Fertilidade e biologia do solo: integração e tecnologias para todos
15 a 19 de Setembro de 2014
Araxá - MG
FertBio 2014

DESAFIOS NA DEFINIÇÃO DE TÉCNICAS ADEQUADAS PARA O MANEJO DO SOLO: ABORDAGEM MICROBIOLÓGICA À LUZ DAS NOVAS TECNOLOGIAS DE SEQUENCIAMENTO

Luiz Fernando Wurdig Roesch & Victor Satler Pylro

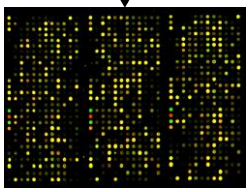
Promoção e realização
Sociedade Brasileira de Ciência do Solo
Núcleo Regional Leste

Busca frequente por indicadores sensíveis para o monitoramento de alterações ambientais

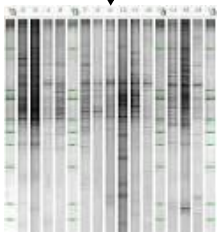
Técnicas Moleculares

Extração de DNA

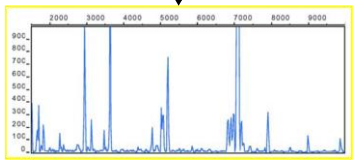
Amplificação e análise



Micro-arranjos



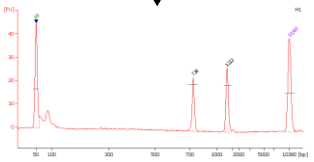
DGGE



TRFLP

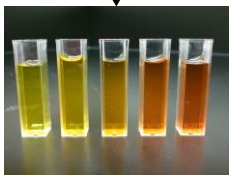
Técnicas Bioquímicas

Perfil de ácidos graxos



Taxa de respiração

Atividade enzimática



nature Vol 437|15 September 2005|doi:10.1038/nature03959

ARTICLES

Genome sequencing in microfabricated high-density picolitre reactors

Marcel Margulies[1]*, Michael Egholm[1]*, William E. Altman[1], Said Attiya[1], Joel S. Bader[1], Lisa A. Bemben[1], Jan Berka[1], Michael S. Braverman[1], Yi-Ju Chen[1], Zhoutao Chen[1], Scott B. Dewell[1], Lei Du[1], Joseph M. Fierro[1], Xavier V. Gomes[1], Brian C. Godwin[1], Wen He[1], Scott Helgesen[1], Chun He Ho[1], Gerard P. Irzyk[1], Szilveszter C. Jando[1], Maria L. I. Alenquer[1], Thomas P. Jarvie[1], Kshama B. Jirage[1], Jong-Bum Kim[1], James R. Knight[1], Janna R. Lanza[1], John H. Leamon[1], Steven M. Lefkowitz[1], Ming Lei[1], Jing Li[1], Kenton L. Lohman[1], Hong Lu[1], Vinod B. Makhijani[1], Keith E. McDade[1], Michael P. McKenna[1], Eugene W. Myers[2], Elizabeth Nickerson[1], John R. Nobile[1], Ramona Plant[1], Bernard P. Puc[1], Michael T. Ronan[1], George T. Roth[1], Gary J. Sarkis[1], Jan Fredrik Simons[1], John W. Simpson[1], Maithreyan Srinivasan[1], Karrie R. Tartaro[1], Alexander Tomasz[3], Kari A. Vogt[1], Greg A. Volkmer[1], Shally H. Wang[1], Yong Wang[1], Michael P. Weiner[4], Pengguang Yu[1], Richard F. Begley[1] & Jonathan M. Rothberg[1]

Revisão e re-orientação de metodologias, permitindo que questões antigas e atuais sejam abordadas sob uma nova ótica

Amostragens mais representativas e identificação de filotipos microbianos

Calagem e fertilização nitrogenada são fatores que interferem significativamente nas comunidades microbianas do solo

Soil Biology & Biochemistry 40 (2008) 2843–2853
Contents lists available at ScienceDirect
Soil Biology & Biochemistry
journal homepage: www.elsevier.com/locate/soilbio

Relative impacts of land-use, management intensity and fertilization upon soil microbial community structure in agricultural systems

Kamlesh Jangid[a,*], Mark A. Williams[b], Alan J. Franzluebbers[c], Jamie S. Sanderlin[d], Jaxk H. Reeves[d], Michael B. Jenkins[c], Dinku M. Endale[c], David C. Coleman[e], William B. Whitman[a]

[a] Department of Microbiology, 1000 Cedar Street, 527 Biological Sciences, University of Georgia, Athens, GA 30602, USA
[b] Department of Plant and Soil Sciences, 470 Dorman Hall, Mail Stop 9555, Mississippi State University, MS 39762, USA
[c] USDA-Agricultural Research Service, 1420 Experiment Station Road, Watkinsville, GA 30677, USA
[d] Department of Statistics, University of Georgia, Athens, GA 30602, USA
[e] Odum School of Ecology, University of Georgia, Athens, GA 30602, USA

Microb Ecol (2008) 55:293–310
DOI 10.1007/s00248-007-9276-4

ORIGINAL ARTICLE

Comparison of Soil Bacterial Communities Under Diverse Agricultural Land Management and Crop Production Practices

Tiehang Wu · Dan O. Chellemi · Jim H. Graham · Kendall J. Martin · Erin N. Rosskopf

The ISME Journal (2010) 4, 1340–1351

www.nature.com/ismej

ORIGINAL ARTICLE

Soil bacterial and fungal communities across a pH gradient in an arable soil

Johannes Rousk[1,7], Erland Bååth[1], Philip C Brookes[2], Christian L Lauber[3], Catherine Lozupone[4], J Gregory Caporaso[4], Rob Knight[4,5] and Noah Fierer[3,6]
[1]Department of Microbial Ecology, Lund University, Ecology Building, Lund, Sweden; [2]Soil Science Department, Rothamsted Research, Harpenden, Herts, UK; [3]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO, USA; [4]Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO, USA; [5]Howard Hughes Medical Institute, University of Colorado, Boulder, CO, USA and [6]Department of Ecology and Evolutionary Biology, University of Colorado, Boulder, CO, USA

