



Opinion paper

Priorities for research in soil ecology



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ABSTRACT

The ecological interactions that occur in and with soil are of consequence in many ecosystems on the planet. These interactions provide numerous essential ecosystem services, and the sustainable management of soils has attracted increasing scientific and public attention. Although soil ecology emerged as an independent field of research many decades ago, and we have gained important insights into the functioning of soils, there still are fundamental aspects that need to be better understood to ensure that the ecosystem services that soils provide are not lost and that soils can be used in a sustainable way. In this perspectives paper, we highlight some of the major knowledge gaps that should be prioritized in soil ecological research. These research priorities were compiled based on an online survey of 32 editors of *Pedobiologia – Journal of Soil Ecology*. These editors work at universities and research centers in Europe, North America, Asia, and Australia. The questions were categorized into four themes: (1) soil biodiversity and biogeography, (2) interactions and the functioning of ecosystems, (3) global change and soil management, and (4) new directions. The respondents identified priorities that may be achievable in the near future, as well as several that are currently achievable but remain open. While some of the identified barriers to progress were technological in nature, many respondents cited a need for substantial leadership and goodwill among members of the soil ecology research community, including the need for multi-institutional partnerships, and had substantial concerns regarding the loss of taxonomic expertise.

1. Introduction

Many, if not most, of the ecosystems on Earth are dependent on, or substantially influenced by, interactions and processes occurring within and among the planet's soils (including sediments). The remarkable biodiversity harbored in soil provides essential ecosystem services (Bardgett and van der Putten, 2014; Wall et al., 2015), and the sustainable management of soils has attracted ever-increasing scientific attention (Wall et al., 2015). Soil organisms and how they drive the processes that underlie essential ecosystem services have fascinated and challenged soil ecologists for decades (Powell et al., 2014). Their importance and complexity are increasingly arousing public and political interest in soil, such as that exemplified by the International Year of Soils in 2015 (Powell and Eisenhauer, 2015) and the annual celebration of World Soil Day (every December 5th, since 2002). Many policy makers and land managers are realizing that soil ecological knowledge is key for sustainable environmental management, for the protection and conservation of soils, and for the nutrition and health of an increasing human population (Wall et al., 2015; Keith et al., 2016). However, despite these points, many

knowledge gaps still exist and hinder researchers from making specific recommendations about soil conservation issues (Phillips et al., 2017) to maintain soil processes linked to ecosystem services under increasing human pressure and global change. As a consequence, soil ecology will remain an extremely important field of research into the future and requires a coordinated global effort to address the most important issues facing the sustainability of soils and gaps in soil ecological knowledge.

In this perspectives paper, we highlight what we have identified as the most crucial and emerging questions in soil ecological research. These research priorities were compiled based on an online survey of 32 editors of *Pedobiologia – Journal of Soil Ecology*. Thus, this list of questions may not be exhaustive and certainly contains some geographical biases (Fig. 1), but we are confident that they will serve as a constructive collection of ideas to target future research and facilitate progress in soil ecology.

2. Survey

Thirty-two editors of *Pedobiologia—Journal of Soil Ecology* participated in the online survey in September and October of 2015. These

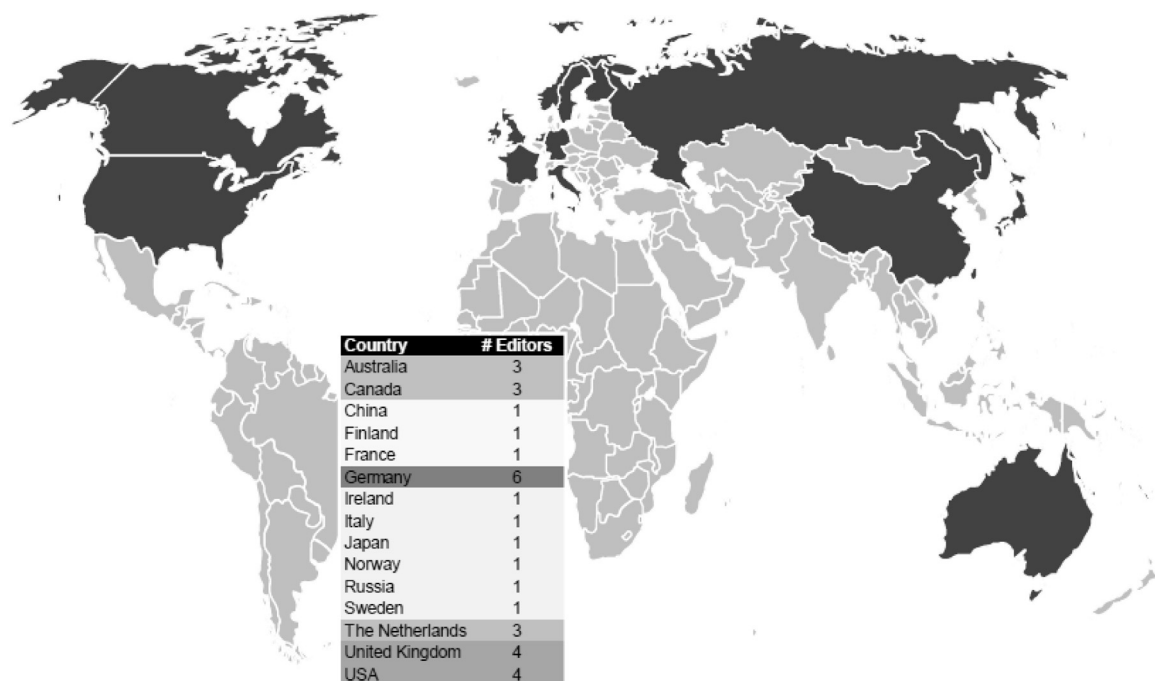


Fig. 1. Geographic location of home institutes of the 32 *Pedobiologia* editors who participated in the present survey. In the map, countries represented by one or more editors are given in dark gray. In the table, different countries are given in alphabetical order, and countries represented by more than one editor are highlighted with different shades of gray.

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