The Clay Research Group

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

March 2015

Edition 118

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CONTENTS

Issue 118, March 2015

Precise Level Update

Full term precise level readings for the Aldenham willow and oak are plotted on page 9 and 10, together with data from the headmaster's house on page 11. This work is funded by Crawford & Company and undertaken by GeoServ Limited.

CRG Web Site

On 23rd January 2015 the CRG web site received a record 6,379 hits in one day and 1,465 pages were viewed.

This Months Edition

Richard Driscoll describes his introduction to Building Research Establishment and domestic subsidence. Richard was in charge of the Foundation Engineering Division at the BRE and involved in the publication of a range of Digests describing what subsidence is, how it should be investigated and the role of trees and their interaction with clay soils.

These guidelines changed the way claims are handled and improved technical standards.

Aston Conference

CPD accredited course

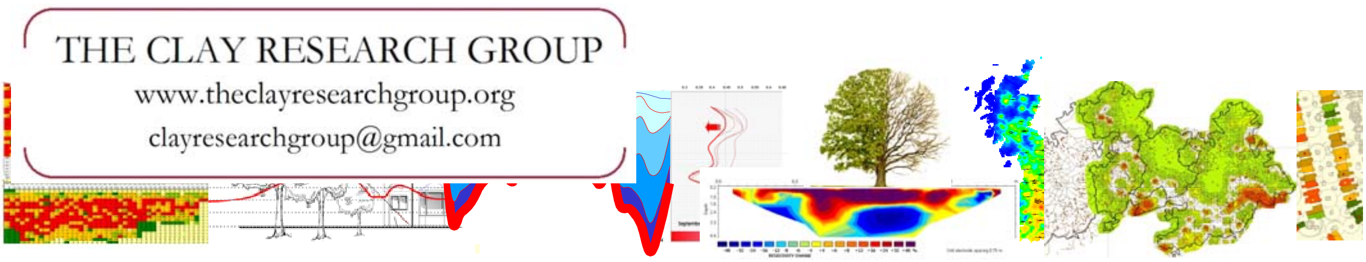
16th June 2015.

Professor Ian Jefferson will bring us up to date with the results of the investigations at Aldenham. Dr. Nigel Cassidy will be looking at below ground investigations and describe what the future might look like.

Tony Boobier will be introducing us to the new age of analytics. What do industry leaders in the field – IBM in particular – think tomorrow holds and how might that be applied to our field of interest.

Other speakers will bring us up to date with case law and arboricultural practices, the implications of The Insurance Act and perhaps an alternative view to the age of Big Data. Is there a role for the human touch?

If you would like to deliver a talk or have suggestions on how the day might be structured to deliver most benefit please contact us.



My Introduction to Subsidence.

Recollections of Richard Driscoll, former Head of Foundation Research at the Building Research Establishment

I went to work at BRE in 1976 at the invitation of Prof. John Burland (the man who 'saved' the Leaning Tower of Pisa and is now Emeritus Prof. of Soil Mechanics at Imperial College).

I thought I was going to work on analysis of the behaviour of piles for off-shore oil platforms. However, as we all know, the summer of 1976 was VERY dry. Late that year there was massive publicity about something called 'subsidence'; a chap called Ronnie Reece, then Claims Manager for Sun Alliance Insurance, was all over the media about the ballooning costs of subsidence claims; the papers (and even TV) were full of alarmist stories about cracking houses.

So, John Burland asked me to handle it since BRE well knew about the technical issues involved (from the work of Bill Ward).

After a high-level meeting at Sun Alliance HQ with representatives of ABI, ICE, I.Struct.E, The Law Society & BRE, we agreed that BRE would examine the situation and see what could be done. With Bill Ward, I embarked on a 'tour' around the south of England examining cases of subsidence reported to us by contacts in the engineering professions.

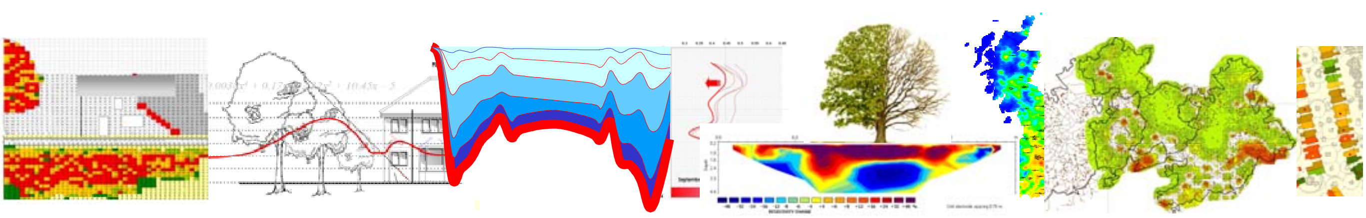
I was alarmed at the many 'trivial' cases we encountered that were being treated as 'severe' and where much underpinning was either underway or planned.

Many homeowners, not surprisingly, were worried that cases must be severe to warrant such disruptive and expensive remediation. The technical quality of investigations of cases left much to be desired.

Further cases were requested and were forthcoming from NHBC and major insurers; I asked for worst examples where possible.

Over a 2 year period a total of 140 cases were examined in detail.

Of these, 70% were classified as Category 2 severity (using the BRE Digest 251 classification), 25% as Category 3 and only 5% as Category 4 or 5.



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My Introduction to Subsidence ... continued

Let me now quote from an article published in Building in 1981[1]:

"Examining the results of this survey it was apparent that one single factor has been responsible for the massive increase in damage claims: this was that, when house insurance cover had been enhanced in 1971 by insurance companies to indemnify against damage caused by ground subsidence, no qualifications had been placed on the amount of damage occurring. In consequence, many cases of damage hitherto regarded as of no great importance had become the subject of insurance claims. In addition, houses with cracks that would once have been disregarded were being significantly devalued unless expensive remedial measures were carried out".