Ecology, 91(12), 2010, pp. 3463–3470

Consistent effects of nitrogen fertilization on soil bacterial communities in contrasting systems

KELLY S. RAMIREZ,[1,6] CHRISTIAN L. LAUBER,[2] ROB KNIGHT,[3,4] MARK A. BRADFORD,[5] AND NOAH FIERER[1,2]

[1]Department of Ecology and Evolutionary Biology, University of Colorado, Boulder, Colorado 80309 USA
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado 80309 USA
[3]Department of Chemistry and Biochemistry, University of Colorado, Boulder, Colorado 80309 USA
[4]Howard Hughes Medical Institute, Chevy Chase, Maryland 20815-6789 USA
[5]School of Forestry and Environmental Studies, Yale University, New Haven, Connecticut 06511 USA

Solos agrícolas geralmente apresentam comunidades microbianas diferentes daquelas encontradas em solos não manejados

Notórios avanços na área da saúde Humana

Medical Hypotheses 74 (2010) 214–215

Contents lists available at ScienceDirect

Medical Hypotheses

journal homepage: www.elsevier.com/locate/mehy

Editorial

The human superorganism – Of microbes and men

NATURE BIOTECHNOLOGY VOLUME 31 NUMBER 4 APRIL 2013

Medicines from microbiota

Bernat Olle

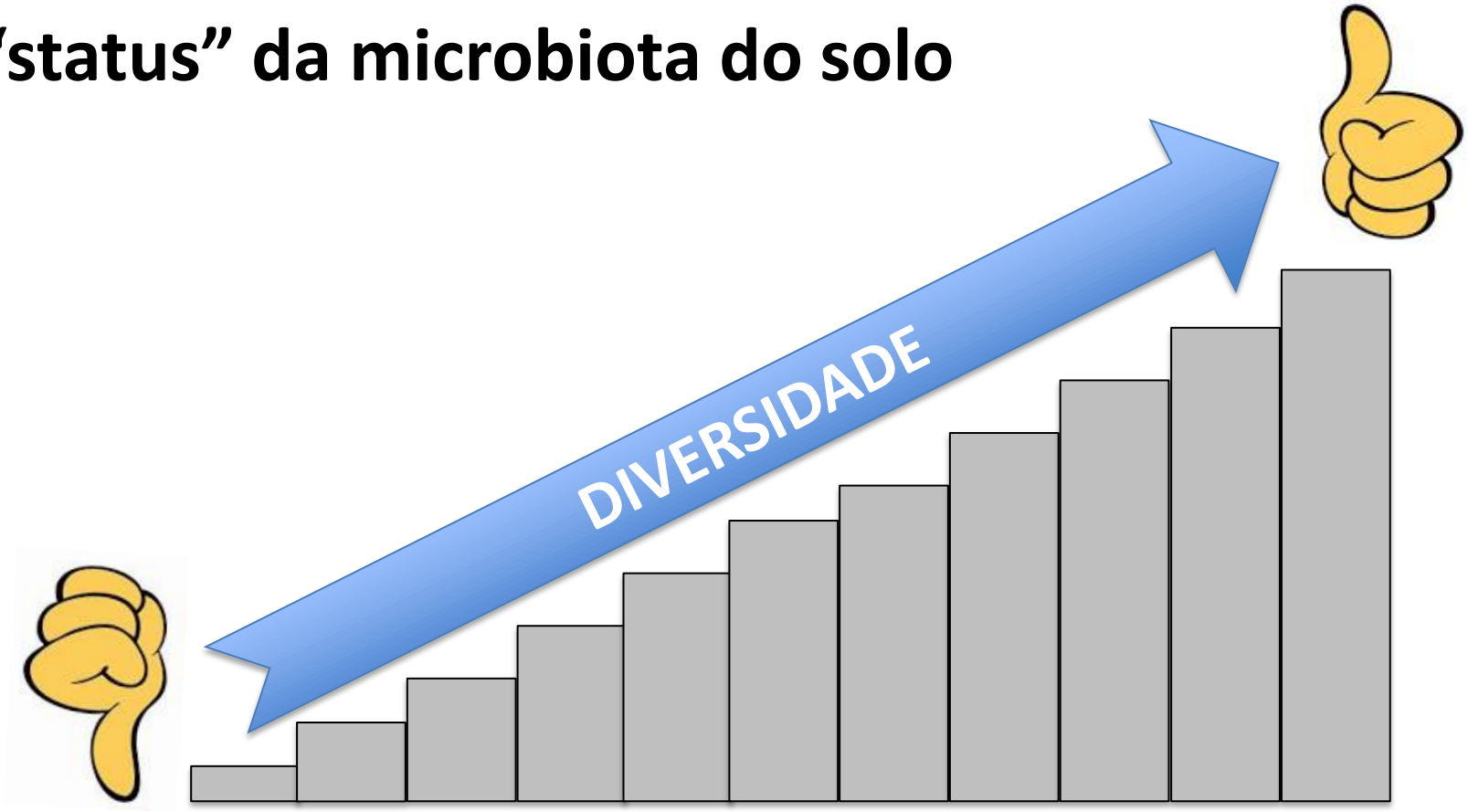
Five years after the launch of the Human Microbiome Project, several ventures are seeking to capitalize on the clinical promise of microbiome modulation. Commercialization of drugs that influence the human flora poses some unique scientific, translational and regulatory challenges.

