Stating the Obvious:

The importance of an Open Grown Tree – from Acorn to Ancient

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Old, open grown trees in open, park-like landscapes are an essential component of the Vera (2000) hypothesis and have provided biological continuity for visible and invisible, old growth biodiversity down the centuries. As early as the 1960s the late distinguished ecologist Francis Rose, from his specialist knowledge of lichens, was expressing doubts (pers comm.) about the concept that dense, continuous, closed canopy forests extended across the whole of northern Europe. The importance and conservation of the open grown tree as natural, cultural and literary icons (Spector et al, 2006) is now gaining recognition across the world. In Australia, for example, the best working definition of woodland is 'ecosystems that contain widely spaced trees with their crowns not touching' (Lindenmayer et al, 2005). Bergman (2006) emphasises the importance of open grown oaks in conservation of their biodiversity in Swedish archipelagos.

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Across Europe, north of the Mediterranean region, these open landscapes have been extensively replaced by dense canopy forests. That open grown and often ageing parkland and hedgerow trees remain in the UK in such numbers is therefore one of our most important contributions to the biodiversity of Europe.

This article is an attempt to illustrate the importance of open grown trees for biodiversity. Initially there was no intention to make comparisons between the two extreme forms of tree i.e. the open grown form versus the forest form tree of a similar age, especially because of the vast range of conditions affecting their growth. However in preparing the article it became clear that there might be some interesting comparisons to be drawn between the two forms at either end of the spectrum. The challenge has been in the exercise of setting out and describing some of the vast array of habitats provided on and within a single tree which are an integral part of the co-evolutionary relationships.

It is very clear today that our ancestors discovered the benefits of the open grown tree and the evidence is all around us today in the form of our fruit and nut orchards and fields full of shrub and soft fruits. Even cabbages benefit from being individually spaced. This knowledge probably extended back to hunter gatherers, when man would have found that open grown trees and shrubs could produce vastly more fruit than their equivalent in a grove or shady woodland. Naturally before fruit comes flowers and pollen and it therefore begs the question whether the analysis of pollen diagrams has recognised the quantity and mobility of pollen production from an open grown tree compared with the smaller, less productive crowns and reduced mobility of pollen from woodland and close grown trees?

An open grown tree is a tree that has grown virtually all its life without competition from other trees. It usually has a short, squat, fat trunk with a very large diameter, spreading limbs of which some grow out almost horizontally. They generally have a large dome-like crown compared with a forest form tree that is tall with a narrow trunk and a small crown. The forest form tree may often retain dead limbs below the crown (depending on species and growing conditions) which have died primarily through competition for light from the canopy and that of it's of neighbouring trees. The degree to which the tree is a light demanding or shade tolerant species will also have some influence on its growth form especially where it is influenced by surrounding trees. Per unit area, the mass and diversity of canopy in woodland and crown might in many instances be very similar. However per tree, the production of leaves and roots will be far greater in the open grown form. The volume of wood in the trunk of a forest form tree might be greater than the trunk of an open grown tree of the same age but the open grown tree will have a greater volume of wood overall, much of which is in its large spreading limbs. Therefore an open grown tree compared with a tree of similar age growing in confined woodland conditions will have a far greater diversity of organisms and a greater biomass production.

