A bug's eye view: soil management effects on microbial biodiversity

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Biodiversity

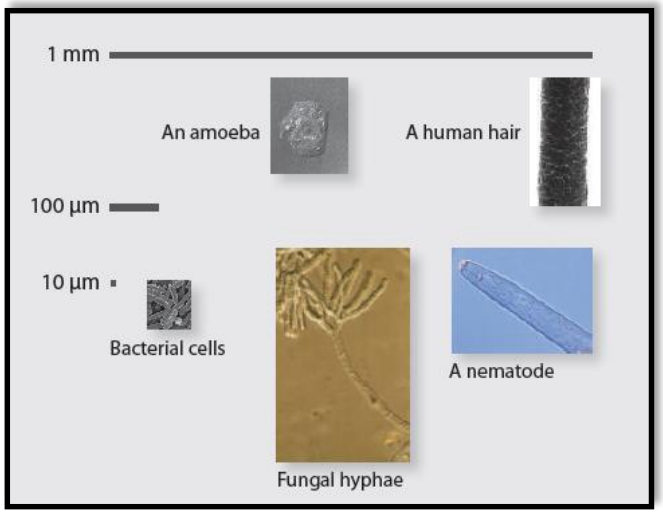
"The variety of life in a particular habitat or ecosystem"

Soil biodiversity: out of sight, out of mind…?

Soil Life

European Atlas of Soil Biodiversity

Up to one quarter of the Earth's species live in soil!



- Microorganisms
- Small and large invertebrates
- Mammals
- Plant roots

Soil biota and function

Ecosystem services
Decomposition & cycling of organic matter
Regulation of nutrient availability
Suppression of pests and disease
Maintenance of soil structure & hydrology
Gas exchange and carbon storage
Soil Detoxification
Plant growth control

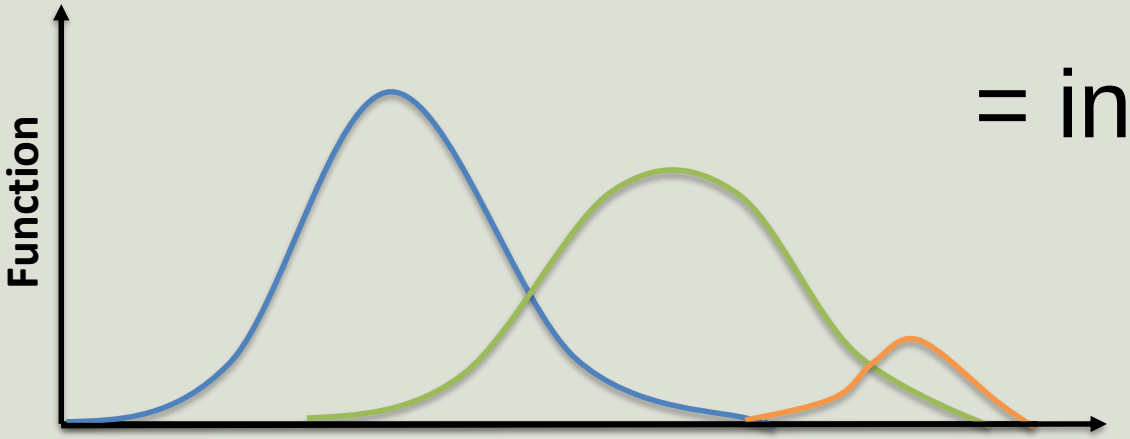
Decomposition

Sask. wind erosion

Estimated value:
$1.5 trillion y^{-1}
(FAO)

Soil biodiversity and function

Functional redundancy

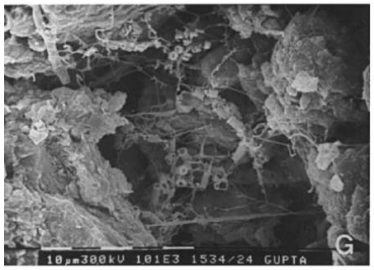


= insurance!

