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Editorial

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The first issue of *Environmental Geotechnics* for 2022 is an In-focus issue on the topic 'Geotechnical aspects of peatland restoration and management'. Peatlands are dynamic eco-hydrological wetland systems that are increasingly under threat worldwide due to natural and anthropogenic effects, especially over the last century. Many peatlands are experiencing degradation due to the effects of large-scale drainage and oxidation, causing their subsidence and ecological deterioration. The peat materials themselves have geomechanical properties towards the minima associated with most inorganic soil deposits – their engineering properties changing over time for increasing levels of humification of the predominant organic matter component, aspects that have been reported on in earlier issues of this journal (Leong and Eriktius, 2014; O'Kelly, 2015, 2016; O'Kelly and Pichan, 2014).

The necessities for conservation, restoration and long-term sustainability of degraded active bog have been emphasised by more onerous environmental legislation and policy in Europe, in part following the Water Framework and Habitats EU Directives (EC, 2013, 2014). This work requires careful management and understanding of the bog hydrology and biodiversity to re-establish the fragile remnants of the original ecosystems, with the aims of developing and sustaining the characteristic functions needed for the transition to a pristine fully functional wetland (O'Kelly and Johnston, 2019). Since the organic fabric can absorb as well as transmit water (and nutrients), peat arguably does not behave as a conventional Darcian medium; hence predicting its behaviour under drainage or rewetting is key to wetland management. The discipline of environmental geotechnics has much to contribute on this and other aspects ranging from: (*a*) the need for a fundamental understanding of the behaviour of peat as an organic soil at low effective stress levels; (*b*) field monitoring and numerical modelling of the geotechnical and hydrological behaviour of peat; (*c*) improving predictions of the behaviour of peat as a hydrogeological medium under drainage or rewetting. Additionally, in the context of climate change, peatlands gain heightened interest due to their ability to absorb and store carbon, especially if they are in a natural, undrained condition.

This In-focus issue offers a selection of four scientific papers that cover a range of diverse topics in this broad research area, including tackling a fundamental question for water content determinations on peat materials, presenting a novel foundation system for supporting lightweight structures bearing on peaty ground, and field and laboratory investigations of upland blanket bogs towards understanding the causal factors for peat landslides. The fifth paper of this issue is a general paper on the geomechanical behaviour of municipal solid waste (MSW).

In first paper, Li *et al*. (2022) investigate a basic question regarding an acceptable oven-drying temperature for performing routine water content determinations on peat materials. Although some of the constituent organic solids can be vulnerable to possible charring/oxidation at the standard oven-drying temperature range of 105–110°C employed for inorganic soils, Li *et al*. (2022) conclude from their experimental investigation that 105°C is suitable for routine water content determinations on the Dianchi highly-decomposed peat materials they examined. This finding is in line with the consensus forming from other investigations on this topic, including for moderately and highly decomposed peats (O'Kelly and Sivakumar, 2014) and other high organic content soils (O'Kelly, 2014). The Li *et al*. (2022) paper also develops a novel method of assessing water content values determined for peat materials employing different oven-drying temperatures – an approach facilitating valid comparisons of measured (reported) water contents determined for peat materials on the basis of significantly different oven-drying temperatures.

Surficial peat deposits typically have small strength and experience high compression for even modest increases in effective stress. The resulting subsidence can severely affect the peatland hydrology and ecosystem, particularly for those peatlands with constructed large-scale drainage systems or upon which linear infrastructure is built. In the second paper, Aminu *et al*. (2022) present a novel ultralightweight footing, constructed of bamboo frame with wrapped waste-plastic-bag (WPB) elements included within its cavities, for supporting lightweight structures bearing on waterlogged peaty ground. When submerged in the extremely high water content peat foundation, the footing benefits from the buoyancy generated by the footing's low density components, thereby reducing the net bearing pressure and hence the footing settlement. Using reduced-scale model testing (Figure 1), they investigated the enhanced bearing capacity for bamboo-frame footings of various depth-to-breath ratios, both with and without WPB inclusions.

(a) (b)

Figure 1. Ultralightweight footing for supporting lightweight structures bearing on peaty ground: (a) model footing comprising of bamboo frame structure incorporating recycled WPB inclusions; (b) vertical load testing of footing in peat bed (taken from Aminu *et al.* (2022))