NIH HUMAN MICROBIOME PROJECT

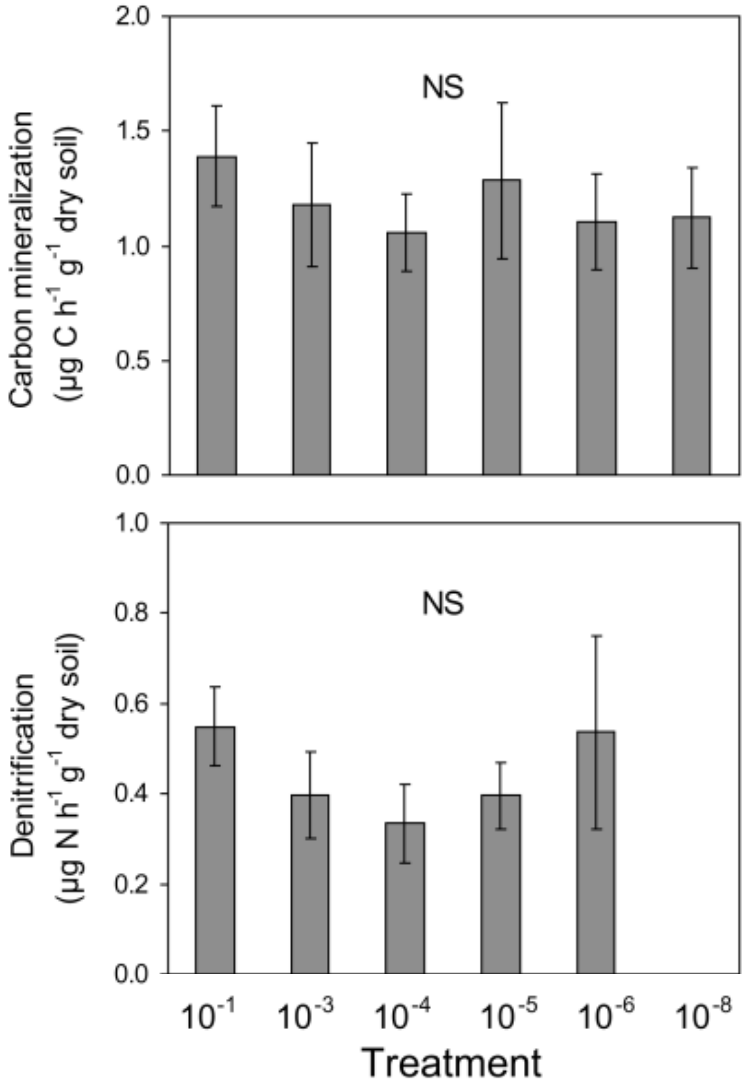
Como tirar melhor proveito das ferramentas de SNG?

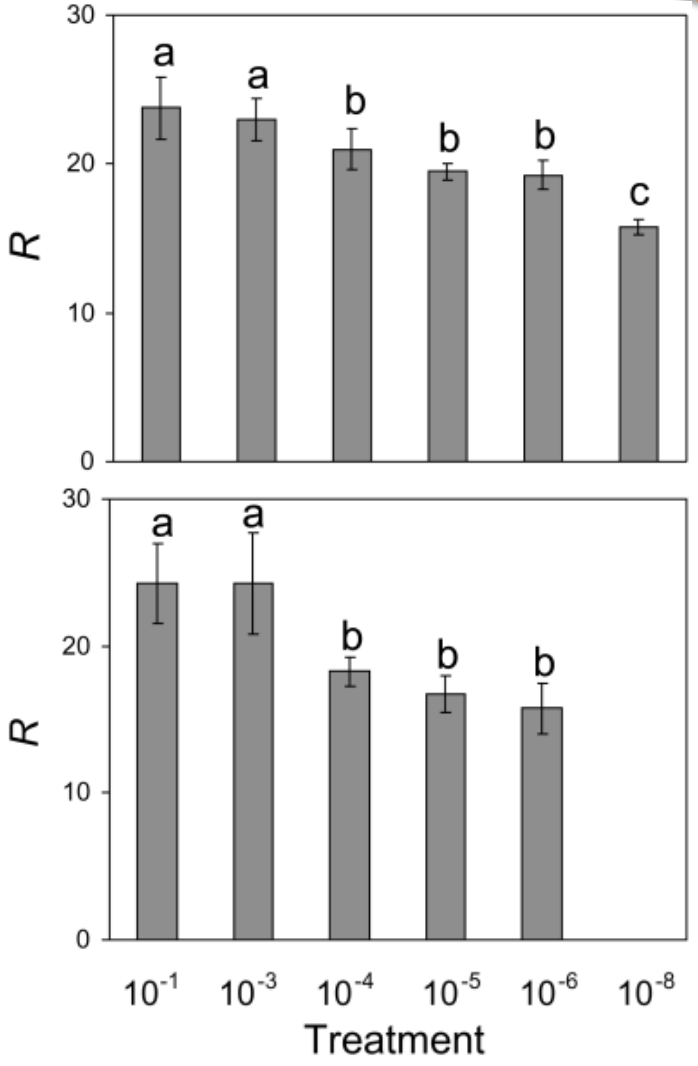
1. Eficácia dos indicadores microbianos
2. O problema da dormência microbiana no solo
3. O problema da escala microbiológica

Índices de diversidade e o "status" da microbiota do solo



Ambientes naturais tendem a apresentar menor diversidade microbiana.





WERTZ, S. et al. Environ Microbiol, v. 8, n. 12

1 2 3

Decline of soil microbial diversity does not influence the resistance and resilience of key soil microbial functional groups following a model disturbance

Sophie Wertz[1], Valérie Degrange[1], James I. Prosser[2], Franck Poly[1], Claire Commeaux[1], Nadine Guillaumaud[1] and Xavier Le Roux[1,*]

Article first published online: 22 MAY 2007
DOI: 10.1111/j.1462-2920.2007.01335.x

Issue

Environmental Microbiology
Volume 9, Issue 9, pages 2211–2219, September 2007

PLOS ONE

Soil-Borne Bacterial Structure and Diversity Does Not Reflect Community Activity in Pampa Biome

Manoeli Lupatini[1], Afnan Khalil Ahmad Suleiman[1], Rodrigo Josemar Seminoti Jacques[1], Zaida Inês Antoniolli[1], Eiko Eurya Kuramae[2], Flávio Anastácio de Oliveira Camargo[3], Luiz Fernando Würdig Roesch[4]*