Soil microbial abundance

Microbial biomass in arable land

= 0.0025 g g^{-1} soil



Gupta and Germida,1988

Equivalent to 100 sheep ha^{-1}!

(K. Ritz)


http://standrewscobourg.org/2014/11/be-the-sheep/

Soil biota and function

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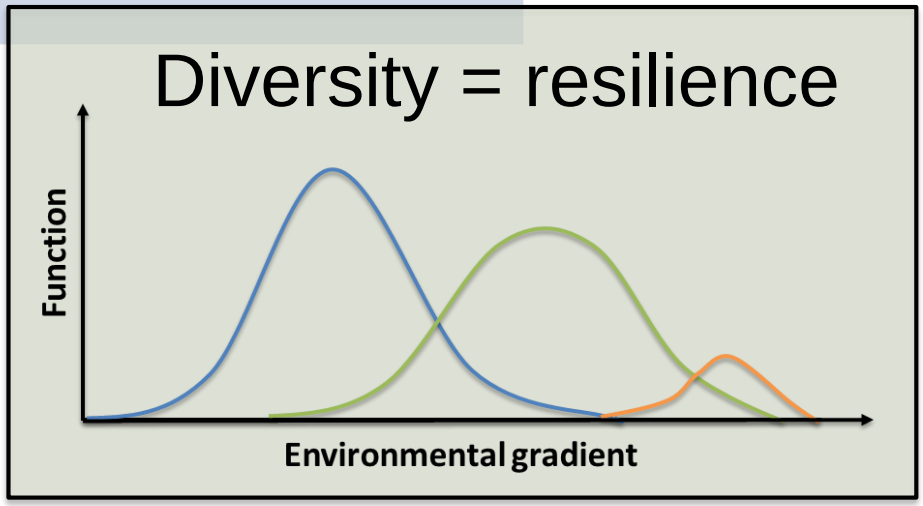
Abundance = capacity

