

# The Clay Research Group

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## RESEARCH AREAS

Climate Change ♦ Data Analysis ♦ Electrical Resistivity Tomography  
Time Domain Reflectometry ♦ BioSciences ♦ Ground Movement  
Soil Testing Techniques ♦ Telemetry ♦ Numerical Modelling  
Ground Remediation Techniques ♦ Risk Analysis  
Mapping ♦ Software Analysis Tools  
Artificial Intelligence



May 2025  
Issue 240

# The Clay Research Group

## CONTENTS

Issue 240, May 2025

### Page 2

ChatGPT – Dealing with Trees

### Page 3

Electronic Stabilisation

### Page 4

UK Met Office Anomaly Maps

April 2025

Weather Elements and Risk

### Page 5

In the News

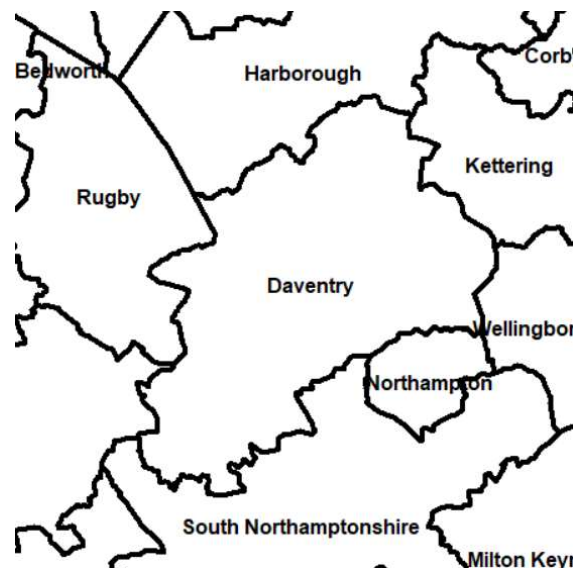
### Pages 6 - 13

Subsidence Risk Analysis by District

**Daventry**

## District and Sector Risk

Daventry is situated in West Northamptonshire, East Midlands with a population of around 28,200 and occupies an area of 663km<sup>2</sup>. It is the subject of the 'Risk by District' series in this month's edition. Its geology is predominantly Lias clay with superficial deposits of Till and sand and gravel deposits – see Page 8.



## Weather patterns and claim numbers.

Clearly warmer, drier weather patterns increase the risk of root induced clay shrinkage claims, but which element makes the greater contribution? On page 4 we compare 2003, a year with high claim numbers, with 2017, a year with far fewer.

The risk maps are built from a data sample covering four claim years, including one surge and three 'normal' years.

## Contributions Welcome

We welcome articles and comments from readers. If you have a contribution, please Email us at: [clayresearchgroup@gmail.com](mailto:clayresearchgroup@gmail.com)

## 20th Anniversary

This edition marks the 20-year anniversary of the CRG newsletter. The early editions had around 200 readers. The number has grown steadily to nearly 7,000.

Our thanks to our sponsors, Innovation Group, contributors and readers.

## THE CLAY RESEARCH GROUP

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## ChatGPT – Root Induced Clay Shrinkage. Dealing with Trees



### Question to ChatGPT

If a tree causes subsidence on clay soil, does it have to be removed or are there other methods of resolving the problem.

### ChatGPT Response

When a tree causes subsidence on clay soil, it can be a tricky situation to resolve, as the tree roots may be drawing moisture from the soil, causing the clay to shrink and resulting in subsidence (settling or shifting of the ground). Removing the tree is one option, but it is not the only solution. Several other methods can be considered, depending on the situation:

#### 1. Soil Moisture Management

- **Watering the soil:** One way to stabilize the soil is by maintaining a consistent moisture level. This can be done by controlling the water content around the tree's roots, preventing the clay soil from drying out too much and shrinking.
- **Irrigation systems:** In some cases, installing a controlled irrigation system around the affected area can help keep the soil moist without over-saturating it.

#### 2. Root Barrier Installation

- If the tree's roots are causing the issue, installing a root barrier can help direct the roots away from the vulnerable area. A root barrier can prevent the roots from affecting the clay soil directly and help limit further subsidence.

#### 3. Soil Stabilization

- **Soil injection:** Some methods, such as soil stabilization injections (e.g., using expanding resins or other chemical agents), can be used to treat the soil and improve its structure. These injections can fill in voids and create a more stable foundation, reducing subsidence.
- **Soil replacement:** In some cases, replacing the soil under the tree with more stable materials may help. This is a more invasive solution and may require significant effort and expense.