October 2013 | Volume 8 | Issue 10 | e76465

Funcionalidade e composição microbiana não estão necessariamente correlacionadas

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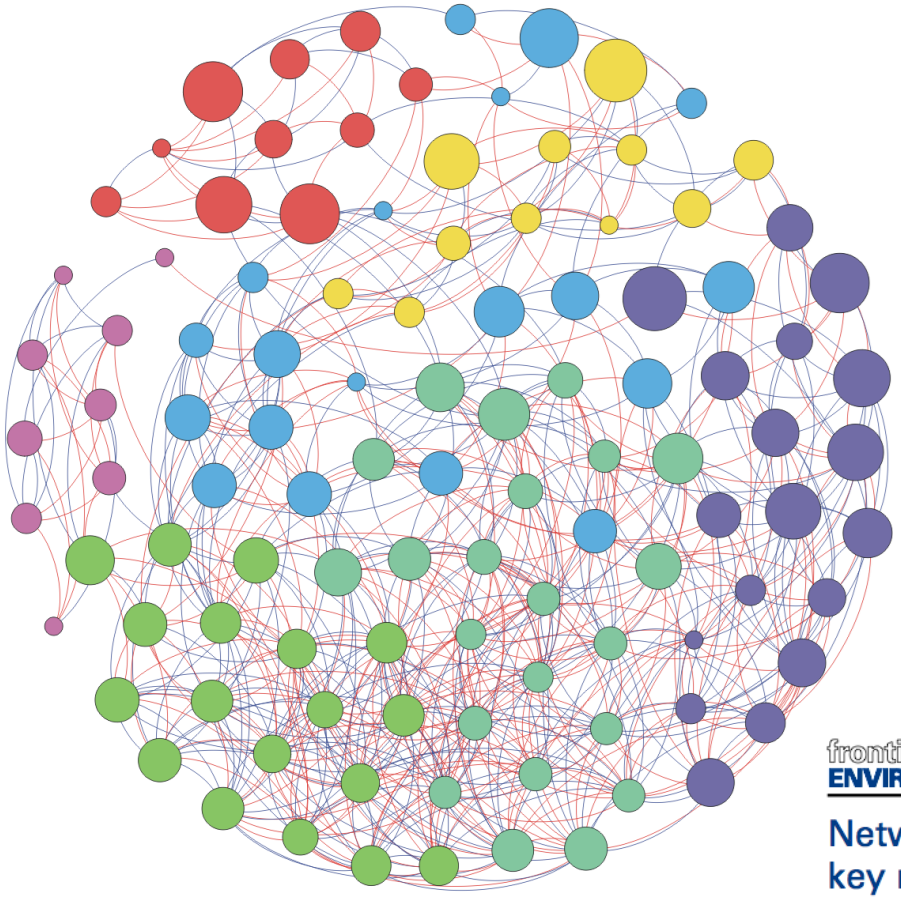
Um conceito mais amplo ?



Rede de interação entre gêneros bacterianos do solo

O todo é diferente da soma das partes individuais.

frontiers in ENVIRONMENTAL SCIENCE
ORIGINAL RESEARCH ARTICLE
published: 08 May 2014
doi: 10.3389/fenvs.2014.00010

Network topology reveals high connectance levels and few key microbial genera within soils

*Manoeli Lupatini[1,2], Afnan K. A. Suleiman[1], Rodrigo J. S. Jacques[1], Zaida I. Antoniolli[1], Adão de Siqueira Ferreira[3], Eiko E. Kuramae[2] and Luiz F. W. Roesch[4]**

[1] Departamento de Solos, Universidade Federal de Santa Maria, Santa Maria, Brazil
[2] Department of Microbial Ecology, Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, Netherlands
[3] Instituto de Ciências Agrárias, Universidade Federal de Uberlândia, Uberlândia, Brazil
[4] Universidade Federal do Pampa, São Gabriel, Brazil

O problema da dormência microbiana no solo

Dormência refere-se a habilidade de um organismo de entrar em um estado reversível de baixa atividade metabólica quando exposto a situações em que as condições ambientais são desfavoráveis.

http://www.nature.com/nature/journal/v458/n7240/full/458831a.html

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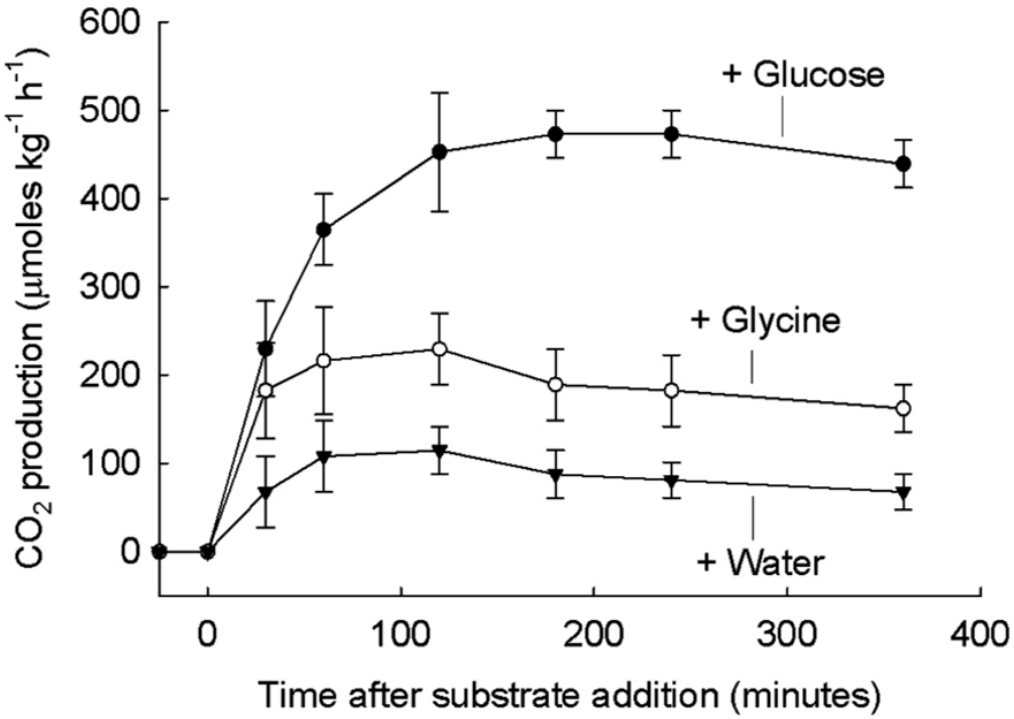


frontiers in MICROBIOLOGY
REVIEW ARTICLE
published: 12 November 2013
doi: 10.3389/fmicb.2013.00324

