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

October 2011

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CONTENTS

Launch of the RICS Subsidence Handbook

The launch of the RICS subsidence handbook took place at their headquarters in Parliament Square on the 28th September.

It was a well attended event with talks from John Parvin (main author of the handbook) and Graeme Phipps from Moniteye. Graeme demonstrated advances in remote monitoring.

John explained that the target audience was general practitioner surveyors who encountered subsidence claims infrequently. The objective was not to provide a definitive technical guide, but to explain the practical issues surrounding the peril in relation to the subsidence policy.

CLIMATE

The SMD model has been refined to take account of the widely fluctuating profiles of 2007 and 2011 associated with climate change.

This reduces the predictive element by adding an additional pattern that doesn't develop until the end of June or beginning of July.

Hopefully the more regular profiles will return in the next few years if the predictions of the climatologists hold true but at the moment, the value of the statistical approach has been reduced.

TREE PLANTING & CLIMATE CHANGE

Species Vulnerability and the Urban Heat Island Effect

Dr. Russ Sharp from Moulton College is researching species of trees that might be planted to reduce the Urban Heat Island effect.

Dr Sharp outlines the problem. *"A Forestry Commission report on climate change impact (2010) showed that most of common tree species it studied would be unsuitable for planting in 2080"* and cites the Beech tree as an example of vulnerability.

"The Beech (Fagus sylvatica) … is a common tree in both urban and rural settings, and is known for its shallow root system and preference for sandy soils, making it particularly susceptible to summer droughts and is thus considered to be particularly vulnerable to climate change"

Dr Sharp is currently writing a research proposal with Prof Li Shao at the Institute of Energy and Sustainable Development at De Montfort University that we will be supporting.

We would be interested to hear from any insurers, arborists and adjusters who would be willing to provide letters of support, confirming the potential benefit of this work to the industry.

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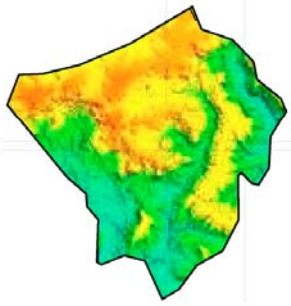
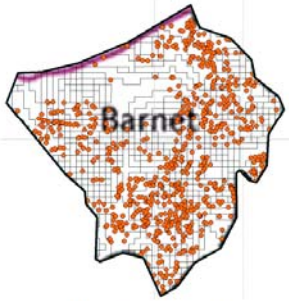
BARNET DATA

Area = 82 sq km : highest number of Council trees in London : 29,119 street trees : 400 new street trees are planted every year : 336 street trees /km^2 : 2,425 trees removed over 5 year period : Of those, 110 due to subsidence : 3,723 trees planted in 5 year term : Net gain of 1298 over 5 year term : Source "Chainsaw Massacre" (2007) London Assembly & web

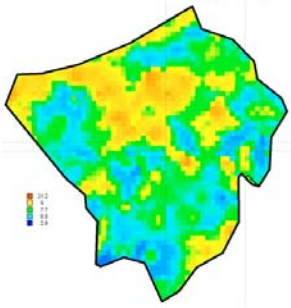
Extract from BGS 1:50,000 Scale Drift Geology Map



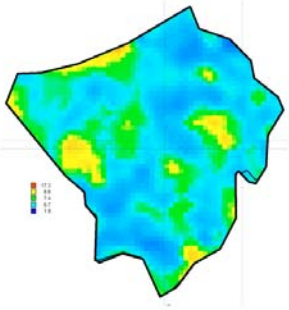
Topographic Map from LiDAR data



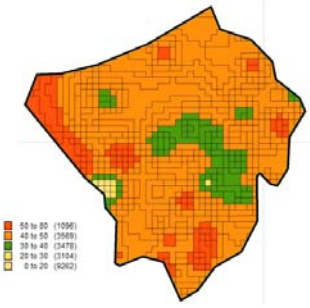
Claim Distribution



Interpolated Thematic Map of Private Trees by Average Height



Interpolated Thematic Map of Public Trees by Average Height



250m Geology Grid built from the Results of Actual Investigations Plotting Plasticity Index

Various datasets showing the geology, topography, claim distribution and tree distribution by height for Barnet.

Differences between the BGS map and the 250m grid are accountable for by (a) depth of the drift deposits, (b) claim distribution and (c) population density.

For example, where the glacial drift is shallow, tree root can still cause shrinkage of the underlying clay at say 2mtrs or so below ground, which means the grid map will record this as a risk from root induced clay shrinkage, whereas the BGS map records more accurately the lithology.