Diversity = resilience



Long-term management: Rotation ABC

<u>Established in 1910</u>

Rotation A: continuous wheat
Rotation C: fallow-wheat-wheat

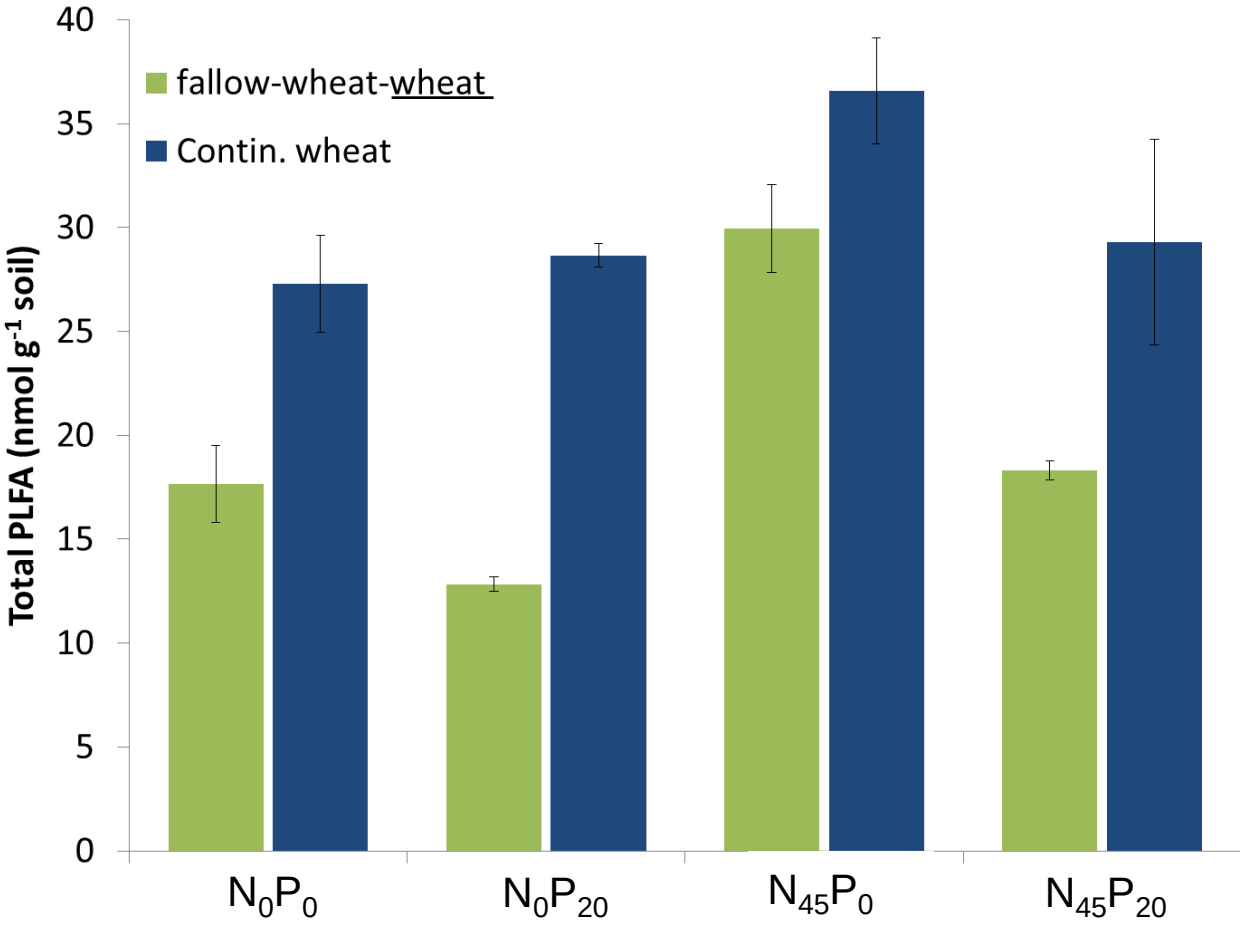
N_0P_0
N_0P_{20}
$N_{45}P_0$
$N_{45}P_{20}$

