

Report for the  
**National Tree Safety Group**

**Estimating the costs and benefits of  
changing the approach to tree safety  
management and the role of local  
risk/benefit evaluation.**

Prepared by

**John Watt**

**Centre for Decision Analysis and Risk  
Management  
Middlesex University**

**September 2011**

## Contents

Contents.....	2
Estimating the costs and benefits of changing the approach to tree safety management and the role of local risk/benefit evaluation. ....	3
Introduction .....	3
Context.....	5
Costs and benefits of changing safety management. ....	7
Local benefit assessment. ....	8
Evaluation of what is reasonable.....	9
Managing the Risk from Trees .....	12
Conclusion.....	14

# Estimating the costs and benefits of changing the approach to tree safety management and the role of local risk/benefit evaluation.

## Introduction

A principal aim of the National Tree Safety Group (NTSG) was to develop a nationally recognised approach to tree safety management at least partly in response to a perception that some valuable trees are being lost because of an increase in defensive arboriculture<sup>1</sup>. It commissioned research into the level of risk and the potential for societal concern, which provided a relatively reassuring picture. This allowed the Group to move forward on two fronts – firstly an engagement with the Health and Safety Executive (HSE) and secondly to provide guidance towards management that is proportionate to the actual risks posed by trees. Together these initiatives had the aim of both actually reducing the likelihood of prosecution following a tree related incident and, perhaps even more importantly, reducing the perception amongst some practitioners that they are at risk of such prosecution. There is evidence that the regulator and the courts seem to be taking a more proportionate line than perhaps had been feared and so the actual instances of prosecution are low.

Deliberations within the NTSG and NTSG Steering Group suggested that the issue of managing trees in a ‘balanced way’ (i.e. for their diverse benefits) actually meets the obligations for human safety in nearly all cases. The NTSG were aware that the play industry and others had arrived at a view that risk was integral to play provision and that play safety management should be couched in terms of a risk-benefit calculation that specifically includes the notion that some risk is desirable but reasonable approaches to prevention of severe harm are required. At the time the guidance was designed to look at the legal requirements, the actual level of risk and the implications for safety management. It was envisaged that it would end by calling for a ‘balanced approach’ that takes a position that trees are good in general, old (mature) trees are especially good and that tree safety management plans should bear this in mind. At that point many people in the discussion demonstrated a desire to produce guidance emanated from position of suggesting regimes (one level of inspection for trees next to roads, another approach for trees in parks etc).

The play industry had ended up in a different place. What it said was that providers have a duty of care to avoid unreasonable risk to children but should approach this holistically. They should implicitly include the consideration of all benefits of play provision (including the taking of some risk) into their calculation of what is reasonable. This emphasises the need for the provider to make a judgement (and defend it if necessary). It also gives an excellent opportunity for the provider to draw stakeholders into the establishment of this policy with all the advantages that this has in terms

---

<sup>1</sup> There has been a widely felt concern about the way that public safety is being addressed in tree risk management. Fear of litigation is leading many landowners to remove trees in the name of ‘health and safety’.

of 'ownership'. This changes the calculation from a cost/benefit calculation couched in purely safety terms to a risk/benefit calculation that looks at both risk and benefit together. This emerging philosophy has slowly gathered support in the play sector and elsewhere in areas of public safety (i.e. where the public is put at risk in places other than work environments). HSE are beginning to show support too.

A suggestion emerged at the NTSG meetings that a position statement be considered to express the approach that the group considered most appropriate and to provide a context against which the guidance document could be framed. It would argue for holistic management of trees undertaken for the optimisation of the benefits they bring while doing what is reasonable to ensure human safety, and recognising that, on occasion, achievement of the benefits will result in some risk. It might argue, as in play, that this risk is actually desirable (and desired). It was felt that such a statement would offer the framework to offer comfort to those who are worried enough to fell trees to avoid going to court. This would happen if it became clear (over time) that people (including the HSE and the courts) will accept that it is reasonable to devise a tree management policy that is inclusive of some risk taking, where this can be argued to be acceptable (both in terms of probability of accident and also in terms of tree management objectives). They could then consult their stakeholders and devise a management policy appropriate to their objectives (and the risk appetite of the stakeholders). It would allow people concerned about the loss of trees to argue for their retention.