Microbes in nature are limited by carbon and energy: the starving-survival lifestyle in soil and consequences for estimating microbial rates

John E. Hobbie[1] and Erik A. Hobbie[2]*

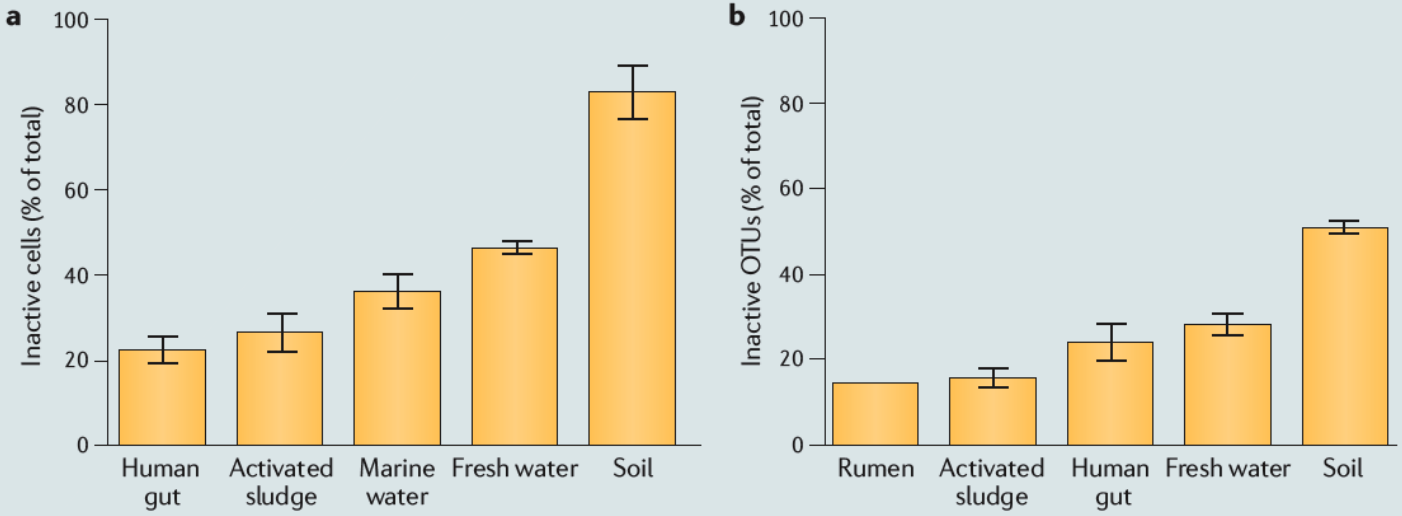
[1] *The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA, USA*
[2] *Earth Systems Research Center, University of New Hampshire, Durham, NH, USA*

Micro-organismos estão sempre prontos para responder a adição de nutrientes.

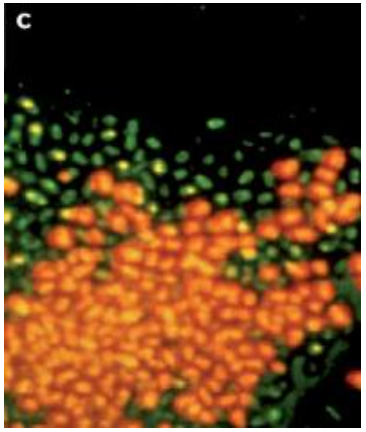
Estilo de vida de fome-sobrevivência!

Evidence for dormancy in natural ecosystems

Large numbers of cells in different environments can be dormant. The figure shows the percentages of cells that were found to be dormant in various environments, as determined by fluorescence *in situ* hybridization (FISH) or staining with 5-cyano-2,3-ditolyl tetrazolium chloride (CTC) (see the figure, part **a**), or by ribosomal RNA–ribosomal DNA terminal restriction fragment length polymorphism (TRFLP) (see the figure, part **b**). The data shown are for the mean ± the standard error of the mean (see Supplementary information S1 (table) for data).



OTU, operational taxonomic unit.



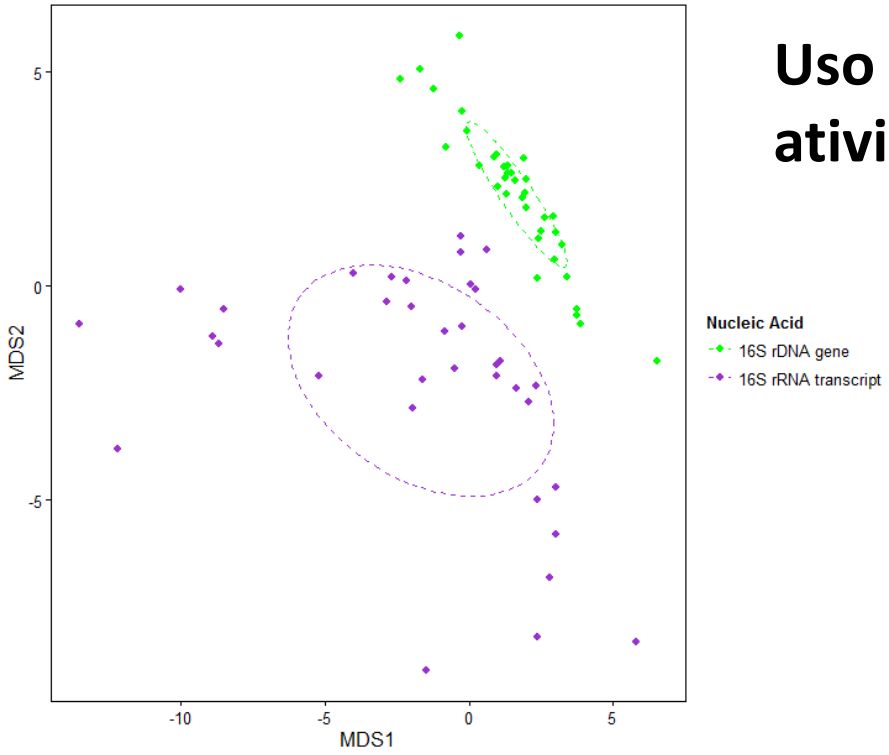
Biofilme bacteriano
Verde = inativo
Laranja = ativo

