



Soil Monitor: an open source web application for real-time soil sealing monitoring and assessment

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Soil sealing is one of the most important causes of land degradation and desertification. In Europe, soil covered by impermeable materials has increased by about 80% from the Second World War till nowadays, while population has only grown by one third. There is an increasing concern at the high political levels about the need to attenuate imperviousness itself and its effects on soil functions. European Commission promulgated a roadmap (COM(2011) 571) by which the net land take would be zero by 2050. Furthermore, European Commission also published a report in 2011 providing best practices and guidelines for limiting soil sealing and imperviousness.

In this scenario, we developed an open source and an open source based Soil Sealing Geospatial Cyber Infrastructure (SS-GCI) named as “Soil Monitor”. This tool merges a webGIS with parallel geospatial computation in a fast and dynamic fashion in order to provide real-time assessments of soil sealing at high spatial resolution (20 meters and below) over the whole Italy. Common open source webGIS packages are used to implement both the data management and visualization infrastructures, such as GeoServer and MapStore. The high-speed geospatial computation is ensured by a GPU parallelism using the CUDA (Computing Unified Device Architecture) framework by NVIDIA[®]. This kind of parallelism required the writing - from scratch - all codes needed to fulfil the geospatial computation built behind the soil sealing toolbox. The combination of GPU computing with webGIS infrastructures is relatively novel and required particular attention at the Java-CUDA programming interface. As a result, Soil Monitor is smart because it can perform very high time-consuming calculations (querying for instance an Italian administrative region as area of interest) in less than one minute. The web application is embedded in a web browser and nothing must be installed before using it. Potentially everybody can use it, but the main targets are the stakeholders dealing with sealing, such as policy makers, land owners and asphalt/cement companies. As a matter of fact, Soil Monitor can be used to improve the spatial planning therefore limiting the progression of disordered soil sealing which causes both the direct loss of soils due to imperviousness but also the indirect loss caused by fragmentation of soils (which has different negative effects on the durability of soil functions, such as habitat corridors). Further, in a future version, Soil Monitor would estimate the best location for a new building or help compensating soil losses by actions in other areas to offset drawbacks at zero. The presented SS-GCI dealing with soil sealing – if opportunely scaled – would aid the implementation of best practices for limiting soil sealing or mitigating its effects on soil functions.