Thereafter, with my colleagues at BRE, I embarked upon a programme to publish best-practice guidance that delivered the collection of BRE Digest that covered all aspects of the clay-tree-subsidence phenomenon.

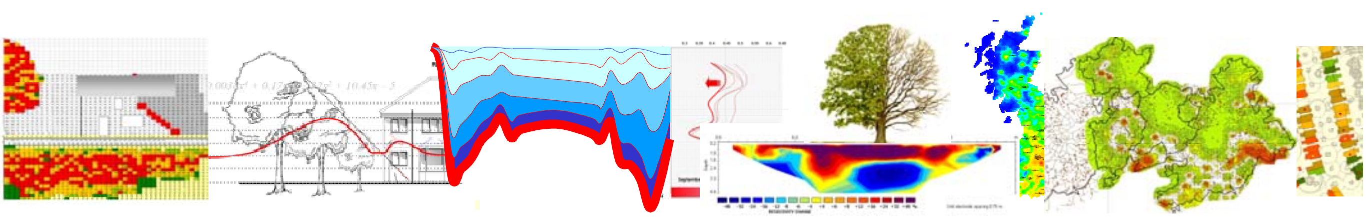
By the way, this phenomenon was not discovered in 1976.

Back in 1841 Bartholomew wrote[2]: ".....but in open country situations, during drought, it (strong clay) is apt to split and cause fracture to the building unless the foundation be laid below the range of the fissures which occur in it".

Following WWII, the last 2 years of which experienced long, dry summers, Ward[3] attributed the phenomenon to many instances of damaged houses in North London that were remote from the impact of bombs that were alleged to have been responsible.

NEXT MONTH: Richard explains the so-called 'Driscoll Criteria' and explores it's provenance and application.

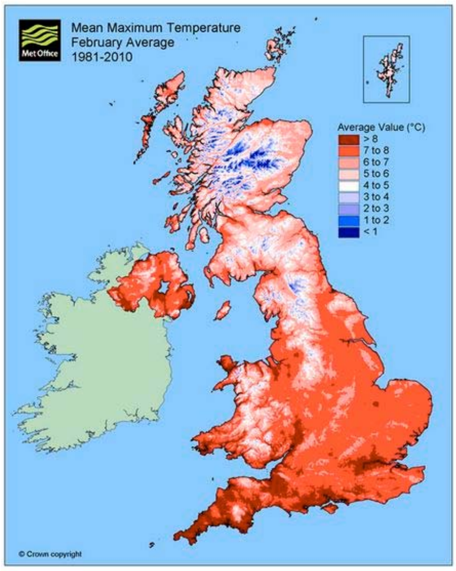
[1] Driscoll R & Burland J B (1981). 'Cracking the Problem'. Building, Vol. 240, issue 25, pp 29-33.
[2] Bartholomew A (1841). Specifications for practical architecture. J Williams & Co, London (1st Edn.)
[3] Ward W H (1947). The effect of fast growing trees and shrubs on shallow foundations. J Inst Landscape Archt, 11, pp 7-16

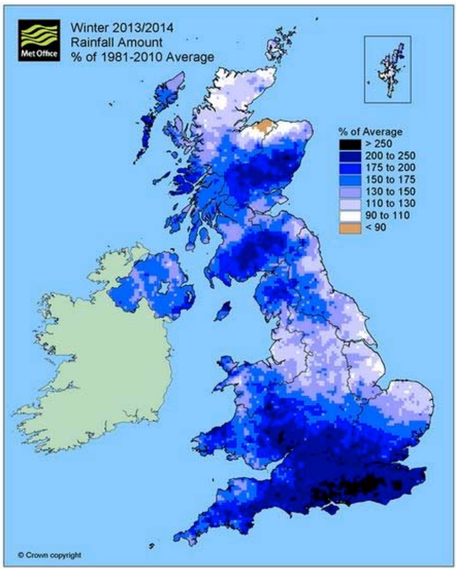


Met Office Winter Update – Warmer, Wetter and Sunnier.

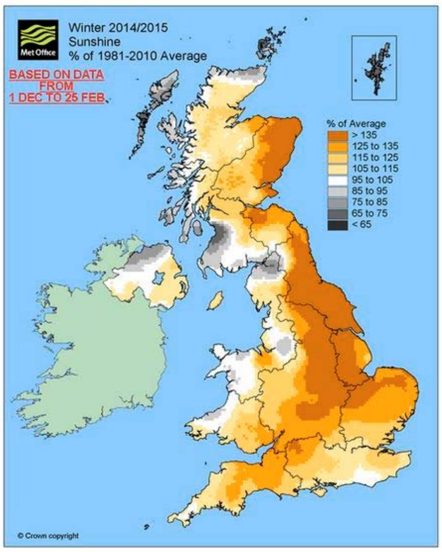
February was warmer than the 30-year average, which covers the period 1981 – 2010.

Right, the mean maximum temperature map shows increases across most of England.



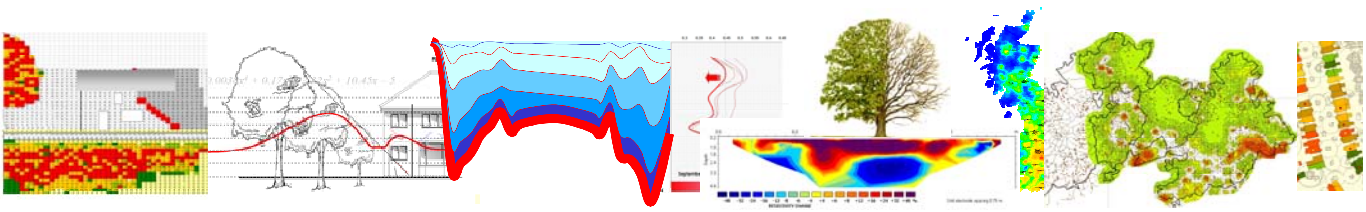


Winter rainfall – this winter was 8% above the average. Last year was the wettest on record - 65% above the average. The Met Office winter includes December, January and February.



