Examinations of turlough soil property spatial variation in a conservation assessment context

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Abstract

Turloughs are a type of karst wetland found extensively in western Ireland. Turloughs have a dynamic flooding regime, are groundwater dependent and lack a surface outflow. The EU Habitats and Water Framework Directives provide the impetus for evaluating the impacts of nutrient pressures on this internationally protected habitat. Differences in hydrogeological settings are thought to be a key driver of nutrient variation among turloughs. An holistic assessment of turlough trophic conditions should include the terrestrial phase, and an improved understanding of turlough soil property spatial variation is necessary for informing attempts to link nutrient pressures and impacts on the terrestrial phase of the habitat. This study compared nutrient-related soil properties among two groups of turloughs situated in East Burren, Co. Clare, and Coole Garryland, Co. Galway. Each group is representative of a contrasting hydrogeological setting indicative of a trophic gradient. Soils within Coole Garryland turloughs are potentially more nutrient rich than East Burren turloughs owing to the larger zones of groundwater contribution with faster throughflow, greater levels of disturbance and more intense grazing pressures. Turloughs in East Burren had distinctly more alkaline and peaty soils than Coole Garryland, reflecting the relatively longer flood durations of the former. There was no clear distinction in soil total phosphorus, total nitrogen or desorbable phosphorus between East Burren and Coole Garryland. The soils of dry, more intensively grazed turloughs are apparently not more nutrient rich than wet, less intensively grazed turloughs. Variation in nutrient availability and inter-relationships of soil properties were examined along the flooding gradients of two turloughs representative of each hydrogeological setting, namely Garryland turlough and Cooloorta turlough. Elevated concentrations of available forms of N and P in the saturated lower zones of each turlough may be the result of anaerobic conditions or nutrient accumulation. High coefficients of variation reveal that available forms of N and P exhibit a high degree of spatial variation in turloughs. Consequently, the occurrence and distribution of vegetation communities and plant species indicative of different trophic conditions are likely to be more useful than soil nutrient assessments for assessing the impacts of nutrient pressures on turloughs. pH was identified as an important driver of P availability in turloughs. The negative association between

available P and pH highlights the potentially significant influence of marl accumulation on turlough ecological functioning. Future turlough soil research should be cognisant of spatial variation along flooding gradients and should focus on N and P mineralisation studies of mineral, organic and calcareous soils to develop understanding of turlough nutrient cycling processes and retention capacities.