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Land use and climatic influences on soil infiltration rates, a global meta-analysis.

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Here we investigate the influence of land use and climatic factors on infiltration rates across the globe. Previous studies have demonstrated that land use may be as, if not more important than soil texture when predicting infiltration rates. Soil water, and its movement, is obviously a key driver of ecological processes, as well as playing a significant role in atmospheric-terrestrial energy exchange. Perhaps less well recognised is the dynamic relationship between the world's soils, their ability to absorb water, and changing patterns of land use and climate. Preliminary work suggested not only a clear hierarchy of land use effects on infiltration when land use was categorised at a broad scale, tree to grass > tree to arable > grass to arable, with ratio differences of 3.2, 2.7 and 0.9 respectively; but, significantly, clear differences also emerged delineated by climatic conditions. These simple ratio differences are corroborated by a strict meta-analysis, bringing together 113 papers from around the world. Studies were selected on the basis that they must yield data from sites which have different land uses, but the same underlying soil type. Only those studies which supply all the necessary summary statistics are included in the final analysis. Building on the preliminary study, more detailed land use classifications are considered. Meta regression is used to demonstrate the relationship of infiltration rates, firstly to the usual soil physical properties, organic matter content, bulk density and texture, and secondly to environmental factors, average temperatures and rainfall; as well as to Köppen climate classifications at different resolutions. Where such details are not provided by the original studies values are provided by readily available databases. The use of these databases also provides the opportunity to assess the accuracy of such data against those values supplied by field observations. A comparison with the SWIG (Soil Water Infiltration Global database) is also made.