

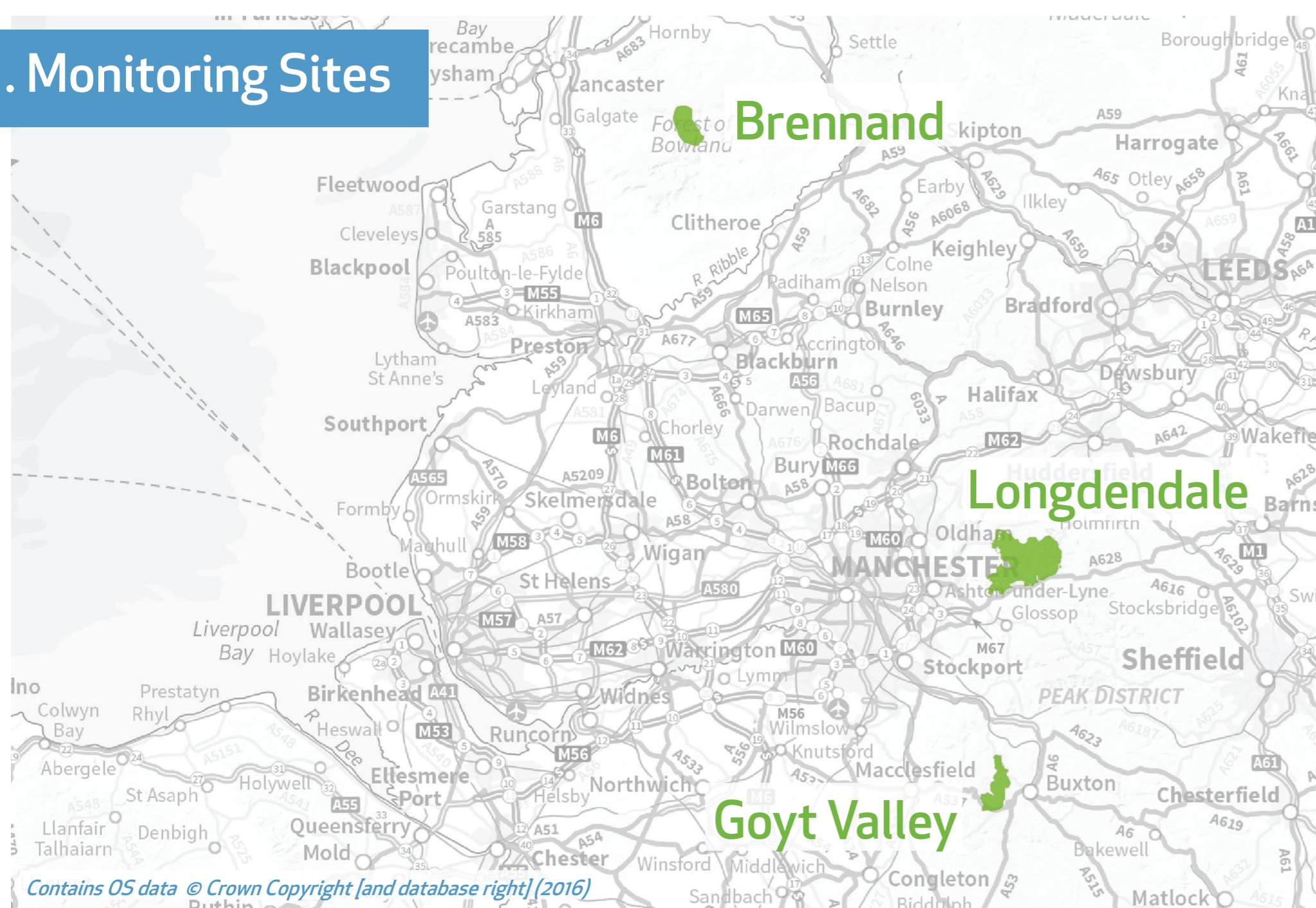
United Utilities' SCaMP Project - monitoring the effects of habitat restoration on hydrology, water colour and carbon over a 10 year period.

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United Utilities' Sustainable Catchment Management Programme (SCaMP) aims to improve catchment quality for nature conservation, raw drinking water and carbon retention via implementation of a suite of habitat restoration measures.

Monitored over a 10-year period, and set to continue to 2020, the results form a significant dataset for the analysis and interpretation of the impacts of restoration on peat groundwater levels, colour production/release and vegetation enhancement. Data from the SCaMP catchments in North-West England show positive trends across the majority of the factors measured.