#### 4. Pruning the Tree

- Reducing the canopy size of the tree may help reduce the water demands placed on the soil by the tree. By pruning the tree, you can lessen its need for moisture, which in turn could reduce the effect on the surrounding soil.



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## 5. Tree Removal (as a Last Resort)

- If other methods don't resolve the issue, or if the tree's impact on the soil is severe, removal might become necessary. This is typically the last resort after other mitigation methods have been explored and proven ineffective.

## 6. Monitoring and Regular Assessment

- Continuous monitoring of the subsidence situation is key. As the soil conditions change, or as the tree matures, adjustments to your approach may be necessary.

## Conclusion

Removing the tree isn't always necessary, and other methods can be used to mitigate or resolve subsidence caused by clay soil. It's advisable to consult with a professional arborist or structural engineer to assess the specific situation and determine the best course of action. They can perform a detailed inspection to recommend the most effective solution based on the severity of the subsidence, the tree type, and the soil conditions.

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## Electrokinetic Stabilisation

Richard Rollit (Technical Director) and Dr Allan Tew (Chief Engineer) of Innovation Group are attending the International Conference on Soil Mechanics and Geotechnical Engineering in Vienna in June 2026, reviewing the potential benefit of using Electrokinesis to resolve the problem of root induced clay shrinkage.

In 2015 Tom Clinton obtained a PhD following a study of the effects of applying EK to clay soils at the Aldenham research site London under the supervision of Professor Ian Jefferson, Birmingham University.

Allan Tew has continued the study, applying it to properties damaged by subsidence, delivering successful outcomes.

The benefits, apart from tree retention, are numerous. The installation uses solar energy, is non-disruptive to the homeowner and safe for pets etc. The Plasticity Index of the clay soil is significantly reduced following treatment.

EKS has also been shortlisted in the category of Claims Initiative of the Year for the forthcoming British Insurance Awards, taking place in July.

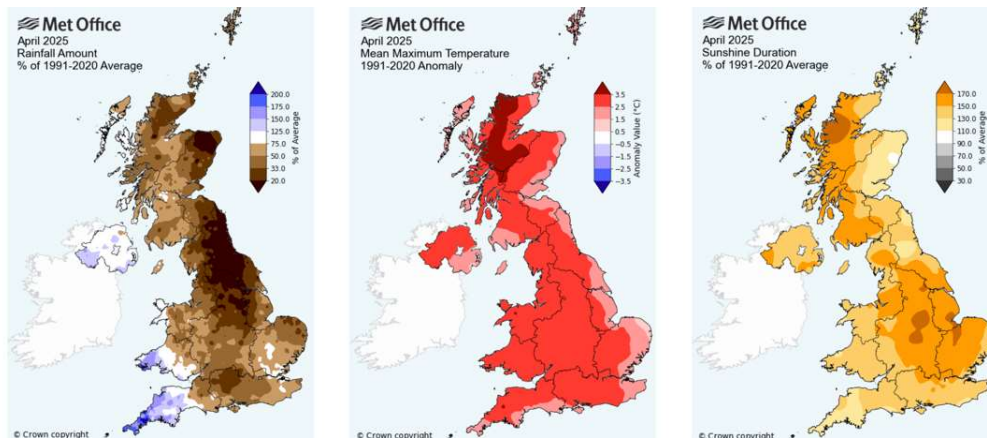




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## Met Office Anomaly Maps for April 2025

Anomaly maps from the Met Office web site for the month of April 2025 comparing data with average for the period 1991 – 2020, reproduced below.



Met Office data shows reduced rainfall, higher temperatures and hours of sunshine duration for April compared with 1991 – 2020 averages.

