

Biodiversity and Ecosystem Services in Soil under Threat

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The soil is a living organism of fabulous complexity. Soil systems contain some of the most species-rich communities in nature. Most authors describe soil communities as being amongst the most species-rich components of terrestrial ecosystems [1,2]. Well-developed temperate woodland soils may contain up to a thousand species of soil fauna [1]. Soil communities are described as “the poor man’s tropical rainforest” [3]. It is noteworthy that only a proportion of all the soil animal species has been described and very little is known about their role, community structure and dynamics. Research concerning soil is not purely an academic subject. The soil is the very basis of earth’s productivity. It is fundamental to agriculture and forestry, water purification and biogeochemical cycling, and is the grounding for civilization [4]. This is particularly true where human activity tends to induce irreversible disturbances. At a time when demographic pressure is too high, and when the needs of human population are intense and immense, it is wise to realize that the soil is central to human survival. Meanwhile, soil biology has fallen somewhat behind advances in the understanding of other types of communities [3]. Soils are still the least understood habitats on Earth, while also being among the most biologically diverse [4].

Scientific analyses indicate that no area is unaffected by human influence. Significant changes in physical and biological systems are occurring on all continents and in most oceans. Over 80% of land area is under the direct influence of humans [5], a large fraction of marine ecosystems (41%) is strongly affected by multiple drivers [6]. The impact of human activities on the planet has accelerated the loss of species and ecosystems to a level comparable to a sixth mass extinction, the first driven by a living species. The current rate of species extinction is now approximately from 1000 to 10,000 times higher than natural rates [7]. Approximately 60% (15 out of 24) of the ecosystem services evaluated are being degraded or used unsustainably [8]. Despite the fact that life in soils is still an enigma, there is no logical reason why soil organisms would be excluded from these processes. It seems of great importance for science and society to know how many species of bacteria, fungi and invertebrates live in soil system and what are critically important ecosystem services provided by them? What kind of further scientific investigations are needed to achieve an accurate quantification of threat to soil biodiversity and essential ecosystem services?

There is lack of information on the current levels of below ground biodiversity and it difficult, therefore, to quantify the effect that human activities are having influence on the soil biota. However, there is evidence that soil biodiversity and ecosystem services provided by the biota in many areas are already in decline [9,10]. If these services are diminished (through the loss of biodiversity), then this could prove expensive for humankind. Ecosystems provide at least US\$33 trillion dollars worth of services annually. About 38% of this estimated value comes from terrestrial system. The important part of it comes from soil biota [7,11]. The list of threats to soil biodiversity is long. The risk of soil degradation (loss of biodiversity and diminishing of ecosystem services) is mainly caused by human activities through different forms of soil and land use. But we are added new threats to this list, e.g. invasive species or genetically modified plants. Some invasive species appeared to reduce the diversity and abundance of soil organisms, as well as the nutrient fluxes processed by the soil community [12,13].

There is evidence for disruption of the food chain of soil organisms, which leads to a reduction in biological diversity, and evidence of extinction in cereal crops GM beneficial fauna [14,15].

Some authors underlined that to avoid the mistakes of past societies, the world must address global soil degradation, one of this century’s most insidious and under-acknowledged challenges [16]. A key task for soil science is to estimate and mitigate the loss of soil biodiversity and the degradation of ecosystem function, gauge the capacity of soil system to withstand disturbance and species loss. Further investigation into some of the following research questions is needed:

- Why soil system is so diverse and how many microorganisms, fungi and invertebrates do live there?
- What is the relative impact of various human activities upon soil biodiversity and the supply of ecosystem services?
- What is the effect of the estimated loss of species on the functioning of soil system?
- To what extent, and over what time scale, are ecosystem services in soil amenable to repair or restoration?
- Which loss of species the soil system can handle and, therefore, continue to function and provide essential ecosystem services?

Our society should support research devoted life in soil and promote practices and technologies that cultivate beneficial soil life and sustain soil ecosystems. It’s time to take seriously the life under the feet.

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