Hours of sunshine were higher than the 30 year average across much of the UK, particularly along the east coast. Apparently it has been the sunniest winter since 1929.

In a nutshell, it's been warmer, wetter and sunnier than the 30 year average.



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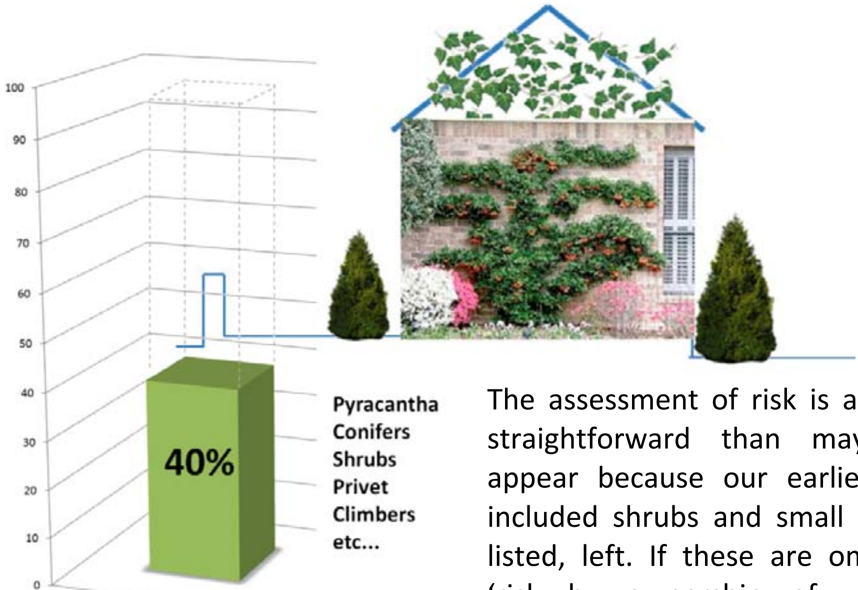
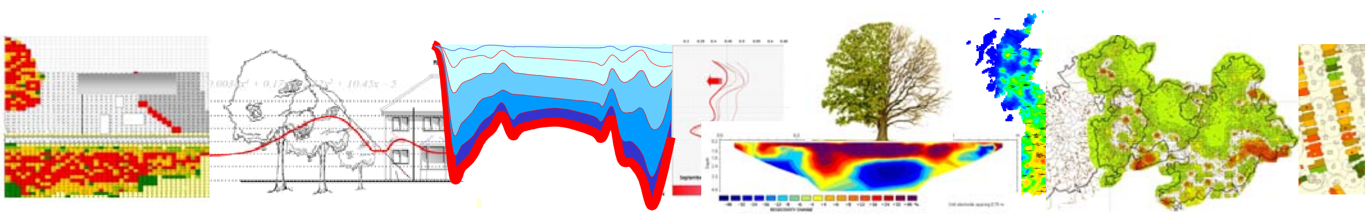
Clarification of risk taking into account shrubs, privet, small conifers etc.



40% of cases of root induced clay shrinkage involved shrubs.

The assessment of risk is a little less straightforward than may initially appear because our earlier analysis included shrubs and small bushes as listed, left. If these are omitted the 'risk by ownership of vegetation' changes. See following page.

Our earlier study of movement to the rear of the headmaster's house at Aldenham illustrated the role played by shrubs in some cases of foundation movement.



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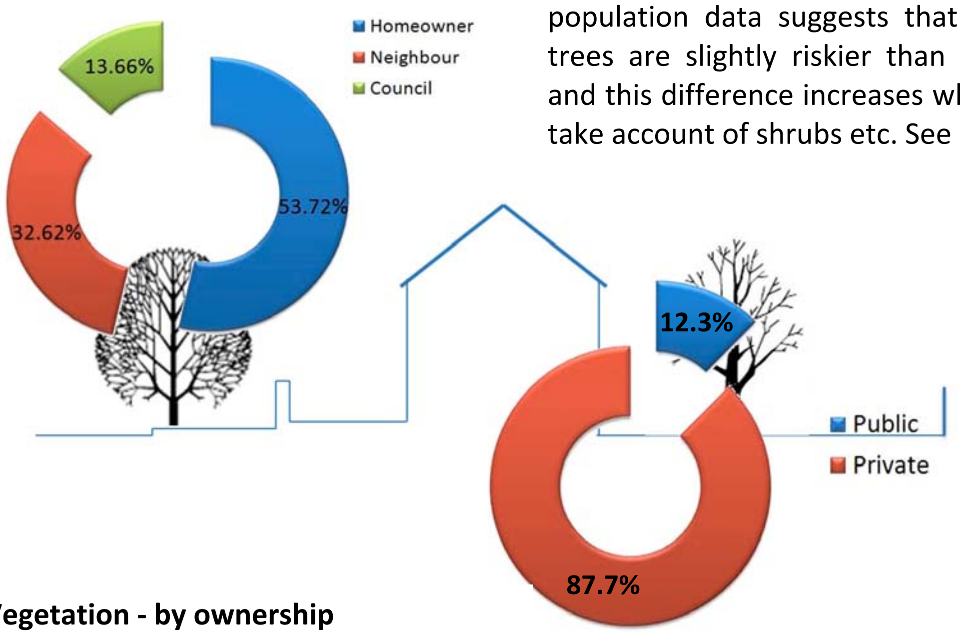
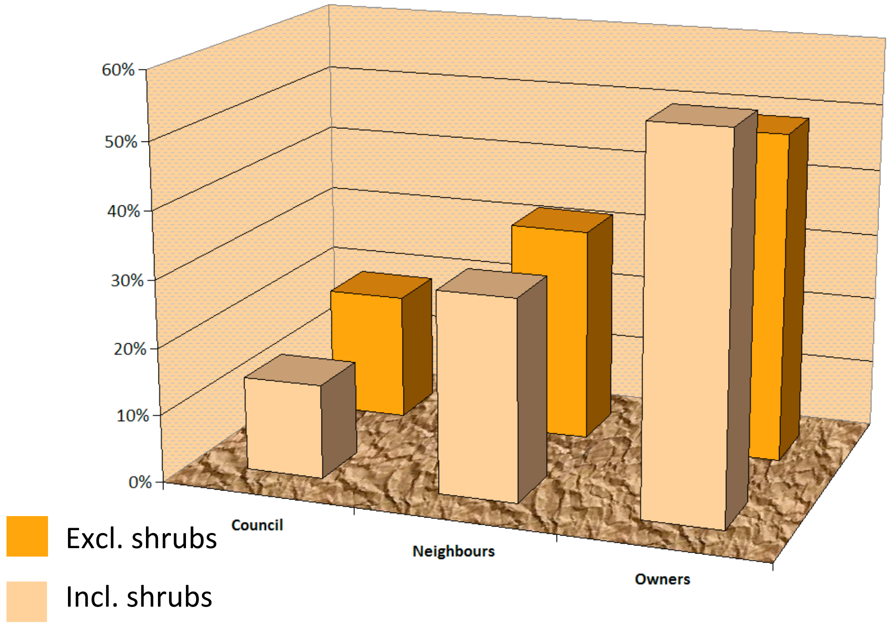
Claims by ownership of vegetation