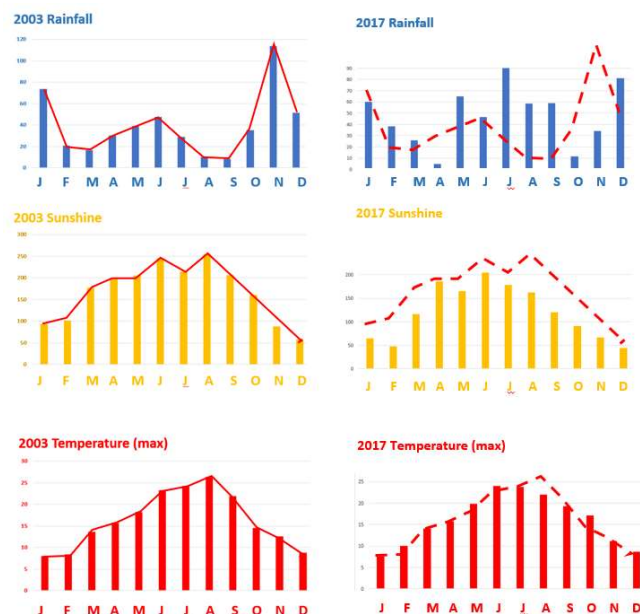
<https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-actual-and-anomaly-maps>

## Weather Elements

Right, monthly values for rainfall, sunshine and temperature for the Heathrow weather station, monitored by the Met Office. The graphs compare values for a surge year (2003, left column), and a year with low subsidence claim numbers (2017, right column).

The profile for each of the elements for a surge year is superimposed onto the 'normal' year and, as we would expect, rainfall delivering a normal claims year is far higher in the summer months and sunshine lower. Values for maximum temperature follow a similar profile.

The fact that the values are an average covering a month reduces their value but nonetheless, they are of interest.



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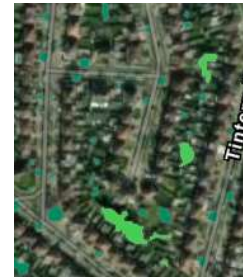
## In the News

**Copernicus report that March 2025 was the Second-warmest globally, with large wet and dry anomalies in Europe.** March 2025 set a new record as Europe's warmest, and the second-warmest globally, marked by significant dry and wet anomalies. **The Met Office** data for England records temperature for March 2025 of 7.5°C compared with the mean maximum temperature of 1.1°C for the period 1991-2020 and reduced rainfall.

**Keiron Hart of Tamla Trees has supplied the following links:**

Mapping of trees outside woodland as defined by the National Forest Inventory and funded by DEFRA. The map identifies tree canopy cover (trees over 3m tall and 5m<sup>2</sup>) in into three categories - lone trees, groups of trees, and small woodlands.

[Trees Outside Woodland Public Map](#)



'Valuing and Protecting Important Trees Outside Woodlands' is a document produced by the Tree Council. The explain their definition of 'important' as *"trees of high social, cultural, and environmental value"* and including *"ancient, veteran, heritage, champion and notable trees, and trees that do not fit within these classifications and are highly valued for other reasons"*.

<https://treecouncil.org.uk/science-and-research/valuing-and-protecting-important-trees-outside-woodlands/>. Sophie Rudgewell is organising a meeting at Alice Holt, in Farnham, Surrey, and online, on 21<sup>st</sup> May. Contact [Sophie.Rudgewell1@defra.gov.uk](mailto:Sophie.Rudgewell1@defra.gov.uk) for more information.

**Richard Driscoll** came across an article in The Times explaining how quantum mechanics and a 6ft tube might be developed to build a *"Google maps of the underworld"* — identifying the location of pipes, ducts and sinkholes etc. The work is being undertaken by Professor Michael Holynski at Birmingham laboratory facility, Delta.G. Apparently inside that tube there is a cloud of tumbling rubidium atoms. As they fall under gravity, they accelerate differently depending on their state. When they are recombined at the bottom, this difference can be measured, giving the value of gravity in the location. Just imagine – trial holes without excavations, and all done in half an hour - perhaps. For more information visit their web site at <https://www.delta-g.co.uk/>

**The British Geological Survey** are extending their risk assessment application, Property Subsidence Assessment, to cover Scotland adding data provided by Bluesky. It offers *"National coverage for Great Britain offering building-level subsidence assessments for over 1.5 million additional buildings and summaries for over 100 000 additional postcodes."* The web site goes on to explain *"The PSA users receive GIS building polygons with an overall susceptibility to subsidence score between 1 and 100, with one being lowest susceptibility."*

<https://www.bgs.ac.uk/news/property-subsidence-assessment-helping-to-mitigate-shrink-swell-hazard-risk/>

