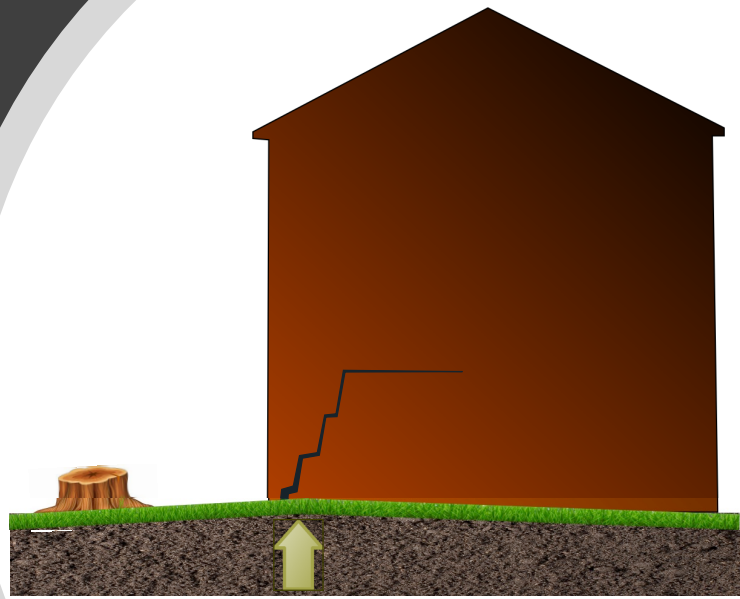
MARTIN DOBSON ASSOCIATES

ARBORICULTURAL CONSULTANCY



Heave:

not all it’s cracked up to be

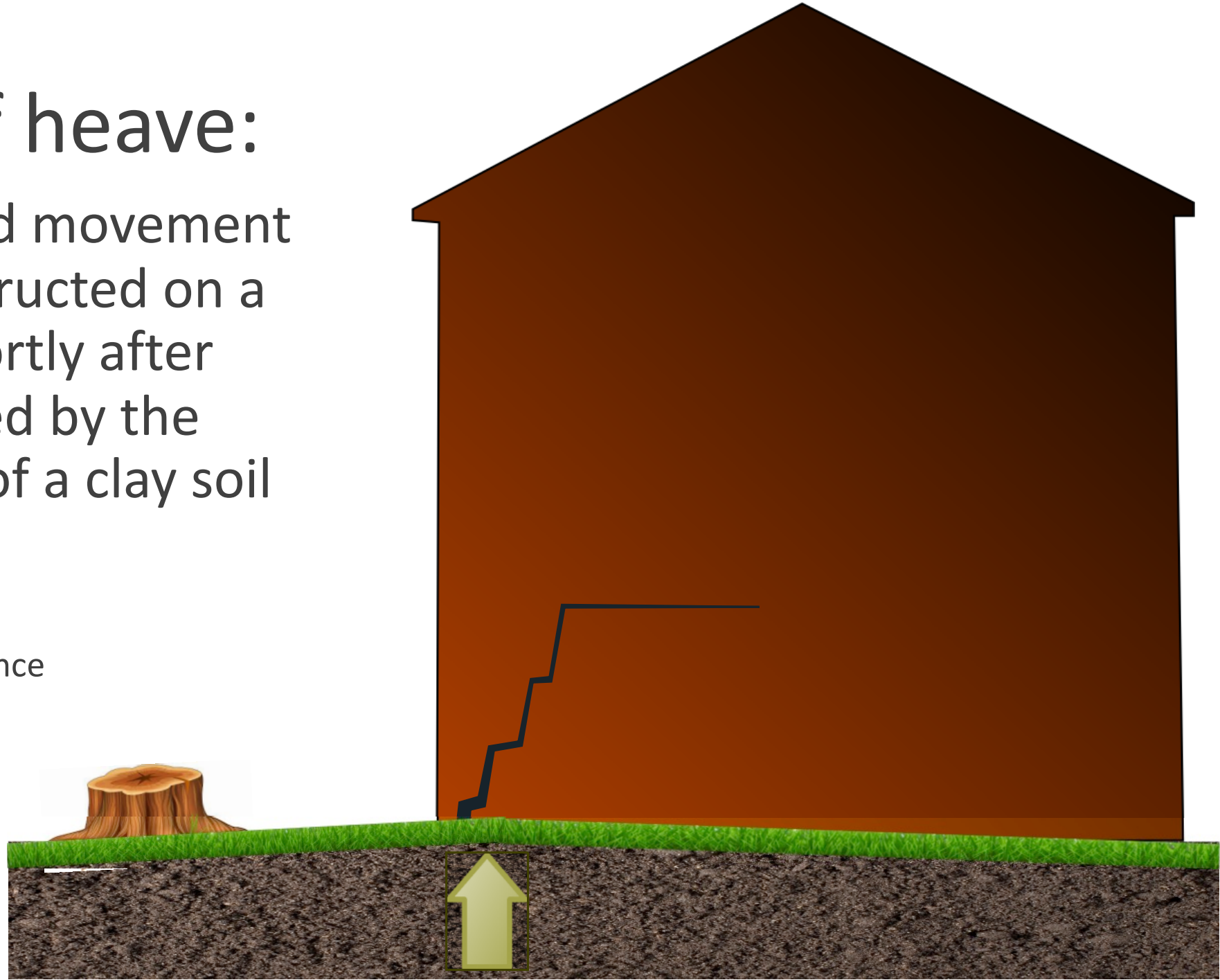
Presented by Dr Martin Dobson

Definition of heave:

Differential upward movement of a building constructed on a desiccated site shortly after construction caused by the swelling pressure of a clay soil as it rehydrates.

Approximately 1.7% of insurance

Claims for structural damage




But first a word about subsidence

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2018 was the joint hottest summer on record for the UK as a whole, and the hottest ever for England, the Met Office has announced.

It said highs for summer 2018 were tied with those of 1976, 2003 and 2006 for being the highest since records began in 1910.

But first a word about *subsidence*

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Summer 2018

Joint hottest on record

15.8C

UK average temperature

17.2C England average

16.0C Wales average

15.1C Northern Ireland average

13.6C Scotland average

Source: Met Office

Cracking summer: UK insurers expect rise in subsidence claims

Heatwave has caused damage to walls of homes, with south-east particularly susceptible

▲ Several big-name insurers have said subsidence incidents are up 20% on

Insurers are bracing themselves for a spike in subsi
summer's heatwave led to cracks appearing in wal
England.

Mai

Homeowners hit with
dry spell threatens ho

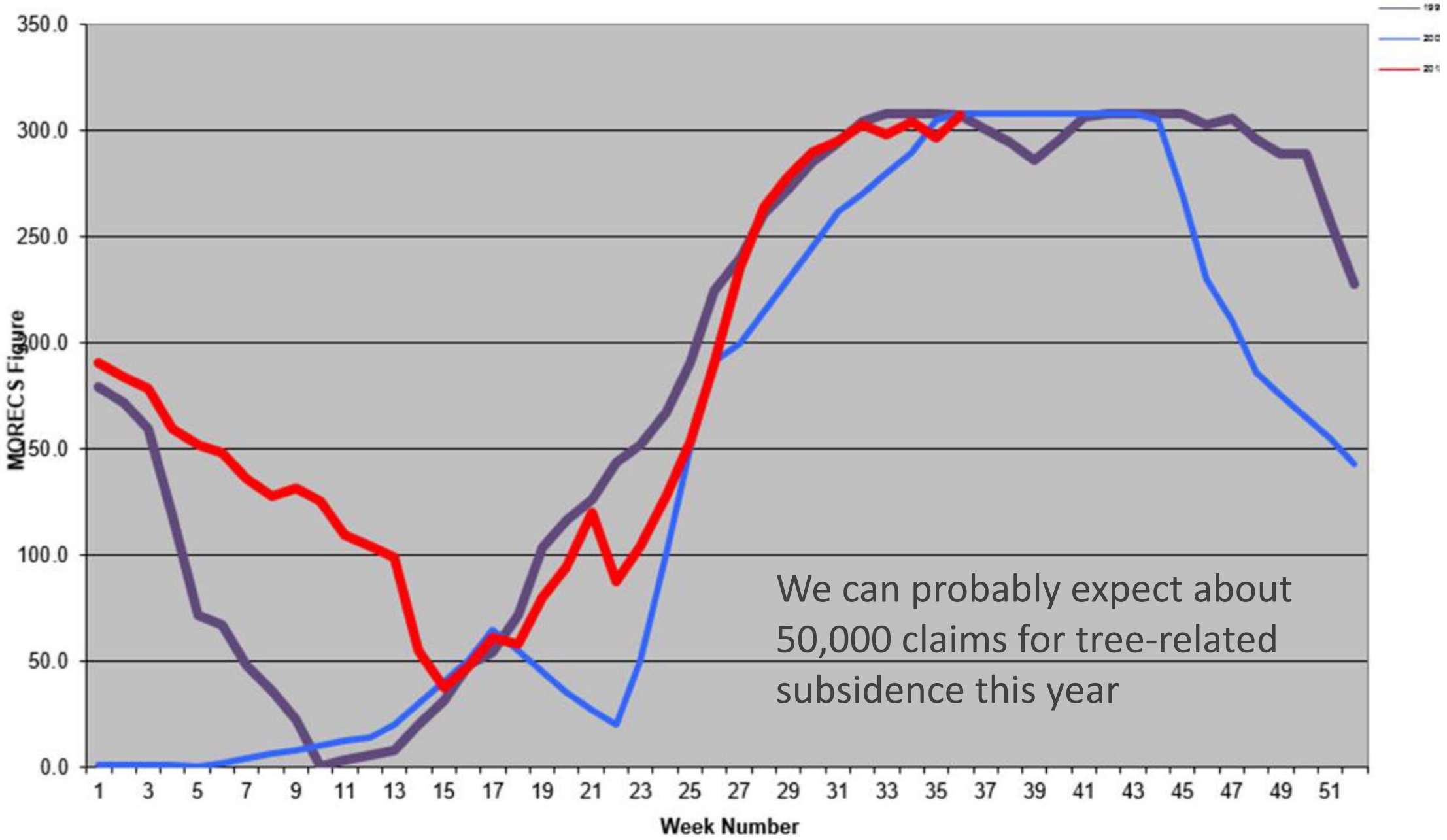
© Getty Images

TENS of thousands of British homes are at risk of sinking into the ground because the heatwave has shrunk the foundations they are built on.

Insurers say they expect subsidence claims to QUADRUPLE as individual bills topping £50,000 send premiums soaring.

Thousands of British homes are at risk of sinking into the ground because the heatwave

2018 versus 1995 (purple) and 2003 (blue) Analogues



The Telegraph

‘I would like to fell the tree in front of my house but I am worried about the risk of heave’.

#Put aside for the moment the rights and wrongs of felling trees in general

‘My tree is alleged to be causing subsidence damage to my neighbour’s house and I have been asked to fell it. But will my house suffer from heave if I do’?

Why are we as arboriculturists being asked this?

Arboricultural
ASSOCIATION

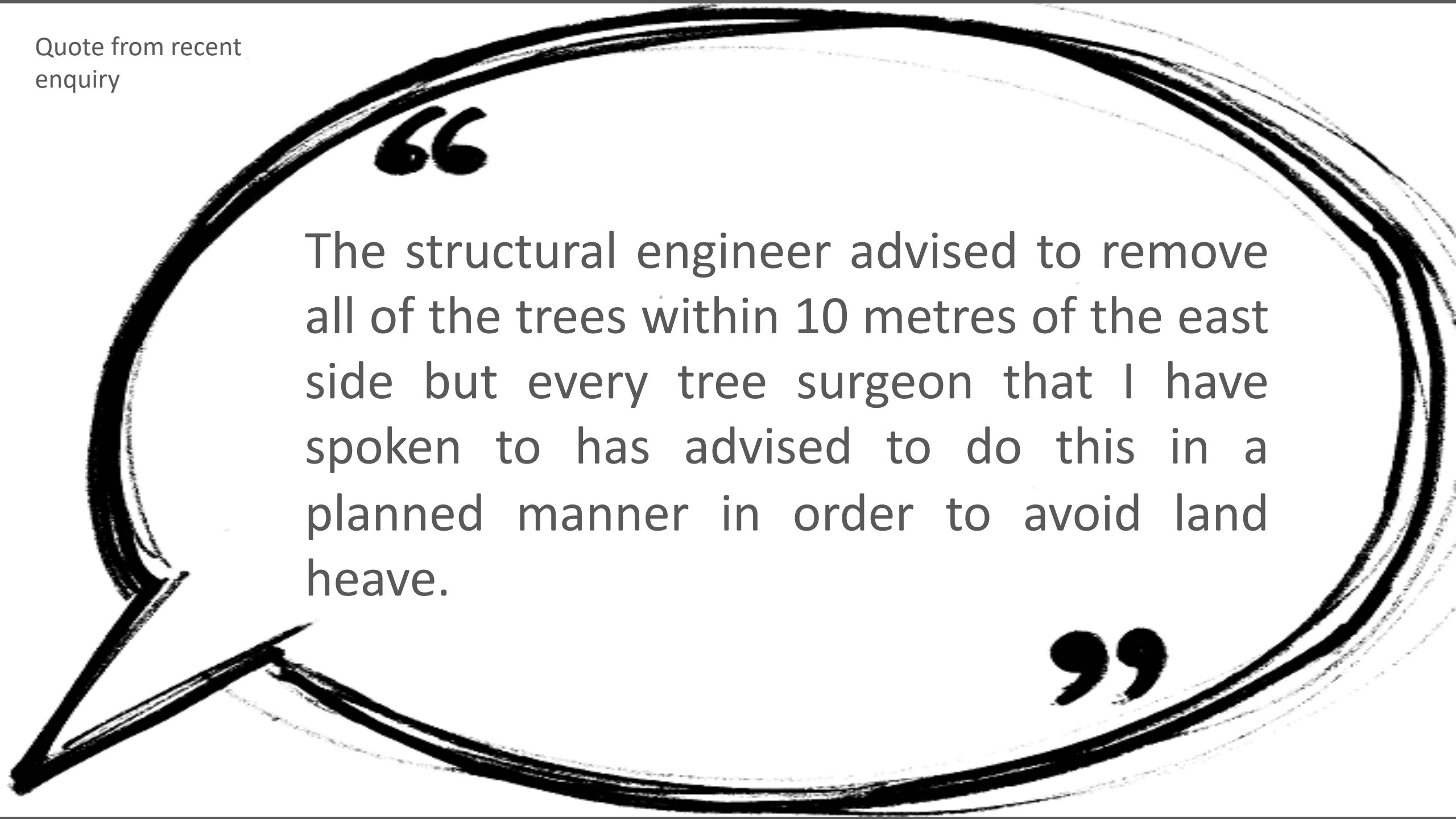
trees.org.uk

Quote from recent structural engineer's report

> Trees should never be completely removed from a clay soil by felling otherwise soil recovery/heave will occur. Cutting back and gradual removal over a number of years should be undertaken otherwise soil recovery could occur rapidly and place pressure on foundations resulting in upward movement/heave which will cause damage to brickwork and cracking.

OK, so what kind of advice are arboriculturists giving?

Quote from recent enquiry



“The structural engineer advised to remove all of the trees within 10 metres of the east side but every tree surgeon that I have spoken to has advised to do this in a planned manner in order to avoid land heave.”

Giles Biddle told us way back in 1992 (ARN 108/92/EXT) that ‘phased removal of a tree over several seasons merely prolongs the period of recovery’.

‘Will my house suffer from heave if I fell the tree?’

Answer:

Nooo!!

Unless:

1) The house is currently suffering from subsidence* or has experienced subsidence in the recent past.
2) The house is less than about 1 - 3 years old.

*In which case upward movement should be called ‘recovery’ rather than ‘heave’.

Or, to put it another way

There is no unreasonable risk of heave consequent upon tree removal if a building is more than 3 years old and has experienced no historic subsidence damage and is not currently experiencing subsidence damage.

So if there’s none of this:*

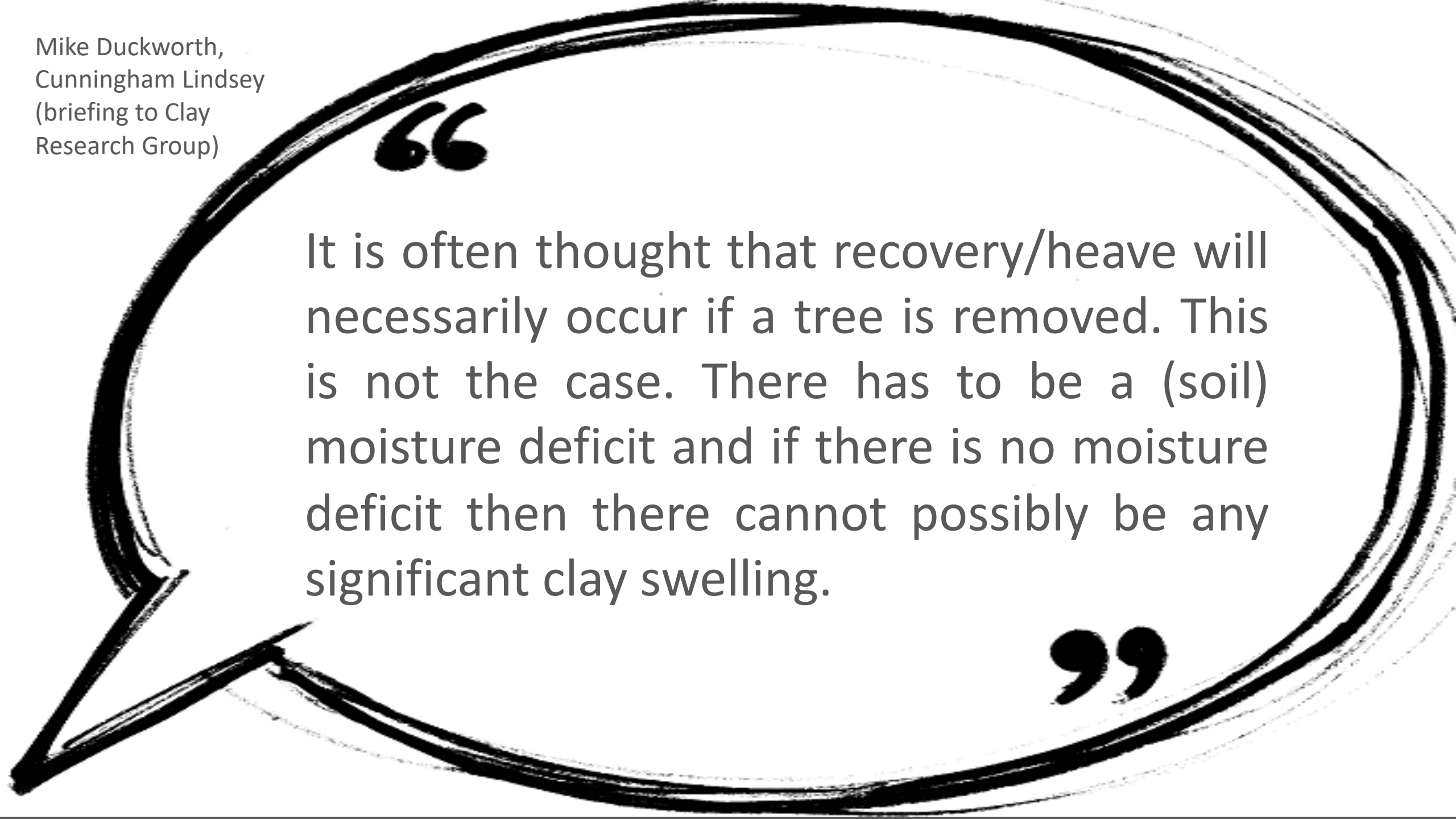
*subsidence crack damage

Or this:

