Second Session: “The importance of soils in a changing climate”

The second session of the Flemish Academy’s Thinkers' Programme on “Soil as a Natural Capital” focuses on “The importance of soils in a changing climate”. A fact finding week will take place during 12th to 14th of February 2020 on the premises of the Flemish Academy in Brussels. Two external experts, Joke van Wensem (NL) and Richard Bardgett (UK), will be invited to discuss the topic in depth with a large group of relevant stakeholders. The **aim** of this note is to present the topic of the second session to the expert group and to facilitate the subsequent organisation of the fact finding week.

Pre-amble. Climate change est. To cope with climate change, the National Climate Committee has instructed members of the federal and regional governments to prepare an adaptation strategy. The Flanders’ climate policy plan focuses on both mitigation and adaptation through dedicated plans of a 35% emission reduction by 2030 and improved climate resilience.

Soil as a greenhouse gas source or sink. Soils represent the largest terrestrial carbon and nitrogen pools and act as both sources and sinks for greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Soil organic matter, with carbon as its main component, is crucial to soil health and fertility, water infiltration and soil water retention. As a major carbon storage system, conserving and restoring soils are essential for both sustainable land use and climate change mitigation. The large amounts of carbon and nitrogen contained in soils can easily be released into the atmosphere depending on soil and land use management. Land management practices such as clearing or planting forests, draining or flooding land, altering peatlands, ploughing or restoring grasslands can tilt the greenhouse gas emission balance towards a sink or source. Preserving soil carbon stocks is vital for soil productivity, soil hydrology and climate change mitigation.

Statement: Soil carbon sequestration and optimal nitrogen balances compensate greenhouse gas emissions and increase climate resilience.

Soil resilience to climate extremes. Soil has an important capacity to regulate water supply. Water percolating through the soil is filtered, stored for plant utilisation, and redistributed across flow paths to groundwater and surface water bodies. Extreme weather impacts of both excess rainfall and drought can be buffered with increased soil water retention capacity to govern the dynamics between runoff, infiltration, storage, evapotranspiration and percolation. Soil water retention provides multiple ecosystem services from ensuring groundwater recharge and erosion control through a regulation of soil water conditions to climate regulation through the processes of evapotranspiration and flood and drought mitigation. After the 2018 exceptional drought, groundwater levels haven’t recovered in Flanders and plans exist to retain rainwater for infiltration into the soil. Remote control of 1.5 million private wells could help manage heavy rainfalls and replenish water reserves during prolonged droughts in Flanders.

Statement: The soil’s capacity to regulate water supply mitigates extreme weather impacts.

Urban Sprawl & soil sealing. The Flanders-Brussels region is one of the most urbanised regions in Europe with 28% built-up area and an overall daily growth of more than 9 ha between 1990 and 2018. Omni-present infrastructure with ribbon development and extensive residential areas are intertwined with open space resulting in a very highly fragmented landscape. Soil sealing, the covering of the

ground by an impermeable material, is one of the main causes of soil degradation in Flanders. Soil sealing often affects fertile land, increases the risk of both flooding and water scarcity and contributes to global warming through the urban heat island effect. Soil loss due to artificial sealing is particularly high in urban areas. Mitigating measures include using permeable materials, supporting 'green infrastructure', and making wider use of natural water harvesting systems. Smarter spatial planning can limit low-density and land consuming urban expansion, i.e. urban sprawl.

Statement: Continuing urban sprawl induces soil degradation and lowers climate resilience.

Soil-climate hazards. Climate change disturbs the balance between fresh, brackish and salt groundwater which is of particular concern in the polders of Flanders. The spatial extent of saline topsoil and the degree of salinisation is currently being measured using air-borne radar. Improving fresh water availability in the shallow subsoil relieves the brackish pressure. Current irrigation practices are confined to the horticulture sector, and have not yet resulted in salinisation. Projected impacts of an increase in sea level are rising groundwater levels and an increase in soil and groundwater salinity. Another clear soil-climate hazard is soil erosion caused by water. Soil erosion is dominant in the south of Flanders due to a combination of an undulating to hilly topography, loess-derived soils and a high share of arable land. Soil erosion and remediation are well documented in Flanders and increasingly embedded in agri-environmental measures and practices.

Statement: Remedial measures successfully alleviate soil-climate hazards.