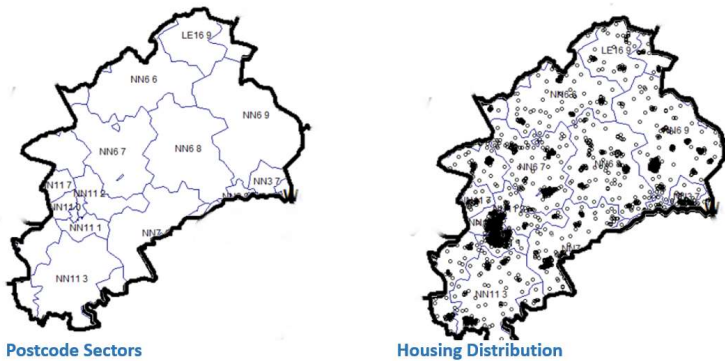


# The Clay Research Group

## Subsidence Risk Analysis – Daventry

Daventry is situated in Northamptonshire, and occupies an area of around 663km<sup>2</sup> with a population approaching 28,200.

### DAVENTRY



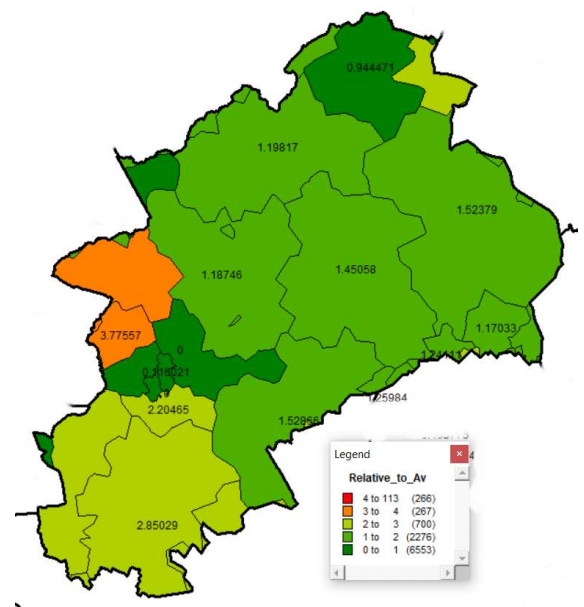
*Distribution of housing stock using full postcode as a proxy. Each sector covers around 3,000 houses on average across the UK and full postcodes include around 15 – 20 houses on average, although there are large variations.*

From the sample we hold, sectors are rated for the risk of domestic subsidence compared with the UK average – see map, right.

Daventry is rated 59th out of 413 districts in the UK from the sample analysed and is around 1.64x the risk of the UK average, or 0.425 on a normalised 0 - 1 scale.

Sector and housing distribution across the district (left, using full postcode as a proxy) helps to clarify the significance of the risk maps on the following pages. Are there simply more claims in a sector because there are more houses?

Using a frequency calculation (number of claims divided by private housing population) the relative risk across the borough at postcode sector level is revealed, rather than a 'claim count' value.



*Sector risk compared to UK (normalised) from the sample analysed. Private ownership only.*





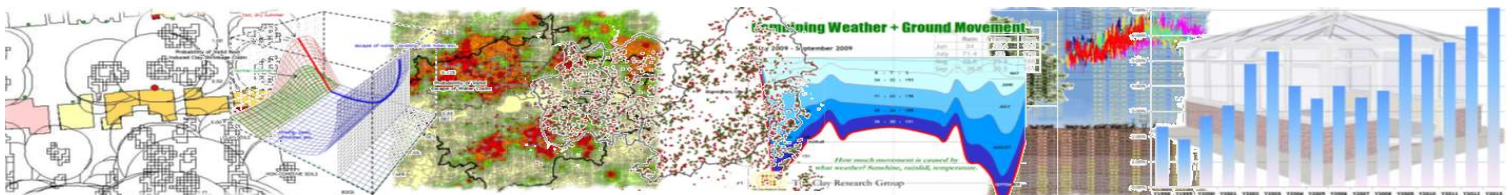
Risk increases with age of property and the model can be further refined if this information is provided by the homeowner at the time of taking out the policy.

A map of the North West region of the Netherlands, with the study area highlighted in the south-west. The study area is divided into three sub-regions labeled NW11.1, NW11.2, and NW11.3.

