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Radiohuseken in Stockholm

After reading various reports, looking at photos of the oak tree taken during the past six decades, hearing the observations made during evaluation and felling, and inspecting the remains of the tree, my conclusions about the health status (vitality and stability) of the Radiohuseken are:

1. The oak tree was dying and had gone into the last phase of its life, i.e. decline leading to eventual collapse due to wood decay fungi. It had passed the point of no return, and vitality could not have been restored by any natural or artificial means.
2. The dead stem and at least one of the severely decayed (but still living) stems posed a danger to their surroundings, as they could have dropped into the street. The still living, but decayed stems would most likely have failed during a heavy rain storm soon after flushing (maximum weight stress). Stem failure would not have been prevented by the presence of crown stabilizing wires.
3. The instability of the upper stems was confirmed by the felling crew's observations during removal of the cables securing the stems prior to felling. Apparently, even the dynamic crown wires were fully taut (also observed by Erik Solfjel, page 11 in report), indicating inability of the stems to hold their own weight. When the wires were cut, at least one of the stems sagged considerably (by almost half a meter), another sign of insufficient intrinsic strength and stability.
4. The risk of failure of the main stem or the root system existed, but it was not yet imminent. However, according to rot measurement at the underground base of the stem, done after felling and excavation around the stem, the decay

near the roots was extensive and more advanced than might have been expected from the fungus present (beef steak fungus, *Fistulina hepatica*).

5. The main causes of the deteriorating health of the oak were severe damages to the root system (due to road construction in the 1950ies and 60ies). But also bark damage on one side of the stem at the bottom of the well built around the trunk. The latter injury remained undetected until the tree had been felled and partly excavated. The recently dead stem was directly above this bark damage.

6. Both of the injuries meant that the availability of water and nutrients decreased due to root death and lack of transport in the stem part, where the bark and cambium had been removed in a long horizontal strip, meaning that no new year rings could be formed in this area.

7. The damage was irreversible, and the resulting loss of vitality became evident as crown symptoms within a decade (see 1968 photo). The death of one of the five original stems during the 1970'ies was another clear sign of the problem, and the recent death of another stem as well as smaller branches shows that the decline process continued.

8. Looking at the year ring width for the past 111 years, it appears that the annual diameter growth dropped from the time of road construction. From 1900 to 1950 ten years of growth approximately equalled 45 mm of diameter growth (just over 2 mm wide year rings). But from 1950 to 2011 ten years of growth equalled a 26 mm of diameter growth (just over 1 mm year rings). Even so, an average annual year ring width of 1 mm is still quite respectable for an oak of 350-450 years.

9. There were three different decay fungi present in the oak tree: sulphur polypore (*Laetiporus sulphureus*), beef steak fungus (*Fistulina hepatica*) and oak mazegill (*Daedalea quercina*). *F. hepatica* was found at the true base of the oak (below the wood deck) to the right of the large wound in the bark. *D. quercina* was present in one of the four stems, the stem with the large longitudinal wound (stem no 4 in Erik Solfjel's report). *L. sulphureus* also appeared on this stem, but in addition a large number of fruitbodies formed on the large wound, where the fifth stem had been removed. Especially *L. sulphureus* and *F. hepatica* decompose the heart wood, and oak trees may survive with internal decay for years, if they are able to keep the rot compartmentalized.

10. Sulphur polypore (*L. sulphureus*) was already present in the tree, when the first dead stem was removed in the 1970'ies, whereas the other two fungi may have arrived later, as the vitality of the oak decreased. In any case the oak had extensive decay in the main stem as well as in at least three of the four separate stems, as shown by the rot measurements and the actual decay visible after felling. *L. sulphureus* decay was most likely present from the stem base and far into the upper stems, although beef steak fungus (*F hepatica*) may have been dominant at the bottom of the tree.

11. The lack of vitality and the presence of wood decay fungi meant that the oak tree had high potential of becoming an increasing safety hazard within a very short time. This is because the rot will develop at an ever accelerating pace, when the vitality decreases, and the ability of the tree to resist the wood decomposers drops. Once a tree goes into the last phase of its life cycle, the deterioration may be rapid, if conditions are unfavourable for the tree.