Or this:

The tree can safely be removed

Mike Duckworth, Cunningham Lindsey (briefing to Clay Research Group)

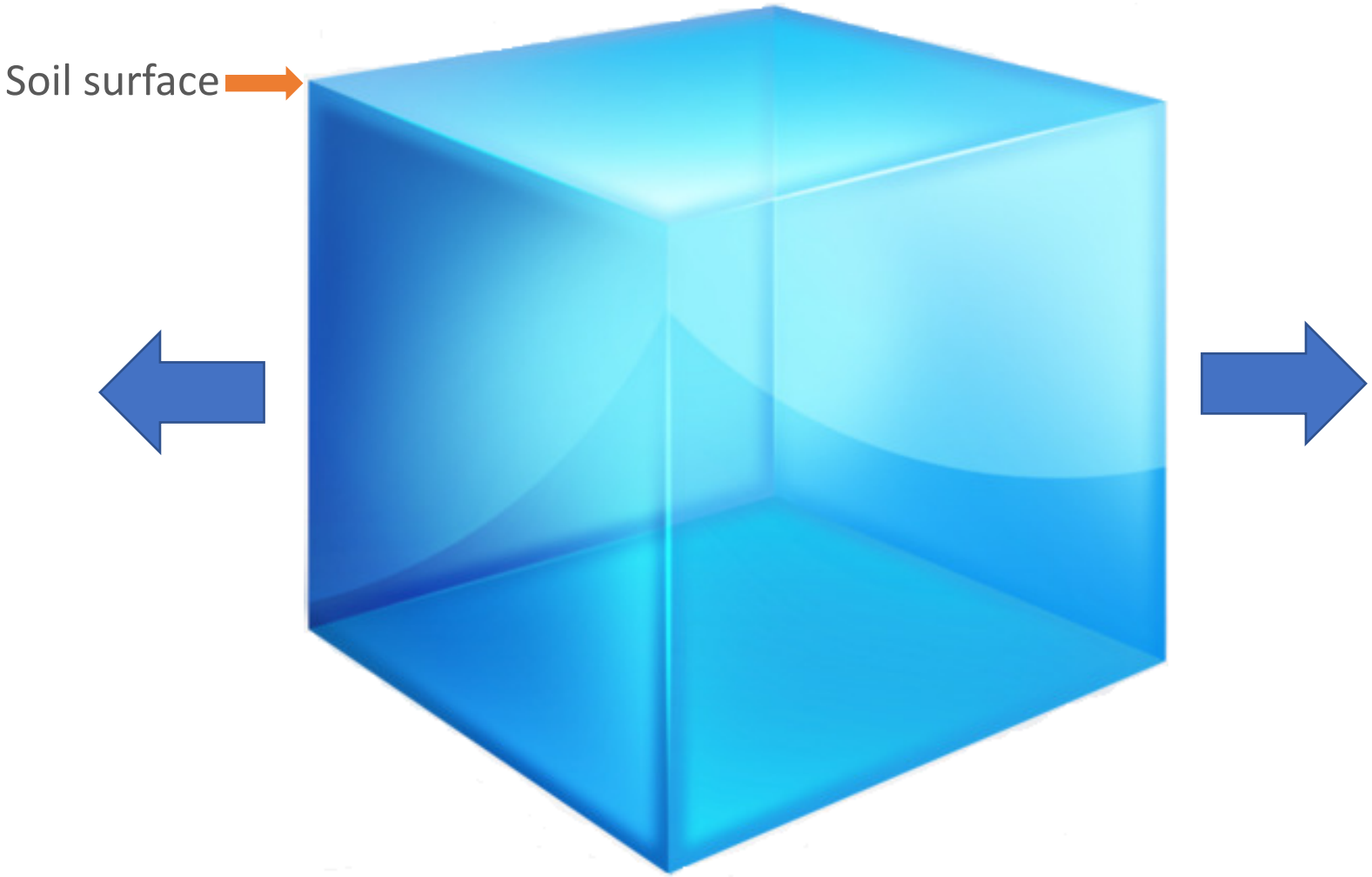


“It is often thought that recovery/heave will necessarily occur if a tree is removed. This is not the case. There has to be a (soil) moisture deficit and if there is no moisture deficit then there cannot possibly be any significant clay swelling.”

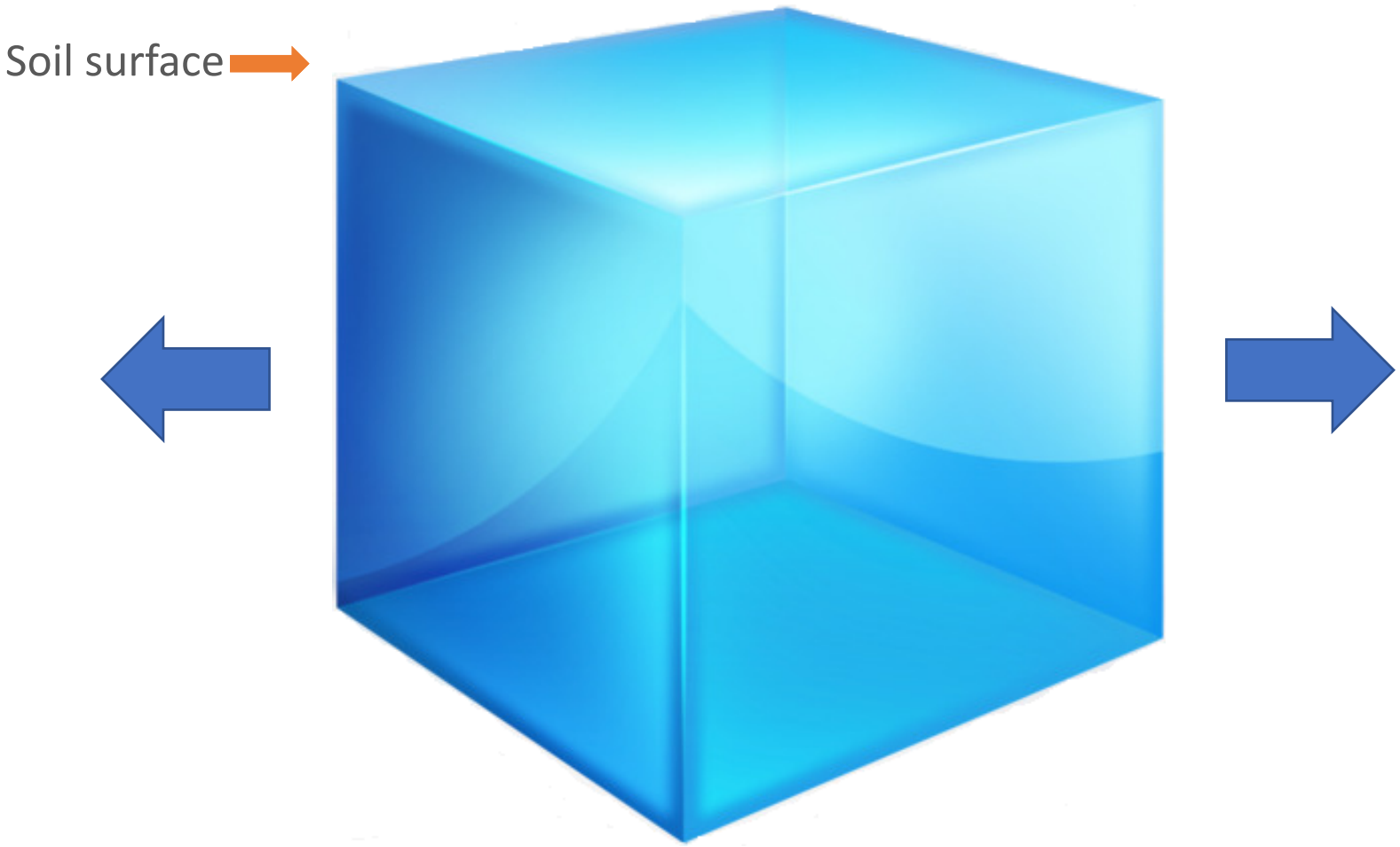
If there was a real risk of heave after tree felling there should have been a surge in heave cases after the 1987 storm.

But there wasn’t.

Clay shrinks during summer as moisture is withdrawn by tree roots



Clay shrinks during summer as moisture is withdrawn by tree roots



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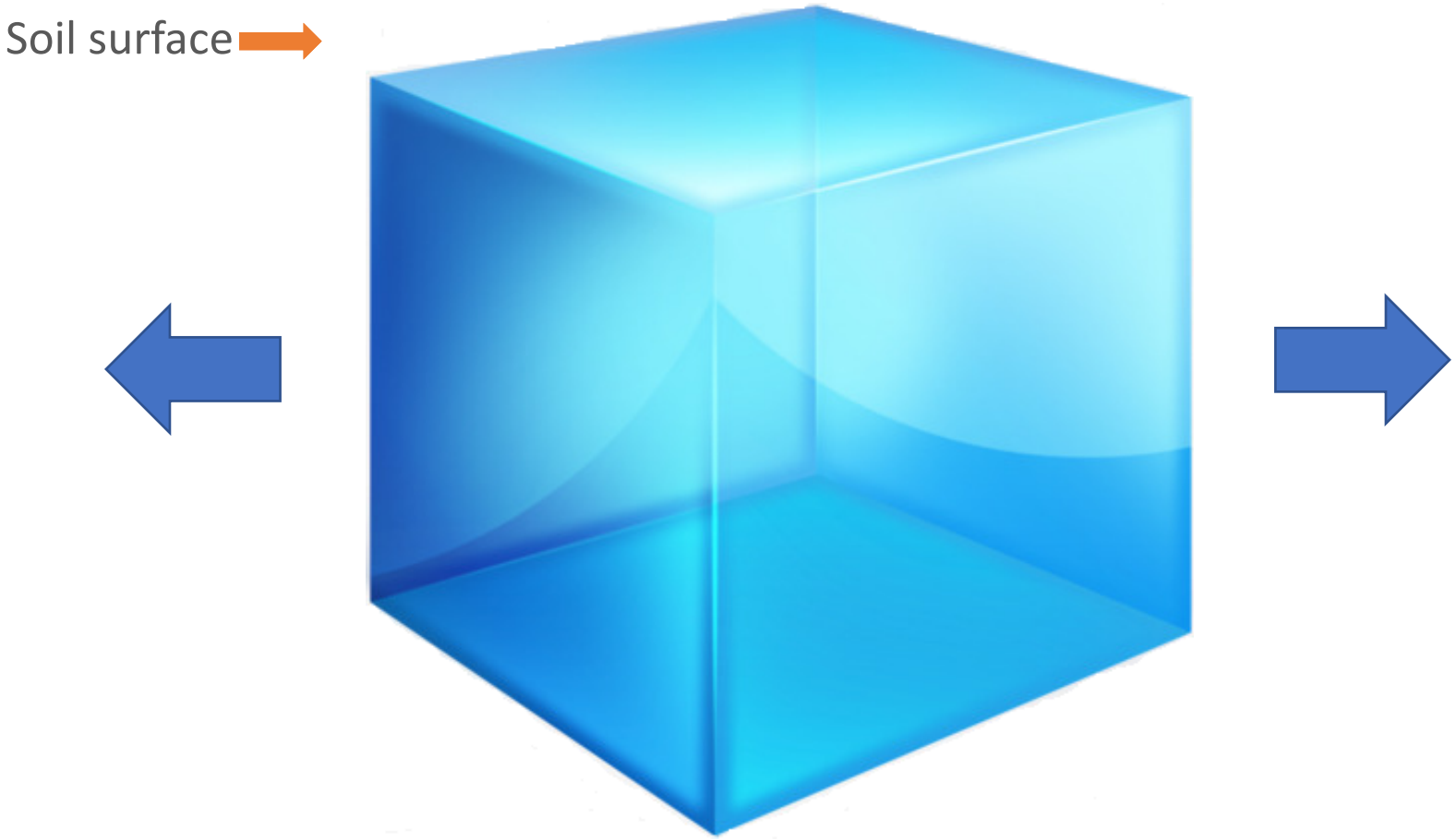
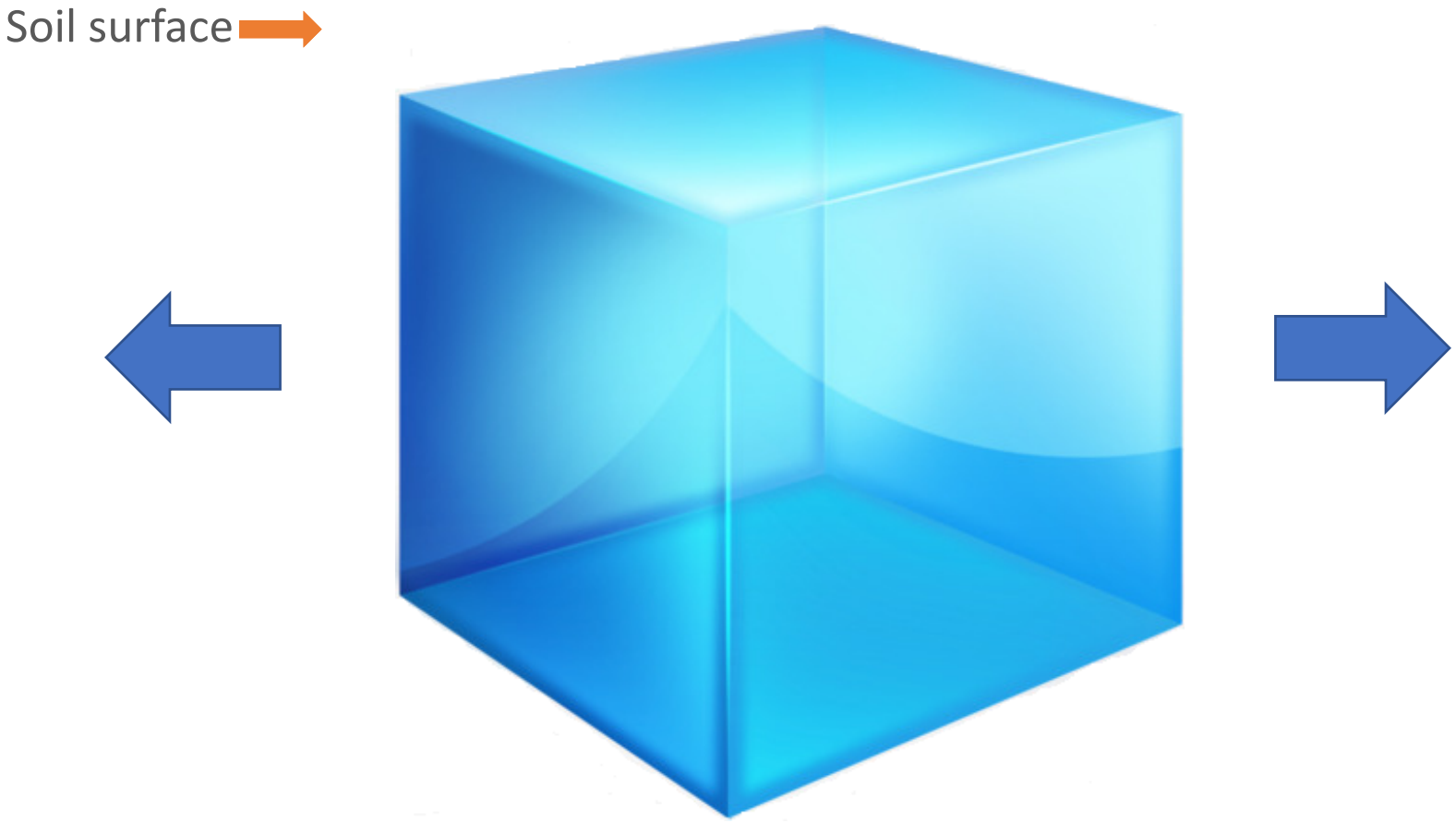
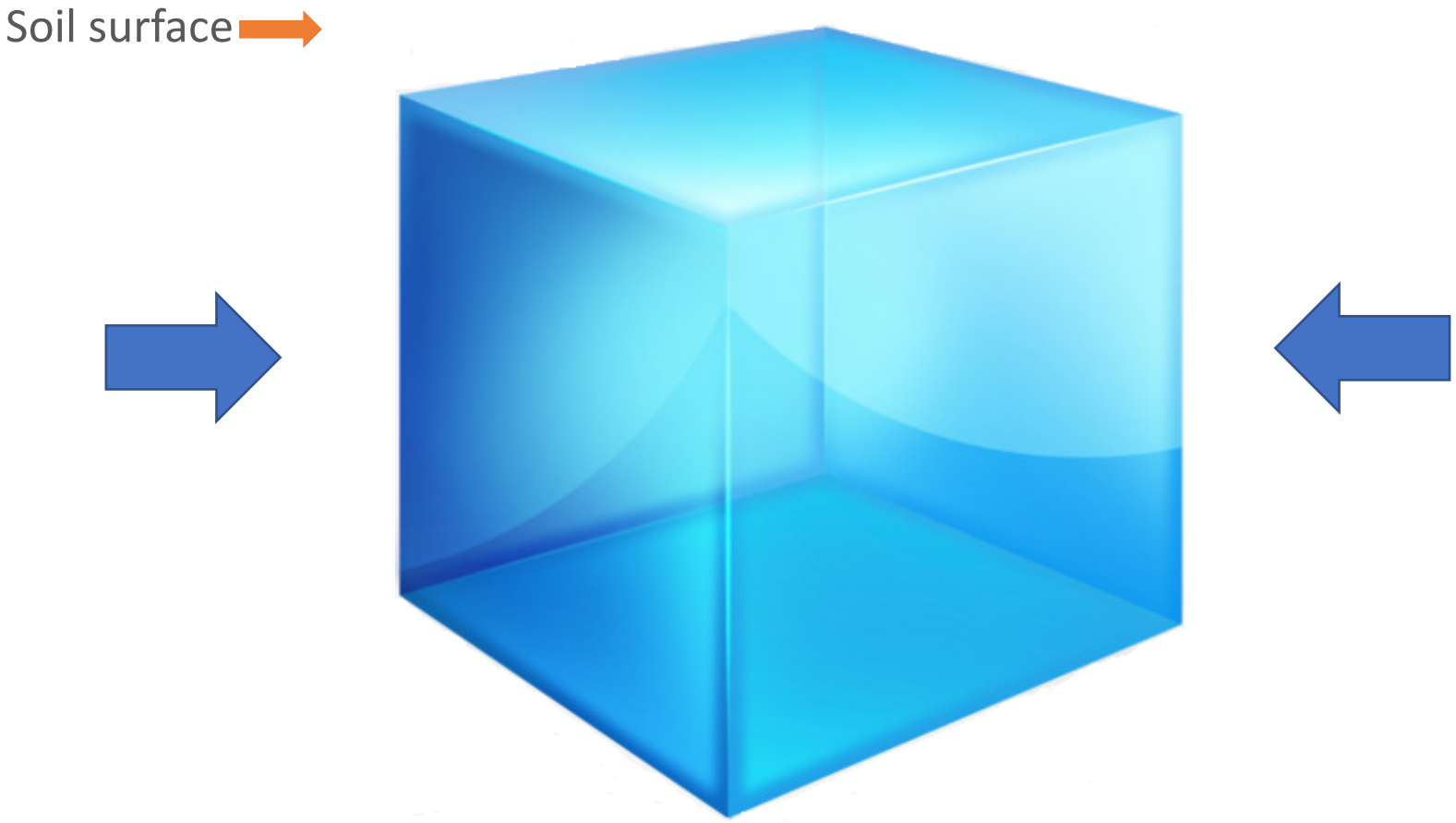