AAFC Lethbridge, AB

1967: 45 kg ha^{-1} N
1972: 20 kg ha^{-1} P

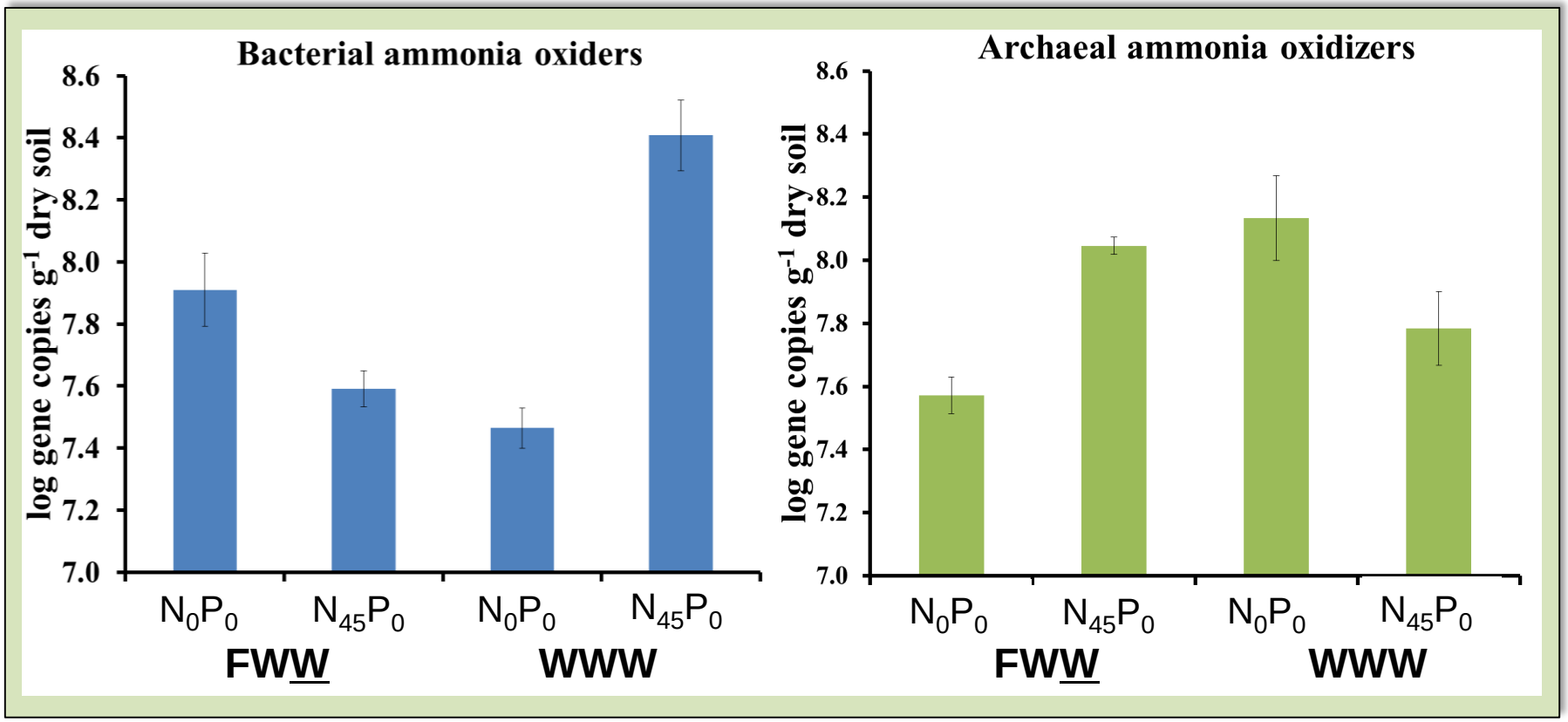
Rotation ABC

Continuous cropping increases microbial biomass, even when nutrients are limiting