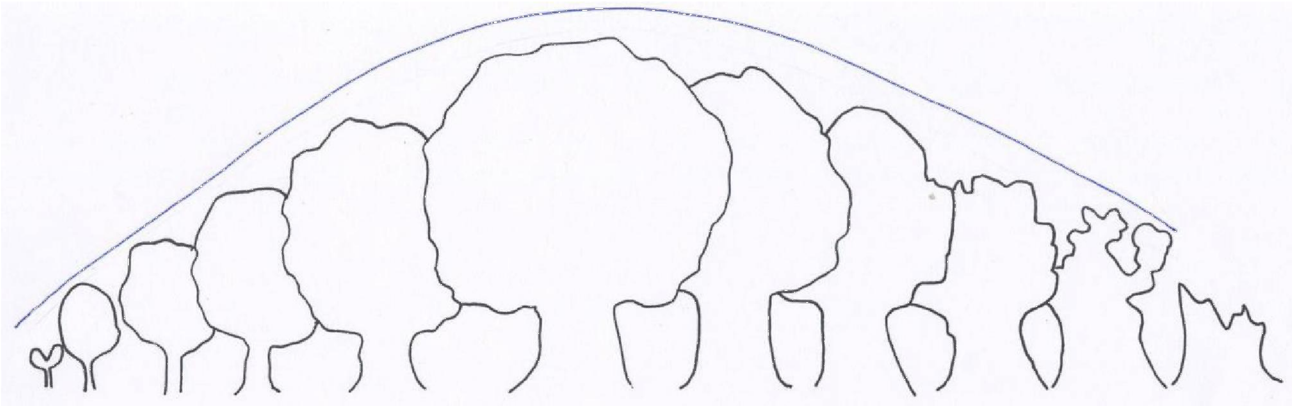

Fig 1. Sequential changes of the crown area/volume and trunk girth/volume of an individual open grown oak. Overall time span could be up to 500 years and might be up to 1000 years.

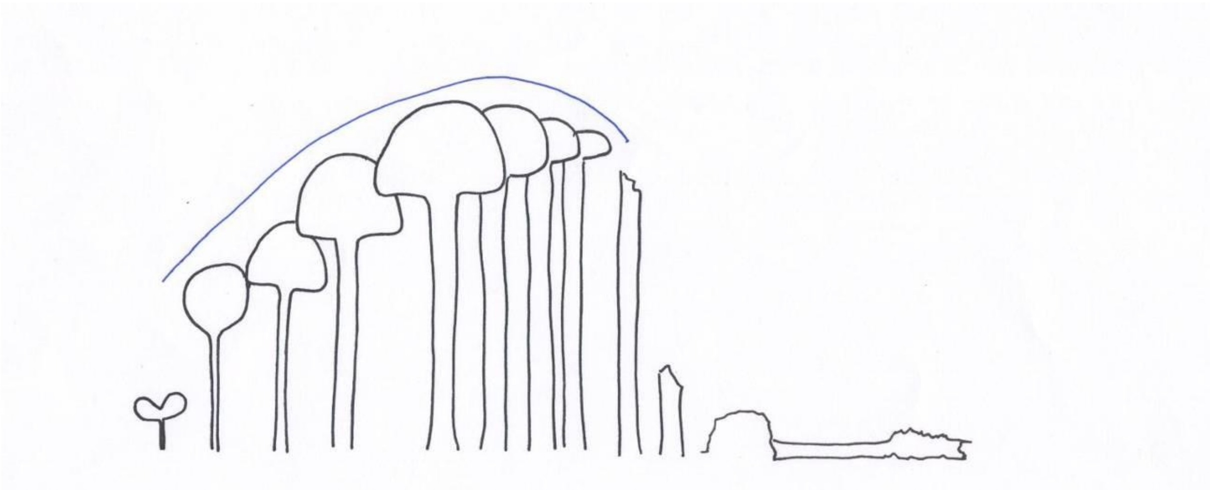

Fig 2. Sequential changes of the crown area and trunk girth of forest form trees. Overall time span in the case of oak could be less than 400 years and in the case of beech between 200-300 years.

The dome of an open grown tree is perhaps the most efficient shape for collecting energy and the greater the leaf area the greater the photosynthesis. The root system below ground must equate proportionately to the crown above ground. An open grown tree has little or no competition whereas woodland trees face constant stress from neighbours and consequently have shorter lives. The former may therefore be productive and therefore providing habitat for as much as several centuries longer.