12. Even if the danger from the four stems could have been dealt with by removing the dead stem and pruning the other stems, this would only have made the main problem worse. Pruning would have removed the twigs and branches with the most productive part of the crown, thus reducing amount of energy available to the tree, which would have meant further loss of vitality.

To sum up: Radiohuseken was destroyed by the vicious road construction carried out in the years before and after 1960. From that moment in time the tree was doomed, and nothing could have been done to save the oak. It is actually amazing that it has taken more than fifty years before the vitality of Radiohuseken finally deteriorated enough to make the presence of decay fungi a serious problem in relation to safety and survival.

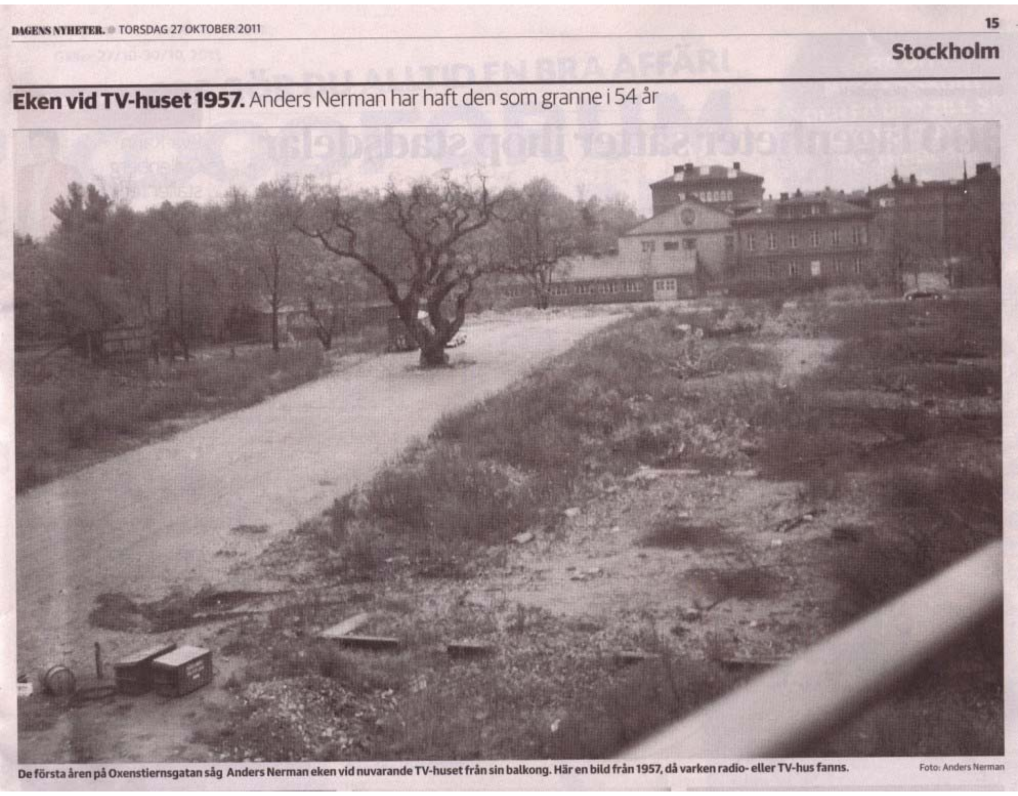
Once the problems of the oak had been observed and documented, it was the responsibility of the managers (Park och Stadsmiljö) to deal with the safety issues by reducing or removing the risk. Otherwise the city of Stockholm would have incurred liability for loss of life or any other damages caused by the predictable collapse of tree parts or the whole tree. Up till now the risk has been dealt with by monitoring the tree condition via visual inspection and rot detection equipment, and by crown reduction, removal of dead branches, and stabilizing wires. However, these measures were no longer sufficient, based on the development of decay and crown symptoms.

At the moment of felling, the tree was not yet an unacceptable risk, even though its vitality and stability was severely compromised. (If the risk of collapse had actually been imminent, criticism of the management for lack of action would have been in order.) There was a high probability that the oak would have developed into an acute hazard within the next 1-2 years, mainly relating to decay in and around the four stems dividing out from the main stem. Leaving the tree to decline, die, and collapse naturally, which would probably have happened within five or ten years, was not an option considering the location in a city road with continuous traffic.