## Private Ownership

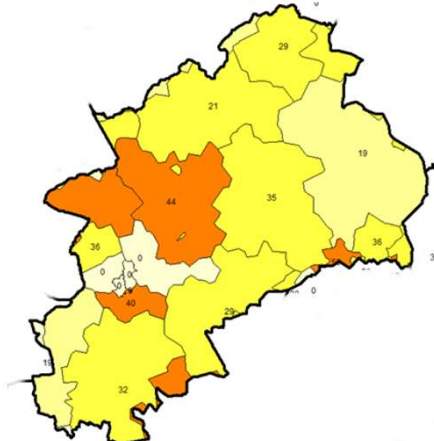




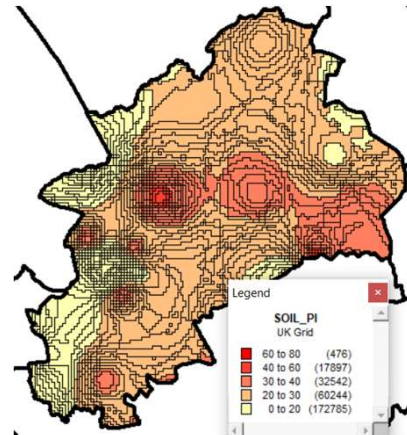


Below, the average PI by postcode sector (left) derived from site investigations and interpolated to develop the CRG 250m grid (right). The higher the PI values, the darker red the CRG grid.

## DAVENTRY – Soil Plasticity Index



### Soil PI Averaged by Sector

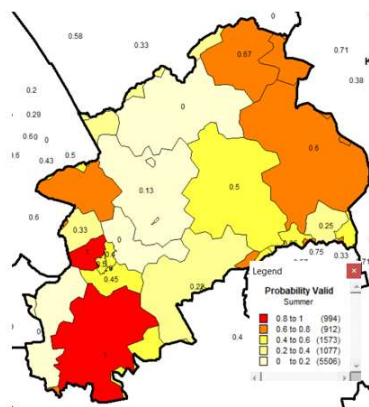


PI Interpolated on 250m CRG grid

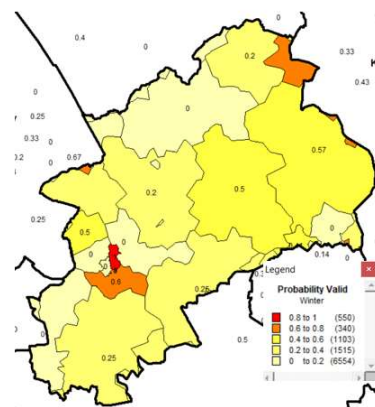
Zero values for PI in some sectors may reflect the absence of site investigation data - not necessarily the absence of shrinkable clay. A single claim in an area with low population can raise the risk as a result of using frequency estimates.

The maps below show the seasonal difference from the sample used. Combining the risk maps by season and reviewing the table on page 11 is perhaps the most useful way of assessing the potential liability, likely cause and geology using the values listed.

## DAVENTRY – by season



## Probability Valid, Summer



**Probability Valid, Winter**

The 'claim by cause' distribution and the risk posed by the soil types is illustrated at the foot of the following page. A high frequency risk can be the product of just a few claims in an area with a low housing density of course and claim count should be used to identify such anomalies.



The figure consists of two maps of the County of Durham, each showing a different risk assessment. The left map, titled 'Sub Risk by District', displays a yellow area with a value of 0.425. The right map, titled 'DISTRICT RISK', displays an orange area with a value of 1.64. Both maps include legends with color-coded risk levels and their corresponding counts.