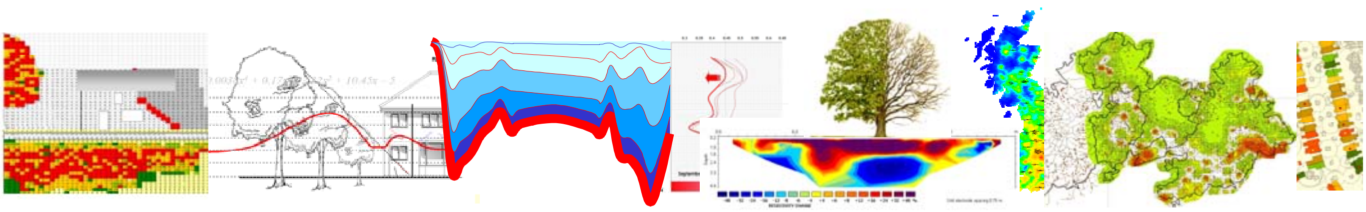
Comparing claims data with population data suggests that public trees are slightly riskier than private and this difference increases when we take account of shrubs etc. See below.



Vegetation - by ownership



The risk posed by public trees increases from around 13.6%, to 19% if shrubs, privet, small conifers, ivy, rose bushes and pyracantha etc., are removed from the analysis.



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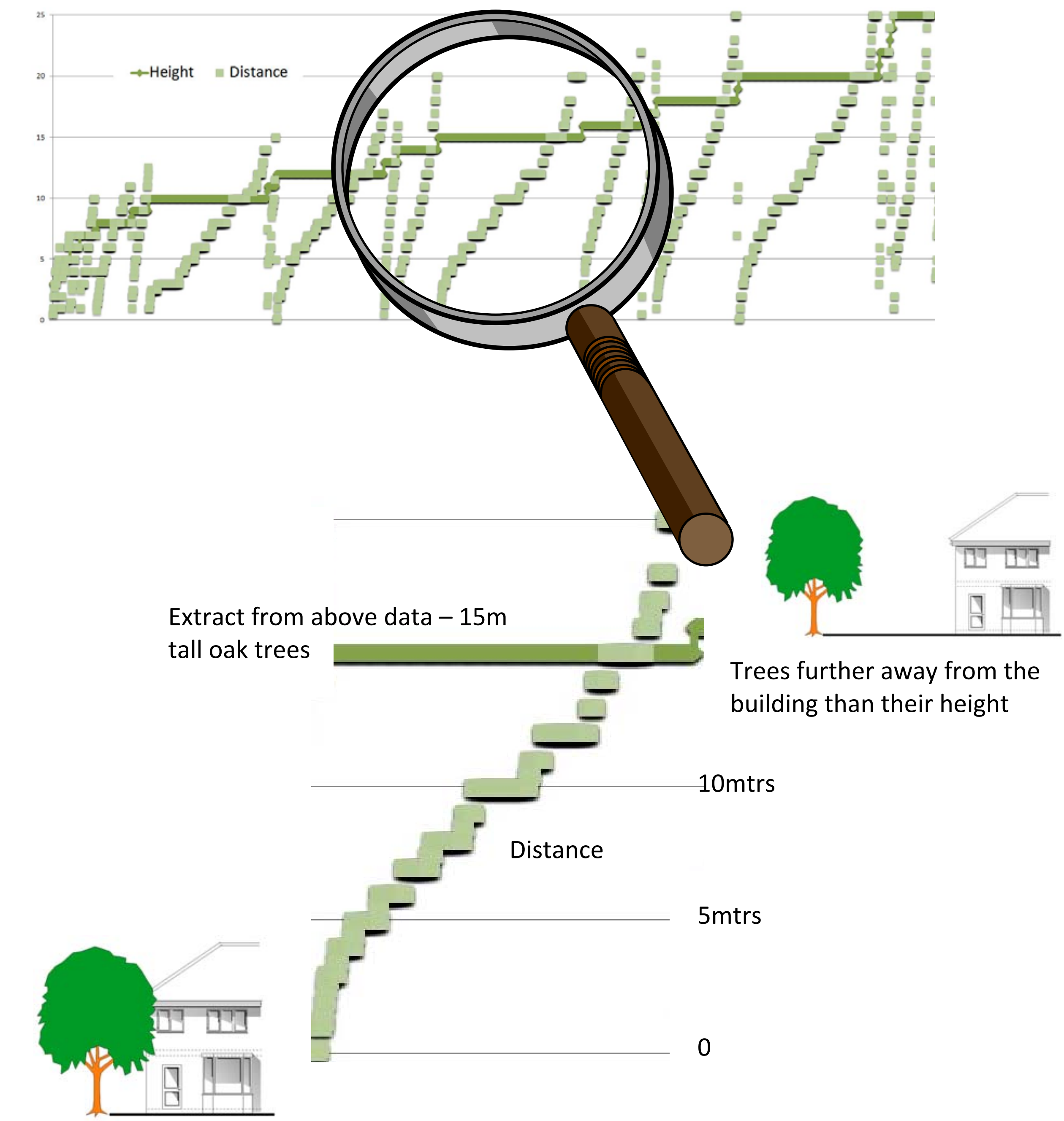
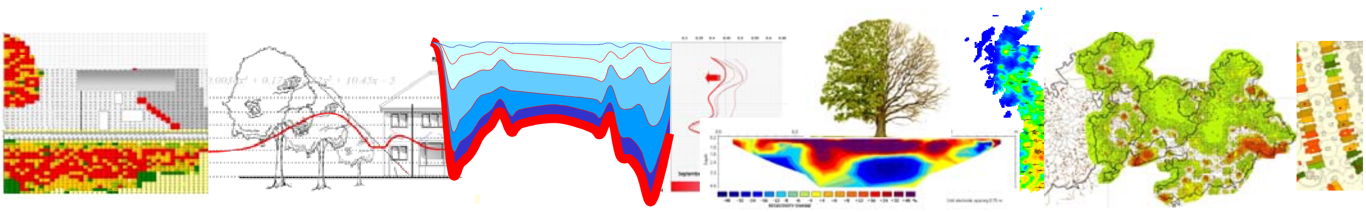
Plotting the Risk of the Oak Tree