This final stage of the DARM research was therefore established to:

1. Work with the steering group to draft an industry statement.
2. Undertake a study of risk/benefit calculation in tree risk management. This would collate national policy with respect to trees, academic research on benefits from trees and could include some hypothetical examples from different types of situation in which the public interacts with trees.
3. Evaluate some economic considerations in general terms.

This report therefore examines the economic considerations that are required to establish whether the current approaches to risk management are reasonable (which is the sole requirement of Health and Safety legislation and is the expectation of the courts). There are two dimensions to this evaluation – a brief overview of the national situation and an outline evaluation of the local parameters that might be important for the calculation of benefit and cost in relation to the identification of options for the management of trees.

When thinking about the risk management of trees it rapidly becomes clear that establishment of context is key to decision making. A full economic costing of the level of risk to individuals in the UK from death or injury from falling trees would be relevant if regulation or legislation were appropriate vehicles for managing safety (as they would be in high risk industries such as nuclear power or offshore oil production). In the current case the preliminary evaluation and discussion of the risk suggest that almost all appropriate management strategies would need to be developed within a local context.

Many current approaches to risk management focus on the identification of clear objectives as a useful start point<sup>2</sup>. Although trees may seem an odd thing to associate with ‘objectives’, their management at local level can certainly be expressed in this way. When this is done, it soon becomes clear that safety must be integrated into wider management with important consequences for the provision of resources. It is easy to conceive of two trees of identical size and condition (likelihood of failure) that would in one case be retained (perhaps because it was a prize specimen in an arboretum) and in the other case removed (for example it was one of many similar trees in a park). The calculation of the relationship of costs and benefit at local level is only rarely an economic cost/benefit analysis (the CAVAT and I-Tree systems offer potential for this to be done). Benefits derived from trees are only rarely traded and thus, like many public goods, do not have a price (though I-Tree permits ecosystem services to be valued). That certainly does not mean that they do not have a value and risk/benefit analysis is a method that permits managers to structure their evaluation of options.

## Context

The Health and Safety Executive has described the philosophy that underpins its decision making in relation to decisions on whether risks from an activity or process are unacceptable, tolerable or broadly acceptable and its application in practice<sup>3</sup>. The framework, known as the Tolerability of Risk (TOR), describes 3 levels – whether a risk is unacceptable, tolerable or broadly acceptable. HSE has actually only proposed numerical criteria for informing decisions on the tolerability of risks for very limited categories of risk, for example, those entailing fatalities, so that there remains an expectation that:

1. Both the level of individual risks and the societal concerns engendered by the activity or process must be taken into account when deciding whether a risk is unacceptable, tolerable or broadly acceptable.
2. A suitable and sufficient risk assessment must be undertaken to determine the measures needed to ensure that risks from the hazard are adequately controlled.
3. Suitable controls must be in place to address all significant hazards that, at a minimum, must achieve the standards of relevant good practice precautions, irrespective of specific risk estimates.
4. As control measures are introduced, the residual risks may fall so low that additional measures to reduce them further are likely to be grossly disproportionate to the risk reduction achieved, though the control measures should still be monitored in case the risks change over time.

The preliminary research undertaken by the Centre for Decision Analysis and Risk Management (DARM) on behalf of the NTSG addressed point 1. It demonstrated that the overall risk to the public from falling trees was extremely low, representing about a 1 in 10 million chance of an individual

---

<sup>2</sup> ISO 3100:2009 Risk management – Principles and guidelines, for example, defines risk as ‘the effect of uncertainty on objectives’

<sup>3</sup> Health and Safety Executive (2001) Reducing risks, protecting people – HSE’s decision making process. HSE Books: Sudbury.

being killed by a falling tree (or part of a tree) in any given year<sup>4</sup>. The research also showed that there is limited societal concern about risks of this type (although there may be adverse publicity in the immediate aftermath of an individual incident). The analysis indicated that it would be unlikely that adjustments to the current management regime would reduce the risk the health and safety in any significant way.

It was, however, recognised that trees are currently managed for a variety of reasons and therefore that the 'suitable and sufficient risk assessment' referred to in point 2 would vary with context. The NTSG guidance is being developed to address this point and to enhance the good practice in the sector.

