



Slumping in the rain – winter soil structure across Scotland and its physical degradation from extreme weather

Rebecca Hall (1,2), Paul Hallett (1), Annette Raffan (1), Allan Lilly (3), Nikki Baggaley (3), John Rowan (4), Bill Crookes (5), and Bruce Ball (6)

(1) University of Aberdeen, Institute of Biological and Environmental Sciences, Aberdeen, United Kingdom (paul.hallett@abdn.ac.uk), (2) School of Biological Sciences, Queen's University Belfast Medical Biology Centre 97 Lisburn Road Belfast BT9 7BL United Kingdom, (3) The James Hutton Institute Craigiebuckler Aberdeen AB15 8QH Scotland UK, (4) School of Social Sciences, University of Dundee, Nethergate, Dundee, DD1 4HN, Scotland, UK, (5) SAC Consulting, JF Niven Building Auchincruive Estate Auchincruive Ayr KA6 5AE, (6) SRUC Crop and Soil Systems Research Group West Mains Road Edinburgh EH9 3JG, UK

Scotland is blessed with fertile and resilient soils that produce great cereal yields and whisky. However, there is worrying anecdotal evidence, confirmed by a small body of science, that some farming practices are causing widespread physical degradation of these soils. Studies from other UK regions have identified soil physical degradation by compaction, unstable seedbeds and erosion as a moderate to serious problem, depending on farming practice, soil properties and climate. In 2015/2016 we sampled 120 fields from 4 catchments in Scotland to describe the state of soil structure in the winter. To obtain a rapid assessment, we used the increasingly popular and easily interpretable Visual Evaluations of Soil Structure (VESS) and Subsoil Structure (SubVESS). We found severe soil structural degradation in 18% of topsoils and 9% of subsoils for 120 fields in 4 catchments. The severe 2015/2016 winter precipitation, the worst ever recorded, caused a 30% increase in occurrence of severely degraded topsoils, as determined from sampling some of the same fields before and after this unprecedented weather event. Run-off, erosion and nutrient losses were about 10X from degraded parts of fields such as tramlines than either within the field or at less trafficked boundaries. There was some agreement between areas identified as structurally degraded and those ranked as being susceptible to topsoil compaction using a simple model. Broad scale surveys that incorporate temporal sampling, such as the study reported here, are essential to provide regional assessments of soil degradation and to inform follow-on, targeted studies, where more in-depth analysis would be feasible.