Example of Height and Distance distribution taken from our Claims Database.





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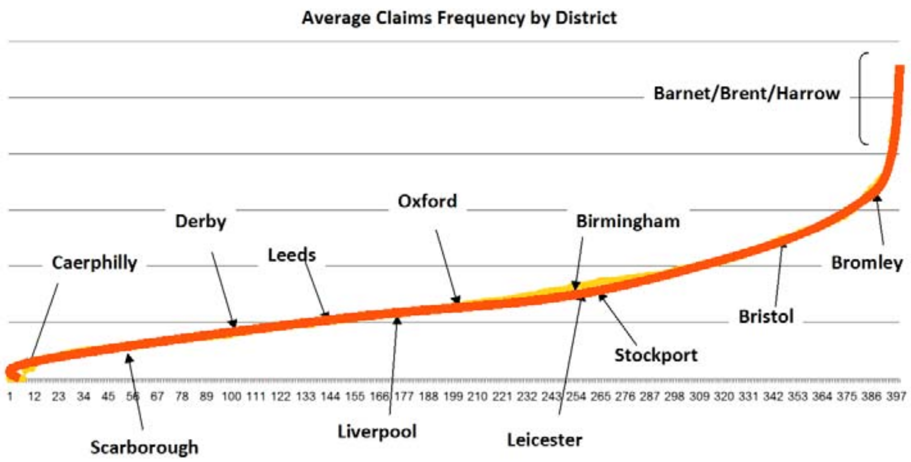
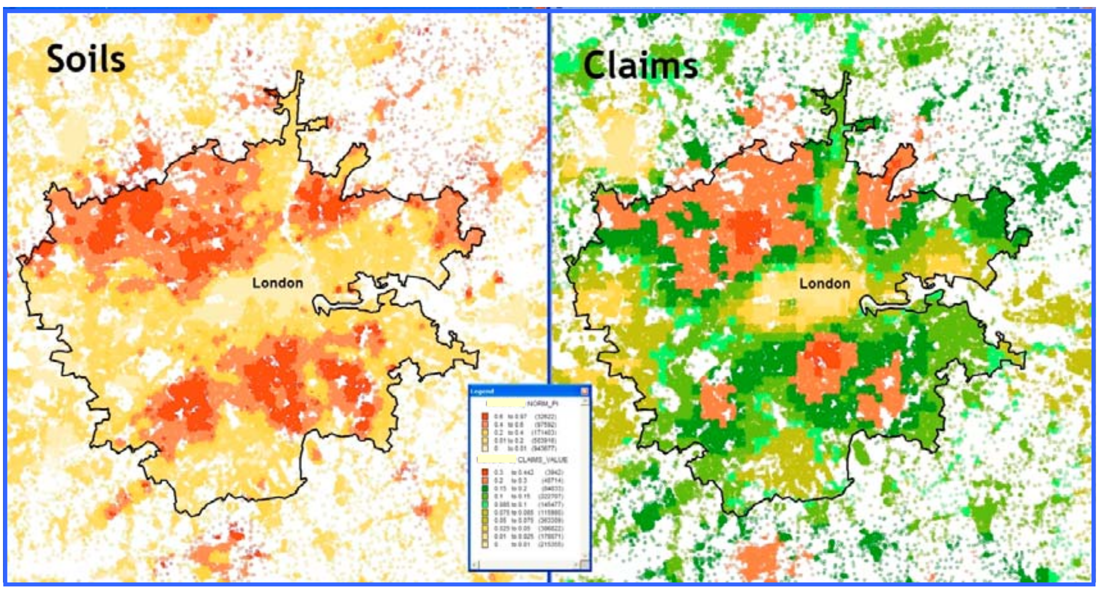
Business Analytics and Risk