Clay shrinks during summer as moisture is withdrawn by tree roots



And swells again during winter when trees are dormant so soil can rehydrate



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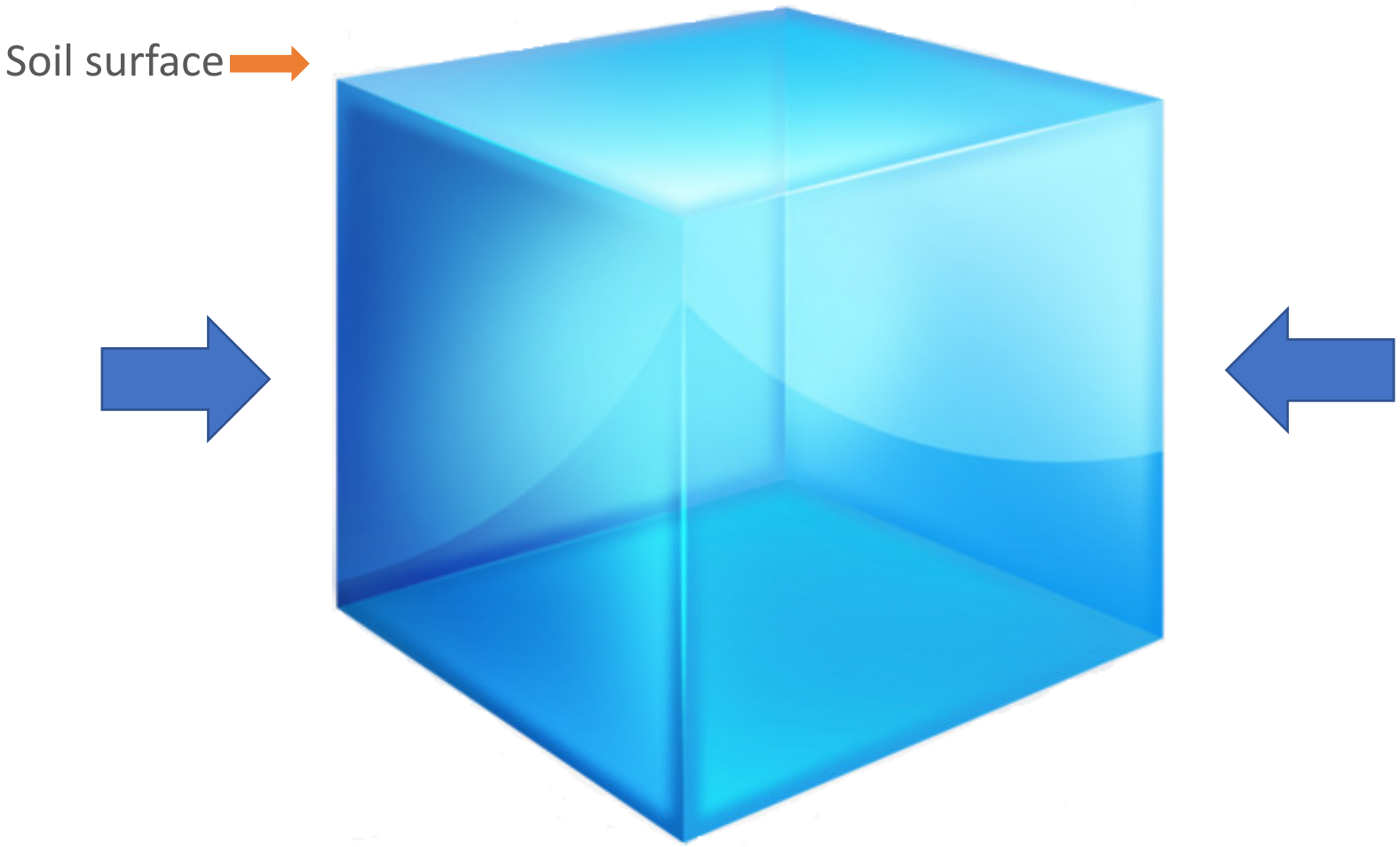

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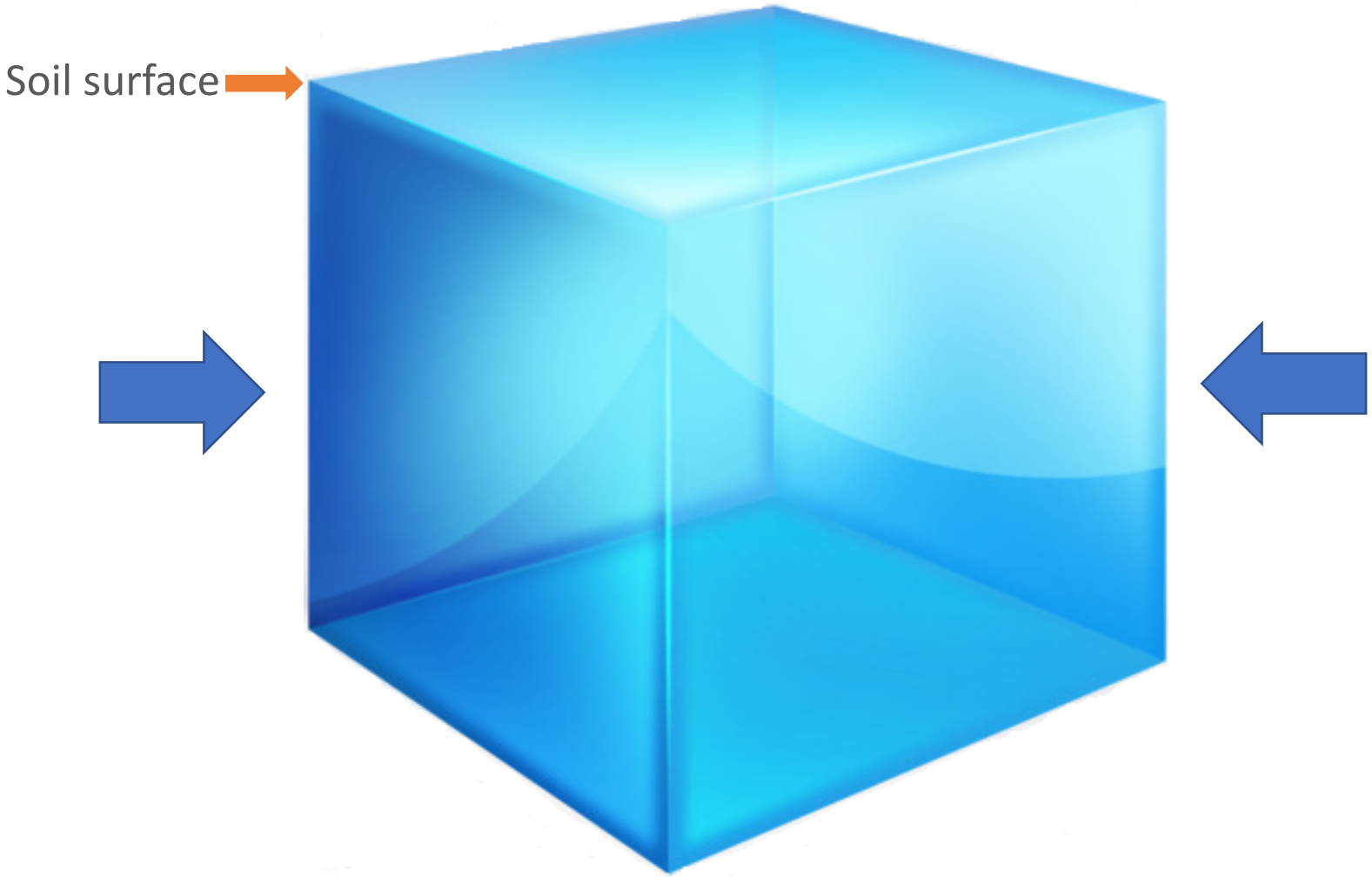
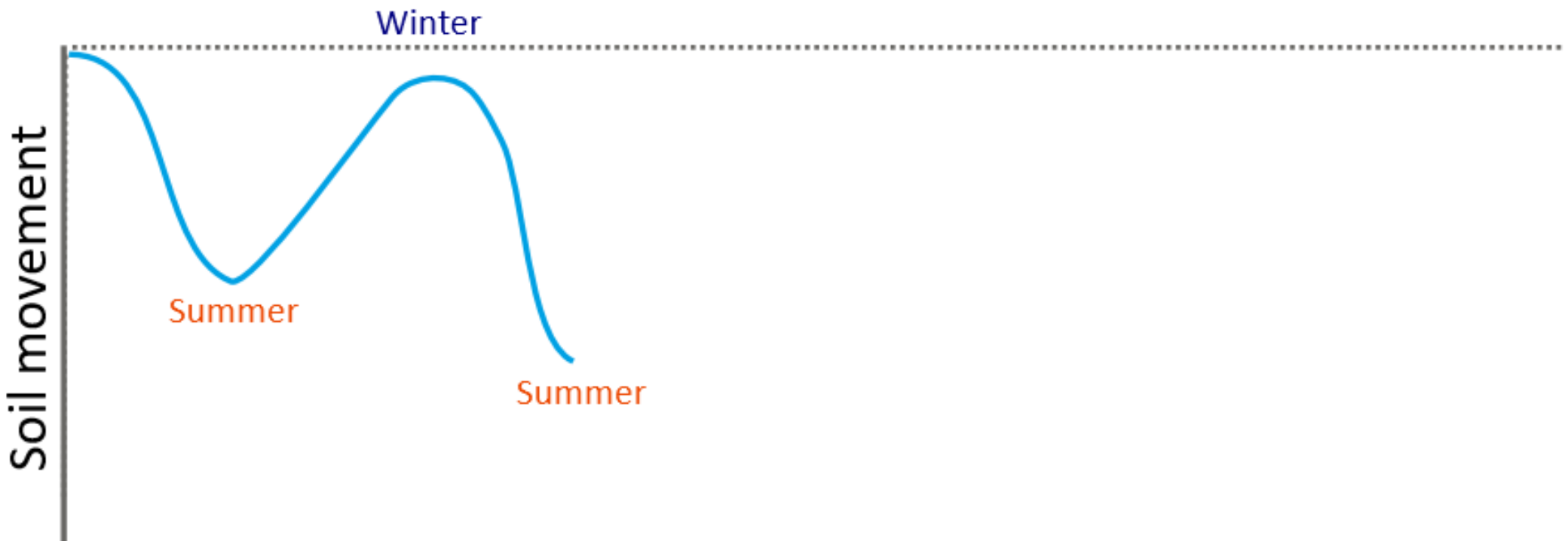
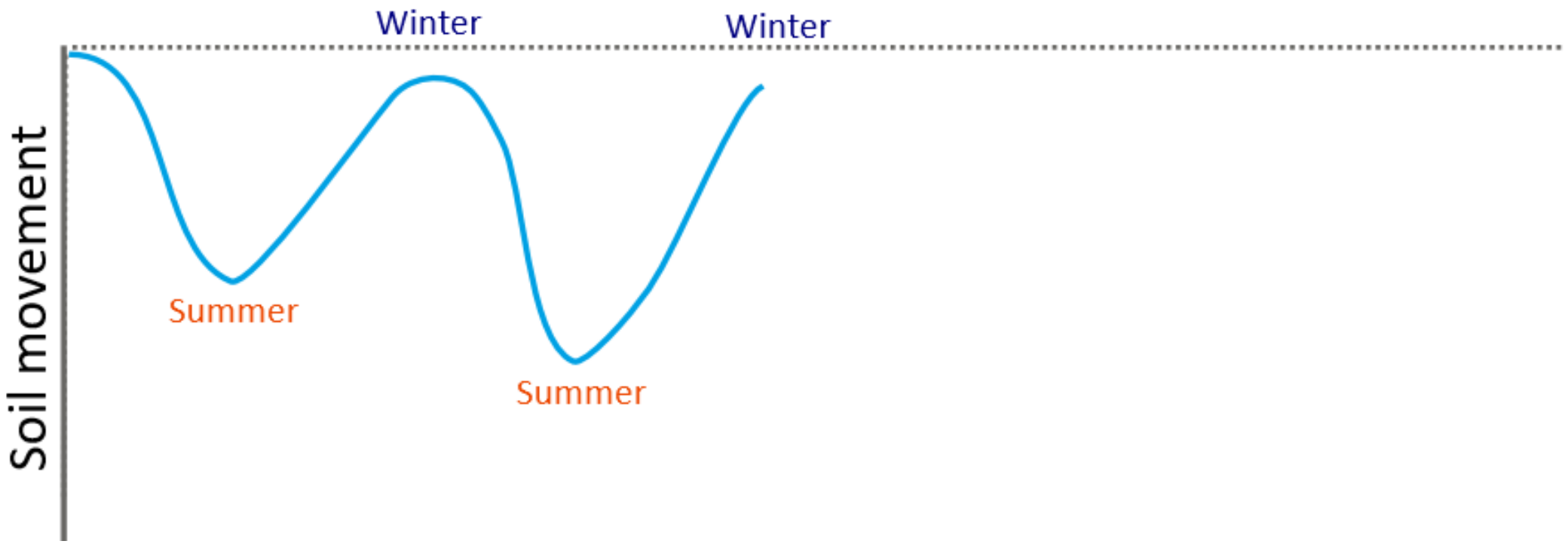
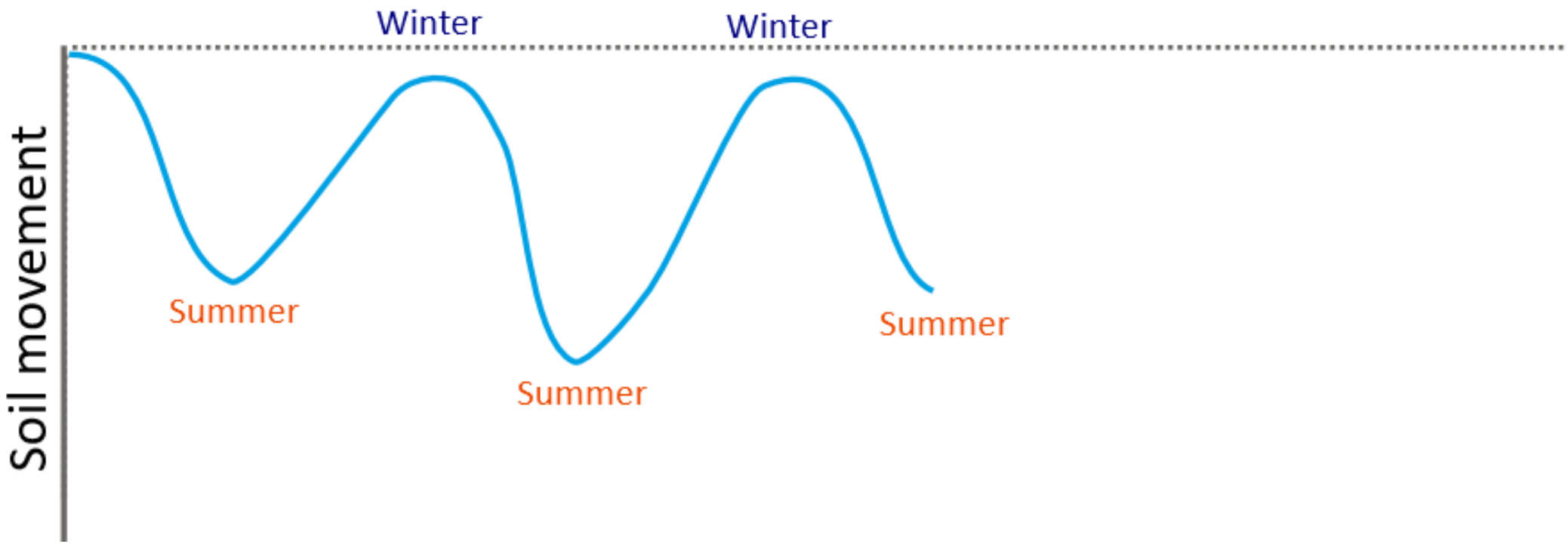