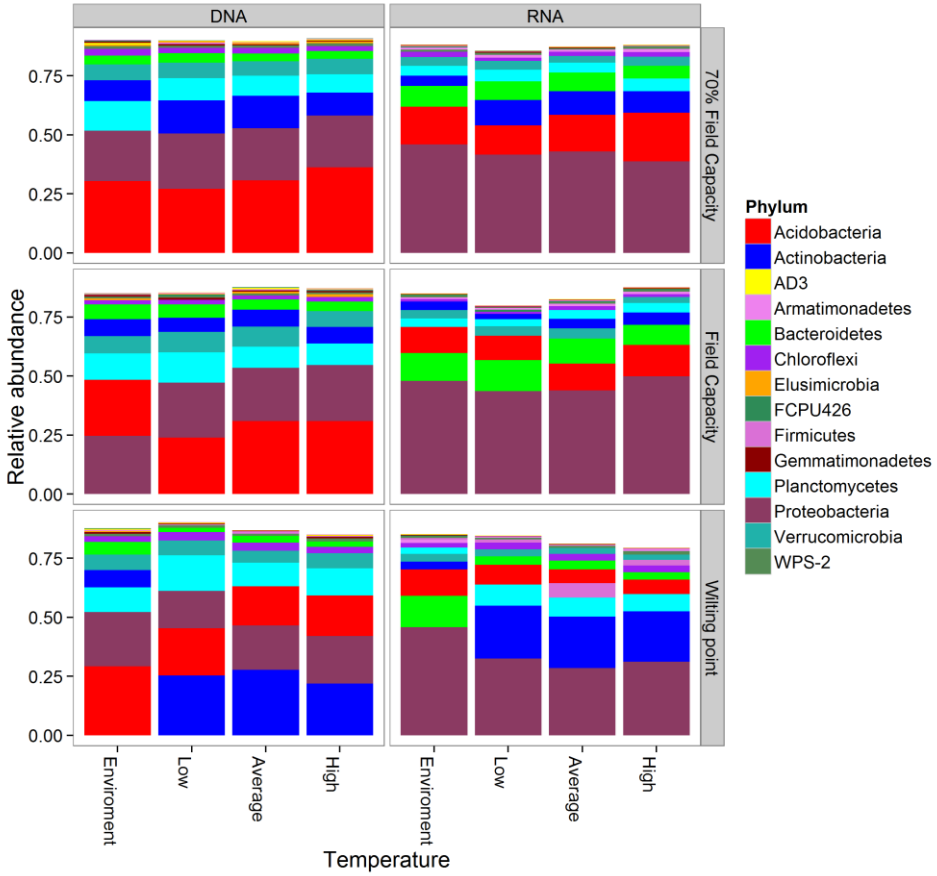
Lennon, J. T., Jones, S.E. (2011) Microbial seed banks: Ecological and evolutionary implications of dormancy. Nat. Rev. Microbiol. 9, 119-130.

O sequenciamento do DNA detecta a microbiota ativa e inativa

1 2 3

Uso do rRNA com um índice de atividade potencial





As mesmas comunidades microbianas do solo os resultados obtidos via DNA são diferentes daqueles obtidos via RNA.
A comunidade potencialmente ativa foi mais heterogênea e dinâmica.

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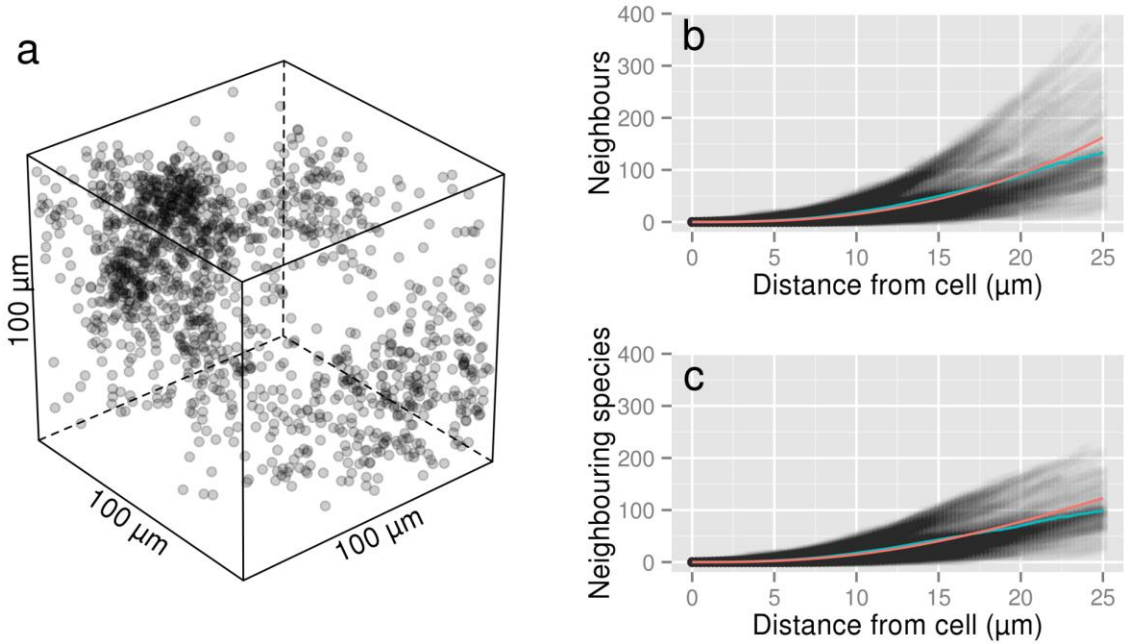
O problema da escala microbiológica



Uma única bactéria poderia potencialmente interagir com apenas 120 a 1.000 células em 20µm ou 50µm de distância respectivamente.

