How does the restoration of a shallow peatland affect water tables, runoff and water storage?

- Restoration can significantly alter rainfall runoff regimes in restored catchments.
- Peak runoff from comparable rainfall events can be reduced by as much as 21%.
- Total runoff generated from comparable rainfall events can be reduced by as much as 32%, as water leaves the restored catchments more slowly, increasing catchment baseflow between rainfall events.
- Rainfall runoff response is catchment specific, smaller rainfall events can result in a limited increase in storm runoff.
- In the short term (<5 years post-restoration) average water tables remain at similar levels post-restoration.
- Water table responses to restoration are spatially complex and in locations where drainage had most significantly altered ground water storage, water tables are seen to rise by as much as 4 cm.

In an intact state, peatland landscapes form as wetlands with water at or near the ground surface for most of the year. These areas are home to specialist plant species adapted to grow in waterlogged ecosystems. The storage and release of water from such landscapes is inherently linked to the way the ecosystem functions as a store of carbon and regulator of river flow. Peatland restoration aims to re-establish more natural hydrological processes in historically drained and damaged peatlands. Across two restored headwater catchments (Aclands and Spooners), discharge was estimated in the main channel leaving the catchment. Additionally, water tables were monitored within and surrounding several drainage features using a network of dipwells extending to the bottom of the peat soil (Figure 12). Water tables are measured as depth to water down from the ground surface.

**Water Table Depth**

The response of water table depth to restoration is spatially and temporally complex, particularly as drainage features often cut across-slope (Figure 13). Pre-restoration, water tables are seen to be lower on the downslope side of drainage features, decreasing with proximity to drains (Figure 13 and 14). Upslope of cross-slope drainage, water tables do not vary with distance to the drain and are persistently below the soil surface.

Post-restoration, changes are observed in water table depths, but these are confounded by significantly reduced rainfall in the years monitored post-restoration, compared to those pre-restoration (Figure 15). Despite this, immediately downslope of drainage features, water tables are seen to increase by an average of 4 cm and become more variable (Table 1, Figure 14) following ditch blocking. However, immediately upslope of drainage features, water tables are seen to be lower (average of ca. 9 cm) illustrating the spatial complexity of the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest restoration has equalised the restoration effect. These results suggest.
water table drawdown in the areas immediately adjacent to drains, and whilst water tables remain predominantly below the surface, drainage features may export less water from the soil.

**Spooners Catchment Runoff**

Runoff production within the larger Spooners catchment was significantly altered by restoration. Rainfall/runoff events with comparable contributing rainfall, had significantly less total discharge (Figure 16 and 17) and a lower peak event discharge post-restoration (p<0.001).

For smaller rainfall events (<10 mm), total event discharge and peak event discharge were reduced by 32 % and 29 % respectively (p<0.01) post-restoration. For larger rainfall runoff events, this effect is less statistically significant (p>0.05). For contrastingly, smaller rainfall events (<10 mm), total and peak discharge were significantly higher post-restoration (mean >100 % at p<0.05). This indicates catchment rewetting may have caused a small increase in runoff connectivity for smaller rainfall events, post-restoration. However, for larger rainfall events, that are more important for flooding and water treatment, this change does not lead to significantly increased peak or total runoff.

**REFERENCES**

The appendices are available to view at www.exeter.ac.uk/creww/research/casestudies/miresproject