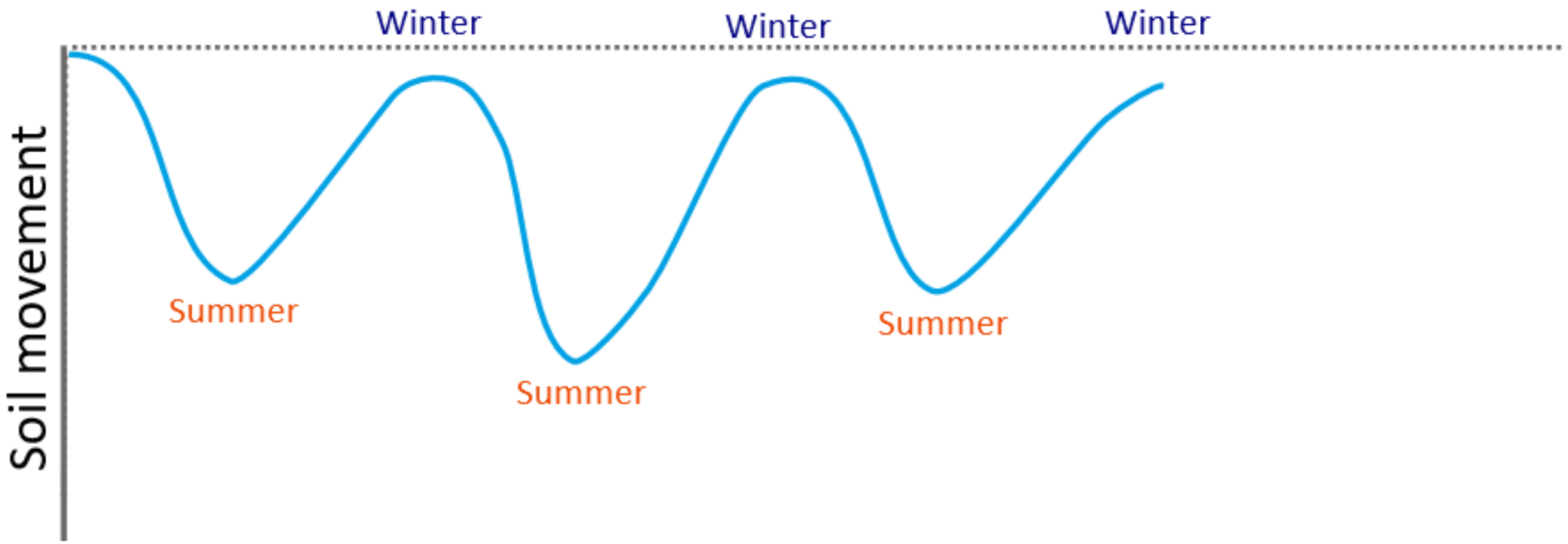

Soil movement
Summer

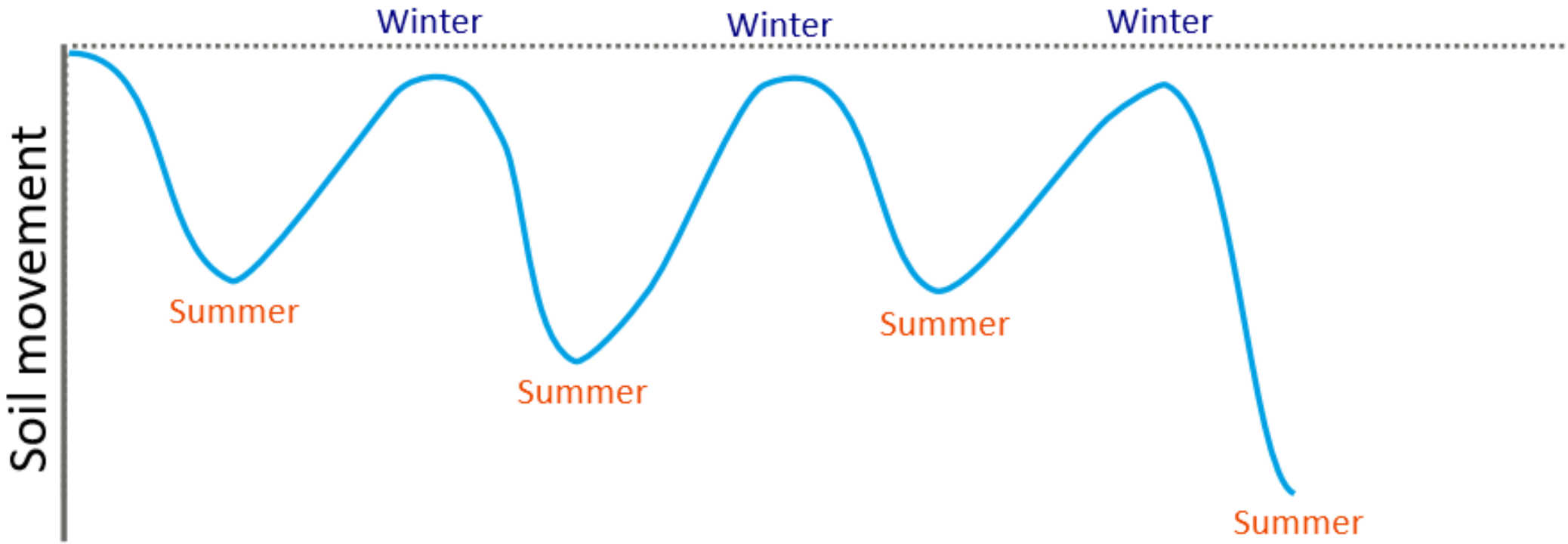

Winter
Summer
Soil movement

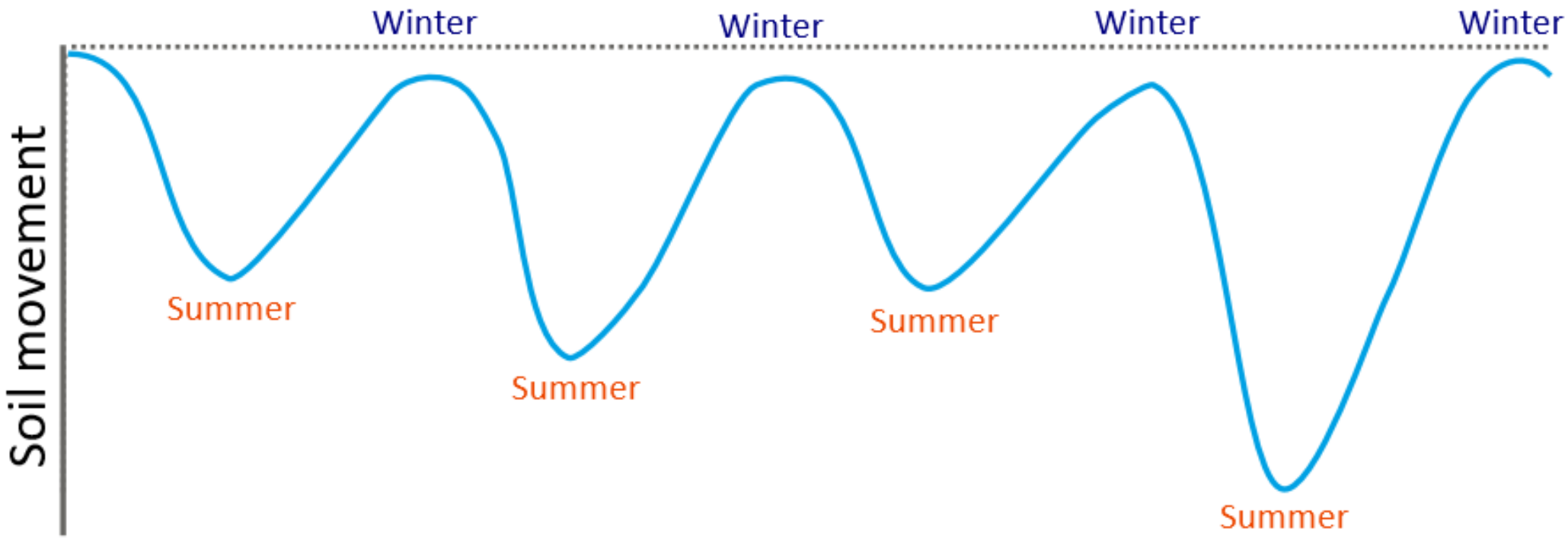

Winter
Soil movement
Summer
Summer

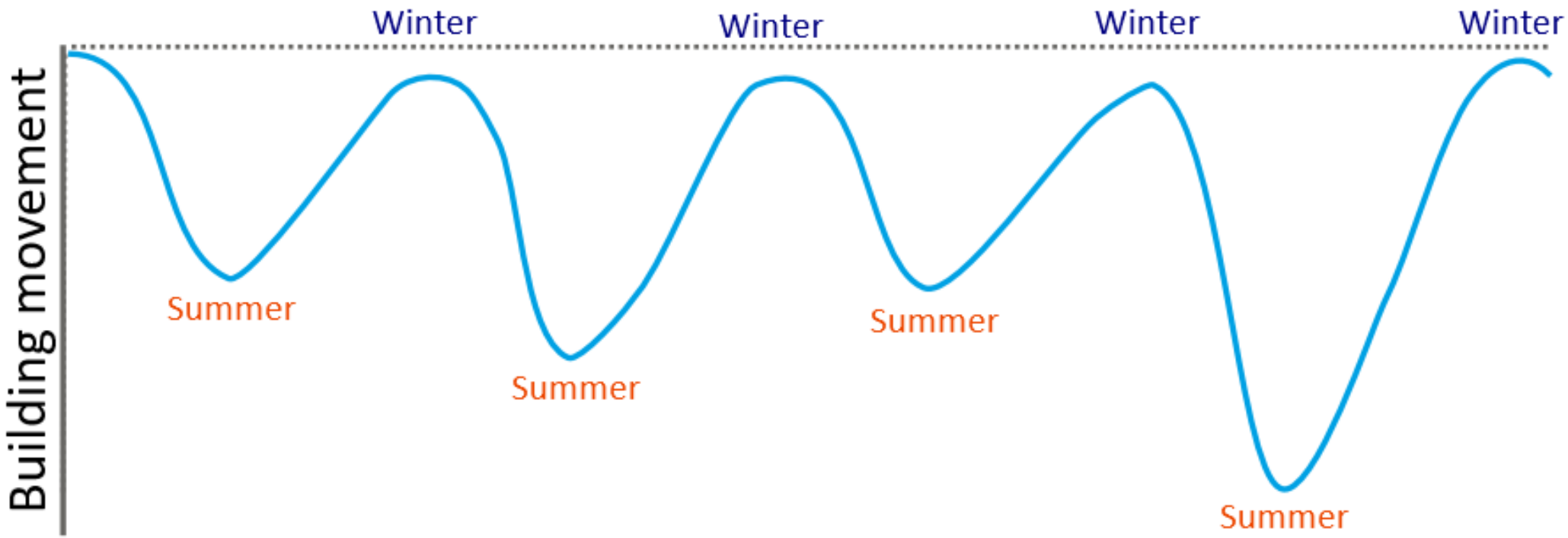

Winter
Winter
Soil movement
Summer
Summer


Winter
Winter
Soil movement
Summer
Summer
Summer

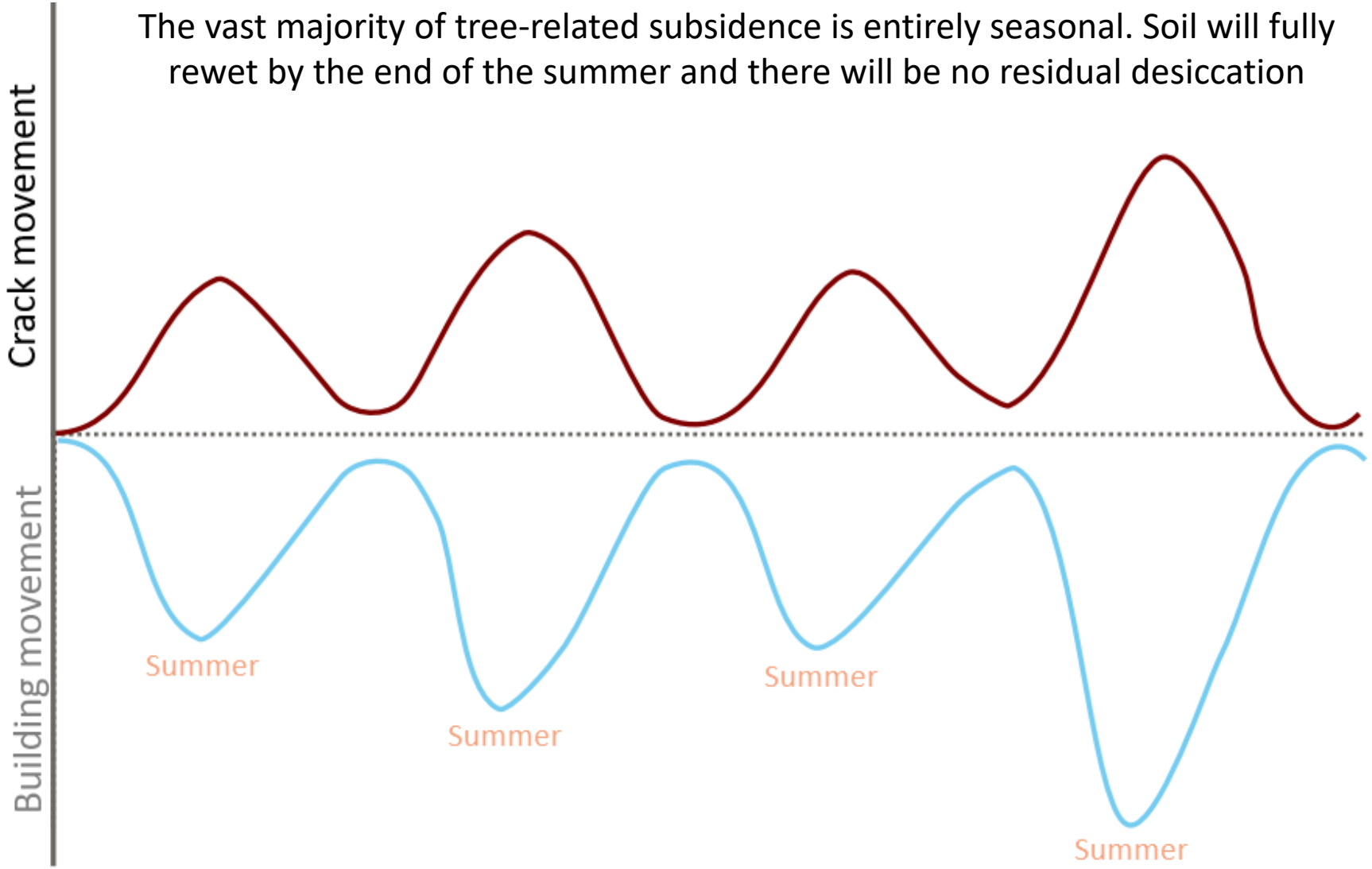

Winter
Winter
Winter
Soil movement
Summer
Summer
Summer

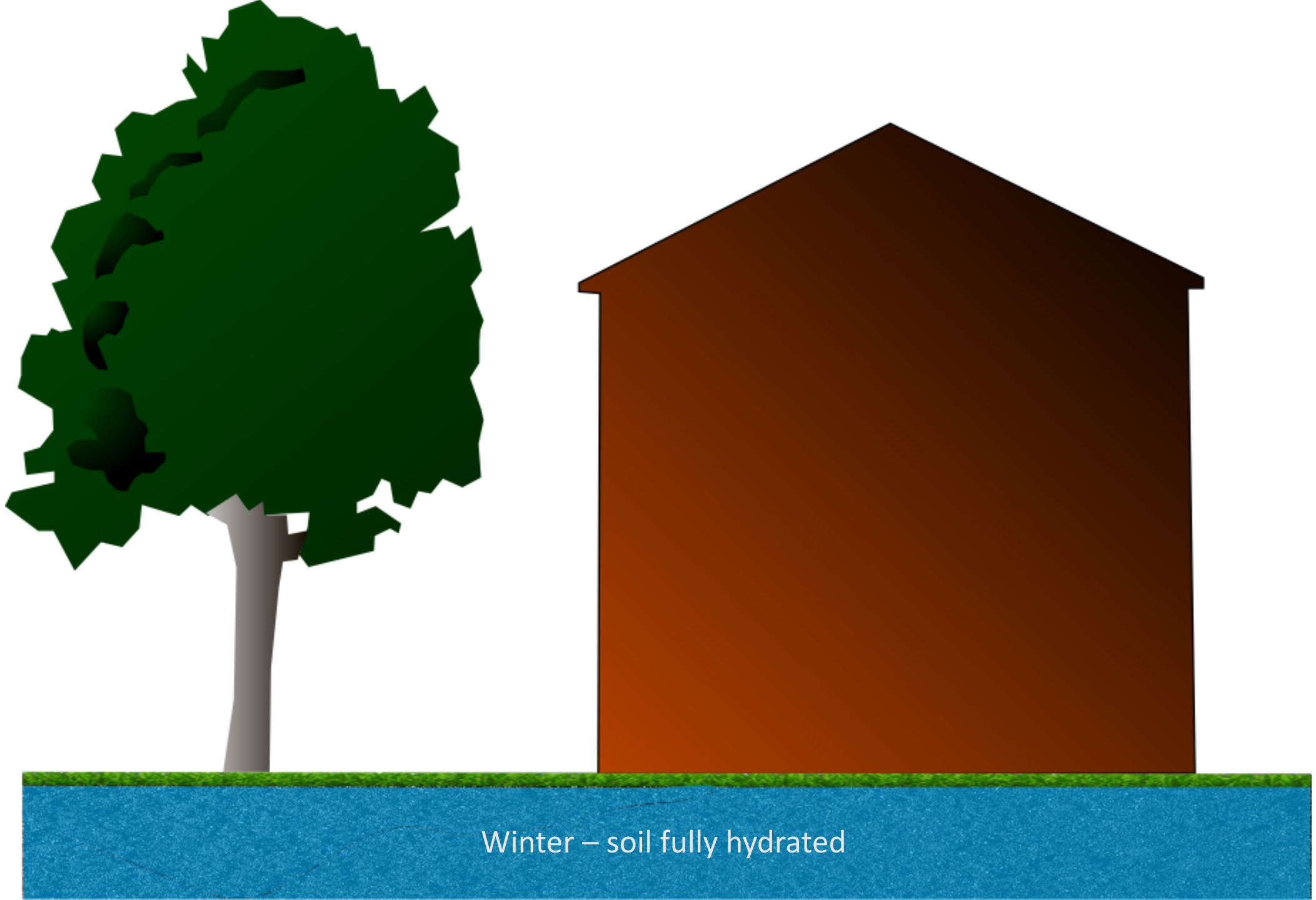

Winter
Winter
Winter
Soil movement
Summer
Summer
Summer
Summer


Winter
Winter
Winter
Winter
Soil movement
Summer
Summer
Summer
Summer


Winter
Winter
Winter
Winter
Building movement
Summer
Summer
Summer
Summer

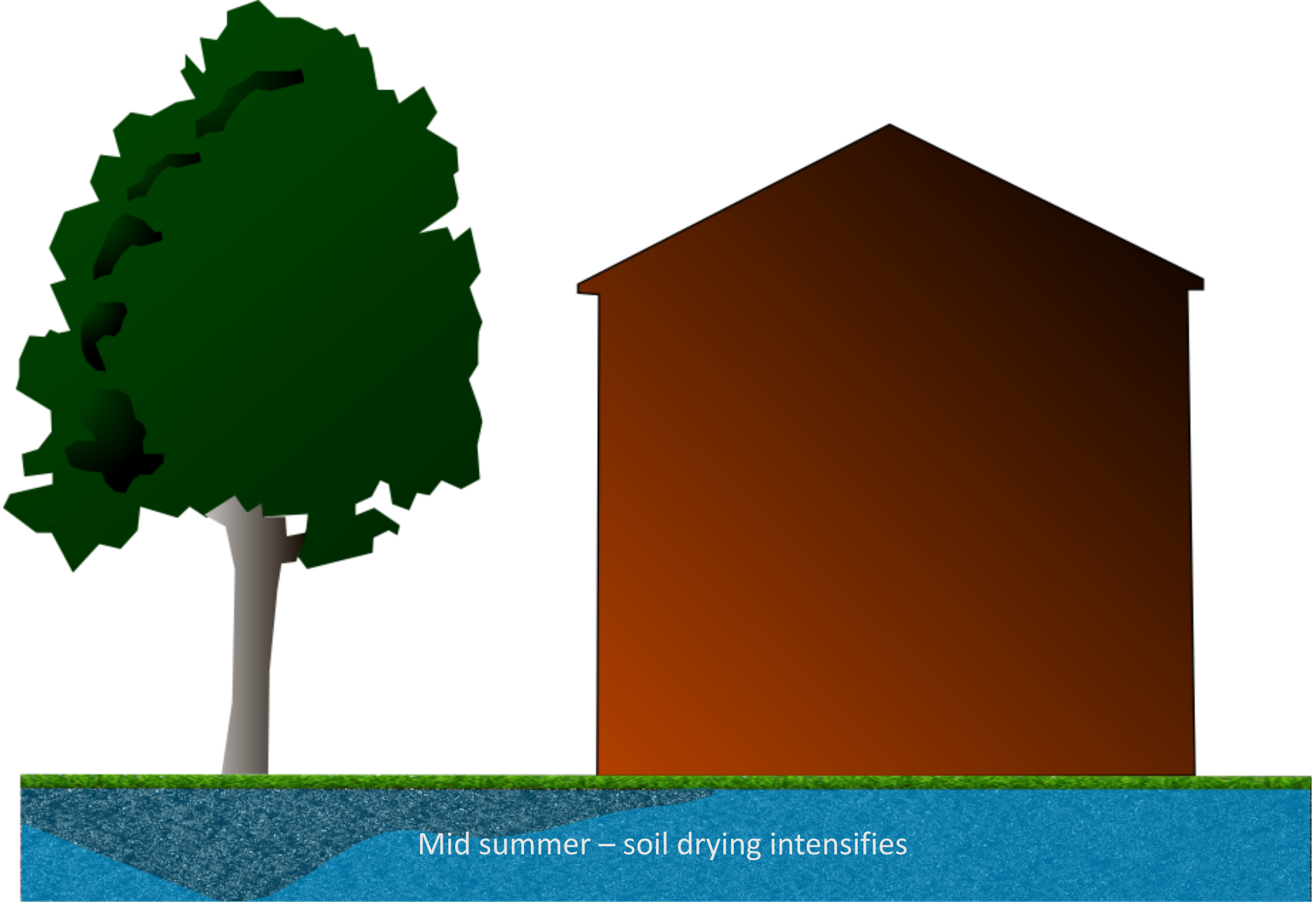
The vast majority of tree-related subsidence is entirely seasonal. Soil will fully rewet by the end of the summer and there will be no residual desiccation