It is therefore clear that, in general, risk from trees has certainly reached the situation addressed in point 4 above, where residual risks (those that remain after management for trees) are sufficiently low that further investment in additional measures is likely to be disproportionate to any safety benefit. As HSE themselves note<sup>5</sup>

"any informed discussion quickly raises ethical, social, economic and scientific considerations, for example:

- How to achieve the necessary trade-offs between benefits to society and ensuring that individuals are adequately protected;
- The need to avoid the imposition of unnecessary restrictions on the freedom of the individual."

A decision to remove trees purely to avoid potential prosecution where there is no obvious danger ignores the evidence that tree related deaths and injuries are very rare indeed. Despite the fact that millions of trees grace our landscape and that nearly everybody passes under trees every day, there are only about six deaths a year from trees (to put this into context, an individual person is about twice as likely to be killed in an accident on a bus). It also is an exaggerated response to the actual risk of prosecution, since court judgments and the Health and Safety Executive have recently shown regard for the landowner taking reasonable and proportionate tree assessment and management without the implied need for burdensome record keeping or costly professional surveying. Lower court judgments against the responsible defendant landowner are often overturned in the higher court in favour of the wider common good. Indeed the Health and Safety Executive has only ever made one tree-related prosecution for deaths from trees.

It was recommended that any new measures that might result from an increase in defensiveness should be considered in terms of their practicability and potential for generating unintended and unwanted consequences, which is the rationale for this report.

---

<sup>4</sup> Risk assessment is usually done in relation to a hypothetical person (a hypothetical type of individual who is deliberately assumed to have some fixed relation to the hazard under consideration) – in this case an ordinary member of the public undertaking normal activities.

<sup>5</sup> Health and Safety Executive (2001) Reducing risks, protecting people – HSE's decision making process. HSE Books: Sudbury.

## Costs and benefits of changing safety management.

A simple analysis shows that, while a considerable amount is spent on looking after trees, a great deal of benefit is derived<sup>6</sup>. It is, however, necessary to consider the case for a change in the way that safety is managed. It is not easy to estimate the proportion of the above baseline costs can be attributed to management activities that relate directly to human safety. Given that a great deal of the benefit estimated above accrues to the public and the burden of maintenance (and the fear of litigation) falls on the landowners or tree manager, the balance of cost and benefit is skewed. Additional burdens placed on tree managers would either divert resources from other management activities or would require additional external resources. The low level of overall risk set out above suggests that such extra resources are not required by the duty of reasonableness as required by the courts or the regulator<sup>7</sup>. If a rough estimation is made of the necessary level of investment required to reduce the risk further, it shows that, even if the risk were in the ALARP region<sup>8</sup>, costs would greatly outweigh benefit. It costs more than £210,000,000 to manage Britain's trees to a level that results in 6 deaths per annum to the public. A crude division equates each death to an investment of £35 million, whereas each death 'costs' £1-2 million<sup>9</sup>. Obviously this estimate contains a number of simplifications:

- Deaths are not the only risk from trees. There will be additional costs from injury and damage to property.
- Not all the investment is necessarily in activities that relate to safety.

It is unlikely that injury costs would come anywhere near to closing the gap between the cost and safety benefit and the protection of property is likely to underpin a great deal of the investment anyway. For example, a considerable portion of the tree management activity in some areas relates to protection of buildings from the action of tree roots by pollarding of street trees. The public pay for this and they also, at least implicitly, are willing to pay for the other benefits.

There is also about 1 death per annum of workers. Given the far smaller numbers in the workforce and the greater ease with which their interaction with the tree can be modelled (they can only be killed or injured while working on a tree) it is simpler to do a cost benefit analysis of safety interventions. The requirements of the Health and Safety at Work Act Etc apply directly.

If practitioners and landowners continue to act in a defensive manner because of the fear of litigation (or decisions in the courts or by the regulator force this type of behaviour by enhancing the actual level of expectation) there will be an increase in cost. The question that needs to be evaluated is whether any additional resource is justified on safety grounds alone. The conclusion

---

<sup>6</sup> The economic and other benefits are reviewed in the NTSG guidance document *Common Sense Risk Management of Trees*

<sup>7</sup> The Tolerability of Risk Framework places the 1 in 10 million per annum risk very clearly in the 'acceptable risk' category.

