Heijden, M. G. (2022). Soil microbiomes and one health. *Nature Reviews Microbiology*, 1-15.

Benefici della biodiversità microbica per la salute

PNAS PNAS PNAS PNAS

PERSPECTIVE

Regulation of the immune system by biodiversity from the natural environment: An ecosystem service essential to health

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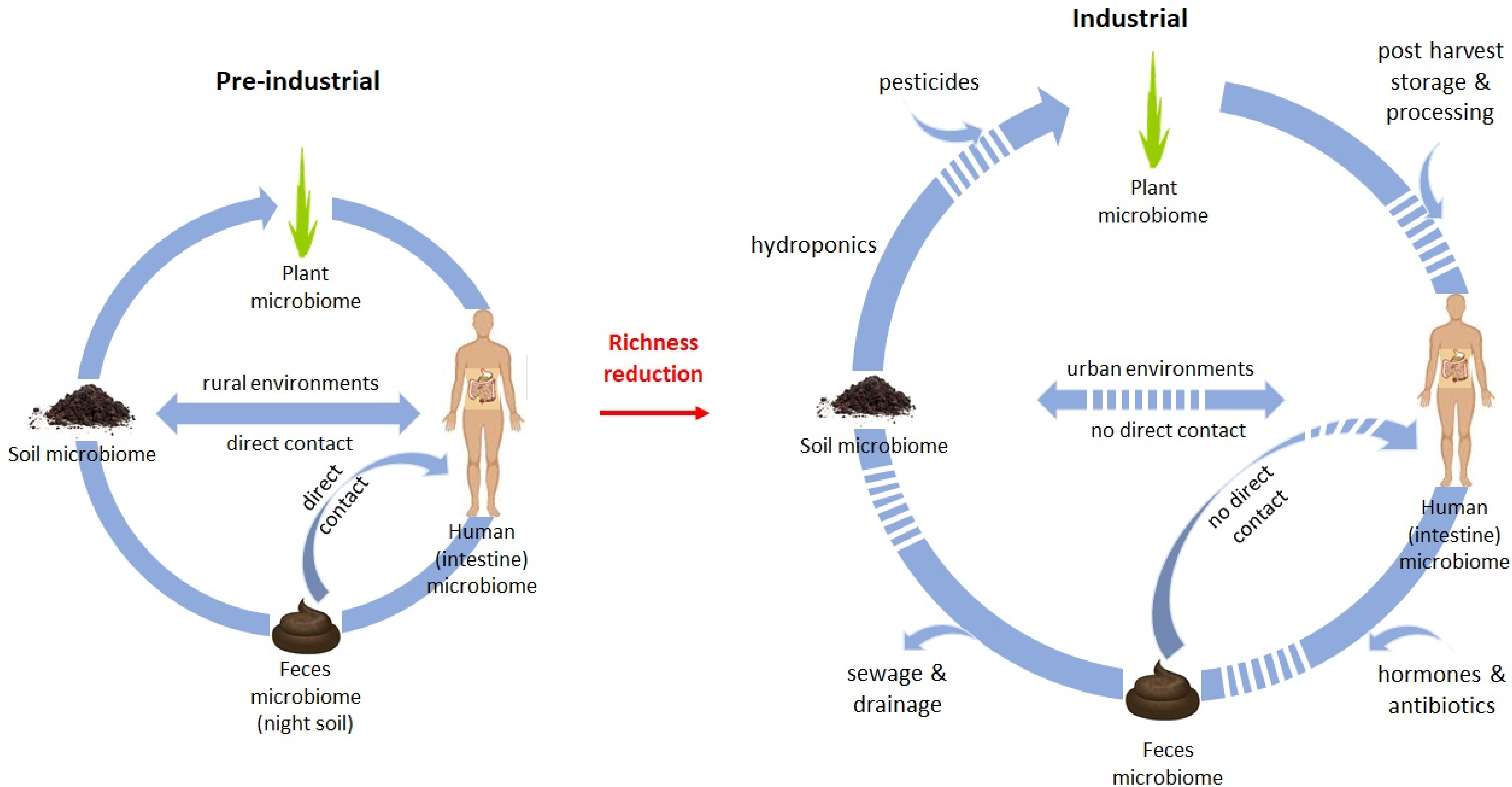
Edited by Ruslan Medzhitov, Yale University School of Medicine, New Haven, CT, and approved October 1, 2013 (received for review July 23, 2013)