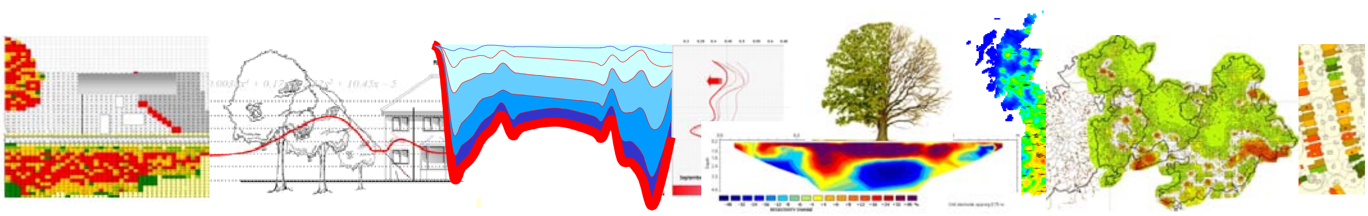
There is nothing new about the illustration below. We have published similar graphs over the years, showing cities, districts or postcodes in rank order of risk.



The value lies in understanding that Oxford is ‘x’ times riskier than Derby, but ‘y’ times less risky than say Bristol. Being able to make such numeric comparisons is essential in the development of automated systems.

Business analytics are an everyday resource and fortunately insurance is populated with data. Soils by their shrink/swell potential, trees by their occurrence, perils by season along with claim numbers etc., all frequency based.





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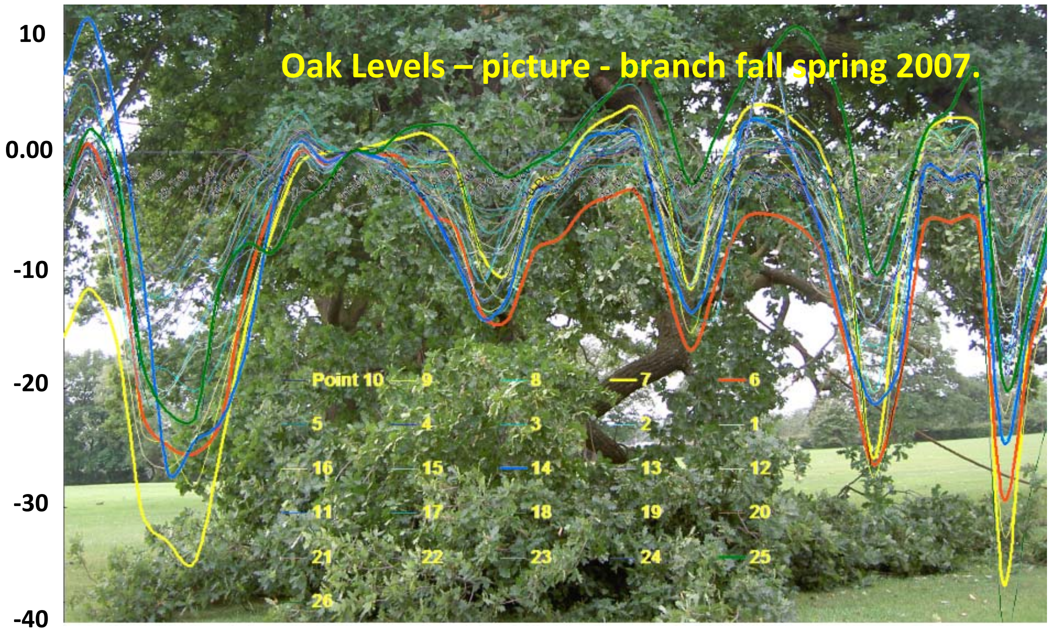
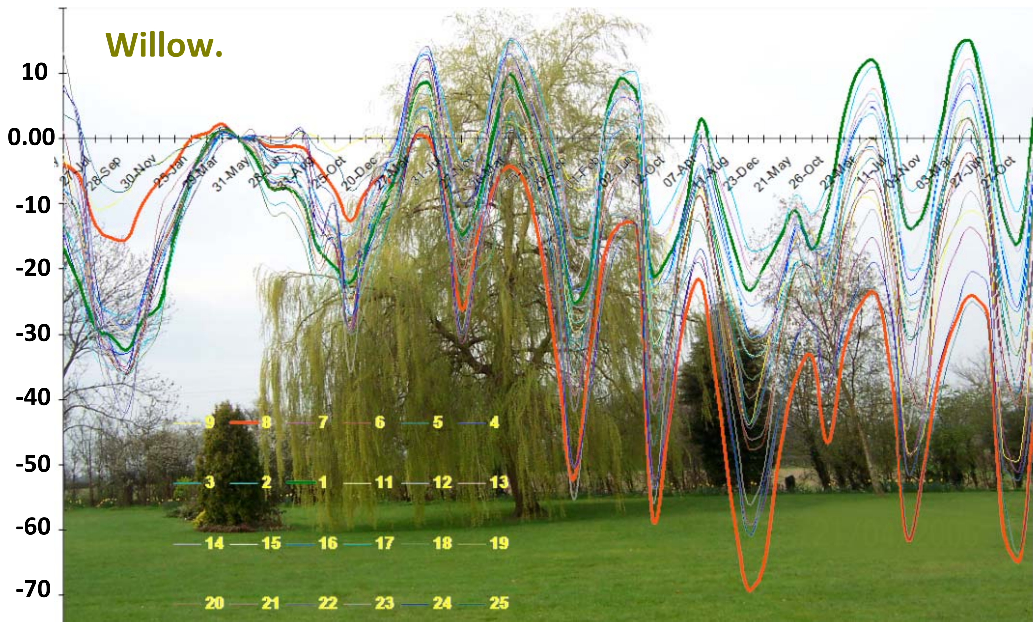
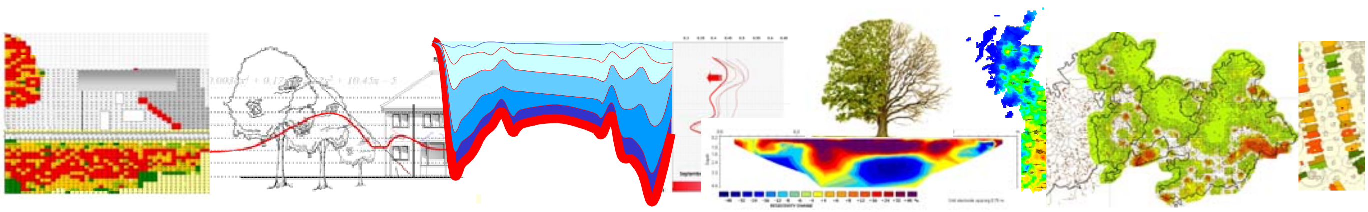
Ground Movement – Aldenham Oak and Willow