1. Monitoring Sites



2. Prior to Restoration

Prior to restoration a number of issues were present across the sites:



- Areas of extensive bare peat.
- Significant artificial drainage and gully erosion.
- Poor vegetation condition and loss of peat from the moorland.
- Effect of grazing and burning regimes over decades.



3. Restoration Measures

The following restoration measures were applied across 12,300ha blanket bog:

- 85km grips blocked with peat or plastic dams.
- 470ha eroding bare peat treated with 'nurse' crop, heather brash, geojute textile.
- 'Novel' coir roll installation.
- Gully blocking with stone dams.
- Reduced or removed grazing and burning across all sites.



4. Monitoring Approach

The monitoring programme developed by PAA covered three main interest areas:



- Hydrology - peat water levels, stage discharge, rainfall gauges.
- Water colour (DOC), turbidity (POC). Spectrometer deployed in the field.
- Vegetation quadrats within plots, including reference plots, fixed point photography.

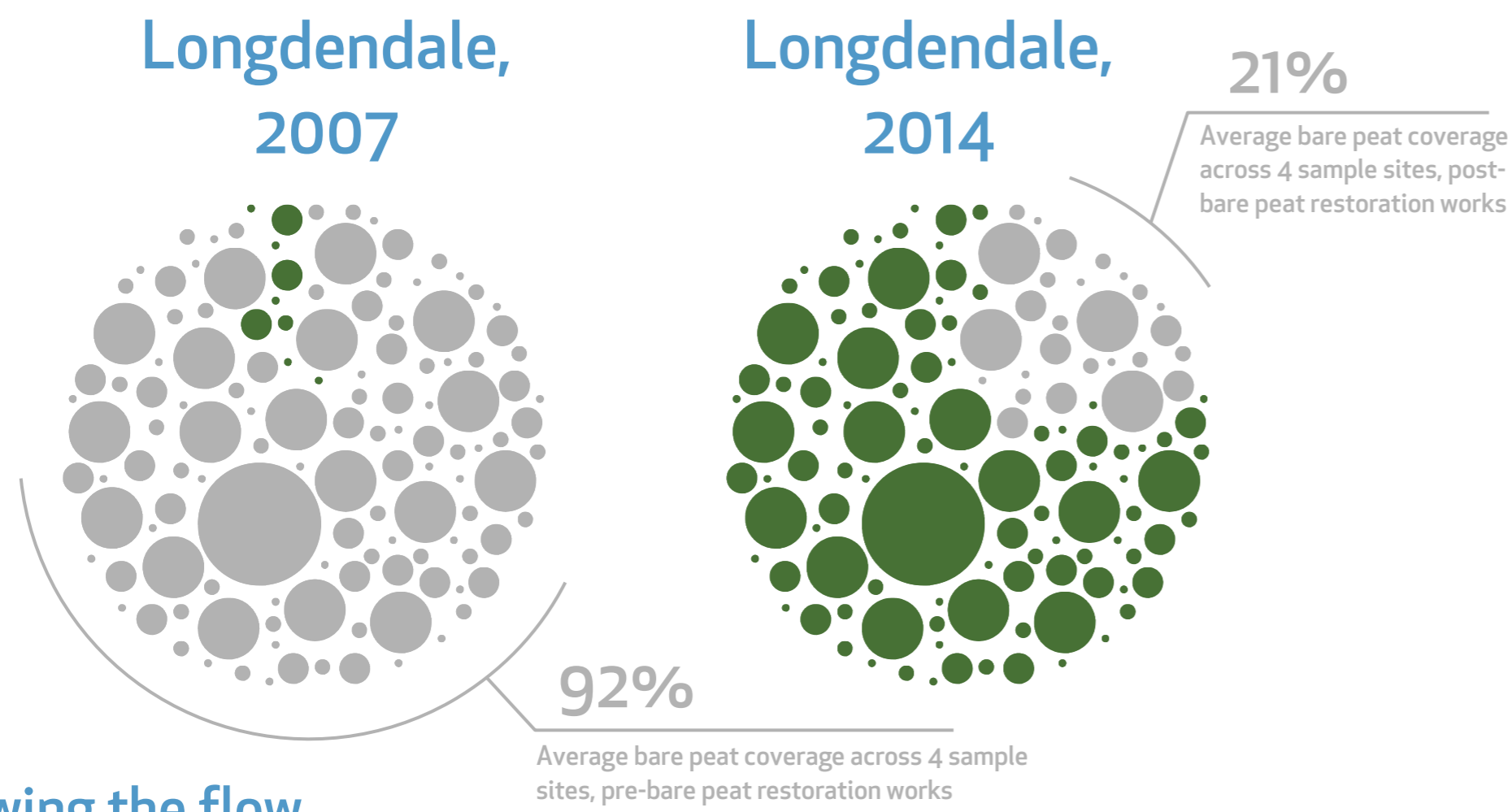
5. Results

- Significant reductions in bare peat and increases in vegetation cover were identified.
- *Sphagnum* cover is increasing where present, responding more quickly if greater cover remains.
