Visual Assessment of Vitality Concentrations in Mature Trees As a Guide to Specifying & Implementing Crown Reduction

Julian Forbes-Laird
BA(Hons), MICFor, MEWI, M.Arbor.A, Dip.Arb.(RFS)
Registered Consultant of the Arboricultural Association
Director & Principal Consultant, FLAC

Structural failure in unmanaged trees

- Major collapses are much more common than windthrow and can severely weaken the tree
- They often preclude the remainder from viable retention
- In the vast number of cases, timely inspection and remedial action can prevent structural failure
- Inspection must be undertaken by a competent assessor: given the specialist nature of the subject matter, I recommend NQF level 6 arb qualification

Observations

Maiden tree with full crown

Historic failure compromising main crown union (note daylight visible through base of main leader)

Progressive fibre buckling present on compression side of fork (red arrow)

Overdeveloped epicormic branching creates notch stress at critical load point (yellow arrow)

Timely inspection and intervention could prevent inevitable failure

Remedial action

- In general, remedial action to prevent major failure = crown reduction
- In general, this should seek to be a one-off treatment, though it can be phased if appropriate (physiological and amenity considerations)
- Crown reduction is not suitable for all trees: tree specific assessment required: above all, subject must have adequate vitality to survive
- If not, then reduction can be used to render the structure stable as an invertebrate habitat

Limitations

- This guidance is not intended to be universally applicable and in many cases it would be inappropriate
- As with all other aspects of managing mature and historic trees, individual assessment by a competent person is essential
- The evidence I have for the phenomenon described is chiefly anecdotal
- The observations are currently restricted to *Acer pseudoplatanus*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Quercus robur*
- Only the latter will be discussed today
- Many trees do not followed the pattern, usually due to ill health

Fallacy

- It is often suggested that minor crown reduction is best for the tree, and that heavy reductions are simply bad practice
- Thus where reduction is necessary, it should be kept to the minimum necessary to achieve the objective
- This makes the assumption that the tree under consideration is seeking to maintain a constant crown volume: it fails to consider the tree from the tree's perspective

Vitality

- The maturing tree expands its crown towards a maximum size, according to its precise physiological, ecological and microenvironmental circumstances
- The further towards the extremities of a tree, the more ephemeral and thus sacrificial are its structures
- E.g. annual renewal of leaves (deciduous spp.) and fine roots
- The persistence of shoots, twigs, branches, limbs and scaffolds varies with their relative importance to the tree and ease of replacement
- However, only rarely are elements of a tree so invested with resources that they become physiologically indispensable
- Trees frequently cope with the loss of even massive parts by preserving a degree of vascular independence, and by utilising flexible carbohydrate transportation, management & storage strategies
- The ageing tree utilises these abilities to develop lower crown vitality concentrations as an insurance policy against upper crown problems (structural vulnerability, water transport difficulties and parasitism)
- The net result is **retrenchment**

A short guide to retrenchment

- Three factors can act either alone or in combination to initiate the processes of retrenchment:
  1. During the maximum crown size state, the scaffold branches become increasingly parasitic on the roots, contributing less & less to the whole plant, leading to systemic disadvantage
  2. The tree suffers significant crown volume loss through structural failure/storm damage
  3. Biotic or abiotic disorders of the root system prevent the continued support of the full crown

- In all of these cases, the tree is governed by the imperative to preserve the root:shoot ratio, and either acts to preserve/restore this or enters into terminal decline

Why and when to consider heavy reduction – From the tree's perspective

Thesis

- Disruption of the root:shoot ratio occurs when the mutuality of this relationship breaks down: this is a biologically intolerable situation
- In the retrenchment scenario, the tree works to re-establish a root:shoot balance based on a lower or inner crown that is both vascularly and structurally simplified and from which it can regrow according to its remaining/ongoing opportunities
- Resources are diverted from supporting the outer crown towards retrenchment, such that the outer crown declines
- The inner crown represents the future, the outer represents the past
- With *Quercus robur*, an intermediate middle crown frequently develops during the transition process
- *(Fraxinus excelsior* develops a very low concentration arising from the stem at ca. 3-6m AGL, probably due to co-evolution with the decay fungus *Inonotus hispidus)*
- Once this process is under way, the carefully targeted removal of the outer crown will not represent a net energy cost to the tree beyond wound management
- If a need is identified to reduce a tree and there is an inner crown apparent, this should be the targeted reduction point
- This may appear somewhat akin to topping, but it is likely to be the best outcome for the tree