Because they are largely derived from the gradual accumulation of decaying plant vegetation, peats begin as fibrous materials that slowly decompose under the prevailing anoxic condition, ultimately producing amorphous peat material. Fibre content is associated with enhanced strength properties, including for tensile strength which is often a key (significant) factor for the geotechnical stability of peat foundations and natural slopes (O'Kelly, 2017). Differences in botanical constituents for various peat materials may partly explain differences in their geotechnical properties, although there is a dearth of reported work on this aspect. The next two papers, by Dykes (2022) and Foteu Madio and Dykes (2022), investigate botanical composition and fibre affects towards gaining improved understanding of instability and failure in upland (blanket) bogs. Here there is heightened interest arising from the dual concerns of (*a*) landslide hazards associated with more likely high-intensity rainfall events and (*b*) environmental impacts of peat failures arising from access road or track construction for wind farms or other purposes on peatlands. For the Croaghan peat slide of August 2014, Dykes (2022) concluded that the slide was triggered by high subsurface water pressures resulting from the extreme rainfall, but ultimately occurred because of a very soft (<<6 kPa shear strength) basal peat layer arising from the decomposition profile of the constituent plant remains. A specific aim of the Foteu Madio and Dykes (2022) paper was to investigate the potential importance of botanical controls on the properties and behaviour of blanket peat involved in peat landslides. In-situ measurements and investigations at three bogflow sites in north-west Ireland were followed by extensive laboratory characterisation of small core, block and monolith samples. For these three sites, the apparent uniformity of the in-situ peat, formed from essentially the same assemblages of plant species that were dominated by sedges, prevented definitive conclusions regarding potential relationships between botanical characteristics and standard physical and geotechnical properties. They recommended more extensive and integrative research to explore the causes and geotechnical effects of different peat accumulation scenarios, echoing similar proposals put forward in O'Kelly (2017).

The final paper (Pulat and Yukselen-Aksoy, 2022) in this issue presents a laboratory investigation on the effects of ageing on the shear strength and compressibility parameters of synthetic representative average MSW compositions of Europe, Turkey and the USA, as well as natural fresh and aged MSW samples collected from the dumpsite of Manisa City, Turkey. Their results showed that the most important waste constituents affecting the primary compression index ratio of MSWs are the organic and paper–cardboard waste fractions – aged samples having lower cohesion and slightly higher friction angle values than the fresh samples.

The Guest Editor hopes that readers enjoy the diversity of topics tackled here and that they may find inspiration for further studies. Finally, the Guest Editor acknowledges the support of all contributing authors and reviewers, without which the issue could not come to fruition.

REFERENCES

Aminu I, Asadi A, O'Kelly BC, Huat BBK and Reul O (2022) Ultralightweight foundation system for peaty ground. *Environmental Geotechnics* **9(1)**: 12–21, https://doi.org/10.1680/jenge.17.00075.

Dykes AP (2022) Recent peat slide in Co. Antrim extends the known range of weak basal peat across Ireland. *Environmental Geotechnics* **9(1)**: 22–35, https://doi.org/10.1680/jenge.17.00088.

EC (European Community) (2013) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. *Official Journal of the European Union* **L 206**.

EC (2014) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. *Official Journal of the European Union* **L 327**.

Foteu Madio ES and Dykes AP (2022) Botanical and geotechnical characteristics of blanket peat at three Irish bogflows. *Environmental Geotechnics* **9(1)**: 36–54, https://doi.org/10.1680/jenge.17.00089.

Leong EC and Eriktius DT (2014) Improvement of peaty soils with municipal solid waste fly ash. *Environmental Geotechnics* **1(4)**: 200–209, https://doi.org/10.1680/envgeo.13.00023.

Li W, O'Kelly BC, Fang K and Yang M (2022) Briefing: Water content determinations of peaty soils using the oven-drying method. *Environmental Geotechnics* **9(1)**: 3–11, https://doi.org/10.1680/jenge.18.00056.

O'Kelly BC (2014) Drying temperature and water content–strength correlations. *Environmental Geotechnics* **1(2)**: 81–95, https://doi.org/10.1680/envgeo.13.00016.

O'Kelly BC (2015) Effective stress strength testing of peat. *Environmental Geotechnics* **2(1)**: 33–44, http://dx.doi.org/10.1680/envgeo.13.00112.

O'Kelly BC (2016) Briefing: Atterberg limits and peat. *Environmental Geotechnics* **3(6)**: 359–363, https://doi.org/10.1680/envgeo.15.00003.

O'Kelly BC (2017) Measurement, interpretation and recommended use of laboratory strength properties of fibrous peat. *Geotechnical Research* **4(3)**: 136–171, https://doi.org/10.1680/jgere.17.00006.

O'Kelly BC and Pichan SP (2014) Effect of decomposition on physical properties of fibrous peat. *Environmental Geotechnics* **1(1)**: 22–32, http://dx.doi.org/10.1680/envgeo.13.00012.

O'Kelly BC and Sivakumar V (2014) Water content determinations for peat and other organic soils using the oven-drying method. *Drying Technology* **32(6)**: 631–643, https://doi.org/10.1080/07373937.2013.849728.

O'Kelly BC and Johnston PM (2019) Environmental geotechnics for peatland management and restoration. *Journal of International Scientific Publications: Ecology & Safety* **13**: 1–15.

Pulat HF and Yukselen-Aksoy Y (2022) Compressibility and shear strength behaviour of fresh and aged municipal solid wastes. *Environmental Geotechnics* **9(1)**: 55–63, https://doi.org/10.1680/jenge.18.00019.