

Abstract

Keywords

1. Introduction
2. Soil biota inside out

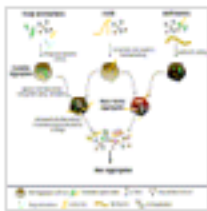


Table 1



3. Soil biota and ecosystem services

- 3.1. Life support role
 - 3.1.1. Nutrient cycling
- 3.2. Regulation of ecosystem processes
 - 3.2.1. Soil structure modification



3.2.2. Pest and disease control

4. Research gaps and opportunities

- 4.1. Soil biota 'hot spots' and ecosystem service providers

Abstract

The soil environment is likely the most complex biological community. Soil organisms are extremely diverse and contribute to a wide range of ecosystem services that are essential to the sustainable function of natural and managed ecosystems. The soil organism community can have direct and indirect impacts on land productivity. Direct impacts are those where specific organisms affect crop yield immediately. Indirect effects include those provided by soil organisms participating in carbon and nutrient cycles, soil structure modification and food web interactions that generate ecosystem services that ultimately affect productivity. Recognizing the great biological and functional diversity in the soil and the complexity of ecological interactions it becomes necessary to focus in this paper on soil biota that have a strong linkage to functions which underpin 'soil based' ecosystem services. Selected organisms from different functional groups (i.e. microsymbionts, decomposers, elemental transformers, soil ecosystem engineers, soil-borne pest and diseases, and microregulators) are used to illustrate the linkages of soil biota and ecosystem services essential to life on earth as well as with those associated with the provision of goods and the regulation of ecosystem processes. These services are not only essential to ecosystem function but also a critical resource for the sustainable management of agricultural ecosystems. Research opportunities and gaps related to methodological, experimental and conceptual approaches that may be helpful to address the challenge of linking soil biodiversity and function to the provision of ecosystem services and land productivity are discussed. These include: 1) integration of spatial variability research in soil ecology and a focus on 'hot spots' of biological activity, 2) using a selective functional group approach to study soil biota and function, 3) combining new and existing methodological approaches that link selected soil organisms, the temporal and spatial dynamics of their function, and their contribution to the provision of selected 'soil based' ecosystem services, 4) using understanding about hierarchical relationships to manage soil biota and function in cropping systems, 5) using local knowledge about plants as indicators of soil quality, remote sensing and GIS technologies, and plant-soil biota interactions to help understand the impacts of soil biota at landscape scale, and 6) developing land quality monitoring systems that inform land users about their land's ecosystem service performance, improve capacities to predict and adapt to environmental changes, and support policy and decision-making.

Keywords

Agriculture; Ecosystem services; Soil biodiversity; Soil biological processes

Bibliographic information

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