Below, precise level monitoring readings taken from April 2006 through to January 2011 for the oak (top picture) and January 2015 for the willow. The underlying picture of the oak was taken in the spring of 2007 following a significant branch fall. Readings were initially taken every month. This extended to two-month intervals in January 2008 which accounts for the closer periodic signatures to the right of the graphs.







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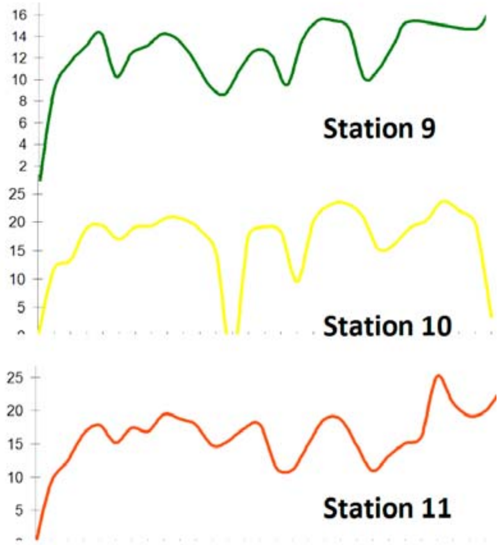
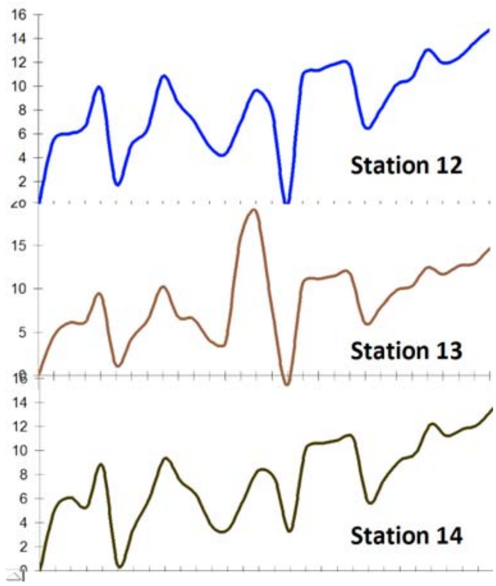
Headmasters House – Level Update

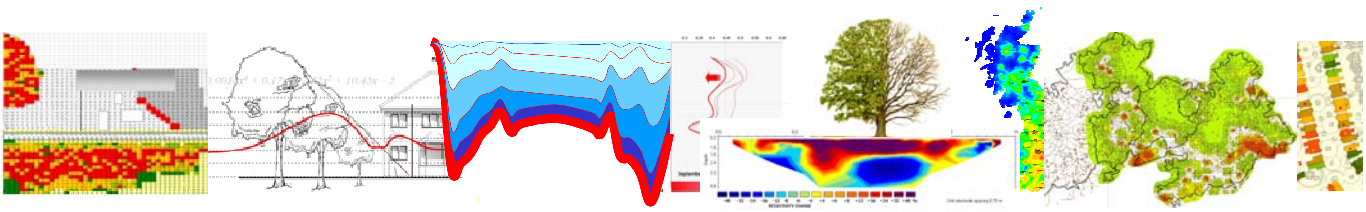
General pattern of recovery shown below, for the points indicated above. There is still a trace of seasonal movement and Station 10 – the point of greatest subsidence on the initial distortion survey – has dipped more recently following winter rainfall, suggesting this may be due to impact damage.