It can be seen that private trees are, on average across the Borough, taller than Council trees, which may be a function of the regular pruning regime.

The interpolation technique uses places where there are no trees (i.e. zero value) in the calculation, reducing the actual tree heights.

In terms of building a risk model, the various layers can be merged to identify historic claim distribution in relation to tree height and the underlying geology, with each element weighted by contribution.

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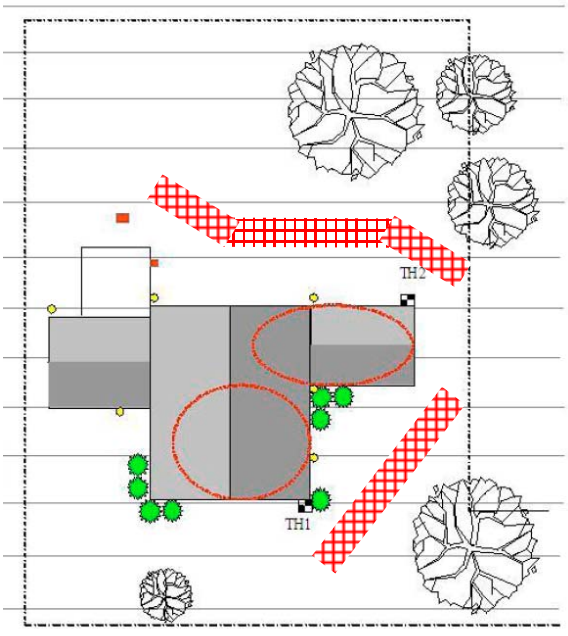
The early dry spell and absence of any rainfall at the beginning of the year gave cause for concern. The Intervention Technique relies on reducing the moisture loss from 2mtrs below ground level, and needs ample rainfall to replenish the hydration chambers.

The UK climate came to the rescue, and water stored over the winter period was sufficient to replicate wetter years – no movement was recorded on any of the 21 claims that have been treated. Below we reproduce details of the first site that was treated in 2008, showing the layout of the trees – see Edition 40 of the newsletter.



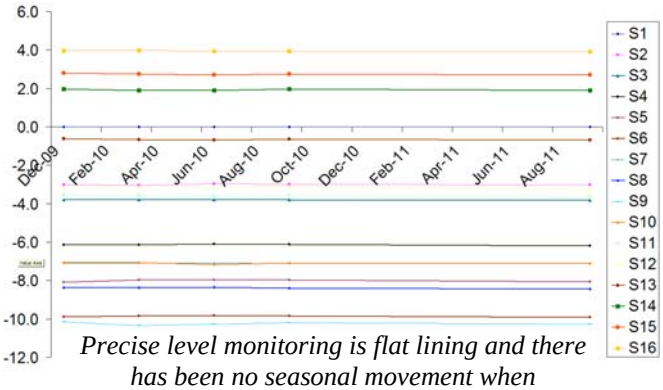
Site Plan showing the location of the surrounding 14m high Oak trees between 6 – 14mtrs away from the property. The geology is the Mercia Mudstone series with a PI of around 24%.

The detached property is situated on a soil with a Plasticity Index of 24% (Mercia Mudstone).

The surrounding trees are Oaks around 14m high and between 6 – 14mtrs away from the building.

Matters are complicated by the fact that extensions have been added to three elevations, all with differing foundation depths, increasing the building vulnerability.

Since installation of the intervention technique, no movement has been recorded. The trees remain in place and a neighbour who has reported similar problems has asked that the treatment be applied to their home in preference to underpinning.



Precise level monitoring is flat lining and there has been no seasonal movement when comparing the results for February 2010 and October 2010 and 2011.

The savings so far amount to around £1.5m in terms of what the 21 claims would otherwise have cost, but more importantly, the speed of installation and claim resolution has reduced the stress to the homeowner, all of whom have provided full support to a system that retains the trees.

The claims where this treatment has been applied often involve high risk, mature trees, with the Oak figuring in most.

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How the Rhizosphere May Favor Water Availability to Roots

Andrea Carminati[a,*] et al
[a] Hydrogeology Dep., UFZ–Helmholtz Centre for Environmental Research, Leipzig, Germany

Extract from Vadose Zone Journal

Received 3 September 2010

Recent studies have shown that the hydraulic properties of the rhizosphere may differ from those of the bulk soil surrounding the root.

This study showed that the water potential gradients in the rhizosphere were much smaller than in the bulk soil. As a consequence the rhizosphere attenuated and delayed the drop in water potential in the vicinity of the root surface when the soil dried.

