



HuMUS - WP4 pilot projects

Structure of the Short final report and its publishable summary

Publishable summary

Biodiversity loss and climate change form pressing global challenges, especially in urban environments, emphasizing the role of nature-based solutions such as road verges. These linear green spaces offer significant ecological and social value in the landscape, and due to their proximity to human activity and concentration in urbanized areas, they are a crucial but underutilized component of the urban green infrastructure. The current project focuses on assessing the potential trade-offs between a well-developed above-ground vegetation and below-ground soil health, particularly in the context of tree-shaded versus unshaded verges. This is especially interesting to inform management practices, which currently focus on vegetation, but do not take soil health explicitly into account.

A field study was conducted on 23 partially shaded road verges in Hasselt, Belgium. Soil samples and vegetation data were collected to evaluate soil health indicators such as soil organic carbon (SOC) and microbial activity, and metrics related to plant diversity and nectar provisioning. Results revealed that SOC levels were consistently high across shaded and non-shaded conditions, nearing levels found in semi-natural grasslands. SOC was positively correlated with microbial life, but this relationship was strongest in the intermediate zones, possibly due to a combination of high plant diversity and nearby tree roots. Contrary to expectations, plant diversity did not negatively correlate with SOC but was significantly lower in shaded areas. These results did not support a clear trade-off between vegetation development and soil health. Instead, a synergy between ecosystem components was observed, indicating that a biodiverse vegetation can support robust soil microbial communities, SOC accumulation and nectar provisioning. These findings support the current practice of extensive mowing and biomass removal to maintain healthy, biodiverse verges, while highlighting the potential for optimizing management further for both ecological and socio-economic factors.

Stakeholder participation was integral to the project's design and execution. Focus groups and citizen outreach informed the research direction, methodology, and site selection, while providing critical insights into socio-economic considerations such as cost, safety, and aesthetic perceptions. This participatory approach enabled the formulation of realistic, context-specific management recommendations that balance ecological outcomes with public and administrative expectations.



It concludes that protecting and managing established road verges through tailored, biodiversity-friendly regimes offers a viable strategy to enhance multiple ecosystem services without sacrificing vegetation quality. It underscores the importance of integrating ecological research with participatory processes to holistically address the complex trade-offs in urban green space management. Future research is needed to further explore the mechanisms driving verge ecosystem function and to refine management approaches that account for both ecological and socio-economic viability.

Concept and Objectives

Biodiversity loss and climate change currently pose major global challenges, especially in inhospitable urban environments which form heat islands. Nature-based solutions, depending on natural vegetation, trees and healthy soils, provide key benefits in mitigating these challenges. They may, for instance, form stepping stones in the landscape which aid organisms in dispersing throughout the landscape, especially in a heavily-urbanized region such as Flanders. In addition, they may provide a wealth of ecosystem services (ES) to society, such as carbon storage, temperature regulation, air purification, water filtration, pollination and pest control. Road verges are exceptionally well located to provide these ES, as nearby traffic forms an important environmental pollution source. Additionally, they are green elements situated close to human movement, highlighting their added value to wellbeing. Their density is also highest in more modified landscapes, which generally lack a lot of ES provisioning. It is therefore important to recognize their contribution in the landscape and value the services they provide.

The management of road verges is generally advised to be relatively extensive, with mowing regimes varying from one to three cuttings per year and removal of biomass, in order to promote a biodiverse vegetation development. This, in turn, is expected to have knock-on positive effects on other ES such as pollination and pest control. However, healthy soils have not been a focus in the management of road verge soils so far, even though brainstorm sessions with the managing entity highlighted their eagerness to do so. Current extensive management may be especially suited for non-shaded grassy habitats, while verges that are shaded by trees may not achieve a well-developed herbaceous vegetation because of their shaded conditions. It is hypothesized that these locations instead may boost a higher soil organic carbon (SOC) level and well-developed below-ground biodiversity, including micro-organisms such as fungi and bacteria. If this tradeoff would indeed be found, it might be more interesting to shift management to boost soil carbon storage further by reducing the number of cuttings and keeping any biomass in the shaded road verges themselves. However, this may further negatively affect the vegetation, representing the potential tradeoff between a well-developed vegetation on the one hand and carbon storage and soil microbial life on the other. Therefore, we aimed to investigate tradeoffs between vegetation and soil health in urban road verges with and without trees in order to inform effective local management policy.

Scientific methods, results and discussion

23 road verges were selected throughout the area of the city of Hasselt, which were all partially shaded by trees and were at least 500 m apart. Identification of the location of these plots was carried out in close collaboration with city representatives during co-creation workshops and participatory cartography sessions. In each verge, three plots were established: i) within the shaded area, ii) 2 m further than the height of the last tree and iii) 10 m further than the height of the last tree (n = 69, Fig. 1). These plot locations were chosen to reflect both shaded and non-shaded conditions, as well as an intermediate