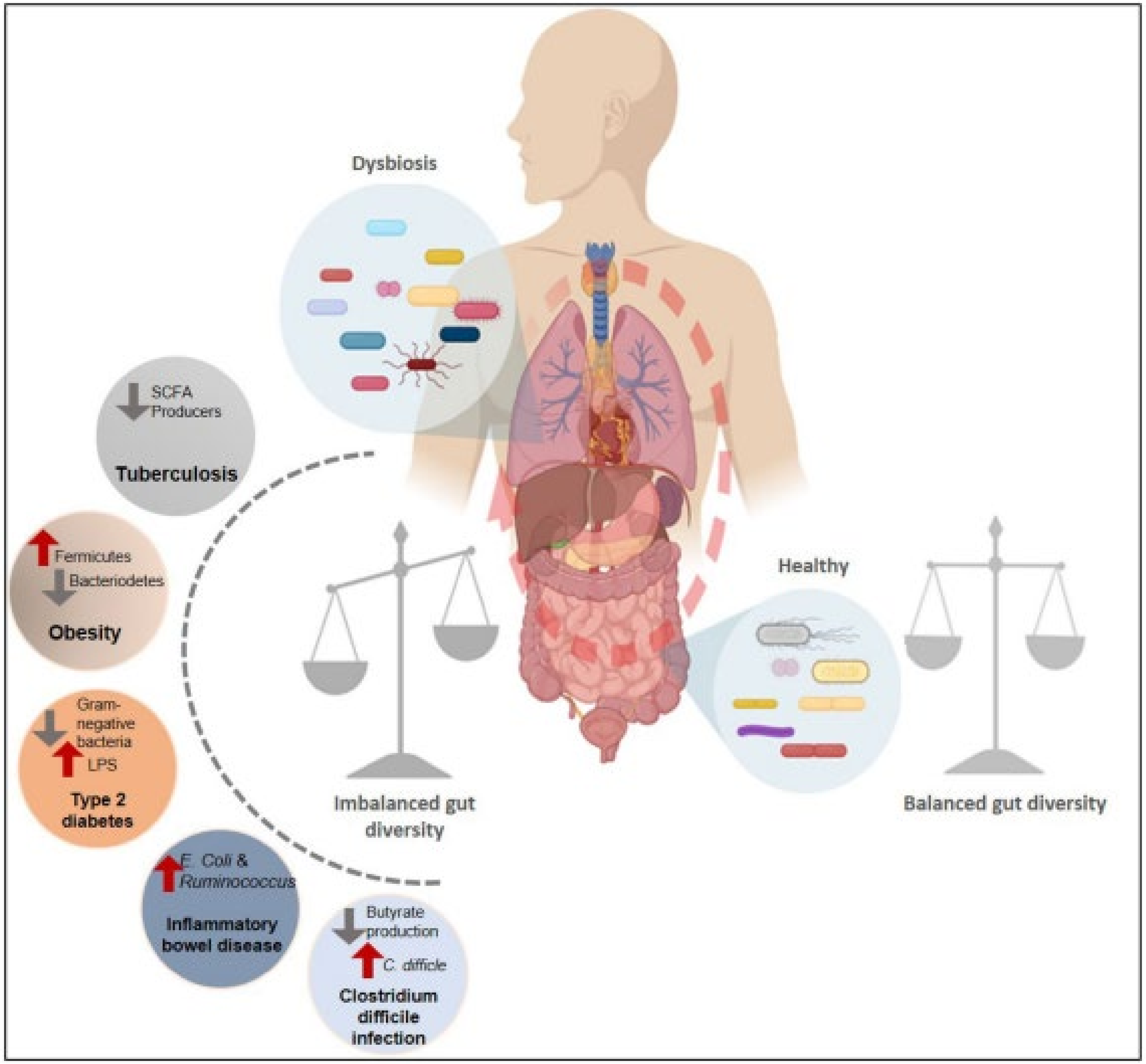
Epidemiological studies suggest that living close to the natural environment is associated with long-term health benefits including reduced death rates, reduced cardiovascular disease, and reduced psychiatric problems. This is often attributed to psychological mechanisms, boosted by exercise, social interactions, and sunlight. Compared with urban environments, exposure to green spaces does indeed trigger rapid psychological, physiological, and endocrinological effects. However, there is little evidence that these rapid transient effects cause long-term health benefits or even that they are a specific property of natural environments. Meanwhile, the illnesses that are increasing in high-income countries are associated with failing immunoregulation and poorly regulated inflammatory responses, manifested as chronically raised C-reactive protein and proinflammatory cytokines. This failure of immunoregulation is partly attributable to a lack of exposure to organisms ("Old Friends") from mankind's evolutionary past that needed to be tolerated and therefore evolved roles in driving immunoregulatory mechanisms. Some Old Friends (such as helminths and infections picked up at birth that established carrier states) are almost eliminated from the urban environment. This increases our dependence on Old Friends derived from our mothers, other people, animals, and the environment. It is suggested that the requirement for microbial input from the environment to drive immunoregulation is a major component of the beneficial effect of green space, and a neglected ecosystem service that is essential for our well-being. This insight will allow green spaces to be designed to optimize health benefits and will provide impetus from health systems for the preservation of ecosystem biodiversity.