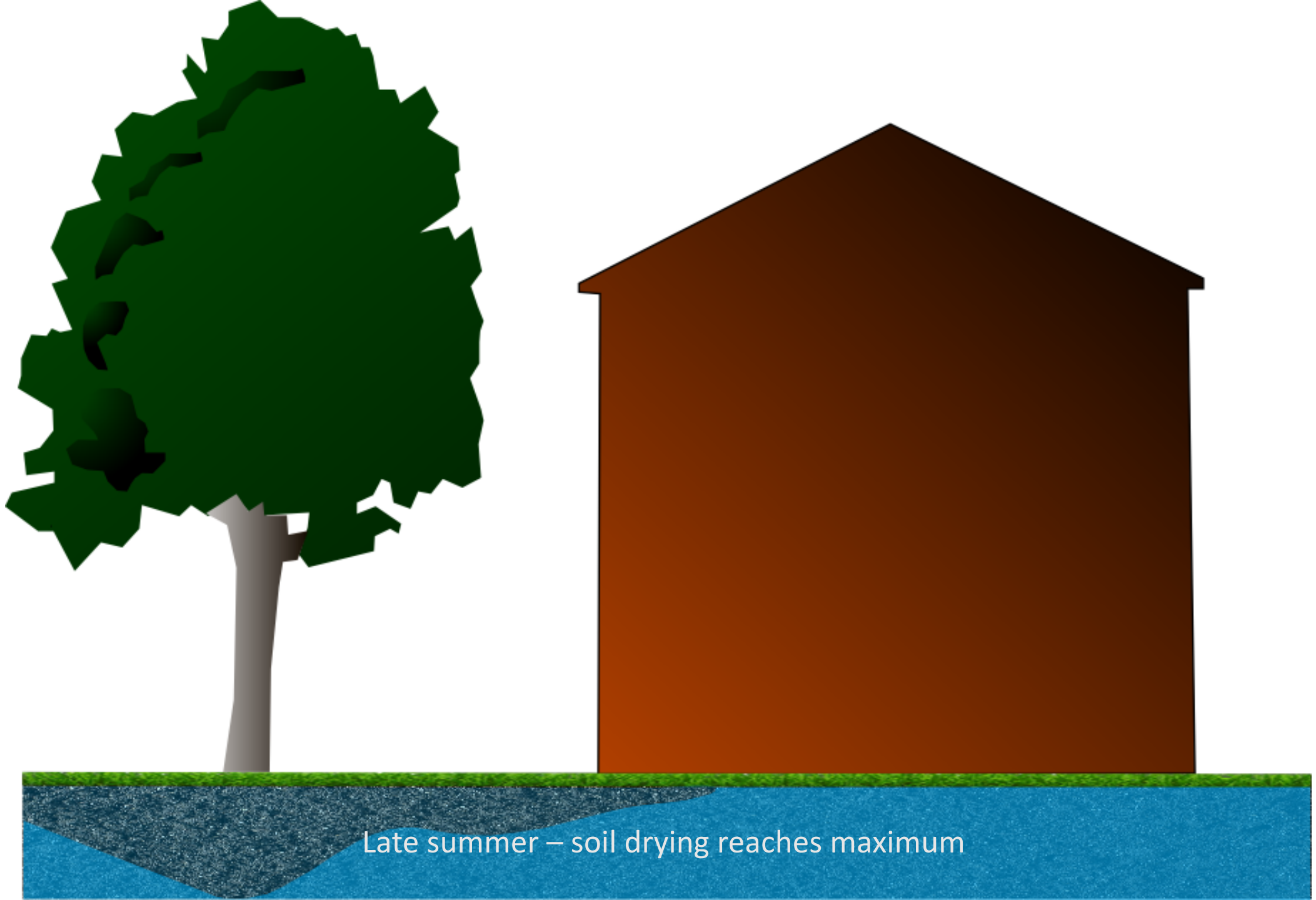


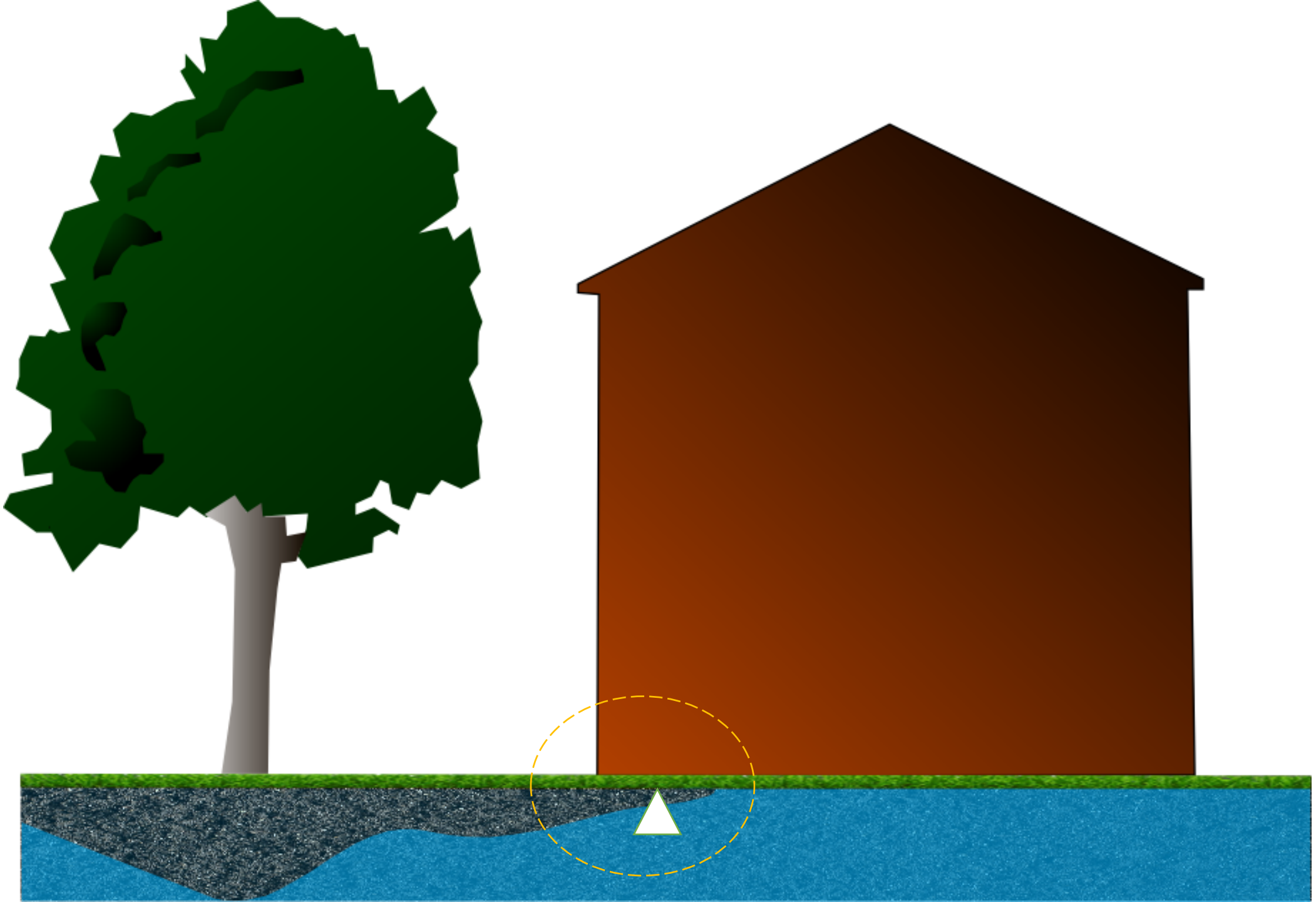

Winter – soil fully hydrated


Spring – soil drying commences


Early summer – soil drying progresses

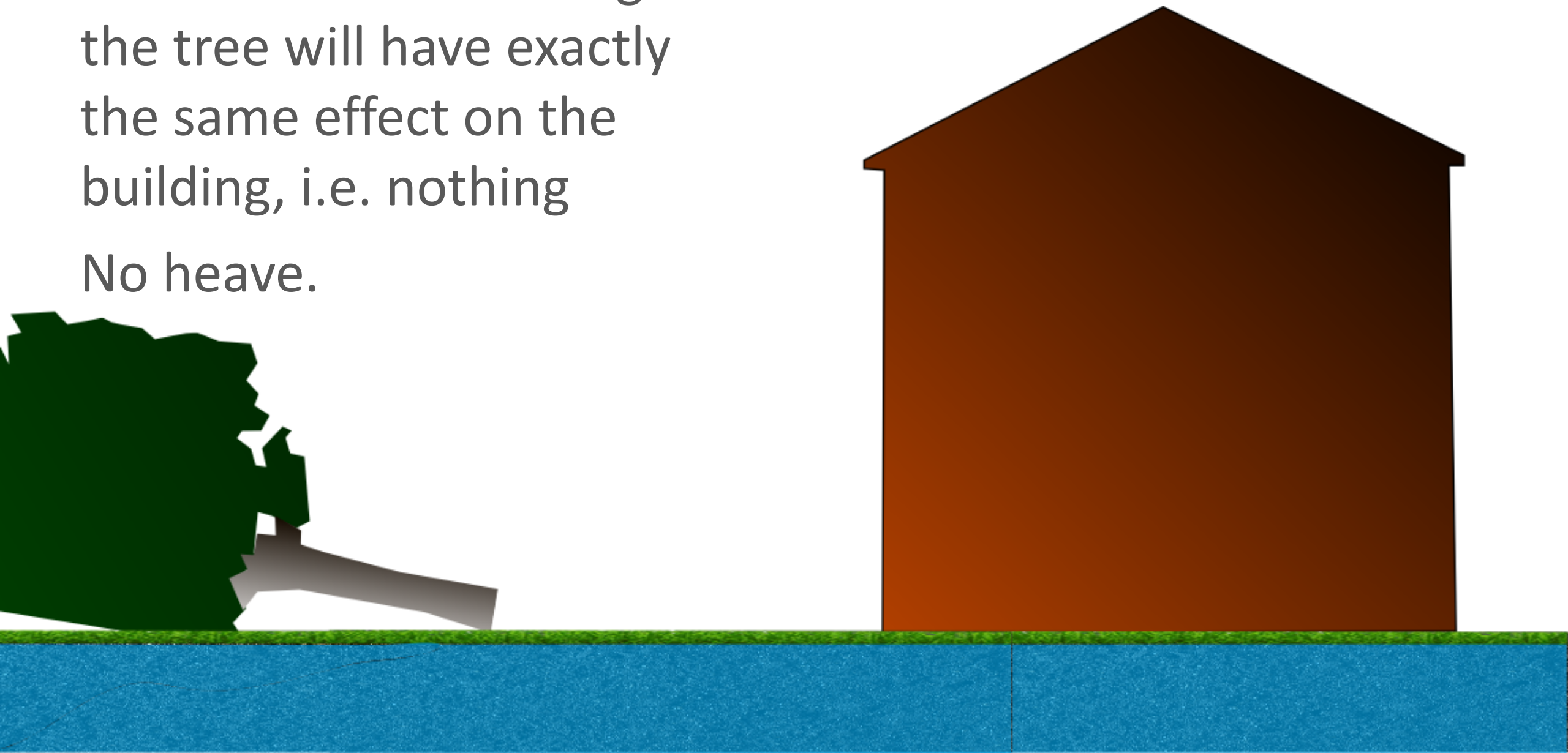

Mid summer – soil drying intensifies


Late summer – soil drying reaches maximum

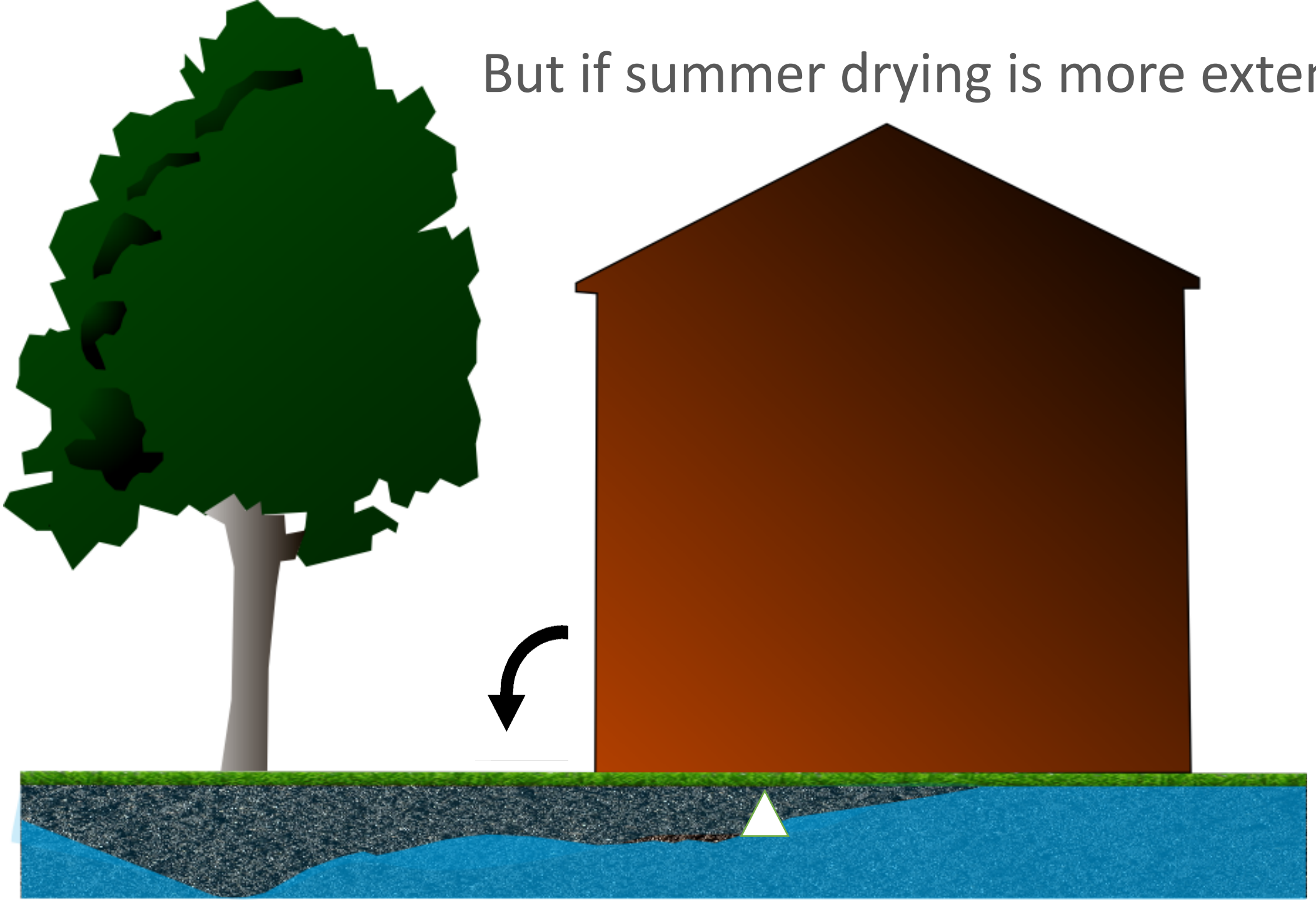


Winter rainfall or felling the tree will have exactly the same effect on the building, i.e. nothing

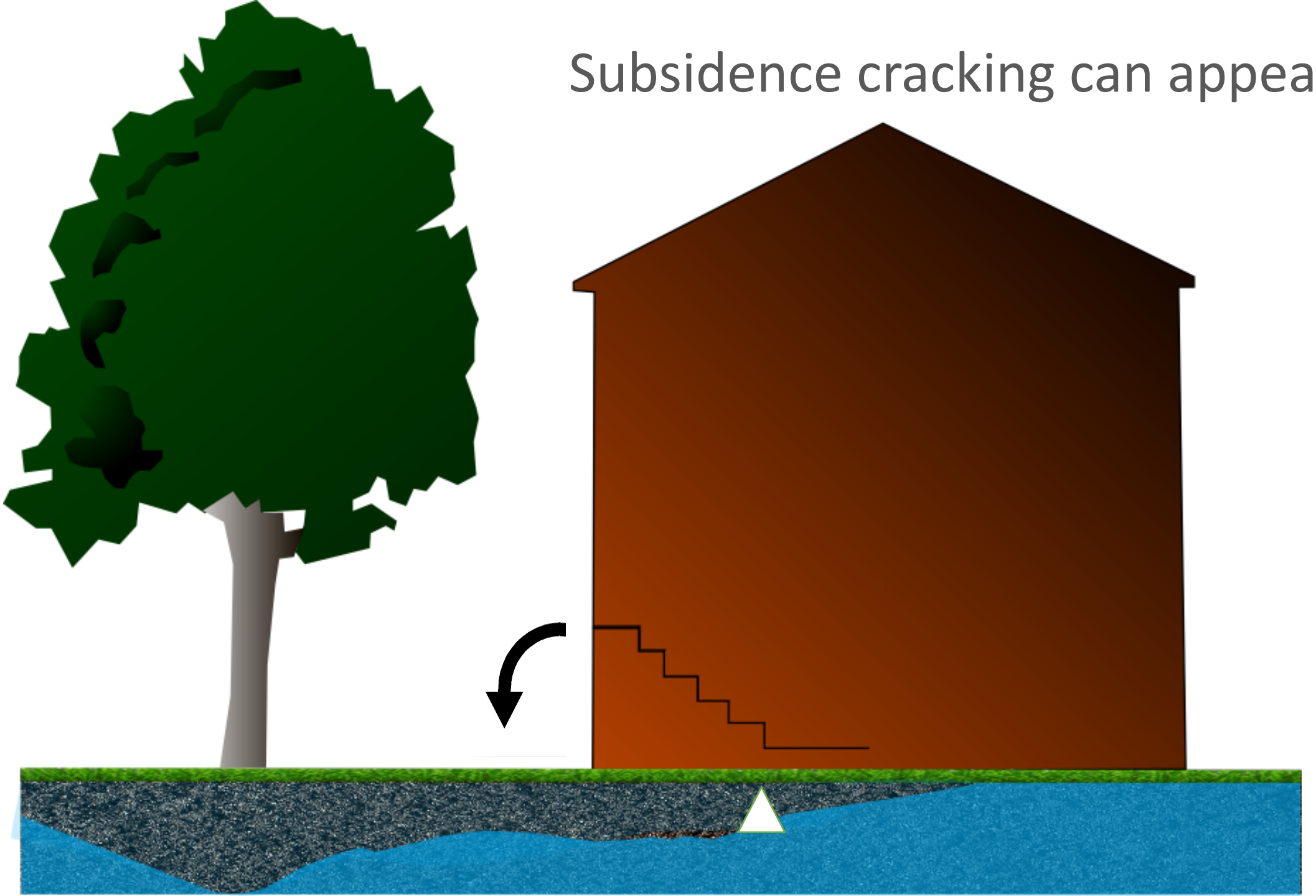
No heave.