Raynaund & Nunan, 2014 PLoS ONE 9(1): e87217. doi:10.1371/journal.pone.0087217

Grande parte dos processos que modelam a comunidade microbiana no solo ocorrem a escalas que geralmente nossos experimentos são incapazes de detectar.

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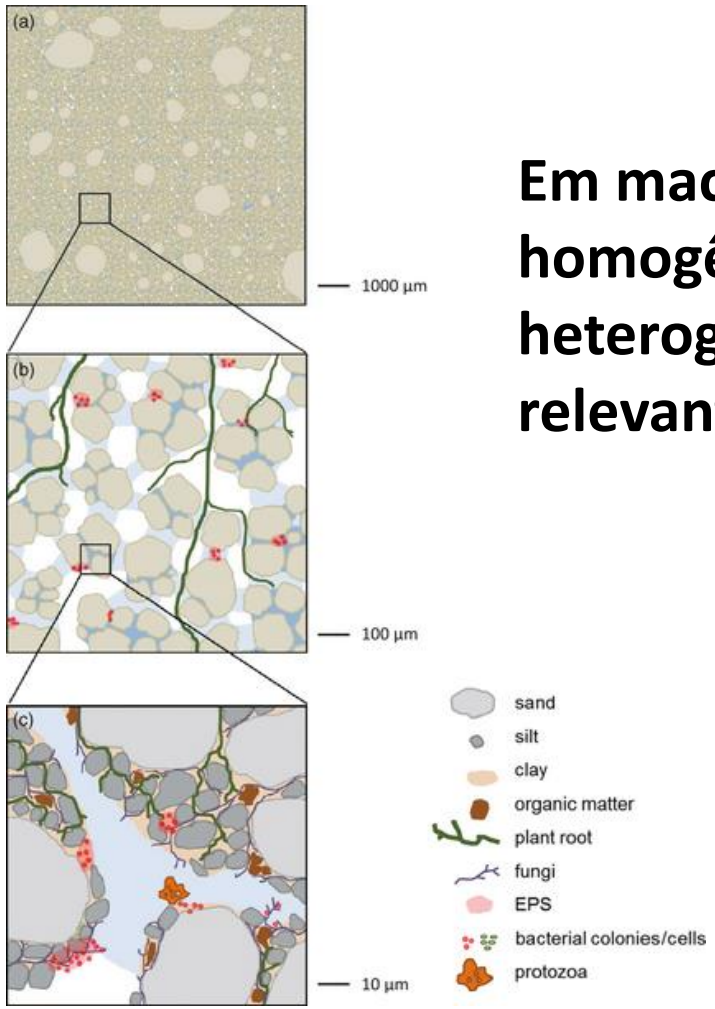


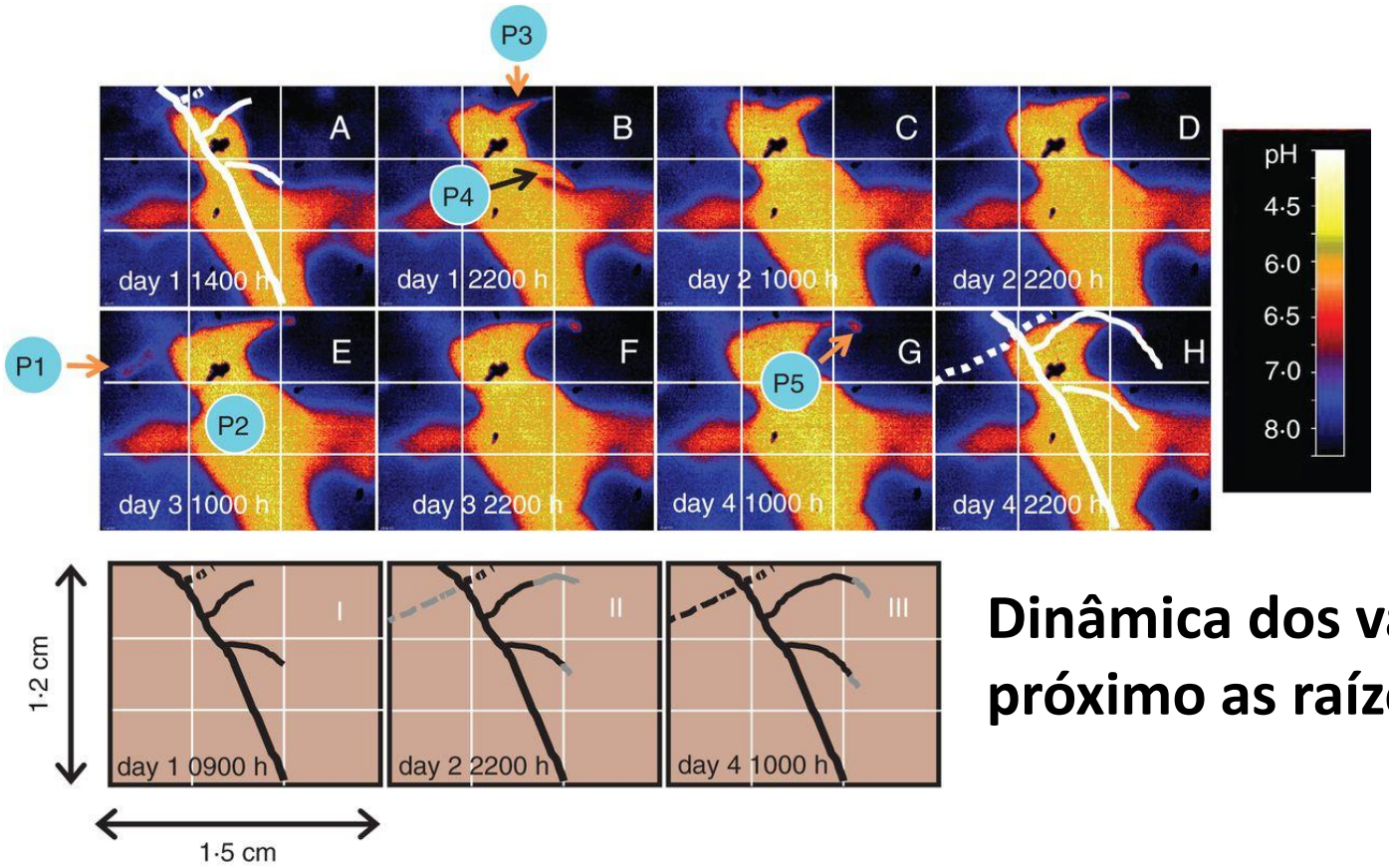
Em macro escala os solos parecem ser mais homogêneos entretanto, uma extrema heterogeneidade é evidente em escalas mais relevantes aos micro-organismos.

