Digital soil assessment modelling for land evaluation in Scotland

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Soils provide a flow of goods and services such as food production, capture and storage of water, carbon and nutrients and in the realisation of a number of UN Sustainable Development Goals. Erosion, decline in soil carbon and biodiversity can lead to soil and land degradation, a serious global challenge for sustainability. It is therefore important to incorporate soils into the ecosystem services framework, linking services with the multitude of functions provided. Most of the mapping and modelling exercises have used proxies to soil information, often in the form of land use and land cover data to produce spatially distributed biophysical parameter values needed for function models. In this work we present an approach to spatially assess the multiple contributions of soil for land evaluation using Spatialised Bayesian Belief Networks. They were used for the joint assessment and mapping of the soil contribution to multiple land use and ecosystem services, using simplified models for the separate functions. We integrated continuous soil information derived from digital soil mapping approaches covering the whole of mainland Scotland. Uncertainty was accounted for and propagated across the whole process. The use of a Bayesian Belief Network approach proved useful to integrate knowledge about interrelationships between soil properties and functions, enhancing the understanding of soil-landscape processes. The results show how a multi-functional analysis can better reveal the contribution of soil to ecosystem service delivery and to some of the UN SDGs for land evaluation.