But if summer drying is more extensive

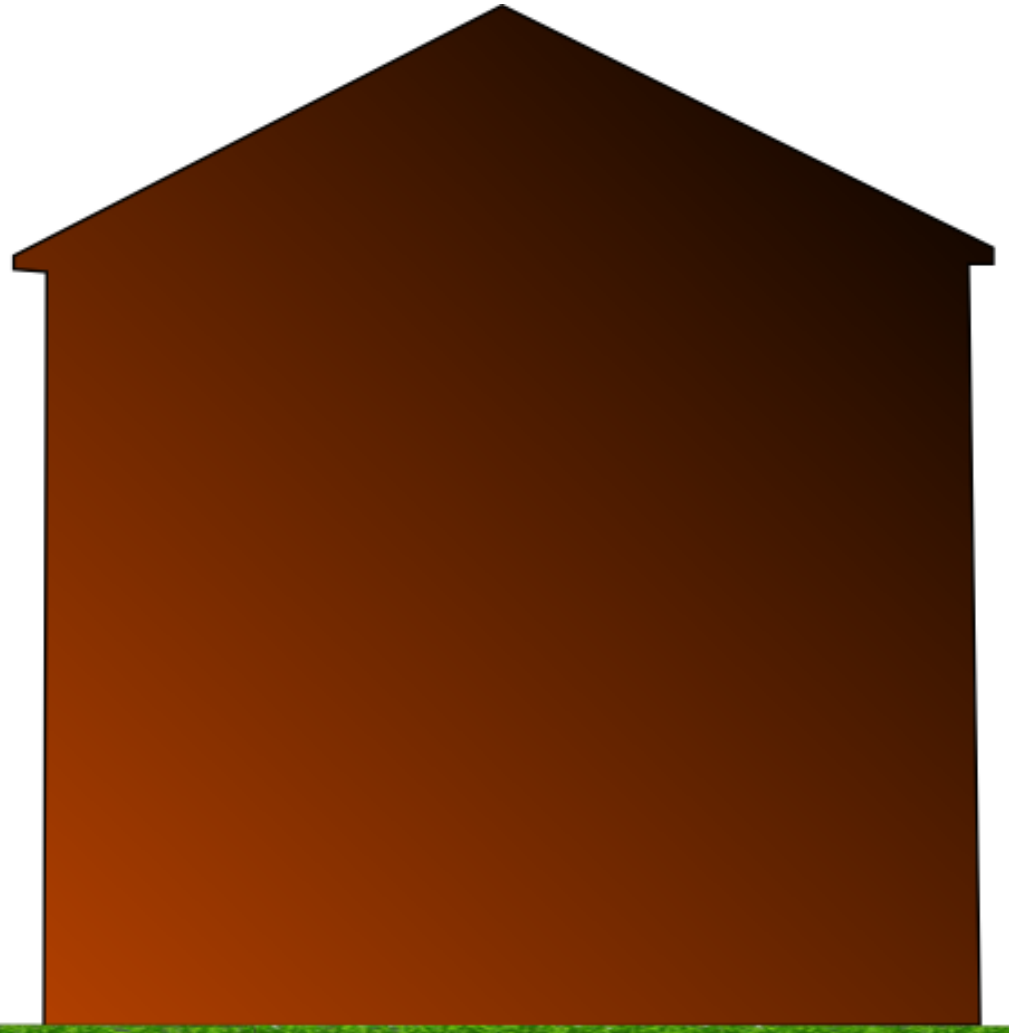


Subsidence cracking can appear



If tree is removed or adequately pruned immediately after cracks appear* the building should recover in one winter.

No heave.

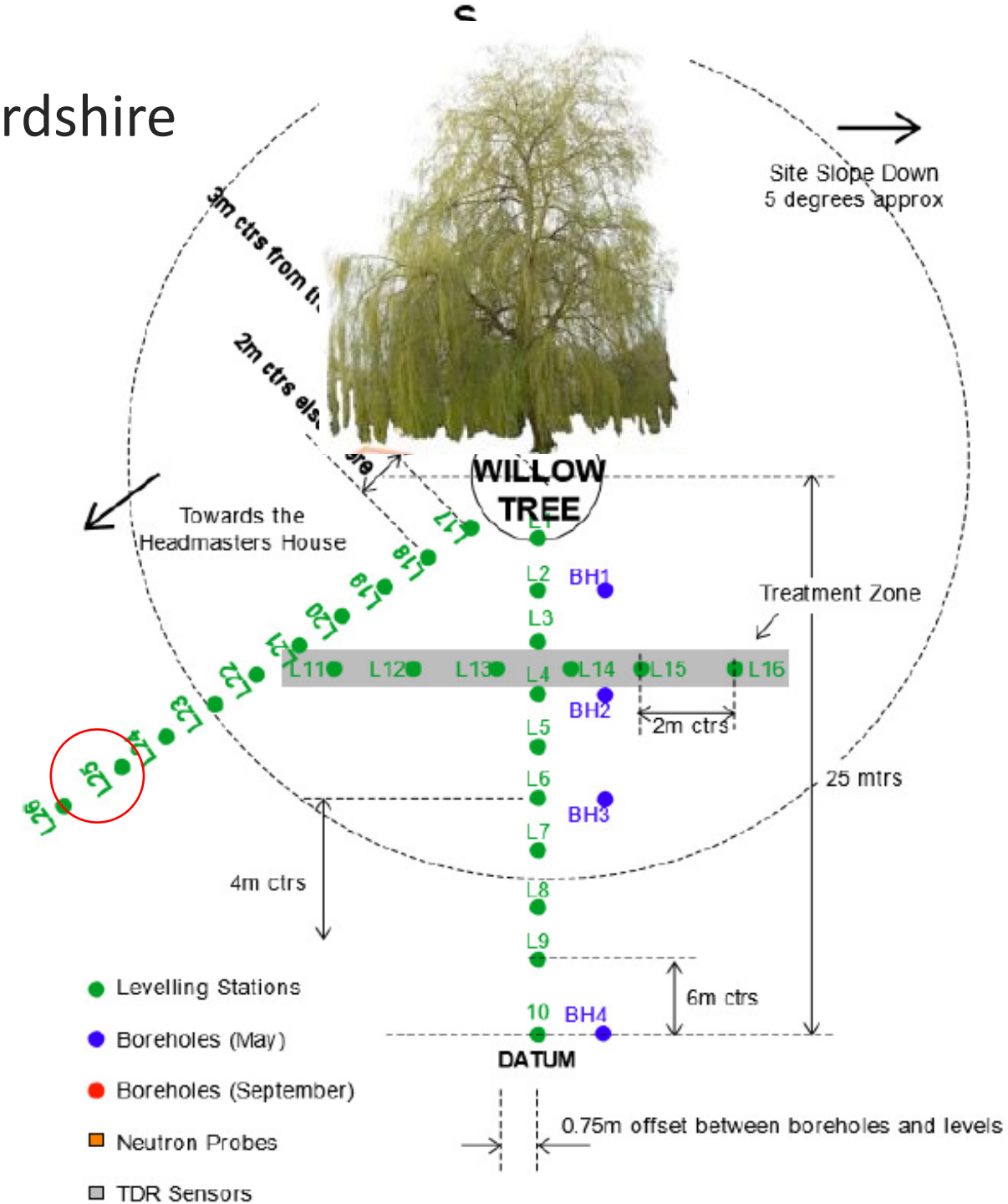


* verified through the usual investigations as being caused by subsidence

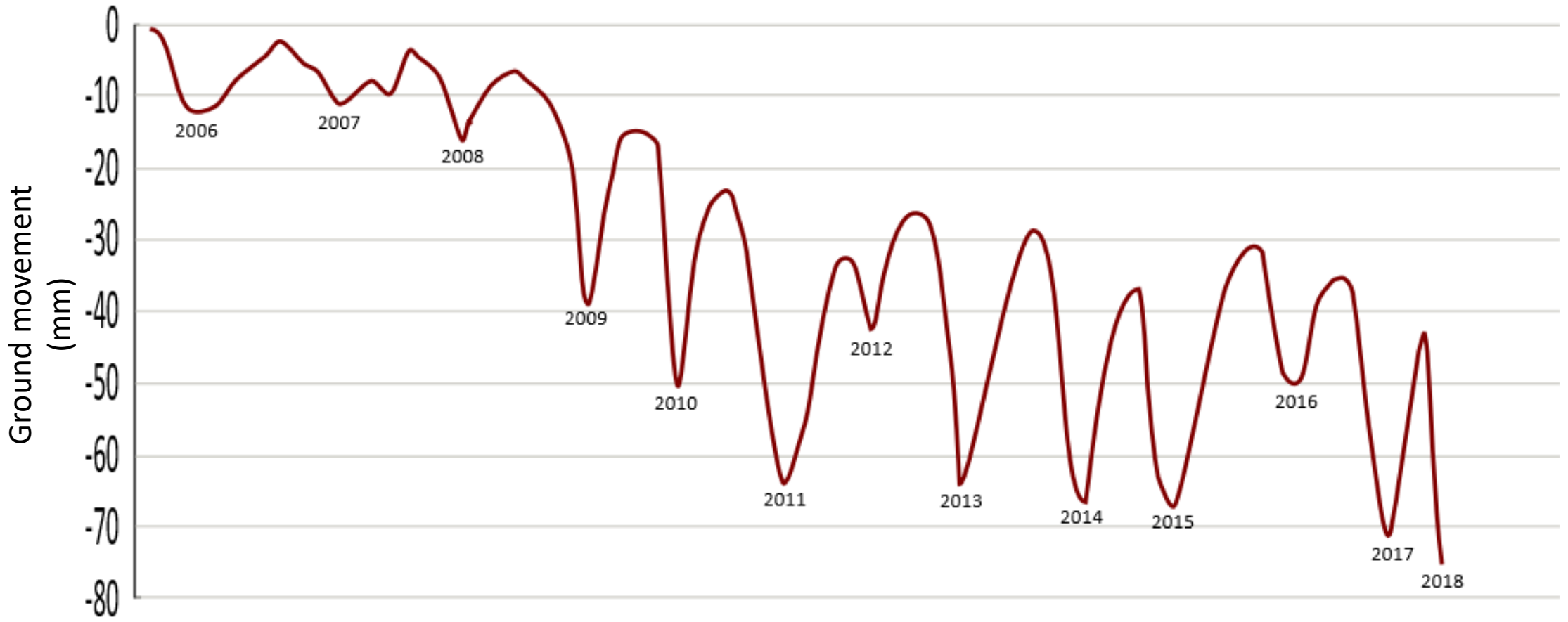

Building movement
Summer

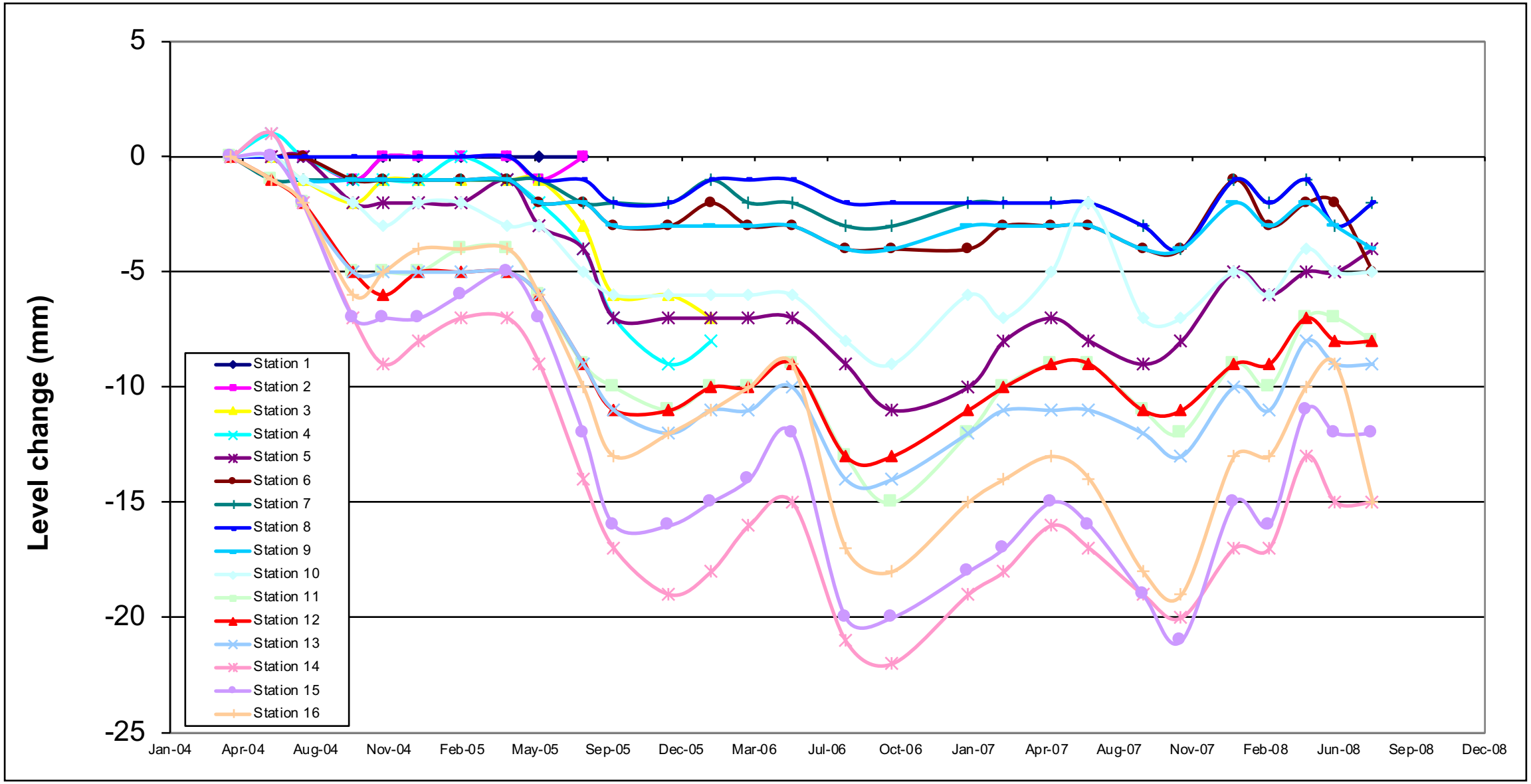

Winter
Building movement
Summer
Fell tree

Aldenham, Hertfordshire
London clay.



Aldenham willow 2006 - 2018




Level change (mm)
5
0
-5
-10
-15
-20
-25
Jan-04
Apr-04
Aug-04
Nov-04
Feb-05
May-05
Sep-05
Dec-05
Mar-06
Jul-06
Oct-06
Jan-07
Apr-07
Aug-07
Nov-07
Feb-08
Jun-08
Sep-08
Dec-08
Station 1
Station 2
Station 3
Station 4
Station 5
Station 6
Station 7
Station 8
Station 9
Station 10
Station 11
Station 12
Station 13
Station 14
Station 15
Station 16

Station 14

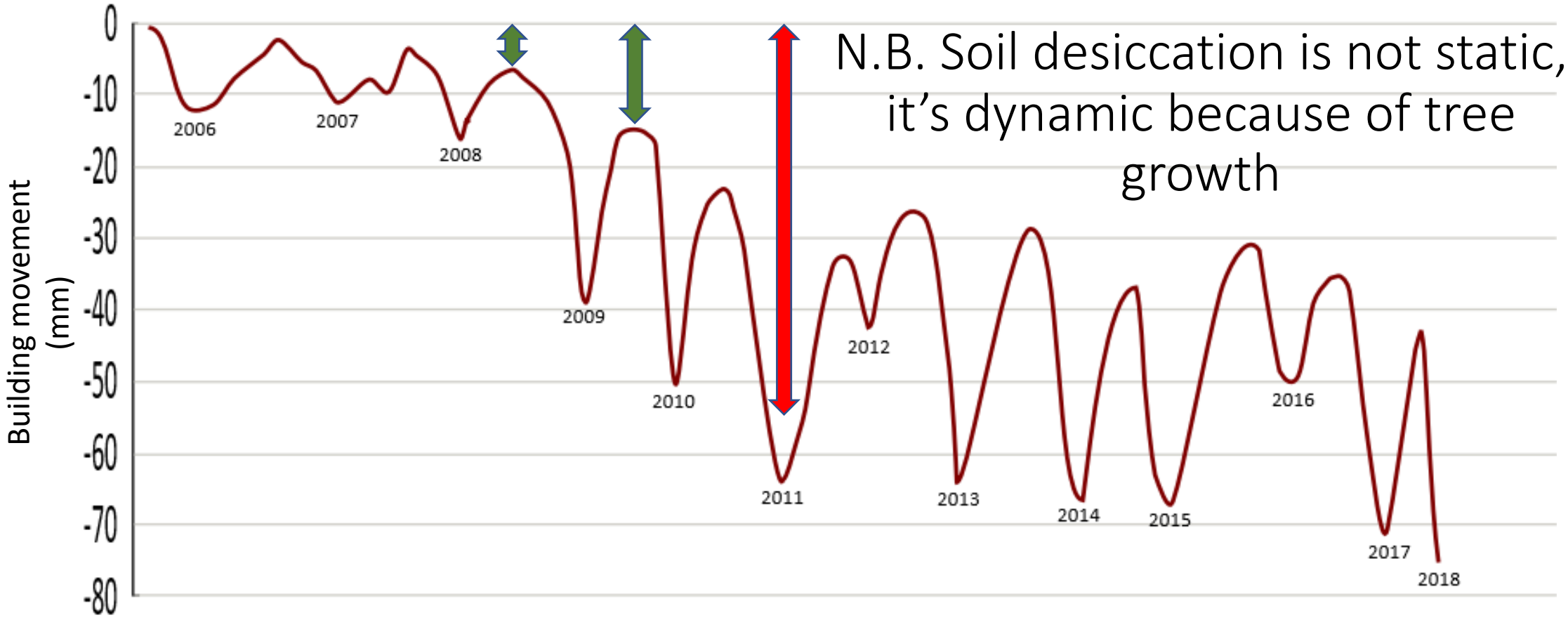
Level change (mm)