REVIEW ARTICLE

Micro-scale determinants of bacterial diversity in soil

Michiel Vos[1], Alexandra B. Wolf[1], Sarah J. Jennings[1] & George A. Kowalchuk[1,2,3]

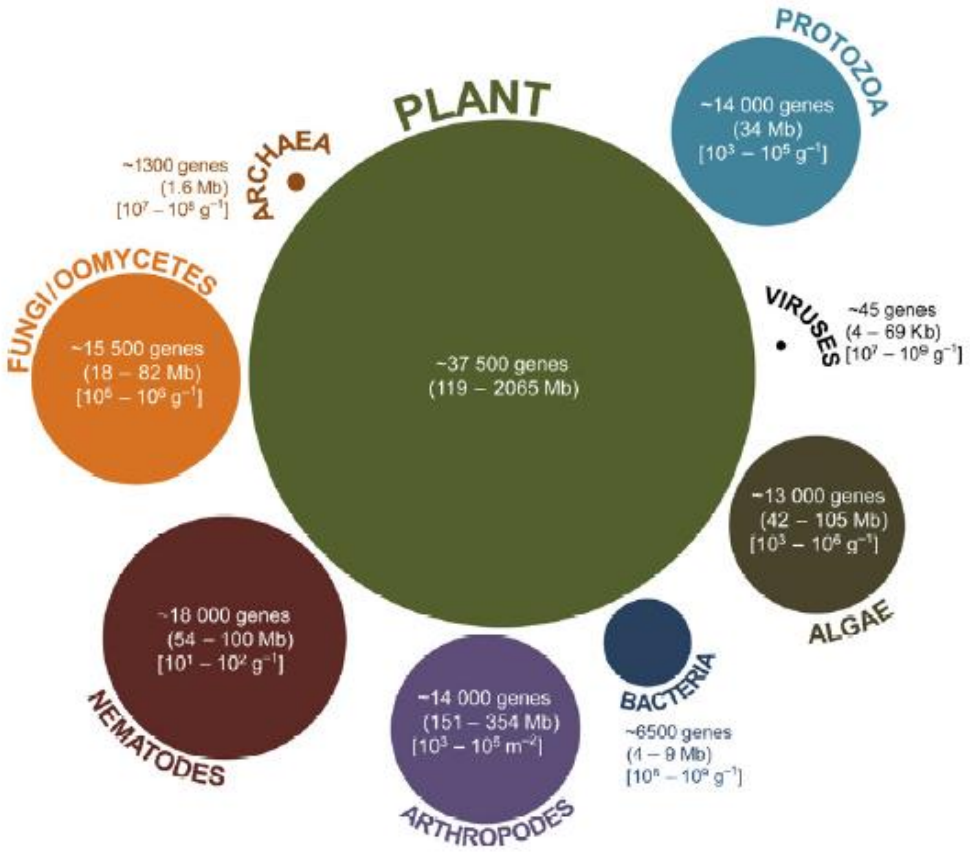
[1]Department of Microbial Ecology, Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, The Netherlands; [2]Department of Ecological Science, Free University of Amsterdam, Amsterdam, The Netherlands; and [3]Institute of Environmental Biology, Utrecht University, Utrecht, The Netherlands



Dinâmica dos valores de pH próximo as raízes

Blossfeld S et al. Ann Bot 2013;112:267-276

1 2 3



REVIEW ARTICLE

The rhizosphere microbiome: significance of plant beneficial, plant pathogenic, and human pathogenic microorganisms

Rodrigo Mendes[1], Paolina Garbeva[2] & Jos M. Raaijmakers[3]

[1]Laboratory of Environmental Microbiology, Embrapa Environment, Jaguariuna, Brazil; [2]Netherlands Institute of Ecology, Royal Dutch Academy of Arts & Sciences (NIOO-KNAW), Wageningen, The Netherlands; and [3]Laboratory of Phytopathology, Bacterial Ecology & Genomics, Wageningen University, Wageningen, The Netherlands

O número de genes de origem microbiana na rizosfera supera o número de genes da planta, de tal forma que esta pode ser vista como um **super-organismo**.

Como tirar melhor proveito das ferramentas de SNG?

NIH HUMAN MICROBIOME PROJECT

Esforços individuais não tem apresentado os resultados esperados

Iniciativas conjuntas, baseadas em análises padronizadas e sob uma perspectiva mais ampla tem demonstrado sucesso.

Microb Ecol (2014) 67:237–241
DOI 10.1007/s00248-013-0302-4

SHORT COMMENTARY

Brazilian Microbiome Project: Revealing the Unexplored Microbial Diversity—Challenges and Prospects

Victor Satler Pylro · Luiz Fernando Wurdig Roesch · José Miguel Ortega · Alexandre Morais do Amaral · Marcos Rogério Tótola · Penny Ruth Hirsch · Alexandre Soares Rosado · Aristóteles Góes-Neto · Artur Luiz da Costa da Silva · Carlos Augusto Rosa · Daniel Kumazawa Morais · Fernando Dini Andreote · Gabriela Frois Duarte · Itamar Soares de Melo · Lucy Seldin · Márcio Rodrigues Lambais · Mariangela Hungria · Raquel Silva Peixoto · Ricardo Henrique Kruger Siu Mui Tsai · Vasco Azevedo · The Brazilian Microbiome Project Organization Committee

As técnicas atualmente disponíveis certamente tem potencial para resolver a maioria dos problemas aqui mencionados porém, antes de decidir pelo uso dessas, o desafio consiste na definição clara das questões biológicas que devem ser testadas e é com base nessas questões, que se poderá definir o melhor desenho experimental e conceitual a ser priorizado.