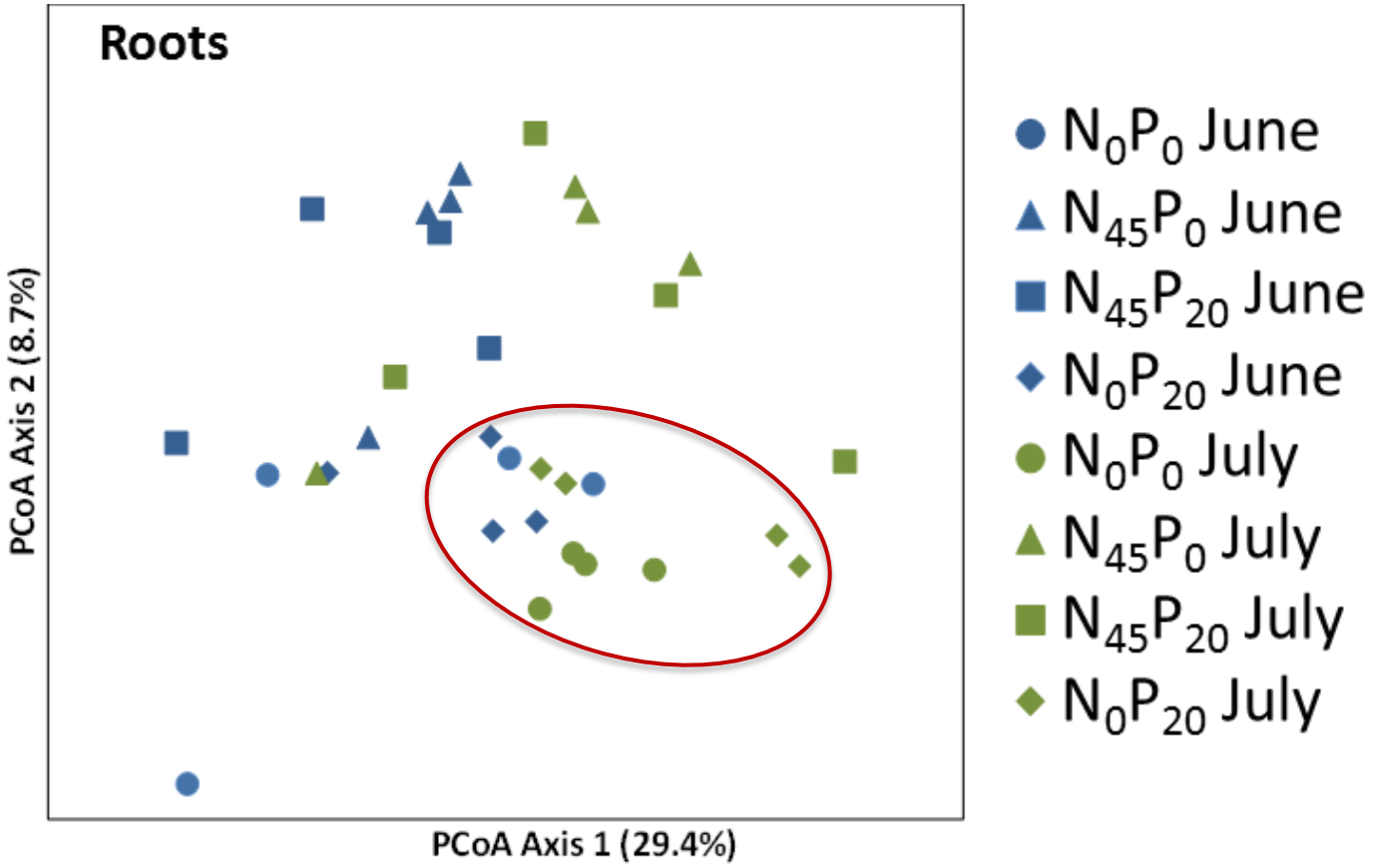
Rotation ABC

Cropping intensity and fertilizer application affects microbial populations differently