The most important lesson to be learnt from the sad fate of Radiohuseken is that if we want large, beautiful trees in our cities, they need to have sufficient space and to be protected from construction work, especially in the root zone. Otherwise the life span of such trees may be much too short, and in some cases the trees may end up constituting an unacceptable danger to their surroundings due to lack of anchor roots or the presence of wood decay fungi.

Venlig hilsen

Iben M. Thomsen
Seniorrådgiver

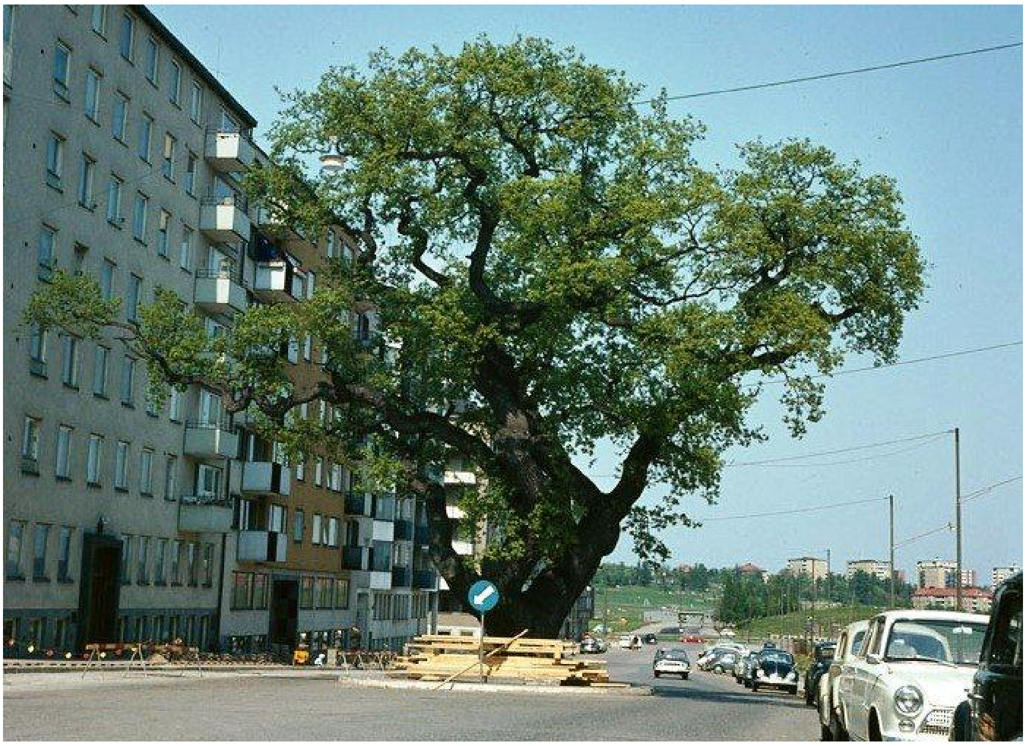

DAGENS NYHETER. TORSDAG 27 OKTOBER 2011 15

Stockholm

Eken vid TV-huset 1957. Anders Nerman har haft den som granne i 54 år

De första åren på Oxenstiernsgatan såg Anders Nerman eken vid nuvarande TV-huset från sin balkong. Här en bild från 1957, då varken radio- eller TV-hus fanns. Foto: Anders Nerman

1957 It looks like there has already been landfill done around the oak tree, because not much main stem is visible below the division into five large stems / branches. Root damage probably occurred to some extent, depending on the material used and how much compression had been done. Unfortunately nothing is known of the tree health prior to this time.



1963 Road construction seems to be almost finished. The tree crown is already thin, but still acceptable for an old oak. Presumably excavation around the buried tree stem and construction of the well with a wood deck at street level was done at this time. Damage to the main stem was probably from this time.