- Removing/reducing grazing and burning alone results in positive change, in some areas.
- Stabilising bare peat is important in re-vegetation of bare peat.
- Nurse crop treatment is effective in promoting re-vegetation.
- Additional heather brash and geojute encourages more rapid re-vegetation of slopes, geojute is important on steeper slopes.
- Water quality is improving with reductions in colour (and turbidity), although colour is still problematic on severely eroded catchments.
- Peat water levels are generally increasing and stabilising, except where severe degradation has occurred.

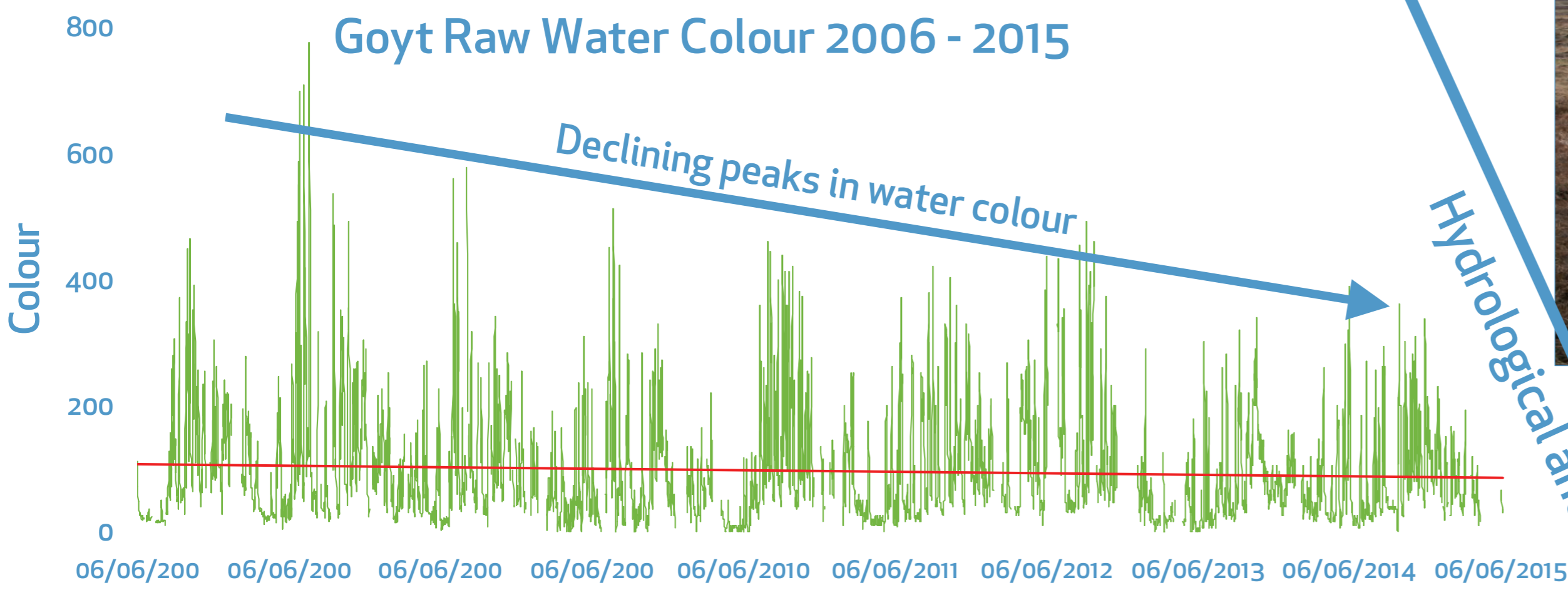
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6. Bare Peat Restoration Effects



- Slowing the flow
- Structural changes and improvements to peat body
- Some observed re-wetting over time
- Restoration of hydrological function
- Vegetation changes and some improvements
- Raw water colour – stabilisation in rate of colour production and release, also some increases.
- Turbidity reductions/stabilisations



Restoration and Water Quality Trajectories

Table showing calculated water quality trajectories for the SCaMP study catchments