<sup>8</sup> ALARP = 'as low as reasonably practicable' and is a requirement for risks with a probability between 1 in 1 million p.a. and 1 in 10000 p.a. for the public (1 in 1000 p.a. for workers)

<sup>9</sup> The 'value of a statistical life' used as an estimate of what a life is 'worth' for the purpose of analysing investment in safety.

from the analysis must be that this is not reasonable and that resources will be deflected from other objectives.

## **Local benefit assessment.**

While it is clear that the overall level of risk does not warrant a substantial increase in overall investment, there is, as noted above, an imbalance in the way that safety costs are distributed. The benefits utilised in the national scale calculations, apart from direct income from woodland such as sales of timber, are mostly accrued by members of society in general. Local authority tree managers at least have a public budget to use for maintenance but many landowners do not derive any direct income from their trees. As a society we wish them to manage their trees in the public interest and it is clear that part of the agenda of at least some of the stakeholders represented in the National Tree Safety Group is to reduce unnecessary loss of valuable trees. Anecdotally, the fear of litigation does seem to have influenced decisions in a number of cases – perhaps fuelled by court cases and attendant publicity. As noted above, there is an incentive on the owner or operator to be defensive since they bear the maintenance costs and it is them that would have to appear in court. Given that investment of additional resources does not seem to be justified, it is useful to consider whether there are any other actions that can be taken.

As also noted above, there seem to be two useful approaches for those that wish to campaign for the reduction in loss of trees. Firstly provision of guidance towards management that shows that a ‘defendable not defensive’ approach is proportionate to the actual risks posed by trees. The guidance being developed by the NTSG in fulfilment of this part of its aims, notes that the actual number of prosecutions is low, which may help to reduce the perception amongst some practitioners that they are at risk of such prosecution. A better understanding of the actual level of risk and the obligations set by the various relevant pieces of legislation may help in providing some reassurance that, even if an accident happens and an investigation is undertaken, prosecution may be avoided.

The second approach is to enter discussions with HSE aimed at an evolution in the way that risks to the public are addressed.

The spirit of the Health and Safety at Work Act and other legislation that addresses people’s safety in the face of risk of death or injury suggests that the operators are the people best placed to address the assessment of risk and to undertake the requisite actions to reduce it to a reasonable level. The Act obliges them to reduce the risk as far as is reasonably practicable. The HSE’s general approach is to set out the (safety) objectives and to give duty holders considerable choice as to the measures they should put in place to meet these objectives. Existing guidance on risk assessment frequently relates particularly to occupational health and safety concerns and has been designed to handle the factors that are relevant in this setting. There is an emerging position in public sector risk management that argues that these methods do not fit the more complex factors associated with

risks to the public (this has now been fully rehearsed by David Ball in his recent book, *Public Safety and Risk Assessment*)<sup>10</sup>.

The HSE also recognise the complexity of the decision-making involved. It recognises, amongst other things, that there are necessary trade-offs between benefits to society and ensuring that individuals are adequately protected, including the need to avoid imposing unnecessary restrictions on people's freedom.

For such a non-prescriptive regime to work, however, duty holders must have a clear understanding of what they must do to comply with their legal obligations.

One main principle should underlie the management of risks from trees. It is that the evaluation of what is reasonable should be based upon a balance between benefit and risk. This calculation can only be undertaken in a local context, since trees provide many different types of benefit in a range of different circumstances. The NTSG has agreed to endorse this as a key component of the position that it recommends for the proportionate and sensible risk management of trees. There are, in addition, a number of key principles that have already been established within the NTSG:

1. Trees provide a wide variety of benefits to society
2. They are organic, living organisms and naturally lose branches or fall.
3. The risk to human safety is extremely low
4. Tree owners have a legal duty of care
5. Tree owners should take a balanced and proportionate approach to tree safety management.

## Evaluation of what is reasonable

The Health and Safety Executive believes that: "public safety aspects can be addressed as part of the approach to managing tree health and tree owners should be encouraged to consider public safety as part of their overall approach to tree management."<sup>11</sup> This is an encouraging position from the regulator, that suggests that HSE, and by implication the courts, will accept that human safety is to be considered within a wider management context rather than being evaluated in isolation or in response to some notional protocol.

The first stage of an evaluation, therefore, looks at the role of the trees themselves. In a private garden, there is no presumption that it is reasonable to expect owners to do anything other than react to obvious signs of danger (which they are likely to do anyway since it is themselves or their house that is most in danger). There is clearly a concept of scale in the consideration of reasonableness and, in the context of the low level of risk noted already, the HSE SIM further states that: "Given the large number of trees in public spaces across the country, control measures that involve inspecting and recording every tree would appear to be grossly disproportionate to the risk".

