Microbial societies do not like oligarchy

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Bacteria and humans tend to live in highly diverse and complex communities. Most interestingly, bacteria and humans appear to prefer to live in a democracy. This is the basic message of the paper entitled "Initial community evenness favours functionality under selective stress", published this week in the last issue of *Nature*. The article reports that initial high community evenness is a key factor in preserving functional stability of an ecosystem in the face of selective stress.

The research has been performed by a consortium of five groups from two Universities in Belgium and Italy, respectively and coordinated by Dr. Lieven Wittebolle, Dr. Massimo Marzorati and Prof. Nico Boon from Ghent University. The research has been performed in collaboration with the research teams of Dr. Lieven Clement, Prof. De Vos and Prof. Verstraete from Ghent University and Prof. Daniele Daffonchio from the University of Milan.

Owing to the present global biodiversity crisis, the biodiversity-stability relationship and the effect of biodiversity on ecosystem functioning have become major topics in ecology. The research is part of a project having as a final objective the understanding of the major factors necessary to steer and engineer microbial communities to obtain stable and reliable biotechnological processes, which are needed in environmental and medical sciences. It has been stated that, for the next decades, the microbial ecologists and environmental microbiologists have to focus on microbial resource management (MRM) to properly manage complex microbial systems. They should address a new mindset based on well-documented concepts, reliable tools and a set of default values.

Biodiversity is a complex term that includes taxonomic, functional, spatial and temporal aspects of organismic diversity, with species richness (the number of species) and evenness (the relative abundance of species) considered among the most important measures. Using experimental microcosms with bacterial communities, this paper shows that initial community evenness is a key factor in preserving the functional stability of an ecosystem. In particular, it demonstrated that a community must have an even distribution among its functional redundant members if it is to respond rapidly to selective stress. In fact, when an ecosystem function in a highly uneven community depends strongly on the dominant species, the functional stability is endangered by environmental fluctuations. In other words, a too strong selection that leads to the dominance of one or a few species will not guarantee a good performing ecosystem.

This finding can have important implications and new opportunities for scientists working in domains such as applied and fundamental environmental sciences, food science and even medical microbiology. Current molecular techniques could be used to predict ecosystem function failure and to manage biotechnological technologies with mixed microbial communities for a long-standing performance.

More information: Wittebolle L., Marzorati M., Clement L., Balloi A., Daffonchio D., Heylen K., De Vos P., Verstraete W., Boon N. 2009. Initial community evenness favors functionality under selective stress. *Nature*, DOI 10.1038/nature07840.

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