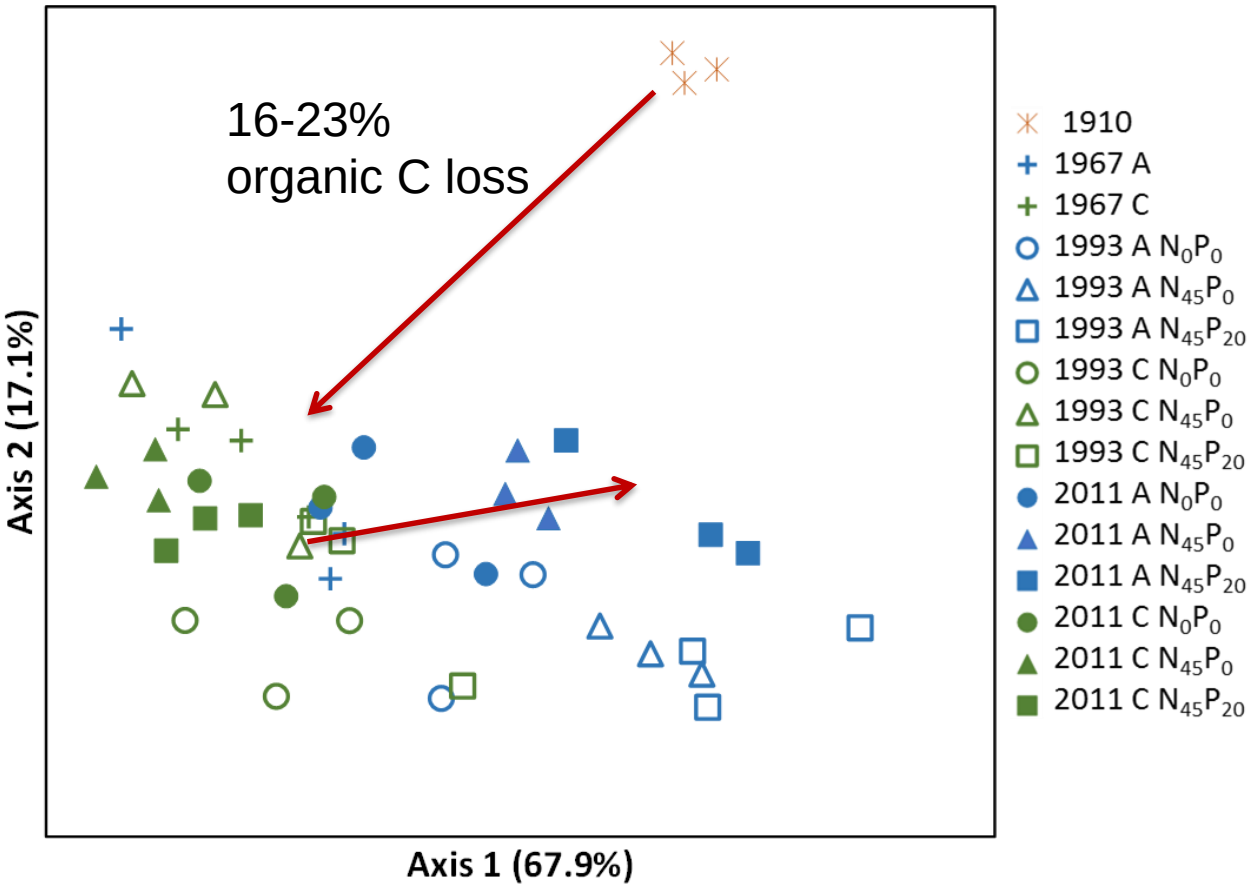
Rotation ABC

Plant-associated bacterial communities differ with long-term fertilizer application