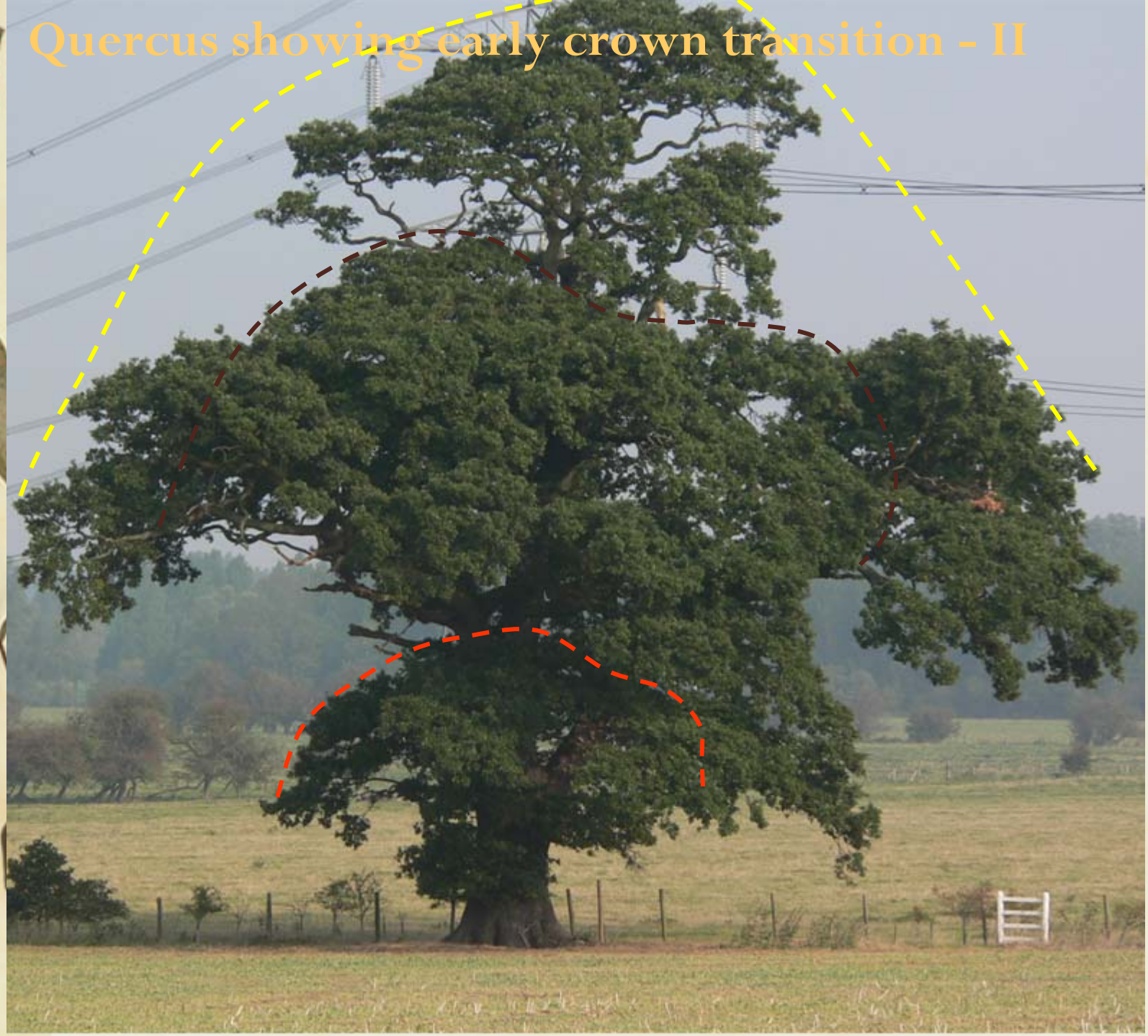
BUT…

Don’t take my word for it: look at the trees

Quercus showing differing stages of retrenchment

Quercus showing early crown transition - I

Quercus showing early crown transition - II

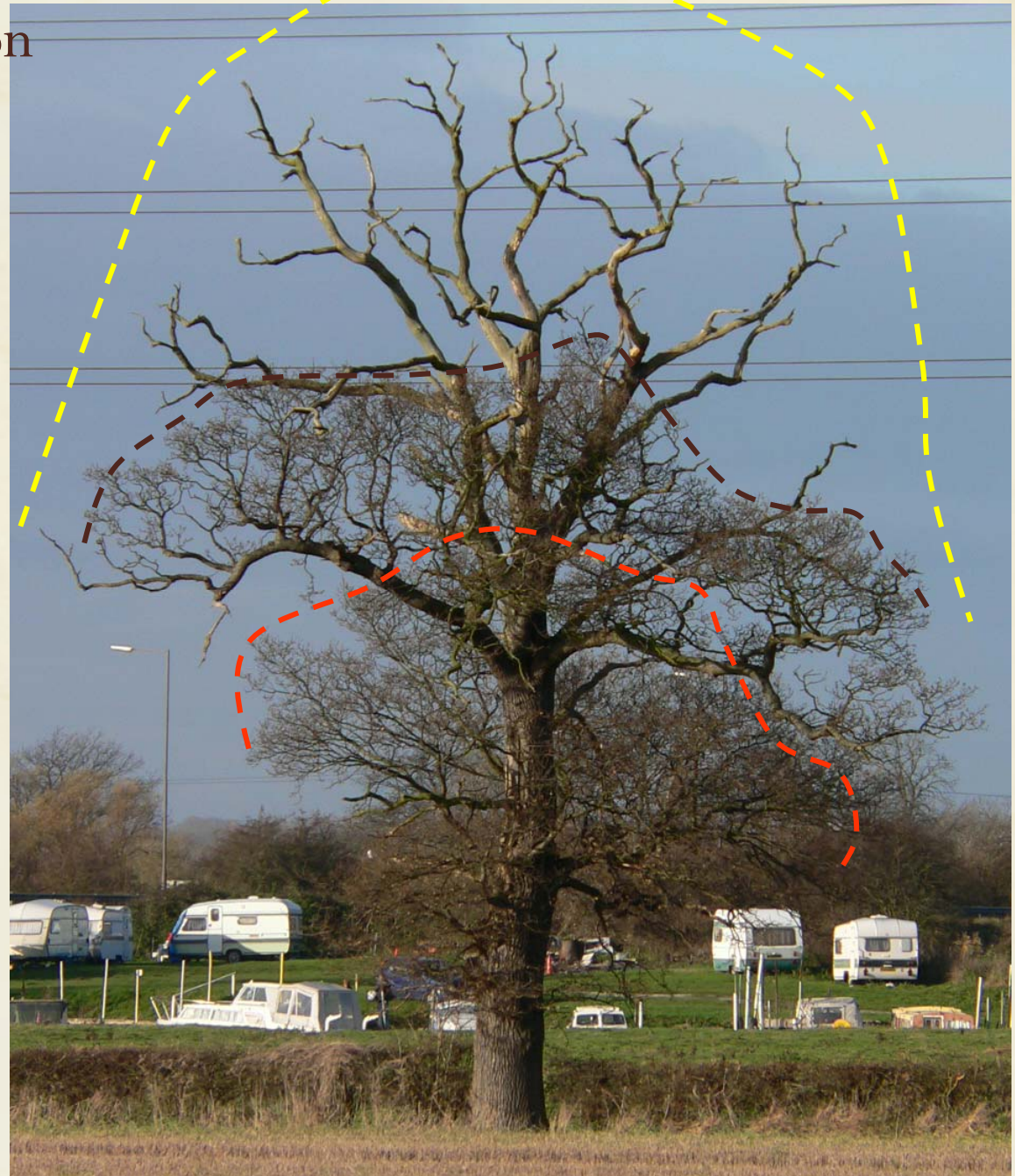


Quercus with crown transition well advanced

Quercus having nearly completed retrenchment

Quercus showing transitional crown development following storm damage

Quercus showing successful transition to lower crown vitality concentration



Matching pair!

Veteran oaks at Chatsworth

- As you will have seen during yesterday's field trip, Chatsworth boasts a considerable population of veteran oak trees
- Many are sufficiently ancient to have completed crown transition (= retrenchment)
- Many have suffered catastrophic failure and / or lightning damage
- In such cases, this was probably the initiator for retrenchment
- The trees shown have generally had aerial deadwood removed

Conclusions

The morphological and physiological condition of the tree should be considered as an integral part of the crown reduction decision-making process

Where crown reduction is deemed necessary:

- Trees approaching or at the maximum crown size state, and showing an even vitality distribution towards the crown extremity, should be reduced based on the minimum necessary to meet the objective
- Trees with declining crown extremities (basipetal mortality) and a general absence of lower crown vitality concentrations are probably in systemic decline
- Such trees should either be reduced based on the minimum intervention necessary to meet the objective, targeting such vitality as is available, or stabilised as a habitat structure, or replaced, depending on the context and on considerations of biodiversity
- Trees showing clearly identifiable lower crown vitality concentrations should be pruned back to these, even if this appears to equate to topping
- For *Quercus robur*, reduction to a middle crown (if present) might also be appropriate providing it achieved the objective of stabilising the tree
- In both latter cases, consideration could be given to stripping back and retaining scaffolds as deadwood habitat, mimicking the form of the unmanaged tree

By anticipating a tree's future intentions, we can manage its retrenchment, thereby allowing the retention of trees that might otherwise be subjected to ineffectual pruning treatments or premature removal


Thank you!