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Underground it is very difficult to assess the extent and volume of any individual root system. However there are some examples to be found. The Ancient Tree Forum traced roots from an ancient open grown oak in a recently cultivated and destroyed ancient grassland sward on a National Trust property. The roots were still 2.5 cm in diameter over 50m from the trunk of the tree. There are also good examples showing the extent of exposed roots; beech trees that are growing on steep banks along old sunken lanes or quarries; granny pines on eroded river banks and hillsides; and ash appears to regularly produce extremely large diameter roots several metres in length just on the surface. Usually the extent of the root area is much greater than the area of the crown and sometimes the volume of the roots maybe greater than the crown. The majority of the roots can be found in the top 30cms of the soil, although there are examples of roots down to 9m (G. Pasola pers comm.). Even in the semi arid mountainous region of northern Portugal, with regular summer temperatures for 3 months of up to 40 c, there are substantial areas of beech woodland and broadleaved wood pasture with ancient open grown oaks (said to have been retained as shade trees for shepherds). To survive in these hostile growing conditions it's reasonable to assume that from the time of their germination these trees have responded to these conditions and put roots deep into the soil and rock in search of a guaranteed supply of ground water. Roots are thought to extend out 1.5 to 2.5 times the radius of the canopy ie well beyond the drip line, from the limited research that has been undertaken.

One also needs to take account of essential mycorrhizal associations (Merryweather 2001) They may extend over very large areas and can be interconnected with other trees and even different species of trees and plants. These complex relationships can be ever changing and are now increasingly being recognised for their importance in natural ecosystems.

Perhaps a tree's roots can be likened to an inverted, much flattened tree. The 'branches, twigs and leaves' of the root system expand and then contract with age, probably in direct correlation with the crown. It appears that subterranean dead roots can have a distinct decay (recycling) ecosystem.

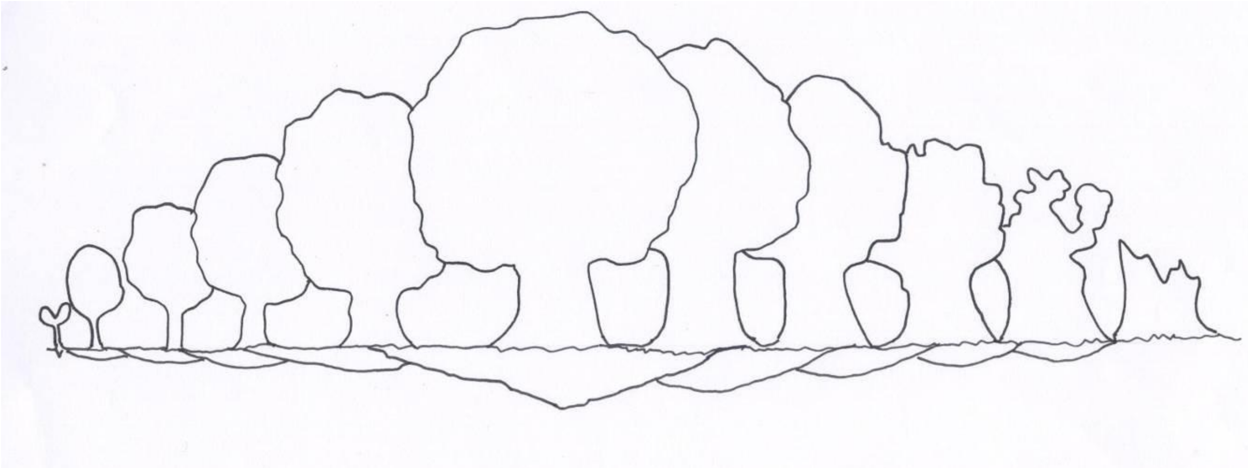

Fig 3: Sequential changes in the root area in relation to crown area of an individual open grown oak.

Forest form trees growing in close competition with small canopies are still capable of gathering sufficient energy to produce often large volumes of wood in the trunk. However trees on the margin with a greater leaf area may be able to provide extra energy to their neighbours on the inside of the group via their network of grafted roots or in fact they may actually be continually robbed.