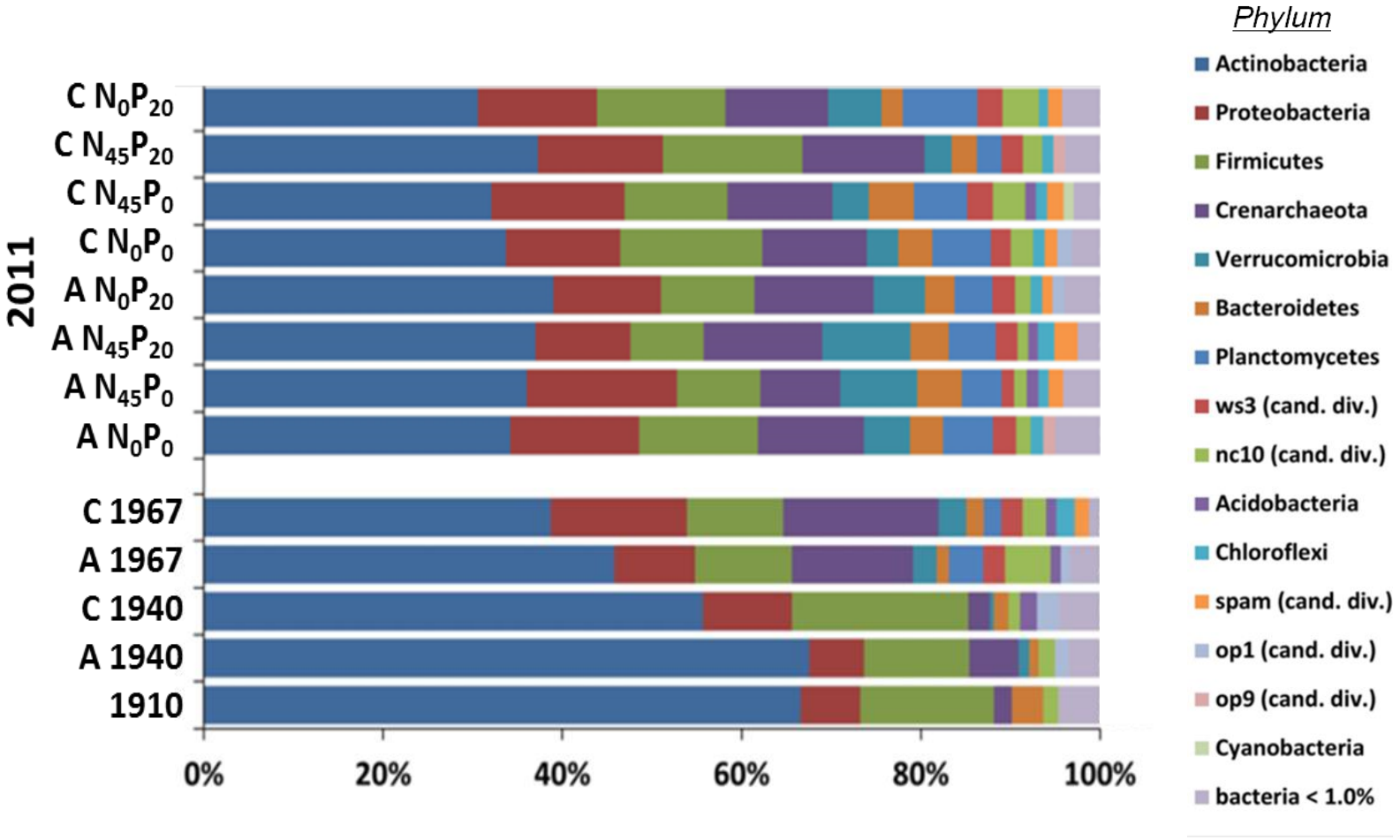
Exploring the soil archive

Soil organic matter composition changes with cultivation; good management may restore inherent fertility