---

<sup>10</sup> Ball, D.J and Ball-King, L. (2011) *Public Safety and Risk Assessment*. Earthscan.

<sup>11</sup> <sup>11</sup> (HSE, SIM 01/2007/05, Management of the risk from falling trees).

What is inherent in this evaluation is a sense of proportion. This can only be achieved by considering the trees' place in a wider management context and the relationship of people to that context.

In some circumstances trees are managed as a crop. Perhaps this context can be compared to the type of workplace environment that the Health and Safety at Work Act was designed to address. Here, the primary focus is on planting, maintaining and harvesting the crop for maximum income. In this simple model of a commercial forest, benefit can be equated to profit in the same way as in a factory or farm. In this case, one might expect a formal health and safety policy to address workforce and visitor safety. Leaving aside the question of amenity use by visitors, it does not seem illogical to apply cost benefit analysis to the valuation of safety interventions as outlined in the Tolerability of Risk Framework. And, given the low level of risk to the public, it is likely that nearly all the investment will be focussed on worker safety. This type of calculation might be appropriate for other commercial operations and public utilities that incorporate trees on their site.

The evaluation seems more complicated when it comes to considering the risk to the public from trees in urban and rural open spaces. In many cases trees may be looked after by local government or public bodies such as the National Trust, who must bear the safety costs. Undoubtedly the trees benefit the organisation, but this is not expressed as an income (though in the case of local authorities society ultimately pays through taxation and it might be argued that public bodies get support for the implementation of their stakeholders desire to retain beautiful trees through membership fees and entrance charges). In many cases even these sources of income are unavailable. It is the dissociation of costs and benefits that leads to the unnecessary loss of trees. Here the benefits are to the public, but the owner, or manager, shoulders the costs and the liability. The establishment of what is reasonable in terms of public safety in these circumstances requires the adoption of a different basis of calculation, which is that the evaluation of what is reasonable should be based upon a balance between benefit and risk.

It is important to note that risk benefit assessment must be conducted against a rationale or an agreed purpose (the objectives of management referred to above). Clearly those responsible for trees have far more objectives to serve than injury prevention alone. David Ball<sup>12</sup> suggests that such a rationale might be expressed as:

"Our aim is to manage public space in order to enable public enjoyment and activities to the full. In doing this we will do everything that is reasonable to ensure safety from harm while seeking to maximise positive social outcomes."

This type of articulation of the approach to land management in the public interest has the advantage of being consistent with the law in recognising that all that is reasonable must be done to ensure safety, while clearly committing to maintenance of the non-traded benefits<sup>13</sup>. The important thing to note is that this philosophy is seeking to manage risk, in a manner that will look after the safety, *and* the health *and* the quality of life of the public.

---

<sup>12</sup> *ibid*

<sup>13</sup> Statements such as this can be linked to HMT (Her Majesty's Treasury) (2003) *The Green Book – evaluation and appraisal in central government*, London: TSO. This has a long list of environmental, landscape, biodiversity and recreational amenity considerations which warrant attention in public sector decision making.

Risk benefit analysis compares (trades off) risks of harm from trees against their benefits, and then evaluates whether to proceed with an activity (which might be inspection of the trees, or maintenance or removal. It might also be an evaluation of a new event such a music festival on the land). This approach permits a justification to be made for a decision to permit, modify or not permit something to go ahead. Obviously there are different scales at which such decisions are made and not all occur in settings where a formal policy is required. On the other hand, a written statement articulating the policy decision, the method by which it was arrived at and the endorsement from stakeholders can be a useful asset if an incident were to occur. As Professor Christopher Hood and colleagues have said<sup>14</sup>:

"What are needed are public statements of how assessors reasoned about the issues, to avoid the impression of ad hoc political judgements masquerading as technocratic expertise."

The main motive for this is the proper management of risk discussed above and, if this is done well, the requirements of providing audit trails and the presentation of evidence for the avoidance of liability will be taken care of without becoming the primary focus, as often seems the case where risk aversion is apparent.