1968 Dieback of twigs has begun in several places, and the lowest side branch (arrow) is already dying. This branch was removed in the 1970'ies, when dead. The crown is thin, and the symptoms are in accordance with severe water and nutrient deficiency due to root death (uptake and transport problems).

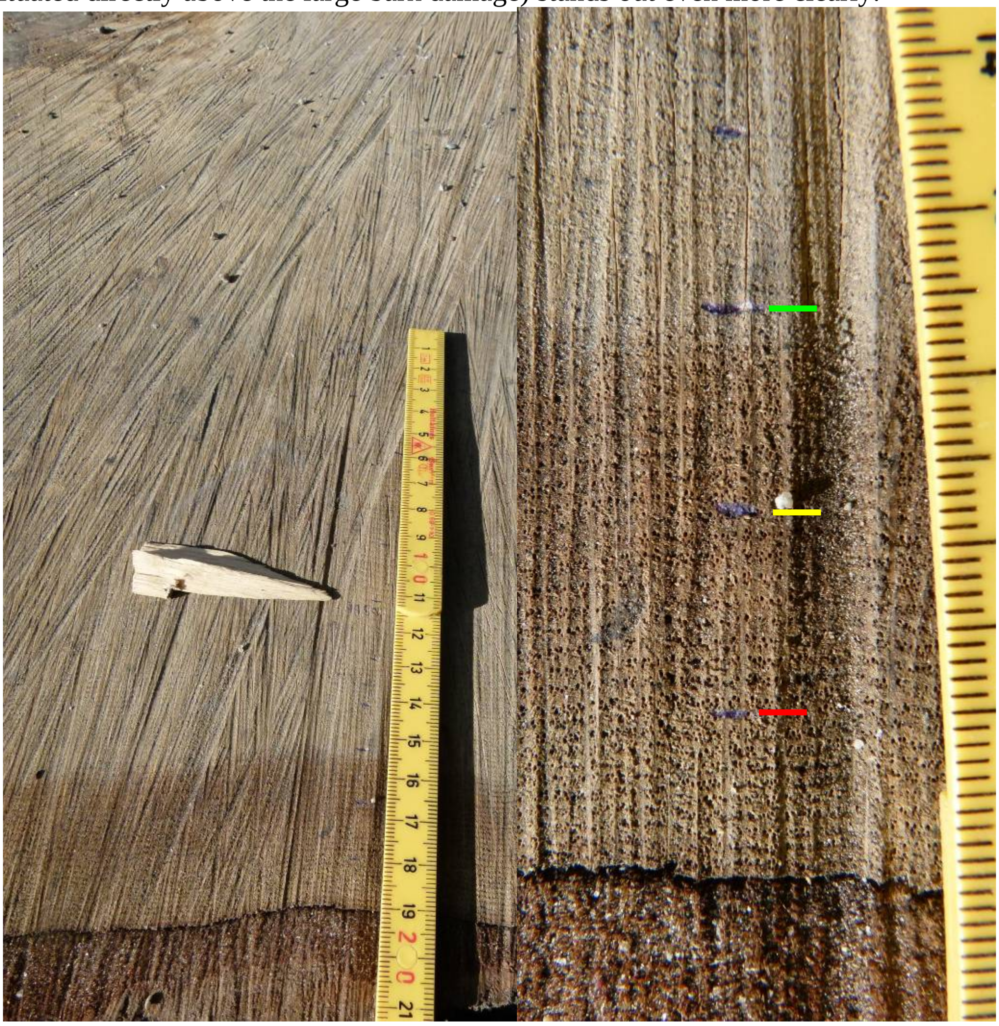
2003 October: after two dry hot summers in a row (2002 and 2003) crown dieback is even more pronounced, with newly dead twigs. Compare with 1963 to see how the crown has condensed to lumps of foliage. In spite of the continued decline the oak still has an acceptable crown, considering the damage to roots and stem (below the tree deck).

2010 July: Dense and dark green foliage gives the oak an appearance of good health and vitality when seen from this angle, but there is still twig dieback.

2011 July: One of the four remaining stems is dying, but the other stems have fairly good foliage in spite of scattered twig dieback. The overall size of the crown is smaller than in 2003, due to crown pruning, mainly of dead parts.

