



# Belowground plant organs and their functional ecology. Introduction

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Although half of a plant is hidden belowground, the belowground organs and their functions are still receiving very little attention from researchers. Fine roots for resource acquisition, coarse roots, rhizomes, tubers, bulbs for clonal multiplication, resource foraging, resource sharing, connection of roots and shoots, fine root placement, space occupation, horizontal mobility, resprouting, carbon sequestration and other functions are not well understood. The reason is belowground position of those organs, lack of morphological understanding of their grow and laborious and destructive methods how to study them. One way how to ignite interest and to support effort of researchers in studying belowground organs is to organize special issues where collection of papers devoted to studies of belowground organs may more easily gain visibility.

The current special issue called “**Belowground plant organs and their functional ecology**” is already third hosted by Folia Geobotanica and devoted to belowground plant organs (Klimešová and Herben 2011, 2014). This time it is presenting

7 papers from 4 continents (South America, North America, Asia, Europe), covering not only seed plants but also ferns and analyzing several interesting topics. Covered topics represent research areas on belowground organs others than fine roots. Papers in special issue are (1) dealing with a role of belowground bud bearing organs in response to disturbance, environment or competition (Bombo et al. 2024, Bam et al. 2024), (2) describing diversity of belowground storage and bud bearing organs in a regional flora (Orzell et al. 2024; Ülgen and Tavşanoğlu 2024) or for one taxonomical group (de Paiva Farias et al. 2024), (3) proposing method how to manipulate root architecture to be able to study its effect on fine root functioning (Lubbe et al. 2024), and (4) reporting rare and interesting morphological trait (Menezes-e-Vasconcelos and Melo-de-Pinna 2024).

The bud bank studies in our issue came from regions that are traditionally studied in this context: from American prairies and Brazilian tropical grasslands, they, however, bring new topics: species level response to fire regime and to competition, invasion, and environmental factors. Bam et al. (2024) examined differences in bud bank placement (close or far from maternal shoot) in two grasses of American prairies, native *Pascopyrum smithii*, and invasive *Bromus inermis*. Their bud banks were more affected by inter-specific competition than by variability in precipitation, by clipping or by intra-specific competition. Without competition, the native species was investing more than invasive plant to lateral spread of

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the clone, but their respective investments changed due to interspecific competition. While native *P. smithii* was producing more clumpier growth form, invasive *B. inermis* invested more in lateral spread. This may be a mechanism behind success of invader in the prairie grasslands. In Brazilian tropical grasslands, Bombo et al. (2024) analyzed belowground bud bearing organs of 8 plant species under different fire regimes. Five studied plants were perennial herbs and three shrubs. All species have bud bank on xylopodia – belowground thickened woody organ composed from stem bases and roots. Species differed by number of buds per bud bearing organ and effect of fire regime on those numbers were very variable, with tendency to diminish for shrubs in fire excluded treatment. The study implies that strategy of plants how to deal with different fire regimes in Cerrado cannot be explained by type of bud bearing organ itself and assessment of additional traits is necessary.

The diversity of belowground storage organs is known only for limited number of habitats or floras. The study by Orzell et al. (2024) present a new data from Florida subtropical grassland about the composition of growth forms, belowground organ types, and lifeforms. Those categories are than put into context of environmental gradients important in the habitat: moisture gradient and fire. The study is providing framework for more detailed studies and may be used as a model for description of other types of fire prone ecosystems. The paper by Ülgen and Tavşanoğlu (2024) excerpts and analyzes data on belowground and clonal growth organs from Flora of Turkey as the first step to understand their role in persistence of plants in Anatolian steppe – the unique ecosystem with dominant perennial herbs tolerating seasonal adversity and subjected to intense land use. They map belowground organ types to taxonomy and to life forms of plants highlighting gaps in our knowledge. Notable is contribution by de Paiva Farias et al. (2024) about belowground traits of ferns inhabiting edges and interiors of Atlantic forest's fragments in Brazil. Not only that authors are aiming to answer question how forest fragmentation affects ferns and their traits but there are proposing set of traits on belowground organs of ferns that may be important to study. Due to scarcity of studies on belowground functional traits in ferns it is an important contribution that could inspire further studies.

Study by Lubbe et al. (2024) is important for holistic understanding of root architecture of the plant individual. It presents method how to obtain different root systems in one species. *Plantago lanceolata* may form taproot in dry soil and adventitious roots growing from short epigeogenous rhizome in wet soil. By removing main root in early ontogeny plants may be manipulated to produce adventitious roots without respect to soil conditions. The method may enable comparison of plants with different root systems and their response to various environmental stimuli. It is not without importance that ability to produce adventitious roots is a prerequisite for clonal growth therefore model can be used also for testing questions connected with clonality. The last study was also focused on root system. The short communication by Menezes-e-Vasconcelos and Melo-de-Pinna (2024) describes interesting traits of one annual species from tropical savanna in Brazil. The species is capable of root sprouting and probably also capable of longer perennation than so far expected. This is important discovery as root sprouting herbs so far received only minor attention of researchers in tropical grasslands although they may represent overlooked strategy how to response disturbance.

I believe that readers will find inspiration and information in presented collection of contributions and belowground plant organs and their functions will attain more interest of researchers in future. I thank all authors and referees for their hard work to make those interesting studies available for wide readership.

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