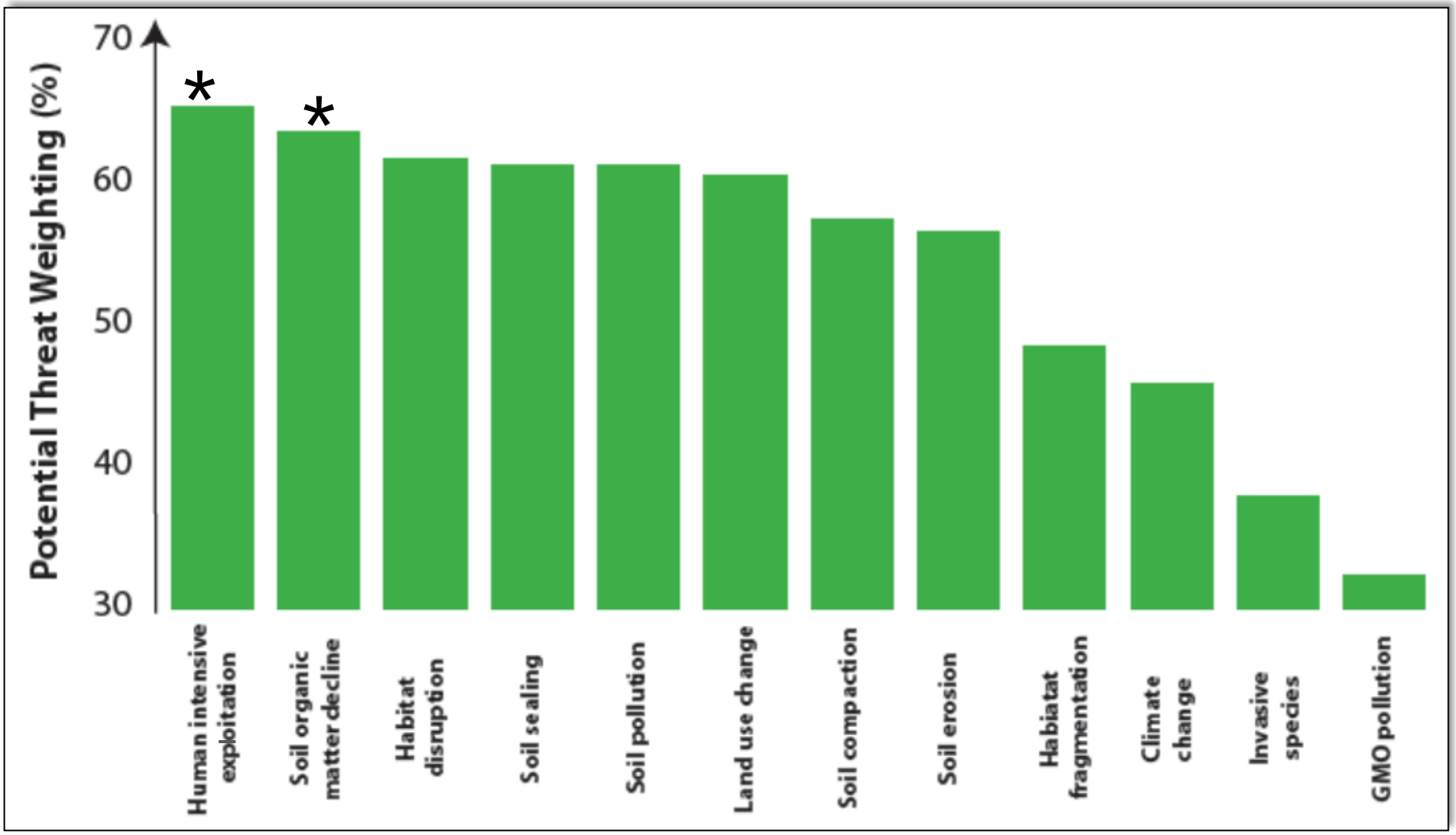


Rotation ABC archived soils

DNA profiling of archived soils has revealed diverse bacterial DNA signatures



Threats to soil biodiversity



European Atlas of Soil Biodiversity

Soil biodiversity

"the wood-wide-web"

The Scientist » News & Opinion » Daily News

New Antibiotic from Soil Bacteria

Researchers have isolated a new kind of antibiotic from a previously unknown and uncultured bacterial genus.

By Anna Azvolinsky | January 7, 2015

3 Comments Like 6.1k +1 44

Ichip being removed from soil
NORTHEASTERN UNIVERSITY, SLAVA EPSTEIN

Many of the most widely used antibiotics have come out of the dirt. Penicillin came from *Penicillium*, a fungus found in soil, and vancomycin came from a bacterium found in dirt. Now, researchers from Northeastern University and NovoBiotic Pharmaceuticals and their colleagues have identified a new Gram-positive bacteria-targeting antibiotic from a soil sample collected in Maine that can kill species including methicillin-resistant *Staphylococcus aureus* (MRSA) and *Mycobacterium tuberculosis*. Moreover, the researchers have not yet found any bacteria that are resistant to the antibiotic, called teixobactin. Their results are published today (January 7) in *Nature*.

The Scientist » News & Opinion » Daily News

Soil Microbiome of Central Park

Nearly 600 soil samples from New York City's famous park reveal that the urban environment harbors just as much biodiversity as natural ecosystems across the globe.

By Jef Akst | September 30, 2014

1 Comment Like 198 +1 2

Central Park in New York City
FLICKR, KEVIN DOOLEY

The soil of New York City's Central Park is bursting with biodiversity spanning all three domains of life, according to a study published today (October 1) in *Proceedings of the Royal Society B*. In fact, the urban environment harbored as many different microbial species as diverse biomes around the world, including the soils of the arctic, desert, and tropical locales.

"This is an excellent work [that] demonstrates the vast diversity of soil community, most of which remained undescribed," microbial ecologist Brajesh Singh of the University of Western Sydney in Australia wrote in an e-mail. "Interestingly they found that belowground diversity from urban and managed soils have similar diversity to some of known natural ecosystems, which indicate the high resilience of belowground diversity to anthropogenic pressures."

Acknowledgements

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Rotation ABC

Cropping intensity and fertilizer application affects microbial populations differently