Oct 2009 .... Jan 2015



Oct 2009 .... Jan 2015



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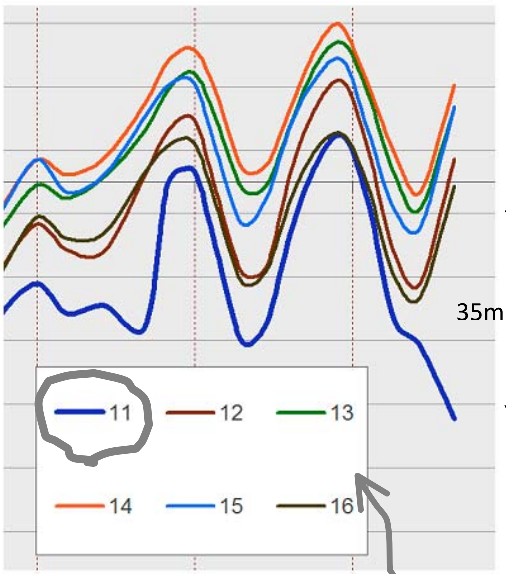
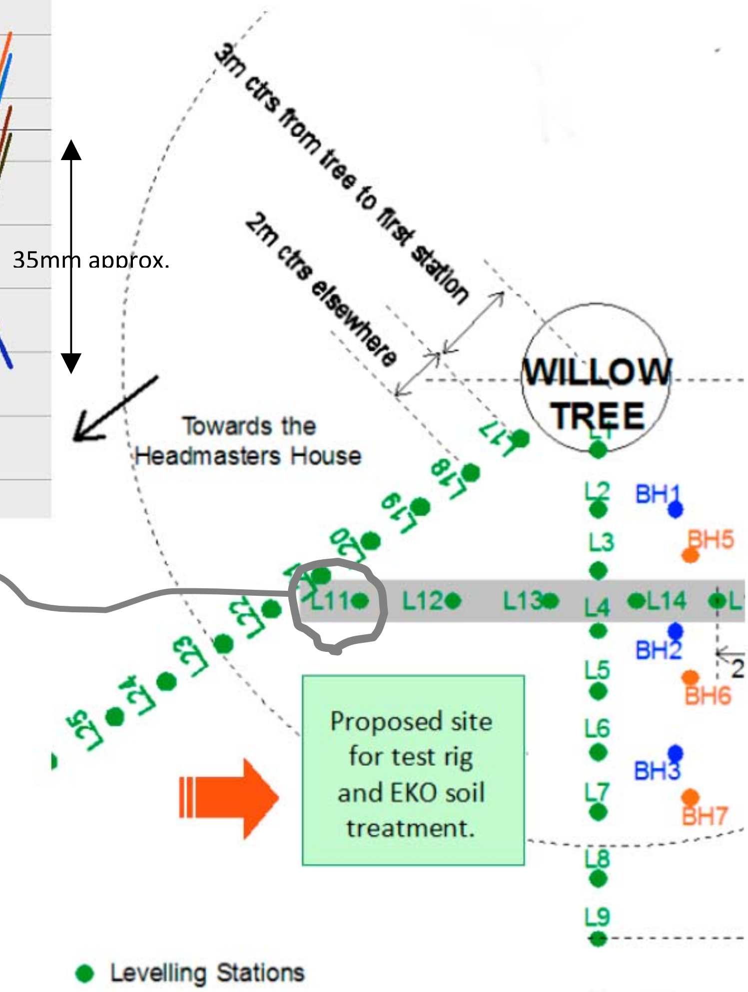
Aldenham Willow – Precise Levels

The latest set of precise levels from the site of the Aldenham willow follow the usual seasonal pattern apart from at Station 11 – see below. The station is adjacent to the test site set up by Tom Clinton as part of his PhD research project into electrokinesis.

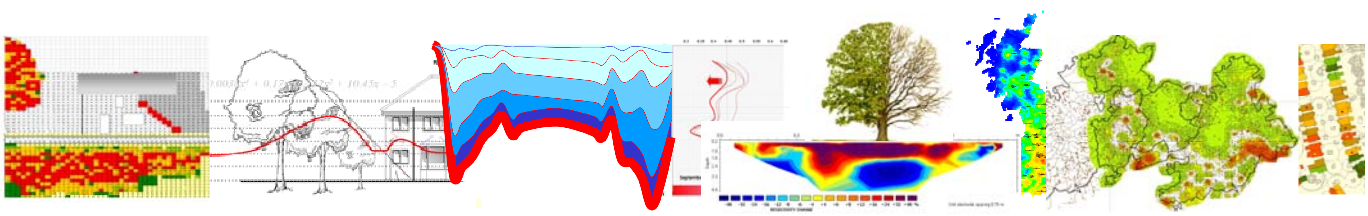




Above, an extract from precise levels taken by GeoServ Limited showing downward movement at Station 11 – indicated by the blue line.

Whether this is associated with the EKO treatment or a result of physical impact (lawn mower or perhaps the installation of the test rig) isn't known.

Clearly it is very localised. There is no evidence of similar movement at Stations L21 or L22 and if physical impact is the cause we assume seasonal movement on an amended profile will be measured going forward.



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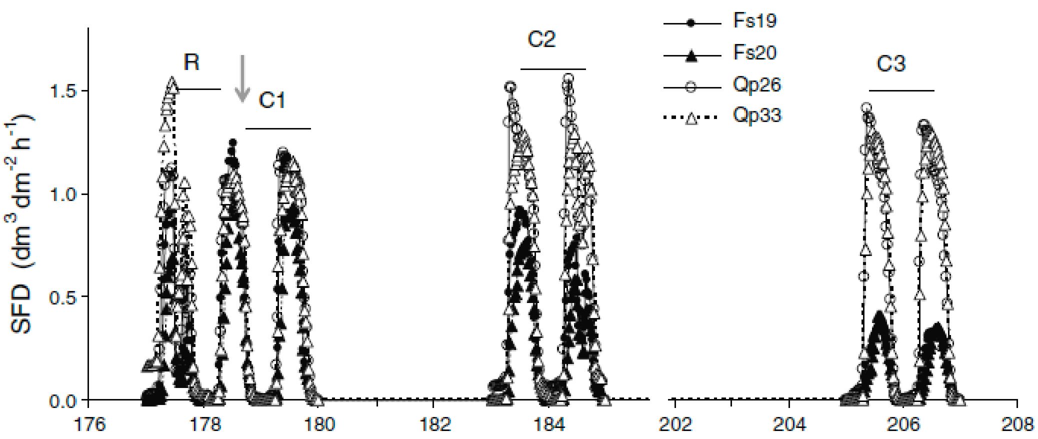
Comparing Hydraulic Lift of Oak and Beech Trees

Evidence of hydraulic lift in a young beech and oak mixed forest using ^{18}O soil water labelling

Zapater *et al* , Journal **Trees,**

October 2011, Volume 25, Issue 5, pp 885-894

"The ability of tree species like Quercus petraea or other oaks to generate HL (hydraulic lift) in mixed temperate forests might help maintain species diversity in these ecosystems submitted to severe drought events."



Extract from Paper

Fig. 3 Diurnal course of sap flux density (SFD) in four trees (black symbols: beech trees, open symbols: oak trees) recorded over 2 days in each campaign (R: reference samples; C1, C2, C3 correspond to the 1st, 2nd, and 3rd campaigns, respectively) during the 2008 growing season. The vertical arrow represents the time of injection of 18O-labelled water. Note that weather conditions were similar for all the measurement days