2011 October: Naturally the crown is expected to look thinner in autumn, but not before the leaves have turned brown. Compare with the crown density in October 2003. July-August 2003 were dry and warm, and although July 2011 was also dry in Stockholm, and the summer of 2011 was generally warm (according to smhi.se), August 2011 had plenty of rain. Overall tree vitality appears lower in October 2011 than in October 2003 even though weather conditions were less favourable in 2002-2003 compared to 2010-2011.

2011 November: By now autumn colour has appeared, the dead stem (which is situated directly above the large bark damage) stands out even more clearly.



Estimating growth for the past 111 years. The white arrow on the left point to the year 1950, and the end of the centimetre rule is at year 1900. Accuracy is probably ± 3 years. On the right, growth of recent years can be seen, and in most cases a year ring is about 1 mm wide. This is fairly good growth considering the age and condition of the oak. The red line is at year 2000, yellow line at 1990 and green line at year 1980. There seems to be a tendency to less growth in the years from 2000-2011 compared to the two earlier decades. The decrease is not in itself distinct enough to be proof of declining vigour of the oak, but it does fit the crown decline visible in the same period.

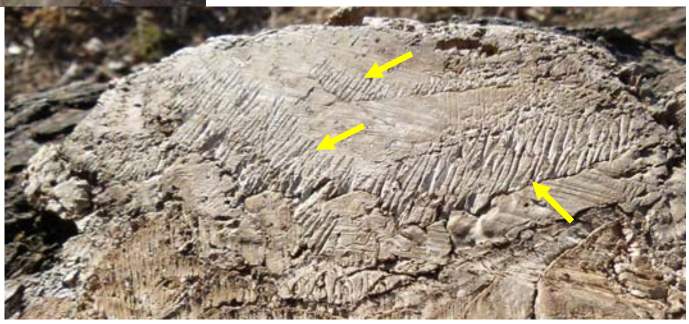
Sulphur polypore (*Laetiporus sulphureus*) on the stem with the large wound in 2010.

There are no earlier records of fruitbodies of *L. sulphureus*, but the fungus was present in the tree at the time the dead stem was removed in the late 1970'ies, because the metal plate on the pruning wound covered rot, next to which fruitbodies appeared in 2001 (below).

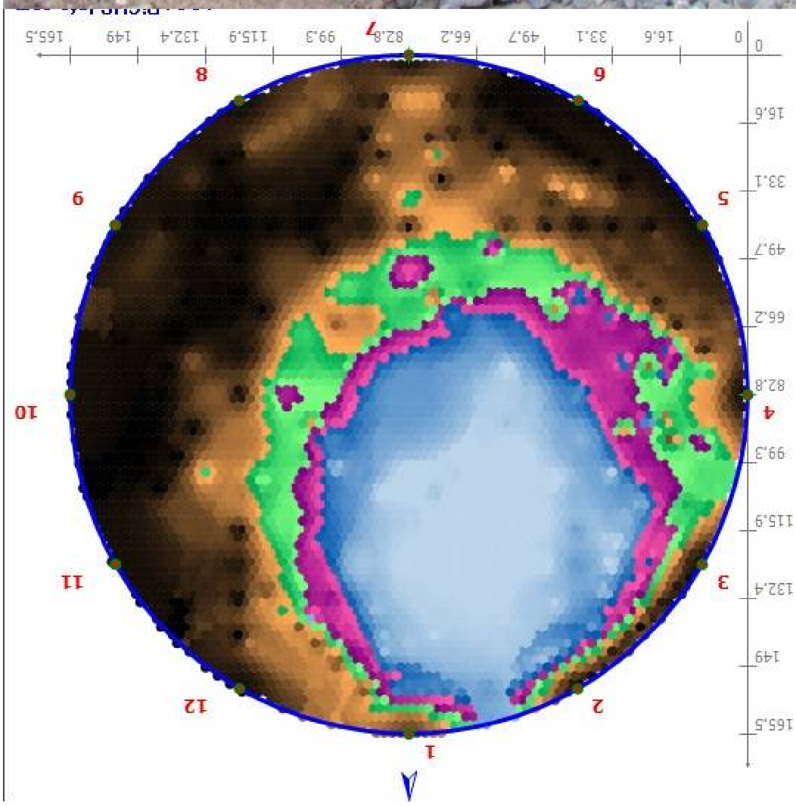
Sulphur polypore (*Laetiporus sulphureus*) fruitbodies on the large old pruning wound and oak mazegill (*Daedalea quercina*) on the stem with the large wound in 2011.