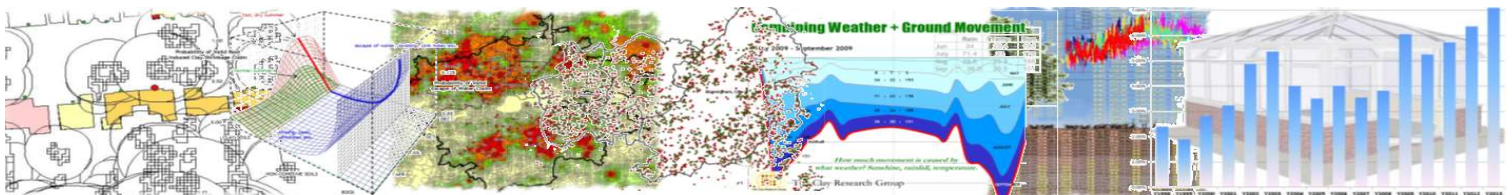
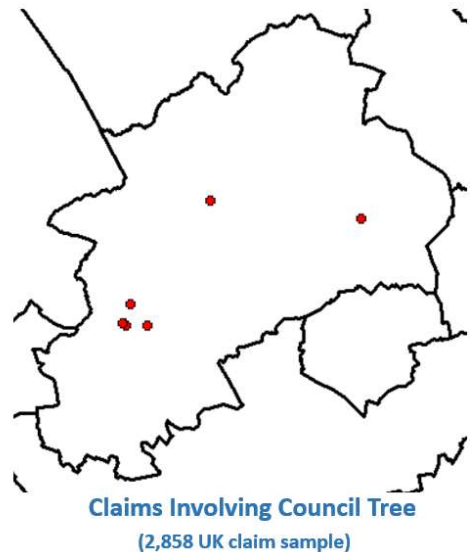
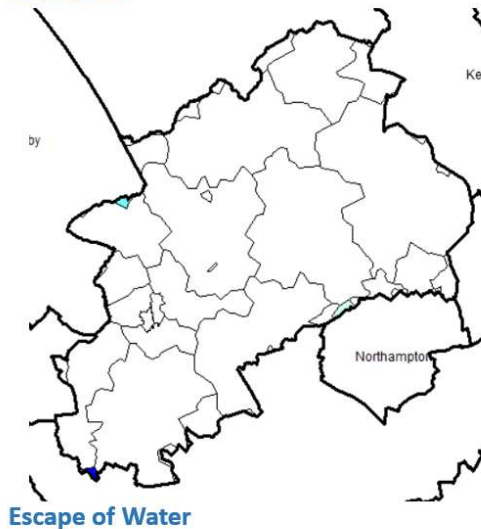
**Sub Risk by District Legend:**

| Color       | Sub Risk   | Count        |
|-------------|------------|--------------|
| Red         | 0.0 to 1   | (1)          |
| Orange      | 0.0 to 0.8 | (10)         |
| Yellow      | 0.8 to 0.8 | (27)         |
| Light Green | 0.2 to 0.4 | (165)        |
| Dark Green  | 0          | to 0.2 (175) |

**DISTRICT RISK Legend:**

| Color       | District Risk | Count        |
|-------------|---------------|--------------|
| Red         | 2             | to 4 (32)    |
| Orange      | 1             | to 2 (16)    |
| Yellow      | 0.75 to 1.25  | (124)        |
| Light Green | 0.5           | to 0.75 (83) |
| Dark Green  | 0             | to 0.5 (83)  |

Below right, map plotting claims where damage has been attributable to vegetation in the ownership of the local authority from a sample of around 2,858 UK claims. The claims usually coincide with the presence of shrinkable soils and the map below reflect the primary geology to be shrinkable clay.





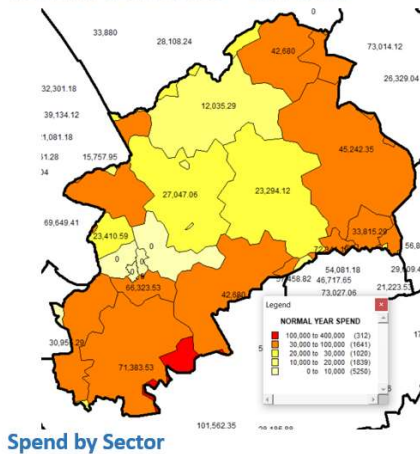


# The Clay Research Group

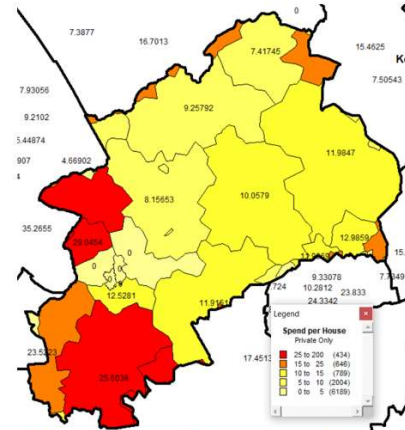
## Aggregate Subsidence Claim Spend by Postcode Sector and Household in Normal & Surge Years

The maps below show the aggregated claim cost from the sample per postcode sector for both normal (top) and surge (bottom) years. The figures will vary by the insurer's exposure, claim sample and distribution of course.