It is not yet possible to articulate a fully developed method for risk benefit analysis for tree risk management but a start may be made by examining precedents and comparisons with other similar circumstances from elsewhere. The NTSG evaluation has considered a number of these including the *'Managing risk in play provision'* report. This recommends that records are kept in a narrative form which identifies the factors that were evaluated and the way that the judgements were made (as well as the judgements themselves). This approach is useful since, as discussed above, it is difficult to find reliable data or to apply formal numerical, or quasi-numerical methods to something as complicated as the management of public expectations for trees, land and safety. The NTSG guidance has developed a number of case studies to show some of the factors that might be considered in a number of hypothetical scenarios articulated at a number of different scales.

*'Managing risk in play provision'* suggests the creation of a list of the benefits of the place or activity linked, where possible, to reputable sources or publications. Risks are then assessed perhaps by using historical injury records for the site or activity in question. If such statistics are not available it might be possible to make extrapolate from comparable circumstances elsewhere. Collecting and using data is not always straightforward but this kind of evidence-driven approach may often be better than trying to use risk-consequence matrices, which are frequently presented as a simple method of risk assessment but have a number of difficulties in practice (not least because of the unpredictability of situations involving the public).

Relating the risk assessment to local policy objectives and making use of local experience is therefore a sensible approach to these complex situations. Special expertise may be necessary to verify the assessment of either the benefits or the risks, but it should be noted that the HSE has itself said that local expertise is preferable, since local people know the local situation. The challenge for the management of public health and well being (together) is in the selection of the correct