Actually, at least one old *D. quercina* fruitbody can be seen in the wound on the picture from 2010 (arrow above), so fruitbodies of this fungus must have been present since 2009 at least.

The identity of *D. quercina* was only certain after the felling, when the mazelike pore layer could be seen close up (arrows).

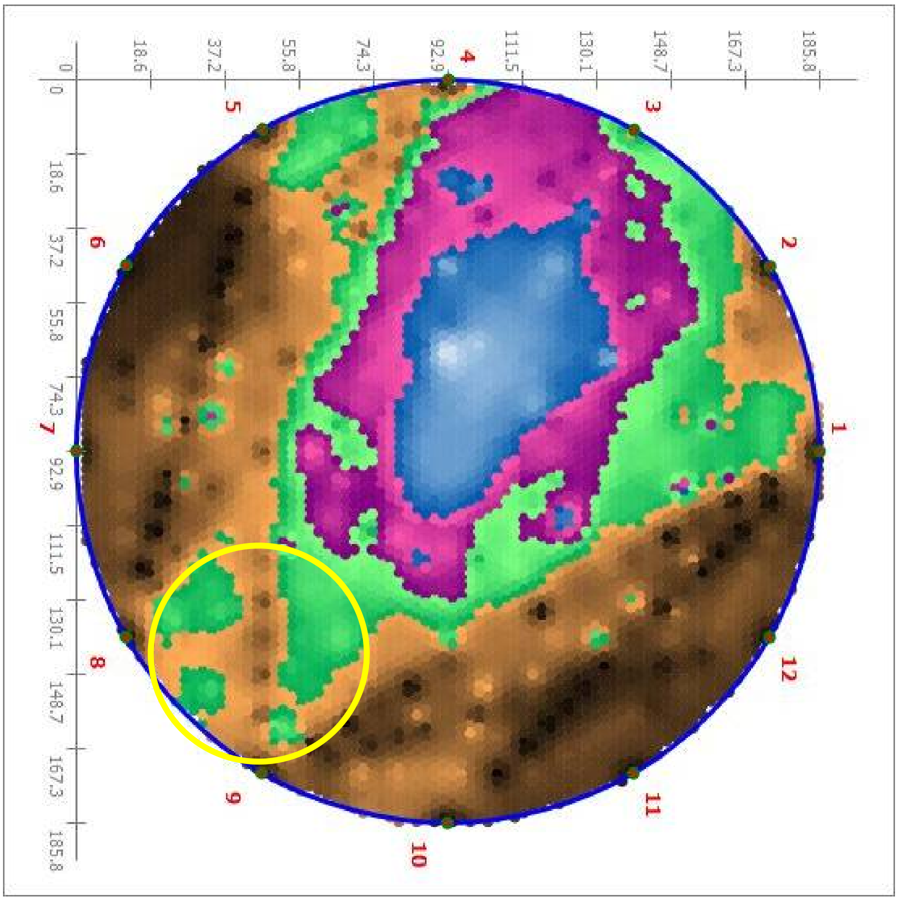


Top: Looking into the well, which has been excavated on one side. Bottom: Large bark damage to the main stem, this damage probably dates from the time of construction of the deep well around the base of the tree. The precise time of wounding can only be determined by cutting the stump at this point and counting year rings, but apparently there has not been any work done in the well after construction. The well was almost 5 meters deep, where the excavation stopped and there were still no signs of the roots. Fruitbodies of beef steak fungus (*Fistulina hepatica*) was found to the right of this wound (arrow).