Perdita di biodiversità microbica



Blum et al. (2019). Does soil contribute to the human gut microbiome?. *Microorganisms*, *7*(9), 287.

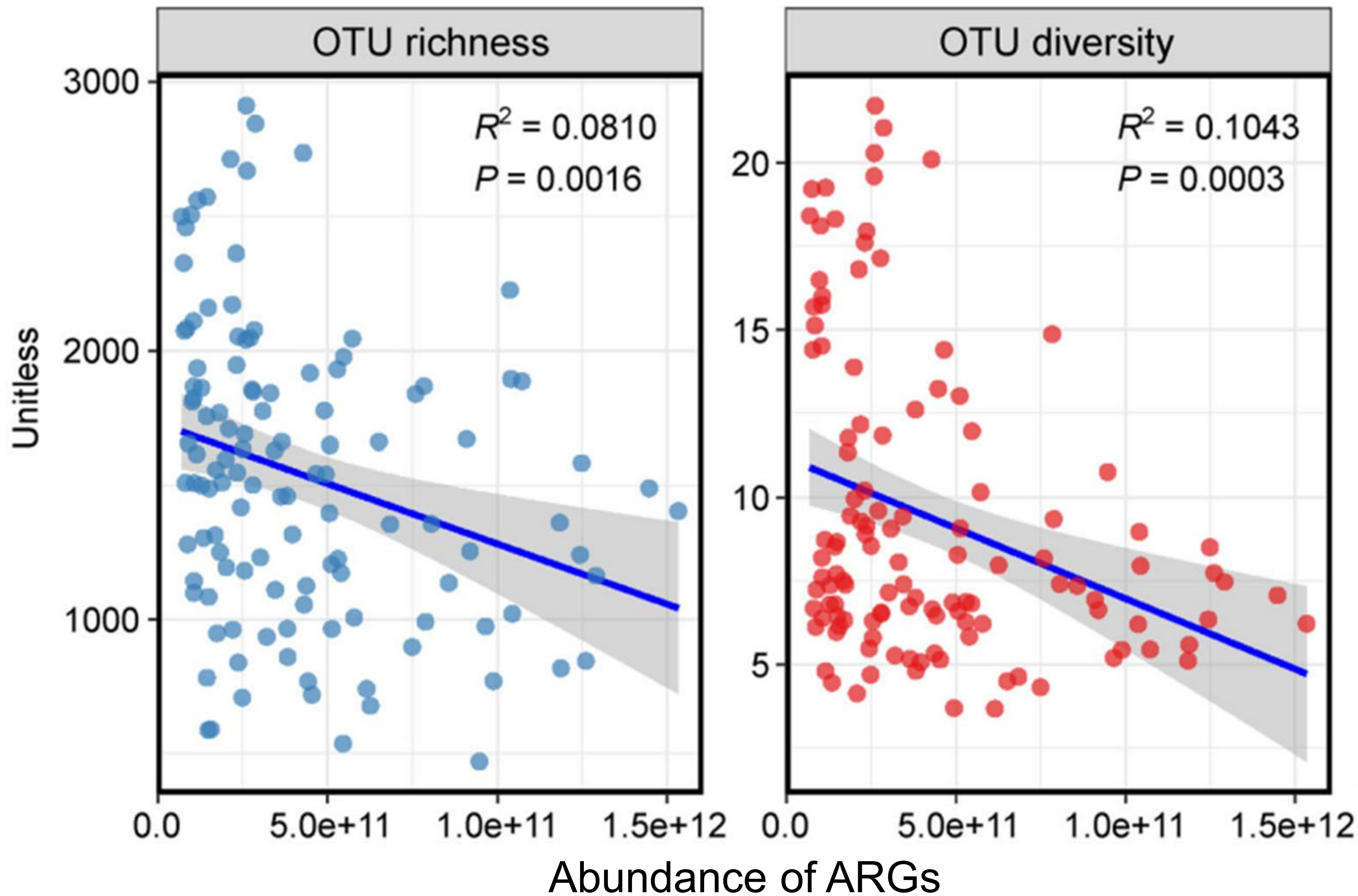
Perdita di biodiversità microbica



Singhvi, et al. (2020). Interplay of Human Gut Microbiome in Health and Wellness. *Indian J Microbiol (Jan–Mar 2020)*, *60*(1), 26-36.