**NORMAL YEAR SPEND – DAVENTRY**



**Spend by Sector**

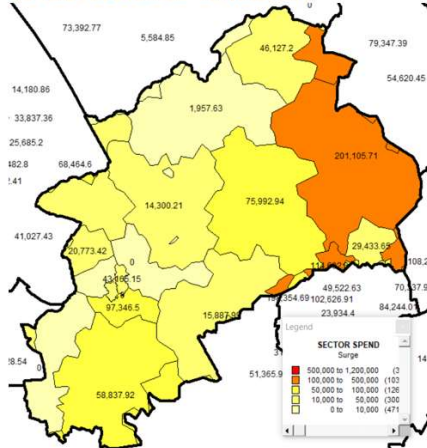


**Spend Averaged Over Private Housing Population**

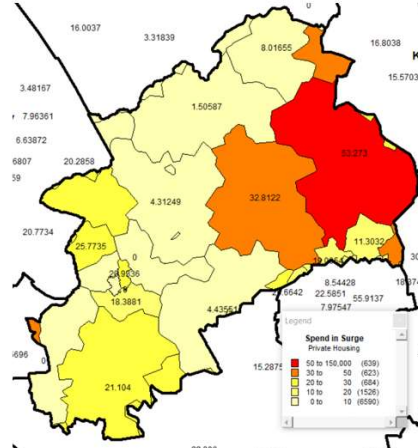
It will also be a function of the distribution of vegetation and age and style of construction of the housing stock. The images to the left in both examples (above and below) represent gross sector spend and those to the right, sector spend averaged across private housing population to derive a notional premium per house for the subsidence peril.

The figures can be distorted by a small number of high value claims. The absence of any distinct difference between surge and normal years reflects the geology.

**SPEND in SURGE – DAVENTRY**



**Spend by Sector**



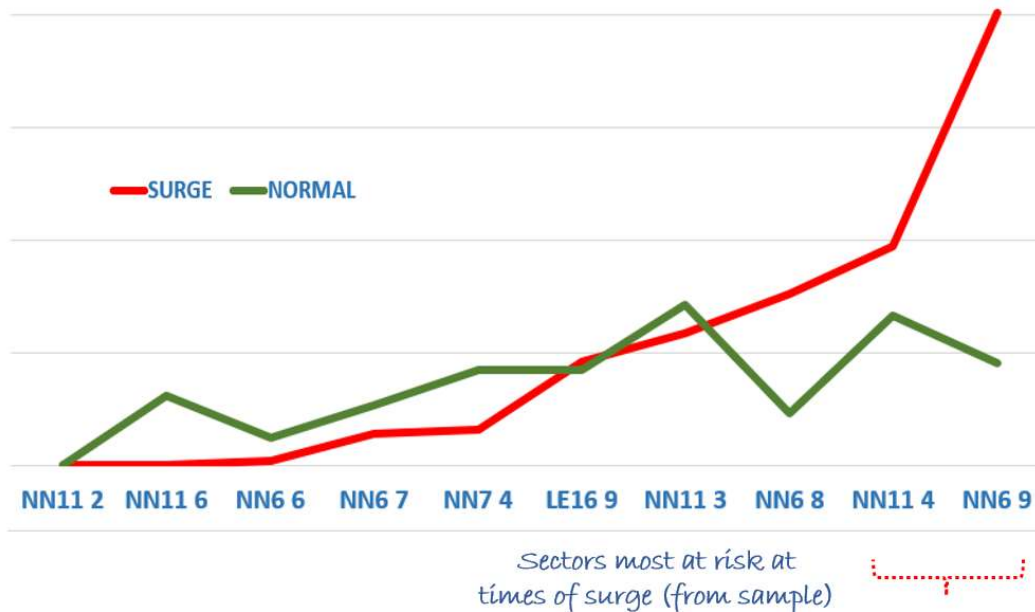
**Spend Averaged over Private Housing Population**



# The Clay Research Group

## DAVENTRY

Comparing Surge -v- Normal Year Claim Spend by Postcode Sector from Sample



The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

It is of course the case that a single expensive claim (a sinkhole for example) can distort the outcome using the above approach. With sufficient data it would be possible to build a street level model.

In making an assessment of risk, housing distribution and count by postcode sector play a significant role. One sector may appear to be a higher risk than another based on frequency, whereas basing the assessment on count may deliver a different outcome. This can also skew the assessment of risk related to the geology, making what appears to be a high-risk series less or more of a threat than it actually is.

The models comparing the cost of surge and normal years are based on losses for surge of just over £400m, and for normal years, £200m.