5
0
-5
-10
-15
-20
-25

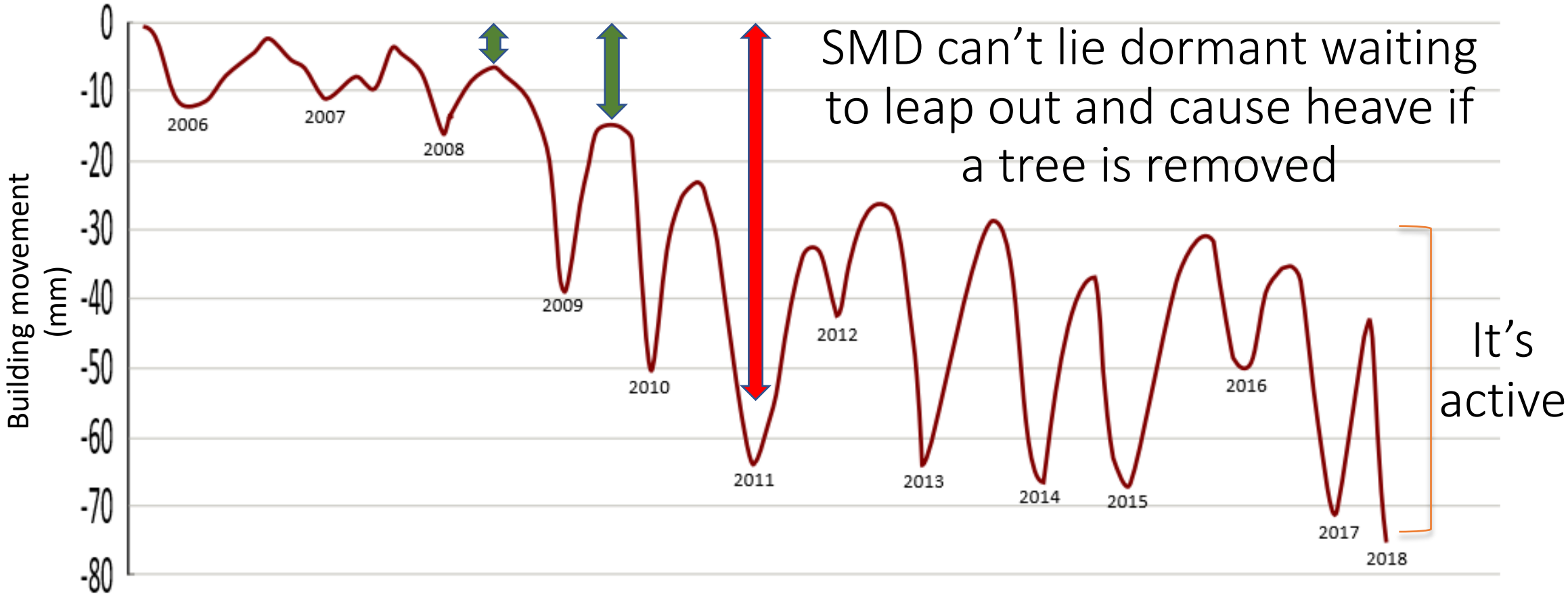
Station 14

Jan-04 Apr-04 Aug-04 Nov-04 Feb-05 May-05 Sep-05 Dec-05 Mar-06 Jul-06 Oct-06 Jan-07 Apr-07 Aug-07 Nov-07 Feb-08 Jun-08 Sep-08 Dec-08

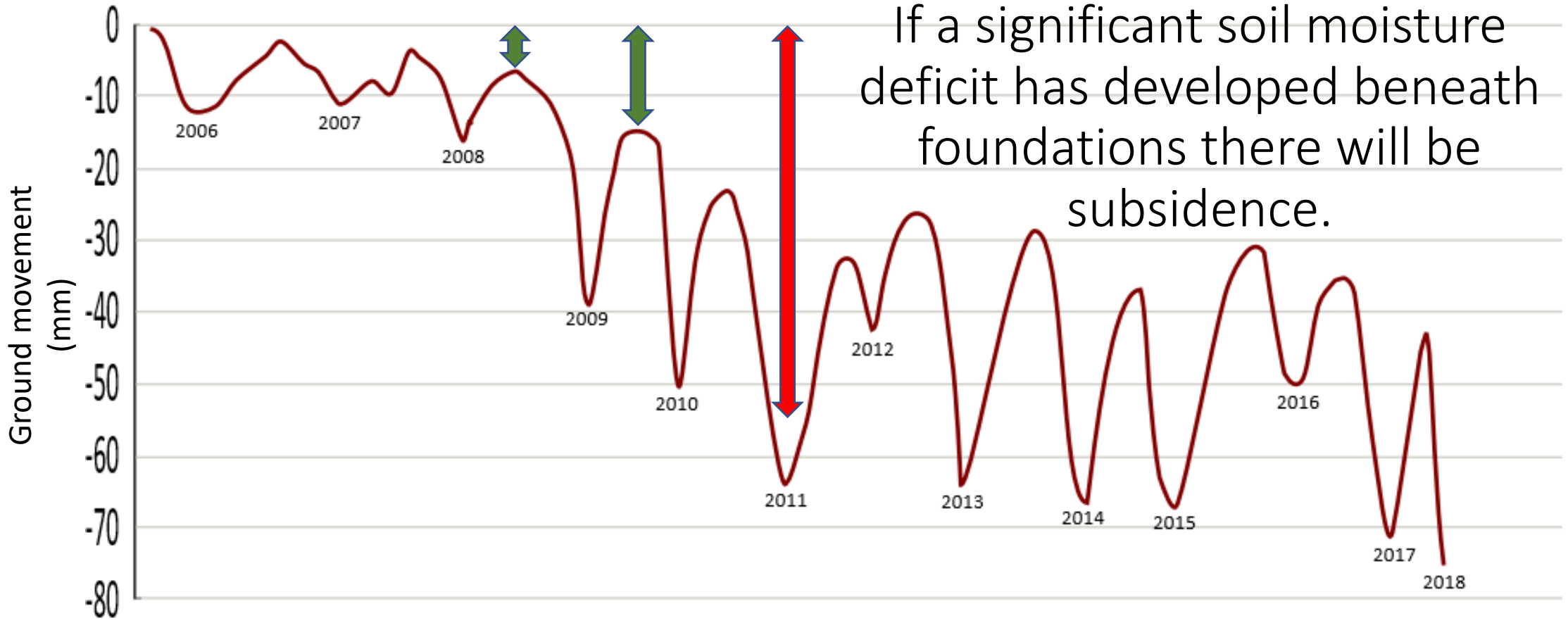
Aldenham willow 2006 - 2018



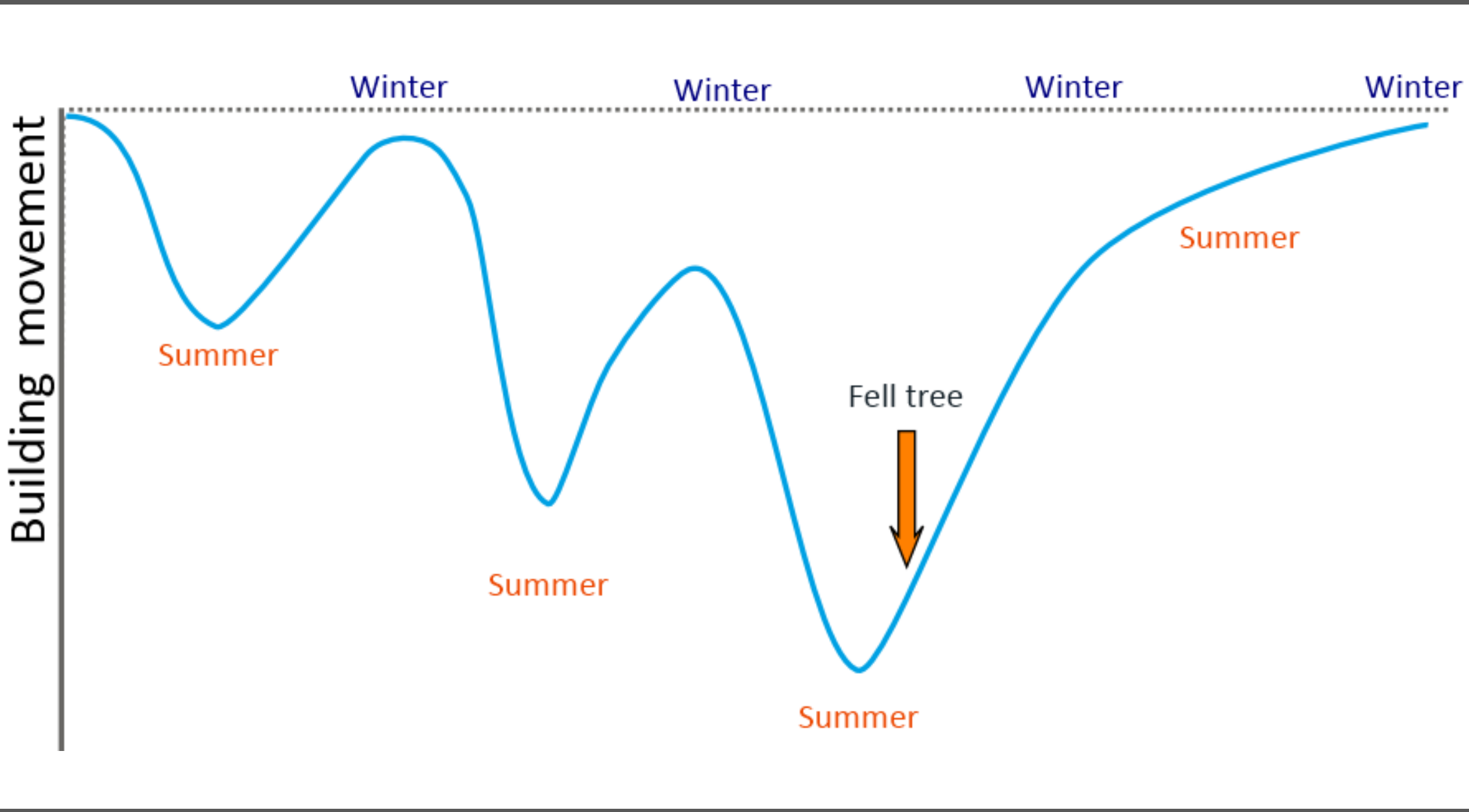
Aldenham willow 2006 - 2018



Aldenham willow 2006 - 2018



If a significant soil moisture deficit has developed beneath foundations there will be subsidence.


Winter
Winter
Winter
Winter
Building movement
Summer
Summer
Fell tree
Summer
Summer

25 years' heave of a building constructed on clay, after tree removal

by John E. CHENEY*

Summary

PRECISE LEVELLING observations have recorded long-term heave of a single-storey building founded on London Clay after removal of trees. Observations were started when heave was suspected and extend from 8 to 32 years after construction.

The observations are presented in graphs and contour plots which show amounts and rates of up-lift, the effect on various parts of the building, and indicate the long time scales involved before movements slowed sufficiently for permanent repair work to be carried out.

From contours of recorded heave, even though for a period starting years after tree removal, it is shown that the most probable position of the removed trees can be deduced and their zone of influence defined.

Two methods of estimating initial un-recorded heave are discussed and it is evident that the maximum total heave was over 160mm (6.5in).

The results of soil swelling-potential and moisture content tests at a nearby site close to remaining trees are used to assess swelling potential of the clay.

Fig. 1. The front of the building in 1985

• N-E Datum

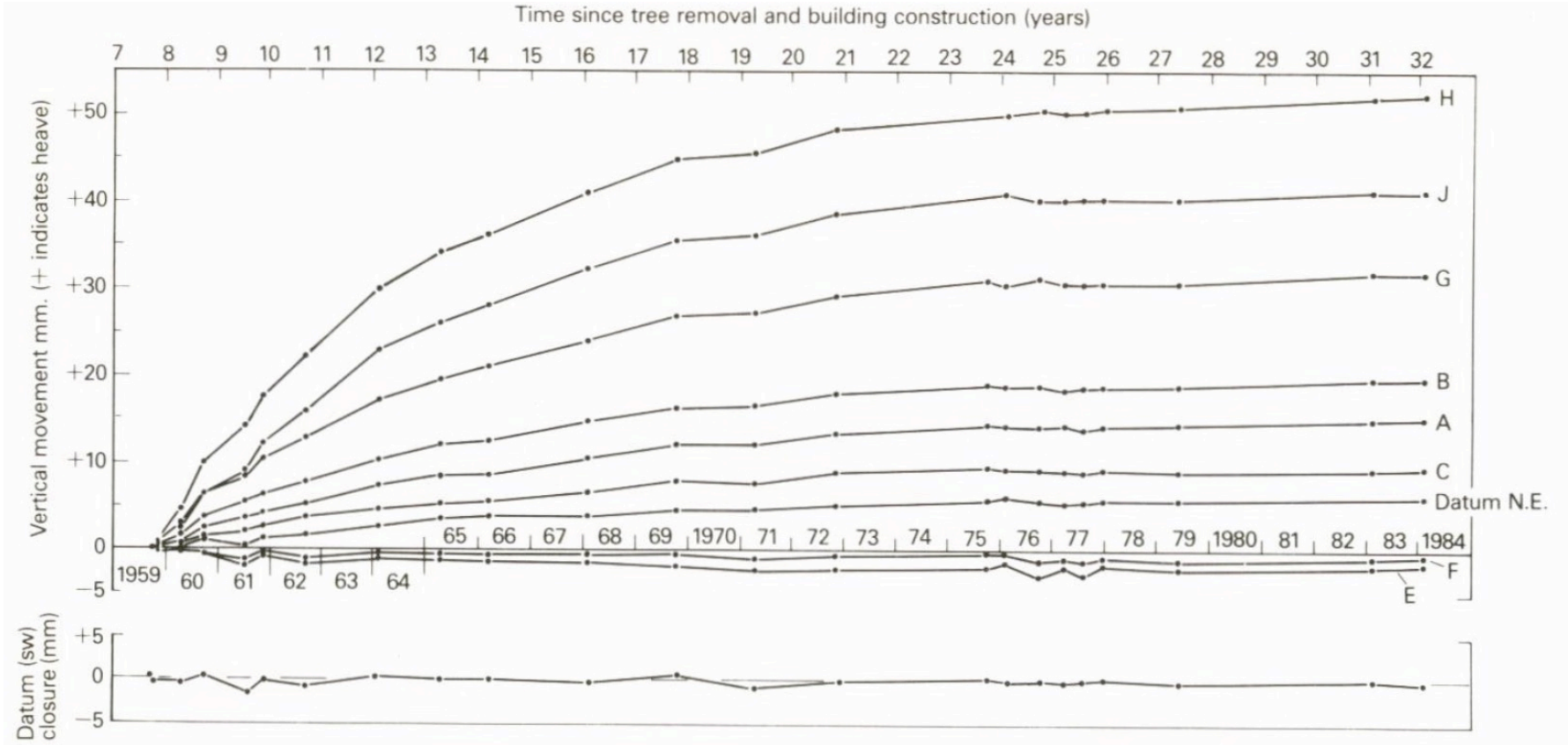


Fig. 5. Graphs of vertical movement recorded by precise levelling since inception of instrumentation in 1959