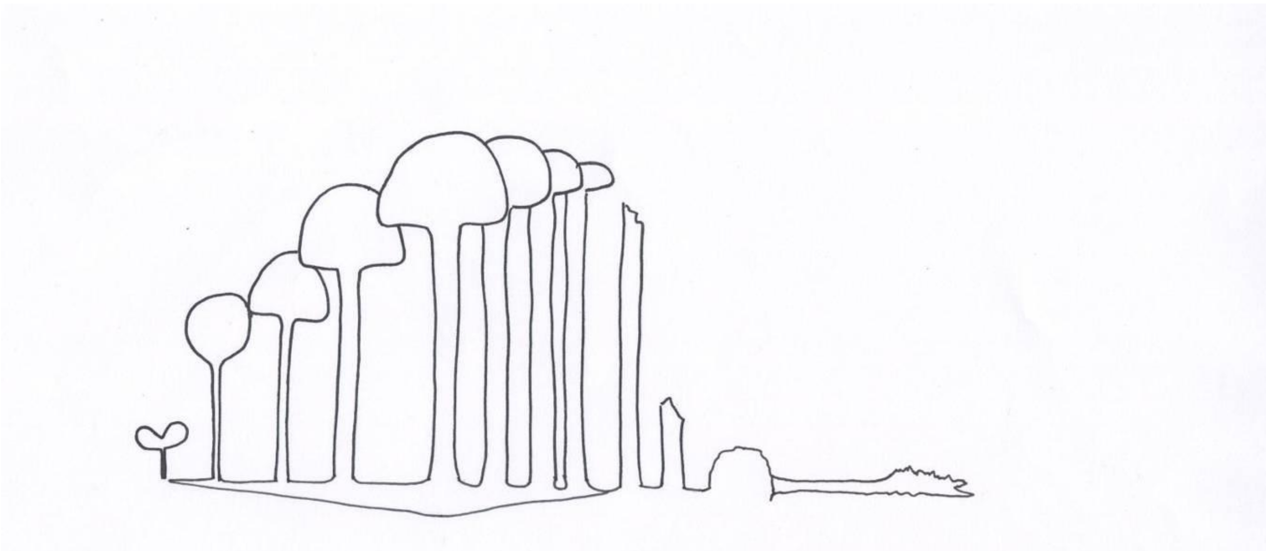

Fig 4. Sequential changes in the root area in relation to crown area of forest form trees.

In dense beech woodland or groves presumably the greater the number of trees, the greater density, the greater the competition, the greater the progressive self thinning, the greater the production of dead wood, the greater the recycling of minerals and nutrients from the decaying wood. There is a constant supply of nutrients to the survivors through this recycling. By having a very efficient, co-evolutionary, micro-organism support system it may be the trees only require a relatively small root area especially feeder roots. Individual trees do not require large spreading buttress roots as they are growing in dense tight conditions. They give each other group support against the elements reducing the need for each tree to adapt individually to wind exposure. However there is intense competition for space for other trees and plant roots to colonise in these far more restricted in dense grove conditions.

It is generally accepted that open grown trees develop substantial buttress roots in response to continual exposure to wind. It will therefore have a greater number, diversity and mass of micro-organisms associated with the roots simply through the greater area available to individual species to colonise the roots.

The length of the decay cycle will be far shorter in the more humid conditions found in woodlands and groves. A mature fallen beech with a trunk diameter of 1m could well disappear back into the woodland soil within 30-40 years. However a large fallen oak limb of about 60cms diameter in open conditions might still be present after 50-100 years. Therefore the time-lapse of decomposition of live wood to dead wood ratio is far shorter in woodland compared with open grown trees. Regardless of whether the center of the tree is ripewood or heartwood it will decay more quickly in woodland.

Hollowing of trees is now widely accepted as a perfectly natural function in non living wood of most plants including palms. It is usually associated with the aging process. In deciduous trees the non – living wood is either heartwood or ripewood which can be decayed by many species of fungi that may be associated with other micro-organisms in the decay process. There are circumstances where some species of saproxylic beetle and other insects including tree ants - behaving in a similar fashion to termites, which may also play important roles. The decay of non living wood in the centre of trees can be an added benefit to the tree by releasing nutrients locked up in the heart- or ripewood. In rainforest systems, minerals and nutrients trapped in the contents of hollow trees eg mould, droppings, are very important as a source of nutrients that in other locations would be leached away through high rainfall (L. Boddy, pers comm.). A succession of different organisms will benefit from different size cavities created by the progress of hollowing.