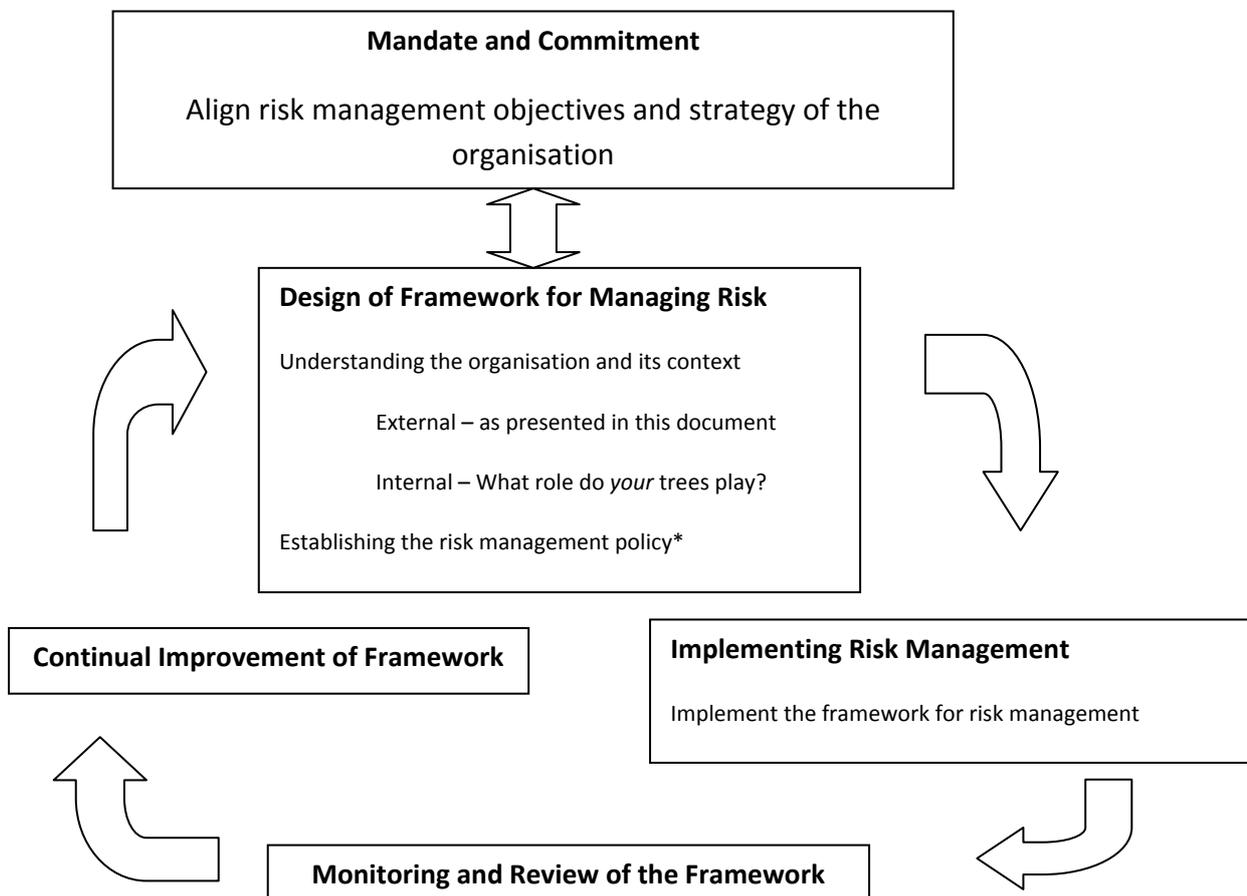
---

<sup>14</sup> Hood, C., Rothstein, H. and Baldwin, R. (2001) *The government of risk - understanding risk regulation regimes*, Oxford: Oxford University Press.

expertise for the assessment. If the assessment focuses too much on the likelihood of tree failure, it may miss the benefits of tree retention. Clearly such complexity carries with it the potential for controversy and argument. The advantage of utilising a risk/benefit approach from the outset is that it addresses this controversy pro-actively. It seeks to establish a consensus on the way forward and, where appropriate, the establishment of policy. Done well, this policy will be supported by local stakeholders, will offer an integration of human safety that satisfies all the demands of ‘reasonableness’ required by the courts and the regulator, and an approach to the management of trees that optimises their benefits.

## Managing the Risk from Trees

It seems reasonable to expect sufficiently large organisations that own or manage trees to develop a formal policy (in line with practice in other sectors). This policy should strike a balance between the risks and the benefits (Figure 1 shows how such a policy might align to wider management).



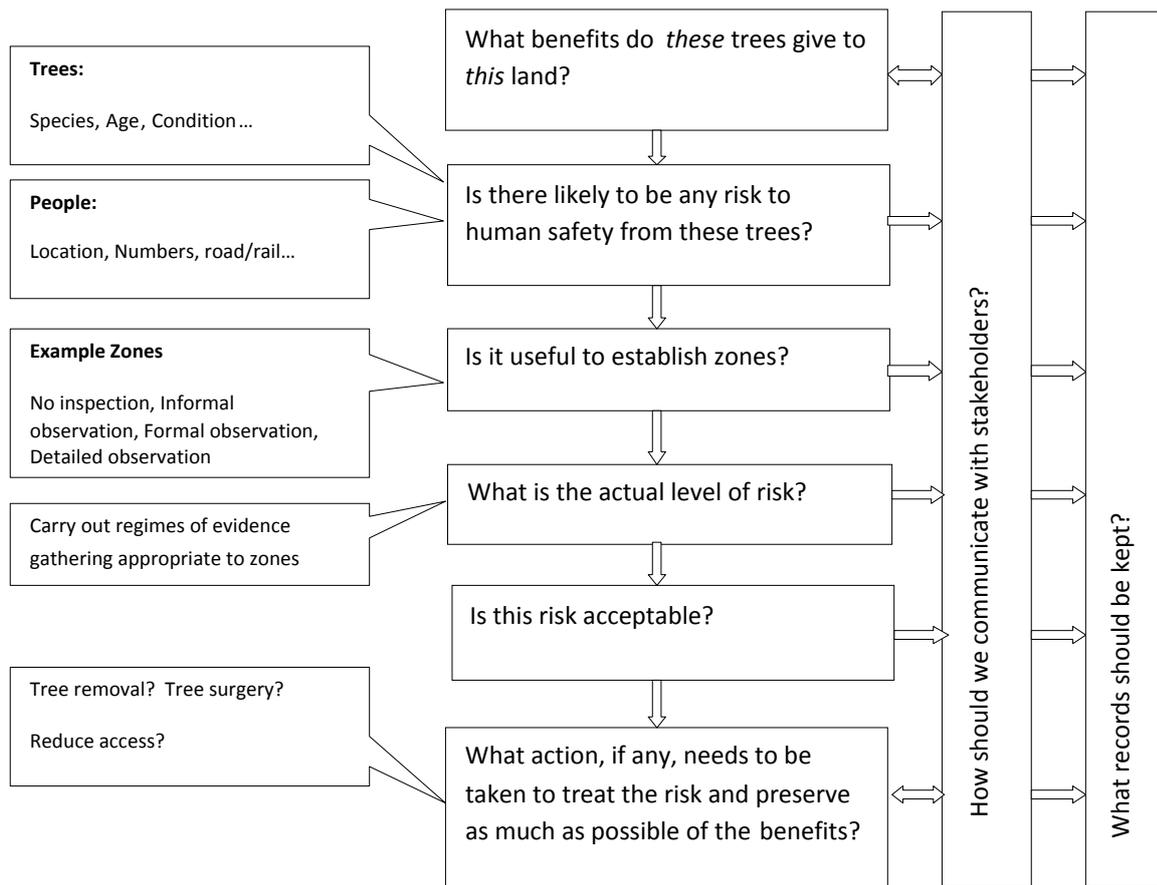
**Figure 1 Relationship of the components of the framework for managing risk (adapted from ISO 3100:2009 Risk Management – Principles and Guidelines).**