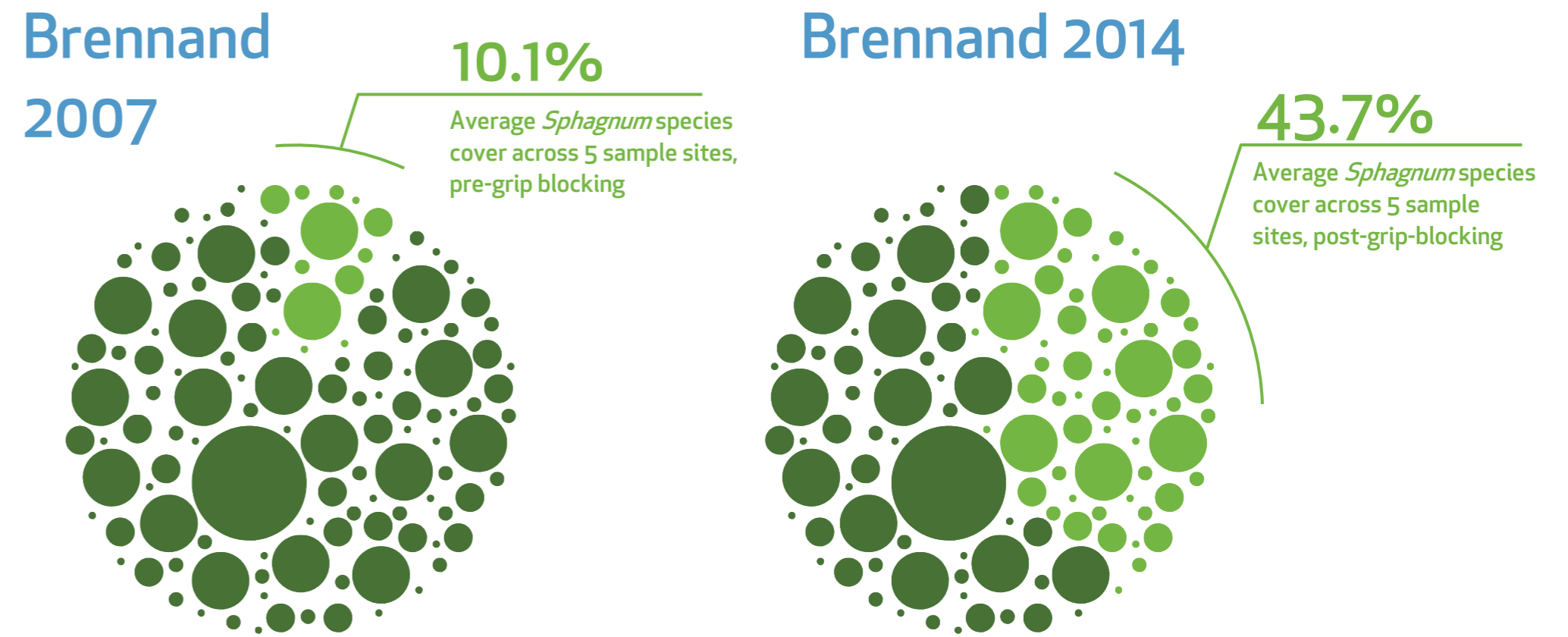
| Site | Slope | Rate (Haz pa) | Trend | Years before 100% change |
|------------------|--------|---------------|------------|--------------------------|
| Goyt | -0.004 | -1.460 | Decreasing | 68.49 |
| Whitendale | -0.001 | -0.365 | Decreasing | 273.97 |
| B - Brown Syke | 0.000 | 0.000 | Stationary | na |
| B - Bield Field | 0.007 | 2.550 | Stationary | 39.22 |
| AG- Small Clough | 0.000 | 0.000 | Stationary | na |
| Etherow Control | 0.290 | 3.480 | Increasing | 28.74 |
| AG - Chew Clough | 0.057 | 20.805 | Increasing | 4.81 |

8. Research Themes and Papers

United Utilities have commissioned PAA to prepare two peer-reviewed research papers, based on the results and observations gained from over nine years of SCaMP monitoring. Research 'themes' identified for publication include:

- An overview paper, presenting the key themes and outcomes from the SCaMP Project.
- Comparing the SCaMP water quality monitoring results within the context and trajectories in environmental monitoring data, collected nationally.
- A conceptual model of dissolved organic carbon (raw water colour) and a Bayesian Network Belief Model to demonstrate the complex interactions between key drivers of DOC production and release.

7. Grip Blocking Effects



- Slowing the flow
- Re-wetting of peat body
- Restoration of hydrological function
- Vegetation changes and improvements

- Raw water colour – changes in rate of colour production and release, including reductions
- Turbidity reductions/stabilisations

United Utilities SCaMP Website
<http://corporate.unitedutilities.com/cr-scamp.aspx>



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