Characterisation of the 2020 Drumkeeran peat landslide: a large peat slide in Ireland.

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Mass movements in peatlands are poorly understood. This is because of the unusual geotechnical properties of the materials (organic soils) and a paucity of well-constrained case studies. At the end of June 2020, a large peat slide occurred on Shass mountain, several kilometres northeast of the village of Drumkeeran in Co. Leitrim, north-western Ireland. The source area of the peat slide is an area of blanket bog within a Special Area of Conservation (SAC). This area is characterised by a topographic slope of 3-5°. On recently published Landslide Susceptibility Maps it was classified as ‘moderately low’ to ‘low’.

To understand this peat slide’s genesis and impact on the landscape, post-slide site investigations and aerial surveys were undertaken in the following days and weeks. These included: photogrammetry and LiDAR surveys via UAVs and crewed aircraft; Ground Penetrating Radar (GPR) profiling; in-situ peat depth measurements, soil coring and a vegetation survey. These data were complemented by pre-and post-slide radar satellite data (Sentinel-1) and were compared to high-resolution pre-slide aerial imagery and digital surface models (DSMs) captured in August 2017 and April 2020.

Mapping and DSM differencing show a source area of 7 ha, from which \(171,000 \text{ m}^3\) of peat flowed 6.6 km down a river channel. The height/run-out ratio was 0.035; the run-out/volume ratio was 0.038. Peak flow or run-up heights near the source area were \(>4\) m. Video, field and satellite evidence indicates that the peat was highly liquified. It deposited in three zones: upstream of a small bridge, which acted as a partial dam and on two floodplain areas. About 45 ha were covered with peat up to 1-3 m thick, these deposits generally thin downstream. Radar intensity data
support local accounts that most of this material failed retrogressively and redeposited within 24 hours.

Data from the nearest meteorological station, 27 km to the west, show that the region experienced a relatively dry period (118 mm of precipitation) in the 2.5 months before the landslide, and a period of exceptionally high rainfall (53 mm) three days immediately beforehand. Flow pathway analysis indicates a natural drainage convergence in the upper catchment. The landslide possibly started here and regressed upslope into ~5 ha of well-drained bog, afforested in 1996, located at the head of the catchment. The areas to the south and east comprise of a mosaic flushes, wet heath, and blanket bog vegetation.

The peat depth was assessed by both GPR data (calibrated by coring), which shows the base of the peat and probing. It ranged from 2-5 m. This accords with a typical 2-4 m thickness of failed peat from DSM differencing. Coring also revealed a ~50cm thick layer clay at the base of the peat. These preliminary results highlight the potential importance of local drainage patterns and localised clay layers in increasing peat-slide susceptibility on low-angle slopes. This characterization underpins further investigation into the multifarious factors causing peat slides, which may be exacerbated by climate change.