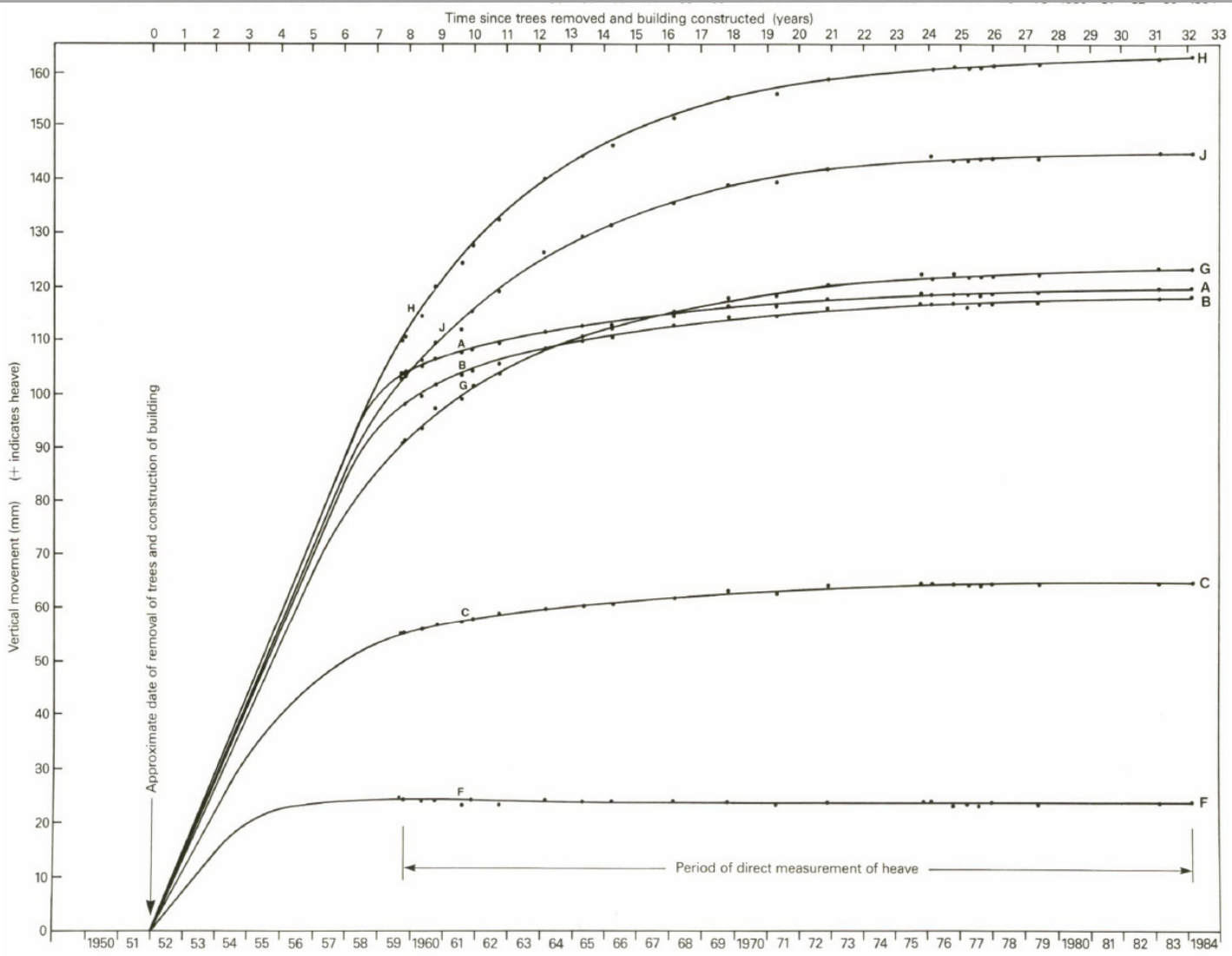
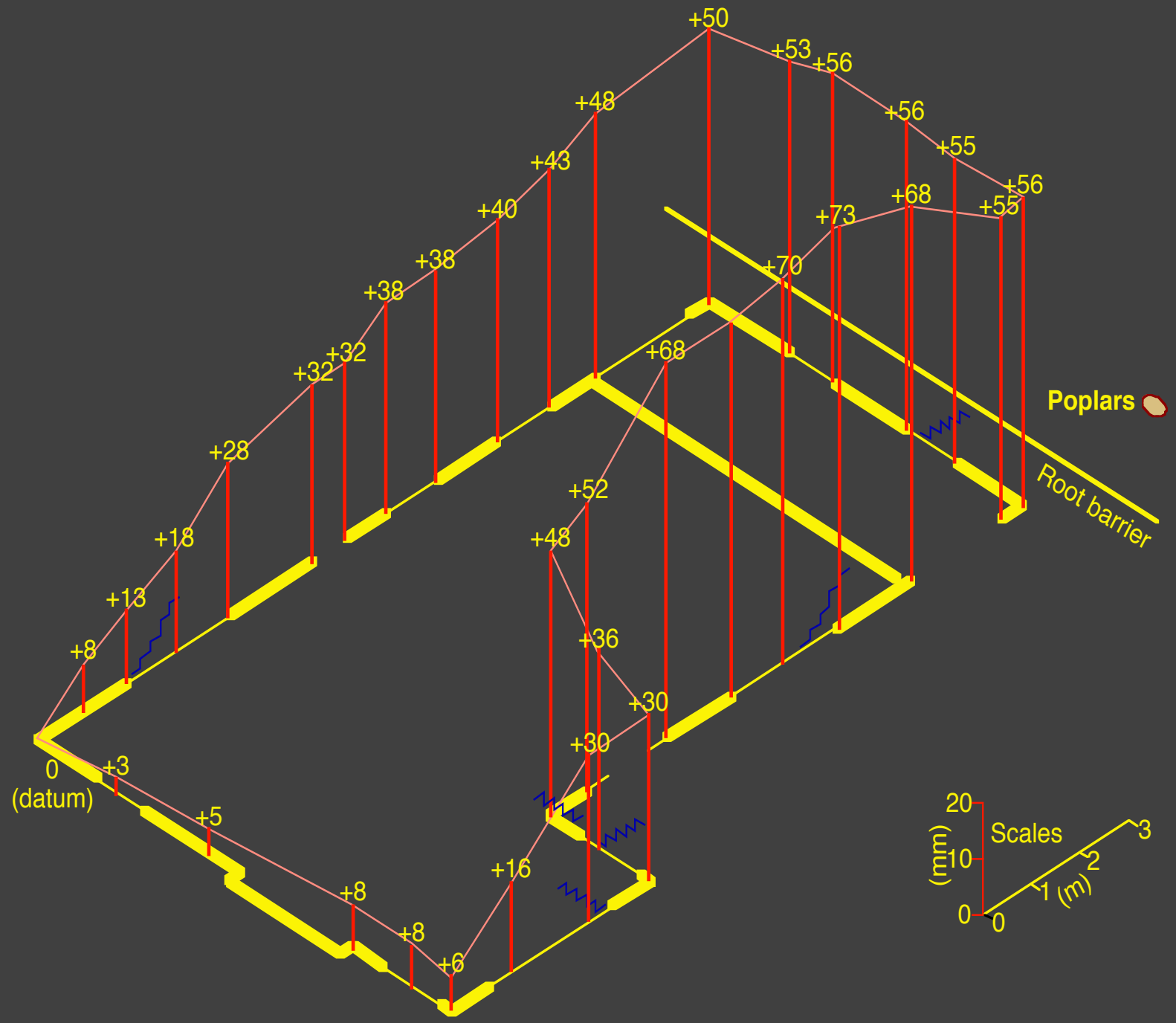
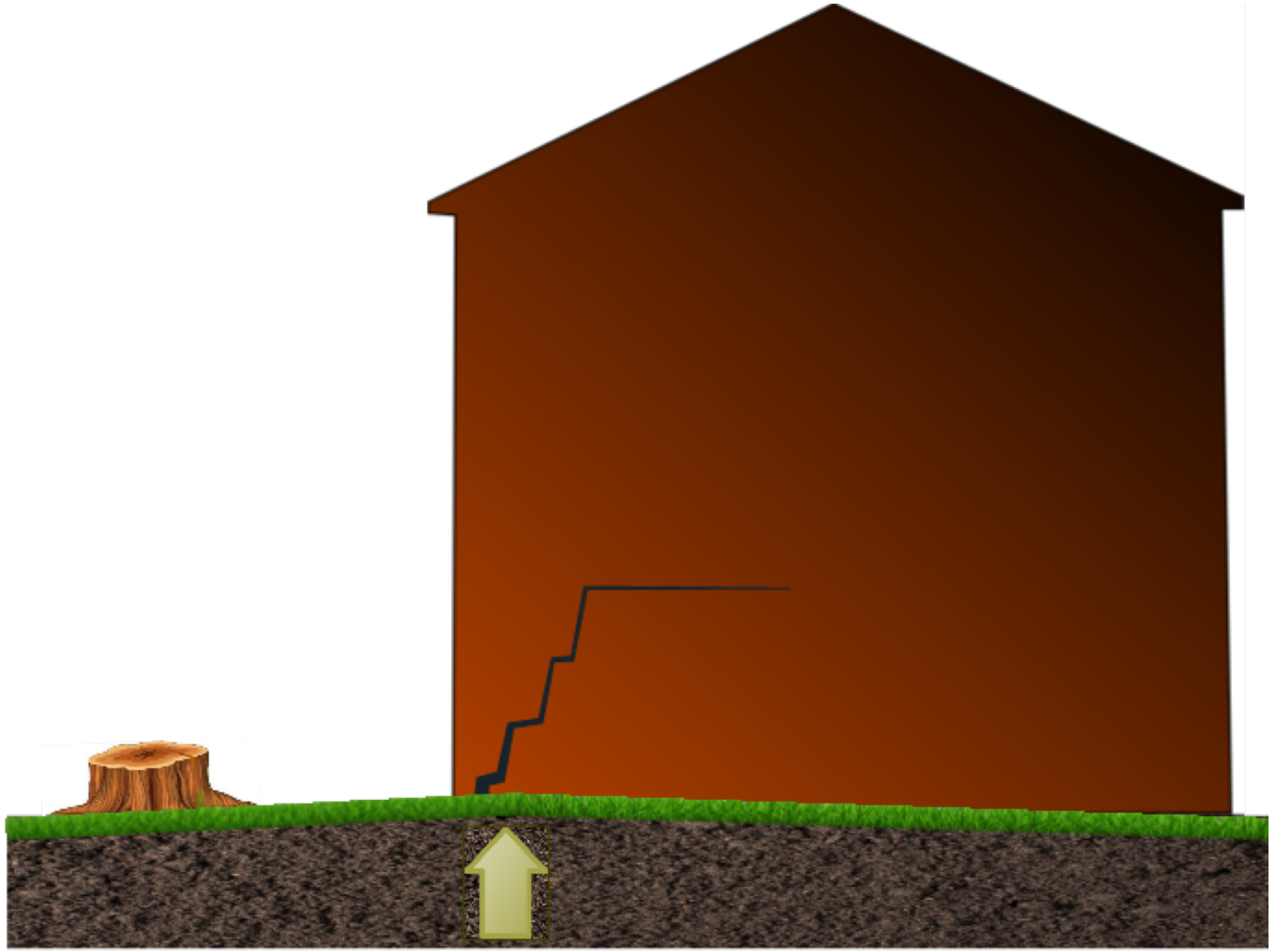


Fig. 7. Graphs of precise levelling observations of 1959-1984 with zeros offset by the amount of pre-1959 movement assumed from out-of-level of damp-proof course (DPC). Also monthly and annual rainfall


+50
+53
+56
+56
+55
+56
+48
+43
+40
+38
+38
+32
+32
+28
+18
+13
+8
0
(datum)
+3
+5
+8
+8
+6
+16
+30
+30
+36
+48
+52
+68
+70
+73
+68
+55
Poplars
Root barrier
Scales
20
10
0
(mm)
0
1
2
3
(m)

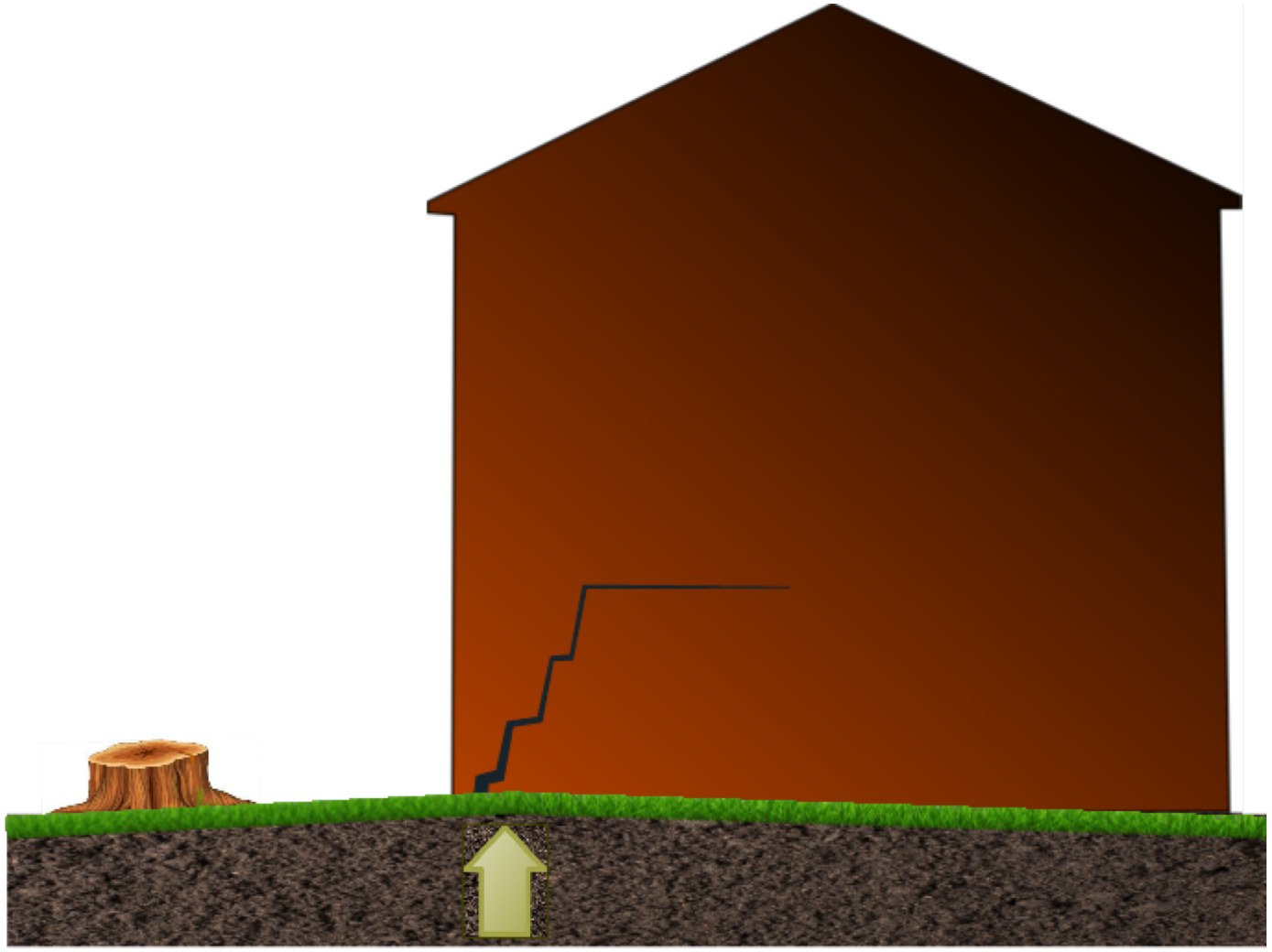
Conclusion 1

If a house is built on a site with a persistent soil moisture deficit where a tree has recently been felled there is a risk of heave.



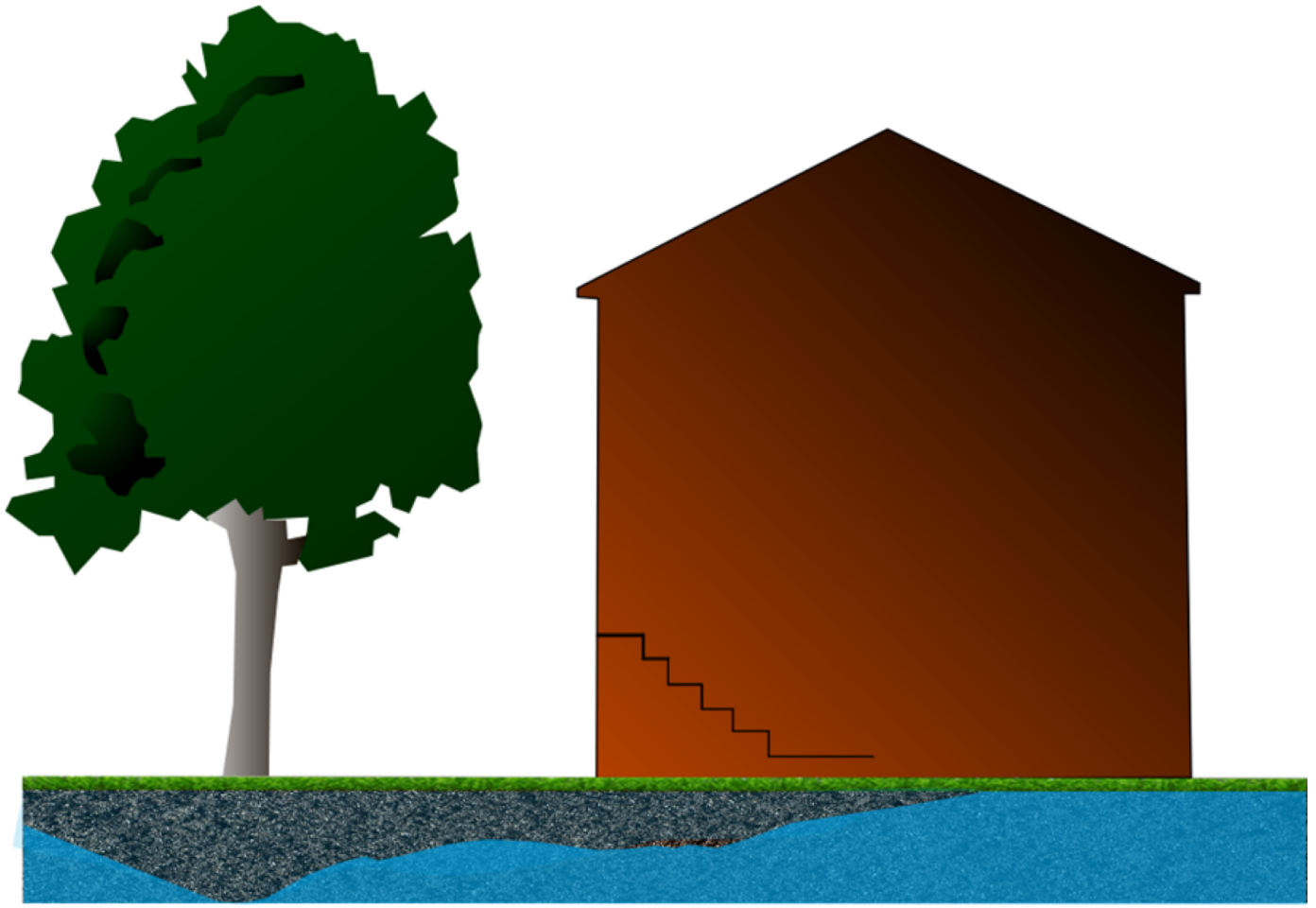
Conclusion 1

In that case the heave will manifest within 1 – 3 years



Conclusion 2

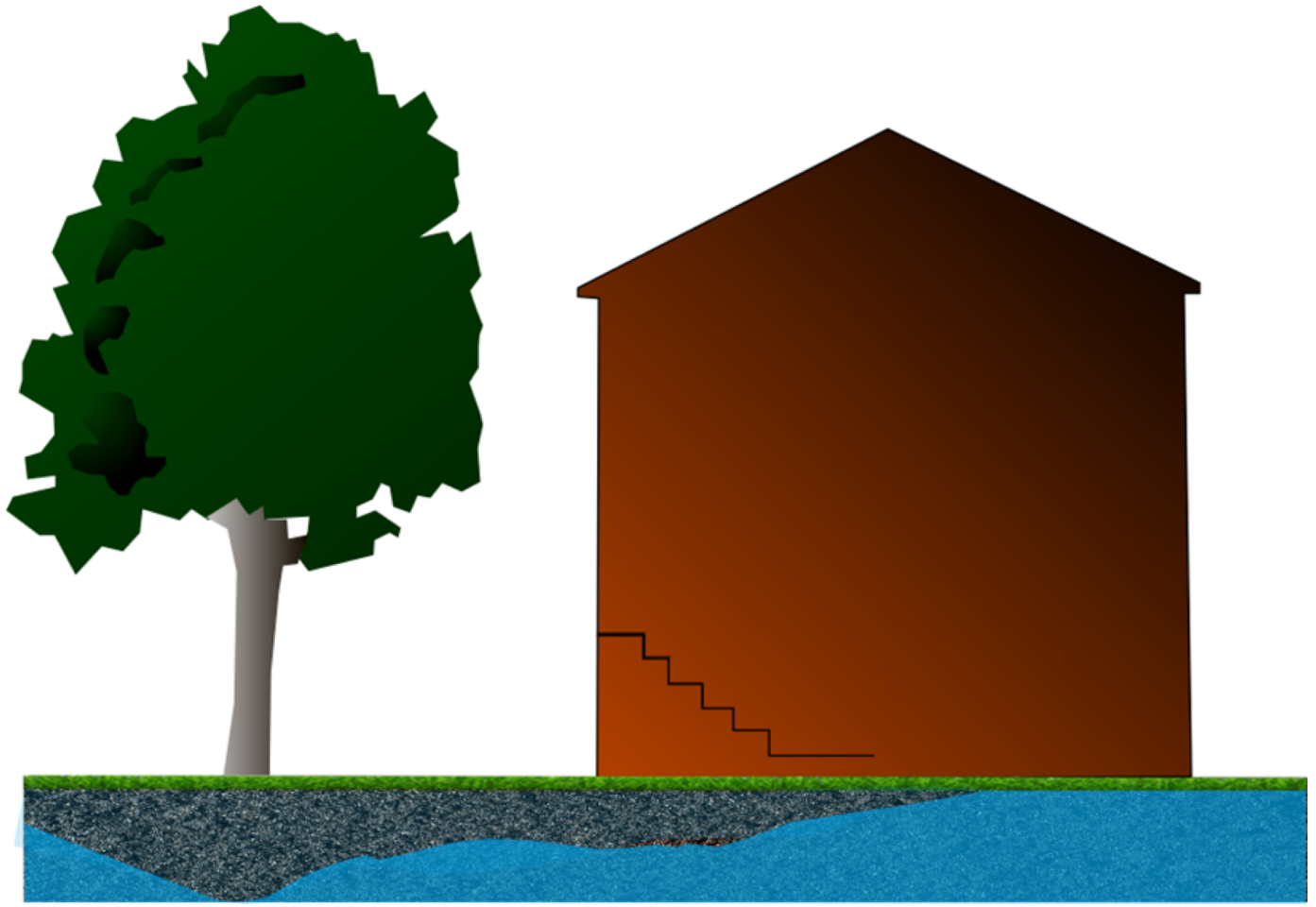
If a house is suffering from subsidence and a persistent soil moisture deficit has developed there is a risk of long term recovery if the tree is felled.



Conclusion 2

Underpin with anti-heave precautions.

Keep the tree



Conclusion 3

If there is no subsidence there can be no persistent soil moisture deficit.

Felling the tree will not result in heave.