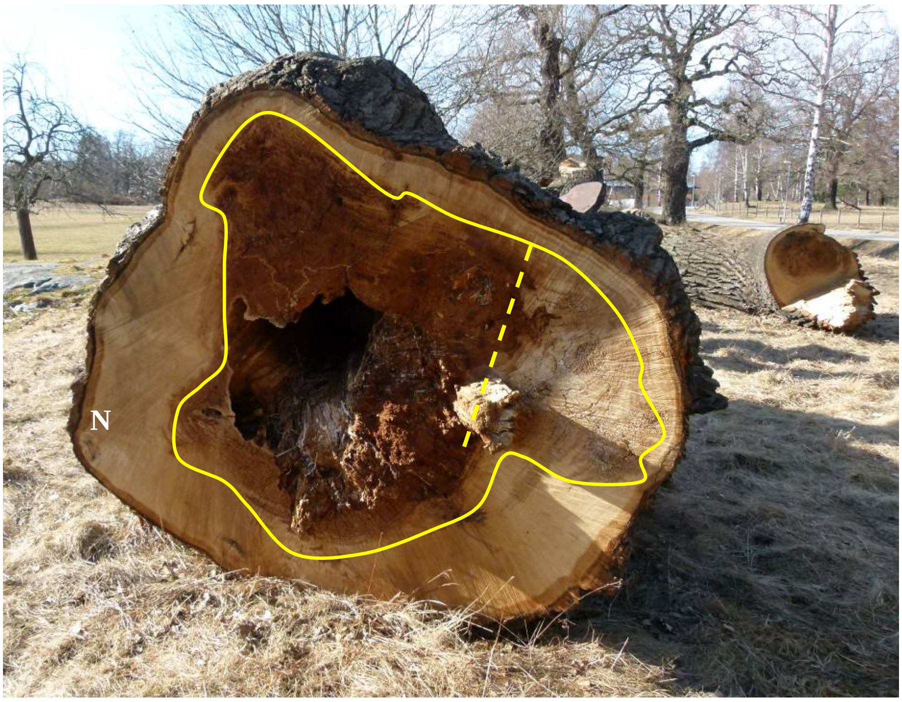


Rot measurement at the base of the main stem in 2011 at the bottom of the excavation. No 1 is towards north and approximately in the middle of the large wound. The rot here is probably mainly due to *F. hepatica*, but *L. suphureus* could also be involved. The amount of rot is surprisingly large and advanced (blue area).

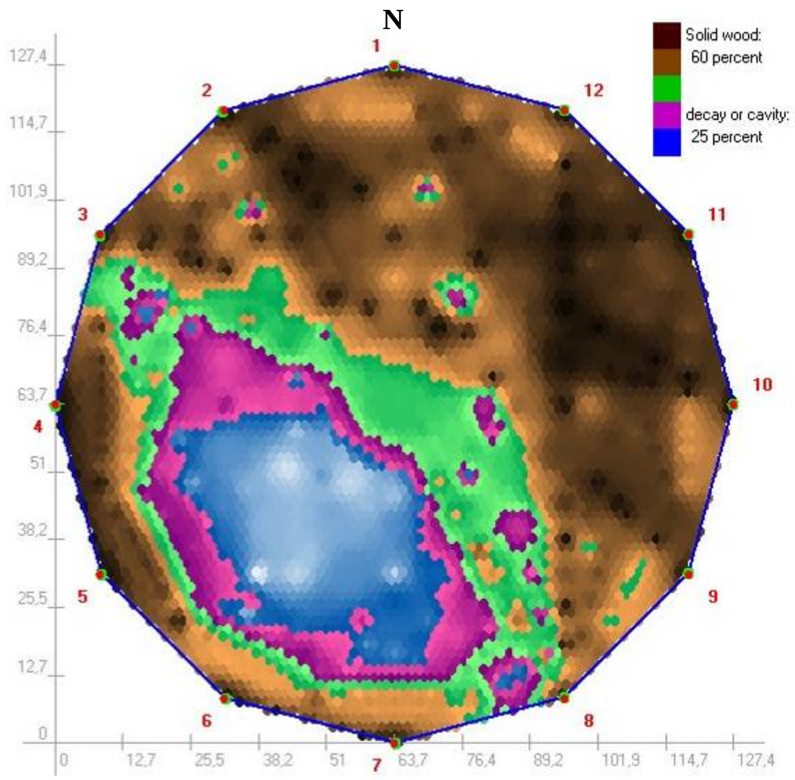
Actual decay inside the main stem in 2011, this corresponds fairly well to the earlier rot measurement shown below, although there is less rot in the area marked by a yellow circle than estimated in the computer image. Both computer image and photo are seen from the same direction (from above), so the result can be compared directly.