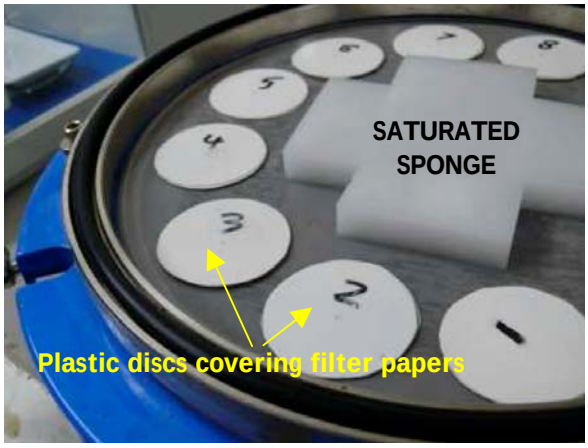
This led to increased water availability to plants, as well as to higher effective conductivity under unsaturated conditions.

The reasons were, (i) the radius of potential water uptake was extended from the root to the rhizosphere surface; and (ii) thanks to the high soil water capacity of the rhizosphere, the water depletion in the bulk soil was compensated by water depletion in the rhizosphere.

We conclude that under the assumed conditions, the rhizosphere works as an optimal hydraulic conductor and as a reservoir of water that can be taken up when water in the bulk soil becomes limiting.

FILTER PAPER CALIBRATION

Clive Bennett of MatLab is been researching methods to test batches of filter paper to calibrate them against the Whatman's supply used in the original method published in BRE IP4/93 (Crilly & Chandler, 1993).



This involved the use of a flexible membrane extractor. The papers were placed directly onto the cellulose membrane and covered with a thin, light, plastic cover (2.8g, 0.014kPa).

Fine pore, saturated sponges were then placed centrally upon the membrane to maintain its moisture content, both these and the papers were then covered with a polythene sheet to reduce evaporation in the extractor chamber (see above).

The research is ongoing with the objective of finding a quick way of calibrating filter papers to ensure the test delivers reliable results.

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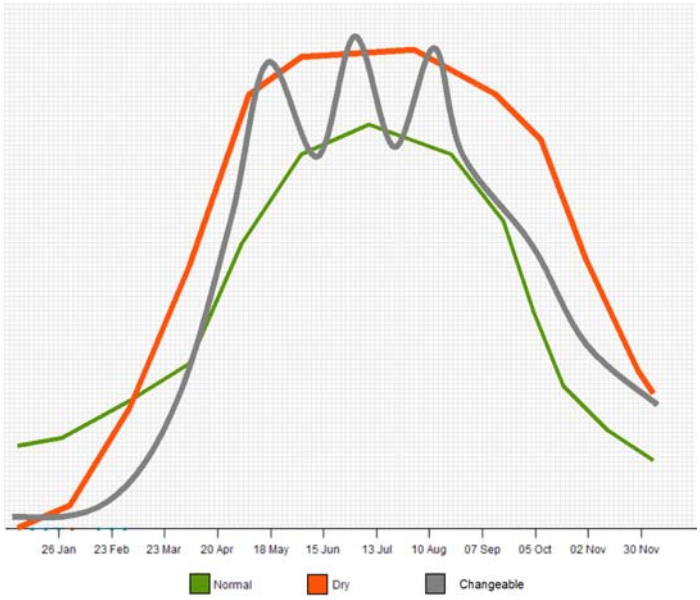
AMENDED CLIMATE MODEL

Below is the amended template showing the various profiles of the developing SMD data supplied by the Meteorological Office for grass cover, medium available water capacity data taken from tile 161 in North London.



The probability pattern matching engine for viewing in 2012 from the end of May through to the end of August now includes the irregular the patterns and becomes effective around 6 weeks later, reducing its effectiveness.

Regular curves of the sort plotted pre-2006 gave an 85% probability of predicting summer claim numbers correctly as early as the end of May. The current situation delays the predictive capability by over a month, until the beginning of July.

This is what we said at the end of May 2011.

"The only thing that will stop 2011 being an event year is a heavy downpour of rain over a period of several days at some time in the next few months. Periods of uninterrupted sunshine lasting for several months are rare in the UK and the published research of others (see "Climate Change on Hold", Page 1 of "Weather Modelling Update April 2011") suggests the weather will become increasingly unpredictable over the next six years or so. The position in 2011 will hinge on whether we see heavy showers in the next few months."

It turned out to be correct, but not as a result of the model, and is of little use to practitioners who need some certainty looking several months ahead.