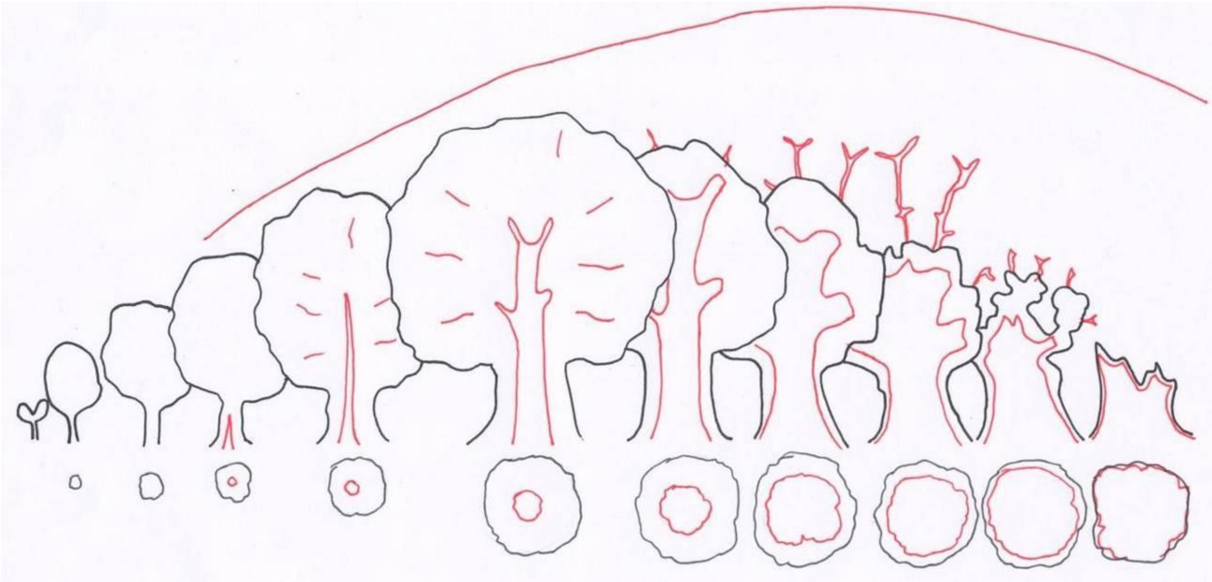

Fig 5. Sequential changes to the deadwood and hollowing of an individual open grown oak
"A supply of successional, structural, sustainable decaying wood from acorn to ancient".

The decay process of the heartwood can begin when the tap root begins to die, however the hollowing process may start in other parts of the tree.

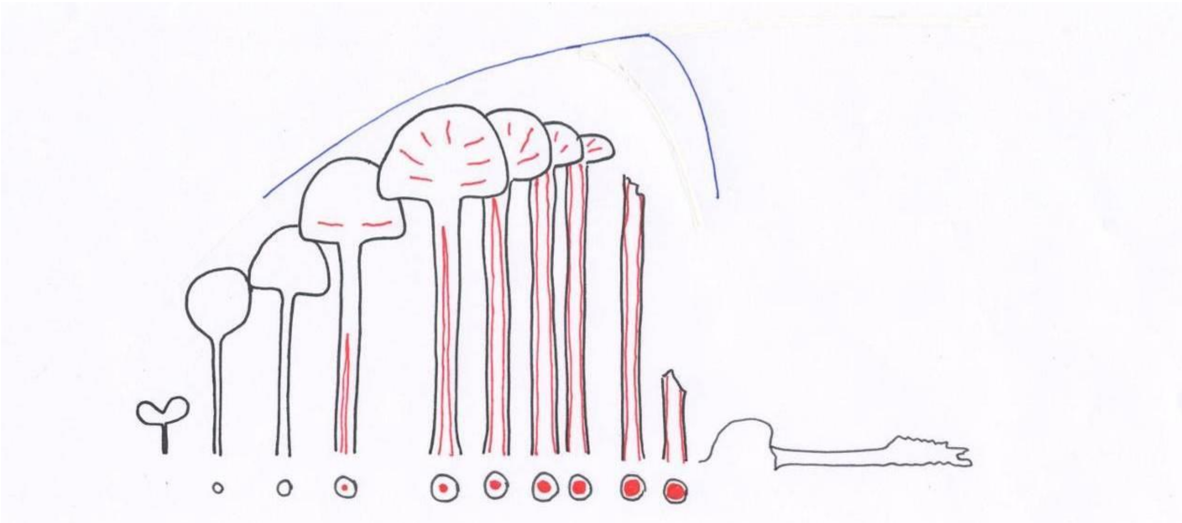

Fig 6. Sequential changes to the hollowing of forest form trees.