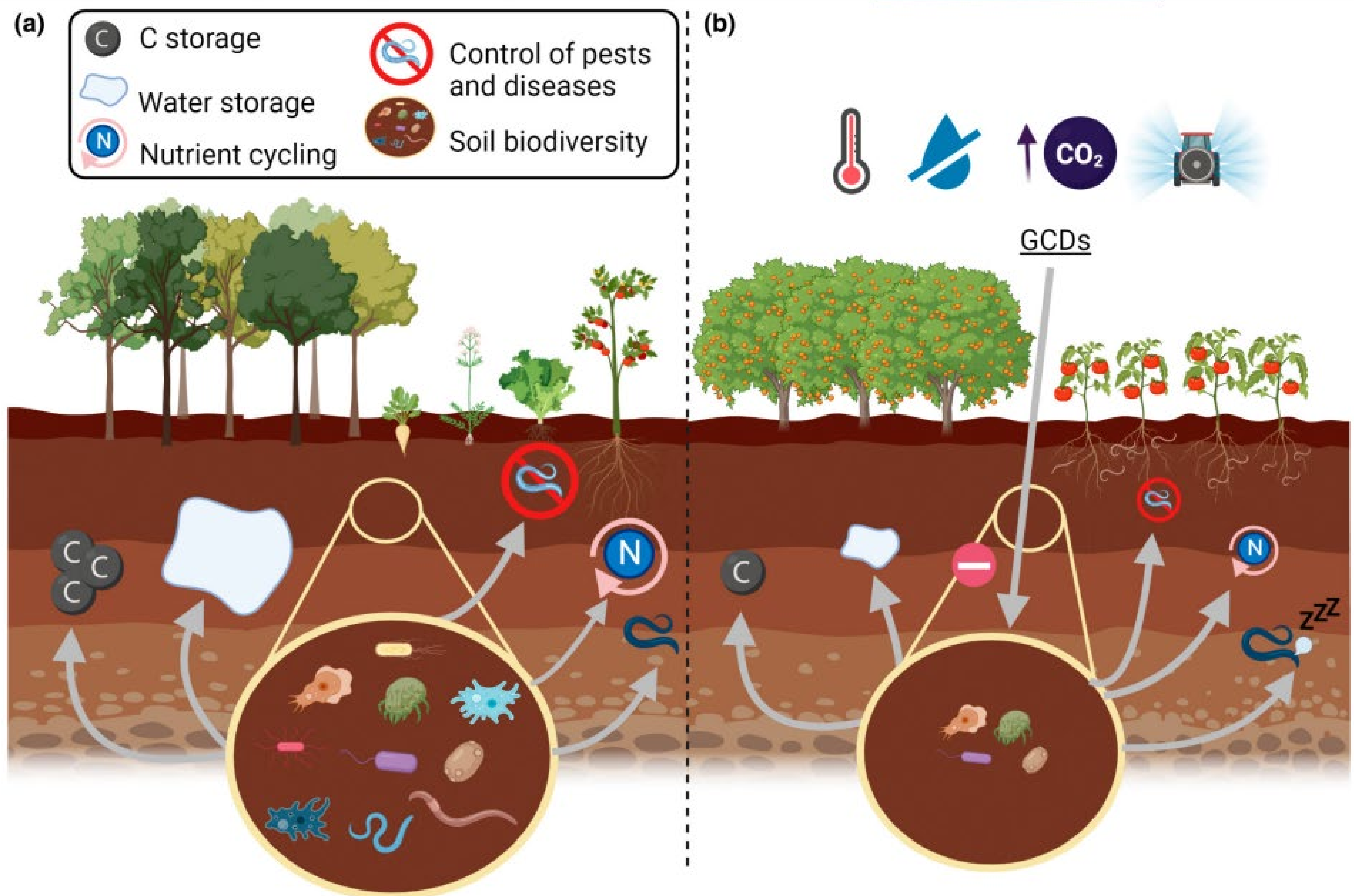
Biodiversità del suolo e antibiotico-resistenza

La diversità microbica del suolo è negativamente correlata con l'abbondanza di geni ARG. La perdita di diversità microbica favorisce la proliferazione di antibiotic-resistenze nel suolo



Chen, et al. (2019). Loss of soil microbial diversity exacerbates spread of antibiotic resistance. *Soil Ecology Letters*, *1*, 3-13.

Effetti dei cambiamenti climatici



Berlinches de Gea, A., Hautier, Y., & Geisen, S. (2023). Interactive effects of global change dvrivers as determinants of the link between soil biodiversity and ecosystem functioning. *Global Change Biology*, *29*(2), 296-307.

Effetti dei cambiamenti climatici

PSF type	Climate change drivers				
	Warming	Drier conditions	Wetter conditions	Fire	Increased CO_2
Fungi					
Pathogens	+++	−−	+++	−−	0
Saprotrophic/organic matter decomposers	++	−−	+++	−−	?
AM fungi	+++	+++	+	−−−	?
EM fungi	+	−−−	+	−−−	+
Bacteria					
Pathogens	+++	−−	+++	−−	?
Symbiotic N fixers	0	−−−	++	0	+
Nonsymbiotic N fixers	0	−−	++	0	+
Drought-tolerant microbes	+	+++	−−	0	?
Other specific coevolved microbes	+++	−−−	++	++	?
Other					
Primary detritivorous invertebrates	++	−−	++	−−	?
Secondary detritivorous invertebrates	++	−−	++	−	?
Root herbivores	++	−−	++	0	?

Pugnaire et al., Sci. Adv. 2019; 5 : eaaz1834 27 November 2019


Grazie per l’attenzione