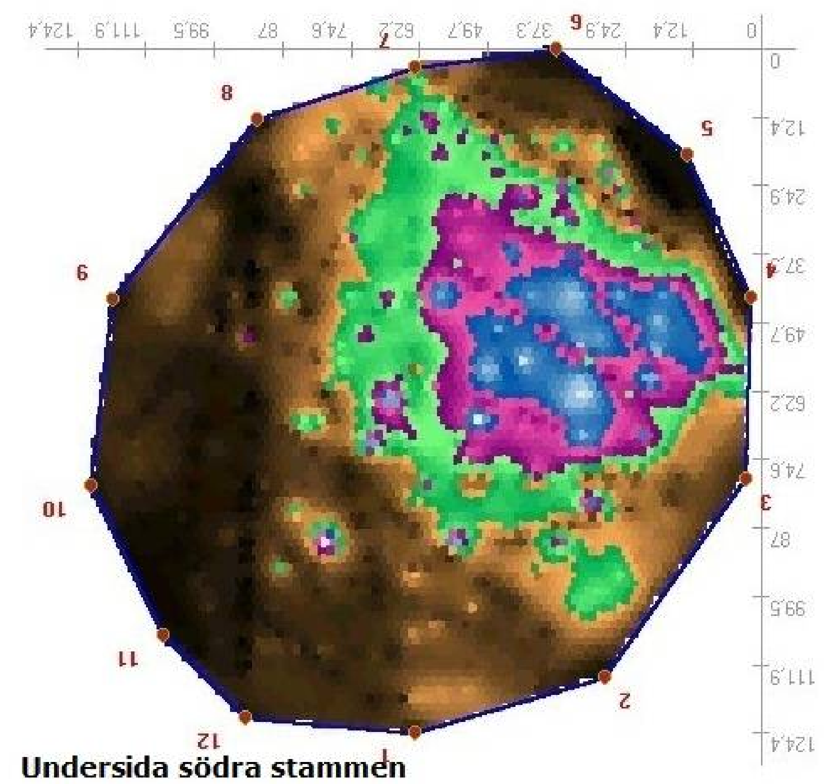
Rot measurement of the main stem in 2003, just above the wood deck. 1 is usually set towards north. The rot shown by purple and blue is quite accurate compared to actual rot extent in 2011 (as seen above after felling).



Main stem cross section just below the division point at 2,5 meters during inspection of remains in March 2012. The extent of decay is quite clear (demarcated by yellow line). The dotted line is the border between two overlapping decay columns, the central dark brown rot caused by sulphur polypore (*Laetiporus sulphureus*), whereas the lighter brown rot to the right is most likely oak mazegill (*Daedalea quercina*).



Compare with rot measurements from 2007, taken 180 cm above the wood deck, it is clear that the extent and severity of decay in the upper part of the main stem was fairly accurately estimated. North is marked on both images, the photo is seen from below, but the computer image is from above. This makes direct comparison slightly difficult, but the main abnormal area (blue) in the computer image corresponds to the upper half of the decay in the photo.



Rot measurement of the south stem in 2003, this is the stem with a long open wound. The upper part of the stem is decayed, compare with actual rot in 2011, see below.

Actual decay inside the south stem in 2011, this corresponds fairly well to the earlier rot measurement, but the amount of decay in the heart wood has increased as may be expected. Note that the main (brown) part of the rot is probably mostly due to sulphur polypore (*Laetiporus sulphureus*), whereas the lighter (grey brown) rot just below the wound surface is caused by oak mazegill (*Daedalea quercina*).

Examples of central heartwood decay in upper stems, the old open wound on the top picture could very well be the original entry point for sulphur polypore (*Laetiporus sulphureus*), as the decay is typical for this fungus.