Depending on the species of fungi and other associated micro-organisms of the decay process present in any tree population, a proportion of the trees will be in the process of hollowing is considered perfectly natural.

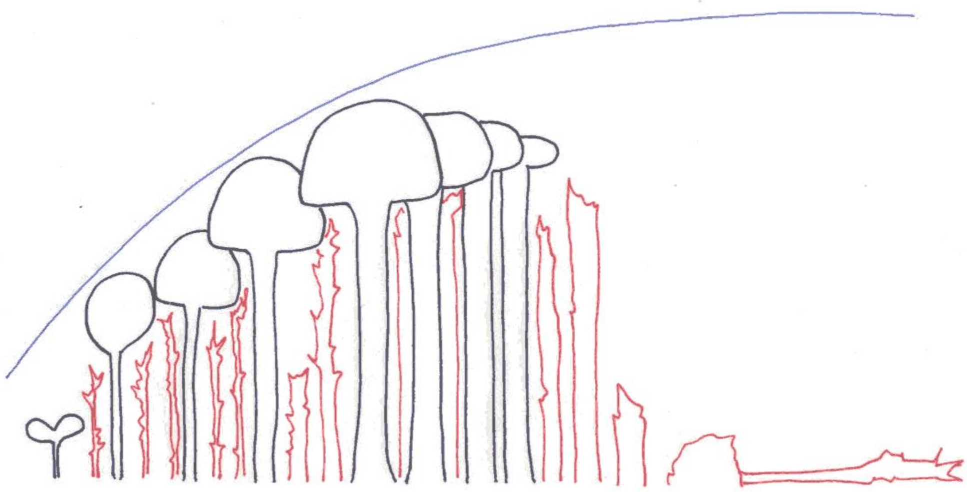

Fig 7. Sequential changes to deadwood from self thinning, through competition, of dense forest form trees.

In most situations the smaller the volume of wood, either standing, dead or fallen the more rapid the decay process. This is especially relevant in species such as beech that have ripewood and not heartwood as in oak. True heartwood which has been air dried in the crown or trunk of a tree through exposure can be sound or in the process of hollowing. In the latter case the outer shell can take centuries to decay.

The biodiversity of the decay (recycling) system is extremely complex and poorly understood. The diversity of species both visible and invisible that carry out essential roles and comprise the major players - 'the bio-engine of recycling', can only be speculated on. We know it would include bacteria, fungi, invertebrates (of which nematodes must be singled out for their importance) and presumably any single organism could be the primary coloniser which might then facilitate an ever changing succession of other micro-organisms. All these organisms will provide food for other organisms. The fruit bodies produced by fungi are an interesting example. The soft fleshy annual mushrooms usually appear from the end of summer through the autumn and into early winter. Not only are they a source of food for animals including man, slugs, several species of insects (beetles and flies) and nematodes. The insects, often flies, are emerging from the fruit bodies at the time when the bulk of other insects are finished for the year. Therefore they provide a succession of food especially for birds, bats and small rodents at a period when other insect food is declining. Other fungal fruit bodies that have a woody texture are usually perennial and associated with decaying wood and do not necessarily produce adult insects in the autumn months. The wholesale picking of fruit bodies not only for commercial reasons but also for the pot by eastern Europeans is on the increase. The impact of this continual removal on the woodland ecosystem appears to be totally lost on so called ecologists.

It has been a very thought provoking exercise to try and encapsulate the differences between open grown and forest form trees over time. It has thrown up more questions than answers, In fact no attempt has been made to explore comparisons between under crown and canopy ground cover or understory trees and shrubs in relation to light demanding or shade tolerant species However, one important question is answered and that is that our old open grown trees of open treed landscapes and wood pasture hold the key to the past. And it is hoped the debate will continue.

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