\*A policy is not always required but it is often useful for organisations of a certain size to both consider the approach to risk and to record that consideration. It may also be useful for transparency as part of wider stakeholder engagement.

A reasonable policy, based on a risk management framework involving a risk-benefit trade-off between safety and other goals and articulating the benefits of trees, should carry as much weight in

protecting the policy-maker against litigation following an incident as any reasonable risk management policy in a workplace setting. A draft framework of this type is suggested in Figure 2.

Exposure to an element of risk is an unavoidable consequence of many of our interactions with trees, and of all environments where trees are part of leisure activities.



**Figure 2 Draft framework for a risk benefit approach to risk management (adapted from ISO 3100:2009 Risk Management – Principles and Guidelines).**

In many circumstances tree management aims to offer people the chance to encounter a stimulating and beautiful environment whilst understanding that there is a degree of residual risk. Therefore it is acceptable that tree management does not seek to eliminate all risk of minor and easily-healed injuries. Tree management should not expose people to significant likelihood of permanent disability or life-threatening injuries. However, it may on occasions be unavoidable that tree management exposes people to the very low risk of serious injury or even death. This is only tolerable in the following conditions:

- The hazards are clear to users
- There are obvious benefits

- Further reducing the risks would remove the benefits
- There are no reasonably practicable ways to manage the risks.

For example, a mature tree in a city park presents a low but irremovable risk of falling on somebody, even if it is frequently inspected and treated. This risk is usually tolerable. The likelihood is typically low, the hazard is clear and people benefit through retention of a feature that is inextricably linked to why they visit the park. Further reduction of this risk is not possible without removing the tree and taking away the benefits. Figure 2 shows a process of decision making that could be utilised to gather the necessary assessment of the risks and benefits within a specific management context and to make a judgement on the acceptability or otherwise of the risk and the need for management action of different types.

## Conclusion

### **Management of human safety must be integrated with overall management of trees.**

The requirements of UK legislation on what is reasonable and the articulation by HSE of their approach, the Tolerability of Risk Framework, suggest that safety management should not be considered in isolation. It should be considered only as part of an integrated management plan that focuses on the wider management of the trees within a particular setting. Establishing the reasons for the tree being there will always dictate the resources invested in its maintenance, whether it is being grown as timber, is an outstanding veteran tree in the park of a stately home or is a self-seeded intruder that needs to be cleared for site development.

### **It is not necessary to remove trees for fear of litigation if they have been managed reasonably within their local context.**

A situation has arisen where some of those responsible for trees are managing them defensively, though fear of litigation. The current analysis shows that this position goes beyond what society views as reasonable, costs unnecessary money and may lead to unnecessary loss of valuable trees.

### **The NTSG should argue for inclusion of social and environmental benefits in the calculation of what is reasonable for tree safety management.**

The above circumstance is exacerbated by the fact that, generally speaking, it is the public who gets the benefit of the trees it is the owners and managers who bear the legal duty and attendant cost. This unnecessary loss of trees, which the landowner would have otherwise retained, can be addressed if the public good (in terms of ecosystem services and resultant health, environmental and social benefits for example) is brought into the calculation of benefit, to demonstrate a reasonable position that will be accepted by the courts.

### **The NTSG could also argue for the retention of amenity trees**

Many stakeholders involved themselves in the issue precisely because they were worried about the loss of amenity trees (and hedgerow trees for example). Arguing for retention would not challenge felling of trees grown for timber or other justifiable removal.